

The use, and usefulness, of spatial conservation prioritizations

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Abstract

Spatial conservation prioritization is used globally to guide decision making with the aim of delivering the best conservation gain per unit investment. However, despite many publications on the topic, the extent to which this approach is used by decision makers has been unclear. To investigate the degree to which prioritization has been adopted by practitioners to guide conservation implementation, we conducted an online survey, collecting data on the approaches used to develop prioritizations and the reported extent of translation to on-the-ground action. Using a cluster analysis, we identified two categories of prioritizations, those developed to advance the field (42% of responses) and those intended for implementation (58% of responses). Respondents reported 74% of the prioritizations intended for implementation had translated to on-the-ground action. Additionally, we identified strong collaboration between academics and practitioners in prioritization development, suggesting a bridging of the theory-practice gap. We recommend continued collaboration and research into the effectiveness of prioritizations in delivering conservation impacts.

KEYWORDS

decision making, land use planning, marine spatial planning, marxan, research-implementation gap, science-policy interface, systematic conservation planning

1 | INTRODUCTION

Threats to biodiversity are a global challenge (Venter et al., 2016). Organizations seeking to protect biodiversity inevitably make difficult trade-offs in deciding where to concentrate their efforts (Margules & Pressey, 2000). Experts can provide useful guidance to decision makers but there are limitations in their ability to address complex spatial optimization problems (Cowling et al., 2003; Martin et al., 2012). As a result, spatial conservation prioritization (hereafter referred to

as prioritization) has emerged to address this challenge. Prioritization is defined as the “biogeographic-economic activity of identifying important areas for biodiversity; where, when and how we might efficiently achieve conservation goals” (Kukkala & Moilanen, 2013).

Prioritization is often contained within a larger systematic conservation planning (SCP) process, which uses one or more operational models to design and translate prioritizations to on-the-ground conservation action (Groves & Game, 2015; Kukkala & Moilanen, 2013). Central among the

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recommendations made by these models and the supporting literature are the involvement of stakeholders in the development process, identification, and collaboration with end users early in the process and the delivery of final products in a user-useful format, such as by producing supporting documents (Jumin et al., 2017; Knight, Cowling, Boshoff, Wilson, & Pierce, 2011; Pierce et al., 2005; Theobald et al., 2000). These approaches help deliver conservation outcomes through improving stakeholder buy-in, increasing trust, and improving communication (Bottrill, Mills, Pressey, Game, & Groves, 2012; Knight et al., 2006; Pierce et al., 2005).

Prioritization has received considerable investment, reflected in academic publications, software development, and legislation (Cullen, 2013; Kukkala & Moilanen, 2013; McIntosh, Grenyer, Pressey, Lloyd, & Smith, 2017). However, it is unclear how widespread development and implementation of prioritizations has been, and consequently, what return this investment has yielded. A decade ago, Knight et al. (2008) found that only 5.7% of prioritizations in the peer-reviewed literature “documented the implementation of actions that promoted nature conservation on-the-ground”, suggesting that prioritizations may be subject to the “implementation gap” (Cook, Mascia, Schwartz, Possingham, & Fuller, 2013; McNie, 2007; Milner-Gulland et al., 2009; Sutherland & Pullin, 2007). To determine the extent to which this gap still exists, this article examines both the peer-reviewed and “gray” literatures to identify global distribution of prioritization use, the extent to which the recommendations of the literature for collaborative cocreation are being followed, and whether prioritizations are translating to on-the-ground implementation of conservation actions.

2 | METHODS

2.1 | Recruitment of authors of spatial conservation prioritizations

We distributed an online survey targeting individuals who had conducted a prioritization activity. Potential respondents were identified through a literature review and a snowballing technique. We used a keyword search in ISI Thompsons Web of Science for papers containing prioritizations (Supporting Information, Literature Search Protocol). The search returned 15,588 papers that were refined by reading article titles or abstracts, or the body of the article, and assessing whether an article detailed a prioritization. We applied six criteria to identify papers containing prioritizations (Table SA). The literature search returned 645 articles. Email addresses for lead authors were extracted from Web of Science. As email addresses were infrequently provided for authors before 2003, only papers published after 31/12/2002 were included. Lead authors were invited by email to participate in the

survey. Of the 587 author email addresses, 79 produced failure notifications, although the actual number of defunct email addresses is likely higher.

