

1 Maladaptation: When adaptation to climate change goes very wrong

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6 Summary

7 Adapting to climate change is necessary to ensure that the impacts will not overwhelm societies and
8 ecosystems around the world. But planning adaptation is an exercise in uncertainty, and built on
9 imperfect information, many adaptation strategies fail. Some go even further, creating conditions that
10 actually worsen the situation; this is called maladaptation. Aside from wasting time and money,
11 maladaptation is a process through which people become even more vulnerable to climate change. Poor
12 planning is the primary cause of maladaptation, yet the diverse manifestations are complex, and
13 identifying maladaptation in advance with certainty is difficult. Nevertheless, there is now sufficient
14 experience to give an indication of how maladaptation can take place, the contexts that may be more
15 prone to such an outcome, and the design flaws in strategies that need to be avoided. Until adaptation
16 projects directly address the drivers of vulnerability, however, maladaptation will continue to be a risk.

18 Introduction

19 Climate change is an accepted reality with consequences now and in the future. To address climate
20 change, greenhouse gas emissions need to be reduced, but this will not happen rapidly enough to avoid
21 serious and irreversible damages. The Earth has already warmed by 1C above pre-industrial levels, and
22 recent scientific evidence suggests that at the current rate of emissions, warming will hit 1.5C sometime in
23 the next 30 years. The consequences of this warming include more extreme weather events, loss of health
24 and functioning of major ecosystems, and other biophysical changes that have adverse outcomes on
25 human health, livelihoods, food security, water supply, human security, and economic growth. Because
26 these impacts are already being felt, finding ways to adjust societies to the changing climate is necessary.
27 For example, to address unreliable rain and water scarcity, farmers can harvest rainwater, improve the
28 efficiency of their irrigation systems and switch to less water-intense crops. These *adaptation measures* are

29 often things that farmers already have in their arsenal of strategies to deal with the uncertainty and risk of
30 farming, and the adaptation needs may be mainly about know-how or technology. In other sectors,
31 however, it is necessary to identify new approaches, or change processes altogether. Adaptation to climate
32 change has as a result become an entire area of research and practice, and governments around the world
33 have developed adaptation policies, plans and programmes.

34

35 Designing adaptation strategies to ensure changes to the climate do no or only minimal harm may seem
36 straightforward enough. In the worst case, they will be ineffective and a waste of financial resources,
37 right? Actually, no. Poorly designed adaptation strategies can result in *maladaptation*, where exposure and
38 sensitivity to climate change impacts are instead increased as a result of action taken. Maladaptation is
39 thus not just a waste of time and money, it is when an action results in conditions that are worse than
40 those which the original strategies were trying to address. Maladaptation is therefore not being poorly
41 adapted to climate change, it is actually a process whereby people become even more likely to be
42 negatively affected by climate change. Although decision makers and practitioners are aware of the need
43 to avoid maladaptation, historically the science of maladaptation has been generally ineffective when it
44 comes to identifying reliable ways to determine, with certainty, when a specific adaptation strategy is
45 heading down an undesirable route. Today, however, we have sufficient experience, with both
46 development and adaptation projects, to provide at least some indication of scenarios in which
47 maladaptation can take place, the institutional and actor arrangements most susceptible to maladaptation,
48 and strategy design flaws to avoid.

49

50

51 **The challenge of adapting to climate change**

52 Decades of dealing with the impacts of disasters have taught us that while humans have some ability to
53 absorb and recover from extreme weather events, losses and damages can set economic and social
54 development back years – even decades. As a result, there is an acknowledgement that strategic and
55 deliberate measures need to be taken to ensure that human societies can progress despite climate change.
56 With this in mind, human adaptation has been defined as a process involving changes and choices that

57 seek to protect individuals and societies from adverse effects of climate change, to allow them to function
58 and attain well-being under changing climatic conditions. This refers both to experienced climate change,
59 as well as to anticipated future changes. A good example of an adaptation strategy in the case of flooding
60 is from Bangladesh where chickens kept for eggs and meat were replaced with ducks, who, unlike
61 chickens, can swim during floods, since people kept losing their poultry when it would flood. This
62 livestock switch is now in fact becoming common in the low lying flood prone country.

