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How do biosphere reserves influence local vulnerability and adaptation? Evidence from Latin America

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ABSTRACT

Resource management regulations, such as those associated with the establishment of protected areas, can increase vulnerability and compromise individual and collective agency for adaptation. In this article, we comparatively analyse how four rural communities located within two biosphere reserves in Mexico and Bolivia experience vulnerability and adaptation to global change. We use focus groups, interviews and scoring exercises to analyse the influence of reserve management practices on locally perceived changes and stresses on livelihoods, and to discuss communities' coping and adaptation strategies. We show that both reserves are perceived as a source of stress but somewhat differently. In Mexico, communities feel vulnerable to the reserve's regulations but less to climatic and economic stresses, whereas in Bolivia communities perceive the insufficient enforcement of the reserve's rules as the most relevant stress to their livelihoods. Most of household-based and collective adaptations to environmental change have been adopted without the support of the biosphere reserves. We discuss how and why the biosphere reserves contribute to local vulnerability and why their role in enhancing local adaptation is limited.

1. Introduction

Over the last decades, the Latin American rural sector has experienced a profound transition from a state-driven protectionist model to a neoliberal, market-oriented economy (Escobal, 2003). In particular, agriculture, livestock and forestry activities have intensified, have had increased environmental impacts and become geared towards the needs of global markets and powerful international agribusiness actors. This process has been accompanied by privatisation and increased foreign ownership of land (Borras et al., 2012). The withdrawal of the state from rural planning and development has been influenced by sustainability and decentralisation discourses, and by ineffective policy reforms resulting in social inequality and associated vulnerability (Eakin and Lemos, 2006). Local elites have often benefited from land tenure reforms to the detriment of commons resource, and indigenous peoples' traditional territories have been granted recognition but de facto remained under state ownership and control. Rural and indigenous communities continued limited access to land and resources is particularly evident within protected areas, where government agencies usually have total or partial decision-making power, thus playing a decisive role in communities' vulnerability and adaptation (Berkes, 2007; Ruiz-Mallén and Corbera, 2013). This is crucial since most protected areas in Latin America are inhabited, and their area has increased from 10.5% of the region in 1990 to 20.8% in 2009 (Elbers, 2011).

In highly biodiverse but economically marginalised areas, strict protected areas can negatively affect local people's opportunities to overcome poverty (Adams et al., 2004; West et al., 2006) and undermine their ability to anticipate and respond to global change (Ervin et al., 2010). Evidence from Nicaragua, Mexico, Ethiopia, Botswana and Kenya, among others, has shown that top-down conservation interventions can also lead to people's displacement from their original territories (Adams and Hutton, 2007; Kaimowitz et al., 2003; Ruiz-Mallén et al., 2014). Forced migration in the

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interest of conservation increases people's vulnerability and can also result in people's dispossession from their native land (Dowie, 2009). These actions continue despite calls for more inclusive conservation approaches (Colchester, 1994; Kaimowitz and Sheil, 2007; Wells et al., 1992).

Since the late 1980s international conservation efforts have advocated for the creation of more participatory resource management approaches and biosphere reserves have been regarded as a means to foster conservation while reducing vulnerability and enhancing adaptation (UNESCO, 2008). Biosphere reserves are conservation sites established by countries and recognised under the UNESCO's Man and the Biosphere programme to promote sustainable development based on local community efforts and sound science.[1] Currently there are 631 reserves in 119 countries, including 14 transboundary sites.[2] Although biosphere reserves are considered a flagship initiative based on participatory and adaptive co-management principles, their inclusion in national protected area systems may mean they are implemented through top-down management approaches rather than being collaboratively managed with local communities. Understanding how biosphere reserves shape local vulnerability and opportunities for adaptation is crucial to guiding the design of adaptation strategies to support local livelihoods.

In this article, we comparatively analyse local communities' vulnerability and adaptation to global change in two biosphere reserves, one in Mexico managed by a top-down approach, and one co-managed in Bolivia. We set out to investigate how biosphere reserve policy and management influence: (1) local people's experienced vulnerability; and (2) their coping and adaptation strategies in response to multiple stresses. The contribution of this analysis is to inform the link between social vulnerability and biodiversity conservation research and how biosphere reserves' management affects local people's vulnerability and adaptation in a context of multiple exposure. We seek to understand how and why management rules and conservation regulations in biosphere reserves are perceived as a source of stress for communities' livelihoods, and what role reserves have in shaping short- and long-term adaptation.