We used a snowball approach to recruit respondents who had not published their prioritizations in the peer-reviewed literature. Sixty-eight experts, identified by publication records or reputations, were invited via email to identify individuals who had developed nonpeer-reviewed prioritizations. Potential respondents were contacted by email and asked to suggest other potential respondents. This process was repeated until no further authors were identified, allowing 161 additional authors to be contacted. Before starting the survey, respondents were presented with a detailed explanation of the purpose and aims of the research. The identities of respondents have been kept confidential.

2.2 | Survey design

Questionnaire design was informed by the prioritization literature; questions were designed to identify whether findings from previous research were representative of prioritization usage more broadly. Respondents were asked questions about four main elements:

1. The respondent: which type of organization did they work for?
2. The development process: was the process computer- or expert-driven, who was involved, what data were used?
3. The intentions: what was the primary aim of the prioritization, was it intended to translate to on-the-ground implementation, were specific outcomes intended?
4. The consequences: was a conservation intervention attempted on-the-ground, were impacts achieved, and was a peer-reviewed publication produced?

An online software, Qualtrics®, was used to host the questionnaire. Table 1 illustrates the questions addressed in the questionnaire, response options are available in the Supporting Information (Tables S1–S14). A metric for the extent to which prioritizations were collaborative was calculated by multiplying the number of stakeholder groups “Strongly involved” in development by two and the number “consulted” by one, and summing the result. Where potential respondents had developed multiple prioritizations, they were asked to report on the most recent one to limit the potential for personal biases. Because of the bias toward recent prioritizations this introduced, temporal trends could not be assessed.

2.3 | Cluster analysis

To identify groups in the data, we used a cluster analysis, a technique that separates data into clusters sharing similar

TABLE 1 The questions addressed in the questionnaire, the responses that were used as predictor variables in the cluster analysis or as comparison variables in order to contrast clusters. Response options are detailed in Table S15

Cluster input variable	Results
Was the prioritization undertaken to achieve any specific outcomes?	Table S1
Was the prioritization intended to translate to specific implementation?	Table S1
Was the prioritization designed to comply with any laws	Table S2
To what extent was an end user identified and involved?	Table S2
To what extent were NGOs involved	Table S3
To what extent was government involved	Table S3
To what extent were academics involved	Table S3
Collaboration metric	Table S4
What was the single most important intended outcome?	Table S5
Which of the following best describes your process?	Table S6
Did you produce a peer-reviewed article?	Table S7
Comparison variable	Results
Has a conservation intervention been attempted on the ground at the priority areas identified by this prioritization as a direct result of the prioritization?	Table S8
What data did you use in the prioritization?	Table S9
What products did you produce?	Table S10
Would you say that overall the prioritization was effective in achieving its goals?	Tables S11 and S14
What software was used?	Table S12
Why was the area selected?	Table S13

characteristics. We used two-step clustering in IBM SPSS software with a log-likelihood distance measure as the data consisted of both ordinal and categorical variables and the number of groups was not known *a priori*. Two-step clustering is a data-driven approach and uses a preclustering method followed by a hierarchical aggregative procedure (Norusis, 2011). Schwarz's Bayesian criterion was used to determine cluster number (Supporting Information page 26) (Barabba, 1990; Schwarz, 1978). Prioritizations were clustered based on key variables that indicated the intended purpose and the approach used in the development of the prioritization (Table 1). Variables that were unlikely to be key determinants of implementation, yet which pertained to development approach, and purpose were used to compare and contrast between clusters (Table 1). These variables were determined

through discussion between the authors based on the recommendations of the literature.

The silhouette coefficient (Supporting Information page 26), a measure of both cohesion (i.e., how similar elements are within clusters) and separation (how different elements are between clusters) was used to assess the goodness of fit of the cluster solution. For categorical and ordinal input variables, the percentage of cases in each of the modal categories was used to interpret the clustering.