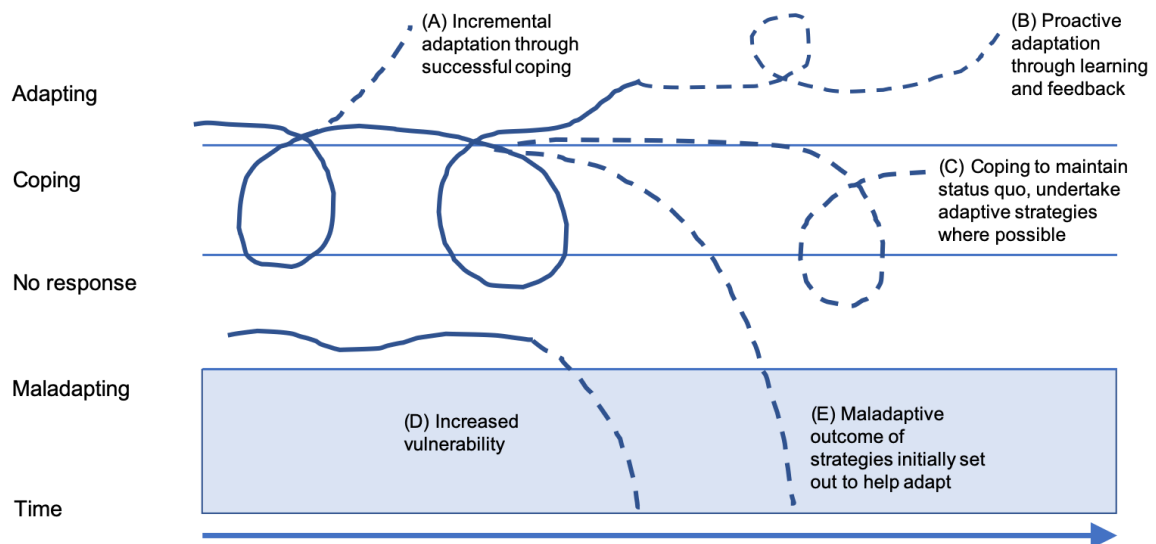
63

64 But there are many uncertain dimensions to climate change that make the outcome of responses to
65 impacts – whether planned deliberately, or actions that develop organically in reaction to the impacts –
66 difficult to predict. For example, if people are relocated from coastal areas to avoid being flooded or
67 affected by storm surges, these hazards will no longer pose a threat; however if they are fishers their
68 coastal access may be constrained, resulting in the inability to keep a protective eye on their boats and
69 fishing equipment, with adverse impacts on incomes and livelihood security. Or if people are given
70 money to rebuild their homes after an extreme storm, they may decide to continue living in the rubble
71 and use the money for other things, like purchasing new livestock or a vehicle.

72

73 The challenge with studying and understanding adaptation is that it is a *process* as much as it is an *outcome*.
74 This is because the climate continues to change, with some known but significantly more unknown
75 consequences for natural and human systems. Further, multiple factors aside from climate influence how
76 effective an adaptation strategy can be, many of which are also changing over time, such as the global
77 economy. As a consequence, if farmers in increasingly dry areas seeking to move away from thirsty cash
78 crops like sugarcane, rice, wheat or cotton that have reliable markets, towards drought tolerant crops such
79 as sorghum and millet, can be a costly and time-consuming investment that may initially hold promise,
80 but potentially fail as a result of market volatility and diet trends. This can be seen in Figure 1, where an
81 adaptive strategy can become maladaptive over time.

82



83

84 Figure 1. A conceptual diagram of adaptation outcomes over time, including maladaptation. Coping
 85 strategies are short-term actions that help people get through a difficult time, usually undertaken with a
 86 belief that the ‘normal’ situation will soon return. Coping strategies are usually high-cost and can become
 87 maladaptive over time if the situation does not improve. The figure describes different outcomes: (A) An
 88 adaptation strategy can start out as a coping strategy focussed on the short term, but then build resilience
 89 incrementally, so that it eventually leads to positive adaptation. (B) An adaptation strategy can go through
 90 incremental stages of effectiveness, but then succeed based on learning. (C) A coping strategy with short-
 91 term implications can be applied several times without allowing people to adapt fully, but also without
 92 making them more vulnerable. (D) No response to a changing climate will eventually lead to increased
 93 vulnerability to climate change, and can be considered maladaptive. (E) Strategies that start out to adapt
 94 or coping can become maladaptive over time.

