

Understanding neglected connections between nature, conservation, and mental health



Thomas Pienkowski

Wolfson College

University of Oxford

Supervised by

Professor E.J. Milner-Gulland and Dr Aidan Keane

Hilary Term 2022

A thesis submitted for the degree of Doctor of Philosophy

Declaration

I declare that this thesis is entirely my own work. Contributions by other authors are stated in the section Thesis outline. None of the work has been submitted, in whole or in part, for any previous degree application.

Thomas Pienkowski

Acknowledgements

First, I sincerely thank those who participated in the studies presented in this DPhil. I calculate that participants collectively contributed over 840 hours of their time across all the chapters of my thesis. Moreover, many participants shared personal stories on often challenging topics. Thank you to everyone who took part and helped promote the internet survey within their networks.

I am incredibly grateful to my supervisors, Professor E.J. Milner-Gulland and Dr Aidan Keane. Through your patience, encouragement, and investment, you have challenged, shaped and supported me beyond just as a researcher. I enjoyed every minute of it.

I also thank the many colleagues with whom I have had the pleasure to work. This includes those involved in my research in Uganda; Moses Musiimenta, Susan Lajiki, Liberty Anichan, Gilbert Guzaarwa, Joseph Rushenjule, Professor Eugene Kinyanda, Professor Birthe Loa Knizek, Dr Caroline Asiimwe, and Geoffrey Muhanguzi. It also includes many who contributed to the Life in Conservation study: Dr Sofia Castelló y Tickell, Dr Emiel de Lange, Dr Mirjam Hazenbosch, Munib Khanyari, Dr William N. S. Arlidge, Dr Gergő Baranyi, Dr Stephanie Brittain, Dr Sarah Papworth, Sonakshi Saxena, Vimean Hout, George Robson, Dr Vik Mohan, Sereyrotha Ken, Dr Simon Mahood, Vena Kapoor, Roshni Ravi, and Dr Izak Smit. I want to highlight and especially thank the last five people on this list for going above and beyond in facilitating the deep dive collaborations. I thank three anonymous conservation organisations for their readiness to collaborate and generous support in chapters 4 to 7.

I am grateful to the many funders who have supported this research. This includes the Natural Environment Research Council (grant number NE/L002612/1), the Royal Society of Tropical Medicine and Hygiene, the Africa-Oxford Initiative, the Parkes Foundation Small Grant Fund, the Tasso Leventis Foundation (University of Oxford), AWS Cloud Credits for Research, and Wolfson College (University of Oxford).

To every member of the ICCS crew, you have absolutely enriched my life during this DPhil, and I am very lucky to count you as cherished friends. Hollie, Rod, Will – wild times mountain biking,

walking, triathaloning, swimming, and much more. You guys have kept me inspired and motivated throughout. Melissa and Ale, chats with you both have helped me through the highs and the lows of my DPhil. Sofia, Mirjam, Munib, and Tim (and Danica) – I have learnt things from all of you (including that Nutella can be added to almost all Italian food, Timmy), and I could not think of a better crew for doing a DPhil alongside. Amy, Steph, Dan, Diogo, and Molly – I am incredibly grateful for your advice and encouragement. In particular, thank you, Steph, for giving me confidence when I needed it.

I thank my parents, without whom I would not be here, and my brothers for being lifelong spotters. And finally, I thank Ruth for her unwavering love and support (and forbearance).

Contents

1. Introduction.....	21
1.1. Problem statement.....	21
1.1.1. Literature review and gaps.....	26
1.1.2. Benefits of addressing these gaps.....	36
1.2. Aims and objectives.....	37
1.3. Summary of conceptual framework and study systems.....	38
1.4. Thesis outline.....	42
1.5. Positionality statement.....	44
2. The role of nature conservation and commercial farming in psychological distress among rural Ugandans.....	48
2.1. Abstract.....	48
2.2. Introduction.....	48
2.3. Conceptual framework.....	50
2.4. Methods.....	52
2.4.1. Study site: Nyabyeya Parish and the surrounding areas.....	52
2.4.2. Ethical considerations.....	55
2.4.3. Study population and sample.....	56
2.4.4. Piloting and translation.....	58
2.4.5. Data analysis.....	58
2.5. Results.....	59
2.5.1. How do Nyabyeya’s residents describe their experiences of distress?.....	59
2.5.2. What are the perceived stressors associated with distress among residents?.....	61
2.5.3. What are the perceived roles of socio-ecological processes in these stressors?.....	62
2.6. Discussion.....	65
2.6.1. Psychological distress in Nyabyeya.....	65
2.6.2. Social determinants of psychological distress.....	67
2.6.3. Social determinants within a socio-ecological context.....	68
2.6.4. Study limitations.....	71
2.6.5. Testing theories through long-term observation.....	73
2.6.6. Policy relevance.....	74
2.7. Conclusion.....	76
3. Predicting the impacts of land management for sustainable development on depression risk in a Ugandan case study.....	77
3.1. Abstract.....	77
3.2. Introduction.....	77
3.3. Nature’s contributions and mental illness.....	79
3.4. Methods.....	83
3.4.1. Target population and sampling strategy.....	83
3.4.2. Component 1: Hypothetical landscape management scenarios.....	86
3.4.3. Component 2: Structural equation modelling of relationships between respondent characteristics and mental health.....	88
3.5. Results.....	96
3.5.1. Component 1: Effects of land management scenarios on access.....	97
3.5.2. Component 2: The relationship between forest use, farm size and social determinants of depression.....	100
3.6. Discussion.....	102
3.6.1. Study limitations.....	104
3.6.2. Land management policy and mental health.....	107
3.6.3. Experimentally testing interventions.....	109

3.7.	Conclusion.....	111
3.8.	Data and code availability	112
4.	Balancing making a difference with making a living in the conservation sector.....	113
4.1.	Abstract	113
4.2.	Introduction	114
4.3.	Methods.....	118
4.3.1.	Study population and sample.....	118
4.3.2.	Quantitative data description	121
4.3.3.	Quantitative data analysis	122
4.3.4.	Qualitative data description and analysis.....	125
4.4.	Results	125
4.4.1.	Variability in satisfaction with goal progress	127
4.4.2.	Goals, barriers, and consequences in respondents' own words	130
4.5.	Discussion	133
4.5.1.	How does goal progress satisfaction vary between groups?.....	135
4.5.2.	Study limitations	137
4.6.	Conclusion.....	139
4.7.	Data and code availability	141
5.	Personal traits predict conservationists' optimism about outcomes for nature	142
5.1.	Abstract	142
5.2.	Introduction	142
5.3.	Methods.....	145
5.4.	Results	148
5.4.1.	Dispositional and situational optimism.....	149
5.4.2.	Context and situational optimism	150
5.5.	Discussion	151
5.5.1.	Dispositional optimism appears important	152
5.5.2.	Some personal characteristics predict situational optimism	153
5.5.3.	Biodiversity and conservation context appear less important.....	154
5.5.4.	The role of optimistic conservation framings	155
5.5.5.	Study limitations	155
5.5.6.	Experimentally testing interventions	156
5.6.	Conclusion.....	157
5.7.	Data and code availability	158
6.	Protecting those who protect nature by supporting conservationists' mental wellbeing	159
6.1.	Abstract	159
6.2.	Introduction	159
6.3.	Methods.....	167
6.3.1.	Variable description.....	167
6.3.2.	Statistical analysis.....	169
6.4.	Results	170
6.4.1.	Personal characteristics and workplace conditions associated with psychological distress.....	171
6.5.	Discussion	174
6.5.1.	Study limitations	175
6.5.2.	Workplace wellbeing in conservation.....	177
6.5.3.	Experimentally testing interventions	182
6.6.	Conclusion.....	184
6.7.	Data and code availability	185
7.	Mental health and workplace risk inequalities among conservation professionals.....	186
7.1.	Abstract	186

7.2.	Introduction	187
7.3.	Methods	189
7.3.1.	Study population and sampling approach	189
7.3.2.	Variable description	192
7.3.3.	Statistical analysis	197
7.4.	Results	199
7.4.1.	Job position, workplace factors, and psychological distress	200
7.4.2.	Differences in efforts and rewards between positions	202
7.5.	Discussion	204
7.5.1.	Patterns of risk factors between job positions	206
7.5.2.	Study limitations	208
7.6.	Conclusion	211
8.	Discussion	212
8.1.	Research summary	212
8.2.	Cross-cutting themes and policy implications	217
8.2.1.	Study design choices and limitations	217
8.2.2.	The impacts of nature loss?	223
8.2.3.	Cost-effectiveness of managing socio-ecological systems for mental health	223
8.2.4.	Landscapes for mental health and conservationists' roles	224
8.2.5.	The right to intervene for conservation	228
8.2.6.	Linking goal progress, optimism, and psychological distress	229
8.2.7.	Unanswered questions about conservation employment	231
8.2.8.	Integrating life-course theory	235
8.3.	COVID-19 impact statement	237
8.4.	Conclusion	239
9.	Bibliography	240
10.	Appendixes	280
10.1.	Chapter 1 Appendixes	280
10.2.	Chapter 2 Appendixes	284
10.3.	Chapter 3 Appendixes	295
10.4.	Chapter 4 Appendixes	334
10.5.	Chapter 5 Appendixes	372
10.6.	Chapter 6 Appendixes	391
10.7.	Chapter 7 Appendixes	416
10.8.	Chapter 8 Appendixes	424

Abstract

The role of natural systems in physical health is increasingly well documented. But, relationships between nature and mental illness – a leading cause of disease and a global public health priority – are comparatively poorly understood. Much of the evidence connecting these areas focuses on an important but limited set of linkages, such as the psychological benefits of green space exposure. Moreover, most of this research has concentrated on urban Global North populations, potentially poorly representing the experiences of the three billion people in the rural Global South. In this thesis, I aim to provide evidence of overlooked connections between nature, its conservation, and mental health. Chapters 2 and 3 combine qualitative interviews, scenario-based questionnaires, and statistical modelling to understand how local people in a rural Ugandan case study perceive the relationship between socio-ecological systems and their management and the social determinants of mental illness. Observational results suggest that commercial agricultural expansion is believed to benefit wealthier households but exacerbate poverty and food insecurity, and thus psychological distress among poorer ones. Equally, conserved forests reportedly have important safety net functions that appear to alleviate distress, but crop-raiding wildlife may indirectly exacerbate it. Furthermore, scenario and modelling analysis suggested that future expansion of commercial farming and tightening of conservation rules may increase depression risk among vulnerable groups. These findings highlight a risk that sustainable development policies and practices that restrict natural resource access may undermine progress toward mental health goals. Chapters 4 to 7 use self-reported data to explore conservationists' mental health, satisfaction with goal progress, and expectations about the future and discuss corresponding implications for collective conservation efforts. For example, many responding to my global internet survey emphasised the difficulties of making a living in the conservation sector. Moreover, one in four conservationists participating in this survey reported moderate or severe distress. Personal (e.g., gender and career stage) and workplace (e.g., being overworked or feelings of contributing to conservation) factors were important predictors of distress risk. There appears to be scope for better supporting conservationists' mental health and motivation, but further evidence, including from experimental

studies, is required to evaluate potential interventions. Nevertheless, this research suggests that failing to account for the mental health impacts of conservation and sustainable development policies might undermine global mental health efforts. Equally, it suggests important avenues that could be explored to simultaneously support mental health and nature conservation goals, such as improving conservationists' working conditions.

List of tables

Table 3.1. Four scenarios were presented to respondents, contrasting business-as-usual (BAU) scenarios against hypothetical changes in land management. Each respondent was randomly assigned one scenario.....	87
Table 3.2. The a priori hypothesised associations between exposure and outcome variables in the structural equation model (where the exposure variable is expected to affect the outcome variable, apart from the when they are expected to have a bi-directional association indicated by co-variance) and a description of the exposure variables. See <i>Appendix: A priori hypothesised linkages between nature and depression</i> for details for evidence supporting each prior. Key: ‘+’ = positive association; ‘-’ = negative association; ‘?’ = uncertain direction of the association; RL = reference level, <i>N</i> = normal distribution (where the first argument is the mean and the second is the variance), <i>B</i> = beta distribution (with the arguments indicating the first and second shape parameters). All continuous variables are scaled and centred.....	92
Table 3.3. Overall and gender-differentiated respondent characteristics. Numeric variables are described by their mean (and standard deviations). Categorical data are described by their counts (and percentages). Key: PHQ-8 = eight-item Patient Health Questionnaire, FIES = Food Insecurity Experience Scale, Alcohol consumption = how many days a week a respondent consumes alcohol.	96
Table 4.1. A priori hypothesised associations between satisfaction with progress towards individual and collective goals and individual and contextual characteristics. Key: (+) = expected positive association, (-) = negative association, and (?) = where the expected direction of association is unclear.	116
Table 4.2. The pre-defined individual and collective goals based on the value-belief-norm theory and its sub-dimensions and other literature (de Groot & Steg, 2007; Papworth et al., 2018; Stern, 2000; Stern et al., 1999). Individual goals correspond to egoistic values, and collective goals relate to biospheric and altruistic values (see <i>Appendix: Goals and goal progress</i>).	122
Table 5.1. A priori hypothesised associations between situational optimism about conservation outcomes and personal characteristics, indicators of the state of biodiversity and conservation at a national level, and other explanatory variables. Key: RL = reference level, (+) = positive association, (-) = negative association, (?) = unclear association.....	145
Table 5.2. Respondents’ selected characteristics. The region variable includes clusters of countries whose conservation context respondents said they were most familiar. LOTR, Life Orientation Test – Revised.....	148
Table 6.1. Personal characteristics and occupational risk factors expected to be associated with psychological distress in two models (see <i>Appendix: Hypothesised associations with psychological distress</i>). The ERI-score model includes the effort-reward imbalance score but excludes each item of the effort-reward imbalance instrument. The ERI-item model includes each item of the instrument but excludes the effort-reward imbalance score. * Variables moderately correlated with other explanatory variables ($\rho > 0.6$) were removed from the statistical analysis post-hoc. †Ordinal exogenous variables were treated as numeric. ‡Conservation-specific items added to the original effort-reward imbalance instrument. Key: RL = reference level, + = expected positive association, - = expected negative association, and ? = ambiguous or unclear expected association.	165
Table 6.2. Respondent characteristics by gender. Continuous variables are described with means (and standard deviations), and categorical variables are described with counts (and percentages).	

Key: LOTR = Life Orientation Test – Revised, ERI (original) = scores from the original effort-reward imbalance instrument, ERI (adapted) = scores from a modified effort-reward imbalance instrument that includes five new items specific to conservation. 171

Table 6.3. Ideas for employers to support staff mental health and wellbeing demonstrated through hypothetical but illustrative vignettes. See *Appendix: Detailed ideas for employers* for details, limitations and risks, links to resources, and a description of our approach to tailoring the Thriving at Work mental health core standards to the conservation sector (Stevenson & Farmer, 2017)... 180

Table 7.1. The a priori hypothesised associations between exposure and outcome variables in the Bayesian structural equation model and a description of the exposure variables. The priors are directly derived from Chapter 6 (see *Appendix: A priori hypothesised linkages position nature and distress* for details). Key: + = positive association, - = negative association, ? = uncertain direction of the association, RL = reference level, and *N* = normal distribution (where the first argument is the mean and the second is the variance). All continuous variables are scaled and centred. 195

Table 7.2. Respondent characteristics. Continuous variables are described with means (and standard deviations), and categorical variables are described with counts (and percentages). Unknown response levels are not shown. Key: LOTR = Life Orientation Test – Revised; ERI (original) = original effort-reward imbalance scores; ERI (adapted) = adapted effort-reward imbalance scores. 199

Table 8.1. Common actions, outcomes, and impacts in inclusive conservation interventions adapted from D. Wright (2021). 226

Table 10.1. The sampling effort in each community and respondents’ approximated age, gender, socio-economic status, and forest proximity. Socio-economic status was subjectively judged based on indicators suggested to us by the Local Council members, including the type of house construction, cooking and toilet facilities, presence of assets such as cars, chairs, and other visual cues. Key: TC = Trading Centre. 286

Table 10.2. Theme definitions. 290

Table 10.3. Household assets included (‘Yes’) or excluded (‘No’) in a logistic principle component analysis to construct an asset index, which was used as a proxy for economic poverty. 318

Table 10.4. Loadings within two-factor graded response model. Ten sets of plausible values of the first factor were extracted and used in the primary analysis. 319

Table 10.5. Loadings within two-factor graded response model. Ten sets of plausible values of the first factor were extracted and used in the primary analysis. 321

Table 10.6. The a priori hypothesised associations between exposure and outcome variables in the structural equation model, the distributional form and type of prior, the supporting evidence, and associated hyperparameters. Key: ‘+’ = positive association; ‘-’ = negative association; ‘?’ = uncertain direction of the association; *N* = normal distribution, and *B* = beta distribution. 322

Table 10.7. The results of an ordinal logistic regression examining the association between “*thinking too much*” and Patient Health Questionnaire (PHQ-8) scores on the log-odds scale. ... 332

Table 10.8. Sub-dimensions of the value-belief-norm theory and corresponding goals. Key: GP = goal progress. 350

Table 10.9. This table defines the key themes identified in the thematic analysis. These themes were identified through the thematic analysis of free-text responses provided by 426 participants that appeared to describe desired states or divergence from those states. The themes were nested into tiers, accompanied by a brief description of the theme and example quotes. Because these themes are nested, many of the examples provided below contribute evidence at multiple themes tiers. 355

Table 10.10. Personal characteristics and occupational risk factors expected to be associated with psychological distress in two models. The ERI-score model includes the effort-reward imbalance score but excludes each item of the effort-reward imbalance instrument. The ERI-item model includes each item of the instrument but excludes the effort-reward imbalance score. * Variables moderately correlated with other explanatory variables ($\rho > 0.6$) were removed from the statistical analysis post-hoc. †Ordinal exogenous variables were treated as numeric. ‡ Conservation-specific items added to the original effort-reward imbalance instrument. Key: RL = reference level; + = expected positive association; - = expected negative association; and ? = ambiguous or unclear expected association. 391

Table 10.11. Six statements describing collective conservation goal progress satisfaction developed based on sub-dimensions of the value-belief-norm theory (de Groot & Steg, 2007; Papworth et al., 2018). 404

Table 10.12. Ideas for employers for supporting staff mental health and wellbeing. 412

Table 10.13. Details of the a priori hypothesised associations between exposure and outcome variables in the Bayesian structural equation model. The black curve represents the prior probability distribution, the blue line represents the coefficient estimate, and the shaded area represents the 95% confidence intervals from the analysis in Chapter 6. 416

Table 10.14. Supplementary structural equation modelling analysis linking goal progress satisfaction, situational optimism, and psychological distress controlling for demographic characteristics among 2,306 conservationists. 424

List of figures

Figure 1.1. A high-level conceptual overview of linkages between nature and people that I explore in my DPhil. The green arrow (indirect link) shows how interacting with nature (green box) influences social determinants (orange box) of mental health (purple box) depending on psychobiological vulnerabilities. The blue arrow (direct link) suggests more direct relationships between people and nature. Finally, the brown arrow (feedback links) suggests how individuals' mental health can influence their interactions with nature.....	38
Figure 1.2. A conceptual model linking goal progress satisfaction, situational optimism, and psychological distress over time. Red lines indicate hypothesised negative associations, and green lines indicate hypothesised positive associations. Solid lines are statistically modelled in the thesis, while the semi-transparent dashed lines are not. Key: 'C. 4' = Chapter 4, 'C. 5' = Chapter 5, and 'C. 6' = Chapter 6.....	40
Figure 2.1. The direct and indirect ways that interacting with ecosystems could influence the risk of psychological distress, depending on an individual's psychobiological characteristics, within a socio-ecological system. The socio-ecological system includes multiple interacting elements; those of interest to a researcher, decision-maker, or other user are termed 'action situations.' The grey arrow signifies how social determinants such as socio-economic status can influence access to the direct psychological benefits of nature contact (see 1.3. Summary of conceptual framework and study systems).....	51
Figure 2.2. Panel a. describes the location of the study site within Uganda indicated by '+' (Esri, USGS, & NOAA, 2009). Panel b. describes the study area, which includes Nyabyeya Parish and its nine communities, the Budongo and Rwensama Forest Reserves, and the indicative location of large-scale commercial sugarcane estates (GADM, 2018; adapted from Kyongera, 2015; UNEP-WCMC & IUCN, 2020). Panel c. describes forest loss between 2000 and 2016 and forest cover (> 75% tree cover) in 2016 (adapted from Hansen et al., 2013). Key: TC = Trading Centre, FR = Forest Reserve.....	53
Figure 2.3. The reported experiences or symptoms of " <i>thinking too much</i> " (and other idioms of distress). The width of the lines illustrates the relative number of interviews that reported connections between nodes. The lines represent associations reported by interviewees but do not imply directional causality. The node size represents the number of interviews mentioning the associated theme for that node.	60
Figure 2.4. The reported sources of " <i>thinking too much</i> " and related idioms of distress. The width of the lines illustrates the relative number of interviews that reported connections between nodes. The lines represent associations reported by interviewees but do not imply directional causality. The node size represents the number of interviews mentioning the associated theme for that node.	61
Figure 2.5. Hypothesised causal connections between two socio-ecological action situations, social determinants and psychological distress.	68
Figure 3.1. Illustrating how interactions between people and nature co-produce contributions that affect social determinants of mental illness, depending on an individual's psychobiological vulnerabilities. Access is one factor that mediates the interaction between people and nature.	79
Figure 3.2. An illustration of the hypothesised links between farm sizes and forest use (proxies for nature's contributions), food insecurity and depression (social determinants) and depression risk (mental illness) in our case study site. Single-headed arrows describe correlations, and bi-directional arrows describe co-variance.....	83

Figure 3.3. Maps describing the study area. Panel a. describes the location of the study site within Uganda (marked with the '+'). Panel b. describes the study area, including the 11 study communities, the Budongo and Rwensama Forest Reserves, and the indicative location of large-scale intensive sugarcane estates (adapted from (Kyongera, 2015; UNEP-WCMC & IUCN, 2020)). Panel c. describes forest loss between 2000 and 2016 and forest cover (> 75% tree cover) in 2016 (adapted from (Hansen et al., 2013))..... 85

Figure 3.4. Scenario-based questionnaire responses to two forest access scenarios. Panel a. describes expected changes in the amount of food from forests over the next decade, panel b. shows reported reasons for this decline, and panel c. illustrates expected consequences for household hunger (among forest users). Panel d. shows expected changes in the amount of income-generating 'things' from the forest, panel e. describes the reported reasons for this decline, and panel f. displays the expected consequences for household poverty (among forest users). Key: BAU = business-as-usual. 98

Figure 3.5. Scenario-based questionnaire responses to two land access scenarios. Panel a. describes the proportion expecting changes in who has land over the next ten years, and panel b. and c. illustrate who is predicted to gain and lose land, respectively (among those expecting a change). Panel d. describes where this land is expected to come from, and panel e. displays what this land might be used for. Panel f. and g. illustrate the expected impacts of losing land on household poverty and hunger, respectively. *Where the chi-square test could not be formed because no respondents expected poorer households to gain land. Key: BAU = business-as-usual. 99

Figure 3.6. Bayesian structural equation modelling results. Panel a. describes the coefficient estimates from the Bayesian structural equation model using data from 695 respondents. The vertical green line represents the point estimate (median of the posterior distribution), the dark purple line represents the 95% credibility interval, and the shaded area represents the 50% credibility interval. The estimated associations between depressive symptom severity and the community dummy variables are not shown. Coefficient estimates are presented in standard deviations. Panel b. illustrates the direction of association between each variable (excluding covariates). The semi-opaque line indicates a marginally statistically uncertain association (as shown in Panel a.). Key: '~' = regression, '~~' = co-variance, 'RL' = reference level..... 101

Figure 4.1. (a) The percentage of respondents who said that ten individual and collective goals were important to them (the total number of respondents was 2694) and (b) the reported satisfaction with progress towards each goal. 127

Figure 4.2. The estimated associations between satisfaction with goal progress and each explanatory variable among 2,336 respondents. Points represent the mean of the posterior distribution, and bars indicate the 95% credibility intervals on the log-odds scale. Dispositional optimism, years in conservation, and work hours are scaled and centred. Thresholds, goal name, and response categories corresponding to missing data are not shown..... 129

Figure 5.1. A conceptual framework for the role of optimism in conservation (adapted from). The current study focuses on the associations described by the solid lines, where an individual's situational optimism is influenced by dispositional optimism and context. The dashed lines show possible associations not explored in the current chapter. Green lines indicate expected positive associations and red lines negative ones (the expected association described by the purple line depends on the indicator in question)..... 143

Figure 5.2. Expectations about conservation outcomes in the next ten years. The perceived likelihood that ten nationally-focused conservation outcomes indicative of the five Strategic Goals (A-E) of the Convention on Biological Diversity's Aichi Biodiversity Targets (SO-1 to SO-10), and locally-focused goals (SO-11), will be met by 2030 (CBD, 2010b). Respondents were asked to think about the country whose conservation context they were most familiar with when evaluating

the ten nationally-focused outcomes. Respondents were asked to think about the specific conservation area or context they were most familiar with when evaluating the locally-focused goals.	149
Figure 5.3. Predictors of situational optimism about conservation outcomes. The associations between nationally- and locally-focused situational optimism and (a) personal characteristics, (b) biodiversity state, conservation effort and focal environment, and (c) regional grouping variables. These estimates were derived from two structural equation models. Coefficients are in standardised units, meaning a one-unit change in continuous explanatory variables is associated with a given standard deviation (SD) change in the response variables, holding all other variables constant. Estimated uncertainty is presented in two-sided 95% confidence intervals. Levels representing unknown or other responses are not shown. Cross-cutting applies to those whose work encompasses terrestrial and marine biomes.	150
Figure 5.4. Dispositional optimism and some contextual factors are associated with situational optimism, but measures may mitigate or manage these associations.....	153
Figure 6.1. The estimated association in standard deviations (SD) between latent psychological distress and personal characteristics and occupational risk factors among 2306 respondents. The ERI-score model included the effort-reward imbalance score but excluded the individual instrument items, while the ERI-item model included these items but excluded the score. ‘SO ~ DO’ indicates the correlation between situational and dispositional optimism. Continuous variables were scaled and centred. ‘Unknown’ response levels are not shown.....	173
Figure 7.1. Hypothesised associations between workplace and personal characteristics and psychological distress (see Table 7.1 for details). Key: ERI = effort-reward imbalance, positive = positive association, negative = negative association, unknown = no hypothesised direction of association.	193
Figure 7.2. Bayesian structural equation modelling results. Panel a. describes the coefficient estimates from the Bayesian structural equation model using data from 280 respondents. Vertical blue lines represent point estimates (median of the posterior distribution), and curves represent the 95% credibility interval (equal-tailed). Coefficient estimates are presented in standard deviations. Estimates associated with “ <i>unknown</i> ” response levels are not shown. Panel b. illustrates the direction of association between each variable. The purple line indicates that organisation is a categorical variable; respondents in organisation two reported significantly lower distress than the reference level organisation, as shown in panel a.	201
Figure 7.3. Variation in responses to effort and reward questions between job positions. Labels include the results of Kruskal-Wallis tests evaluating differences in responses between job positions. Key: RC = reverse coding, adapted = the items added to the original effort-reward imbalance instrument.	203
Figure 8.1. How nature’s contributions, including the regulation of environmental processes (dark green) that support material and non-material contributions (light green) (IPBES, 2019), might directly and indirectly (through social determinants, orange) influence mental health (Patel, Saxena, et al., 2018).	215
Figure 10.1. Panel a. illustrates the reported causes of poverty and inadequate money. Panel b. illustrates reported factors affecting farm productivity (CFM = Community Forest Management, NFC = Nyabyeya Forestry College). Panel c. describes the reported causes of inadequate land. Panel d. illustrates the reported role of the sugarcane industry in displacing smallholder farming. Panel e. describes reported factors that contributed to household development. Panel f. illustrates the reported consequences of poverty and inadequate money.	292

Figure 10.2. Panel a. illustrates the reported causes of hunger and inadequate food. Panel b. describes reported factors causing crop losses. Panel c. shows the locations of interviews that report crop-raiding by wildlife (manually dislocated to retain anonymity). Panel d. illustrates the consequences of crop-raiding by wildlife, particularly among farmers bordering the Budongo and Rwensama Forest Reserves. Illustrates the reported consequences of experiencing hunger or inadequate food.	293
Figure 10.3. Panel a. illustrates the reported uses of the forest. Panel b. describes the risks associated with illegal activities in the forest.	294
Figure 10.4. Patterns of missing data within our data.	329
Figure 10.5. The coefficient estimates from the Bayesian structural equation model using data from 695 respondents. The vertical green line represents the point estimate (median of the posterior distribution), the dark purple line represents the 95% credibility interval, and the shaded area represents the 50% credibility interval. The estimated associations between depressive symptom severity and the community dummy variables are not shown. Coefficient estimates are presented in standard deviations.	333
Figure 10.6. The estimated associations between satisfaction with goal progress and each explanatory variable among 2022 respondents who said they worked or conducted research in conservation. Points represent the mean of the posterior distribution, and bars indicate the 95% credibility intervals on the log-odds scale. Dispositional optimism, years in conservation, and work hours are scaled and centred. Thresholds, ‘goal name’ and response categories corresponding to missing data are not shown.	334
Figure 10.7. The pattern of missing data within the dataset. Missing values among some categorical variables (excluding region) were assigned the category of unknown or other and are not shown as these were not treated as missing data within the multiple imputation.	351
Figure 10.8. Exploring how the inclusion of the COVID-19 dummy variable influences the estimated associations between satisfaction with goal progress and each explanatory variable among 2336 respondents. Points represent the mean of the posterior distribution, and bars indicate the 95% credibility intervals on the log-odds scale. Dispositional optimism, years in conservation, and work hours are scaled and centred. Thresholds, ‘goal name’ and response categories corresponding to missing data are not shown.	353
Figure 10.9. Exploring the associations between a dummy variable indicating if respondents worked over 40 hours and goal progress satisfaction among 2336 respondents. Points represent the mean of the posterior distribution, and bars indicate the 95% credibility intervals on the log-odds scale. Dispositional optimism and years in conservation are scaled and centred. Thresholds, ‘goal name’ and response categories corresponding to missing data are not shown.	369
Figure 10.10. Exploring how disaggregating the ‘collective’ goals into those relating to altruistic and biospheric values influences associations with the explanatory variables among 2336 respondents. Points represent the mean of the posterior distribution, and bars indicate the 95% credibility intervals on the log-odds scale. Dispositional optimism, years in conservation, and work hours are scaled and centred. Thresholds, ‘goal name’ and response categories corresponding to missing data are not shown.	370
Figure 10.11. The estimated associations between goal endorsement and each explanatory variable among 2336 respondents. Points represent the mean of the posterior distribution, and bars indicate the 95% credibility intervals on the log-odds scale. Dispositional optimism, years in conservation, and work hours are scaled and centred. Thresholds, ‘goal name’ and response categories corresponding to missing data are not shown.	371

Figure 10.12. The association between nationally- and locally-focused situational optimism and (a.) individual characteristics, (b) biodiversity state, conservation effort and focal environment, and (c) regional grouping variables among a more strictly defined sub-set of conservationists. Coefficients are in standardised units, meaning a one-unit change in continuous explanatory variables are associated with a given standard deviation (SD) change in the response variables. Estimate uncertainty is presented in 95% confidence intervals. Levels representing unknown or other responses are not shown..... 372

Figure 10.13. The structure of the structural equation models, excluding the regression relationships with the explanatory variables. Coefficients are in standardised units, meaning a one-unit change in continuous explanatory variables are associated with a given standard deviation change in the response variables. SO = nationally-focused situational optimism (panel a.), SO-11 = locally-focused situational optimism (panel b.), and DO = dispositional optimism. Estimate uncertainty is presented according to p-values, where * = p-value < 0.05, ** = p-value < 0.01, and *** = p-value < 0.001. 375

Figure 10.14. The pattern of missing data within the dataset. Missing values among some categorical variables were assigned the category of unknown or other, and are not shown as these were not treated as missing data within the multiple imputation. 377

Figure 10.15. The association between nationally- and locally-focused situational optimism and (a.) individual characteristics, (b) biodiversity state, conservation effort and focal environment, and (c) regional grouping variables among a subset of responses with no missing data. Coefficients are in standardised units, meaning a one-unit change in continuous explanatory variables are associated with a given standard deviation (SD) change in the response variables. Estimate uncertainty is presented in 95% confidence intervals. 378

Figure 10.16. The association between nationally- and locally-focused situational optimism and (a.) individual characteristics, including if the survey was taken during the COVID-19 pandemic, (b) biodiversity state, conservation effort and focal environment, and (c) regional grouping variables. Coefficients are in standardised units, meaning a one-unit change in continuous explanatory variables are associated with a given standard deviation (SD) change in the response variables. Estimate uncertainty is presented in 95% confidence intervals. Levels representing unknown or other responses are not shown..... 379

Figure 10.17. The association nationally- and locally-focused situational optimism and (a.) individual characteristics, (b) projected biodiversity state in, conservation effort and focal environment, and (c) regional grouping variables. Coefficients are in standardised units, meaning a one-unit change in continuous explanatory variables are associated with a given standard deviation (SD) change in the response variables. Estimate uncertainty is presented in 95% confidence intervals. Levels representing unknown or other responses are not shown. 380

Figure 10.18. The association between age and years in conservation (both scaled and centred), with a regression line (blue) and 95% confidence intervals (light blue). 381

Figure 10.19. The association between nationally- and locally-focused situational optimism and (a.) individual characteristics including age, (b) biodiversity state, conservation effort and focal environment, and (c) regional grouping variables among a more strictly defined sub-set of conservationists. Coefficients are in standardised units, meaning a one-unit change in continuous explanatory variables are associated with a given standard deviation (SD) change in the response variables. Estimate uncertainty is presented in 95% confidence intervals. Levels representing unknown or other responses are not shown..... 382

Figure 10.20. The association between nationally- and locally-focused situational optimism and (a.) individual characteristics, (b) biodiversity state, conservation effort and focal environment, and (c) regional grouping variables, when including more strictly protected areas. Coefficients are in

standardised units, meaning a one-unit change in continuous explanatory variables are associated with a given standard deviation (SD) change in the response variables. Estimate uncertainty is presented in 95% confidence intervals. Levels representing unknown or other responses are not shown.	383
Figure 10.21. The association between nationally- and locally-focused situational optimism and (a.) individual characteristics, (b) biodiversity state, conservation effort and focal environment, and (c) regional grouping variables, when including un-categorised protected areas. Coefficients are in standardised units, meaning a one-unit change in continuous explanatory variables are associated with a given standard deviation (SD) change in the response variables. Estimate uncertainty is presented in 95% confidence intervals. Levels representing unknown or other responses are not shown.	384
Figure 10.22. The association between nationally- and locally-focused situational optimism and (a.) individual characteristics, (b) biodiversity state, conservation effort and focal environment, (c) threats to biodiversity, and (d) regional grouping variables. Coefficients are in standardised units, meaning a one-unit change in continuous explanatory variables are associated with a given standard deviation (SD) change in the response variables. Estimate uncertainty is presented in 95% confidence intervals. Levels representing unknown or other responses are not shown.	386
Figure 10.23. The association between nationally- and locally-focused situational optimism and (a.) individual characteristics and (b) biodiversity state, conservation effort and focal environment among respondents familiar with conservation in Europe and North America (N = 886). In addition, the association between situational optimism and (c.) individual characteristics and (d) biodiversity state, conservation effort and focal environment among respondents familiar with conservation in Sub-Saharan Africa (N = 474). Coefficients are in standardised units. Estimate uncertainty is presented in 95% confidence intervals.	388
Figure 10.24. Nationally-focused situational optimism (scaled and centred) in the country whose conservation context respondents were most familiar.	389
Figure 10.25. Latent dispositional optimism factor scores (scaled and centred) in the country whose conservation context respondents were most familiar.	389
Figure 10.26. The estimated association in standard deviations (SD) between latent psychological distress and personal characteristics and occupational risk factors among 2017 respondents. This analysis was implemented with those who said they currently worked in conservation. The ERI-score model included the effort-reward imbalance score but excluded the individual instrument items, while the ERI-item model included these items but excluded the score. Continuous variables were scaled and centred. 'Unknown' response levels are not shown.....	396
Figure 10.27.	399
Figure 10.28. Illustrating which observations are missing.....	400
Figure 10.29. The estimated association in standard deviations (SD) between latent psychological distress and personal characteristics and occupational risk factors among 2306 respondents. Dispositional optimism was removed from the analysis. ERI-score model included the effort-reward imbalance score but excluded the individual instrument items, while the ERI-item model included these items but excluded the score. Continuous variables were scaled and centred. 'Unknown' response levels are not shown.....	403
Figure 10.30. The estimated association in standard deviations (SD) between latent psychological distress and personal characteristics and occupational risk factors among 2,306 respondents. Situational optimism was replaced with a measure of respondents' satisfaction with collective conservation goal progress. ERI-score model included the effort-reward imbalance score but excluded the individual instrument items, while the ERI-item model included these items but	

excluded the score. Continuous variables were scaled and centred. ‘Unknown’ response levels are not shown.	405
Figure 10.31. The estimated association in standard deviations (SD) between latent psychological distress and personal characteristics and occupational risk factors among 2,306 respondents. Years in conservation was replaced with age. The ERI-score model included the effort-reward imbalance score but excluded the individual instrument items, while the ERI-item model included these items but excluded the score. Continuous variables were scaled and centred. ‘Unknown’ response levels are not shown.	406
Figure 10.32. The estimated association in standard deviations (SD) between latent psychological distress and personal characteristics and occupational risk factors among 2,306 respondents. Both age and years in conservation were included in this analysis. The ERI-score model included the effort-reward imbalance score but excluded the individual instrument items, while the ERI-item model included these items but excluded the score. Continuous variables were scaled and centred. ‘Unknown’ response levels are not shown.....	407
Figure 10.33. The estimated association in standard deviations (SD) between latent psychological distress and personal characteristics and occupational risk factors among 1,208 women respondents. The ERI-score model included the effort-reward imbalance score but excluded the individual instrument items, while the ERI-item model included these items but excluded the score. Continuous variables were scaled and centred. ‘Unknown’ response levels are not shown.....	408
Figure 10.34. The estimated association in standard deviations (SD) between latent psychological distress and personal characteristics and occupational risk factors among 969 men respondents. The ERI-score model included the effort-reward imbalance score but excluded the individual instrument items, while the ERI-item model included these items but excluded the score. Continuous variables were scaled and centred. ‘Unknown’ response levels are not shown.....	409
Figure 10.35. The estimated association in standard deviations (SD) between latent psychological distress and personal characteristics and occupational risk factors among 2,306 respondents, within the inclusion of a dummy variable indicating if the participant responded to the survey before (prior to 1 st January 2020) or after the start of the COVID-19 pandemic. Continuous variables were scaled and centred. ‘Unknown’ response levels are not shown.	410
Figure 10.36. The coefficient estimates from the Bayesian structural equation model using data from 278 respondents (two respondents were excluded because they did not provide sufficient data to calculate the original effort-reward imbalance scores). Vertical blue lines represent point estimates (median of the posterior distribution), and curves represent the 95% credibility interval. Coefficient estimates are presented in standard deviations. Estimates associated with “ <i>unknown</i> ” response levels are not shown.	420
Figure 10.37. Patterns of missing data for the variables used in the analysis.	421
Figure 10.38. The coefficient estimates from the Bayesian structural equation fitted with the software’s default diffuse priors using data from 280 respondents. Vertical blue lines represent point estimates (median of the posterior distribution), and curves represent the 95% credibility interval (quantiles). Coefficient estimates are presented in standard deviations. Estimates associated with “ <i>unknown</i> ” response levels are not shown.....	423

List of acronyms and abbreviations

BAU	Business as usual
CASCADE	Conservation and Sustainability Consortium of Academic Institutions
CBD	Convention on Biological Diversity
CFI	Comparative fit index
CFM	Community Forest Management
CI	Credibility interval
CIPD	Chartered Institute of Personnel and Development
COVID-19	SARS-CoV-2 (2019-nCoV) coronavirus
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition
DO	Dispositional optimism
ERI	Effort-reward imbalance
FIES	Food Insecurity Experience Scale
FR	Forest reserve
GP	Goal progress
GPS	Goal progress satisfaction
HIV/AIDS	Human immunodeficiency virus / acquired immunodeficiency syndrome
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IUCN	International Union for Conservation of Nature
Kessler-10	Ten-item Kessler Psychological Distress Scale
Kessler-6	Six-item Kessler Psychological Distress Scale
LOTR	Life Orientation Test – Revised
MSPSS	Multidimensional Scale of Perceived Social Support
NFC	Nyabyeya Forestry College
PHQ-8	Patient Health Questionnaire-8
PHQ-9	Patient Health Questionnaire-9
RC	Reverse coding
REDD+	Reducing emissions from deforestation and forest degradation
RL	Reference level
RMSEA	Root mean square error of approximation
SD	Standard deviation
SDG	Sustainable Development Goals
SESF	Socio-ecological systems framework
SMART	Specific, measurable, achievable, relevant, time-bound
SO	Situational optimism
SRMR	Standardised root mean square residual
TC	Trading Centre
TLI	Tucker–Lewis index
TWAS	The World Academy of Sciences
UN	United Nations
WAMBS-Checklist	When to worry and how to Avoid the Misuse of Bayesian Statistics Checklist
WHO	World Health Organization
WWF	World Wide Fund for Nature

1. Introduction

1.1. Problem statement

Nature underpins diverse aspects of human health and wellbeing (IPBES, 2019). Yet, the natural world is being changed in unprecedented ways, presenting new and serious threats to human health (Whitmee et al., 2015). Many of these threats remain poorly understood, hampering efforts to manage social and ecological systems for the long-term health of people and nature.

Nature has been defined in many ways (Ducarme & Couvet, 2020). Here, it is understood as “*the nonhuman world, including coproduced features, with particular emphasis on living organisms, their diversity, their interactions among themselves and with their abiotic environment*” (IPBES, 2019). Biodiversity exists within nature, described as the “*variability among living organisms from all sources [...] and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems*” (UN, 1992). Furthermore, ecosystems have been defined as a “*dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit*” (UN, 1992).

Nature’s contributions are the benefits and costs produced through interactions between people and nature that underpin diverse aspects of human wellbeing (Diaz, Demissew, Joly, Lonsdale, & Larigauderie, 2015; Reid et al., 2005). The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) identifies 18 categories of nature’s contributions to people (IPBES, 2019). These include material and non-material contributions, such as food, materials, or artistic inspiration. For example, animals pollinate over 75% of globally important food crops (Klein et al., 2007), over two billion people rely on wood fuel for energy (Schiermeier, Tollefson, Scully, Witze, & Morton, 2008), and aquatic foods provide essential nutrients for millions globally (Golden et al., 2021).

However, nature and its contributions to people are globally threatened. Land-use change, overexploitation, climate change, pollution, and invasive species represent the greatest direct

threats to nature globally (Cardinale et al., 2012; Maxwell, Fuller, Brooks, & Watson, 2016). These direct threats emerge from indirect sociocultural, political, economic, demographic and other drivers (Díaz et al., 2015). These threats have contributed to unprecedented rates of nature loss worldwide. For instance, average vertebrate species extinction rates are 8 to 100 times higher than background levels (Ceballos et al., 2015), with around 25% of assessed animal and plant species threatened with extinction (IUCN, 2020a). Around 7% of intact forests were lost between 2000 and 2013 (Potapov et al., 2017), and over half of assessed wetlands have been lost since 1700 (Davidson, 2014). These losses have resulted in widespread declines in nature's capacity to support human wellbeing. For example, IPBES estimated that nature's capacity to support 14 of the 18 categories of contribution is declining (IPBES, 2019).

Several overlapping global policy frameworks seek to address this global biodiversity crisis. The United Nations Convention on Biological Diversity (CBD) was signed by the United Nations (UN) in Rio de Janeiro in 1992 (UN, 1992). The CBD envisions that *“biodiversity is valued, conserved, restored and wisely used [...] sustaining a healthy planet and delivering benefits essential for all people”* by 2050 (CBD, 2010b). In support of this vision, governments are expected to agree on a post-2020 global biodiversity framework in Kunming, China, in May 2022. This framework is anticipated to include goals to support ecosystem integrity, maintain and enhance nature's contributions, ensure equitable benefit sharing from nature, and mainstream biodiversity into sustainable development policies and planning (CBD, 2021). Complementing this framework is the International Treaty on Plant Genetic Resources for Food and Agriculture (FAO, 2009). The Treaty includes goals to conserve and sustain genetic resources, including wildlife, that contribute to food systems. Furthermore, the UN 2030 sustainable development agenda includes 17 goals to ensure long-term human wellbeing (UN, 2015). These Sustainable Development Goals (SDG) include those directly focused on human wellbeing, such as ending poverty (SDG 1) and hunger (SDG 2) and ensuring health for all (SDG 3). They also include goals to protect the biosphere and its ability to support humanity into the future, such as protecting life on land (SDG 15) and below water (SDG 14) (UN, 2015).

However, progress towards the visions outlined in these frameworks has been inadequate. None of the CBD's key conservation targets – including the recently expired 2020 Aichi Biodiversity Targets – were fully met in the last two decades (CBD, 2010a; CBD, 2020b). Although there has been progress towards some SDGs, many are expected to be missed by 2030, partly because of the COVID-19 global pandemic. For instance, 7% of people globally are expected to still be living in poverty by 2030 (UN, 2021). Overall, these trends suggest that the global biodiversity crisis, combined with the impacts of climate change, threatens to undermine recent advances in human wellbeing (Whitmee et al., 2015).

Human wellbeing is multi-dimensional and can be evaluated using subjective and objective measures of a person's quality of life (Woodhouse et al., 2015). The World Bank Voices of the Poor initiative synthesised research among 20,000 poor women and men from 23 countries to understand their experiences of wellbeing and illbeing (Narayan, Chambers, Shah, & Petesch, 2000). They identified a broad range of wellbeing dimensions related to material conditions, social relations, feelings of security and agency, and health (Narayan et al., 2000). The World Health Organisation (WHO) defines health as a “*state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity*” (WHO, 1946). Although this definition has been criticised as having an unrealistic emphasis on “*complete*” wellbeing (Huber et al., 2011), it remains widely accepted and used.

Growing evidence illustrates the health threats posed by the global biodiversity crisis (Whitmee et al., 2015). For example, dense forest loss between 2005 and 2014 was associated with a higher incidence of diarrhoea among a study of 35,547 Cambodian children (Pienkowski, Dickens, Sun, & Carrasco, 2017). Habitat changes have been linked to increased malaria transmission in the Brazilian Amazon (MacDonald & Mordecai, 2019). Multiple zoonotic diseases have emerged at the human-wildlife-livestock interface (K. E. Jones et al., 2008; Wolfe, Dunavan, & Diamond, 2007). Declining fish catches may worsen micronutrient deficiencies in many parts of the world (Golden et al., 2016). In light of these and other examples, the fields of Planetary Health, EcoHealth, and One Health have emerged to explore, document, and catalyse action to address the

health impacts of environmental change (Lerner & Berg, 2017). For example, a seminal report by The Rockefeller Foundation–Lancet Commission on planetary health states that *“far-reaching changes to the structure and function of the Earth’s natural systems represent a growing threat to human health”* (Whitmee et al., 2015). However, much of this research focuses on physical or non-specific health threats associated with nature loss. Arguably, comparatively less attention has been paid to the mental health consequences of nature loss. For example, among 1,910 articles mentioning nature loss and human health (or related terms) in their title or abstract, only 1.3% explicitly included terms associated with mental health or common mental disorders (see *Appendix: Nature and mental health literature search*).

Mental health has been defined as *“a state of wellbeing in which the individual realises [their] own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to [their] community”* (WHO, 2004a). Mental wellbeing is a related concept and has been defined as *“the psychological, cognitive and emotional quality of a person’s life. This includes the thoughts and feelings that individuals have about the state of their life, and a person’s experience of happiness”* (Linton, Dieppe, & Medina-Lara, 2016). Mental health and mental wellbeing are sometimes used interchangeably in literature exploring relations between nature and mental health (de Vries & Snep, 2019). I refer to mental wellbeing where necessary but primarily focus on mental health and illness.

Mental illness has been defined as a disturbance of *“thought, emotion, behaviour, and relationships with others that lead to substantial suffering and functional impairment”* in major life activities (Patel, Saxena, et al., 2018). Stage-based models of mental illness suggest a continuum from mental health, to non-specific and low-level psychological distress, to increasingly severe and specific symptoms used in formal diagnosis (McGorry et al., 2014; McGorry & van Os, 2013). Psychological distress – a state of emotional disturbance that impairs day-to-day activities and social functioning – is typically experienced in increasing intensity across these stages (Drapeau, Marchand, & Beaulieu-Prvost, 2012; Payton, 2009). However, it is not a mental disorder (Drapeau et al., 2012). Moreover, an individual’s risk of mental illness is influenced by multiple

biological and environmental factors (Tsuang, Bar, Stone, & Faraone, 2004), including the external stressors experienced over their life course (Koenen, Rudenstine, Susser, & Galea, 2013; Patel, Saxena, et al., 2018). These stressors can relate to the social, economic, demographic, environmental, and cultural pressures, collectively termed *social determinants* in public health research (Lund et al., 2018).

Mental illness is a leading cause of disease and disability globally. Anxiety and depressive disorders were among the top 25 causes of disease burden globally in 2019 (GBD 2019 Diseases and Injuries Collaborators, 2020). The Global Burden of Disease estimates that mental disorders contributed 15% of total years lived with disability in 2019 (IHME, 2021). Others suggest this burden is higher, estimating that mental, neurological, and substance use disorders and self-harm accounted for 32.4% of years lived with disability globally in 2015 (Vigo, Thornicroft, & Atun, 2016). Moreover, evidence suggests the rates of common mental disorders have increased during the COVID-19 pandemic (Santomauro et al., 2021). Despite the substantial burden of mental illness, mental health has been neglected within public health policy and spending (Kleinman, 2009). For instance, only around 2% of government health spending was directed to mental healthcare on average across assessed countries in 2015 (Vigo, Kestel, Pendakur, Thornicroft, & Atun, 2019). A survey of 84,850 adults from 17 countries found that the proportion with mood, anxiety or substance use disorders who accessed mental health services (in the past 12 months) ranged from 1.6% in Nigeria to 17.9% in the United States of America (P. S. Wang et al., 2007). Recognising these disparities, a Global Mental Health movement has emerged over the past two decades and has successfully raised the profile of mental health as an international priority (Patel & Prince, 2010). For example, there was no explicit reference to mental health in the 2015 Millennium Development Goals. In contrast, the 2030 SDGs contain three Targets (3.4., 3.5., and 3.8) that directly and indirectly aim to improve mental health worldwide (UN, 2015). This inclusion is partly a result of the efforts of the Global Mental Health movement (Patel, Saxena, et al., 2018).

The potential role of nature in mental health perhaps remains underappreciated within global mental health research and other spheres. For example, the Lancet Commission on Global Mental Health and Sustainable Development report highlights the psychological impacts of climate change but not the global biodiversity crisis (Patel, Saxena, et al., 2018). Evidence linking nature, its conservation, and mental health is growing. However, the following identifies several areas where this evidence appears incomplete or absent.

1.1.1. Literature review and gaps

1.1.1.1. Frequently discussed linkages

A large body of research explores the relationships between nature and mental health. Here, I examine some of the most frequently cited linkages (e.g., Bratman et al., 2019; Romanelli et al., 2015; WHO, 2021b). These relate to the: 1) direct psychological benefits of nature exposure, 2) indirect role of ecosystem services in social determinants of mental health, 3) ecological grief and related concepts, and 4) place-based relationships with the natural world. I conclude by defining one of the literature gaps targeted in my thesis: how nature's contributions can influence livelihood-related social determinants of mental illness.

One increasingly well-studied linkage relates to the psychological benefits of green and blue space exposure (R. M. Collins et al., 2020; Twohig-Bennett & Jones, 2018). This linkage suggests that people's direct sensory interactions with nature can promote positive psychological states or mental wellbeing and health (Bratman, Daily, Levy, & Gross, 2015). A large body of evidence finds positive links between nature exposure and positive psychological outcomes. Some of this evidence comes from observational studies. In a recent systematic map of 276 studies linking greenspace to mental health or wellbeing indicators, 152 were from observational studies (including 20 that used longitudinal methods) (R. M. Collins et al., 2020). For example, a study among 16,307 respondents in 18 countries found that the frequency of visits to green and blue spaces was positively associated with self-reported mental wellbeing and negatively associated with "*mental distress*" (M. P. White et al., 2021). Yet, such observational studies are vulnerable to issues such as confounding by socio-economic and demographic factors (Kabisch, 2019). So, other

studies use experimental methods to explore links between nature exposure and indicators of mental health or wellbeing, such as among 124 experimental studies identified in the aforementioned systematic review (R. M. Collins et al., 2020). For example, a recent study exposed participants to videos containing high or low tree or bird species richness, who responded to self-reported indicators of positive (vitality, positive affect) and negative (anxiety) psychological states (Wolf, Zu Ermgassen, Balmford, White, & Weinstein, 2017). The study found that those who watched videos with greater species richness reported more positive psychological states than those exposed to less species richness. Multiple frameworks have been proposed to explain these observed relationships. Marselle (2019) highlight several key frameworks, including the Biophilia hypothesis, stress reduction theory, attention restoration theory, and the ecosystem service cascade model.

Biophilia is the “*innately emotional affiliation of human beings to other living organisms*” (Kellert & Wilson, 1993). Within the Biophilia hypothesis, people seek contact with natural landscapes and species, which supposedly elicits positive psychological responses. Evidence for this hypothesis tends to come from studies exploring people’s preference for more biodiverse areas (Johansson, Gyllin, Witzell, & Küller, 2014). The Biophilia hypothesis is sometimes presented as an overarching concept in which stress reduction theory and attention restoration theory are situated rather than a mechanism in its own right (Jimenez et al., 2021).

Within stress reduction theory, individuals are expected to encounter stress in their everyday lives (R. S. Ulrich et al., 1991). Cumulative stress over time may cause distress and poor health (Hartig et al., 2011). However, the visual characteristic of natural environments (e.g., moderate levels of complexity from species diversity) are expected to yield positive emotional responses that may alleviate stress (Hartig & Evans, 1993). There appears to be some evidence supporting the stress reduction theory. For example, Yao, Zhang, and Gong (2021) conducted a meta-analysis of 31 before-after studies, of which 23 used randomised treatments. This analysis found significant reductions in some indicators of negative psychological states, including salivary cortisol, and self-

reported anxiety and stress, following nature exposure. However, Marselle (2019) cites several studies providing inconclusive evidence supporting stress reduction theory.

In attention restoration theory, directed attention influences people's ability to plan, solve problems, process information, fulfil tasks, and perform other activities (S. Kaplan, 1995).

However, R. Kaplan and Kaplan (1989) argue that the ability to direct attention is limited and can become fatigued, impairing the ability to perform activities. Environments with engaging features allow for "*effortless attention*", which supposedly alleviates direct attention fatigue (R. Kaplan, 1984). It has been proposed that attention restoration can play a role in stress reduction and, conceivably, mental health and wellbeing (e.g., Berto, 2014; Marselle, 2019). There appears to be some empirical support that exposure to nature might restore directed attention (though I did not find any studies that tested subsequent implications for mental health, as defined above). For example, meta-analyses among 31 studies found that people's ability to repeat numbers forward and backwards or connect sets of dots improved compared to controls following direct nature exposure (Ohly et al., 2016).

The ecosystem service cascade model was first proposed by Haines-Young and Potschin (2010) and later developed by others, eventually becoming a core framework for ecosystem service research (Heink & Jax, 2019). Within this framework, biophysical structures and processes (e.g., biomass growth) support ecosystem functions (e.g., macronutrient sequestration) that deliver services (e.g., enhancing water quality), which benefit people (e.g., access to potable water) and ultimately supporting wellbeing (e.g., reduced diarrheal disease). Sandifer, Sutton-Grier, and Ward (2015), Bratman et al. (2019), and others use the ecosystem service framework to connect nature to multiple aspects of health, including mental health. These authors largely focus on the direct psychological benefits of nature exposure. However, the ecosystem service cascade model may also be used to understand indirect links between nature and mental health, discussed below.

While there is good evidence of the direct psychological benefits of nature exposure, the exact mechanisms remain uncertain (Barnes et al., 2019). For example, many studies do not use methods that distinguish between mechanisms proposed in the above frameworks. Furthermore, it remains

unclear precisely what characteristics of green spaces are associated with positive outcomes. For example, in an extensive review of relevant literature, Marselle, Martens, Dallimer, and Irvine (2019) suggests that the relationship between biodiversity and mental health remains unclear. Additionally, many studies in this field use self-reported mental health or wellbeing measures. For example, although the precise number is not provided, most of the 263 studies included in a review of literature on green spaces and mental health used self-reported instruments (Wendelboe-Nelson, Kelly, Kennedy, & Cherrie, 2019). A range of non-self-reported measures was also used, including salivary cortisol, salivary alpha-amylase, blood pressure, and respiration rate. However, these measures are perhaps more likely to reflect transient psychological states such as stress levels (though even this is contestable) rather than mental health as defined above. In general, there are no widely agreed-upon biomarkers for mental illness or health in psychiatric research (Mahmood, 2020; J. Marsh, 2016; Munkholm, 2021; Peterson, 2020; Yuan, Chen, Xia, Dai, & Liu, 2019).

The frameworks presented above largely describe the direct psychological benefits of nature exposure. However, natural areas may also play more indirect roles in mental health. For example, natural areas provide space for exercise, which has well-evidenced mental health benefits (Mikkelsen, Stojanovska, Polenakovic, Bosevski, & Apostolopoulos, 2017; Morres et al., 2019). Some evidence suggests that the combined effects of nature exposure and exercise may be particularly beneficial (Barton & Pretty, 2010; H. Li, Zhang, Bi, Cao, & Zhang, 2022). Similarly, natural areas or engagement in nature-based care interventions might facilitate social interactions that support mental health (Steigen, Eriksson, Kogstad, & Bergh, 2022). Natural areas can also provide cultural ecosystem services, which some suggest might play roles in mental health and wellbeing (e.g., Bryce et al., 2016; Nawrath, Elsey, & Dallimer, 2022; O'Brien et al., 2017), though robust empirical evidence of this appears to be lacking. Equally, urban greenspaces might ameliorate other environmental stressors such as noise, air pollution, and heat (Dzhambov & Dimitrova, 2015; Oliveira, Andrade, & Vaz, 2011; Selmi et al., 2016), through consequences for mental health and wellbeing remain uncertain. For example, one observational study evaluated whether biodiversity mediated the relationship between noise and air pollution and indicators of

mental wellbeing among 282 urban residents in the United Kingdom (J. C. Fisher et al., 2022). However, neither actual nor perceived biodiversity had a mediation effect, through increased flowering plant richness was associated with mental wellbeing. This evidence could be situated within the framework I suggest in my thesis, where nature's contributions affect social determinants of mental health.

Furthermore, multiple studies document unequal access and exposure to green and blue spaces (Heynen, Perkins, & Roy, 2006; Mushangwe, Astell-Burt, Steel, & Feng, 2021; J. Roe, Aspinall, & Ward Thompson, 2016; Vaughan et al., 2013). For example, one study of 10,780 residents in the United Kingdom found that access to nature varied between ethnic and socio-economic groups (Dadvand et al., 2014). Enhancing access to green spaces among disadvantaged or marginalised groups has been proposed as a tool for addressing mental health inequalities (McEachan et al., 2016; Mitchell, Richardson, Shortt, & Pearce, 2015).

Another set of increasingly well-understood linkages relates to people's experiences of eco-anxiety, climate anxiety, solastalgia, ecological grief, and related concepts (Hickman, 2020). This group of concepts broadly relates to negative psychological outcomes from witnessing – directly or indirectly through media and discourse – nature loss and climate change. There exist multiple overlapping definitions of these different terms (Hickman, 2020). For example, Clayton, Manning, Krygsman, and Speiser (2017) define eco-anxiety as a “*chronic fear of environmental doom*”. Cunsolo and Ellis (2018) describe ecological grief as “*the grief felt in relation to experienced or anticipated ecological losses, including the loss of species, ecosystems and meaningful landscapes due to acute or chronic environmental change*”. Moreover, as yet, there appears to be no widely accepted framework for understanding these related concepts. However, there are several commonly mentioned themes. First, these negative emotions are often discussed as an expected or “*healthy response*” to the loss of nature (Cunsolo, Harper, et al., 2020). As such, it should not be considered a mental illness or disorder. Second, some consider these reactions to be the consequence of innate biophilia that people supposedly hold (Albrecht, 2022; Usher, Durkin, & Bhullar, 2019). Finally, Hickman (2020) argues that eco-anxiety and related concepts are not only

an emotional response to the environmental crisis but arise from the knowledge that humans are both causing and failing to address this crisis. Eco-anxiety may be a common phenomenon. For example, in a recent study among 10,000 young people (aged 16-25) in ten countries, 59% said they were very or extremely worried about climate change (Hickman et al., 2021). However, there appears to be limited empirical evidence of the scale or severity of these experiences. Much of the available evidence comes from observational qualitative and quantitative studies, including those cited above.

Furthermore, other research explores how environmental change can alter place-based relationships and lifestyles in ways that affect mental health. For instance, several studies describe how climate change has disrupted Canadian Inuit communities' cultural identity, wild-harvesting practices, and other activities in ways that may threaten their mental health (Cunsolo, Borish, et al., 2020; Cunsolo Willox, Harper, Edge, et al., 2013; Cunsolo Willox, Harper, Ford, et al., 2013; Cunsolo Willox et al., 2012). Another study among Australian farmers found that climate change exacerbated concerns about adverse weather and perceived risks of depression and suicide (N. R. Ellis & Albrecht, 2017). However, these studies tend to focus on the impacts of climate change rather than the links between ecological systems and mental health. Additionally, this research is primarily based on observational qualitative case studies in a relatively limited set of geographical locations. Furthermore, these studies provide important insights into locally-appropriate conceptions of mental health and illness but do not use standardised instruments for measuring mental illness. So, while this research provides a rich understanding of dynamics within specific places, the results may not be generalisable.

Much of the research linking nature and mental health focuses on beneficial relationships. For example, many studies explore the psychologically beneficial effects of nature exposure (e.g., Barnes et al., 2019; Frumkin et al., 2017; Markevych et al., 2017; Sandifer et al., 2015; M. P. White, Elliott, Gascon, Roberts, & Fleming, 2020). However, there are many cases where interacting with nature may be detrimental to mental health. For example, many articles recognise that natural areas can also be a source of negative feelings, such as from fear of crime or wildlife

(Olivos-Jara, Segura-Fernández, Rubio-Pérez, & Felipe-García, 2020; Sreetheran & van den Bosch, 2014; R. Ulrich, 1993). Several studies in rural India illustrate how traumatic human-wildlife conflicts can harm the mental health of people and their families (Barua, Bhagwat, & Jadhav, 2013; Chowdhury, Mondal, Brahma, & Biswas, 2008, 2016; Jadhav & Barua, 2012). In some cases, these undesirable outcomes may emerge through complex socio-ecological processes, such as increased proximity between people and wildlife.

Across these linkages, there are several main ways that people interact with nature. Much of the evidence describing the direct psychological benefits of nature exposure focus on people's sensory exposure nature. This includes being physically situated in or near nature, either intentionally, like when visiting green spaces (e.g., M. P. White et al., 2021), or incidentally, such as when living close to natural areas (e.g., D. T. C. Cox et al., 2017). It also included more indirect exposure to nature, such as when being shown images and videos in experimental settings (e.g., Wolf et al., 2017). Furthermore, emerging research explores how nature influences some social determinants of mental wellbeing and health, including environmental stressors, exercise and physical health, and social relations. Other research focuses on how people interact with the concept of nature and its loss. For example, how ecological grief emerges from reading about, viewing through media, or discussing ecological degradation (e.g., Hickman, 2020). Other research focuses on the relational interactions between people and nature, such as the role of place-based relationships in identity (Cunsolo Willox, Harper, Edge, et al., 2013).

There appear to be two main gaps in the types of linkages explored in existing literature, which I seek to help address in this thesis. First, some research explores how interacting with nature influences some social determinants of mental health, such as alleviating urban environmental stressors. However, little research examines social determinants related to the material conditions of people's lives, despite these being significant predictors of mental health (e.g., Lund et al., 2010). Second, much of this research examines people's non-use interactions with nature. However, nature's direct material contributions, like food, fuel, materials, and other products, play crucial roles in people's lives worldwide (IPBES, 2019), particularly in low-income settings

(Fedele, Donatti, Bornacelly, & Hole, 2021). One exception comes from a study of how the collapse in Atlantic Cod fisheries led to a loss of livelihoods, which appeared to be a significant and chronic source of distress among affected fishers (Scyphers, Picou, & Grabowski, 2019).

1.1.1.2. Geographical representativeness of evidence

Many studies exploring the psychological benefits of nature exposure come from the Global North, often from urban contexts. For example, one review of 143 studies on the health benefits of green spaces found that only 3.5% were done in Global South countries (Twohig-Bennett & Jones, 2018). Similarly, a systematic map of 276 studies linking nature exposure and mental health found that 83% were conducted in predominately high-income Europe, North America, Australia and New Zealand while 15% were conducted in Asia (R. M. Collins et al., 2020). Another recent review on the same topic found similar geographical biases in studies in urban settings (Wendelboe-Nelson et al., 2019). Some emerging research recognises and is seeking to address this gap. For example, one study found visits (over 25 minutes) were associated with positive experiential wellbeing in Georgetown, Guyana (J. C. Fisher et al., 2021). Another example explored associations between urban green spaces and depression symptoms in South Africa (Tomita et al., 2017).

Many of the studies featured in the reviews mentioned above focus on urban areas. The need for green spaces is often framed around increased urbanisation (Kabisch, 2019) and dominant frameworks presented above arguably presume a deficit in nature exposure, such as in urban settings. Yet, nearly four billion people live in lower-middle- and low-income countries, of which nearly 60% live in rural areas (World Bank, 2021). The relationships between nature and mental health experienced by those in the rural Global South are likely to be diverse and context-specific. However, they may differ from those described in studies among populations in the urban Global North. For example, studies exploring dose-response relationships between indicators of mental health and wellbeing and nature exposure tend to look at a fraction of people's waking time (Shanahan et al., 2016; M. P. White et al., 2019). However, there may be little marginal benefit from nature exposure for farmers who routinely spend significant time working in agroecological

systems. Moreover, many people – such as subsistence farmers, fishermen, or hunters – in rural areas of the global south depend on natural resources for their material wellbeing. As such, the first evidence gap described above may be particularly relevant in rural Global South settings.

Consequently, the current evidence base may poorly describe nature-mental health linkages in many parts of the world.

1.1.1.3. Feedback processes

Finally, feedback processes may exist where an individual's mental health influences how they interact with nature. For example, Davies, Dallimer, Fisher, and Fuller (2019) and M. P. White et al. (2020) suggest that those who experience psychologically positive interactions with nature might be more supportive of conservation and likely to engage in pro-environmental behaviours. Conversely, negative interactions with nature, such as traumatic interactions with wildlife, might undermine support for conservation (Barua et al., 2013).

Another potential feedback process comes from biodiversity conservation professionals. Many conservationists are motivated to work in the sector because of the high value they ascribe to nature (Papworth, Thomas, & Turvey, 2018). Consequently, conservationists and other environmental professionals may experience acute grief at witnessing the loss of nature while struggling to prevent it (Fraser, Pantescio, Plemons, Gupta, & Rank, 2013; Gordon, Radford, & Simpson, 2019; Pihkala, 2020). This grief, combined with sometimes challenging working conditions – such as those faced by rangers (Belhekar, Paranjpye, Bhatkhande, & Chavan, 2020; Gao & Li, 2021) – may affect conservation professionals' mental health. In turn, poor mental health can affect performance and engagement (Burton, Schultz, Chen, & Edington, 2008; Cotton & Hart, 2003). Yet, there appears to be relatively limited research linking conservationists' beliefs about the state of nature and conservation to their mental health or discussing potential implications for collective conservation efforts.

In the early 2000s, Seligman and Csíkszentmihályi (2000) proposed that psychological research had primarily focused on the causes, experiences, and consequences of mental illness. In contrast, they argued that comparatively little attention had been paid to mental health and the “*positive*

features that make life worth living". They called for the development of the field of positive psychology, defined as *"the study of the conditions and processes that contribute to the flourishing or optimal functioning of people, groups, and institutions"* (Gable & Haidt, 2005). Since then, positive psychology has been applied to a wide range of contexts, including within the workplace (Seligman, 2019). One dominant framework in this literature is the psychological capital framework. Psychological capital has been defined as *"an individual's positive psychological state of development that is characterized by: (1) having confidence (efficacy) to take on and put in the necessary effort to succeed at challenging tasks; (2) making a positive attribution (optimism) about succeeding now and in the future; (3) persevering toward goals and when necessary, redirecting paths to goals (hope) in order to succeed; and (4) when beset by problems and adversity, sustaining and bouncing back and even beyond (resilience) to attain success"* (Luthans, Youssef-Morgan, Avolio, & Youssef-Morgan, 2015). This framework suggests that personal resources, including efficacy, resilience, and optimism, contribute to positive workplace attitudes, behaviours, performance, and wellbeing (Luthans & Youssef-Morgan, 2017). The psychological capital framework has been applied in multiple studies among working populations. For example, in a meta-analysis of 105 studies, W.-Y. Wu and Nguyen (2019) found good evidence that psychological capital was positively associated with job satisfaction, organisational commitment and citizenship behaviour, and performance, echoing previous meta-analyses (Avey, Reichard, Luthans, & Mhatre, 2011). Similarly, several recent meta-analyses of experimental and quasi-experimental studies found that positive psychology interventions can increase desirable work outcomes, like performance and engagement (Bolier et al., 2013; Carr et al., 2021; Donaldson, Lee, & Donaldson, 2019). I draw on elements of positive psychology and psychological capital scholarship to understand associations between optimism, goal progress satisfaction, and psychological distress among a subset of conservation professionals. I also discuss how these factors might influence other desirable work outcomes, such as motivation and performance, though these are not empirically evaluated within the thesis. Additionally, in chapters 6 and 7, I discuss in detail existing research on working conditions in conservation, so do not repeat it here.

1.1.2. Benefits of addressing these gaps

A more representative understanding of the links between nature and mental health may be helpful in several ways. First, a better understanding of these links can help account for the less well-recognised elements of nature's contributions to human wellbeing. A core goal of the post-2020 global biodiversity framework is to mainstream nature into the plans, policies, and strategies of government, business, and other sectors (CBD, 2021). Part of this mainstreaming involves accounting for nature's contributions to different sectors of society, such as the role of green spaces in supporting public health. In an effort to support this, a Global Action Plan for Biodiversity and Health has been proposed to help mainstream biodiversity-health linkages into cross-sectoral and sector-specific planning (CBD SBSTTA, 2021). One objective of this plan is to consolidate research on the entire range of linkages between nature and mental health. However, a patchy understanding of these linkages may mean nature's role in mental health is under-represented. Consequently, the full health costs of the global biodiversity crisis may be underestimated, meaning decision-makers may take inadequate action to avert nature loss. Moreover, opportunities to simultaneously support public health and nature conservation may be missed.

Second, efforts to protect nature may have both positive and negative impacts on mental health. Nature conservation has been defined as "*actions that are intended to establish, improve or maintain good relations with nature*" (Sandbrook, 2015). Conservation has been apparent in many cultures throughout history (e.g., Colding & Folke, 2001; J. P. G. Jones, Andriamarivololona, & Hockley, 2008), although this does not imply those cultures had sustainable relationships with nature (Raymond, 2007). Many conservation practices involve regulating people's interactions with nature, with complex costs and benefits for those involved. For example, protected areas are a dominant approach within the western conservation tradition, but "*fortress conservation*" approaches have been implicated in the displacement of tens of millions of people (Agrawal & Redford, 2009; Daniel Brockington & James Igoe, 2006). Partly in response to concerns about the social impacts of conservation, more people-centred approaches to conservation have emerged over the last decades (Mace, 2014). Yet, community-based conservation approaches have had

equivocal success (J. Brooks, Waylen, & Mulder, 2013; Galvin, Beeton, & Luizza, 2018), potentially contributing to the resurgence in interest in using protected areas (Büscher & Fletcher, 2020). These overlapping trends have led to the emergence of a broad range of conservation tools and approaches (Salafsky et al., 2008) that have diverse and often context-dependent impacts on human wellbeing (McKinnon et al., 2016). For example, some protected areas have helped sustain communal natural resource use, while others have disrupted social relations and governance systems (Pullin et al., 2013). As illustrated in the following chapters, many of the effects of conservation on people's livelihoods and social context may also have implications for their mental health. A better understanding of the role of conservation in wellbeing, broadly defined, can help conservation practitioners avoid activities that harm mental health and choose activities that support it. In so doing, conservation efforts may simultaneously contribute towards meeting the aspirations of the CBD, SDGs, and other global policy frameworks.

1.2. Aims and objectives

My DPhil aims to support efforts to conserve nature and enhance global health by providing evidence of previously neglected linkages between nature, its loss and conservation, and mental health. In doing so, I hope to contribute to the ultimate goals of enhancing human wellbeing while maintaining a safe, functional, and productive biosphere. My DPhil has seven specific objectives:

Objective 1: To illustrate previously unexplored ways in which interacting with ecosystems may influence psychological distress through a rural Ugandan case study.

Objective 2: To predict how land management for sustainable development could alter access to nature in ways that affect mental health. Specifically, exploring how agricultural intensification and restrictive protected areas may increase depression risk in the future through a Ugandan case study.

Objective 3: To understand how satisfied conservationists are with progress towards goals they consider important, how this satisfaction varies with respect to key covariates, and implications for their wellbeing and motivation.

Objective 4: To examine conservationists’ expectations about future outcomes for people and nature, variability between groups, and potential consequences for conservationists’ motivation.

Objective 5: To explore patterns and risk factors of psychological distress among conservationists, steps to support their mental health, and how these may enhance collective conservation efforts.

Objective 6: To explore how workplace risk factors for psychological distress vary between conservation job roles.

1.3. Summary of conceptual framework and study systems

The following provides a high-level overview of the conceptual framework guiding this thesis, components of which are explained in more detail in each chapter (Figure 1.1). Within this framework, nature’s contributions can affect social determinants of mental illness. For example, wild capture fisheries support diets (Golden et al., 2021), with food security being a known social determinant of mental illness (Lund et al., 2010; Lund et al., 2018; Weaver & Hadley, 2009). Drawing on a rural Global South case study in western Uganda, I explore indirect linkages between nature and mental health in chapters 2 and 3. I discuss the conceptual framework in detail in Chapter 2, and further develop it in Chapter 3, so do not repeat it in detail here.

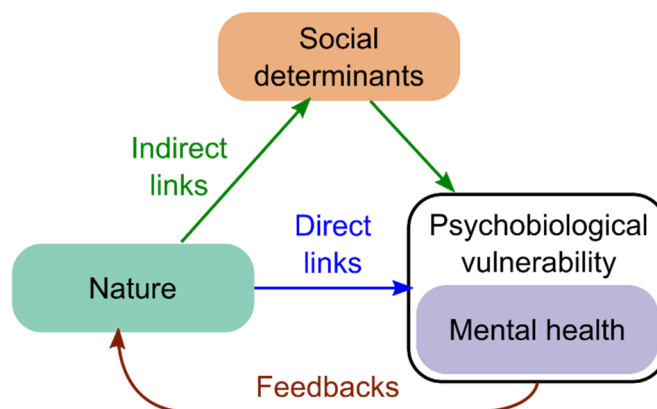


Figure 1.1. A high-level conceptual overview of linkages between nature and people that I explore in my DPhil. The green arrow (indirect link) shows how interacting with nature (green box) influences social determinants (orange box) of mental health (purple box) depending on psychobiological vulnerabilities. The blue arrow (direct link) suggests more direct relationships between people and nature. Finally, the brown arrow (feedback links) suggests how individuals’ mental health can influence their interactions with nature.

In chapters 4 to 7, I explore how conservationists' beliefs about the state of nature may influence their experiences of psychological distress and discuss how this may influence their collective efforts, giving rise to potential feedback processes. Chapters 4, 5, and 6 use the data collected through a global internet survey conducted from July 2019 to August 2020 (with two main recruitment drives in July 2019 and May 2020). I expected those without regular internet or email access to be less likely to participate in the internet survey. Therefore, I sought to compare the results from the internet survey with in-depth '*deep dives*' within three organisations in Cambodia, India, and South Africa, providing a more rounded picture of the experiences of conservation professionals in different roles and contexts. Specifically, Chapter 7 investigated how potential risk and protective factors for psychological distress varied between job roles within three case study organisations.

Chapters 4 to 6 each explore elements of a wider conceptual framework, an overview of which I present below. I could not find a single holistic framework for understanding the relationships between optimism, goal progress and attainment, and psychological distress. Therefore, I draw on positive psychology and psychological capital concepts to explore how perceptions and expectations about the state of nature may influence conservationists' experiences of psychological distress. I do not test the validity of this overarching framework or propose it as a definitive way of understanding these relationships. However, the following is used as a general conceptual model for linking elements explored in more detail in chapters 4 to 6.

1.3.1.1. Overview of the conceptual framework used in chapters 4 to 6

First, I define several key concepts; dispositional optimism, situational optimism, and goals. Dispositional optimism is the general expectation of good outcomes in life (Carver & Scheier, 2014; Malouff & Schutte, 2017). Situational optimism is the general expectation of positive outcomes within a specific context (Tusaie & Patterson, 2006). Goals are desired outcomes, states, or processes, which reflect perceived discrepancies between the current and desired state of the world (Austin & Vancouver, 1996; Edwin A. Locke & Latham, 2006).

Those with greater dispositional optimism are anticipated to provide more positive assessments of goal progress (Carver & Scheier, 1998b) (Figure 1.2). For example, in a longitudinal study among 409 Italians, Monzani et al. (2015) found that dispositional optimism was positively associated with perceived progress towards goals. Dispositional optimism is generally considered a stable trait (Tusaie & Patterson, 2006). However, emerging evidence suggests it may be more changeable and “state-like” than previously thought, shifting over time in response to life events (Millstein et al., 2019). Consequently, there might conceivably be bi-directional feedback between dispositional and situational optimism over the long term. Nevertheless, I expect more dispositionally optimistic conservationists to report greater goal progress satisfaction, as Chapter 4 explored.

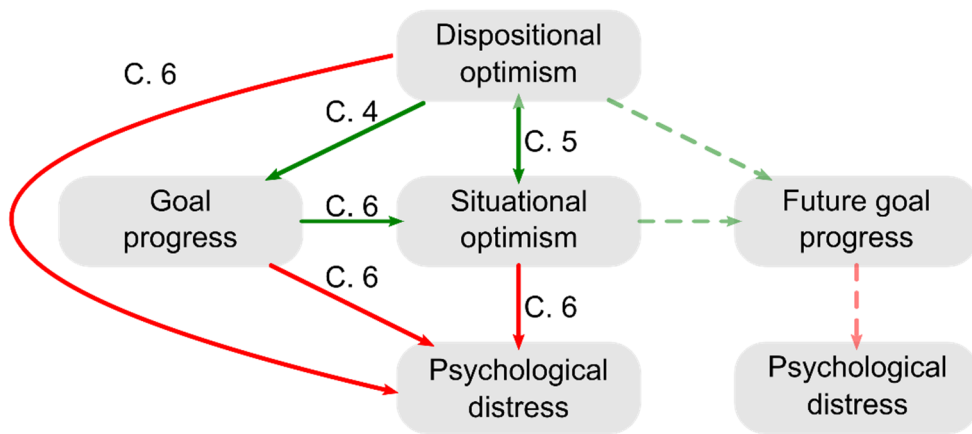


Figure 1.2. A conceptual model linking goal progress satisfaction, situational optimism, and psychological distress over time. Red lines indicate hypothesised negative associations, and green lines indicate hypothesised positive associations. Solid lines are statistically modelled in the thesis, while the semi-transparent dashed lines are not. Key: ‘C. 4’ = Chapter 4, ‘C. 5’ = Chapter 5, and ‘C. 6’ = Chapter 6.

Furthermore, prior goal attainment success and dispositional optimism might influence situational optimism about attaining future goals (Eccles et al., 1983; Eccles & Wigfield, 2020; Jansen, 2011; Wigfield & Eccles, 2000). For example, a study of 7,237 students in the United States found that previous academic performance was positively correlated with expectations of future success (Fong, Kremer, Hill-Troglin Cox, & Lawson, 2021). Therefore, I expected both dispositional optimism and satisfaction with current goals progress to be associated with situational optimism in conservation, as explored in chapters 5 and 6.

Dissatisfaction with progress to goals is expected to be a source of distress (Carver & Scheier, 1998a). For example, in a meta-analysis of 85 studies, Klug and Maier (2014) found that perceived goal progress was negatively correlated with subjective indicators of illbeing but positively correlated with wellbeing. Furthermore, above, I discuss how ecological grief may partly stem from concerns about ongoing biodiversity loss (Clayton et al., 2017; Cunsolo & Ellis, 2018; Hickman, 2020). Consequently, I expect those who are more situationally optimistic about conservation and satisfied with goal progress to report less psychological distress, as explored in Chapter 6.

Multiple studies suggest that dispositional optimism is associated with better mental and physical health, potentially because of their abilities to better cope with stressors (Conversano et al., 2010; Rius-Ottenheim, van der Mast, Zitman, & Giltay, 2013). For example, a recent meta-analysis of 31 studies found a significant negative association between dispositional optimism and depression risk in young people (Uribe, de Oliveira, Junior, & da Silva Pedroso, 2021). This relationship is explored in Chapter 6.

Furthermore, the expectancy-value model of motivation suggests that individuals are more likely to pursue goals they value and believe can be achieved (Carver, Scheier, & Segerstrom, 2010; Wigfield & Eccles, 2000). Consequently, dispositional and situational optimism may increase motivation towards and attainment of challenging goals in the future (Monzani et al., 2015). Consequently, there may be positive feedback between goal attainment and expectations of future success over time, though this was not explored in the thesis.

Finally, conservationists' goal progress satisfaction and situational optimism are only one of many factors expected to influence their workplace mental health. Chapters 6 and 7 examine previous research on these factors and their relative contributions to experiences of psychological distress among samples of conservation professionals.

1.4. Thesis outline

Chapter 2: In this chapter, I asked how interactions with ecological systems influence stressors associated with psychological distress in a rural Ugandan case study. This chapter is available as a pre-print (see *Appendix: Author contributions to each chapter* and):

Pienkowski, T., Keane, A., Kinyanda, E., Knizek, B.L., Asiimwe, C., Muhanguzi, G. & Milner-Gulland, E. J. (2021). The role of nature conservation and commercial farming in psychological distress among rural Ugandans. *bioRxiv*. DOI: <https://doi.org/10.1101/2021.06.08.446718>

Chapter 3: Expanding protected areas and agricultural intensification are two proposed approaches for meeting global biodiversity and sustainable development goals. Yet, their consequences for mental health are poorly understood. Building on Chapter 2, I explore how future land management practices may change patterns of access to nature in ways that may affect residents' mental health. This chapter has been accepted for publication as:

Pienkowski, T., Keane, A., Kinyanda, E., Asiimwe, C. & Milner-Gulland, E. J. (2021). Predicting the impacts of land management for sustainable development on depression risk in a Ugandan case study. *Scientific Reports*. DOI: 10.1038/s41598-022-14976-3

Chapter 4: Goals play important roles in people's lives. Understanding conservationists' satisfaction with progress towards goals they consider important may flag risks to their motivation and wellbeing and provide insights into real-world trends. Through a global internet survey, I asked a sample of conservationists how satisfied they were with progress towards their goals, how this satisfaction varied between groups, and about their associated experiences. This chapter has been published as:

Pienkowski, T., Keane, A., Castelló Y Tickell, S., Hazenbosch, M., Arlidge, W.N.S, Baranyi, G., Brittain, S., de Lange, E., Khanyari, M., Papworth, S., & Milner-Gulland, E.

J. (2021). Balancing making a difference with making a living in the conservation sector. *Conservation Biology*. DOI: <https://doi.org/10.1111/cobi.13846>

Chapter 5: In the face of unprecedented biodiversity loss, the belief that conservation can succeed could play a role in ensuring it does. Through the internet survey used in Chapter 4, I asked conservationists how optimistic they felt about outcomes for people and nature over the next ten years. This chapter has been published as:

Pienkowski, T., Keane, A., de Lange, E., Khanyari, M., Castelló Y Tickell, S., Hazenbosch, M., Arlidge, W.N.S., Baranyi, G., Brittain, S., Papworth, S., & Milner-Gulland, E. J. (2022). Personal traits predict conservationists' optimism about outcomes for nature. *Conservation Letters*. DOI: 10.1111/conl.12873

Chapter 6: Biodiversity conservation work can be both rewarding and challenging, with potential impacts on conservationists' mental health and performance. But little is known about the prevalence of poor mental health within the conservation sector and the workplace factors that affect it. Through the internet survey, I asked about experiences of psychological distress, personal characteristics, and workplace conditions. This chapter is available as a pre-print:

Pienkowski, T., Keane, A., Castelló Y Tickell, S., de Lange, E., Hazenbosch, M., Khanyari, M., Arlidge, W.N.S., Baranyi, G., Brittain, S., Kapoor, V., Mohan, V., Papworth, S., Ravi, R., Smit, I. & Milner-Gulland, E. J. (2021). Protecting those who protect nature by supporting conservationists' mental wellbeing. *Research Square*. DOI: 10.21203/rs.3.rs-1132018/v1

Chapter 7: Workplaces can be sources of both stress and support affecting mental health, but these factors can differ between job roles. Yet, there is limited evidence of how workplace risk factors for poor mental health vary between job positions in conservation. In this chapter, I explore patterns of psychological distress and associated workplace risk factors in a survey of 280 conservationists across ten sites in three organisations.

1.5. Positionality statement

Many aspects of the research process are influenced by the beliefs and characteristics of those conducting it (Moon & Blackman, 2014). Personal experiences and outlooks can determine the questions asked, the concepts and methods used, how data is analysed, interpreted, and communicated, and the broader impacts of research (Boyce, Bhattacharyya, & Linklater, 2021; Montana, Elliott, Ryan, & Wyborn, 2020; Moon et al., 2019). Recognising this, many have called for greater reflexivity – an individual’s ability “*to examine [their] feelings, reactions, and motives [...] and how these influence what [they do or think]*” (Cambridge Dictionary, 2021) – in conservation science (e.g., Beck, Elliott, Booher, Renn, & Montgomery, 2021; Boyce et al., 2021; Montana et al., 2020). Here, I reflect on my background, values, and motivations related to my research. I then discuss how these may influence specific aspects of my DPhil.

I grew up in a middle-class family in a suburban area in southern England, close to woodland and farmland. As a teenager, I spent most of my free time in this countryside, either by myself or with friends. I would track and stalk wildlife, gather foods, make shelters, build fires, craft items, and fell trees – quite often trespassing or breaking conservation rules. After studying biology and economics at college, I completed a year-long bushcraft instructor course and then spent several months training to be a field guide in South Africa. I had struggled at school. But, after being convinced by friends, I started an undergraduate conservation degree at Bangor University. This course completely changed my experience of learning, largely because of the enthusiasm and support from an excellent set of lecturers and PhD students.

Since then, I have worked in conservation research and practice, including in Jamaica, Belize, and Singapore. This background shaped my values and motivations in a couple of key ways. First, I value the relationships between people and nature; I see little benefit in maintaining natural habitat purely for its own sake. I am thus motivated to work in conservation because of its importance for long-term human health and wellbeing. Yet, I have seen both the benefits and the harm that conservation activities can have for local people. I believe conservation poses the greatest risks to

people when decision-makers are distanced (including in terms of life experience and accountability) from those affected. I recognise the need for collective action across scales – from global to local – but generally support the devolution of conservation decision-making in many cases. Finally, like most early-career conservationists, I struggled with job insecurity and career uncertainty. Moreover, working as a development officer for a Belizean non-governmental organisation, I was acutely aware of the funding challenges small organisations face. But, I have also been lucky to work with fantastic and supportive teams doing meaningful work. These experiences have been a core motivation for leading the Life in Conservation project, on which chapters 4 to 7 are based.

Being a privileged white western male academic had multiple implications for my research in Uganda. Chapter 2 was an exploratory study where I identified interview themes that were most commonly mentioned. Nevertheless, my choice to focus on inequality and ultimately how potential future scenarios (in Chapter 3) impacted different groups reflected my political priorities. My identity also influenced numerous other aspects of the research process. Despite the pre-interview information saying otherwise, some participants thought the research might lead to a project that would benefit them. As a result, some respondents may have exaggerated the challenges they face in the hope of future gain. Furthermore, residents within one community were concerned that I might have been there to take their land. This concern was linked to an ongoing land dispute with a local sugarcane estate owner, whom some residents suspected I might have been working for. Consequently, some residents in this community were hesitant to discuss land issues openly. As a result, this community was excluded from the study in Chapter 3. Relatedly, residents probably withheld information about sensitive topics, such as illegal behaviours (e.g., logging) or witchcraft. Precise information on illegal behaviours was not central to the research. But witchcraft appeared to play a role in mental illness, which I could only explore superficially. Being a male also likely influenced what I was told about gendered topics. For example, women were unlikely to have disclosed challenges around the use of contraception and menstrual products. Although potentially prevalent (based on what two female colleagues living in the area said), issues of sexual violence

were only raised by a few respondents. Furthermore, HIV/AIDS is often stigmatised, and most participants did not explicitly discuss it. Again, HIV/AIDS is likely an important factor affecting mental health, which was not captured in my interviews (although I asked about non-specific physical health in Chapter 3).

More fundamentally, my research in these chapters was largely extractive. I worked with Ugandan colleagues, who were co-authors on several manuscripts. I also shared my results with Budongo Conservation Field Station and employed several residents who played key roles in collecting data. I also discussed potential options for conducting participatory research with community leaders and Village Health Team (see Ethical considerations for details). However, the research had no direct benefits (but provided compensation) to participants. As such, it could be seen as “*helicopter research*”, where westerners collect data in the Global South but offer few local benefits (Haelewaters, Hofmann, & Romero-Olivares, 2021). Participatory research that leads to on-the-ground action can take time and resources that are often lacking for doctoral students. As such, the issues of “*helicopter research*” could be tackled through long-term conservation research partnerships (discussed in Chapter 8, section Landscapes for mental health and conservationists’ roles).

Being part of the conservation sector also influenced many aspects of chapters 4 to 7. For example, the motivation to investigate conservationists’ workplace wellbeing came partly from the desire to help address challenges I and my peers have experienced. However, I can more easily relate to the experiences of office-based workers, in contrast to frontline staff such as rangers. As a result, some of the recommendations made (especially in chapters 4 to 6 and Chapter 8, section Unanswered questions about conservation employment) might be more appropriate in office-based settings. As such, my work complements work by others focused on specific job roles in conservation, such as rangers (e.g., Appleton, 2016; Moreto, 2016; Singh et al., 2020). Similarly, I was cautious about investigating themes outside of my disciplinary training and experiences as a cis straight white able-bodied western male. Consequently, this research and its recommendations should be considered alongside that of authors with different perspectives (e.g., Demery & Pipkin, 2021;

Duff, 2020; M. S. Jones & Solomon, 2019; M. S. Jones, Teel, Martinez, & Solomon, 2020; Mbaria & Ogada, 2016).

2. The role of nature conservation and commercial farming in psychological distress among rural Ugandans

2.1. Abstract

Poor mental health is a leading contributor to the global burden of disease, but there is limited understanding of how it is influenced by socio-ecological contexts, particularly in the Global South. We asked how people's interactions with ecosystems were perceived to influence stressors associated with psychological distress in a rural Ugandan case study. We conducted and thematically analysed 45 semi-structured interviews with residents of Nyabyeya Parish, Masindi District. Our results suggest that poverty and food insecurity were the primary reported causes of "*thinking too much*" and related idioms suggesting psychological distress. The expansion of commercial agriculture may have been associated with the contraction of subsistence farming, reportedly exacerbating poverty and food insecurity among poorer households but contributing incomes to wealthier ones. Furthermore, households bordering a conservation area reported that crop losses from wildlife contributed to food insecurity. However, forest resources were important safety nets for those facing poverty and food insecurity. Our study suggests how two globally prevalent land uses – commercial agriculture and nature conservation – may influence social determinants of psychological distress in our study area. Psychological distress does not necessarily imply mental disorder. Nonetheless, exploring socially-mediated interactions with ecosystems may help explain the aetiology of psychological distress. Furthermore, we suggest opportunities to manage socio-ecological systems to support mental health. We also highlight co-benefits and trade-offs between global sustainability goals that could be managed for mental health.

2.2. Introduction

Chapter 1 describes how health increasingly features in mainstream environmental discourse. For example, the sixth United Nations flagship Global Environment Outlook report states, "*a healthy*

planet is a necessary foundation for human physical, psychological, social, economic and emotional health and wellbeing” (UNEP, 2019). Accordingly, many now claim that environmental protection is necessary to meet health-related Sustainable Development Goals (SDG) (e.g., Myers, 2017; Wood et al., 2018).

Mental illness is a core determinant of health, being among the largest cause of years lived with disability, mostly attributed to common mental disorders such as depression (NCCMH, 2011; Vigo et al., 2016). Despite its associated large burden of disease, mental illness continues to be neglected within public health agendas (Vigo et al., 2019). This issue is particularly prominent in low-income countries, where mental disorders are among the largest causes of years lived with disability, but less than 5% of those in need receive adequate care (IHME, 2021; Vigo et al., 2019). This neglect of mental illness has been called a “*failure of humanity*” (Kleinman, 2009) and appears to be reflected in research linking nature to human health. For example, among 1,306 articles mentioning natural environments and human health, illness, or diseases, only 5% included terms associated with mental health or common mental disorders in their title or abstract (see *Appendix: Environment and mental health literature search*) (NCCMH, 2011; Scopus, 2019). A growing body of research explores the psychological impacts of climate change and air, soil, and water pollution (Cianconi, Betrò, & Janiri, 2020; Frumkin & Haines, 2019; Middleton, Cunsolo, Jones-Bitton, Wright, & Harper, 2020). However, relatively few studies examine the role of habitats, biodiversity, and other ecological factors, which we henceforth refer to as ecosystems.

Chapter 1 discusses several key gaps within the emerging literature linking nature to mental health and illness. Here we focus on two key gaps; the neglect of the rural Global South and a limited understanding of the indirect ways that ecosystem change influences social determinants of mental illness. These limitations within the literature have produced an incomplete and geographically-biased understanding of how interacting with ecosystems might influence mental health and illness. Accounting for the role of ecosystems may help explain variation in mental illness between groups, such as the observed but unexplained differences between communities in Uganda (Kinyanda, Kizza, Abbo, Ndyabangi, & Levin, 2013; Kinyanda et al., 2017; Kinyanda,

Woodburn, et al., 2011). Furthermore, understanding how interacting with ecosystems may influence mental health might also help predict and avoid the negative impacts of ecological degradation. A more nuanced and locally appropriate understanding of these interactions may reveal new opportunities to jointly meet global biodiversity and mental health priorities (Patel, Saxena, et al., 2018; Whitmee et al., 2015).

This chapter aims to illustrate previously unexplored ways in which interacting with ecosystems may influence psychological distress through a rural Ugandan case study. However, the study does not seek to estimate the severity or prevalence of psychological distress within the study sample or population. The case study is conducted among nine rural communities in Nyabyeya Parish, in western Uganda. This Parish borders Budongo Forest Reserve, a valuable site for Ugandan nature conservation but which has experienced extensive recent land-use change. Therefore, the relationship between ecosystems and people's experiences of psychological distress may be particularly acute. Within the case study, we ask:

1. How do Nyabyeya's residents describe their experiences of distress?
2. What are the perceived stressors causing this distress among residents?
3. How do interactions with ecosystems influence these stressors?

2.3. Conceptual framework

We developed a conceptual framework describing how interactions between social systems and ecosystems might influence social determinants of psychological distress. This framework was the basis of the interview guide. The conceptual framework has three primary components related to; a) how stressors may elevate the risk of psychological distress, b) the types of stressors people experience, and c) the ways people's socio-ecological context can influence these stressors.

The first component of the framework describes how excessive exposure to stressors may increase the risk of psychological distress (Figure 2.1). Stressors are events, conditions, or forces that result in emotional or physical stress (VandenBos, 2007). Stressors are routine in everyday life; mental

health includes the ability to cope with daily stressors (WHO, 2004a). However, prolonged or severe stress becomes problematic when it causes psychological distress (Ridner, 2004).

As discussed in Chapter 1, psychological distress can be experienced along the spectrum of stage-based models of mental illness. Individuals can move in both directions along this spectrum, and experiences of stressors over an individual’s life course can be risk factors within this stage-based model (Johnstone et al., 2018; Lund et al., 2018). Furthermore, the pathogenic effect of these stressors, and an individual’s predisposition to mental illness, is partly a function of their genetic, neurodevelopmental, and psychological characteristics (Goh & Agius, 2010; McGorry et al., 2014). As an exploratory study using qualitative methods, we seek to identify stressors that individuals associate with non-specific psychological distress. We emphasise that further research is required to understand if these translate into a greater risk of later-stage syndromes. We explored experiences of distress using locally appropriate terms. These idioms of distress are culturally and socially situated ways of experiencing and describing distress (Nichter, 2010).

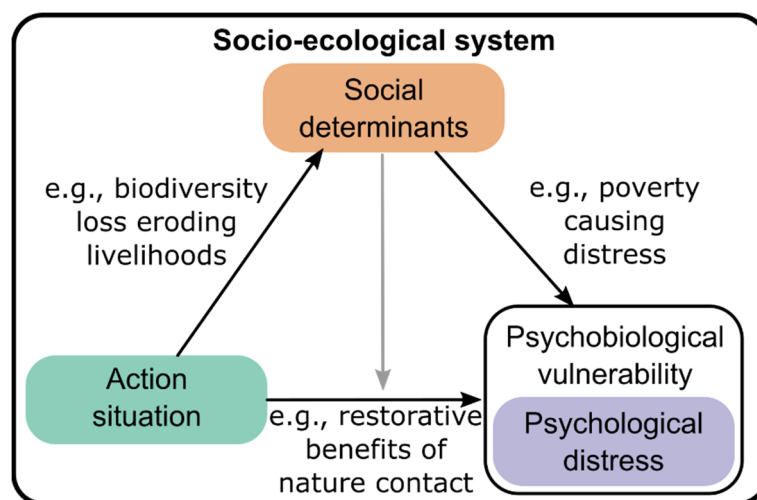


Figure 2.1. The direct and indirect ways that interacting with ecosystems could influence the risk of psychological distress, depending on an individual’s psychobiological characteristics, within a socio-ecological system. The socio-ecological system includes multiple interacting elements; those of interest to a researcher, decision-maker, or other user are termed ‘action situations.’ The grey arrow signifies how social determinants such as socio-economic status can influence access to the direct psychological benefits of nature contact (see 1.3. Summary of conceptual framework and study systems).

The second component describes broad categories of stressors faced by populations experiencing poverty, drawing on the Voices of the Poor initiative (Narayan et al., 2000). This initiative identified five categories of stressors: material lack and want; physical illbeing; bad social

relations; insecurity and vulnerability; and powerlessness, frustration, and anger. These broad categories represent potential social determinants of psychological distress among those experiencing poverty.

The final component describes how the interaction of social and ecological systems defines the context of people's lives, including the stressors they face. Ostrom and colleagues provide a multi-level framework for organising and structuring the many features found in socio-ecological systems (Colding & Barthel, 2019; Ostrom, 2007). Social elements of this framework include governance systems and local actors (and their socio-economic, cultural, religious, and other characteristics). Ecological aspects of this framework include natural resource systems and their characteristics. Interactions of these elements over time result in the co-evolution of socio-ecological systems (Liu et al., 2007). This socio-ecological systems framework is often used to examine a specific phenomenon of interest, termed the *action situation*. Within our study, the action situation was not known in advance and so is not specified at this stage. In summary, our overall framework describes how interactions with ecosystems may influence social determinants of psychological distress, as expressed in locally appropriate terms.

2.4. Methods

2.4.1. Study site: Nyabyeya Parish and the surrounding areas

The scope of the case study includes Nyabyeya Parish, the nine communities within it, and the surrounding area (Figure 2.2). This study area was chosen for several reasons. First, the area has experienced substantial changes in land cover over the last 30 years, with widespread loss of forest outside Forest Reserves and a shift from subsistence to contract farming (Babweteera et al., 2018). These socio-ecological changes were expected to affect the livelihoods of residents, many of whom were subsistence farmers or made a living through forest resource use. We anticipated that these and other changes might have implications for residents' experience of psychological distress. However, these changes are typical of similar transitions in other parts of Uganda and East Africa (e.g., Curtis, Slay, Harris, Tyukavina, & Hansen, 2018; Martiniello, 2021). As such, the current

study results were expected to be reasonably generalisable to similar contexts. Second, the Interdisciplinary Centre for Conservation Science (ICCS, of which I was part) had existing links with Budongo Conservation Field Station, which was interested in collaborating on this research. Other potential study areas were considered, including Burunge Wildlife Management Area, Kilombero Nature Forest Reserve, and Ruaha National Park in Tanzania and Harapan Rainforest in Indonesia. However, the current case study area was expected to provide more generalisable insights (for the reasons mentioned above).

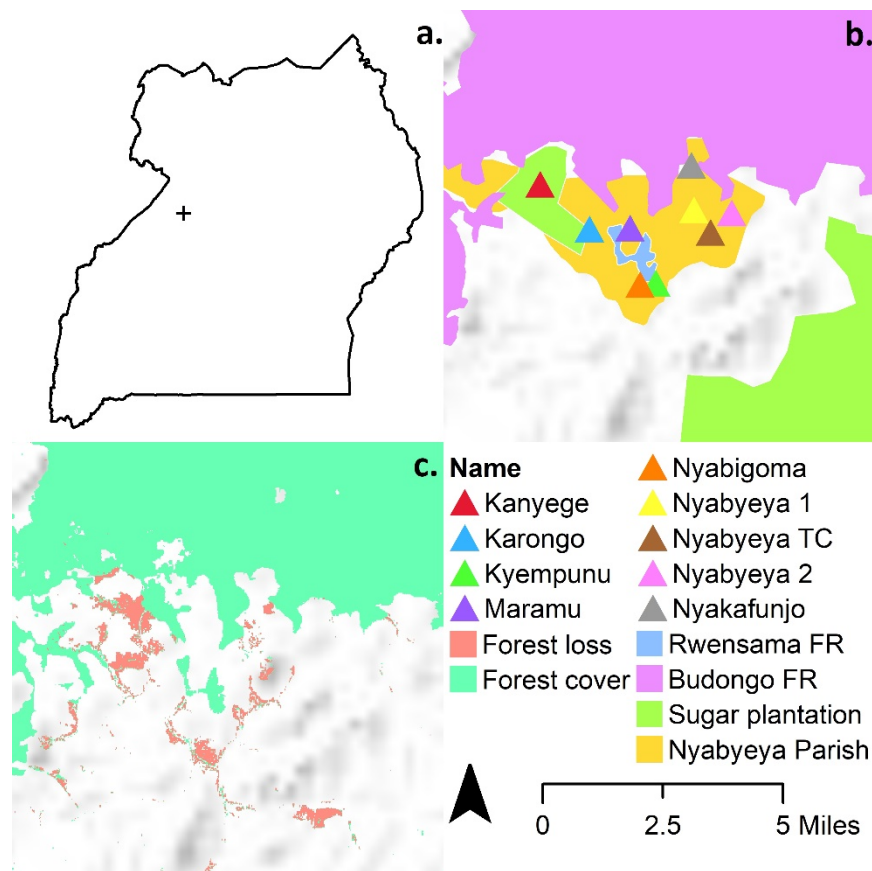


Figure 2.2. Panel a. describes the location of the study site within Uganda indicated by '+' (Esri, USGS, & NOAA, 2009). Panel b. describes the study area, which includes Nyabyeya Parish and its nine communities, the Budongo and Rwensama Forest Reserves, and the indicative location of large-scale commercial sugarcane estates (GADM, 2018; adapted from Kyongera, 2015; UNEP-WCMC & IUCN, 2020). Panel c. describes forest loss between 2000 and 2016 and forest cover (> 75% tree cover) in 2016 (adapted from Hansen et al., 2013). Key: TC = Trading Centre, FR = Forest Reserve.

Budongo Forest Reserve, neighbouring the smaller and fragmented Rwensama Forest Reserve, was gazetted for timber production by the British in the 1930s (Paterson, 1991). By 1960, Budongo Sawmills was the largest timber producer in the country and was a driver of in-migration before

closing in the late 1990s (Babweteera et al., 2018; Babweteera et al., 2012). The refurbishment of Kinyara Sugar Works in the 1990s was another pull factor for migrants and now represents an important source of employment in mid-western Uganda (Babweteera et al., 2012). As a result of these migration patterns, Nyabyeya Parish is linguistically and culturally diverse while being home to the indigenous Banyoro people.

Since 2000, the Ugandan government has adopted policies seeking to alleviate rural poverty through agricultural industrialisation (Nabwire, 2015). These policies, accompanied by increased global demand, contributed to the expansion of commercial sugarcane farming in Masindi District and other parts of Uganda (Jeary, Kandel, Martiniello, & Twongyirwe, 2018). Most of Nyabyeya's residents are small-scale farmers who grow food crops for subsistence and sale (Babweteera et al., 2018). However, some wealthier land-owning residents have transitioned to small-scale contract sugarcane farming (termed *out-growers*) to supply Kinyara Sugar Works, which sells to national and international markets (Twongyirwe, Bithell, Richards, & Rees, 2017). Nyabyeya also includes several large-scale commercial sugarcane estates that supply Kinyara Sugar Works.

Nyabyeya Parish has experienced significant forest loss over the last 50 years, much of which occurred before the 2000s and outside the boundaries of the forest reserves (Twongyirwe et al., 2017). As a result, the forest edge now largely coincides with the boundaries of the two reserves. Budongo Forest Reserve forms an important component of the Albertine Rift, a valuable region for conservation in Africa (Plumptre et al., 2007). However, the smaller Rwensama Forest Reserve appears to be heavily degraded. Moreover, illegal timber extraction, charcoal production, and hunting occur within both forests. The latter often involves the use of snares, which are a significant threat to endangered chimpanzees and other wildlife (Babweteera et al., 2018). Nevertheless, Nyabyeya's forests are important sources of firewood, medicine, wild food, and other products (Babweteera et al., 2018; Eilu & Bukenya-Ziraba, 2004; Tumusiime, Eilu, Tweheyo, & Babweteera, 2010). At the same time, chimpanzees, baboons, and other wildlife are reportedly significant causes of crop losses for farmers on the edges of the two forest reserves (Hill, 2015).

There appear to be no nationally representative estimates of the prevalence and severity of psychological distress in Uganda. However, one regional study suggested that 0.9% of 6,663 respondents' in south-western Uganda screened positive for severe psychological distress (Kinyanda, Waswa, Baisley, & Maher, 2011). More broadly, depressive disorders were estimated to be the third-largest source of years lived with disability in Uganda in 2016 (IHME, 2021). One nationally representative study of 4,660 Ugandans estimated that 29.3% of respondents might have met the diagnostic criteria for current major depressive disorder in 2003 or 2004 (Kinyanda, Woodburn, et al., 2011). Furthermore, formal care for those with poor mental health is limited across the country (Molodynski, Cusack, & Nixon, 2017). Within our study site, the closest mental healthcare provider to Nyabyeya Parish is Hoima Regional Referral Hospital, over an hour's drive away.

2.4.2. Ethical considerations

Ethical approval was granted by the Uganda National Council of Science and Technology (Ref. SS6007) of the Government of Uganda and the Central University Research Ethics Committee (Ref. R63458) of the University of Oxford (see *Appendix: Ethical procedure for interviews*). This protocol included steps for bringing the interview to a close and offering to facilitate transport to Hoima Regional Referral Hospital for respondents who appeared distressed by the interview. However, none of the respondents indicated distress as a result of the interview.

The study was designed in collaboration with staff at Budongo Conservation Field Station, which has the mission to “enhance our understanding of tropical forest ecosystems and species, that will inform policy to advance sustainable management of tropical rain forest ecosystems” (Budongo Conservation Field Station, 2022). I met with Dr Caroline Asiimwe and Mr Geoffrey Muhanguzi during a scoping visit to the study area over several days in June 2018. We discussed our respective interests, areas for potential collaboration, and possible funding sources. Following this, Dr Caroline Asiimwe visited Oxford University (with the support of the Africa Oxford Initiative) to develop the project concept further. During the scoping visit in June 2018, I also met with

leaders in each community and members of Village Health Teams. Although they were happy for me to conduct the research, they were not interested in investing time in co-designing the study.

2.4.3. Study population and sample

The study population includes male and female household heads (the primary decision-makers) over the age of 18 in the nine study communities. These individuals were selected as they were considered knowledgeable about household and community conditions. This population included indigenous Banyoro and in-migrants, spanning subsistence and small-scale contract sugarcane farmers, non-farmers, and landless commercial agricultural workers.

The a priori target sample included five respondents in each of the nine communities. This target sample was chosen to ensure equal representation across all communities. The initial plan was to conduct these 45 interviews and then assess if data saturation (the point where no new salient themes are identified through additional interviews) had been reached, conducting further interviews if not. However, data saturation was met within the initially planned 45 interviews.

Respondents were purposively sampled by walking through each community. Purposeful sampling is an approach for selecting “information-rich cases” related to a topic of interest and is often used to capture a range of perspectives from different groups (Palinkas et al., 2015; Sharma, 2017). This approach was suitable for our study aim, which sought to identify potential mechanisms linking peoples’ interactions with ecosystems to their experiences of psychological distress (which were then evaluated in Chapter 3 using systematic sampling approaches). Respondents were sampled to capture variation in demographic and socio-economic characteristics. We sought to capture an approximately equal balance between men and women by visually assessing candidate respondents’ gender. We also sought to sample from a range of age groups, including those between 18 and 35 who were considered ‘young’, between 35 and 55 who were ‘middle-aged’, and those over 55 who were ‘older’. Candidate respondents were asked their age prior to starting the interview. We also sought to sample a range of socio-economic groups based on a visual inspection of assets identified through consultation with local leaders. Items including plastic chairs, solar

panels, goats and chickens, shoes, and the state of household members' clothing were used to identify those with 'middle' socio-economic status. Homes with brick walls, tin roofs, cement floors, and a car or motorbike indicated 'high' status. Those without these assets were considered to be of low socio-economic status. We also sought to capture variation in forest proximity, including those visually estimated to be living within 30 meters of a Forest Reserve, those between 30 and 100 meters, and those over 100 meters.

At the respondent's request, one interview conducted in Kanyege was excluded from the study. An additional interview was conducted in Nyabigoma community as another interview in this community was incomplete (see *Appendix: Interview sampling effort*). As a result, forty-five semi-structured interviews, lasting 118 minutes on average, were conducted in the nine communities from September to November 2019.

Data were collected through semi-structured interviews led by me, following an interview guide (see *Appendix: Interview guide*). This approach allows for new themes to emerge while also focusing data collection on pre-defined topics and facilitating comparability between interviews (Newing, 2010). They are an effective method when collecting open-ended qualitative data, investigating participants' perceptions and feelings, and exploring sensitive and personal topics (DeJonckheere & Vaughn, 2019). The interview guide included broad themes from the conceptual framework in three sections. The first section discussed specific themes derived from the socio-ecological system framework, relating to actors, governance systems, natural resource systems, the broader social, economic, political, and environmental context, and their interactions. The second section was related to the five illbeing domains in the Voices of the Poor framework. The third section focused on the respondent's experience of distress. During the second section, respondents were asked about perceived causes and consequences of stressors, thereby eliciting connections between socio-ecological context and experiences of distress. All themes (indicated by bullet points within the interview guide in *Appendix: Interview guide*) were covered in all interviews.

2.4.4. Piloting and translation

Interviews were piloted with two individuals from a community outside the study area. The dialogue was translated between English and Kiswahili and Runyoro (spoken by indigenous Banyoro) by three research assistants and was recorded on a Dictaphone. The three research assistants included two women (in their late 20s) who lived within the study communities and one man (in his mid-30s) from a neighbouring district who had previously assisted with research within the study area. The in-situ translations were transcribed as we did not have the resources to translate the interviews verbatim, meaning some nuances may have been lost. However, the three research assistants listened through all interview recordings, checking the accuracy of the transcripts against the original dialogue in Kiswahili and Runyoro. Moreover, the thematic analysis (discussed below) was largely semantic, focusing on what respondents explicitly stated rather than looking for latent meaning. Consequently, it is unlikely that the use of verbatim translation would have significantly changed the results.

2.4.5. Data analysis

We employed inductive thematic analysis to identify, analyse, organise, and report interview themes, following Braun and Clarke (2006). The thematic analysis proceeded through the following steps (see *Appendix: Thematic analysis steps (Chapter 2)*):

1. Familiarisation with data, including re-reading transcripts and post-scripts and comparing word clouds between demographic and social groups.
2. Generating codes and systematically applying them to the text through two rounds.
3. Identifying and clustering codes into themes.
4. Reviewing themes, ensuring consistency within (but discrete differences between) them, and visually exploring connections between themes as networks.
5. Defining and naming themes (see *Appendix: Theme definitions (Chapter 2)*).

2.5. Results

We interviewed 21 men and 24 women, of whom 12 were ‘young’, 23 were ‘middle-aged’, and 10 were ‘older’ (see *Appendix: Interview sampling effort*). Furthermore, 12 respondents were considered to be of ‘low’ socio-economic status, 23 of ‘middle’, and 10 of ‘high’. Additionally, 12 were estimated to live within approximately 30 meters of a Forest Reserve, 15 between 30 and 100 meters, and 18 over 100 meters.

A broad range of themes was discussed during the interviews, but those most frequently mentioned and relevant to the research questions are presented (but see *Appendix: Other linkages*). In summary, “*thinking too much*” and related terms (henceforth termed *thinking too much*) were associated with heart palpitations, chest and abdominal discomfort, fatigue, feeling faint, weakness, “*growing thin*”, and changes in appetite. The primary reported causes of *thinking too much* were poverty and food insecurity. Broader socio-ecological processes purportedly influenced patterns of poverty and food insecurity in several ways. First, the expansion of commercial agriculture was reportedly associated with declining subsistence farming. This decline was a perceived contributor to poverty and food insecurity among poorer households with limited land. However, engaging in commercial agriculture was a source of income for wealthier land-owning families, who included many indigenous Banyoro. Second, households bordering Budongo and Rwensama Forest Reserves reported crop losses from wildlife, allegedly contributing to food insecurity. These border households included those who had migrated to the area to work in Budongo Sawmills before it closed, who often settled around the forest edge. Finally, forest resources were reported sources of food and income for those experiencing poverty and food insecurity. Illegally harvested timber, wild meat, and charcoal appeared to be particularly important for these groups. These themes and connections are described in detail in the following.

2.5.1. How do Nyabyeya’s residents describe their experiences of distress?

Terms used to describe the experience of distress included “*kufikiri sana*” in Kiswahili and “*kuterageza muno*” in Runyoro, both of which translate to “*thinking too much*” in English. For

instance, respondent R05 (lower-income older female) said, “*it brings me so many thoughts, I think too much*”. “*Kufikiri sana*” in Kiswahili and “*kuterageza muno*” in Runyoro are sometimes translated into English as “*overthinking*”, “*strong thoughts*”, “*lots of thoughts*”, “*too many thoughts*”, and “*thinking a lot*”. However, the local research team members confirmed that these variations in translation were used to describe the same phenomena, thinking too much.

When asked about the experience of *thinking too much*, respondents mentioned a range of experiences (Figure 2.3). For instance, R29 (lower-income middle-aged male) stated, “*You find yourself growing more thin and thin. Like the way they say that too much thoughts causes pressure.*” Several reported that the experience of *thinking too much* disrupted daily activities. For example, R09 (middle-income middle-aged male) said, “*You sleep now from night up till 10 am. [...] you are supposed to wake up and get your hoe and start digging, so those are all about thoughts.*”

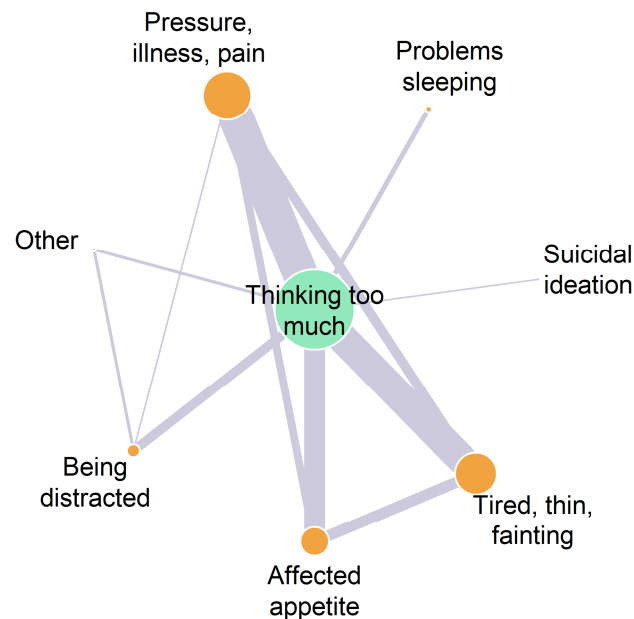


Figure 2.3. The reported experiences or symptoms of “*thinking too much*” (and other idioms of distress). The width of the lines illustrates the relative number of interviews that reported connections between nodes. The lines represent associations reported by interviewees but do not imply directional causality. The node size represents the number of interviews mentioning the associated theme for that node.

