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Participatory scenarios to explore local adaptation to global change in biosphere reserves: Experiences from Bolivia and Mexico

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ABSTRACT

In an era of anthropogenic stress on ecological systems at multiple scales, involving rural people in planning for adaptation to social-ecological changes is crucial to strengthen local efforts in dealing with uncertainty. In protected areas, this enquiry is even more relevant since conservation regulations can impinge negatively on people's ability to adapt. In this paper, we use participatory scenarios to explore the desired adaptation options of four rural communities located in two biosphere reserves in Bolivia and Mexico. We collaboratively design four plausible scenarios in each country that encompass distinct climatic, policy, and socio-economic horizons up to 2030. In Bolivia, the scenarios consider colonisation and infrastructure development as key drivers of social-ecological change, whereas in Mexico drivers include rainfall variability and conservation regulations. We discuss these scenarios at community level and highlight that winners and losers of such scenarios are significantly determined by people's ability to access land and natural resources. Communities' preferred policies and strategies for their future adaptation remain limited, thus revealing a context of restricted opportunities in both biosphere reserves. We conclude with policy recommendations to support local livelihoods in the studied protected areas and beyond.

1. Introduction

In the current context of social-ecological change, adaptation policies and strategies need to be opened to continuous learning, reflection, and innovation (Kristjanson et al., 2014). This is particularly relevant in highly vulnerable areas, such as the Latin American tropical region, where changing climatic patterns, political processes, and economic globalisation are likely to increase social-environmental risks especially among rural and indigenous societies whose livelihoods are strongly reliant on natural resources (Eakin and Lemos, 2006). Adapting to social-ecological changes while protecting biodiversity and ecosystem services, which are vital for water and food security, is a challenge for governments, conservation practitioners, researchers, and communities (Brooke, 2008; Pacheco et al., 2011).

Protected areas can contribute to support adaptation if managed under more inclusive approaches and focus on strengthening the adaption options of rural communities located within or around them (Bunce et al., 2010). Strict conservation regulations and lack of local involvement in protected areas decision-making have been found to increase local people's vulnerability (West et al., 2006). Although 15% of the world's land is protected, only 5% of this area is totally governed by indigenous peoples and local communities (Juffe-Bignoli et al., 2014). Inhabited protected areas managed under other governance schemes should desirably make an effort to guide and support rural communities in managing resources sustainably, while ensuring people can progress economically and respond to continuous development challenges (Dudley et al., 2010).

Biosphere reserves, for example, and based on their constitutive mandate to be participatory and inclusionary (Bouamrane, 2007), should proactively involve local people in decision-making and become more attentive to local priorities and concerns regarding conservation challenges, as well as broader social-ecological dynamics. In this regard, co-management approaches constitute

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an attempt to construct collaborative networks between stakeholders at different scales (e.g., local communities, regional or national government) to deal with change and uncertainty (Tompkins and Adger, 2004). In some Latin American biosphere reserves, however, top-down management approaches prevail and constrain conditions for local adaptation due to strict land use regulations and limited local participation in decision-making (Speelman et al., 2014). Exploring "winners and losers" in the context of biosphere reserves, and identifying desirable adaptation options results then critical in advancing current debates on conservation governance and adaptation (Reed, 2008).

In this article we identify and discuss desired adaptation options in relation to future scenarios of social-ecological change in two biosphere reserves in Bolivia and Mexico using participatory scenarios. Within each reserve, we focus on two communities affected by multiple drivers of change, i.e., conservation regulations, climate perturbations, demographic, infrastructure, and/or market-related changes (Ruiz-Mallén et al., 2015). Our enquiry contributes to debates on biodiversity conservation, adaptation, and governance in two ways. First, it sheds light on how conservation policy (i.e., top-down and co-management approaches) and structural factors (e.g., access to land and resources) influence local adaptation to on-going social-ecological change, based on communities' perceptions of "winners and losers". Second, it provides relevant lessons for future adaptation policy in the selected biosphere reserves and the neighbouring region based on local people's views and needs for institutional support.