95 Source: Adapted from Singh et al, 2016

96

97 As a consequence, determining whether a specific adaptation strategy has been effective or is even
 98 whether it has been a complete success is often difficult. Against this backdrop, the discussion on
 99 maladaptation has been unable to draw strict and definitive lines around the process that translates
 100 adaptation into maladaptation. Yet the concept is still important because it speaks to the constant need to
 101 assess human behaviour, expectations and understandings of risk. In addition, maladaptation is a
 102 reminder that managing how humans relate to the environment around them is challenging, and that as a

103 result of imperfect knowledge, choices and decisions can lead to adverse outcomes. But maladaptation
104 matters because it raises awareness of the multitude of different actors who are ‘doing’ adaptation,
105 including both those who are designing and implementing strategies, as well as those who are the
106 supposed beneficiaries of the strategies. It draws our attention to unequal power balances that exist within
107 this system, and the extent to which the factors that determine vulnerability to climate change in the first
108 place continue to be perpetuated through badly designed adaptation strategies, resulting in maladaptation.

109

110 **Maladaptation at one end of a spectrum of responses**

111 Adaptation to environmental change first appeared in the academic literature in the middle of the last
112 century, but only became a subject of study in the context of climate change in the 1990s. It was
113 contained in a small group of scholars, but had a breakthrough when negotiations on the UN climate
114 change convention stalled as countries battled over details around greenhouse gas emissions reduction
115 strategies in the early 2000s. With unclear prospects for stopping climate change, it emerged as a more
116 serious threat to society, and the need to adapt to the impacts it would cause was thrust into the
117 mainstream. Until that point, scientists had mainly taken a theoretical approach to studying adaptation,
118 among other things describing how adaptation could occur through identifying typologies. These
119 differentiated for instance between *planned* adaptation driven by explicit plans, such as zoning for urban
120 development to prevent people from living in floodplains, and *autonomous* adaptation, a more organic
121 response driven by people who were adapting, such as farmers independently switching to different crops
122 in response to drier weather. Other distinctions include temporal and spatial dimensions, including
123 whether a strategy is considered short term or long term, proactive or reactive, or localised or widespread.
124 While the general understanding of adaptation has advanced significantly with a new generation of work
125 on adaptation typologies, the attributes around which they are based continue to be a crucial focus of
126 research. In particular, effectiveness (weighing costs, effort against outcome) and feasibility (financial,
127 institutional, socio-cultural) of adaptation strategies receive significant focus, but this work is still in its
128 infancy. While they are theoretically logical, most of these attributes are difficult to identify on the
129 ground.

130

131 Crucially, maladaptation cannot be understood properly without an explanation of vulnerability to climate
132 change. Vulnerability refers to susceptibility to being harmed by climate change. Vulnerability is not an
133 inherent characteristic that people are born with, but rather a filter that is created by social and cultural
134 norms, physical and ecological contexts, and economic biases. Importantly, there are few blanket
135 statements that can be made about who or what is vulnerable to climate change. For instance, poverty is
136 not always equivalent to vulnerability to climate change, because the poor often have more experience
137 with hardship and therefore have more survival strategies at hand, even though they do not have ability to
138 buy resources or services that would help them avoid being affected by a given weather event. Thus, such
139 broad generalisation is unhelpful as vulnerability can only be fully understood if it is unpacked by looking
140 at the so-called ‘root causes’. These factors run deep and contribute to systemic inequalities often driven
141 by historical power struggles and imbalances. The way society constructs race, ethnicity, poverty, political
142 affiliation and gender can create conditions that mean that a natural hazard can quickly turn into a
143 disastrous event for those who are placed into these categories. To illustrate, studies (e.g. Bradshaw and
144 Fordham, 2013) describe how women in Bangladesh get caught at home during floods and unable to
145 escape to higher ground, since socio-cultural norms dictate that they are not allowed to leave their houses
146 without being accompanied by a male relative.

147

148 There are many possible outcomes of adaptation strategies, but these are often unable to address the root
149 causes of vulnerability, such as gender norms. When things go really wrong, the outcome is that
150 vulnerability to climate change is increased: this is maladaptation. The way this term is used is variable,
151 and there are at least three ways in which is used across policy, practice and science, described below.