Several respondents indicated that the frequency and duration of *thinking too much* depended on the presence of specific stressors. For instance, when asked how to alleviate *thinking too much*,

R38 (middle-income older male) said, “*There is no way you can reduce those thoughts if you are still with those challenges unless those challenges are not there.*” However, several others indicated the experience of *thinking too much* was more chronic, such as R27 (lower-income middle-aged female), who said, “*you cannot imagine the period that those thoughts can get finished from you.*”

2.5.2. What are the perceived stressors associated with distress among residents?

Many respondents reported that poverty, bad health, and inadequate food were associated with *thinking too much* (Figure 2.4). For instance, when asked what the term “*overthinking*” meant, R20 (middle-income older female) responded, “*No energy for digging, no money brings famine, it makes you overthink. You start thinking, what will I eat.*” Although being poor was used as an umbrella term for someone’s socio-economic condition, it was often associated with not having enough money to meet essential needs. These needs included basic housing, paying for healthcare and school fees, and buying food. Therefore, in the following, we use the term poverty to mean inadequate money.

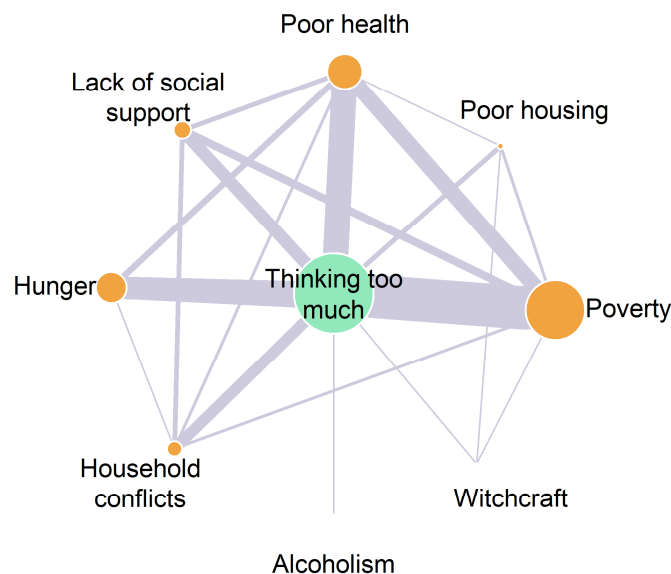


Figure 2.4. The reported sources of “*thinking too much*” and related idioms of distress. The width of the lines illustrates the relative number of interviews that reported connections between nodes. The lines

represent associations reported by interviewees but do not imply directional causality. The node size represents the number of interviews mentioning the associated theme for that node.

Many respondents used the terms famine and hunger to describe not having enough food. When asked how this affected respondents, several mentioned reducing the number of meals eaten per day, eating less favoured food, or reducing dietary diversity. For instance, when asked about the experience of hunger, R13 (middle-income younger male) stated, “*You cannot eat expensive things, and if you have been eating like four cups of posho (maize flour) now, you end up reducing to two cups.*” Although a few respondents indicated that the current experience of hunger was a cause of *thinking too much*, many more said that the prospect of food supplies running out before the next harvest season caused them distress.

2.5.3. What are the perceived roles of socio-ecological processes in these stressors?

We focus on poverty and hunger in the following because they were the most frequently mentioned intermediaries between the respondent’s broader socio-ecological context and *thinking too much*. Further evidence and other pathways of interest are presented in *Appendix: Causes of poverty*, *Appendix: Causes of hunger*, and *Appendix: Forest use*.

2.5.3.1. Poverty, farm size, and the sugarcane industry

The primary reported contributors to poverty were low farm production, poor health, and lack of employment. For instance, R29 (lower-income middle-aged male) stated, “*What has caused the poverty in this community is lack of enough land, you do not have where to dig, you just have a plot.*” When discussing farm production, many subsistence farmers suggested there was inadequate or “*squeezed*” land. For instance, when asked to describe the history of the community, R25 (medium-income middle-aged male) said, “*others are getting problems of land because it is small where they can do good farming to get good money [...] that’s what is making us to suffer.*” When asked why there was inadequate land, most subsistence farming respondents said that the expansion of contract farming and large-scale commercial estates had displaced small-scale farming. For instance, R02 (middle-income middle-aged male) stated, “*you cannot struggle for a small piece of land since sugarcane has taken most parts of the land.*” Mechanisms of

displacement reported by both commercial and subsistence farmers included the voluntary selling or renting of land to meet immediate needs, forced displacement by large-scale commercial estates (particularly in Karongo and Kanyege in the west), and increased prices restricting land purchase. Furthermore, a large number claimed that the sugarcane industry affected land availability without explaining the process through which this happened.

However, both subsistence and small-scale contract farmers said that the sugarcane industry benefited those able to engage in it. For instance, when describing the drivers of household development, R01 (middle-income middle-aged female) said, “*sugarcane growing, and after growing, they sell and get a lot of money.*” Nevertheless, many subsistence farmers reported barriers to small-scale contract farming; the most commonly mentioned was not having enough land. Consequently, several respondents said that the benefits of the sugarcane industry mainly accrued to wealthier households with large amounts of land.

Several suggested that the indigenous Banyoro and early migrants owned more land – and were thus more likely to be small-scale contract farmers – than recent migrants. For instance, R41 (middle-income older female) stated, “*Those people that have a large amount of land, they are the people who came first and a long time ago [...] when you look at this time, land is too expensive, and it is not easy to [get].*” However, a few others suggested that some recent and relatively wealthy migrants also purchased land for small-scale contract farming. Several respondents also reported that commercial agriculture was a pull factor for transient labourers. For instance, R33 (lower-income middle-aged female) stated, “*those people who do sugar cane cutting, they always come, and they can spend here some time but when they do close the factory, maybe for maintenance, they always go back in their places.*”

Additionally, several respondents – mostly from Maramu, Nyakafunjo, and Nyabyeya 1 – described a Community Forest Management initiative. Some residents were permitted to grow crops and timber on National Forest Authority land within this initiative. Notionally, this initiative sought to discourage illegal forest use and provide a buffer between farms and Budongo Forest Reserve. However, this study did not evaluate the effectiveness of this initiative.

2.5.3.2. *Hunger, nature conservation, and the sugarcane industry*

The main reported drivers of hunger included insufficient land (linked to the sugarcane industry, as above), inadequate money to buy food, and crop losses. Many subsistence farmers said that unexpected and unseasonal rains in June and July 2019 left crops rotting in their fields. Many also reported that crop-raiding by wildlife (baboons, chimpanzees, and wild pigs) contributed to crop losses. For instance, R16 (lower-income younger female) stated that “*Wild animals are good at spoiling most of our food crops.*” Both reserve-adjacent and non-reserve-adjacent interviewees said that those at the forest edge were most affected by crop raiding.

In response to crop-raiding, many subsistence farmers reported having to guard their crops, which several respondents said disrupted other income-generating activities or leisure time.

Consequently, several subsistence farmers had negative attitudes towards wildlife and a desire to trap or kill wild animals. However, it was unclear if respondents acted upon these desires. For instance, R18 (middle-income middle-aged female) stated, “[wild animals] *cannot leave you to eat your food, and you are not allowed to kill them, meaning you just suffer. But if you get time, you can go and wait for them. You chase them.*” Similarly, when asked about setting traps in the forest, R03 (lower-income middle-aged male) said, “*because if it is disturbing your crops, the best thing is to kill it, you eat, and even your crops get saved.*”

2.5.3.3. *The importance of the forest during hunger and poverty*

As well as the threats posed by crop-raiding wildlife, many said that subsistence farmers and landless young men harvested forest resources to cope with hunger or poverty. This forest use included legal (e.g., harvesting wild plants and mushrooms) and illegal activities (e.g., producing charcoal, hunting, and timber harvesting). Several respondents said that landless young men who illegally harvested timber were often paid by wealthier households, including those outside the study area. Similarly, several respondents said that charcoal was typically produced by poorer households and sold to wealthier ones. For instance, R02 (middle-income middle-aged male) said, “[people are struggling to survive] *as the sugarcane is the most [common] crop grown on the ground, so [food crop] gardens are few.*” R02 then proceeded to say, “*and that is why people are*

entering in the forest just stealing the forest, just burning charcoal, collecting firewood in days that are not allowed.”

Hunting and harvesting of forest foods reportedly directly contributed to diets. Furthermore, income generated from forest product harvesting was used to purchase food and meet other needs. However, many respondents also mentioned the range of risks associated with illegal forest use, including corporal punishment, fines, and imprisonment. For example, R33 (lower-income middle-aged female) said, *“If you are caught, the only thing is caning and getting imprisoned and you getting out of prison, meaning that you are going to pay some money.”* However, no respondents explicitly associated these risks with *thinking too much*.

Additionally, interviewees were asked if they had witnessed changes in forest cover around communities. Some older respondents described seeing widespread forest loss outside of reserves over their lifetimes.

2.6. Discussion

We brought together three existing frameworks to understand how interacting with ecosystems influences social determinants of psychological distress. In the following, we answer our three research questions by situating our results within this conceptual framework and broader literature. We then describe how these examples help address key gaps in evidence linking ecosystems and mental health.

2.6.1. Psychological distress in Nyabyeya

In our study, changes in weight and appetite, sleep disturbance, fatigue and feeling faint, problems concentrating, suicidal ideation, heart palpitations, and chest and abdominal discomfort were associated with *thinking too much*. These symptoms are consistent with a stage-based model of mental illness and can be found along the spectrum of severity (Patel, Saxena, et al., 2018). Many of these symptoms have been reported in other studies on *thinking too much* in Sub-Saharan Africa (Backe, Bosire, Kim, & Mendenhall, 2021). Moreover, several respondents described how

experiences of *thinking too much* disrupted daily activities, which is a defining characteristic of psychological distress (Drapeau et al., 2012). However, other diagnostic symptoms were not reported by our respondents. For instance, low mood was not mentioned but indicates conditions such as depression (APA, 2013). Furthermore, there was variation in the symptoms associated with *thinking too much*. For instance, some emphasised the loss of appetite and weight loss, whereas others highlighted chest discomfort. In general, idioms of distress can have symbolic and political connotations, with wide within- and between-cultural variation in meaning (Cork, Kaiser, & White, 2019; Kaiser et al., 2015; Pedersen, Kienzler, & Gamarra, 2010). Consequently, such idioms are unlikely to map directly on to psychiatric categories.

Nevertheless, multiple studies in Uganda and East Africa have found both qualitative and statistical associations between *thinking too much* and psychological distress and common mental disorders (Kaiser et al., 2015). For instance, a study among perinatal women and healthcare workers in eastern Uganda found an overlap between *thinking too much* and diagnostic criteria for major depression (Tol et al., 2018). Moreover, in Chapter 3, we find a strong positive association between the reported frequency of experiencing *thinking too much* and depression symptom severity (measured using the Patient Health Questionnaire (PHQ-8, see 3.5. Results). More generally, in a review of 60 studies in Sub-Saharan Africa, Backe et al. (2021) state that “‘*thinking too much*’ is a useful idiom for understanding rumination and psychiatric distress [...] in clinical settings.”

In summary, our results corroborate those of other studies, providing good evidence that *thinking too much* is an idiom used to describe degrees of psychological distress. However, these results cannot be used to diagnose the severity of psychological distress nor its prevalence within the study sample or population. Moreover, this current study does not evaluate associations between reported *thinking too much* and quantitative scales used to measure psychological distress severity (such as the Kessler Psychological Distress Scale, used in chapters 6 and 7).

2.6.2. Social determinants of psychological distress

We also explored the perceived stressors contributing to psychological distress among residents. The following focuses on the most apparent intermediaries between socio-ecological context and experiences of distress (but see *Appendix: Other linkages*). Firstly, respondents' often described poverty in terms of not having enough money. Additionally, many respondents reported skipping meals, reducing their dietary diversity, and eating less preferred foods during times of hunger, suggesting moderate food insecurity (A. D. Jones, Ngure, Pelto, & Young, 2013). As such, economic poverty and food insecurity appeared prevalent among respondents. Moreover, these stressors appeared to be important causes of psychological distress. This result is consistent with other literature (e.g., A. D. Jones, 2017; Lund et al., 2010; Lund et al., 2018; Weaver & Hadley, 2009). For instance, poverty was a major reported cause of *thinking too much* among residents in central and western Uganda (Miller et al., 2021).

However, other themes from the Voices of the Poor framework appeared less salient. For instance, physical illbeing appeared to be a source of distress. Yet, it was not frequently mentioned in relation to ecosystems. This result is perhaps surprising, given the many ways that ecosystems are known to affect physical health (Whitmee et al., 2015). For instance, multiple studies link forest cover and loss to diarrheal disease in tropical countries (e.g., Herrera et al., 2017; Pienkowski et al., 2017). This lack of a clear link may have been a consequence of the methods we used, which focused on themes and processes that were apparent to respondents. In other words, respondents may have been unaware of how some aspects of their ecological context affected their physical health (if at all). As such, our research could be combined with evidence generated using other methods to provide a holistic understanding of how socio-ecological processes indirectly influence mental health.

In summary, economic poverty and food insecurity were reported by many participants. These stressors appeared to contribute to experiences of psychological distress.

2.6.3. Social determinants within a socio-ecological context

Finally, we asked how interacting with ecosystems influenced stressors associated with psychological distress. Here, we focus on the three most salient mechanisms (but see *Appendix: Other linkages*).

2.6.3.1. Agro-ecological systems and psychological distress

Since the early 1990s, Kinyara Sugar Works has expanded its output by purchasing sugarcane from small-scale contract farmers and sugarcane estates in Nyabyeya (Babweteera et al., 2012; Twongyirwe et al., 2017). Our results indicate that most of those who benefited from this expansion were wealthier families with large amounts of land, many of whom were indigenous Banyoro. However, this expansion reportedly displaced subsistence farming, potentially exacerbating social determinants of psychological distress among poorer households (Figure 2.5).

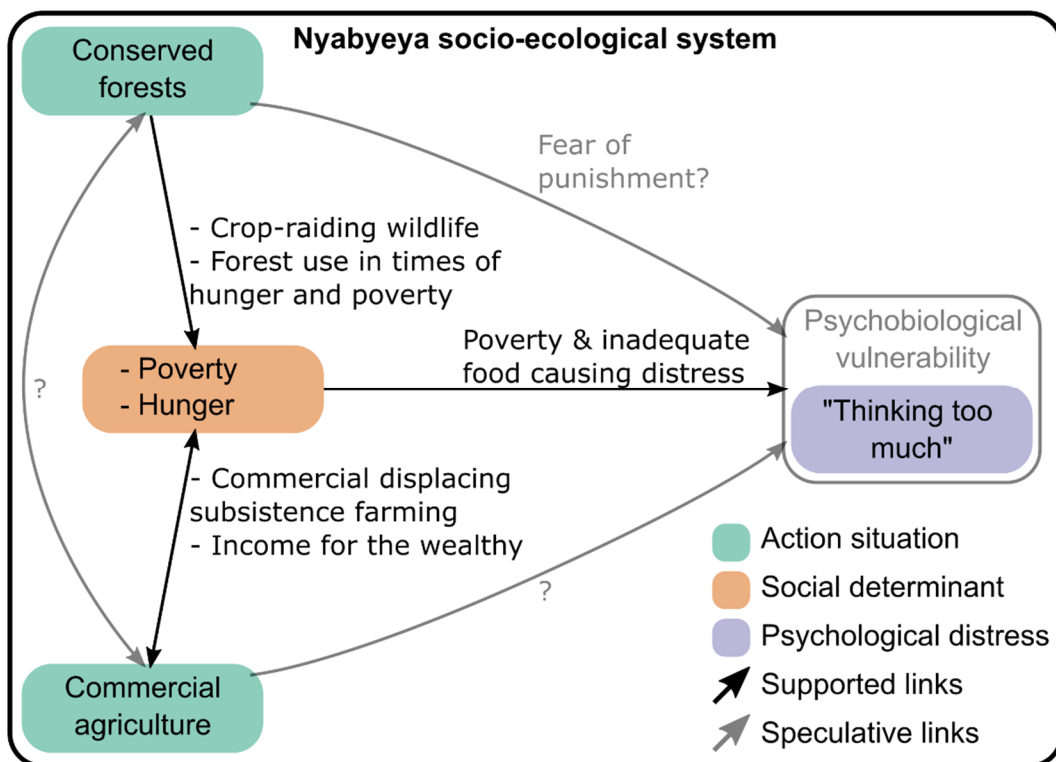


Figure 2.5. Hypothesised causal connections between two socio-ecological action situations, social determinants and psychological distress.

Recognising the limitations of large-scale agribusiness as a tool for poverty alleviation, the Ugandan government has sought to promote more inclusive contract farming models (B. White,

Borras Jr, Hall, Scoones, & Wolford, 2012). Yet, our results corroborate other studies suggesting that this model has limitations in terms of delivering pro-poor development. For instance, contract sugarcane farming has been linked to increased inequality and land dispossession in other parts of Uganda (e.g., Martiniello, 2021; Mwavu et al., 2018). More broadly, numerous studies across countries illustrate commercial agriculture's diverse impacts on smallholder farming systems, in some cases contributing to food insecurity and poverty among vulnerable groups (Hall, Scoones, & Tsikata, 2017). As noted above, poverty and food insecurity are important social determinants of psychological distress and mental illness (e.g., A. D. Jones, 2017; Lund et al., 2010; Lund et al., 2018; Weaver & Hadley, 2009). As such, changing food production systems could influence the mental health of many rural populations globally. Whether these effects are desirable or not may depend on how equitably benefits are distributed.

2.6.3.2. *Conserved landscapes and psychological distress*

Nyabyeya was comparatively sparsely populated when Budongo Forest Reserve was first gazetted in the 1930s (Paterson, 1991). Since then, the population has grown, in part because of immigration. Simultaneously, large amounts of forest appear to have been lost outside of the forest reserve. Much of this loss appears to have occurred before the 2000s, partly attributed to commercial agricultural expansion (Kyongera, 2015; Twongyirwe et al., 2017). In this context, Budongo Forest Reserve appears to be a contributor to livelihoods, particularly for those experiencing poverty and food insecurity (Figure 2.5).

In general, nature conservation seeks to maintain ecosystems and their essential contributions to human wellbeing (IPBES, 2019). In doing so, conservation might influence social determinants of mental health for many worldwide. For instance, small-scale wild-capture fisheries support the livelihoods of over 100 million people in developing countries (World Bank, FAO & WorldFish, 2012). Sustainable fisheries management may help sustain these livelihoods and, indirectly, mental health. Yet, not all interactions with ecosystems are desirable. Several studies describe how interactions with wildlife can be distressing, potentially contributing to the risk of mental illness (e.g., Barua et al., 2013; Chowdhury et al., 2016; Jadhav & Barua, 2012). For instance, Chowdhury

et al. (2016) interviewed 65 widows whose husbands had been killed by tigers and who subsequently faced stigma and other social challenges. Their study suggested that respondents' status as "*tigers-widows*" contributed to their risk of mental illness, with 44% of them being formally diagnosed with a mental disorder. Our results suggest that living next to crop-raiding wildlife can also be a stressor potentially indirectly linked to experiences of psychological distress. As such, the full set of social costs and benefits associated with conservation should be considered when managing landscapes to protect nature. For instance, the post-2020 global biodiversity framework includes plans to double the current extent of protected areas globally by 2030 (CBD, 2021). However, many have argued that these plans have not been based on a thorough assessment of their social impacts (e.g., ICCA Consortium, 2021),

Conservation scientists recognise that wellbeing is multidimensional and includes mental health aspects (Woodhouse et al., 2015). However, little research appears to explore the roles of conservation in psychological distress and mental illness. For instance, McKinnon et al. (2016) systematically reviewed 1043 articles and grey literature exploring the impacts of conservation on human wellbeing, identifying 60 that focused on health. We examined the abstracts and summaries of these and found just one that focused on the relationships between conservation and psychological distress or mental illness. This one exception was a study describing the psychological trauma associated with human-wildlife conflict around conservation areas in India (Ogra, 2008).

Despite the limited number of articles explicitly connecting conserved ecosystems and mental health, we believe these links are prevalent and important. For instance, McKinnon et al. (2016) also found 700, 310, and 94 articles relating conservation to economic living standards, social relations, and security and safety, respectively, all of which are recognised social determinants of common mental disorders (Lund et al., 2018). Given this, it is highly likely that conservation has myriad desirable and undesirable impacts on people's lives in ways that influence their risk of psychological distress and perhaps mental illness. Given the magnitude of the global burden of

mental illness and the extent to which conservation influences lives worldwide, this appears to be a significant omission from conservation research.

2.6.4. Study limitations

Semi-structured interviews following interview guides are an established method in qualitative social science research (Corbin & Strauss, 2015). This approach is often used in theory-generating research to identify new themes while permitting some comparability between responses (Newing, 2010), as we sought to do in the current study. However, semi-structured interviews are not suitable for studies seeking specific data on pre-defined questions and where minimising variability in question delivery is an overriding priority. We considered the advantages of this theory generating approach to outweigh its limitations in light of the aims of this Chapter. We then used structured surveys, delivered in a standardised way across all respondents, to evaluate these theories in Chapter 3.

Nevertheless, care must be taken when using these methods. For example, interviewers must avoid using leading questions and (verbal and non-verbal) cues that might influence responses (DeJonckheere & Vaughn, 2019). Building on my experience of using these methods during my MSc thesis research in Belize, I practised interviewing techniques with the help of a PhD student trained in the social sciences. Equally, the interviewer must recognise and account for how their characteristics and outlooks influence the research process. Therefore, I describe my positionality in relation to research subjects and its implications for my research in Chapter 1 (see Positionality statement).

Purposeful sampling is another established method in qualitative social science research (Palinkas et al., 2015). It can be an efficient approach for capturing a range of perspectives and information from specific social groups (Sharma, 2017). However, this non-probability sampling approach cannot be used to estimate the prevalence of a phenomenon across a population, though this was not the aim of the Chapter. Moreover, the current study involved making subjective appraisals of relative socio-economic status based on a visual inspection of asset ownership. We sought to

minimise this subjectivity by using a standard set of assets for distinguishing between ‘low’, ‘middle’, and ‘high’ status houses. This approach was deemed adequate for ensuring that we sampled from a range of households with different statuses. However, these categories should not be interpreted as a precise estimate of relative socio-economic status. A more systematic approach for measuring household socio-economic status was used in Chapter 3, where the hypotheses generated in this exploratory chapter were evaluated.

This chapter was primarily focused on respondents’ perspectives. Local and Indigenous knowledge can be a valuable source of information for landscape management and conservation decision-making (Wheeler & Root-Bernstein, 2020). People who interact with ecosystems on a daily basis over long periods of time, including as part of their livelihood strategies, can have a detailed understanding of local socio-ecological systems (Folke, 2004; Ingold, 2000). Consequently, residents in the study area were considered well-positioned to discuss how their interactions with ecosystems influenced the challenges they faced and associated experiences of distress. However, these perspectives are also shaped by social and cognitive factors. For instance, physical illbeing appeared to be a source of distress but was not clearly mentioned in relation to ecosystems, despite substantial evidence that these areas can be connected (Whitmee et al., 2015). As such, the current study may not have captured the full breadth of possible linkages between interactions with ecosystems and social determinants of psychological distress. Moreover, residents may hold an inaccurate understanding of socio-ecological dynamics or may have strategically misreported in the hope of gaining future benefits. Further research might combine long-term monitoring of socio-ecological dynamics to evaluate the reliability of respondents’ perceptions (see below).

As noted above, our results, combined with those of other studies, provide good evidence that the term *thinking too much* is used to describe experiences of psychological distress. However, our results do not tell us how severe the experiences of distress are when residents use this term. As such, the results from this Chapter do not tell us the strength of the association between reported stressors and *thinking too much*. (However, in *Appendix: Linkages with thinking too much*, we find strong positive associations between the frequency of *thinking too much* and indicators of food

insecurity and economic poverty.) We are unaware of any established instruments for measuring the severity of *thinking too much*, though idioms of distress have been used to augment existing scales (Kaiser et al., 2015). However, further research could compare the frequency of reported *thinking too much* against scores from externally validated instruments such as the Kessler Psychological Distress Scale (Kessler et al., 2002).

2.6.5. Testing theories through long-term observation

As discussed above, local people's perspectives can provide insights into the stressors they experience and for understanding complex socio-ecological systems (Bennett, 2016; Ingold, 2000; Narayan et al., 2000). However, they are also subjective, so triangulating the results against other evidence may help anticipate the impacts of future landscape changes. The current study suggests several long-term landscape dynamics that might have implications for residents' mental health, including the expansion of commercial agriculture and the potential livelihood impacts of forest loss. It may be ethically and practically challenging to evaluate the impacts of these dynamics through experimental testing. For example, randomly deforesting Reserves that provide important livelihood resources might be politically unacceptable. Instead, the possible mental health impacts of these dynamics could be evaluated through a cohort study, providing stronger evidence than cross-sectional designs (Burns, Rohrich, & Chung, 2011).

Cohort studies recruit participants, some of whom are expected to be exposed to risk or protective factors (Belbasis & Bellou, 2018). The cohort is followed over time to explore if these factors contribute to health outcomes. This method can help researchers understand what factors alter the likelihood of developing a disease or condition (Barrett & Noble, 2019).

In the case of this system, such a study might ask, 'how does commercial agricultural expansion affect social determinants of common mental disorders in Uganda?' This hypothetical study could involve the random selection of sampling units (e.g., parishes), in which households are randomly (if lists can be obtained) or systematically sampled. These sampling units are expected to have different probabilities of being subjected to the exposure variable, commercial agriculture

expansion. Individual and household data would be measured at the start and periodically during the study period (whose length would depend on the timeframe on which changes in agricultural systems are expected to occur, but might span multiple years). The outcome variables might include depression and generalised anxiety disorders, measured using screening instruments or diagnostic interviews among household members. The exposure variable could be the proportion of the sampling unit's agricultural area covered by commercial crops, measured using remote sensing. Mediating variables could include socio-economic status (but see below for the difficulties in doing this) alongside covariates (e.g., social support, demographic characteristics). These data could be combined in time-series analysis of whether commercial agricultural expansion is associated with depression or anxiety incidence, depending on household socio-economic status. The study would need to account for migration patterns, such as through follow-up interviews with households who left the sampling units to understand the factors causing them to leave. Although offering robust data, this study design might still be susceptible to confounding (e.g., if peri-urban area proximity simultaneously provides better social services that support mental health and commercial market access that encourages agricultural expansion) (Barrett & Noble, 2019). Similar methods might be used to explore the impacts of forest expansion and contraction or the gazettement of protected areas over time. In general, such studies are likely to be costly and time-consuming, and given the rate and potential lumpiness of systemic change are likely to need to be carried on over multiple years. Nevertheless, they could be a powerful approach for exploring fundamental questions about the relationship between nature, people, and conservation in new and robust ways.

2.6.6. Policy relevance

Uganda has adopted the SDGs, which include Goal 3 to “*Ensure healthy lives and promote well-being for all at all ages*” and SGD 10 to “*Reduce inequality within and among countries*” (United Nations (UN), 2015). Perceptions play a central role in people's subjective evaluations of their wellbeing (Diener, 2009; Diener, Suh, Lucas, & Smith, 1999), including regarding their health (K. V. Das et al., 2020; Lombardo, Jones, Wang, Shen, & Goldner, 2018). For example, the lived

experience of food insecurity – such as worrying about getting enough food of sufficient quality – is strongly associated with indicators of poor mental health (A. D. Jones, 2017). Therefore, managing the factors perceived to affect mental health may help promote healthy lives and wellbeing, as subjectively experienced. In the current study context, this may mean acknowledging and acting on people’s concerns about landscape management and policy (Bennett, 2016). For example, the Ugandan Government might investigate how rural residents view contract farming and avoid policies perceived to worsen inequalities and trigger *thinking too much*. Doing so might support progress to SGDs 3 and 10. This process might be facilitated by strengthening Ugandan’s decentralised governance system (see Mushemeza (2019) for ideas on how this could be done), with local councils soliciting residents’ perspectives and raising them with decision-makers in central government.

Moreover, though not objective descriptions of reality, perspectives can be valuable sources of evidence for understanding socio-ecological system dynamics (as discussed above). Such evidence might be beneficial in the context of the precautionary principle; “*when an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically*” (Wingspread Statement, 1998). In other words, though not providing definitive evidence, local people’s perspectives may flag issues and opportunities that warrant further investigation before actions are pursued. For example, reports that contract farming might increase inequality may highlight the need for further social impact evaluation.

Perceptions can also influence attitudes and behaviours and the success of projects that depend on local support (Bennett, 2016; Bennett et al., 2019). For example, perceptions regarding forests as a source of resources and a home for crop-raiding wildlife – both reportedly indirectly linked to *thinking too much* – might influence attitudes toward its protection. Preventing or compensating for human-wildlife conflict has been a persistent issue in the study area and elsewhere in East Africa (Fungo, 2011; Webber, Hill, & Reynolds, 2007). However, there are emerging innovations that Ugandan authorities might consider, such as community-operated compensation schemes (Watve,

Patel, Bayani, & Patil, 2016). If successful, such interventions might reduce experiences of *thinking too much* and foster support for local forest conservation, potentially contributing to sustainable development and biodiversity goals.

2.7. Conclusion

The global mental health and ecological crises present growing threats to human wellbeing (IPBES, 2019; Patel, Saxena, et al., 2018). While an increasing number of studies explore how changes to ecosystems harm physical health, relatively few explore ecosystems' roles in mental illness. We use a new framework that situates social determinants of psychological distress in socio-ecological systems. Using this framework, we find that commercial agriculture and nature conservation may influence social determinants of psychological distress in our case study. Further research is required to understand if these reported links with psychological distress are also associated with mental illness.

Nevertheless, accounting for people's interactions with ecosystems may help better explain the aetiology of mental illness, particularly if ecological change continues to escalate. Furthermore, our study indicates opportunities to manage perceived co-benefits and trade-offs between SDGs, thereby potentially supporting subjective experiences of mental health. In summary, our case study demonstrates the importance of taking a more holistic and locally nuanced approach to understanding how people's relationships with ecosystems relate to psychological distress and mental illness.

3. Predicting the impacts of land management for sustainable development on depression risk in a Ugandan case study

3.1. Abstract

Agricultural intensification and expanding protected areas are proposed sustainable development approaches. But, their consequences for mental health – a global priority – are poorly understood. We predict how forest conservation and contract farming may alter resource access and depression risk in rural Uganda. We asked 695 residents in 11 communities about their expectations under land management scenarios, their household characteristics, and experiences of depression symptoms. Over 80% of respondents presented with a *business-as-usual forest access* scenario expected reduced forest income and food over the next decade. This number climbed to over 90% among respondents presented with a *restricted forest access* scenario. Over 80% said losing forest access would increase food insecurity and poverty among forest-dependent households. Furthermore, over 99% of those presented with two land access scenarios (*business-as-usual land access* and *sugarcane expansion land access*) expected wealthy households to gain land but poorer families to lose it. This land redistribution was expected to increase poverty and food insecurity among small-scale farmers. Bayesian structural equation modelling suggested that depression severity was positively associated with food insecurity (estimate = 0.20, 95% credibility interval (CI) = 0.12 - 0.28) and economic poverty (estimate = 0.11, 95% CI 0.02 - 0.19). Conservation and agricultural approaches that restrict access to livelihood resources may threaten vulnerable groups' mental health.

3.2. Introduction

Humanity faces the joint challenge of reversing the loss of nature whilst supporting human health and wellbeing. Two intersecting global policy frameworks seek to address this challenge. The proposed post-2020 global biodiversity framework aims to catalyse “*urgent action across society to put biodiversity on a path to recovery for the benefit of planet and people*” as a step towards

living in harmony with nature by 2050 (CBD, 2021). Simultaneously, the 17 United Nations 2030 Sustainable Development Goals (SDG) include ending poverty (SDG 1) and hunger (SDG 2) while reducing inequalities (SDG 10) and ensuring health for all (SDG 3) (UN, 2015).

How landscapes are managed will play a key role in addressing this joint challenge in the coming decades. For example, feeding the world's population whilst protecting nature will require significant changes in how agroecological systems are organised (M. Clark, Hill, & Tilman, 2018). Often, land management interventions change who has access to nature, with complex trade-offs and co-benefits in relation to multiple dimensions of wellbeing (E. C. Ellis, Pascual, & Mertz, 2019; Lu, Liu, Yu, & Fu, 2021). A core part of wellbeing is mental health, defined as the capacity of thoughts, emotions, and behaviours that enable people to realise their potential, cope with stresses, work productively, and contribute to their community (Patel, Saxena, et al., 2018; World Health Organization (WHO), 2004a). Yet, evidence of how land management can influence access to nature in ways that affect mental health – an emerging global priority (P. Y. Collins et al., 2011; Patel, Saxena, et al., 2018) – is patchy (as discussed in detail in chapters 2 and 8).

This patchy understanding has several implications. First, there may be hidden trade-offs between mental health and other sustainable development targets that are poorly accounted for when designing land management policy. For instance, some land management approaches that seek to protect nature (SDG 15) could alter access to natural resources in ways that undermine progress toward mental health targets (SDG Target 3.4) (as discussed in Chapter 2). Second, understanding these connections may reveal land management approaches that simultaneously contribute to mental health and other sustainable development objectives. For example, given the strong links between poverty and mental illness (Lund et al., 2018), land management policies that promote sustainable natural resource use could support mental health. Anticipating these trade-offs and co-benefits could help decision-makers choose land management approaches that promote mental health within a functional and diverse biosphere (M. Nilsson, Griggs, & Visbeck, 2016).

This chapter aims to predict how land management for sustainable development could alter access to nature in ways that affect mental health. Specifically, we explore how agricultural intensification

and restrictive protected areas may increase depression risk through a Ugandan case study. In doing so, we encourage policymakers to anticipate how land management approaches could alter access to nature in ways that either undermine or support mental health goals.

3.3. Nature’s contributions and mental illness

In the following, we illustrate how access to nature can influence social determinants of mental health (Figure 3.1). We do so by drawing on three bodies of evidence. First, we follow the definition of mental illness provided in Chapter 1. Multiple factors influence an individual’s risk of mental illness, including the interaction of psychobiological vulnerabilities and external stressors (Patel, Saxena, et al., 2018). These stressors can emerge from the economic, social, cultural, demographic, and environmental context of people’s lives, termed *social determinants* within public health literature (Lund et al., 2018). For instance, poverty is a recognised social determinant of mental illness (Kinyanda, Waswa, et al., 2011; Kinyanda, Woodburn, et al., 2011; Lund et al., 2010; Lund et al., 2018). Many of these social determinants might be influenced by interactions with the natural world, discussed next.

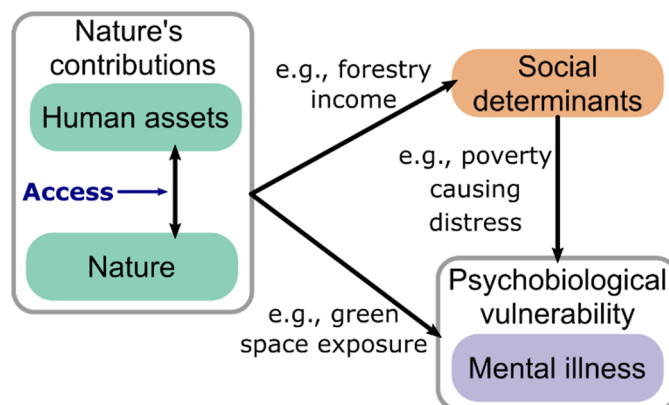


Figure 3.1. Illustrating how interactions between people and nature co-produce contributions that affect social determinants of mental illness, depending on an individual’s psychobiological vulnerabilities. Access is one factor that mediates the interaction between people and nature.

Second, nature refers to the natural world, with an emphasis on biodiversity (IPBES, 2020) (as defined in Chapter 1). In our study, both land and forests are considered part of nature. The

interaction of nature and human assets (like infrastructure, technology, or financial capital) co-produce food, energy sources, materials, medicine, and other contributions to human wellbeing (IPBES, 2020). These are termed *nature's contributions* to people (Díaz et al., 2015). For example, wild foods harvested from nature support dietary diversity and good nutrition in many parts of the world (Ickowitz, Powell, Salim, & Sunderland, 2014). Therefore, the interactions between human assets and nature may alter social determinants of mental illness. For instance, forest resources can contribute to food security, a known social determinant of common mental disorders (Ickowitz et al., 2014; Lund et al., 2018).

Finally, access has been defined as the “*ability to benefit from things*” (Ribot & Peluso, 2003). An individual or group’s ability to access something can be determined by the rights, knowledge, authority, social relations, markets, and other factors available to them (Ribot & Peluso, 2003). Access often mediates relationships between nature and people’s wellbeing (Berbés-Blázquez, González, & Pascual, 2016; Blaikie, 1989; Hicks & Cinner, 2014) and can be determined by formal and informal institutions and governance systems (Díaz et al., 2015). For instance, Thoms (2008) describes how elites within community forestry groups in Nepal restricted access to forests, harming the livelihoods of poorer households. Therefore, access is a crucial factor in determining who can co-produce and enjoy nature’s contributions (Díaz et al., 2015). Furthermore, multiple factors can change patterns of resource access, including land management policies and practices. For example, recent “*land grabs*” driven by agricultural modernisation, conservation, urbanisation, and other pressures have changed who has access to land in many parts of the world (Peluso & Lund, 2011). A wide range of actors can influence land management (Ostrom, 2007). However, in this study, we are principally interested in how local and national governments control and incentivise land management practices. We explore how two landscape management approaches for sustainable development – agricultural intensification through contract farming and protected areas – alter patterns of access to land and forests.

Protected areas cover 15% of the world’s land area and range from categories that permit sustainable use to those strictly limiting public access (UNEP-WCMC & IUCN, 2020). Residents

can face a wide range of benefits and costs from living next to protected areas, which can be highly contextual and differentiated between groups (Pullin et al., 2013). Protected areas are a critical approach within the post-2020 global biodiversity framework, with plans to double their current extent by 2030 (CBD, 2021; UNEP-WCMC & IUCN, 2020). This expansion is expected to affect the lives of hundreds of millions of people (Schleicher et al., 2019), including changing patterns of access to nature. While the social impacts of this expansion might vary between contexts, there are widespread concerns about its impact on Indigenous groups and other residents (ICCA Consortium, 2021).

Like protected areas, agriculture is a globally prevalent land use, covering 37% of the world's land surface (FAO, 2021). Contract farming has been promoted as a tool for sustainable development, offering the potential to increase food production, agricultural incomes, and employment while constraining nature loss (Vabi Vamuloh, Panwar, Hagerman, Gaston, & Kozak, 2019). Contract farming is where a processor agrees to purchase agricultural commodities from smallholder farmers under contract. Contracts can reduce farmers' uncertainty about returns on investment and the transaction cost of finding buyers while improving access to inputs, finance, and extension services (Meemken & Bellemare, 2020). However, the distribution of benefits and costs of contract farming partly depends on who can engage in it and how it changes access to resources like land (Bellemare & Bloem, 2018). For instance, the expansion of contract farming had complex and differentiated social impacts in parts of Ghana, Kenya and Zambia but resulted in the consolidation of land by elites in several cases (Hall et al., 2017). As such, the ability of contract farming to promote equitable sustainable development partly depends on how inclusive it is (Vabi Vamuloh et al., 2019).

Our case study predicts how stricter protection of forests and the expansion of contract farming might alter access to nature and its contributions to social determinates of depression. We focus on these land uses because they are globally prevalent, closely linked to rural livelihoods, and likely to play central roles in efforts to meet global sustainability targets (M. Clark et al., 2018). We use scenario-based questionnaires as a predictive approach that can provide evidence of credible

outcomes associated with potential intervention (Travers, Clements, & Milner-Gulland, 2016). Scenario-based questionnaires can leverage local expertise to explore how and why people might behave under plausible future scenarios (Travers et al., 2016). For example, Cinner, Folke, Daw, and Hicks (2011) conducted scenario-based questionnaires with Tanzanian fishers, with many saying they would increase their fishing effort if catches declined. In addition, scenario-based questionnaires can be combined with other methods to provide nuanced predictions of future outcomes. We, therefore, combine interviews with a Bayesian structural equation model analysis, modelling pathways between nature use and depressive symptom severity. This combined approach illustrates how future land management may change access to forests and land (Component 1) in ways that influence social determinants of depression (Component 2) among communities around Budongo Forest in Masindi District, western Uganda. Component 1 explores how land management could influence access to land and forests, and in turn food and income, through hypothetical scenarios. In this Component, we ask two research questions:

- RQ1: What are the perceived impacts of restricted forest access on food security and economic poverty among forest-using households compared to business-as-usual (BAU) over the next decade?
- RQ2: What are the perceived impacts of an expansion of contract farming on land distribution, food security, and economic poverty compared to BAU over the next decade?

Component 2 empirically models relationships between indicators of land and forest use, poverty and food security, and depression risk (Figure 3.2). Here, we hypothesise that:

- H1: Forest use is positively associated with economic poverty and food insecurity.
- H2: Farm size is negatively associated with poverty and food insecurity.
- H3: Food insecurity and economic poverty are positively correlated with depressive symptom severity, controlling for covariates.

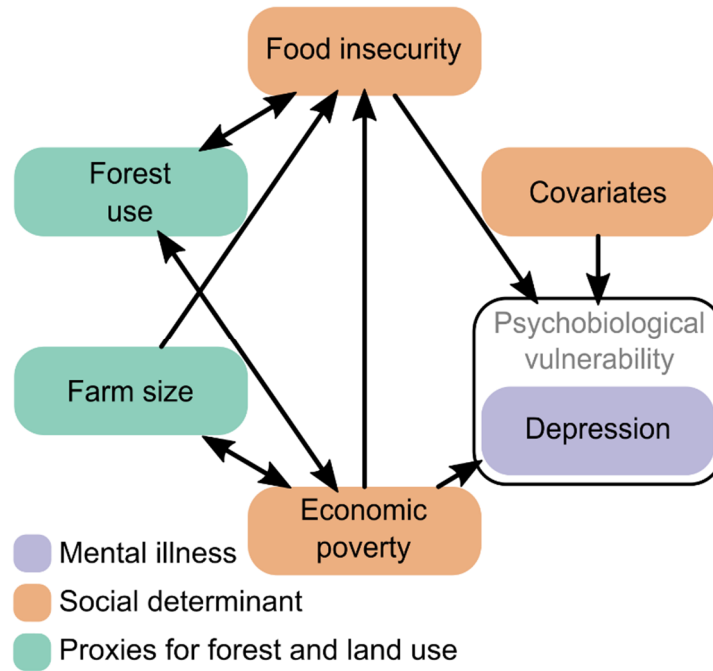


Figure 3.2. An illustration of the hypothesised links between farm sizes and forest use (proxies for nature’s contributions), food insecurity and depression (social determinants) and depression risk (mental illness) in our case study site. Single-headed arrows describe correlations, and bi-directional arrows describe covariance.

3.4. Methods

3.4.1. Target population and sampling strategy

This study builds on the findings of previous qualitative research in the same study site around Budongo Forest in Chapter 2 (Figure 3.3, see *Appendix: Study site description*). The target population includes male and female household heads (aged 18 to 60) of small-scale subsistence and contract farming households in 11 communities in Nyabyeya and Kabango parishes. This total population was estimated to include 2,124 households, based on counts provided by community leaders. The research team systematically sampled this population by walking along all roads and paths in each community (identified with the help of community leaders) once, selecting every third household to be surveyed. If sampled household heads were not at home or easily accessible, the research team arranged to return at a later time or date to survey them when they were at home. Based on estimates provided by community leaders, the sampling strategy was expected to yield 708 respondents, representing approximately one-third of farming households. The surveys were

conducted between 8 am and 5 pm, Mondays to Saturdays from March to May 2021. Non-farming households were excluded from the systematic sample. These excluded households were predominately short-term economic migrants whose relationships with local forests and agricultural systems were substantially different from those described in (Figure 3.2). Consequently, separate research questions, hypothesised relationships, survey instruments, and analysis would be needed to understand the socio-ecological dynamics linked to the mental health of this group. The implications of this decision are discussed within section 3.6.1. Study limitations.

Respondents were surveyed in English, Kiswahili and Runyoro languages, the most widely spoken languages in the study area. All residents within the study population area spoke at least one of these languages. The survey was forward translated by a professional translation service, then back-translated and refined with the help of five research assistants familiar with the local context and dialects over two weeks in March 2020. The survey was then piloted with 20 respondents in a neighbouring community outside the study area to ensure the questions were correctly interpreted. After this piloting, minor changes were made to the wording of questions and their translations to be more easily interpreted and consistent across languages. Other changes are described for specific variables below (see Study variables). I trained the research team over two weeks in February 2021. This training involved the enumerators practising following the exact wording of the survey forms in a standardised way and the sampling procedure. The surveys were conducted using the ODK software on electronic tablets.

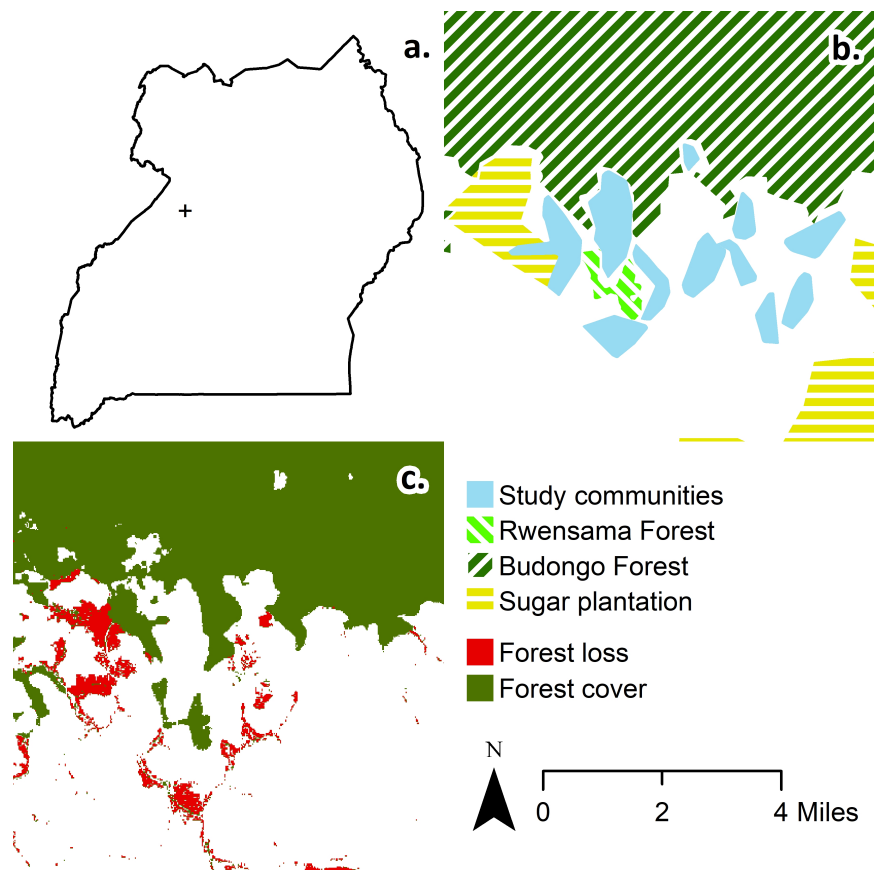


Figure 3.3. Maps describing the study area. Panel a. describes the location of the study site within Uganda (marked with the '+'). Panel b. describes the study area, including the 11 study communities, the Budongo and Rwensama Forest Reserves, and the indicative location of large-scale intensive sugarcane estates (adapted from (Kyongera, 2015; UNEP-WCMC & IUCN, 2020)). Panel c. describes forest loss between 2000 and 2016 and forest cover (> 75% tree cover) in 2016 (adapted from (Hansen et al., 2013)).

Ethical approval was granted by the Uganda National Council of Science and Technology (Ref. SS6007) of the Government of Uganda and an Ethical Review Board at the University of Oxford, United Kingdom (Ref. R63458/ RE002). The study followed the approved ethical protocol, which included gaining the informed consent of participants, providing in-kind compensation for respondents' time, and employing a trained psychiatric clinical officer to accompany the team. The ODK software was used to calculate eight-item Patient Health Questionnaire (PHQ-8) scores during the survey; the psychiatric clinical officer debriefed respondents with scores of 17 or over or who appeared to be distressed (following a standardised 'distress procedure'). This debrief included providing immediate care and asking respondents if they wanted to be referred (and provided transport) to specialists at Hoima Regional Referral Hospital. In total, 57 individuals crossed the diagnostic threshold for referral, 20 agreed to be referred, and six attended the referral.

Additionally, the study was conducted following the United Kingdom and Ugandan government COVID-19 safety guidelines and other procedures.

3.4.2. Component 1: Hypothetical landscape management scenarios

Many residents have witnessed changing forest and land access and management, as illustrated in Chapter 2. As such, the study participants were considered well-positioned to predict how hypothetical landscape management scenarios might affect their lives. Each respondent was randomly assigned a set of questions corresponding to one of four hypothetical scenarios (Table 3.1). One pair of scenarios included questions about the expected changes in the amount of food and income-generating things that households would get from the forest in the next ten years. This pair contrasted a BAU scenario against one in which access to forests was restricted. The second pair of scenarios explored expected changes in who has access to land over the next ten years. In this second pair, a BAU scenario was contrasted against one in which government policies increased sugarcane prices, incentivising the expansion of contract farming. These scenarios were designed to reflect plausible land management approaches that the Ugandan government might take to meet conservation and sustainable development targets. For example, Uganda is a party to the Convention on Biological Diversity (CBD, 2022). Within the post-2020 global biodiversity framework, countries are expected to substantially increase their extent of protected areas, including those under strict protection, by 2030 (CBD, 2021). One approach that the Ugandan government might take to meet this target is to designate Forest Reserves as more strictly protected areas. Equally, the Ugandan National Development Plan 2020/21-2024/25 aims to raise farmers' incomes by increasing land productivity (National Planning Authority of Uganda, 2020). Following recent policy trends, contract farming is likely to continue to be promoted as a tool to reach this goal. These hypothetical intervention scenarios were also chosen because they were comparable to residents' lived experiences and thus likely to yield to more accurate predictions than for interventions entirely unfamiliar to residents. For example, many residents have witnessed the expansion of sugarcane contract farming stimulated by Ugandan government policy over the last 30 years (as observed in Chapter 2, Babweteera et al., 2018). Similarly, many residents have

seen changes in forest rules and their enforcement, notably with the introduction of the National Forestry Authority and the National Forestry and Tree Planting Act in 2003 (Government of Republic of Uganda, 2003).

Table 3.1. Four scenarios were presented to respondents, contrasting business-as-usual (BAU) scenarios against hypothetical changes in land management. Each respondent was randomly assigned one scenario.

	Business-as-usual	Hypothetical intervention
Forest access	<p>BAU forest access: <i>“Some households in this community get food from the forest, like herbs, animals and mushrooms. In the next ten years, do you think households will get less food from the forest, more food from the forest, or will there be no change?”</i></p> <p><i>“Some households in this community get things from the forest to make money, like selling firewood, timber, and charcoal. In the next ten years, do you think households will get fewer things from the forest to make money, more things from the forest to make money, or will there be no change?”</i></p>	<p>Restricted forest access: <i>“Some households in this community get food from the forest, like herbs, animals and mushrooms. I want you to imagine that people were not allowed to get anything from the forest, and there were more guards in the forest, over the next ten years. When you imagine this, do you think households would get less food from the forest, more food from the forest, or would there be no change?”</i></p> <p><i>“Some households in this community get things from the forest to make money, like selling firewood, timber, and charcoal. I want you to still imagine that people were not allowed to get anything from the forest, and there were more guards in the forest, over the next ten years. When you imagine this, do you think people would get fewer things from the forest to make money, more things from the forest to make money, or would there be no change?”</i></p>
Land access	<p>BAU land access: <i>“Do you think there will be a change in who has land over the next ten years?”</i></p>	<p>Sugarcane expansion land access: <i>“I want you to imagine that the price of sugarcane increased, and people wanted to grow more sugarcane over the next ten years. When you imagine this, do you think there would be a change in who has land over the next ten years?”</i></p>

Respondents were asked about the expected consequences of each scenario on incomes and food availability. Most of the questions in this part of the survey were closed-ended, with participants choosing from pre-defined responses. However, four questions asked respondents to explain why they expected a given change to occur. For these, the enumerator was instructed to listen to select explanations given from a pre-defined list. If explanations were given that were not on this list, the enumerator recorded a few keywords summarising the explanation. This approach let us check that respondents understood the scenarios and provided context to their expectations. However, there were a limited number of non-listed responses (that were categorised as “other” in the results, alongside other responses categories that were rarely mentioned). These data were presented using

descriptive statistics, and Pearson's chi-square tests (with p-values computed using Monte Carlo simulation) were used to explore differences between scenarios.

3.4.3. Component 2: Structural equation modelling of relationships between respondent characteristics and mental health

Respondents were also asked about their household and personal characteristics and experiences of depressive symptoms. As described below, these data were analysed within a Bayesian structural equation model.

3.4.3.1. Study variables

The outcome variable within the statistical analysis was depressive symptom severity. A modified version of the nine-item Patient Health Questionnaire (PHQ-9) (Kroenke, Spitzer, & Williams, 2001) was used to measure depressive symptom severity. The PHQ-9 is widely used and is a recommended depression screening tool in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (APA, 2013). A recent meta-analysis of 29 studies comparing PHQ-9 scores to semi-structured interviews by qualified diagnosticians found that cut-off scores of 10 or above had a 0.88 sensitivity (i.e., true positive rate) and 0.85 specificity (i.e., true negative rate) (Levis, Benedetti, Thombs, & Collaboration, 2019). One validation study among 212 Ugandans found that PHQ-9 scores of 5 or above had 0.67 sensitivity and 0.78 specificity when compared to structured diagnostic interviews (the Mini International Neuropsychiatric Interview) (Nakku et al., 2016). The PHQ-9 has been employed in multiple studies in Uganda (e.g., Kaggwa, Najjuka, Ashaba, & Mamun, 2022; Kinyanda et al., 2021; Wagner et al., 2014). One item – related to suicidality – appeared to be misinterpreted during piloting and was removed. This modified instrument, referred to as the PHQ-8, is increasingly used and has equivalent diagnostic accuracy with the PHQ-9 (Y. Wu et al., 2020). The PHQ-8 asks respondents how many times they have experienced a given symptom in the past two weeks according to four response levels (with scoring from “*Not at all*” = 0 to “*Nearly every day*” = 3).

Depression severity can be calculated by summing a respondent's scores across items, with scores of 15 to 19 indicating moderately severe depressive symptoms and 20 to 24 indicating severe symptoms (Kroenke et al., 2009). Such scoring is useful when estimating the prevalence of a construct within a population, but this was not the study's purpose. Total PHQ-8 scores were not used within the statistical analysis for several reasons. First, PHQ-8 scores are bound between 0 and 24 and are ordinal; treating them as a continuous variable risks biased estimates. Second, simple scoring equally weights each item, ignoring their relative contributions to the underlying latent factor. Finally, collapsing the data into a binary variable leads to a significant loss of information, reducing the statistical power of the analysis, and is particularly problematic if the cut-point is unrealistic (Altman & Royston, 2006). Instead, the PHQ-8 was used to estimate latent depressive symptom severity, existing on a continuous scale (*see Appendix: Latent psychological distress*). This approach was suitable for meeting the study's aim, leveraging the full information available within the PHQ-8 while respecting model assumptions. Plausible values were extracted from a graded response model, implemented with ten imputed datasets (introduced below).

Furthermore, "*thinking too much*" is a colloquial term associated with psychological distress in the study area and in many parts of East Africa (Kaiser et al., 2015). A one-item instrument asked if respondents experienced *thinking too much*, with the same response levels as used in the PHQ-8. This instrument was used to triangulate the current research results with those described in Chapter 2.

The two focal social determinants of depression were food insecurity and economic poverty. Food security encompasses food sufficiency, nutrient adequacy, cultural acceptability, safety, certainty, and stability (Coates, 2013). Our study focused on food sufficiency, experienced as a continuum from worrying about not having enough to eat to reducing food consumption (Ballard, Kepple, & Cafiero, 2013). We used the Food Insecurity Experience Scale (FIES) developed by the Food and Agriculture Organization Voices of the Hungry project. The FIES is simple and rapid to use, appears to be valid across cultural and socio-economic contexts, and has been used in studies in Uganda (Coates, 2013; Sseguya, Mazur, & Flora, 2017). The FIES has two variations; the first asks

respondents to recall experiences across 12 months, which we considered too insensitive to recent changes, and the second spans one month, which may limit comparability between the study's start and end. Therefore, we adjusted the FIES, asking respondents to consider their experiences over a three-month timeframe, hoping to capture medium-term insecurity while smooth across short-term variability. The consequences of this timeframe in relation to the recall period within the PHQ-8 are discussed in the study limitations. The FIES was used to estimate latent food insecurity in ten sets of plausible values, using a two-parameter logistic item response model (see *Appendix: Latent food insecurity*).

Here, economic poverty means inadequate incomes and wealth, considered core aspects of material poverty (Narayan et al., 2000). Asset ownership is often used to indicate material poverty (Harttgen & Vollmer, 2013). We used an asset index based on a survey developed by other researchers during a study conducted in a nearby area in 2015, which we piloted and adapted in March 2019 (Travers, Archer, et al., 2019). After data collection, ten of the 31 assets were excluded because they were either a) very uncommon, b) dependent on community-level access to utilities, or c) appeared to depend on a respondent's livelihood strategy (see *Appendix: Economic poverty*). Logistic principle component analysis was conducted with the remaining items. The first component scores were extracted, scaled, centred, and treated as a proxy for economic poverty.

The focal proxies for nature use were farm size and forest use. These were used as proxies because we could not directly measure interactions between residents and nature. Residents of the study site use a wide range of legally and illegally harvested forest resources (Babweteera et al., 2018).

Legally harvested resources include firewood, medicines, and wild plants and mushrooms. Illegal forest resources include wild meat, timber, and wood for charcoal production. Given the sensitivity around direct questioning of illegal behaviours, we designed an instrument with seven Likert-scaled items (with five response levels ranging from “*disagree a lot*” to “*agree a lot*”) to estimate forest use, also treated as a latent variable. These items included non-specific (focusing on the role of the forest in general) and semi-specific (relating to household reliance on forest-related food and income) questions. For instance, one of the seven statements was, “*Your household gets good*

money from things in the forest.” This instrument was used to estimate latent forest use, again following the steps described for estimating latent depression, with the extraction of ten sets of plausible values (see *Appendix: Latent forest use*).

We chose to estimate farm size for several reasons. Subsistence farming in the study area generally utilised family labour, basic tools, and land; fertilisers, pesticides, and other industrial inputs were rarely used. Land size was the most commonly reported limiting factor for farm production in Chapter 2 (see Figure 10.1.d in *Appendix: Causes of poverty*). Furthermore, farmers rarely weigh their crops and only sell a portion of them at markets, so there would be no reliable way of estimating yields for each crop. Therefore, estimated relative farm size was chosen as a suitable indicator. Land boundaries and ownership are sensitive topics, and farms can be far from households where the surveys were conducted, so farm sizes were not physically measured. Instead, we designed an instrument with six Likert-scaled items (with five response levels ranging from “*disagree a lot*” to “*agree a lot*”) to estimate relative farm size. For example, one of the statements read, “*Your household’s farm is smaller than most others in this community.*” This instrument was used to estimate latent relative farm size, following the steps described above for estimating latent depression, before extracting ten sets of plausible values (see *Appendix: Relative land size*).

The analysis also included covariates identified during the prior qualitative study at the same site and by reviewing relevant literature (Table 3.2, see *Appendix: A priori hypothesised linkages between nature and depression*). Psychobiological vulnerability can moderate the links between social determinants and mental illness but was assumed to vary randomly in the population in relation to the exposure variable, so it was not measured.

Table 3.2. The a priori hypothesised associations between exposure and outcome variables in the structural equation model (where the exposure variable is expected to affect the outcome variable, apart from the when they are expected to have a bi-directional association indicated by co-variance) and a description of the exposure variables. See *Appendix: A priori hypothesised linkages between nature and depression* for details for evidence supporting each prior. Key: ‘+’ = positive association; ‘-’ = negative association; ‘?’ = uncertain direction of the association; RL = reference level, N = normal distribution (where the first argument is the mean and the second is the variance), B = beta distribution (with the arguments indicating the first and second shape parameters). All continuous variables are scaled and centred.

Outcome variable	Expected association	Exposure variable	Description of parent variable	Prior distribution
Depression	(+)	Food insecurity	A latent variable derived from the Food Insecurity Experience Scale (FIES) (A. D. Jones et al., 2013).	$N(0.25, 4)$
Depression	(+)	Economic poverty	An asset index adapted from Travers, Archer, et al. (2019).	$N(0.25, 4)$
Food insecurity	(+) co-variance	Forest use	A latent variable from an instrument designed to indicate forest use.	$B(12,11)$
Food insecurity	(-)	Farm size	A latent variable from an instrument designed to indicate relative farm size.	$N(-0.25, 4)$
Food insecurity	(+)	Economic poverty	As above.	$N(0.25, 4)$
Food insecurity	(-)	Distance to a forest reserve	Distance from the household to the edge of the nearest forest reserve.	$N(-0.25, 4)$
Economic poverty	(+) co-variance	Forest use	As above.	$B(12, 11)$
Economic poverty	(-) co-variance	Farm size	As above.	$B(11, 12)$
Depression	(+)	Age	The respondent’s age in years.	$N(0.25, 4)$
Depression	(+)	Gender	RL = male. The respondent’s gender.	$N(0.25, 4)$
Depression	(-)	Education	RL = no education. The respondent’s highest level of education.	$N(-0.25, 4)$
Depression	(-)	Social support	A latent variable derived from a modified version of the Multidimensional Scale of Perceived Social Support (MSPSS) (Zimet, Powell, Farley, Werkman, & Berkoff, 1990).	$N(-0.25, 4)$
Depression	(+/?)	Marital status	RL = married once or polygamous. Respondent’s marital status.	Divorced/widow/er: $N(0.25, 4)$

				Never married: $N(0, 9)$
Depression	(-) co-variance	Physical health	A single-item self-reported health question from the General Household Survey (Bowling, 2005; ONS, 2007).	$B(11, 12)$
Depression	(+)	Alcohol consumption	How many days a week does a respondent drink.	$N(0.25, 4)$
Depression	(+)	Smoking	If the respondent smokes every day.	$N(0.25, 4)$
Depression	(?)	Community name	RL = Nyabyeya Trading Centre. The name of the community in which the respondent resides.	$N(0,9)$

3.4.3.2. *Statistical analysis*

Within the sample, 0.2% of the data were missing (see *Appendix: Patterns of missing data (Chapter 3)*). We considered these values ‘missing at random’, meaning that there may be systematic differences between the missing and observed values, but they can be explained by other observed variables (Bhaskaran & Smeeth, 2014). (The literature on missing data also refers to values which are ‘missing completely at random’, which denotes a situation where there are no systematic differences between missing and observed values.) This missingness was partly because one of the questions related to social support was mistakenly excluded from an early version of the survey, implemented among the first 32 respondents (4.6% of the sample). However, potential systematic differences between the missing and observed values for this variable are expected to be explained by the other (correlated) social support questions. Additionally, 2% of respondents did not answer at least one of the six questions related to land size. However, these respondents answered other questions about land size and socio-economic status, which were strongly correlated with land size. Fourteen other variables had less than 0.5% of missing values, but these were correlated with other data, so they were also assumed to be ‘missing at random’. These missing data were substituted through multivariate imputation by chained equations, where ten datasets were created containing imputed values (see *Appendix: Imputation of missing data (Chapter 3)*).

A Bayesian structural equation model was fit for each of the imputed datasets. Bayesian methods are increasingly commonly used across multiple disciplines, including ecology, behaviour, and the social sciences (van de Schoot et al., 2021). Bayesian approaches are a powerful tool for systematically and transparently combining prior evidence and new data to draw inferences about the world (McElreath, 2016). In the current study, this approach allowed us to incorporate evidence from well-developed bodies of theory into our analysis. A structural equation modelling approach allowed us to model associations between explanatory variables. The analysis was performed in the Stan computational framework (accessed using the *blavaan* package (Merkle, Fitzsimmons, Uanhoro, & Goodrich, 2020)). The model’s structure is based on the results of previous qualitative

research in the study area (corresponding to Figure 3.2) described in Chapter 2. Moderately informative priors were chosen when there was evidence of an expected direction of effect. Reviewing evidence cited in *Appendix: A priori hypothesised linkages between nature and depression*, and in discussion with collaborations, I selected priors that indicated the direction and general magnitude of effect sizes. However, I also chose wide prior distributions since there were no studies using the same combination of survey instruments within the target population. For instance, substantial evidence suggests positive associations between food insecurity and depression risk (Kinyanda et al., 2017; Lund et al., 2018; Weaver & Hadley, 2009). However, none of these studies used the FIES and PHQ-8 within the target population. Therefore, for this association, we chose a normal prior distribution that assumed a one standard deviation (SD) change in food security was associated with a 0.25 SD change in depressive symptom severity, with a variance of 4 ($SD = 2$).

Weakly informative priors were used where there was little prior evidence of an expected direction of effect. Using a seed value of 4343, the model was run for 4,000 burn-in and 4,000 post-burn-in iterations (8,000 total), with the posterior distribution estimated with the Markov Chain Monte Carlo sampler, across four Markov chains, following McElreath (2016). The models were evaluated according to the ten steps described in the When to worry and how to Avoid the Misuse of Bayesian Statistics Checklist (WAMBS)-Checklist (see *Appendix: WAMBS-Checklist (Chapter 3)*) (Depaoli & Van de Schoot, 2017). Finally, the model results associated with each of the ten imputed datasets were pooled by combining the posterior distributions. Point estimates are the median of the posterior distribution.

We also implemented several post hoc supplementary analyses. First, we modelled the association between *thinking too much* and latent depressive symptom severity using a Bayesian ordinal regression with weakly informative priors (see *Appendix: Thinking too much and depression*). Second, we repeated the primary analysis described above, replacing depressive symptom severity with *thinking too much* (treated as a continuous variable, see *Appendix: Linkages with thinking too much*).

3.5. Results

The survey was completed by 695 respondents from 11 communities (Table 3.3). Of these, 11.2% reported moderately severe depressive symptoms (PHQ-8 scores = [15, 19]) and 4.6% reported severe symptoms (PHQ-8 scores = [20, 24]). We also found a positive association between the reported experience of *thinking too much* and PHQ-8 scores (log odds = 1.27, 95% CI = 1.22 - 1.31). For instance, someone with a PHQ-8 score of 20 was 2.38 times more likely to report *thinking too much* nearly every day than someone with a score of 10 (see *Appendix: Linkages with thinking too much*).

Table 3.3. Overall and gender-differentiated respondent characteristics. Numeric variables are described by their mean (and standard deviations). Categorical data are described by their counts (and percentages). Key: PHQ-8 = eight-item Patient Health Questionnaire, FIES = Food Insecurity Experience Scale, Alcohol consumption = how many days a week a respondent consumes alcohol.

Characteristic	Overall N = 695	Women N = 414	Men N = 281
PHQ-8 score	9.7 (4.9)	10.1 (5.0)	9.1 (4.8)
Strong thoughts?			
Not at all	96 (14%)	63 (15%)	33 (12%)
Few days	241 (35%)	132 (32%)	109 (39%)
More than half the days	97 (14%)	54 (13%)	43 (15%)
Nearly every day	261 (38%)	165 (40%)	96 (34%)
FIES score	4.9 (2.5)	5.2 (2.5)	4.6 (2.5)
Age	35.6 (11.4)	34.8 (11.1)	36.8 (11.8)
Education			
No education	63 (9.1%)	58 (14%)	5 (1.8%)
Primary	465 (67%)	282 (68%)	183 (65%)
Secondary	144 (21%)	67 (16%)	77 (27%)
Beyond Secondary	23 (3.3%)	7 (1.7%)	16 (5.7%)
Marital status			
Divorced or widow/er	117 (17%)	95 (23%)	22 (7.8%)
Married/polygamous	532 (77%)	298 (72%)	234 (83%)
Never married	46 (6.6%)	21 (5.1%)	25 (8.9%)
Health			
Very bad	31 (4.5%)	19 (4.6%)	12 (4.3%)
Bad	75 (11%)	51 (12%)	24 (8.5%)
Fair	364 (52%)	208 (50%)	156 (56%)
Good	159 (23%)	97 (23%)	62 (22%)
Very good	66 (9.5%)	39 (9.4%)	27 (9.6%)
Alcohol consumption	0.5 (1.2)	0.3 (1.0)	0.7 (1.4)
Daily smoker			
No	619 (89%)	395 (95%)	224 (80%)
Yes	76 (11%)	19 (4.6%)	57 (20%)
Language			
English	96 (14%)	37 (8.9%)	59 (21%)
Kiswahili	502 (72%)	312 (75%)	190 (68%)
Runyoro	97 (14%)	65 (16%)	32 (11%)

3.5.1. Component 1: Effects of land management scenarios on access

In total, 353 respondents were asked about either the BAU forest access (188) or restricted forest access (165) scenarios. Most of these respondents felt households would get less food (Figure 3.4a) and fewer income-generating things (Figure 3.4d) from the forest over the next ten years. The expected decline in food and *things* was significantly higher among restricted forest access scenario respondents. Many of those expecting declines indicated that this would be because residents would be stopped from accessing the forest (Figure 3.4b and Figure 3.4e), particularly in the restricted forest access scenario. The majority believed that households who got less food and fewer things from the forest would experience greater food insecurity (Figure 3.4c) and poverty (Figure 3.4f), with no significant difference between scenarios.

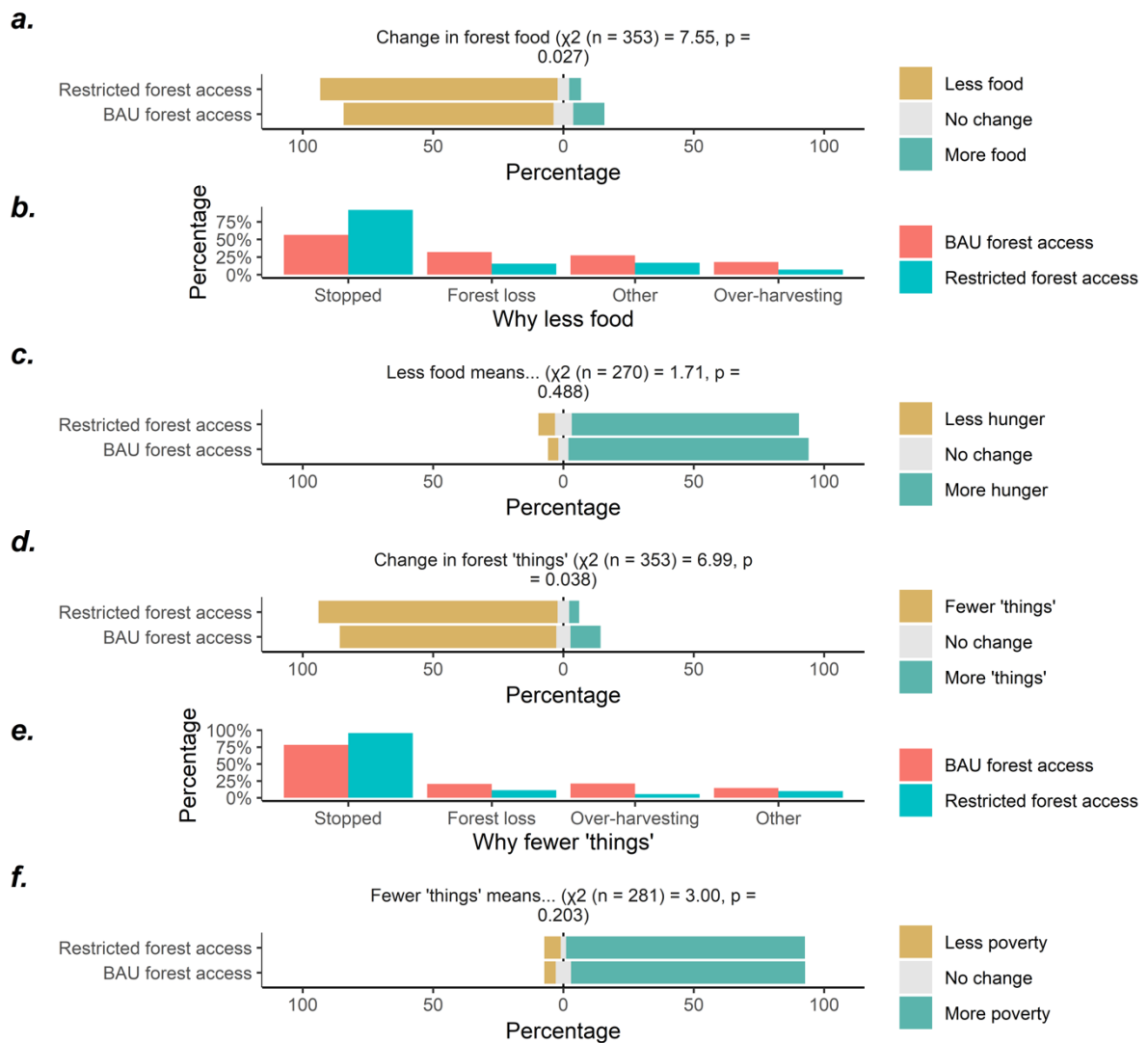


Figure 3.4. Scenario-based questionnaire responses to two forest access scenarios. Panel a. describes expected changes in the amount of food from forests over the next decade, panel b. shows reported reasons for this decline, and panel c. illustrates expected consequences for household hunger (among forest users). Panel d. shows expected changes in the amount of income-generating ‘things’ from the forest, panel e. describes the reported reasons for this decline, and panel f. displays the expected consequences for household poverty (among forest users). Key: BAU = business-as-usual.

The other half of the respondents (342) respondents were asked to consider the BAU land access (163) and sugarcane expansion land access (179) scenarios. Most of these respondents expected a change in who has land over the next ten years, with no significant difference in responses between the two scenarios (Figure 3.5a). Among those expecting a change, almost all said wealthier households would gain land and poorer households would lose it, with no significant difference between scenarios (Figure 3.5b and Figure 3.5c). While many indicated that households would buy or rent this land, a sizable proportion also believed this land would be “taken” from others (Figure

3.5d). Many expecting a change in land distributions indicated that acquired land would be used for cash crops, particularly in the sugarcane expansion land access scenario (Figure 3.5e). In both scenarios, many indicated that a decline in a household's land would lead to an increase in poverty (Figure 3.5f) and hunger (Figure 3.5g). However, associated poverty increases were slightly lower in the sugarcane expansion land access scenario.

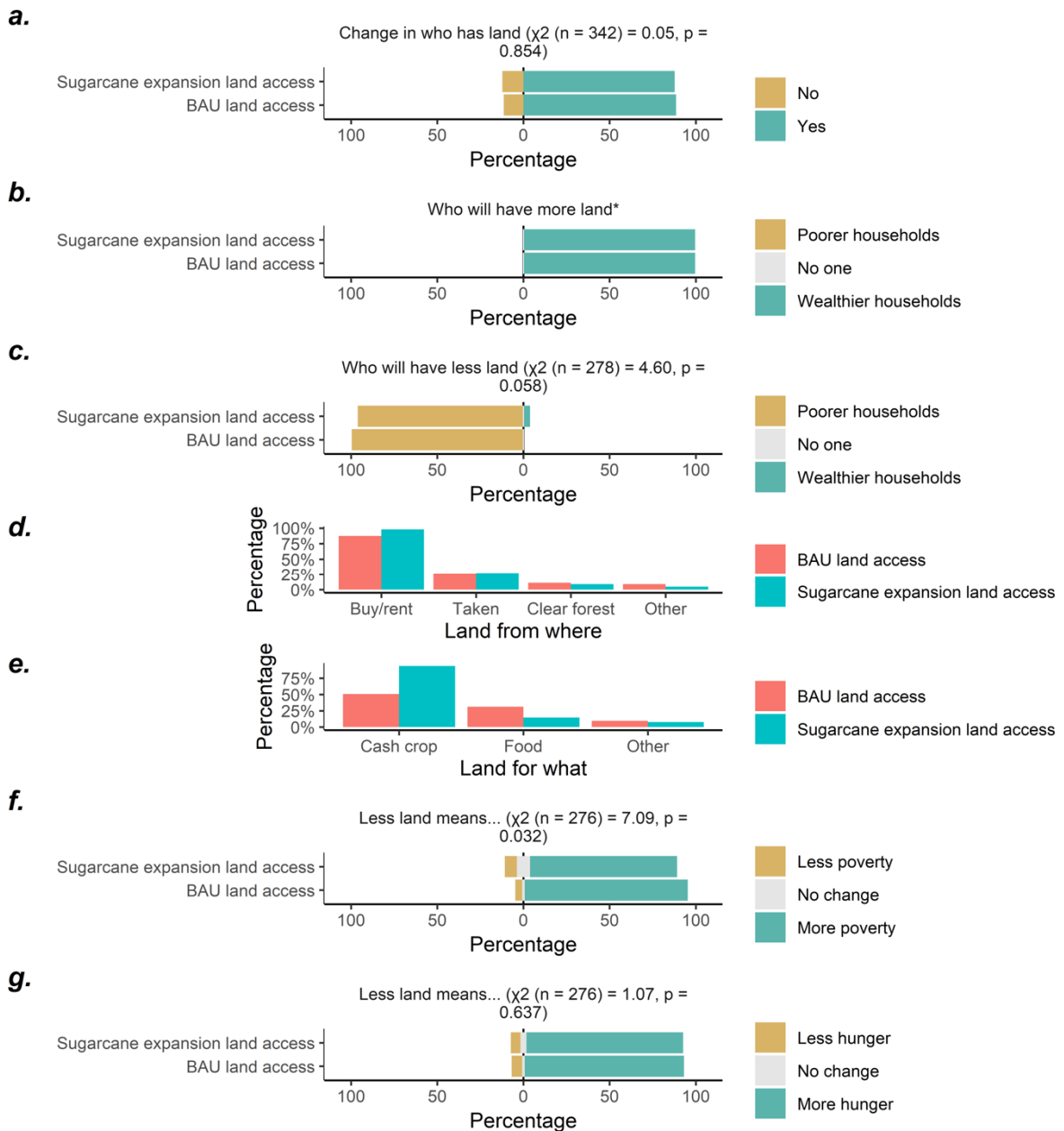


Figure 3.5. Scenario-based questionnaire responses to two land access scenarios. Panel a. describes the proportion expecting changes in who has land over the next ten years, and panel b. and c. illustrate who is predicted to gain and lose land, respectively (among those expecting a change). Panel d. describes where this land is expected to come from, and panel e. displays what this land might be used for. Panel f. and g. illustrate the expected impacts of losing land on household poverty and hunger, respectively. *Where the chi-

square test could not be formed because no respondents expected poorer households to gain land. Key: BAU = business-as-usual.

3.5.2. Component 2: The relationship between forest use, farm size and social determinants of depression

Within the statistical analysis, forest use was positively associated with food insecurity and (with less statistical certainty) economic poverty (Figure 3.6a). Conversely, farm size was negatively associated with economic poverty and food insecurity. Furthermore, food insecurity and economic poverty were positively associated with depressive symptom severity. The analysis also supported many of the hypothesised associations between depressive symptom severity and the covariates. For instance, men and those with higher education, greater social support, and better health reported lower depressive symptom severity. Additionally, the analysis was repeated with the software's default weakly informative priors, the results of which were effectively the same as those presented here (see *Appendix: WAMBS-Checklist (Chapter 3)*).

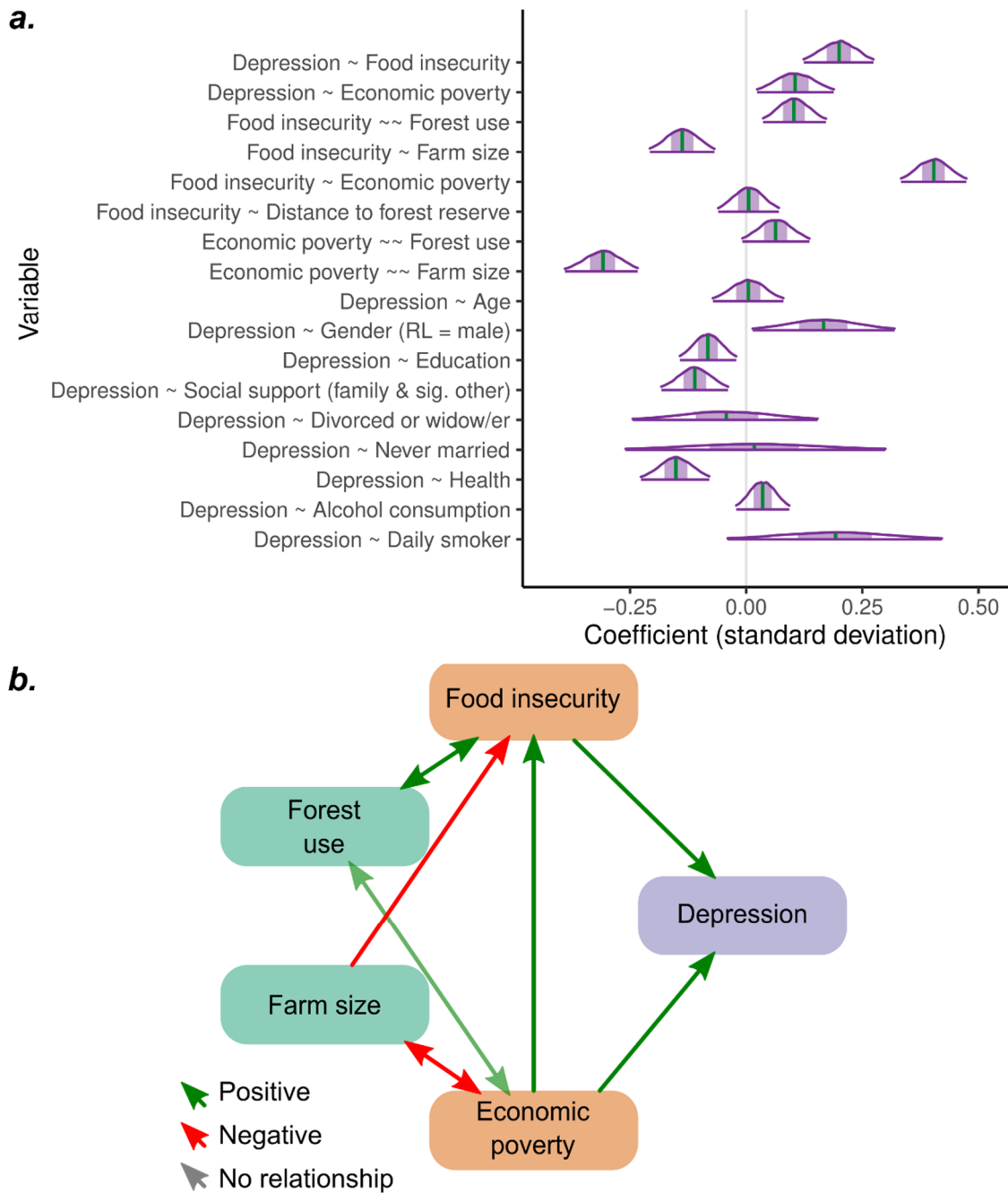


Figure 3.6. Bayesian structural equation modelling results. Panel a. describes the coefficient estimates from the Bayesian structural equation model using data from 695 respondents. The vertical green line represents the point estimate (median of the posterior distribution), the dark purple line represents the 95% credibility interval, and the shaded area represents the 50% credibility interval. The estimated associations between depressive symptom severity and the community dummy variables are not shown. Coefficient estimates are presented in standard deviations. Panel b. illustrates the direction of association between each variable (excluding covariates). The semi-opaque line indicates a marginally statistically uncertain association (as shown in Panel a.). Key: ‘~’ = regression, ‘~~’ = co-variance, ‘RL’ = reference level.

When looking at the total effects, those with 1 SD higher forest use than the mean had an estimated 0.03 (95% CI = 0.00 - 0.05, Figure 3.6b) SD higher depressive symptom severity. Similarly, those

with 1 SD larger farm sizes than the mean reported 0.08 (95% CI = 0.11 - 0.05) SD lower depression severity. In other words, forest users were at a slightly greater risk of depression, but those with larger farms were at a slightly lower risk.

We repeated the analysis, substituting latent depressive symptom severity with an instrument asking about *thinking too much*. The results of this supplementary analysis were largely consistent with those presented above, although with some differences associated with the covariates (see *Appendix: Linkages with thinking too much*).

3.6. Discussion

Landscape management can often change patterns of access to nature, with complex outcomes for human wellbeing (E. C. Ellis et al., 2019; Lu et al., 2021). Yet, we are unaware of any studies predicting how changing access to land and forest resources influence social determinants of mental illness. Our study helps address this gap, describing the expected consequences of changes in landscape management on social determinants of depression in a Global South case study. In the following, we summarise our results in relation to our original research questions and hypotheses, discuss key study considerations, and then situate the results within a wider research and policy context.

Our respondents expected that restricted forest access – in both forest scenarios – would increase food insecurity and economic poverty among forest-using households (RQ1). Moreover, our modelling suggested that forest use was positively associated with food insecurity and economic poverty (to a lesser extent) (H1). Food insecurity and poverty appeared to be important social determinants of depressive symptom severity (H3). Combined, these results suggest that conservation approaches that restrict forest access may exacerbate social determinants of depression among forest users. These results corroborate other studies in several ways. Studies have found that access to multi-use protected areas can sometimes support residents' livelihood and food security (Pullin et al., 2013). For example, Naidoo et al. (2019) synthesised data from over 60,000 households in 34 developing countries, finding that children (under five) living near

multi-use protected areas with tourism had higher height-for-age scores and were less likely to be stunted than comparators far from protected areas. However, strictly protected areas that restrict access to nature's contribution may increase economic poverty and food insecurity in some cases (Pullin et al., 2013). For instance, Golden, Fernald, Brashares, Rasolofoniaina, and Kremen (2011) estimated that removing access to wild meat would lead to a 29% increase in the number of children suffering from anaemia in rural north-eastern Madagascar. Furthermore, extensive prior evidence suggests that poverty and food insecurity are important social determinants of common mental disorders (A. D. Jones, 2017; Lund et al., 2018; Ridley, Rao, Schilbach, & Patel, 2020). For example, Kinyanda, Woodburn, et al. (2011) found that indicators of poverty (such as low socio-economic status and no education) were associated with greater risks of depression among a nationally representative sample of 4,660 Ugandans.

Furthermore, respondents also expected more inequitable land distribution, largely attributed to contract sugarcane farming, with those losing land being at greater risk of food insecurity and economic poverty (RQ2). Our statistical analysis suggested that farm size was negatively associated with poverty and food insecurity (H2). Together, these results suggest that agricultural approaches that restrict access to land may worsen social determinants of depression among small-scale farmers. These results align with other studies suggesting that contract farming can benefit participating households. For instance, Meemken and Bellemare (2020) evaluated nationally representative data from six countries, finding that contract farmers obtained higher incomes than non-contract farmers in some contexts. Equally, the current study also corroborates other research suggesting contract farming can increase inequality and worsen outcomes in some cases (Bellemare & Bloem, 2018; Hall et al., 2017). For example, in a case study around Kakira Sugar Works in Uganda, Martiniello (2021) found that the expansion of sugarcane contract farming marginalised poor smallholders. Moreover, contract farming approaches may occur hand-in-hand with other factors – like global market exposure, indebtedness, and uncertain yields – linked to high rates of suicide in some farming communities (Bryant & Garnham, 2013; Mohanakumar & Sharma, 2006).

However, we found relatively little difference within each scenario pair. This result could be because the hypothetical interventions resembled land management practices that were expected to occur regardless. For instance, residents who have witnessed the expansion of contract farming over the last two decades may expect this trend to continue. If this is the case, those who influence land management, such as the Ugandan government, should consider policies that actively divert from this trajectory, as discussed below.

3.6.1. Study limitations

Our approach combining modelling of current dynamics with expectations under different scenarios allows us to explore plausible land management outcomes in the future. We believed that residents were well-positioned to evaluate the impacts of changing land management on their own lives. Yet, scenario-based questionnaires have several limitations. First, a respondent's ability to accurately predict their actions may decline as the scenarios become more complex (Travers et al., 2016). However, we presented relatively simple scenarios, which were extensions of current land management practices. Second, these evaluations may not have fully accounted for indirect, unintuitive, or hidden feedbacks that might affect residents in complex socio-ecological systems. For instance, preventing hunting might lead to increased populations of crop-raiding wildlife, further harming food security. Similarly, respondents' perceptions of the world are influenced by personal and social as well as experiential factors. As such, they are subjective interpretations of reality, which need to be treated cautiously (as discussed in the limitations of Chapter 2 and the critical review of methods in Chapter 8). Finally, respondents may provide strategic responses if they believe this will influence the choice of intervention. We sought to reduce this potential effect by explaining that no planned intervention was associated with the research. In general, a large body of research explores the limitations of expert elicitation methods in conservation and related fields (e.g., Burgman et al., 2011). Many of these limitations might also apply when using scenario-based questionnaires, suggesting the potential value of structured elicitation protocols when using these interviews (e.g., V. Hemming, Burgman, Hanea, McBride, & Wintle, 2018). Equally, a researcher's positionality may influence which and how scenarios are presented, how

participants respond, and how the results are interpreted. Therefore, we suggest the need for reflexivity when using these methods, as in other areas of sustainability research (Bennett et al., 2017; Montana et al., 2020). Finally, while there is increasing application of scenario-based interviews and questionnaires in conservation and related fields (e.g., Travers et al., 2016), there appears to be limited evidence testing how well respondents' predictions perform against actual interventions.

We also assumed that psychobiological vulnerability varied randomly with respect to the exposure variables, such as economic poverty. However, there can be dynamic bi-directional feedback between mental illness and life stressors over an individual's life course. For instance, results presented in Chapter 2 suggested that *thinking too much* was linked with impaired livelihood activities, potentially worsening social determinants of psychological distress. These dynamic feedbacks represent an opportunity for future time-series research, exploring how landscapes, livelihoods, and mental health co-evolve over time.

We restricted our study population to farming households and did not consider the impacts of land management on the mental health of other groups. However, contract farming can have complex effects on non-farmers, such as labourers (Bellemare & Bloem, 2018; Hall et al., 2017). The expansion of sugarcane farming in the study area has provided jobs for landless residents and migrants (Babweteera et al., 2018), so it might have supported the mental health of these groups. These potential benefits should be understood and accounted for when weighing up the suitability of different land management approaches.

We did not collect non-response rates within the sampling approach, so we do not have precise estimates of how many chose not to participate. However, the research team estimated (based on recollection) that less than 15 people declined to participate, representing around 2% of the target sample. This estimate appears consistent with the difference between the target sample of 708 respondents and the actual sample of 695 (a difference of 13). Though not systematically reported, a commonly stated reason for declining to participate was that the respondents did not have time.

The PHQ-8 has been used internationally and is based on an instrument that has been used in Uganda (Kinyanda et al., 2021; Wagner et al., 2014). However, western diagnostic criteria and psychological concepts might not be universally appropriate and overlook culturally relative syndromes (Kaiser et al., 2015). Results presented in Chapter 2 suggested partial overlap in symptoms associated with *thinking too much* and depression. Our study found a strong association between depressive symptom severity, estimated using the PHQ-8, and reported experiences of *thinking too much*. Moreover, *thinking too much* had similar associations with our explanatory variables as found in the primary analysis. This result suggests that our findings – and their broader policy implications – are unlikely to be an artefact of using a western diagnostic tool.

Like other screening instruments, the PHQ-8 cannot be used to diagnose individuals with depression. Screening instruments are often used to identify individuals for referral to specialists for formal diagnosis (Ferenchick, Ramanuj, & Pincus, 2019). This latter step is often performed through semi- or structured diagnostic assessments by qualified experts, following standardised classification systems (e.g., the Diagnostic and Statistical Manual of Mental Disorders and International Statistical Classification of Diseases and Related Health Problems). Even when using these gold-standard approaches, correctly diagnosing individuals can be challenging for multiple reasons, such as the subjective nature of evaluating functional impairment (L. A. Clark, Cuthbert, Lewis-Fernández, Narrow, & Reed, 2017). However, the current study did not attempt to diagnose individuals. Instead, we sought to identify risk factors for depression symptom severity at a population level. This application of screening instruments is routine in mental health research. For example, in a recent review of articles on income inequality and depression, 22 of 26 studies used screening instruments (including the PHQ-9) rather than diagnostic interviews (Patel, Burns, et al., 2018). Overall, our study cannot diagnose individuals with depression but can indicate factors associated with depression symptom severity at a population level.

The adapted FIES instrument asked respondents about experiences of food insecurity in the past three months, while the PHQ-8 uses a two week recall period. Consequently, our estimated association between food insecurity and depression symptom severity is likely to be conservative.

Using a more recent recall period within the FIES would likely have yielded a greater association between food insecurity and depression symptom severity, providing stronger evidence supporting our third hypothesis (H3).

Finally, respondents generally expected the hypothetical interventions to have detrimental impacts on vulnerable groups. Consequently, these scenarios appear to be negative for some residents (though the *sugarcane expansion land access* scenario was predicted to be beneficial for wealthier ones). As such, our study emphasised the potential risks of some sustainable development landscape management interventions. The study did not explore hypothetical interventions that are likely to be more universally beneficial. Future research could use scenario-based approaches to explore ways landscape management interventions might actively support residents' mental health (discussed in the following section). Moreover, this future research could use participatory approaches to identify plausible and desirable interventions that residents might want to see. The current study did not use participatory approaches for reasons described in Ethical considerations. However, such approaches could help direct policy to solutions driven by local visions and interests.

3.6.2. Land management policy and mental health

Common mental disorders are a leading cause of morbidity and disability (Prince et al., 2007), but there has been a “*collective failure to respond to this global health crisis*” (Patel, Saxena, et al., 2018). Recognising this, the field of global mental health has emerged, which seeks to enhance both the treatment and prevention of mental illness worldwide (Kleinman, 2009). As part of this prevention, there have been recent calls to better understand and manage the social, cultural, and economic causes of mental illness. For instance, P. Y. Collins et al. (2011) highlight the need to better “*support community environments that promote physical and mental wellbeing throughout life*”. However, our results suggest the need to look beyond the social context to understand distal socio-ecological factors indirectly influencing mental health. These factors include how landscape management can influence social determinants of mental illness. Moreover, our study responds to calls for forward-looking predictive landscape planning (Travers, Selinske, et al., 2019). In doing

so, our study suggests potential trade-offs that should be accounted for within land management for holistic sustainable development.

Protected areas will remain a core part of global conservation efforts, with the “30 by 30” plan to double their current extent over the next decade (CBD, 2021). The social impacts of this expansion may vary depending on residents’ context-dependent relationships with nature and access rules. However, our results suggest restrictive protected areas may threaten the mental health of those whose livelihoods depend on access to nature. In these contexts, gazettement strictly protected areas might undermine progress in health (SDG 3) and other sustainable development goals among some groups. However, protected areas are unlikely to be unambiguously bad for mental health. For example, Buckley et al. (2019) estimated that the economic value of improved mental health among visitors to protected areas was several orders of magnitude greater than their management budgets. Nevertheless, many residents of biodiverse countries depend on nature for their basic needs while being under-served by mental healthcare services (Fedele et al., 2021; Saxena, Thornicroft, Knapp, & Whiteford, 2007). So, promoting the expansion of protected areas in these places might exacerbate social determinates of mental illness among already vulnerable populations. Though not tested in the current study, decision-makers might promote new livelihood strategies to offset the potential impacts of strictly protected area expansion on vulnerable forest-dependent groups. Such support might include targeting agricultural development projects to the poorest in communities (discussed below). Or, they might include promoting alternative livelihood projects, such as livestock husbandry, aquaculture, or ecotourism. However, the effectiveness of such interventions remains uncertain (D. Roe et al., 2015; Wicander & Coad, 2018). Moreover, many case studies show how alternative livelihood interventions can exacerbate social issues (e.g., M. Das & Chatterjee, 2015, who illustrate how ecotourism ventures can exacerbate social inequalities in some cases). Consequently, it is uncertain if alternative livelihood projects would offset the potential costs of strictly protected areas expansion on forest-dependent groups. Therefore, governments might explore alternatives to strictly protected areas. While our study did not evaluate these alternatives, there may be potential mental health benefits of fostering

sustainable forest use. In Uganda, this could include strengthening and promoting collaborative forest management agreements, a legal mechanism with dual aims of enhancing livelihoods while conserving forests (Turyahabwe, Agea, Tweheyo, & Tumwebaze, 2012). More broadly, mounting evidence shows that Indigenous groups and local communities play vital roles in protecting nature (Dawson et al., 2021; Garnett et al., 2018). Though beyond the results of the current study, governments, conservation organisations, and other actors might consider ways to support residents to use nature sustainably. This support could include, for example, strengthening residents' collective land tenure, self-determined governance systems, and their ability to defend against external drivers of nature loss (ICCA Consortium, 2021). Further research is needed to evaluate how land management approaches can effectively support residents' mental health. However, such alternatives might help prevent mental illness (SDG 3) while meeting other conservation and sustainable development goals.

Contract farming has been promoted as a tool for more inclusive agricultural development, including within Uganda (Ministry of Agriculture, 2016; Vabi Vamuloh et al., 2019). In general, the extent to which contract farming contributes to equitable sustainable development depends on how well it engages small-scale farmers (Vabi Vamuloh et al., 2019). Further research is needed to understand how policy responses to these challenges could support mental health. However, these policies could include making contract farming more inclusive, such as prioritising agricultural extension services to the poorest in communities. However, more inclusive contract farming may not always be feasible, suggesting the value of alternative options for the poorest in communities. In our study site, this might include promoting collaborative forest management with households with limited land. Moreover, land managers might consider ways to reduce adverse spillover effects, such as enhancing tenure by making it easier and cheaper for poorer households to claim land titles.

3.6.3. Experimentally testing interventions

Above, we suggest that well-designed collaborative forest management agreements might play a role in meeting both biodiversity and agricultural intensification targets while perhaps supporting

residents' mental health. This proposition could be tested through a stepped wedge cluster randomised control trial, asking 'do collaborative forest management agreements maintain biodiversity, reduce household poverty, food insecurity, and depression and generalised anxiety disorder incidence?'

Randomised control trials reduce selection bias (though they may not eliminate it as people may choose not to participate) and minimise confounding by randomly assigning treatments to study subjects (Kendall, 2003). Cluster trials randomly assign the treatment to groups of subjects, so they are useful when interventions cannot be easily targeted at individuals (K. Hemming, Eldridge, Forbes, Weijer, & Taljaard, 2017). Stepped wedge randomised control trials reconcile the need for robust evaluation with logistical or political considerations (K. Hemming, Haines, Chilton, Girling, & Lilford, 2015). For example, implementing an intervention in some communities but not others might cause dissatisfaction within control groups, increasing drop-out. Stepped wedge approaches involve the sequential transfer of randomly selected clusters from the control to intervention until all are exposed (K. Hemming et al., 2015). These approaches are not widely applied in conservation yet, although see Clements, Neang, Milner-Gulland, and Travers (2020) (who rolled out a certified rice programme amongst small-scale farmers in Cambodia) for an example.

In a hypothetical study, parishes bordering Forest Reserves could be randomly selected, and all communities within an appropriate fixed distance of the forest boundary could be identified. The number of communities and (randomly) sampled households required to achieve a desired level of precision could be determined through power analysis, accounting for the expected degree of intra-cluster correlation. The study would require free, prior, and informed consent from communities and individuals. Additionally, strong community engagement, equitable benefit-sharing, and strengthening local governance would increase the interventions' probability of success (J. Brooks et al., 2013; J. S. Brooks, Waylen, & Borgerhoff Mulder, 2012). As such, the candidate communities would have to be engaged and ideally active participants in the project development (Newton & Elliott, 2016). The project would require the support of the National Forestry Authority, which would partner with communities in the agreements. Furthermore, it would also

need to be conducted in partnership with local conservation organisations with experience successfully implementing such initiatives.

Participating communities would be randomly assigned to larger clusters, in which the intervention would be sequentially implemented. Within the conservation agreements, participants might be provided support for agroforestry, sustainable forest product harvesting, or other activities. Key biodiversity and household variables would be measured prior to, at the point of transferring groups, and at the end of the study. The biodiversity outcome variables could include plant, bird, and mammal richness within the study area. Social outcome variables could include household income and food security and individual depression or anxiety incidence (measured using screening instruments or diagnostic interviews). The distribution of results across the intervention group would be compared with the control, controlling for different exposure times (K. Hemming et al., 2015). Complementary qualitative methods could be used to gain an in-depth understanding of the factors perceived to contribute to the interventions' outcomes and identify unanticipated consequences.

Significant resources are invested into community-based conservation interventions. However, many evaluations of their effectiveness have provided low-quality evidence (J. Brooks et al., 2013). The proposed study would be complex, costly, and time-consuming, representing a significant undertaking. However, such methods could provide robust and much-needed causal evidence of the effectiveness of collaborative forest management or other livelihood-based conservation interventions.

3.7. Conclusion

Our results suggest that the expansion of strictly protected areas may harm the mental health of forest users. They also indicate that contract-farming approaches that worsen inequitable land distributions may harm the mental health of small-scale farmers. These findings suggest that decision-makers seeking to support mental health should be wary of approaches that impair livelihood activities by restricting access to nature. However, health is only one of the multiple

sustainable development objectives, and the links between landscapes and wellbeing can be complex and context-dependent (E. C. Ellis et al., 2019; Lu et al., 2021). Given this complexity, navigating trade-offs and synergies offered by different land management approaches can be challenging. Future research is needed to explore how landscape management could support mental health alongside other societal priorities. However, several principles might help in this process. First, a “*whole-of-government*” approach – encouraging dialogue and strategic planning across government agencies (CBD, 2021) – can help promote coherent and coordinated sustainable development policy. For example, this could include exploring if sustainable forest use interventions could be a tool for preventing mental illness. Second, decision-makers, practitioners, and researchers should be wary of one-size-fits-all solutions, such as plans focused on expanding protected areas. Instead, a “*whole-of-society*” approach – strengthening the inclusion and participation of diverse societal actors (CBD, 2021) – might help find locally appropriate and socially just landscape solutions. This approach could include scenario-based stakeholder engagement for inclusive, transparent, and forward-looking landscape planning. These and other approaches may help reduce the immense global burden of mental illness, supporting sustainable development and living in harmony with nature.

3.8. Data and code availability

The anonymised data used in the statistical analysis is available from Figshare (DOI: 10.6084/m9.figshare.16955221). The code used in the statistical analysis is available from: https://github.com/Pienkowski/Uganda_quant_analysis_pub.

4. Balancing making a difference with making a living in the conservation sector

4.1. Abstract

Goals play important roles in people's lives by focusing attention, mobilising effort, and sustaining motivation. Understanding conservationists' satisfaction with goal progress may provide insights into real-world environmental trends and flag risks to their wellbeing and motivation. We asked 2,694 conservationists working globally how satisfied they were with progress towards goals important to them. We then explored how this satisfaction varied between groups. Finally, we looked at respondents' experiences associated with goal progress satisfaction. Most of our participants responded in English, had university-level education, and worked in desk-based academic and practitioner roles, with nearly half from Europe or North America. Many (94.0%) said "*making a meaningful contribution to conservation*" was an important goal for them, with over half being satisfied or very satisfied in this area (52.5%). However, respondents were generally dissatisfied with progress to collective conservation goals, such as stopping species loss. Some groups were more likely to report dissatisfaction than others. For instance, those in conservation for longer tended to be less satisfied with collective goal progress (log-odds -0.21, 95% credibility interval (CI) -0.32 to -0.10), but practitioners reported greater satisfaction (log-odds 0.38, 95% CI 0.15 - 0.60). Likewise, those who are more optimistic in life (log-odds 0.24, 95% CI 0.17 - 0.32), male (log-odds 0.25, 95% CI 0.10 - 0.41), and working in conservation practice (log-odds 0.25, 95% CI 0.08 - 0.43) reported greater satisfaction with individual goal progress. Free-text responses suggested widespread dissatisfaction around livelihood goals, particularly related to job security and adequate compensation. While contributing to conservation appeared to be a source of satisfaction, slow goal progress in other areas – particularly around making a living – looked to be a source of distress and demotivation. Employers, funders, professional societies, and others should consider ways to help those in the sector make a difference whilst making a living, including by prioritising conservationists' wellbeing when

allocating funding. This support could include avoiding exploitative practices, fostering supportive work environments, and celebrating positive outcomes.

4.2. Introduction

Goals play essential roles in many aspects of people's lives, including among conservationists (Kruglanski, 1996). Setting goals can increase performance on tasks by directing attention, mobilising action, and helping sustain effort (Latham & Locke, 2007; E. A. Locke & Latham, 2002; Lunenburg, 2011). Goals can be important for groups and organisations; collectively held goals are likely to increase group performance, but conflicting goals can undermine it (Latham & Locke, 2007). Conservation is mission-driven (Soulé, 1985), so goals are expected to direct conservationists' attention and effort. But how satisfied are conservation professionals with progress towards goals important to them?

Goal progress leads to feelings of control, competence, and autonomy and alleviates the stress associated with undesirable situations and unmet needs (Deci & Ryan, 2000). And so, goal progress may contribute to conservationists' psychological wellbeing, but inadequate progress may be a source of distress (Ryan & Deci, 2001; Strauman, 2002; Wrosch, Scheier, & Miller, 2013). For example, a meta-analysis of 85 studies found that perceived goal progress was consistently, and perhaps bi-directionally, associated with subjective wellbeing and negatively correlated with subjective illbeing (Klug & Maier, 2014). Relatedly, environmentalists exposed to biodiversity loss, and tasked with preventing it, might face particularly acute "*ecological grief*" (Gordon et al., 2019). In turn, distress and grief can reduce workplace performance, harming concentration, workplace relationships, and judgment (Hazen, 2008; Hilton & Whiteford, 2010). The distress associated with goal progress dissatisfaction might be offset by support in other areas of conservationists' professional lives. This could involve addressing imbalances between workplace effort and reward, better management of the demands of the job, ensuring organisational equity and justice, and fostering workplace social support – factors known to influence psychological wellbeing (van der Molen, Nieuwenhuijsen, Frings-Dresen, & de Groene, 2020).

Relatedly, satisfaction with current goal progress may support motivation. According to expectancy-value theory, motivation is a function of both the expectation of success and the value of doing a task (Eccles et al., 1983; Wigfield & Cambria, 2010; Wigfield & Eccles, 2000). For instance, according to the theory, a conservationist's motivation is influenced by the perceived likelihood and value of attaining a goal. Expectations of future success can be influenced by multiple factors, including perceptions of one's ability, control over the outcome, and experiences of previous success. Consequently, progress towards goals in the present elevates expectations of future success and, therefore, motivation (Eccles et al., 1983; Wigfield & Eccles, 2000). Finding high levels of dissatisfaction would suggest the need for further research investigating impacts on motivation and, perhaps, conservation outcomes.

Satisfaction with goal progress is expected to vary within the conservation community and by context (Table 4.1). This variation may depend on whether goals are considered at an individual level (individual goals) or at a collective level (collective goals). Understanding variation in satisfaction might suggest groups and regions where resourcing should be invested to enable individual or collective goals to be met or support offered to offset dissatisfaction with inadequate goal progress.

Table 4.1. A priori hypothesised associations between satisfaction with progress towards individual and collective goals and individual and contextual characteristics. Key: (+) = expected positive association, (-) = negative association, and (?) = where the expected direction of association is unclear.

Goal type	Expected association	Factor	Possible links between the factor and goal progress satisfaction
Individual	(+)	Dispositional optimism	Optimists tend to sustain greater effort and be more likely to attain goals (Forgeard & Seligman, 2012). They may also have more positive outlooks on life in general. As a result of these factors, they are expected to provide more positive assessments of individual and collective goal progress.
Collective	(+)		
Individual	(+)	Years in conservation	Those in the sector for longer may be more established in their careers and are thus expected to assess their individual goal progress more positively. However, they may have a longer-term view of progress toward collective goals, which might be negative because of historic failure to meet conservation targets (CBD, 2020a).
Collective	(-)		
Individual	(?)	Work hours	Those working longer hours might make greater progress toward individual goals. Alternatively, some may work longer hours – a sign of overcommitment – because of dissatisfaction with perceived individual and collective goal progress (de Jonge, Bosma, Peter, & Siegrist, 2000).
Collective	(?)		
Individual	(+)	Gender (male)	Men, women, and those who do not identify themselves as either may face differing constraints in conservation work (M. S. Jones & Solomon, 2019). In general, we expect men to face fewer barriers in pursuing some individual goals, thus providing more positive assessments on individual goals but not necessarily on collective goals.
Collective	(?)		
Individual	(+)	Education	More education can improve career prospects and enable people to take roles in which they have more influence over their individual goal progress, so we expect those with higher education to provide more positive assessments (Crawford, Gregg, Macmillan, Vignoles, & Wyness, 2016).
Collective	(-)		Environmental awareness may be positively associated with educational level (e.g., Kollmuss & Agyeman, 2010). So, we expect those with university-level education to be more aware of threats to nature and thus be less satisfied with collective goal progress.
Individual	(?)	Practice or academia	Individuals with more positive outlooks might be attracted to one type of job role. Or, opportunities to pursue individual goals may vary between practitioner or academic settings. However, the expected direction of the relationship is unclear.
Collective	(?)		Those in practice may be more directly exposed to biodiversity loss, leading to negative assessments, or more exposed to conservation action, resulting in positive assessments. Equally, academics trained to reflect on downsides, and more exposed to global-level studies but distanced from real-world action, might be less satisfied with collective goal progress. As a result, the expected direction of the relationship is unclear.

Individual	(?)	Focal biome	Opportunities and constraints to pursuing individual and collective goals may vary between terrestrial, marine, or cross-cutting biomes, although the expected direction of the relationship is unclear.
Collective	(?)		
Individual	(?)	Region (where most familiar with the conservation context)	As above, opportunities and constraints to pursuing individual and collective goals may vary between regions, although the expected direction of the relationship is unclear.
Collective	(?)		

Our study asks a) how satisfaction with progress towards goals considered important varies with respect to key covariates (Table 4.1) and b) how conservationists describe experiences associated with goal progress. To answer these questions, we surveyed 2,694 conservationists working globally between July 2019 and August 2020. This survey included a mix of quantitative and qualitative questions, which we analysed using mixed-effects ordinal logistic regression within a Bayesian framework and thematic analysis.

4.3. Methods

4.3.1. Study population and sample

There is no widely agreed-upon definition of what a conservation professional is or their responsibilities (Appleton et al., 2021). Therefore, we drew on existing definitions of ‘conservation’ and ‘professional’ to describe our target population. Sandbrook (2015) proposed a definition of conservation as “actions that are intended to establish, improve or maintain good relations with nature”. This definition emphasises how conservation is active (“actions”) and can form new links (“establish”) or support existing ones (“improve or maintain”) with nature. It highlights how conservation seeks to improve relationships (“good relations”) but is not always successful (“intended to”). Finally, it leaves room for different interpretations of the subject of conservation action by broadly referring to “nature”, which might include people, wildlife, and abiotic factors. Furthermore, Mieg (2009) describes professionals as “relatively autonomous occupational groups that claim jurisdiction over a certain class of tasks.” We considered conservation professionals to be an occupational group who self-identify as actors intending to establish, improve, or maintain good relations with nature. This description emphasises conservation as a form of work (“occupation”) and identity (“self-identify”) while drawing on phrasing used by Sandbrook (2015). We consider this occupational group to include those in conservation science, practice, and policymaking and in training or seeking to work in conservation. We reviewed generic lists of job types and adapted them during a series of workshops among six co-authors, creating a list of job categories from which respondents were

asked to choose. Those selecting fieldworker, ranger, manager, administration, consultant/self-employed; intern or policymaker were aggregated as ‘practitioner’ and those choosing researcher; bachelors student; or graduate student were categorised as ‘academic’. Those who did complete this section of the survey or chose “other” job category were categorised as ‘unknown’. See *Appendix: Definitions of a conservationist (Chapter 4)*, which explores the sensitivity of our results to a more conservative definition of conservationist. Our target population included all conservation professionals (as defined above) with regular internet access who spoke English, French, Spanish, Portuguese, Kiswahili, or Khmer.

A draft survey was piloted among 23 members of the Interdisciplinary Centre for Conservation Science and Wildlife Conservation Research Unit (at Oxford University), Budongo Conservation Field Station in Uganda, and the Nature Conservation Foundation in India. These groups were chosen because they were deemed similar to the profile of the target population (e.g., from multiple countries working in both conservation science and practice). This piloting involved emailing the survey invitation to members of these groups, asking if they understood the instructions and questions, had any difficulty completing the survey or had other feedback. Minor adjustments were made to the survey wording, instructions, and structure following piloting. For example, we included a ‘not applicable’ option for several effort-reward imbalance items that did not apply to those who worked as senior managers (which was factored into the calculation of individual effort-reward imbalance scores). Similarly, we adjusted the order of the survey questions to cluster those on similar themes together.

There is no comprehensive list of conservation professionals or organisations, either at national or global scales. As a result, probability sampling approaches, such as random sampling from a comprehensive pre-defined list, were not possible. Therefore, we sought to maximise the number of responses across the target population using snowball and self-selection sampling. These sampling approaches are useful when it is difficult to identify candidate respondents (e.g., because no population list exists) or where there is no way of directly contacting participants (e.g., where

contact information is not widely available), as was the case in the current study (Sharma, 2017). However, see Study limitations for a discussion on the limitations of this approach.

We recruited participants in three main ways, over two recruitment phases in July 2019 and May 2020. First, we created a list of 216 conservation organisations operating in countries speaking the survey languages. This list was developed by searching websites and social media for active organisations with email addresses, using keywords (e.g., “conservation” and its translations) and the name of each country where the survey languages were spoken. We then emailed this list, asking for the survey to be shared among staff and networks. In parallel, we shared the survey through relevant mailing lists and newsletters, identified through professional societies and elsewhere. For example, we shared the survey through the mailing lists of all Society for Conservation Biology thematic groups and regional chapters. We disseminated the survey through social media, principally Twitter and Facebook. This step involved creating a series of posts, which we then asked high-profile conservation organisations and individuals to share. Finally, the survey was advertised to attendees at the International Congress for Conservation Biology 2019. See *Appendix: Survey development*, *Appendix: Sample recruitment email*, and *Appendix: Life in Conservation survey form*).

The survey was translated from English into French, Spanish, and Portuguese because these are the most commonly spoken languages by country. Arabic is also spoken across many countries, but our research team did not include any members who could back-translate from this language. These languages poorly represented East Africa, so the survey was translated into Kiswahili. The Khmer translation of the survey (for Chapter 7) was available when the survey was deployed, so it was also included (see 4.5.3. Study limitations, which discusses the consequences of these decisions). The survey was forward-translated by a professional translation service and then back-translated into English by members of the research team. Discrepancies were discussed, and forward translations were corrected. Our ethical protocol was approved by an Ethical Review Board at the University of Oxford (R62487/RE001, see *Appendix: Sample recruitment email*).

4.3.2. Quantitative data description

A wide range of goals are expected to be important to conservationists; we pre-defined goals to aid comparison between respondents and keep the survey short. We based our goal selection process on the value-belief-norm theory, which builds on work by Heberlein (1972), Stern, Dietz, and Kalof (1993), and others. These authors suggested that pro-environmental behavioural intentions arise from caring about nature and its role in society (Stern, 2000), but that pro-environmental behaviour can have personal costs and benefits, and so behavioural intentions are also influenced by their consequences for individuals (de Groot & Steg, 2009). Consequently, the value-belief-norm theory suggests that pro-environmental behavioural intentions are motivated by egoistic, altruistic, and biospheric values (Stern, 2000; Stern, Dietz, Abel, Guagnano, & Kalof, 1999). Other research suggests that the aim of “*making a difference*” is also important to conservationists (Papworth et al., 2018). We, therefore, developed a set of statements spanning this range of values during a series of workshops attended by six co-authors. These statements span sub-dimensions of the egoistic, altruistic, and biospheric values described by de Groot and Steg (2007), as well as a statement reflecting the individual goal of “*making a difference*” (see *Appendix: Goals and goal progress*). However, many conservation goals – such as those reflected in our statements – entail positive outcomes for both people and nature. For instance, the goal of “*stopping damage to the natural world*” may be closely associated with values around protecting nature, but also a concern for the human wellbeing impacts of nature loss. Consequently, egoistic values corresponded to statements regarding individual goals, and statements relating to altruistic and biospheric values were clustered as collective conservation goals (Table 4.2).