3 | RESULTS

We secured 161 responses in total, of which 107 were obtained from authors of papers published in the peer-reviewed literature, a 21% response rate that represents 17% of the total literature identified. Of those that began the survey, 96% completed it. No respondent completed multiple questionnaires. Responses were biased toward peer-reviewed prioritizations; 80% of reported prioritizations had been published in the peer-reviewed literature. Respondents worked for universities (51%), governments (23%) and conservation NGOs (16%). Prioritizations were most frequently developed for areas within the United States (24%), Australia (10%), Canada (5%), and South Africa (5%) (Figure 1). Overall, 47 separate countries were represented in addition to nine multinational prioritizations. Development of prioritizations was most often led by universities (36%), governments (34%), and conservation NGOs (22%). Reported prioritizations covered terrestrial (57%), marine (16%), freshwater (16%), and coastal (11%) realms; 26% reported covering multiple realms.

3.1 | Prioritization developers, methods, and goals

Schwarz Bayesian criterion produced a two cluster solution determined by the highest ratio of distance (Table S16), with a silhouette coefficient of 0.2 (results between 0.2 and 0.5 are considered a fair solution [Norusis, 2011]). Responses were split: 69 (42%) were allocated to Cluster 1 and 96 (58%) to Cluster 2. The most important variable for determining cluster membership was whether the prioritization was intended to translate to specific implementation (Table 2). The extent of collaboration, identification, and collaboration with an end user and the involvement of NGOs and governments were also important in determining cluster membership. The involvement of academics had a negligible effect on cluster membership. Both included examples from all seven continents; Cluster 1 included plans from 26 countries and seven multinational regions (e.g., sub-Saharan Africa) and Cluster 2 included plans from 39 countries and two multinational regions.

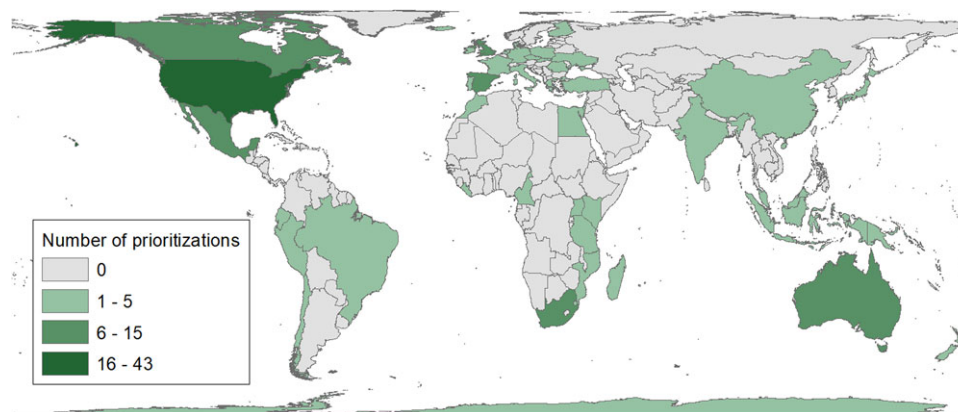


FIGURE 1 The global distribution of spatial conservation prioritizations surveyed in this research

TABLE 2 The relative importance of cluster input variables in predicting cluster membership as determined by the two-step cluster analysis, where importance is scored between 1 (most important) and 0 (least important)

Cluster input variable	Predictor Importance
Was the prioritization was intended to translate to specific implementation?	1
To what extent was an end user identified and involved?	0.87
Collaboration metric	0.83
To what extent were NGOs involved	0.7
To what extent was government involved	0.69
Did you produce a peer-reviewed article?	0.4
Was the prioritization designed to comply with any laws	0.32
Which of the following best describes your process?	0.26
What was the single most important intended outcome?	0.24
Was the prioritization undertaken to achieve any specific outcomes?	0.24
To what extent were academics involved	0.06

3.2 | Characteristics of cluster 1: advancement focused prioritizations

These prioritizations were intended to translate to specific implementation actions in 24% of cases (Table S1). They were less collaboratively developed than those in Cluster 2 with an average collaboration metric of 3 and end users (such as government or conservation NGOs) were infrequently identified

(29%) or involved in development (9%) (Tables S2 and S4). All prioritizations in this cluster were published in peer-reviewed journals. These prioritizations were rarely created to comply with laws (13%) (Table S2) and were more frequently developed using computer-based (70%) rather than expert processes (Table S6). Respondents reported that over half (55%) were intended to lead to specific outcomes with the majority intending to improve prioritization techniques (45%) or to contribute to creating a more effective protected area network (35%) (Tables S1 and S5). Academics were strongly involved in 76% of cases.