152

153 *Rebounding vulnerability*

154 The most accepted definition of maladaptation is when an adaptation strategy aimed at a group of people
155 actually makes them more vulnerable to climate change than they were before. This has been described as
156 ‘rebounding vulnerability’; ie the vulnerability returns (in the same or different form). An even more
157 specific use suggests that such an outcome could also undermine opportunities for future successful
158 adaptation, including creating barriers for sustainable development. This could include a strategy that

159 encourages farmers to sell their land and become employed in another industry that is equally sensitive to
160 climate change impacts, but gives a wage and in the short term offers more security. But it can be
161 maladaptive as it leaves farmers no option to return to farming when the other industry is affected and
162 jobs are cut.

163

164 *Shifting vulnerability*

165 Another use of maladaptation is when an adaptation strategy redistributes vulnerability so that others who
166 were not beneficiaries of an adaptation strategy instead become more vulnerable to climate change than
167 they were before the strategy was implemented. For example, when people upstream develop irrigation to
168 address water insecurity resulting from climate change, and take more water out of the river, this leaves
169 less water available for the people downstream. This has been called ‘shifting vulnerability’. Others have
170 also described maladaptation when a strategy to reduce greenhouse gas emissions or address other
171 development needs ends up making people more vulnerable to climate change. For example, a forestry
172 project in Cambodia was implemented to secure carbon credits, yet the approach included replacing
173 diverse natural forest with acacia plantations, preventing local residents from using the forests in
174 traditional ways. Although the project employed large numbers of local workers, once complete
175 employment was terminated, leaving people uncertain how to secure their livelihoods.

176

177 *Creating negative externalities*

178 Maladaptation is also used to describe adverse outcomes of projects that introduce new problems, which
179 are not necessarily linked with increasing vulnerability to climate change. For example, in Peru women
180 were given access to microcredit to start their own projects as part of an adaptation strategy, but domestic
181 violence rose dramatically because men were jealous of the women’s success. While this is not a positive
182 outcome, to describe this as maladaptation opens the door for all adverse outcomes to be considered
183 maladaptation and confuses what causes vulnerability to climate change in the first place. Decades of
184 experience with development projects have shown the difficulty of limiting negative *externalities*, that is,
185 the adverse impacts on anyone outside of the beneficiaries of a specific intervention. It would be

186 extremely challenging to design a project that benefitted everyone and had no costs for anyone, anywhere,
187 even though this is always the goal.

188

189 Importantly, using maladaptation to describe shifting vulnerability and negative externalities ultimately
190 does not highlight the crucial problem that each adaptation intervention has the potential to backfire on
191 the very people who are supposed to be benefitting from it, which should actually be completely
192 preventable. Nevertheless, drawing lines between different experiences proves to be difficult, and many
193 cases of maladaptation will also have negative implications for people outside the immediate beneficiary
194 group, and can increase vulnerability not just to climate change, but to many other threats as well.

195

196 **Examples of maladaptation**

197 To better illustrate what maladaptation looks like, this section describes different examples of
198 maladaptation, drawn from various academic studies, and summarises ways in which maladaptation can
199 be manifest. This is not an exhaustive list of categories, but covers a large number of attempted and
200 planned adaptations in three broad categories of adaptation types: infrastructural, institutional and
201 behavioural.

202

203 ***Infrastructural maladaptation***

204 The literature is rich with many cases of maladaptation stemming from coastal areas, which are faced with
205 the need to protect against the effects of sea-level rise, salt-water intrusion, coastal storms and other
206 consequences of climate change. Different forms of protection ranging from infrastructure, mangrove
207 planting, managed retreat, to adopting a discourse of 'living with floods' have been implemented around
208 the world. But most of these choices come with consequences. A case from Fiji demonstrates that
209 seawalls built to protect people from rising sea-levels have actually made those living close to them more
210 exposed to hazards, because they end up preventing storm-water drainage. In part, seawalls and other
211 infrastructure give people a false sense of security, and encourage them to remain in places or continue
212 with activities that make them vulnerable to climate change if and when the infrastructure fails. In the
213 studied example, the seawalls also shifted vulnerability to people elsewhere along the coast, because of

214 changes in sediment deposits, and created negative environmental consequences by threatening marine
215 ecosystem health (e.g. Piggott-McKellar et al, 2020). Another study in Bangladesh examined these
216 measures from a gendered perspective, noting that flood control had numerous negative consequences,
217 including eliminating floodplains that had been an important income and food source, and reducing the
218 nutrients in the soils that resulted from the flood water. But for women, these measures cut off even
219 more opportunities than for men. Landless, poor women could no longer find food and resources to sell
220 when these flooded areas disappeared, reducing their livelihood security (e.g. Sultana, 2010).