2. Vulnerability, adaptation and conservation in biosphere reserves

Vulnerability is understood as "the state of susceptibility to harm from exposure to stresses -or difficult situations- associated with environmental and social change and from the absence of capacity to adapt" (Adger, 2006, p. 268). Stresses[3] can be continuous hazards, such as prolonged droughts, or discrete events such as price-shocks and land displacement. Social vulnerability studies have helped to assess the impacts of weather extremes, economic downturns and lack of entitlements on people's livelihoods, but they have often analysed a single stress (Adger, 1999; Wisner et al., 2004). The importance of examining the role of multiple stresses and cross-scale interactions in vulnerability and adaptation responses has been recently acknowledged (Eakin and Luers, 2006). For example, climate variability and foreign direct investment flows can reveal substantively different patterns of "winners and losers" across geographies and governance scales if the two processes are analysed together rather than separately (O'Brien and Leichenko, 2000).

But we know that people are not passive agents at the mercy of multiple, dynamic and evolving stresses. Adaptation, defined in this article as a process of social adjustment to stresses to avoid or moderate harm or exploit opportunities (adapted from IPCC, 2014, p. 5), has been instrumental in human development and history, and it continues to explain the co-evolution of social-ecological systems. Adaptation responses are thus mediated by social circumstances and ecological factors at different and linked scales (Folke et al., 2005; Nelson et al., 2007). In the face of rainfall variability and economic pressures, Bolivian highland farmers have for example increased household investment in adaptation through increased use of water, labour and forms of social assets (McDowell and Hess, 2012), whereas coffee growers across Mesoamerica have developed adaptation actions consisting in adopting new crop varieties and management innovations (Eakin et al., 2014). Moreover, rural communities' capacity to adapt also depends on people's own skills and behaviour, mediated by cultural and psycho-social aspects, such as gender, values, beliefs, social status and attitudes to risk (Adger et al., 2009; Ribot and Peluso, 2003). For example, Zimbabwean farmers have typically chosen not to change their agricultural practices in response to a scientific forecast of dry conditions because they perceived higher risks in changing than in retaining their ongoing practices (Grothmann and Patt, 2005).

However, local people's adaptation, particularly in a rural context, will also depend on their ability to access to and benefit from natural resources (Adger, 2003). Household and community access to broader institutions and decision-making processes can also determine their adaptation choices (Agrawal, 2010). Climate change vulnerability studies have explored cross-scale dynamics in rural people's perceived exposure and adaptation responses determined by their access to resources and entitlements (Osbahr et al., 2008; Yates, 2012). Research exploring perceived vulnerability has also highlighted how national adaptation policies, including the creation of protected areas, might result in additional stresses for rural communities lacking control over resources (Bunce et al., 2010). Therefore, there remains a need to understand how and why locally experienced risk and livelihoods responses are shaped by cross-scale institutional processes that influence communities' access to land and participation in decision-making in conservation contexts.

In this regard, scholars and practitioners of biodiversity conservation have paid attention to how externally-driven resource management rules have impacted local livelihoods, analysing the extent to which such rules interact with other stresses and affect local adaptation and conservation "buy-in" (Aswani et al., 2007; Cinner et al., 2009). Rural and indigenous communities living within or around government-managed protected areas, such as national parks, have been often excluded from decision-making. Such exclusion has subsequently constrained further their access to conservation benefits and has resulted in increased vulnerability (Adams et al., 2004; Bunce et al., 2010; West et al., 2006). In contrast, collaboratively managed protected areas have more often offered a governance setting that has allowed local people to better respond and adapt to environmental changes (Olsson et al., 2004; Tompkins and Adger, 2004). Building collaborative governance systems in conservation facilitates local adaptation as long as institutional arrangements are flexible enough to allow for learning and dealing with unexpected changes (Berkes and Turner, 2006).

The latter is especially relevant in biosphere reserves since, according to UNESCO's Madrid Action Plan, such approaches have

[1] Biosphere Reserves – Learning Sites for Sustainable Development. UNESCO. http://www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/biosphere-reserves/ [Accessed 10/05/2014]

[2] World Network of Biosphere Reserves, UNESCO. http://www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/biosphere-reserves/world-network-wnbr/ [Accessed 21/01/2015].

[3] The use of the word *stress* in this article simplifies the wider range of related terms in vulnerability studies, which include disturbances, hazards, disasters, shocks and perturbations (Luers et al., 2003).