These prioritizations were reported to have led to on-the-ground implementation or were in the process of being implemented in 21% of instances (Table S8) and 57% of respondents reported that they considered that their prioritization was either “somewhat effective” or “very effective” in achieving its goals (2008). The outputs of these prioritizations were largely electronic maps (78%) and peer-reviewed publications (100%), hard copy maps (41%), and reports (42%) (Table S10). They were developed using multiple types of software but most frequently GIS (49%) and Marxan, a spatial prioritization software package (25%) (Ball & Possingham, 2000) and they used on average four distinct categories of data (Tables S9 and S12). The study area for the prioritizations was predominantly chosen due to threats to the study area (52%), because the data already existed (51%) and because of the presence of target species (50%) and important ecosystems (49%) (Table S13).

3.3 | Characteristics of cluster 2: implementation focused prioritizations

These prioritizations were predominantly intended to lead to specific on-the-ground implementation (87%) and end users were frequently identified and involved in the development process (74%) (Tables S1 and S2). They were more collaborative than Cluster 1 with an average collaboration metric of 8, involving NGOs (59%), academics (69%), and

governments (71%) (Tables S3 and S4). They were published as peer-reviewed articles in 63% of instances (Table S7). They were often developed to comply with laws (51%), and used approaches that were more frequently either expert-driven or a mix of computer- and expert-driven than those in Cluster 1 (55%) (Tables S2 and S6). They were frequently intended to deliver specific outcomes (85%), most frequently improved protected area networks (37%), or incorporation of biodiversity into government processes (26%) (Tables S1 and S5).

Respondents reported that these prioritizations frequently led to on-the-ground implementation or were in the process of being implemented (74%) (Table S8). Three-quarters of respondents reported that they considered that their prioritization was either “somewhat effective” or “very effective” in achieving its goals (Table S11). Prioritizations in this cluster were associated with multiple outputs; respondents reported producing electronic maps (96%), usage guidelines (70%), policy briefings (57%), media articles (55%), and reports (83%) (Table S10). Data pertaining to implementation were used more frequently in Cluster 2 than in Cluster 1; cost of implementation (33%), land use (82%), and threat data (78%) were more frequently used (Table S9). They were most frequently developed using GIS (60%) and Marxan (34%) and used on average six distinct categories of data (Tables S9 and S12). Study areas were selected for multiple reasons, predominantly the presence of important ecosystems (68%), target species (57%), threats to the area (58%), and/or because it was the area in which the prioritization developer already worked (61%) (Table S13).

4 | DISCUSSION

Our results segregate prioritizations into two clear clusters. Cluster 1, the advancement cluster, comprises prioritizations developed by academics predominantly without intention to be translated into action but rather to deliver technical advances. Cluster 2, the implementation cluster, comprised prioritizations that were predominantly intended to lead to on-the-ground implementation.

While it can be argued that prioritizations are inherently intended to lead to action (Knight et al., 2008), those in the advancement cluster were only intending to do so in a quarter of instances. Instead, their primary aims were to “improve prioritization techniques” or to “contribute to more effective protected area networks.” These tools were also developed less collaboratively and were more focused on computer-driven than expert-driven approaches, as would be expected if the primary aim was to deliver technical advances. Interestingly, respondents stating that their approaches were entirely computer-driven did not appear to consider their efforts in developing the prioritization to be an expert contribution.

Those that intended to contribute to scientific debate and deliver technical advances potentially achieved their objectives, as all prioritizations in this cluster were published in a peer-reviewed journal. Despite being predominantly technical exercises, 21% of these prioritizations were reported to either have translated to on-the-ground implementation or be in the process of being implemented.