221

222 ***Institutional maladaptation***

223 An examination of agricultural climate insurance shows that farmers with insurance change the way they
224 use their land or interact differently with networks that they had previously relied on to reduce the risk
225 posed by climate. These changes include a focus on insured cash crops over drought resistant subsistence
226 crops, intercropping or moisture conservation techniques, meaning that the farmers become reliant on
227 the insurance. Furthermore, without the need to weigh the risks of planting different crops on a seasonal
228 basis, farmers are no longer engaging with their previous networks, thereby reducing the overall
229 knowledge base, social capital and risk awareness necessary to mitigate the uncertainty (e.g. Müller et al,
230 2017).

231

232 ***Behavioural maladaptation***

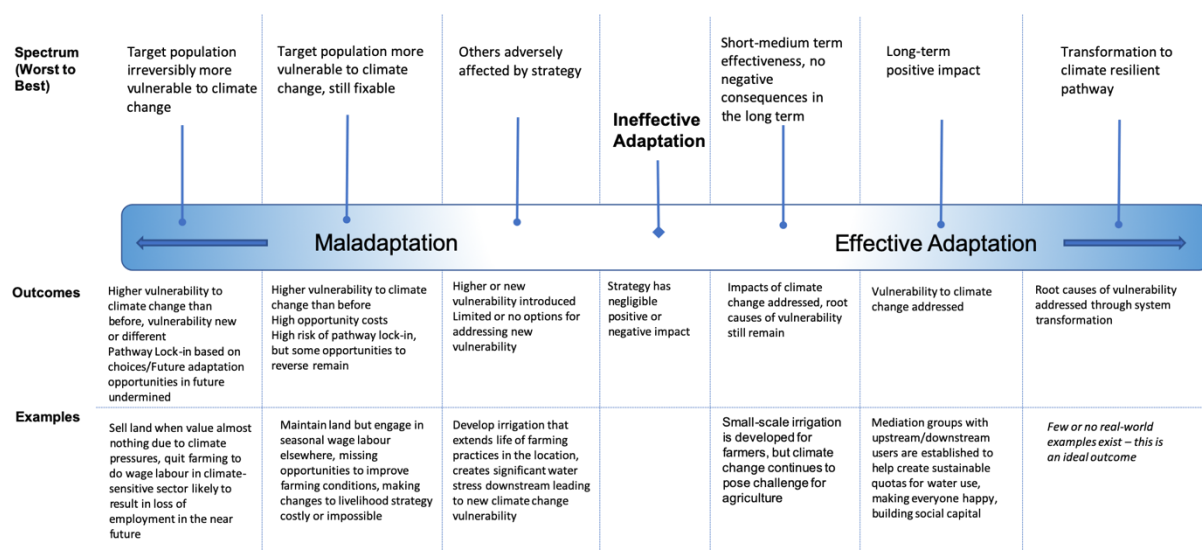
233 Adapting to climate change involves changes in attitudes and behaviour, which is likely more important
234 than physical or institutional changes. The strategy of switching from chickens to ducks mentioned
235 earlier, for instance, is only possible if people accept changing their diets to eat duck eggs and meat. But
236 not all behavioural changes turn out well. A study in northern Ghana looking at how farming
237 communities were responding to climate change shows how farmers were temporarily migrating away
238 from rural areas in search of employment due to the insecurity caused by lack of rainfall. But this strategy,
239 while diversifying incomes and reducing pressure on food reserves, ends up creating labour shortages so
240 that when farming conditions are good, there are not enough people available to ensure a successful

241 harvest. Consequently, the act of migrating makes farming even more difficult, and changes societal
 242 structures introducing new dynamics and challenges (e.g. Antwi-Agyei et al, 2018).