Table 4.2. The pre-defined individual and collective goals based on the value-belief-norm theory and its sub-dimensions and other literature (de Groot & Steg, 2007; Papworth et al., 2018; Stern, 2000; Stern et al., 1999). Individual goals correspond to egoistic values, and collective goals relate to biospheric and altruistic values (see *Appendix: Goals and goal progress*).

Individual goals	Collective goals
Making a meaningful contribution to conservation	Stopping human-driven species loss
Being a leader	Ensuring people benefit from nature in a sustainable way
Influencing other people's behaviour	Making sure people are treated equally and fairly
Earning money	Avoiding conflict between people and conservation
	Stopping damage to the natural world
	Creating a more sustainable world

Not all conservationists are likely to prioritise the same goals, so we first asked respondents if each goal was important to them. For those goals considered important, we then asked respondents to indicate their satisfaction or dissatisfaction according to five response levels ranging from “*very dissatisfied*” to “*very satisfied*”. Respondents were asked to think about their personal work context when responding to the questions about individual goals and the conservation area or context they were most familiar with when responding to questions about collective goals.

4.3.3. Quantitative data analysis

All quantitative data handling and analysis were performed in the statistics software R (R Core Team, 2020). The survey was administered over six pages, with results saved after each page (unless respondents selected an option to formally withdraw from the study, in which case their data were deleted). In total, 2,961 consented to start the survey. Those that completed the goal endorsement and satisfaction questions (on the first page) were included in the descriptive results (sample $N = 2,694$). Within this sample, those that completed questions related to goal endorsement, progress, and dispositional optimism (on the third page) and had binary gender identities (since the inclusion of five non-binary respondents introduced statistical separation) were included in the statistical analysis (sub-sample $N = 2,336$). For reference, 2,341 completed the survey questions relevant to Chapter 5, and 2,311 completed those for Chapter 6. Most respondents who formally opted out of the survey and left comments explaining why said they did not have

time or got bored. Our sampling approach, where people shared the survey through their networks, meant we could not determine the number who saw the survey but chose not to participate.

Some respondents within the sub-sample used in the statistical analysis did not complete all questions (see *Appendix: Patterns of missing data (Chapter 4)*). Missing categorical data were classed as ‘unknown’ in the statistical analysis. For example, 127 people in the sub-sample did not complete the job role question, and 391 selected ‘other’ from the list of positions, so they were aggregated into the category called ‘unknown’ position (518). This categorisation meant that the missing values of these categorical variables did not need to be imputed (see below). Additionally, 13.6% of respondents did not complete the survey question related to the number of years they worked in conservation. Ninety percent of these also chose not to disclose their age, so it is likely that many of these did not want to disclose this personal information. Furthermore, over 5% did not get this far in the survey. We did not expect people’s concerns about disclosing personal information or their decision to leave the survey early to be associated with their experiences of goal progress satisfaction, so we treated these data as missing at random. Therefore, these missing data within the sub-sample were substituted through multivariate imputation by chained equations, where ten datasets were created containing imputed values using the package mice (see *Appendix: Patterns of missing data (Chapter 4)*) (van Buuren S & K, 2011).

Multivariate mixed-effects ordinal logistic regression models were implemented using these imputed data. Two models were fitted, the first where the response variable was reported satisfaction with progress to endorsed individual goals, and the second satisfaction with endorsed collective goals. Each model was fitted with each of the ten imputed datasets. Not all respondents endorsed all goals. So, the endorsed goals were stacked row-wise and “*respondent ID*” was included as a random effect, allowing goal progress satisfaction to be treated as a single variable while accounting for dependencies within responses from the same individual. The explanatory variables included “*goal name*” (for each goal within the set of the individual or collective goals, Table 4.2). The proportional odds assumption was graphically assessed and considered to have been adequately met, following Harrell (2015).

Dispositional optimism was estimated using the Life Orientation Test – Revised (Scheier, Carver, & Bridges, 1994). Ten sets of plausible values were extracted for use in the statistical analysis (see *Appendix: Life Orientation Test – Revised (Chapter 4)*). A dummy variable corresponding to the period before and after the start of the COVID-19 pandemic was included in additional analysis, the results of which were consistent with those presented below (see *Appendix: COVID-19 and goal progress*). The analysis was performed in the Stan computational framework, accessed using the brms package (Bürkner, 2017; Carpenter et al., 2017). Weakly informative priors, compared with the sample size and scale of explanatory variables (with all continuous variables being scaled and centred), were chosen. The same normal prior distribution was used for all coefficient and intercept parameters (Equation 1).

$$prior = N(0, 10)$$

Equation 1

where N denoted the normal distribution with a mean of 0 and a standard deviation (SD) of 10. A normal distribution was chosen because extreme parameter estimates were deemed less likely than those near zero (Lemoine, 2019). Additionally, the software’s default weakly informative priors (a half student-t distribution with 3 degrees of freedom and a scale parameter of 2.5) were used for the SD of random effects. The models were fitted with a logit link function and were run for 4,000 burn-in, followed by 4,000 post-burn-in iterations used to estimate the posterior distribution (8,000 total) using the Markov Chain Monte Carlo sampler, and a seed value of 123, across four Markov chains, following McElreath (2016). The models were evaluated according to steps 1-7 and 10 of the When to worry and how to Avoid the Misuse of Bayesian Statistics Checklist (WAMBS)-Checklist (see *Appendix: WAMBS-Checklist (Chapter 4)*) (Depaoli & Van de Schoot, 2017). The model results from each set of ten imputed datasets were pooled by combining the posterior distributions.

4.3.4. Qualitative data description and analysis

Respondents were invited to provide open-ended free-text responses to the question, “*Do you have any thoughts or comments on the challenges and rewards experienced by those in conservation?*”.

A total of 965 people provided a free-text response. Around 426 provided responses that described desired states from which goals could be inferred. These desired states related to both the external world, such as biological or social conditions, and those experienced by individuals, such as a respondent’s perceived job prospects. For instance, if a respondent stated they intended to continue working to conserve nature, then one could infer that conserving nature was a goal important to them. This subset of responses provided insights into respondents’ experiences associated with goal progress and so was included within the thematic analysis.

The thematic analysis was inductive, meaning the themes emerged from reviewing the text. The analysis followed Braun and Clarke (2006) through the steps described below:

1. Familiarisation with data by reading all responses.
2. Iteratively generating increasingly specific codes and systematically applying them across the text through three rounds of coding.
3. Searching and clustering codes and associated text into themes.
4. Selecting the most frequently mentioned key themes, ensuring they were internally consistent but discrete.
5. Defining and naming key themes (see *Appendix: Theme definitions (Chapter 4)*).

4.4. Results

A total of 2,694 respondents familiar with conservation in 145 countries told us which of our goals they endorsed or considered important and how satisfied they were with progress towards each goal. This sample included 969 men, 1,208 women, and 5 who were non-binary, with the remainder being unknown. Respondents’ positions included administration (54), bachelors student (36), consultant/self-employed (130), fieldworker (139), graduate student (241), intern (21), manager (328), other (391), policymaker (33), ranger (26), researcher (817), and unknown (478).

These were aggregated into those who worked in academic (1,094), practitioner (731), and unknown (869) positions. Respondents had a mean of 12.2 (SD = 10.5) years working in conservation, with 2,069 having received university-level education. Additionally, 95.4% of respondents completed the survey in English, 2.8% in French, 1.0% in Portuguese, 0.6% in Spanish, less than 0.1% in Kiswahili, and none in Khmer. Of these, 9.2% were nationals of Central and Southern Asian countries, 4.3% from Eastern and South-Eastern Asia, 48.6% from Europe and Northern America, 5.8% from Latin America and the Caribbean, 1.2% from Northern Africa and Western Asia, 4.9% from Oceania, 8.2% from Sub-Saharan Africa, with the remaining 17.9% being unknown.

Some goals were more frequently endorsed than others (Figure 4.1a). For instance, almost all respondents (94.0%) said that “*making a meaningful contribution to conservation*” was important, but just over a third (39.6%) endorsed the goal of making money. In general, the collective goals were more frequently endorsed than the individual ones, except “*making a meaningful contribution*”.

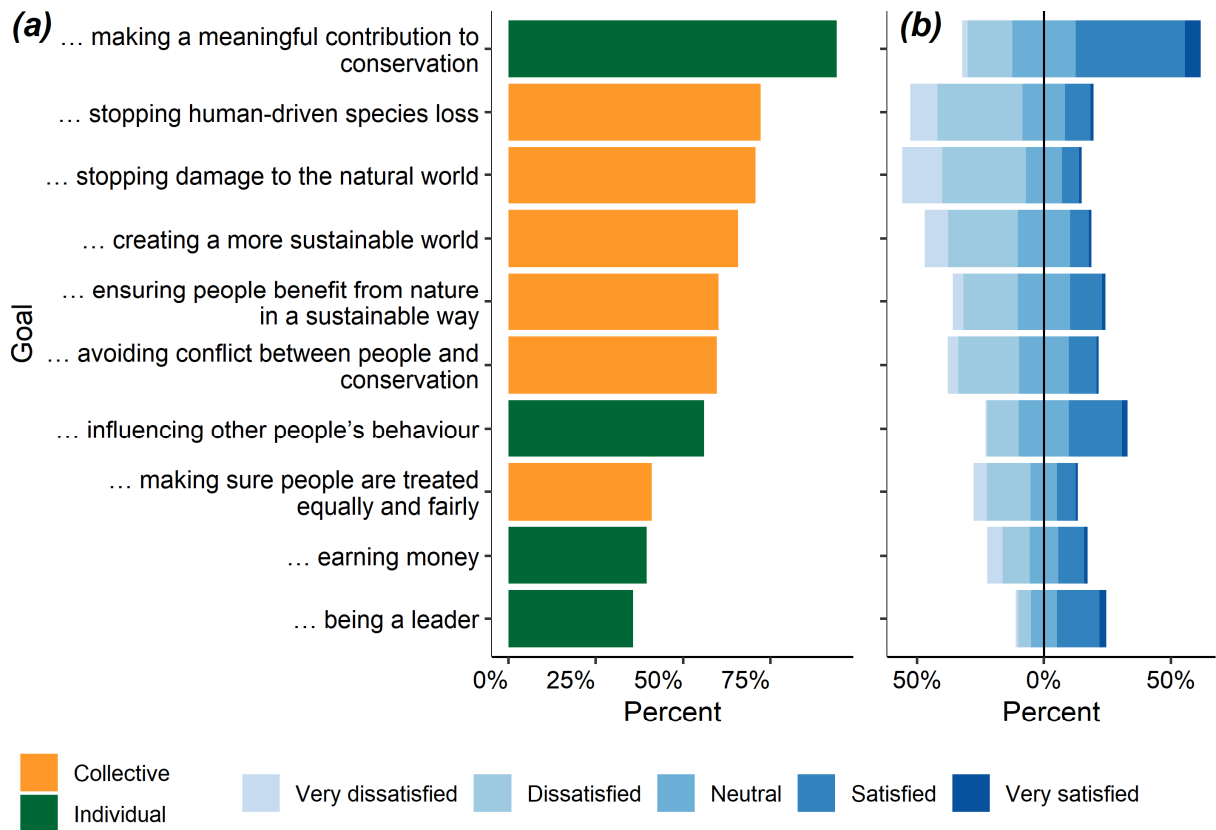


Figure 4.1. (a) The percentage of respondents who said that ten individual and collective goals were important to them (the total number of respondents was 2694) and (b) the reported satisfaction with progress towards each goal.

There was mixed satisfaction with progress towards goals that respondents considered important (Figure 4.1b). For instance, of those who thought “*making a meaningful contribution*” was an important goal (94.0%), around half were satisfied or very satisfied with progress towards it (52.5%). In contrast, for the next most frequently endorsed goal – “*stopping human-driven species loss*” (important to 72.2%) – only 15.6% said they were satisfied or very satisfied with progress towards it. A post hoc mixed-effects ordinal logistic regression suggested there was greater satisfaction with progress towards individual compared with collective goals (log-odd 1.76, 95% CI = 1.69 - 1.83, $N = 2,336$).

4.4.1. Variability in satisfaction with goal progress

The statistical analysis used a sub-set of 2,336 respondents’ (see the methods above for details). Investigating research question a), variability in perceived satisfaction with goal progress was associated with various factors in the statistical analysis (Figure 4.2). Dispositional optimism was

positively associated with satisfaction with progress towards individual but not collective goals. Those with 1 SD higher dispositional optimism than the mean had an estimated 30.3% higher probability of being satisfied or very satisfied with progress towards individual goals compared to those 1 SD below the mean. Years in conservation were positively associated with satisfaction with individual goal progress but negatively associated with satisfaction with collective goals. For instance, someone in conservation for 30 years was 52.6% more likely to be satisfied or very satisfied with progress towards individual goals and 36.5% less likely for collective goals than someone in conservation for five years. Work hours were negatively associated with collective goals progress satisfaction, with someone working 40 hours being 18.2% less likely to be satisfied or very satisfied with progress towards collective goals than someone working 20 hours. Work hours were not strongly associated with individual goal progress. Men reported a 15.5% higher probability than women of being satisfied or very satisfied with progress towards individual goals and 19.3% for collective goals. Those with university-level education were 50.4% less likely to be satisfied or very satisfied with progress towards collective goals than those without university-level education, but this association was not seen for individual goals. Those working in conservation practice reported a 16.3% higher probability of being satisfied or very satisfied with individual goals than those in academia and 36.9% higher for collective goals. There was also some variability in goal progress satisfaction between regions. For instance, those familiar with conservation in Oceania reported a 16.3% higher probability of being satisfied or very satisfied with progress towards individual goals than those in Europe and North America. There was no evidence of an effect associated with the other variables.

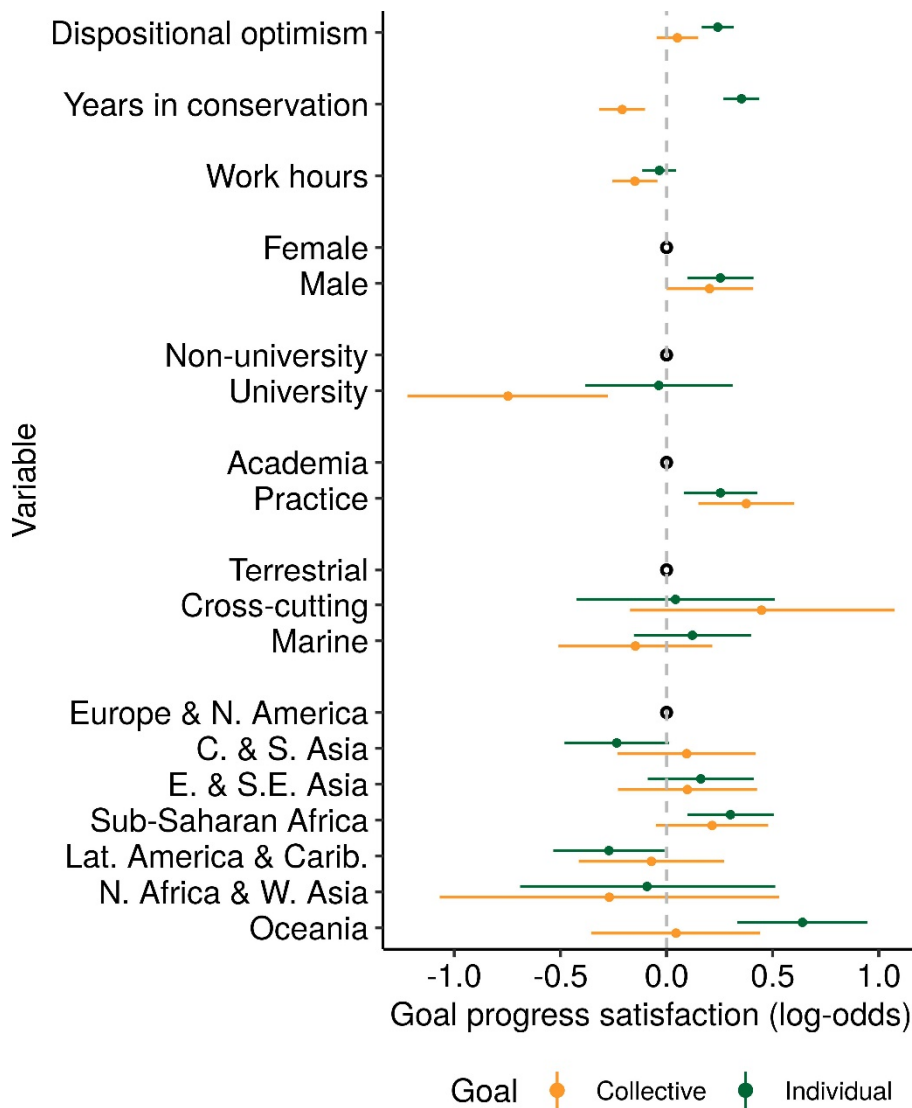


Figure 4.2. The estimated associations between satisfaction with goal progress and each explanatory variable among 2,336 respondents. Points represent the mean of the posterior distribution, and bars indicate the 95% credibility intervals on the log-odds scale. Dispositional optimism, years in conservation, and work hours are scaled and centred. Thresholds, goal name, and response categories corresponding to missing data are not shown.

The primary analysis assumed a linear relationship between work hours and goal progress satisfaction. Testing this, the analysis was repeated after substituting numeric work hours with a binary variable indicating if the respondent worked over forty hours per week (see *Appendix: Altering the analysis of work hours*). Forty hours was chosen for the cut-off as this represents a commonly accepted standard for the working week of a person in full-time employment. Consistent with the main analysis, working over 40 hours per week was negatively associated with

collective (log-odds = -0.22, 95% CI = -0.42 to -0.03) but not individual (log-odds = -0.03, 95% CI = -0.18 to 0.12) goal progress satisfaction.

Two further post hoc mixed-effects ordinal logistic regressions were implemented, following similar model specifications to the main analysis but disaggregating the collective goals (see *Appendix: Disaggregating altruistic biospheric goals*). The first model included the biospheric-related goals and the second the altruistic-related ones. The results of both of these models described similar patterns as found within the main analysis.

4.4.2. Goals, barriers, and consequences in respondents' own words

Exploring research question b), a total of 426 participants provided free-text responses that appeared to describe desired states or divergence from those states. The following sections describe the themes that were most commonly mentioned across respondents, accompanied by the number of respondents who offered relevant text (in brackets), followed by an illustrative quote.

4.4.2.1. *Desired collective states, progress, and barriers*

Many respondents (110) described desired states related to collective conservation outcomes (including relating to people and nature) or divergence from those outcomes. Some of these responses (55) related to the state of nature and the environment, with most being dissatisfied with progress in these areas. For example, one respondent said it *“always feels like we should do more and what we do isn't enough [...] it feels like a drop in the ocean when I read all of the headlines on widespread species endangerment across the world”*. Others (24) indicated desired states related to people's relationships with nature and conservation, with mixed sentiments of satisfaction and dissatisfaction. For instance, one respondent said, *“we will lose everything and our children will have a very tough life”* if we fail to address the biodiversity crisis. Many (67) suggested conservation faced insurmountable odds, such as the respondent who said, *“ultimately we act to protect life, all life, on Earth. This is an incredible, essential, and arguably insurmountable goal.”*

Some (125) respondents indicated broad-scale factors that appeared to impede progress towards collective conservation aims. These responses centred on conflicts between the aims and interests of conservation versus those of governments, businesses, the public and other actors (87), often discussed in relation to inadequate funding (45). For instance, one said, *“It feels like most of the human race is rowing in a different direction from those of us in conservation.”* Another stated, *“the public does not always see the value in conserving landscapes/species and funding can change rapidly due to political shifts”*. Others (33) mentioned conflicts between aims and interests within conservation. These included apparent tensions between individuals and organisations; funders and practitioners; science, policy, and practice; and among organisations. These often surrounded differences in approaches to conservation. For instance, one said, *“I am also increasingly becoming aware of tensions in the conservation fraternity [...] which can sometimes become rather aggressive (e.g. between those for and those against resource use in protected areas).”*

4.4.2.2. *Desired individual states, progress, and barriers*

Many respondents (252) described desired individual states or divergence from those states. A large number (147) of free-text responses indicated that *“making a difference”* was important to them, with most being satisfied in this area. For instance, one said, *“the best rewards is the personal satisfaction of working for nature in particular the wildlife I work on!”* But, some (20) highlighted how people’s *“passion”* or desire to make a difference created a culture of exploitation in the sector. For instance, one respondent said, *“we are expected to love our jobs - and we do - but are therefore not paid enough, because we do it “for the love of it”. My landlord, alas, does not accept passion as a payment method.”*

Several (19) stated their desire to contribute to conservation came at the expense of pursuing livelihood goals. For instance, one respondent said, *“The biggest dilemma I have is how do I work in a field that I believe in [...] while at the same time be able to provide for my family”*. Another said, *“I realize that there is a trade-off for doing work that is interesting and rewarding and inspiring and financial remuneration.”* Many respondents (143) discussed desired states relating to

their livelihoods, such as adequate and commensurate incomes; job security; career progression; and maintaining a work-life balance. Most of these respondents were dissatisfied in these areas, such as one respondent who said, *“It’s hard to find a meaningful job that pays a liveable wage.”* Some (20) highlighted that support and positive interactions with colleagues were important to them, with most being satisfied in this area. However, some (5) of these respondents indicated dissatisfaction associated with discrimination, particularly around gender and race.

Respondents (85) also indicated factors impeding progress to desired states at an individual level, mainly related to respondents’ livelihoods. These primarily related to resource and funding constraints (60), challenges in gaining appropriate experience (14), and lack of time within a working week (8). Several highlighted that these constraints affected the least wealthy the most. For instance, one said, *“I worry about conservation work being a rich man’s game. It certainly preferences those who are financially able to work with little to no pay to gain experience and can afford a degree.”* Some suggested this reduced diversity and meritocracy in conservation, such as one who said, *“as we cannot hope to attract the brightest and best, we normally end up with people who have a passion and an ability to subsidise their career.”*

4.4.2.3. Consequences of (lack of) progress towards desired states

Some (81) highlighted negative consequences associated with inadequate progress to desired states, including impacts on motivation (30), mental wellbeing (31), and the feeling of being overwhelmed (18). For instance, one respondent said, *“where I work in Cambodia, the feeling of being hopeless at achieving goals and making the impact you crave for your profession and your personal passion can drive one into a depressed state of mind.”* Several (26) indicated strategies or mindsets that helped them deal with dissatisfaction, including focusing on personal contributions, trying to remain optimistic, reminding oneself of their *“love of nature”*, considering how the work aligns with their values, and in some cases seeking professional support. For instance, one said, *“Focus on your core values and goals in conservation, and making decisive manageable efforts in the direction of your goals on a daily basis”.*

Several (40) mentioned the positive impacts of goal progress, including feeling fulfilled (13) and motivated (3). For example, one said, “*balanced against this is the knowledge that those of us working in conservation are doing something worthwhile with our lives, which gives great satisfaction.*” Another said, “*successful conservation spurs one to work better and harder*”.

4.5. Discussion

The high proportion of respondents who said the goal of “*making a meaningful contribution*” was important suggests working in conservation is more than just a job for many in our sample. Across the pre-defined and free-text responses, most appeared to be satisfied in this area. However, there was an apparent tension between many respondents’ desire to contribute to conservation and their ability to pursue livelihood goals. The free-text responses suggested that many aspirations around livelihoods were not reflected in our set of pre-defined goals. For instance, while “*earning money*” might not have been a priority, many desired adequate incomes and job security. Nevertheless, many respondents indicated having to invest significant time, effort, and emotional commitment in pursuing livelihood goals, as has been noted in other research (e.g., Ramos, Mustafa, Primack, & Campos-Arceiz, 2017). As a result, for many respondents, working in conservation appeared to be a trade-off between contributing to a cause they cared about and their need to earn a living.

We recognise that many conservation organisations aim to provide stable and appropriately compensated jobs but are often constrained by inadequate funding (Malcom et al., 2019).

However, we encourage employers to consider ways to better support their staff in these areas. For instance, employers might examine their use of volunteer labour and prioritise paying for salaries rather than short-term contracts and consultancies (Vercammen, Park, Goddard, Lyons-White, & Knight, 2020). They may seek ways to pay staff living wages and contribute to health insurance, pensions, and other benefits, factors known to increase staff retention in other sectors (Lehmann, Dieleman, & Martineau, 2008). Funders might consider ways to support the livelihoods of conservationists with the budgets they have. This support could include providing funding over longer periods and allowing a greater share of budgets to be used for staff overheads. Similarly,

fundings might reject projects with unrealistic aspirations that risk staff becoming overworked or from organisations that do not pay living wages. As well as supporting their wellbeing, improving conservationists' livelihood security might enable them to better deliver conservation outcomes.

Other research likewise suggests that “*making a difference*” motivates those in the conservation sector (Papworth et al., 2018). This desire to “*make a difference*” is also found in other sectors, such as public health and humanitarian aid (e.g., A. Greenberg et al., 2019; Roth, 2015). Yet some respondents expressed concern that conservationists' passion for nature put them at risk of exploitation by employers. This risk also appears in other sectors where job fulfilment is used to legitimise the poor treatment of employees, such as requiring staff to do unpaid overtime, work excessive hours, or do tasks irrelevant to their job description (Kim, Campbell, Shepherd, & Kay, 2020). Sandbrook (2019) expressed concern that the professionalisation of conservation might displace passion towards protecting nature. Yet, many of our respondents felt that contributing to conservation was important to them, suggesting they remain passionate about safeguarding nature. Rather than displacing passion, the professionalisation of conservation could help ensure that those working in the sector are highly valued, fairly compensated, and otherwise at less risk of exploitation than currently.

Respondents' dissatisfaction with progress towards collective conservation goals is perhaps unsurprising, given the scale of threats to biodiversity and their implications for human wellbeing (CBD, 2020a; IPBES, 2020). There appeared to be greatest dissatisfaction with progress toward goals most directly related to the state of nature, such as the goal of “*stopping human-driven species loss*”. These subjective appraisals appear to corroborate formal assessments, affirming the need for greater action to protect nature (e.g., CBD, 2020a). Many free-text responses suggested there was limited progress because biodiversity conservation was not prioritised and funded by governments, the public, businesses, and other sectors of society. Recognising this, conservationists have been calling for greater investment to reduce biodiversity loss (e.g., Malcom et al., 2019). Sundin, Andersson, and Watt (2018) argue that stories can help mobilise societal support for conservation. In this respect, conservationists' accounts of why they are dissatisfied

with progress towards collective goals, drawing on their direct experiences, might be seen as particularly legitimate and motivating.

The free-text responses corroborated other research suggesting inadequate goal progress is a source of distress and demotivation, but progress contributes to wellbeing (Eccles et al., 1983; Ryan & Deci, 2001; Strauman, 2002; Wigfield & Eccles, 2000; Wrosch et al., 2013). Distressed and demotivated conservationists might be offered support in other aspects of their work lives. This support could involve encouraging workplace sociability, tackling organisational injustice (such as discrimination), and helping staff maintain a work-life balance (van der Molen et al., 2020). Some individuals distressed by the “*gloom-and-doom*” conservation discourse might find it useful to engage with optimism movements, such as Conservation Optimism, Earth Optimism, and Ocean Optimism (Swaigood & Sheppard, 2010). Others might choose to focus on their own contributions, celebrating the positive outcomes from their work.

4.5.1. How does goal progress satisfaction vary between groups?

Dispositional optimists may be more likely to sustain their effort and thus to progress towards goals than pessimists (Forgeard & Seligman, 2012). This may explain why optimists reported greater satisfaction with progress towards individual goals that one can influence, but not collective goals outside an individual’s control. While dispositional optimism is a relatively stable trait, encouragement from others – such as colleagues and friends – might help pessimists sustain effort towards challenging goals (Fishbach, Eyal, & Finkelstein, 2010).

Early-career respondents appeared particularly dissatisfied with progress towards the pre-defined individual goals, echoed in the free-text responses. One reported barrier was that employers often evaluated candidates based on their experience, which disproportionately favoured those who could afford to work in poorly paid or voluntary positions. This barrier might be lowered by adopting competency-based recruitment methods, which evaluate candidates based on demonstrated ability rather than experience (Draganidis & Mentzas, 2006). Furthermore,

organisations should consider whether their use of unpaid labour is unfair and counter-productive to the conservation sector's long-term sustainability (Vercammen et al., 2020).

Some respondents might work long hours because of heavy job demands or because they are overcommitted to their work. Overcommitment is a set of behaviours, emotions, and attitudes associated with excessive striving toward goals (de Jonge et al., 2000). In our study, overcommitment might emerge from dissatisfaction with progress towards collective goals, leading individuals to work longer hours in the hope of being able to “*make a difference*”. Other research suggests that many conservationists regularly work outside normal office hours, including on the weekends (Campos-Arceiz, Koh, & Primack, 2013). These individuals might benefit most from efforts to reduce overcommitment, such as managing employee workloads, not rewarding overwork, and encouraging individuals to not work excessive hours.

Previous research suggests gender-differentiated challenges within conservation, which might explain why men were more satisfied with individual goal progress than women (M. S. Jones & Solomon, 2019). Free-text responses also suggested women faced greater challenges pursuing individual goals than men. Competency-based recruitment may play a role in reducing gender discrimination (Draganidis & Mentzas, 2006). Further research could usefully explore why female conservationists appear less satisfied with collective goal progress than males.

Our results supported our expectation that those with university-level education would be less satisfied with collective goal progress. This finding could be because those with higher education have greater environmental awareness (e.g., Kollmuss & Agyeman, 2010) because they are more exposed to “*gloom-and-doom*” discourses (Swaisgood & Sheppard, 2010) or other factors.

However, those with higher education may not necessarily provide more accurate assessments. Indeed, qualifications, track record, and experience can be poor predictors of the accuracy of expert judgments (Burgman et al., 2011).

Practitioners reported greater satisfaction with collective goal progress than academics.

Practitioners may be more aware of examples of conservation success in the areas they are familiar

with or less exposed to global-scale biodiversity threats. Alternatively, individuals with positive conservation outlooks may self-select into practitioner roles, where positivity might be encouraged more than in academia. Equally, practitioners also appeared more satisfied with progress towards individual goals, perhaps partly because it might be harder for academics to see how their work “*makes a difference*”. Academics might, therefore, be at higher risk of distress and demotivation associated with goal progress dissatisfaction. However, the full range of challenges faced in different roles should be considered when deciding where resourcing to support conservationists should be directed.

The lack of significant variability in goal progress satisfaction between regions and biomes was unexpected, given the actual variability in progress to conservation targets between places (CBD, 2020a). This variability did not appear to follow easily explained patterns, so further research could usefully explore the causes of these differences and the appropriate scale of analysis.

Additionally, the post-hoc supplemental analysis (see *Appendix: Disaggregating altruistic biospheric goals*) suggests that many of the explanatory variables had similar associations with progress to goals related to both altruistic and biospheric values. This likely reflects how many conservation goals have positive implications for both people and nature. Thus, those groups more satisfied with progress toward goals related to nature are also likely to be more satisfied with progress toward goals concerning people.

4.5.2. Study limitations

The snowball and self-selection sampling approach used in this study has several limitations (Sharma, 2017). First, our sampling approach was vulnerable to self-selection bias. Those wanting to share stronger opinions may have been more likely to participate, potentially biasing results towards more extreme responses. However, we used relatively neutral and non-specific language when inviting participants to help reduce this risk (see *Appendix: Sample recruitment email*). Second, not all people in the target population had an equal probability of being presented with the survey. Those subscribed to conservation mailing lists and newsletters, active on social media, or

affiliated with the organisations we contacted were most likely to have seen the survey invitation. Consequently, our sample is likely to underrepresent those less active on internet platforms, as reflected in the profile of our respondents. For example, 40% of respondents whose positions (were known) worked in conservation practice. Only 164 (9% of those whose position was known) of these identified as rangers or fieldworkers. Similarly, most respondents completed the survey in English and had university-level education, and nearly half were from Europe and Northern America. We could not find any comprehensive lists of conservationists that might correspond to our target population (professionals with regular internet access who spoke the survey languages). So, it was not possible to precisely assess how representative our sample was. However, it is evident that the study under-represented non-English speakers and those working in frontline roles, outside of Europe and Northern America, and without university-level education. Consequently, our results cannot be generalised across the target population. Moreover, the target population is only a subset of conservation professionals globally, which extends to those who do not speak the survey languages or have regular internet access. However, these results flag potential opportunities and issues that employers of staff with profiles similar to our sample might consider when seeking to better support workers.

In general, a growing number of studies examine the perspectives and experiences of conservationists using similar methods to us (e.g., Montana, Sandbrook, Robertson, & Ryan, 2019; Papworth et al., 2018; Sandbrook, Fisher, Holmes, Luque-Lora, & Keane, 2019; Sandbrook, Scales, Vira, & Adams, 2011). These studies can provide useful insights into experiences in the conservation sector. For example, Sandbrook et al. (2019) used snowball sampling through internet surveys to explore perceptions among 9,264 conservationists. However, such research (including the current study) risks overlooking the experiences of those working in some of the most important but challenging conservation contexts (Milner-Gulland, 2021). Further research is needed to understand the heterogeneity of experiences and avoid worsening potential inequalities within the conservation sector. This research could be supported by the widespread adoption of a clear definition of who conservation professionals are and what their different roles entail, as

suggested by Appleton et al. (2021). Even more useful would be the creation of national or international databases of conservation organisations or professionals, which could be sampled, though this may not be realistic and might pose security risks.

Our study was observational and cross-sectional and could not evaluate causal relationships. For example, it is unclear if individuals become more satisfied with progress to personal goals as their careers advance (e.g., gaining more secure jobs) or if those who are dissatisfied leave the sector. Future research could explore this question by following cohorts of conservation professionals over time or examining the career trajectories of those previously trained in conservation.

Aside from gender, we did not examine how goal progress satisfaction varied by other identities, such as race, ethnicity, or sexuality. These identities can have profound effects on conservationists' experiences, particularly given colonial legacies in conservation (Butler, 2021; Demery & Pipkin, 2021; Duff, 2020). But, we felt that an internet survey would be an inappropriate platform for investigating these topics and that we did not have the disciplinary expertise to do this adequately. Further research could help understand how discrimination and other barriers influence progress towards goals, particularly those around conservationists' livelihoods and careers.

Finally, wellbeing is multidimensional and can be evaluated using both subjective and objective indicators (Diener et al., 1999; McGregor, 2007; Woodhouse et al., 2015). Our analysis did not differentiate between sub-dimensions of self-reported wellbeing. So, our results do not tell us if the reported challenges and rewards are associated with respondents' psychological wellbeing. However, these reported challenges and rewards highlight areas likely to be important for conservation professionals with similar profiles to our sample, which employers could consider.

4.6. Conclusion

Understanding conservationists' satisfaction with goal progress might highlight risks to the wellbeing and motivation of those in the sector. To our knowledge, we provide the first study asking how satisfied conservationists are with goals they consider important, how this satisfaction varies between groups, and how it is experienced. Our study includes voices from nearly 2,700

conservationists familiar with conservation in 145 countries. Most of these respondents were English speaking, worked in academic or desk-based roles, and had university-level education, and nearly half were from Europe or North America. Additionally, those with stronger opinions might have been more likely to participate. So, our results might over-emphasise the challenges and rewards experienced by conservation professionals and should not be indiscriminately generalised across the target population of conservation professionals working globally. Nevertheless, our results might describe the experiences of conservation professionals with similar characteristics as our sample – i.e., highly educated, English speaking, and in desk-based roles, including many in academia.

Among this sample, the goal of “*contributing to conservation*” was important to most. However, many struggled to earn adequate incomes and maintain stable careers while pursuing this goal. Employers, funders, and other actors should consider ways to support those working in the sector to deliver conservation outcomes whilst having stable and rewarding livelihoods. This could involve conservation organisations giving greater priority to their staff’s wellbeing and working conditions when considering how funding is allocated.

Moreover, respondents felt like little progress was being made towards collective conservation goals, corroborating formal assessments, which appeared to be a source of distress and a threat to motivation. Employers and others in the sector might consider ways to offset this distress by offering support in other aspects of conservationists’ professional lives. This could include, for instance, fostering supportive work environments and celebrating positive outcomes in one’s work. Such support might be directed to at-risk groups, such as those who are less optimistic, early-career professionals, those who are overworked, women, and others who feel they would benefit from support.

Further research is needed to understand how many leave the sector because of these challenges. Nevertheless, our research demonstrates conservationists’ fortitude and commitment to protecting nature despite the challenges they face. Conservation is mission-driven and aims to improve relations between people and nature and so is implicitly aspirational (Sandbrook, 2015; Soulé,

1985). Reflecting on conservationists' goals might shed light on new approaches for meeting these aspirations, such as creating more sustainable career pathways that allow those in the sector to focus on delivering conservation outcomes.

4.7. Data and code availability

Study data is available at

https://figshare.com/articles/dataset/Conservationists_goal_progress_dataset/14501238

(doi:10.6084/m9.figshare.14501238). Study code is available at

<https://github.com/Pienkowski/LiC-goal-progress>.

5. Personal traits predict conservationists' optimism about outcomes for nature

5.1. Abstract

In the face of unprecedented biodiversity loss, the belief that conservation goals can be met could play an important role in ensuring they are. We asked conservationists how optimistic they felt about key biodiversity outcomes over the next ten years. In total, 2,341 people familiar with conservation in 144 countries responded; most had university-level education, worked in desk-based academic and practitioner roles, and responded in English. Respondents expressed optimism that enabling conditions for conservation would improve but felt pressures would continue, and the state of biodiversity was unlikely to get better. Respondents with greater general optimism about life, at early-career stages, and working in practice and policy (compared to academia) reported higher conservation optimism. But, most of our biodiversity and conservation status indicators were not associated with conservation optimism. Unbounded optimism without appropriate action would be misguided in the face of growing threats to biodiversity. However, supporting those struggling to see the light at the end of the tunnel could help sustain efforts to overcome these threats.

5.2. Introduction

Thirty years have passed since the first global commitment to protect biodiversity was agreed at the 1992 Rio Earth Summit (UN, 1992). But this commitment has been followed by inadequate collective action, with overwhelming evidence of ongoing global biodiversity loss (CBD, 2020a; IPBES, 2020). So, it might be hard to see why conservationists should think conservation goals will be met in the future. Yet, optimism – the expectation that good things will happen (Carver et al., 2010) – may play a role in ensuring these goals are met.

Optimism includes dispositional and situational aspects, as defined in Chapter 1. Situational optimism about conservation may be influenced by both dispositional optimism and contextual

factors, such as witnessing biodiversity loss (Tusaie & Patterson, 2006). In Chapter 1, I emphasise the role of previous goal progress in situational optimism. In this chapter, I focus on objective indicators of the state of nature and conservation efforts as contextual determinants of situational optimism (Figure 5.1). (See Chapter 8, where I explore the association between goal progress satisfaction and situational optimism.)

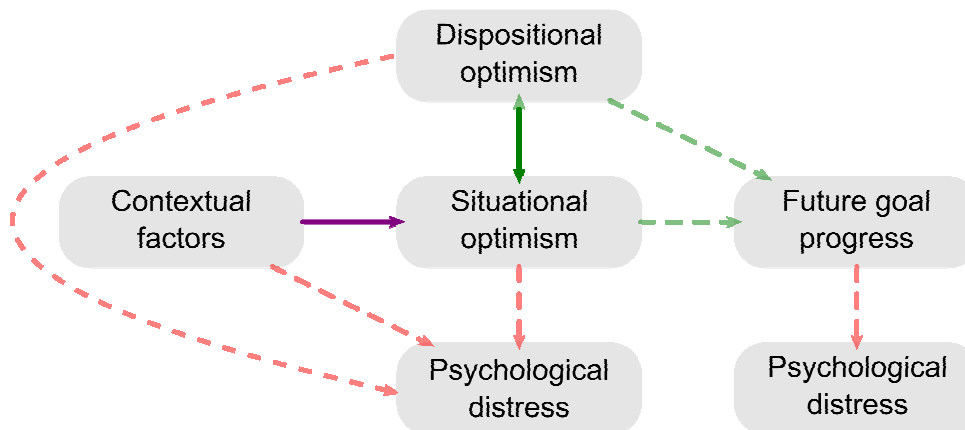


Figure 5.1. A conceptual framework for the role of optimism in conservation (adapted from). The current study focuses on the associations described by the solid lines, where an individual’s situational optimism is influenced by dispositional optimism and context. The dashed lines show possible associations not explored in the current chapter. Green lines indicate expected positive associations and red lines negative ones (the expected association described by the purple line depends on the indicator in question).

Situational optimism might have implications for individuals’ actions and experiences. The expectancy-value model of motivation suggests that individuals are more likely to pursue goals they value and believe can be achieved (Carver et al., 2010; Wigfield & Eccles, 2000). Consequently, situational optimism may increase motivation towards and attainment of challenging goals (Monzani et al., 2015), although we found no studies testing this among conservationists. Low situational optimism about conservation and dissatisfaction with goal progress may be stressors contributing to psychological distress, as discussed in Chapter 1 (Klug & Maier, 2014). We make the distinction between situational optimism and perceived group efficacy, which is an individual’s evaluation of a group’s ability to perform specific tasks (van Zomeren, Postmes, & Spears, 2008). Both situational optimism and efficacy perceptions are likely to influence expectations of future success and thus motivation, but our study only examines the former.

Situational optimism may also be useful to promote within groups working towards shared goals (Luthans & Youssef-Morgan, 2017), such as within conservation organisations and movements. For instance, optimistic individuals can contribute to an organisational culture that fosters desirable employee attitudes, behaviours, and performance (Avey et al., 2011). Finding widespread low situational optimism suggests threats to motivation, wellbeing, and organisational efforts across the sector, which could be offset by support in other aspects of conservationists' work lives.

Yet, being highly optimistic may also lead to misjudged risks and wasted resources pursuing unattainable aims (Carver et al., 2010; Forgeard & Seligman, 2012). Moreover, high levels of environmental optimism could lead to complacency (Gifford, 2011). Finally, a culture that stigmatises failure may hamper opportunities to learn from it (Catalano, Redford, Margoluis, & Knight, 2018). Consequently, optimism should not be indiscriminately promoted (Luthans & Youssef-Morgan, 2017).

Individuals may be optimistic about conservation outcomes at different scales. For instance, a conservationist might be optimistic that the goals of a local protected area will be attained but believe national-level policy goals will not. Furthermore, a conservationist's situational optimism might be influenced by multiple factors like personal characteristics, the state of biodiversity where they work, or regional social and ecological differences (Table 5.1). Understanding which groups are the least situationally optimistic could be used by employers, funders, and others to direct support, such as improving other aspects of conservationists' work lives, to those who need it most.

Table 5.1. A priori hypothesised associations between situational optimism about conservation outcomes and personal characteristics, indicators of the state of biodiversity and conservation at a national level, and other explanatory variables. Key: RL = reference level, (+) = positive association, (-) = negative association, (?) = unclear association.

Explanatory variable	Hypothesised association
Dispositional optimism	(+) After accounting for contextual factors, we expect dispositional and situational optimism to be positively correlated (Tusaie & Patterson, 2006).
Years in conservation	(-) We expected those working in conservation for longer to have witnessed slow progress towards biodiversity targets and thus be less situationally optimistic.
Practice/policy (RL = academia)	(?) Academics may have been more aware of the extent of biodiversity loss and so less situationally optimistic. Alternatively, practitioners might be more likely to witness biodiversity loss.
University (RL = non-university education)	(+) Environmental awareness may be positively associated with educational level (e.g., Kollmuss & Agyeman, 2010). So, we expect those with university-level education to be more aware of threats to nature and thus be less optimistic about conservation outcomes.
Male (RL = female)	(?) We have no expectations about the association between situational optimism and gender, but we include this variable out of interest.
Red List Index Primary cover Protected area cover Conservation spending Governance	(+) We anticipated greater situational optimism about conservation outcomes in countries with a high proportion of non-threatened species, natural land cover, protected area coverage, higher conservation spending, and better overall governance.
Biome (RL = terrestrial)	(?) Marine and terrestrial environments face differing threats, and situational optimism may vary among those working across these biomes.
Region (RL = North America and Europe)	(?) After controlling for other contextual factors, social, ecological, and political differences between regions may influence situational optimism about conservation outcomes.

5.3. Methods

As in Chapter 4, the target population included all conservation professionals with regular internet access who spoke English, French, Spanish, Portuguese, Kiswahili, or Khmer. This population was sampled following methods described in Chapter 4 (see *Appendix: Definitions of a conservationist (Chapter 5)*, exploring how the study results were insensitive to a more conservative definition of conservation professional).

We designed a ten-item instrument assessing respondents' optimism about future conservation outcomes in the country whose conservation context respondents were most familiar (see *Appendix: Situational optimism instrument*). This instrument was designed over a series of workshops attended by six co-authors. The choice of items was guided by the five Strategic Goals of the Convention on Biological Diversity's Aichi Biodiversity Targets, representing a broad consensus on conservation aspirations (CBD, 2010b). We sought non-technical statements that minimised variability in responses due to knowledge about actual progress towards the Strategic Goals. Respondents were asked to evaluate the likelihood of outcomes within the country whose conservation context they were most familiar with, according to four response levels from 'definitely won't' to 'definitely will'. This instrument was used to quantify respondents' latent situational optimism at a national level, hereafter referred to as nationally-focused situational optimism. Conservationists are also expected to be motivated by local outcomes, so an additional one-item measure of locally-focused situational optimism was included. Respondents were prompted to consider the most important goals related to a particular place, situation, or work focus when answering this question.

Factors associated with nationally- and locally-focused situational optimism were explored through two structural equation models. This approach allowed us to estimate latent variables and the relationships between variables within the same model (see *Appendix: Factor structure*). These models included an estimate of latent dispositional optimism derived from the Life Orientation Test – Revised (a widely-used, standardised and validated tool) (Scheier et al., 1994) and personal characteristics (Table 5.1).

The two models also included measures of biodiversity status and conservation effort (Table 5.1). We used two indicators of the state of biodiversity; species extinction risk and the extent of natural land cover in 2020. As a proxy for species extinction risk, we used the International Union for Conservation of Nature (IUCN) Red List Index within a given country in 2020 (IUCN, 2020b). We used the aggregated Red List Index across five taxa, weighted by the proportion of each species' distribution within a given country (Rodrigues et al., 2014). A Red List Index score of 1 means all

species in a country are listed as Least Concern, and 0 means all are considered Extinct (IUCN, 2020b). As a measure of the extent of natural land cover, we measured the mean extent of primary natural forest and non-forest land cover within each country in 2020, as calculated in the Shared Socio-economic Pathways scenario 2 by the Land-Use Harmonization project (Hurt et al., 2020).

Finally, we used three indicators of conservation effort: conservation spending, protected area cover, and national governance quality. As an indicator of conservation spending, we used the annual estimated country-level conservation spending between 2001 and 2008 (where data were available), weighted by each country's geographical area (Waldron et al., 2013). As an indicator for the area under effective biodiversity protection, we calculated the proportion of countries' geographical extent covered by IUCN Category I to VI protected areas in 2020 (UNEP-WCMC & IUCN, 2020). Finally, as a proxy for general environmental governance, we constructed a composite variable based on the Worldwide Governance Indicators within each country in 2018, assuming this is closely associated with good environmental governance (Kaufmann, Kraay, & Mastruzzi, 2011).

All analysis was performed in the statistics software R (version 4.0.2, R Core Team, 2020). Not all respondents completed all questions, with complete cases for 1,988 observations (see *Appendix: Patterns of missing data (Chapter 5)*). Missing data were substituted with synthetic values through multivariate imputation by chained equations creating ten datasets containing imputed data using the package mice (version 3.9.0, van Buuren S & K, 2011), described in *Appendix: Imputation of missing data (Chapter 5)*. Furthermore, five respondents reported non-binary gender identities and were removed from the statistical analysis to avoid statistical separation.

Two models were estimated for each of the ten imputed datasets, using the robust weighted least squares estimator and polychoric correlation. The estimates and variances from the models applied to the ten imputed datasets were pooled following Rubin's Rules, and coefficient estimates were presented in standardised units (Rubin, 1987). (Further analysis exploring modelling assumptions are presented in *Appendix: Sensitivity testing*.)

5.4. Results

Our survey was completed by 2,341 conservationists familiar with conservation in 144 countries (Table 5.2). Of these, 2,336 were included in the statistical analysis.

Table 5.2. Respondents' selected characteristics. The region variable includes clusters of countries whose conservation context respondents said they were most familiar. LOTR, Life Orientation Test – Revised.

Characteristic	Overall N = 2,341	Women N = 1,208	Men N = 969	Non- binary N = 5	Unknown N = 159
LOTR	15.0 (3.9)	15.1 (3.9)	15.1 (3.8)	9.0 (5.8)	14.1 (3.5)
Years in conservation	12.2 (10.5)	10.2 (8.2)	14.3 (12.1)	7.8 (3.1)	26.6 (17.1)
Age	36.9 (11.2)	35.1 (9.5)	39.2 (12.7)	29.6 (2.9)	37.0 (10.9)
Position					
Academic	1,094 (47%)	584 (48%)	491 (51%)	3 (60%)	16 (10%)
Practice/policy	729 (31%)	393 (33%)	323 (33%)	2 (40%)	11 (6.9%)
Unknown	518 (22%)	231 (19%)	155 (16%)	0 (0%)	132 (83%)
Education					
Non-university	141 (6.0%)	50 (4.1%)	78 (8.0%)	0 (0%)	13 (8.2%)
University	2,069 (88%)	1,158 (96%)	888 (92%)	5 (100%)	18 (11%)
Unknown	131 (5.6%)	0 (0%)	3 (0.3%)	0 (0%)	128 (81%)
Region					
Central and South Asia	294 (13%)	128 (11%)	138 (14%)	0 (0%)	28 (18%)
East and South-East Asia	260 (11%)	139 (12%)	100 (10%)	0 (0%)	21 (13%)
North America and Europe	888 (38%)	506 (42%)	331 (34%)	4 (80%)	47 (30%)
Latin America and the Caribbean	230 (9.8%)	112 (9.3%)	107 (11%)	0 (0%)	11 (6.9%)
North Africa and West Asia	37 (1.6%)	12 (1.0%)	19 (2.0%)	0 (0%)	6 (3.8%)
Oceania	155 (6.6%)	86 (7.1%)	60 (6.2%)	0 (0%)	9 (5.7%)
Sub-Saharan Africa	475 (20%)	225 (19%)	212 (22%)	1 (20%)	37 (23%)
Unknown	2	0	2	0	0

Although none of the Aichi Biodiversity Targets was fully met in 2020, conservationists in our study were optimistic that some related outcomes might be met by 2030 (Figure 5.2) (CBD, 2020a). For instance, many anticipated increased public support for conservation. However, this apparent optimism around enabling conditions did not translate into expected improvements in the state of nature. For example, less than a quarter thought that goals to improve biodiversity (Aichi Strategic Goal C) will be met during the next ten years. Furthermore, few respondents were optimistic that the locally-focused conservation goals most important to them would be met by the end of the decade (see *Appendix: Geographic patterns of optimism*).

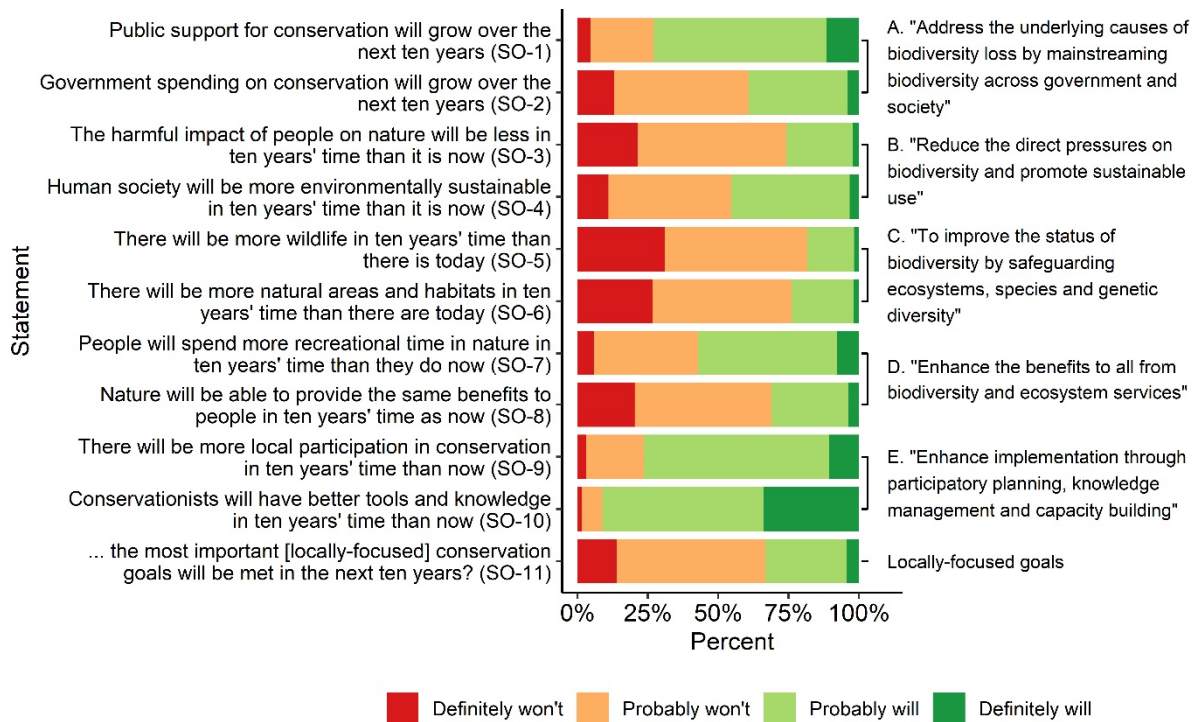


Figure 5.2. Expectations about conservation outcomes in the next ten years. The perceived likelihood that ten nationally-focused conservation outcomes indicative of the five Strategic Goals (A-E) of the Convention on Biological Diversity's Aichi Biodiversity Targets (SO-1 to SO-10), and locally-focused goals (SO-11), will be met by 2030 (CBD, 2010b). Respondents were asked to think about the country whose conservation context they were most familiar with when evaluating the ten nationally-focused outcomes. Respondents were asked to think about the specific conservation area or context they were most familiar with when evaluating the locally-focused goals.

5.4.1. Dispositional and situational optimism

Dispositional optimism was correlated with nationally- and locally-focused situational optimism (Figure 5.3a). Those at the 90th percentile of dispositional optimism scores reported an estimated 0.25 standard deviation (SD) higher nationally-focused situational optimism than those at the 50th. Dispositional optimism appeared to be one of the strongest predictors of both locally- and nationally-focused situational optimism (see *Appendix: Life Orientation Test – Revised (Chapter 5)*).

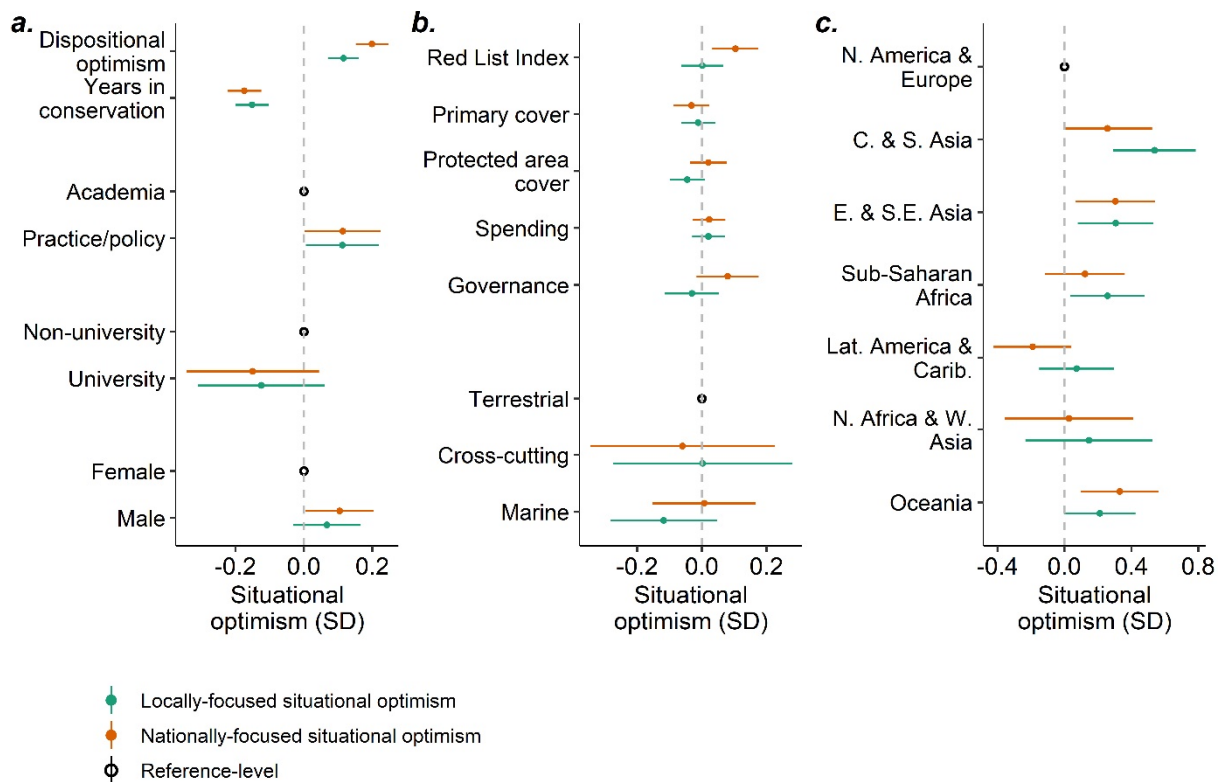


Figure 5.3. Predictors of situational optimism about conservation outcomes. The associations between nationally- and locally-focused situational optimism and (a) personal characteristics, (b) biodiversity state, conservation effort and focal environment, and (c) regional grouping variables. These estimates were derived from two structural equation models. Coefficients are in standardised units, meaning a one-unit change in continuous explanatory variables is associated with a given standard deviation (SD) change in the response variables, holding all other variables constant. Estimated uncertainty is presented in two-sided 95% confidence intervals. Levels representing unknown or other responses are not shown. Cross-cutting applies to those whose work encompasses terrestrial and marine biomes.

5.4.2. Context and situational optimism

Those in conservation for longer reported lower levels of nationally- and locally-focused situational optimism (Figure 5.3a). For instance, someone working in conservation for five years had an estimated 0.33 SD higher nationally-focused situational optimism than someone in the sector for 25 years. Those in conservation practice reported higher levels of nationally- and locally-focused situational optimism than those in academia.

Red List Index scores describing the overall threat status of national species were positively associated with nationally-focused situational optimism (Figure 5.3) (IUCN, 2020b). For instance, those considering Botswana, a country with a relatively high Red List Index score of 0.97, had an

estimated 0.37 SD higher nationally-focused situational optimism than those considering New Zealand, a low-scoring country (0.62).

There appeared to be substantial variation in situational optimism between regions (Figure 5.3c). For instance, those familiar with conservation in Oceanian and Central, East, and South Asian countries tended towards greater nationally-focused situational optimism than those familiar with North American and European countries.

5.5. Discussion

Respondents' optimism about conservation outcomes were mixed. Many did not expect improved enabling conditions (like better conservation knowledge) to translate into reduced pressures on nature or better biodiversity status. These expectations about the future appeared consistent with formal evaluations around current progress toward conservation goals. The Global Biodiversity Outlook 5 consolidated dozens of indicators of progress to the Aichi Biodiversity Targets (which were supposed to have been met in 2020) (CBD, 2020a). As an example, Target One stated, "By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably." The Outlook report concluded that some progress had been made to this target. Similarly, our respondents were confident that public support for conservation would grow over the next ten years (SO-1). As another example, Target Twelve stated, "By 2020, the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained." The Outlook report concluded that there had been no progress in preventing extinction, and the conservation status of threatened species had worsened. Echoing this, most respondents thought there probably would not be more wildlife or natural areas over the next ten years (SO-5 and SO-6). These results suggest that respondents' expectations about the future were generally consistent with formal assessments of current trends. However, given the subjective nature of perceptions, we advise against directly interpreting conservationists' responses as indicators of real-world trends.

Our study did not measure respondents' motivation and behaviour. However, the conservation community continues to strive towards biodiversity goals, despite our results suggesting many believe these will not be met in the medium-term. Within the expectancy-value model of motivation, this could be because of the high value conservationists place on nature (Carver et al., 2010; Papworth et al., 2018; Wigfield & Eccles, 2000).

5.5.1. Dispositional optimism appears important

As hypothesised, dispositional optimism was associated with respondents' expectations of future success. These expectations may influence goal perseverance and attainment, with potential impacts on wellbeing and progress towards wider conservation targets (Carver et al., 2010; Forgeard & Seligman, 2012; Klug & Maier, 2014). This result suggests that those who tend to be less optimistic might benefit most from support in challenging roles or choose to avoid such positions (Figure 5.4). To aid this, individuals might reflect on how their outlooks and emotions influence their experiences in different roles (Zeidner, Matthews, & Roberts, 2004). Employers should also be mindful of their team's composition, recognising the potential complementarity of those who are more and less optimistic. Organisations might also offer resources to staff struggling with optimism about conservation. For instance, they could offer access to evidence-based interventions such as Best Possible Self – a method where people imagine desired future states (Malouff & Schutte, 2017). Furthermore, our study design could not evaluate the causal relationship between dispositional and situational optimism. However, future research could explore potential bi-directional feedback. Though speculative, efforts to enhance conservation optimism over time (discussed below) might increase optimism about life in general, with its associated benefits and risks. Conversely, contextual factors that diminish situational optimism – potentially including gloom-and-doom discourse (Swaigood & Sheppard, 2010) – might also negatively impact dispositional optimism. Future research, such as cohort studies and experimental interventions of positive conservation messaging, could evaluate these hypotheses.

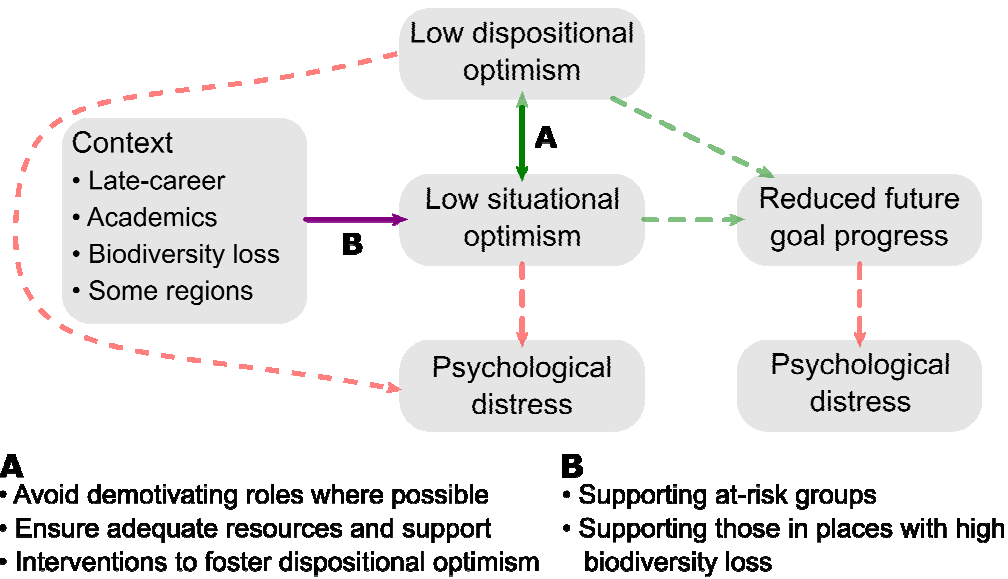


Figure 5.4. Dispositional optimism and some contextual factors are associated with situational optimism, but measures may mitigate or manage these associations.

5.5.2. Some personal characteristics predict situational optimism

The state of biodiversity would almost certainly be worse in the absence of conservation actions (Bolam et al., 2020; Hoffmann et al., 2015). Still, inadequate progress toward conservation targets has been recognised for decades (Pullin, 2002). Witnessing this is a reasonable explanation for why those in the sector for longer are less optimistic. Those with long experience of biodiversity loss may have more pessimistic projections into the future than early-career conservationists. (See *Appendix: Sensitivity testing* for further analysis with the inclusion of age as an explanatory variable.)

Job position was also associated with situational optimism. Conservation practice may attract those who are optimistic about enacting real-world change, or such optimism may be cultivated and rewarded within practitioner circles. Alternatively, academics may be distanced from on-the-ground examples of positive change or more exposed to the global scale of biodiversity threats. These results suggest that those with low dispositional optimism, academics, or senior conservationists might benefit from support. However, Chapter 4 and other studies suggest that other groups – like early-career conservationists or those working in frontline roles – face other

serious challenges (Singh et al., 2020). As such, patterns of situational optimism should be only one of many factors determining where support should be directed.

5.5.3. Biodiversity and conservation context appear less important

Our results imply that respondents' situational optimism was not particularly sensitive to most of our chosen biodiversity status and conservation effort indicators. One explanation for this is that respondents may have unrealistic evaluations of the state of nature and conservation. However, respondents' expectations about the future were generally consistent with formal assessments at a global level. Another plausible explanation is that respondents' expectations were more informed by global trends and less by national-level conditions (despite respondents being asked to think about the country they were most familiar with). Consequently, conservationists might have realistic expectations at a global but not a national level. Another possible explanation is that respondents may have considered contextually-important factors when giving their assessments, which may not be reflected in these coarse, nationally-aggregated indicators. For example, protected area coverage was an indicator in the Aichi Biodiversity Targets (CBD, 2010b). However, "paper parks", which exist in law but fail to protect biodiversity effectively, are common (Di Minin & Toivonen, 2015). As such, protected area coverage may be a poor indicator of actual conservation effort. In contrast, Red List Index scores were positively correlated with respondents' nationally-focused situational optimism. The Red List Index is built from thousands of species assessments and is a robust indicator of biodiversity status (Rodrigues et al., 2014). As such, it might have more closely matched conservationists' experiences. As stated above, conservationists' subjective perspectives should not be assumed to indicate real-world trends reliably. However, future research could explore what factors conservationists consider when thinking about the future. Doing so might possibly highlight potentially relevant contextual factors that might be tracked to provide a more holistic picture of progress towards conservation goals.

Our results also implied significant regional differences in situational optimism, perhaps reflecting social, ecological, or political factors not captured by other variables. For instance, Latin American

environmentalists face the highest risk of violence globally because of their work, so they might be less optimistic about conservation prospects than those in other regions (Global Witness, 2020).

5.5.4. The role of optimistic conservation framings

Some have suggested that gloom-and-doom discourse may create a culture of “*learned helplessness*” (Swaigood & Sheppard, 2010). Potentially in response, several environmental optimism movements sharing positive conservation outcomes have emerged, including Conservation Optimism, Earth Optimism, and Ocean Optimism. Reflecting on positive outcomes may remind those in the sector that the conservation movement is making a difference, as demonstrated empirically (Bolam et al., 2020; Hoffmann et al., 2015), perhaps elevating situational optimism.

Yet, as in other fields, trade-offs, opportunities for abuse, and unequal power dynamics are ever-present in conservation. Thus, alleged conservation success stories should be treated critically and should not obscure or minimise the harm that can be caused to others. Building transparency could involve promoting the voices of those most exposed to the benefits and costs of conservation interventions, particularly when their stories are not unambiguously positive. Fundamentally, building optimism may engender confidence to seek out, engage with, and address conservation problems rather than overlook them (Catalano et al., 2018).

5.5.5. Study limitations

As in Chapter 4, the study sample is biased towards university-level educated, English speaking, and desk-based practitioners and academics. Conversely, it may not reflect the expectations of those in frontline positions and with less education, who play essential roles in conservation. The levels of optimism about conservation, the factors associated with it, and its implications for motivation might differ among those poorly represented in the current study. A better understanding could help prioritise where support could be directed across the conservation sector.

We trialled a middle response level in the nationally-focused situational optimism instrument (“equally likely as not”). But, some who piloted the study said this was confusing since the statement would either happen or not. We also trialled using more response levels but could not find a combination of unambiguous phrases. For example, we trialled a scale including “possibly will”, “probably will”, and “definitely will”, but pilot respondents said there was overlap between the first two. We considered a “do not know” option but believed this would dissuade those with less technical knowledge or confidence from answering, despite us being primarily interested in their perceptions. A consequence of this is that respondents were unable to communicate their uncertainty. An alternative method might have been to ask respondents to indicate the probability that a statement would happen on a sliding scale, with an accompanying question asking them to indicate their confidence, as suggested by V. Hemming et al. (2018). Additionally, limitations discussed in Chapter 4 regarding the study’s observational design and the choice to only look at gender (not other identities) also apply to this Chapter.

5.5.6. Experimentally testing interventions

Above, we highlight the emergence of several optimism movements in conservation. However, we are unaware of any experimental studies testing their impacts on workplace outcomes. Such an experimental test could ask, ‘how does optimistic and doom-and-gloom messaging influence sickness-absence among desk-based staff in non-governmental conservation organisations?’ This question could be tested through a randomised control trial. As mentioned in Chapter 3, randomised control trials reduce selection bias and eliminate confounding (Kendall, 2003).

In this hypothetical study, a suitable number of organisations could be randomly selected from a sampling frame of conservation charities registered in the United Kingdom. All staff within these selected organisations could be randomly assigned into three groups. The number of organisations and individuals could be determined through power analysis. Each group would receive one of three series of texts they are required to read, one provided per week over a suitable timeframe. Each of the three text sets would describe a conservation context, presented using optimistic or

pessimistic framings or passages unrelated to conservation (the control). For example, the optimistic text might highlight positive outcomes and opportunities within specific conservation contexts and the doom-and-gloom one might focus on challenges and threats. The control text might use a neutral and generic magazine article. An intermediate variable could be situational optimism about conservation outcomes based on, for example, the instrument used in this chapter. The outcome variable could be sickness-absence, often used as an indicator of stress-related health (e.g., Thorsen et al., 2019). These data could be collected in periods prior to, at the end of, and after (perhaps with a delay to understand if outcomes persist) the intervention. These data could be analysed within a difference-in-difference analysis to determine the causal associations between messaging, situational optimism, and sickness absence. Such a study could help evaluate if optimism movements play a role in supporting the mental health of desk-based conservation professionals in the United Kingdom.

5.6. Conclusion

Our results suggest that conservationists (with university-level education working in desk-based academic and practitioner roles) have limited optimism that key conservation goals, such as improving the status of biodiversity (CBD, 2010b), will be met in the medium term. These expectations may reflect a realistic evaluation of the threats facing nature and people. Still, these results might suggest potentially widespread threats to motivation and wellbeing among those with characteristics similar to our respondents.

Optimism is not appropriate in all circumstances, and other factors – such as emotions like anger – have roles in motivating action (van Zomeren et al., 2008). Future research could usefully evaluate the links between situational optimism, motivation, and conservation outcomes. For instance, optimism may enhance motivation to act, but evidence-based approaches are needed to ensure these actions are effective (Sutherland, Pullin, Dolman, & Knight, 2004). Nevertheless, positive psychology scholarship suggests that optimism can help individuals and groups realise their aspirations (Luthans & Youssef-Morgan, 2017). For some, engaging with optimism movements

like Conservation Optimism, Earth Optimism, and Ocean Optimism might help them overcome feelings of “*helplessness*” (Swaisgood & Sheppard, 2010). Others might benefit from support in other areas of their work lives. This support could include funders prioritising conservationists’ livelihoods when allocating funds, employers fostering supportive work environments, or individuals sharing strategies that help them cope (as suggested in chapters 4 and 6). Such support may be particularly beneficial for some groups, such as those who have seen limited conservation progress during their careers or are working in challenging geographic areas.

Conservation is entering a crucial window for “*bending the curve*” upwards on biodiversity loss, where things might get worse before they get better (Leclère et al., 2020). During this critical time, building a shared belief that conservation goals can be met may help ensure they are.

5.7. Data and code availability

Study data is available at [doi:10.6084/m9.figshare.14016086](https://doi.org/10.6084/m9.figshare.14016086) and code at <https://github.com/Pienkowski/LiC-optimism>.

6. Protecting those who protect nature by supporting conservationists' mental wellbeing

6.1. Abstract

Biodiversity conservation work can be challenging but rewarding, with potential consequences for conservationists' mental health. Yet, little is known about patterns of mental health among conservationists and its associated protective and risk factors. A better understanding can help improve working conditions, supporting conservationists' job satisfaction, productivity, and engagement, while reducing costs from staff turnover, absenteeism, and presenteeism. We surveyed 2,311 conservation professionals across 143 countries, asking about experiences of psychological distress, personal characteristics, and workplace conditions. Nearly half of respondents were from Europe and North America, and most had university-level education, were in desk-based academic and practitioner roles, and responded in English. Moderate or severe distress was reported by 27.8% of respondents (Kessler Psychological Distress Scale scores between 25-50). Respondents with low dispositional and conservation-specific optimism, poor physical health, limited social support, women, and early-career professionals were most at risk. Heavy workload, job demands, and organisational instability were linked to higher distress in our sample, but job stability and satisfaction with one's contributions to conservation were associated with lower distress. We suggest possible ways employers and others might help support the mental health of conservation professionals in desk-based roles.

6.2. Introduction

As in other sectors, the challenges and rewards that conservationists face may be significant factors affecting their mental health (Lamontagne et al., 2014). Mental illness is a leading contributor to the global burden of disease, with over 260 million people estimated to have had depression in 2017 (Monitor Deloitte, 2017). In the United Kingdom alone, poor mental health was estimated to cost employers between £33 billion and £42 billion in 2016 (Stevenson & Farmer, 2017). Most

people experience variable mental health throughout their lives and can be helped to thrive even when experiencing mental illness (Stevenson & Farmer, 2017).

Conservation can be a tough sector to work in. Conservationists exposed to the loss of nature but provided with inadequate support might face acute ecological grief (Gordon et al., 2019). This grief may be a natural and legitimate response to perceived societal inaction, feelings of powerlessness, and the expectation that future environmental targets will not be met (Cunsolo & Ellis, 2018; Hickman, 2020). These feelings may be exacerbated by the “*gloom-and-doom*” narrative prevalent in some conservation discourse (Swaisgood & Sheppard, 2010). The conservation sector is also underfunded. For example, conservation spending is estimated to be an order of magnitude smaller than is required to meet critical global biodiversity targets (Barbier, Burgess, & Dean, 2018). This underfunding may partly explain the prevalence of precarious, inadequately compensated, and poorly resourced conservation jobs (as reported in Chapter 4). Furthermore, the vocational nature of conservation work can encourage exploitative practices, such as long-term unpaid or low-paid work, that affect those from disadvantaged backgrounds and junior members of the profession worst (Fournier & Bond, 2015; Rönnblad et al., 2019; Vercammen et al., 2020). Moreover, many conservation roles blur the boundary of personal and professional lives. For instance, conservation scientists often work outside regular office hours, may be based in remote locations, and spend significant time away from friends and family (Campos-Arceiz et al., 2013; Ramos et al., 2017). Similarly, some in the sector can have conflicting responsibilities and loyalties, which may be distressing. For instance, protected area rangers can come from or live in the communities they police, which may create tensions with friends, neighbours, and family (Moreto, 2016). In other cases, conservationists can face hard choices when trading-off objectives (McShane et al., 2011), which could be compounded by the challenges of interdisciplinary research and practice (Sellberg, Cockburn, Holden, & Lam, 2021) and ideological conflicts with peers (e.g., Cleary, 2018). These challenges are not equally experienced within the sector and can vary by job role, geography, race and ethnicity, sexual orientation, religion, gender, and other identities and social relations (Chaudhury & Colla, 2021;

Demery & Pipkin, 2021; M. S. Jones & Solomon, 2019). For example, several recent studies examine workplace stressors – such as isolation from family, poor health and safety, and inadequate compensation – experienced by conservation rangers (Belecky, Singh, & Moreto, 2019; Belhekar et al., 2020; Gao & Li, 2021; Moreto, 2016; Singh et al., 2020; Spira, Kirkby, & Plumptre, 2019).

Yet, working in conservation can also be rewarding. Many people across numerous sectors seek work that aligns with their values or contributes to societal causes (Berg, Grant, & Johnson, 2010). Doing value-aligned work is also important for many conservationists, such as those motivated by their love of nature and its perceived intrinsic and instrumental values (Papworth et al., 2018). Engaging in value-aligned work can be a source of satisfaction and meaning in conservationists' lives, as illustrated in reports by some in Chapter 4. Some types of conservation work also provide beneficial opportunities to spend time in nature, travel, learn and grow, and interact with colleagues and other groups (Larson et al., 2020; Papworth et al., 2018).

These challenges and rewards, and the balance between them, are likely to play a role in conservationists' mental health. There are multiple reasons why the conservation sector should care about the mental health of its members. For individuals, good working conditions can enhance job satisfaction and quality of life beyond work (Waddell & Burton, 2006). Such conditions are often associated with better job performance and career advancement and might help those who want to remain in the sector to do so (Kahya, 2007). There are also pragmatic reasons why organisations should care about staff mental health. Good working conditions can increase staff engagement, creativity and productivity while reducing costs from absenteeism, presenteeism (working while being unwell), and staff turnover (Cotton & Hart, 2003; Stevenson & Farmer, 2017). Good working conditions may also ease stress-induced workplace conflict and reduce incentives for misconduct (V. C. S. Lau, Au, & Ho, 2003; Moreto, Brunson, & Braga, 2015). In many countries, employers have a duty of care towards their staff; failure to fulfil this duty might pose liability risks. Across the sector, a more productive and innovative workforce might be better able to deliver conservation action. In general, there is good evidence that a) there exists a

prevention gap for mental illness (P. Y. Collins et al., 2011; Furber et al., 2015), b) working conditions can contribute to or ameliorate mental illness risk (Harvey et al., 2017; Theorell et al., 2015), and c), and that conservation can be a challenging sector to work in for some (as described above). Consequently, it is worth understanding and managing workplace factors associated with poor mental health among conservation professionals, regardless of its prevalence in other sectors.

Substantial evidence suggests that good working conditions can be good for mental health (Waddell & Burton, 2006). Efforts to support mental health at work can involve “*promoting the positive*”, preventing harm, and helping manage mental illness regardless of the cause (Lamontagne et al., 2014; Stevenson & Farmer, 2017). Promoting the positives involves identifying and enhancing aspects of work that support job satisfaction and wellbeing. Among conservationists, these aspects may include feeling like one is making a “*meaningful contribution*”, discussed in Chapter 4, or spending time in nature (Papworth et al., 2018).

Supporting mental health also involves preventing harm from workplace stressors. These include imbalances between workplace efforts and rewards, high job demand, job insecurity, and lack of social support from colleagues (e.g., Duchaine et al., 2020; Harvey et al., 2017; van der Molen et al., 2020). Finally, organisations can also provide adjustments to support those with mental illness to stay in or return to work (although these interventions are beyond the scope of this chapter).

Healthcare, education, emergency services, and other sectors have a history of investigating and acting to support workers’ mental health. For example, we found multiple meta-analyses exploring risk factors for mental illness among healthcare workers and interventions to support them (López-López et al., 2019; Petrie et al., 2019). In contrast, we found only a few studies exploring mental health among conservationists (see Belhekar et al. (2020) and Gao and Li (2021), who examine psychological wellbeing and stress among rangers in India and China, respectively). As such, the conservation sector as a whole appears to have lagged behind other sectors. Nevertheless, there is growing recognition of the need to better support those in conservation, given the diverse challenges many in the sector face. For example, the International Ranger Federation aims to professionalise ranger roles and plans to develop minimum standards around working conditions

and welfare (URSA, 2021). Equally, the Lonely Conservationists website shares conservationists' experiences and resources to support mental health (www.lonelyconservationists.com). Therefore, while the lessons learned in other sectors are likely to be informative, these should be evaluated and tailored to the unique challenges and rewards experienced by conservationists.

This study aims to increase understanding of the workplace factors associated with psychological distress within conservation. Severe psychological distress is *“indicative of impaired mental health and may reflect common mental disorders, like depressive and anxiety disorders”* (Viertiö et al., 2021). Indeed, psychological distress is often defined by symptoms of depression and anxiety (e.g., Burnette, Knouse, Vavra, O'Boyle, & Brooks, 2020; Lopes Cardozo et al., 2012; Russ et al., 2012). Yet, psychological distress is not a mental disorder, and high levels of distress cannot be used to diagnose mental illness (Drapeau et al., 2012; Payton, 2009). We chose to focus on psychological distress for several reasons. First, following Stevenson and Farmer (2017), we distinguish between three main groups of workers; those who are thriving, struggling, or ill. We are interested in the workplace factors that might influence people's movements among these groups. As a result, we focus on non-specific psychological distress experienced at varying severities across the three groups rather than the presence of specific disorders found among the last group. Second, we considered it unethical to use a screening instrument for specific common mental disorders through an internet survey. These instruments may trigger distress among some respondents, but we would have been unable to provide support to respondents if this occurred. The instrument used in the current study was considered less distressing. Finally, we did not know which common mental disorders were most likely associated with working conditions in this sector. So, we decided to use a non-specific measure of psychological distress, encompassing a broad range of symptoms. In general, studies on the correlates of poor mental health require brief, validated instruments, as used in the current study (Prochaska, Sung, Max, Shi, & Ong, 2012).

The study asked what personal characteristics and workplace factors were associated with psychological distress among a subset of conservation professionals (defined below). Two structural equation models were fitted, exploring hypothesised associations between personal

characteristics, workplace conditions, and latent psychological distress (Table 6.1, see *Appendix: Hypothesised associations with psychological distress*). One set of variables in the analysis related to the extent to which workplace rewards offset efforts, measured using a modified version of the effort-reward imbalance instrument (Siegrist et al., 2004). The first model (ERI-score model) included the total effort-reward imbalance score for each respondent but excluded individual instrument items. Conversely, the second model (ERI-item model) included each item of the effort-reward imbalance instrument but excluded total imbalance scores.

Table 6.1. Personal characteristics and occupational risk factors expected to be associated with psychological distress in two models (see *Appendix: Hypothesised associations with psychological distress*). The ERI-score model includes the effort-reward imbalance score but excludes each item of the effort-reward imbalance instrument. The ERI-item model includes each item of the instrument but excludes the effort-reward imbalance score. * Variables moderately correlated with other explanatory variables ($\rho > 0.6$) were removed from the statistical analysis post-hoc. †Ordinal exogenous variables were treated as numeric. ‡Conservation-specific items added to the original effort-reward imbalance instrument. Key: RL = reference level, + = expected positive association, - = expected negative association, and ? = ambiguous or unclear expected association.

Association	Name	Model	Description or statement
-	Dispositional optimism	Both	A latent variable derived from the Life Orientation Test – Revised (Scheier et al., 1994). Dispositional optimism is the general expectation of good outcomes in life (Carver & Scheier, 2014).
-	Situational optimism	Both	A latent variable describing situational optimism about conservation outcomes over the next decade (see Chapter 5). Situational optimism is the expectation of positive outcomes within a specific context (Tusaie & Patterson, 2006). A correlation between situational and dispositional optimism was included in the analysis.
-	Gender	Both	Female or male (RL = female).
?	Age*	Both	Age in years.
?	Years in conservation	Both	Years working in conservation.
?	National / non-national	Both	Working in one’s country of nationality or not (RL = national).
?	Education	Both	University or non-university education (RL = non-University).
-	Physical health†	Both	<i>“How is your physical health in general?”</i>
-	Personal relationships†	Both	Satisfied with <i>“your personal relationships?”</i>
-	Friends and family support†	Both	Satisfied with <i>“the support you get from your friends and family?”</i>
-	Friends and family time†	Both	Satisfied with <i>“the amount of time you are able to spend with friends and family”†</i>
+	Effort-reward score	ERI-score model	The adapted effort-reward imbalance score (Siegrist et al., 2004).
+	Heavy workload†	ERI-item model	<i>“I have constant time pressure due to a heavy work load”.</i>
+	Many disturbances ^{*,†}	ERI-item model	<i>“I have many interruptions and disturbances while performing my job”.</i>
+	Increasingly demanding job†	ERI-item model	<i>“Over the past few years, my job has become more and more demanding”.</i>

+	Not enough resources ^{†,‡}	ERI-item model	<i>"I do not have the resources I need to achieve my work goals"</i> .
+	Not enough funding ^{*,†,‡}	ERI-item model	<i>"The organisation I work for does not have enough funding to achieve its main aims"</i> .
+	Organisational instability ^{†,‡}	ERI-item model	<i>"The organisation I work for may not exist in five years' time"</i> .
-	Respect I deserve ^{*,†}	ERI-item model	<i>"I receive the respect I deserve from my boss and work colleagues"</i> .
-	Job advancement prospects ^{*,†}	ERI-item model	<i>"My job promotion or advancement prospects are poor"</i> . (reverse coding)
-	Do not expect undesirable job change [†]	ERI-item model	<i>"I have experienced or I expect to experience an undesirable change in my work situation"</i> . (reverse coding)
-	Good job security [†]	ERI-item model	<i>"My job security is poor"</i> . (reverse coding)
-	Respect and prestige [†]	ERI-item model	<i>"Considering all my efforts and achievements, I receive the respect and prestige I deserve at work"</i> .
-	Job advancement [†]	ERI-item model	<i>"Considering all my efforts and achievements, my job promotion or advancement prospects are adequate"</i> .
-	Income is alright [†]	ERI-item model	<i>"Considering all my efforts and achievements, my salary or income is alright"</i> .
-	Contribution to conservation ^{†,‡}	ERI-item model	<i>"I am satisfied with the contribution I make to conservation"</i> .
-	Social pride ^{†,‡}	ERI-item model	<i>"My friends and family are proud that I work in conservation"</i> .
?	Position	Both	Academia and research or practice and policy (RL = academia and research).
+	Dangerous at night ^{*,†}	Both	<i>"It is dangerous to go outside at night alone"</i> .
+	Dangerous situations [†]	Both	<i>"My work puts me in dangerous situations"</i> .
+	Not feeling safe [†]	Both	<i>"I do not feel safe, even where I live"</i> .
+	Working hours	Both	Work hours per week.

6.3. Methods

As in Chapter 4, the target population included all conservation professionals with regular internet access who spoke the six internet survey languages, sampled using the approach described in Chapter 4.

6.3.1. Variable description

Psychological distress was measured using the Kessler Psychological Distress Scale (Kessler-10) (Kessler et al., 2002). The Kessler-10 was created by reducing an initial set of 612 items from existing instruments through multiple phases of expert consultation, piloting, Item Response Theory analysis, validation (including through reappraisal using structured clinical interviews), and deployment in general population surveys (Kessler et al., 2002). The Kessler-6 (which uses six items of the Kessler-10) had a sensitivity of 0.36 and a specificity of 0.96 using the cut-off of 13 when compared to clinical diagnoses for serious mental illness using the Structured Clinical Interview for DSM-IV (Kessler et al., 2003). The authors of this study also diagrammatically illustrate the specificity and sensitivity of the Kessler-10, which was effectively the same as the Kessler-6, but did not report the exact values. Another study found that the Kessler-6 had a sensitivity of 0.76 and specificity of 0.75 for correctly screening individuals with moderate mental distress (based on results from the 2007 California Health Interview Survey) (Prochaska et al., 2012).

Overall, the Kessler-10 is a well-validated, easy to interpret, and quick to administer instrument, widely used across multiple populations (Bougie, Arim, Kohen, & Findlay, 2016; Dingwall & Cairney, 2010; Easton, Safadi, Wang, & Hasson, 2017; Kessler et al., 2002; Kessler et al., 2003; Min & Lee, 2015; Oakley Browne, Wells, Scott, & McGee, 2010). The Kessler-10 was included in the United States National Health Interview Survey, Australian National Survey of Mental Health and Well-Being, and World Health Organization World Mental Health Survey to screen for non-specific psychological distress (Kessler & Üstün, 2004).

The Kessler-10 consists of ten Likert-scaled items asking how frequently symptoms are experienced, each with five response levels from “*none of the time*” (scored 1) to “*all of the time*” (scored 5). Scores across each item are added to provide a total score, ranging from 10 (indicating no distress) to 50 (indicating severe distress). Those scoring 25-29 are likely to be moderately distressed, and those scoring 30 or above are likely to be severely distressed (Yiengprugsawan, Kelly, & Tawatsupa, 2014). Rather than using these raw scores, we used the scale to estimate latent psychological distress.

Latent dispositional optimism was estimated using the Life Orientation Test – Revised, using the factor structure described in other literature (see *Appendix: Life Orientation Test – Revised (Chapter 4)*) (Scheier et al., 1994; Vecchione, Alessandri, Caprara, & Tisak, 2014b). Latent situational optimism was estimated using a ten-item instrument developed in Chapter 5. In summary, this instrument included pairs of statements corresponding to the five Strategic Goals of the Convention on Biological Diversity’s Aichi Biodiversity Targets (CBD, 2010b). Respondents were asked about the likelihood that each statement would be achieved in the next decade. This latent variable was estimated using the factor structure described in Chapter 5 (see *Appendix: Situational optimism instrument*).

According to the effort-reward imbalance model, people work on the expectation that their efforts will be compensated with rewards; an imbalance occurs when efforts exceed rewards (Siegrist, 1996). The effort-reward imbalance instrument measures the balance of workplace efforts and rewards. The effort-reward imbalance instrument is an established and validated tool that has been used in numerous studies examining occupational health worldwide (Rugulies, Aust, & Madsen, 2017; Siegrist & Li, 2016; Siegrist, Li, & Montano, 2019). It is one of the most commonly used instruments for understanding workplace stressors (Harvey et al., 2017) and was found to be the strongest predictor of stress-related mental disorders in a multi-cohort analysis of 73,874 workers in seven counties (van der Molen et al., 2020). The original effort-reward imbalance instrument includes three Likert-scaled items describing efforts and seven describing rewards (Siegrist et al., 2004). We adapted this instrument by adding three new effort items and two reward items relevant

to the conservation sector (see *Appendix: Effort-reward imbalance*). Effort-reward imbalance scores are calculated following Equation 2.

$$ERI_i = \frac{e_i}{r_i c_i}$$

Equation 2

where i is the individual, e is the sum score of effort items, r is the sum score of reward items, and c is the number of effort items divided by the number of reward items. This score was used in the ERI-score model. We were also interested in the association between each item of the effort-reward imbalance instrument and psychological distress; these items were included (and the imbalance score was excluded) in the ERI-item model.

6.3.2. Statistical analysis

All analysis was performed using the R statistics software (version 4.0.2) (R Core Team, 2020). After coding missing categorical data as unknown, 1.3% of values in the survey data were missing, mostly where individuals did not complete the survey or chose not to disclose their age or years in conservation (see *Appendix: Patterns of missing data (Chapter 6)*). Missing values were replaced with synthetic ones following multivariate imputation by chained equations; ten imputed datasets were created using the mice package (version 3.9.0, see *Appendix: Imputation of missing data (Chapter 6)*) (van Buuren S & K, 2011). Five observations from those reporting non-binary gender identities were removed from the statistical analysis, as their inclusion introduced statistical separation.

The ERI-score model and ERI-item model were estimated for each of the ten imputed datasets, using the robust weighted least squares estimator and polychoric correlation. For each model, estimates and variances were pooled using Rubin's Rules, and coefficient estimates were presented in standardised units (Rubin, 1987).

6.4. Results

Our survey was completed by 2,311 respondents who said they were familiar with conservation across 143 countries (Table 6.2). Of these, 2,213 were completed in English, 55 in French, 24 in Portuguese, 17 in Spanish, 2 in Kiswahili, and none in Khmer. Respondents had a mean Kessler-10 score of 20.9 (standard deviation (SD) = 7.0) and median score of 20.0 (inter-quartile range = 9.0). Among the respondents, 14.8% had scores suggesting moderate distress (25-29), and a further 13.0% had scores indicating severe distress (> 30).

Table 6.2. Respondent characteristics by gender. Continuous variables are described with means (and standard deviations), and categorical variables are described with counts (and percentages). Key: LOTR = Life Orientation Test – Revised, ERI (original) = scores from the original effort-reward imbalance instrument, ERI (adapted) = scores from a modified effort-reward imbalance instrument that includes five new items specific to conservation.

Characteristic	Overall N = 2311	Women N = 1208	Men N = 969	Non- binary N = 5	Unspecified N = 129
Kessler-10 score	20.9 (7.0)	21.7 (7.3)	19.8 (6.5)	30.8 (7.2)	21.9 (6.7)
LOTR score	15.0 (3.9)	15.1 (3.9)	15.1 (3.8)	9.0 (5.8)	14.2 (3.5)
Age	37.0 (11.2)	35.1 (9.5)	39.2 (12.7)	29.6 (2.9)	37.8 (10.7)
Years in conservation	12.2 (10.5)	10.2 (8.2)	14.3 (12.1)	7.8 (3.1)	26.6 (17.1)
National / non-national					
National	1704 (77%)	920 (76%)	755 (78%)	5 (100%)	24 (75%)
Non-national	509 (23%)	287 (24%)	214 (22%)	0 (0%)	8 (25%)
Unknown	98	1	0	0	97
Education					
Non-university	141 (6.1%)	50 (4.1%)	78 (8.0%)	0 (0%)	13 (10%)
University	2069 (90%)	1158 (96%)	888 (92%)	5 (100%)	18 (14%)
Unknown	101 (4.4%)	0 (0%)	3 (0.3%)	0 (0%)	98 (76%)
Position					
Academic	1094 (47%)	584 (48%)	491 (51%)	3 (60%)	16 (12%)
Practice	729 (32%)	393 (33%)	323 (33%)	2 (40%)	11 (8.5%)
Unknown	488 (21%)	231 (19%)	155 (16%)	0 (0%)	102 (79%)
Working hours	43.5 (13.2)	43.2 (12.9)	44.0 (13.6)	49.0 (10.8)	43.2 (10.1)
Nationality (region)					
Central & Southern Asia	249 (11%)	117 (9.7%)	129 (13%)	0 (0%)	3 (9.4%)
Eastern & South-Eastern Asia	116 (5.2%)	79 (6.5%)	37 (3.8%)	0 (0%)	0 (0%)
Europe & Northern America	1308 (59%)	752 (62%)	526 (54%)	5 (100%)	25 (78%)
Latin America & the Caribbean	157 (7.1%)	80 (6.6%)	76 (7.8%)	0 (0%)	1 (3.1%)
Northern Africa & Western Asia	32 (1.4%)	11 (0.9%)	21 (2.2%)	0 (0%)	0 (0%)
Oceania	131 (5.9%)	72 (6.0%)	57 (5.9%)	0 (0%)	2 (6.2%)
Sub-Saharan Africa	220 (9.9%)	96 (8.0%)	123 (13%)	0 (0%)	1 (3.1%)
Unknown	98	1	0	0	97
ERI (original)	1.2 (0.5)	1.3 (0.5)	1.2 (0.4)	1.4 (0.6)	1.3 (0.5)
ERI (adapted)	1.1 (0.4)	1.1 (0.4)	1.1 (0.3)	1.2 (0.4)	1.1 (0.4)

6.4.1. Personal characteristics and workplace conditions associated with psychological distress

Two structural equation models were implemented with 2,306 observations (five respondents with non-binary gender identities were excluded from the sample for reasons described in the methods).

Both models fitted the data well (see *Appendix: Model fit*). Dispositional optimism was negatively

associated with distress in both models (Figure 6.1a). For instance, those with 1 SD higher dispositional optimism reported 0.29 SD lower distress than those at the mean (in the ERI-score model). Situational optimism about conservation outcomes was slightly negatively associated with psychological distress; those with 1 SD greater situational optimism than the mean reported 0.05 SD lower distress (ERI-score model). Men reported lower distress than women. For instance, men reported 0.21 SD lower psychological distress than women (ERI-score model). Years of experience in conservation were negatively associated with distress in both models. For instance, those in conservation for five years reported 0.19 SD higher distress than those in conservation for 15 years (ERI-score model). The results also suggested co-morbidity between physical health and psychological distress in both models; those who said their physical health was bad reported 0.18 SD higher distress than those who said their health was fair (ERI-score model). All three social support measures were negatively associated with psychological distress in both models. For example, those satisfied with the support received from their friends and family reported 0.25 SD lower distress than those who said they were dissatisfied (ERI-score model).

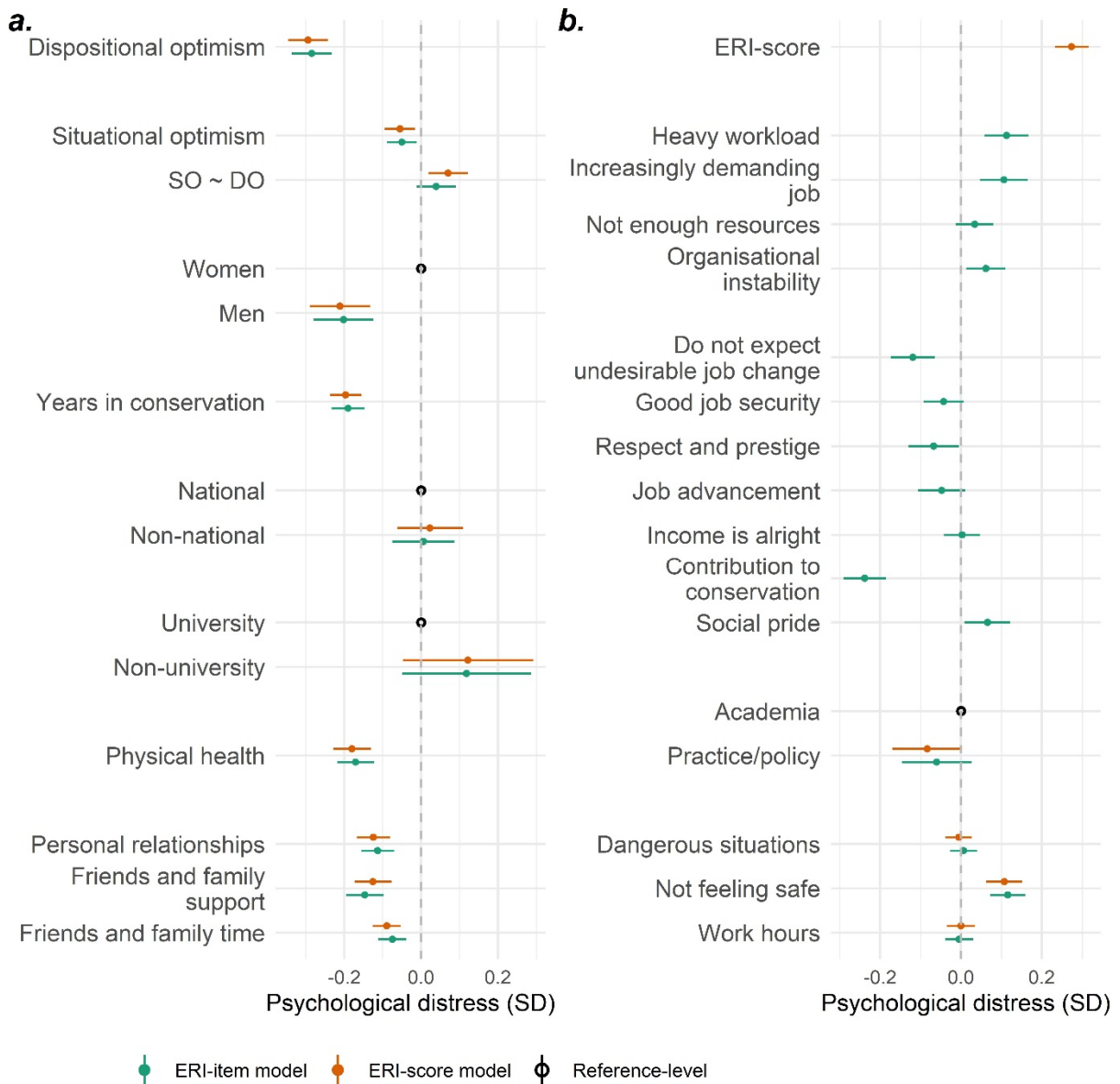


Figure 6.1. The estimated association in standard deviations (SD) between latent psychological distress and personal characteristics and occupational risk factors among 2306 respondents. The ERI-score model included the effort-reward imbalance score but excluded the individual instrument items, while the ERI-item model included these items but excluded the score. ‘SO ~ DO’ indicates the correlation between situational and dispositional optimism. Continuous variables were scaled and centred. ‘Unknown’ response levels are not shown.

Likewise, workplace characteristics were associated with psychological distress in both models (Figure 6.1b). For instance, those reporting 1 SD higher effort-reward imbalance scores had 0.27 SD higher psychological distress than those at the mean (ERI-score model). Moreover, many of the individual effort-reward instrument items were also associated with psychological distress.

Notably, those who agreed with the statement “*I am satisfied with the contribution I make to*

conservation” reported 0.24 SD lower psychological distress than those who disagreed (ERI-item model). This effect represented the second largest negative association with psychological distress, following dispositional optimism. As another example, those who agreed with the statement, “*I have constant time pressure due to a heavy work load*” reported 0.11 SD higher psychological distress than those who disagreed (ERI-item model). Equally, those who agreed with the statement “*Considering all my efforts and achievements, I receive the respect and prestige I deserve at work*” reported 0.07 SD lower distress than those who disagreed with the statement (ERI-score model). Furthermore, personal insecurity was positively associated with distress in both models. For example, those who agreed that they did not feel safe, even where they lived, reported 0.23 SD higher distress than those who disagreed (ERI-item model). Supplementary analysis removing dispositional optimism (see *Appendix: Removing dispositional optimism*), replacing situational optimism with a measure of collective conservation goals progress (see *Appendix: Including goal progress satisfaction*), exploring the role of age (see *Appendix: Impacts of age*), disaggregating the analysis by gender (see *Appendix: Disaggregated by gender*), and exploring the impact of the COVID-19 pandemic (see *Appendix: COVID-19 and psychological distress*) were used to explore the sensitivity of our results.

6.5. Discussion

More than one in four in our sample of conservationists had scores suggesting moderate or severe distress. Both personal characteristics and workplace conditions were associated with this distress. Individuals with low dispositional and situational optimism, poor health, limited social support, women, and at early career stages were most at risk. Workplace efforts (like high job demand and organisational insecurity), rewards (like feeling as if one is contributing to conservation), and imbalances between them were also associated with distress risk.

Care should be taken when directly comparing Kessler-10 scores between studies among different populations and sectors, as they may vary because of demographic and other characteristics rather than workplace differences. However, looking at results from general population studies provides

context for interpreting the magnitude of and variation in Kessler-10 scores observed in the current study. For instance, the 8,841 Australian adults sampled in a nationally representative 2007 study had a mean Kessler-10 score of 14.5 (Slade, Grove, & Burgess, 2011). As stated above, whether conservationists are more or less distressed than other groups is perhaps less important than identifying risk factors that can be managed to reduce distress, regardless of its absolute levels. However, future research using comparator groups would help determine whether the conservation sector suffers unusually high levels of distress, the causes of which would warrant further detailed investigation (see 9.2.1. Study design choices and limitations).

6.5.1. Study limitations

This chapter has the same limitations as chapters 4 and 5 in terms of being biased towards university-level educated, English speaking, and desk-based professionals, with many from or working in Europe and North America. Our results do not reflect the experiences of those in frontline roles, who may face unique and substantial challenges and risks (Belecky et al., 2019; Belhekar et al., 2020; Gao & Li, 2021; Moreto, 2016; Singh et al., 2020; Spira et al., 2019).

Improving working conditions in offices and headquarters, but overlooking those in frontline roles, may create or worsen health inequalities within the conservation sector. As a result, the suggestions below should be considered hand-in-hand with measures specific to frontline roles. In aid of this, Chapter 7 was designed to complement and help offset the limitations of this chapter through ‘*deep dives*’ within conservation practitioner organisations in Cambodia, India, and South Africa. Chapter 7 explores patterns of potential risk and protective factors for psychological distress between job roles in a set of case study organisations.

Although our survey asked about age and gender, we did not explore how other identities and social relations – such as race, sexual orientation, disability, and their intersections – affect workplace wellbeing (Chaudhury & Colla, 2021; Demery & Pipkin, 2021). Similarly, resident communities and Indigenous groups play crucial roles in conserving nature, but our study does not explicitly explore their experiences. Future research could explore these dimensions, potentially

using in-depth qualitative methods to provide nuanced insights (e.g., M. S. Jones & Solomon, 2019).

Our study was a cross-sectional observational study and so does not allow for causal inference. While some of our observations are supported by prior research (such as the impacts of effort-reward imbalance (B. Lau, 2008)), others were exploratory (like the role of situational optimism). This limitation is discussed in detail in Chapter 8.

As discussed in Chapter 3, screening instruments cannot be used to diagnose specific conditions. This point applies particularly to the Kessler-10, which measures the severity of non-specific psychological distress rather than any individual disorder. As a result, our methods cannot be used to estimate the prevalence of specific mental illnesses. However, our use of the Kessler-10 is typical of occupational health studies. For example, multiple studies use screening instruments, including the Kessler-10, to identify workplace factors and interventions associated with psychological distress (e.g., Eguchi, Tsutsumi, Inoue, Hikichi, & Kawachi, 2018; Hilton & Whiteford, 2010; Hilton et al., 2008; Sampasa-Kanyinga, Zamorski, & Colman, 2018; van der Molen et al., 2020). Our analysis illustrates the workplace factors associated with psychological distress within our sample, which employers might manage to help support staff. Future research could explore if these factors also influence the risk of specific mental disorders such as depression.

Fully evaluating the psychometric properties of instruments involves assessing their reliability (e.g., test-retest, inter- and intra-rater reliability), validity (e.g., content, construct, and criterion validity), and other aspects (Mokkink et al., 2010). The psychometric properties of the original effort-reward imbalance model have been extensively tested (e.g., Siegrist et al., 2019). We compared the results from the original and adapted effort-reward imbalance models (described in *Appendix: Effort-reward imbalance*). However, we did not formally test the psychometric properties of the adapted instrument, such as through test-retesting or comparing scores to other measures of effort-reward imbalance. (We note that internal consistency is generally easy to assess

but does not apply to composite variables such as the effort-reward imbalance model.) Therefore, the adapted instrument would need rigorous psychometric testing before being considered suitable for routine use by others.

6.5.2. Workplace wellbeing in conservation

Swaigood and Sheppard (2010) suggest there may be a culture of “*learned helplessness*” within the conservation sector, potentially leading to demotivation and distress. Our results suggest that those with lower situational optimism about conservation tend to report higher levels of distress, but this effect size was relatively small when controlling for dispositional optimism. In contrast, respondents’ satisfaction with their individual contributions to conservation was one of the largest predictors of distress. This contrast suggests that respondents may be less distressed by the “*bigger picture*” of ongoing nature loss but more concerned about their individual contributions. This corroborates other research suggesting that ecological grief emerges partly from feelings of individual and collective powerlessness to prevent environmental degradation (Hickman, 2020). Qualitative results from Chapter 4 suggest that many focus on their contributions to stay motivated in the face of ongoing nature loss. Further research is needed to understand the causal relationships between individuals’ satisfaction with their contributions to conservation and their experiences of distress. However, nature would be worse off in the absence of conservationists (Bolam et al., 2020; Hoffmann et al., 2015). Optimism movements, like Conservation Optimism, Earth Optimism, and Ocean Optimism, that share examples of positive conservation outcomes may help illustrate this fact (as discussed in Chapter 5). Some individuals struggling with the “*bigger picture*” may find it helpful to engage with these movements and concentrate on their positive roles within collective conservation efforts. Additionally, those with low dispositional optimism appeared to be at greater risk of psychological distress. Dispositional optimism is generally stable over an individual’s life course (Carver & Scheier, 2014). Therefore, individuals struggling with low dispositional optimism might benefit most from support when working in challenging roles or avoid such positions altogether, where feasible, as discussed in chapters 4 and 5.

In general, women tend to report higher rates of psychological distress than men for multiple and complex reasons, regardless of profession (Drapeau et al., 2012). We did not explore why women in our study reported higher rates of distress than men, and there are multiple possible explanations for this result. One possible explanation is that the observed difference was because of factors not related to conservation work. Another potential explanation is that women may have faced gender-differentiated challenges in conservation work. For example, several studies suggest that women conservationists can sometimes face unequal compensation, exclusion, harassment and institutional injustice, assumptions of inadequacy, and other forms of discrimination (M. S. Jones & Solomon, 2019; M. S. Jones et al., 2020). The authors of this research suggest offering women mentoring and career development opportunities, improving organisational justice and transparency, and addressing salary inequalities (M. S. Jones & Solomon, 2019). However, further research would be needed to understand why women in our sample reported higher rates of distress than men.

Those involved in conservation for longer were expected to be more established in their careers, with more secure and better-compensated roles, than early-career conservationists, as suggested in Chapter 4. Moreover, people tend to become less distressed with age, which was strongly associated with experience in our study (Drapeau et al., 2012). Consequently, our results indicate the need for targeted support for early-career conservationists. Moreover, lack of experience can be a barrier to entry for those wanting to enter the conservation sector, particularly for those from disadvantaged backgrounds, as described in Chapter 4 and other literature (Fournier & Bond, 2015; Vercammen et al., 2020). While unpaid volunteer positions can help some individuals gain experience, employers should ask if their use of unpaid labour propagates inequalities and undermines meritocracy in the sector. Moreover, they might examine their hiring practices and adopt competency rather than experience-based recruitment approaches, especially for junior positions.

Work and non-work factors can also interact to affect psychological distress. Our results corroborate other research illustrating how poor general health, inadequate social support, and feeling in danger can be linked to worse mental health (Davey, Obst, & Sheehan, 2001;

Ohrnberger, Fichera, & Sutton, 2017; Uchino, 2006). Employers can support employees' work-life balance by, for instance, adopting sustainable career management approaches, such as allowing career breaks, part-time or flexible working patterns, and investing in employees' development (Kossek, Valcour, & Lirio, 2014). They can also reduce incentives to overwork, such as setting realistic deadlines, valuing quality over quantity, and increasing employees' control of their day-to-day activities.

Workplace challenges and rewards found in other sectors – like heavy job load or the expectation of an undesirable job change (Duchaine et al., 2020; Harvey et al., 2017; van der Molen et al., 2020) – appeared to be important determinants of distress in our study. This result has several implications. First, improved worker wellbeing may not be conditional on addressing the global biodiversity crisis or associated feelings of ecological grief. In other words, conservationists can be supported to thrive at work, even when environmental trends look dire. Second, it implies that many challenges faced by our respondents are not unique to the sector. Consequently, conservation organisations can probably learn much from how other sectors, such as healthcare, education, and emergency services, have identified and managed these issues (e.g., López-López et al., 2019; Petrie et al., 2019).

Many generic guidelines exist across the world to help organisations manage staff mental health and wellbeing. Among these, the United Kingdom Government's Thriving at Work mental health core standards provide up-to-date and accessible advice applicable across organisational sizes and contexts (Stevenson & Farmer, 2017). The Thriving at Work report is an independent review based on consultations with experts, employers, those with lived experience of workplace mental illness, and other stakeholders. Stevenson and Farmer (2017) suggest that users tailor these standards to specific sectors. Therefore, we adapted the standards through interviews and written feedback from a purposeful sample of 20 team leaders and human resource personnel in 14 conservation organisations. These individuals were selected from multiple countries for their people management and broad conservation experience. They were asked to critically evaluate each

standard, with feedback integrated into the proposed ideas (Table 6.3, see *Appendix: Detailed ideas for employers* for further details and limitations around each option).

Table 6.3. Ideas for employers to support staff mental health and wellbeing demonstrated through hypothetical but illustrative vignettes. See *Appendix: Detailed ideas for employers* for details, limitations and risks, links to resources, and a description of our approach to tailoring the Thriving at Work mental health core standards to the conservation sector (Stevenson & Farmer, 2017).

Ideas	Hypothetical vignettes
Understand experiences, attitudes, and knowledge among staff.	Asili na Watu is a Tanzanian organisation with 20 employees. They asked their staff to complete a short anonymous survey, describing the things they found most challenging and rewarding in their jobs. They used these results to guide the development of their wellbeing at work plan.
Produce, implement, and update a wellbeing at work plan.	Bugs Benevolence Society is a medium-sized non-governmental organisation with mostly office-based staff. They found high rates of sickness absence due to staff burnout. So, they formed a committee, led by the human resource manager, to look into this issue. The committee found that these issues stemmed from poor work planning and a culture that rewarded overwork. So, they designed a six-month plan with senior management for how they would address these issues. This plan included specific, measurable, achievable, relevant, and time-bound (SMART) goals to implement the other suggestions presented in this table.
Develop awareness of mental health and resources among all staff.	The National Nature Agency is a governmental organisation with over 1000 staff. They have resources on mental health, and the support available to staff, on their intranet. However, these resources are rarely used. In response, senior leadership asked their human resource teams to tailor the resources for each office. They also launched an awareness-raising campaign at their all-staff meeting, which included anonymous stories and clear guidance on available support.
Encourage open conversations about wellbeing and mental health and the support available.	As part of their awareness-raising campaign, the National Nature Agency also encouraged office managers to set aside informal spaces where staff could socialise within each office. In parallel, they suggested that team leaders set an example by being open about their struggles and the resources and support that helped them cope.
Provide good working conditions – ‘promoting the positives’.	Many of Asili na Watu’s staff started working in conservation because of their love of natural history and spending time in nature. However, many of the office-based staff do not have opportunities to spend time in nature. So, the executive director organised bird watching and hiking activities on the last Friday of every month, open to all staff members. They also produce an annual internal report that shares achievements while recognising and reflecting on problems and issues. This report emphasises the positive contributions of individuals and teams, ensuring that the contributions of all staff are recognised.
Provide good working conditions – removing the risks.	Bugs Benevolence Society identified a set of actions for addressing burnout and overwork within their mental health at work plan. This included implementing policies around flexible working, not working beyond a maximum number of hours, and opportunities to take career breaks. They also evaluated whether they met statutory requirements around work hours, minimum wages, holiday, sick, and maternity pay, and workplace discrimination. Moreover, they also recognised that organisational instability was a source of distress in their organisation. So, the leadership team commissioned a working group to evaluate the organisation’s resilience and long-term sustainability. One of the working groups’ conclusions was the

	need to grow their <i>rainy day fund</i> , amassed from 2.5% of every grant application.
Promote effective team leadership.	Bugs Benevolence Society recognised that issues of overwork stemmed from the organisation's culture and management approaches. In response, they organised training for team leaders in strategic planning, time management, and effective leadership. They also altered employee performance evaluations to focus on impacts (like achieving on-the-ground project goals) rather than inputs (like the amount of time spent at work) and outputs (like the number of reports produced).
Routinely monitor employee mental health and wellbeing.	The National Nature Agency subscribed to a mood tracker app, which employees can voluntarily choose to use. The app allows staff to indicate how they are feeling and provide anonymous feedback. These anonymised and aggregated data are used by human resource personnel to track staff morale. Furthermore, struggling employees can use the app to ask the human resource team for help.

We removed strongly correlated variables from our statistical analysis to avoid collinearity.

However, some of the suggestions presented above might have desirable simultaneous effects across multiple challenges and rewards over time. For example, leadership quality has been linked to many positive workplace outcomes, including staff mental health (Kelloway & Barling, 2010; Montano, Reeske, Franke, & Hüffmeier, 2017). Promoting effective team leadership might help strengthen institutional stability, job security, and satisfaction with contributions to conservation while potentially alleviating overwork and heavy job demand. Furthermore, several recent experimental and observational studies suggest the potential benefits of workplace mental health training among leaders (Stuber et al., 2021). For example, in a cluster randomised controlled trial, Milligan-Saville et al. (2017) found that workplace mental health training among 128 managers significantly reduced work-related sickness absence.

The suggestions presented in Table 6.3 focus on employer-employee relations. However, being unable to secure work in the conservation sector can also be distressing, as shown in Chapter 4. Recognising this, initiatives including Conservation Careers (<https://www.conservation-careers.com/>) and Young Ecologists Talk & Interact (<https://www.meetyeti.net/>) consolidate and advertise opportunities for those seeking work.

