



An integrative research framework for enabling transformative adaptation



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ABSTRACT

Transformative adaptation will be increasingly important to effectively address the impacts of climate change and other global drivers on social-ecological systems. Enabling transformative adaptation requires new ways to evaluate and adaptively manage trade-offs between maintaining desirable aspects of current social-ecological systems and adapting to major biophysical changes to those systems. We outline such an approach, based on three elements developed by the Transformative Adaptation Research Alliance (TARA): (1) the benefits of *adaptation services*; that sub-set of ecosystem services that help people adapt to environmental change; (2) The *values-rules-knowledge perspective (vrk)* for identifying those aspects of societal decision-making contexts that enable or constrain adaptation and (3) the *adaptation pathways approach* for implementing adaptation, that builds on and integrates adaptation services and the *vrk* perspective. Together, these elements provide a future-oriented approach to evaluation and use of ecosystem services, a dynamic, grounded understanding of governance and decision-making and a logical, sequential approach that connects decisions over time. The TARA approach represents a means for achieving changes in institutions and governance needed to support transformative adaptation.

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1. Introduction

The IPCC Fifth Synthesis Report stated it is *very likely* that surface temperature and sea levels will continue to rise and extreme weather events become more frequent (IPCC, 2014). By 2050 the global population is projected to increase from 7.2 to 9.6 billion (UN, 2014), with mounting pressures on terrestrial, marine and freshwater resources. Global networks of commerce, technology and information have produced unstable systems that are vulnerable to uncontrollable failure, posing considerable threats to society (Helbing, 2013; Streek et al., 2016). Climate change combines with other drivers to synergise rates and extent of change to social-ecological systems. Dealing with synergistic effects of other global change drivers and climate change requires transformative approaches to adaptation.

Adaptation to global change presents a profound challenge because it requires the tackling of short- and long-term threats, changes and uncertainty that transcend sectors and scales. Over the past decade, efforts to understand the impacts of climate change on biodiversity conservation have led to new concepts and approaches to support adaptation of biodiversity (Mawdsley, 2011; Cross et al., 2012; Reid, 2015). Conservation policy and practice have focussed on ecosystems, species and maintenance of biophysical integrity but tended to neglect institutional contexts: the people and organisations responsible for implementing adaptation (Armsworth et al., 2015). Smith (1997) emphasised the need for adaptation to be *anticipatory* rather than reactive, aimed at reducing social vulnerability to climate change and with policy criteria based on institutional attributes of flexibility, adaptability, resilience, and where benefits exceed costs. Almost 20 years later, anticipatory action has been limited. There remains a compelling need for researchers and practitioners to work together to identify how to put concepts of anticipatory transformative adaptation into practice.

Adaptation has been framed as a continuum of resilience, transition and transformation (Pelling, 2011). At one end of the

spectrum are incremental responses to proximate causes of vulnerability, while at the other is transformative adaptation to long-term, large-scale, non-linear, uncertain changes (Wise et al., 2014). Yet, most adaptation practice is reactive, local and short-term (Hodgkinson et al., 2014). Such actions are likely to be maladaptive (Barnett and O'Neill, 2010) because effects of long-term environmental change are marginalised and the interactions between decision lifetimes, uncertainties about the nature of biophysical change and possible adaptation options tend to be downplayed (Stafford Smith et al., 2011). Proponents of short-term adaptation may not acknowledge that ecosystems are likely to transform (Park et al., 2012; Wise et al., 2014). But even when ecosystem transformation is acknowledged, societal transformation is considered beyond the capacity for adaptation because of a perceived lack of new options (Dow et al., 2013). The alternative view is that transformative adaptation of social-ecological systems is both necessary and possible, based on anticipatory approaches in which new options are co-created, explored and experimented with (Rickards and Howden, 2012; Rickards, 2013).

We define a social-ecological system as a coupled biogeophysical entity (e.g. an ecosystem, landscape or bioregion), with social actors and institutions, that has properties of complexity, adaptiveness and multiple cross-scale feedbacks (Fischer et al., 2015). Transformation of a social-ecological system may be initiated by changes in ecosystem drivers (e.g. temperature regime, water availability, nutrient balance), followed by ecosystem changes (e.g. in extent and composition of vegetation communities and their associated biota), leading to adaptation by social actors, including altered use of ecosystem services, livelihoods and governance arrangements for natural resources (Box 1). Changes in ecosystem drivers may be due to climate change or other anthropogenic pressures, including transformations in social systems such as establishment of an irrigation system. Such changes have occurred at Lake Faguibine, Mali (Djoudi et al., 2013) and the Murray-Darling Basin, Australia (Colloff et al., 2016a) where complex, non-linear transformative ecological and social

Box 1. Definitions of concepts of the three types of transformation used in the TARA approach.

There are multiple uses of the term *transformation* in relation to adaptation to global environmental change (Feola, 2015). We do not consider transformation as a process separate from adaptation that occurs after limits of adaptation are reached (Dow et al., 2013). Three types are defined: transformation as a process of change in a social-ecological system without deliberate intervention is described by Types 1 and 2 below. Transformation as a deliberate process is described by Type 3.

- (1) *Transformation of ecosystems*: is defined by a permanent shift to an alternative stable state, as in resilience thinking (Walker et al., 2004). But such 'Type 1 transformation' also involves a change in the way a focal ecosystem is viewed from the relevant decision context. This change requires a reframing of how the ecosystem is considered in relation to its core driver and response variables, its attributes that are valued by society, and how people relate to and act within the system, including options for managing and using the ecosystem that are normalised and permitted.
- (2) *Transformation of decision contexts*: focusses on the recognition that because ecosystems and their drivers are transforming, so transformation to decision contexts supported by evolving governance arrangements is required (Gorddard et al., 2016). Thus, 'Type 2 transformation' represents a major shift in the social arrangements that define the decision context, including: (1) the networks that are formed in the process of decision making; (2) the knowledge and belief systems ("knowledge"), societal values and motivations ("values") and formal and informal rules and governance arrangements ("rules") that define how powers are defined, allocated and used, and (3) how resource allocations flow to empower the decision process and are affected by the focal decision-making group.
- (3) *Transformation as developing the capacity for adaptive, transformative governance*: the capacity to develop adaptive, transformative governance is relative to the type of change that is intended and the position of the people within the system who are seeking the change. Transformative change in governance (e.g. Chaffin et al., 2016) will be needed to support transformative change in the decision context for adaptation. Like specific resilience, with its requirement to specify resilience of what, for what (Carpenter et al., 2001), it is necessary to frame 'Type 3 transformation' as developing the capacity for adaptive, transformative governance for *whom*, to enable *what* kinds of changes in governance systems, for *what* purpose.

Change in decision contexts relating to Type 1 and Type 2 transformations cannot be separated in practice because Type 2 transformations are a consequence of Type 1 and both require no deliberate human intervention in order to occur. Reframing decisions that can be considered as transformative therefore requires transformation of governance arrangements (type 3).

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