243

244 In sum, adaptation and maladaptation must be seen as a continuum, where the outcomes range from an
 245 ideal transformation toward a climate-resilient pathway on the one side, to irreversibly higher vulnerability
 246 on the other (Figure 2). While we have numerous examples of maladaptation around the world, it
 247 continues to happen, and the shift between adaptation and maladaptation can be subtle and rapid.

248 Similarly, a strategy can have some positive outcomes but still result in maladaptation.



249
 250 Figure 2. A spectrum of responses from adaptation to maladaptation. This spectrum describes how adaptation and
 251 maladaptation can have different degrees of success or failure, spanning from transformation to climate-resilient pathway,
 252 and ideal outcome of an adaptation strategy, to a situation where the target population is irreversibly more vulnerable to
 253 climate change. But some maladaptive strategies may not be beyond repair, and may be able to move back into the
 254 ineffective or even effective adaptation zone over time (as described in Figure 1). Ineffective adaptation sits at the centre,
 255 where the outcome is essentially negligibly positive or negative. Figure 2 reflects a snapshot, rather than movement in
 256 time.

257 Source: Author.

258

259 Addressing maladaptation: questions and solutions

260 While there have been some efforts to identify the various trajectories of maladaptation as described in
 261 Figure 1, the ability to catch maladaptation before it happens is inherently connected to the challenge of
 262 evaluating adaptation. Indeed, some of the key questions that remain for researchers include what
 263 qualifies as ‘successful’ adaptation, and in particular when this success can be declared. The many
 264 different understandings of the scope and purpose of adaptation are part of the reason that designating
 265 when it has achieved its goal is difficult. Just as there is a range of adaptation strategies, there is also a

266 spectrum of maladaptation types (Figure 2). In particular, if adaptation does not address the root causes
267 of vulnerability, instead only touching on the impacts of climate change, this dissonance in
268 understandings becomes problematic.

269

270 One thing that research has been able to determine, however, is a number of ways in which poorly
271 planned adaptation translates to maladaptation. Extensive studies built on the study of development, and
272 *mal*development, recognise that when key factors such as inequality, interconnectedness of development
273 pathways, and dependency on infrastructure or institutional structures, are not factored into designing
274 adaptation strategies, they can fail badly and result in exacerbating these drivers of vulnerability (see Table
275 1 and Figure 2). One recurring finding is the need to better understand the context of the location or
276 group of people in which an adaptation strategy is implemented, to ensure that strategy actually
277 corresponds with the causes of vulnerability, and does not just address the symptoms of it.

278

279 Both planned and autonomous adaptation can lead to maladaptation, but for different reasons. The
280 causes of maladaptation in planned strategies appear primarily about poor design and sloppy application
281 by outside actors who have funds or project expertise, but little knowledge of the social or ecological
282 contexts of the locations in which they are implementing projects. In contrast, maladaptation occurring in
283 autonomous strategies, where people who need to adapt are the ones making decisions, appears to have
284 more to do with limited information leading to poor choices, lack of support networks to fall back on,
285 and insufficient capacity to undertake new employment or follow through with the strategies. In the
286 former case, the design flaws can mostly be addressed (there will always be imperfect information and
287 uncertainty about the way in which the climate is changing), but addressing the inequitable power
288 dynamics between those implementing an adaptation strategy and the people who are supposed to adapt
289 (so-called 'beneficiaries') requires particular care. This refers to the way in which decision makers and
290 others with funding hold power over beneficiaries, by engaging them in projects that may not necessarily
291 want, often without allowing thorough consultations or equitable participation in project design.

292

293 Research and practice have identified a number of solutions to the types of maladaptive outcomes that
 294 can emerge from adaptation projects, some of which are described in Table 1. A large portion of these
 295 involve having a better overview of the context into which an adaptation strategy is to be implemented.
 296 For example, the tension between different actors can also manifest in confusion about who the intended
 297 project beneficiaries are, on occasion leaving those who are the most vulnerable to climate change
 298 marginalised from a project. Ironically, they are already so marginalised such that their voices rarely get
 299 heard. As described in Table 1, a solution to this would be paying more attention to who the different
 300 actors are, and from a development actors' perspective, going beyond tried and tested networks to ensure
 301 that the most powerful people are not suppressing any voices. Similarly, looking beyond the lifetime of
 302 the project is crucial, so that not only secondary but also possible tertiary impacts, at both positive and
 303 negative sides of a project are understood. When adaptation is autonomous, this would involve reflection
 304 of the many different possible consequences of decisions, some of which may be irreversible.