More broadly, other actors may also play a role in supporting conservationists. For example, professional associations (like the Society for Conservation Biology) could help develop and

promote best practice workplace guidelines. A good example comes from the Universal Ranger Support Alliance, which developed an action plan to professionalise ranger roles (URSA, 2021). Other support could include developing tools and resources to help organisations evaluate and strengthen their resilience and long-term sustainability, such as those offered by Capacity for Conservation (<https://capacityforconservation.org/>). Moreover, funders may evaluate how and where they direct their resources, including making good workplace practices and policies a condition of receiving grants and providing capacity-building funds. Funders might also consider providing funding over longer times, with a greater share of budgets used for staff overheads, and helping organisations build *rainy day funds* to enhance institutional and employment stability.

6.5.3. Experimentally testing interventions

Above, we suggest that addressing effort-reward imbalances might reduce psychological distress among conservation professionals. We provide ideas on how this might be done within the conservation sector. However, workplace interventions should be evidence-based. We are unaware of any experimental evidence testing interventions to address effort-reward imbalances within the conservation sector. Moreover, in light of scarce conservation funding (Malcom et al., 2019; Waldron et al., 2013), interventions that deliver positive returns on investments may be more attractive to employers. Therefore, an experimental study might ask, ‘what is the return on investment in individual and organisational level interventions to reduce sickness absence by addressing effort-reward imbalance among desk-based conservation professionals in the United Kingdom?’ This question could be explored using a randomised cluster design, the benefits of which have been discussed in chapters 3 and 5.

The hypothetical study might use the same procedure for randomly sampling United Kingdom-based organisations described in Chapter 5. In general, occupational health interventions tend to focus on either the individual or organisational level (T. Cox, Taris, & Nielsen, 2010). Therefore, organisations would be randomly assigned to one of three groups. In the first group, all staff could be enrolled in an intervention to help them cope with existing workplace stressors, such as

mindfulness training. A recent meta-analysis of 56 randomised control trials found evidence that mindfulness interventions at work can reduce stress, burnout, mental distress, and somatic complaints (Vonderlin, Biermann, Bohus, & Lyssenko, 2020). However, individual-level interventions have been criticised for not addressing the workplace drivers of distress, while organisational interventions might provide more sustainable benefits (Lamontagne, Keegel, Louie, Ostry, & Landsbergis, 2007). Much of the evidence describing organisational interventions appears to be sector-specific, such as institutional measures to support physicians (e.g., Petrie et al., 2019). Therefore, organisational intervention in the current study might involve mental health training for managers (Milligan-Saville et al., 2017) augmented by the introduction of work planning and time-management measures, such as those discussed by Capacity for Conservation (2022). No interventions would be trialled within the final group of organisations, who would act as the control. The outcome variable could be the return on investment, with returns derived from reductions in sickness absence and staff turnover (the forgone total economic cost for each employee) before and after the intervention and investment based on training, staff time, and other costs. Such as study might indicate if investing in supporting conservation professionals' mental health would deliver positive financial returns and whether individual or organisational-level interventions are more cost-effective.

The study could also be extended to explore potential impacts on performance. Desk-based conservation professionals are often called upon to do a wide range of tasks (Andrade et al., 2014; J. Lucas, Gora, & Alonso, 2017), so there may be no standardisable objective performance indicators. In lieu of these, one outcome could be perceived performance, measured using the Individual Work Performance Questionnaire (Koopmans, Bernaards, Hildebrandt, de Vet, & van der Beek, 2014) or other validated instruments. These reports could be triangulated against performance evaluations by supervisors. These results might help determine if supporting conservationists' mental health might translate into more effective conservation organisations. However, these subjective appraisals may not provide accurate indicators of actual performance, so they would need to be interpreted with caution if used at all. Variations could involve looking at

changes in objectively measurable performance among staff in specific positions across multiple organisations. For example, examining changes in funds raised by development teams across charities as the result of the above interventions.

6.6. Conclusion

Most people spend a significant amount of their waking lives at work, and workplace conditions can strongly influence mental health (Lamontagne et al., 2014). Furthermore, supporting workers' mental health and wellbeing can contribute to their quality of life, increase productivity and engagement, and reduce organisational costs (Cotton & Hart, 2003; V. C. S. Lau et al., 2003; Stevenson & Farmer, 2017). Yet, while some conservation organisations proactively support staff mental health, there is limited empirical evidence to guide and expand on these efforts (but see Belhekar et al. (2020) and Gao and Li (2021)).

We provide the first large study examining mental health and its predictors in an international sample of conservation professionals. This sample was biased toward those in desk-based academic and practitioner roles with university-level education who spoke English. Moreover, those with stronger opinions might have been more likely to participate. So, our results should not be extrapolated across all conservation professionals. However, our results call attention to potential protective and risk factors that employers of staff with similar characteristics to our sample might think about in their own organisations. Furthermore, employers should consider the findings and suggestions presented here alongside specific to other groups, such as frontline staff.

Over a quarter of our sample reported moderate or severe psychological distress. Some social groups in our sample were at particular risk, particularly women, early-career professionals, or those with low dispositional and situational optimism. Individuals, employers, funders, professional societies and others can play a role in addressing the root causes of this distress, such as by tackling workplace discrimination or avoiding practices that may propagate social inequalities. Moreover, our results suggest how workplace factors may contribute to or alleviate distress among conservationists. Employers, funders, and professional societies should seek to

reduce these workplace risks, like overwork and job instability. Simultaneously, they may promote the positives, such as celebrating individual and collective contributions to conservation efforts. In general, while some aspects of conservation work reflected in our sample are unique, much can be learned from the steps taken in other sectors. Identifying cost-effective workplace mental health interventions that ultimately improve outcomes for people and nature would help justify using scarce resources to support conservationists.

We encourage the conservation community as a whole to think about better ways to support those who support nature. We suggest ways this could be done, drawing on best practice guidelines. These efforts are likely to take time, resources, and commitment. Nevertheless, supporting conservationists will be increasingly critical going forward, given their essential roles in addressing the global biodiversity and climate crises.

6.7. Data and code availability

Study data is available at <https://doi.org/10.6084/m9.figshare.14016086> and code at https://github.com/Pienkowski/LiC-conservation_distress.

7. Mental health and workplace risk inequalities among conservation professionals

7.1. Abstract

People spend significant amounts of time at work, and workplaces can be sources of both stress and support affecting mental health. Poor mental health harms wellbeing, reduces productivity, and increases organisational costs. Yet, there is limited evidence of how workplace risk factors for poor mental health vary between job positions in conservation. This study explores patterns of psychological distress and associated workplace risk factors in different organisational positions. We surveyed 280 frontline practitioners, office-based staff, and researchers across ten sites in three conservation organisations in India, South Africa, and Cambodia. Respondents were asked about experiences of psychological distress; moderate or severe distress was reported by 28.9%. We then explored associations between job position, work-related mediators (effort-reward imbalance, perceived social support, and exposure to dangerous situations), and psychological distress within a Bayesian structural equation model. Frontline practitioners reported greater effort-reward imbalances (0.35 standard deviation (SD), 95% credibility interval (CI) 0.03 - 0.67) than their colleagues, which in turn was positively associated with psychological distress (0.24 SD, 95% CI 0.10 - 0.39). Frontline practitioners also reported greater exposure to dangerous situations than colleagues (0.43 SD, 95% CI 0.12 - 0.74), although this was not associated with distress. After accounting for these mediated relationships, office-based staff and researchers reported greater psychological distress than frontline practitioners for reasons not captured in our study (0.37 SD, 95% CI 0.02 - 0.72). Psychological distress was prevalent within our sample but varied between organisations, while the workplace factors contributing to it differed between job roles. Therefore, conservation employers seeking to support the mental health of their staff should understand and offer support tailored to role-specific challenges. While the challenges faced by frontline practitioners are increasingly recognised, our results also emphasise the need to investigate and

manage challenges faced by office-based staff and researchers. Doing so might enhance conservationists' wellbeing while strengthening their ability to reverse the loss of nature and its contributions to society.

7.2. Introduction

One in eight people worldwide was estimated to have had a mental disorder in 2019 (IHME, 2021). Workplaces can be sources of both stress and support, affecting people's mental health (Stevenson & Farmer, 2017). For example, challenging work combined with inadequate rewards (effort-reward imbalances), low control over daily tasks, bullying, and other stressors have been associated with an increased risk of mental illness across multiple studies (Rugulies et al., 2017; Stansfeld & Candy, 2006; Theorell et al., 2015). Mental illness not only threatens people's quality of life but also their performance at work (Hennekam, Richard, & Grima, 2020). For instance, poor working conditions that harm mental health can reduce productivity and increase organisational costs from presenteeism (working while unwell), absenteeism, staff turnover, and workplace conflicts (Cotton & Hart, 2003; Stevenson & Farmer, 2017). In the United States alone, poor mental health was estimated to cost employers \$198.6 billion in 2018, 70% of which was attributed to presenteeism (P. E. Greenberg et al., 2021).

Many sectors take seriously the impacts of working conditions on employees' mental health and performance. For example, numerous reviews and meta-analyses explore the prevalence and risk factors for mental illness and burnout among nurses (Gómez-Urquiza et al., 2017; Monsalve-Reyes et al., 2018; Tung, Lo, Ho, & Tam, 2018; Varghese et al., 2021). This research has been accompanied by practical efforts to improve working conditions in these sectors. For example, the National Health Service in England has adopted a work plan that seeks to improve working conditions, thereby reducing staff turnover and improving patient care (NHS, 2019). In contrast, there appears to be limited empirical research investigating the mental health of conservation professionals and the workplace factors influencing it. Important exceptions include a study among 286 Chinese nature reserve staff, which found that age, time with family, income, and other factors

were negatively associated with reported stress (Gao & Li, 2021). One study among 42 forest guards from six tiger reserves in India found that reported job satisfaction, alongside other factors, was linked to psychological wellbeing (Belhekar et al., 2020). Chapter 6 found that personal characteristics (e.g., gender and social support) and workplace challenges and rewards were associated with psychological distress among 2,311 conservationists worldwide. Although not specifically focused on mental health, other research provides valuable insights into the workplace challenges faced by conservation professionals. These include studies describing difficulties in maintaining work-life balances, which can harm personal relationships (Campos-Arceiz et al., 2013; Ramos et al., 2017). It also includes research examining a broad range of issues faced by conservation rangers, including inadequate resourcing, poor health and safety conditions, dangers involved in law enforcement, and poor compensation (Belecky et al., 2019; Moreto, 2016; Singh et al., 2020; Spira et al., 2019). For example, in the largest peer-reviewed study of its kind to date, Singh et al. (2020) surveyed 1,742 rangers from 293 conservation sites across 40 countries in Asia, Africa and Latin America. Of these, 68.1% said they were not provided with adequate equipment to do their jobs and ensure their safety, 79.9% said they had faced a life-threatening event during their careers, and 26.5% said they saw their families for less than five days each month. These studies demonstrate that conservation can be a tough sector to work in for some, suggesting the need for employers, funders, professional societies, and other actors to better support conservationists' mental health.

However, the conservation sector spans diverse job positions and career paths; the challenges and rewards experienced in these different roles may vary significantly. For example, office-based staff may spend more time with family than colleagues in frontline roles (e.g., Gao & Li, 2021). Yet, limited research explores how mental health and associated risk and protective factors vary between job positions (but see Gao and Li (2021), who found no significant difference in reported stress between rangers and non-rangers in China). This may be because of the difficulties of sampling across the full range of conservation job types, leading to a selective understanding of the stressors they face. For example, Chapter 6 utilises a large sample of conservation professionals.

However, most participants had university-level education and responded in English, and only 8% identified as rangers.

A more complete understanding of potential health inequalities in the conservation sector may assist in targeting workplace interventions to those who need them most. Moreover, this understanding can help determine what interventions are suitable for addressing the challenges faced in different conservation roles. Therefore, this study aims to explore how the association between workplace factors and psychological distress varies between conservation positions. We meet this aim through a survey of conservation professionals working in three organisations in South Africa, Cambodia, and India. We asked how reported effort-reward imbalance, social support, and dangerous working conditions vary between job positions and are these associated with psychological distress? We focus on psychological distress for similar reasons to those presented in Chapter 6 and to allow comparison of results with this previous chapter.

7.3. Methods

7.3.1. Study population and sampling approach

An Ethical Review Board at the University of Oxford approved the study protocol (R62487/RE002). Only I had access to data that could be linked to specific organisations or used to triangulate individual respondents. Recognising the sampling biases in chapters 4 to 6, the current study was designed to capture experiences from those in frontline roles with non-university level education who did not speak English and operated in the Global South. To aid comparison with the internet survey results, we sought to identify workplace factors associated with distress that might be common across countries and institutional contexts. Equally, the study sought to make comparisons between roles within organisations. Therefore, the study was designed to capture a cross-section of staff in all organisational roles within the partner organisations.

The target population included all staff working in ten sites in three conservation organisations in South Africa, Cambodia, and India. The total population included 440 staff, comprising 115 from

Organisation One, 84 from Organisation Two, and 240 from Organisation Three (this order does not correspond to the order in the previous sentence).

These organisations were purposefully chosen based on several criteria. First, they were selected to capture a range of conservation contexts, including spanning governmental and non-governmental settings in Global South countries. Focusing on a specific country or organisational type would have limited comparability with the results of the internet survey. Second, the study involved collecting sensitive information, which might threaten organisational reputations or employee-employer relationships. As a result, the project was deemed most viable if done in collaboration with organisations that already had some foundation of trust with ICCS. Three of the research team members had previously collaborated with the partner organisations, which was the basis of the current study. (See Study limitations for a discussion of the limitations of this approach.)

One of the collaborating partners was established as a non-governmental organisation in the mid-1990s. This organisation's mission focuses on understanding and conserving the natural world through community-based projects, research and monitoring, education and outreach, protected area management, and other activities. Another partner is a governmental organisation established in the early 20th century. Its mission focuses on sustainably managing national parks for biodiversity, cultural heritage, tourism, and other purposes. It pursues this mission through protected area management, community engagement, eco-tourism, and other activities. The final partner was established in the late 1990s as a branch of an international conservation non-governmental organisation. This organisation's mission focuses on protecting biodiversity, which it does so through a combination of protected area management, livelihood-based projects, and other activities. All three organisation includes frontline staff involved in protected area management, biodiversity monitoring and evaluation, and community engagement. All have office-based staff in management and administration roles and researchers who do field and desk-based work. Moreover, all three operate at a national level (and are primarily staffed by citizens), with multiple offices across their respective countries.

The study sites included eight where conservation activities were directly implemented and two administrative sites (based in urban areas). These sites were purposefully selected to capture a spread of remote, rural, and urban settings. The multivariate statistical analysis (described below) included a categorical variable corresponding to each organisation. This variable accounted for the variability between organisations and countries, allowing us to examine common workplace factors associated with distress across contexts.

We sought a census of all staff working at these ten sites for two reasons. First, the partner organisations could not share a list of staff to sample from for data protection reasons, and asking collaborators to sample staff themselves would breach respondents' anonymity. Second, there were a limited number of staff at each site, so we sought a census to maximise the sample size. The survey was translated from English to Khmer and Tamil to ensure that all members of the surveyed populations could complete it in a language in which they felt comfortable.

Staff in organisations one and two were surveyed from September to December 2019 and December 2019 to January 2020, respectively. Frontline staff were surveyed in person by an external research consultant, and office-based staff were invited by email to complete an internet survey. This approach was used for several reasons. Desk-based staff were deemed more likely to participate if they could answer the survey in their own time, and some of them travelled, so they could only be recruited via email. Frontline staff did not have regular email or computer access, and some had limited reading abilities, so the surveys had to be delivered in person. Though considered the most practical approach, this mix of survey methods also posed limitations, as discussed in Study limitations). The two consultants were recruited because they had prior experience conducting survey research, were nationals of the countries where data were collected and spoke the survey languages. Two members of ICCS who were involved in the project spoke the survey languages and were in the relevant countries at the time. Together, they and I provided four days of training. This training covered ethical procedures (e.g., protocols for bringing the survey to a close if respondents appeared distressed, which was never needed) and how to deliver

the survey to ensure consistency across organisations and respondents. The research consultants practised delivering the surveys to the two members of ICCS, who were very familiar with the survey and project since they had contributed to its design. The two ICCS members supervised the research, including coordinating with managers in each organisation.

Organisation three was surveyed from March to April 2021. Staff in this final organisation were only offered the internet survey because of concerns about COVID-19 transmission. Frontline staff in this organisation had good reading abilities so could self-administer the survey. Furthermore, these were provided access to devices for completing the internet survey and provided opportunities during their workday to take part.

Several measures were taken to increase respondents' confidence that the research was independent and that they would be anonymous. First, we hired external research consultants who were entirely independent of the study organisations. Second, during communications, it was made clear to staff that researchers at the University of Oxford were leading the project and that their data would not be disclosed to employers. Furthermore, these previous points were reiterated in the survey information, and we collected no personally identifiable information like names. Finally, the in-person surveys were conducted in private spaces, where no other staff could overhear.

7.3.2. Variable description

The response variable in the statistical analysis was psychological distress (Figure 7.1). This variable was measured using the Kessler Psychological Distress Scale (Kessler-10) (Kessler et al., 2002). Details about the Kessler-10, including how it is scored, are introduced in Chapter 6.

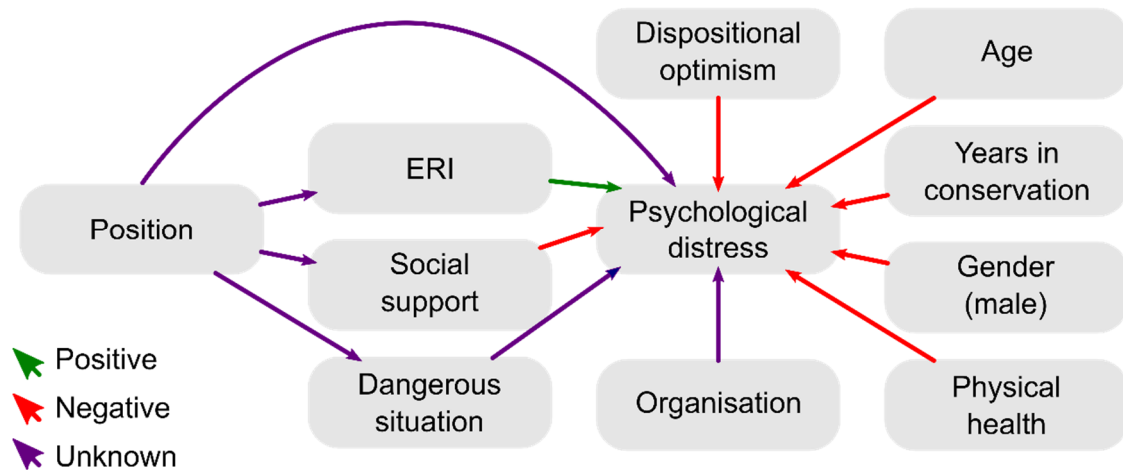


Figure 7.1. Hypothesised associations between workplace and personal characteristics and psychological distress (see Table 7.1 for details). Key: ERI = effort-reward imbalance, positive = positive association, negative = negative association, unknown = no hypothesised direction of association.

A latent variable describing respondents' levels of psychological distress was estimated and used within the statistical analysis. Six of the Kessler-10 items were used within this analysis (Kessler-6). The Kessler-6 scale has similar psychometric properties to the Kessler-10 (Kessler et al., 2002), and Kessler-10 and Kessler-6 scores (calculated using the same method as above) within our study were highly correlated ($\rho = 0.97$). The Kessler-6 scale was used because the Kessler-10 includes paired items that would be challenging to account for within the following analysis. Parallel analysis using polychoric correlation and a weighted least squares estimator (using the psych package (Revelle, 2019)) suggested extracting one factor. A one-factor graded response model was therefore fitted using the mirt package (Chalmers, 2012). This analysis suggested the Kessler-6 scale had adequate discriminatory power within our sample, although with strong floor and ceiling effects (indicating poor discriminatory power at high and low levels of distress). This model had a root mean square error of approximation (RMSEA) of 0.11 (95% confidence interval 0.08 - 0.15), comparative fit index (CFI) of 0.94, and standardised root mean square residual (SRMR) of 0.07. The RMSEA suggested that the model did not fit the data well. However, RMSEA can be a poor indicator of fit for simple models with few degrees of freedom and should be avoided in these cases (Kenny, Kaniskan, & McCoach, 2014). In contrast, the CFI and SRMR suggest the model adequately fitted the data, so we proceeded with its use. One set of plausible values was extracted

from a graded responses model fitted to each of ten imputed datasets (discussed below) (Von Davier, Gonzalez, & Mislevy, 2009). These plausible values of latent psychological distress were used as the primary outcome variable within the Bayesian structural equation model (Table 7.1). Additionally, raw Kessler-6 scores are presented to allow for comparison with studies where it is also used.

Table 7.1. The a priori hypothesised associations between exposure and outcome variables in the Bayesian structural equation model and a description of the exposure variables. The priors are directly derived from Chapter 6 (see *Appendix: A priori hypothesised linkages position nature and distress* for details). Key: + = positive association, - = negative association, ? = uncertain direction of the association, RL = reference level, and N = normal distribution (where the first argument is the mean and the second is the variance). All continuous variables are scaled and centred.

Outcome	Association	Exposure	Exposure variable description	Prior
Effort-reward score	?	Position	A categorical variable that includes frontline practitioners, office-based practitioners, researchers (RL), and unknown.	All $N(0, 10^2)$
Social support (composite)	?	Position	As above.	All $N(0, 10^2)$
Dangerous situations	?	Position	As above.	All $N(0, 10^2)$
Distress	?	Position	As above.	All $N(0, 10^2)$
Distress	+	Effort-reward score	An adapted effort-reward imbalance score (Siegrist et al., 2004).	$N(0.274, 0.021^2)$
Distress	-	Social support (composite)	A fixed composite variable made from responses to three social support questions.	$N(-0.113, 0.022^2)$
Distress	-	Dangerous situations	<i>“My work puts me in dangerous situations”</i> .	$N(-0.005, 0.017^2)$
Distress	-	Dispositional optimism	Scores from the Life Orientation Test – Revised (Scheier et al., 1994). Dispositional optimism is the general expectation of good outcomes in life (Carver & Scheier, 2014).	$N(-0.124, 0.022^2)$
Distress	-	Age	Age in years.	$N(-0.136, 0.033^2)$
Distress	-	Years in conservation	Years working in conservation.	$N(-0.088, 0.034^2)$
Distress	-	Gender	Female (RL) or male.	$N(-0.211, 0.04^2)$
Distress	-	Physical health	<i>“How is your physical health in general?”</i>	$N(-0.18, 0.025^2)$
Distress	?	Organisation	A categorical variable corresponding to the three organisations (RL = organisation one).	All $N(0, 10^2)$

The primary exposure variable was “position”. Participants were asked to indicate their job roles, and responses were aggregated into the categories of frontline practitioners (rangers and field-workers), office-based practitioners (managers, administrators, consultants, and interns), and

researchers (researchers and students), with a final category, unknown. These aggregate categories were based on discussions with the collaborators in the three partner organisations, who knew what each job role entailed.

The analysis included three mediator variables; effort-reward imbalance, social support, and whether respondents felt their work put them in dangerous situations. Within effort-reward imbalance theory, people work on the understanding that their efforts will be compensated by rewards (Siegrist, 1996). When efforts outweigh rewards, an imbalance occurs. Siegrist et al. (2004) developed an effort-reward imbalance instrument to measure employees' perceived experiences relating to this balance. This original instrument includes three Likert-scaled items describing efforts and seven relating to rewards. In this instrument, efforts relate to workload, disturbances and interruptions, and job demand, while rewards relate to financial compensation, career prospects and job security, and esteem and recognition (Siegrist, 2017). However, we adapted the instrument to capture additional efforts and rewards specific to conservation (see *Appendix: Effort-reward imbalance*). These additions included three new effort items (relating to adequate resourcing and organisational stability) and two reward items (regarding satisfaction with contributions to conservation and esteem from friends and family). The analysis was repeated with both the original and adapted effort-reward imbalance instrument, yielding similar results (see *Appendix: Original effort-reward imbalance instrument*). Effort-reward imbalance scores are calculated as in Chapter 6 (Equation 2). Scores greater than 1 indicate that efforts outweigh rewards.

Social support can be an important predictor of mental health and is influenced by multiple factors (Drapeau et al., 2012). For example, previous evidence suggests that conservation work can limit interactions with friends and family (e.g., Belecky et al., 2019; Moreto, 2016; Singh et al., 2020; Spira et al., 2019), and potentially ultimately, feelings of social support. Social support was estimated using a fixed composite variable derived from three questions adapted from the World Health Organization Quality of Life survey (WHO, 2004b). This adapted instrument asks respondents how satisfied they are with their personal relationships, their support from friends and

family, and the amount of time spent with family. Responses levels ranged from “*Very dissatisfied*” (scored 1) to “*Very satisfied*” (scored 5). Scores across the three items were added together to provide a total score, which was scaled and centred, and treated as numeric data within the analysis.

Finally, previous research suggests that traumatic experiences, including at work, can harm mental health (e.g., Davey et al., 2001; Keinan & Malach-Pines, 2007). Therefore, respondents were also asked to what extent they agreed with the statement, “*My work puts me in dangerous situations*”. Response levels ranged from “*Strongly disagree*” (scored 1) to “*Strongly agree*” (scored 5) and were assumed to be approximately evenly spaced along an underlying normally distributed latent variable, so these scores were scaled and centred and treated as numeric in the analysis.

Additionally, the analysis included several covariates expected to be associated with psychological distress. These covariates were selected based on variables identified as important within Chapter 6 and previous literature (Drapeau et al., 2012). The covariates included dispositional optimism (scores from the Life Orientation Test – Revised (Scheier et al., 1994)), gender, age, years in conservation, physical health (adapted from ONS (2007)), and a dummy variable corresponding to each organisation.

7.3.3. Statistical analysis

All analysis was performed using the R statistics software (version 4.0.2) (R Core Team, 2020). First, 35 respondents who did not complete all Kessler-10 questions were removed from the analysis, and missing categorical data were coded as unknown. After this, 1.5% of the values of explanatory variables used in the statistical analysis were missing, mostly when individuals did not disclose their age (see *Appendix: Patterns of missing data (Chapter 7)*). Missing values were substituted with synthetic ones through multivariate imputation by chained equations, using the mice package (version 3.9.0), creating ten imputed datasets (van Buuren S & K, 2011). Ordinal variables were imputed using proportional odds models, numeric variables with predictive mean matching, and unordered categorical variables with polytomous logistic regression (van Buuren,

2012). The pre- and post-imputation distributions of variables were inspected and were found to be consistent.

A Bayesian structural equation model was fitted for each of the imputed datasets. The statistical analysis was performed in the Stan computational framework, accessed using the *blavaan* package (Merkle et al., 2020). The structural equation modelling approach allowed us to evaluate the mediating role of effort-reward imbalance, social support, and exposure to dangerous situations. Furthermore, the Bayesian approach allowed us to incorporate previous information from Chapter 6, assessed associations between workplace factors, personal characteristics, and psychological distress (a latent variable estimated using the Kessler-10 scale). The companion study uses the same survey questions, which were used to create variables comparable to the ones used here (including being on the same scales). Coefficient estimates and standard errors from this companion study were used to create strongly informative normally distributed priors; the estimates were used as the mean and the square of the standard errors used as the variance in these priors (see *Appendix: A priori hypothesised linkages position nature and distress*). A diffuse normally distributed prior with a mean of 0 and a variance of 100 (SD = 10) was used for all variables with no prior information from the companion study. This set of associations with diffuse priors included the relationships between job position and the three mediator variables.

A seed value of 123 was used, and the models were run for 5,000 burn-in followed by 5,000 post-burn-in iterations (10,000 total). The posterior distribution was estimated with the Markov Chain Monte Carlo sampler, across four Markov chains, following McElreath (2016). The models were evaluated according to the ten steps in the When to worry and how to Avoid the Misuse of Bayesian Statistics Checklist (WAMBS)-Checklist (see *Appendix: WAMBS-Checklist (Chapter 7)*) (Depaoli & Van de Schoot, 2017). This includes repeating the analysis with only diffuse priors, a summary of the results of which are discussed below. The posterior distributions from each model applied to each of the ten imputed datasets were combined. Point estimates were the median of this pooled posterior distribution, and 95% CI were equal-tailed (i.e., the 95% interval has 2.5% of the posterior distribution on either side of its limit).

Additionally, we investigated the variation in responses to effort and reward questions between job positions. This exploration was accompanied by a series of Kruskal-Wallis tests, with ordinal response variables corresponding to each effort-reward item and job position used as the explanatory variable.

7.4. Results

A total of 280 respondents across the three organisations completed the survey. Participants had a mean Kessler-10 score of 20.6 (SD = 7.6), and a median score of 19.0 (inter-quartile range = 12.0) (Table 7.2). Furthermore, 52.9% reported minimal distress (scores of 10-19), 13.2% had mild distress (20-24), 14.3% had moderate distress (25-29), and 14.6% were severely distressed (30 or above). Additionally, participants had a mean Kessler-6 score of 12.5 (SD = 4.8).

Table 7.2. Respondent characteristics. Continuous variables are described with means (and standard deviations), and categorical variables are described with counts (and percentages). Unknown response levels are not shown. Key: LOTR = Life Orientation Test – Revised; ERI (original) = original effort-reward imbalance scores; ERI (adapted) = adapted effort-reward imbalance scores.

Characteristic	Overall N = 280	Frontline N = 76	Office-based N = 60	Research N = 75	Unknown N = 69
Kessler-10 score	20.6 (7.6)	19.5 (8.1)	21.0 (8.0)	20.8 (7.4)	21.1 (6.9)
Kessler-6 score	12.5 (4.8)	11.7 (5.1)	12.9 (5.1)	13.0 (4.1)	12.7 (4.9)
ERI (original)	1.1 (0.4)	1.2 (0.4)	1.1 (0.5)	1.0 (0.3)	1.2 (0.5)
ERI (adapted)	1.0 (0.3)	1.0 (0.3)	0.9 (0.3)	0.9 (0.2)	1.1 (0.4)
Social support	0.0 (1.0)	0.2 (1.0)	0.1 (0.8)	0.0 (1.1)	-0.2 (1.1)
Dangerous situations					
Strongly disagree	49 (18%)	8 (11%)	13 (22%)	15 (20%)	13 (19%)
Disagree	72 (26%)	13 (17%)	20 (33%)	22 (29%)	17 (25%)
Neither	44 (16%)	12 (16%)	12 (20%)	12 (16%)	8 (12%)
Agree	71 (26%)	30 (39%)	8 (13%)	17 (23%)	16 (24%)
Strongly agree	42 (15%)	13 (17%)	7 (12%)	9 (12%)	13 (19%)
LOTR score	14.8 (3.7)	13.8 (3.2)	15.7 (4.3)	15.0 (3.9)	14.8 (3.2)
Age	38.1 (10.2)	37.3 (9.6)	37.8 (9.1)	35.3 (9.8)	43.0 (10.9)
Years in conservation	10.2 (8.1)	9.5 (7.1)	11.0 (8.9)	9.9 (8.3)	10.6 (8.8)
Gender					
Female	79 (28%)	8 (11%)	27 (45%)	22 (29%)	22 (32%)
Male	178 (64%)	68 (89%)	33 (55%)	46 (61%)	31 (45%)
Physical health					
Very bad	2 (0.7%)	0 (0%)	0 (0%)	1 (1.3%)	1 (1.5%)
Bad	11 (4.0%)	2 (2.6%)	2 (3.3%)	3 (4.0%)	4 (6.0%)
Fair	85 (31%)	31 (41%)	12 (20%)	21 (28%)	21 (31%)
Good	121 (44%)	23 (30%)	33 (55%)	34 (45%)	31 (46%)
Very good	59 (21%)	20 (26%)	13 (22%)	16 (21%)	10 (15%)
Organisation					
One	97 (35%)	40 (53%)	20 (33%)	21 (28%)	16 (23%)
Two	72 (26%)	15 (20%)	17 (28%)	29 (39%)	11 (16%)
Three	111 (40%)	21 (28%)	23 (38%)	25 (33%)	42 (61%)

7.4.1. Job position, workplace factors, and psychological distress

Job position was associated with two of the three workplace mediator variables (Figure 7.2).

Frontline practitioners reported 0.35 (95% CI 0.03 - 0.67) SD higher effort-reward imbalance and 0.43 (95% CI 0.12 - 0.74) SD greater agreement that their work put them in dangerous situations than researchers. Those reporting 1 SD higher effort-reward imbalance were estimated to experience 0.24 (95% CI 0.10 - 0.39) SD higher levels of psychological distress. As such, when examining the indirect mediating role of effort-reward imbalance, frontline practitioners reported 0.09 SD higher psychological distress. However, neither social support nor reported exposure to dangerous situations was significantly associated with distress. Furthermore, when examining the direct (non-mediated) association, frontline practitioners reported 0.37 (95% CI 0.02 - 0.72) SD lower psychological distress. Finally, when considering all direct and indirect associations together (i.e., the total effect), frontline practitioners may have experienced lower levels of psychological distress than those in research roles, but this was statistically uncertain (-0.29 SD, 95% CI -0.65 to 0.06).

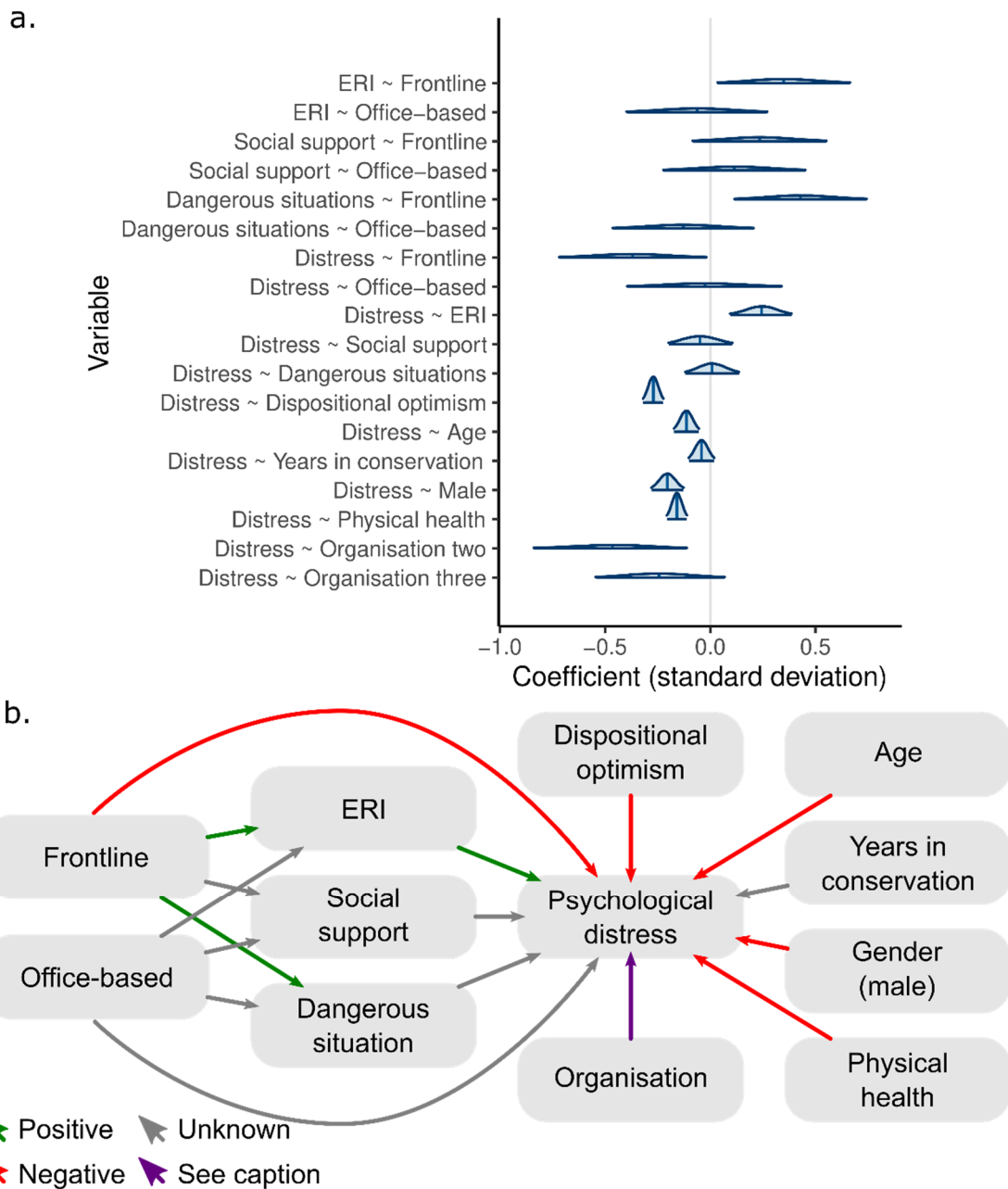


Figure 7.2. Bayesian structural equation modelling results. Panel a. describes the coefficient estimates from the Bayesian structural equation model using data from 280 respondents. Vertical blue lines represent point estimates (median of the posterior distribution), and curves represent the 95% credibility interval (equal-tailed). Coefficient estimates are presented in standard deviations. Estimates associated with “unknown” response levels are not shown. Panel b. illustrates the direction of association between each variable. The purple line indicates that organisation is a categorical variable; respondents in organisation two reported significantly lower distress than the reference level organisation, as shown in panel a.

Several of the covariates were also associated with psychological distress. Those with 1 SD higher dispositional optimism than the mean reported 0.27 (95% CI 0.22 - 0.32) SD lower distress.

Furthermore, respondents aged 50 reported 0.28 SD lower distress than those aged 25. Men

reported 0.20 (95% CI 0.13 - 0.28) SD lower distress than women. Moreover, those who said their

physical health was good reported 0.19 SD lower distress than those who said their health was fair. Finally, those working in organisation two reported 0.46 (95% CI 0.11 - 0.84) SD lower psychological distress than those in organisation one.

The analysis presented here was contrasted against an alternative model with the software's default diffuse priors (see *Appendix: WAMBS-Checklist (Chapter 7)*). In summary, the directions and size of the association between job position, effort-reward imbalance, exposure to dangerous situations, dispositional optimism, and psychological distress were similar to those presented above.

However, the associations of age, gender, physical health and one organisation with psychological distress became non-significant when using diffuse priors.

7.4.2. Differences in efforts and rewards between positions

The statistical analysis suggested that frontline practitioners faced greater effort-reward imbalances than their colleagues. To explore this further, we first explored the overall patterns of response to the effort and reward items across all respondents, then how these varied between job positions (Figure 7.3).

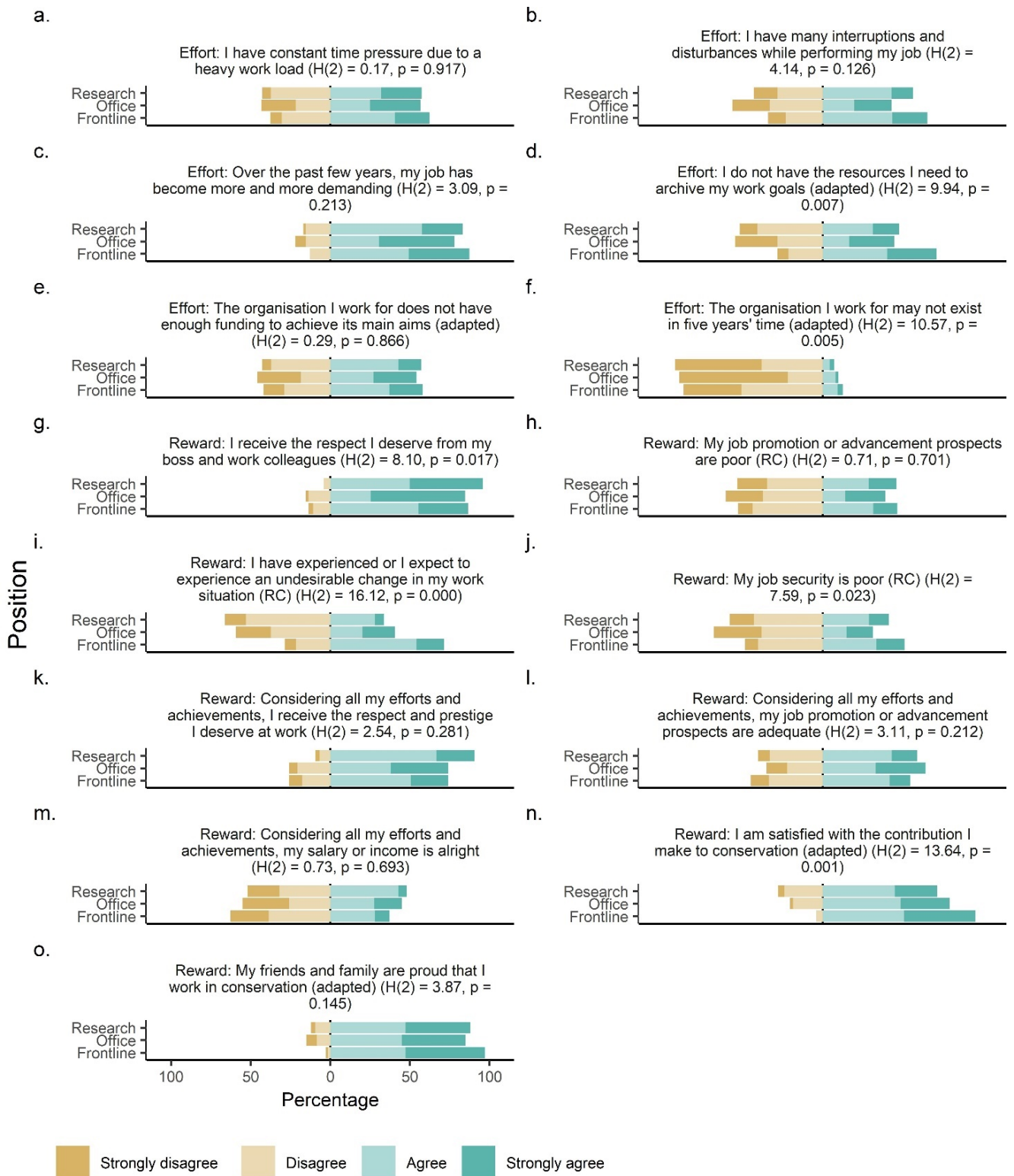


Figure 7.3. Variation in responses to effort and reward questions between job positions. Labels include the results of Kruskal-Wallis tests evaluating differences in responses between job positions. Key: RC = reverse coding, adapted = the items added to the original effort-reward imbalance instrument.

There were notably high levels of agreement and disagreement with some of the items across all positions. For instance, among the effort items, the majority (81.9%) of respondents agreed or strongly agreed with the statement, “*Over the past few years, my job has become more and more demanding*” (Figure 7.3c). However, a majority (90.3%) were confident that their organisation would still exist in five years (Figure 7.3f). Among the reward items, most (85.7%) agreed or strongly agreed with the statement “*I receive the respect I deserve from my boss and work colleagues*” (Figure 7.3g). Furthermore, the majority of respondents said they were satisfied with their contributions to conservation (81.7%, Figure 7.3n) and felt their friends were proud that they worked in conservation (89.2%, Figure 7.3o). A slight majority (58.8%) felt their salary was not commensurate with their efforts and achievements.

Moreover, there was variability in these responses between job positions; the following summary focuses on effort and reward items where there were statistically significant differences (p -value < 0.05) in responses between positions. In terms of efforts, frontline practitioners were significantly more likely to report inadequate resourcing (Figure 7.3d) and beliefs that their organisation may not exist in five years than colleagues (Figure 7.3f). Researchers were significantly more likely to say they received the respect they deserved from colleagues than those in other positions (Figure 7.3g). Furthermore, frontline practitioners reported significantly lower rewards in the form of job security than their colleagues (Figure 7.3i and Figure 7.3j). However, frontline practitioners were most likely to be satisfied with their contributions to conservation (Figure 7.3n).

7.5. Discussion

Over a quarter of participants reported moderate or severe distress. This prevalence was similar to that found in Chapter 6, in which 14.8% of surveyed conservationists were moderately distressed, and 13.0% indicated severe distress, with a mean Kessler-10 score of 20.9 (SD = 7.0).

The conservation movement might learn valuable lessons from sectors where distress is prevalent. For example, many countries have a shortage of nurses, partly because of high turnover linked to poor working conditions and job stress (Drennan & Ross, 2019; Senek et al., 2020). Recognising

these challenges, the National Health Service in England has implemented measures to increase the retention of nurses and other healthcare workers (NHS, 2019). These measures include enhancing career development opportunities, adopting flexible working practices, addressing discrimination and bullying, and strengthening support for victims of violence. However, while much can be learned from other sectors, conservationists may face unique challenges and rewards. For example, Chapter 5 suggests that many in the sector are pessimistic about society meeting crucial conservation goals over the next ten years. In turn, low conservation optimism was associated with slightly higher rates of psychological distress in Chapter 6, although the causal relationships between these variables are uncertain.

As such, efforts to improve working conditions should be based on evidence specific to the experiences of conservation professionals. In aid of this, in Chapter 6, I suggested ways conservation organisations might manage the mental health of their staff, drawing on best practice guidelines tailored through input from key informants. These guidelines include taking steps to remove workplace threats to mental health. For example, many respondents in our study highlighted the challenges of increasingly demanding workloads. Interventions to reduce workload might include reducing weekly work hours (Schiller et al., 2018) and training team leaders and staff in time management and organisation (Green & Skinner, 2005). Equally, employers might also promote the positives of working in conservation. These measures might include tackling areas where staff feel under-rewarded. For example, some respondents across roles reported poor job advancement prospects. Therefore, employers might consider supporting staff career development through mentoring schemes, access to training, and opportunities to gain qualifications. Crucially, employers should examine their internal practices to ensure equal opportunities for career advancement (M. S. Jones & Solomon, 2019). Promoting the positives might also involve recognising and upholding existing aspects of work that employees value. For example, many of our respondents were satisfied with their contributions to conservation. Chapter 6 suggests conservationists who are more satisfied with their contributions tend to report lower psychological distress, although it is uncertain if these are causally linked. Therefore, employers

might consider ways to celebrate individual and team efforts and positive outcomes of their work while recognising the risks of creating an ‘only good news’ culture (WWF, 2020a).

7.5.1. Patterns of risk factors between job positions

This study asked how effort-reward imbalances, social support, and exposure to dangerous situations vary between job positions and if these factors are associated with psychological distress. Our results suggest that while there might not be differences in overall psychological distress between job roles in our sample, risk factors do vary. For example, frontline practitioners reported greater effort-reward imbalances than office-based staff or researchers, which was associated with greater psychological distress. However, office-based practitioners and researchers reported higher rates of psychological distress than frontline staff for reasons not captured in our analysis. These results indicate that there may be no one-size-fits-all solutions for supporting mental health in the conservation sector. Instead, measures should be tailored based on an understanding of experiences across different roles. Again, lessons can be learned from other sectors in this respect. For example, the Talk Health and Care platform was launched to allow National Health Service staff in England to share challenges and post ideas, notionally helping inform management planning (Iacobucci, 2018). Similar tools could help conservation staff across organisational positions share the challenges they face. Such tools may be particularly useful when staff are spread over multiple locations, especially where frontline workers have limited direct contact with head offices and human resource personnel.

Furthermore, our results corroborate other studies finding associations between effort-reward imbalances and mental health. For example, one meta-analysis of eight cohort studies encompassing 84,963 employees found that individuals exposed to effort-reward imbalances were at a significantly greater risk of depressive disorders (Rugulies et al., 2017). Rebalancing efforts and rewards could involve mitigating workplace challenges while promoting the positives of conservation work, as discussed above. However, our results also illustrate how patterns of effort and reward can vary depending on job position. In particular, frontline practitioners in our study

reported greater under-resourcing and job insecurity than office-based staff and researchers. Some of our results echo those found in other studies among rangers. For example, Moreto (2016) describes a wide range of stressors reported during interviews with rangers in Uganda. These included inadequate resourcing, low financial compensation, difficult relationships with residents, misconduct by colleagues, and dangerous working conditions (Moreto, 2016). Many of these themes are also reflected in other studies among rangers (e.g., Belecky et al., 2019; Singh et al., 2020; Spira et al., 2019). Other research suggests that job satisfaction pay, time spent with friends and family, and financial compensation may be associated with reported stress and psychological wellbeing (Belhekar et al., 2020; Gao & Li, 2021). Recognising the challenges faced by rangers, participants at the 9th World Ranger Congress in November 2019 endorsed the Chitwan Declaration (IRF, 2019). This declaration calls on conservation leaders to improve health and safety conditions (including around housing, utilities, and emergency procedures), provide decent life insurance, and support work-life balances (such as providing sufficient annual leave) among rangers. The Universal Ranger Support Alliance supports the implementation of this declaration through a targeted action plan that includes promoting minimum standards for ranger welfare and employment (URSA, 2021). Our results – particularly around effort-reward imbalances and exposure to dangerous situations – provide further evidence supporting this call.

Yet, our results also highlight how non-frontline workers, such as office-based staff, might also face challenges affecting their mental health. These challenges were not captured in the three mediator variables included in our study but may include other work-related factors. For instance, many conservationists, including office-based and frontline staff alike, are motivated to work in conservation because they enjoy nature and the outdoors (Papworth et al., 2018; Singh et al., 2020). However, office-based staff might face daily evidence of conservation's failure to reach its goals but have fewer opportunities to spend time in nature than colleagues in frontline roles. Consequently, employers might provide opportunities for office-based staff to visit natural areas and perhaps directly contribute to conservation activities.

Furthermore, we also found differences in the prevalence of psychological distress among organisations. These differences could result from organisational factors not captured in our study, such as leadership style, management support, or group cohesion and supportiveness (Bronkhorst, Tummers, Steijn, & Vijverberg, 2015). Alternatively, some organisations are likely to operate in places with more severe conservation challenges than others, which may be traumatic for those caring about nature (Fraser et al., 2013; Pihkala, 2020). For instance, Chapter 5 found that those in countries with a higher proportion of threatened species tend to report lower optimism about conservation, which in turn was associated with greater psychological distress in Chapter 6. Or, the results may have been because of differences in response style between cultures. Further research investigating these differences could identify organisational risks and protective factors and where resources to support mental health should be directed.

Overall, these results suggest the need for role-specific measures to support mental health. These measures may include reducing effort-reward imbalances (while managing exposure to dangerous situations) that some frontline practitioners face. However, these efforts should also be accompanied by further research to understand the stresses and challenges faced by office-based staff and researchers and how they can be mitigated.

7.5.2. Study limitations

As discussed in Chapter 6, a growing number of studies examine the perspectives and experiences of conservation professionals (e.g., Montana et al., 2019; Papworth et al., 2018; Sandbrook et al., 2019; Sandbrook et al., 2011). However, many of these poorly represent the experiences of frontline conservationists. This bias perhaps reflects the challenges of conducting research among populations that need to be sampled in person and who might be working in remote locations.

Within this Chapter, each collaboration involved a significant investment of time and resources (e.g., completing internal ethical procedures, hiring and training research assistants, and providing project reports). Furthermore, we initially planned to collaborate with a fourth partner, but they dropped out due to challenges presented by the COVID-19 pandemic. A consequence of these

factors was that our sample size was relatively modest. As a result, we do not interpret our results as providing strong evidence that there are no total differences (all direct and indirect associations taken together) in psychological distress between job roles.

We purposefully selected a partner organisation for reasons described in the method and because there was no comprehensive list of conservation organisations that could have been probability sampled (as discussed in Chapter 4). This approach complemented Chapter 6, adding to the weight of evidence that effort-reward imbalances might be a risk factor for psychological distress across conservation professionals. However, the purposeful sampling approach means the absolute levels of psychological distress or other variables cannot be generalised from our sample to other organisations.

The first two organisations had high response rates (84% and 86% of the target populations). Collaborators in the first two organisations said the staff mostly did not participate because they did not have time. Participation in the third organisation was lower (46%) for two possible reasons. First, participants may have been less likely to respond to an email invitation than an in-person request (necessary because of the ongoing pandemic). Second, staff were reportedly over-stretched because of the COVID-19 pandemic, so they may not have had time to participate. We arranged for team leaders to allocate time for their staff to complete the survey. Nevertheless, staff who were busier were less likely to participate. Consequently, the association between effort-reward imbalance and psychological distress should be considered a lower bound estimate. The true relationship may be stronger, which would suggest even more the need for employers to manage overwork.

Individuals may have responded differently to the survey depending on if it was self-administered or conducted with the research consultant. For example, respondents might have disclosed greater dissatisfaction with employment conditions through the self-administered internet survey. This represents a potential source of social desirability bias. However, collaborators and the two ICCS

members embedded in the partner organisations were confident that staff knew the survey was independent and anonymous, so they would not have censored their responses.

We used a cross-sectional study design, which did not allow for causal inference. For instance, it is unclear from our study alone that tackling effort-reward imbalances will reduce psychological distress, although other research suggests it may (Rugulies et al., 2017). Future research using longitudinal or experimental study designs could investigate if our observed associations are causal.

Two organisations were sampled before and one during the COVID-19 pandemic. As noted above, rates of mental illness appear to have generally increased since the start of the pandemic (Santomauro et al., 2021). Our study design means it is not possible to disentangle the effects of organisational differences from the impacts of the pandemic. However, we note that the organisation where staff reported higher rates of distress was not the same as the organisation sampled during the pandemic. Consequently, we observed organisational differences in distress irrespective of the pandemic. More broadly, our study sampled from a range of organisational contexts with different sizes, establishment dates, ways of working, organisational remits, and other factors. We included a categorical variable corresponding to each organisation to account for these differences since we were interested in the workplace factors associated with distress across contexts. However, this approach meant we could not investigate the role of these institutional and country-specific factors within our analysis.

As stated in previous chapters, Kessler-10 scores cannot be used to diagnose specific conditions. A full discussion of the implications of this, which also apply to the current study, is presented in Chapter 6.

Finally, because of our modest sample size, we used informative priors when previous evidence from Chapter 6 was available. Informative priors were used for many of the covariates, and in some cases, yielded results significantly different to those from a supplementary analysis with diffuse priors (see *Appendix: WAMBS-Checklist (Chapter 7)*). For example, the association

between gender and psychological distress was significant in the above analysis but not when using diffuse priors. This effect is an intended consequence of using informative priors (McElreath, 2016). However, it meant the accuracy and precision of the estimates – where informative priors were used – were conditional on the results from the companion study. There exist multiple strategies for choosing informative priors, including based on meta-analyses, reviews, empirical studies, and expert elicitation (Zondervan-Zwijnenburg, Peeters, Depaoli, & Van de Schoot, 2017). We chose to base our informative priors on a single companion study because it a) was one of the few examining psychological distress among conservation professionals, b) used the same survey questions and response scales as the current study, and c) had results consistent with findings from other sectors and in general populations (e.g., Drapeau et al., 2012; Kagan, 2020; Rugulies et al., 2017). Moreover, the primary results relevant to research question 2 were the same in the analysis using both strongly and diffuse priors. In other words, our primary conclusions regarding the relationship between job positions, mediator variables, and psychological distress would have been the same if only diffuse priors were used.

7.6. Conclusion

This study explored patterns of psychological distress and associated workplace risk factors between roles in a sample of conservation organisations. We did not find overall differences in psychological distress between frontline practitioners, office-based staff, and researchers.

However, these groups may face different challenges at work, with frontline practitioners reporting higher effort-reward imbalances while their colleagues experienced distress for unknown reasons.

These findings highlight the need for employers to understand and offer tailored support to different groups within organisations. Ultimately, alleviating potential workplace sources of distress might help employers meet their duty of care while strengthening conservationists' efforts to reverse the loss of nature.

8. Discussion

8.1. Research summary

Evidence of the links between nature and health is mounting, as described in Chapter 1. However, much of this research focuses on physical illness, with patchy evidence describing relationships with mental health. My thesis contributes to addressing several key evidence gaps introduced in Chapter 1. I provide observational evidence from a Global South case study of the role of natural resources in livelihood-related social determinants of self-reported mental health. I also explore how perceptions and working conditions might affect a subset of conservation professionals' experiences of psychological distress, discussing possible implications for their mental health, productivity, and perhaps collective ability to protect nature.

Davies et al. (2019) argue that while the links between nature and health are increasingly well-evidenced, the role of conservation in these relationships remains uncertain. They suggest two main ways in which nature, health, and conservation may be linked. First, managing biodiverse areas that support health may offer a 'win-win' for conservation and public health. Second, positive interactions with nature might increase people's interest, concern, and willingness to act to protect it, supporting conservation goals. However, there exists limited evidence evaluating interventions to meet these joint goals, nor are many natural areas explicitly managed with both in mind (Davies et al., 2019). My thesis provides evidence that relates to these arguments in several key ways.

My thesis suggests the value of considering material contributions from biodiverse areas when seeking win-win outcomes for conservation and public mental health. Chapter 3 explores a potential win-lose scenario where a conservation intervention might be promoted at the expense of livelihood-related social determinants of depressive symptoms. Chapters 2 and 3 also propose possible (though untested) win-win scenarios, where well-designed livelihood-based conservation interventions might help meet biodiversity and public mental health goals. These chapters draw on

residents' perspectives on the factors that influence their mental health. Generally, there is growing recognition of the need to consider both subjective and objective wellbeing outcomes in policymaking (e.g., Australian Government, 2022; Cummins, Eckersley, Pallant, van Vugt, & Misajon, 2003; Durand, 2015; McLeod, 2018; ONS, 2019; OECD, 2013; Seaford, 2011; Steptoe, Deaton, & Stone, 2015; Stiglitz, Sen, & Fitoussi, 2009). This need to account for perspectives (even if imperfect descriptions of reality, as discussed below) and subjective experiences also extends to landscape management and governance (Bennett, 2016). By extension, conservation efforts that alleviate the subjective experience of stressors might offer win-wins, while those that are perceived to exacerbate them may not.

This point is relevant for international conservation policy. For example, the first draft of the post-2020 global biodiversity framework includes the long-term goal that *“Nature’s contributions to people are valued, maintained or enhanced through conservation and sustainable use supporting the global development agenda for the benefit of all”* (CBD, 2021). I consider *“Nature’s contributions”* to include perceived contributions and *“for the benefit of all”* to encompass mental health aspects. Substantial literature and numerous tools discuss monitoring and managing the social benefits and costs of conservation action (e.g., Franks, Small, & Booker, 2018; Milner-Gulland et al., 2014; Woodhouse, de Lange, & Milner-Gulland, 2016; Woodhouse et al., 2015; J. H. Wright et al., 2016). Many of these resources examine actual and perceived changes in the material contributions from nature as the result of conservation efforts. Such tools could be extended to include indicators of poor mental health, an essential aspect of wellbeing rarely discussed in conservation impact research. Doing so might help in choosing approaches that support nature’s perceived contributions to mental health, thereby contributing to the goals of the post-2020 global biodiversity framework.

Furthermore, though some of the results of chapters 2 and 3 might be specific to the case study, the overall conceptual framework is more generalisable. Many of nature’s contributions to people may influence social determinants of mental illness (Figure 8.1). Some evidence of these indirect linkages is emerging, such as the role of green spaces in facilitating exercise and social interactions

(Barton & Pretty, 2010; H. Li et al., 2022; Steigen et al., 2022) and ameliorating environmental stressors (J. C. Fisher et al., 2022), discussed in Chapter 1. Situating this existing evidence within an overarching social determinants framework might help facilitate communication between conservation and global mental health fields and identify gaps in understanding. Moreover, a core goal of the post-2020 global biodiversity framework is to mainstream nature into societal decision-making (CBD, 2021). In aid of this, a proposed aim in the Global Action Plan for Biodiversity and Health is to consolidate research on the entire range of linkages between nature and mental health. The framework used in chapters 2 and 3 might account for the full range of health benefits from nature and the risks presented by its loss, thereby motivating greater societal conservation action.

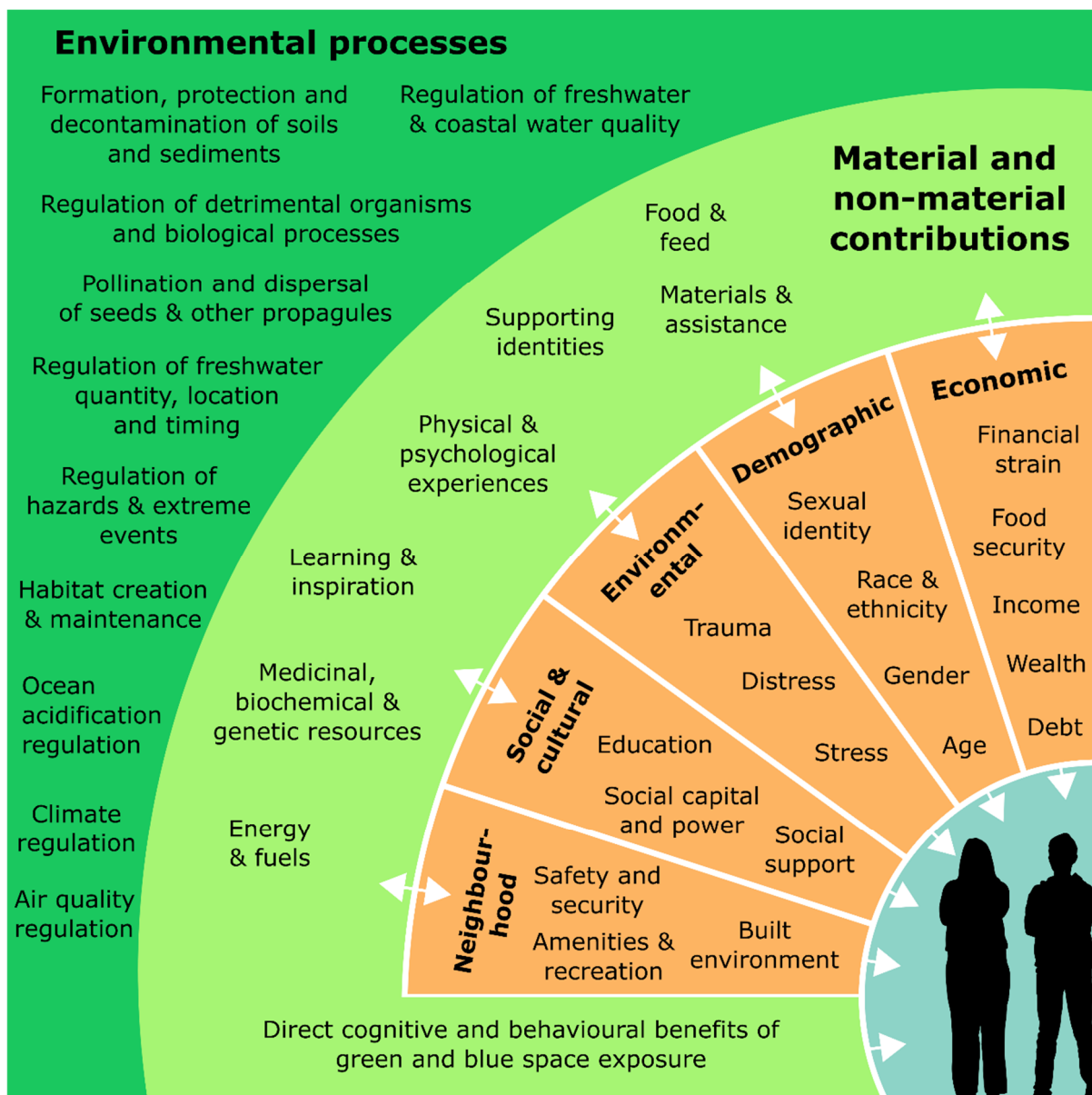


Figure 8.1. How nature’s contributions, including the regulation of environmental processes (dark green) that support material and non-material contributions (light green) (IPBES, 2019), might directly and indirectly (through social determinants, orange) influence mental health (Patel, Saxena, et al., 2018).

Perceptions can also influence attitudes and behaviours and the success of projects that depend on local support (Bennett, 2016). For example, in Chapter 2, I mention how perceived costs and benefits of living next to Budongo Forest Reserve might influence attitudes toward its protection. While positive experiences might increase support for conservation, as Davies et al. (2019) suggest, negative experiences might undermine it. Again, this point has relevance for international policy. The draft post-2020 global biodiversity framework includes the target to “Ensure that at least 30 per cent globally of land areas and of sea areas [...] are conserved through effectively and

equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures...” (CBD, 2021). This target spans a wide range of potential area-based conservation approaches. However, this target has been controversial (Milner-Gulland, 2021), with many concerned about the potential impacts on local and Indigenous communities (ICCA Consortium, 2021; Schleicher et al., 2019). The actual impacts of these proposals may depend on if and how they are implemented. Nevertheless, residents’ perceptions – including around impacts on mental health – may be important in determining if such plans are successful (Bennett et al., 2019).

Appleton et al. (2021) argue that meeting global conservation targets will require an increased number of skilled, knowledgeable, experienced, and committed people spanning a broad range of disciplines. They also argue that this group needs to be supported in their work through improving working and employment conditions. Yet, there is limited research on conservation professionals’ workplace experiences that could guide such efforts. Chapters 4 to 7 contribute to this emerging literature, albeit recognising the limits to how widely the results can be generalised. These chapters suggest workplace factors that conservation organisations – particularly those employing desk-based university-level educated and English-speaking staff – might act upon. For example, effort-reward imbalances were consistently associated with psychological distress in both samples in chapters 6 and 7, echoing results from other sectors (e.g., Dragano et al., 2017; P. Eddy, Heckenberg, Wertheim, Kent, & Wright, 2016; Pennie Eddy, Wertheim, Hale, & Wright, 2018; B. Lau, 2008; Rugulies et al., 2017). So, employers of staff with profiles similar to our samples might consider identifying and managing sources of effort-reward imbalance. Chapters 6 and 7 suggest potential ways this might be done, though further evaluation of their effectiveness is needed. Again, these results are based on self-reports by respondents. Yet, perceptions about working conditions play important roles in employees’ job satisfaction (e.g., Mathieu, Hofmann, & Farr, 1993; Perrachione, Rosser, & Petersen, 2008), wellbeing (e.g., Bentley et al., 2012; Jarden, Sandham, Siegert, & Koziol-McLain, 2019), motivation and performance (e.g., Dean, Dean, & Rebalsky, 1996; Gerlach, 2019; Griffin & Neal, 2000), and intentions to leave (e.g., Arnoux-

Nicolas, Sovet, Lhotellier, Di Fabio, & Bernaud, 2016; Loi, Hang-Yue, & Foley, 2006). Moreover, perceptions around the progress to collective goals might be particularly important in mission-driven vocational sectors such as conservation (Soulé, 1985). As such, understanding conservation professionals' perspectives might shed light on ways to support them in their work. Identifying ways to support conservation professionals across different roles and organisational contexts may play an important role in professionalising the sector. Ultimately, doing so might help support the sector's efforts to reverse global nature loss (Appleton et al., 2021; Singh et al., 2020).

8.2. Cross-cutting themes and policy implications

8.2.1. Study design choices and limitations

I describe the rationale and limitations of the methods used in each empirical chapter. In some cases (e.g., the use of semi-structured interviews in Chapter 2 or negatively framed scenario questionnaires in Chapter 3), the methods were considered suitable for the study purposes. In other cases, the methods presented limitations for interpreting and generalising results. Here, I focus on four key limitations: the observation cross-sectional approach, the absence of experimental testing possible interventions, the use of perceptions, the biases in the sample in chapters 4 to 6, and the use of screening instruments.

8.2.1.1. *Observational and cross-sectional study designs*

As mentioned above, the data I collected within my DPhil was observational and cross-sectional, presenting several limitations. First, it precluded causal inference. For example, my results do not provide causal evidence that commercial agricultural expansion reduced the availability of land for subsistence agriculture. Randomised control trials are often situated near the apex of hierarchies of evidence-based medicine, offering powerful approaches for determining causality (Murad, Asi, Alsawas, & Alahdab, 2016). Yet, randomised control trials become increasingly challenging as the scale of the exposure grows or when experimentation is logistically, politically, or ethically unfeasible (Bosdriesz et al., 2020; Sanson-Fisher, Bonevski, Green, & D'Este, 2007). Some policy-relevant research topics, including at the nature-health interface, are not amenable to experimental

testing (Cook, Howarth, & Wheeler, 2019; Parkhurst & Abeysinghe, 2016). For example, there is growing recognition in global mental health research for the need to move beyond just individual-level determinants of mental illness and towards understanding complex “macro-social” factors whose effects are not easily tested experimentally (Patel, Saxena, et al., 2018; Rose-Clarke et al., 2020). Furthermore, the potential cascading effects of landscape management interventions on mental health would likely occur gradually over time. As a result, an experimental study in this context would take multiple years. It might have been more feasible to experimentally test an intervention in chapters 4 to 7. However, doing so would still have required a prior understanding of the conservation workplace factors associated with psychological distress that an intervention could target.

Second, the cross-sectional approach meant I captured a snapshot of each study system at a single point in time. However, socio-ecological systems are not static and evolve over time (Liu et al., 2015). In Chapter 3, participants were asked to make predictions about the future. Yet, it is unclear if these predictions will prove accurate or affect residents’ mental health as expected. Furthermore, I also assumed that people’s mental health does not affect how they interact with nature. In contrast, the dynamic stress vulnerability model suggests bi-directional feedback between mental health and socio-economic status (Ormel & Neeleman, 2000) and perhaps subsequent interactions with nature. Moreover, chapters 4 to 7 explore potential feedback between conservationists’ mental health and their contributions to conservation, but my study did not monitor changes in performance or conservation outcomes. Chapter 2 suggests the potential value of cohort study designs for understanding these longitudinal dynamics, but these can be costly and take time.

Overall, studies on lower rungs of the hierarchy of evidence-based medicine, such as observational research, can be valuable in these cases. Nevertheless, they still require cautious interpretation as they do not provide evidence of causality and provide only a temporal snapshot of a given study system.

8.2.1.2. *Absence of intervention evaluation*

I did not evaluate possible interventions in my thesis. Therefore, my research does not provide specific evidence of approaches that might actively support biodiversity and mental health goals. Such solutions might help meet Convention on Biological Diversity and international sustainable development goals, as discussed above. One approach might have been to implement an experimental impact evaluation, though this would have been subject to the same constraints discussed in the previous section. Recognising that experimental tests are not always feasible or desirable, development studies and other disciplines have developed numerous retrospective impact evaluation tools. “*Complex-aware*” evaluation approaches include outcome harvesting, process monitoring, and “*most significant change*” (USAID, 2016). Outcome harvesting collects evidence of changes over time and then works backwards to evaluate the contribution of different factors – including interventions – to those changes (Wilson-Grau, 2018). The approach is participatory and iterative, utilises both qualitative and quantitative evidence, and emphasises learning for adaptive management (Wilson-Grau & Britt, 2012). This approach is particularly useful in complex systems and for identifying unintended outcomes. However, it does not provide precise quantitative estimates of impact, is susceptible to confounding, focuses on outcomes that participants are aware of, and requires substantial participant input. Outcome harvesting has been done by multiple organisations worldwide (Wilson-Grau, 2015), including the World Bank (S. B. Fisher, Gold, & Wilson-Grau, 2014). This approach could have been used, for example, to evaluate if livelihood-based conservation interventions were perceived to have influenced social determinants of common mental disorders.

8.2.1.3. *Use of perceptions*

Evidence has been defined as “*some form of data – including epidemiologic (quantitative) data, results of program or policy evaluations, and qualitative data – for uses in making judgments or decisions*” (Brownson, Fielding, & Maylahn, 2009). Perceptions can provide valuable evidence on how people experience and interact with the world for conservation, public health, and development research. As mentioned above, perceptions are core to people’s subjective evaluations

of their wellbeing, recognised as an important consideration in decision-making. Furthermore, in some cases, perceptions can offer valuable insights into complex social-ecological systems, including understanding the social outcomes of conservation and how these influence behaviour and social relations (Adams & Sandbrook, 2013; Bennett, 2016; Ingold, 2000). Similarly, the perspectives of those with lived experiences of mental illness can help identify social determinants and pathways to prevention and treatment, with calls for greater use of qualitative methods in global mental health research (Lewis, 2021; Rose-Clarke et al., 2020; Zolnierrek, 2011).

However, people's perceptions are based on subjective interpretations of sensory experiences. These interpretations are influenced by values, beliefs, social norms, knowledge, past experiences, and myriad contextual factors (Given, 2008; Moon & Blackman, 2014). Different individuals and groups can perceive the same situation differently, and these perceptions can change over time (Bennett, 2016). Furthermore, people's reports of their perceptions may be affected by social desirability or other forms of response bias. So, self-reported perceptions are not objective descriptions of external reality. In the thesis, I have sought to acknowledge both the insights offered by perspectives and the need for their cautious interpretation.

8.2.1.4. *Bias from snowball and self-selection sampling*

In Chapter 4, I discuss in detail why probabilistic sampling from a sampling frame was not feasible and why snowball and self-selection approaches were used. This approach yielded a sample that poorly represented those in frontline roles, without university-level education, and who did not speak English. Furthermore, those with stronger opinions might have been more likely to participate. Therefore, these results should not be generalised across the entire target population. However, the results from these chapters flag potential factors – such as effort-reward imbalance – that employers of staff with profiles similar to our sample might consider when seeking to enhance working conditions. Furthermore, Chapter 7 was designed to help offset some of the limitations of the previous chapters. This chapter provided corroborative evidence (when examining the results with non-informative priors) of the association between effort-reward imbalance and psychological distress.

An alternative approach might have been to pre-define a target sample for each main job category and geographical location within the target population. Then, to have purposefully selected a panel of conservationists who would have shared the survey with a subsequent purposeful selection of people in their networks to meet the pre-defined sample. However, purposeful sampling also introduces bias (as discussed in Chapter 2), and it would be impossible to know how representative the sample was of the target population. Moreover, this approach would also have presented the same challenges encountered in Chapter 7 regarding recruiting respondents in remote locations with limited reading ability and no internet access. A parallel approach might have been to choose a narrower target population, such as conservation professionals who were members of the Society for Conservation Biology. However, this approach would have still introduced non-response bias as participation would be voluntary, and the eventual sample size would probably have been small. These points suggest inherent difficulties in studying dispersed, poorly defined, but nonetheless important populations.

8.2.1.5. *The use of screening instruments*

Recalling the definition in Chapter 1, mental illness is a disturbance of emotions, thoughts, behaviours and social interactions that causes substantial suffering and impairs life activities (Patel, Saxena, et al., 2018). As discussed in previous chapters, correctly diagnosing individuals with mental illnesses, even using established diagnostic interviews, is challenging (L. A. Clark, Cuthbert, Lewis-Fernández, Narrow, & Reed, 2017). Biomarkers offer the promise of objective diagnosis of common mental disorders, but their development remains nascent, as mentioned in Chapter 1.

The methods in Chapter 2 do not attempt to estimate the severity of psychological distress or if symptoms cross diagnostic thresholds for specific disorders. However, including a screening instrument alongside the semi-structured interviews in Chapter 2 might have helped identify information-rich cases and patterns of distress within the sample. For example, it might have been useful to compare the stressors reported by those with high Kessler-10 scores to those with low ones. On the other hand, the Kessler-10 would provide no information on how residents express

experiences of psychological distress, which was useful for triangulating the validity of the PHQ-8 in Chapter 3. As a result, the Kessler-10 could have been included in addition to exploring how residents express experiences of distress.

As previously mentioned, our use of screening instruments – though routine in similar research and suitable for meeting the study objectives – cannot be used to diagnose individuals with mental illness. However, chapters 2, 3, 6, and 7 aimed to identify potential risk and protective factors for psychological distress and depression symptom severity at a population level. Such information, often based on studies using screening instruments, is valuable in public mental health. A given individual's risk of mental illness is influenced by a complex combination of sociobiological and contextual factors (Koenen et al., 2013; Tsuang et al., 2004). But, cumulative risk and protective factors, often found along “*social gradients*” of inequality, can influence the prevalence of common mental disorders within a population (Allen, Balfour, Bell, & Marmot, 2014). Policies and efforts to manage these factors may help address the prevention gap – “*where resource allocation to reducing incidence through prevention has lagged efforts to reduce duration of disorders through treatment*” (Jorm, Patten, Brugha, & Mojtabai, 2017). For example, chapters 2 and 3 suggest avoiding agricultural policies that may increase social inequalities, which are known risk factors for mental illness (Patel, Burns, et al., 2018). Or, results from chapters 4 to 7 might help some employers fulfil their roles in a multi-sectoral approach to mental illness prevention (Lamontagne et al., 2014; WHO, 2021a).

Additionally, in-depth research has been conducted exploring the nuances of what *thinking too much* means. For example, in an ethnopsychology of urban Kenyans, Kaiser et al. (2015) state that this term “*was commonly interwoven with other idioms of distress to convey thinking intensely about socially distressing experiences, such as financial worry, loss of a loved one, feeling unsafe in one's neighborhood, past traumatic experience*”. Moreover, they describe how *thinking too much* was often framed by respondents as a bridge between stress and “*depression*”, a term adopted from global psychological discourse. However, such an in-depth investigation into all the

potential linguistic, cultural, and historical connotations of the idiom was tangential to my research objectives.

8.2.2. The impacts of nature loss?

My thesis did not explore the impacts of nature loss, so the following discussion is beyond the direct results of my research. However, the conceptual framework in chapters 2 and 3 suggests that the loss of nature's contributions – from habitat degradation, overexploitation, pollution, invasive species, and other factors (Tilman et al., 2017) – may threaten the mental health of those dependent on them. For instance, industrial agricultural expansion is a leading driver of tropical forest loss (Curtis et al., 2018). This forest loss can have multiple socio-economic and cultural impacts on forest-dependent communities, changing lives in ways potentially harmful to mental health. For example, industrial agricultural expansion in northern Myanmar appears to have driven deforestation and the subsequent loss of construction materials, food, and income-generating products important to residents (Papworth et al., 2017). The loss of these contributions might exacerbate multiple social determinants of mental illness.

But, the loss of nature may not be unambiguously bad or good for mental health. Instead, changing ecosystems often have diverse and cascading costs and benefits that accrue to different groups at different spatial and temporal scales. In the previous example from Myanmar, poor households that lost access to natural resources also appeared to have gained new work and trade opportunities offered by industrial agriculture (Papworth et al., 2017). More broadly, such industrial agriculture may benefit contract farmers or a nation's public in ways supporting their mental health. This example suggests complex synergies and trade-offs presented by changing socio-ecological systems in terms of mental health.

8.2.3. Cost-effectiveness of managing socio-ecological systems for mental health

It is unclear whether fostering sustainable access to nature's contributions, as suggested in Chapter 3, is a cost-effective way to support mental health. A recent review of public health literature found that targeted interventions (e.g., screening followed by cognitive behavioural therapy) tended to be

more cost-effective at reducing the burden of mental illness than universal prevention measures (Le et al., 2021). In light of this, it is uncertain if indirect preventative measures – such as fostering sustainable access to nature’s contributions – would be cost-effective compared to targeted mental health interventions.

However, only considering cost-effectiveness in relation to a single outcome overlooks possible co-benefits and trade-offs with other societal priorities. For instance, managing landscapes to enhance their multifunctionality – like promoting agroecological diversity – can contribute to multiple sustainable development objectives (O’Farrell & Anderson, 2010). But, weighing up the value of qualitatively different outcomes can be challenging, especially when groups have differing priorities. In response, approaches such as multi-criteria decision analysis (that systematically weights preferences across multiple criteria) have been developed (K. Marsh, Phillips, Fordham, Bertranou, & Hale, 2012). These approaches have already been adopted within conservation planning (Adem Esmail & Geneletti, 2018). However, they could be extended to help choose cost-effective land and sea management approaches that support mental health alongside other sustainable development objectives. Ultimately, such holistic approaches might more cost-effectively enhance human wellbeing than investing in interventions that only target specific wellbeing domains, such as mental health. Selecting approaches that maximise co-benefits and minimise trade-offs across societal priorities is consistent with the “*whole-of-government*” approach discussed in Chapter 3 (CBD, 2021).

8.2.4. Landscapes for mental health and conservationists’ roles

In chapters 2, 3, and 8, I discuss possible approaches to managing landscapes in ways that could support residents’ mental health. These approaches could include what the Global Environment Facility calls “*inclusive conservation*” (GEF, 2020). Inclusive conservation has been described as “*conservation where indigenous peoples and local communities are the key actors governing, managing and conserving their lands, waters and other gifts of nature and, as necessary and desired, invite others to collaborate with and support them on community-defined terms*” (Farvar

et al., 2018). Calls for inclusive conservation are partly based on the logic that residents – under the right conditions – will act collectively to sustainably manage natural resources to maintain their long-term wellbeing (D. Nilsson, Baxter, Butler, & McAlpine, 2016). However, the extent to which these approaches represent viable conservation strategies is likely to vary between places and contexts. For example, Ostrom (2015) describes a set of conditions or “*design principles*” under which local groups may collaborate to manage natural resources sustainably:

1. The boundaries of the resource, and those with rights to use it, are clearly defined.
2. Rules regulating the use of a resource are appropriate within that social and ecological context.
3. Those affected by rules over resource use can participate in decision-making.
4. There is effective monitoring of resource use, and those doing the monitoring are accountable to other resource users.
5. There are appropriate sanctions for those who break resource use rules.
6. There are low-cost conflict resolution mechanisms.
7. Local resource users have the right to organise themselves to manage the resource. For instance, national governments do not restrict local collective action.

In addition to these principles, it is assumed that the loss of a resource will harm all users, so there is a desire to manage the resource sustainably (Ostrom, 2015). However, these conditions are unlikely to exist across all social contexts. For example, external actors who pay residents to illegally harvest timber from Budongo Forest (discussed in Chapter 2) may have limited interest in long-term forest sustainability. Moreover, local residents are not the only actors who have a legitimate stake in how landscapes and seascapes are managed (Newton & Elliott, 2016). For example, deforestation in the Amazon Basin contributes to climate changes that affect humanity globally (Lawrence & Vandecar, 2015).

Consequently, a model where conservation is entirely locally-led is unlikely to be feasible or desirable across all contexts. Nevertheless, the Convention on Biological Diversity’s draft post-

2020 framework includes the target of ensuring “*equitable and effective participation in decision-making related to biodiversity by indigenous peoples and local communities, and respect [of] their rights over lands, territories and resources*” (CBD, 2021). Furthermore, Chapter 5 suggests that many conservationists believe there will be more local participation in conservation over the next ten years. This move towards more locally-led conservation may, in some cases, lead to better outcomes for residents, including regarding their mental health (Table 8.1). Such a move could be supported by, for example, financing streams that directly connect funders (including private individuals) to on-the-ground conservation action. These new funding streams are already emerging, such as through the Key Conservation app (Key Conservation, 2022) and the use of block-chain and non-fungible token technologies for more easily verifiable conservation impact (e.g., Moonjelly DAO, 2022).

Table 8.1. Common actions, outcomes, and impacts in inclusive conservation interventions adapted from D. Wright (2021).

Actions	Outcomes	Impacts	Mental health consequences
Collaborative management	Improved employment and benefit-sharing	Improved livelihoods	Alleviate direct stressors linked to mental illness, such as poverty
Participatory action	Knowledge production and sharing	Improved governance	Avoid practices that may threaten mental health, and adopt ones that support it
Institutional strengthening	Enhanced social capital and trust	Ecosystem conservation	Maintain nature’s contributions that indirectly support mental health
Technical and financial support	Collective action	Empowerment and self-determination	Support sense of agency, a social determinant of mental health

But what would the implications of a shift towards more locally-led conservation be for non-local conservation professionals? By non-local conservation professionals, I mean those who do not live with the long-term direct consequences of conservation decision-making. This group may include conservationists trained in the Global North who temporarily work in biodiverse Global South countries. These individuals might include what Holmes (2011) calls the “*transnational conservation elite*”, although his characterisation of this elite does not accurately describe many non-local conservation professionals who responded to my global internet survey. This non-local

group might also include those practising conservation in countries they come from but in regions where they do not live. (For example, two of my Ugandan collaborators who worked for Budongo Conservation Field station lived in Kampala.)

Growing literature discusses ways that researchers and practitioners can help promote locally-led conservation (e.g., Kashwan, Duffy, Massé, Asiyanbi, & Marijnen, 2021; Lanjouw, 2021; Rai et al., 2021; Trisos, Auerbach, & Katti, 2021). However, I am unaware of any research that asks explicitly how a shift to locally-led conservation would affect the roles and wellbeing of non-local professionals. Such a transition might be desirable overall but may still have implications for these non-local conservation professionals that are worth understanding and managing. These implications could include changes in job roles and patterns of employment. For example, this transition may entail reallocating funding to local groups, leading to job losses in transnational conservation organisations. Chapters 4, 6, and 7 suggest that job losses and poor employment prospects are significant stressors for conservation professionals. Perhaps the prospect of these losses is part of the reason why international organisations have been reluctant to cede control (and funding) to local conservation groups, despite decades of commitments to do so (Newing & Perram, 2019). Speculatively, non-local conservation professionals might proactively support the transition towards locally-led conservation if their roles within this new model were more clearly defined.

A shift towards inclusive conservation may also have implications for other actors, such as higher-education institutions. Currently, higher-education institutions often train graduates from the Global North to work transnationally. However, a move towards locally-led conservation may increase the demand for locally-trained graduates within the Global South. Well-resourced Global North institutions could support this transition through collaborations with under-resourced universities, learning from partnership models in other fields. For instance, North-South global health partnerships seek to strengthen healthcare systems, deliver capacity-building, and enhance research quality (Crisp, 2008; Färnman, Diwan, Zwarenstein, Atkins, & consortium, 2016). Such partnerships can face challenges, particularly due to unequal power relations (Binagwaho, Allotey,

Sangano, Ekström, & Martin, 2021; Boum Li et al., 2018). Nevertheless, well-designed and equitable health partnerships can be effective (Larkan, Uduma, Lawal, & van Bavel, 2016). A similar model of global conservation partnerships – which draws on lessons learned from global health – might also help deliver locally-led conservation. Such partnerships could include, for example, establishing joint research units between universities that focus on addressing locally relevant conservation issues.

8.2.5. The right to intervene for conservation

Exploring the implications of a shift towards inclusive conservation may also raise fundamental questions about the role of non-local actors in conservation action. These questions may include if and why external conservation actors have the right to intervene in people's lives. The right to intervene was originally discussed in the context of states intervening in the domestic affairs of other countries, such as to stop a government from persecuting its citizens (Klintworth, 1992). Right to intervene concepts have also been applied to the protection of the non-human world. For example, Eckersley (2007) asks if the international community has a right to intervene to prevent the extinction of a species or avert an environmental crisis. Duffy (2015) further develops these ideas, discussing how right to intervene concepts are used to justify militarised approaches to conservation. However, many forms of conservation – including those that would not be considered militarised – have implications for those living in conserved landscapes (McKinnon et al., 2016), as illustrated in chapters 2 and 3. As such, individuals, institutions, and the conservation movement may ask on what grounds they have a right to intervene in the lives of others. This question has relevance to many debates within the conservation movement, which at times have been divisive. For example, Milner-Gulland (2021) describes how proposals to ban wildlife trade, stop trophy hunting, and substantially expand protected areas have caused bitter disagreement among some conservationists. Chapter 4 suggests that such conflicts might be a source of tension and distress for some in the sector. Many of these debates – explicitly or implicitly – hinge on the relative prioritisation of local and non-local actors' interests. For example, at the time of writing, the United Kingdom government was passing a bill to prohibit the import of wild animal

specimens from trophy hunting (United Kingdom Parliament, 2022). The campaign to ban trophy hunting has, in part, been driven by animal welfare groups and those advocating for protectionist conservation approaches, including many based outside of trophy hunting countries (Madzwamuse, Rihoy, & Louis, 2020). This campaign has been criticised for marginalising the voices of affected communities (Resource Africa, 2022), with the ban threatening to reverse conservation gains and harm local livelihoods (Sills et al., 2019). In such debates, conservationists should critically interrogate on what basis they have the right to intervene in the lives of others. Doing so might prompt some to re-evaluate how they use their positions of relative power (Sandbrook, 2017). Indeed, Chapter 4 and other research (e.g., Sandbrook et al., 2019) demonstrate that many conservationists value social equity, self-determination, and local participation. In light of this, some conservationists might gain fulfilment from working in more inclusive models, where local actors invite them to collaborate rather than intervene.

8.2.6. Linking goal progress, optimism, and psychological distress

Chapter 1 described an overarching conceptual framework linking goal progress satisfaction, situational optimism about conservation, and psychological distress (Figure 1.2). Elements of this wider framework were explored in chapters 4, 5, and 6. In this section, I describe some results from a supplementary structural equation model, using data from 2,306 internet survey respondents (*Appendix: Goal progress, optimism, and distress*). The results of this supplementary analysis are consistent with those hypothesised in Figure 1.2 and are informative when considering interventions that seek to motivate conservationists. For example, some have argued that current environmental discourse focuses on threats rather than solutions, disempowering conservationists (Swaisgood & Sheppard, 2010). In response, movements like *Conservation Optimism* seek to motivate conservationists by demonstrating that their efforts can succeed (Conservation Optimism, 2020). The aforementioned supplementary analysis is consistent with this theory of change; those who feel that progress is being made in the present tend to be more optimistic about meeting future conservation targets. Furthermore, the expectation that goals can be attained may increase motivation to pursue them (Carver et al., 2010; Monzani et al., 2015; Wigfield & Eccles, 2000), as

discussed in chapters 4 and 5. The supplementary analysis also suggests that those with more positive evaluations of conservation trends tend to report lower psychological distress, consistent with literature among other populations (Klug & Maier, 2014).

However, this supplementary analysis was correlative, and there remain many untested questions about the effectiveness of optimism movements. For example, it is unclear if sharing positive conservation stories changes attitudes about future success, although climate-related evidence suggests that examples of action increase beliefs that change is possible (De Meyer, Coren, McCaffrey, & Slean, 2020). Furthermore, there is no evidence that increased optimism translates into greater action by conservationists, as discussed in Chapter 5. Indeed, the effectiveness of positive vs negative framings in generating behavioural changes in other areas, such as public health, is inconclusive and may be context-dependent (Kidd, Bekessy, & Garrard, 2019). More broadly, although conservationists play vital roles, many societal actors shape the state of nature and how it is managed (Sandbrook, 2017). In this context, it is unclear if demotivation is systematic in conservation or a limiting factor in societal transformation towards sustainability. Despite these uncertainties, a substantial number of conservationists choose to engage with optimism movements. For example, ConservationNOW is a network of over 140 conservation organisations employing hundreds of staff across multiple countries, with the shared aim of being “*optimistic but realistic*” (Conservation Optimism, 2022). Nearly 24,000 people, including many conservationists, follow the Earth Optimism movement on Twitter. Consequently, optimism movements appear to play a valuable function – including providing supportive communities – for the many conservationists who engage with them. Future research could explore why and how these movements resonate with many people, shedding light on the experiences and aspirations of conservationists.

A notable result from chapters 4 and 6 is that those dissatisfied with their contributions to conservation tended to report greater psychological distress. One possible explanation for this is that conservationists cope with ecological grief by focusing on “*making a difference*” (Papworth et al., 2018). Those who do not cope in this way may be more vulnerable to ecological grief. Indeed,

evidence from other groups suggests that feelings of powerlessness to prevent environmental loss can be distressing (Hickman, 2020). If this is the case, optimism movements might emphasise how successful outcomes are often the result of sustained work by many people. In doing so, they may help individuals recognise how their efforts contribute to broader societal goals.

Furthermore, there exist multiple awards celebrating the valuable work of a select number of individuals (e.g., the Disney Conservation Fund Heroes, Whitley Awards, and TWAS-Samira Omar Prize). These could be complemented by awards recognising the achievements of conservationists working as teams. Ultimately, to “*create meaningful conservation we need big collaborative teams, not individual heroes*” (Butler, 2021).

8.2.7. Unanswered questions about conservation employment

Chapters 6 and 7 draw heavily on occupational psychology research in other sectors, such as nursing. As discussed in these chapters, the conservation sector lags behind these other fields in both research and practice around working conditions and mental health. Comparisons with other fields also reveal many fundamental questions about employment in conservation. For example, there are an estimated 18,000 conservation professionals in the United Kingdom and 22,020 conservation scientists in the United States of America (BLS, 2022; ONS, 2022). However, similar estimates are not available for many countries, and there is scarce data on other themes like staff turnover or entry into and exit out of the sector. Indeed, there appears to be no widely agreed-upon definition of who a conservationist is and, therefore, of the bounds of the sector.

Furthermore, there is little data on the number of people trained in conservation or how many successfully gain employment in the sector. One survey of nearly 200 conservationists suggested that job-seekers applied for 39 positions each year on average (Conservation Careers, 2022). The team conducting this survey also spoke to several employers, who said they often receive hundreds of applications when advertising some positions (Conservation Careers, 2022). Although I did not find details on the study methods, these results suggest that many job-seekers may struggle to find paid conservation work.

Similarly, there appear to be no data describing patterns of over- or undersupply of qualified candidates across conservation roles. Several studies explore the content of conservation training in higher education and how this matches with the competencies required to work in different positions (Andrade et al., 2014; Elliott, Ryan, & Wyborn, 2018; J. Lucas et al., 2017). For example, Gardner (2021) examined descriptions of undergraduate conservation degrees in the United Kingdom, finding that many tended to be biocentric, poorly preparing graduates to work in interdisciplinary practice. Furthermore, Appleton (2016) compiled a list of competencies (skills, knowledge, and personal qualities) required by protected area practitioners. These include planning and administration, applied protected area management, and general personal competencies valuable for practitioners, including executives, managers, technical staff, and skilled workers. This literature provides an essential foundation for understanding the competencies required in conservation, but does not indicate where there are shortages of adequately qualified personnel. Overall, these uncertainties make it challenging to characterise patterns of employment and capacity within the conservation sector. Such characterisation might guide efforts to ensure the conservation workforce is prepared to meet the challenges of mainstreaming biodiversity. These efforts could include establishing groups to anticipate and work with training providers to address potential skills shortages in the future. For instance, The Conservation and Sustainability Consortium of Academic Institutions (CASCADE) is a partnership of United Kingdom higher education institutions aiming to provide leadership in biodiversity conservation (CASCADE, 2022). One of their primary aims is to develop capacity for interdisciplinary conservation science. CASCADE could be a platform for understanding the numbers of people trained in conservation science at the postgraduate level (and from what backgrounds), in what skills, and their subsequent career paths. CASCADE could then engage with employers to understand and help address their current and anticipated staff needs. Equally, such work might highlight ways to better prepare graduates to act as conservation ambassadors in jobs across sectors, helping mainstream biodiversity. These functions are not limited to higher-education institutions. For instance, the Belize National Ranger Training Academy was established by Ya'axché Conservation Trust with

the aim of enhancing protected areas management in Belize (L. Mcloughlin, personal communication, January 24, 2022). Organisations such as this are well placed to evaluate conservation needs and combine locally relevant expertise with universal standards (e.g., Appleton, 2016) to strengthen capacity within conservation.

Again, lessons can be learnt from other sectors. For example, the National Health Service in England works with higher education institutions and government agencies to fill gaps in their workforce (NHS, 2019). However, it is also worth recognising features of the conservation sector that should be considered when drawing on lessons from other professions. For instance, conservationists work across non-governmental, private sector, educational, and governmental organisations of all sizes (J. Lucas et al., 2017). Conservation work spans a vast range of tasks, with many organisations recruiting staff from diverse professional backgrounds (Cleary, 2018). These and other features limit the scope for comparison with other sectors, highlighting the need for research specific to conservation.

The lack of systematic attention to employment in conservation might, in part, be because of its vocational nature. For instance, Van Dyke and Lamb (2020) state, “*the majority of people active in conservation careers see their work as an expression of ‘vocation,’ not simply ‘occupational interest’*”. This perception is perhaps reinforced by the idea that individuals need to be passionate about nature to protect it effectively (Sandbrook, 2019). Indeed, qualitative results from Chapter 4 suggest that many work in the sector because of their passion for nature. However, this emphasis on conservation as a vocation may have downsides. For instance, many may seek conservation work to fulfil a “*life calling*” rather than a means to earn a living and because there are available jobs (Van Dyke & Lamb, 2020). Consequently, there may be many more aspiring conservationists than paid positions, especially at early-career stages. This imbalance risks driving down terms of employment to the point where, in some cases, those who can afford it work for little or no compensation while those who cannot have to leave the sector (Vercammen et al., 2020). Conservation would no doubt be worse off in the absence of passionate individuals. However, those considering careers in conservation should be aware of the associated costs,

benefits, and risks. To aid this, current conservationists could share their experiences of securing jobs, including how many of their peers did not find permanent positions. Furthermore, in the context of higher education, many conservation degrees prepare students to follow research careers, but most conservation jobs are outside academia (J. Lucas et al., 2017). As such, educators might improve students' employability by designing curricula around the contemporary needs of practitioner organisations (Andrade et al., 2014; Elliott et al., 2018; Gardner, 2021; J. Lucas et al., 2017).

Additionally, chapters 4 and 5 suggest ways in which people's perspectives on progress to personal and collective goals might change over the course of their careers. Results in these chapters suggested that those in our sample who worked in conservation for longer were more satisfied with progress to personal goals but less satisfied and optimistic about progress to collective goals. These chapters discuss plausible explanations for these results. But results across these might indicate how relative sources of distress related to perceived goal progress may change over conservation professionals' careers. My research was cross-sectional, so it is unclear if these observations might be due to period (experiencing specific historical processes or events), age, or career-stage effects. However, the state of nature has been in rapid decline over the recent decades, while there are now unprecedented plans to bend the curve upwards on biodiversity loss (Mace, 2014). So, the experiences of those in conservation during this decline may be very different to those who might witness the global restoration of nature.

Overall, there appears to be a growing number of initiatives and studies looking beyond conservation practices and toward the characteristics and experiences of conservationists themselves (e.g., Appleton et al., 2021; Belecky et al., 2019; Vercammen et al., 2020). Exploring these characteristics and how they influence conservation actions may shed light on new strategies for meeting biodiversity targets. For example, Chapter 6 describes how investing in conservationists' mental health might make organisations more cost-effective. Such processes of self-assessment appear to be relatively routine for established sectors, such as healthcare (e.g., the workforce capacity assessments mentioned above). Similar trends in conservation might indicate

ways in which the field is maturing. This process might help better prepare the conservation sector to reverse the loss of nature over the coming decades. However, this preparation is perhaps complicated by the many trajectories societies could take to meet biodiversity, climate, and sustainable development aspirations. For example, Wyborn et al. (2020) imagine different scenarios for nature and society in 2050. One of these scenarios includes the significant expansion of protected areas, which might entail recruiting and training many more wildlife rangers. Alternatively, following the path towards inclusive conservation might have profound implications for who is employed in the sector and the skills they require. These uncertainties provide all the more reason to explore current and future trends in conservation employment.

8.2.8. Integrating life-course theory

Life-course theory explains how multiple factors shape a person's life from birth to death through an interdisciplinary lens (Hutchison, 2011). These factors include the complex interaction of biological, genetic, psychosocial, and environmental elements over a person's life, which are particularly important during childhood and adolescence (Patel, Saxena, et al., 2018). For example, multiple studies suggest that adverse childhood experiences, including extreme poverty, can severely harm adult mental health (Evans, 2016; T. M. Jones, Nurius, Song, & Fleming, 2018; Nelson, Bhutta, Burke Harris, Danese, & Samara, 2020; Nurius, Green, Logan-Greene, & Borja, 2015). Life-course theory is a powerful approach for explaining how experiences and contextual factors can have cumulative impacts on health over time (Pearlin, Schieman, Fazio, & Meersman, 2005). Many studies that contribute to life-course theory use longitudinal cohort studies. I discuss the potential value of cohort studies for understanding the potential impacts of large scale and long term socio-ecological changes on mental health in Chapter 2.

Cohort studies might play other roles in sustainable development planning. Businesses, governments, and other actors are increasingly adopting the goals “*no net loss*” and “*net gain*” of biodiversity as the result of economic development projects (Bull & Strange, 2018). Recognising that nature contributes to human wellbeing, there have also been calls to ensure that local residents

are “*no worse off*” or actively gain following these projects (Griffiths, Bull, Baker, & Milner-Gulland, 2018; J. P. G. Jones et al., 2019). These wellbeing net gains could be made by avoiding, minimising, remediating, and offsetting lost contributions from nature to affected groups (J. P. G. Jones et al., 2019).

However, there exist multiple challenges with this approach. For example, people’s goals and aspirations are shaped by their socio-ecological context and can change due to external interventions (Milner-Gulland et al., 2014). For example, there was variability in preferences for offsets – linked to two hydropower developments – between Ugandan communities, with some more affected by the loss of access to spiritual sites than others (Griffiths et al., 2019).

Consequently, net gain interventions need to monitor and account for how people’s aspirations change over time, including in response to development projects (Milner-Gulland et al., 2014).

Another challenge is understanding how long wellbeing net gain activities should last (J. P. G. Jones et al., 2019). A potential complicating factor is that the impacts of life events on subjective wellbeing may diminish over time (although significant life events can have lasting effects) (Diener et al., 1999; R. E. Lucas, 2007). Moreover, “*shifting baselines*” mean that people may not accurately recall past conditions of nature (Papworth, Rist, Coad, & Milner-Gulland, 2009) or its contributions to people. Consequently, perceived losses of nature’s contributions may attenuate over time, suggesting that developers may not be required to fund wellbeing net gain activities in perpetuity. Cohort studies could help understand over what timescale the impacts of lost contributions from nature are felt, and thus how long wellbeing net gains activities should be sustained.

Life-course theory and cohort studies could also play valuable roles in conservation project monitoring and evaluation. Many conservation projects have the dual role of safeguarding nature while improving human wellbeing (Mace, 2014). However, this monitoring and evaluation often examines outcomes over short-term project time scales. A life-course approach could be useful in conservation monitoring and evaluation in several ways. First, the impacts of conservation

interventions might be felt most keenly by certain age groups. For example, individuals are at the greatest risk of poor mental health during adolescence and early adulthood, in part because of greater sensitivity to stressors during developmental stages (Jurewicz, 2015; Smith & Pollak, 2020). However, these groups are often not prioritised within conservation interventions, although with some exceptions (e.g., Warrior Watch, a participatory monitoring and awareness-raising programme that engages young men in lion conservation in Kenya (Ewaso Lions, 2022)). Accounting for these age-differentiated impacts can provide a fuller account of the effects of conservation interventions.

Furthermore, conservation interventions might have cumulative and long-lasting positive or negative impacts on mental health and wellbeing. For example, violent conservation practices may be traumatic for victims (Agrawal & Redford, 2009; Dan Brockington & James Igoe, 2006). Traumatic and adverse events can have long-term impacts on mental health (Smith & Pollak, 2020). Therefore, past actions by conservation organisations may have lasting impacts on people today, even if current practices have changed. For example, the international conservation organisation WWF was involved in alleged human rights abuses in Africa and Southeast Asia (WWF, 2020a). While WWF reportedly changed its management practices in response (WWF, 2020b), survivors may still be experiencing the psychological impacts of abuse. This lasting harm might add credence to the argument that those harmed by conservation are entitled to compensation and reparations (Büscher & Fletcher, 2019). Conversely, well-designed conservation interventions may enhance residents' quality of life. Consequently, the mental health benefits of interventions – such as through sustainable use projects that help reduce child poverty – may have a positive lasting legacy beyond project timeframes.

8.3. COVID-19 impact statement

Suspended fieldwork. Fieldwork in Uganda that contributed data to two of my chapters had to be suspended in March 2020. This fieldwork was supposed to be completed in June 2020. However, the lockdown in the United Kingdom and Uganda meant I had to stop data collection and return to

the United Kingdom. The next season when I can conduct data collection is March-June 2021. It was uncertain if I would be able to complete this work since it was not known how long the pandemic would last (and because of funding uncertainties described below). Therefore, at this time, I shifted the focus on my DPhil towards the data I had collected through the internet survey. As a result, this work became a more significant part of my DPhil, and I dropped plans to conduct focus group data collection to validate the results from chapters 2 and 3.

Lost funding. As well as suspending fieldwork, I was expecting to receive between £2,000 and £4,000 from the NERC DTP Extraordinary Funding fund. This was the primary source of funds for the fieldwork discussed above, which contributes to two chapters. This funding was diverted to pay for extensions for other NERC DTP students. Furthermore, I had to return to the United Kingdom after two weeks of preparatory fieldwork – this incurred a cost of around £1,500 (for flights, paying the wages of four RA staff, and other fieldwork related costs) that could not be recouped. Consequently, as well as having to suspend the fieldwork, I have also had to write additional grant applications (e.g., Royal Society for Tropical Medicine and Hygiene Small Grants). This meant it was uncertain if I would be able to complete this research (so had to shift the focus of my DPhil in anticipation), and I had to spend significant time (six weeks) writing additional grants.

Disruption of Chapter 7 data collection. I laid the foundation to work with a fourth ‘*deep dive*’ partner in Chapter 7, based in East Africa. Their participation would have increased the sample size by about 90 respondents. However, the organisation withdrew its participation because of the disruption caused by the COVID-19 pandemic. Furthermore, one of the organisations declined the use of in-person surveys because of the risks of transmission. As a result, the sample size in Chapter 7 was smaller than expected, and I could not use consistent methods for all organisations.

Unable to access facilities. Being unable to access suitable working facilities, such as my office or library, has reduced my productivity. Consequently, I estimate I have lost approximately two weeks because of having to work in unsuitable environments. This includes, for instance, living in a house with limited and intermittent internet access.

8.4. Conclusion

The CBD holds the vision of people “*living in harmony with nature by 2050*” (CBD, 2010b).

Underpinning this vision is the recognition that people have profoundly changed the non-human world, but our collective wellbeing depends on the state of nature in myriad ways. Yet, despite decades of research, understanding of the complex linkages between nature and human wellbeing remains incomplete.

My DPhil shows how two global priorities – protecting global biodiversity and alleviating the substantial burden of mental illness – may be connected through important but poorly understood mechanisms. In doing so, my research makes several overarching contributions. First, my DPhil suggests that nature’s contributions may influence social determinants of mental illness. Yet, my research only scratches the surface of the myriad ways that interacting with nature may affect the social and economic context of people’s lives in ways that affect their mental health. Future research could examine many other relationships between nature’s contributions and social determinants of mental health. Second, I illustrate how policy and management may mediate relationships between nature and people and perhaps mental health. Finally, my DPhil suggests feedback processes between mental health and the state of nature. Focusing on a crucial set of actors, I explore how workplace challenges and personal vulnerabilities may affect conservationists’ mental health and perhaps their collective abilities to recover nature. My DPhil also highlights questions for future research. For example, how to effectively manage landscapes to promote mental health alongside other societal objectives. Or if and how supporting conservationists’ workplace wellbeing might help deliver better outcomes for nature and people. Such questions could be explored using cohort or experimental methods to provide robust causal evidence. Overall, my DPhil contributes to a better understanding of the linkages between nature and wellbeing, thereby offering evidence to help societies effectively steer towards the vision of living in harmony with nature.

9. Bibliography

- Aboa, B. (2011). Effort-reward imbalance at work and psychological distress: A validation study of post-myocardial infarction patients. *Psychosomatic Medicine*, 73(5), 448-455. doi:10.1097/PSY.0b013e31829d1e0a
- Adem Esmail, B., & Geneletti, D. (2018). Multi-criteria decision analysis for nature conservation: A review of 20 years of applications. *Methods in Ecology and Evolution*, 9(1), 42-53. doi:<https://doi.org/10.1111/2041-210X.12899>
- Ager, A., Pasha, E., Yu, G., Duke, T., Eriksson, C., & Cardozo, B. L. (2012). Stress, mental health, and burnout in national humanitarian aid workers in Gulu, northern Uganda. *Journal of Traumatic Stress*, 25(6), 713-720. doi:10.1002/jts.21764
- Agrawal, A., & Redford, K. (2009). Conservation and displacement: An overview. *Conservation and Society*, 7(1), 1-10. doi:10.4103/0972-4923.54790
- Albrecht, G. A. (2022). Negating solastalgia: An emotional revolution from the Anthropocene to the Symbiocene *American Imago*, 77(1), 9-30. doi:10.1353/aim.2020.0001
- Allen, J., Balfour, R., Bell, R., & Marmot, M. (2014). Social determinants of mental health. *International Review of Psychiatry*, 26(4), 392-407. doi:10.3109/09540261.2014.928270
- Altman, D. G., & Royston, P. (2006). The cost of dichotomising continuous variables. *BMJ*, 332(7549), 1080-1080. doi:10.1136/bmj.332.7549.1080
- American Psychiatric Association (APA). (2013). *Diagnostic and statistical manual of mental disorders (DSM-5)*. Washington, DC, United States & London, United Kingdom: American Psychiatric Publishing.
- Andrade, K., Corbin, C., Diver, S., Eitzel, M. V., Williamson, J., Brashares, J., & Fortmann, L. (2014). Finding your way in the interdisciplinary forest: Notes on educating future conservation practitioners. *Biodiversity and Conservation*, 23(14), 3405-3423. doi:10.1007/s10531-014-0818-z
- Appleton, M. R. (2016). *A global register of competences for protected area practitioners*. Retrieved from Gland, Switzerland: https://www.iucn.org/sites/dev/files/content/documents/global_register_of_competences_for_pa_practitioners_e_version_0.pdf
- Appleton, M. R., Barborak, J. R., Daltry, J. C., Long, B., O'Connell, M., Owen, N. R., . . . Valencia, L. M. (2021). How should conservation be professionalized? *Oryx*, 1-10. doi:10.1017/S0030605321000594
- Arnoux-Nicolas, C., Sovet, L., Lhotellier, L., Di Fabio, A., & Bernaud, J.-L. (2016). Perceived work conditions and turnover intentions: The mediating role of meaning of work. *Frontiers in Psychology*, 7, 704. doi:10.3389/fpsyg.2016.00704
- Austin, J. T., & Vancouver, J. B. (1996). Goal constructs in psychology: Structure, process, and content. *Psychological Bulletin*, 120(3), 338-375. doi:10.1037/0033-2909.120.3.338
- Australian Government. (2022). Wellbeing: Health and subjective wellbeing. Retrieved from <https://www.aihw.gov.au/reports-data/indicators/australias-welfare-indicators/healthandsubjectivewellbeing/health-and-subjective-wellbeing>
- Avey, J. B., Reichard, R. J., Luthans, F., & Mhatre, K. H. (2011). Meta-analysis of the impact of positive psychological capital on employee attitudes, behaviors, and performance. *Human Resource Development Quarterly*, 22, 127-152. doi:<https://doi.org/10.1002/hrdq.20070>
- Azur, M. J., Stuart, E. A., Frangakis, C., & Leaf, P. J. (2011). Multiple imputation by chained equations: What is it and how does it work? *International Journal of Methods in Psychiatric Research*, 20(1), 40-49. doi:10.1002/mpr.329
- Babweteera, F., Christopher, M., Asiimwe, C., Eric, O., Muhanguzi, G., Okimat, J. P., & Robinson, S. (2018). Budongo forest: A paradigm shift in conservation? In C. Sandbrook, C. J. Cavanagh, & D. M. Tumusiime (Eds.), *Conservation and Development in Uganda* (pp. 104-122): Taylor and Francis Inc.
- Babweteera, F., Sheil, D., Reynolds, V., Plumptre, A. J., Zuberbuhler, K., Hill, C. M., . . . Tweheyo, M. (2012). Environmental and anthropogenic changes in and around Budongo

- Forest Reserve. In A. J. Plumptre (Ed.), *The Ecological Impact of Long-term Changes in Africa's Rift Valley* (1 ed., pp. 31-53). Hauppauge, United States: Nova Science Publishing Inc.
- Backe, E. L., Bosire, E. N., Kim, A. W., & Mendenhall, E. (2021). "Thinking too much": A systematic review of the idiom of distress in Sub-Saharan Africa. *Culture, Medicine, and Psychiatry*, 45(4), 655-682. doi:10.1007/s11013-020-09697-z
- Ballard, T., Kepple, A., & Cafiero, C. (2013). *The Food Insecurity Experience Scale: Development of a global standard for monitoring hunger worldwide*. Retrieved from Rome, Italy: http://www.fao.org/fileadmin/templates/ess/voh/FIES_Technical_Paper_v1.1.pdf
- Barbier, E. B., Burgess, J. C., & Dean, T. J. (2018). How to pay for saving biodiversity. *Science*, 360(6388), 486-488. doi:10.1126/science.aar3454
- Barnes, M. R., Donahue, M. L., Keeler, B. L., Shorb, C. M., Mohtadi, T. Z., & Shelby, L. J. (2019). Characterizing nature and participant experience in studies of nature exposure for positive mental health: An integrative review. *Frontiers in Psychology*, 9, 2617.
- Barrett, D., & Noble, H. (2019). What are cohort studies? *Evidence Based Nursing*, 22(4), 95-96. doi:10.1136/ebnurs-2019-103183
- Barton, J., & Pretty, J. (2010). What is the best dose of nature and green exercise for improving mental health? A multi-study analysis. *Environmental Science & Technology*, 44(10), 3947-3955. doi:10.1021/es903183r
- Barua, M., Bhagwat, S. A. A., & Jadhav, S. (2013). The hidden dimensions of human-wildlife conflict: Health impacts, opportunity and transaction costs. *Biological Conservation*, 157, 309-316. doi:10.1016/j.biocon.2012.07.014
- Bastianello, M. R., Pacico, J. C., & Hutz, C. S. (2014). Optimism, self-esteem and personality: adaptation and validation of the Brazilian version of the Revised Life Orientation Test (LOT-R). *Psico-USF*, 19, 523-531. doi:<http://dx.doi.org/10.1590/1413-82712014019003014>
- Beck, J. M., Elliott, K. C., Booher, C. R., Renn, K. A., & Montgomery, R. A. (2021). The application of reflexivity for conservation science. *Biological Conservation*, 262, 109322. doi:<https://doi.org/10.1016/j.biocon.2021.109322>
- Belbasis, L., & Bellou, V. (2018). Introduction to epidemiological studies. In E. Evangelou (Ed.), *Genetic Epidemiology: Methods and Protocols* (pp. 1-6). New York, United States: Springer New York.
- Belecky, M., Singh, R., & Moreto, W. (2019). *Life on the frontline 2019: A global survey of the working conditions of rangers*. Retrieved from Gland, Switzerland: https://files.worldwildlife.org/wwfcmprod/files/Publication/file/k36blpy2c_wwf_rangers_survey_report_2019.pdf?_ga=2.35115108.473405458.1642848442-387985832.1642848441
- Belhekar, V., Paranjpye, P., Bhatkhande, A., & Chavan, R. (2020). Guarding the guardians: Understanding the psychological well-being of forest guards in Indian tiger reserves. *Biodiversity*, 21(2), 83-89. doi:10.1080/14888386.2020.1809521
- Bellemare, M. F., & Bloem, J. R. (2018). Does contract farming improve welfare? A review. *World Development*, 112, 259-271. doi:<https://doi.org/10.1016/j.worlddev.2018.08.018>
- Bennett, N. J. (2016). Using perceptions as evidence to improve conservation and environmental management. *Conservation Biology*, 30(3), 582-592. doi:<https://doi.org/10.1111/cobi.12681>
- Bennett, N. J., Di Franco, A., Calò, A., Nethery, E., Niccolini, F., Milazzo, M., & Guidetti, P. (2019). Local support for conservation is associated with perceptions of good governance, social impacts, and ecological effectiveness. *Conservation Letters*, 12(4), e12640. doi:<https://doi.org/10.1111/conl.12640>
- Bennett, N. J., Roth, R., Klain, S. C., Chan, K., Christie, P., Clark, D. A., . . . Wyborn, C. (2017). Conservation social science: Understanding and integrating human dimensions to improve conservation. *Biological Conservation*, 205, 93-108. doi:<https://doi.org/10.1016/j.biocon.2016.10.006>

- Bentley, T. A., Catley, B., Cooper-Thomas, H., Gardner, D., O'Driscoll, M. P., Dale, A., & Trenberth, L. (2012). Perceptions of workplace bullying in the New Zealand travel industry: Prevalence and management strategies. *Tourism Management*, 33(2), 351-360. doi:<https://doi.org/10.1016/j.tourman.2011.04.004>
- Berbés-Blázquez, M., González, J. A., & Pascual, U. (2016). Towards an ecosystem services approach that addresses social power relations. *Current Opinion in Environmental Sustainability*, 19, 134-143. doi:<https://doi.org/10.1016/j.cosust.2016.02.003>
- Berg, J. M., Grant, A. M., & Johnson, V. (2010). When callings are calling: Crafting work and leisure in pursuit of unanswered occupational callings. *Organization Science*, 21(5), 973-994. doi:10.1287/orsc.1090.0497
- Berto, R. (2014). The role of nature in coping with psycho-physiological stress: A literature review on restorativeness. *Behavioral Sciences*, 4(4), 394-409. doi:10.3390/bs4040394
- Bhaskaran, K., & Smeeth, L. (2014). What is the difference between missing completely at random and missing at random? *International journal of epidemiology*, 43(4), 1336-1339. doi:10.1093/ije/dyu080
- Binagwaho, A., Allotey, P., Sangano, E., Ekström, A. M., & Martin, K. (2021). A call to action to reform academic global health partnerships. *BMJ*, 375, n2658. doi:10.1136/bmj.n2658
- Blaikie, P. (1989). Environment and access to resources in Africa. *Africa*, 59(1), 18-40. doi:10.2307/1160761
- Boden, J. M., & Fergusson, D. M. (2011). Alcohol and depression. *Addiction*, 106(5), 906-914. doi:10.1111/j.1360-0443.2010.03351.x
- Bolam, F. C., Mair, L., Angelico, M., Brooks, T. M., Burgman, M., Hermes, C., . . . Butchart, S. H. M. (2020). How many bird and mammal extinctions has recent conservation action prevented? *Conservation Letters*, 14, e12762. doi:<https://doi.org/10.1111/conl.12762>
- Bolier, L., Haverman, M., Westerhof, G. J., Riper, H., Smit, F., & Bohlmeijer, E. (2013). Positive psychology interventions: A meta-analysis of randomized controlled studies. *BMC Public Health*, 13(1). doi:10.1186/1471-2458-13-119
- Bosdriesz, J. R., Stel, V. S., van Diepen, M., Meuleman, Y., Dekker, F. W., Zoccali, C., & Jager, K. J. (2020). Evidence-based medicine - When observational studies are better than randomized controlled trials. *Nephrology (Carlton, Vic.)*, 25(10), 737-743. doi:10.1111/nep.13742
- Bougie, E., Arim, R. G., Kohen, D. E., & Findlay, L. C. (2016). Validation of the 10-item Kessler Psychological Distress Scale (K10) in the 2012 Aboriginal Peoples Survey. *Health Reports*, 27(1), 3-10.
- Boum Ii, Y., Burns, B. F., Siedner, M., Mburu, Y., Bukusi, E., & Haberer, J. E. (2018). Advancing equitable global health research partnerships in Africa. *BMJ Global Health*, 3(4), e000868. doi:10.1136/bmjgh-2018-000868
- Bove, R., & Vaggia, C. (2009). Polygyny and women's health in sub-Saharan Africa. *Social Science & Medicine*, 68(1), 21-29. doi:<https://doi.org/10.1016/j.socscimed.2008.09.045>
- Bowling, A. (2005). Just one question: If one question works, why ask several? *Journal of Epidemiology and Community Health*, 59(5), 342-345. doi:10.1136/jech.2004.021204
- Boyce, P., Bhattacharyya, J., & Linklater, W. (2021). The need for formal reflexivity in conservation science. *Conservation Biology*, 1-9. doi:10.1111/cobi.13840
- Bratman, G. N., Anderson, C. B., Berman, M. G., Cochran, B., de Vries, S., Flanders, J., . . . Daily, G. C. (2019). Nature and mental health: An ecosystem service perspective. *Science Advances*, 5(7), eaax0903. doi:10.1126/sciadv.aax0903
- Bratman, G. N., Daily, G. C., Levy, B. J., & Gross, J. J. (2015). The benefits of nature experience: Improved affect and cognition. *Landscape and Urban Planning*, 138, 41-50. doi:10.1016/j.landurbplan.2015.02.005
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101. doi:10.1191/1478088706qp063oa
- Bridger, R. S., Dew, A., Brasher, K., Munnoch, K., & Kilminster, S. (2009). Chronic and acute psychological strain in naval personnel. *Occupational Medicine*, 59(7), 454-458. doi:10.1093/occmed/kqp104

- Brockington, D., & Igoe, J. (2006). Eviction for conservation: A global overview. *Conservation and Society*, 4(3), 424-470.
- Brockington, D., & Igoe, J. (2006). Eviction for conservation: A global overview. *Conservation and Society*, 4(3), 424--470. doi:10.1126/science.1098410
- Bronkhorst, B., Tummers, L., Steijn, B., & Vijverberg, D. (2015). Organizational climate and employee mental health outcomes: A systematic review of studies in health care organizations. *Health Care Management Review*, 40(3), 254-271. doi:10.1097/HMR.000000000000026
- Brooks, J., Waylen, K. A., & Mulder, M. B. (2013). Assessing community-based conservation projects: A systematic review and multilevel analysis of attitudinal, behavioral, ecological, and economic outcomes. *Environmental Evidence*, 2(1), 2. doi:10.1186/2047-2382-2-2
- Brooks, J. S., Waylen, K. A., & Borgerhoff Mulder, M. (2012). How national context, project design, and local community characteristics influence success in community-based conservation projects. *Proceedings of the National Academy of Sciences of the United States of America*, 109(52), 21265-21270. doi:10.1073/pnas.1207141110
- Brownson, R. C., Fielding, J. E., & Maylahn, C. M. (2009). Evidence-based public health: A fundamental concept for public health practice. *Annual Review of Public Health*, 30(1), 175-201. doi:10.1146/annurev.publhealth.031308.100134
- Bruton, A., Conway, J. H., & Holgate, S. T. (2000). Reliability: What is it, and how is it measured? *Physiotherapy*, 86(2), 94-99. doi:10.1016/S0031-9406(05)61211-4
- Bryant, L., & Garnham, B. (2013). Beyond discourses of drought: The micro-politics of the wine industry and farmer distress. *Journal of Rural Studies*, 32, 1-9. doi:<https://doi.org/10.1016/j.jrurstud.2013.03.002>
- Bryce, R., Irvine, K. N., Church, A., Fish, R., Ranger, S., & Kenter, J. O. (2016). Subjective well-being indicators for large-scale assessment of cultural ecosystem services. *Ecosystem Services*, 21, 258-269. doi:<https://doi.org/10.1016/j.ecoser.2016.07.015>
- Buckley, R., Brough, P., Hague, L., Chauvenet, A., Fleming, C., Roche, E., . . . Harris, N. (2019). Economic value of protected areas via visitor mental health. *Nature Communications*, 10(1), 5005. doi:10.1038/s41467-019-12631-6
- Budongo Conservation Field Station. (2022). About Budongo. Retrieved from <http://www.budongo.org/about/>
- Bull, J. W., & Strange, N. (2018). The global extent of biodiversity offset implementation under no net loss policies. *Nature Sustainability*, 1(12), 790-798. doi:10.1038/s41893-018-0176-z
- Bureau of Labor Statistics (BLS). (2022). Occupational employment and wages, May 2020 - 19-1031 conservation scientists. Retrieved from <https://www.bls.gov/oes/current/oes191031.htm>
- Burgman, M. A., McBride, M., Ashton, R., Speirs-Bridge, A., Flander, L., Wintle, B., . . . Twardy, C. (2011). Expert status and performance. *PLoS One*, 6(7), e22998. doi:10.1371/journal.pone.0022998
- Bürkner, P. (2017). brms: An R package for Bayesian multilevel models using Stan. *Journal of Statistical Software*, 80(1), 1-28. doi:10.18637/jss.v080.i01
- Burnette, J. L., Knouse, L. E., Vavra, D. T., O'Boyle, E., & Brooks, M. A. (2020). Growth mindsets and psychological distress: A meta-analysis. *Clinical Psychology Review*, 77, 101816. doi:<https://doi.org/10.1016/j.cpr.2020.101816>
- Burns, P. B., Rohrich, R. J., & Chung, K. C. (2011). The levels of evidence and their role in evidence-based medicine. *Plastic and reconstructive surgery*, 128(1), 305-310. doi:10.1097/PRS.0b013e318219c171
- Burton, W. N., Schultz, A. B., Chen, C. Y., & Edington, D. W. (2008). The association of worker productivity and mental health: A review of the literature. *International Journal of Workplace Health Management*, 1(2), 78-94. doi:10.1108/17538350810893883
- Büscher, B., & Fletcher, R. (2019). Towards convivial conservation. *Conservation & Society*, 17(3), 283-296. doi:10.4103/cs.cs_19_75
- Büscher, B., & Fletcher, R. (2020). *The Conservation Revolution: Radical Ideas for Saving Nature Beyond the Anthropocene*. New York, United States: Verso.

