



Social-ecological regime shifts (SERS) in coastal systems

Prateep Kumar Nayak^{a,*}, Derek Armitage^b

^a School of Environment, Enterprise and Development, Environmental Change and Governance Group, Faculty of Environment, University of Waterloo, 200 University Avenue West, Waterloo, Ontario N2L 3G1, Canada

^b School of Environment, Resources and Sustainability, Environmental Change and Governance Group, Faculty of Environment, University of Waterloo, 200 University Avenue West, Waterloo, Ontario N2L 3G1, Canada

ARTICLE INFO

Keywords:

Social-ecological systems
Regime shifts
Environmental change
Power and social equity
Governance
Coastal lagoon system

ABSTRACT

Regime shifts from one ecological state to another are often portrayed as sudden, dramatic, and difficult to reverse given the extent of substantial reorganizations in system structure, functions and feedbacks. However, most assessments of regime shifts in terrestrial and aquatic systems have emphasized their physical and/or biological dimensions. Our objective is to illustrate how equivalent concern with ecological and social processes can enhance our ability to understand and navigate ‘social-ecological’ regime shifts. We draw on two coastal lagoon systems experiencing rapid change to provide an empirical foundation for an initial analytical framework. Key issues we address include: 1) distinguishing underlying versus proximate drivers of rapid change (ecological and social); 2) considering appropriate scales of intervention; 3) considering the appropriate unit(s) for understanding regime shifts; 4) reflecting on social equity and the distribution of impacts (and benefits) of regime shifts; 5) assessing the influence of social power in the framing of and response to regime shifts; and 6) clarifying the role of management and governance in the context of rapid social-ecological change. Effective responses to social-ecological regime shifts will require a transition towards interdisciplinary research, inclusion of integrative and scale-specific suite of attributes for assessment, and interventions in management and governance approaches that are more multi-level, collaborative and adaptive.

1. Introduction

Regime shifts from one ecological state to another are often recognized as sudden, dramatic, and difficult to reverse, and involve a substantial reorganizations in system structure, function and feedback (Crépin et al., 2012; Hughes et al., 2013). Understanding and responding to such shifts is a significant challenge for resource managers (Walker and Meyers, 2004). Efforts to detect and assess regime shifts currently emphasize their ecological or biophysical dimension (Beaugrand, 2004; Karunanithi et al., 2008; Biggs et al., 2009). However, ecological regime shifts are catalyzed most often by anthropogenic or socio-economic drivers (e.g., resource exploitation, contaminant loading, climate change), and we need to more effectively identify and assess linked social and ecological regime shifts and their outcomes. Despite advances, opportunities for conceptual development in this area remain (see Crépin et al., 2012; Lade et al., 2013; Hughes et al., 2013; Nayak et al., 2016; Kull et al., 2018).

We adopt a ‘social-ecological system’ perspective here to broaden our understanding of regime shifts, and to consider the implications for management and governance. We define social-ecological regime shifts

as abrupt, long-term and significant changes in linked systems of people and nature with uncertain implications for ecosystem services and human wellbeing (Nayak et al., 2016). A social-ecological perspective emphasizes the integrated concept of humans in nature and stresses that the delineation between the social and the ecological is artificial and arbitrary (Berkes and Folke, 1998). This perspective has important consequences for how we anticipate, interpret and respond to regime shifts (RS).

We illustrate first how social and ecological theory, and linkages between the two, provide a more realistic context within which to understand and navigate regime shifts. Second, we identify core issues that require further attention if efforts to anticipate and navigate regime shifts are to succeed: 1) distinguishing underlying versus proximate ecological and social drivers of regime shifts; 2) considering appropriate levels and scales of intervention in linked social-ecological regime shifts; 3) reflecting on social equity and the disproportionate distribution of impacts (and benefits) of RS; 4) assessing the influence of social power in the framing of RS; and 5) considering the appropriate units for understanding RS, and 6) the clarifying the role of governance arrangements in navigating RS. We conclude by reflecting on the

* Corresponding author.

E-mail address: pnayak@uwaterloo.ca (P.K. Nayak).

Table 1
Related concepts and definitions to describe social and ecological change.

Concepts	Definitions	Adapted from
Ecological regime shift	Sudden and irreversible shifts in ecosystem, whereby a threshold is passed and fundamentally different core functions and structure of the new regime results.	Scheffer and Carpenter 2003; Biggs et al., 2009
Critical transition	A point in time and space in which a minor perturbation or disturbance can trigger a drastic change in a system state	Scheffer, 2009
Threshold	A break point between two alternate system configurations.	Walker and Meyers 2004
Resilience	System capacity to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks.	Walker et al., 2004
Transformation	A physical and/or qualitative change in the form, structure or meaning making which may be unintentional or deliberate.	O'Brien, 2012

limitations and gaps of our current understanding of RS, the challenges this poses for how we navigate social-ecological regime shifts and other forms of rapid change, and the potential benefit from explicit adoption of a social-ecological perspective.