305

306 Table 1. Different manifestations of maladaptation and possible solutions

	Possible Maladaptive Consequences	Problem	Potential solution
Planned Adaptation	Exacerbation of existing vulnerability drivers	Not understanding what drives vulnerability to climate change and not addressing it in an adaptation strategy, or implementing a strategy that opens the door for these drivers to thrive or spread	A better assessment of what causes vulnerability to climate change among the beneficiaries, as well as a better overview of different pressures in their lives, which may become drivers of vulnerability when new strategies are implemented
	Introduction of new vulnerability drivers		
	Unintended groups are inadvertently beneficiaries	Not recognising the right actors: either the ones who are in need of adaptation, or the ones who are behaving in a way that is making a situation worse for another group	Developing projects with attention to actors to ensure that existing partner networks do not exclude the most vulnerable people
	People who should have been beneficiaries become even more marginalised, and vulnerable to climate change		
	Exacerbation of existing vulnerability drivers	Not understanding the wider drivers of development	Ensuring that the most powerful people are not put in a position to marginalise the most vulnerable even more Thorough assessment of development contexts to ensure that adaptation strategies are in harmony with them
	Introduction of new vulnerability drivers		
	Adaptation strategies become ineffective or go counter to other development trends or choices	Investing heavily in infrastructure or permanent land-use changes	Assessment of the root causes of vulnerability to determine how they relate to development drivers or barriers
	Lock people into development pathways that can prevent them from adapting to climate change impacts in the future, such as cutting off access to certain resources		
	Reduced soil nutrients due to lack of flood water/nutrient replenishment	Assess the longevity and long-term costs and consequences of large environmental changes	
	High opportunity and/or sunk costs		Assess the primary, secondary and tertiary negative externalities associated with infrastructure projects on both ecosystems and humans
	Create incentives for people to settle in areas that are only		

Autonomous Adaptation	temporarily safe, such as flood embankments; false sense of security		
	Opportunities for future adaptation and sustainable development are reduced or eliminated because of the lock-in effect of the choices made	Adaptation strategies are implemented for their short-term benefits, such as migration or selling of assets	Ensure that poverty and capacity gaps are addressed so that people have more options and are less likely to make bad choices that determine their future pathways
	Opportunities for adapting within existing livelihood strategies become limited Alternative livelihoods may hamper prospects for future development	Adaptation strategies are implemented for their ease of access, desire for cash incomes, or because of lack of skills to otherwise diversify, such as abandoning farming to begin wage labour	Ensure a diversity of livelihood options, including training and skills development, through equitable development interventions, to avoid people falling prey to middle men who are looking for cheap and dispensable labourers

307 Source: Author, based on examples described in literature listed in Further Reading.

308

309 **Conclusion**

310 Maladaptation is when adaptation to climate change goes beyond wrong. A number of slightly varying
311 understandings of this term exist. At the heart is the idea that maladaptation is an unexpected and
312 unwanted outcome of an adaptation strategy that is originally implemented with good intentions. With
313 growing experience of adaptation on the ground, it has become clear that poorly designed adaptation
314 strategies are often the driver of maladaptation. However, there are a number of ways in which these
315 flaws can materialise, and they cannot always be known in advance. They include: not being aware of
316 what drives vulnerability to climate change in the first place, putting emphasis on the wrong actors, not
317 understanding the wider development context, and investing in infrastructure or other semi-permanent
318 changes that can lead to lock-in effects.

319

320 Over the last decade, experience with implementing adaptation has become widespread, and the study of
321 these experiences have also followed suit. Researchers and practitioners are starting to get a better picture
322 of what can define the limits to adaptation from physical, social, financial, and emotional perspectives.
323 Similarly, they are slowly beginning to grasp how one might define adaptation success. At the same time,
324 the uncertainty of how climate change will affect ecosystems and human societies means that every
325 strategy carries a certain degree of risk. In early days of adaptation scholarship, the ideas of ‘win-win’ or
326 ‘no-regrets’ adaptation strategies were heralded as guiding principles, but over time it has become clear
327 that responding to climate change is complex, and rarely is any strategy only positive. Adaptation
328 strategies need to be embedded in and consistent with development efforts, however many development

329 trajectories are heading toward unsustainability, making this alignment impossible. Consequently, until
330 vulnerability reduction is at the heart of adaptation measures, the risk of maladaptation will continue to
331 linger.