- Butler, R. A. (2021). Reckoning with elitism and racism in conservation: Q&A with Colleen Begg. Retrieved from <https://news.mongabay.com/2021/06/reckoning-with-elitism-and-racism-in-conservation-qa-with-colleen-begg/>
- Cambridge Dictionary. (2021). Reflexivity. Retrieved from <https://dictionary.cambridge.org/dictionary/english/reflexivity>
- Campos-Arceiz, A., Koh, L. P., & Primack, R. B. (2013). Are conservation biologists working too hard? *Biological Conservation*, *166*, 186-190. doi:10.1016/j.biocon.2013.06.029
- Cano-García, F. J., Sanduvete-Chaves, S., Chacón-Moscoso, S., Rodríguez-Franco, L., García-Martínez, J., Antuña-Bellerín, M. A., & Pérez-Gil, J. A. (2015). Factor structure of the Spanish version of the Life Orientation Test-Revised (LOT-R): Testing several models. *International Journal of Clinical and Health Psychology*, *15*, 139-148. doi:<http://dx.doi.org/10.1016/j.ijchp.2015.01.003>
- Capacity for Conservation. (2022). Self-led organisational development. Retrieved from <https://capacityforconservation.org/>
- Cardinale, B. J., Duffy, J. E., Gonzalez, A., Hooper, D. U., Perrings, C., Venail, P., . . . Naeem, S. (2012). Biodiversity loss and its impact on humanity. *Nature*, *486*(7401), 59-67. doi:10.1038/nature11148
- Carpenter, B., Gelman, A., Hoffman, M. D., Lee, D., Goodrich, B., Betancourt, M., . . . Riddell, A. (2017). Stan: A probabilistic programming language. *Journal of Statistical Software*, *76*(1), 1-32. doi:10.18637/jss.v076.i01
- Carr, A., Cullen, K., Keeney, C., Canning, C., Mooney, O., Chinseallaigh, E., & O'Dowd, A. (2021). Effectiveness of positive psychology interventions: A systematic review and meta-analysis. *The Journal of Positive Psychology*, *16*(6), 749-769. doi:10.1080/17439760.2020.1818807
- Carver, C. S., & Scheier, M. F. (1998a). Affect: Issues and comparisons. In C. S. Carver & M. F. Scheier (Eds.), *On the Self-Regulation of Behavior* (pp. 148-170). Cambridge, United Kingdom: Cambridge University Press.
- Carver, C. S., & Scheier, M. F. (1998b). Expectancies and disengagement. In C. S. Carver & M. F. Scheier (Eds.), *On the Self-Regulation of Behavior* (pp. 171-189). Cambridge, United Kingdom: Cambridge University Press.
- Carver, C. S., & Scheier, M. F. (2014). Dispositional optimism. *Trends in Cognitive Sciences*, *18*(6), 293-299. doi:10.1016/j.tics.2014.02.003
- Carver, C. S., Scheier, M. F., & Segerstrom, S. C. (2010). Optimism. *Clinical Psychology Review*, *30*(7), 879-889. doi:10.1016/j.cpr.2010.01.006
- Catalano, A. S., Redford, K., Margoluis, R., & Knight, A. T. (2018). Black swans, cognition, and the power of learning from failure. *Conservation Biology*, *32*, 584-596. doi:<https://doi.org/10.1111/cobi.13045>
- Ceballos, G., Ehrlich, P. R., Barnosky, A. D., García, A., Pringle, R. M., & Palmer, T. M. (2015). Accelerated modern human-induced species losses: Entering the sixth mass extinction. *Science Advances*, *1*(5), e1400253. doi:10.1126/sciadv.1400253
- Chachamovich, E., Fleck, M. P., & Power, M. (2009). Literacy affected ability to adequately discriminate among categories in multipoint Likert Scales. *Journal of Clinical Epidemiology*, *62*(1), 37-46. doi:10.1016/j.jclinepi.2008.03.002
- Chalmers, R. P. (2012). mirt: A multidimensional Item Response Theory package for the R environment. *Journal of Statistical Software*, *48*, 1-29. doi:10.18637/jss.v048.i06
- Chaudhury, A., & Colla, S. (2021). Next steps in dismantling discrimination: Lessons from ecology and conservation science. *Conservation Letters*, *14*(2), e12774. doi:10.1111/conl.12774
- Chiesi, F., Galli, S., Primi, C., Innocenti Borgi, P., & Bonacchi, A. (2013). The accuracy of the Life Orientation Test-Revised (LOT-R) in measuring dispositional optimism: Evidence from Item Response Theory analyses. *Journal of Personality Assessment*, *95*(5), 523-529. doi:10.1080/00223891.2013.781029

- Chowdhury, A. N., Mondal, R., Brahma, A., & Biswas, M. K. (2008). Eco-psychiatry and environmental conservation: Study from sundarban delta, India. *Environmental Health Insights*, 2(1), 61-76. doi:<https://doi.org/10.1177/EHI.S935>
- Chowdhury, A. N., Mondal, R., Brahma, A., & Biswas, M. K. (2016). Ecopsychosocial aspects of human-tiger conflict: An ethnographic study of tiger widows of Sundarban delta, India. *Environmental Health Insights*, 10, 1-29. doi:10.4137/EHI.S24899
- Cianconi, P., Betrò, S., & Janiri, L. (2020). The impact of climate change on mental health: A systematic descriptive review. *Frontiers in Psychiatry*, 11, 74. doi:10.3389/fpsyt.2020.00074
- Cinner, J. E., Folke, C., Daw, T., & Hicks, C. C. (2011). Responding to change: Using scenarios to understand how socioeconomic factors may influence amplifying or dampening exploitation feedbacks among Tanzanian fishers. *Global Environmental Change*, 21(1), 7-12. doi:<https://doi.org/10.1016/j.gloenvcha.2010.09.001>
- Clark, L. A., Cuthbert, B., Lewis-Fernández, R., Narrow, W. E., & Reed, G. M. (2017). Three approaches to understanding and classifying mental disorder: ICD-11, DSM-5, and the National Institute of Mental Health's Research Domain Criteria (RDoC). *Psychological Science in the Public Interest*, 18(2), 72-145. doi:10.1177/1529100617727266
- Clark, M., Hill, J., & Tilman, D. (2018). The diet, health, and environment trilemma. *Annual Review of Environment and Resources*, 43(1), 109-134. doi:10.1146/annurev-environ-102017-025957
- Clayton, S., Manning, C. M., Krygsman, K., & Speiser, M. (2017). *Mental health and our changing climate: Impacts, implications, and guidance*. Retrieved from United States: <https://www.apa.org/news/press/releases/2017/03/mental-health-climate.pdf>
- Cleary, D. (2018). What are the grounds needed for dialogue? In P. B. Larsen & D. Brockington (Eds.), *The Anthropology of Conservation NGOs: Rethinking the Boundaries* (pp. 251-257). London, United Kingdom: Palgrave Macmillan.
- Clements, T., Neang, M., Milner-Gulland, E. J., & Travers, H. (2020). *Measuring impacts of conservation interventions on human well-being and the environment in Northern Cambodia*. Retrieved from <https://doi.org/10.23846/DPW1IE106>
- Coates, J. (2013). Build it back better: Deconstructing food security for improved measurement and action. *Global Food Security*, 2(3), 188-194. doi:10.1016/j.gfs.2013.05.002
- Colding, J., & Barthel, S. (2019). Exploring the social-ecological systems discourse 20 years later. *Ecology and Society*, 24(1), 2. doi:10.5751/es-10598-240102
- Colding, J., & Folke, C. (2001). Social taboos: "Invisible" systems of local resource management and biological conservation. *Ecological Applications*, 11(2), 584-600. doi:[https://doi.org/10.1890/1051-0761\(2001\)011\[0584:STISOL\]2.0.CO;2](https://doi.org/10.1890/1051-0761(2001)011[0584:STISOL]2.0.CO;2)
- Collins, P. Y., Patel, V., Joestl, S. S., March, D., Insel, T. R., Daar, A. S., . . . Walport, M. (2011). Grand challenges in global mental health. *Nature*, 475(7354), 27-30. doi:10.1038/475027a
- Collins, R. M., Spake, R., Brown, K. A., Ogutu, B. O., Smith, D., & Eigenbrod, F. (2020). A systematic map of research exploring the effect of greenspace on mental health. *Landscape and Urban Planning*, 201, 103823. doi:<https://doi.org/10.1016/j.landurbplan.2020.103823>
- Conservation and Sustainability Consortium of Academic Institutions (CASCADE). (2022). Conservation and Sustainability Consortium of Academic Institutions. Retrieved from <https://cascade.ac.uk/>
- Conservation Careers. (2022). Conservation job applications: Key stats. Retrieved from <https://www.conservation-careers.com/conservation-jobs-careers-advice/conservation-job-applications-key-stats/>
- Conservation Optimism. (2020). Conservation optimism theory of change. Retrieved from <https://conservationoptimism.org/wp-content/uploads/2020/04/ConservationOptimismTOC.pdf>
- Conservation Optimism. (2022). ConservationNOW. Retrieved from <https://conservationoptimism.org/conservationnow/>
- Convention on Biological Diversity (CBD). (2010a). *Global Biodiversity Outlook 3*. Retrieved from Montreal, Canada: <https://www.cbd.int/gbo/gbo5/publication/gbo-5-en.pdf>

- Convention on Biological Diversity (CBD). (2010b). *The Strategic Plan for Biodiversity 2011-2020 and the Aichi Biodiversity Targets COP 10 decision X/2*. Retrieved from Nagoya, Japan: <https://www.cbd.int/decision/cop/?id=12268>
- Convention on Biological Diversity (CBD). (2020a). *Global Biodiversity Outlook 5*. Retrieved from Montreal, Canada: <https://www.cbd.int/gbo/gbo5/publication/gbo-5-en.pdf>
- Convention on Biological Diversity (CBD). (2020b). *Zero draft of the post-2020 global biodiversity framework*. Retrieved from Montreal, Canada: <https://www.cbd.int/doc/c/efb0/1f84/a892b98d2982a829962b6371/wg2020-02-03-en.pdf>
- Convention on Biological Diversity (CBD). (2021). *First draft of the post-2020 global biodiversity framework*. Retrieved from Montreal, Canada: <https://www.cbd.int/doc/c/abb5/591f/2e46096d3f0330b08ce87a45/wg2020-03-03-en.pdf>
- Convention on Biological Diversity (CBD). (2022). List of parties. Retrieved from <https://www.cbd.int/information/parties.shtml>
- Convention on Biological Diversity Subsidiary Body on Scientific, Technical and Technological Advice. (2021). *Biodiversity and health*. Retrieved from Montreal, Canada: <https://www.cbd.int/doc/c/76f9/1b75/42e360ab3ae6e53d0762c449/sbstta-24-09-en.pdf>
- Conversano, C., Rotondo, A., Lensi, E., Vista, O. D., Arpone, F., & Reda, M. A. (2010). Optimism and its impact on mental and physical well-being. *Clinical Practice & Epidemiology in Mental Health*, 6(1), 25-29. doi:10.2174/1745017901006010025
- Cook, P. A., Howarth, M., & Wheeler, C. P. (2019). Biodiversity and health in the face of climate change: Implications for public health. In M. R. Marselle, J. Stadler, H. Korn, K. N. Irvine, & A. Bonn (Eds.), *Biodiversity and Health in the Face of Climate Change* (pp. 251-281). Cham, Switzerland: Springer International Publishing.
- Coombs, R. H. (1991). Marital status and personal well-being: A literature review. *Family Relations*, 40(1), 97-102. doi:10.2307/585665
- Corbin, J., & Strauss, A. (2015). *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory* (J. Corbin & A. Strauss Eds. 4 ed.). Thousand Oaks, United States: SAGE Publications.
- Cork, C., Kaiser, B. N., & White, R. G. (2019). The integration of idioms of distress into mental health assessments and interventions: A systematic review. *Global Mental Health*, 6(e7), 1-32. doi:10.1017/gmh.2019.5
- Cotton, P., & Hart, P. M. (2003). Occupational wellbeing and performance: A review of organisational health research. *Australian Psychologist*, 38(2), 118-127. doi:10.1080/00050060310001707117
- Cox, D. T. C., Shanahan, D. F., Hudson, H. L., Plummer, K. E., Siriwardena, G. M., Fuller, R. A., . . . Gaston, K. J. (2017). Doses of neighborhood nature: The benefits for mental health of living with nature. *Bioscience*, 67(2), 147-155. doi:10.1093/biosci/biw173
- Cox, T., Taris, T. W., & Nielsen, K. (2010). Organizational interventions: Issues and challenges. *Work & Stress*, 24(3), 217-218. doi:10.1080/02678373.2010.519496
- Crawford, C., Gregg, P., Macmillan, L., Vignoles, A., & Wyness, G. (2016). Higher education, career opportunities, and intergenerational inequality. *Oxford Review of Economic Policy*, 32(4), 553-575. doi:10.1093/oxrep/grw030
- Crisp, L. N. (2008). Global health partnerships: The UK contribution to health in developing countries. *Public Policy and Administration*, 23(2), 207-213. doi:10.1177/0952076707086256
- Cropanzano, R., & Mitchell, M. S. (2005). Social exchange theory: An interdisciplinary review. *Journal of Management*, 31(6), 874-900. doi:10.1177/0149206305279602
- Csárdi, G., & Nepusz, T. (2006). The igraph software package for complex network research. *InterJournal Complex Systems*, 1695(5), 1-9. doi:10.5281/zenodo.3630268
- Cummins, R. A., Eckersley, R., Pallant, J., van Vugt, J., & Misajon, R. (2003). Developing a national index of subjective wellbeing: The Australian Unity Wellbeing Index. *Social Indicators Research*, 64(2), 159-190. doi:10.1023/A:1024704320683
- Cunsolo, A., Borish, D., Harper, S. L., Snook, J., Shiwak, I., Wood, M., & The Herd Caribou Project Steering Committee. (2020). "You can never replace the caribou": Inuit

- experiences of ecological grief from caribou declines. *American Imago*, 77(1), 31-59. doi:10.1353/aim.2020.0002
- Cunsolo, A., & Ellis, N. R. (2018). Ecological grief as a mental health response to climate change-related loss. *Nature Climate Change*, 8(4), 275-281. doi:10.1038/s41558-018-0092-2
- Cunsolo, A., Harper, S. L., Minor, K., Hayes, K., Williams, K. G., & Howard, C. (2020). Ecological grief and anxiety: The start of a healthy response to climate change? *The Lancet Planetary Health*, 4(7), e261-e263. doi:10.1016/S2542-5196(20)30144-3
- Cunsolo Willox, A., Harper, S. L., Edge, V. L., Landman, K., Houle, K., & Ford, J. D. (2013). The land enriches the soul: On climatic and environmental change, affect, and emotional health and well-being in Rigolet, Nunatsiavut, Canada. *Emotion, Space and Society*, 6, 14-24. doi:<https://doi.org/10.1016/j.emospa.2011.08.005>
- Cunsolo Willox, A., Harper, S. L., Ford, J. D., Edge, V. L., Landman, K., Houle, K., . . . Wolfrey, C. (2013). Climate change and mental health: An exploratory case study from Rigolet, Nunatsiavut, Canada. *Climatic Change*, 121(2), 255-270. doi:10.1007/s10584-013-0875-4
- Cunsolo Willox, A., Harper, S. L., Ford, J. D., Landman, K., Houle, K., & Edge, V. L. (2012). "From this place and of this place:" Climate change, sense of place, and health in Nunatsiavut, Canada. *Social Science & Medicine*, 75(3), 538-547. doi:<https://doi.org/10.1016/j.socscimed.2012.03.043>
- Curtis, P. G., Slay, C. M., Harris, N. L., Tyukavina, A., & Hansen, M. C. (2018). Classifying drivers of global forest loss. *Science*, 361(6407), 1108-1111.
- Dadvand, P., Wright, J., Martinez, D., Basagaña, X., McEachan, R. R., Cirach, M., . . . Nieuwenhuijsen, M. J. (2014). Inequality, green spaces, and pregnant women: Roles of ethnicity and individual and neighbourhood socioeconomic status. *Environment International*, 71, 101-108. doi:10.1016/j.envint.2014.06.010
- Das, K. V., Jones-Harrell, C., Fan, Y., Ramaswami, A., Orlove, B., & Botchwey, N. (2020). Understanding subjective well-being: Perspectives from psychology and public health. *Public Health Reviews*, 41(1), 25. doi:10.1186/s40985-020-00142-5
- Das, M., & Chatterjee, B. (2015). Ecotourism: A panacea or a predicament? *Tourism Management Perspectives*, 14, 3-16. doi:<https://doi.org/10.1016/j.tmp.2015.01.002>
- Database of Global Administrative Areas (GADM). (2018). Download GADM data: Uganda level-0. Retrieved from: https://gadm.org/download_country_v3.html
- Davey, J. D., Obst, P. L., & Sheehan, M. C. (2001). Demographic and workplace characteristics which add to the prediction of stress and job satisfaction within the police workplace. *Journal of Police and Criminal Psychology*, 16(1), 29-39. doi:10.1007/BF02802731
- Davidson, N. C. (2014). How much wetland has the world lost? Long-term and recent trends in global wetland area. *Marine and Freshwater Research*, 65(10), 934-941. doi:<https://doi.org/10.1071/MF14173>
- Davies, Z. G., Dallimer, M., Fisher, J. C., & Fuller, R. A. (2019). Biodiversity and health: Implications for conservation. In M. R. Marselle, J. Stadler, H. Korn, K. N. Irvine, & A. Bonn (Eds.), *Biodiversity and Health in the Face of Climate Change* (pp. 283-294). Cham, Switzerland: Springer International Publishing.
- Dawson, N. M., Coolsaet, B., Sterling, E. J., Loveridge, R., Gross-Camp, N. D., Wongbusarakum, S., . . . Rosado-May, F. J. (2021). The role of Indigenous peoples and local communities in effective and equitable conservation. *Ecology and Society*, 26(3), 19. doi:10.5751/ES-12625-260319
- de Groot, J. I., & Steg, L. (2007). Value orientations to explain environmental attitudes and beliefs: How to measure egoistic, altruistic and biospheric value orientations. *Environment and Behavior*, 40(3), 330-354. doi:10.1177/0013916506297831
- de Groot, J. I., & Steg, L. (2009). Morality and prosocial behavior: The role of awareness, responsibility, and norms in the norm activation model. *Journal of Social Psychology*, 149(4), 425-449. doi:10.3200/SOCP.149.4.425-449
- de Jonge, J., Bosma, H., Peter, R., & Siegrist, J. (2000). Job strain, effort-reward imbalance and employee well-being: A large-scale cross-sectional study. *Social Science & Medicine*, 50(9), 1317-1327. doi:10.1016/S0277-9536(99)00388-3

- De Meyer, K., Coren, E., McCaffrey, M., & Slean, C. (2020). Transforming the stories we tell about climate change: From 'issue' to 'action'. *Environmental Research Letters*, 16(1), 015002. doi:10.1088/1748-9326/abcd5a
- de Vries, S., & Snep, R. (2019). Biodiversity in the context of 'biodiversity – mental health' research. In M. R. Marselle, J. Stadler, H. Korn, K. N. Irvine, & A. Bonn (Eds.), *Biodiversity and Health in the Face of Climate Change* (pp. 159-173). Cham, Switzerland: Springer International Publishing.
- Dean, P. J., Dean, M. R., & Rebalsky, R. M. (1996). Employee perceptions of workplace factors that will most improve their performance. *Performance Improvement Quarterly*, 9(2), 75-89. doi:<https://doi.org/10.1111/j.1937-8327.1996.tb00721.x>
- Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, 11(4), 227-268. doi:10.1207/S15327965PLI1104_01
- DeJonckheere, M., & Vaughn, L. M. (2019). Semistructured interviewing in primary care research: A balance of relationship and rigour. *Family Medicine and Community Health*, 7(2), e000057. doi:10.1136/fmch-2018-000057
- Demery, A.-J. C., & Pipkin, M. A. (2021). Safe fieldwork strategies for at-risk individuals, their supervisors and institutions. *Nature Ecology & Evolution*, 5(1), 5-9. doi:10.1038/s41559-020-01328-5
- Depaoli, S., & Van de Schoot, R. (2017). Improving transparency and replication in Bayesian statistics: The WAMBS-Checklist. *Psychological Methods*, 22(2), 240-261. doi:10.1037/met0000065
- Di Minin, E., & Toivonen, T. (2015). Global protected area expansion: Creating more than paper parks. *Bioscience*, 65(7), 637-638. doi:10.1093/biosci/biv064
- Díaz, S., Demissew, S., Carabias, J., Joly, C., Lonsdale, M., Ash, N., . . . Zlatanova, D. (2015). The IPBES Conceptual Framework — connecting nature and people. *Current Opinion in Environmental Sustainability*, 14, 1-16. doi:10.1016/j.cosust.2014.11.002
- Diaz, S., Demissew, S., Joly, C., Lonsdale, W. M., & Larigauderie, A. (2015). A Rosetta Stone for nature's benefits to people. *PLoS Biology*, 13(1), e1002040. doi:10.1371/journal.pbio.1002040
- Diener, E. (2009). Subjective well-being. In E. Diener (Ed.), *The Science of Well-Being: The Collected Works of Ed Diener* (pp. 11-58). Dordrecht, Netherlands: Springer Netherlands.
- Diener, E., Suh, E. M., Lucas, R. E., & Smith, H. L. (1999). Subjective well-being: Three decades of progress. *Psychological Bulletin*, 125(2), 276-302. doi:10.1037//0003-066X.55.1.3
- Dingwall, K. M., & Cairney, S. (2010). Psychological and cognitive assessment of Indigenous Australians. *Australian and New Zealand Journal of Psychiatry*, 44(1), 20-30. doi:10.3109/00048670903393670
- Donaldson, S. I., Lee, J. Y., & Donaldson, S. I. (2019). Evaluating positive psychology interventions at work: A systematic review and meta-analysis. *International Journal of Applied Positive Psychology*, 4(3), 113-134. doi:10.1007/s41042-019-00021-8
- Draganidis, F., & Mentzas, G. (2006). Competency based management: A review of systems and approaches. *Information Management & Computer Security*, 14(1), 51-64. doi:10.1108/09685220610648373
- Dragano, N., Siegrist, J., Nyberg, S. T., Lunau, T., Fransson, E. I., Alfredsson, L., . . . consortium, I. P.-W. (2017). Effort-reward imbalance at work and incident coronary heart disease: A multicohort study of 90,164 individuals. *Epidemiology*, 28(4), 619-626. doi:10.1097/EDE.0000000000000666
- Drapeau, A., Marchand, A., & Beaulieu-Prvost, D. (2012). Epidemiology of psychological distress. In L. Labate (Ed.), *Mental Illnesses: Understanding, Prediction and Control* (pp. 105-134): INTECH.
- Drapeau, A., Marchand, A., & Forest, C. (2014). Gender differences in the age-cohort distribution of psychological distress in Canadian adults: Findings from a national longitudinal survey. *BMC Psychology*, 2, 25. doi:10.1186/s40359-014-0025-4

- Drennan, V. M., & Ross, F. (2019). Global nurse shortages-the facts, the impact and action for change. *Br Med Bull*, *130*(1), 25-37. doi:10.1093/bmb/ldz014
- Ducarme, F., & Couvet, D. (2020). What does 'nature' mean? *Palgrave Communications*, *6*(1), 14. doi:10.1057/s41599-020-0390-y
- Duchaine, C. S., Aubé, K., Gilbert-Ouimet, M., Vézina, M., Ndjaboué, R., Massamba, V., . . . Brisson, C. (2020). Psychosocial stressors at work and the risk of sickness absence due to a diagnosed mental disorder: A systematic review and meta-analysis. *JAMA Psychiatry*, *77*(8), 842-851. doi:10.1001/jamapsychiatry.2020.0322
- Duff, R. K. (2020). Building a road to recovery for subtle racism in conservation (commentary). Retrieved from <https://news.mongabay.com/2020/11/building-a-road-to-recovery-for-subtle-racism-in-conservation-commentary/>
- Duffy, R. (2015). *Responsibility to protect? Ecocide, interventionism and saving biodiversity*. Paper presented at the Political Studies Association Conference, Sheffield, UK. <https://www.psa.ac.uk/sites/default/files/conference/papers/2015/Duffy%20-%20PSA%202015%20paper.pdf>
- Durand, M. (2015). The OECD Better Life Initiative: How's life? and the measurement of well-being. *Review of Income and Wealth*, *61*(1), 4-17. doi:<https://doi.org/10.1111/roiw.12156>
- Dzhambov, A. M., & Dimitrova, D. D. (2015). Green spaces and environmental noise perception. *Urban Forestry & Urban Greening*, *14*(4), 1000-1008. doi:<https://doi.org/10.1016/j.ufug.2015.09.006>
- Easton, S. D., Safadi, N. S., Wang, Y., & Hasson, R. G. (2017). The Kessler psychological distress scale: Translation and validation of an Arabic version. *Health and Quality of Life Outcomes*, *15*(1), 215. doi:10.1186/s12955-017-0783-9
- Eccles, J. S., Adler, T. F., Futterman, R., Goff, S. B., Kaczala, C. M., Meece, J., & Midgley, C. (1983). Expectancies, values and academic behaviors. In J. T. Spence (Ed.), *Achievement and Achievement Motives* (pp. 75-146). San Francisco, United States: W. H. Freeman.
- Eccles, J. S., & Wigfield, A. (2020). From expectancy-value theory to situated expectancy-value theory: A developmental, social cognitive, and sociocultural perspective on motivation. *Contemporary Educational Psychology*, *61*, 101859. doi:<https://doi.org/10.1016/j.cedpsych.2020.101859>
- Eckersley, R. (2007). Ecological intervention: Prospects and limits. *Ethics & International Affairs*, *21*(3), 293-316. doi:<https://doi.org/10.1111/j.1747-7093.2007.00101.x>
- Eddy, P., Heckenberg, R., Wertheim, E. H., Kent, S., & Wright, B. J. (2016). A systematic review and meta-analysis of the effort-reward imbalance model of workplace stress with indicators of immune function. *J Psychosom Res*, *91*, 1-8. doi:10.1016/j.jpsychores.2016.10.003
- Eddy, P., Wertheim, E. H., Hale, M. W., & Wright, B. J. (2018). A systematic review and meta-analysis of the effort-reward imbalance model of workplace stress and hypothalamic-pituitary-adrenal axis measures of stress. *Psychosomatic Medicine*, *80*(1), 103-113. doi:10.1097/PSY.0000000000000505
- Eguchi, H., Tsutsumi, A., Inoue, A., Hikichi, H., & Kawachi, I. (2018). Association of workplace social capital with psychological distress: Results from a longitudinal multilevel analysis of the J-HOPE Study. *BMJ Open*, *8*(12), e022569. doi:10.1136/bmjopen-2018-022569
- Eilu, G., & Bukenya-Ziraba, R. (2004). Local use of climbing plants of Budongo Forest Reserve, western Uganda. *Journal of Ethnobiology*, *24*(2), 307-327.
- Elliott, L., Ryan, M., & Wyborn, C. (2018). Global patterns in conservation capacity development. *Biological Conservation*, *221*, 261-269. doi:10.1016/j.biocon.2018.03.018
- Ellis, E. C., Pascual, U., & Mertz, O. (2019). Ecosystem services and nature's contribution to people: Negotiating diverse values and trade-offs in land systems. *Current Opinion in Environmental Sustainability*, *38*, 86-94. doi:<https://doi.org/10.1016/j.cosust.2019.05.001>
- Ellis, N. R., & Albrecht, G. A. (2017). Climate change threats to family farmers' sense of place and mental wellbeing: A case study from the Western Australian Wheatbelt. *Social Science & Medicine*, *175*, 161-168. doi:10.1016/j.socscimed.2017.01.009

- Eriksson, C. B., Bjorck, J. P., Larson, L. C., Walling, S. M., Trice, G. A., Fawcett, J., . . . Foy, D. W. (2009). Social support, organisational support, and religious support in relation to burnout in expatriate humanitarian aid workers. *Mental Health, Religion & Culture*, *12*(7), 671-686. doi:10.1080/13674670903029146
- Esri, USGS, & NOAA. (2009). World Terrain Base (for Export). Retrieved 26/08/2020, from Esri https://tiledbasemaps.arcgis.com/arcgis/rest/services/World_Terrain_Base/MapServer
- Evans, G. W. (2016). Childhood poverty and adult psychological well-being. *Proceedings of the National Academy of Sciences*, *113*(52), 14949. doi:10.1073/pnas.1604756114
- Ewaso Lions. (2022). Ewaso Lions. Retrieved from <https://ewasolions.org/>
- Färnman, R., Diwan, V., Zwarenstein, M., Atkins, S., & consortium, A. (2016). Successes and challenges of north-south partnerships - key lessons from the African/Asian Regional Capacity Development projects. *Global Health Action*, *9*, 30522-30522. doi:10.3402/gha.v9.30522
- Farvar, M. T., Borrini-Feyerabend, G., Campese, J., Jaeger, T., Jonas, H., & Stevens, S. (2018). *Whose 'inclusive conservation'?* Retrieved from Tehran, Iran: <https://www.iccaconsortium.org/wp-content/uploads/2018/10/Consortium-Policy-Brief-no-5-Whose-inclusive-conservation.pdf>
- Fedele, G., Donatti, C. I., Bornacelly, I., & Hole, D. G. (2021). Nature-dependent people: Mapping human direct use of nature for basic needs across the tropics. *Global Environmental Change*, *71*, 102368. doi:<https://doi.org/10.1016/j.gloenvcha.2021.102368>
- Ferenchick, E. K., Ramanuj, P., & Pincus, H. A. (2019). Depression in primary care: Part 1—screening and diagnosis. *BMJ*, *365*, 1794. doi:10.1136/bmj.1794
- Fick, S. E., & Hijmans, R. J. (2017). WorldClim 2: New 1km spatial resolution climate surfaces for global land areas. *International Journal of Climatology*, *37*, 4302-4315. doi:<https://doi.org/10.1002/joc.5086>
- Firth, J., Siddiqi, N., Koyanagi, A., Siskind, D., Rosenbaum, S., Galletly, C., . . . Maj, M. (2019). The Lancet Psychiatry Commission: A blueprint for protecting physical health in people with mental illness. *The Lancet Psychiatry*, *6*(8), 675-712. doi:10.1016/S2215-0366(19)30132-4
- Fishbach, A., Eyal, T., & Finkelstein, S. R. (2010). How positive and negative feedback motivate goal pursuit. *Social and Personality Psychology Compass*, *4*(8), 517-530. doi:10.1111/j.1751-9004.2010.00285.x
- Fisher, J. C., Bicknell, J. E., Irvine, K. N., Fernandes, D., Mistry, J., & Davies, Z. G. (2021). Exploring how urban nature is associated with human wellbeing in a neotropical city. *Landscape and Urban Planning*, *212*, 104119. doi:<https://doi.org/10.1016/j.landurbplan.2021.104119>
- Fisher, J. C., Rankin, E., Irvine, K. N., Goddard, M. A., Davies, Z. G., & Dallimer, M. (2022). Can biodiverse streetscapes mitigate the effects of noise and air pollution on human wellbeing? *Environmental Research*, *212*, 113154. doi:<https://doi.org/10.1016/j.envres.2022.113154>
- Fisher, S. B., Gold, J. R., & Wilson-Grau, R. (2014). *Cases in outcome harvesting: Ten pilot experiences identify new learning from multi-stakeholder projects to improve results*. Retrieved from Washington, D.C., United States: <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/419021468330946583/cases-in-outcome-harvesting-ten-pilot-experiences-identify-new-learning-from-multi-stakeholder-projects-to-improve-results>
- Flora, D. B., & Curran, P. J. (2004). An empirical evaluation of alternative methods of estimation for confirmatory factor analysis with ordinal data. *Psychological Methods*, *9*(4), 466-491. doi:10.1037/1082-989X.9.4.466
- Fluharty, M., Taylor, A. E., Grabski, M., & Munaf. (2017). The association of cigarette smoking with depression and anxiety: A systematic review. *Nicotine and Tobacco Research*, *19*(1), 3-13. doi:10.1093/ntr/ntw140
- Folke, C. (2004). Traditional knowledge in social-ecological systems. *Ecology and Society*, *9*(3), 7. doi:<http://www.ecologyandsociety.org/vol9/iss3/art7/>

- Fong, C. J., Kremer, K. P., Hill-Troglin Cox, C., & Lawson, C. A. (2021). Expectancy-value profiles in math and science: A person-centered approach to cross-domain motivation with academic and STEM-related outcomes. *Contemporary Educational Psychology, 65*, 101962. doi:<https://doi.org/10.1016/j.cedpsych.2021.101962>
- Food Agriculture Organization (FAO). (2009). *International treaty on plant genetic resources for food and agriculture*. Retrieved from Rome, Italy: <https://www.fao.org/3/i0510e/i0510e.pdf>
- Food and Agriculture Organization of the United Nations (FAO). (2021). FAOSTAT. Retrieved from <https://www.fao.org/faostat/en/#data>
- Forgeard, M. J. C., & Seligman, M. E. P. (2012). Seeing the glass half full: A review of the causes and consequences of optimism. *Pratiques Psychologiques, 18*, 107-120. doi:10.1016/j.prps.2012.02.002
- Fournier, A. M. V., & Bond, A. L. (2015). Volunteer field technicians are bad for wildlife ecology. *Wildlife Society Bulletin, 39*(4), 819-821. doi:10.1002/wsb.603
- Franks, P., Small, R., & Booker, F. (2018). *Social Assessment for Protected and Conserved Areas (SAPA) Methodology manual for SAPA facilitators*. Retrieved from <https://pubs.iied.org/sites/default/files/pdfs/migrate/14659IIED.pdf>
- Fraser, J., Pantesco, V., Plemons, K., Gupta, R., & Rank, S. J. (2013). Sustaining the conservationist. *Ecopsychology, 5*(2), 7-79. doi:10.1089/eco.2012.0076
- Fraval, S., Hammond, J., Bogard, J. R., Ng'endo, M., van Etten, J., Herrero, M., . . . van Wijk, M. T. (2019). Food access deficiencies in sub-Saharan Africa: Prevalence and implications for agricultural interventions. *Frontiers in Sustainable Food Systems, 3*, 104. doi:10.3389/fsufs.2019.00104
- Freeman, A., Tyrovolas, S., Koyanagi, A., Chatterji, S., Leonardi, M., Ayuso-Mateos, J. L., . . . Haro, J. M. (2016). The role of socio-economic status in depression: Results from the COURAGE (aging survey in Europe). *BMC Public Health, 16*(1), 1-8. doi:10.1186/s12889-016-3638-0
- Frumkin, H., Bratman, G. N., Breslow, S. J., Cochran, B., Kahn, P. H., Jr., Lawler, J. J., . . . Wood, S. A. (2017). Nature contact and human health: A research agenda. *Environmental Health Perspectives, 125*(7), 075001. doi:10.1289/ehp1663
- Frumkin, H., & Haines, A. (2019). Global environmental change and noncommunicable disease risks. *Annual Review of Public Health, 40*, 261-282. doi:10.1146/annurev-publhealth-040218-043706
- Fungo, B. (2011). A review crop raiding around protected areas: Nature, control and research gaps. *Environmental Research Journal, 5*(2), 87--92. doi:10.3923/erj.2011.87.92
- Furber, G., Segal, L., Leach, M., Turnbull, C., Procter, N., Diamond, M., . . . McGorry, P. (2015). Preventing mental illness: Closing the evidence-practice gap through workforce and services planning. *BMC Health Services Research, 15*(1), 283. doi:10.1186/s12913-015-0954-5
- Gable, S. L., & Haidt, J. (2005). What (and why) is positive psychology? *Review of General Psychology, 9*(2), 103-110. doi:10.1037/1089-2680.9.2.103
- Galvin, K. A., Beeton, T. A., & Luizza, M. W. (2018). African community-based conservation: A systematic review of social and ecological outcomes. *Ecology and Society, 23*(3), 39. doi:10.5751/ES-10217-230339
- Gao, Y., & Li, B. V. (2021). Evaluation of the status, job satisfaction and occupational stress of Chinese nature reserve staff. *Global Ecology and Conservation, 29*, e01731. doi:<https://doi.org/10.1016/j.gecco.2021.e01731>
- Gardner, C. J. (2021). Not teaching what we practice: Undergraduate conservation training at UK universities lacks interdisciplinarity. *Environmental Conservation, 48*(1), 65-70. doi:10.1017/S0376892920000442
- Garipy, G., Honkaniemi, H., & Quesnel-Valle, A. (2016). Social support and protection from depression: Systematic review of current findings in western countries. *British Journal of Psychiatry, 209*(4), 284-293. doi:10.1192/bjp.bp.115.169094

- Garnett, S. T., Burgess, N. D., Fa, J. E., Fernández-Llamazares, Á., Molnár, Z., Robinson, C. J., . . . Leiper, I. (2018). A spatial overview of the global importance of Indigenous lands for conservation. *Nature Sustainability*, *1*(7), 369-374. doi:10.1038/s41893-018-0100-6
- GBD 2019 Diseases and Injuries Collaborators. (2020). Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: A systematic analysis for the Global Burden of Disease Study 2019. *The Lancet*, *396*(10258), 1204-1222. doi:10.1016/S0140-6736(20)30925-9
- Gerlach, G. I. (2019). Linking justice perceptions, workplace relationship quality and job performance: The differential roles of vertical and horizontal workplace relationships. *German Journal of Human Resource Management*, *33*(4), 337-362. doi:10.1177/2397002218824320
- Gifford, R. (2011). The dragons of inaction: Psychological barriers that limit climate change mitigation and adaptation. *American Psychologist*, *66*(4), 290-302. doi:10.1037/a0023566
- Global Environment Facility (GEF). (2020). *GEF-7 inclusive conservation initiative: Overview*. Retrieved from Washington, United States: <https://static1.squarespace.com/static/5e459a2695a35014a0e1132b/t/5e7e0d42554fd6780a62dbbc/1585319235932/ICI+2+Page+Overview+03.26.2020+-+English.pdf>
- Global Witness. (2020). *Defending tomorrow: The climate crisis and threats against land and environmental defenders*. Retrieved from London, United Kingdom: https://www.globalwitness.org/documents/19938/Defending_Tomorrow_EN_high_res_-_July_2020.pdf
- Goh, C., & Agius, M. (2010). The stress-vulnerability model how does stress impact on mental illness at the level of the brain and what are the consequences. *Psychiatria Danubina*, *22*(2), 198-202. doi:10.1016/S0924-9338(10)71572-8
- Golden, C. D., Allison, E. H., Cheung, W. W. L., Dey, M. M., Halpern, B. S., McCauley, D. J., . . . Myers, S. S. (2016). Nutrition: Fall in fish catch threatens human health. *Nature*, *534*(7607), 317-320. doi:10.1038/534317a
- Golden, C. D., Fernald, L. C., Brashares, J. S., Rasolofoniaina, B. J., & Kremen, C. (2011). Benefits of wildlife consumption to child nutrition in a biodiversity hotspot. *Proceedings of the National Academy of Sciences*, *108*(49), 19653-19656. doi:10.1073/pnas.1112586108
- Golden, C. D., Koehn, J. Z., Shepon, A., Passarelli, S., Free, C. M., Viana, D. F., . . . Thilsted, S. H. (2021). Aquatic foods to nourish nations. *Nature*, *598*(7880), 315-320. doi:10.1038/s41586-021-03917-1
- Gómez-Urquiza, J. L., De la Fuente-Solana, E. I., Albendín-García, L., Vargas-Pecino, C., Ortega-Campos, E. M., & Cañadas-De la Fuente, G. A. (2017). Prevalence of burnout syndrome in emergency nurses: A meta-analysis. *Critical Care Nurse*, *37*(5), e1-e9. doi:10.4037/ccn2017508
- Gordon, T. A. C., Radford, A. N., & Simpson, S. D. (2019). Grieving environmental scientists need support. *Science*, *366*(6462), 8-10. doi:10.1126/science.aaz2422
- Government of Republic of Uganda. (2003). *National Forestry and Tree Planting Act*. Retrieved from Entebbe, Uganda: https://www.nfa.go.ug/images/National_Forestry_and_Tree_Planting_Act_2003.pdf
- Green, P., & Skinner, D. (2005). Does time management training work? An evaluation. *International Journal of Training and Development*, *9*(2), 124-139. doi:<https://doi.org/10.1111/j.1468-2419.2005.00226.x>
- Greenberg, A., Michlig, G. J., Larson, E., Varallyay, I., Chang, K., Enobun, B., . . . Harvey, S. A. (2019). "I knew I could make a difference": Motivations and barriers to engagement in fighting the West African ebola outbreak among U.S.-based health professionals. *Qualitative Health Research*, *29*(4), 522-532. doi:10.1177/1049732318771306
- Greenberg, P. E., Fournier, A.-A., Sisitsky, T., Simes, M., Berman, R., Koenigsberg, S. H., & Kessler, R. C. (2021). The economic burden of adults with major depressive disorder in the United States (2010 and 2018). *PharmacoEconomics*, *39*(6), 653-665. doi:10.1007/s40273-021-01019-4

- Griffin, M. A., & Neal, A. (2000). Perceptions of safety at work: A framework for linking safety climate to safety performance, knowledge, and motivation. *Journal of Occupational Health Psychology, 5*(3), 347-358. doi:10.1037//1076-8998.5.3.347
- Griffiths, V. F., Bull, J. W., Baker, J., & Milner-Gulland, E. J. (2018). No net loss for people and biodiversity. *Conservation Biology, 33*(1), 76-87. doi:10.1111/cobi.13184
- Griffiths, V. F., Sheremet, O., Hanley, N., Baker, J., Bull, J. W., & Milner-Gulland, E. J. (2019). Local people's preferences for biodiversity offsets to achieve 'no net loss' for economic developments. *Biological Conservation, 236*, 162-170. doi:<https://doi.org/10.1016/j.biocon.2019.05.049>
- Haber, M. G., Cohen, J. L., Lucas, T., & Baltes, B. B. (2007). The relationship between self-reported received and perceived social support: A meta-analytic review. *American Journal of Community Psychology, 39*(1-2), 133-144. doi:10.1007/s10464-007-9100-9
- Haelewaters, D., Hofmann, T. A., & Romero-Olivares, A. L. (2021). Ten simple rules for Global North researchers to stop perpetuating helicopter research in the Global South. *PLOS Computational Biology, 17*(8), e1009277. doi:10.1371/journal.pcbi.1009277
- Haines-Young, R., & Potschin, M. (2010). The links between biodiversity, ecosystem services and human well-being. In C. L. J. Frid & D. G. Raffaelli (Eds.), *Ecosystem Ecology: A New Synthesis* (pp. 110-139). Cambridge, United Kingdom: Cambridge University Press.
- Hall, R., Scoones, I., & Tsikata, D. (2017). Plantations, outgrowers and commercial farming in Africa: Agricultural commercialisation and implications for agrarian change. *The Journal of Peasant Studies, 44*(3), 515-537. doi:10.1080/03066150.2016.1263187
- Hansen, M. C., Potapov, P. V., Moore, R., Hancher, M., Turubanova, S. A., Tyukavina, A., . . . Townshend, J. R. (2013). High-resolution global maps of 21st-century forest cover change. *Science, 342*(6160), 850-853. doi:10.1126/science.1244693
- Harrell, F. E., Jr. (2015). Ordinal logistic regression. In F. E. Harrell, Jr. (Ed.), *Regression Modeling Strategies: With Applications to Linear Models, Logistic and Ordinal Regression, and Survival Analysis* (2 ed., pp. 315-316). New York, United States: Springer.
- Hartig, T., & Evans, G. W. (1993). Psychological foundations of nature experience. In T. Gärling & R. G. Golledge (Eds.), *Advances in Psychology* (Vol. 96, pp. 427-457): North-Holland.
- Hartig, T., van den Berg, A. E., Hagerhall, C. M., Tomalak, M., Bauer, N., Hansmann, R., . . . Waaseth, G. (2011). Health benefits of nature experience: Psychological, social and cultural processes. In K. Nilsson, M. Sangster, C. Gallis, T. Hartig, S. de Vries, K. Seeland, & J. Schipperijn (Eds.), *Forests, Trees and Human Health* (pp. 127-168). Dordrecht, Netherlands: Springer Netherlands.
- Hartgen, K., & Vollmer, S. (2013). Using an asset index to simulate household income. *Economics Letters, 121*(2), 257-262. doi:<https://doi.org/10.1016/j.econlet.2013.08.014>
- Harvey, S. B., Modini, M., Joyce, S., Milligan-Saville, J. S., Tan, L., Mykletun, A., . . . Mitchell, P. B. (2017). Can work make you mentally ill? A systematic meta-review of work-related risk factors for common mental health problems. *Occupational and Environmental Medicine, 74*(4), 301-310. doi:10.1136/oemed-2016-104015
- Hazen, M. A. (2008). Grief and the workplace. *Academy of Management Perspectives, 22*(3), 78-86. doi:10.5465/amp.2008.34587996
- Heberlein, T. A. (1972). The land ethic realized: Some social psychological explanations for changing environmental attitudes. *Journal of Social Issues, 28*(4), 79-87. doi:10.1111/j.1540-4560.1972.tb00047.x
- Heink, U., & Jax, K. (2019). Going upstream — How the purpose of a conceptual framework for ecosystem services determines its structure. *Ecological Economics, 156*, 264-271. doi:<https://doi.org/10.1016/j.ecolecon.2018.10.009>
- Hemming, K., Eldridge, S., Forbes, G., Weijer, C., & Taljaard, M. (2017). How to design efficient cluster randomised trials. *BMJ, 358*, j3064. doi:10.1136/bmj.j3064
- Hemming, K., Haines, T. P., Chilton, P. J., Girling, A. J., & Lilford, R. J. (2015). The stepped wedge cluster randomised trial: Rationale, design, analysis, and reporting. *BMJ, 350*, h391. doi:10.1136/bmj.h391

- Hemming, V., Burgman, M. A., Hanea, A. M., McBride, M. F., & Wintle, B. C. (2018). A practical guide to structured expert elicitation using the IDEA protocol. *Methods in Ecology and Evolution*, 9(1), 169-180. doi:<https://doi.org/10.1111/2041-210X.12857>
- Hennekam, S., Richard, S., & Grima, F. (2020). Coping with mental health conditions at work and its impact on self-perceived job performance. *Employee Relations: The International Journal*, 42(3), 626-645. doi:10.1108/ER-05-2019-0211
- Herrera, D., Ellis, A., Fisher, B., Golden, C. D., Johnson, K., Mulligan, M., . . . Ricketts, T. H. (2017). Upstream watershed condition predicts rural children's health across 35 developing countries. *Nature Communications*, 8, 811. doi:10.1038/s41467-017-00775-2
- Heynen, N., Perkins, H. A., & Roy, P. (2006). The political ecology of uneven urban green space: The impact of political economy on race and ethnicity in producing environmental inequality in Milwaukee. *Urban Affairs Review*, 42(1), 3-25. doi:10.1177/1078087406290729
- Hickman, C. (2020). We need to (find a way to) talk about... eco-anxiety. *Journal of Social Work Practice*, 34(4), 411-424. doi:10.1080/02650533.2020.1844166
- Hickman, C., Marks, E., Pihkala, P., Clayton, S., Lewandowski, E. R., Mayall, E. E., . . . van Susteren, L. (2021). Young people's voices on climate anxiety, government betrayal and moral injury: A global phenomenon. *Ssrn*. doi:<https://dx.doi.org/10.2139/ssrn.3918955>
- Hicks, C. C., & Cinner, J. E. (2014). Social, institutional, and knowledge mechanisms mediate diverse ecosystem service benefits from coral reefs. *Proceedings of the National Academy of Sciences*, 111(50), 17791. doi:10.1073/pnas.1413473111
- Hill, C. M. (2015). Perspectives of “conflict” at the wildlife–agriculture boundary: 10 years on. *Human Dimensions of Wildlife*, 20(4), 296-301. doi:10.1080/10871209.2015.1004143
- Hilton, M. F., & Whiteford, H. A. (2010). Associations between psychological distress, workplace accidents, workplace failures and workplace successes. *International Archives of Occupational and Environmental Health*, 83(8), 923-933. doi:10.1007/s00420-010-0555-x
- Hilton, M. F., Whiteford, H. A., Sheridan, J. S., Cleary, C. M., Chant, D. C., Wang, P. S., & Kessler, R. C. (2008). The prevalence of psychological distress in employees and associated occupational risk factors. *Journal of Occupational and Environmental Medicine*, 50(7), 746-757. doi:10.1097/JOM.0b013e31817e9171
- Hinz, A., Sander, C., Glaesmer, H., Brähler, E., Zenger, M., Hilbert, A., & Kocalevent, R.-D. (2017). Optimism and pessimism in the general population: Psychometric properties of the Life Orientation Test (LOT-R). *International Journal of Clinical and Health Psychology*, 17(2), 161-170. doi:<http://dx.doi.org/10.1016/j.ijchp.2017.02.003>
- Hoffmann, M., Duckworth, J. W., Holmes, K., Mallon, D. P., Rodrigues, A. S. L., & Stuart, S. N. (2015). The difference conservation makes to extinction risk of the world's ungulates. *Conservation Biology*, 29(5), 1303-1313. doi:<https://doi.org/10.1111/cobi.12519>
- Hojat, M., Vergare, M., Isenberg, G., Cohen, M., & Spandorfer, J. (2015). Underlying construct of empathy, optimism, and burnout in medical students. *International Journal of Medical Education*, 6, 12-16. doi:10.5116/ijme.54c3.60cd
- Holmes, G. (2011). Conservation's friends in high places: Neoliberalism, networks, and the transnational conservation elite. *Global Environmental Politics*, 11(4), 1-21. doi:10.1162/GLEP_a_00081
- Huber, M., Knottnerus, J. A., Green, L., van der Horst, H., Jadad, A. R., Kromhout, D., . . . Smid, H. (2011). How should we define health? *BMJ*, 343, d4163. doi:10.1136/bmj.d4163
- Hurt, G., Chini, L., Sahajpal, R., Froking, S., Bodirsky, B. L., Calvin, K., . . . Zhang, X. (2019). Harmonization of global land use change and management for the period 850–2100 (LUH2) for CMIP6. Retrieved from: <https://doi.org/10.22033/ESGF/input4MIPs.10468>
- Hurt, G., Chini, L., Sahajpal, R., Froking, S., Bodirsky, B. L., Calvin, K., . . . Zhang, X. (2020). Harmonization of global land use change and management for the period 850–2100 (LUH2) for CMIP6. *Geoscientific Model Development*, 13, 5425-5464. doi:<https://doi.org/10.5194/gmd-13-5425-2020>
- Hutchison, E. D. (2011). Life course theory. In R. J. R. Levesque (Ed.), *Encyclopedia of Adolescence* (pp. 1586-1594). New York, United States: Springer New York.

- Iacobucci, G. (2018). NHS staff get online service to voice concerns about working conditions. *BMJ*, 362, k3864. doi:10.1136/bmj.k3864
- ICCA Consortium. (2021). *Territories of Life: 2021 report*. Retrieved from <https://report.territoriesoflife.org/wp-content/uploads/2021/05/ICCA-Territories-of-Life-2021-Report-FULL-150dpi-ENG.pdf>
- Ickowitz, A., Powell, B., Salim, M. A., & Sunderland, T. C. H. (2014). Dietary quality and tree cover in Africa. *Global Environmental Change*, 24, 287-294. doi:10.1016/j.gloenvcha.2013.12.001
- Ingold, T. (2000). *The Perception of the Environment* (1 ed.). London, United Kingdom: Routledge.
- Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). (2019). *Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*. Retrieved from Bonn, Germany: https://ipbes.net/sites/default/files/inline/files/ipbes_global_assessment_report_summary_for_policymakers.pdf
- Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). (2020). *Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*. Retrieved from Bonn, Germany: https://ipbes.net/sites/default/files/inline/files/ipbes_global_assessment_report_summary_for_policymakers.pdf
- International Ranger Federation (IRF). (2019). *Chitwan Declaration, 2019*. Retrieved from Chitwan, Nepal: https://www.internationalrangers.org/wpcontent/uploads/Chitwan-Declaration_2019_EN.pdf
- International Union for Conservation of Nature (IUCN). (2020a, 01/10/2020). The IUCN Red List of Threatened Species Version 2020-2. Retrieved from <https://www.iucnredlist.org>
- International Union for Conservation of Nature (IUCN). (2020b). Red List Index. Retrieved from <https://www.iucnredlist.org/assessment/red-list-index>
- Jadhav, S., & Barua, M. (2012). The elephant vanishes: Impact of human-elephant conflict on people's wellbeing. *Health & Place*, 18(6), 1356-1365. doi:10.1016/j.healthplace.2012.06.019
- Jansen, L. A. (2011). Two concepts of therapeutic optimism. *Journal of Medical Ethics*, 37(9), 563-566. doi:10.1136/jme.2010.038943
- Janzen, B. L., Muhajarine, N., Zhu, T., & Kelly, I. W. (2007). Effort-reward imbalance, overcommitment, and psychological distress in Canadian police officers. *Psychological Reports*, 100(2), 525-530. doi:10.2466/PRO.100.2.525-530
- Jarden, R. J., Sandham, M., Siegert, R. J., & Koziol-McLain, J. (2019). Strengthening workplace well-being: Perceptions of intensive care nurses. *Nursing in Critical Care*, 24(1), 15-23. doi:<https://doi.org/10.1111/nicc.12386>
- Jaworski, M., Iwanow, L., Grochans, E., Młynarska, A., Gurowiec, P. J., Uchmanowicz, I., . . . Panczyk, M. (2020). Optimistic thinking, satisfaction with life and job and nursing care rationing: Multicentre study in Poland. *Journal of Nursing Management*, 28(8), 1948-1959. doi:10.1111/jonm.12974
- Jeary, K., Kandel, M., Martiniello, G., & Twongyirwe, R. (2018). Conservation and agriculture: Finding an optimal balance? In C. Sandbrook, C. J. Cavanagh, & D. M. Tumusiime (Eds.), *Conservation and Development in Uganda* (pp. 189-205). London, United Kingdom: Routledge.
- Jenkins, C. N., Pimm, S. L., & Joppa, L. N. (2013). Global patterns of terrestrial vertebrate diversity and conservation. *Proceedings of the National Academy of Sciences*, 110(28), E2602-E2610. doi:10.1073/pnas.1302251110
- Jimenez, M. P., DeVille, N. V., Elliott, E. G., Schiff, J. E., Wilt, G. E., Hart, J. E., & James, P. (2021). Associations between nature exposure and health: A review of the evidence.

- International Journal of Environmental Research and Public Health*, 18(9), 4790.
doi:10.3390/ijerph18094790
- Johansson, M., Gyllin, M., Witzell, J., & Küller, M. (2014). Does biological quality matter? Direct and reflected appraisal of biodiversity in temperate deciduous broad-leaf forest. *Urban Forestry & Urban Greening*, 13(1), 28-37. doi:<https://doi.org/10.1016/j.ufug.2013.10.009>
- Johnstone, L., Boyle, M., Cromby, J., Dillon, J., Harper, D., Kinderman, P., & Read, J. (2018). *The power threat meaning framework*. Retrieved from Leicester, United Kingdom: <https://www.bps.org.uk/sites/bps.org.uk/files/Policy%20-%20Files/PTM%20Main.pdf>
- Jones, A. D. (2017). Food insecurity and mental health status: A global analysis of 149 countries. *American Journal of Preventive Medicine*, 53(2), 264-273.
doi:10.1016/j.amepre.2017.04.008
- Jones, A. D., Ngure, F. M., Pelto, G., & Young, S. L. (2013). What are we assessing when we measure food security? A compendium and review of current metrics. *Advances in Nutrition*, 4(5), 481-505. doi:10.3945/an.113.004119
- Jones, J. P. G., Andriamarivololona, M. M., & Hockley, N. (2008). The importance of taboos and social norms to conservation in Madagascar. *Conservation Biology*, 22(4), 976-986.
doi:<https://doi.org/10.1111/j.1523-1739.2008.00970.x>
- Jones, J. P. G., Bull, J. W., Roe, D., Baker, J., Griffiths, V. F., Starkey, M., . . . Milner-Gulland, E. J. (2019). Net gain: Seeking better outcomes for local people when mitigating biodiversity loss from development. *One Earth*, 1(2), 195-201. doi:10.1016/j.oneear.2019.09.007
- Jones, K. E., Patel, N. G., Levy, M. A., Storeygard, A., Balk, D., Gittleman, J. L., & Daszak, P. (2008). Global trends in emerging infectious diseases. *Nature*, 451(7181), 990-993.
doi:10.1038/nature06536
- Jones, M. S., & Solomon, J. (2019). Challenges and supports for women conservation leaders. *Conservation Science and Practice*, 1(6), e36. doi:10.1111/csp2.36
- Jones, M. S., Teel, T. L., Martinez, D. E., & Solomon, J. (2020). Conflict and adaptation at the intersection of motherhood and conservation leadership. *Biological Conservation*, 243, 108487. doi:<https://doi.org/10.1016/j.biocon.2020.108487>
- Jones, T. M., Nurius, P., Song, C., & Fleming, C. M. (2018). Modeling life course pathways from adverse childhood experiences to adult mental health. *Child Abuse & Neglect*, 80, 32-40.
doi:<https://doi.org/10.1016/j.chiabu.2018.03.005>
- Jorgensen, T. D., Pornprasertmanit, S., Schoemann, A. M., & Rosseel, Y. (2020). semTools: Useful tools for structural equation modeling (Version 05-3). <https://CRAN.R-project.org/package=semTools>.
- Jorm, A. F., Patten, S. B., Brughra, T. S., & Mojtabai, R. (2017). Has increased provision of treatment reduced the prevalence of common mental disorders? Review of the evidence from four countries. *World Psychiatry*, 16(1), 90-99. doi:10.1002/wps.20388
- Jurewicz, I. (2015). Mental health in young adults and adolescents - supporting general physicians to provide holistic care. *Clinical Medicine*, 15(2), 151-154. doi:10.7861/clinmedicine.15-2-151
- Kabisch, N. (2019). The influence of socio-economic and socio-demographic factors in the association between urban green space and health. In M. R. Marselle, J. Stadler, H. Korn, K. N. Irvine, & A. Bonn (Eds.), *Biodiversity and Health in the Face of Climate Change* (pp. 91-119). Cham, Switzerland: Springer International Publishing.
- Kagan, M. (2020). Social support moderates the relationship between death anxiety and psychological distress among Israeli nurses. *Psychological Reports*, 124(4), 1502-1514.
doi:10.1177/0033294120945593
- Kaggwa, M. M., Najjuka, S. M., Ashaba, S., & Mamun, M. A. (2022). Psychometrics of the Patient Health Questionnaire (PHQ-9) in Uganda: A systematic review. *Frontiers in Psychiatry*, 13, 781095. doi:10.3389/fpsy.2022.781095
- Kahn, J. R., & Pearlin, L. I. (2006). Financial strain over the life course and health among older adults. *Journal of Health and Social Behavior*, 47(1), 17-31.
doi:10.1177/002214650604700102

- Kahya, E. (2007). The effects of job characteristics and working conditions on job performance. *International Journal of Industrial Ergonomics*, 37(6), 515-523. doi:10.1016/j.ergon.2007.02.006
- Kaiser, B. N., Haroz, E. E., Kohrt, B. A., Bolton, P. A., Bass, J. K., & Hinton, D. E. (2015). Thinking too much: A systematic review of a common idiom of distress. *Social Science and Medicine*, 147, 170-183. doi:10.1016/j.socscimed.2015.10.044
- Kaplan, R. (1984). Impact of urban nature: A theoretical analysis. *Urban Ecology*, 8(3), 189-197. doi:[https://doi.org/10.1016/0304-4009\(84\)90034-2](https://doi.org/10.1016/0304-4009(84)90034-2)
- Kaplan, R., & Kaplan, S. (1989). *The experience of nature: A psychological perspective*. Cambridge, United Kingdom: Cambridge University Press.
- Kaplan, S. (1995). The restorative benefits of nature: Toward an integrative framework. *Journal of Environmental Psychology*, 15(3), 169-182. doi:[https://doi.org/10.1016/0272-4944\(95\)90001-2](https://doi.org/10.1016/0272-4944(95)90001-2)
- Kashwan, P., Duffy, R. V., Massé, F., Asiyambi, A. P., & Marijnen, E. (2021). From racialized neocolonial global conservation to an inclusive and regenerative conservation. *Environment: Science and Policy for Sustainable Development*, 63(4), 4-19. doi:10.1080/00139157.2021.1924574
- Kaufmann, D., Kraay, A., & Mastruzzi, M. (2011). The Worldwide Governance Indicators: Methodology and analytical issues. *Hague Journal on the Rule of Law*, 3, 220-246. doi:10.1017/S1876404511200046
- Keinan, G., & Malach-Pines, A. (2007). Stress and burnout among prison personnel: Sources, outcomes, and intervention strategies. *Criminal Justice and Behavior*, 34(3), 380-398. doi:10.1177/0093854806290007
- Kellert, S. R., & Wilson, E. O. (1993). *The Biophilia Hypothesis*. Washington, D.C., United States: Island Press.
- Kelloway, E. K., & Barling, J. (2010). Leadership development as an intervention in occupational health psychology. *Work & Stress*, 24(3), 260-279. doi:10.1080/02678373.2010.518441
- Kendall, J. M. (2003). Designing a research project: Randomised controlled trials and their principles. *Emergency Medicine Journal*, 20(2), 164. doi:10.1136/emj.20.2.164
- Kennedy, C. M., Oakleaf, J. R., Theobald, D. M., Baruch-Mordo, S., & Kiesecker, J. (2019). Managing the middle: A shift in conservation priorities based on the global human modification gradient. *Global Change Biology*, 25, 811-826. doi:10.1111/gcb.14549
- Kenny, D. A., Kaniskan, B., & McCoach, D. B. (2014). The performance of RMSEA in models with small degrees of freedom. *Sociological Methods & Research*, 44(3), 486-507. doi:10.1177/0049124114543236
- Kessler, R. C., Andrews, G., Colpe, L. J., Hiripi, E., Mroczek, D. K., Normand, S. L. T., . . . Zaslavsky, A. M. (2002). Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychological Medicine*, 32(6), 959-976. doi:10.1017/S0033291702006074
- Kessler, R. C., Barker, P. R., Colpe, L. J., Epstein, J. F., Gfroerer, J. C., Hiripi, E., . . . Zaslavsky, A. M. (2003). Screening for serious mental illness in the general population. *Archives of General Psychiatry*, 60(2), 184-189. doi:10.1001/archpsyc.60.2.184
- Kessler, R. C., & Üstün, T. B. (2004). The World Mental Health (WMH) Survey Initiative version of the World Health Organization (WHO) Composite International Diagnostic Interview (CIDI). *International Journal of Methods in Psychiatric Research*, 13(2), 93-121. doi:<https://doi.org/10.1002/mpr.168>
- Key Conservation. (2022). Help conservation in real time. Retrieved from <https://www.keyconservation.org/>
- Kidd, L. R., Bekessy, S. A., & Garrard, G. E. (2019). Neither hope nor fear: Empirical evidence should drive biodiversity conservation strategies. *Trends in Ecology and Evolution*, 34(4), 278-282. doi:10.1016/j.tree.2019.01.018
- Kim, J. Y., Campbell, T. H., Shepherd, S., & Kay, A. C. (2020). Understanding contemporary forms of exploitation: Attributions of passion serve to legitimize the poor treatment of

- workers. *Journal of Personality and Social Psychology*, 118(1), 121-148.
doi:10.1037/pspi0000190
- Kinman, G., & Jones, F. (2008). Effort-reward imbalance and overcommitment: Predicting strain in academic employees in the United Kingdom. *International Journal of Stress Management*, 15(4), 381-395. doi:10.1037/a0013213
- Kinyanda, E., Kizza, R., Abbo, C., Ndyabangi, S., & Levin, J. (2013). Prevalence and risk factors of depression in childhood and adolescence as seen in four districts of North-Eastern Uganda. *BMC International Health and Human Rights*, 13, 19. doi:10.1186/1472-698X-13-19
- Kinyanda, E., Kyohangirwe, L., Mpango, R. S., Tusiime, C., Ssebunnya, J., Katumba, K., . . . Patel, V. (2021). Effectiveness and cost-effectiveness of integrating the management of depression into routine HIV Care in Uganda (the HIV + D trial): A protocol for a cluster-randomised trial. *International Journal of Mental Health Systems*, 15(1), 45. doi:10.1186/s13033-021-00469-9
- Kinyanda, E., Nakasujja, N., Levin, J., Birabwa, H., Mpango, R., Grosskurth, H., . . . Patel, V. (2017). Major depressive disorder and suicidality in early HIV infection and its association with risk factors and negative outcomes as seen in semi-urban and rural Uganda. *Journal of Affective Disorders*, 212, 117-127. doi:10.1016/j.jad.2017.01.033
- Kinyanda, E., Waswa, L., Baisley, K., & Maher, D. (2011). Prevalence of severe mental distress and its correlates in a population-based study in rural south-west Uganda. *BMC Psychiatry*, 11(97), 1-9. doi:10.1186/1471-244X-11-97
- Kinyanda, E., Woodburn, P., Tugumisirize, J., Kagugube, J., Ndyabangi, S., & Patel, V. (2011). Poverty, life events and the risk for depression in Uganda. *Social Psychiatry and Psychiatric Epidemiology*, 46(1), 35-44. doi:10.1007/s00127-009-0164-8
- Klein, A.-M., Vaissière, B. E., Cane, J. H., Steffan-Dewenter, I., Cunningham, S. A., Kremen, C., & Tscharntke, T. (2007). Importance of pollinators in changing landscapes for world crops. *Proceedings of the Royal Society B: Biological Sciences*, 274(1608), 303-313. doi:10.1098/rspb.2006.3721
- Kleinman, A. (2009). Global mental health: A failure of humanity. *The Lancet*, 374(9690), 603-604. doi:[https://doi.org/10.1016/S0140-6736\(09\)61510-5](https://doi.org/10.1016/S0140-6736(09)61510-5)
- Klintworth, G. (1992). 'The right to intervene' in the domestic affairs of states. *Australian Journal of International Affairs*, 46(2), 248-266. doi:10.1080/10357719208445088
- Klug, H. J. P., & Maier, G. W. (2014). Linking goal progress and subjective well-being: A meta-analysis. *Journal of Happiness Studies*, 16(1), 37-65. doi:10.1007/s10902-013-9493-0
- Koenen, K., Rudenstine, S., Susser, E., & Galea, S. (2013). Life course approaches to mental illness: The emergence of a concept. In K. Koenen, S. Rudenstine, E. Susser, & S. Galea (Eds.), *A Life Course Approach to Mental Disorders* (pp. 1-7). Oxford, United Kingdom: Oxford University Press.
- Kollmuss, A., & Agyeman, J. (2010). Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research*, 8(3), 239-260. doi:10.1080/13504620220145401
- Koopmans, L., Bernaards, C. M., Hildebrandt, V. H., de Vet, H. C. W., & van der Beek, A. J. (2014). Construct validity of the individual work performance questionnaire. *Journal of Occupational and Environmental Medicine*, 56(3), 331-337. doi:10.1097/JOM.0000000000000113
- Kossek, E. E., Valcour, M., & Lirio, P. (2014). The sustainable workforce: Organizational strategies for promoting work-life balance and wellbeing. In P. Y. Chen & C. L. Cooper (Eds.), *Work and Wellbeing* (pp. 295-318). Hoboken, United States: Wiley Blackwell.
- Kroenke, K., Spitzer, R. L., & Williams, J. B. W. (2001). The PHQ-9: Validity of a brief depression severity measure. *Journal of General Internal Medicine*, 16(9), 606-613. doi:10.1046/j.1525-1497.2001.016009606.x
- Kroenke, K., Strine, T. W., Spitzer, R. L., Williams, J. B. W., Berry, J. T., & Mokdad, A. H. (2009). The PHQ-8 as a measure of current depression in the general population. *Journal of Affective Disorders*, 114(1), 163-173. doi:<https://doi.org/10.1016/j.jad.2008.06.026>

- Kruglanski, A. W. (1996). Goals as knowledge structures. In P. M. Gollwitzer & J. A. Bargh (Eds.), *The Psychology of Action: Linking Cognition and Motivation to Behavior* (pp. 599-618). New York, United States: The Guilford Press.
- Kyongera, D. (2015). *Mapping private sector investments and their impacts on great ape habitats in Uganda's Albertine Rift region*. Retrieved from London, United Kingdom: <https://pubs.iied.org/pdfs/G03910.pdf>
- Lamontagne, A. D., Keegel, T., Louie, A. M., Ostry, A., & Landsbergis, P. A. (2007). A systematic review of the job-stress intervention evaluation literature, 1990-2005. *International Journal of Occupational and Environmental Health*, *13*(3), 268-280. doi:10.1179/oeh.2007.13.3.268
- Lamontagne, A. D., Martin, A., Page, K. M., Reavley, N. J., Noblet, A. J., Milner, A. J., . . . Smith, P. M. (2014). Workplace mental health: Developing an integrated intervention approach. *BMC Psychiatry*, *14*(1), 131. doi:10.1186/1471-244X-14-131
- Lanjouw, A. (2021). De-colonizing conservation in a global world. *American Journal of Primatology*, *83*(4), e23258. doi:<https://doi.org/10.1002/ajp.23258>
- Larkan, F., Uduma, O., Lawal, S. A., & van Bavel, B. (2016). Developing a framework for successful research partnerships in global health. *Globalization and Health*, *12*(1), 17. doi:10.1186/s12992-016-0152-1
- Larson, L. R., Cooper, C. B., Futch, S., Singh, D., Shipley, N. J., Dale, K., . . . Takekawa, J. Y. (2020). The diverse motivations of citizen scientists: Does conservation emphasis grow as volunteer participation progresses? *Biological Conservation*, *242*, 108428. doi:<https://doi.org/10.1016/j.biocon.2020.108428>
- Latham, G. P., & Locke, E. A. (2007). New developments in and directions for goal-setting research. *European Psychologist*, *12*(4), 290-300. doi:10.1027/1016-9040.12.4.290
- Lau, B. (2008). Effort-reward imbalance and overcommitment in employees in a Norwegian municipality: A cross sectional study. *Journal of Occupational Medicine and Toxicology*, *3*, 9. doi:10.1186/1745-6673-3-9
- Lau, V. C. S., Au, W. T., & Ho, J. M. C. (2003). A qualitative and quantitative review of antecedents of counterproductive behavior in organizations. *Journal of Business and Psychology*, *18*(1), 73-99. doi:10.1023/A:1025035004930
- Lawrence, D., & Vandecar, K. (2015). Effects of tropical deforestation on climate and agriculture. *Nature Climate Change*, *5*(1), 27-36. doi:10.1038/nclimate2430
- Le, L. K.-D., Esturas, A. C., Mihalopoulos, C., Chiotelis, O., Bucholc, J., Chatterton, M. L., & Engel, L. (2021). Cost-effectiveness evidence of mental health prevention and promotion interventions: A systematic review of economic evaluations. *PLoS Medicine*, *18*(5), e1003606. doi:10.1371/journal.pmed.1003606
- Leclère, D., Obersteiner, M., Barrett, M., Butchart, S. H. M., Chaudhary, A., De Palma, A., . . . Young, L. (2020). Bending the curve of terrestrial biodiversity needs an integrated strategy. *Nature*, *585*(7826), 551-556. doi:10.1038/s41586-020-2705-y
- Lehmann, U., Dieleman, M., & Martineau, T. (2008). Staffing remote rural areas in middle- and low-income countries: A literature review of attraction and retention. *BMC Health Services Research*, *8*(1), 19. doi:10.1186/1472-6963-8-19
- Lemoine, N. P. (2019). Moving beyond noninformative priors: Why and how to choose weakly informative priors in Bayesian analyses. *Oikos*, *128*(7), 912-928. doi:<https://doi.org/10.1111/oik.05985>
- Lerner, H., & Berg, C. (2017). A comparison of three holistic approaches to health: One Health, EcoHealth, and Planetary Health. *Frontiers in Veterinary Science*, *4*, 163-163. doi:10.3389/fvets.2017.00163
- Levis, B., Benedetti, A., Thombs, B. D., & Collaboration, D. E. S. D. (2019). Accuracy of Patient Health Questionnaire-9 (PHQ-9) for screening to detect major depression: individual participant data meta-analysis. *BMJ*, *365*, 11476. doi:10.1136/bmj.11476
- Li, C. H. (2016). Confirmatory factor analysis with ordinal data: Comparing robust maximum likelihood and diagonally weighted least squares. *Behavior Research Methods*, *48*(3), 936-949. doi:10.3758/s13428-015-0619-7

- Li, H., Zhang, X., Bi, S., Cao, Y., & Zhang, G. (2022). Psychological benefits of green exercise in wild or urban greenspaces: A meta-analysis of controlled trials. *Urban Forestry & Urban Greening*, 68, 127458. doi:<https://doi.org/10.1016/j.ufug.2022.127458>
- Linton, M.-J., Dieppe, P., & Medina-Lara, A. (2016). Review of 99 self-report measures for assessing well-being in adults: Exploring dimensions of well-being and developments over time. *BMJ Open*, 6(7), e010641. doi:10.1136/bmjopen-2015-010641
- Liu, J., Dietz, T., Carpenter, S. R., Alberti, M., Folke, C., Moran, E., . . . Taylor, W. W. (2007). Complexity of coupled human and natural systems. *Science*, 317(5844), 1513-1516. doi:10.1126/science.1144004
- Liu, J., Mooney, H., Hull, V., Davis Steven, J., Gaskell, J., Hertel, T., . . . Li, S. (2015). Systems integration for global sustainability. *Science*, 347(6225), 1258832. doi:10.1126/science.1258832
- Locke, E. A., & Latham, G. P. (2002). Building a practically useful theory of goal setting and task motivation: A 35-year odyssey. *American Psychologist*, 57(9), 705-717. doi:10.1037//0003-066x.57.9.705
- Locke, E. A., & Latham, G. P. (2006). New directions in goal-setting theory. *Current Directions in Psychological Science*, 15(5), 265-268. doi:10.1111/j.1467-8721.2006.00449.x
- Loi, R., Hang-Yue, N., & Foley, S. (2006). Linking employees' justice perceptions to organizational commitment and intention to leave: The mediating role of perceived organizational support. *Journal of Occupational and Organizational Psychology*, 79(1), 101-120. doi:<https://doi.org/10.1348/096317905X39657>
- Lombardo, P., Jones, W., Wang, L., Shen, X., & Goldner, E. M. (2018). The fundamental association between mental health and life satisfaction: Results from successive waves of a Canadian national survey. *BMC Public Health*, 18(1), 342. doi:10.1186/s12889-018-5235-x
- Lopes Cardozo, B., Gotway Crawford, C., Eriksson, C., Zhu, J., Sabin, M., Ager, A., . . . Simon, W. (2012). Psychological distress, depression, anxiety, and burnout among international humanitarian aid workers: A longitudinal study. *PLoS One*, 7(9), e44948. doi:10.1371/journal.pone.0044948
- López-López, I. M., Gómez-Urquiza, J. L., Cañadas, G. R., De la Fuente, E. I., Albendín-García, L., & Cañadas-De la Fuente, G. A. (2019). Prevalence of burnout in mental health nurses and related factors: A systematic review and meta-analysis. *International Journal of Mental Health Nursing*, 28(5), 1035-1044. doi:<https://doi.org/10.1111/inm.12606>
- Lu, N., Liu, L., Yu, D., & Fu, B. (2021). Navigating trade-offs in the social-ecological systems. *Current Opinion in Environmental Sustainability*, 48, 77-84. doi:<https://doi.org/10.1016/j.cosust.2020.10.014>
- Lucas, J., Gora, E., & Alonso, A. (2017). A view of the global conservation job market and how to succeed in it. *Conservation Biology*, 31(6), 1223-1231. doi:<https://doi.org/10.1111/cobi.12949>
- Lucas, R. E. (2007). Adaptation and the set-point model of subjective well-being: Does happiness change after major life events? *Current Directions in Psychological Science*, 16(2), 75-79. doi:10.1111/j.1467-8721.2007.00479.x
- Lund, C., Breen, A., Flisher, A. J., Kakuma, R., Corrigall, J., Joska, J. A., . . . Patel, V. (2010). Poverty and common mental disorders in low and middle income countries: A systematic review. *Social Science & Medicine*, 71(3), 517-528. doi:10.1016/j.socscimed.2010.04.027
- Lund, C., Brooke-Sumner, C., Baingana, F., Baron, E. C., Breuer, E., Chandra, P., . . . Saxena, S. (2018). Social determinants of mental disorders and the Sustainable Development Goals: A systematic review of reviews. *The Lancet Psychiatry*, 5(4), 357-369. doi:10.1016/s2215-0366(18)30060-9
- Lunenburg, F. C. (2011). Goal-setting theory of motivation. *International Journal of Business Management and Administration*, 15(1), 1-6.
- Luthans, F., & Youssef-Morgan, C. M. (2017). Psychological capital: An evidence-based positive approach. *Annual Review of Organizational Psychology and Organizational Behavior*, 4(1), 339-366. doi:10.1146/annurev-orgpsych-032516-113324

- Luthans, F., Youssef-Morgan, C. M., Avolio, B. J., & Youssef-Morgan, C. M. (2015). Introduction to the meaning of and need for psychological capital. In *Psychological Capital and Beyond* (pp. 1-18). New York, United States: Oxford University Press.
- Lyrakos, G. N., Damigos, D., Mavreas, V., Georgia, K., & Dimoliatis, I. D. K. (2009). A Translation and validation study of the Life Orientation Test Revised in the Greek speaking population of nurses among three hospitals in Athens and Ioannina. *Social Indicators Research*, *95*, 129-142. doi:10.1007/s11205-009-9453-6
- MacDonald, A. J., & Mordecai, E. A. (2019). Amazon deforestation drives malaria transmission, and malaria burden reduces forest clearing. *Proceedings of the National Academy of Sciences*, *116*(44), 22212-22218. doi:<https://doi.org/10.1073/pnas.1905315116>
- Mace, G. M. (2014). Whose conservation? *Science*, *345*(6204), 1558-1560. doi:10.1126/science.1254704
- Madzwamuse, M., Rihoy, E., & Louis, M. (2020). Contested conservation: Implications for rights, democratization, and citizenship in Southern Africa. *Development*, *63*(1), 67-73. doi:10.1057/s41301-020-00237-1
- Mahmood, T. (2020). Biomarkers in psychiatry: A clinician's viewpoint. *Br Med Bull*, *135*(1), 23-27. doi:10.1093/bmb/ldaa019
- Malcom, J., Schwartz, M. W., Evansen, M., Ripple, W. J., Polasky, S., Gerber, L. R., . . . Miller, J. R. B. (2019). Solve the biodiversity crisis with funding. *Science*, *365*(6459), 1256. doi:10.1126/science.aay9839
- Malouff, J. M., & Schutte, N. S. (2017). Can psychological interventions increase optimism? A meta-analysis. *Journal of Positive Psychology*, *12*(6), 594-604. doi:10.1080/17439760.2016.1221122
- Marchand, A., Demers, A., & Durand, P. (2005). Does work really cause distress? The contribution of occupational structure and work organization to the experience of psychological distress. *Soc Sci Med*, *61*(1), 1-14. doi:10.1016/j.socscimed.2004.11.037
- Markevych, I., Schoierer, J., Hartig, T., Chudnovsky, A., Hystad, P., Dzhambov, A. M., . . . Fuertes, E. (2017). Exploring pathways linking greenspace to health: Theoretical and methodological guidance. *Environmental Research*, *158*, 301-317. doi:<https://doi.org/10.1016/j.envres.2017.06.028>
- Markus, K. A., & Smith, K. M. (2012). Content validity. In N. J. Salkind (Ed.), *Encyclopedia of Research Design* (pp. 239-243). Thousand Oaks, United States: SAGE Publications.
- Marselle, M. R. (2019). Theoretical foundations of biodiversity and mental well-being relationships. In M. R. Marselle, J. Stadler, H. Korn, K. N. Irvine, & A. Bonn (Eds.), *Biodiversity and Health in the Face of Climate Change* (pp. 133-158). Cham, Switzerland: Springer International Publishing.
- Marselle, M. R., Martens, D., Dallimer, M., & Irvine, Katherine N. (2019). Review of the mental health and wellbeing benefits of biodiversity. In M. R. Marselle, J. Stadler, H. Korn, K. N. Irvine, & A. Bonn (Eds.), *Biodiversity and Health in the Face of Climate Change* (pp. 175-211). Cham, Switzerland: Springer International Publishing.
- Marsh, J. (2016). Blood biomarkers in psychiatry. *The Lancet Psychiatry*, *3*(8), 693. doi:10.1016/S2215-0366(16)30176-6
- Marsh, K., Phillips, C. J., Fordham, R., Bertranou, E., & Hale, J. (2012). Estimating cost-effectiveness in public health: A summary of modelling and valuation methods. *Health Economics Review*, *2*(1), 17. doi:10.1186/2191-1991-2-17
- Martiniello, G. (2021). Bitter sugarification: Sugar frontier and contract farming in Uganda. *Globalizations*, *18*(3), 355-371. doi:10.1080/14747731.2020.1794564
- Mathieu, J. E., Hofmann, D. A., & Farr, J. L. (1993). Job perception-job satisfaction relations: An empirical comparison of three competing theories. *Organizational Behavior and Human Decision Processes*, *56*(3), 370-387. doi:<https://doi.org/10.1006/obhd.1993.1060>
- Maxwell, S. L., Fuller, R. A., Brooks, T. M., & Watson, J. E. M. (2016). Biodiversity: The ravages of guns, nets and bulldozers. *Nature*, *536*, 143-145. doi:10.1038/536143a
- Mbaria, J., & Ogada, M. (2016). *The Big Conservation Lie*. Auburn, United States: Lens & Lens.

- McEachan, R. R., Prady, S. L., Smith, G., Fairley, L., Cabieses, B., Gidlow, C., . . . Nieuwenhuijsen, M. J. (2016). The association between green space and depressive symptoms in pregnant women: Moderating roles of socioeconomic status and physical activity. *Journal of Epidemiology and Community Health*, 70(3), 253-259. doi:10.1136/jech-2015-205954
- McElreath, R. (2016). *Statistical Rethinking: A Bayesian Course with Examples in R and Stan* (1 ed.). Boca Raton, United States: Chapman & Hall/CRC.
- McGorry, P., Keshavan, M., Goldstone, S., Amminger, P., Allott, K., Berk, M., . . . Hickie, I. (2014). Biomarkers and clinical staging in psychiatry. *World Psychiatry*, 13(3), 211-223. doi:10.1002/wps.20144
- McGorry, P., & van Os, J. (2013). Redeeming diagnosis in psychiatry: Timing versus specificity. *The Lancet*, 381(9863), 343-345. doi:10.1016/s0140-6736(12)61268-9
- McGregor, J. A. (2007). Researching human well-being: From concepts to methodology. In I. Gough & J. A. McGregor (Eds.), *Well-being in developing countries: From theory to research* (pp. 316-350). Cambridge, United Kingdom: Cambridge University Press.
- McKinnon, M. C., Cheng, S. H., Dupre, S., Edmond, J., Garside, R., Glew, L., . . . Woodhouse, E. (2016). What are the effects of nature conservation on human well-being? A systematic map of empirical evidence from developing countries. *Environmental Evidence*, 5(1), 8. doi:10.1186/s13750-016-0058-7
- McLeod, K. (2018). *Our people – Multidimensional wellbeing in New Zealand*. Retrieved from Wellington, New Zealand: <https://www.treasury.govt.nz/sites/default/files/2018-11/ap18-04.pdf>
- McShane, T. O., Hirsch, P. D., Trung, T. C., Songorwa, A. N., Kinzig, A., Monteferrri, B., . . . O'Connor, S. (2011). Hard choices: Making trade-offs between biodiversity conservation and human well-being. *Biological Conservation*, 144(3), 966-972. doi:10.1016/j.biocon.2010.04.038
- Meemken, E.-M., & Bellemare, M. F. (2020). Smallholder farmers and contract farming in developing countries. *Proceedings of the National Academy of Sciences*, 117(1), 259. doi:10.1073/pnas.1909501116
- Merkle, E. C., Fitzsimmons, E., Uanhoro, J., & Goodrich, B. (2020). Efficient Bayesian structural equation modeling in Stan. *arXiv preprint*, 1-21. doi:arXiv:2008.07733v1
- Middleton, J., Cunsolo, A., Jones-Bitton, A., Wright, C. J., & Harper, S. L. (2020). Indigenous mental health in a changing climate: A systematic scoping review of the global literature. *Environmental Research Letters*, 15(5), 053001. doi:10.1088/1748-9326/ab68a9
- Mieg, H. A. (2009). Two factors of expertise? Excellence and professionalism of environmental experts. *High Ability Studies*, 20(1), 91-115. doi:10.1080/13598130902860432
- Mikkelsen, K., Stojanovska, L., Polenakovic, M., Bosevski, M., & Apostolopoulos, V. (2017). Exercise and mental health. *Maturitas*, 106, 48-56. doi:<https://doi.org/10.1016/j.maturitas.2017.09.003>
- Miller, A. P., Ziegel, L., Mugamba, S., Kyasanku, E., Wagman, J. A., Nkwanzu-Lubega, V., . . . Ddaaki, W. (2021). Not enough money and too many thoughts: Exploring perceptions of mental health in two Ugandan districts through the mental health literacy framework. *Qualitative Health Research*, 31(5), 967-982. doi:10.1177/1049732320986164
- Milligan-Saville, J. S., Tan, L., Gayed, A., Barnes, C., Madan, I., Dobson, M., . . . Harvey, S. B. (2017). Workplace mental health training for managers and its effect on sick leave in employees: A cluster randomised controlled trial. *The Lancet Psychiatry*, 4(11), 850-858. doi:[https://doi.org/10.1016/S2215-0366\(17\)30372-3](https://doi.org/10.1016/S2215-0366(17)30372-3)
- Millstein, R. A., Chung, W.-J., Hoepfner, B. B., Boehm, J. K., Legler, S. R., Mastromauro, C. A., & Huffman, J. C. (2019). Development of the state optimism measure. *General Hospital Psychiatry*, 58, 83-93. doi:10.1016/j.genhosppsy.2019.04.002
- Milner-Gulland, E. J. (2021). The global conservation movement is divided but not diverse: Reflections on 2020. *Oryx*, 55(3), 321-322. doi:10.1017/S003060532100048X

- Milner-Gulland, E. J., McGregor, J. A., Agarwala, M., Atkinson, G., Bevan, P., Clements, T., . . . Wilkie, D. (2014). Accounting for the impact of conservation on human well-being. *Conservation Biology*, 28(5), 1160-1166. doi:10.1111/cobi.12277
- Min, J. W., & Lee, S. H. (2015). Validation of the K6/K10 scales of psychological distress and their optimal cutoff scores for older Koreans. *International Journal of Aging & Human Development*, 80(3), 264-282. doi:10.1177/0091415015590316
- Ministry of Agriculture, Animal Industry and Fisheries. (2016). *Agriculture sector strategic plan 2015/16 - 2019/20*. Retrieved from Entebbe, Uganda: <http://npa.go.ug/wp-content/uploads/2016/08/ASSP-Final-Draft.pdf>
- Mitchell, R. J., Richardson, E. A., Shortt, N. K., & Pearce, J. R. (2015). Neighborhood environments and socioeconomic inequalities in mental well-being. *American Journal of Preventive Medicine*, 49(1), 80-84. doi:<https://doi.org/10.1016/j.amepre.2015.01.017>
- Mohanakumar, S., & Sharma, R. K. (2006). Analysis of farmer suicides in Kerala. *Economic and Political Weekly*, 41(16), 1553-1558.
- Mokink, L. B., Terwee, C. B., Patrick, D. L., Alonso, J., Stratford, P. W., Knol, D. L., . . . de Vet, H. C. W. (2010). The COSMIN study reached international consensus on taxonomy, terminology, and definitions of measurement properties for health-related patient-reported outcomes. *Journal of Clinical Epidemiology*, 63(7), 737-745. doi:<https://doi.org/10.1016/j.jclinepi.2010.02.006>
- Molodynski, A., Cusack, C., & Nixon, J. (2017). Mental healthcare in Uganda desperate challenges but real opportunities. *BJPsych International*, 14(4), 98-100. doi:10.3109/09
- Monitor Deloitte. (2017). *Mental health and employers: The case for investment*. Retrieved from Cambridge, United States: <https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/public-sector/deloitte-uk-mental-health-employers-monitor-deloitte-oct-2017.pdf>
- Monsalve-Reyes, C. S., San Luis-Costas, C., Gómez-Urquiza, J. L., Albendín-García, L., Aguayo, R., & Cañadas-De la Fuente, G. A. (2018). Burnout syndrome and its prevalence in primary care nursing: A systematic review and meta-analysis. *BMC Family Practice*, 19(1), 59. doi:10.1186/s12875-018-0748-z
- Montana, J., Elliott, L., Ryan, M., & Wyborn, C. (2020). The need for improved reflexivity in conservation science. *Environmental Conservation*, 47(4), 217-219. doi:10.1017/s0376892920000326
- Montana, J., Sandbrook, C., Robertson, E., & Ryan, M. (2019). Revealing research preferences in conservation science. *Oryx*, 55(3), 1-8. doi:10.1017/s003060531900067x
- Montano, D., Reeske, A., Franke, F., & Hüffmeier, J. (2017). Leadership, followers' mental health and job performance in organizations: A comprehensive meta-analysis from an occupational health perspective. *Journal of Organizational Behavior*, 38(3), 327-350. doi:<https://doi.org/10.1002/job.2124>
- Monzani, D., Steca, P., Greco, A., D'Addario, M., Pancani, L., & Cappelletti, E. (2015). Effective pursuit of personal goals: The fostering effect of dispositional optimism on goal commitment and goal progress. *Personality and Individual Differences*, 82, 203-214. doi:<https://doi.org/10.1016/j.paid.2015.03.019>
- Moon, K., & Blackman, D. (2014). A guide to understanding social science research for natural scientists. *Conservation Biology*, 28(5), 1167-1177. doi:<https://doi.org/10.1111/cobi.12326>
- Moon, K., Blackman, D. A., Adams, V. M., Colvin, R. M., Davila, F., Evans, M. C., . . . Wyborn, C. (2019). Expanding the role of social science in conservation through an engagement with philosophy, methodology, and methods. *Methods in Ecology and Evolution*, 10(3), 294-302. doi:<https://doi.org/10.1111/2041-210X.13126>
- Moonjelly DAO. (2022). Decentralizing ocean conservation. Retrieved from <https://www.moonjelly.io/home?hsLang=en>
- Moreto, W. D. (2016). Occupational stress among law enforcement rangers: Insights from Uganda. *Oryx*, 50(4), 646-654. doi:10.1017/S0030605315000356

- Moreto, W. D., Brunson, R. K., & Braga, A. A. (2015). 'Such misconducts don't make a good ranger': Examining law enforcement ranger wrongdoing in Uganda. *British Journal of Criminology*, 55(2), 359-380. doi:10.1093/bjc/azu079
- Morres, I. D., Hatzigeorgiadis, A., Stathi, A., Comoutos, N., Arpin-Cribbie, C., Krommidas, C., & Theodorakis, Y. (2019). Aerobic exercise for adult patients with major depressive disorder in mental health services: A systematic review and meta-analysis. *Depression and Anxiety*, 36(1), 39-53. doi:<https://doi.org/10.1002/da.22842>
- Munkholm, K. (2021). Unconvincing evidence for peripheral biomarkers in major mental disorders. *Translational Psychiatry*, 11(1), 237. doi:10.1038/s41398-021-01355-1
- Murad, M. H., Asi, N., Alsawas, M., & Alahdab, F. (2016). New evidence pyramid. *Evidence Based Medicine*, 21(4), 125. doi:10.1136/ebmed-2016-110401
- Mushangwe, S., Astell-Burt, T., Steel, D., & Feng, X. (2021). Ethnic inequalities in green space availability: Evidence from Australia. *Urban Forestry & Urban Greening*, 64, 127235. doi:<https://doi.org/10.1016/j.ufug.2021.127235>
- Mushemeza, E. D. (2019). *Decentralisation in Uganda: Trends, achievements, challenges and proposals for consolidation*. Retrieved from Kampala, Uganda: <https://www.acode-u.org/uploadedFiles/PRS93.pdf>
- Mwavu, E. N., Kalema, V. K., Bateganya, F., Byakagaba, P., Waiswa, D., Enuru, T., & Mbogga, M. S. (2018). Expansion of commercial sugarcane cultivation among smallholder farmers in Uganda: Implications for household food security. *Land*, 7(2), 1-15. doi:10.3390/land7020073
- Myers, S. S. (2017). Planetary health: Protecting human health on a rapidly changing planet. *The Lancet*, 390(10114), 2860-2868. doi:10.1016/s0140-6736(17)32846-5
- Nabwire, L. (2015). *Uganda's dilemmas in the transition to modern commercial agriculture: Implications for the poverty reduction agenda*. Retrieved from Brighton, United Kingdom: <https://assets.publishing.service.gov.uk/media/57a08998e5274a31e0000180/Nabwire.pdf>
- Naidoo, R., Gerkey, D., Hole, D., Pfaff, A., Ellis, A. M., Golden, C. D., . . . Fisher, B. (2019). Evaluating the impacts of protected areas on human well-being across the developing world. *Science Advances*, 5(4), eaav3006. doi:10.1126/sciadv.aav3006
- Nakku, J. E. M., Rathod, S. D., Kizza, D., Breuer, E., Mutyaba, K., Baron, E. C., . . . Kigozi, F. (2016). Validity and diagnostic accuracy of the Luganda version of the 9-item and 2-item Patient Health Questionnaire for detecting major depressive disorder in rural Uganda. *Global Mental Health*, 3, 14--21. doi:10.1017/gmh.2016.14
- Narayan, D., Chambers, R., Shah, M. K., & Patesch, P. (2000). *Voices of the poor: Crying out for change*. Retrieved from New York, United States: https://iiif.wellcomecollection.org/file/b28144995_Voices%20of%20the%20poor%20crying%20out.pdf
- National Academy of Medicine. (2014). Measures reviewed for each candidate domain. In Institute of Medicine (US). Committee on the Recommended Social and Behavioral Domains and Measures for Electronic Health Records (Ed.), *Capturing Social and Behavioral Domains and Measures in Electronic Health Records: Phase 2* (pp. 127-226). Washington, D.C., United States: National Academies Press.
- National Collaborating Centre for Mental Health (NCCMH). (2011). Common mental health disorders. In *Common mental health disorders: Identification and pathways to care* (pp. 123). Leicester, United Kingdom: The British Psychological Society and The Royal College of Psychiatrists.
- National Health Service (NHS). (2019). *The NHS long term plan*. Retrieved from London, United Kingdom: <https://www.longtermplan.nhs.uk/>
- National Planning Authority of Uganda. (2020). *Third national development plan (NDP III) 2020/21 - 2024/25*. Retrieved from Entebbe, Uganda: http://www.npa.go.ug/wp-content/uploads/2020/08/NDPIII-Finale_Compressed.pdf
- Nawrath, M., Elsey, H., & Dallimer, M. (2022). Why cultural ecosystem services matter most: Exploring the pathways linking greenspaces and mental health in a low-income country.

- Science of The Total Environment*, 806, 150551.
doi:<https://doi.org/10.1016/j.scitotenv.2021.150551>
- Nelson, C. A., Bhutta, Z. A., Burke Harris, N., Danese, A., & Samara, M. (2020). Adversity in childhood is linked to mental and physical health throughout life. *BMJ*, 371, m3048. doi:10.1136/bmj.m3048
- Newing, H. (2010). Qualitative interviews and focus groups. In H. Newing (Ed.), *Conducting Research in Conservation: Social Science Methods and Practice* (1 ed., pp. 98-18). Milton Park, United Kingdom: Routledge.
- Newing, H., & Perram, A. (2019). What do you know about conservation and human rights? *Oryx*, 53(4), 595-596. doi:10.1017/S0030605319000917
- Newton, A., & Elliott, M. (2016). A typology of stakeholders and guidelines for engagement in transdisciplinary, participatory processes. *Frontiers in Marine Science*, 3, 230. doi:<https://doi.org/10.3389/fmars.2016.00230>
- Nichter, M. (2010). Idioms of distress revisited. *Culture, Medicine and Psychiatry*, 34(2), 401-416. doi:10.1007/s11013-010-9179-6
- Nilsson, D., Baxter, G., Butler, J. R. A., & McAlpine, C. A. (2016). How do community-based conservation programs in developing countries change human behaviour? A realist synthesis. *Biological Conservation*, 200, 93-103. doi:<https://doi.org/10.1016/j.biocon.2016.05.020>
- Nilsson, M., Griggs, D., & Visbeck, M. (2016). Policy: Map the interactions between Sustainable Development Goals. *Nature*, 534(7607), 320-322. doi:10.1038/534320a
- Nurius, P. S., Green, S., Logan-Greene, P., & Borja, S. (2015). Life course pathways of adverse childhood experiences toward adult psychological well-being: A stress process analysis. *Child Abuse & Neglect*, 45, 143-153. doi:<https://doi.org/10.1016/j.chiabu.2015.03.008>
- O'Brien, L., De Vreese, R., Kern, M., Sievänen, T., Stojanova, B., & Atmiş, E. (2017). Cultural ecosystem benefits of urban and peri-urban green infrastructure across different European countries. *Urban Forestry & Urban Greening*, 24, 236-248. doi:<https://doi.org/10.1016/j.ufug.2017.03.002>
- O'Farrell, P. J., & Anderson, P. M. L. (2010). Sustainable multifunctional landscapes: A review to implementation. *Current Opinion in Environmental Sustainability*, 2(1), 59-65. doi:<https://doi.org/10.1016/j.cosust.2010.02.005>
- Oakley Browne, M. A., Wells, J. E., Scott, K. M., & McGee, M. A. (2010). The Kessler Psychological Distress Scale in Te Rau Hinengaro: The New Zealand Mental Health Survey. *The Australian and New Zealand Journal of Psychiatry*, 44(4), 314-322. doi:10.3109/00048670903279820
- Office for National Statistics (ONS). (2007). *General Household Survey 2007: Household and individual questionnaires*. Retrieved from Titchfield, United Kingdom: <http://www.ons.gov.uk/ons/rel/ghs/general-household-survey/2007-report/index.html>
- Office for National Statistics (ONS). (2019). *Personal and economic well-being: What matters most to our life satisfaction?* Retrieved from Newport, United Kingdom: <https://www.ons.gov.uk/peoplepopulationandcommunity/wellbeing/articles/personalandeconomicwellbeingintheuk/whatmattersmosttoourlifesatisfaction>
- Office for National Statistics (ONS). (2022). Annual population survey - Employment by occupation by sex. Retrieved from <https://www.nomisweb.co.uk/datasets/aps168/reports/employment-by-occupation?compare=K02000001>
- Ogra, M. V. (2008). Human-wildlife conflict and gender in protected area borderlands: A case study of costs, perceptions, and vulnerabilities from Uttarakhand (Uttaranchal), India. *Geoforum*, 39(3), 1408-1422. doi:<https://doi.org/10.1016/j.geoforum.2007.12.004>
- Ohly, H., White, M. P., Wheeler, B. W., Bethel, A., Ukoumunne, O. C., Nikolaou, V., & Garside, R. (2016). Attention restoration theory: A systematic review of the attention restoration potential of exposure to natural environments. *Journal of Toxicology and Environmental Health, Part B*, 19(7), 305-343. doi:10.1080/10937404.2016.1196155

- Ohrnberger, J., Fichera, E., & Sutton, M. (2017). The relationship between physical and mental health: A mediation analysis. *Social Science and Medicine*, 195(November), 42-49. doi:10.1016/j.socscimed.2017.11.008
- Oliveira, S., Andrade, H., & Vaz, T. (2011). The cooling effect of green spaces as a contribution to the mitigation of urban heat: A case study in Lisbon. *Building and Environment*, 46(11), 2186-2194. doi:<https://doi.org/10.1016/j.buildenv.2011.04.034>
- Olivos-Jara, P., Segura-Fernández, R., Rubio-Pérez, C., & Felipe-García, B. (2020). Biophilia and biophobia as emotional attribution to nature in children of 5 years old. *Frontiers in Psychology*, 11, 511. doi:10.3389/fpsyg.2020.00511
- Organisation for Economic Co-operation and Development (OECD). (2013). *OECD Guidelines on Measuring Subjective Well-being*. Retrieved from <http://dx.doi.org/10.1787/9789264191655-en>
- Ormel, J., & Neeleman, J. (2000). Towards a dynamic stress-vulnerability model of depression. The role of neuroticism, life events and gender. In T. Harris (Ed.), *Where Inner and Outer Worlds Meet: Psychosocial Research in the Tradition of George W. Brown* (pp. 151-170). London, United Kingdom: Routledge
- Oryx. (2001). Code of conduct for researchers contributing articles to Oryx - The International Journal of Conservation. *Oryx*, 35(2), 99-100. doi:10.1046/j.1365-3008.2001.00172.x
- Ostrom, E. (2007). A diagnostic approach for going beyond panaceas. *Proceedings of the National Academy of Sciences*, 104(39), 15181-15187. doi:<https://doi.org/10.1073/pnas.0702288104>
- Ostrom, E. (2015). *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge, United Kingdom: Cambridge University Press.
- Otsuka, K. (2013). Food insecurity, income inequality, and the changing comparative advantage in world agriculture. *Agricultural Economics*, 44(s1), 7-18. doi:<https://doi.org/10.1111/agec.12046>
- Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N., & Hoagwood, K. (2015). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and Policy in Mental Health*, 42(5), 533-544. doi:10.1007/s10488-013-0528-y
- Papworth, S., Rao, M., Oo, M. M., Latt, K. T., Tizard, R., Pienkowski, T., & Carrasco, L. R. (2017). The impact of gold mining and agricultural concessions on the tree cover and local communities in northern Myanmar. *Scientific Reports*, 7(1), 46594. doi:10.1038/srep46594
- Papworth, S., Rist, J., Coad, L., & Milner-Gulland, E. J. (2009). Evidence for shifting baseline syndrome in conservation. *Conservation Letters*, 2(2), 93-100. doi:<https://doi.org/10.1111/j.1755-263X.2009.00049.x>
- Papworth, S., Thomas, R. L., & Turvey, S. T. (2018). Increased dispositional optimism in conservation professionals. *Biodiversity and Conservation*, 28(2), 401-414. doi:10.1007/s10531-018-1665-0
- Parkhurst, J. O., & Abeyasinghe, S. (2016). What constitutes “good” evidence for public health and social policy-making? From hierarchies to appropriateness. *Social Epistemology*, 30(5-6), 665-679. doi:10.1080/02691728.2016.1172365
- Patel, V., Burns, J. K., Dhingra, M., Tarver, L., Kohrt, B. A., & Lund, C. (2018). Income inequality and depression: A systematic review and meta-analysis of the association and a scoping review of mechanisms. *World Psychiatry*, 17(1), 76-89. doi:10.1002/wps.20492
- Patel, V., & Kleinman, A. (2003). Poverty and common mental disorders in developing countries. *Bulletin of the World Health Organization*, 81(8), 609-615.
- Patel, V., & Prince, M. (2010). Global mental health: A new global health field comes of age. *Jama*, 303(19), 1976-1977. doi:10.1001/jama.2010.616
- Patel, V., Saxena, S., Lund, C., Thornicroft, G., Baingana, F., Bolton, P., . . . Unützer, J. (2018). The Lancet Commission on global mental health and sustainable development. *The Lancet*, 392(10157), 1553-1598. doi:10.1016/s0140-6736(18)31612-x
- Paterson, J. D. (1991). The ecology and history of Uganda's Budongo forest. *Forest & Conservation History*, 35(4), 179-187.

- Payton, A. R. (2009). Mental health, mental illness, and psychological distress: Same continuum or distinct phenomena? *Journal of Health and Social Behavior*, 50(2), 213-227. doi:10.1177/002214650905000207
- Pearlin, L. I., Schieman, S., Fazio, E. M., & Meersman, S. C. (2005). Stress, health, and the life course: Some conceptual perspectives. *Journal of Health and Social Behavior*, 46(2), 205-219. doi:10.1177/002214650504600206
- Pedersen, D., Kienzler, H., & Gamarra, J. (2010). Llaki and ñakary: Idioms of distress and suffering among the highland Quechua in the Peruvian Andes. *Culture, Medicine and Psychiatry*, 34(2), 279-300. doi:10.1007/s11013-010-9173-z
- Peluso, N. L., & Lund, C. (2011). New frontiers of land control: Introduction. *The Journal of Peasant Studies*, 38(4), 667-681. doi:10.1080/03066150.2011.607692
- Perrachione, B. A., Rosser, V. J., & Petersen, G. J. (2008). Why do they stay? Elementary teachers' perceptions of job satisfaction and retention. *The Professional educator*, 32(2), 1.
- Peterson, B. S. (2020). Editorial: Biomarkers in precision medicine for mental illnesses. *Journal of Child Psychology and Psychiatry*, 61(12), 1279-1281. doi:<https://doi.org/10.1111/jcpp.13357>
- Petrie, K., Crawford, J., Baker, S. T. E., Dean, K., Robinson, J., Veness, B. G., . . . Harvey, S. B. (2019). Interventions to reduce symptoms of common mental disorders and suicidal ideation in physicians: A systematic review and meta-analysis. *The Lancet Psychiatry*, 6(3), 225-234. doi:[https://doi.org/10.1016/S2215-0366\(18\)30509-1](https://doi.org/10.1016/S2215-0366(18)30509-1)
- Pienkowski, T., Dickens, B. L., Sun, H., & Carrasco, L. R. (2017). Empirical evidence of the public health benefits of tropical forest conservation in Cambodia: A generalised linear mixed-effects model analysis. *The Lancet Planetary Health*, 1(5), e180-e187. doi:10.1016/s2542-5196(17)30081-5
- Pienkowski, T., Keane, A., Castelló y Tickell, S., Hazenbosch, M., Arlidge, W. N. S., Baranyi, G., . . . Milner-Gulland, E. J. (2021). Balancing making a difference with making a living in the conservation sector. *Conservation Biology*, 1-13. doi:<https://doi.org/10.1111/cobi.13846>
- Pihkala, P. (2020). The cost of bearing witness to the environmental crisis: Vicarious traumatization and dealing with secondary traumatic stress among environmental researchers. *Social Epistemology*, 34(1), 86-100. doi:10.1080/02691728.2019.1681560
- Plumptre, A. J., Davenport, T. R. B., Behangana, M., Kityo, R., Eilu, G., Ssegawa, P., . . . Moyer, D. (2007). The biodiversity of the Albertine Rift. *Biological Conservation*, 134(2), 178-194. doi:10.1016/j.biocon.2006.08.021
- Polit, D. F. (2015). Assessing measurement in health: Beyond reliability and validity. *International Journal of Nursing Studies*, 52(11), 1746-1753. doi:10.1016/j.ijnurstu.2015.07.002
- Potapov, P., Hansen Matthew, C., Laestadius, L., Turubanova, S., Yaroshenko, A., Thies, C., . . . Esipova, E. (2017). The last frontiers of wilderness: Tracking loss of intact forest landscapes from 2000 to 2013. *Science Advances*, 3(1), e1600821. doi:10.1126/sciadv.1600821
- Prince, M., Patel, V., Saxena, S., Maj, M., Maselko, J., Phillips, M. R., & Rahman, A. (2007). No health without mental health. *The Lancet*, 370(9590), 859-877. doi:10.1016/s0140-6736(07)61238-0
- Prochaska, J. J., Sung, H.-Y., Max, W., Shi, Y., & Ong, M. (2012). Validity study of the K6 scale as a measure of moderate mental distress based on mental health treatment need and utilization. *International Journal of Methods in Psychiatric Research*, 21(2), 88-97. doi:10.1002/mpr.1349
- Pullin, A. S. (2002). *Conservation Biology*. Cambridge, United Kingdom: Cambridge University Press.
- Pullin, A. S., Bangpan, M., Dalrymple, S., Dickson, K., Haddaway, N. R., Healey, J. R., . . . Oliver, S. (2013). Human well-being impacts of terrestrial protected areas. *Environmental Evidence*, 2(1), 1-41. doi:10.1186/2047-2382-2-19
- R Core Team. (2020). R: A language and environment for statistical computing (Version 4.0.2). Vienna, Austria: R Foundation for Statistical Computing.

