



Short communication

Redefining maladaptation



Sirkku Juhola^{a,b,*}, Erik Glaas^c, Björn-Ola Linnér^c, Tina-Simone Neset^c

^a Department of Environmental Sciences, University of Helsinki, Finland

^b Department of Real Estate, Planning and Geoinformatics, Aalto University, Finland

^c Department of Thematic Studies – Environmental Change and the Center for Climate Science and Policy Research, Linköping University, Sweden

ARTICLE INFO

Article history:

Received 2 July 2015

Received in revised form 26 September 2015

Accepted 26 September 2015

Keywords:

Climate change
Adaptation
Maladaptation
Vulnerability
Feedbacks

ABSTRACT

As experiences of implementation of climate change adaptation are accumulating, there is a need to increase the understanding of the potential negative consequences of adaptation actions that might occur, and the capacity of research to assess them. Maladaptation used in this context has remained elusively defined and sparingly used, and therefore difficult to apply. Based on a literature review, we discuss the conceptual boundaries of maladaptation and how it can be used to analyse negative outcomes of adaptation and propose a refined definition. We present a typology of maladaptation that distinguishes between three types of maladaptive outcomes – *rebounding vulnerability*, *shifting vulnerability* and *eroding sustainable development*, and argue that maladaptation can be defined as *a result of an intentional adaptation policy or measure directly increasing vulnerability for the targeted and/or external actor(s), and/or eroding preconditions for sustainable development by indirectly increasing society's vulnerability*. We note that the recognition of adaptation as an intentional action and the importance of setting clear spatial and temporal boundaries, as well as thresholds, are key to analysing negative outcomes.

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1. From adaptation to maladaptation

The need for adaptation to climate change has been widely recognised (Pielke et al., 2007; IPCC, 2007, 2014), and the study of adaptation as a social process has generated a field of research that is rapidly accumulating (Smit et al., 2000; Kelly and Adger, 2000; Adger et al., 2005; Smit and Wandel, 2006; Gallopín, 2006; Füssel, 2007a,b; Ford et al., 2011). This development can be characterised with a move from impact-led research towards a better understanding of social processes that underlie the ability of societies to adapt to the consequences brought about by climate change (Burton et al., 2002).

Progress has also been made in terms of implementation which can be exemplified by the national adaptation strategies developed by several countries (Biesbroek et al., 2010). The literature on the outcomes of adaptation has primarily asked how successful adaptation actions have been in relation to equity, efficiency and legitimacy (Adger et al., 2007). It has also centred on comparisons of national or local approaches, and more recently

on the identification of barriers and limits to adaptation (Adger et al., 2009; Moser and Ekstrom, 2010; Biesbroek et al., 2013), whilst less effort has been put into studying the effects of implemented adaptation policy and measures (Klein and Juhola, 2014). As experiences of implementing adaptation are accumulating at a rapid pace, there is a need to increase the understanding of the potential negative consequences of adaptation actions.

The concept maladaptation has been proposed to study the outcomes of adaptation that fail to reduce climate-related risk, or that generate negative consequences for others. One of the earliest attempts to systematically conceptualise maladaptation emerged from Barnett and O'Neill (2010) and others have followed since. Recognising the early mentions of the concept by Smit (1993) and Burton (1997) in the 1990s, Barnett and O'Neill define maladaptation to be 'action taken ostensibly to avoid or reduce vulnerability to climate change that impacts adversely on, or increases the vulnerability of other systems, sectors or social groups' (Barnett and O'Neill, 2010: p. 211). The authors further point to five different types of maladaptation that can arise in the form of (1) increasing GHG emissions, (2) disproportionately burdening the most vulnerable, (3) high opportunity costs, (4) reducing incentives to adapt, and (5) path dependency.

Within this rapidly increasing research field, empirical studies highlighting maladaptation have emerged in the recent years. However, despite the unspoken recognition that not all adaptation

* Corresponding author at: Department of Environmental Sciences, University of Helsinki, Finland.

E-mail addresses: sirkku.juhola@helsinki.fi (S. Juhola), erik.glaas@liu.se (E. Glaas), bjorn-ola.linner@liu.se (B.-O. Linnér), tina.neset@liu.se (T.-S. Neset).

actions will be successful, the concept of maladaptation has remained sparingly used and elusive, as recognised by the IPCC, which has made it difficult to apply as an analytical concept for studying outcomes of adaptation policy (Noble et al., 2014). In this paper, we revisit the definitions of maladaptation to explore its potential as an analytical and operational concept. To do this, we present a review of this literature in the form of a typology and identify key elements in order to make it analytically distinct and operationally apt.

2. A review of recent literature

With regards to maladaptation, the IPCC states that '[T]he adaptation literature is replete with advice to avoid maladaptation, but it is less clear what is precisely included as "maladaptation"' (Noble et al., 2014: p. 28). These difficulties stem from a number of sources. Granberg and Glover, for example, argue that '... there are neither widely accepted criteria nor yardsticks that have been developed to identify maladaptation' (2013: p. 4). Furthermore, in addition to the varying local circumstances and the passage of time, the authors argue that identifying maladaptation is also plagued by problems of subjective judgement.