332

333 **Recommended reading**

334 Antwi-Agyei, P., A.J. Dougill, L.C. Stringer, S.N. Ardey Codjoe (2018) ‘Adaptation opportunities and
335 maladaptive outcomes in climate vulnerability hotspots of northern Ghana’, *Climate Risk
336 Management*, 19: 83-93, <https://doi.org/10.1016/j.crm.2017.11.003>.

337 Barnett, J., S. O’Neill (2010) ‘Maladaptation’, *Global Environmental Change*, 20(2): 211-213,
338 <https://doi.org/10.1016/j.gloenvcha.2009.11.004>

339 Bours, D. (2014) ‘Musings on maladaptation, and how to measure it’ Earth-Eval blogpost
340 <https://www.eartheval.org/blog/musings-maladaptation-and-how-measure-it>

341 Bradshaw, S., M. Fordham (2013) ‘Women, girls and disasters - A Review for DFID’, available at
342 <https://gsdrc.org/document-library/women-girls-and-disasters-a-review-for-dfid/>.

343 Caldas, A. (2016) ‘Planning Failures: A Story of Unintended Consequences’, Union of Concerned
344 Scientists blogpost: [https://blog.ucsusa.org/astrid-caldas/planning-failures-a-story-of-unintended-](https://blog.ucsusa.org/astrid-caldas/planning-failures-a-story-of-unintended-consequences)
345 [consequences](https://blog.ucsusa.org/astrid-caldas/planning-failures-a-story-of-unintended-consequences)

346 Ford, J. D., L. Berrang-Ford, A. Lesnikowski, M. Barrera, and S. J. Heymann (2013) ‘How to track
347 adaptation to climate change: a typology of approaches for national-level application’ *Ecology and
348 Society*, 18(3):40, <http://dx.doi.org/10.5751/ES-05732-180340>

349 Jones, L., E. Carabine, E.L.F. Schipper (2015) ‘(Re)Conceptualising Maladaptation in Policy and
350 Practice: Towards an Evaluative Framework’ PRISE Working Paper, DOI.
351 <http://dx.doi.org/10.2139/ssrn.2643009>

352 Juhola, S., E. Glaas, B. Linnér, T.S. Neset (2016) ‘Redefining maladaptation’, *Environmental Science and
353 Policy*, 55(1):135-140, <https://doi.org/10.1016/j.envsci.2015.09.014>

354 Magnan, A., E.L.F. Schipper, M. Burkett, S. Bharwani, I. Burton, S. Eriksen, F. Gemenne, J. Schaar
355 and G. Ziervogel (2016) ‘Reframing Maladaptation to Climate Change’, *WIREs Climate Change*,
356 7(5):646-665, <https://doi.org/10.1002/wcc.409>

357 Müller, B., L. Johnson, D. Kreuer (2017) 'Maladaptive outcomes of climate insurance in agriculture',
358 *Global Environmental Change*, 46: 23-33, <https://doi.org/10.1016/j.gloenvcha.2017.06.010>

359 Piggott-McKellar, A.E., P.D. Nunn, K.E. McNamara, S.T. Sekinini (2020) 'Dam(n) Seawalls: A Case
360 of Climate Change Maladaptation in Fiji' in W.L. Filho (ed.), *Managing Climate Change*
361 *Adaptation in the Pacific Region*, Climate Change Management, Springer, pp: 69-84
362 https://doi.org/10.1007/978-3-030-40552-6_4

363 Singh, C., P. Dorward, H. Osbahr (2016) 'Developing a holistic approach to the analysis of farmer
364 decision-making: Implications for adaptation policy and practice in developing countries' *Land Use*
365 *Policy*, 59(31): 329-342.

366 Sultana, F. (2010) 'Living in hazardous waterscapes: Gendered vulnerabilities and experiences of floods
367 and disasters' *Environmental Hazards* 9: 43-53

368 Work, C. V. Rong, D. Song, A. Scheidel (2019) 'Maladaptation and development as usual? Investigating
369 climate change mitigation and adaptation projects in Cambodia', *Climate Policy*, 19(sup1): S47-
370 S62, <https://doi.org/10.1080/14693062.2018.1527677>

371