- Rai, N. D., Devy, M. S., Ganesh, T., Ganesan, R., Setty, S. R., Hiremath, A. J., . . . Rajan, P. D. (2021). Beyond fortress conservation: The long-term integration of natural and social science research for an inclusive conservation practice in India. *Biological Conservation*, 254, 108888. doi:<https://doi.org/10.1016/j.biocon.2020.108888>
- Ramos, H. M., Mustafa, M., Primack, R., & Campos-Arceiz, A. (2017). What do conservation biologists think about their job and working conditions? *Biological Conservation*, 211, 183-188. doi:10.1016/j.biocon.2016.10.033
- Raymond, H. (2007). The ecologically noble savage debate. *Annual Review of Anthropology*, 36(1), 177-190. doi:10.1146/annurev.anthro.35.081705.123321
- Reid, W. V., Mooney, H. A., Cropper, A., Capistrano, D., Carpenter, S. R., Chopra, K., . . . Zurek, M. B. (2005). *Ecosystems and human well-being - synthesis: A report of the Millennium Ecosystem Assessment* (1597260401). Retrieved from Washington, D.C, United States: <https://www.millenniumassessment.org/documents/document.356.aspx.pdf>
- Resource Africa. (2022). Open letter: Celebrity campaigns undermine successful conservation and human rights. Retrieved from <https://resourceafrica.net/open-letter-celebrity-campaigns-undermine-successful-conservation-and-human-rights/>
- Revelle, W. (2019). psych: Procedures for psychological, psychometric, and personality research (Version 1.9.12). Evanston, USA: Northwestern University. Retrieved from <https://CRAN.R-project.org/package=psych>
- Riahi, K., van Vuuren, D. P., Kriegler, E., Edmonds, J., O'Neill, B. C., Fujimori, S., . . . Tavoni, M. (2017). The Shared Socioeconomic Pathways and their energy, land use, and greenhouse gas emissions implications: An overview. *Global Environmental Change*, 42, 153-168. doi:10.1016/j.gloenvcha.2016.05.009
- Ribot, J. C., & Peluso, N. L. (2003). A theory of access. *Rural Sociology*, 68(2), 153-181. doi:<https://doi.org/10.1111/j.1549-0831.2003.tb00133.x>
- Ridley, M., Rao, G., Schilbach, F., & Patel, V. (2020). Poverty, depression, and anxiety: Causal evidence and mechanisms. *Science*, 370(6522), eaay0214. doi:10.1126/science.aay0214
- Ridner, S. H. (2004). Psychological distress: Concept analysis. *Journal of Advanced Nursing*, 45(5), 536-545. doi:10.1046/j.1365-2648.2003.02938.x
- Rius-Ottenheim, N., van der Mast, R. C., Zitman, F. G., & Giltay, E. J. (2013). The role of dispositional optimism in physical and mental well-being. In A. Efklides & D. Moraitou (Eds.), *A Positive Psychology Perspective on Quality of Life* (pp. 149-173). Dordrecht, Netherlands: Springer Netherlands.
- Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F. S., Lambin, E. F., . . . Foley, J. A. (2009). A safe operating space for humanity. *Nature*, 461, 472-475. doi:10.1038/461472a
- Rodrigues, A. S. L., Brooks, T. M., Butchart, S. H. M., Chanson, J., Cox, N., Hoffmann, M., & Stuart, S. N. (2014). Spatially explicit trends in the global conservation status of vertebrates. *PLoS One*, 9, e113934. doi:10.1371/journal.pone.0113934
- Roe, D., Booker, F., Day, M., Zhou, W., Allebone-Webb, S., Hill, N. A. O., . . . Sunderland, T. C. H. (2015). Are alternative livelihood projects effective at reducing local threats to specified elements of biodiversity and/or improving or maintaining the conservation status of those elements? *Environmental Evidence*, 4(1), 22. doi:10.1186/s13750-015-0048-1
- Roe, J., Aspinall, P. A., & Ward Thompson, C. (2016). Understanding relationships between health, ethnicity, place and the role of urban green space in deprived urban communities. *International Journal of Environmental Research and Public Health*, 13(7), 681. doi:10.3390/ijerph13070681
- Romanelli, C., Cooper, D., Campbell-Lendrum, D., Maiero, M., Karesh, W. B., Hunter, D., & Golden, C. D. (2015). *Connecting global priorities: biodiversity and human health: a state of knowledge review*. Retrieved from Geneva, Switzerland
- Rönblad, T., Grönholm, E., Jonsson, J., Koranyi, I., Orellana, C., Kreshpaj, B., . . . Bodin, T. (2019). Precarious employment and mental health: A systematic review and meta-analysis of longitudinal studies. *Scandinavian Journal of Work, Environment & Health*, 45(5), 429-443. doi:10.5271/sjweh.3797

- Rose-Clarke, K., Gurung, D., Brooke-Sumner, C., Burgess, R., Burns, J., Kakuma, R., . . . Lund, C. (2020). Rethinking research on the social determinants of global mental health. *Lancet Psychiatry*, 7(8), 659-662. doi:10.1016/s2215-0366(20)30134-6
- Rosseel, Y. (2012). lavaan: An R package for structural equation modeling. *Journal of Statistical Software*, 48(2), 1-36. doi:10.18637/jss.v048.i02
- Roth, S. (2015). Aid work as edgework – voluntary risk-taking and security in humanitarian assistance, development and human rights work. *Journal of Risk Research*, 18(2), 139-155. doi:10.1080/13669877.2013.875934
- Rubin, D. B. (1987). Underlying Bayesian theory. In D. B. Rubin (Ed.), *Multiple Imputation for Nonresponse in Surveys* (1st ed., pp. 1-76). Hoboken, United States: John Wiley & Sons.
- Rugulies, R., Aust, B., & Madsen, I. E. (2017). Effort-reward imbalance at work and risk of depressive disorders. A systematic review and meta-analysis of prospective cohort studies. *Scandinavian Journal of Work, Environment & Health*, 43(4), 294-306. doi:10.5271/sjweh.3632
- Russ, T. C., Stamatakis, E., Hamer, M., Starr, J. M., Kivimäki, M., & Batty, G. D. (2012). Association between psychological distress and mortality: Individual participant pooled analysis of 10 prospective cohort studies. *BMJ*, 345, e4933. doi:10.1136/bmj.e4933
- Ryan, R. M., & Deci, E. L. (2001). On happiness and human potentials: A review of research on hedonic and eudaimonic well-being. *Annual Review of Psychology*, 52(1), 141-166. doi:10.1146/annurev.psych.52.1.141
- Salafsky, N., Salzer, D., Stattersfield, A. J., Hilton-Taylor, C., Neugarten, R., Butchart, S. H. M., . . . Wilkie, D. (2008). A standard lexicon for biodiversity conservation: Unified classifications of threats and actions. *Conservation Biology*, 22(4), 897-911. doi:10.1111/j.1523-1739.2008.00937.x
- Sampasa-Kanyinga, H., Zamorski, M. A., & Colman, I. (2018). The psychometric properties of the 10-item Kessler Psychological Distress Scale (K10) in Canadian military personnel. *PLoS One*, 13(4), e0196562. doi:10.1371/journal.pone.0196562
- Sandbrook, C. (2015). What is conservation? *Oryx*, 49(4), 565-566. doi:10.1017/S0030605315000952
- Sandbrook, C. (2017). Weak yet strong: The uneven power relations of conservation. *Oryx*, 51(3), 379-380. doi:10.1017/S0030605317000618
- Sandbrook, C. (2019). From passion to professionalism and back again: The battle for the soul of conservation. In C. Wyborn, N. Kalas, & N. Rust (Eds.), *Seeds of change: Provocations for a New Research Agenda* (pp. 150-151). Gland, Switzerland: Luc Hoffmann Institute.
- Sandbrook, C., Fisher, J. A., Holmes, G., Luque-Lora, R., & Keane, A. (2019). The global conservation movement is diverse but not divided. *Nature Sustainability*, 2(4), 316-323. doi:10.1038/s41893-019-0267-5
- Sandbrook, C., Scales, I. R., Vira, B., & Adams, W. M. (2011). Value plurality among conservation professionals. *Conservation Biology*, 25(2), 285-294. doi:10.1111/j.1523-1739.2010.01592.x
- Sandifer, P. A., Sutton-Grier, A. E., & Ward, B. P. (2015). Exploring connections among nature, biodiversity, ecosystem services, and human health and well-being: Opportunities to enhance health and biodiversity conservation. *Ecosystem Services*, 12, 1-15. doi:10.1016/j.ecoser.2014.12.007
- Sanson-Fisher, R. W., Bonevski, B., Green, L. W., & D'Este, C. (2007). Limitations of the randomized controlled trial in evaluating population-based health interventions. *American Journal of Preventive Medicine*, 33(2), 155-161. doi:<https://doi.org/10.1016/j.amepre.2007.04.007>
- Santomauro, D. F., Mantilla Herrera, A. M., Shadid, J., Zheng, P., Ashbaugh, C., Pigott, D. M., . . . Ferrari, A. J. (2021). Global prevalence and burden of depressive and anxiety disorders in 204 countries and territories in 2020 due to the COVID-19 pandemic. *The Lancet*, 398(10312), 1700-1712. doi:10.1016/S0140-6736(21)02143-7

- Saxena, S., Thornicroft, G., Knapp, M., & Whiteford, H. (2007). Resources for mental health: scarcity, inequity, and inefficiency. *The Lancet*, *370*(9590), 878-889. doi:[https://doi.org/10.1016/S0140-6736\(07\)61239-2](https://doi.org/10.1016/S0140-6736(07)61239-2)
- Schafer, J. L., & Graham, J. W. (2002). Missing data: Our view of the state of the art. *Psychological Methods*, *7*(2), 147-177. doi:10.1037//1082-989X.7.2.147
- Scheier, M. F., & Carver, C. S. (1992). Effects of optimism on psychological and physical well-being: Theoretical overview and empirical update. *Cognitive Therapy and Research*, *16*(2), 201-228. doi:10.1016/j.ultsonch.2016.07.011
- Scheier, M. F., Carver, C. S., & Bridges, M. W. (1994). Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): A re-evaluation of the Life Orientation Test. *Journal of Personality and Social Psychology*, *67*(6), 1063-1078. doi:10.1037//0022-3514.67.6.1063
- Schiermeier, Q., Tollefson, J., Scully, T., Witze, A., & Morton, O. (2008). Energy alternatives: Electricity without carbon. *Nature*, *454*(7206), 816-823. doi:10.1038/454816a
- Schiller, H., Lekander, M., Rajaleid, K., Hellgren, C., Åkerstedt, T., Barck-Holst, P., & Kecklund, G. (2018). Total workload and recovery in relation to worktime reduction: A randomised controlled intervention study with time-use data. *Occupational and Environmental Medicine*, *75*(3), 218-226. doi:10.1136/oemed-2017-104592
- Schleicher, J., Zaehring, J. G., Fastré, C., Vira, B., Visconti, P., & Sandbrook, C. (2019). Protecting half of the planet could directly affect over one billion people. *Nature Sustainability*, *2*(12), 1094-1096. doi:10.1038/s41893-019-0423-y
- Schou-Bredal, I., Heir, T., Skogstad, L., Bonsaksen, T., Lerdal, A., Grimholt, T., & Ekeberg, Ø. (2017). Population-based norms of the Life Orientation Test–Revised (LOT-R). *International Journal of Clinical and Health Psychology*, *17*(3), 216-224. doi:<https://doi.org/10.1016/j.ijchp.2017.07.005>
- Scopus. (2019). Advanced search. Retrieved from <https://www.scopus.com>
- Scyphers, S. B., Picou, J. S., & Grabowski, J. H. (2019). Chronic social disruption following a systemic fishery failure. *Proceedings of the National Academy of Sciences*, *116*(46), 22912. doi:10.1073/pnas.1913914116
- Seaford, C. (2011). Time to legislate for the good life. *Nature*, *477*(7366), 532-533. doi:10.1038/477532a
- Seligman, M. E. P. (2019). Positive Psychology: A personal history. *Annual Review of Clinical Psychology*, *15*(1), 1-23. doi:10.1146/annurev-clinpsy-050718-095653
- Seligman, M. E. P., & Csíkszentmihályi, M. (2000). Positive psychology. An introduction. *The American Psychologist*, *55*(1), 5-14. doi:<https://doi.org/10.1037/0003-066X.55.1.5>
- Sellberg, M. M., Cockburn, J., Holden, P. B., & Lam, D. P. M. (2021). Towards a caring transdisciplinary research practice: Navigating science, society and self. *Ecosystems and People*, *17*(1), 292-305. doi:10.1080/26395916.2021.1931452
- Selmi, W., Weber, C., Rivière, E., Blond, N., Mehdi, L., & Nowak, D. (2016). Air pollution removal by trees in public green spaces in Strasbourg city, France. *Urban Forestry & Urban Greening*, *17*, 192-201. doi:<https://doi.org/10.1016/j.ufug.2016.04.010>
- Senek, M., Robertson, S., Ryan, T., King, R., Wood, E., Taylor, B., & Tod, A. (2020). Determinants of nurse job dissatisfaction - findings from a cross-sectional survey analysis in the UK. *BMC Nursing*, *19*(1), 88. doi:10.1186/s12912-020-00481-3
- Shanahan, D. F., Bush, R., Gaston, K. J., Lin, B. B., Dean, J., Barber, E., & Fuller, R. A. (2016). Health benefits from nature experiences depend on dose. *Scientific Reports*, *6*(1), 28551. doi:10.1038/srep28551
- Sharma, G. (2017). Pros and cons of different sampling techniques. *International Journal of Applied Research*, *3*(7), 749-752.
- Shi, M., Liu, L., Wang, Z. Y., & Wang, L. (2016). Prevalence of depressive symptoms and its correlations with positive psychological variables among Chinese medical students: An exploratory cross-sectional study. *BMC Psychiatry*, *16*, 3. doi:10.1186/s12888-016-0710-3

- Shimazu, A., & de Jonge, J. (2009). Reciprocal relations between effort-reward imbalance at work and adverse health: A three-wave panel survey. *Social Science and Medicine*, 68(1), 60-68. doi:10.1016/j.socscimed.2008.09.055
- Shumaker, S. C., Frazier, S. K., Moser, D. K., & Chung, M. L. (2017). Psychometric properties of the Multidimensional Scale of Perceived Social Support in patients with heart failure. *Journal of Nursing Measurement*, 25(1), 90-102. doi:10.1891/1061-3749.25.1.90
- Siegrist, J. (1996). Adverse health effects of high-effort low-reward conditions. *Journal of Occupational Health Psychology*, 1(1), 27-41. doi:10.1037/1076-8998.1.1.27
- Siegrist, J. (2017). The effort-reward imbalance model. In C. L. Cooper & J. C. Quick (Eds.), *The Handbook of Stress and Health: A Guide to Research and Practice* (pp. 24-35). Hoboken, United States: John Wiley & Sons.
- Siegrist, J., & Li, J. (2016). Associations of extrinsic and intrinsic components of work stress with health: A systematic review of evidence on the effort-reward imbalance model. *International Journal of Environmental Research and Public Health*, 13(4), 432-432. doi:10.3390/ijerph13040432
- Siegrist, J., Li, J., & Montano, D. (2019). *Psychometric properties of the Effort-Reward Imbalance Questionnaire*. Retrieved from Centre for Health and Society: https://www.uniklinik-duesseldorf.de/fileadmin/Fuer-Patienten-und-Besucher/Kliniken-Zentren-Institute/Institute/Institut_fuer_Medizinische_Soziologie/Dateien/ERI/ERI_Psychometric-New.pdf
- Siegrist, J., Starke, D., Chandola, T., Godin, I., Marmot, M., Niedhammer, I., & Peter, R. (2004). The measurement of effort-reward imbalance at work: European comparisons. *Social Science and Medicine*, 58(8), 1483-1499. doi:10.1016/S0277-9536(03)00351-4
- Sills, J., Dickman, A., Cooney, R., Johnson Paul, J., Louis Maxi, P., & Roe, D. (2019). Trophy hunting bans imperil biodiversity. *Science*, 365(6456), 874-874. doi:10.1126/science.aaz0735
- Singh, R., Gan, M., Barlow, C., Long, B., McVey, D., Kock, R., . . . Belecky, M. (2020). What do rangers feel? Perceptions from Asia, Africa and Latin America. *Parks*, 26.1, 63-76. doi:10.2305/IUCN.CH.2020.PARKS-26-1RS.en
- Slade, T., Grove, R., & Burgess, P. (2011). Kessler Psychological Distress Scale: Normative data from the 2007 Australian National Survey of Mental Health and Wellbeing. *Australian and New Zealand Journal of Psychiatry*, 45(4), 308-316. doi:10.3109/00048674.2010.543653
- Slavin, V., Creedy, D. K., & Gamble, J. (2020). Single item measure of social supports: Evaluation of construct validity during pregnancy. *Journal of Affective Disorders*, 272, 91-97. doi:<https://doi.org/10.1016/j.jad.2020.03.109>
- Smith, K. E., & Pollak, S. D. (2020). Early life stress and development: Potential mechanisms for adverse outcomes. *Journal of Neurodevelopmental Disorders*, 12(1), 34. doi:10.1186/s11689-020-09337-y
- Soulé, M. E. (1985). What is conservation biology? *Bioscience*, 35(11), 727-734. doi:10.2307/1310054
- Spira, C., Kirkby, A. E., & Plumptre, A. J. (2019). Understanding ranger motivation and job satisfaction to improve wildlife protection in Kahuzi-Biega National Park, eastern Democratic Republic of the Congo. *Oryx*, 53(3), 460-468. doi:10.1017/S0030605318000856
- Sreetheran, M., & van den Bosch, C. C. K. (2014). A socio-ecological exploration of fear of crime in urban green spaces – A systematic review. *Urban Forestry & Urban Greening*, 13(1), 1-18. doi:<https://doi.org/10.1016/j.ufug.2013.11.006>
- Sseguya, H., Mazur, R. E., & Flora, C. B. (2017). Social capital dimensions in household food security interventions: Implications for rural Uganda. *Agriculture and Human Values*, 35(1), 117-129. doi:10.1007/s10460-017-9805-9
- Stansfeld, S. A., & Candy, B. (2006). Psychosocial work environment and mental health: A meta-analytic review. *Scandinavian Journal of Work, Environment & Health*, 32(6), 443-462. doi:10.5271/sjweh.1050

- Stansfeld, S. A., Fuhrer, R., Shipley, M., & Marmot, M. (1999). Work characteristics predict psychiatric disorder: Prospective results from the Whitehall II study. *Occupational and Environmental Medicine*, 56(5), 302-307. doi:10.1136/oem.56.5.302
- Steigen, A. M., Eriksson, B. G., Kogstad, R. E., & Bergh, D. (2022). The meaning of social support in nature-based services for young adults with mental health problems. *International Journal of Environmental Research and Public Health*, 19(3), 1638. doi:10.3390/ijerph19031638
- Steptoe, A., Deaton, A., & Stone, A. A. (2015). Subjective wellbeing, health, and ageing. *The Lancet*, 385(9968), 640-648. doi:[https://doi.org/10.1016/S0140-6736\(13\)61489-0](https://doi.org/10.1016/S0140-6736(13)61489-0)
- Stern, P. (2000). New environmental theories: Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues*, 56(3), 407-424. doi:10.1111/0022-4537.00175
- Stern, P., Dietz, T., Abel, T., Guagnano, G., & Kalof, L. (1999). A value-belief-norm theory of support for social movements: The case of environmentalism. *Research in Human Ecology*, 6(2), 81-97. doi:10.2307/2083693
- Stern, P., Dietz, T., & Kalof, L. (1993). Value orientations, gender, and environmental concern. *Environment and Behavior*, 25(5), 322-348. doi:<https://doi.org/10.1177/0013916593255002>
- Stevenson, D., & Farmer, P. (2017). *Thriving at work: The Stevenson / Farmer review of mental health and employers*. Retrieved from London, United Kingdom: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/658145/thriving-at-work-stevenson-farmer-review.pdf
- Stiglitz, J. E., Sen, A., & Fitoussi, J.-P. (2009). *Report by the commission on the measurement of economic performance and social progress*. Retrieved from <https://ec.europa.eu/eurostat/documents/8131721/8131772/Stiglitz-Sen-Fitoussi-Commission-report.pdf>
- Strauman, T. J. (2002). Self-regulation and depression. *Self and Identity*, 1(2), 151-157. doi:10.1080/152988602317319339
- Stuber, F., Seifried-Dübon, T., Rieger, M. A., Gündel, H., Ruhle, S., Zipfel, S., & Junne, F. (2021). The effectiveness of health-oriented leadership interventions for the improvement of mental health of employees in the health care sector: A systematic review. *International Archives of Occupational and Environmental Health*, 94(2), 203-220. doi:10.1007/s00420-020-01583-w
- Sundin, A., Andersson, K., & Watt, R. (2018). Rethinking communication: Integrating storytelling for increased stakeholder engagement in environmental evidence synthesis. *Environmental Evidence*, 7(1), 6. doi:10.1186/s13750-018-0116-4
- Sutherland, W. J., Pullin, A. S., Dolman, P. M., & Knight, T. M. (2004). The need for evidence-based conservation. *Trends in Ecology & Evolution*, 19(6), 305-308. doi:<https://doi.org/10.1016/j.tree.2004.03.018>
- Swaigood, R. R., & Sheppard, J. K. (2010). The culture of conservation biologists: Show me the hope! *Bioscience*, 60(8), 626-630. doi:10.1525/bio.2010.60.8.8
- Switzer, G. E., Wisniewski, S. R., Belle, S. H., Dew, M. A., & Schultz, R. (1999). Selecting, developing, and evaluating research instruments. *Social Psychiatry and Psychiatric Epidemiology*, 34(8), 399-409. doi:10.1007/s001270050161
- Tankamani, N., & Shahidi, S. (2017). The relationship between spiritual intelligence, optimism and happiness in university students. *International Journal of Applied Behavioral Sciences*, 3(3), 39-46. doi:10.22037/ijabs.v3i3.14506
- The Institute for Health Metrics and Evaluation (IHME). (2021). Global Burden of Disease (GBD) Compare. Retrieved from <http://www.healthdata.org/>
- Theorell, T., Hammarström, A., Aronsson, G., Träskman Bendz, L., Grape, T., Hogstedt, C., . . . Hall, C. (2015). A systematic review including meta-analysis of work environment and depressive symptoms. *BMC Public Health*, 15(1), 738. doi:10.1186/s12889-015-1954-4

- Thoms, C. A. (2008). Community control of resources and the challenge of improving local livelihoods: A critical examination of community forestry in Nepal. *Geoforum*, 39(3), 1452-1465. doi:<https://doi.org/10.1016/j.geoforum.2008.01.006>
- Thorsen, S. V., Pedersen, J., Flyvholm, M.-A., Kristiansen, J., Rugulies, R., & Bültmann, U. (2019). Perceived stress and sickness absence: A prospective study of 17,795 employees in Denmark. *International Archives of Occupational and Environmental Health*, 92(6), 821-828. doi:10.1007/s00420-019-01420-9
- Tilman, D., Clark, M., Williams, D. R., Kimmel, K., Polasky, S., & Packer, C. (2017). Future threats to biodiversity and pathways to their prevention. *Nature*, 546, 73-81. doi:10.1038/nature22900
- Tol, W. A., Ebrecht, B., Aiyo, R., Murray, S. M., Nguyen, A. J., Kohrt, B. A., . . . Nakku, J. (2018). Maternal mental health priorities, help-seeking behaviors, and resources in post-conflict settings: A qualitative study in eastern Uganda. *BMC Psychiatry*, 18(1), 39. doi:10.1186/s12888-018-1626-x
- Tomita, A., Vandormael, A. M., Cuadros, D., Di Minin, E., Heikinheimo, V., Tanser, F., . . . Burns, J. K. (2017). Green environment and incident depression in South Africa: A geospatial analysis and mental health implications in a resource-limited setting. *The Lancet Planetary Health*, 1(4), e152-e162. doi:10.1016/S2542-5196(17)30063-3
- Travers, H., Archer, L. J., Mwedde, G., Roe, D., Baker, J., Plumpton, A., . . . Milner-Gulland, E. J. (2019). Understanding complex drivers of wildlife crime to design effective conservation interventions. *Conservation Biology*, 33, 1296-1306. doi:10.1111/cobi.13330
- Travers, H., Clements, T., & Milner-Gulland, E. J. (2016). Predicting responses to conservation interventions through scenarios: A Cambodian case study. *Biological Conservation*, 204(B), 403-410. doi:<https://doi.org/10.1016/j.biocon.2016.10.040>
- Travers, H., Selinske, M., Nuno, A., Serban, A., Mancini, F., Barychka, T., . . . Milner-Gulland, E. J. (2019). A manifesto for predictive conservation. *Biological Conservation*, 237, 12-18. doi:10.1016/j.biocon.2019.05.059
- Trisos, C. H., Auerbach, J., & Katti, M. (2021). Decoloniality and anti-oppressive practices for a more ethical ecology. *Nature Ecology & Evolution*, 5(9), 1205-1212. doi:10.1038/s41559-021-01460-w
- Tsuang, M. T., Bar, J. L., Stone, W. S., & Faraone, S. V. (2004). Gene-environment interactions in mental disorders. *World Psychiatry*, 3(2), 73-83.
- Tumusiime, D. M., Eilu, G., Tweheyo, M., & Babweteera, F. (2010). Wildlife snaring in Budongo forest reserve, Uganda. *Human Dimensions of Wildlife*, 15(2), 129-144. doi:10.1080/10871200903493899
- Tung, Y.-J., Lo, K. K. H., Ho, R. C. M., & Tam, W. S. W. (2018). Prevalence of depression among nursing students: A systematic review and meta-analysis. *Nurse Education Today*, 63, 119-129. doi:<https://doi.org/10.1016/j.nedt.2018.01.009>
- Turyahabwe, N., Agea, J. G., Tweheyo, M., & Tumwebaze, S. B. (2012). Collaborative forest management in Uganda: Benefits, implementation challenges and future directions. In J. J. Diez (Ed.), *Sustainable Forest Management: Case Studies* (pp. 51-74). London, United Kingdom: InTech.
- Tusaie, K. R., & Patterson, K. (2006). Relationships among trait, situational, and comparative optimism: Clarifying concepts for a theoretically consistent and evidence-based intervention to maximize resilience. *Archives of Psychiatric Nursing*, 20(3), 144-150. doi:10.1016/j.apnu.2005.10.004
- Tweheyo, M., Hill, C. M., & Obua, J. (2005). Patterns of crop raiding by primates around the Budongo Forest Reserve, Uganda. *Wildlife Biology*, 11(3), 237-247. doi:10.2981/0909-6396(2005)11[237:Pocrbp]2.0.Co;2
- Twohig-Bennett, C., & Jones, A. (2018). The health benefits of the great outdoors: A systematic review and meta-analysis of greenspace exposure and health outcomes. *Environmental Research*, 166, 628-637. doi:10.1016/j.envres.2018.06.030
- Twongyirwe, R., Bithell, M., Richards, K. S., & Rees, W. G. (2017). Do livelihood typologies influence local perceptions of forest cover change? Evidence from a tropical forested and

- non-forested rural landscape in western Uganda. *Journal of Rural Studies*, 50, 12-29. doi:10.1016/j.jrurstud.2016.12.009
- Uchino, B. N. (2006). Social support and health: A review of physiological processes potentially underlying links to disease outcomes. *Journal of Behavioral Medicine*, 29(4), 377-387. doi:10.1007/s10865-006-9056-5
- Ulrich, R. (1993). Biophilia, biophobia, and natural landscapes. In S. R. Kellert & E. O. Wilson (Eds.), *The Biophilia Hypothesis* (pp. 73-137). Washington, D.C., United States: Island Press.
- Ulrich, R. S., Simons, R. F., Losito, B. D., Fiorito, E., Miles, M. A., & Zelson, M. (1991). Stress recovery during exposure to natural and urban environments. *Journal of Environmental Psychology*, 11(3), 201-230. doi:[https://doi.org/10.1016/S0272-4944\(05\)80184-7](https://doi.org/10.1016/S0272-4944(05)80184-7)
- UN Environment World Conservation Monitoring Centre (UNEP-WCMC), & International Union for Conservation of Nature (IUCN). (2020, 16/05/2020). Protected Planet: The World Database on Protected Areas (WDPA). 3.1. Retrieved from <https://www.protectedplanet.net/>
- United Kingdom Parliament. (2022). Hunting Trophy Import (Prohibition) Bill. Retrieved from <https://bills.parliament.uk/bills/2971>
- United Nations (UN). (1992). *The convention on biological diversity*. Retrieved from Rio de Janeiro, Brazil: <https://www.cbd.int/doc/legal/cbd-en.pdf>
- United Nations (UN). (2015). *Transforming our world: The 2030 agenda for sustainable development*. Retrieved from New York, United States: https://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E
- United Nations (UN). (2020). Regional groupings. Retrieved from <https://unstats.un.org/sdgs/report/2019/regional-groups/>
- United Nations (UN). (2021). *The Sustainable Development Goals report 2021*. Retrieved from New York, United States: <https://www.un-ilibrary.org/content/books/9789210049603>
- United Nations Environment Programme (UNEP). (2019). *Global Environment Outlook – GEO-6: Healthy planet, healthy people* (9781108707664). Retrieved from Cambridge, United Kingdom: https://wedocs.unep.org/bitstream/handle/20.500.11822/27539/GEO6_2019.pdf?sequence=1&isAllowed=y
- United Nations Environment World Conservation Monitoring Centre (UNEP-WCMC), & International Union for Conservation of Nature (IUCN). (2020, 16/05/2020). Protected Planet: The World Database on Protected Areas (WDPA). 3.1. Retrieved from <https://www.protectedplanet.net/>
- United States Agency for International Development (USAID). (2016). *Discussion note: Complexity-aware monitoring*. Retrieved from <https://www.usaid.gov/sites/default/files/documents/1865/201sad.pdf>
- Universal Ranger Support Alliance (URSA). (2021). *Action plan for supporting implementation of the International Ranger Federation's Chitwan Declaration and furthering the professionalisation of rangers (2021 - 2025)*. Retrieved from <https://www.ursa4rangers.org/download/597/>
- Uribe, F. A. R., de Oliveira, S. B., Junior, A. G., & da Silva Pedrosa, J. (2021). Association between the dispositional optimism and depression in young people: A systematic review and meta-analysis. *Psicologia: Reflexão e Crítica*, 34(1), 37. doi:10.1186/s41155-021-00202-y
- Usher, K., Durkin, J., & Bhullar, N. (2019). Eco-anxiety: How thinking about climate change-related environmental decline is affecting our mental health. *International Journal of Mental Health Nursing*, 28(6), 1233-1234. doi:<https://doi.org/10.1111/inm.12673>
- Vabi Vamuloh, V., Panwar, R., Hagerman, S. M., Gaston, C., & Kozak, R. A. (2019). Achieving Sustainable Development Goals in the global food sector: A systematic literature review to examine small farmers engagement in contract farming. *Business Strategy and Development*, 2(4), 276-289. doi:<https://doi.org/10.1002/bsd2.60>

- van Buuren, S. (2012). Imputation in practice. In S. van Buuren (Ed.), *Flexible Imputation of Missing Data* (1 ed., pp. 123-152). Boca Raton, United States: CRC Press LLC.
- van Buuren S, & K, G.-O. (2011). mice: Multivariate imputation by chained equations in R. *Journal of Statistical Software*, 45(3), 1-67. doi:10.18637/jss.v045.i03
- van de Schoot, R., Depaoli, S., King, R., Kramer, B., Märtens, K., Tadesse, M. G., . . . Yau, C. (2021). Bayesian statistics and modelling. *Nature Reviews Methods Primers*, 1(1), 1. doi:10.1038/s43586-020-00001-2
- van der Molen, H. F., Nieuwenhuijsen, K., Frings-Dresen, M. H. W., & de Groene, G. (2020). Work-related psychosocial risk factors for stress-related mental disorders: An updated systematic review and meta-analysis. *BMJ Open*, 10(7), e034849. doi:10.1136/bmjopen-2019-034849
- Van Dyke, F., & Lamb, R. L. (2020). Conservation as vocation. In F. Van Dyke & R. L. Lamb (Eds.), *Conservation Biology: Foundations, Concepts, Applications* (pp. 531-570). Cham, Germany: Springer International Publishing.
- van Vegchela, N., de Jongea, J., Bosmab, H., & Schaufelia, W. (2005). Reviewing the effort-reward imbalance model: Drawing up the balance of 45 empirical studies. *Social Science and Medicine*, 60(5), 1117-1131. doi:10.1016/j.socscimed.2004.06.043
- van Zomeren, M., Postmes, T., & Spears, R. (2008). Toward an integrative social identity model of collective action: A quantitative research synthesis of three socio-psychological perspectives. *Psychological Bulletin*, 134(4), 504-535. doi:10.1037/0033-2909.134.4.504
- VandenBos, G. R. (2007). *APA Dictionary of Psychology*. Washington, DC, United States: American Psychological Association.
- Varghese, A., George, G., Kondaguli, S. V., Naser, A. Y., Khakha, D. C., & Chatterji, R. (2021). Decline in the mental health of nurses across the globe during COVID-19: A systematic review and meta-analysis. *Journal of Global Health*, 11, 05009. doi:10.7189/jogh.11.05009
- Vaughan, K. B., Kaczynski, A. T., Wilhelm Stanis, S. A., Besenyi, G. M., Bergstrom, R., & Heinrich, K. M. (2013). Exploring the distribution of park availability, features, and quality across Kansas City, Missouri by income and race/ethnicity: An environmental justice investigation. *Annals of Behavioral Medicine*, 45, S28-S38. doi:10.1007/s12160-012-9425-y
- Vecchione, M., Alessandri, G., Caprara, G. V., & Tisak, J. (2014a). Are method effects permanent or ephemeral in nature? The case of the Revised Life Orientation Test. *Structural Equation Modeling: A Multidisciplinary Journal*, 21, 117-130. doi:10.1080/10705511.2014.859511
- Vecchione, M., Alessandri, G., Caprara, G. V., & Tisak, J. (2014b). Are method effects permanent or ephemeral in nature? The case of the Revised Life Orientation Test. *Structural Equation Modeling: A Multidisciplinary Journal*, 21(1), 117-130. doi:10.1080/10705511.2014.859511
- Vercammen, A., Park, C., Goddard, R., Lyons-White, J., & Knight, A. (2020). A reflection on the fair use of unpaid work in conservation. *Conservation and Society*, 18(4), 399-404. doi:10.4103/cs.cs_19_163
- Viertiö, S., Kiviruusu, O., Piirtola, M., Kaprio, J., Korhonen, T., Marttunen, M., & Suvisaari, J. (2021). Factors contributing to psychological distress in the working population, with a special reference to gender difference. *BMC Public Health*, 21(1), 611. doi:10.1186/s12889-021-10560-y
- Vigo, D., Kestel, D., Pendakur, K., Thornicroft, G., & Atun, R. (2019). Disease burden and government spending on mental, neurological, and substance use disorders, and self-harm: Cross-sectional, ecological study of health system response in the Americas. *The Lancet Public Health*, 4(2), e89-e96. doi:10.1016/s2468-2667(18)30203-2
- Vigo, D., Thornicroft, G., & Atun, R. (2016). Estimating the true global burden of mental illness. *The Lancet Psychiatry*, 3(2), 171-178. doi:10.1016/s2215-0366(15)00505-2
- Von Davier, M., Gonzalez, E., & Mislevy, R. J. (2009). *What are plausible values and why are they useful? IERI Monograph Series. Issues and Methodologies in Large-Scale Assessments*. Retrieved from Amsterdam, The Netherlands:

https://www.ierinstitute.org/fileadmin/Documents/IERI_Monograph/IERI_Monograph_Volume_02_Chapter_01.pdf

- Vonderlin, R., Biermann, M., Bohus, M., & Lyssenko, L. (2020). Mindfulness-based programs in the workplace: A meta-analysis of randomized controlled trials. *Mindfulness, 11*(7), 1579-1598. doi:10.1007/s12671-020-01328-3
- Waddell, G., & Burton, K. (2006). *Is work good for your health and well-being?* Retrieved from Norwich, United Kingdom: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/214326/hwwb-is-work-good-for-you.pdf
- Wagner, G. J., Ghosh-Dastidar, B., Slaughter, M., Akena, D., Nakasujja, N., Okello, E., & Musisi, S. (2014). The role of depression in work-related outcomes of HIV treatment in Uganda. *International Journal of Behavioral Medicine, 21*(6), 946-955. doi:10.1007/s12529-013-9379-x
- Waldron, A., Mooers, A. O., Miller, D. C., Nibbelink, N., Redding, D., Kuhn, T. S., . . . Gittleman, J. L. (2013). Targeting global conservation funding to limit immediate biodiversity declines. *Proceedings of the National Academy of Sciences, 110*(29), 12144-12148. doi:10.1073/pnas.1221370110
- Wang, J. L., Schmitz, N., & Dewa, C. S. (2010). Socioeconomic status and the risk of major depression: The Canadian national population health survey. *Journal of Epidemiology and Community Health, 64*(5), 447-452. doi:10.1136/jech.2009.090910
- Wang, P. S., Aguilar-Gaxiola, S., Alonso, J., Angermeyer, M. C., Borges, G., Bromet, E. J., . . . Wells, J. E. (2007). Use of mental health services for anxiety, mood, and substance disorders in 17 countries in the WHO world mental health surveys. *The Lancet, 370*(9590), 841-850. doi:[https://doi.org/10.1016/S0140-6736\(07\)61414-7](https://doi.org/10.1016/S0140-6736(07)61414-7)
- Watve, M., Patel, K., Bayani, A., & Patil, P. (2016). A theoretical model of community operated compensation scheme for crop damage by wild herbivores. *Global Ecology and Conservation, 5*, 58-70. doi:<https://doi.org/10.1016/j.gecco.2015.11.012>
- Weaver, L. J., & Hadley, C. (2009). Moving beyond hunger and nutrition: A systematic review of the evidence linking food insecurity and mental health in developing countries. *Ecology of Food and Nutrition, 48*(4), 263-284. doi:10.1080/03670240903001167
- Webber, A. D., Hill, C. M., & Reynolds, V. (2007). Assessing the failure of a community-based human-wildlife conflict mitigation project in Budongo Forest Reserve, Uganda. *Oryx, 41*(2), 177-184. doi:10.1017/S0030605307001792
- Wendelboe-Nelson, C., Kelly, S., Kennedy, M., & Cherrie, J. W. (2019). A scoping review mapping research on green space and associated mental health benefits. *International Journal of Environmental Research and Public Health, 16*(12), 2081. doi:10.3390/ijerph16122081
- Wheeler, H. C., & Root-Bernstein, M. (2020). Informing decision-making with Indigenous and local knowledge and science. *Journal of Applied Ecology, 57*(9), 1634-1643. doi:<https://doi.org/10.1111/1365-2664.13734>
- White, B., Borrás Jr, S. M., Hall, R., Scoones, I., & Wolford, W. (2012). The new enclosures: Critical perspectives on corporate land deals. *The Journal of Peasant Studies, 39*(3-4), 619-647. doi:10.1080/03066150.2012.691879
- White, M. P., Alcock, I., Grellier, J., Wheeler, B. W., Hartig, T., Warber, S. L., . . . Fleming, L. E. (2019). Spending at least 120 minutes a week in nature is associated with good health and wellbeing. *Sci Rep, 9*(1), 7730. doi:10.1038/s41598-019-44097-3
- White, M. P., Elliott, L. R., Gascon, M., Roberts, B., & Fleming, L. E. (2020). Blue space, health and well-being: A narrative overview and synthesis of potential benefits. *Environmental Research, 191*, 110169. doi:<https://doi.org/10.1016/j.envres.2020.110169>
- White, M. P., Elliott, L. R., Grellier, J., Economou, T., Bell, S., Bratman, G. N., . . . Fleming, L. E. (2021). Associations between green/blue spaces and mental health across 18 countries. *Scientific Reports, 11*(1), 8903. doi:10.1038/s41598-021-87675-0
- Whitmee, S., Haines, A., Beyrer, C., Boltz, F., Capon, A. G., de Souza Dias, B. F., . . . Yach, D. (2015). Safeguarding human health in the Anthropocene epoch: report of The Rockefeller

- Foundation–Lancet Commission on planetary health. *The Lancet*, 386(10007), 1973-2028. doi:10.1016/s0140-6736(15)60901-1
- Wicander, S., & Coad, L. (2018). Can the provision of alternative livelihoods reduce the impact of wild meat hunting in West and Central Africa? *Conservation and Society*, 16(4), 441-458.
- Wigfield, A., & Cambria, J. (2010). Expectancy-value theory: Retrospective and prospective. In T. C. Urdan & S. A. Karabenick (Eds.), *The Decade Ahead: Theoretical Perspectives on Motivation and Achievement* (Vol. 16A, pp. 35-70). Bingley, United Kingdom: Emerald Group Publishing Limited.
- Wigfield, A., & Eccles, J. S. (2000). Expectancy–value theory of achievement motivation. *Contemporary Educational Psychology*, 25(1), 68-81. doi:10.1006/ceps.1999.1015
- Wilson-Grau, R. (2015). Outcome harvesting. Retrieved from https://www.betterevaluation.org/en/plan/approach/outcome_harvesting#OH_what_is_OutcomeHarvesting
- Wilson-Grau, R. (2018). *Outcome harvesting: Principles, steps, and evaluation applications*. Charlotte, United States: IAP.
- Wilson-Grau, R., & Britt, H. (2012). *Outcome harvesting*. Retrieved from Cairo, Egypt https://www.outcomemapping.ca/download/wilsongrau_en_Outome%20Harvesting%20Brief_revised%20Nov%202013.pdf
- Wilson, M. (2005). *Constructing Measures: An Item Response Modeling Approach*. Mahwah, United States: Lawrence Erlbaum Associates.
- Wingspread Statement. (1998). The precautionary principle. Retrieved from <https://ratical.org/co-globalize/REHW586.html>
- Wolf, L. J., Zu Ermgassen, S., Balmford, A., White, M. P., & Weinstein, N. (2017). Is variety the spice of life? An experimental investigation into the effects of species richness on self-reported mental well-being. *PLoS One*, 12(1), e0170225-e0170225. doi:10.1371/journal.pone.0170225
- Wolfe, N. D., Dunavan, C. P., & Diamond, J. (2007). Origins of major human infectious diseases. *Nature*, 447(7142), 279-283. doi:10.1038/nature05775
- Wood, S. L. R., Jones, S. K., Johnson, J. A., Brauman, K. A., Chaplin-Kramer, R., Fremier, A., . . . DeClerck, F. A. (2018). Distilling the role of ecosystem services in the Sustainable Development Goals. *Ecosystem Services*, 29(A), 70-82. doi:10.1016/j.ecoser.2017.10.010
- Woodhouse, E., de Lange, E., & Milner-Gulland, E. J. (2016). *Evaluating the impacts of conservation interventions on human well-being: Guidance for practitioners* (978-1-78431-375-3). Retrieved from <http://pubs.iied.org/14667IIED>
- Woodhouse, E., Homewood, K. M., Beauchamp, E., Clements, T., McCabe, J. T., Wilkie, D., & Milner-Gulland, E. J. (2015). Guiding principles for evaluating the impacts of conservation interventions on human well-being. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 370(1681), 20150103. doi:10.1098/rstb.2015.0103
- World Bank. (2020a, 24/09/2020). Arable land (% of land area). Retrieved from <https://data.worldbank.org/indicator/AG.LND.ARBL.ZS>
- World Bank. (2020b, 24/09/2020). Fertilizer consumption (kilograms per hectare of arable land). Retrieved from <https://data.worldbank.org/indicator/AG.CON.FERT.ZS>
- World Bank. (2020c, 23/09/2020). GDP per capita, PPP (current international \$). Retrieved from <https://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD>
- World Bank. (2021). World Bank Open Data. Retrieved from <https://data.worldbank.org/>
- World Bank, Food Agriculture Organization (FAO), & WorldFish. (2012). *Hidden harvests: The global contribution of capture fisheries*. Retrieved from Washington, DC, United States: <http://documents1.worldbank.org/curated/en/515701468152718292/pdf/664690ESW0P1210120HiddenHarvest0web.pdf>
- World Health Organization (WHO). (1946). *Preamble to the Constitution of World Health Organization*. Retrieved from New York, United States: https://www.who.int/governance/eb/who_constitution_en.pdf

- World Health Organization (WHO). (2004a). *Promoting mental health: Concepts, emerging evidence, practice: Summary report*. Retrieved from Geneva, Switzerland: <https://apps.who.int/iris/bitstream/handle/10665/42940/9241591595.pdf>
- World Health Organization (WHO). (2004b). *The World Health Organization Quality of Life (WHOQOL)-BREF*. Retrieved from Geneva, Switzerland: https://www.who.int/substance_abuse/research_tools/en/english_whoqol.pdf
- World Health Organization (WHO). (2021a). *Comprehensive Mental Health Action Plan 2013–2030*. Retrieved from Geneva, Switzerland: <https://www.who.int/publications/i/item/9789240031029>
- World Health Organization (WHO). (2021b). *Green and Blue Spaces and Mental Health: New Evidence and Perspectives for Action*. Retrieved from Copenhagen, Denmark: <https://apps.who.int/iris/bitstream/handle/10665/342931/9789289055666-eng.pdf>
- Wright, D. (2021, 14/12/2021). *Pathways to impact for inclusive conservation*. Paper presented at the International Congress for Conservation Biology 2021, Kigali, Rwanda.
- Wright, J. H., Hill, N. A., Roe, D., Rowcliffe, J. M., Kumpel, N. F., Day, M., . . . Milner-Gulland, E. J. (2016). Reframing the concept of alternative livelihoods. *Conserv Biol*, 30(1), 7-13. doi:10.1111/cobi.12607
- Wrosch, C., Scheier, M. F., & Miller, G. E. (2013). Goal adjustment capacities, subjective well-being, and physical health. *Social and Personality Psychology Compass*, 7(12), 847-860. doi:10.1111/spc3.12074
- Wu, W.-Y., & Nguyen, K.-V. H. (2019). The antecedents and consequences of psychological capital: A meta-analytic approach. *Leadership & Organization Development Journal*, 40(4), 435-456. doi:10.1108/LODJ-06-2018-0233
- Wu, Y., Levis, B., Riehm, K. E., Saadat, N., Levis, A. W., Azar, M., . . . Thombs, B. D. (2020). Equivalency of the diagnostic accuracy of the PHQ-8 and PHQ-9: A systematic review and individual participant data meta-analysis. *Psychological Medicine*, 50(8), 1368-1380. doi:<https://doi.org/10.1017/S0033291719001314>
- WWF. (2020a). *Embedding human rights in nature conservation: From intent to action. Report of the Independent Panel of Experts of the Independent Review of allegations raised in the media regarding human rights violations in the context of WWF's conservation work*. Retrieved from Gland, Switzerland: https://wwfint.awsassets.panda.org/downloads/independent_review_independent_panel_of_experts_final_report_24_nov_2020.pdf
- WWF. (2020b). *WWF management response to recommendations from independent panel report: Embedding human rights in nature conservation: From intent to action*. Retrieved from Gland, Switzerland: https://wwfint.awsassets.panda.org/downloads/4_ir_wwf_management_response.pdf
- Wyborn, C., Davila, F., Pereira, L., Lim, M., Alvarez, I., Henderson, G., . . . Woods, E. (2020). Imagining transformative biodiversity futures. *Nature Sustainability*, 3(9), 670-672. doi:10.1038/s41893-020-0587-5
- Yao, W., Zhang, X., & Gong, Q. (2021). The effect of exposure to the natural environment on stress reduction: A meta-analysis. *Urban Forestry & Urban Greening*, 57, 126932. doi:<https://doi.org/10.1016/j.ufug.2020.126932>
- Yiengprugsawan, V., Kelly, M., & Tawatsupa, B. (2014). Kessler Psychological Distress Scale. In A. C. Michalos (Ed.), *Encyclopedia of Quality of Life and Well-Being Research* (pp. 3469-3470). Dordrecht, The Netherlands: Springer Netherlands.
- Yuan, N., Chen, Y., Xia, Y., Dai, J., & Liu, C. (2019). Inflammation-related biomarkers in major psychiatric disorders: A cross-disorder assessment of reproducibility and specificity in 43 meta-analyses. *Translational Psychiatry*, 9(1), 233. doi:10.1038/s41398-019-0570-y
- Zeidner, M., Matthews, G., & Roberts, R. D. (2004). Emotional intelligence in the workplace: A critical review. *Applied Psychology*, 53(3), 371-399. doi:<https://doi.org/10.1111/j.1464-0597.2004.00176.x>
- Zenger, M., Finck, C., Zanon, C., Jimenez, W., Singer, S., & Hinz, A. (2013). Evaluation of the Latin American version of the Life Orientation Test-Revised. *International Journal of*

- Clinical and Health Psychology*, 13, 243-252. doi:[https://doi.org/10.1016/S1697-2600\(13\)70029-2](https://doi.org/10.1016/S1697-2600(13)70029-2)
- Zimet, G. D., Dahlem, N. W., Zimet, S. G., Gordon, K., & Farley, G. K. (2010). The multidimensional scale of perceived social support the multidimensional scale of perceived social support. *Journal of Personality Assessment*, 52(1), 37-41. doi:10.1207/s15327752jpa5201
- Zimet, G. D., Powell, S. S., Farley, G. K., Werkman, S., & Berkoff, K. A. (1990). Psychometric characteristics of the Multidimensional Scale of Perceived Social Support. *Journal of Personality Assessment*, 55(3-4), 610-617. doi:10.1080/00223891.1990.9674095
- Zondervan-Zwijnenburg, M., Peeters, M., Depaoli, S., & Van de Schoot, R. (2017). Where do priors come from? Applying guidelines to construct informative priors in small sample research. *Research in Human Development*, 14(4), 305-320. doi:10.1080/15427609.2017.1370966
- Zumbo, B. D., Gadermann, A. M., & Zeisser, C. (2007). Ordinal versions of coefficients alpha and theta for Likert rating scales. *Journal of Modern Applied Statistical Methods*, 6(1), 21-29. doi:10.22237/jmasm/1177992180

10. Appendixes

10.1. Chapter 1 Appendixes

10.1.1. Appendix: Nature and mental health literature search

Two searches were performed on 1 December 2021 in the Scopus abstract and citation database (Scopus, 2019). The first uses the following search string:

```
(TITLE-ABS ("nature loss" OR "biodiversity loss" OR "habitat loss" OR "ecosystem loss"  
OR "habitat degradation" OR "ecosystem degradation" OR "forest loss" OR "forest  
degradation" OR "deforestation" OR "species extinction" OR "species loss" OR "wetland  
loss" OR "wetland degradation" OR ("hunt*" AND "overexploitation") OR ("wildlife"  
AND "overexploitation") OR ("fish*" AND "overexploitation") OR ("fish*" AND  
"collapse") OR ("fish*" AND "failure") OR "land use change" OR "ecosystem change"))  
AND (TITLE-ABS ("human" OR "people" OR "humanity" OR "social" OR "household"))  
AND (TITLE-ABS ("health" OR "illness" OR "disease" OR "infection")) AND (LIMIT-  
TO (DOCTYPE , "ar"))
```

This first search returned 1,910 results. The second included additional search terms associated with common mental disorders (NCCMH 2011):

```
(TITLE-ABS ("nature loss" OR "biodiversity loss" OR "habitat loss" OR "ecosystem loss"  
OR "habitat degradation" OR "ecosystem degradation" OR "forest loss" OR "forest  
degradation" OR "deforestation" OR "species extinction" OR "species loss" OR "wetland  
loss" OR "wetland degradation" OR ("hunt*" AND "overexploitation") OR ("wildlife"  
AND "overexploitation") OR ("fish*" AND "overexploitation") OR ("fish*" AND  
"collapse") OR ("fish*" AND "failure") OR "land use change" OR "ecosystem change"))  
AND (TITLE-ABS ("human" OR "people" OR "humanity" OR "social" OR "household"))  
AND (TITLE-ABS ("health" OR "illness" OR "disease" OR "infection")) AND (LIMIT-  
TO (DOCTYPE , "ar")) AND (TITLE-ABS ("mental health" OR "mental illness" OR  
"mental disorder" OR "depression" OR "depressive disorder" OR "anxiety" OR "post-  
traumatic stress" OR "panic disorder" OR "social anxiety" OR "obsessive-compulsive  
disorder" OR "phobias" OR "psychological distress" ))
```

The second returned 23 results or 1.2% of the first search.

10.1.2. Appendix: Author contributions to each chapter

Chapter 2 author contributions: **TP**: conceptualisation; formal analysis; data collection; methodology; resources and funding; writing - original draft; writing - review & editing. **AK**: conceptualisation; methodology; resources and funding; supervision; writing - review & editing. **EK**: conceptualisation; methodology; resources and funding; supervision; writing - review & editing. **BLK**: methodology; writing - review & editing. **CA**: conceptualisation; methodology; resources and funding; writing - review & editing. **GM**: methodology; writing - review & editing. **EJMG**: conceptualisation; methodology; resources and funding; supervision; writing - review & editing.

Chapter 3 author contributions: **TP**: conceptualisation; formal analysis; data collection; methodology; resources and funding; writing - original draft; writing - review & editing. **AK**: conceptualisation; methodology; supervision; writing - review & editing. **EK**: conceptualisation; methodology; writing - review & editing. **CA**: conceptualisation; methodology. **EJMG**: conceptualisation; methodology; resources and funding; supervision; writing - review & editing.

Chapter 4 author contributions: **TP**: conceptualisation; methodology; software; formal analysis; data collection; resources and funding; writing - original draft; writing - review & editing; funding acquisition. **AK**: conceptualisation; methodology; data collection; writing - review & editing; supervision. **SCT**: conceptualisation; methodology; data collection; writing - review & editing. **MH**: conceptualisation; methodology; data collection; writing - review & editing. **WNSA**: conceptualisation; methodology; writing - review & editing. **GB**: conceptualisation; methodology; writing - review & editing. **SB**: conceptualisation; methodology; data collection; writing - review & editing. **EDL**: conceptualisation; methodology; data collection; writing - review & editing. **MK**: conceptualisation; methodology; data collection; writing - review & editing. **SP**: conceptualisation; methodology; data collection; writing - review & editing. **EJMG**: conceptualisation; methodology; data collection; resources and funding; writing - review & editing; supervision.

Chapter 5 author contributions: **TP**: conceptualisation; methodology; software; formal analysis; data collection; resources and funding; writing - original draft; writing - review & editing; funding acquisition. **AK**: conceptualisation; methodology; data collection; writing - review & editing; supervision. **EDL**: conceptualisation; methodology; data collection; writing - review & editing. **MK**: conceptualisation; methodology; data collection; writing - review & editing. **SCT**: conceptualisation; methodology; data collection; writing - review & editing. **MH**: conceptualisation; methodology; data collection; writing - review & editing. **WNSA**: conceptualisation; methodology; data collection; writing - review & editing. **GB**: conceptualisation; methodology; data collection; writing - review & editing. **SB**: conceptualisation; methodology; data collection; writing - review & editing. **SP**: conceptualisation; methodology; data collection; writing - review & editing. **EJMG**: conceptualisation; methodology; data collection; resources and funding; writing - review & editing; supervision.

Chapter 6 author contributions: **TP**: conceptualisation; methodology; software; formal analysis; data collection; resources and funding; writing - original draft; writing - review & editing; funding acquisition. **AK**: conceptualisation; methodology; data collection; writing - review & editing; supervision. **SCT**: conceptualisation; methodology; data collection; writing - review & editing. **EDL**: conceptualisation; methodology; data collection; writing - review & editing. **MH**: conceptualisation; methodology; data collection; writing - review & editing. **MK**:

conceptualisation; methodology; data collection; writing - review & editing. **WNSA**:
conceptualisation; methodology; data collection; writing - review & editing. **GB**:
conceptualisation; methodology; data collection; writing - review & editing. **SB**: conceptualisation;
methodology; data collection; writing - review & editing. **VK**: conceptualisation; methodology;
data collection; writing - review & editing. **VM**: writing - review & editing. **SP**: conceptualisation;
methodology; data collection; writing - review & editing. **RR**: conceptualisation; methodology;
data collection; writing - review & editing. **IS**: data collection; writing - review & editing. **EJMG**:
conceptualisation; methodology; data collection; resources and funding; writing - review &
editing; supervision; funding acquisition.

10.1.3. Appendix: Other research and policy outputs

During my DPhil, I led and contributed to other research and policy outputs within and beyond the field of Planetary Health:

Booth, H., Ramdhan, M.S., Hafizh, A., Wongsopatty, K., Mourato, S., **Pienkowski, T.**, Adrianto, L. & Milner-Gulland, E.J. (2021). Designing locally-appropriate conservation incentives for small-scale fishers. *OSF Pre-prints*. DOI: 10.31219/osf.io/bxzfs

Booth, H., Arias, M., Brittain, S., ... **Pienkowski, T.** & Milner-Gulland, E. J. (2021). “Saving lives, protecting livelihoods, and safeguarding nature”: Risk-based wildlife trade policy for sustainable development outcomes post-COVID-19. *Frontiers in Ecology and Evolution*, 9, 99. DOI: 10.3389/fevo.2021.639216

Pienkowski, T., Cook, C., Verma, M. & Carrasco, L.R. (2021). Conservation cost-effectiveness: A review of the evidence base. *Conservation Science and Practice*, 3, e357. DOI: <https://doi.org/10.1111/csp2.357>

Pienkowski, T. & Whitmee, S. (2020). Intrinsically interlinked: Healthy planet, healthy people. In Almond, R.E.A., Grooten, M. & Peterson, T. (Eds). *Living Planet Report 2020-Bending the curve of biodiversity loss*. 81-85. WWF, Gland, Switzerland.

Veríssimo, D., **Pienkowski, T.**, Arias, M., Cugnière, L., Doughty, H., Hazenbosch, M., de Lange, E., Moskeland, A., & Grace, M. (2020). Ethical publishing in biodiversity conservation science. *Conservation & Society*, 18(3), 220-225. DOI: <https://www.jstor.org/stable/26937763>

Teoh, S.H.S., Symes, W.S., Sun, H., **Pienkowski, T.** & Carrasco, L.R. (2019). A global meta-analysis of the economic values of provisioning and cultural ecosystem services. *Science of the Total Environment*, 649, 1293-1298. DOI: <https://doi.org/10.1016/j.scitotenv.2018.08.422>.

Pienkowski, T., Bickersteth, S. & Milner-Gulland E. J. (2019). Evidencing links between biodiversity and health: A rapid review with a water quality case study. A report prepared for the Secretariat of the Rockefeller Foundation Economic Council on Planetary Health at the Oxford Martin School. <https://www.planetaryhealth.ox.ac.uk/wp-content/uploads/sites/7/2019/05/Biodiversity-and-Health-for-web-v2.pdf>

Pienkowski, T., Dickens, B.L., Sun, H. & Carrasco, L.R. Linking forests, deforestation, and nutritional outcomes: An observational study in nine African countries. (2018) *The Lancet Planetary Health* 2, S4 (conference proceeding).

10.2. Chapter 2 Appendixes

10.2.1. Appendix: Environment and mental health literature search

Two searches were performed on 14 June, 2020 in the Scopus abstract and citation database (Scopus, 2019). The first uses the following search string:

```
(TITLE-ABS ("natural environment")) AND (TITLE-ABS (("human" OR "people" OR "humanity")) AND (TITLE-ABS ("health" OR "illness" OR "disease"))) AND (LIMIT-TO (DOCTYPE, "ar"))
```

This first search returned 1,306 results. The second included additional search terms associated with common mental disorders (NCCMH, 2011):

```
(TITLE-ABS ("natural environment")) AND (TITLE-ABS (("human" OR "people" OR "humanity")) AND (TITLE-ABS ("health" OR "illness" OR "disease"))) AND (TITLE-ABS (("mental health" OR "mental illness" OR "mental disorder" OR "depression" OR "depressive disorder" OR "anxiety" OR "post-traumatic stress" OR "panic disorder" OR "social anxiety" OR "obsessive-compulsive disorder" OR "phobias"))) AND (LIMIT-TO (DOCTYPE, "ar"))
```

This second search returned 65 results or 5% of the first search.

10.2.2. Appendix: Ethical procedure for interviews

The ethical procedure was developed after reviewing the Code of Conduct for researchers contributing articles to *Oryx – The International Journal of Conservation* (Oryx, 2001). Before commencing the interviews, respondents were informed of the purpose of the research and who was conducting it. They were also informed that participation was voluntary, and respondents could withdraw anytime during or after the interview. Respondents were informed about how the data would be used, the risks of participation, the complaints procedure, and contact details for the ethical review board that approved the study. Documented, free, prior, and informed consent was then sought before individuals could participate. Any respondents that reported that they were under the age of 18 were not interviewed. Respondents were debriefed after completing the interview, which included providing the contact details of the research team and the Ethical Review Board. Respondents were provided with household essentials (including soap, salt, oil, and sugar) as in-kind compensation for their time.

10.2.3. Appendix: Interview sampling effort

Table 10.1. The sampling effort in each community and respondents' approximated age, gender, socio-economic status, and forest proximity. Socio-economic status was subjectively judged based on indicators suggested to us by the Local Council members, including the type of house construction, cooking and toilet facilities, presence of assets such as cars, chairs, and other visual cues. Key: TC = Trading Centre.

Community	Gender	Age	Socio-economic status	Forest proximity	Study ID
Nyabyeya TC	Female	Middle-aged	Middle	Far	1
Nyabyeya TC	Male	Middle-aged	Middle	Far	2
Nyabyeya TC	Male	Middle-aged	Low	Closer	3
Nyabyeya TC	Female	Middle-aged	High	Far	4
Nyabyeya TC	Female	Older	Low	Closer	5
Nyabigoma	Male	Older	High	Far	6
Nyabigoma	Female	Older	Low	Far	7
Nyabigoma	Female	Young	Middle	Closer	8
Nyabigoma	Male	Middle-aged	Middle	Far	9
Nyabigoma	Female	Young	Middle	Far	10
Nyabigoma	Male	Young	Middle	Far	11
Nyakafunjo	Male	Young	Middle	Adjacent	12
Nyakafunjo	Male	Young	Middle	Adjacent	13
Nyakafunjo	Male	Older	Middle	Adjacent	14
Nyakafunjo	Female	Young	Low	Adjacent	15
Nyakafunjo	Female	Young	Low	Adjacent	16
Kyempunu	Male	Young	Middle	Adjacent	17
Kyempunu	Female	Middle-aged	Middle	Adjacent	18
Kyempunu	Male	Young	High	Far	19
Kyempunu	Female	Older	Middle	Closer	20
Kyempunu	Male	Middle-aged	Middle	Adjacent	21
Nyabyeya 2	Male	Young	Middle	Closer	22
Nyabyeya 2	Female	Older	Low	Closer	23
Nyabyeya 2	Female	Middle-aged	High	Adjacent	24
Nyabyeya 2	Male	Middle-aged	Middle	Far	25
Nyabyeya 2	Female	Middle-aged	Middle	Closer	26
Kanyege	Female	Middle-aged	Low	Far	27
Kanyege	Female	Middle-aged	High	Far	28
Kanyege	Male	Middle-aged	Low	Far	29
Kanyege	Female	Young	Low	Closer	30
Karongo	Female	Middle-aged	High	Closer	31
Karongo	Male	Middle-aged	High	Adjacent	32
Karongo	Female	Middle-aged	Low	Closer	33
Karongo	Male	Middle-aged	Middle	Closer	34
Karongo	Male	Middle-aged	Low	Far	35
Maramu	Female	Middle-aged	High	Far	36
Maramu	Female	Middle-aged	Low	Adjacent	37
Maramu	Male	Older	Middle	Closer	38
Maramu	Male	Middle-aged	High	Closer	39
Maramu	Male	Middle-aged	Middle	Adjacent	40
Nyabyeya 1	Female	Older	Middle	Far	41
Nyabyeya 1	Female	Older	Middle	Far	42
Nyabyeya 1	Female	Middle-aged	High	Far	43
Nyabyeya 1	Female	Young	Middle	Closer	44
Nyabyeya 1	Male	Older	Middle	Closer	45

10.2.4. Appendix: Interview guide

[Actors]: Tell me about the people that live in this area?

- History of the community and people within it
- Leaders
- Community groups, other groups
- Socio-economic attributes
- Gender
- Ethnicity
- Age

[Resource systems]: Tell me about the important places in and around the community?

- Important places
- Important resources
- Access to what areas/resources
- Human facilities
- Productivity of system
- Seasonality and variation over time

[Resource units]: What are the most important resources in your daily lives?

- Resources
- Location of resources
- Abundance or size of the resource
- Wildlife
- Plants
- State of resources
- Change over time

[Interactions and Outcomes]: What do people do in the area?

- Livelihoods
- Food
- Fuel
- Water
- Medicine
- Spiritual and cultural
- Recreation
- Harvesting
- Information sharing
- Conflicts
- Deliberation and decision
- Investment

- Lobbying
- Networks and social relations

[Governance systems]: How are decisions made about the community and environment?

- Laws and rules
- Governance organisations
- Access and property rights
- Informal and formal decision making
- Civil society organisations
- Relations between actors and systems
- Sanctions

[Social, economic, and political settings]: How does the wider economy influence the community?

- Economic development
- Business
- National government

[Related ecosystems]: Changes in the wider world?

- Climate change

‘Voices of the poor’

Material lack and want

[Material lack and want]: What problems do people have about having enough in life?*

- Food
- Livelihood, assets, and money
- Housing and shelter

[Vulnerability]: Who is most affected by these problems?‡

[Socio-ecological systems framework (SESF)-link]: Why do people have these problems?

Physical illbeing

[Physical illbeing]: What problems do people have with their health?*

- Hunger, pain, and discomfort
- Exhaustion and poverty of time

[Vulnerability]: Who is most affected by these problems?‡

[SESF-link]: Why do people have these problems?

Bad social relations

[Bad social relations]: What problems do people have with their relationships with others?*

[Vulnerability]: Who is most affected by these problems?‡

[SESF-link]: Why do people have these problems?

Insecurity, vulnerability, worry, and fear

[Insecurity, vulnerability, worry, and fear]: What are people worried about and what causes them fear?*

[Vulnerability]: Who is most affected by these problems?‡

[SESF-link]: Why do people have these problems?

Powerlessness, helplessness, frustration, and anger

[Powerlessness, helplessness, frustration, and anger]: What makes people feel angry or like they have no control in their lives?*

[Vulnerability]: Who is most affected by these problems?‡

[SESF-link]: Why do people have these problems?

Secondary questions

To be asked in relation to major stressors identified in the interview

***[Idioms of distress]:** What feelings do people have when they have these problems?

***[Stressor characteristics]:** How long do these feelings last, and how often do they happen?

‡[Factors affecting stressor exposure]: Why are these people most affected by these problems?

10.2.5. Appendix: Thematic analysis steps (Chapter 2)

We employed inductive thematic analysis. This included identifying, analysing, organising, and reporting themes within data following Braun and Clarke (2006):

- Familiarisation with data: Two research assistants who lived in the study communities and I discussed themes and topics immediately after each interview. This discussion was documented in a post-script. I then read each transcript and compared word clouds between different groups (based on gender, apparent socio-economic status, age, and proximity to the forest edge).
- Generating codes and coding text: Two sets of codes were developed. The first was created following the initial round of familiarisation. These five codes were broad and used to cluster related text. The second set of codes was developed by reading the clustered text. These were then systematically applied to all transcripts through a second round of coding the clustered text. In some cases, codes were revised (split or combined), and new codes were identified during the second coding round.
- Searching and clustering into themes: Themes were identified by clustering related codes. Some themes emerged during the development of the second set of codes. Other themes were identified when reviewing text within each code. These themes were explored by visualising connections between codes as a network. Specifically, any given section of the text for each interview may have been given multiple codes. When a section of text was coded as two more codes, this represented a connection between those codes. A maximum of one connection was recorded for each interview for any given pair of codes. These connections are represented as a network for selected themes of interest. Within the network, the width of the connector corresponded to the number of interviews reporting the connection and the node's size corresponded to the number of interviews mentioning that code. A maximum of one connection was recorded for any two codes in an interview. These were then visualised as network diagrams in the R programming language, using the package igraph (Csárdi & Nepusz, 2006; R Core Team, 2020).
- Reviewing themes: The codes and related text were reviewed to ensure consistency within the theme but discrete differences between them. In some cases, themes were merged or split apart.
- Defining and naming themes: A short description was provided for each theme.

10.2.6. Appendix: Theme definitions (Chapter 2)

Table 10.2. Theme definitions.

Theme name	Definition
[Symptoms of] “ <i>Thinking too much</i> ”	The physical and psychological symptoms experienced when “ <i>thinking too much</i> ”.
[Causes of] “ <i>Thinking too much</i> ”	The causes of “ <i>thinking too much</i> ”.
Causes of poverty	The causes of poverty. Poverty was often used synonymously with not having enough money and as a more general state defined by multiple deficiencies.
Farm productivity	The factors influencing subsistence and small-scale commercial farming.
Causes of not enough land	The explanations for why respondents said there was not enough land.
Sugarcane displacing crop farming	The reasons why respondents said that sugarcane farming was perceived to be displacing sugarcane farming (although many said this was happening, without providing a reason).
Drivers of development	The factors that bring development to a household.
Consequences of poverty	The consequences of experiencing poverty.
Causes of hunger	The causes of hunger, or not having enough food.
Crops losses or poor harvests	The causes of crop-losses and poor harvests.
Crop-raiding consequences	The consequences of crop-raiding by wildlife for affected households.
Consequences of hunger	The consequences and coping strategies associated with hunger or not having enough food.
Using the forest	The ways that people used the forest.
Illegal forest use risks	The risks associated with engaging in illegal forest activities.

10.2.7. Appendix: Other linkages

The main text presented themes relating interactions with ecosystems to experiences of distress that respondents most consistently mentioned. However, there was evidence of other potential pathways for how interacting with ecosystems may influence social determinants of psychological distress.

- One mechanism by which land reportedly transitioned from subsistence to small-scale commercial farmland was through the voluntary sale of land. When asked why respondents sold land, several said this was a means of getting money to meet immediate needs. These immediate needs included paying for healthcare, school fees, or house construction. However, a few suggested men would sell land to pay for alcohol, gambling, or during affairs. All of these were mentioned as contributors to household conflict and food insecurity, and therefore potentially psychological distress.
- Several respondents said that water sources within the two forest reserves were of better quality than those outside the reserves. A few respondents said that water quality affected the risk of diarrheal disease and other illnesses, affecting physical health. Physical health was a major stressor associated with psychological distress. However, the physical illnesses associated with distress were typically major disabilities, chronic illness, and HIV/AIDs – suffering diarrheal disease itself did not appear to be a major source of distress.
- Many female respondents reported fear of chimpanzees, particularly when working on farms close to the forest edge or collecting firewood from Budongo Forest Reserve. This fear was not a reported cause of psychological distress. However, during data collection, a young child taken into the forest by its mother was severely injured by a chimpanzee. Such events are rare, but one of the research assistants said the family subsequently left the community because of stigmatisation.
- Several respondents said that two local non-governmental organisations and the National Forestry Authority intended to reforest buffer strips within river valleys. Several of these respondents claimed that riparian buffer areas were under the jurisdiction of the National Forestry Authority. However, some households were farming in these areas and were told they would have to leave. This dispossession had not happened at the time of data collection. However, given concerns about land availability and its possible role in poverty and food insecurity, this may be a source of distress.

10.2.8. Appendix: Causes of poverty

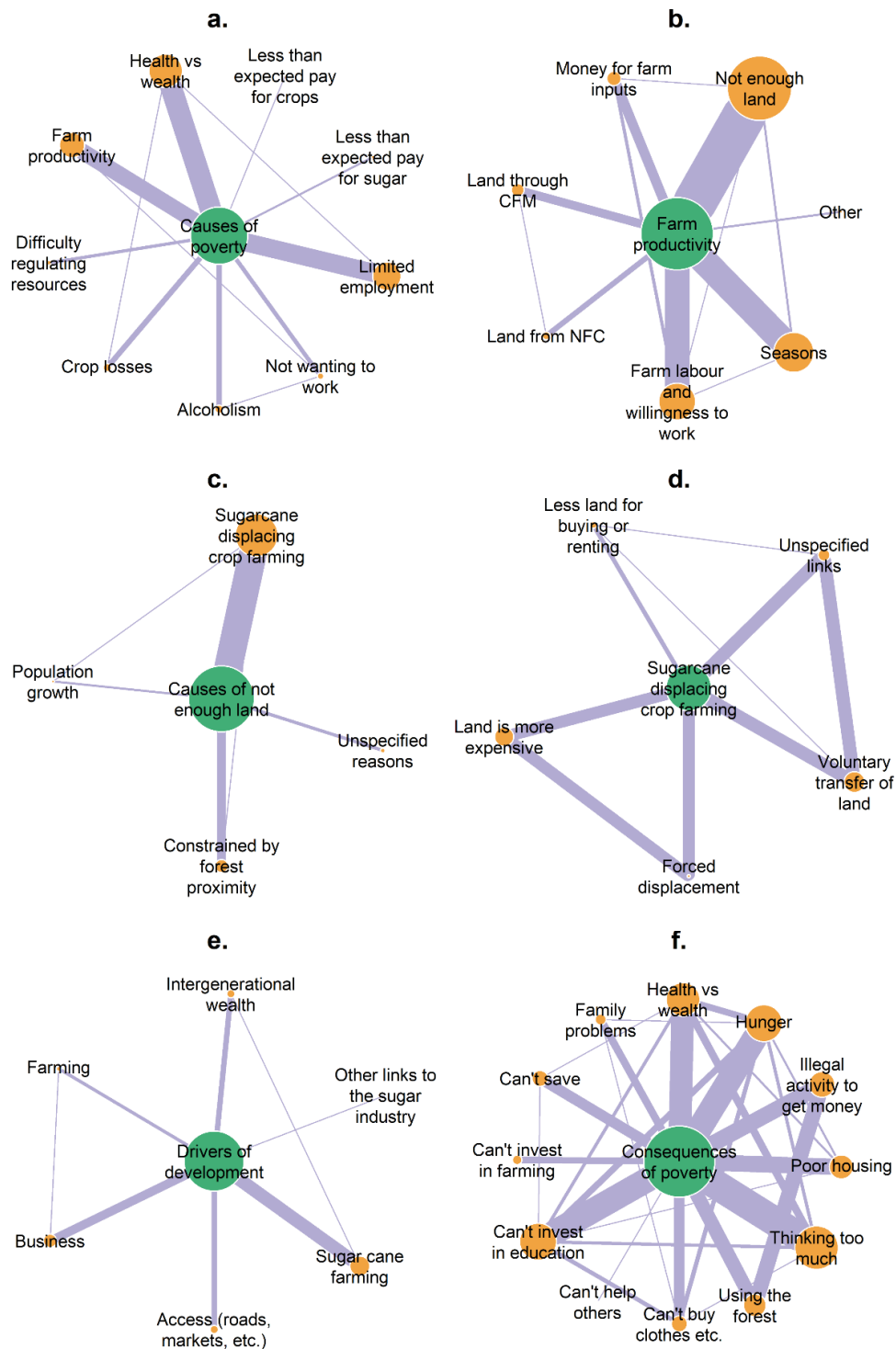


Figure 10.1. Panel a. illustrates the reported causes of poverty and inadequate money. Panel b. illustrates reported factors affecting farm productivity (CFM = Community Forest Management, NFC = Nyabyeya Forestry College). Panel c. describes the reported causes of inadequate land. Panel d. illustrates the reported role of the sugarcane industry in displacing smallholder farming. Panel e. describes reported factors that contributed to household development. Panel f. illustrates the reported consequences of poverty and inadequate money.

10.2.9. Appendix: Causes of hunger

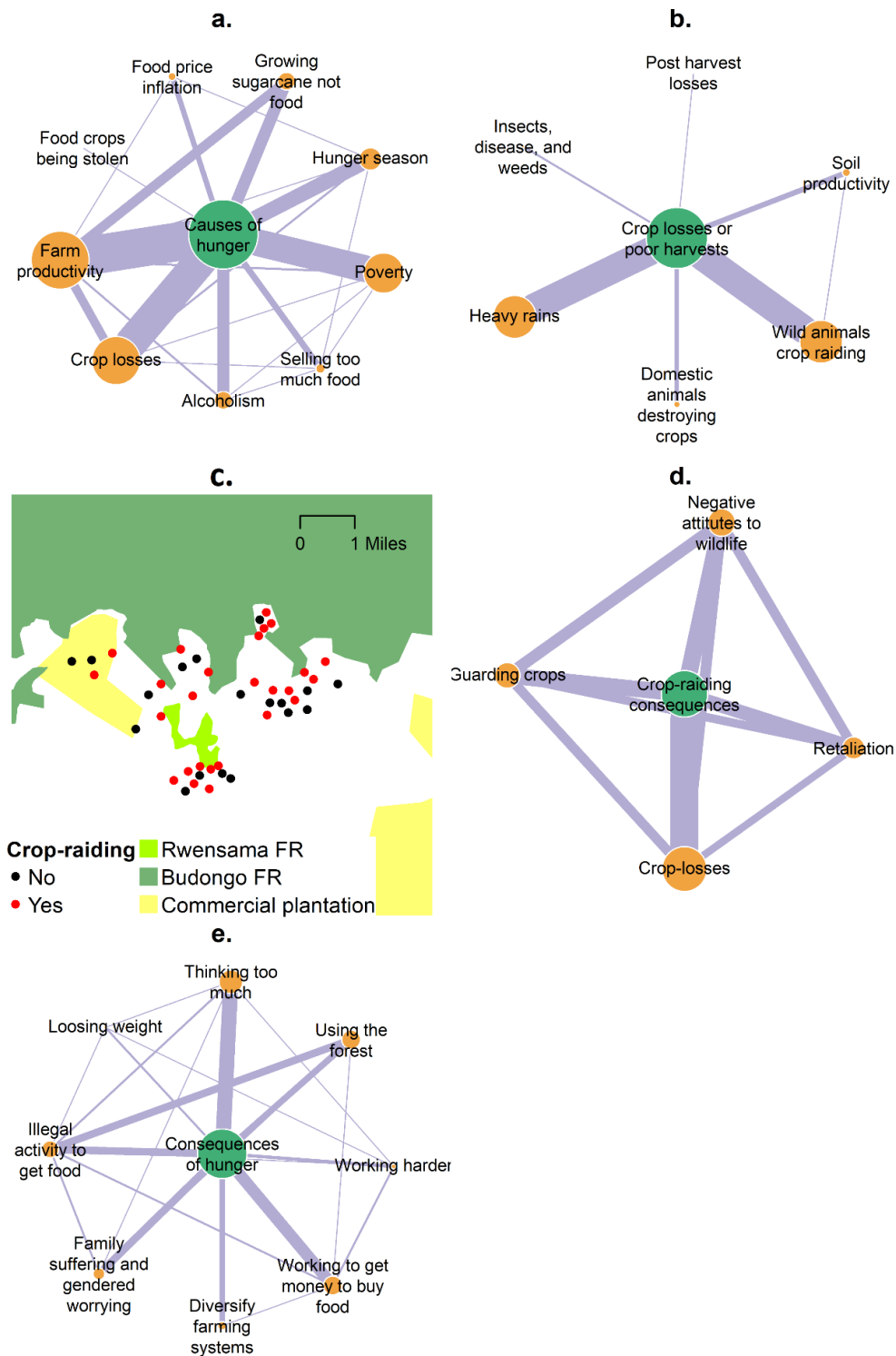


Figure 10.2. Panel a. illustrates the reported causes of hunger and inadequate food. Panel b. describes reported factors causing crop losses. Panel c. shows the locations of interviews that report crop-raiding by wildlife (manually dislocated to retain anonymity). Panel d. illustrates the consequences of crop-raiding by wildlife, particularly among farmers bordering the Budongo and Rwensama Forest Reserves. Illustrates the reported consequences of experiencing hunger or inadequate food.

10.2.10. Appendix: Forest use

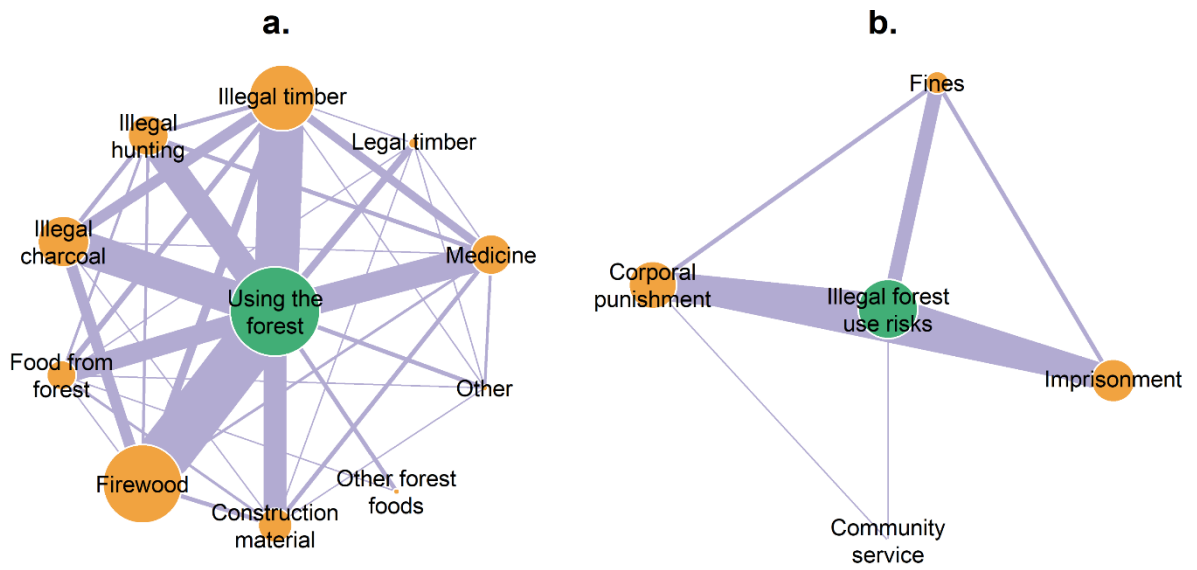


Figure 10.3. Panel a. illustrates the reported uses of the forest. Panel b. describes the risks associated with illegal activities in the forest.

10.3. Chapter 3 Appendixes

10.3.1. Appendix: Study site description

Since 1986, the Ugandan government has adopted a wide range of reforms to modernise the country's agricultural sector, leading to massive growth in cash crop production, including sugarcane (Martiniello, 2021). Contract sugarcane farming was promoted as a mechanism for inclusive development but increased inequalities in several parts of the country (Martiniello, 2021). For example, there has been an expansion of contract sugarcane farming around Budongo Forest to supply Kinyara Sugar Works. This expansion appears to have deepened inequitable land distributions, increasing incomes for wealthier landowners but worsening economic poverty, food insecurity, and subsequent psychological distress among small-scale farmers (Chapter 2). This land redistribution appears to have occurred through several mechanisms, including voluntary selling or renting land to meet immediate needs and coercive or forced displacement (Chapter 2).

Forest reserves are an essential part of Uganda's protected areas network, which covers 16% of the country's land surface (UNEP-WCMC & IUCN, 2020). Budongo Forest Reserve, which neighbours the smaller Rwensama Forest Reserve, was gazetted by the British in the 1930s and is managed by the National Forestry Authority (Paterson, 1991). The forest is a source of illegal timber, charcoal and wild meat, and legally harvested medicines, firewood, plants and mushrooms (Babweteera et al., 2018). These forest food and income sources appear to alleviate stressors causing psychological distress among poorer households (Chapter 2).

10.3.2. Appendix: Survey information and questions (Chapter 3)

The survey information as read to participants prior to starting the survey and seeking their consent. The survey was delivered through electronic tablets using the ODK software. Conditional logic was used to ask paired questions. For example, the first part of question 1.9.a asks “How is your health in general? Is your health good, fair, or bad?”. If the respondent says “good”, then the participant is then asked “Is your health very good or just good?” (question 1.9.a). Similar conditional logic was used for many of the Likert-scaled items and in the sets of scenario questions. This approach was used to reduce the cognitive load of each question and to ensure consistent in delivery.

10.3.2.1. Survey information

Introduction

This study is being conducted by the Interdisciplinary Centre for Conservation Science (ICCS) at the University of Oxford in collaboration with MRC/UVRI & LSHTM Uganda Research Unit.

This document is called the participant information sheet and contains information to help you decide if you would like to participate in the study. Joining the study is entirely up to you. The study staff will talk with you about this information and answer any questions that you may have. Please feel free to talk to others about this study if you wish.

Before we start

Before we start, I would like to read out some symptoms that are related to COVID-19. I would like you to tell me if you or any of your family have had any of these symptoms in the past week:

- a high temperature – this means you feel hot to touch on your chest or back (you do not need to measure your temperature)
- a new, continuous cough – this means coughing a lot for more than an hour, or 3 or more coughing episodes in 24 hours (if you usually have a cough, it may be worse than usual)
- a loss or change to your sense of smell or taste – this means you've noticed you cannot smell or taste anything, or things smell or taste different to normal

Have you had any of these symptoms? [*If yes, follow the ‘Closing an interview or survey’ procedure. If no, proceed with the survey information form.*]

What is the Purpose of the study?

The ICCS and MRC/UVRI & LSHTM Uganda Research Unit is conducting research to understand the things that people find difficult in their lives, in these communities. We are most interested in things to do with the environment around you.

Why have I been asked to take part?

You have been asked to take part because you are the male or female head of the household in a community we are collecting data in.

Do I have to take part?

You do not have to take part in the research or answer any of the questions and are free to stop anytime.

What will happen to me if I take part?

We want to ask you a set of questions about yourself and the challenges you face.

What will I have to do?

If you decide to take part, then we will sit together, and I will ask you questions, which can choose to answer or not answer.

What are the possible risks and inconveniences?

Since we will be asking about some of the challenges people in your community face, you may find the conversation upsetting or distressing. The chat is expected to take around 30 minutes.

What are the possible benefits?

There are no direct benefits from taking part, and nothing is expected to change in the community because of the research. You will not be paid to take part, but you will be compensated for your time (discussed below).

How many participants will be enrolled in this study?

We are speaking to 708 people in the area.

For how long will I have to participate in the study?

Participation lasts for as long as the interview takes.

Can I change my mind about participating in the study?

You can withdraw from the study at any time. You can stop and withdraw from the study by telling us at any time during the survey. You can also withdraw later on by contacting us on here [*provide contact sheet*].

What will happen to information collected about me?

All information collected about you will be kept private. Only the study staff and authorities who check that the study is being carried out properly will be allowed to look at information about you. Data may be sent to other study staff at the University of Edinburgh, but this will be anonymized. This means that any information about you which leaves the study site will have your name and address removed so that you cannot be recognized.

Your personal details will be kept in a different safe place to the other study information and will be destroyed at the end of the study. The data will be made available to other researchers worldwide for research and to improve medical knowledge and patient care. Your personal information will not be included, and there is no way that you can be identified.

What happens to the results of the study?

We will be conducting a meeting with community leaders to tell them about the results of the study. The study results will also be published in a journal so that other researchers can learn from them. Your personal information will not be included in the study report, and there is no way that you can be identified from it.

What other choices do I have besides participating in this study?

You can freely choose not to take part in the study. Choosing not to participate will not affect you in any way.

Will it cost you anything to take part in this study?

There is no cost to you for participating.

Will you be paid to take part in this study?

No, you will not be paid for participating in this study. However, you will be given compensation (including oil, tea, soap, sugar and salt worth UGX 15,000) for your time.

What will happen if I get injured as a result of participation in this study?

We do not anticipate any injury as a result of your participation in this research study. However, if you become ill or injured during your participation in this study, please inform the study staff immediately. The study staff will inform you where you can get additional treatment when required.

Who has allowed this research to take place?

This study was first reviewed by the Unit's Scientific Committee prior to submission to an independent Research ethics committee (UVRI-REC) and Uganda National Council for Science and Technology (UNCST) who have looked carefully at this work and agreed that the research is important, it will be conducted properly and participants' safety and rights have been respected. The study was also approved by the University of Oxford Central University Research Ethics Committee (reference number: R63458/RE001).

Whom should you call if you have questions regarding this study or if you get an injury?

If you have any questions about this study or a study-related injury, please contact Thomas Pienkowski, the principle investigator of this study on telephone number [redacted]/WhatsApp: [redacted] or Professor Eugene Kinyanda a lead supervisor of this study on telephone number [redacted].

If you have any questions about your rights as a research participant, please contact: Mr. Tom Lutalo chairman of the UVRI-REC on telephone numbers [redacted].

10.3.2.2. *Survey questions*

Section 1: Demographics & general health

	QUESTION	RESPONSE	NOTES
0	Enumerator ID	MM GG LA SL JR	The enumerator initials.
1.1	Study I.D. Number	.....
1.2	Location (<i>in-built GPS</i>)	.....	“Wait for "Using GPS. Accuracy is..." to appear, then click "Save GeoPoint".”
1.3	Community	Nyabyeya T.C. Nyabyeya One Nyabyeya Two Nyabigoma Nyakafunjo Kyempunu Korongo Maramu Ewafala Kadukuru One Kadukuru Two	
1.4	Date of interview	dd / mm / yy /...../.....	
1.5	Sex?	Male Female Refused/other	
1.6	How many years old are you?	.....yrs Don't Know Refused	“The respondent must between 18 and 60.”
1.7	Where did you stop in your education?	No education Started primary Finished primary Started secondary Finished secondary Beyond secondary Don't Know Refused	
1.8	What is your marital status? Are you...	Single Married once Polygamist Divorced or separated I lost my husband or wife Don't Know Refused	
1.9.a	How is your health in general? Is your health good, fair, or bad?	Good Fair Bad Don't Know Refused	

1.9.b	[If good] Is your health very good or just good?	Very good Good Don't Know Refused	Only one of this pair of questions is presented, depending on the response to the previous question.
1.9.c	[If bad] Is your health very bad or just bad?	Very bad Bad Don't Know Refused	
1.10	How many children under 18 live in your household?	.....	"Under 18, living here."
1.11	How many adults 18 or over live in your household?	.....	"18 and above, living here. Including yourself."
1.12	What is the main source of money in your household?	Farming Cattle keeping Trapping fish Worker (like cutting sugar cane or weeding, driver) Own business Other Don't Know Refused	

Section 2: Socio-economic status, farming, and forest

QUESTION		RESPONSE	
2.1	I am now going to read to you some things. For each thing I am going to read to you, I would like you to tell me if your household has it. Does your household have...?		
		Yes	No
2.1.1	A gas cooker		
2.1.2	At least two sets of clothes for every person in the household		
2.1.3	Two goats		
2.1.4	At least two meals per day		
2.1.5	Mains electricity		
2.1.6	A wooden bed (frame)		
2.1.7	A big solar panel		
2.1.8	At least two Jerry cans		
2.1.9	One mattress or more		
2.1.10	A television		
2.1.11	Brick walls for your house		
2.1.12	A motorbike		
2.1.13	Two hoes		
2.1.14	A blanket for every person in the household		
2.1.15	A bank account		
2.1.16	A bicycle		
2.1.17	A water tank		
2.1.18	A pair of shoes for every member of the household		
2.1.19	Iron sheets on your roof		
2.1.20	A radio		
2.1.21	Three saucepans		
2.1.22	Solar battery		
2.1.23	A mobile phone		
2.1.24	Two or more plastic chairs		
2.1.25	A car		
2.1.26	A fridge		

2.1.27	A cement floor for your house		
2.1.28	A member in a savings group		
2.1.29	A sofa		
2.1.30	Two or more wooden chairs		
2.1.31	Soap		
2.2.a	In the past month, how hard has it been for you to pay for the things you need the most like food, medicine, or clothing? Was it hard or not hard?	Hard Not hard Don't Know Refused	
2.2.b	[If hard] Was it very hard, hard, or a bit hard?	Very hard Hard A bit hard Don't Know Refused	This question was only presented if the respondent said 'hard' to the previous question.
2.3	I would now like to ask you about your farm.		
2.3.1.a	Thinking about your farmland, how much land does your household have? Count all the land you own and rent together. Is it a small amount of land, a large amount of land, or in the middle?	Small land In the middle Large land Don't Know Refused	
2.3.1.b	[If small] It is a very small amount of land or just a small amount of land?	Very small land Small land Don't Know Refused	Only one of this pair of questions is presented, depending on the response to the previous question.
	[If large] It is a very large amount of land or just a large amount of land?	Very large land Large land Don't Know Refused	
2.3.2a	Can you tell me in plots, or acres or hectares how much land your household has for farming? Count any owned or rented land together.	.....	"Put 98 if does not know. One and a half is 1.5, a half is 0.5, a third is 0.33, and quarter is 0.25.
2.3.2b	What unit?	Plot Acre Hectare Don't Know Refused	Did they say it in plots, acres, or hectares? Put 98 if does not know. (4 plots = 1 acre & 2 and ½ acre = 1 hectare).
2.4	Does your household grow sugarcane for selling?	Yes No Don't Know Refused	Selling to the factory.
2.5	We would like to hear how you feel about some sayings. These sayings are going to be read to you. We would like you to tell us if you agree or disagree with these sayings using the answers given. Have you understood?		
2.5.1.a	Your household's farm is bigger than most others in this community. Do you agree, you disagree, or you are in the middle?	Agree In the middle Disagree Don't Know Refused	
2.5.1.b	[If agree] Do you agree a lot, or you agree a little?	Agree a lot Agree a little	

		Don't Know Refused	Only one of this pair of questions is presented, depending on the response to the previous question.
2.5.1.b	[If disagree] Do you disagree a lot, or you disagree a little?	Disagree a lot Disagree a little Don't Know Refused	
2.5.2.a	Your household's farm is big enough for you to get the things you need, like food, school fees, or medicine. Do you agree, you disagree, or you are in the middle? Do you agree, you disagree, or you are in the middle?	Agree In the middle Disagree Don't Know Refused	
2.5.2.b	Do you agree a lot, or you agree a little?	Agree a lot Agree a little Don't Know Refused	Only one of this pair of questions is presented, depending on the response to the previous question.
2.5.2.c	Do you disagree a lot, or you disagree a little?	Disagree a lot Disagree a little Don't Know Refused	
2.5.3.a	Your household struggles because you do not have enough land. Do you agree, you disagree, or you are in the middle?	Agree In the middle Disagree Don't Know Refused	
2.5.3.b	Do you agree a lot, or you agree a little?	Agree a lot Agree a little Don't Know Refused	Only one of this pair of questions is presented, depending on the response to the previous question.
2.5.3.c	Do you disagree a lot, or you disagree a little?	Disagree a lot Disagree a little Don't Know Refused	
2.5.4.a	Your household has enough land to live well. Do you agree, you disagree, or you are in the middle?	Agree In the middle Disagree Don't Know Refused	
2.5.4.b	Do you agree a lot, or you agree a little?	Agree a lot Agree a little Don't Know Refused	Only one of this pair of questions is presented, depending on the response to the previous question.
2.5.4.c	Do you disagree a lot, or you disagree a little?	Disagree a lot Disagree a little Don't Know Refused	
2.5.5.a	Your household gets good money from your farm.	Agree In the middle Disagree Don't Know Refused	
2.5.5.b	Do you agree a lot, or you agree a little?	Agree a lot Agree a little Don't Know Refused	Only one of this pair of questions is presented,

2.5.5.c	Do you disagree a lot, or you disagree a little?	Disagree a lot Disagree a little Don't Know Refused	depending on the response to the previous question.
2.5.6.a	Your household's farm is smaller than most others in this community. Do you agree, you disagree, or you are in the middle?	Agree In the middle Disagree Don't Know Refused	
2.5.6.b	Do you agree a lot, or you agree a little?	Agree a lot Agree a little Don't Know Refused	Only one of this pair of questions is presented, depending on the response to the previous question.
2.5.6.c	Do you disagree a lot, or you disagree a little?	Disagree a lot Disagree a little Don't Know Refused	
2.6	I would now like to ask you about the things you get from the forest. Like before, we would like to hear how you feel about some sayings.		
2.6.1.a	Your household gets things from the forest that help you a lot. Do you agree, you disagree, or you are in the middle?	Agree In the middle Disagree Don't Know Refused	
2.6.1.b	Do you agree a lot, or you agree a little?	Agree a lot Agree a little Don't Know Refused	Only one of this pair of questions is presented, depending on the response to the previous question.
2.6.1.c	Do you disagree a lot, or you disagree a little?	Disagree a lot Disagree a little Don't Know Refused	
2.6.2	Your household gets good money from things in the forest. Do you agree, you disagree, or you are in the middle?	Agree In the middle Disagree Don't Know Refused	
2.6.2.a	Do you agree a lot, or you agree a little?	Agree a lot Agree a little Don't Know Refused	Only one of this pair of questions is presented, depending on the response to the previous question.
2.6.2.b	Do you disagree a lot, or you disagree a little?	Disagree a lot Disagree a little Don't Know Refused	
2.6.3.a	The forest helps you buy things you need, like food, school fees, or medicine. Do you agree, you disagree, or you are in the middle?	Agree In the middle Disagree Don't Know Refused	
2.6.3.b	Do you agree a lot, or you agree a little?	Agree a lot Agree a little Don't Know Refused	Only one of this pair of questions is presented, depending on the response to the previous question.
2.6.3.c	Do you disagree a lot, or you disagree a little?	Disagree a lot Disagree a little Don't Know Refused	

2.6.4.a	It would be very bad for your household if you could not get things from the forest. Do you agree, you disagree, or you are in the middle?	Agree In the middle Disagree Don't Know Refused	
2.6.4.b	Do you agree a lot, or you agree a little?	Agree a lot Agree a little Don't Know Refused	Only one of this pair of questions is presented, depending on the response to the previous question.
2.6.4.c	Do you disagree a lot, or you disagree a little?	Disagree a lot Disagree a little Don't Know Refused	
2.6.5.a	Your household gets food from the forest. Do you agree, you disagree, or you are in the middle?	Agree In the middle Disagree Don't Know Refused	
2.6.5.b	Do you agree a lot, or you agree a little?	Agree a lot Agree a little Don't Know Refused	Only one of this pair of questions is presented, depending on the response to the previous question.
2.6.5.c	Do you disagree a lot, or you disagree a little?	Disagree a lot Disagree a little Don't Know Refused	
2.6.6.a	Getting things from the forest helps your household to survive. Do you agree, you disagree, or you are in the middle?	Agree In the middle Disagree Don't Know Refused	
2.6.6.b	Do you agree a lot, or you agree a little?	Agree a lot Agree a little Don't Know Refused	Only one of this pair of questions is presented, depending on the response to the previous question.
2.6.6.c	Do you disagree a lot, or you disagree a little?	Disagree a lot Disagree a little Don't Know Refused	
2.6.7.a	Your household would have no money or food if you could not go to the forest. Do you agree, you disagree, or you are in the middle?	Agree In the middle Disagree Don't Know Refused	
2.6.7.b	Do you agree a lot, or you agree a little?	Agree a lot Agree a little Don't Know Refused	Only one of this pair of questions is presented, depending on the response to the previous question.
2.6.7.c	Do you disagree a lot, or you disagree a little?	Disagree a lot Disagree a little Don't Know Refused	
2.7	Is any part of your farm beside the forest?	Yes No Don't Know Refused	

Section 3: Food Insecurity Experience Scale (FIES)

	QUESTION	RESPONSE	NOTES
3	Now I would like to ask you some questions about food.		
3.1	During the last 3 months, was there a time when you or others in your household worried about not having enough food to eat because of a lack of money or other resources?	Yes No Don't Know Refused	Last 3 months
3.2	Still thinking about the last 3 months, was there a time when you or others in your household were unable to eat healthy and nutritious food because of a lack of money or other resources?	Yes No Don't Know Refused	Last 3 months
3.3	Was there a time when you or others in your household ate only a few kinds of foods because of a lack of money or other resources?	Yes No Don't Know Refused	Last 3 months
3.4	Was there a time when you or others in your household had to skip a meal because there was not enough money or other resources to get food?	Yes No Don't Know Refused	Last 3 months
3.5	Still thinking about the last 3 months, was there a time when you or others in your household ate less than you thought you should because of a lack of money or other resources?	Yes No Don't Know Refused	Last 3 months
3.6	Was there a time when your household ran out of food because of a lack of money or other resources?	Yes No Don't Know Refused	Last 3 months
3.7	Was there a time when you or others in your household were hungry but did not eat because there was not enough money or other resources for food?	Yes No Don't Know Refused	Last 3 months
3.8	Was there a time when you or others in your household went without eating for a whole day because of a lack of money or other resources?	Yes No Don't Know Refused	Last 3 months

Section 4: Multidimensional Scale of Perceived Social Support (MSPSS) – 6-item

	QUESTION	RESPONSE	NOTES
4	We would like to hear how you feel about some sayings. These sayings are going to be read to you. We would like you to tell us if you agree or disagree with these sayings using the answers given. Have you understood?		
4.1.a	There is a special person around you when you are in need. Do you agree, you disagree, or you are in the middle?	Agree In the middle Disagree Don't Know Refused	
4.1.b	Do you agree a lot, or you agree a little?	Agree a lot Agree a little Don't Know	Only one of this pair of questions

		Refused	is presented, depending on the response to the previous question.
4.1.c	Do you disagree a lot, or you disagree a little?	Disagree a lot Disagree a little Don't Know Refused	
4.2.a	Your family tries to help you. Do you agree, you disagree, or you are in the middle?	Agree In the middle Disagree Don't Know Refused	
4.2.b	Do you agree a lot, or you agree a little?	Agree a lot Agree a little Don't Know Refused	Only one of this pair of questions is presented, depending on the response to the previous question.
4.2.c	Do you disagree a lot, or you disagree a little?	Disagree a lot Disagree a little Don't Know Refused	
4.3.a	You get the comfort and support you need from your family. Do you agree, you disagree, or you are in the middle?	Agree In the middle Disagree Don't Know Refused	
4.3.b	Do you agree a lot, or you agree a little?	Agree a lot Agree a little Don't Know Refused	Only one of this pair of questions is presented, depending on the response to the previous question.
4.3.c	Do you disagree a lot, or you disagree a little?	Disagree a lot Disagree a little Don't Know Refused	
4.4.a	You know your friends will be around to help when trouble finds you. Do you agree, you disagree, or you are in the middle?	Agree In the middle Disagree Don't Know Refused	
4.4.b	Do you agree a lot, or you agree a little?	Agree a lot Agree a little Don't Know Refused	Only one of this pair of questions is presented, depending on the response to the previous question.
4.4.c	Do you disagree a lot, or you disagree a little?	Disagree a lot Disagree a little Don't Know Refused	
4.5.a	You can talk about your problems with your friends. Do you agree, you disagree, or you are in the middle?	Agree In the middle Disagree Don't Know Refused	
4.5.b	Do you agree a lot, or you agree a little?	Agree a lot Agree a little Don't Know Refused	Only one of this pair of questions is presented, depending on the response to the previous question.
4.5.c	Do you disagree a lot, or you disagree a little?	Disagree a lot Disagree a little Don't Know Refused	
4.6.a	There is a special person with whom you can share joys and sorrows.	Agree In the middle	

	Do you agree, you disagree, or you are in the middle?	Disagree Don't Know Refused	
4.6.b	Do you agree a lot, or you agree a little?	Agree a lot Agree a little Don't Know Refused	Only one of this pair of questions is presented, depending on the response to the previous question.
4.6.c	Do you disagree a lot, or you disagree a little?	Disagree a lot Disagree a little Don't Know Refused	

Section 5: Alcohol use and smoking

	QUESTION	RESPONSE	NOTES
5.1.1	Do you take alcohol?	Yes No Don't Know Refused	
5.1.2	How many days a week?	.....times a week	0 = less than once a week, 98 = don't know, 99 = refuse
5.2	Do you smoke tobacco every day?	Yes No Don't Know Refused	

Section 6: Patient Health Questionnaire (PHQ-8)

	QUESTION	RESPONSE	
6	I would now like to ask you some questions about how you feel.		
6.1	Over the past two weeks, how many times were you disturbed by little interest or pleasure in doing things? Was it not at all, a few days, more than half the days, or nearly every day?	0 = Not at all 1 = Few days 2 = More than half the days 3 = Nearly every day NA = Don't Know	
6.2	Over the past two weeks, how many times were you disturbed by feeling down, unhappy, or like you cannot see a way forward? Was it not at all, a few days, more than half the days, or nearly every day?	0 = Not at all 1 = Few days 2 = More than half the days 3 = Nearly every day NA = Don't Know	
6.3	Over the past two weeks, how many times were you disturbed by trouble falling or staying asleep, or sleeping too much? Was it not at all, a few days, more than half the days, or nearly every day?	0 = Not at all 1 = Few days 2 = More than half the days 3 = Nearly every day NA = Don't Know	
6.4	Over the past two weeks, how many times were you disturbed by feeling tired or having little energy? Was it not at all, a few days, more than half the days, or nearly every day?	0 = Not at all 1 = Few days 2 = More than half the days 3 = Nearly every day NA = Don't Know	
6.5	Over the past two weeks, how many times were you disturbed by not	0 = Not at all 1 = Few days	

	wanting to eat or eating too much? Was it not at all, a few days, more than half the days, or nearly every day?	2 = More than half the days 3 = Nearly every day NA = Don't Know	
6.6	Over the past two weeks, how many times were you disturbed by feeling bad about yourself, or you are a failure, or you have failed yourself or your family? Was it not at all, a few days, more than half the days, or nearly every day?	0 = Not at all 1 = Few days 2 = More than half the days 3 = Nearly every day NA = Don't Know	
6.7	Over the past two weeks, how many times were you disturbed by challenges putting your mind on what you are doing, like a church service or speaking with people? Was it not at all, a few days, more than half the days, or nearly every day?	0 = Not at all 1 = Few days 2 = More than half the days 3 = Nearly every day NA = Don't Know	
6.8	Over the past two weeks, how many times were you disturbed by moving or speaking so slowly that other people notice? Or in the opposite way, fidgeting so much that you move a lot more than how you used to do? Was it not at all, a few days, more than half the days, or nearly every day?	0 = Not at all 1 = Few days 2 = More than half the days 3 = Nearly every day NA = Don't Know	
	TOTAL score (sum items 6.1 to 6.8)	.....	This is scored automatically in ODK. At the end of the survey, if respondents scored over 17 the referral protocol was followed.
6.9	Over the past two weeks, how many times were you disturbed by thinking to much or too many thoughts? Was it not at all, a few days, more than half the days, or nearly every day?	0 = Not at all 1 = Few days 2 = More than half the days 3 = Nearly every day NA = Don't Know	

Section 7a: Scenario set 1

	QUESTION	RESPONSE	
	We have nearly finished our questions. When we ask you these questions, we would like to think about the next ten years. You might not know the answer, but I would like you to think about what could happen. We want to remind you that there is no plan or project coming from this research. Do you understand?		
7a.1.1. a	Some households in this community get food from the forest, like herbs, animals and mushrooms. In the next ten years, do you think households will get less food from the forest, more food from the forest, or will there be no change?	Less food No change More food Don't Know Refused	
7a.1.1. b	[If less] Why is this?	Because the guards will stop them Because of over-hunting	

		<p>Because there is less forest/less food for animals</p> <p>Because of disease</p> <p>Other reasons</p> <p>Don't Know</p> <p>Refused</p>	<p>Only one of these is asked, based on the response to the previous question.</p>
7a.1.1.c	[If more] Why is this?	<p>Because there are more people</p> <p>Because of more hunger</p> <p>Because of more poverty</p> <p>Because people want to eat more of those foods</p> <p>Because there will be more food in the forest</p> <p>Other reasons</p> <p>Don't Know</p> <p>Refused</p>	<p>“Let the respondent answer first. If they don't know, then read out the responses. Select all that apply.”</p>
7a.1.1.d	[If other from SEVAFWHYA or SEVAFWHYB] Write a few words summarising the response, in English.	.....	<p>The enumerator was trained to summarise responses in a few words, if not listed above.</p>
7a.1.2	If households get less food from the forest in the next ten years, would there be more hunger, less hunger, or no change?	<p>More hunger</p> <p>No change</p> <p>Less hunger</p> <p>Don't Know</p> <p>Refused</p>	
7a.1.3	If households get more food from the forest in the next ten years, would there be more hunger, less hunger, or no change?	<p>More hunger</p> <p>No change</p> <p>Less hunger</p> <p>Don't Know</p> <p>Refused</p>	
7a.2.1.a	Some households in this community get things from the forest to make money, like selling firewood, timber, and charcoal. In the next ten years, do you think households will get fewer things from the forest to make money, more things from the forest to make money, or will there be no change?	<p>More things</p> <p>No change</p> <p>Fewer things</p> <p>Don't Know</p> <p>Refused</p>	
7a.2.1.b	[If less] Why is this?	<p>Because the guards will stop them</p> <p>Because of over harvesting</p> <p>Because the forest will become farmland</p> <p>Because of disease</p> <p>Other reasons</p> <p>Don't Know</p> <p>Refused</p>	<p>Only one of these is asked, based on the response to the previous question.</p>
7a.2.1.c	[If more] Why is this?	<p>Because there are more people</p> <p>Because of more hunger</p> <p>Because of more poverty</p> <p>Because people want to get more money</p> <p>Because there will be more things in the forest for money</p> <p>Other reasons</p> <p>Don't Know</p> <p>Refused</p>	<p>“Let the respondent answer first. If they don't know, then read out the responses. Select all that apply.”</p>

7a.2.1. d	[If other from SEVAMONWHYA or SEVAMONWHYB] Write a few words summarising the response, in English.	.....	The enumerator was trained to summarise responses in a few words, if not listed above.
7a.2.2	If households get fewer things for money from the forest in the next ten years, would there be more poverty, less poverty, or no change?	More poverty No change Less poverty Don't Know Refused Less food	
7a.2.3	If households get more things for money from the forest in the next ten years, would there be more poverty, less poverty, or no change?	More poverty No change Less poverty Don't Know Refused Less food	

Section 7b: Scenario set 2

	QUESTION	RESPONSE	
	We have nearly finished our questions. When we ask you these questions, we would like to think about the next ten years. You might not know the answer, but I would like you to think about what could happen. We want to remind you that there is no plan or project coming from this research. Do you understand?		
7b.1.1. a	Some households in this community get food from the forest, like herbs, animals and mushrooms. I want you to imagine that people were not allowed to get anything from the forest, and there were more guards in the forest, over the next ten years. When you imagine this, do you think households would get less food from the forest, more food from the forest, or would there be no change?	Less food No change More food Don't Know Refused	
7b.1.1. b	[If less] Why is this?	Because the guards will stop them Because of over-hunting Because there is less forest/less food for animals Because of disease Other reasons Don't Know Refused	Only one of these is asked, based on the response to the previous question.
7b.1.1. c	[If more] Why is this?	Because there are more people Because of more hunger Because of more poverty Because people want to eat more of those foods Because there will be more food in the forest Other reasons Don't Know Refused	“Let the respondent answer first. If they don't know, then read out the responses. Select all that apply.”

7b.1.1. d	[If other from SEVBFWHYA or SEVBFWHYB] Write a few words summarising the response, in English.	.....	The enumerator was trained to summarise responses in a few works, if not listed above.
7b.1.2	If households get less food from the forest in the next ten years, would there be more hunger, less hunger, or no change?	More hunger No change Less hunger Don't Know Refused	
7b.1.3	If households get more food from the forest in the next ten years, would there be more hunger, less hunger, or no change?	More hunger No change Less hunger Don't Know Refused	
7b.2.1	Some households in this community get things from the forest to make money, like selling firewood, timber, and charcoal. I want you to still imagine that people were not allowed to get anything from the forest, and there were more guards in the forest, over the next ten years. When you imagine this, do you think people would get fewer things from the forest to make money, more things from the forest to make money, or would there be no change?	More things No change Fewer things Don't Know Refused	
	[If less] Why is this?	Because the guards will stop them Because of over harvesting Because the forest will become farmland Because of disease Other reasons Don't Know Refused	Only one of these is asked, based on the response to the previous question.
	[If more] Why is this?	Because there are more people Because of more hunger Because of more poverty Because people want to get more money Because there will be more things in the forest for money Other reasons Don't Know Refused	"Let the respondent answer first. If they don't know, then read out the responses. Select all that apply."
	[If other from SEVBFWHYA or SEVBFWHYB] Write a few words summarising the response, in English.	.....	The enumerator was trained to summarise responses in a few works, if not listed above.
7b.2.2	If households get fewer things for money from the forest in the next ten years, would there be more poverty, less poverty, or no change?	More poverty No change Less poverty Don't Know Refused	

		Less food	
7b.2.3	If households get more things for money from the forest in the next ten years, would there be more poverty, less poverty, or no change?	More poverty No change Less poverty Don't Know Refused Less food	

Section 7c: Scenario set 3

	QUESTION	RESPONSE	
	We have nearly finished our questions. When we ask you these questions, we would like to think about the next ten years. You might not know the answer, but I would like you to think about what could happen. We want to remind you that there is no plan or project coming from this research. Do you understand?		
7c.1.1. a	Do you think there will be a change in who has land over the next ten years?	Yes No Don't Know Refused	
7c.1.1. b	[If yes] Why is this?	More people sugarcane farming More people food crop farming More people growing other cash crops other than sugarcane Other reasons Don't Know Refused	“Let the respondent answer first. If they don't know, then read out the responses. Select all that apply.”
7c.1.1. c	[If other from SEVCWHYA] Write a few words summarising the response, in English.	.....	The enumerator was trained to summarise responses in a few words, if not listed above.
7c.1.2	Who will get more land? Would it be households with more money, or households with less money, or others not mentioned would get more land, or do you think there would be no change?	Households with more money Households with less money Others No one Don't Know Refused	
7c.1.3	Who will get less land? Would it be households with more money, or households with less money, or others not mentioned would get more land, or do you think there would be no change?	Households with more money Households with less money Others No one Don't Know Refused	
7c.1.4	Where would this land come from?	Clearing the forest Buying or renting land from other farmers Taking land from other farmers Buying or renting land from others who own land but don't farm Taking land from others who own land but don't farm Others	

		Don't Know Refused	
7c.1.5	If those households got less land in the next ten years, would there be more poverty, less poverty, or no change in those households?	More poverty No change Less poverty Don't Know Refused	
7c.1.6	If those households got less land in the next ten years, would there be more hunger, less hunger, or no change in those households?	More hunger No change Less hunger Don't Know Refused	

Section 7d: Scenario set 4

	QUESTION	RESPONSE	
	We have nearly finished our questions. When we ask you these questions, we would like to think about the next ten years. You might not know the answer, but I would like you to think about what could happen. We want to remind you that there is no plan or project coming from this research. Do you understand?		
7d.1.1. a	I want you to imagine that the price of sugarcane increased, and people wanted to grow more sugarcane over the next ten years. When you imagine this, do you think there would be a change in who has land over the next ten years?	Yes No Don't Know Refused	
7d.1.1. b	[If yes] Why is this?	More people sugarcane farming More people food crop farming More people growing other cash crops other than sugarcane Other reasons Don't Know Refused	"Let the respondent answer first. If they don't know, then read out the responses. Select all that apply."
7d.1.1. c	[If other from SEVDWHYA] Write a few words summarising the response, in English.	.....	The enumerator was trained to summarise responses in a few words, if not listed above.
7d.1.2	If the price of sugarcane increased and people wanted to grow more sugarcane, who would get more land? Would it be households with more money, or households with less money, or others not mentioned would get more land, or do you think there would be no change?	Households with more money Households with less money Others No one Don't Know Refused	
7d.1.3	If the price of sugarcane increased, and people wanted to grow more sugarcane, who would get less land?	Households with more money Households with less money Others No one	

	Would it be households with more money, or households with less money, or others not mentioned would get less land, or do you think there would be no change?	Don't Know Refused	
7d.1.4	Where would this land come from?	Clearing the forest Buying or renting land from other farmers Taking land from other farmers Buying or renting land from others who own land but don't farm Taking land from others who own land but don't farm Others Don't Know Refused	
7d.1.5	If those households got less land in the next ten years, would there be more poverty, less poverty, or no change in those households?	More poverty No change Less poverty Don't Know Refused	
7d.1.6	If those households got less land in the next ten years, would there be more hunger, less hunger, or no change in those households?	More hunger No change Less hunger Don't Know Refused	

10.3.3. Appendix: Latent psychological distress

Total eight-item Patient Health Questionnaire (PHQ-8) scores were not used within the statistical analysis (Kroenke et al., 2001; Y. Wu et al., 2020). Instead, the PHQ-8 was used to estimate latent depression risk. The dataset was split into training (2/3 of observations) and test (1/3 of observations) sets. Using the training set and the psych package, parallel analysis using polychoric correlation and a weighted least squares estimator suggested extracting one factor (Revelle, 2019). Exploratory factor analysis (using the semTools package) with the training set suggested each item was reasonably well loaded on the one extracted factor, with a good model fit (Jorgensen, Pornprasertmanit, Schoemann, & Rosseel, 2020). Confirmatory factor analysis using the test data yielded similar results, although with a poorer model fit (likely because of the small size of the test dataset). A one-factor graded response model was fitted to all the data using the mirt package (Chalmers, 2012). This analysis indicated that the instrument had reasonable discriminatory power, despite some floor and ceiling effects. This model had a root mean square error of approximation (RMSEA) of 0.048 (95% confidence interval 0.033 - 0.065), comparative fit index (CFI) of 0.864, Tucker–Lewis index (TLI) of 0.810, and standardised root mean square residual (SRMR) of 0.044. One set of plausible values was extracted from a graded responses model run with each of the ten imputed datasets. Plausible values were used because the software used in the structural equation model could not estimate factors from ordinal data.

