Forest Ecology and Management 409 (2018) 56–66

Contents lists available at ScienceDirect

Forest Ecology and Management

journal homepage: www.elsevier.com/locate/foreco

Improving the sustainability of working landscapes in Latin America: An application of community-based monitoring data on bird populations to inform management guidelines

Rubén Ortega-Álvarez[a], J. Jaime Zúñiga-Vega[a,*], Viviana Ruiz-Gutiérrez[b], Esteban Berrones Benítez[c,d], Israel Medina Mena[c,e], Francisco Ramírez Felipe[c,f]

[a] Grupo de Ecología Evolutiva y Demografía Animal, Departamento de Ecología y Recursos Naturales, Facultad de Ciencias, Universidad Nacional Autónoma de México, Ciudad Universitaria, Ciudad de México 04510, Mexico
[b] Cornell Lab of Ornithology, Cornell University, 159 Sapsucker Woods Road, Ithaca, NY 14850, USA
[c] Red de Monitoreo Comunitario de Aves de la CONABIO, Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO), Liga Periférico-Insurgentes Sur, No. 4903, Col. Parques del Pedregal, Delegación Tlalpan, Ciudad de México 14010, Mexico
[d] Alta Cima, Gómez Farías, Tamaulipas, Mexico
[e] Adolfo López Mateos, Catemaco, Veracruz, Mexico
[f] Los Mangos, Hueyapan de Ocampo, Veracruz, Mexico

ARTICLE INFO

Keywords:
Cropfields
Forestry
Occupancy models
Productive activities
Shrub cover
Tree species richness

ABSTRACT

Balancing the needs of increasing yields of productive systems while adhering to principles of sustainability is one of the most pressing challenges of the 21st century. However, baselines for management guidelines aimed at mitigating the impacts of working landscapes on biodiversity are lacking for the most biodiverse regions in the world. In addition, there is a scarcity of empirical examples of how information collected using community-based approaches can be used to both define management guidelines and measure outcomes for sustainability. In this study, we used bird observations collected by community monitors to identify the functional relationships between bird occupancy and habitat traits to inform management of productive landscapes. Our results indicated that relationships between bird occupancy and habitat traits depended on species residence status and their affinity to urban-cropfield areas. Percentage of shrub cover was found to significantly influence the probability of occurrence across bird species in the landscape, followed by tree diameter, tree species richness, and time since anthropogenic disturbance. Tree species richness was the only habitat trait that was found to have a positive relationship across all species groups. Seasonal variation in the number of bird species related to habitat traits was only important for shrub cover. Following our results, we identified specific management targets for current land use categories (i.e., conservation forests, forestry plots, urban-cropfield areas) to benefit birds. Overall, we concluded that selective forestry management was not entirely detrimental for birds, as it preserves habitat heterogeneity and vegetation structure. In contrast, intensive forestry management was found to be unfavorable for most bird species, likely driven by the clearing of critical vegetation from the area. Our participatory approach for defining research objectives and collecting data to directly inform management guidelines for communal lands, while using robust analytical tools, shows great potential for promoting sustainable working landscapes in biodiverse regions across the globe.

1. Introduction

Increasing food security while promoting sustainability in productive landscapes is one of the top priorities for biodiversity conservation worldwide (Griggs et al., 2013; Millennium Ecosystem Assessment, 2005). The development of a roadmap to achieve these objectives is particularly challenging in dynamic, tropical ecosystems, where high biodiversity overlaps with accelerated rates of land-use change and important levels of poverty (Adams et al., 2004). In these regions of the world, such as Latin America, productive activities in rural areas often take place within multifunctional landscapes (Fry, 2001), where we can find a mosaic of productive systems and management practices, such as agricultural systems, residential areas, and cattle grazing. Unfortunately, methodologies to assess and adaptively manage such

* Corresponding author.
E-mail address: jzuniga@ciencias.unam.mx (J.J. Zúñiga-Vega).

https://doi.org/10.1016/j.foreco.2017.09.033
Received 15 May 2017; Received in revised form 11 September 2017; Accepted 13 September 2017
0378-1127/ © 2017 Elsevier B.V. All rights reserved.

biodiverse productive landscapes in an integrated manner are still scarce (European Union, 2011; United Nations, 2016).

Rural and indigenous communities are at the nexus of both conservation and development of working landscapes, and represent the social core of land stewardship in tropical ecosystems (Sunderlin et al., 2005). The relevance of these rural and indigenous communities (both referred to as "communities" hereafter) for sustainability is often overlooked but highly critical, as they usually inhabit, own, and manage a considerable proportion of the biodiversity rich ecoregions of the globe (WWF, 2000). As a result, several studies in the last decade have highlighted the active involvement of local communities in determining, monitoring, and managing the effects of their productive activities as a priority task to achieve sustainability in productive landscapes (Lee, 2013; Millennium Ecosystem Assessment, 2005; Ortega-Álvarez et al., 2015).

Current guidelines for sustainable certification schemes for working landscapes in tropical ecosystems are often not empirically tested for their regional efficacy (Auld et al., 2008; Conroy, 2007; van Kooten et al., 2005). As a result, there is little evidence about the conservation value of existing guidelines and sustainable management practices for increasing biodiversity (Blackman and Rivera, 2010; Milder et al., 2015). In addition, most existing guidelines are defined remotely, and do not incorporate the objectives or knowledge of local communities (Durst et al., 2006; Ebeling and Yasué, 2009; Vandergeest, 2007). The integration of local communities into the data collection and decision-making process of management practices and certifications of productive systems is a critical need for sustainability (Medina, 2005). A community-based approach shows great potential towards increasing our current ability to evaluate the impact of existing sustainability guidelines on biodiversity (Vandergeest, 2007), and provide a science-based framework for identifying realistic management interventions to reduce the impacts of productive systems on biodiversity in community-owned landscapes (Ortega-Álvarez et al., 2012; Vandergeest, 2007).