Prioritizations in the implementation-focused cluster were predominantly intended to lead to action and to achieve a broader set of goals than those in the advancement cluster, in particular to contribute to “more effective protected area networks” and to “incorporate biodiversity into government processes.” These prioritizations are inherently more practical and are intended more often as political tools than those in the advancement cluster. As a consequence, implementation-focused prioritizations are designed more collaboratively, are associated with supporting products, and routinely identify and involve end users. These collaborative development approaches align with recommendations in the literature, appear to be embedded in larger SCP frameworks, and suggest a clear intent to translate prioritizations into action through engagement of larger sociopolitical processes (Cowling & Pressey, 2003; Jumin et al., 2017; McIntosh et al., 2017; Pierce et al., 2005). Interestingly, in practice, prioritizations are used infrequently for fundraising or improving organizational effectiveness but instead for more effective protected areas and engagement with government decision-making processes, often to address specific legislations. As one respondent put it “Prioritization is not an exact science, but a dialogue that software tools can effectively mediate.”

We are cautious to extrapolate reported implementation to on-the-ground effectiveness. Measuring effectiveness of conservation actions is notoriously challenging and was beyond the scope of this study (Sutherland, Pullin, Dolman, & Knight, 2004). Additionally, it must be highlighted that as these results are self-reported, findings regarding effectiveness should be treated as perceptions and therefore prone to a range of biases. It is important that future research examines these prioritizations and establishes whether the reported on-the-ground implementation is actually contributing toward achieving conservation goals.

Accessing prioritizations outside of the peer-reviewed literature is challenging. There is no single database, there are language barriers, and they are often not disseminated. As a result, the majority of responses we collected were derived from peer-reviewed literature. Additionally, it is likely that a limited number of experts are responsible for multiple prioritizations due to the specialist skills required. As each respondent filled out a single questionnaire, these experts may be underrepresented in this study. Despite these limitations we feel, we have obtained a reasonable sample of available studies for undertaking the cluster analysis. Half of our respondents worked for universities, suggesting that

practitioners were well represented in the results. Including the gray literature also helped us obtain global coverage, receiving responses from 64 countries and nine multinational areas, which was four times higher than the review of peer-reviewed literature between 1980 and 2011 by Kukkala and Moilanen (2013). Our survey is also supported by previous work: the characteristics of the advancement cluster are similar to the findings of a previous survey of the peer-reviewed literature (Knight et al., 2008). Our finding that prioritizations in the advancement cluster were intended to translate to on-the-ground implementation in 24% of instances is similar to Knight et al.'s (2008) finding that 26% "had the objective of implementing some form of action." However, we are able to build on this finding with information from the gray literature, which paints a very different and previously untold story.

There is a commonly perceived gap between conservation academics and practitioners (Cook et al., 2013; McNie, 2007; Sutherland & Pullin, 2007). While prioritizations in the advancement cluster were predominantly driven by the academic community and were less likely to be implemented, our findings suggest that the approaches developed through these methodological advances appear to have been broadly adopted and used in practice to guide implementation. Additionally, we found that academics were frequently directly involved in implementation-focused prioritizations and that the peer-reviewed literature is open to publishing practice-driven research, suggesting that this potential gap is being bridged through collaboration. These findings therefore suggest that the considerable efforts invested in developing prioritization techniques, and the SCP operational models in which they are embedded, have led to the development of globally used tools that are guiding conservation decisions, while also generating novel science.