The statements within the PHQ-8 were:

- Over the past two weeks, how many times were you disturbed by little interest or pleasure in doing things? Was it not at all, a few days, more than half the days, or nearly every day?
- Over the past two weeks, how many times were you disturbed by feeling down, unhappy, or like you cannot see a way forward? Was it not at all, a few days, more than half the days, or nearly every day?
- Over the past two weeks, how many times were you disturbed by trouble falling or staying asleep, or sleeping too much? Was it not at all, a few days, more than half the days, or nearly every day?
- Over the past two weeks, how many times were you disturbed by feeling tired or having little energy? Was it not at all, a few days, more than half the days, or nearly every day?
- Over the past two weeks, how many times were you disturbed by not wanting to eat or eating too much? Was it not at all, a few days, more than half the days, or nearly every day?
- Over the past two weeks, how many times were you disturbed by feeling bad about yourself, or you are a failure, or you have failed yourself or your family? Was it not at all, a few days, more than half the days, or nearly every day?
- Over the past two weeks, how many times were you disturbed by challenges putting your mind on what you are doing, like a church service or speaking with people? Was it not at all, a few days, more than half the days, or nearly every day?
- Over the past two weeks, how many times were you disturbed by moving or speaking so slowly that other people notice? Or in the opposite way, fidgeting so much that you move a

lot more than how you used to do? Was it not at all, a few days, more than half the days, or nearly every day?

“*Thinking too much*” is a colloquial term used to indicate degrees of psychological distress in the study area (Chapter 2). An additional variable corresponding to the format of the PHQ-8 was therefore included, asking respondents if they “*think too much*”. This variable was not used in the formal assessment of depression risk but was instead used to triangulate the study with the previous qualitative study results.

10.3.4. Appendix: Latent food insecurity

The Food Insecurity Experience Scale (FIES) was used to estimate food insecurity. Rasch, two-parameter, and three-parameter logistic item response models were fit. The two-parameter model had 24.1 lower Akaike information criterion scores than the next best model, and so was chosen. This model had a RMSEA of 0.087 (95% CI 0.073 - 0.102), CFI = 0.971, TLI of 0.959, and SRMR of 0.051. Ten sets of plausible values were extracted, as above.

The statements within the FIES were:

- During the last 3 months, was there a time when you or others in your household worried about not having enough food to eat because of a lack of money or other resources?
- Still thinking about the last 3 months, was there a time when you or others in your household were unable to eat healthy and nutritious food because of a lack of money or other resources?
- Was there a time when you or others in your household ate only a few kinds of foods because of a lack of money or other resources?
- Was there a time when you or others in your household had to skip a meal because there was not enough money or other resources to get food?
- Still thinking about the last 3 months, was there a time when you or others in your household ate less than you thought you should because of a lack of money or other resources?
- Was there a time when your household ran out of food because of a lack of money or other resources?
- Was there a time when you or others in your household were hungry but did not eat because there was not enough money or other resources for food?
- Was there a time when you or others in your household went without eating for a whole day because of a lack of money or other resources?
- We would like to hear how you feel about some sayings. These sayings are going to be read to you. We would like you to tell us if you agree or disagree with these sayings using the answers given. Have you understood?

10.3.5. Appendix: Economic poverty

A logistic principle component analysis was conducted with 21 household assets (Table 10.3). The number of principle components to estimate in the model was selected through an iterative process. This process involved repeating the logistic principle component analysis ten times, starting with extracting one component and ending with extracting ten. Out of these ten candidate models, we choose the one whose factor scores had the biggest linear association with an external measure of subjective financial strain. This measure of financial strain is a single-item question recommended by the National Academy of Medicine (Kahn & Pearlin, 2006; National Academy of Medicine, 2014). This analysis suggested using nine principle components within the model (which explained 85.7% of the total variance). The first component was used as a proxy for economic poverty.

Table 10.3. Household assets included ('Yes') or excluded ('No') in a logistic principle component analysis to construct an asset index, which was used as a proxy for economic poverty.

Assets	Included
A gas cooker	No
At least two sets of clothes for every person in the household	Yes
Two goats	No
At least two meals per day	Yes
Mains electricity	No
A wooden bed (frame)	Yes
A big solar panel	Yes
At least two Jerry cans	Yes
One mattress or more	Yes
A television	No
Brick walls for your house	Yes
A motorbike	No
Two hoes	Yes
A blanket for every person in the household	Yes
A bank account	No
A bicycle	Yes
A water tank	No
A pair of shoes for every member of the household	Yes
Iron sheets on your roof	Yes
A radio	Yes
Three saucepans	Yes
Solar battery	No
A mobile phone	Yes
Two or more plastic chairs	Yes
A car	No
A fridge	No
A cement floor for your house	Yes
A member in a savings group	Yes
A sofa	Yes
Two or more wooden chairs	Yes
Soap	Yes

10.3.6. Appendix: Latent forest use

We designed an instrument with seven Likert-scaled items to estimate forest use. Parallel and exploratory factor analysis with the training data was performed, followed by confirmatory factor analysis with the test data. Parallel analysis with the training set suggested the extraction of two factors. Exploratory factor analysis suggested that four items were heavily loaded on the first factor, two were cross-loaded, and the final was heavily loaded on the second factor. Therefore, a two-factor graded response model was fit (Table 10.4). This model had an RMSEA of 0.087 (95% CI 0.068 - 0.106), CFI of 0.966, TLI of 0.941, and SRMR of 0.048. The four items heavily loaded on the first factor specifically related to food and income, while the three items heavily loaded on the second factor related to non-specific forest dependence. Therefore, one set of plausible values associated with the first dimension – deemed most relevant for this study – were extracted from each imputed dataset.

Table 10.4. Loadings within two-factor graded response model. Ten sets of plausible values of the first factor were extracted and used in the primary analysis.

Statement	First factor	Second factor
Your household gets things from the forest that help you a lot.		0.787
Your household gets good money from things in the forest.	0.860	
The forest helps you buy things you need, like food, school fees, or medicine.	0.888	
It would be very bad for your household if you could not get things from the forest.	0.261	0.638
Your household gets food from the forest.	0.771	
Getting things from the forest helps your household to survive.	0.305	0.682
Your household would have no money or food if you could not go to the forest.	0.744	

10.3.7. Appendix: Relative land size

We designed an instrument with six Likert-scaled items to estimate land size. Again, the same steps described to estimate latent depression symptom severity were repeated. This analysis suggested the extraction of one factor, so a one-factor graded response model was fit. This model had an RMSEA of 0.080 (95% CI 0.059 - 0.103), CFI of 0.970, TLI of 0.951, and SRMR of 0.057. As above, one set of plausible values was extracted from each imputed dataset.

The statements within the land instrument were:

- Your household's farm is bigger than most others in this community.
- Your household's farm is big enough for you to get the things you need, like food, school fees, or medicine.
- Your household struggles because you do not have enough land.
- Your household has enough land to live well.
- Your household gets good money from your farm.
- Your household's farm is smaller than most others in this community.

10.3.8. Appendix: Latent social support

Social support was estimated using a modified version of the Multidimensional Scale of Perceived Social Support (MSPSS) (Shumaker, Frazier, Moser, & Chung, 2017; Zimet, Dahlem, Zimet, Gordon, & Farley, 2010; Zimet et al., 1990). The MSPSS is used to estimate latent social support from three sources; friends, family, and significant others. The modification of the MSPSS involves using six of the 12-items, as indicated by Slavin, Creedy, and Gamble (2020). We further simplified the instrument by reducing the number of response levels from seven to five to simplify. Furthermore, we also altered some of the phrases and changed from the first to the second person following piloting. For instance, one of the original statements is “*I can count on my friends when things go wrong*”, which we changed to “*You know your friends will be around to help when trouble finds you.*”

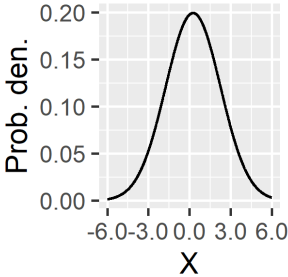
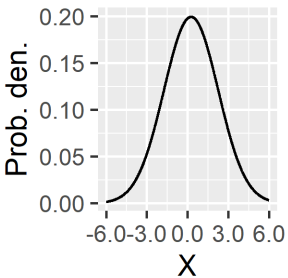
The modified version of the MSPSS was used to estimate latent social support, following steps similar to those described in the main text for estimating latent depression. The parallel analysis with the training data suggested the extraction of two factors. Subsequent exploratory factor analysis using all responses suggested three items were heavily loaded onto the first factor, one item was cross-loaded, and two items were loaded on a second factor (Table 10.5). This model had an RMSEA of 0.083 (95% CI 0.061 - 0.107), CFI of 0.970, TLI of 0.944, and SRMR of 0.057. The first factor related to social support from family was deemed more relevant than support from friends. Therefore, ten sets of plausible values associated with the first factor were extracted.

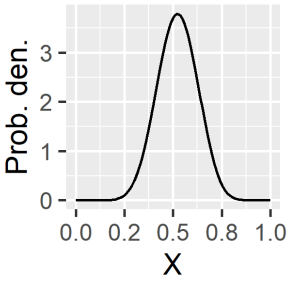
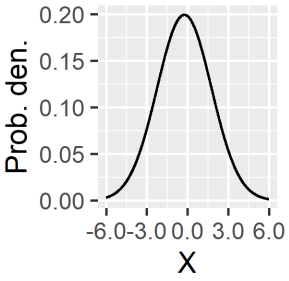
Table 10.5. Loadings within two-factor graded response model. Ten sets of plausible values of the first factor were extracted and used in the primary analysis.

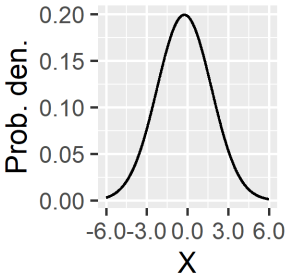
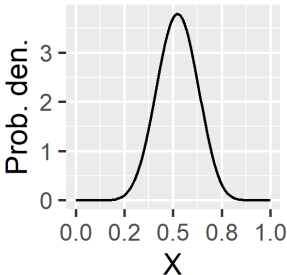
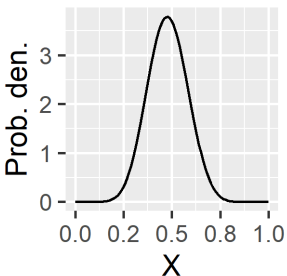
Statement	First factor	Second factor
There is a special person around you when you are in need.	0.578	
Your family tries to help you.	0.864	
You get the comfort and support you need from your family.	0.902	
You know your friends will be around to help when trouble finds you.		0.819
You can talk about your problems with your friends.		0.711
There is a special person with whom you can share joys and sorrows.	0.327	0.440

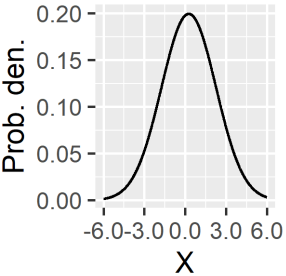
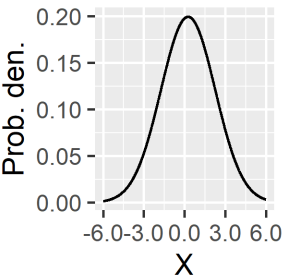
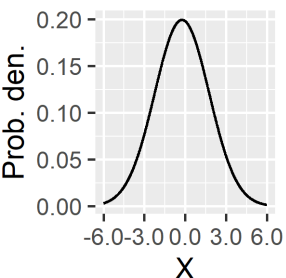
10.3.9. Appendix: A priori hypothesised linkages between nature and depression

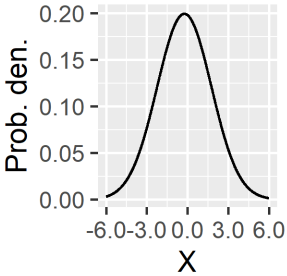
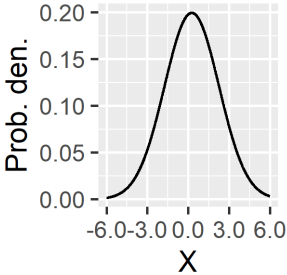
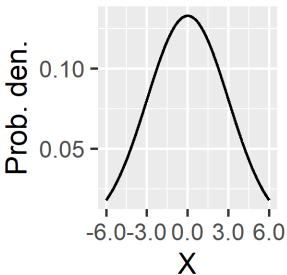
Table 10.6. The a priori hypothesised associations between exposure and outcome variables in the structural equation model, the distributional form and type of prior, the supporting evidence, and associated hyperparameters. Key: '+' = positive association; '-' = negative association; '?' = uncertain direction of the association; N = normal distribution, and B = beta distribution.

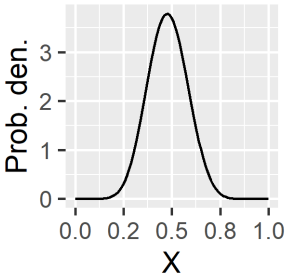
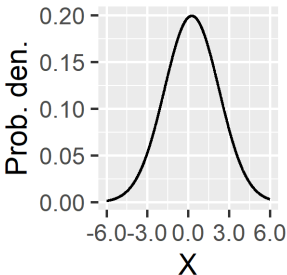
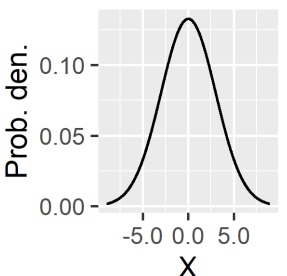
Outcome variable	Expected association	Exposure variable	Distributional form of the priors	Type of prior	Prior evidence	Picture of plot	Hyperparameters
Depression	(+)	Food insecurity	Normal	Moderately informative	Food insecurity is a widely recognised and strong social determinant of common mental disorders, including depression (A. D. Jones, 2017; Lund et al., 2010; Lund et al., 2018; Weaver & Hadley, 2009). Food insecurity also appears to be a prominent stressor associated with psychological distress in the study site (Chapter 2) and other parts of Uganda (Kinyanda et al., 2017).		$N(0.25, 4)$
Depression	(+)	Economic poverty	Normal	Moderately informative	Economic poverty is also a widely recognised and strong social determinant of common mental disorders, such as depression (Lund et al., 2010; Lund et al., 2018; Patel & Kleinman, 2003). Again, economic poverty also appears to be a major stressor associated with psychological distress in the study site (Chapter 2) and Uganda generally (Kinyanda, Woodburn, et al., 2011).		$N(0.25, 4)$

Food insecurity	(+) co-variance	Forest use	Beta	Moderately informative	Prior evidence from the study site suggests that legally and illegally harvested forest resources are an important source of food and income (used to purchase food) for some households, particularly in times of need (Chapter 2). And so, food-insecure households appear more likely to be forest users, but forest use alleviates food insecurity.		$B(12, 11)$
Food insecurity	(-)	Farm size	Normal	Moderately informative	Multiple on-farm factors influence food security, including absolute farm size (Fraval et al., 2019; Otsuka, 2013). Previous research found that small farm sizes were considered a major cause of food insecurity for residents (Chapter 2).		$N(-0.25, 4)$
Food insecurity	(+)	Economic poverty	Normal	Moderately informative	In general, food insecurity and economic poverty are often closely tied and sometimes treated as sub-dimensions of general poverty (e.g., Lund et al., 2010). Previous research within the study site suggests a strong association between food insecurity and economic poverty, with money used to purchase food, especially in times of need (Chapter 2).		$N(0.25, 4)$

Food insecurity	(-)	Distance for forest reserve	Normal	Moderately informative	Previous research suggests that crop-raiding may threaten food security in the study area and mostly occurs close to the forest edge (Hill, 2015; Tweheyo, Hill, & Obua, 2005).		$N(-0.25, 4)$
Economic poverty	(+) co-variance	Forest use	Beta	Moderately informative	Prior research in the study site suggests that legally and illegally harvested forest resources are an important source of income for some households. So, poor households are more likely to be forest users, but forest resource utilisation helps alleviate poverty (Chapter 2).		$B(12, 11)$
Economic poverty	(-) co-variance	Farm size	Beta	Moderately informative	Most land outside the forest reserves within the study site has been cleared for agriculture, meaning there is little available land for agricultural expansion (Babweteera et al., 2012). Residents of the area reported rising land prices leading to increasingly inequitably distributed farm sizes between wealthier and poorer households (Chapter 2).		$B(11, 12)$

Depression (+)	Age	Normal	Moderately informative	Although the association may not be linear, prior evidence suggests a general positive association between age and poor mental health in Uganda (Kinyanda, Waswa, et al., 2011; Kinyanda, Woodburn, et al., 2011).		$N(0.25, 4)$
Depression (+)	Gender	Normal	Moderately informative	Evidence from Uganda indicates women may be at higher risk of poor mental health than men (Kinyanda et al., 2017; Kinyanda, Woodburn, et al., 2011). Prior research in the case study suggests women might face more significant threats to mental health due to having fewer assets and less income, greater childcare responsibilities, and other factors (Chapter 2).		$N(0.25, 4)$
Depression (-)	Education	Normal	Moderately informative	While the relationship between educational level and mental health can be complex (Lund et al., 2018), educational attainment is often associated with socio-economic status (Lund et al., 2010). Some evidence for Uganda suggests that higher levels of education are associated with better mental health (Kinyanda, Woodburn, et al., 2011).		$N(-0.25, 4)$

Depression (-)	Social support	Normal	Moderately informative	Significant evidence suggests that those with less social support (from spouses, family, and friends) have worse mental health, including research in Uganda (Garipy, Honkaniemi, & Quesnel-Valle, 2016; Haber, Cohen, Lucas, & Baltes, 2007; Kinyanda et al., 2017).		$N(-0.25, 4)$
Depression (+/?)	Marital status: divorced or widowed	Normal	Moderately informative	Although married individuals tend to have better mental health, this relationship may be more complex in contexts where polygamy is common (Bove & Vallengia, 2009; Coombs, 1991). Prior evidence from Uganda suggests that those divorced or widowed are at around double the risk of depression than the general population in Uganda (Kinyanda, Woodburn, et al., 2011). We adopt a moderately informative prior for 'divorced or widowed' but a weakly informative prior for 'never married'.		$N(0.25, 4)$
Depression (+/?)	Marital status: never married	Normal	Weakly informative			$N(0, 9)$

Depression	(-) co-variance	General health	Beta	Moderately informative	A large amount of research describes bi-directional comorbidity between mental and physical health (Firth et al., 2019).		$B(2, 3)$
Depression	(+)	Alcohol consumption	Normal	Moderately informative	Evidence suggests a positive association between drinking and depression risk, with the former tending to causally influence the latter (Boden & Fergusson, 2011).		$N(0.25, 4)$
Depression	(+)	Smoking	Normal	Moderately informative	Tobacco smoking is often positively associated with depression risk, although the direction of causality is uncertain (Fluharty, Taylor, Grabski, & Munaf, 2017). Some evidence that smoking might be a risk factor in Uganda (Kinyanda, Waswa, et al., 2011).		$N(0.25, 4)$

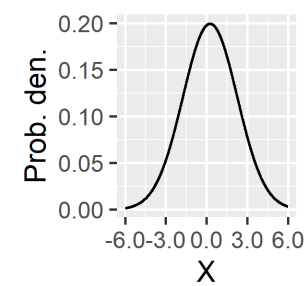
Depression (?)

Community name (all)

Normal

Weakly informative

Prior research within the study site suggests community-level differences in access to utilities, markets, and sources of employment (Chapter 2). The inclusion of this variable controls for these differences.



$N(0,9)$

10.3.10. Appendix: Patterns of missing data (Chapter 3)

Approximately 0.2% of the data were missing (Figure 10.4). This missingness is partly attributed to one of the questions (indicated by 'SOCJOY') mistakenly not being asked in an early version of the survey. Additionally, several respondents did not wish to respond to questions about their land size (e.g., those questions starting with the indicator 'LAND...').

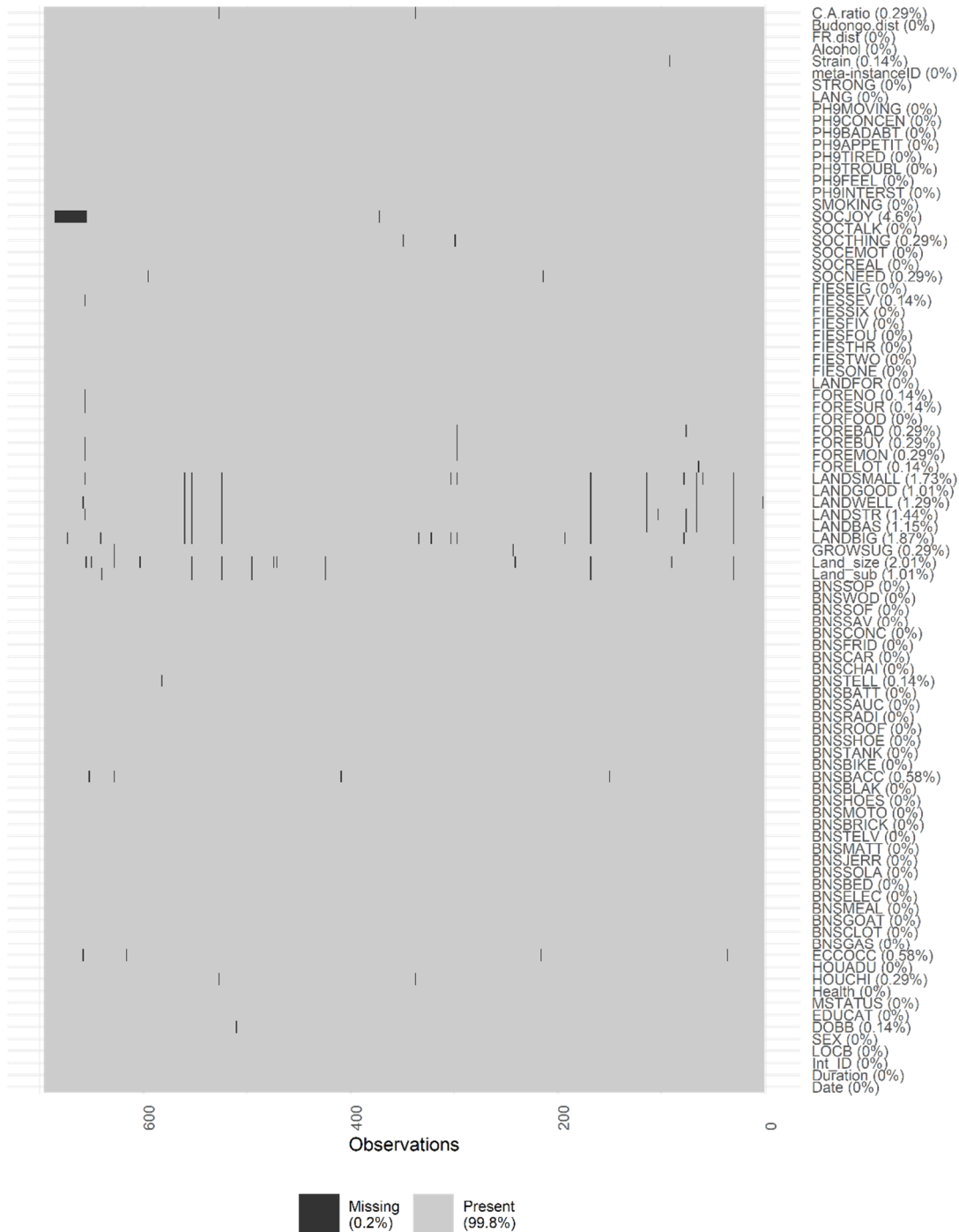


Figure 10.4. Patterns of missing data within our data.

10.3.11. Appendix: Imputation of missing data (Chapter 3)

Missing values were assumed to be missing at random in relation to the response variable and so were substituted with synthetic values through multivariate imputation by chained equations, using the mice package (van Buuren S & K, 2011). This imputation created ten datasets containing the imputed data. Ordinal variables were imputed using proportional odds models, numeric variables with predictive mean matching, and unordered categorical variables with polytomous logistic regression. The pre- and post-imputation distributions of these variables were consistent.

10.3.12. Appendix: WAMBS-Checklist (Chapter 3)

The models were evaluated according to the ten steps described in the When to worry and how to Avoid the Misuse of Bayesian Statistics (WAMBS)-Checklist (Depaoli & Van de Schoot, 2017).

- “*Do you understand the priors?*”: TP discussed the priors with EJMG and AK.
- “*Does the trace-plot exhibit convergence?*”: We inspected the trace-plots, potential scale reduction factor from the Gelman-Rubin Diagnostic, and the Geweke Diagnostic for the model run with the first of the ten imputed datasets. These diagnostics suggested the models had converged, with equality between the first and second half of iterations.
- “*Does convergence remain after doubling the number of iterations?*”: The number of pre- and post-burn-in iterations doubled to 8,000 each (16,000 in total), and trace plots, potential scale reduction factor, and Geweke Diagnostic were re-examined. These results suggested that local convergence was not an issue.
- “*Does the histogram have enough information?*”: We inspected the histograms of estimates in each iteration, and there appeared to be sufficient information to approximate the posterior, with a single clear peak and sloping sides for each parameter.
- “*Do the chains exhibit a strong degree of autocorrelation?*”: We found a small amount of autocorrelation, but it was not accompanied by convergence issues, so it was not concerning.
- “*Does the posterior distribution make substantive sense?*”: The posterior distributions were consistent with our hypothesis and a plausible mean and spread.
- “*Do different specifications of the multivariate variance priors influence the results?*”: We re-run the model with a multivariate variance prior of $\text{gamma}(1, 0.05)$, which had no discernible effect on the posterior distribution.
- “*Is there a notable effect of the prior when compared with noninformative priors?*”: We repeated the analysis with the software’s default weakly informative priors, with no discernible effect on the posterior distribution.
- “*Are the results stable from a sensitivity analysis?*”: We re-ran the analysis twice, first increasing all hyperparameters (e.g., shifting from $N(0.25, 4)$ to $N(0.50, 4)$), then decreasing them (e.g., shifting from $N(0.25, 4)$ to $N(0.00, 4)$). These changes had no discernible effect on the posterior distribution.
- “*Is the Bayesian way of interpreting and reporting model results used?*”: We presented the median, 95% and 50% credibility intervals of the posterior distribution.

10.3.13. Appendix: Thinking too much and depression

We modelled the association between “*thinking too much*” (the outcome variable) and latent depressive symptom severity (using the raw PHQ-8 scores as the exposure variable) within a Bayesian ordinal regression. We used the software’s default weakly informative priors. The models were fitted with a logit link function and were run for 4,000 burn-in and 4,000 post-burn-in iterations across four Markov chains and using the Markov Chain Monte Carlo sampler. The analysis was repeated with all ten imputed datasets, and the prior distributions were pooled. PHQ-8 scores were strongly positively correlated with “*thinking too much*” (Table 10.7).

Table 10.7. The results of an ordinal logistic regression examining the association between “*thinking too much*” and Patient Health Questionnaire (PHQ-8) scores on the log-odds scale.

Variable	Estimate	Standard error	95% CI
Threshold one (Not at all | Few days)	1.08	1.19	0.77-1.53
Threshold two (Few days | More than half the days)	9.46	1.21	6.49-13.89
Threshold three (More than half the days | Nearly every day)	19.19	1.23	12.88-28.83
PHQ-8 score	1.27	1.02	1.22-1.31

10.3.14. Appendix: Linkages with thinking too much

We repeated the primary analysis but replaced depressive symptom severity with “*thinking too much*”. Assuming that responses to “*thinking too much*” were driven by an underlying latent variable, we scaled and centred the variable and treated it as continuous. The same priors, number of iterations and chains, seed, and sampling algorithm used in the primary analysis were also used here.

The results of this analysis were generally consistent with the primary analysis (Figure 10.5). However, in contrast with the primary analysis, age had a significant positive association with “*thinking too much*”, but gender and education did not. Further analysis would be needed to understand these differences. However, these results suggest that “*thinking too much*” and depression may affect slightly different demographic groups.

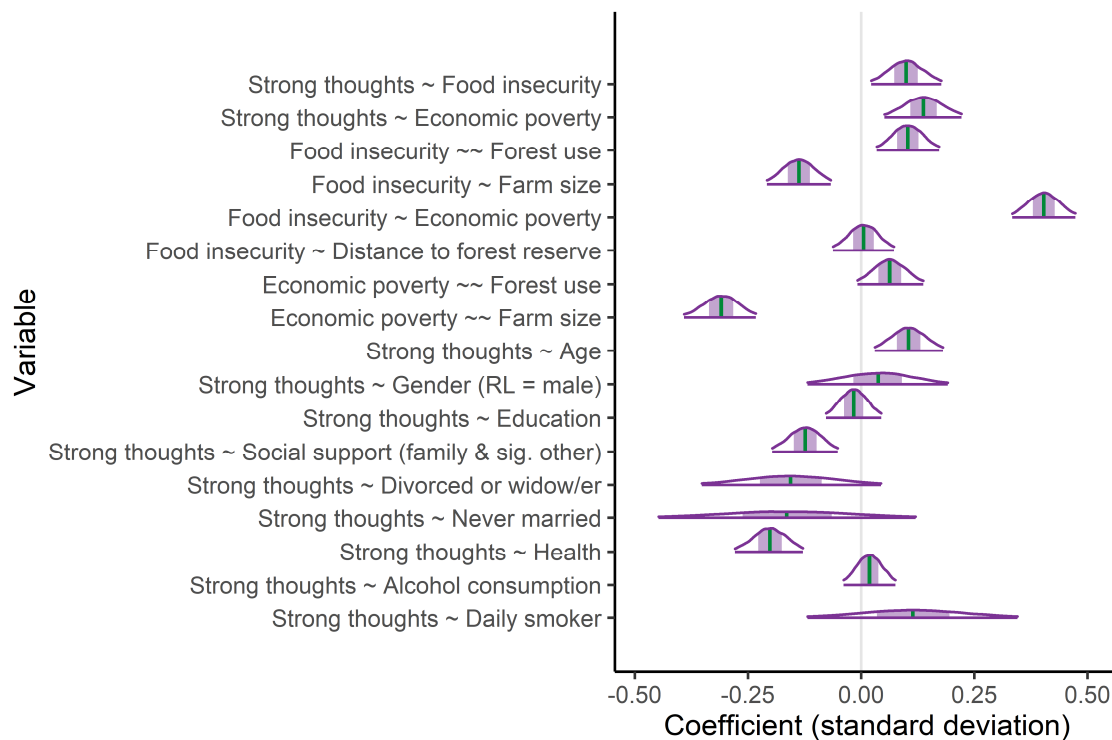


Figure 10.5. The coefficient estimates from the Bayesian structural equation model using data from 695 respondents. The vertical green line represents the point estimate (median of the posterior distribution), the dark purple line represents the 95% credibility interval, and the shaded area represents the 50% credibility interval. The estimated associations between depressive symptom severity and the community dummy variables are not shown. Coefficient estimates are presented in standard deviations.

10.4. Chapter 4 Appendixes

10.4.1. Appendix: Definitions of a conservationist (Chapter 4)

We adopted a broad definition of conservation, which may include those not formally working in the sector. A more conservative definition of conservationists might be restricted to those currently working or conducting research within the sector. To explore the sensitivity of our results, we repeated the analysis among 2022 respondents who said they worked or conducted research in conservation, using the first of the ten imputed datasets. The results of this analysis were consistent with the primary analysis (Figure 10.6).

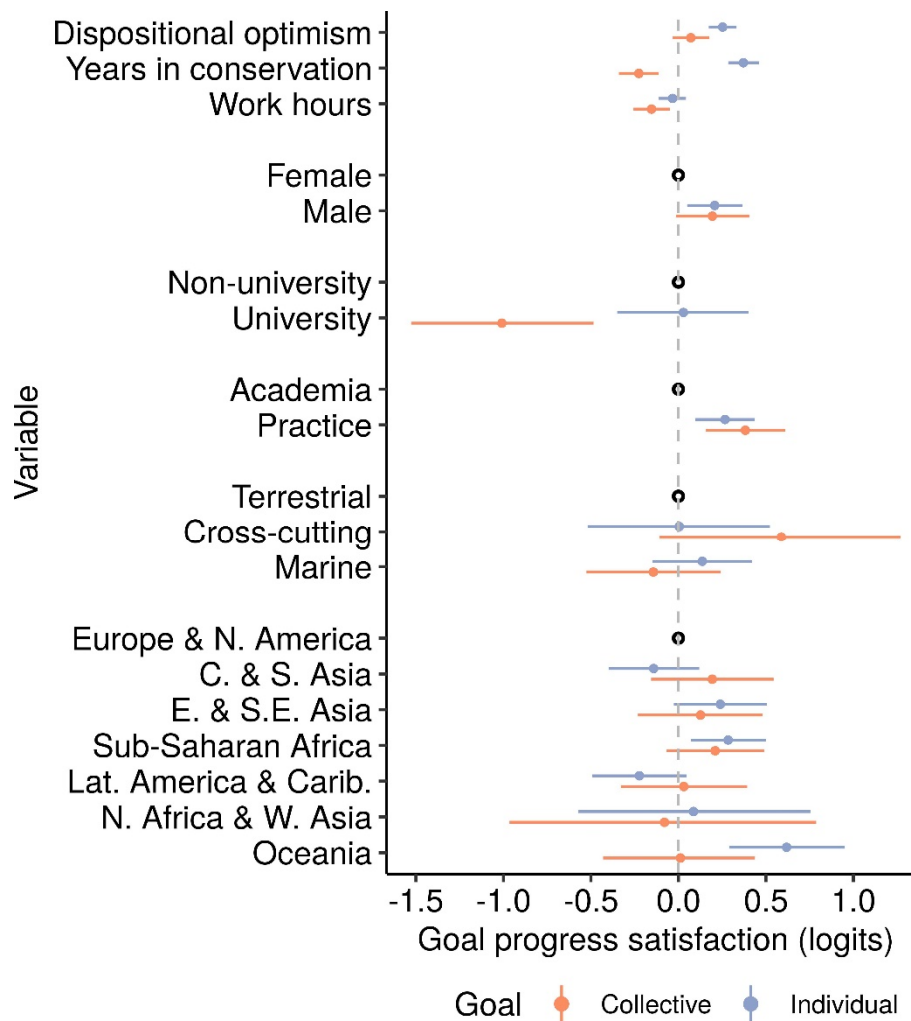


Figure 10.6. The estimated associations between satisfaction with goal progress and each explanatory variable among 2022 respondents who said they worked or conducted research in conservation. Points represent the mean of the posterior distribution, and bars indicate the 95% credibility intervals on the log-odds scale. Dispositional optimism, years in conservation, and work hours are scaled and centred. Thresholds, 'goal name' and response categories corresponding to missing data are not shown.

10.4.2. Appendix: Survey development

The survey used in chapters 4 to 7 were developed through several steps. First, we reviewed selected literature to develop a theoretical framework encompassing chapters 4 to 7. This selective review drew on theories from positive psychology (e.g., Luthans & Youssef-Morgan, 2017; Malouff & Schutte, 2017), well-being research (e.g., Carver & Scheier, 2014; Carver et al., 2010; Scheier & Carver, 1992) and occupational health (Burton et al., 2008; Davey et al., 2001; Lamontagne et al., 2014; Marchand, Demers, & Durand, 2005; Stansfeld & Candy, 2006). This review examined frameworks related to goal progress satisfaction, optimism, working conditions and other social determinants, and psychological distress. All co-authors reviewed this document including one with a background in occupational health and psychiatric epidemiology. During this process, we evaluated existing psychological instruments, selecting those that were widely used, validated, and relatively short (e.g., the Life Orientation Test – Revised (Scheier et al., 1994)). However, we were unable to find pre-existing instruments for two key psychological constructs; goal progress satisfaction and situational optimism about conservation (see 11.5.2. Appendix: Situational optimism instrument). Therefore, over a series of three workshops we discussed key dimensions of these constructs, drawing on the theoretical framework, and conceptualised the structure of each instrument (e.g., the choice to use Likert-scaled items). We then proposed and evaluated candidate statements, selecting those that we considered most related to the dimensions of interest (face validity), which would be easily interpreted and translated. Similarly, we were also interested in the potential role of workplace rewards and challenges unique to conservation, that were not represented within original effort-reward imbalance instrument. Therefore, during the workshops, a similar process was used to identify additional conservation workplace challenges and rewards, and develop and evaluate candidate items. Based on this, I created the draft survey within an R Shiny application (hosted on shinyapps.io). This was piloted, as described in Chapter 4. Furthermore, I also used parallel analysis, the ordinal alpha, exploratory factor analysis and models from item response theory to evaluate internal consistency (e.g., see 11.5.2. Appendix: Situational optimism instrument).

10.4.3. Appendix: Sample recruitment email

The following is a sample recruitment message, which we asked contacted conservation organisations to share within among their staff and networks. This message was translated into the survey languages.

“Do you work, study, or do research in conservation? The Interdisciplinary Centre for Conservation Science (ICCS) would like to learn about your #lifeinconservation, and the challenges and rewards you face through this 8-minute online survey available in multiple languages: <https://livedataoxford.shinyapps.io/lifeinconservation/>

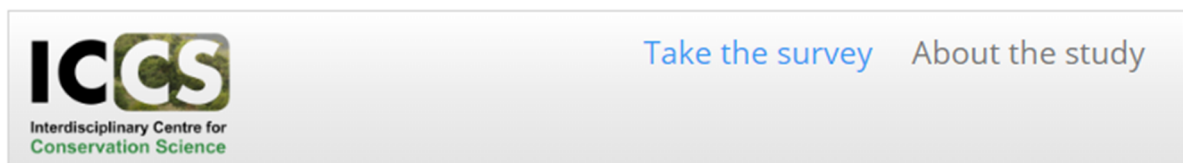
At the end, you’ll be able to see some of your results compared to others who have taken the survey. The ICCS would like to reach a diverse group of people working in conservation and would be grateful if you could share the survey with colleagues and friends. More details can be found by following the survey link or searching for #lifeinconservation on Twitter.”

10.4.4. Appendix: Life in Conservation survey form

The following illustrates the survey form used in chapters 4 to 7. This survey is available at <https://livedataoxford.shinyapps.io/lifeinconservation/>. The survey form uses conditional logic in multiple places.

- Those under 18 are re-directed out of the survey.
- When asked the goal progress questions (page 1), respondents are first asked if the goal is important to them. If they answer yes, they are their degree of satisfaction or dissatisfaction.
- Three of the Kessler-10 items are paired. The exact statements are provided below the survey form.

I show the survey through screen shots to illustrate exactly what users see.



Language

- English
- Española
- Française
- Kiswahili
- Portuguesa
- ལྷོ་ཕྱོད་

About the survey and consent

We are collecting information for a research project exploring the rewards and challenges faced by people working in conservation practice or science.

This project is conducted by the Universities of Oxford, Edinburgh, and Royal Holloway, in the UK. You can find more about the research team on the 'About the study' page.

We are looking for people over the age of 18 to volunteer to take this survey, which will take around 10-15 minutes.

At the end of the survey, we will show you some of your results, compared to previous responses.

Consent

Please read through the following points before you agree to take part. I understand that...

- Participation is voluntary.
- We won't collect or share any personally identifiable information, including IP addresses.
- [shinyapps.io](#) hosts the survey platform and [states that it is GDPR compliant](#). shinyapps.io collects and stores the IP addresses of visitors for 30 days before deleting them. shinyapps.io states that it does not control or process any information you provide in the survey. Please see their [privacy policy](#) for more details.
- The results will be published online, along with the anonymous data.
- Some of the questions measure symptoms of distress.
- You are free to leave the survey at any time; each page has a button "leave the survey". If you click this button, none of your responses will be saved.
- Your responses are submitted at the end of the survey. Once submitted, you will not be able to withdraw since we have no way of identifying your response.
- The study has been reviewed and approved by the [University of Oxford Central University Research Ethics Committee \(CUREC\)](#).
- For questions, comments, or complaints, please email Thomas Pienkowski (thomas.pienkowski@zoo.ox.ac.uk) or Professor E.J. Milner-Gulland (ej.milner-gulland@zoo.ox.ac.uk), and we will aim to get back to you within 10 working days.
- If you remain unhappy or wish to make a formal complaint, please email the Medical Sciences Interdivisional Research Ethics Committee (ethics@medsci.ox.ac.uk) quoting 'R62487/RE001'.

Do you consent to take part?

Yes

How old are you? *

Prefer not to say but over 18

Have you completed this survey (to the end) before? *

Yes

No

Next

Your personal goals

Please think about your personal goals at work. Which of the following goals are important to you? Please select any or all that apply to you. *

- ... making a meaningful contribution to conservation

How satisfied are you with your progress to these personal work goals? *

- Very dissatisfied Dissatisfied Neutral Satisfied Very satisfied

- ... being a leader

How satisfied are you with your progress to these personal work goals? *

- Very dissatisfied Dissatisfied Neutral Satisfied Very satisfied

- ... influencing other people's behaviour

- ... earning money

Conservation goals

Please think about the conservation area or context that you are most familiar with. For example, this could be a place, a situation, or your focus of work, policy, or research.

In a few words, please describe in general terms the context or area that you are thinking about (optional).

Type here (up to 150 characters)...

When thinking about the conservation area or context you are most familiar with, which of the following goals are important for you? Please select any or all that apply to you. *

- ... stopping human-driven species loss

How satisfied are you with the progress that you think is being made by conservationists to achieving this goal? *

- Very dissatisfied Dissatisfied Neutral Satisfied Very satisfied

- ... ensuring people benefit from nature in a sustainable way

- ... making sure people are treated equally and fairly

- ... avoiding conflict between people and conservation

- ... stopping damage to the natural world

- ... creating a more sustainable world

The future of the area or context you are most familiar with

Thinking about the area or context you are most familiar with, how likely do you think it is that the most important conservation goals will be met in the next ten years? *

- Definitely won't Probably won't Probably will Definitely will

Page 1 of 6

Next

Please complete all the questions to proceed *

I want to leave the survey

I want to re-start the survey

The challenges you face

How much do you agree or disagree with the following statements?

I have constant time pressure due to a heavy work load *

- Strongly disagree Disagree Agree Strongly agree

I have many interruptions and disturbances while performing my job *

- Strongly disagree Disagree Agree Strongly agree

Over the past few years, my job has become more and more demanding *

- Strongly disagree Disagree Agree Strongly agree

I do not have the resources I need to achieve my work goals *

- Strongly disagree Disagree Agree Strongly agree

The organisation I work for does not have enough funding to achieve its main aims *

- Strongly disagree Disagree Agree Strongly agree

The organisation I work for may not exist in five years' time *

- Strongly disagree Disagree Agree Strongly agree

I receive the respect I deserve from my boss and work colleagues *

Strongly disagree Disagree Agree Strongly agree Not applicable

My job promotion or advancement prospects are poor *

Strongly disagree Disagree Agree Strongly agree Not applicable

I have experienced or I expect to experience an undesirable change in my work situation *

Strongly disagree Disagree Agree Strongly agree

My job security is poor *

Strongly disagree Disagree Agree Strongly agree

The rewards you gain

How much do you agree or disagree with the following statements?

Considering all my efforts and achievements, I receive the respect and prestige I deserve at work *

Strongly disagree Disagree Agree Strongly agree

Considering all my efforts and achievements, my job promotion or advancement prospects are adequate *

Strongly disagree Disagree Agree Strongly agree Not applicable

Considering all my efforts and achievements, my salary or income is alright *

Strongly disagree Disagree Agree Strongly agree

I am satisfied with the contribution I make to conservation *

Strongly disagree Disagree Agree Strongly agree

My friends and family are proud that I work in conservation *

Strongly disagree Disagree Agree Strongly agree

Page 2 of 6

Next

Please complete all the questions to proceed *

Thinking about the future of conservation

Which country's conservation context are you most familiar with? If you are familiar with multiple countries, please select one representative country. *

Please type here

Thinking about the future of conservation in the country you are most familiar with, how probable is it that the following conservation goals will be achieved?

Public support for conservation will grow over the next ten years *

Definitely won't Probably won't Probably will Definitely will

Government spending on conservation will grow over the next ten years *

Definitely won't Probably won't Probably will Definitely will

The harmful impact of people on nature will be less in ten years' time than it is now *

Definitely won't Probably won't Probably will Definitely will

Human society will be more environmentally sustainable in ten years' time than it is now *

Definitely won't Probably won't Probably will Definitely will

There will be more wildlife in ten years' time than there is today *

Definitely won't Probably won't Probably will Definitely will

There will be more natural areas and habitats in ten years' time than there are today *

Definitely won't Probably won't Probably will Definitely will

People will spend more recreational time in nature in ten years' time than they do now *

Definitely won't Probably won't Probably will Definitely will

Nature will be able to provide the same benefits to people in ten years' time as now *

Definitely won't Probably won't Probably will Definitely will

There will be more local participation in conservation in ten years' time than now *

Definitely won't Probably won't Probably will Definitely will

Conservationists will have better tools and knowledge in ten years' time than now *

Definitely won't Probably won't Probably will Definitely will

Thinking about the future in general

How much do you agree or disagree with the following statements?

In uncertain times, I usually expect the best *

Strongly disagree Disagree Neither Agree Strongly agree

If something can go wrong for me, it will *

Strongly disagree Disagree Neither Agree Strongly agree

I'm always optimistic about my future *

Strongly disagree Disagree Neither Agree Strongly agree

I hardly ever expect things to go my way *

Strongly disagree Disagree Neither Agree Strongly agree

I rarely count on good things happening to me *

Strongly disagree Disagree Neither Agree Strongly agree

Overall, I expect more good things to happen to me than bad *

Strongly disagree Disagree Neither Agree Strongly agree

Page 3 of 6

Next

How you've been feeling

The following questions are about how you have been feeling during the past 30 days. About how often during the past 30 days did you feel...

... tired out for no good reason? *

- None of the time A little of the time Some of the time Most of the time All of the time

...nervous? *

- None of the time A little of the time Some of the time Most of the time All of the time

...so nervous that nothing could calm you down? *

- None of the time A little of the time Some of the time Most of the time All of the time

...hopeless? *

- None of the time A little of the time Some of the time Most of the time All of the time

...restless or fidgety? *

- None of the time A little of the time Some of the time Most of the time All of the time

...depressed? *

- None of the time A little of the time Some of the time Most of the time All of the time

...that everything was an effort? *

- None of the time A little of the time Some of the time Most of the time All of the time

...worthless? *

- None of the time A little of the time Some of the time Most of the time All of the time

Page 4 of 6

Next

Health and well-being

How is your physical health in general? *

- Very bad Bad Fair Good Very good

How satisfied are you with your personal relationships? *

- Very dissatisfied Dissatisfied Neither Satisfied Very satisfied

How satisfied are you with the support you get from your friends and family? *

- Very dissatisfied Dissatisfied Neither Satisfied Very satisfied

How satisfied are you with the amount of time you are able to spend with friends and family? *

- Very dissatisfied Dissatisfied Neither Satisfied Very satisfied

Thinking about where you spend most of your time, how much do you agree or disagree with the following statements?

It is dangerous to go outside at night alone *

- Strongly disagree Disagree Neither Agree Strongly agree

My work puts me in dangerous situations *

- Strongly disagree Disagree Neither Agree Strongly agree

I do not feel safe, even where I live *

- Strongly disagree Disagree Neither Agree Strongly agree

Page 5 of 6

Next

Please complete all the questions to proceed *

I want to leave the survey

I want to re-start the survey

Some questions about you

Do you work or conduct research in nature conservation? *

- Yes
- No

How many years have you worked or conducted research in conservation? *

What is your main role? *

- Ranger
- Fieldworker
- Manager
- Administration
- Graduate student
- Bachelors student
- Researcher
- Consultant/self-employed
- Policymaker
- Intern
- Other

What is your gender? *

- Female
- Male
- Prefer not to say
- Other

What is your highest level of education? *

- None
- Primary school
- Secondary school
- College
- University
- Prefer not to say

What is your nationality? *

In which country do you spend most of your time at the moment? *

Approximately how many hours do you normally work each week? *

Prefer not to say

Do you have any thoughts or comments on the challenges and rewards experienced by those in conservation (optional)?

Submit

Please complete all the questions to proceed *

I want to leave the survey

I want to re-start the survey



[Take the survey](#) [About the study](#)

About the project

This project explores the challenges and rewards that those working or conducting research in conservation face. The online survey aims to build a broad picture of these challenges and rewards. This will be accompanied by more in-depth surveys in selected conservation organisations.

Some of the questions used in this survey are established psychological instruments. However, other questions were developed and piloted during this study. The results of this study will be published in peer-reviewed articles, alongside the anonymous data, and contribute to the Doctoral thesis of Thomas Pienkowski. We will also be providing a publically available summary of the results.

About us

This project is a collaboration between researchers at the Universities of Oxford, Edinburgh, and Royal Holloway. These researchers are based at the [Interdisciplinary Centre for Conservation Science \(ICCS\)](#), [Conservation Science](#) and [Conservation and Behaviour](#) research groups.

Contact

Interdisciplinary Centre for Conservation Science

Thomas Pienkowski

Email: thomas.pienkowski@zoo.ox.ac.uk

Sofia Castello y Tickell

Email: sofia.castelloytickell@zoo.ox.ac.uk

E.J. Milner-Gulland

Email: ej.milner-gulland@zoo.ox.ac.uk

Address:

Department of Zoology, University of Oxford, Zoology Research and Administration Building, 11a Mansfield Rd, Oxford OX1 3SZ

Conservation Science

Aidan Keane

Email: aidan.keane@ed.ac.uk

Address:

School of GeoSciences, University of Edinburgh, Crew Building, The King's Buildings, Alexander Crum Brown Road, Edinburgh EH9 3FF

Conservation and Behaviour

Sarah Papworth

Email: sarah.papworth@rhul.ac.uk

Address:

School of Biological Sciences, Royal Holloway, University of London, Egham Hill, Egham TW20 0EX

The phrasing of the Kessler-10 instrument is as follows:

“The following questions are about how you have been feeling during the past 30 days. About how often during the past 30 days did you feel...

1. ... tired out for no good reason?
2. ...nervous?
3. ...so nervous that nothing could calm you down?
4. ...hopeless?
5. ...restless or fidgety?
6. ...so restless that you could not sit still?
7. ...depressed?
8. ...so depressed that nothing could cheer you up?
9. ...that everything was an effort?
10. ...worthless?”

The response levels are “None of the time”, “A little of the time”, “Some of the time”, “Most of the time”, and “All of the time”. Items 3, 6, and 8 are not asked if the response to the prior question (2, 5, or 7) is “None of the time”.

10.4.5. Appendix: Internet survey ethical protocol

Before starting the survey, respondents were told their participation was voluntary, that they could withdraw at any time, who was conducting it, and its purpose. Respondents were also told how the data would be stored and used and the role of third parties. They were also provided with the contact details of the researchers and the Ethical Review Board that approved the study (Medical Sciences Interdivisional Research Ethics Committee, University of Oxford Central University Research Ethics Committee, reference number: R62487/RE001). Free, prior and informed consent was documented, and only those indicating their age was over 18 were allowed to participate. Respondents were debriefed when they completed the survey or left it early. Those who completed the survey were provided with a summary of their results.

10.4.6. Appendix: Goals and goal progress

The individual and collective goals were developed during workshops attended by six co-authors (Table 10.8). During these workshops, a series of candidate statements were developed based on sub-dimensions of the value-belief-norm theory and other literature (de Groot & Steg, 2007; Papworth et al., 2018). The candidate statement that was considered to correspond closely to each sub-dimension was then selected. For instance, the goal of “*influencing other people’s behaviour*” was selected as corresponding to the sub-dimension “*social power: control over others, dominance*” within egoistic aspirations.

Table 10.8. Sub-dimensions of the value-belief-norm theory and corresponding goals. Key: GP = goal progress.

Dimension	Sub-dimension	Goal type	Corresponding goals
Egoistic	Influential: having an impact on people and events	Individual	GP-1: making a meaningful contribution to conservation
	Authority: the right to lead or command		GP-2: being a leader
	Social power: control over others, dominance		GP-3: influencing other people’s behaviour
	Wealth: material possessions, money		GP-4: earning money
Altruistic	Equality: equal opportunity for all	Collective	GP-7: making sure people are treated equally and fairly
	Social justice: correcting injustice, care for the weak		
	A world at peace: free of war and conflict		GP-8: avoiding conflict between people and conservation
	Helpful: working for the welfare of others		GP-6: ensuring people benefit from nature in a sustainable way
Biospheric	Preventing pollution: protecting natural resource		GP-5: stopping human-driven species loss
	Respecting the earth: harmony with other species		GP-10 creating a more sustainable world
	Unity with nature: fitting into nature		
	Protecting the environment: preserving nature		GP-9: stopping damage to the natural world

10.4.7. Appendix: Patterns of missing data (Chapter 4)

Missing data either arose because some respondents did not wish to disclose personal information (such as the number of years in conservation) or because respondents left the survey before completing the question. Missing data among the categorical variables were assigned the levels “*unknown*” or “*other*” and are not shown since these were not treated as missing data within the multiple imputation (Figure 10.7). Using the mice package, these missing data were substituted with synthetic values through multivariate imputation by chained equations creating ten datasets containing imputed data (van Buuren S & K, 2011). Ordinal variables were imputed using proportional odds models, numeric variables with predictive mean matching, and unordered categorical variables with polytomous logistic regression (the ordinal and categorical variables each only have two missing observations, so are not discernible in Figure 10.7). Synthetic values were computed based on the other variables in the data. The pre- and post-imputation distributions of these variables were inspected and found to be consistent.

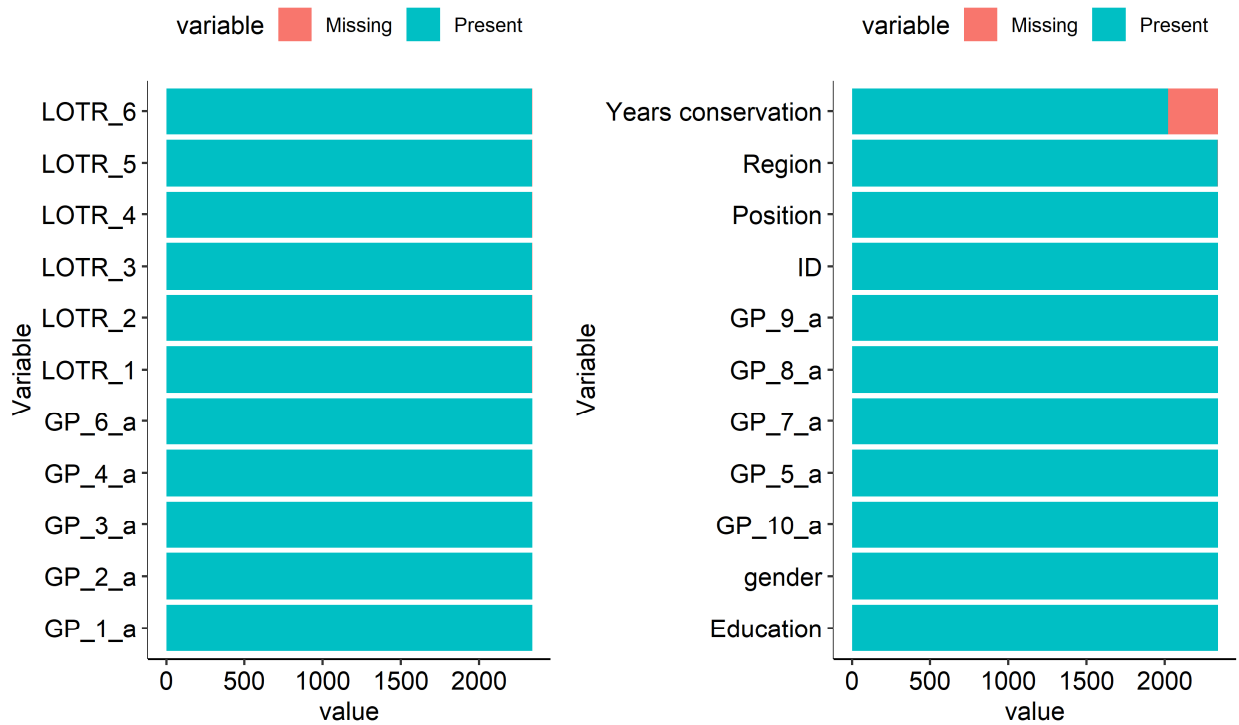


Figure 10.7. The pattern of missing data within the dataset. Missing values among some categorical variables (excluding region) were assigned the category of unknown or other and are not shown as these were not treated as missing data within the multiple imputation.

10.4.8. Appendix: Life Orientation Test – Revised (Chapter 4)

The Life Orientation Test – Revised has been validated and used in multiple countries (e.g., Bastianello, Pacico, & Hutz, 2014; Cano-García et al., 2015; Chiesi, Galli, Primi, Innocenti Borgi, & Bonacchi, 2013; Hinz et al., 2017) and has been successfully deployed to measure dispositional optimism in the conservation community (Papworth et al., 2018). The Life Orientation Test – Revised consists of three positively worded (scored 0 to 4) and three negatively worded (scored 4 to 0) Likert-scaled items with five response levels ranging from “*strongly disagree*” to “*strongly agree*” (Scheier et al., 1994). Our survey did not include the four filler items found in the original instrument. Respondents had a mean Life Orientation Test – Revised score of 15.0 (standard deviation (SD) = 3.9).

The items within Life Orientation Test – Revised had an Ordinal Alpha of 0.79. The item response category characteristic curves and item information curves from a graded response model suggested reasonably discriminatory power across most of the latent construct. However, some ceiling effects were observed at extremely high levels of dispositional optimism. We constructed a structural equation model following the factor structure recommended in previous literature (Vecchione, Alessandri, Caprara, & Tisak, 2014a). With this structure, all items are loaded onto one factor, assumed to represent dispositional optimism, and the three positively worded items were loaded onto a second factor, representing the method effect of the positive wording. Conceptually, these factors are orthogonal, and so their covariance was fixed to zero (Vecchione et al., 2014a). This model was fit using the package lavaan, employing polychoric correlations and a robust weighted least squares estimators (Rosseel, 2012). The comparative fit index was 0.995, and the mean root mean square error of approximation was 0.064. The mean Tucker-Lewis index was 0.989, and the standardised root mean square residual was 0.027, suggesting an adequate model fit.

10.4.9. Appendix: COVID-19 and goal progress

The analysis was repeated with the inclusion of a dummy variable corresponding to the period of COVID-19 (coded as 0 for before 1st January 2020 and 1 for after). The results of this additional analysis were consistent with those presented within the chapter (Figure 10.8). The positive correlation between the COVID-19 and perceived satisfaction with individual and collective goal progress may result from confounding. During the second recruitment phase, additional effort was made to target conservationists working in conservation practice outside of Europe and North America, who may have tended to report greater satisfaction with goal progress than those already sampled. As such, this observed correlation may be an artefact of the sampling strategy rather than an effect associated with COVID-19.

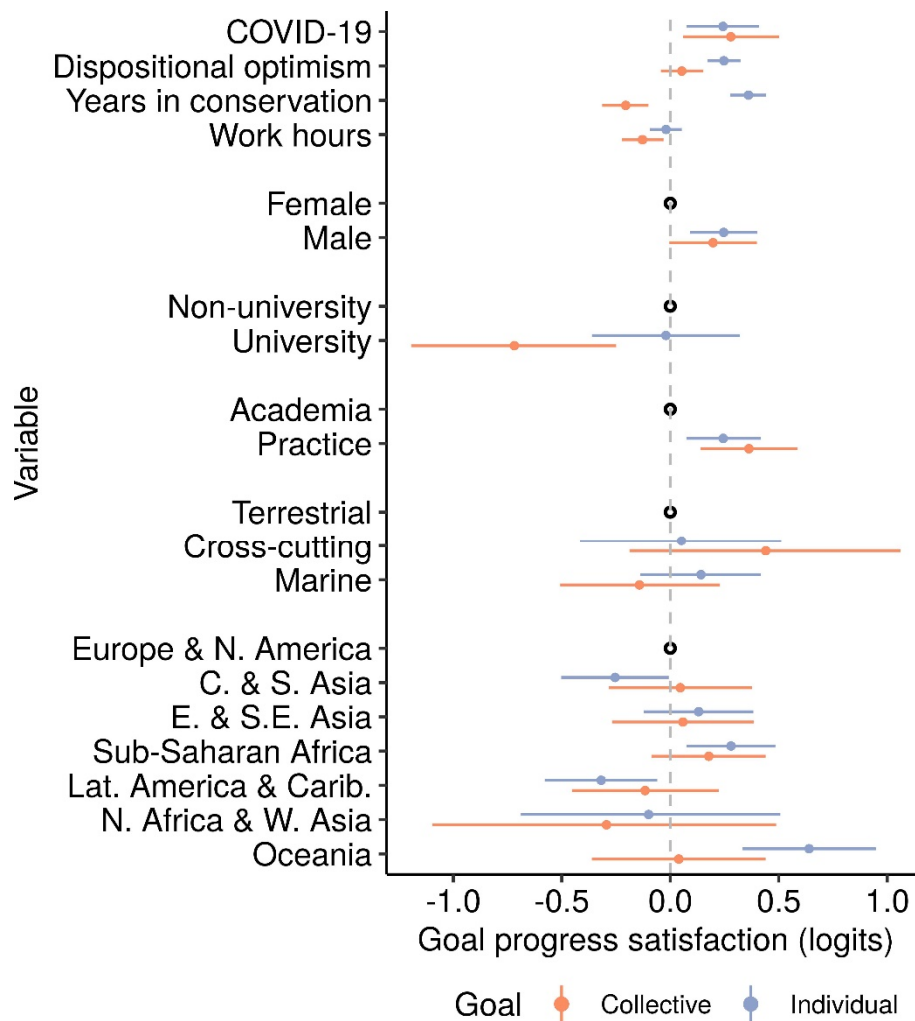


Figure 10.8. Exploring how the inclusion of the COVID-19 dummy variable influences the estimated associations between satisfaction with goal progress and each explanatory variable among 2336 respondents. Points represent the mean of the posterior distribution, and bars indicate the 95% credibility intervals on the log-odds scale. Dispositional optimism, years in conservation, and work hours are scaled and centred. Thresholds, 'goal name' and response categories corresponding to missing data are not shown.

10.4.10. Appendix: WAMBS-Checklist (Chapter 4)

The trace plots, potential scale reduction factor from the Gelman-Rubin Diagnostic, and the Geweke Diagnostic for each model and parameter were visually inspected. These diagnostics suggested the models had converged, and there was equality between the first and second half of iterations. The number of pre- and post-burn-in iterations was then doubled to 8,000 (meaning 16,000 iterations in total), and trace-plots, potential scale reduction factor, and Geweke Diagnostic were re-examined, suggesting local convergence was not an issue. The histograms of estimates in each iteration were inspected, and there appeared to be sufficient information to approximate the posterior, with a single clear peak and sloping sides for each parameter. The autocorrelation between chains was examined. There appeared to be some autocorrelation, but it was not accompanied by convergence issues, so it was not concerning. The posterior distributions were also examined, checking that the posterior standard deviations were not greater than the original parameters scales. Following these steps, the models corresponding to the two goal types were implemented in each of the ten imputed datasets.

10.4.11. Appendix: Theme definitions (Chapter 4)

Table 10.9. This table defines the key themes identified in the thematic analysis. These themes were identified through the thematic analysis of free-text responses provided by 426 participants that appeared to describe desired states or divergence from those states. The themes were nested into tiers, accompanied by a brief description of the theme and example quotes. Because these themes are nested, many of the examples provided below contribute evidence at multiple themes tiers.

Tier 1 theme	Tier 2 theme	Tier 3 theme	Tier 4 theme	Description	Response #	Examples
Desire types and progress				Desired states and progress to those states	356	<p><i>“Although I’ve been the first to work in a number of areas, I never get grants, while others with little to no experience in these areas do. If I could get out of research I would do but I’m too advanced in my career for a new start.”</i></p> <p><i>“Always feel like we should do more and what we do isn’t enough - my job may sound very beneficial (saving the bees) but it feels like a drop in the ocean when I read all of the headlines on widespread species endangerment across the world.”</i></p>
	Desired collective states			Desired states of the world external to an individual, related to conservation outcomes, and progress to those states	110	<p><i>“Conservationists work long hours because they care about the environment but have to struggle to find funding and have to watch the environment disappearing around them so it can feel like fighting a losing battle.”</i></p> <p><i>“Feeling of doing something for the greater good and for the general welfare of future generations.”</i></p>

		<p>People's relationships with nature and conservation</p>	<p>Desired states related to links between people, nature, and conservation, and progress to those states</p>	<p>24</p>	<p><i>"We will lose everything and our children will have a very tough life" if we fail to address the biodiversity crisis.</i></p> <p><i>"Incredibly rewarding & personally satisfying to see impact from your work & know that you have helped nature and made people's lives better."</i></p> <p><i>"Feeling of doing something for the greater good and for the general welfare of future generations."</i></p>
		<p>State of nature and the environment</p>	<p>Desired states of the non-human natural world and progress to those states</p>	<p>55</p>	<p><i>It "always feels like we should do more and what we do isn't enough [...] it feels like a drop in the ocean when I read all of the headlines on widespread species endangerment across the world".</i></p> <p><i>"Biggest challenges: (i) the permanent sensation of fighting a losing battle to try to convince people (politicians, business people, media) to act to avoid the worst of the environmental emergency."</i></p> <p><i>"Rewards: Change of attitudes and perceptions towards nature as a result of our job and a better future for our environment."</i></p>
		<p>Undefined conservation goals</p>	<p>Unclear desired states associated with conservation,</p>	<p>50</p>	<p><i>"I'm not satisfied with conservation in a wider context - public, policy etc. I'm also not satisfied with the outcomes, even if I am satisfied with</i></p>

		and progress to those states		<p><i>the inputs. The inputs are simply too small to produced the desired outcomes.”</i></p> <p><i>“I think it is common for us to feel undervalued and underpaid, and to feel that we aren’t making significant strides in conservation given the seemingly insurmountable challenges we face.”</i></p>	
		Insurmountable odds	Unlikely success towards desired states associated with conservation	67	<p><i>“Conservation is kind of like a job that often feels like fighting a losing battle. Nonetheless, I would much rather fight a battle I agree with than chose to surrender to what I don’t.”</i></p> <p><i>“Ultimately we act to protect life, all life, on Earth. This is an incredible, essential, and arguably insurmountable goal.”</i></p>
	Desired individual states		Desired states of the world directly related to an individual, and progress to those states	252	<p><i>“A salary comparable to other jobs with similar education would be nice.”</i></p> <p><i>“Feeling of doing something for the greater good and for the general welfare of future generations.”</i></p>
		‘Making a difference’	The desire to “make a difference” and progress towards it	147	<p><i>“The best rewards is the personal satisfaction of working for nature in particular the wildlife I work on!”</i></p> <p><i>“Depending on your goals level of attainment, aim big be happy with small wins.”</i></p>

		Exploitation and volunteerism	“Passionate” individuals being exploited	20	<p>[A challenge is] <i>“that we are doing it because we care, so we don’t need to be paid as much as other sectors. We are expected to go above and beyond for very little compensation.”</i></p> <p><i>“We are expected to love our jobs - and we do - but are therefore not paid enough, because we do it “for the love of it”. My landlord, alas, does not accept passion as a payment method.”</i></p>
	Livelihood goals		Desires around individual livelihoods and progress to those desires	143	<p><i>“As a PhD student, I feel that we’re undervalued compared to PhD students in other countries, in terms of salary. I also think that job security is a huge problem - so many of us worry about getting academic jobs after graduating.”</i></p> <p><i>“It’s hard to find a meaningful job that pays a liveable wage.”</i></p> <p><i>“Generally speaking is a challenging work that demands a lot of effort to get funded for work in the area and for get a satisfied salary. I think one of the more challenging issues is to earn enough money to live, at least, adequately.”</i></p>
	Other personal goals		Other desires at an individual level and progress to those desires (Support and positive	47 (20) (5)	<i>“If you are persistent and love nature you always will get rewards and respect from your friends and colleagues, perhaps, not always financial satisfaction”</i>

		interactions with colleagues) (Dissatisfaction associated with discrimination)		<i>“It is very nice to see when it works especially with people, but it requires lots of work and sometimes can be quite risky in terms of personal security”.</i>
Factors inhibiting progress		Factors that appeared to impede progress towards desired states	167	<i>“At this education level it’s pretty impossible to keep regular work doing seasonal, non-benefited, grant-funded field or lab work. I was in a MS program, where the funding was pulled and so now I’m at a place where I’m stuck.”</i> <i>“Insecure employment is a constant challenge. It is also a barrier that restricts much of the conservation field to those with sufficient privilege to tolerate such low-paying, tenuous work, hurting our diversity and our mission as a whole.”</i>
	Inhibiting progress to desired collective states	Factors that appeared to impede progress towards desired states that exist beyond the scale of individuals	125	<i>“Because there are such limited resources, strategic planning and is often overlooked or conducted poorly. Human welfare is also overlooked and people are overworked, undervalued and generally not supported. This overall reduces the effectiveness of conservation campaigns and programs.”</i> <i>“The public does not always see the value in conserving landscapes/species and funding can</i>

			<i>change rapidly due to political shifts or what types of conservation are in fashion at the time.”</i>
Inadequate funding	Inadequate funding	45	<p><i>“Definitely not enough funds. Other challenges are just part of the work and partly the reason why we love it so much. This profession is a reward. Everything in it! Except the funding of course!”</i></p> <p><i>“the public does not always see the value in conserving landscapes/species and funding can change rapidly due to political shifts”</i></p> <p><i>“It is a challenge to be able to stay focused on specific conservation issues for long enough to affect change, largely due to funding availability.”</i></p>
Societal goal conflict	Conflict between the activities and goals of different actors in society	114	<p><i>“Actual conservation and restoration of ecosystems runs counter to most governmental goals because conservation requires that human population numbers, growth, distribution, and support of are never dealt with holistically.”</i></p> <p><i>“Inadequate funding and resources devoted to conservation. Short term economic gain weighed more heavily than long term sustainability.”</i></p>

		Within society	Conflict between activities and goals within society	87	<p><i>“Political goals over-shadowing conservation”</i></p> <p><i>“It is deeply rewarding and at the same time depressing. It feels like most of the human race is rowing in a different direction from those of us in Conservation.”</i></p>
		Within conservation (‘career vs ‘passion’)	Conflict between activities and goals within the conservation sector (and ‘career conservationists’ and those in the sector because of their ‘passion’)	33 (9)	<p><i>“I am also increasingly becoming aware of tensions in the conservation fraternity (including the “conservationist-orientated” public here) which can sometimes become rather aggressive (e.g. between those for and those against resource use in protected areas.”</i></p> <p><i>“Conservation should be about coming together and preserving nature. Instead, it feels as if its just a business at the end of the day. Too much professional competition and consultants / NGO’s / specialists / academics not being able to work together.”</i></p> <p><i>“true conservationists work for the cause and the passion, however they are often undermined by people who think they are real conservationists but who are only there for power and fame.”</i></p>
			Factors that appeared to impede	85	<i>“We are passionate yet constantly up against it being paid little, funded</i>

	Inhibiting progress to desired individual states	progress towards desired states that exist at the scale of an individual		<i>poorly to protect places and animals most people don't care about. It can be disheartening. But working by doing your passion isn't work. So we are the lucky ones."</i>
	Resource and funding constraints	Inadequate funding inhibiting progress to desired states at an individual scale	60	<p><i>"Applause and recognition is there, but lack of funding and salaries. It becomes very stressful to constantly keep looking for funds every year."</i></p> <p><i>"I worry about conservation work being a rich man's game. It certainly preferences those who are financially able to work with little to no pay to gain experience and can afford a degree. Yet these credentials give no guarantee of job security. These conditions prevent so many important contributions from people of minority and socioeconomically disadvantaged backgrounds from ever being possible."</i></p> <p><i>"as we cannot hope to attract the brightest and best, we normally end up with people who have a passion and an ability to subsidise their career."</i></p>
	Challenges gaining appropriate experience	Challenge of gaining appropriate experience inhibiting progress to desired states at an individual scale	14	<i>"A serious challenge to many young career conservationists is the cost of studying at university and conducting research, coupled with the sheer amount of experience required for any paid or non-paid entry level job. Experience is hard to get as almost</i>

				<p><i>every research station asks for payment for you to work.”</i></p> <p><i>“The classic experience wall is a constant frustration. You have to have experience to gain experience. All I need is a break and for more employers to invest in us early-career conservationists with entry-level positions and graduate opportunities. These do not currently exist without a clause requiring years of experience already!”</i></p>
	Lack of time	Lack of time inhibiting progress to desired states at an individual scale	8	<p><i>“If we are to affect systemic change up front certain time constraints and the view that one can be paid and do it in a 40 hour work week is unrealistic.”</i></p> <p><i>“My workload is enough for 2 full time researchers, there is a lot of time pressure and institution disorganization (administrative), I have to enact VERY strong boundaries around the amount of time I’m willing to devote to work given health challenges and a life outside of work, and VERY LOW PAY”</i></p>
	Goal conflict at an individual level: ‘Making a difference’ and livelihood goals	Conflict between goals that impede progress at an individual level	19	<p><i>“The biggest dilemma I have is how do I work in a field that I believe in and interests me, while at the same time be able to provide for my family at what I consider a necessary level (i.e. afford private health care should I/they need it).”</i></p>

				<i>“I realize that there is a tradeoff for doing work that is interesting and rewarding and inspiring and financial remuneration.”</i>
Impacts of progress – good and bad		The impacts of progress or absence of progress to desired states	107	<i>“Conservation is a really fulfilling career in a lot of aspects but jobs are not stable and are financially challenging, this delivers extra stress and the need to seek for jobs out of conservation even when you are working in conservation projects.”</i>
				<i>“Change is slow and this can be disheartening. We are not taught how to deal with feeling like there is no progress (even if there is).”</i>
Negative consequences		The detrimental impacts of inadequate progress to desired states	81	<i>“Conservation and research is a lost cause. With the meagre funding and no respect for what we do there is no hope. So many good people don’t enter research as there are no prospects in this field.”</i>
				<i>“It’s a long, tough road and the outlook can be very gloomy at times but it is something that must be done...”</i>
	Demotivation	Impacts of inadequate progress on motivation	30	<i>“Particularly in places like where I work in Cambodia the feeling of being hopeless at achieving goals and making the impact you crave for your profession and your personal passion</i>

				<p><i>can drive one into depressed state of mind.”</i></p> <p><i>“If you work as an academic on large issues, it’s sometimes hard to see one’s direct impact on the ground. If you work on a single project, you can feel like you’re making a small progress and have victories here and there but they rarely feel secure long-term or significant in the face of the general trend of catastrophic biodiversity decline. This makes it often difficult to sustain motivation.”</i></p>
	Mental well-being	Impacts of inadequate progress on mental well-being	31	<p><i>“These challenges are also felt across cultural and socio-economic statuses, for example our community wardens (community members from remote, rural villages of Cambodia) have reported feeling frustrated and depressed because for the last decade they have been trying to protect the forest upon which their survival depends, and feel they are not able to achieve this goal.”</i></p> <p><i>“I think a lot of people in conservation want to make these giant, world-renowned kind of impacts and can get upset/depressed/lost/feel meaningless when this doesn’t happen.”</i></p> <p><i>“where I work in Cambodia, the feeling of being hopeless at achieving</i></p>

				<i>goals and making the impact you crave for your profession and your personal passion can drive one into a depressed state of mind.”</i>
	Overwhelmed	Feelings of being overwhelmed because of lack of progress	18	<p><i>“While awareness on environmental issues is certainly growing, the majority of people are not very connected to the real problems. Being constantly exposed to these challenges through this line of work can be depressing and overwhelming at times. While there are definitely ‘wins’, overall it feels like our future problems are going to be dire.”</i></p> <p><i>“To work in conservation is very stressful because you are aware of The biodiversity crisis and you don’t see people reacting to it. We are aware that Without action we will lose everything and our children will have a very tough life but we don’t have the means to change what is happening. Sometimes I’ve the feeling that I’m the only one worried about what we are doing to the biosphere and to ourselves.”</i></p>
	Other	Other impacts associated with lack of progress	15	<i>“Financial rewards (pension as well as salary) are much lower than most other professions requiring similar levels of experience/expertise. In my current situation, my pension fund is so poor that I cannot see how I will be able to live when I retire [...] and so</i>

				<p><i>am considering leaving a profession I love”.</i></p> <p><i>“Conservation and research is a lost cause. With the meagre funding and no respect for what we do there is no hope. So many good people don’t enter research as there are no prospects in this field.”</i></p>	
Positive consequences	The positive impacts of progress to desired states	40		<p><i>“Overall, it is a source of great satisfaction to work in conservation, because you never need to ask yourself why you are doing what you are doing, as people do in other sectors.”</i></p> <p><i>“The challenges are more on field as compared or thought in project designs in the office and comparatively the appreciation and rewards are less. By the end of the day satisfaction of working for the betterment is the only reward which keeps conservationists moving.”</i></p>	
	Satisfaction		Feeling of satisfaction associated with progress towards desired states	13	<p><i>“It is rewarding emotionally and satisfying with respect to goals but the money is always low, and funding uncertain.”</i></p> <p><i>“We are constantly working with too few resources, and consequently we are losing the battle to conserve biodiversity and create a sustainable future for the planet and all of its inhabitants. This is demoralizing and</i></p>

					<i>exhausting. Balanced against this is the knowledge that those of us working in conservation are doing something worthwhile with our lives, which gives great satisfaction.”</i>	
		Other	Other positive impacts associated with progress towards desired states	29	<i>“I think we probably all feel proud when we watch the latest nature documentary, to know that we are working in conservation.”</i>	
			Motivation	Successful conservation being a source of motivation	3	<i>“Successful conservation spur one to work better and harder. Conservation can be tough, and tougher in not financially rewarding.”</i>
Coping with impacts of inadequate progress				Strategies used to cope with dissatisfaction with progress to desired states	26	<i>“Exceptionally difficult to be optimistic. Must adopt realistic goals to avoid feeling hopeless.”</i> <i>“Focus on your core values and goals in conservation, and making decisive manageable efforts in the direction of your goals on a daily basis”</i> <i>“I think you cannot "survive" in this field if you don't learn to gain satisfaction from small achievements or improvements...”</i> <i>“The sheer love for nature in all its originality must keep us moving forward with our beliefs.”</i>

10.4.12. Appendix: Altering the analysis of work hours

The analysis was repeated, replacing the numeric variable work hours with a dummy variable indicating if respondents worked over 40 hours (coded as 0 if working 40 or fewer hours and 1 if working over 40 hours). The results of this additional analysis were consistent with those presented within the chapter (Figure 10.9).

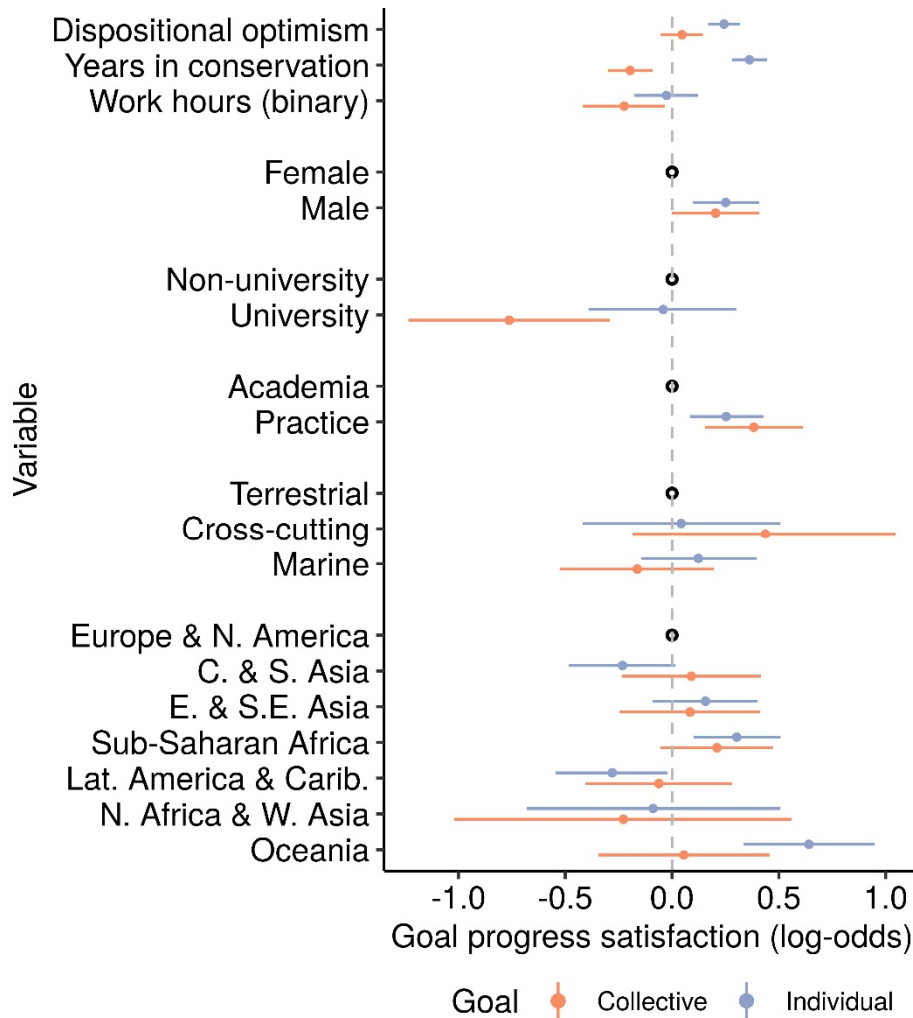


Figure 10.9. Exploring the associations between a dummy variable indicating if respondents worked over 40 hours and goal progress satisfaction among 2336 respondents. Points represent the mean of the posterior distribution, and bars indicate the 95% credibility intervals on the log-odds scale. Disposition optimism and years in conservation are scaled and centred. Thresholds, ‘goal name’ and response categories corresponding to missing data are not shown.

10.4.13. Appendix: Disaggregating altruistic biospheric goals

The collective goals were disaggregated into two datasets, the first including the three goals related to altruistic values and the second the three goals related to biospheric values. Two mixed-effects ordinal logistic regressions were implemented, following similar model specifications to the primary analysis. These results suggest the explanatory variables have similar associations with both the altruistic and the biospheric related goal progress satisfaction (Figure 10.10). Moreover, the results of both of these models described similar patterns as found within the main analysis. We expect this is because many of the goals imply positive outcomes for both people and nature, supporting the decision to cluster these ‘collective’ goals.

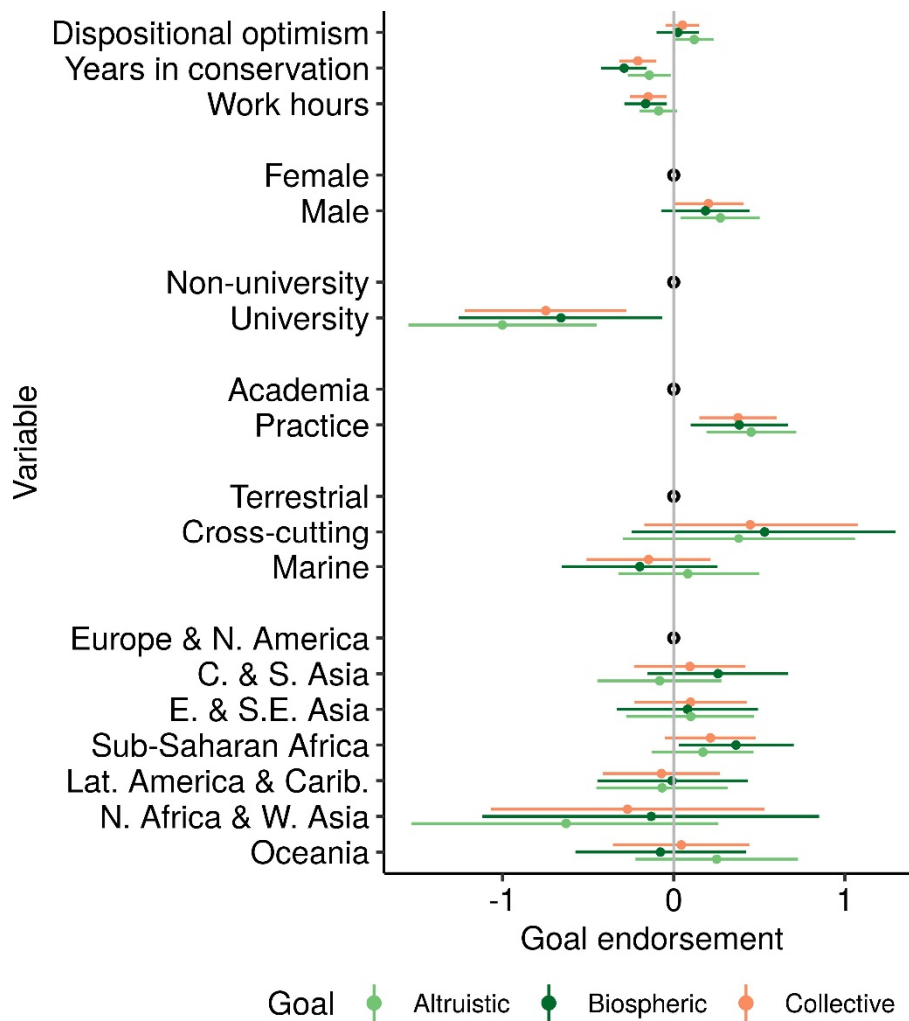


Figure 10.10. Exploring how disaggregating the ‘collective’ goals into those relating to altruistic and biospheric values influences associations with the explanatory variables among 2336 respondents. Points represent the mean of the posterior distribution, and bars indicate the 95% credibility intervals on the log-odds scale. Dispositional optimism, years in conservation, and work hours are scaled and centred. Thresholds, ‘goal name’ and response categories corresponding to missing data are not shown.

10.4.14. Appendix: Variability in goal endorsement

The goals associated with the individual and collective goal types were used to create two composite variables. To create each composite variable, observations within each goal type were stacked row-wise and were accompanied by an extra variable identifying the goals and a respondent identifier. A multivariate mixed-effects logistic regression was implemented within a Bayesian framework for each of the two goal types and each imputed dataset. The response variable was reported goal endorsement (i.e. if the respondent felt the goal was important to them). The explanatory variables and random effects were the same as described in the primary analysis. These Bayesian logistic regressions were performed in the Stan computational framework, using the same generic and uninformative priors, seed, number of pre- and post-burn-in iterations, and chains as the primary analysis. The models were evaluated according to steps 1-7, and 10 of the When to worry and how to Avoid the Misuse of Bayesian Statistics Checklist (WAMBS)-Checklist (Depaoli & Van de Schoot, 2017). The results are illustrated below in Figure 10.11.

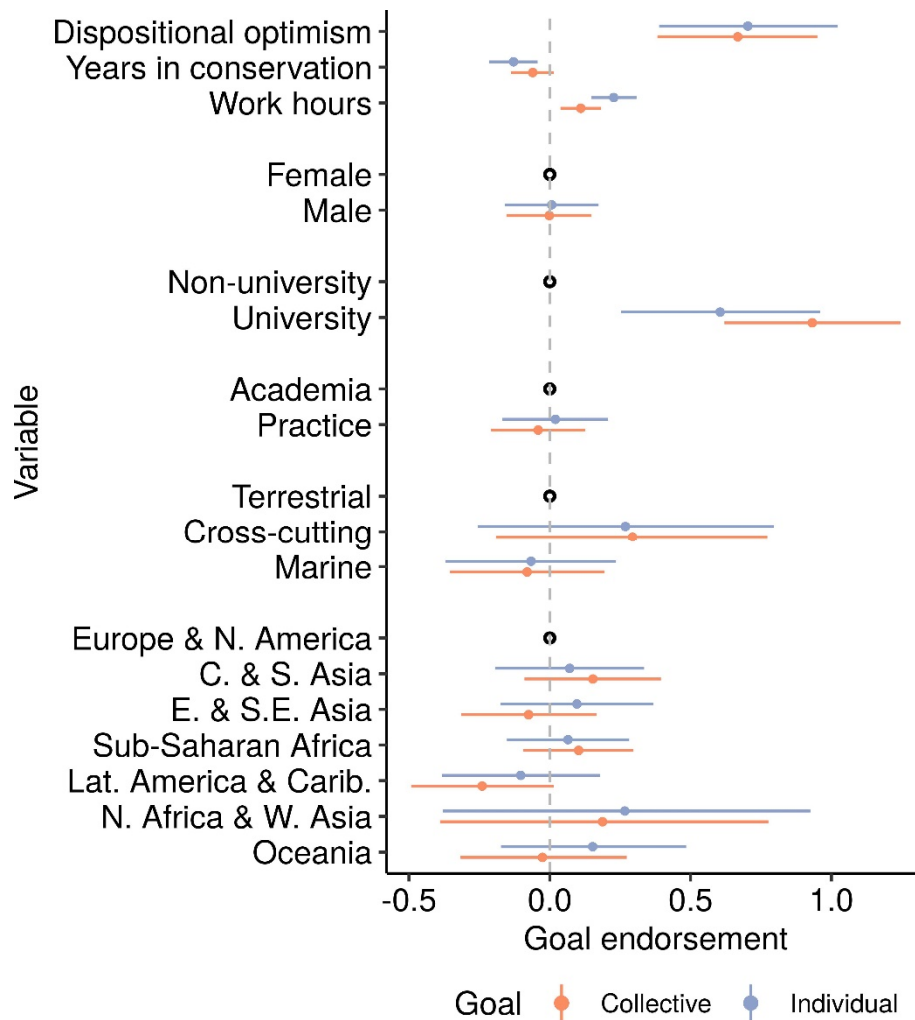


Figure 10.11. The estimated associations between goal endorsement and each explanatory variable among 2336 respondents. Points represent the mean of the posterior distribution, and bars indicate the 95% credibility intervals on the log-odds scale. Disposition optimism, years in conservation, and work hours are scaled and centred. Thresholds, 'goal name' and response categories corresponding to missing data are not shown.

10.5. Chapter 5 Appendixes

10.5.1. Appendix: Definitions of a conservationist (Chapter 5)

Our primary analysis adopted a broad definition of a conservationist, which included those not formally employed within the sector. A stricter definition of conservationists may include only those who currently work or conduct research within conservation. To explore how sensitive our results were to different definitions, we repeated the analysis among 2,022 respondents who said they worked or conducted research in conservation. The results of this analysis were consistent with the primary analysis (Figure 10.12).

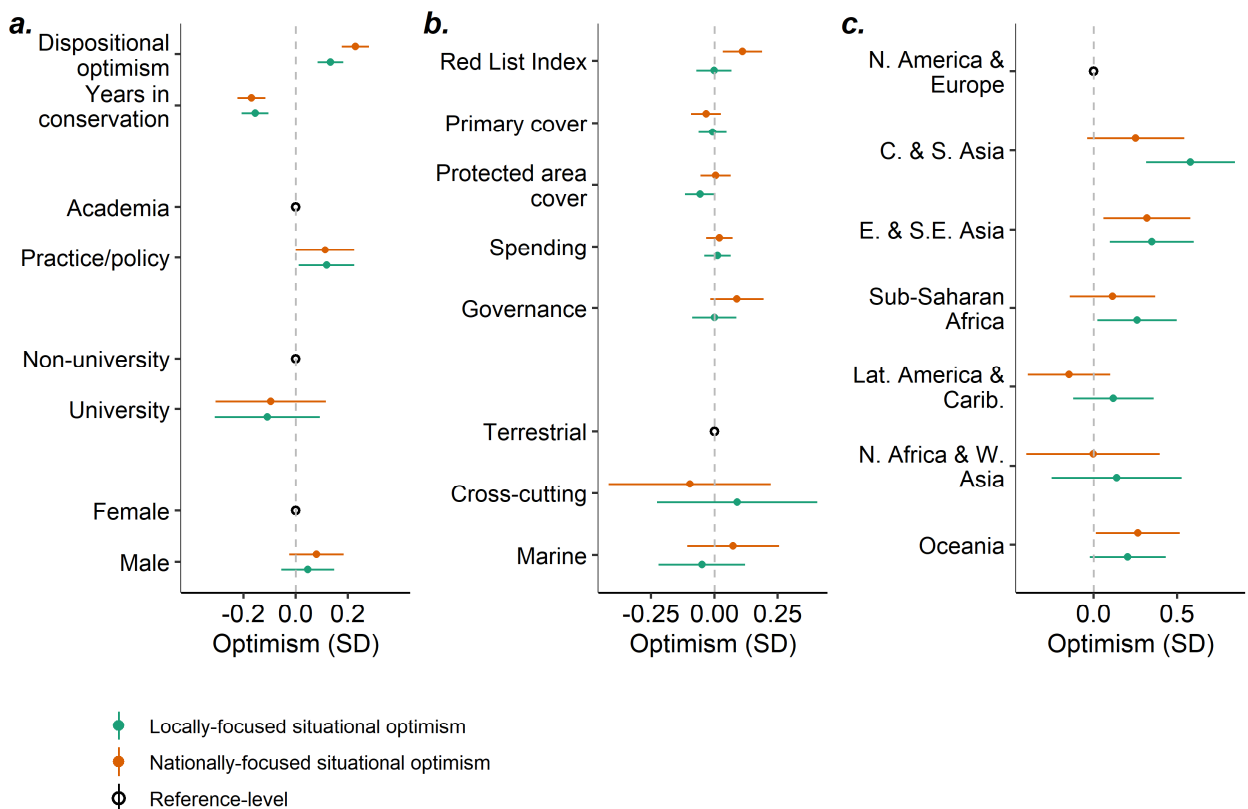


Figure 10.12. The association between nationally- and locally-focused situational optimism and (a) individual characteristics, (b) biodiversity state, conservation effort and focal environment, and (c) regional grouping variables among a more strictly defined sub-set of conservationists. Coefficients are in standardised units, meaning a one-unit change in continuous explanatory variables are associated with a given standard deviation (SD) change in the response variables. Estimate uncertainty is presented in 95% confidence intervals. Levels representing unknown or other responses are not shown.

10.5.2. Appendix: Situational optimism instrument

There appeared to be no established instruments for measuring nationally-focused situational optimism about conservation, so one was designed during a series of workshops attended by six of the co-authors. We aimed to ensure the instrument was interpretable by a wide range of conservationists, with differing technical expertise and formal education (Switzer, Wisniewski, Belle, Dew, & Schultz, 1999). We also sought to develop a reliable instrument, meaning it was internally consistent and was expected to be consistent between uses (Bruton, Conway, & Holgate, 2000; Polit, 2015). Furthermore, several measures were taken to enhance face and construct validity (Markus & Smith, 2012; Wilson, 2005). Firstly, we considered the five Strategic Goals of the Aichi Biodiversity Targets to represent broad and generally held nationally-level conservation aspirations (CBD, 2010b). We developed pairs of statements reflecting the key themes of each Strategic Goal. In doing so, we sought non-technical statements that minimised variability in responses due to knowledge about actual progress towards the Strategic Goals. Secondly, to ensure the instrument was relatable, respondents were asked to evaluate the likelihood of outcomes within the country whose conservation context they were most familiar with. Finally, we sought to discriminate across the full range of latent nationally-focused situation optimism by including several very likely and unlikely outcomes. The instrument consisted of 10 Likert-scaled items labelled from 'SO-1' to 'SO-10'. Evidence suggests that an individual's ability to discriminate between response levels declines at lower literacy levels, so a relatively low number of four response levels was chosen to aid interpretability for those with less formal education (Chachamovich, Fleck, & Power, 2009).

The nationally-focused situational optimism instrument was developed using the items 'SO-1' to 'SO-10' within the training dataset through the following steps. The polychoric correlation of nationally-focused situational optimism items was inspected, with an Ordinal Alpha of 0.86, suggesting good internal consistency (Zumbo, Gadermann, & Zeisser, 2007). A parallel analysis suggested the extraction of three factors, but the root mean square error of approximation indicated this model was poorly fitted. Comparing the root mean square error of approximation across exploratory factor analyses suggested that a five-factor model had an adequate fit. When repeating the five-factor analysis with different random seeds, seven items were consistently loaded onto three factors. However, three items (SO-7, SO-9, and SO-10) loaded onto different factors over different iterations and were often cross-loaded or uniquely loaded on a single factor, and so these three items were discarded. A graded response model was used to explore the association between the latent construct and each of the remaining items. The item response category characteristic curves and item information curves suggested reasonable discrimination across most of the latent construct. However, floor effects among some items suggested the instrument may have had poor discriminatory power among those with extremely low nationally-focused situational optimism. We sought to extract a single latent variable representing respondents' nationally-focused situational optimism. As a result, we accounted for the covariance between the items loaded on the three factors through correlated error terms, with the residual covariance across all items assumed to represent situational optimism using the test dataset. The comparative fit index was 0.998, and the mean root mean square error of approximation was 0.037. Furthermore, the mean Tucker-Lewis index was 0.996, and the standardised root mean square residual was 0.029, suggesting a good model fit.

An additional question asked respondents to consider the most important locally-focused goals associated with the conservation context in which they worked. Respondents were then asked to evaluate if they thought these goals would or would not be met within the next ten years, according to the same Likert scale described above (labelled 'SO-11'). The locally-focused situational optimism variable was ordinal. However, we assumed responses to it were driven by an underlying normally distributed latent variable and that the response levels were evenly spaced on the latent scale. Consequently, this variable was scaled, centred and treated as a continuous variable.

During the model development, the first of the ten imputed datasets was randomly split into training and test datasets (containing 70% and 30% of data, respectively). The instruments were developed using the packages psych (version 1.9.12) and lavaan (version 0.6-6), employing polychoric correlations because of the ordinal nature of the items (Revelle, 2019; Rosseel, 2012). Weighted least squares and robust weighted least squares estimators were used, which make no assumptions about the distribution of observed variables and is robust to floor and ceiling effects among endogenous variables (Flora & Curran, 2004; C. H. Li, 2016).

Furthermore, we assumed that good national governance was likely to be associated with good environmental governance, including in the design, implementation and enforcement of environmental regulation within and outside conservation areas. Worldwide Governance Indicators aim to measure control of corruption, government effectiveness, political stability, regulatory quality, the rule of law, and public accountability (Kaufmann et al., 2011). There was a high correlation between these dimensions, and exploratory factor analysis suggested strong loading on a single factor, so a fixed composite variable was created by summing their standardised values.

Additionally, respondents were asked to describe in a few words the context or area they worked in. These free-text responses were coded into broad 'focal biome' categories: terrestrial, marine, cross-cutting (spanning terrestrial and marine), and unknown. Finally, political, cultural, and economic factors which were not reflected in the chosen biodiversity state and conservation effort indicators were expected to influence situational optimism. These factors were not known in advance but were assumed to be geographically clustered by region. Consequently, a regional categorical variable was developed. This variable was derived from the Sustainable Development Goal regional groupings of the countries whose conservation context respondents were most familiar with (UN, 2020). These regional groupings were: Europe & North America; Sub-Saharan Africa; Central & South Asia; East & Southeast Asia; Latin America & Caribbean; North Africa & West Asia; and Oceania. For instance, Sub-Saharan Africa was the regional grouping for those that said they were most familiar with the conservation context in Botswana.

10.5.3. Appendix: Factor structure

The following describes the factor structure of the two structural equation models (Figure 10.13). Regression associations with other explanatory variables are not shown.

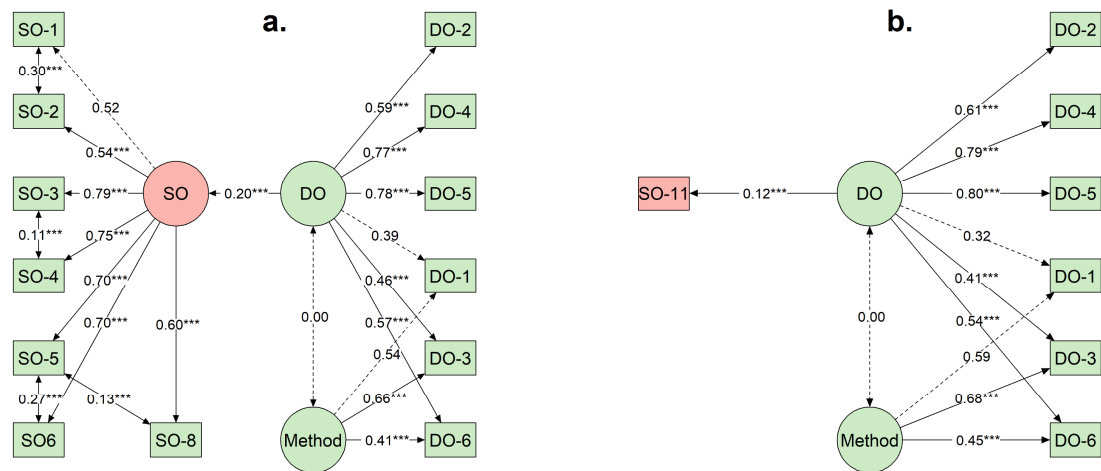


Figure 10.13. The structure of the structural equation models, excluding the regression relationships with the explanatory variables. Coefficients are in standardised units, meaning a one-unit change in continuous explanatory variables are associated with a given standard deviation change in the response variables. SO = nationally-focused situational optimism (panel a.), SO-11 = locally-focused situational optimism (panel b.), and DO = dispositional optimism. Estimate uncertainty is presented according to p-values, where * = p-value < 0.05, ** = p-value < 0.01, and *** = p-value < 0.001.

Two structural equation models were estimated for each of the ten imputed datasets, each with 2,336 observations, using the robust weighted least squares estimator and polychoric correlation. The explanatory variables were regressed against latent nationally-focused situational optimism in the first model, and locally-focused situational optimism in the second. The mean comparative fit index was 0.958, and the mean root mean square error of approximation was 0.044 (95% CI = 0.042 - 0.046). Similarly, the mean Tucker-Lewis index was 0.989, and the mean standardised root mean square residual was 0.077. Likewise, the fit measures for the locally-focused situational optimism model across the imputed datasets also suggested good fit. The mean comparative fit index was 0.947, and the mean root mean square error of approximation was 0.046 (95% CI = 0.043 - 0.049). The mean Tucker-Lewis index was 0.992, and the mean standardised root mean square residual was 0.087.

10.5.4. Appendix: Imputation of missing data (Chapter 5)

Not all respondents completed all questions. Synthetic values were computed using appropriate imputation models based on the other variables in the data. For example, conservation spending was unavailable for 13 of the 144 countries, representing 1.2% of the data. These missing spending data were imputed based on a range of country-level variables. In addition to the variables used in the analysis, these included five indicators of biodiversity threat, an indicator of natural habitat modification, current vertebrate diversity, and per capita gross domestic product in 2019 (purchasing price parity, international \$, Jenkins, Pimm, & Joppa, 2013; Kennedy, Oakleaf, Theobald, Baruch-Mordo, & Kiesecker, 2019; World Bank, 2020c). The following analysis was repeated with both the complete cases and imputed datasets and results compared.

10.5.5. Appendix: Patterns of missing data (Chapter 5)

Missing data either arose because respondents did not wish to disclose some responses (such as the number of years in conservation), or because respondents left the survey before completing the question. Missing data among the categorical variables were assigned the category of unknown or other and are not shown since these were not treated as missing data within the multiple imputation (Figure 10.14). These missing data were substituted with synthetic values through multivariate imputation by chained equations creating ten datasets containing imputed data, using the package mice (van Buuren S & K, 2011). Synthetic values were computed based on the other variables in the data, with years in conservation and spending treated as continuous variables and imputed using predictive mean matching. The pre- and post-imputation distributions of these variables were inspected and found to be consistent.

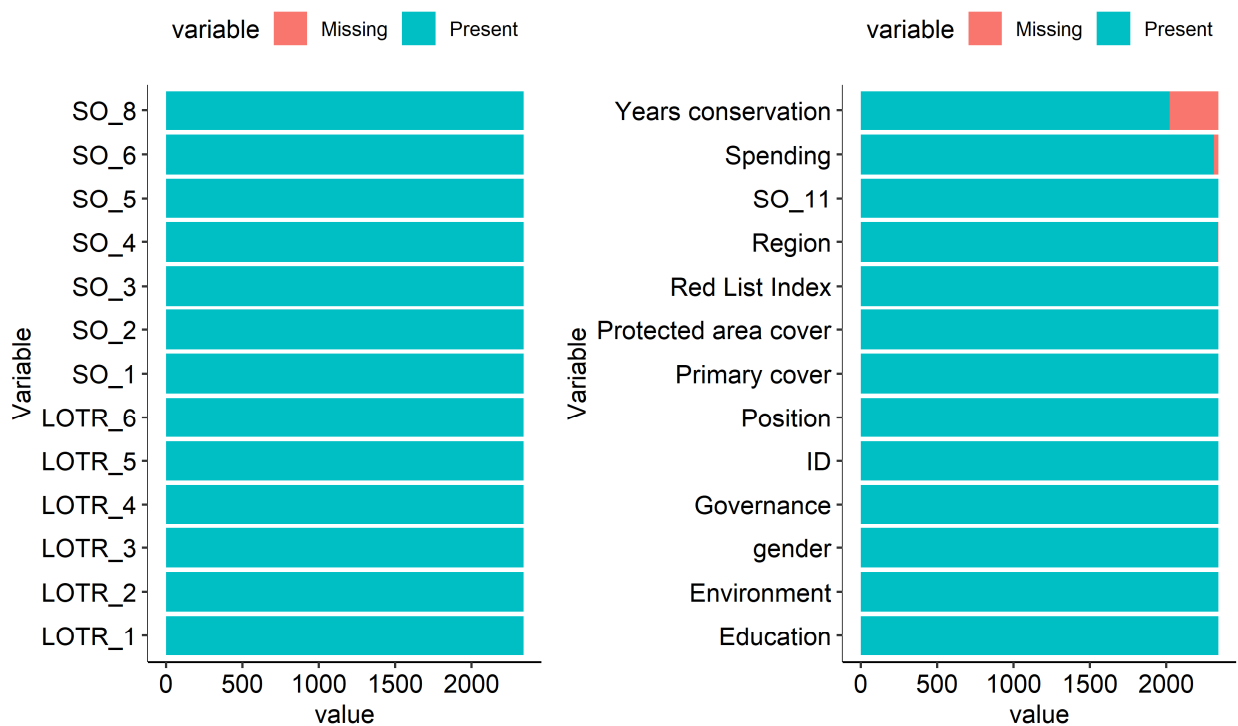


Figure 10.14. The pattern of missing data within the dataset. Missing values among some categorical variables were assigned the category of unknown or other, and are not shown as these were not treated as missing data within the multiple imputation.

Multiple imputation by chained equations can be used when assuming that the imputed variables are missing at random. Missing at random means “that the probability that a value is missing depends only on observed values and not on unobserved values” (Azur, Stuart, Frangakis, & Leaf, 2011). The primary analysis assumes that values are missing at random. The following does not attempt to evaluate if this assumption is met but repeats the primary analysis with a subset of 1,988 responses to explore the sensitivity of the results to the exclusion of observations with missing data. The results of this analysis were consistent with the primary analysis, suggesting the results may not be sensitive to the exclusion of observations with missing values in contrast to their imputation (Figure 10.15).

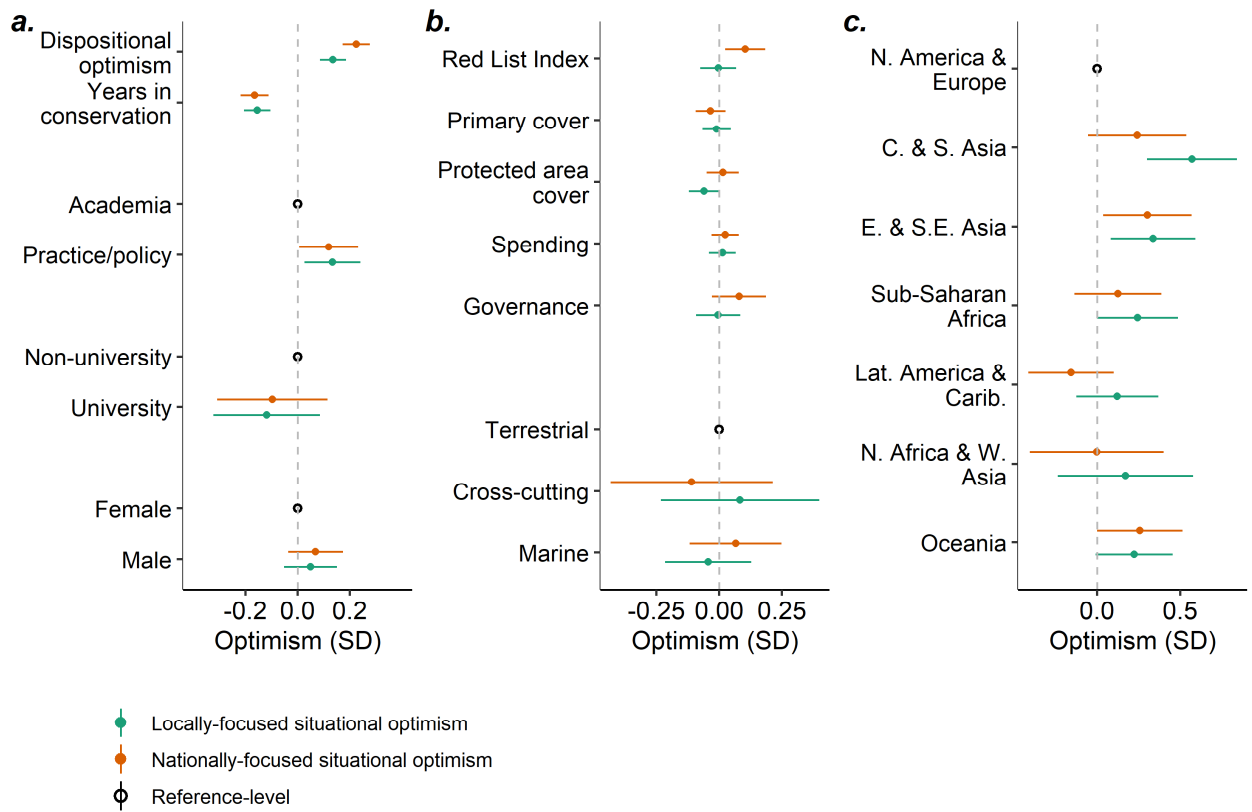


Figure 10.15. The association between nationally- and locally-focused situational optimism and (a) individual characteristics, (b) biodiversity state, conservation effort and focal environment, and (c) regional grouping variables among a subset of responses with no missing data. Coefficients are in standardised units, meaning a one-unit change in continuous explanatory variables are associated with a given standard deviation (SD) change in the response variables. Estimate uncertainty is presented in 95% confidence intervals.

10.5.6. Appendix: Sensitivity testing

10.5.6.1. The COVID-19 pandemic

The survey duration overlapped with the COVID-19 pandemic, which became globally prevalent at the start of 2020. Consequently, the analysis was repeated, including a dummy variable describing if responses were provided before or after the 1st January 2020. Those taking the survey during the COVID-19 pandemic appeared to report higher levels of optimism than those who completed the survey before (Figure 10.16). This result may be an artefact of the sampling strategy. The second sampling phase corresponded to the start of the COVID-19 pandemic and sampled a larger proportion of respondents from outside Europe and North America compared to the first phase. As such, this positive association may reflect higher levels of residual optimism in non-European and North American countries not captured by the country grouping variable.

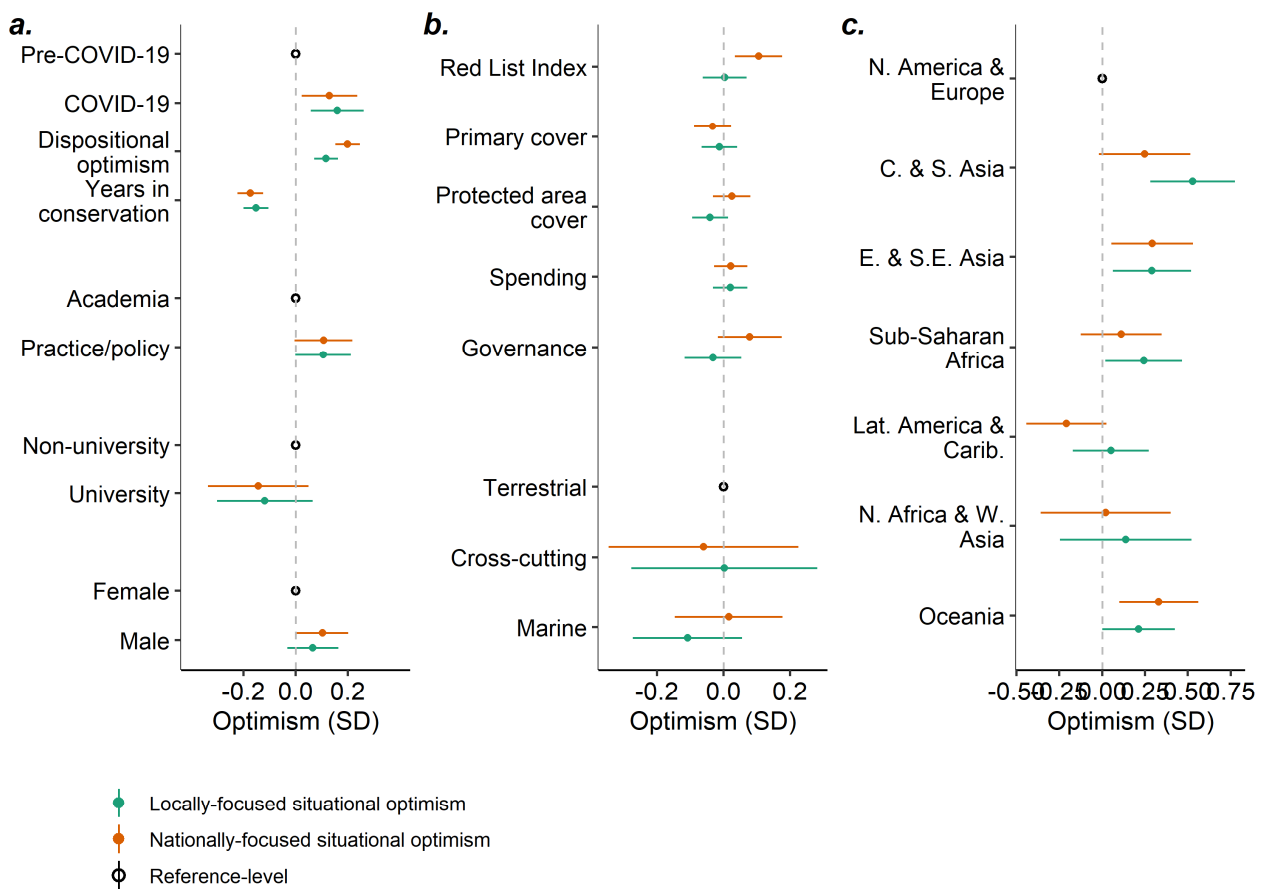


Figure 10.16. The association between nationally- and locally-focused situational optimism and (a.) individual characteristics, including if the survey was taken during the COVID-19 pandemic, (b) biodiversity state, conservation effort and focal environment, and (c) regional grouping variables. Coefficients are in standardised units, meaning a one-unit change in continuous explanatory variables are associated with a given standard deviation (SD) change in the response variables. Estimate uncertainty is presented in 95% confidence intervals. Levels representing unknown or other responses are not shown.

10.5.6.2. Projected biodiversity state in 2030

Our primary analysis includes indicators of the state of biodiversity in 2020, assuming that conservationists' projections were based on current experiences. However, we asked respondents to evaluate expected conservation outcomes by 2030, and so we explored the sensitivity of our results by including the projected Red List Index and primary land cover variables. We did not include projected conservation effort variables since these data were not readily available.

To calculate projected Red List Index scores, we simple extrapolated the Red List Index trend between 2010 and 2020 towards 2030. Doing so accounts for both the current Red List Index score and the rate of recent changes in the score when projecting to 2030. To calculate the projected primary land cover, we extracted the projected proportion of primary land cover under the Shared Socioeconomic Pathways scenario 2 (Hurtt et al., 2019; Hurtt et al., 2020). The results of this analysis were consistent with the primary analysis, which is not surprising, given that the pattern of current and projected values between countries was similar (Figure 10.17).