2. Adaptation options for global change

Adaptation options are defined by the Intergovernmental Panel on Climate Change (IPCC) as available and appropriate strategies needed to address information, resources, and action for ensuring society safety and assets security in response to social-environmental impacts (Noble et al., 2014). In developing countries, rural communities have historically implemented adaptation strategies without or with significant support from other actors, drawing on their capacity to mobilise a diversity of assets (Armitage, 2005). Agrawal (2010) classified these locally developed adaptation strategies as storing, diversification, common pooling, market exchange, and mobility. In the current context of dynamic change, however, the identification and implementation of effective strategies for adaptation often requires the engagement of individuals, organisations, and governments at multiple levels (UNEP, 2008). Governments and/or NGOs can support rural people's adaptation through capacity building, financing mechanisms, infrastructure, technological options, and the like (Biagini et al., 2014).

The 2010 UNFCCC Cancun Adaptation Framework[1] highlights the need to engage stakeholders in sharing knowledge on adaptation actions and in undertaking adaptation activities. However, in low income and high vulnerable regions collaboration between local people and institutions in adaptation research and policy is limited (Felton et al., 2009). Most climate change adaptation strategies across Latin America have been reported to be reactive community-based actions to short-term changes, with limited state involvement (Berrang-Ford et al., 2011). Moreover, when planning for adaptation, governments mostly rely on biophysical models overlooking socio-economic and political impacts (Burton et al., 2002) and ignoring communities' knowledge, practices, and beliefs that have historically help them to adapt to change (Berkes et al., 2000). Only Bolivia, Dominican Republic, Mexico, and Nicaragua recognise the role that local knowledge, risk perceptions, and values can play in guiding formal decision-making for adaptation, as those might explain locally preferred adaptation choices (Ruiz-Mallén et al., 2013).

Government-driven strategies for adaptation can also indirectly reinforce existing inequalities between groups of users (e.g., farmers vs. pastoralists) and challenge the capacities of those more vulnerable to make their livelihoods more responsive to changing contexts (Snorek et al., 2014). These power inequalities define who will succeed or gain something (winner) and who will experience disadvantages or deprivation (loser) from climate change and economic globalisation, or from more concrete and locally experienced social-ecological changes (O'Brien and Leichenko, 2000, 2003). Power inequalities can also emerge from the less documented globalisation of conservation, or the international trend in conservation consisting of top-down designed initiatives disconnected from local conditions (Rodríguez et al., 2007).

Adaptation-concerned scholars and practitioners claim that more information and data on local understandings of change are needed to further recognise social vulnerability and adaptation at the local scale and to develop well-targeted adaptation policies (Noble et al., 2014). In the context of biosphere reserves, it is crucial to explore how conservation stakeholders, including local communities, see the future, which winners and losers – as locally perceived – they identify in plausible futures, and what should be done to develop and/or strengthen local adaptation strategies in conservation contexts.

3. Study areas and methods

3.1. Selected communities in Bolivia and Mexico

This study was part of a larger research project on community-based management and conservation in Latin America (www.combioserve.org). In 2012, we obtained free, prior, and informed consent from regional authorities and local leaders of the four communities participating in the study. In Bolivia, we worked with Alto Colorado and San Luis Chico (hereafter San Luis), two Tsimane'[2] villages located within the Pilón Lajas Biosphere Reserve and Indigenous Territory (PLBRIT), in Beni Department. Alto Colorado has 260 inhabitants spread across 46 households and is located along the Yucumo-Rurrenabaque road whereas the 20 households (83 inhabitants) of San Luis live more isolated along the Quiquibey river. In Mexico, we worked with the migrant *mestizo* and indigenous (mostly Chol) villages of Once de Mayo and Santo Domingo-El Sacrificio (hereafter Once and Sacrificio). Their territory partially overlaps with the buffer and core areas of the Calakmul Biosphere Reserve (CBR) in the state of Campeche. Once has approximately 260 people spread across 78 households while Sacrificio has 620 people and 134 households (Fig. 1).

These four communities were selected based on geographic, political, and socio-economic criteria that could influence adaptation options. First, communities' lands partially or totally overlap with areas declared as biosphere reserves. The PLBRIT in Bolivia was established in 1977 and since 1992 is co-managed between the Protected Areas National Service and the organisation representing the indigenous communities living in the area (Consejo Regional Tsimane'-Mosetene) (Bottazzi, 2009). In Mexico, the CBR was established in 1989 and decision-making is entirely dominated by the government's National Commission of Protected Areas. These distinct management regimes may differently influence local communities' vulnerability and adaptation.

[1] United Nations Framework Convention on Climate Change https://unfccc.int/adaptation/items/5852.php.

[2] The Tsimane' are a relatively autarkic indigenous society in the Amazonia (Godoy et al., 2009).