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REFERENCES

- Ball, I., & Possingham, H. P. (2000). *Marxan (v1.8.2): Marine reserve design using spatially explicit annealing, a manual*. Brisbane: University of Queensland.
- Barabba, V. P. (1990). The market research encyclopedia. *Harvard Business Review*, 68, 105–116.
- Bottrill, M. C., Mills, M., Pressey, R. L., Game, E. T., & Groves, C. (2012). Evaluating perceived benefits of ecoregional assessments. *Conservation Biology*, 26, 851–861.
- Cook, C. N., Mascia, M. B., Schwartz, M. W., Possingham, H. P., & Fuller, R. A. (2013). Achieving conservation science that bridges the knowledge-action boundary. *Conservation Biology*, 27, 669–678.
- Cowling, R., & Pressey, R. (2003). Introduction to systematic conservation planning in the Cape Floristic Region. *Biological Conservation*, 112, 1–13.
- Cowling, R. M., Pressey, R. L., Sims-Castley, R., Le Roux, A., Baard, E., Burgers, C. J., & Palmer, G. (2003). The expert or the algorithm? -Comparison of priority conservation areas in the Cape Floristic Region identified by park managers and reserve selection software. *Biological Conservation*, 112, 147–167.
- Cullen, R. (2013). Biodiversity protection prioritisation: A 25-year review. *Wildlife Research*, 40, 108–116.
- Groves, C. R., & Game, E. T. (2015). *Conservation Planning: Informed Decisions for a Healthier Planet*, p. 608, Roberts and Company Publishers Inc., Colorado, USA. ISBN 978-1-936221-51-6.
- Jumin, R., Binson, A., McGowan, J., Magupin, S., Beger, M., Brown, C., ... Klein, C. (2017). From marxan to management : Ocean zoning with stakeholders for Tun Mustapha Park in Sabah, Malaysia. *Oryx*, 1–12. <https://doi.org/10.1017/S0030605316001514>
- Knight, A. T., Cowling, R. M., Boshoff, A. F., Wilson, S. L., & Pierce, S. M. (2011). Walking in STEP: Lessons for linking spatial prioritizations to implementation strategies. *Biological Conservation*, 144, 202–211.
- Knight, A. T., Cowling, R. M., Rouget, M., Balmford, A., Lombard, A. T., & Campbell, B. M. (2008). Knowing but not doing: Selecting priority conservation areas and the research-implementation gap. *Conservation Biology*, 22, 610–617.
- Knight, A. T., Driver, A., Cowling, R. M., Maze, K., Desmet, P. G., Lombard, A. T., ... Von Hase, A. (2006). Designing systematic conservation assessments that promote effective implementation: Best practice from South Africa. *Conservation Biology*, 20, 739–750.
- Kukkala, A. S., & Moilanen, A. (2013). Core concepts of spatial prioritisation in systematic conservation planning. *Biological Reviews of the Cambridge Philosophical Society*, 88, 443–464.
- Margules, C. R., & Pressey, R. L. (2000). Systematic conservation planning. *Nature*, 405, 243–253.
- Martin, T. G., Burgman, M. A., Fidler, F., Kuhnert, P. M., Low-Choy, S., McBride, M., & Mengersen, K. (2012). Eliciting expert knowledge in conservation science. *Conservation Biology*, 26, 29–38.
- McIntosh, E. J., Grenyer, R., Pressey, R. L., Lloyd, S., & Smith, R. (2017). The impact of systematic conservation planning. *Annual Review of Environment and Resources*, 42, 677–697.
- McNie, E. C. (2007). Reconciling the supply of scientific information with user demands: An analysis of the problem and review of the literature. *Environmental Science & Policy*, 10, 17–38.
- Milner-Gulland, E. J., Fisher, M., Browne, S., Redford, K. H., Spencer, M., & Sutherland, W. J. (2009). Do we need to develop a more relevant conservation literature? *Oryx*, 44, 1.
- Norusis, M. J. (2011). Cluster analysis. In *IBM SPSS statistics 19 statistical procedures companion*. Chapter 16. Upper Saddle River, NJ: Prentice Hall.
- Pierce, S. M., Cowling, R. M., Knight, A. T., Lombard, A. T., Rouget, M., & Wolf, T. (2005). Systematic conservation planning products for land-use planning: Interpretation for implementation. *Biological Conservation*, 125, 441–458.
- Schwarz, G. (1978). Estimating the dimension of a model. *Annals of Statistics*, 6, 461–464.
- Sutherland, W., & Pullin, A. (2007). The great divide. *Nature*, 450, 135–136.

- Sutherland, W. J., Pullin, A. S., Dolman, P. M., & Knight, T. M. (2004). The need for evidence-based conservation. *Trends in Ecology & Evolution*, 19, 305–308.
- Theobald, D. M., Hobbs, N. T., Bearly, T., Zack, J. A., Shenk, T., & Riebsame, W. E. (2000). Incorporating biological information in local land-use decision making for conservation planning. *Landscape Ecology*, 15, 35–45.
- Venter, O., Sanderson, E. W., Magrach, A., Allan, J. R., Beher, J., Jones, K. R., ... Watson, J. E. M. (2016). Sixteen years of change in the global terrestrial human footprint and implications for biodiversity conservation. *Nature Communications*, 7, 1–11.

SUPPORTING INFORMATION

Additional Supporting Information may be found online in the supporting information tab for this article.

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