When thinking about maladaptation, it is crucial to consider the definition of adaptation, given the reciprocity of the two concepts. The IPCC's Fifth Assessment Report (AR5) defines adaptation as a 'process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects' (AR5, glossary).

The Fourth Assessment Report (AR4) clarified the intent behind this adjustment (planned vs. autonomous). Planned adaptation is 'the result of a deliberate policy decision, based on an awareness that conditions have changed or are about to change and that action is required to return to, maintain, or achieve a desired state' (AR4, glossary). The Fifth Assessment Report (AR5) further defined autonomous adaptation to be in response to experienced climate and its effects, without planning explicitly or consciously focused on addressing climate change" and it is also referred to as "spontaneous adaptation" (AR5, glossary).

Maladaptation, according to AR5, is 'a cause of increasing concern to adaptation planners, where intervention in one location or sector could increase the vulnerability of another location or sector, or increase the vulnerability of the target group to future climate change' (AR5, glossary). Whilst the IPCC highlights the urgency of focusing on the negative consequences of adaptation, their definition does not go far in making it analytically distinct or to operationalise it for further research and practice to study negative outcomes.

A body of literature has emerged since 2010 that discusses numerous empirical examples of maladaptation, providing an opportunity to assess what has, and has not, been included in the analyses of maladaptive outcomes. In this literature review,¹ we collected these latest empirical examples of maladaptation in the scientific literature. We used this research as the basis of our conceptual work because it enables us to compile and structure practical examples of maladaptation presented to date, rather than relying on a smaller sample. A majority of the studies reviewed for this paper are various forms of case studies conducted on different scales – stretching from national to individual level. The studies are

based in various continents, cover various sectors, with majority focusing on agricultural and urban planning.

We group the examples of maladaptive outcomes in these studies using a simple typology approach. In scientific research, a typology is a way of classifying and organising phenomena into distinct types (Ziemski, 1975). In this categorisation of the literature, we used the negative feedback loops of adaptation as our organising method. This is what the widely used definition by Barnett and O'Neill refers to as 'the impacts adversely affect other systems, sectors or social groups' (Barnett and O'Neill, 2010). We further divided these feedbacks based on who or what is affected and in what way. Hence, we deduce that three types of maladaptation can be identified: (1) rebounding vulnerability, (2) shifting vulnerability and (3) eroding sustainable development (Table 1).

Rebounding vulnerability is a simple connection implying an adaptation action that increases current or future climate change vulnerability of the implementing actor (or the targeted actor(s) if implemented by e.g. a local government). The actor(s) can be affected in three different ways; through increasing exposure; or increasing sensitivity; or by decreasing the actors' adaptive capacity.² Many of these studies analysed the negative feedbacks within small communities, emphasising how adaptation can lead to adverse impacts locally. The temporal aspect was considered to be important here. For example, a short time perspective on adaptation can lead to decreased adaptive capacity and hinder future choices (Ford et al., 2013).

Shifting vulnerability increases current or future vulnerability for one or several external actors. The external actors' vulnerability can be affected through increased exposure or sensitivity, or by decreased adaptive capacity. Many of these examples emerge from larger-scale adaptation actions where increased vulnerability has a spill-over effect in other locations. Examples of these include effects of coastal structures that may cause erosion elsewhere (Grothmann and Patt, 2005), or when a development of desalination plants to adapt to drinking water deficiency leads to disproportionately high cost for low income water users (Barnett and O'Neill, 2013; McEvoy and Wilder, 2012).

Eroding sustainable development is an outcome of an adaptation action that increases GHG emissions and negatively impacts environmental conditions and/or social and economic values. These side effects are presented as negative for society as a whole without singling out affected actors, creating common pool problems. The studies concentrate on the effects of adaptation that undermine the base on which adaptation relies. Essentially, the focus here is on negative feedbacks that occur on a global scale, undermining the conditions for sustainable development. Many of the examples of maladaptive actions increase GHG emissions, which consequently exacerbate climate change and hence cause the need for more adaptation (Hopkins, 2014; Andersson-Sköld et al., 2015; Beilin et al., 2011; Brown, 2011; Adger et al., 2010).

3. Applying the maladaptation concept – elements to consider

The above typology reflects the way in which the concept has been used in the literature in recent years. It raises a number of interesting questions when placed next to the existing definitions of maladaptation. The IPCC AR5 definition and the one offered by Barnett and O'Neill and our typology based on the review of the

¹ Literature review: search in Scopus for "maladaptation and Climate Change" resulted in 66 articles. 22 of these articles were found relevant for the analysis based on initial assessment of keywords search. These were complemented with papers about maladaptation cited in IPCC (WGII, AR5, chapter 14) and within the found articles. In total 31 papers were analysed in depth.

² Definitions of Vulnerability and its dimensions according to the IPCC AR5 Glossary (Agard et al., 2014): "Vulnerability: The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt."

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