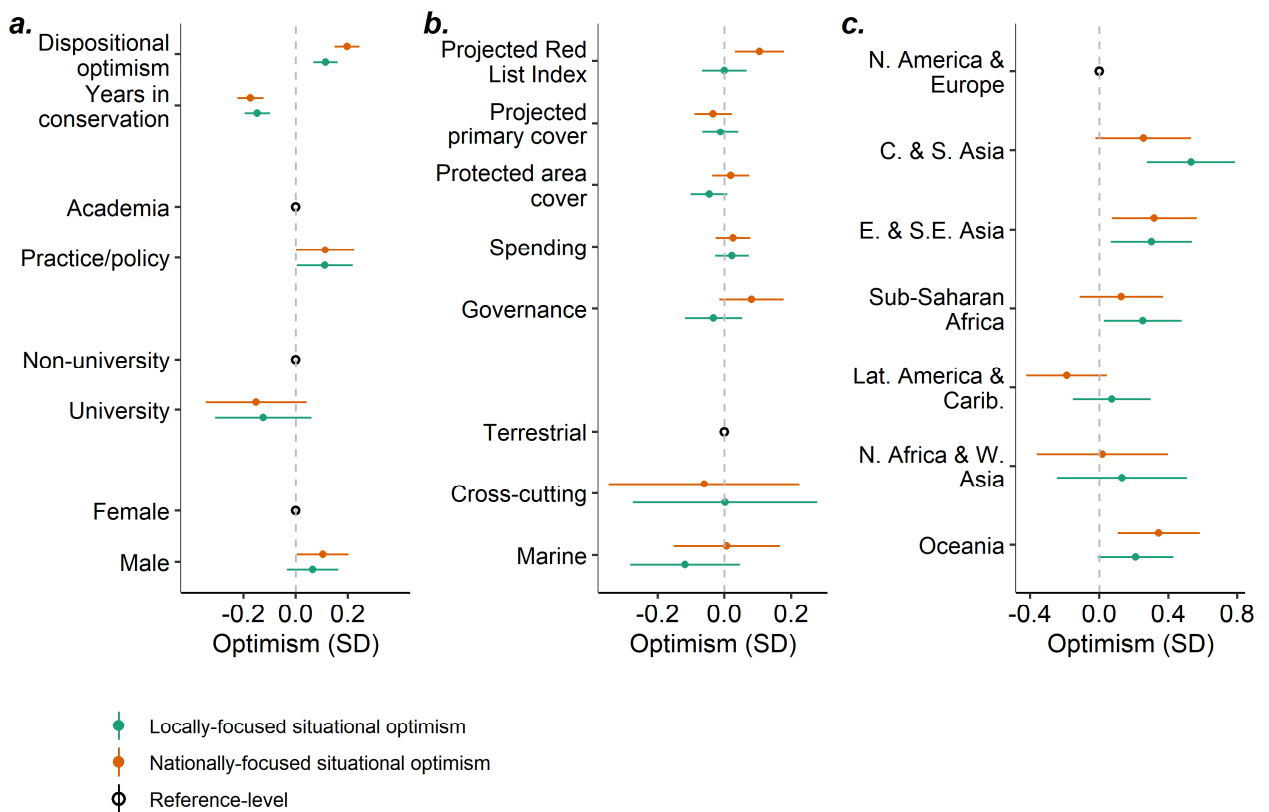


Figure 10.17. The association nationally- and locally-focused situational optimism and (a.) individual characteristics, (b) projected biodiversity state in, conservation effort and focal environment, and (c) regional grouping variables. Coefficients are in standardised units, meaning a one-unit change in continuous explanatory variables are associated with a given standard deviation (SD) change in the response variables. Estimate uncertainty is presented in 95% confidence intervals. Levels representing unknown or other responses are not shown.

10.5.6.3. The role of age

Age was positively correlated with years in conservation ($r = 0.78$, p -value < 0.001 , Figure 10.18) and dispositional optimism ($r = 0.13$, p -value < 0.001). When included in the primary analysis, age was negatively correlated with nationally- and locally-focused situational optimism (Figure 10.19).

At the same time, the partial coefficient estimate between experience and nationally- and locally-focused situational optimism was also smaller, as might be expected. Within this additional analysis, a 25-year-old with five years of conservation experience has an estimated 0.35 higher standard deviation nationally-focused situational optimism than a 45-year-old with 25 years of experience. However, we had no prior evidence suggesting a plausible mechanism by which age would influence nationally- and locally-focused situational optimism, which was independent of experience and dispositional optimism. As a result, age was not included in the primary analysis since its inclusion was not theoretically supported.

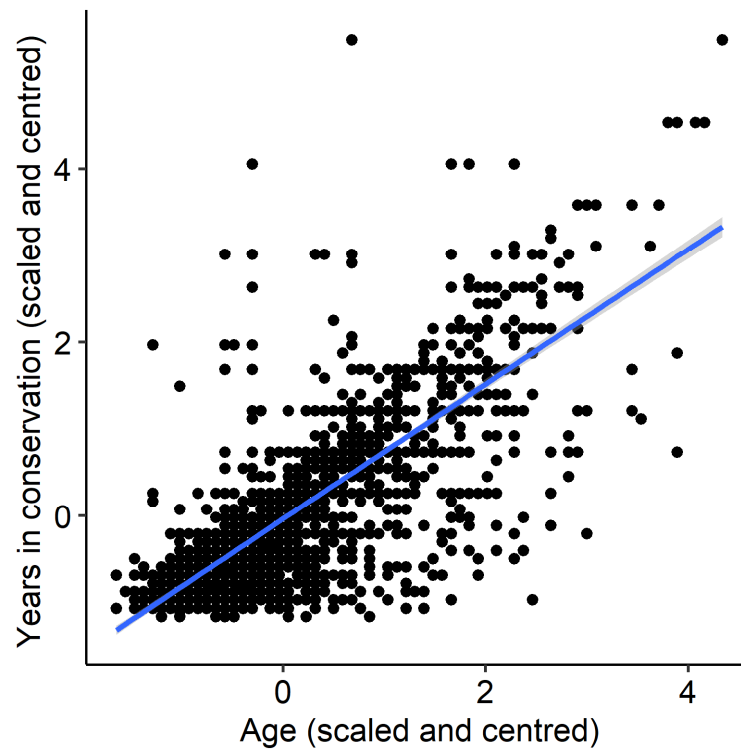


Figure 10.18. The association between age and years in conservation (both scaled and centred), with a regression line (blue) and 95% confidence intervals (light blue).

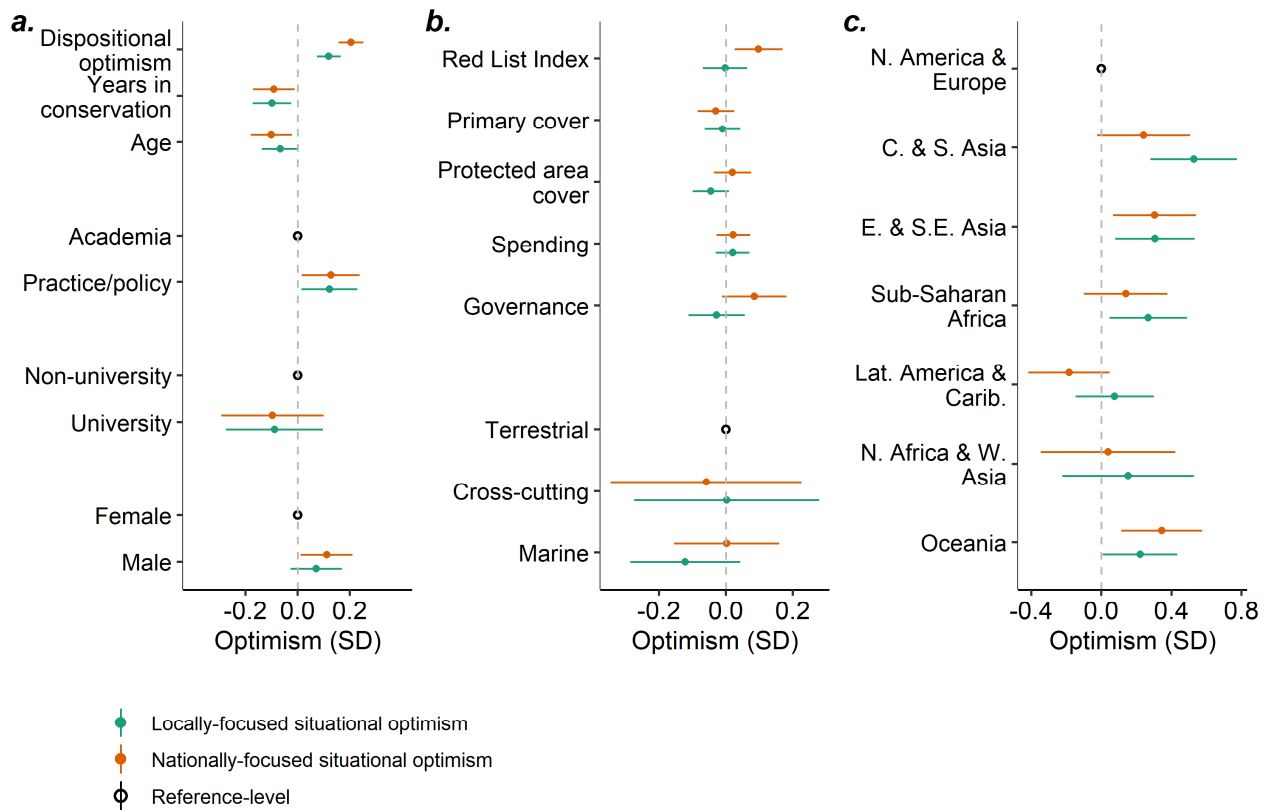


Figure 10.19. The association between nationally- and locally-focused situational optimism and (a) individual characteristics including age, (b) biodiversity state, conservation effort and focal environment, and (c) regional grouping variables among a more strictly defined sub-set of conservationists. Coefficients are in standardised units, meaning a one-unit change in continuous explanatory variables are associated with a given standard deviation (SD) change in the response variables. Estimate uncertainty is presented in 95% confidence intervals. Levels representing unknown or other responses are not shown.

10.5.6.4. Stricter protected areas

Our primary analysis included all protected areas with International Union for Conservation of Nature (IUCN) Categorisations. Whereas less strict protected areas seek to contribute to a range of social objectives, thereby indirectly supporting conservation, strictly protected areas tend to focus on ecological outcomes. As such, those in countries with a higher proportion of restrictedly protected areas may have higher nationally-focused situational optimism than those with a lower proportion. At the same time, such protected areas may be larger and have a higher profile than other protected area types, so they might be more salient for conservationists when considering future conservation outcomes. To explore how sensitive our results were to the inclusion of different protected areas categories, we repeated the analysis with the inclusion of only IUCN Categories I and II protected areas. As anticipated, when restricting the analysis to only strictly protected areas, those evaluating countries with a high proportion of protected area coverage reported higher nationally-focused situational optimism than those considering countries with a low proportion (Figure 10.20). Additionally, the association between primary cover and nationally-focused situational optimism became significantly negatively correlated. This result might be an artefact of controlling for strict protected area cover, where those evaluating conservation outcomes in countries with a high proportion of primary forest cover outside strict protection were less optimistic.



Figure 10.20. The association between nationally- and locally-focused situational optimism and (a.) individual characteristics, (b) biodiversity state, conservation effort and focal environment, and (c) regional grouping variables, when including more strictly protected areas. Coefficients are in standardised units, meaning a one-unit change in continuous explanatory variables are associated with a given standard deviation (SD) change in the response variables. Estimate uncertainty is presented in 95% confidence intervals. Levels representing unknown or other responses are not shown.

10.5.6.5. *Uncategorised protected areas*

Our primary analysis included all protected areas that had IUCN Categorisations. However, a large number of protected areas are yet to be categorised and were therefore excluded from our analysis. Nevertheless, they are likely to contribute to conservation efforts, although this contribution may be highly variable. To explore how sensitive our results were to the inclusion of all protected areas included in the World Database of Protected Areas (UNEP-WCMC & IUCN, 2020), we repeated the analysis with the inclusion of all protected areas. The results of this analysis were consistent with the primary analysis (Figure 10.21).

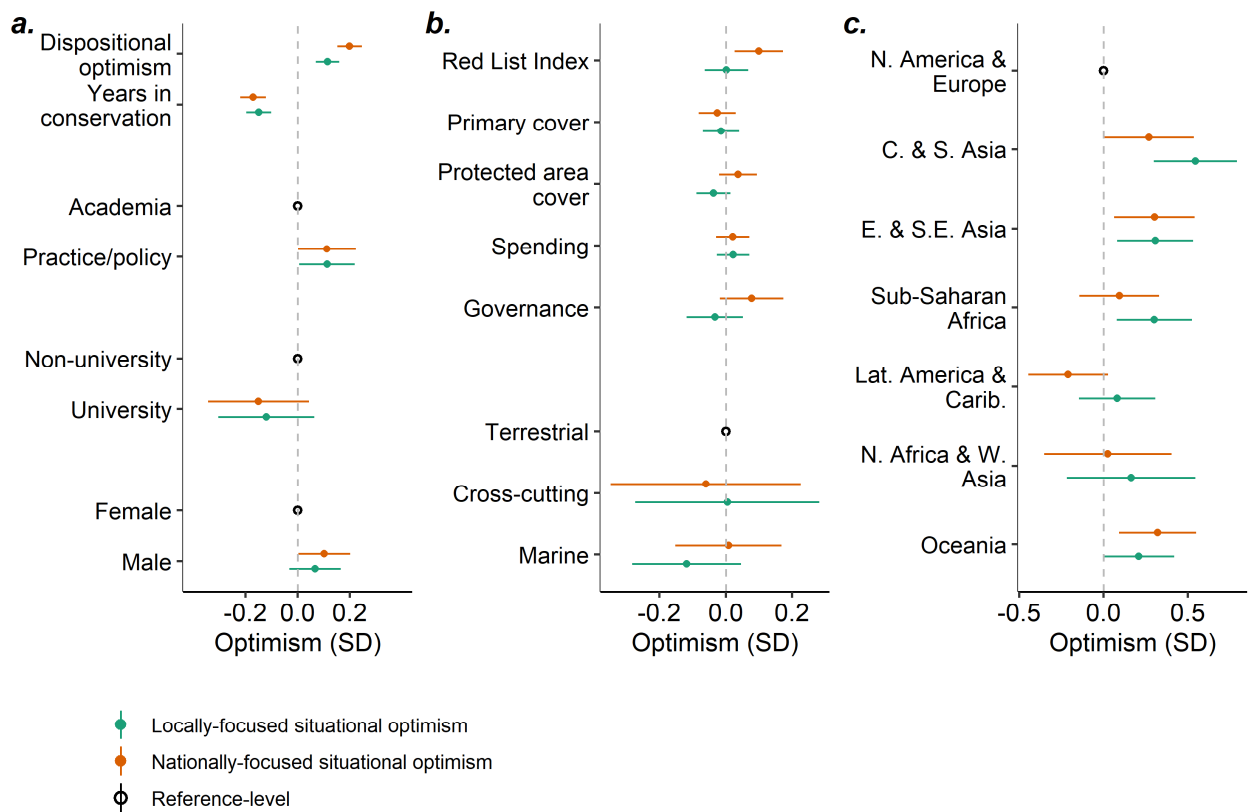


Figure 10.21. The association between nationally- and locally-focused situational optimism and (a.) individual characteristics, (b) biodiversity state, conservation effort and focal environment, and (c) regional grouping variables, when including un-categorised protected areas. Coefficients are in standardised units, meaning a one-unit change in continuous explanatory variables are associated with a given standard deviation (SD) change in the response variables. Estimate uncertainty is presented in 95% confidence intervals. Levels representing unknown or other responses are not shown.

10.5.6.6. The inclusion of biodiversity threat variables

Our analysis included variables seeking to describe the state of nature and humanities efforts to protect it. These two groups of variables align with the pressure-state-response framework but do not directly include threat indicators. We expected that threats to nature would be reflected in the state and response variables. As such, including additional threat variables was expected to be redundant. However, this assumption was tested by including indicators of five key threats to nature identified in the literature (Maxwell et al., 2016; Tilman et al., 2017). These were:

- Land-use change: We calculated the mean projected primary natural forest and non-forest land-use loss from 2020 to 2030 in each country, under the Shared Socioeconomic Pathways scenario 2 (SSP2), released by the Land-Use Harmonization (LUH2) project (Hurtt et al., 2019; Hurtt et al., 2020). SSP2 is a ‘middle of the road’ scenario, where humanity follows the same social, economic, and technological trends as seen historically (Riahi et al., 2017).
- Hunting pressure: We calculated the proportion of endangered and critically endangered terrestrial bird, reptile, amphibian, and mammal species that listed hunting and trapping as threats from the International Union for Conservation of Nature Red List of Threatened

Species in 2020 (IUCN, 2020a). Within this calculation, the contribution of each species was weighted by the proportion of its distribution found within each country.

- Invasive species pressure: The same procedure described above was repeated, but considering those species that listed invasive and other problematic species, genes & diseases as a threat in 2020. As above, this proportion of species threatened by invasive species was also distribution-weighted.
- Climate change pressure: We calculated the projected change in annual mean temperature change between the 1970-2000 period and 2021-2040 period, taking the mean change across each countries geographic extend under SSP2. This value was derived from the mean values across six available global climate models listed in WorldClim calculated at 10-minute spatial resolution (Fick & Hijmans, 2017).
- Pollution: Excess nutrients are a major source of pollution threatening biodiversity, primarily through the eutrophication of freshwater and marine systems from agricultural fertiliser run-off (Rockström et al., 2009). We, therefore, used mean arable fertiliser consumption per unit of total land area in each country in 2016 as a proxy for pollution pressure (World Bank, 2020a, 2020b).

Following the inclusion of these threat variables, the association between Red List Index nationally-focused situational optimism becomes non-significant, as might be anticipated (Figure 10.22). However, the associations between the threat variables and respondents nationally- and locally-focused situational optimism did not conform to expectations. For instance, those evaluating countries with a higher proportion of species threatened by hunting, controlling for all other variables, appeared to be more optimistic. This may result from some residual confounding associated with geographic differences not accounted for by the inclusion of regional groupings or other variables. However, these unexpected results may reflect the limitations of these indicators. For instance, the hunting and invasive species variables account for threats across all populations of a species, but not if that threat occurs within each country.

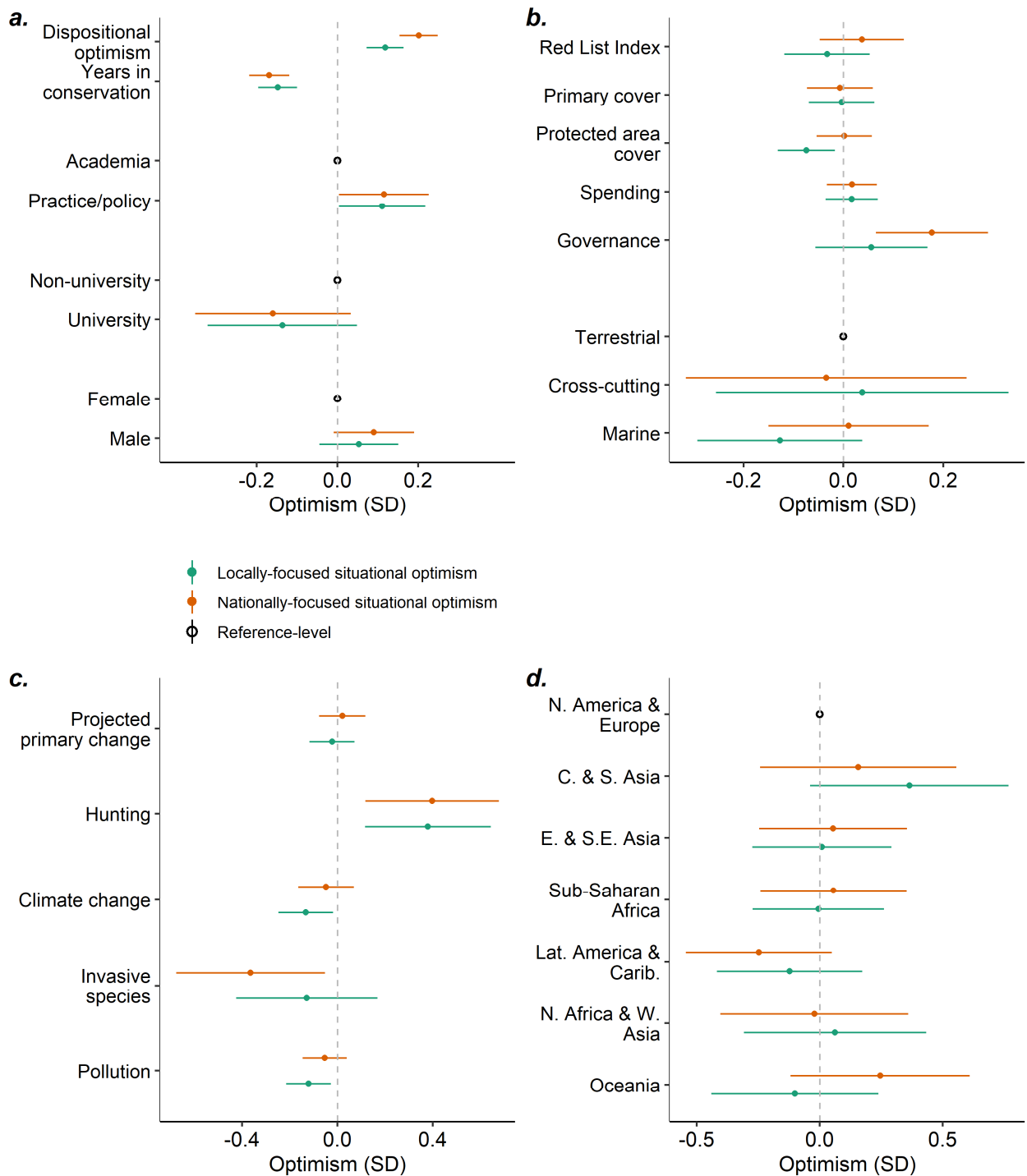


Figure 10.22. The association between nationally- and locally-focused situational optimism and (a.) individual characteristics, (b) biodiversity state, conservation effort and focal environment, (c) threats to biodiversity, and (d) regional grouping variables. Coefficients are in standardised units, meaning a one-unit change in continuous explanatory variables are associated with a given standard deviation (SD) change in the response variables. Estimate uncertainty is presented in 95% confidence intervals. Levels representing unknown or other responses are not shown.

10.5.6.7. Disaggregating the analysis by region

We were also interested in variability in results between regions. Therefore, we repeated the analysis for each region with more than 400 associated observations (Europe and Northern

America ($n = 886$) and Sub-Saharan Africa ($n = 474$), which we felt was around the minimum required for the analysis. This disaggregated analysis suggests some areas of consistency with the primary analysis, such as the positive association between situational and dispositional optimism (Figure 10.23). We also found other areas where the results were not consistent between regions or with the primary analysis, illustrated below. However, these results should be treated with caution, given their respective small sample sizes.

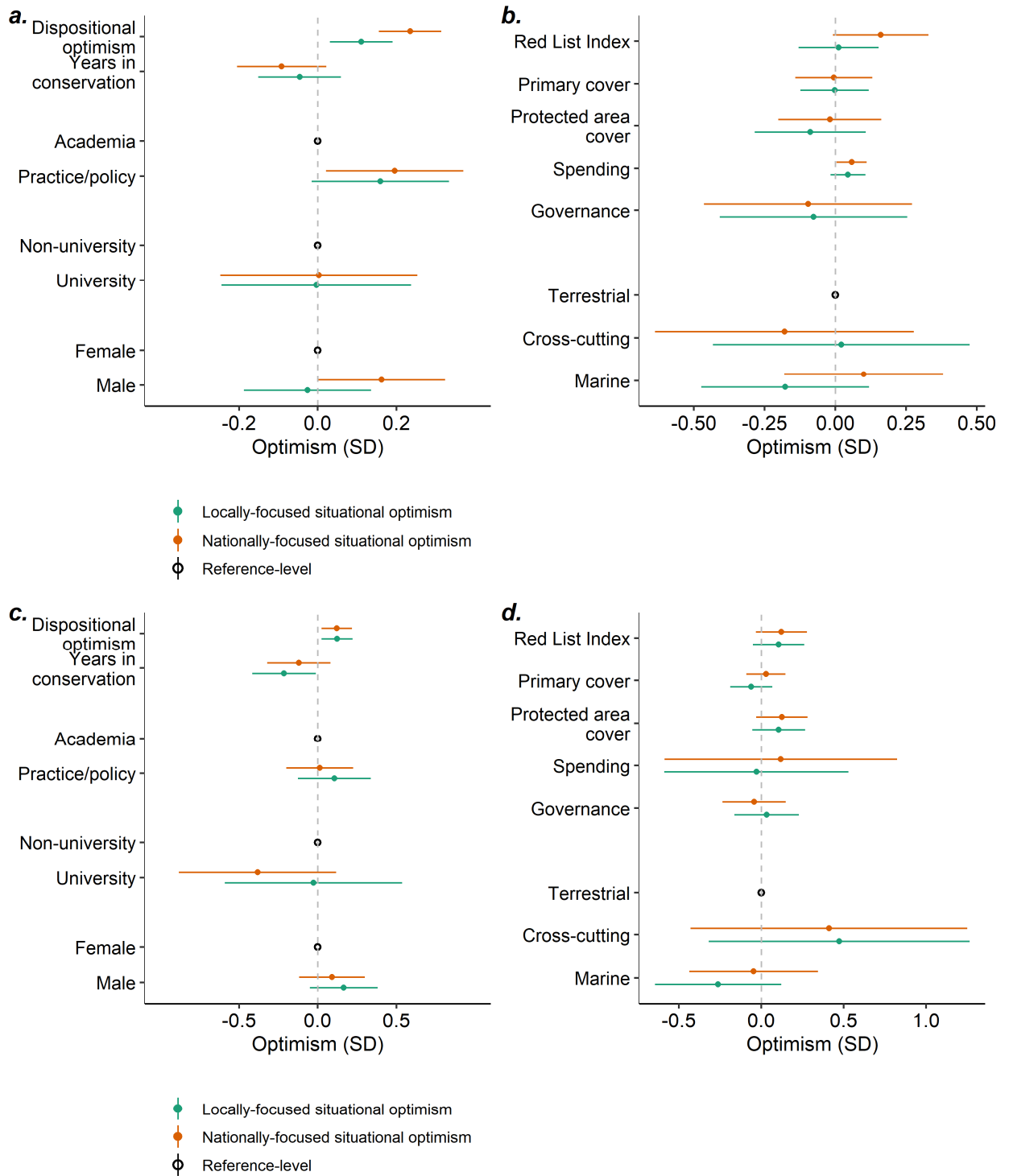


Figure 10.23. The association between nationally- and locally-focused situational optimism and (a.) individual characteristics and (b.) biodiversity state, conservation effort and focal environment among respondents familiar with conservation in Europe and North America (N = 886). In addition, the association between situational optimism and (c.) individual characteristics and (d.) biodiversity state, conservation effort and focal environment among respondents familiar with conservation in Sub-Saharan Africa (N = 474). Coefficients are in standardised units. Estimate uncertainty is presented in 95% confidence intervals.

10.5.7. Appendix: Geographic patterns of optimism

The nationally-focused situational optimism (Figure 10.24) and dispositional optimism (Figure 10.25) factor scores between countries whose conservation context respondents were most familiar with. These factor scores were extracted from two structural equation models, which each included only the items found in the nationally-focused situational optimism and Life Orientation Test – Revised instruments (following the structure described in the main text).

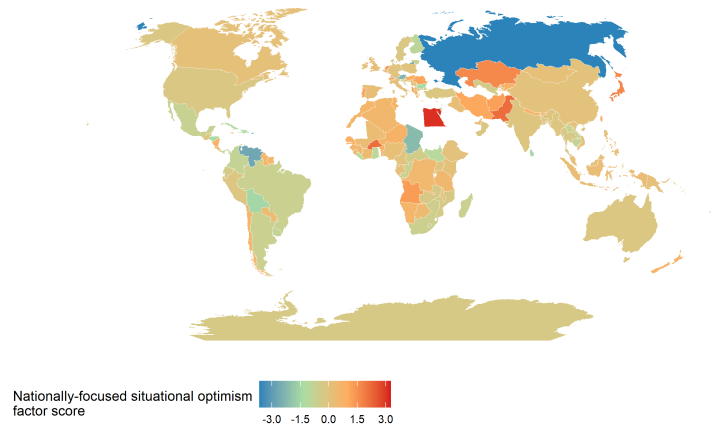


Figure 10.24. Nationally-focused situational optimism (scaled and centred) in the country whose conservation context respondents were most familiar.

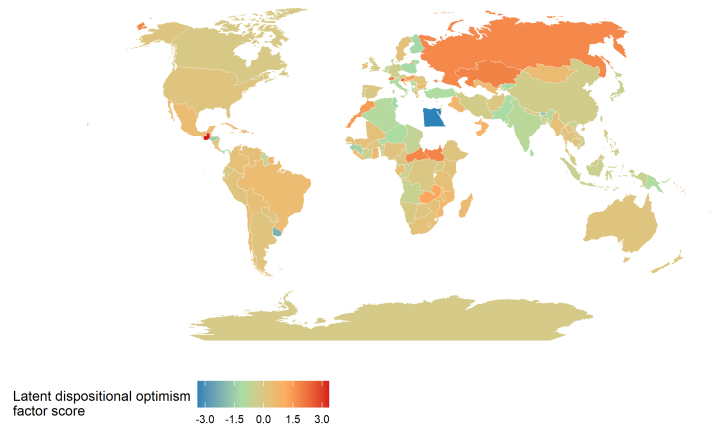


Figure 10.25. Latent dispositional optimism factor scores (scaled and centred) in the country whose conservation context respondents were most familiar.

10.5.8. Appendix: Life Orientation Test – Revised (Chapter 5)

Within our sample, the mean Life Orientation Test – Revised score was 15.0 (SD = 3.9). This score is close to the mean score of 15.2 among 171 United Kingdom conservation professionals, which was significantly higher than the score of 13.5 in a comparator group of 256 non-conservationists (Papworth et al., 2018). However, the average score in our study appeared slightly lower than those found among general population studies in countries such as Norway (17.2, SD = 3.0), Germany (16.2, SD = 3.8), and Colombia (16.1, SD = 4.1), although this direct comparison does not account for demographic differences (Hinz et al., 2017; Schou-Bredal et al., 2017; Zenger et al., 2013).

Studies among 265 United States, 2,925 Chinese, and 138 Indian medical students reported Life Orientation Test – Revised scores of 17.2 (SD = 4.9), 17.35 (SD = 3.42), and 15.97 (SD = 3.53) respectively (Hojat, Vergare, Isenberg, Cohen, & Spandorfer, 2015; Shi, Liu, Wang, & Wang, 2016; Tankamani & Shahidi, 2017). Other sampled populations include 1,010 Polish and 276 Greek nurses, who had mean scores of 14.60 (SD = 3.76) and 14.4 (SD = 4.1), respectively (Jaworski et al., 2020; Lyrakos, Damigos, Mavreas, Georgia, & Dimoliatis, 2009). Once again, direct comparisons do not control for demographic differences. Nevertheless, our scores appear in the typical range of those often reported. Further research with a large comparator group could reveal if conservationists tend to have different levels of dispositional optimism than those in other occupations. Crucially, it could help understand if individuals with certain personality traits self-select into conservation or if these traits develop during careers.

10.6. Chapter 6 Appendixes

10.6.1. Appendix: Hypothesised associations with psychological distress

Table 10.10. Personal characteristics and occupational risk factors expected to be associated with psychological distress in two models. The ERI-score model includes the effort-reward imbalance score but excludes each item of the effort-reward imbalance instrument. The ERI-item model includes each item of the instrument but excludes the effort-reward imbalance score. * Variables moderately correlated with other explanatory variables ($\rho > 0.6$) were removed from the statistical analysis post-hoc. † Ordinal exogenous variables were treated as numeric. ‡ Conservation-specific items added to the original effort-reward imbalance instrument. Key: RL = reference level; + = expected positive association; - = expected negative association; and ? = ambiguous or unclear expected association.

Variable type	Name	Statement	Description	Expected association with psychological distress
Personal characteristics	Dispositional optimism		A latent variable derived from the Life Orientation Test – Revised	(-) Those optimistic in life are expected to report lower psychological distress (Conversano et al., 2010).
	Situational optimism		Latent situational optimism about conservation outcomes.	(-) Those more optimistic about outcomes for nature are expected to report lower psychological distress (Chapter 5). A correlation between situational and dispositional optimism was included in the analysis.
	Gender		Female or male (RL = female)	(-) Gender-differentiated stressors are expected to affect men and women, with evidence that women can face barriers in conservation work (M. S. Jones & Solomon, 2019). Outside work, there can be greater social and cultural risk factors for psychological distress among women (Drapeau et al., 2012; Drapeau, Marchand, & Forest, 2014).
	Age*		Age in years	(?) Changes in biological and behavioural characteristics and how individuals are treated over their life course are expected to influence their risk of psychological distress, although exactly how is uncertain in this case (Drapeau et al., 2014).
	Years in conservation		Years working in conservation	(?) Those in conservation for longer are expected to be more established in their careers, with more secure roles and better compensation than early-career conservationists (Pienkowski et al.,

			2021). Alternatively, those in the sector for longer may have witnessed repeated failure to meet conservation goals, which may be distressing.
National / non-national		National or non-national (RL = national)	(?) Employees that are nationals of the country they work in may face differing pressures compared to non-nationals (Ager et al., 2012; Eriksson et al., 2009), although relationships with reported psychological distress are unclear.
Education		University or non-university education (RL = non-University)	(?) Education level is both a consequence and determinant of socio-economic status and social mobility, which are associated with poor mental health (Freeman et al., 2016; J. L. Wang, Schmitz, & Dewa, 2010). Equally, those with higher education may be more aware of the scale of nature loss, which may be distressing.
Physical health [†]	<i>“How is your physical health in general?”</i>	A single item ordinal variable measuring general health.	(-) There is often co-morbidity between physical and mental health, which may be bi-directional, so we expect good health to be negatively associated with psychological distress (Ohrnberger et al., 2017).
Personal relationships [†]	Satisfied with: <i>“...your personal relationships?”</i>	Each of the three social support items	(-) Social support appears consistently associated with better mental and physical health, although the relationship may be bi-directional (Uchino, 2006).
Friends and family support [†]	<i>“...the support you get from your friends and family?”</i>		
Friends and family time [†]	<i>“...the amount of time you are able to spend with friends and family”[†]</i>		
Workplace conditions	Effort-reward score	The adapted effort-reward imbalance score (ERI-score model).	(+) A high ratio of effort relative to reward is expected to be associated with psychological distress (e.g., Aboa, 2011; Bridger, Dew, Brasher, Munnoch, & Kilminster, 2009; Janzen, Muhajarine,

Zhu, & Kelly, 2007; Kinman & Jones, 2008; B. Lau, 2008; Stansfeld, Fuhrer, Shipley, & Marmot, 1999).

Heavy workload [†]	<i>“I have constant time pressure due to a heavy work load”</i>	The effort items from the adapted effort-rewards imbalance instrument (ERI-item model).	(+) Each effort item from the adapted effort-rewards imbalance instrument is expected to be positively associated with psychological distress.
Many disturbances ^{*,†}	<i>“I have many interruptions and disturbances while performing my job”</i>		
Increasingly demanding job [†]	<i>“Over the past few years, my job has become more and more demanding”</i>		
Not enough resources [†]	<i>“I do not have the resources I need to archive my work goals”</i>		
Not enough funding ^{*,†}	<i>“The organisation I work for does not have enough funding to achieve its main aims”[‡]</i>		
Organisational instability [†]	<i>“The organisation I work for may not exist in five years time”[‡]</i>		
Respect I deserve ^{*,†}	<i>“I receive the respect I deserve from my boss and work colleagues”</i>	The reward items from the adapted effort-rewards imbalance	(-) Each reward item from the adapted effort rewards imbalance instrument is expected to be negatively associated with psychological distress.

Job advancement prospects ^{*,†}	<i>“My job promotion or advancement prospects are poor”</i> (reverse coding)	instrument (ERI-item model).
Do not expect undesirable job change [†]	<i>“I have experienced or I expect to experience an undesirable change in my work situation”</i> (reverse coding)	
Good job security [†]	<i>“My job security is poor”</i> (reverse coding)	
Respect and prestige [†]	<i>“Considering all my efforts and achievements, I receive the respect and prestige I deserve at work”</i>	
Job advancement [†]	<i>“Considering all my efforts and achievements, my job promotion or advancement prospects are adequate”</i>	
Income is alright [†]	<i>“Considering all my efforts and achievements, my salary or income is alright”</i>	
Contribution to conservation [†]	<i>“I am satisfied with the contribution I make to conservation”</i> [‡]	

Social pride [†]	<i>“My friends and family are proud that I work in conservation”[‡]</i>		
Position		Academia and research or practice and policy (RL = academia and research)	(?) Academics and practitioners or policymakers face different challenges and rewards, although the relationship with reported psychological distress is unclear.
Dangerous at night ^{*,†}	<i>“It is dangerous to go outside at night alone”</i>	Each of the three items describing personal security at work and home	(+) Threats to personal security at work and home are expected to be positively associated with psychological distress (Davey et al., 2001; Keinan & Malach-Pines, 2007).
Dangerous situations [†]	<i>“My work puts me in dangerous situations”</i>		
Not feeling safe [†]	<i>“I do not feel safe, even where I live”</i>		
Working hours		Work hours per week	(+) Some evidence suggests that high working hours is expected to contribute to burnout and psychological distress (Harvey et al., 2017).

10.6.2. Appendix: Definitions of a conservationist (Chapter 6)

We used a broad definition of conservationists, which may include those not currently employed in conservation or those who did not disclose their current employment status. A stricter definition of conservationists may include only those who currently work or conduct research within conservation. To explore the sensitivity of our primary analysis to how we define conservationists, we repeated the analysis with 2017 responses from those who said they worked or conducted research in conservation. The results of this analysis were consistent with the primary analysis (Figure 10.26).

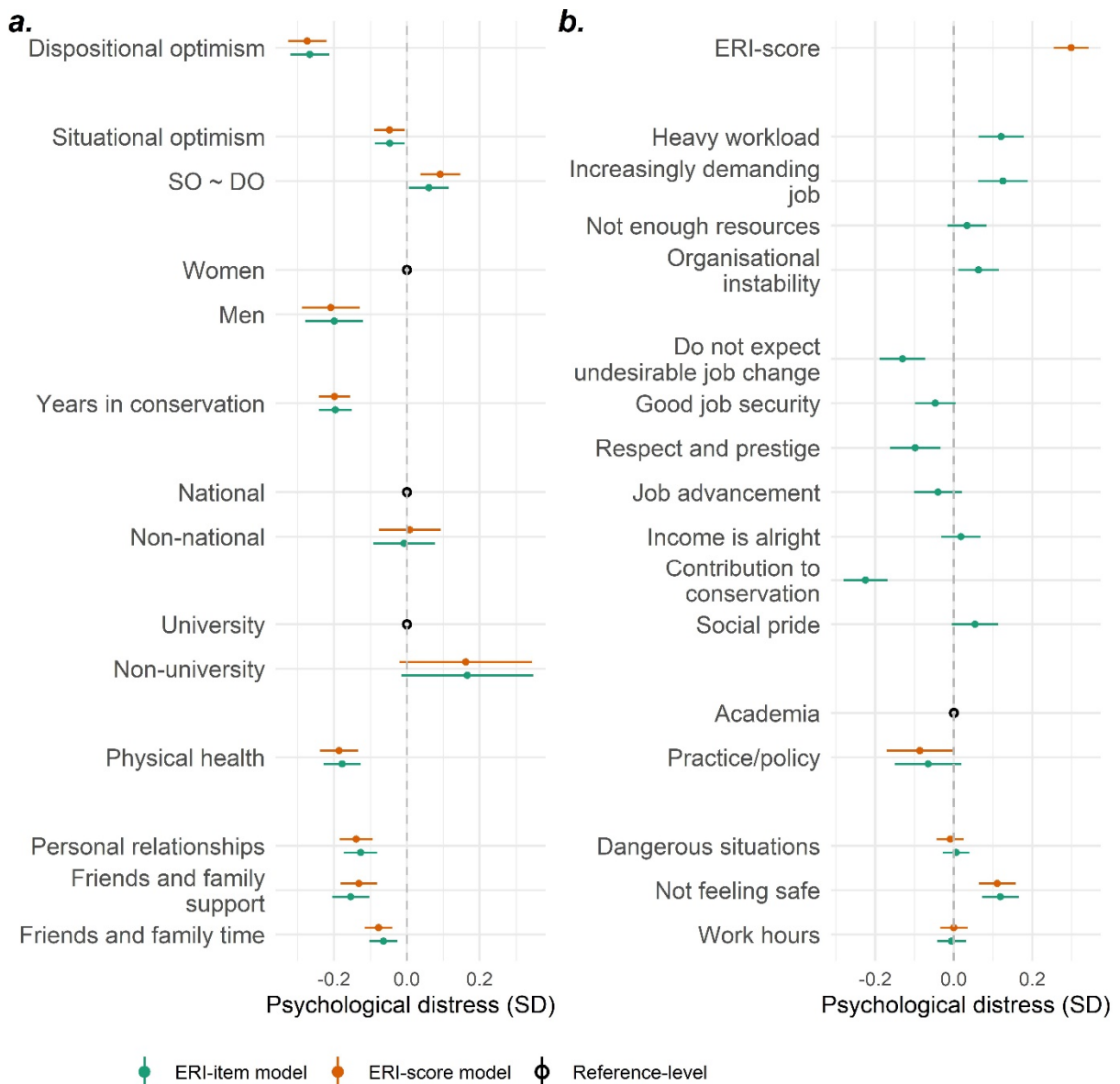


Figure 10.26. The estimated association in standard deviations (SD) between latent psychological distress and personal characteristics and occupational risk factors among 2017 respondents. This analysis was implemented with those who said they currently worked in conservation. The ERI-score model included the effort-reward imbalance score but excluded the individual instrument items, while the ERI-item model included these items but excluded the score. Continuous variables were scaled and centred. 'Unknown' response levels are not shown.

10.6.3. Appendix: Effort-reward imbalance

Within social-exchange theory, there are established principles that influence peoples' interactions. One of these is the reciprocity rule. This rule states that when one individual supplies a benefit, the receiver should respond in-kind (Cropanzano & Mitchell, 2005). Breaking this rule – where effort is not compensated – is a stressor.

The effort-reward imbalance (ERI) model is informed by this rule (Siegrist, 1996). It assumes that people work on the expectation that their efforts will be compensated through money, career opportunities, esteem and other occupational benefits. The experience of inadequate reward, in relation to effort, is a stressor (Siegrist, 1996). Ongoing stress, as the result of an effort-reward imbalance, can harm both mental and physical health (van Vegchela, de Jongea, Bosmab, & Schaufelia, 2005). Multiple studies explore associations between ERI and psychological distress in occupational environments. The ERI was positively associated with psychological distress in cross-sectional studies among 844 British academics, 78 Canadian police officers, 814 Canadian citizens, 1,803 Norwegians, 243 Japanese workers, and 2,596 United States naval personnel (Aboa, 2011; Bridger et al., 2009; Janzen et al., 2007; Kinman & Jones, 2008; B. Lau, 2008). A large cross-sectional study of 10,308 civil servants in the United Kingdom found that ERI was correlated with psychological distress among men but not women (Stansfeld et al., 1999). These studies are observational and assume that ERI causes psychological distress. This assumption was tested in a multi-phase study of 211 Japanese workers that found a bi-directional relationship between ERI and psychological distress (Shimazu & de Jonge, 2009). In other words, ERI appears to increase the risk of distress but suffering from distress simultaneously leads to greater ERI.

The ERI model has a standardised ten-item self-reporting instrument (Siegrist, 1996). Three Likert-scaled items define effort. A set of six Likert-scaled items define reward. The instrument has four response levels ranging from (“*strongly disagree*” = 0) to “*strongly agree*” (4). Three items are reverse coded, after which the scores for each item are added together to give a total effort and a total reward score. A value of 1 indicates a balance between efforts and rewards, values approaching 0 indicate high reward vs low effort, and values above 1 indicate high effort vs low reward.

In addition to the ten statements within the original ERI model, we included five more that described unique challenges and rewards within the conservation sector (shown in bold below). Furthermore, to ease interpretability, we adjusted some of the phrases used in the instrument (underlined):

- [ERI1] I have constant time pressure due to a heavy work load
- [ERI2] I have many interruptions and disturbances while performing my job
- [ERI3] Over the past few years, my job has become more and more demanding
- [ADD1] **I do not have the resources I need to archive my work goals**
- [ADD2] **The organisation I work for does not have enough funding to achieve its main aims**
- [ADD3] **The organisation I work for may not exist in five years' time**
- [ERI4] I receive the respect I deserve from my boss and work colleagues

- [ERI5] My job promotion or advancement prospects are poor (reverse coding)
- [ERI6] I have experienced or I expect to experience an undesirable change in my work situation (reverse coding)
- [ERI7] My job security is poor (reverse coding)
- [ERI8] Considering all my efforts and achievements, I receive the respect and prestige I deserve at work
- [ERI9] Considering all my efforts and achievements, my job promotion or advancement prospects are adequate (NA)
- [ERI10] Considering all my efforts and achievements, my salary or income is alright
- [ADD4] I am satisfied with the contribution I make to conservation
- [ADD5] My friends and family are proud that I work in conservation

The analysis was repeated with the scores and items from the original ERI instrument. The effect sizes are generally consistent between this supplementary analysis and the main results. However, the confidence intervals are slightly smaller and so the association between these variables and psychological distress becomes statistically significant.

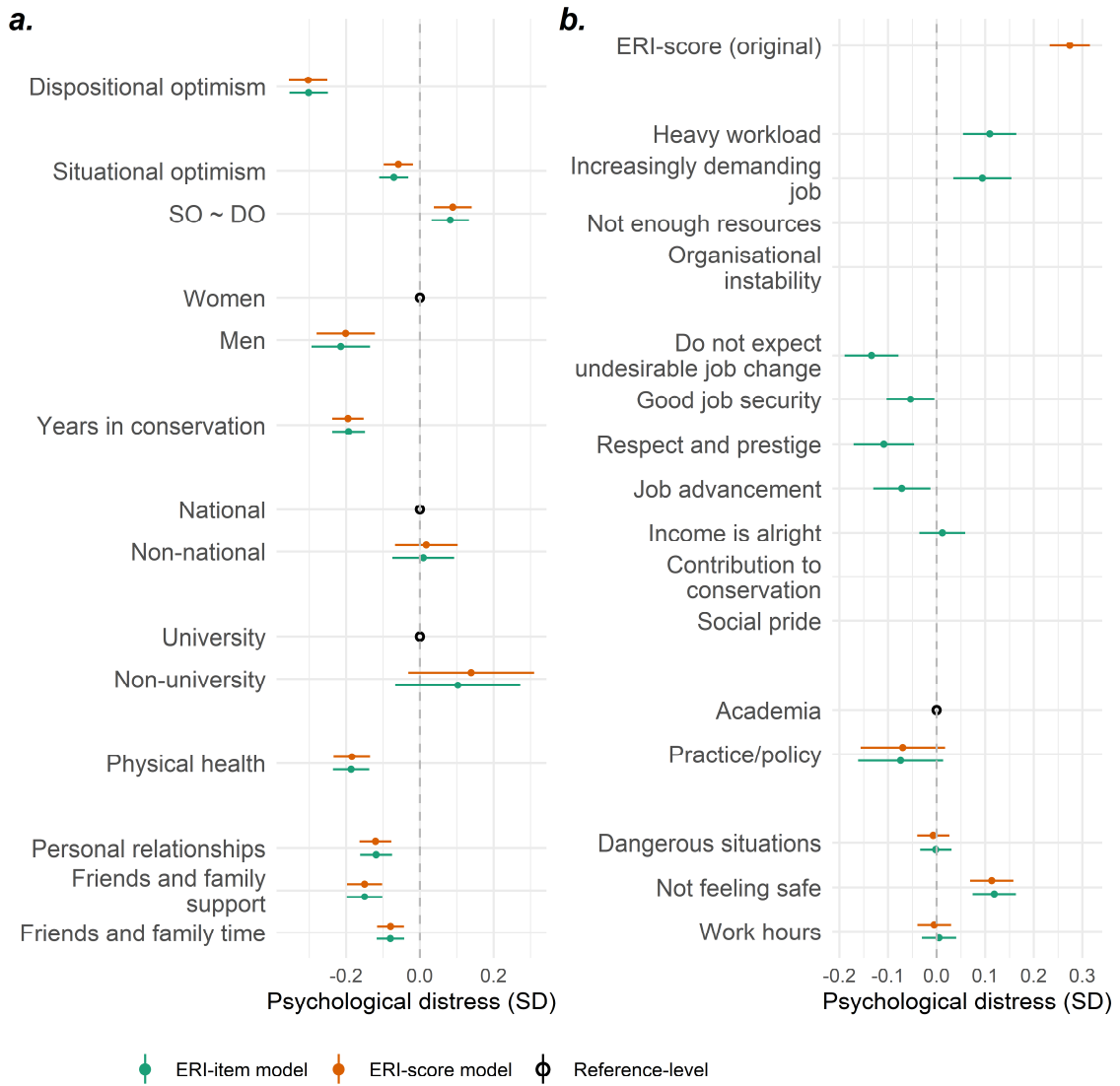


Figure 10.27. The estimated association in standard deviations (SD) between latent psychological distress and personal characteristics and occupational risk factors among 2,306 respondents. Scores and items from the original effort-reward imbalance model were used. The ERI-score model included the effort-reward imbalance score but excluded the individual instrument items, while the ERI-item model included these items but excluded the score. Continuous variables were scaled and centred. 'Unknown' response levels are not shown.

10.6.4. Appendix: Patterns of missing data (Chapter 6)

Around 1% of values in the survey data were missing (Figure 10.28).

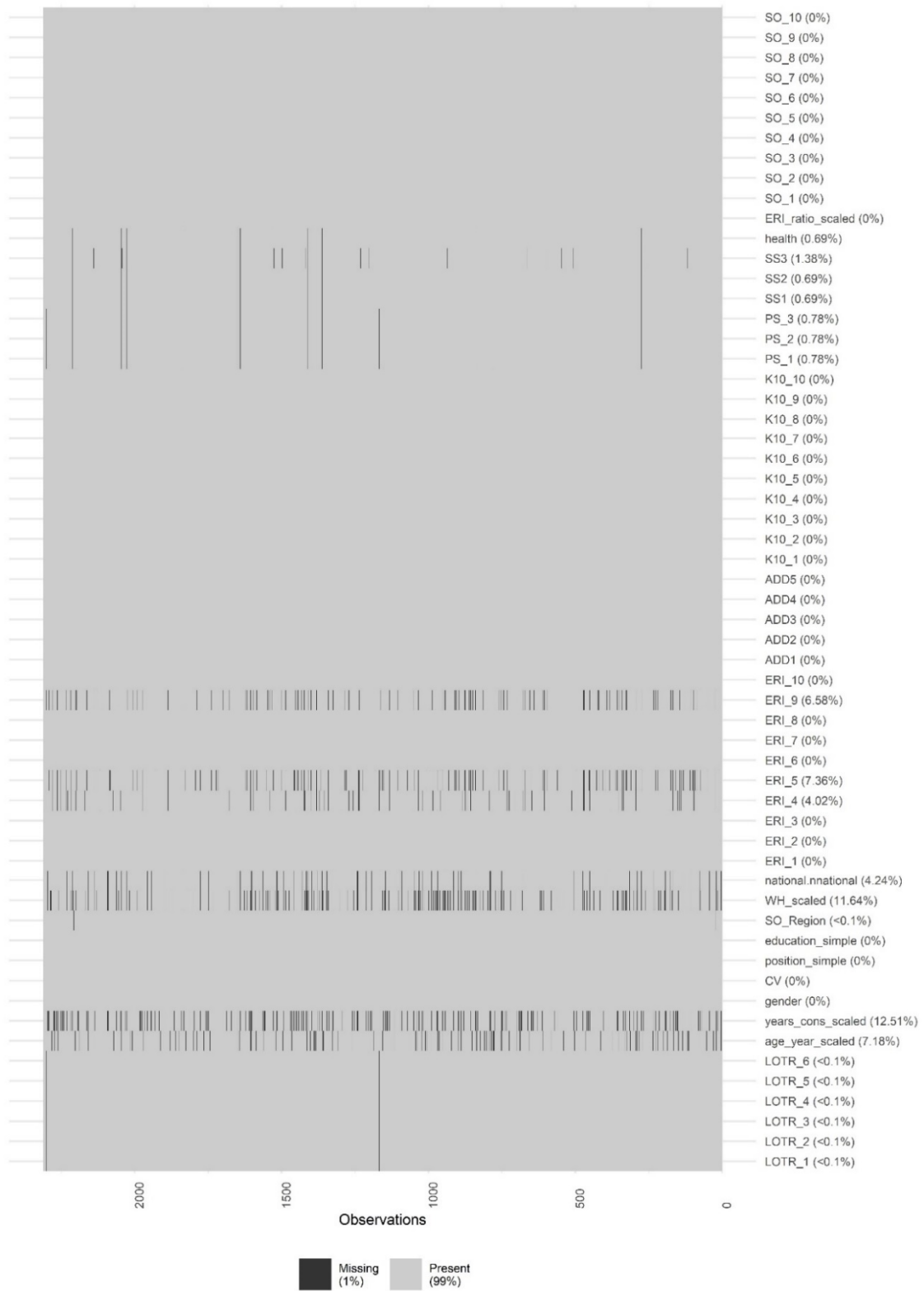


Figure 10.28. Illustrating which observations are missing.

10.6.5. Appendix: Imputation of missing data (Chapter 6)

Implementing an analysis with only complete cases can be an inefficient use of data that contains some missingness. For instance, if one value of a given variable is missing from an otherwise complete observation, that entire observation would still be excluded when only analysing complete cases. In these instances, it can be useful to substitute the missing value with plausible synthetic values. There are multiple methods for doing this. However, multivariate imputation by chained equations is a popular approach.

Multivariate imputation by chained equations creates synthetic values based on data within a specific observation (which is missing the value) and the associations between variables across observations (Schafer & Graham, 2002). As a hypothetical example, Respondent A did not disclose the number of years they worked in conservation, but they did report their age. Modelling across other respondents with complete cases found a 0.75 correlation between age and years in conservation. Based on this, the missing value for Respondent A can be estimated based on their reported age. However, that single estimate does not capture the uncertainty associated with the imputation. Therefore, multiple imputed datasets containing different plausible values (reflecting the underlying uncertainty with a given imputation) are typically used with secondary analysis.

A key assumption when using this approach is that data is missing at random. Missing at random means that the probability that a value (like years of experience) is missing is not conditional on the outcome variable of interest (once accounting for the effect of all other observed variables) (Azur et al., 2011). For example, the probability that values of years of experience are missing is the same for someone who is highly distressed as for someone with low levels of distress. We assumed that respondents did not want to disclose personal information for variables such as age because of concerns about anonymity. For other variables, including the missing ERI values, we assumed some did not respond because they felt the question did not apply to them. Based on this, we assumed that all missing values were missing at random.

Therefore, these missing data were substituted through multivariate imputation by chained equations creating ten datasets with imputed data, using the package mice (van Buuren S & K, 2011). Numeric variables with predictive mean matching, ordinal variables were imputed using proportional odds models, and unordered categorical variables with polytomous logistic regression. The pre- and post-imputation distributions of variables were inspections and were consistent.

10.6.6. Appendix: Model fit

The ERI-score model had a mean root mean square error of approximation of 0.05 (95% confidence interval 0.05 - 0.05), Tucker–Lewis index of 0.98, and standardised root mean square residual of 0.06 across the ten imputed datasets. The ERI-item model had a mean root mean square error of approximation of 0.04 (95% confidence interval 0.04 - 0.04), Tucker–Lewis index of 0.98, and standardised root mean square residual of 0.05 across the imputed datasets. These measures suggested that both models fitted the data well.

10.6.7. Appendix: Removing dispositional optimism

Dispositional optimism may be a confounding variable between psychological distress and other explanatory variables. To evaluate this, we repeated the analysis after the dispositional optimism variable and compared the results to those of the original model. However, the results were consistent with the primary analysis, suggesting dispositional optimism did not have a confounding effect (Figure 10.29).

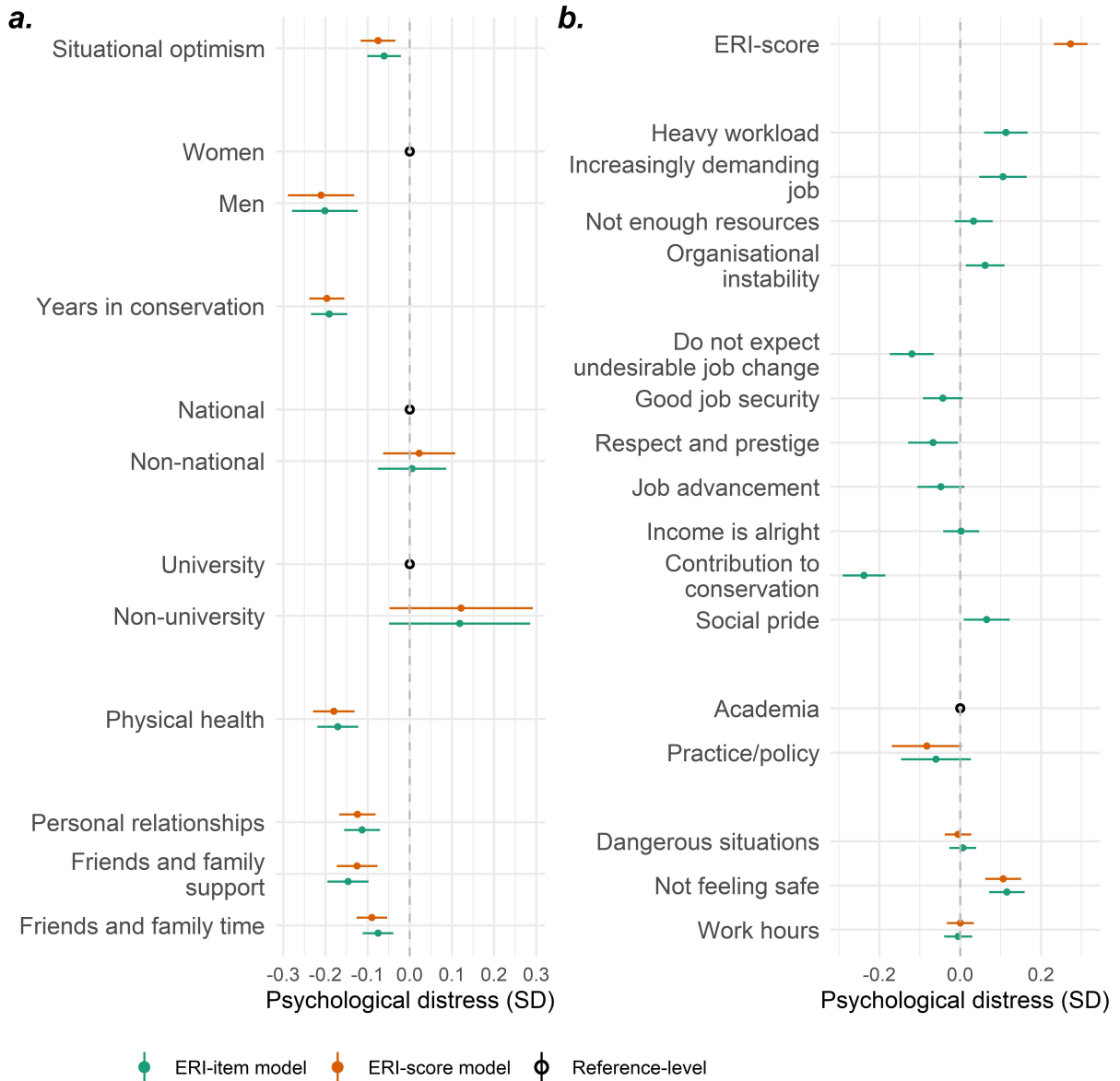


Figure 10.29. The estimated association in standard deviations (SD) between latent psychological distress and personal characteristics and occupational risk factors among 2306 respondents. Dispositional optimism was removed from the analysis. ERI-score model included the effort-reward imbalance score but excluded the individual instrument items, while the ERI-item model included these items but excluded the score. Continuous variables were scaled and centred. 'Unknown' response levels are not shown.

10.6.8. Appendix: Including goal progress satisfaction

Goal progress increases feelings of control, autonomy, and competence and alleviates distress caused by unmet needs and undesirable situations (Deci & Ryan, 2000). Consequently, satisfaction with goals progress may contribute to wellbeing, but inadequate progress may be a source of distress (Ryan & Deci, 2001; Strauman, 2002; Wrosch et al., 2013). For instance, a meta-analysis of 85 studies found consistent positive associations between subjective wellbeing and perceived goal progress (Klug & Maier, 2014). We, therefore, replaced situational optimism with a measure of satisfaction with collective conservation goal progress. This measure was developed in Chapter 4.

In summary, six statements were developed, based on sub-dimensions of the value-belief-norm theory and other literature (de Groot & Steg, 2007; Papworth et al., 2018) (Table 10.11). These were developed during a series of workshops attended by six authors. Not all conservationists were expected to endorse the same goals. So, respondents were first asked which goals were important. Second, for those considered important, respondents were to indicate their satisfaction or dissatisfaction according to five response levels ranging from “*very dissatisfied*” (1) to “*very satisfied*” (5). Respondents were asked to think about the conservation area or context they were most familiar with when responding to questions about collective goals. The satisfaction scores for each endorsed goal were added together, then scaled and centred for each respondent. This variable was used to indicate satisfaction with collective conservation goal progress.

Table 10.11. Six statements describing collective conservation goal progress satisfaction developed based on sub-dimensions of the value-belief-norm theory (de Groot & Steg, 2007; Papworth et al., 2018).

Dimension	Sub-dimension	Corresponding goals
Altruistic	Equality: equal opportunity for all	<i>“Making sure people are treated equally and fairly”</i>
	Social justice: correcting injustice, caring for the weak	
	A world at peace: free of war and conflict	<i>“Avoiding conflict between people and conservation”</i>
	Helpful: working for the welfare of others	<i>“Ensuring people benefit from nature in a sustainable way”</i>
Biospheric	Preventing pollution: protecting natural resource	<i>“Stopping human-driven species loss”</i>
	Respecting the earth: harmony with other species	<i>“Creating a more sustainable world”</i>
	Unity with nature: fitting into nature	
	Protecting the environment: preserving nature	<i>“Stopping damage to the natural world”</i>

In this supplementary analysis, collective goal progress satisfaction had a small negative association with psychological distress (Figure 10.30). This small association corroborates our

suggestion that respondents may be less concerned about the “*bigger picture*” of ongoing biodiversity loss in contrast to their own role (indicated by their reported satisfaction with their “*contributions to conservation*”).

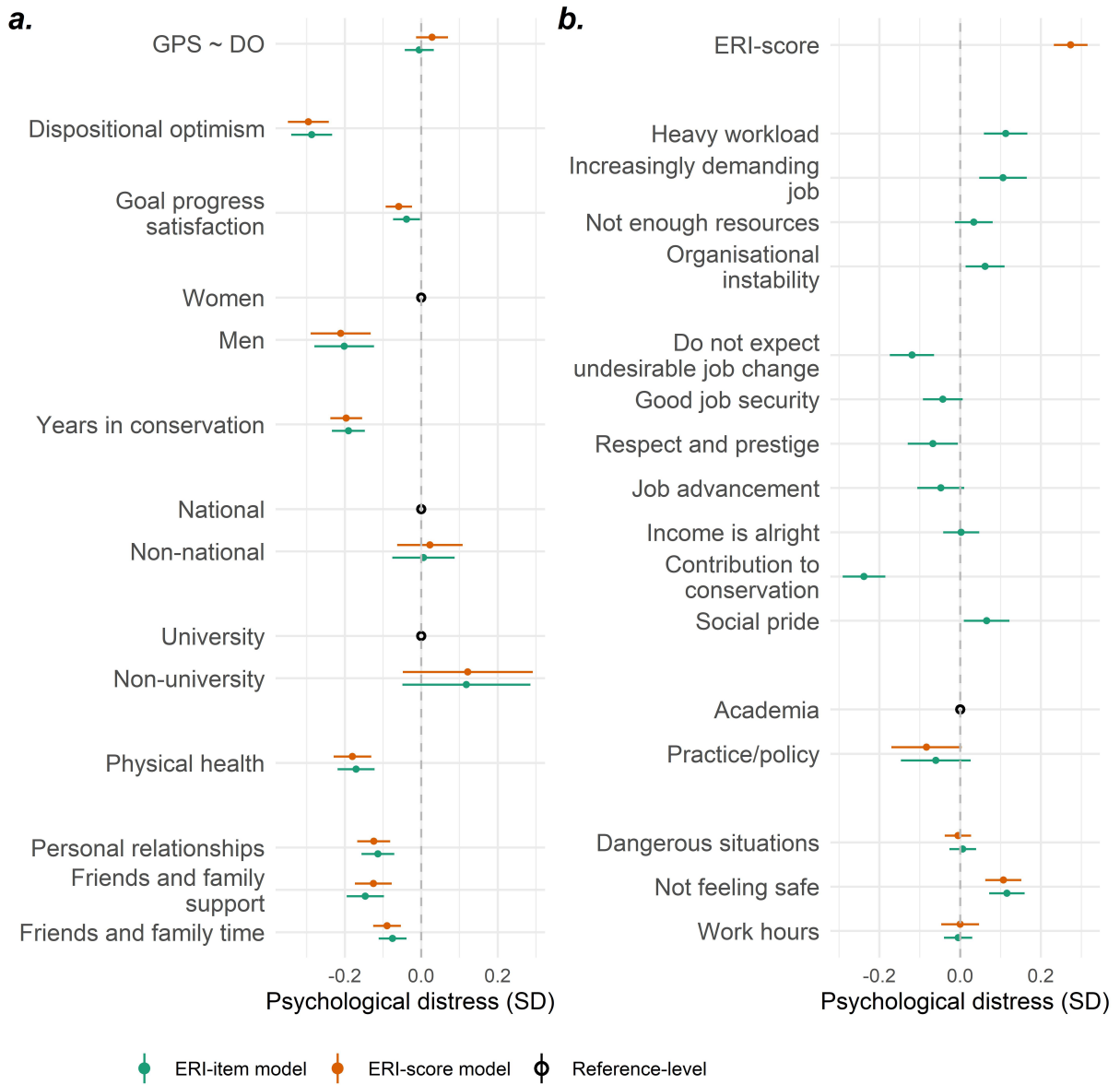


Figure 10.30. The estimated association in standard deviations (SD) between latent psychological distress and personal characteristics and occupational risk factors among 2,306 respondents. Situational optimism was replaced with a measure of respondents’ satisfaction with collective conservation goal progress. ERI-score model included the effort-reward imbalance score but excluded the individual instrument items, while the ERI-item model included these items but excluded the score. Continuous variables were scaled and centred. ‘Unknown’ response levels are not shown.

10.6.9. Appendix: Impacts of age

Age was excluded from the primary analysis because of its strong association with years' experience in conservation. To explore the sensitivity of our primary result, we substituted the years in conservation variable with age. The results of this analysis were consistent with the primary analysis (Figure 10.31). Furthermore, the primary analysis interprets years in conservation as a proxy for many social, professional, and biological changes throughout the life course. However, we conducted a supplementary analysis that included both years in conservation and age. Both had similar associations with psychological distress, which were approximately half as large as the association observed for years in conservation in the original analysis (Figure 10.32).

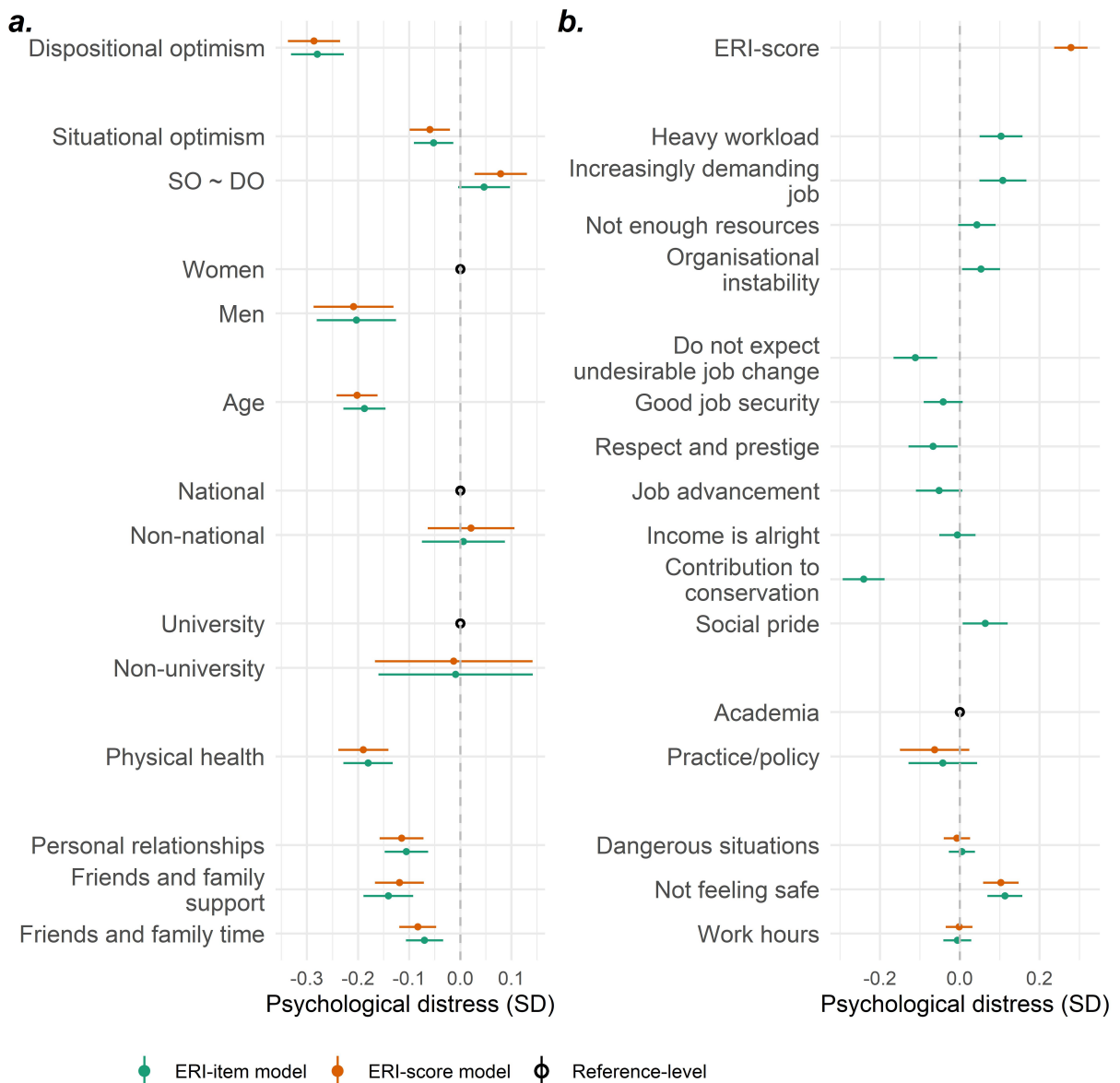


Figure 10.31. The estimated association in standard deviations (SD) between latent psychological distress and personal characteristics and occupational risk factors among 2,306 respondents. Years in conservation was replaced with age. The ERI-score model included the effort-reward imbalance score but excluded the individual instrument items, while the ERI-item model included these items but excluded the score. Continuous variables were scaled and centred. 'Unknown' response levels are not shown.

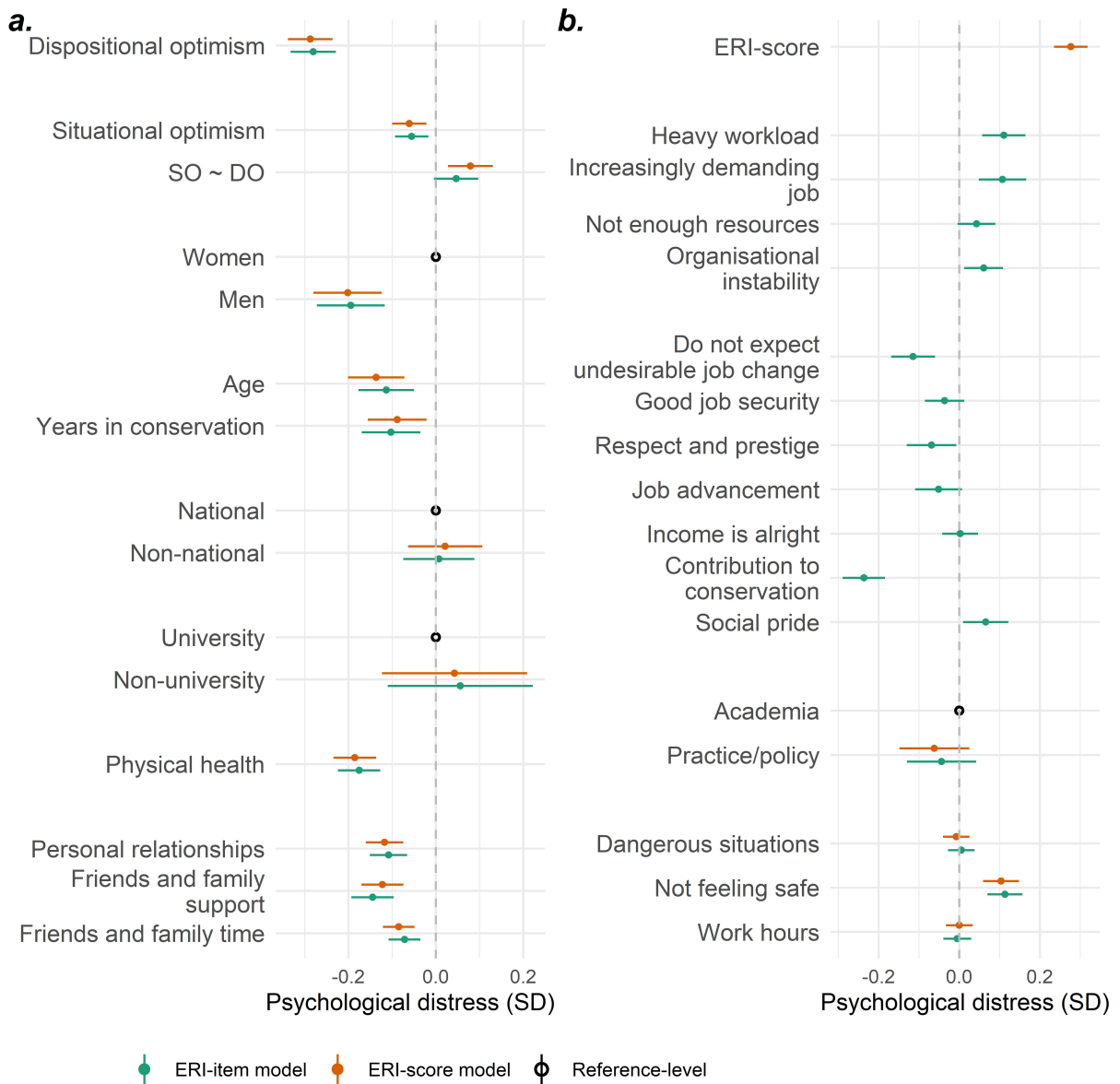


Figure 10.32. The estimated association in standard deviations (SD) between latent psychological distress and personal characteristics and occupational risk factors among 2,306 respondents. Both age and years in conservation were included in this analysis. The ERI-score model included the effort-reward imbalance score but excluded the individual instrument items, while the ERI-item model included these items but excluded the score. Continuous variables were scaled and centred. 'Unknown' response levels are not shown.

10.6.10. Appendix: Disaggregated by gender

To explore how risk factors for psychological distress varied between men and women, the analysis was repeated disaggregated by gender. The results were broadly consistent between the two analyses (Figure 10.33 and Figure 10.34). However, one notable difference was that women in academia reported higher rates of distress than those in practice. In contrast, there was no significant difference in distress between male academics and practitioners.

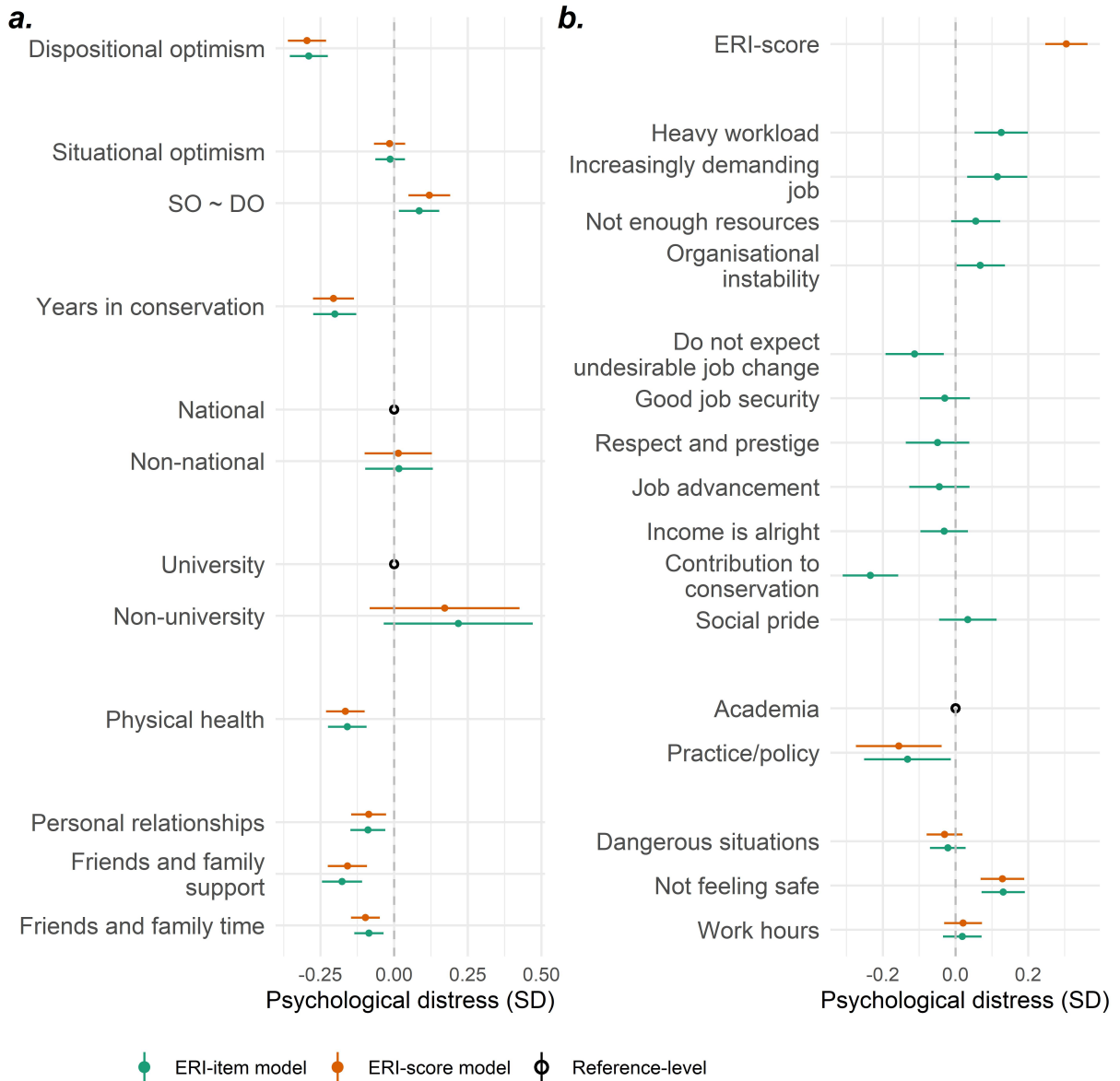


Figure 10.33. The estimated association in standard deviations (SD) between latent psychological distress and personal characteristics and occupational risk factors among 1,208 women respondents. The ERI-score model included the effort-reward imbalance score but excluded the individual instrument items, while the ERI-item model included these items but excluded the score. Continuous variables were scaled and centred. 'Unknown' response levels are not shown.

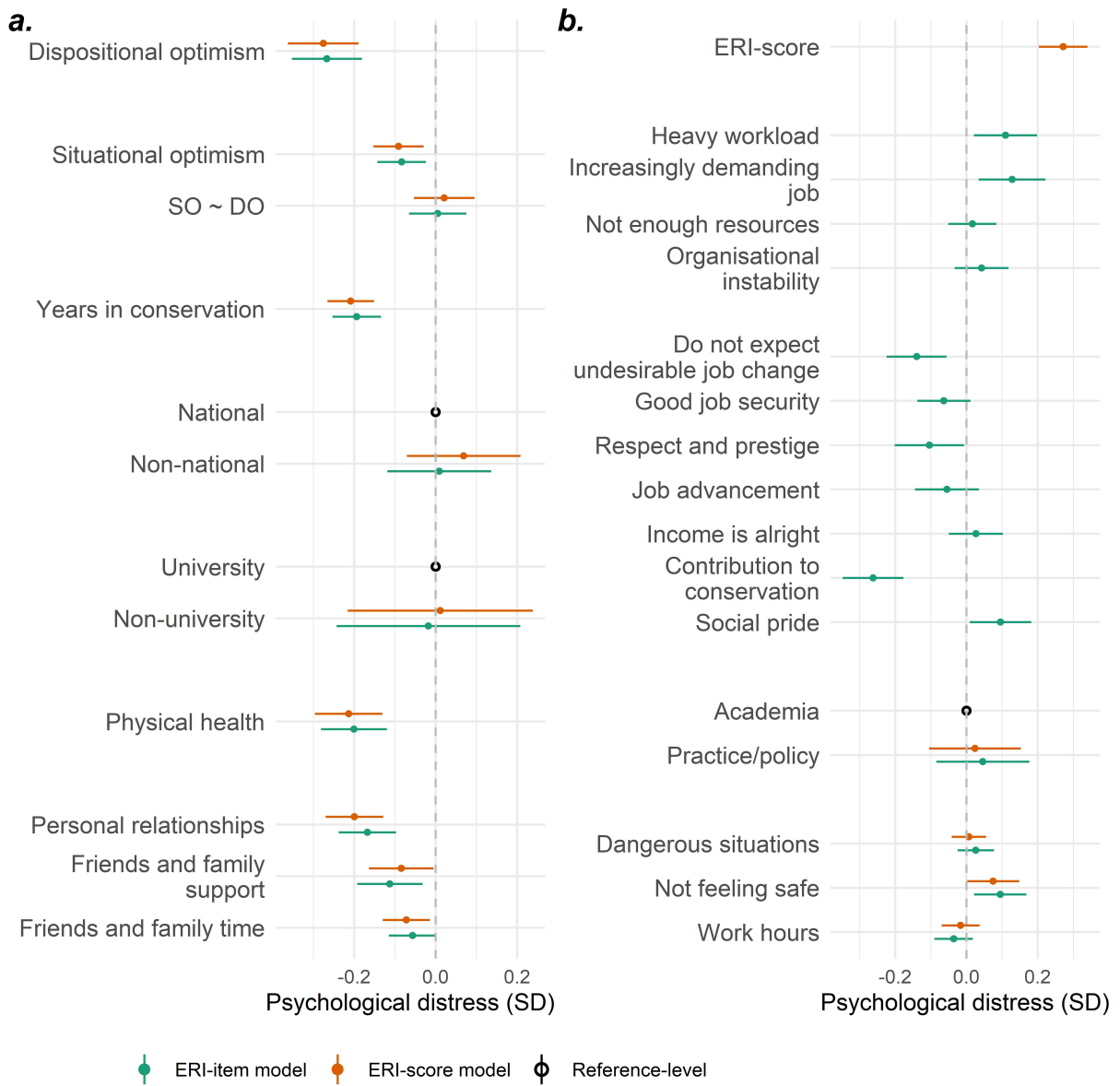


Figure 10.34. The estimated association in standard deviations (SD) between latent psychological distress and personal characteristics and occupational risk factors among 969 men respondents. The ERI-score model included the effort-reward imbalance score but excluded the individual instrument items, while the ERI-item model included these items but excluded the score. Continuous variables were scaled and centred. 'Unknown' response levels are not shown.

10.6.11. Appendix: COVID-19 and psychological distress

The analysis was repeated with the inclusion of a dummy variable corresponding to the period of COVID-19 (coded as 0 for before 1st January 2020 and 1 for after). The results of this additional analysis were consistent with the primary analysis (Figure 10.35). Surprisingly, we found no evidence of an association between the COVID-19 dummy variable and psychological distress. Any number of factors could explain this result, but doing so is outside the scope of our study.

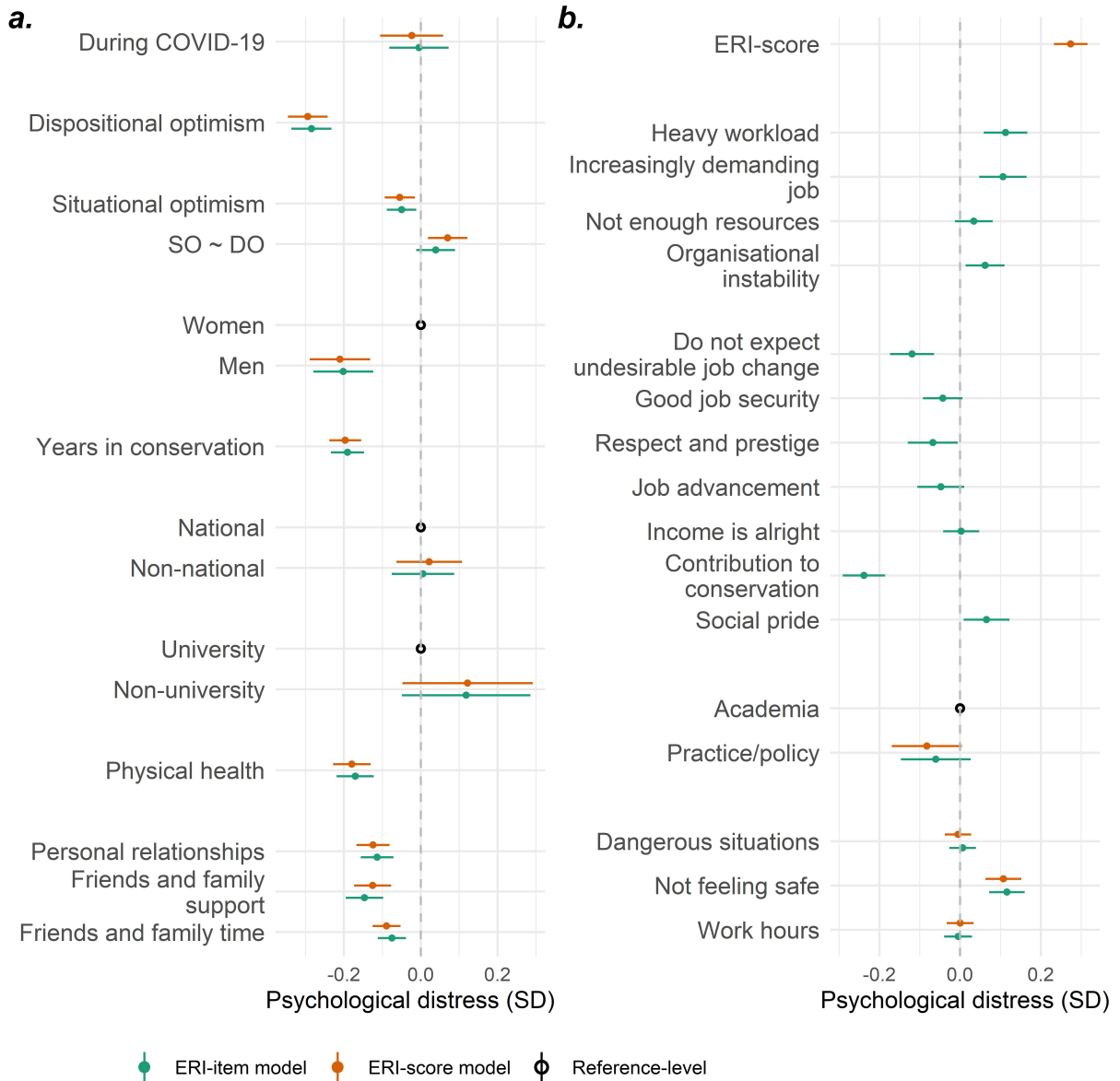


Figure 10.35. The estimated association in standard deviations (SD) between latent psychological distress and personal characteristics and occupational risk factors among 2,306 respondents, within the inclusion of a dummy variable indicating if the participant responded to the survey before (prior to 1st January 2020) or after the start of the COVID-19 pandemic. Continuous variables were scaled and centred. ‘Unknown’ response levels are not shown.

10.6.12. Appendix: Detailed ideas for employers

The following ideas are based on the Thriving at Work report, an independent review of how employers can support employees' mental health (Stevenson & Farmer, 2017). This review drew on the insights from an expert advisory group, workshops with people with lived experience of workplace mental health issues, consultations with over 200 employers and stakeholders, and other activities. The authors encouraged users to tailor the core standards to their context.

We adapted these core standards through interviews and written feedback from a purposeful sample of 20 team leaders and human resource (HR) personnel in 14 conservation organisations. These individuals work internationally (7) or in Central and Southern Asia (5), Sub-Saharan Africa (4), and Eastern and South-Eastern Asia (4). These individuals were selected because they managed people or had HR responsibilities and had broad conservation experience. We asked the interviewees:

1. What aspects of the core standards they agreed with and felt were beneficial?
2. What aspects they disagreed with or would change?
3. How they would put each recommendation into practice?
4. Were there other suggestions or activities they had implemented or considered for supporting staff mental health?

Interviewees were asked to think about desk-based staff, reflecting the profile of our respondents. This feedback was systematically reviewed and used to adapt the core standards.

The options presented in Table 10.12 focus on office-based workers but could be considered alongside advice for supporting other groups, such as rangers or field-based staff. Furthermore, some conservation organisations already take proactive measures to support staff mental health and wellbeing, particularly those that are larger and better resourced. Consequently, our ideas are aimed at those taking the first steps to actively managing staff wellbeing, which may include many smaller or less well-resourced organisations.

Table 10.12. Ideas for employers for supporting staff mental health and wellbeing.

Idea	Description	Considerations and risks
Understand experiences, attitudes, and knowledge among staff.	This option involves exploring the challenges, rewards, experiences, and attitudes around wellbeing and mental health within an organisation. Doing so may help tailor actions to specific needs in an organisation and between groups. Exploring attitudes around mental health and wellbeing might reveal the need for awareness-raising, including around stigma. Furthermore, this step may also involve identifying gaps in knowledge and expertise around mental health, which may be addressed through training and recruitment.	Staff may be hesitant to disclose challenges because of concerns about reprisal. Similarly, some might not be open about their attitudes towards mental health. Furthermore, it may be challenging to create an environment where individuals speak openly.
Produce, implement, and update a wellbeing at work plan.	The plan should outline the steps taken to manage employee wellbeing at work. These steps should be based on an understanding of the experiences of staff in different roles in an organisation. The steps could include awareness-raising, training managers, enhancing positive job aspects, addressing workplace stressors. The plan could be developed after consulting the many free-to-use internet resources in this area (e.g., Business in the Community: Mental health toolkit for employers). It is important that the plan is not just produced but implemented and periodically updated, which may partly depend on the levels of engagement across an organisations hierarchy. Employers might consider co-designing the plan with staff – including allowing different groups and teams to develop measures appropriate for them. Furthermore, discussing the costs (such as sickness absence and staff turnover) and benefits (like engagement and productivity) linked to working conditions might generate senior management buy-in. Senior managers can play a critical role in organisational culture, so they should promote the plan and set an example through their behaviour. In some cases, some awareness-raising might be needed before the plan is developed.	<p>Staff may raise issues during the consultation that are challenging or take time to address. Failing to manage expectations about what the plan can achieve, especially in the short run, could be demotivating and create resentment.</p> <p>Similarly, designing but failing to implement the plan over the long term may waste resources and be demotivating. This point emphasises the importance of senior management buy-in and recognition that implementation is an ongoing process.</p> <p>Plans that are “handed down” from a head office or human resource personnel – rather than designed with staff input – may have limited uptake. Nevertheless, leaders and human resource personnel may play a key role in driving the process.</p> <p>Designing a comprehensive plan is likely to take time, effort, and resources. Small organisations without dedicated human resource personnel may struggle to find the right people to lead this process. In this case, an ad-hoc committee might be tasked with leading the plan. Alternatively, they might identify a ‘champion’ to lead this process. However, these responsibilities should be reflected in work plans (rather than being extra commitments) and be supported by senior management. These individuals may also require additional training (see <i>Promote effective team leadership</i>).</p>

Develop awareness of wellbeing and resources among all staff.

Awareness among supervisors, team leaders, and other employees may help individuals care for themselves and others. Raising awareness of signs of poor mental health and burnout may help individuals and teams take proactive steps to manage these issues. Organisations could dedicate time to discussing mental health and wellbeing, such as during all-staff and team meetings. Employers could also share some of the many free to use internet resources discussing workplace wellbeing and mental health:

- [Mind: Taking care of yourself](#)
- [Mind: Taking care of your staff](#)

Employers could make these resources available on staff intranets or subscribe to an Employee Assistance Program (which can include resources and counselling services).

Encourage open conversations about wellbeing and mental health and the support available.

Staff should be encouraged to talk openly about wellbeing and mental health, where appropriate. These conversations can occur across settings, such as during meetings, when recruiting staff, or in conversation with line managers. A Wellness Action Plan may facilitate conversations between employees and line managers (e.g., [Mind: Guide for line managers](#)). Furthermore, ideas and beliefs about mental health can vary between places and groups. In some contexts, talking about wellbeing might be an entry point for discussing mental health and stigma.

Many factors beyond work and related to individual circumstances can influence someone risk of poor mental health. So, the responsibility to manage mental health is balanced between employers and individuals. Discussions could include raising awareness of this balance of responsibilities and the need for staff engagement.

Developing and implementing a Wellness Action Plan can be a time consuming and in-depth process. So, these might be prioritised for staff who are struggling.

Poorly informed or stigmatising opinions expressed during conversations might be counter-productive. In some contexts, prior awareness-raising and a set of ground rules might be needed. Those leading efforts at an organisation might facilitate these conversations.

Provide good working conditions – ‘promoting the positives’.

Good working conditions can include ‘promoting the positives’. This promotion may include recognising and celebrating successes (particularly at a team level) and fostering social support between colleagues (such as through group tea breaks and activities). In addition, employers might examine employees’ motivations and positive work experiences in order to enhance them. For instance, many are motivated to work in conservation because they enjoy spending time in nature (Papworth et al., 2018). Furthermore, exercise in nature can support good mental health (Barton & Pretty, 2010). So, staff might be provided with opportunities to do outdoor activities, like hiking.

Providing benefits is not a substitute for meeting legal requirements around working conditions. Promoting the positives should go hand-in-hand with removing risks.

Some actions might be relatively cheap, such as set times for group coffee breaks or highlighting successes. Others might be more time consuming and costly, such as providing private medical insurance or subscribing to an Employee Assistance Program. As such, some means of ‘promoting the positive’ might not be feasible for small or poorly resourced organisations.

Focusing only on celebrating successes may create a culture that deters sharing failures, uncertainties, and criticisms. Doing so

	<p>Organisations might consider making public commitments to supporting mental health, such as signing the Mindful Employer Charter (giving access to resources and training). They may also consider providing private medical insurance or subscribing to an Employee Assistance Program.</p>	<p>may limit opportunities to learn from failure and address problems (Catalano et al., 2018). Consequently, celebrating successes could occur within an action learning cycle that also recognises and learns from issues.</p>
<p>Provide good working conditions – removing the risks.</p>	<p>Good working conditions can also include removing workplace risks to wellbeing. Our results suggest that excessive workload, high job demand, job instability, organisational instability, and an overall imbalance of efforts and rewards can be distressing. Employers might also consider other risk factors around emotional demand, job control, health and safety, pay, issues of discrimination and bullying, and career progression (Duchaine et al., 2020; van der Molen et al., 2020). In addition, employers should meet minimum legal requirements, which vary between countries and roles). In the United Kingdom, these include:</p> <ul style="list-style-type: none"> • Fulfilling duty of care responsibilities (including health and safety in the workplace). • Paying minimum wage (but aspiring to pay a living wage). • Providing statutory holiday, sick, maternity and other pay (where eligible). • Not mandating employees work more than 48 hours a week (unless they opt to do so). • Protecting against discrimination. • Protecting those who report wrongdoing in the workplace. 	<p>Some risk factors, such as those linked to work-life balance, might be reasonably feasible to address. For example, organisations might adopt rules around emailing outside office hours or move towards flexible working patterns. However, other challenges, such as job and organisational insecurity, might be outside an employer’s immediate control. These intractable challenges suggest the need to manage staff expectations – perhaps during the planning phase – for what challenges are likely to remain. It also highlights the need for other actors, such as funders, to create structural changes to support wellbeing in the sector.</p>
<p>Promote effective team leadership.</p>	<p>While the emphasis should be on removing workplace risk factors, some staff might also benefit from resources to help build resilience (e.g., Mind: How to manage stress).</p> <p>Good team leadership may support employee wellbeing at multiple levels. Good leadership can help ‘promote the positives’ (such as fostering collegial support) and removing risks (like managing team workloads). Team leaders can also be trained to identify signs of burnout and poor mental health and make adjustments or provide resources to those who are struggling. Employers might improve team</p>	<p>Reviewing internet resources and training may have limited effectiveness unless leaders are rewarded for supporting team wellbeing. This reward could include recognising good practices during performance reviews.</p>

Routinely monitor employee mental health and wellbeing.

leadership by recruiting those with appropriate management skills. Alternatively, employers might arrange formal training (e.g., [Mindful Employer Charter](#)) or encourage, create time, and expect leaders to review internet resources (e.g., [CIPD: Factsheets A – Z](#), [Mind: Taking care of your staff](#), [Mind: Guide for line managers](#)).

Many employers monitor sickness absence, which can help identify those who may be struggling. This monitoring could be combined with informal monitoring by team leaders trained to spot signs of burnout and poor mental health. This monitoring may help identify individuals needing support. Moreover, it might reveal workplace stressors that should be addressed.

Training may not be feasible for small, inadequately resourced organisations or where teams are isolated. In these cases, team leaders might be supported and expected to review free to use internet resources.

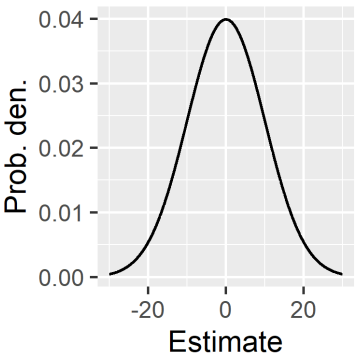
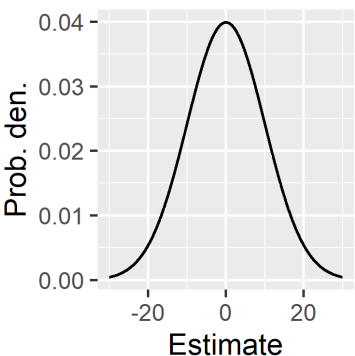
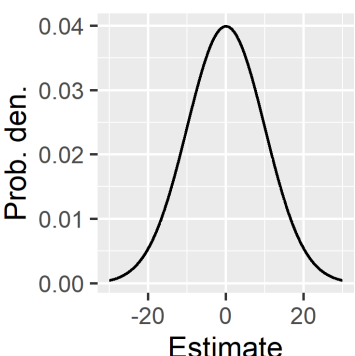
These data are sensitive, so they should be handled by dedicated human resource personnel. Organisations without such personnel should consider the risks of collecting these data, who would access them, and why. In particular, there may be risks that data are used to discriminate against staff. In some cases, organisations may decide against adopting this option.

Sickness absence data alone will not indicate presentism, a significant burden for individuals and organisations.

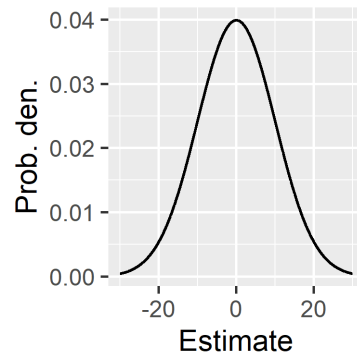
10.7. Chapter 7 Appendixes

10.7.1. Appendix: A priori hypothesised linkages position nature and distress

Table 10.13. Details of the a priori hypothesised associations between exposure and outcome variables in the Bayesian structural equation model. The black curve represents the prior probability distribution, the blue line represents the coefficient estimate, and the shaded area represents the 95% confidence intervals from the analysis in Chapter 6.

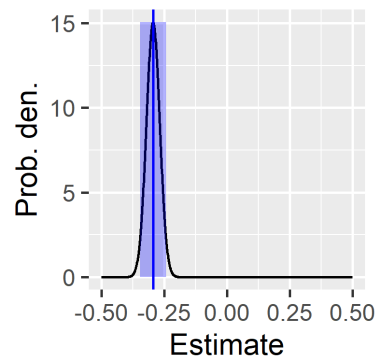
Outcome	Exposure	Prior plot	Prior evidence
Effort-reward score	Position		A diffuse prior was used as we had no prior information.
Social support (composite)	Position		A diffuse prior was used as we had no prior information.
Dangerous situations	Position		A diffuse prior was used as we had no prior information.

Distress Position



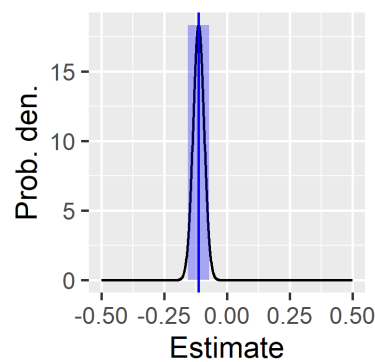
A diffuse prior was used as we had no prior information.

Distress Effort-reward score



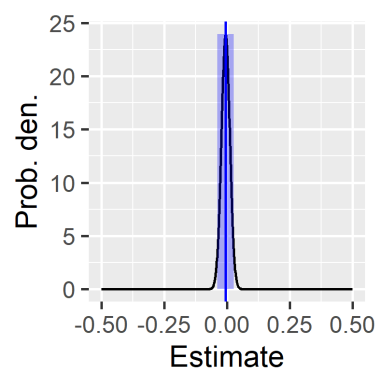
Informative priors were derived from the companion study.

Distress Social support (composite)



Informative priors were derived from the companion study. This companion study included three separate variables describing social support. However, we constructed a fixed composite variable (as described in the main text) using the three corresponding items. The prior was then calculated by taking the mean coefficient estimates and standard errors across the three social support variables in the previous study.

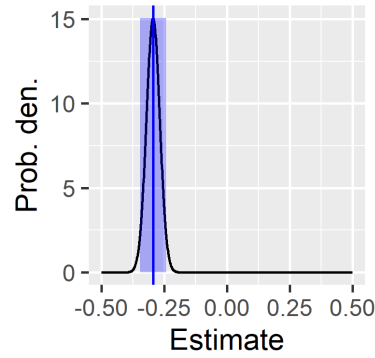
Distress Dangerous situations



Informative priors were derived from the companion study.

Distress

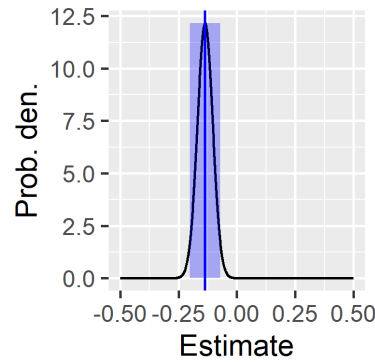
Dispositional optimism



Informative priors were derived from the companion study.

Distress

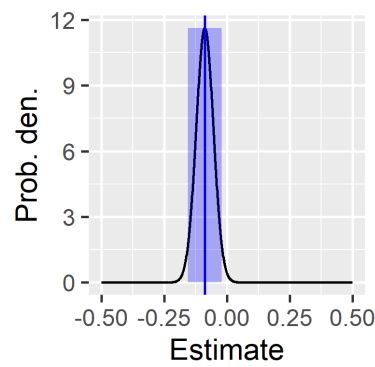
Age



Informative priors were derived from the companion study. Only years in conservation were included in the companion study's primary analysis, as this co-varied with age. However, a supplementary analysis included both age and years in conservation in the same model. Therefore, we derived the priors from this supplementary analysis.

Distress

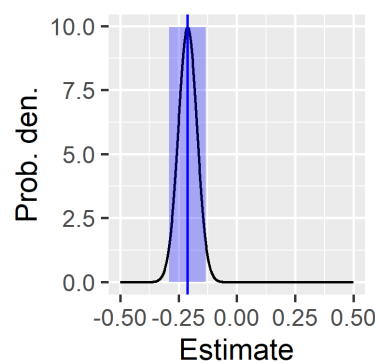
Years in conservation



See the above row.

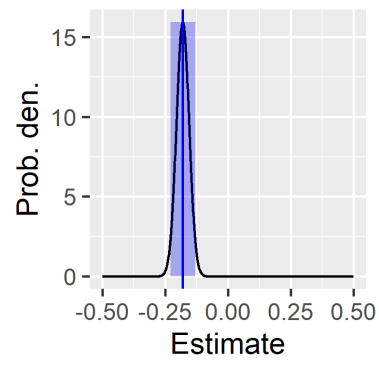
Distress

Gender



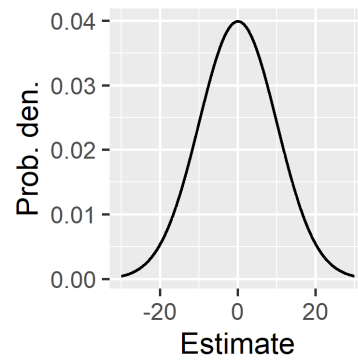
Informative priors were derived from the companion study.

Distress Physical health



Informative priors were derived from the companion study.

Distress Organisation



A diffuse prior was used as we had no prior information.

10.7.2. Appendix: Original effort-reward imbalance instrument

The primary analysis used an adapted version of the effort-reward imbalance instrument, adding five additional items specific to conservation. We repeated the analysis with the original effort-reward imbalance instrument to contrast the results (Figure 10.36).

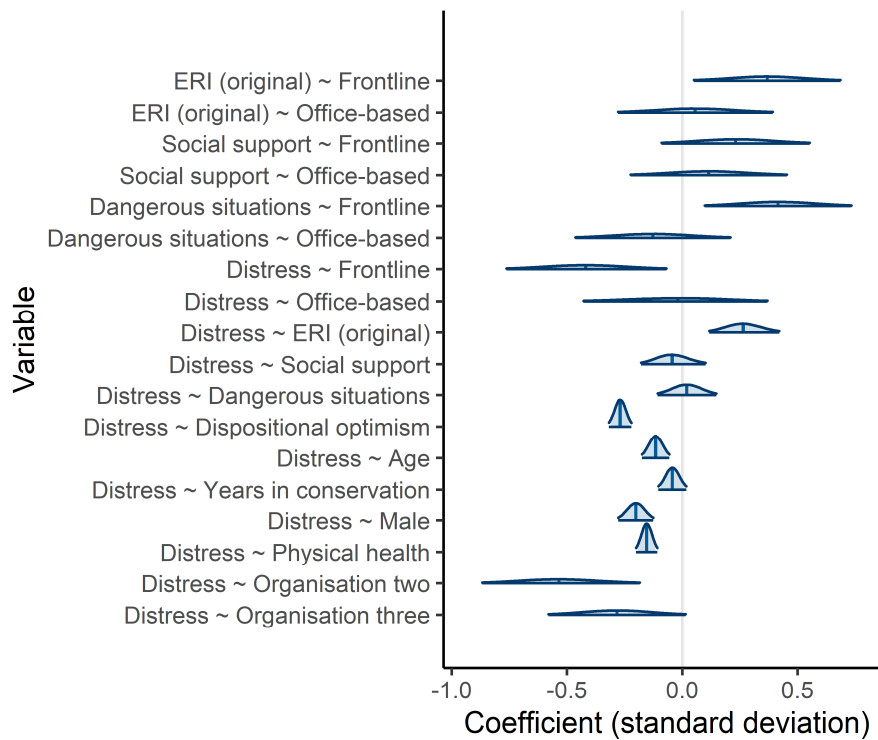


Figure 10.36. The coefficient estimates from the Bayesian structural equation model using data from 278 respondents (two respondents were excluded because they did not provide sufficient data to calculate the original effort-reward imbalance scores). Vertical blue lines represent point estimates (median of the posterior distribution), and curves represent the 95% credibility interval. Coefficient estimates are presented in standard deviations. Estimates associated with “unknown” response levels are not shown.

10.7.3. Appendix: Patterns of missing data (Chapter 7)

Approximately 1.5% of the values used in the analysis were missing (Figure 10.37). Most of these missing values were where respondents did not wish to disclose their age or years in conservation. We believed this to be because respondents were concerned that these data could be triangulated to identify individuals rather than being related to the outcome variable. Therefore, we assumed these data to be missing at random.

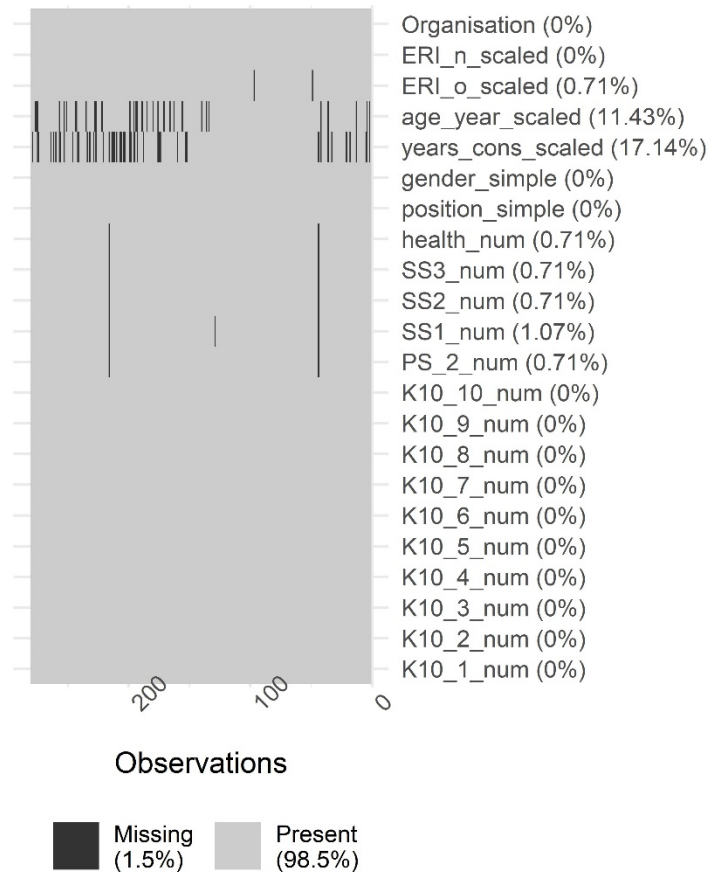


Figure 10.37. Patterns of missing data for the variables used in the analysis.

10.7.4. Appendix: WAMBS-Checklist (Chapter 7)

The Bayesian analysis was evaluated following the ten steps described in the WAMBS-Checklist (Depaoli & Van de Schoot, 2017).

- “*Do you understand the priors?*”: TP discussed the priors with AK and EJMG.
- “*Does the trace-plot exhibit convergence?*”: The trace plots, potential scale reduction factor from the Gelman-Rubin Diagnostic, and the Geweke Diagnostic for the model run with the first of the ten imputed datasets were inspected. These diagnostics suggested the models had converged, with equality between the first and second half of the iterations.
- “*Does convergence remain after doubling the number of iterations?*”: The number of pre- and post-burn-in iterations were doubled to 10,000 each (20,000 in total), and trace plots, potential scale reduction factor, and Geweke Diagnostic were re-examined. These results suggested that local convergence was not an issue.
- “*Does the histogram have enough information?*”: The histograms of estimates were inspected, and there appeared to be sufficient information to approximate the posterior, with a single clear peak and sloping sides for each parameter.
- “*Do the chains exhibit a strong degree of autocorrelation?*”: A small amount of autocorrelation was found, but it was not accompanied by convergence issues.
- “*Does the posterior distribution make substantive sense?*”: The posterior distributions were consistent with the hypotheses with plausible means and spreads.
- “*Do different specifications of the multivariate variance priors influence the results?*”: The model was re-run with a multivariate variance prior of $\text{gamma}(1, 0.05)$, which had nominal effects on the results.
- “*Is there a notable effect of the prior when compared with noninformative priors?*” The use of diffuse priors substantially altered some results (Figure 10.38). The consequences of this are discussed in the main text.
- “*Are the results stable from a sensitivity analysis?*”: The analysis was repeated twice, first increasing then decreasing the mean of the normally distributed priors by 0.2. These models suggested the results were sensitive to the choice of priors, as expected when using informative priors with a small sample size.
- “*Is the Bayesian way of interpreting and reporting model results used?*”: We presented the median, 95% and 89% equal-tailed credibility intervals of the posterior distribution.

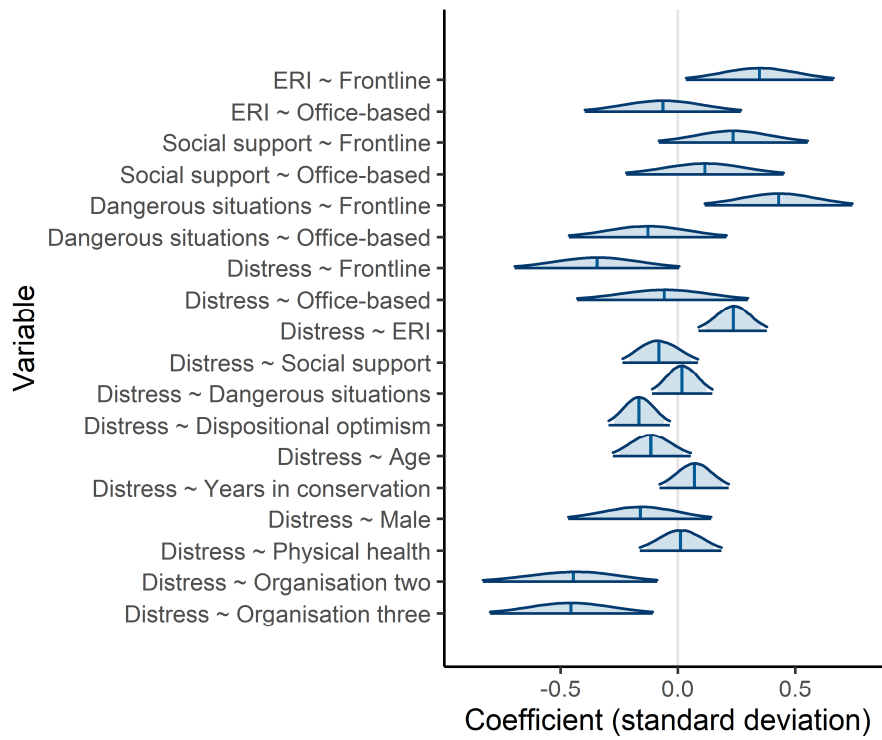


Figure 10.38. The coefficient estimates from the Bayesian structural equation fitted with the software’s default diffuse priors using data from 280 respondents. Vertical blue lines represent point estimates (median of the posterior distribution), and curves represent the 95% credibility interval (quantiles). Coefficient estimates are presented in standard deviations. Estimates associated with “*unknown*” response levels are not shown.

10.8. Chapter 8 Appendixes

10.8.1. Appendix: Goal progress, optimism, and distress

This supplementary analysis corresponded to , using 2,306 responses to the internet survey (described in chapters 4 to 6). A structural equation model was implemented with each of the ten imputed datasets from Chapter 6, using the robust weighted least squares estimator and polychoric correlation. The estimates and variances from these models were pooled following Rubin's Rules, and coefficient estimates were presented in standardised units (Rubin, 1987) (Table 10.14).

Table 10.14. Supplementary structural equation modelling analysis linking goal progress satisfaction, situational optimism, and psychological distress controlling for demographic characteristics among 2,306 conservationists.

Response	Explanatory	Standardised coefficient	95% Confidence interval
Collective goal progress satisfaction (GPS)	Dispositional optimism (DO)	0.06	0.02 - 0.10
Situational optimism (SO)	DO	0.10	0.05 - 0.15
SO	GPS	0.40	0.36 - 0.45
Psychological distress	DO	-0.35	-0.29 to -0.40
Psychological distress	GPS	-0.05	-0.01 to -0.09
Psychological distress	SO	-0.08	-0.03 to -0.13
Psychological distress	Years in conservation	-0.2	-0.15 to -0.24
Psychological distress	Male	-0.25	-0.17 to -0.33
Psychological distress	Physical health	-0.22	-0.17 to -0.27
Psychological distress	Personal relationships	-0.15	-0.10 to -0.19
Psychological distress	Friends and family support	-0.18	-0.13 to -0.23
Psychological distress	Friends and family time	-0.15	-0.11 to -0.18