2. An interdisciplinary approach to comprehend rapid environmental change

Regime shifts are not simply about large changes. Rather, regime shifts involve changes in the internal feedbacks within a system that keep it “locked” into and/or which reinforce a specific system configuration, regime or state. Changes in the internal feedbacks that may lead to an ecosystem regime shift are difficult to predict (Biggs et al., 2009; Karunanithi et al., 2008). Boerlijst et al. (2013) show that early warning signals in catastrophic regime shifts may be absent, despite suggestions to the contrary (see also Dakos et al., 2008; Biggs et al., 2009). Hughes et al. (2013) suggest that many regime shifts may emerge slowly and imperceptibly, implying that the transition between system states may be easy to miss. Ongoing development of indicators to better anticipate regime shifts provides helpful insights (Carpenter and Brock, 2006; van Nes and Scheffer, 2007; Dakos et al., 2008). However, these indicators are based on time series data that rely on studying the behaviour of the system, and its characteristic levels of variability and autocorrelation in time. Other methods used to detect regime shifts are reliant on models that produce quantitative representations of abrupt changes in ecosystems (May 1977; Scheffer and van Nes, 2004; Gal and Anderson, 2010; Lees et al., 2016).

Improved understanding of ecological dimensions of regime shifts provides an important foundation for better prediction, but they may be incomplete as a basis for the analysis of social-ecological regime shifts. Interdisciplinary perspectives are needed to address linked social and biophysical processes that may possibly signal regime shifts. Such strategies are less well-developed (see Béné et al., 2011), and in particular, there is considerable scope to better incorporate social theory to address this challenge (Crépin et al., 2012; Lade et al., 2013; Selkoe et al., 2015; Kull et al., 2018). A social-ecological systems approach (see Berkes and Folke, 1998; Ostrom, 2009) offer one potential entrée to a more interdisciplinary perspective.

Berkes and Folke (1998) define social-ecological systems (SES) as complex, integrated systems in which humans are part of nature. An SES perspective emphasizes the mutual feedback between ecological and social subsystems (i.e., they are not easily delineated), and the cross-scale feedback, uncertainty, non-linearity and self-organization that results (Levin, 1999). Since the social and ecological subsystems are highly interconnected and interacting, rapid changes in biophysical attributes cannot be understood in isolation of the social. Critical linkages are recognized among ecological systems and people's knowledge (e.g., local or traditional knowledge), formal and informal management institutions, and the rules and norms that mediate how humans interact with the environment (Ostrom, 2009). An SES perspective helps to place regime shifts within an integrated human-environment context in which social outcomes are contingent upon ecological processes and

vice versa (Charles, 2007; Christie, 2011; Berkes, 2011; Nayak, 2014). Moving from an ecological to social-ecological perspective of regime shifts has implications for assessment and subsequent governance response. In particular, current approaches to understand regime shifts have not typically considered the social conditions (poverty, power, institutions) that act as drivers of social-ecological change, and that are also crucial to navigating regime shifts when they do occur. However, there are some efforts to capture this complexity.

Béné et al. (2011), for example, used local knowledge and scientific perspectives to identify socially and culturally relevant thresholds and indicators of change in aquatic contexts. Specifically, they used a “threshold dashboard” developed with communities, in conjunction with a parallel expert-led dashboard, to assess social-ecological system change. Their analysis compared desirable, undesirable and crisis states, and indicators of thresholds at different scales. There were some overlaps and differences in the choice of measures used by the communities and the experts that reflected an emphasis on different key sub-systems and SES variables. However, insights from this methodology and other interdisciplinary perspectives (see Crépin et al., 2012; Hughes et al., 2013) confirm the benefit of understanding regime shifts and their implications for sustainability using a linked social-ecological perspective (Blythe, 2015).

A social-ecological systems perspective encourages a different way of thinking through the challenge of regime shifts. Specifically, a systems perspective facilitates a shift away from a focus on discrete drivers and cause-effect impacts on system components, and toward a focus on interactions and feedbacks between components and dynamics to which they give rise. Table 1 summarizes selected concepts, meanings and definitions used in the literature to signify various types of changes in social-ecological systems. Table 2 complements Table 1 by summarizing cross-cutting social-ecological system attributes, and providing further direction to examine social-ecological aspects of regime shifts. Tables 1 and 2 were instrumental in constructing the two coastal case studies (see details in section below) as the empirical basis for analyzing SERS attributes in this paper.

3. Research context and methods

Experiences with rapid social-ecological change in two coastal lagoon systems - the Chilika lagoon, Bay of Bengal in India and the Tam Giang-Cau Hai lagoon complex (hereafter the Tam Giang lagoon) in Vietnam - provide the empirical foundation for our analysis. Both lagoons have or are currently experiencing significant environmental and social change from a wide range of drivers, and major shifts in social and ecological system components, and interactions and feedbacks between them, at local and regional scales. We offer brief narratives of social-ecological change processes and examples in both lagoons in the main text below. Additional information on the cases is presented in the results and discussion.

The case study data reported in this paper come from ongoing longitudinal studies in Chilika (since 2007) and Tam Giang (since 2006). We used participatory field research in both sites using a mix of

Download English Version:

<https://daneshyari.com/en/article/8060613>

Download Persian Version:

<https://daneshyari.com/article/8060613>

[Daneshyari.com](https://daneshyari.com)