In order to target specific guidelines and practices that are most likely to increase the ecological value of different types of land uses, it is important to evaluate the specific outcomes of these practices on environmental conditions (Gergel et al., 2002; McIntyre and Hobbs, 1999). In addition, it is also crucial to provide robust measures of how environmental changes associated with guidelines and practices influence habitat use by different biological groups (Dahm et al., 2013; Perfecto et al., 2003). If we assume that individuals will avoid habitats that present a cost to their fitness, we can use the probability of use, or occurrence, of bird populations as a metric for evaluating the impact of land-use practices on biodiversity. Among animals, birds have been widely used as a study system to analyze the effects of habitat properties on biodiversity (Chace and Walsh, 2006; Gottschalk et al., 2005; Jones, 2001). Birds represent an excellent model system because they can be efficiently surveyed in a cost-effective manner, respond to human alteration of ecosystems, and exhibit a vast array of different ecological preferences (Burnett et al., 2005; Gardali et al., 2006). Moreover, birds are usually a charismatic and culturally important taxonomical group, they have been successfully used in community-based monitoring efforts, and they are useful for environmental education programs (Ahlering and Faaborg, 2006; Greenwood, 2007).

There is a wealth of information in the field of agroecology on how avian communities use different land-use types and habitat traits in working landscapes. However, most of these studies have not accounted for heterogeneity in detectability among species and habitat types, which have been shown to generate false patterns in the occurrence of species when not accounted for (Archaux et al., 2012; Ruiz-Gutiérrez and Zipkin, 2011). Therefore, when detectability is correlated with land-use type, management guidelines that aim to improve the ecological value of landscapes are likely to be misguided (MacKenzie, 2005). Lastly, few of these studies have been performed with the active participation and collaboration of communities to define the research objectives and collect the data to be used (Barbour and Schlesinger, 2012), hampering the understanding, management, and development of communal productive lands.

The main objective of this work was to measure the effects of current communal management guidelines and practices in a working landscape on biodiversity, by examining the functional relationships between habitat characteristics of community-managed productive landscapes on bird populations. More specifically, we aimed to identify specific thresholds of traits that could be used to define targets to increase the utility of specific land uses for bird populations. We applied an occupancy modeling framework as a robust and powerful analytical tool for monitoring biodiversity and guiding management decisions (MacKenzie, 2005; MacKenzie et al., 2003) by correcting for potential bias driven by heterogeneity in detection among species and habitat types (Mackenzie et al., 2002). We examined the effect of distinct habitat characteristics on occupancy probability of individual species, considering specific metrics that are related to forestry management activities currently performed by the communities. We further considered ecologically relevant features that have been ignored by local management guidelines and practices, and modeled seasonal variation in the effects of habitat variables on occupancy probability of bird species. Lastly, we used our results to propose key management actions to increase bird occupancy.

Our study provides a cost-effective, efficient approach to improve how we measure the effects of productive activities on biodiversity and define guidelines that are likely to be applied by community members who can directly influence management practices in working landscapes. Methods, results, and management guidelines derived from this study may represent a replicable scheme for other communities around the globe to support livelihoods and biodiversity conservation as a whole.

2. Materials and methods

2.1. Study landscape

This study was conducted in the Sierra de Juárez region of Oaxaca in southern Mexico. Oaxaca has some of the highest levels of biodiversity and cultural richness in Mexico (Anta Fonseca and Merino, 2003). A large percentage of the most biologically important Mexican forests are located in Oaxaca, and a great number of these are owned and managed by communities (Anta Fonseca, 2007). Community-managed landscapes are different than other types of landscapes (i.e., private lands, state lands) as they are collectively owned and managed by a local group through property rights and obligations. Decisions on most aspects of landscape planning and management are performed by the group through collective consensus. Territorial rights agreed by communities regulate the exclusion, access, use, inheritance, and the alienation of the land and their associated resources (Bray and Merino-Pérez, 2005).

Our research was carried out in collaboration with the "zapotec" and "chinantec" indigenous communities of Santiago Xiacui, La Trinidad de Ixtlán, Capulálpam de Méndez, and Santiago Comaltepec. These communities are organized in a regional multi-community institution known as the "Association of Zapotecos-Chinantecos Forestry Communities of Sierra de Juárez" (referred to as UZACHI hereafter), which assists these communities in forest management, their main productive activity (Roldán Félix, 2011). Our study area within this landscape (~6335.5 ha) is a mosaic of different land uses, which are owned by three of the four UZACHI communities. Until 1981, regional forests were exploited by a foreign paper mill, but since then, local communities recovered their rights on forests and managed them by their own (Chapela, 2008).

The landscape managed by the UZACHI communities is an ideal study system because: (a) it possess high levels of biodiversity and cultural richness; (b) local governance systems facilitate landscape management processes; (c) community members are interested in

Download English Version:

https://daneshyari.com/en/article/6541870

Download Persian Version:

https://daneshyari.com/article/6541870

Daneshyari.com