Economía Sociedad y Territorio

ISSN 2448-6183

Vol. 25, 2025, e2323
http://dx.doi.org/10.22136/est20252323

Article

Wildlife management in a Mexican biosphere reserve: challenges for inclusive environmental governance

Manejo de vida silvestre en una reserva de la biósfera mexicana: retos para una gobernanza ambiental inclusiva

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Abstract

One strategy for including inhabitants in public policies are the UMAs, which generate income by using resources sustainably. However, the scope of their goals and how they have been implemented in biosphere reserves is unclear. The decision-making processes and the procedures for environmental, economic, and institutional development are analyzed. Despite the communities' limited participation in policy design and their dependence on government funding, they play a crucial role in management. The UMAs contribute to economic diversification and generate income, but they mainly benefit landholders.

Keywords: *environmental governance, biosphere reserves, Mexican state of Morelos.*

Resumen

Una estrategia para incluir habitantes en políticas públicas son las UMA que generan ingresos usando sustentablemente los recursos. Sin embargo, no queda claro el alcance de sus objetivos ni cómo se les ha implementado en las reservas de la biósfera. Se analizan procesos de toma de decisiones y procedimientos para el desarrollo ambiental, económico e institucional. Pese a la limitada participación de las comunidades en el diseño de políticas y en su dependencia de financiamiento gubernamental, desempeñan un papel fundamental en el manejo. Las UMAs contribuyen a la diversificación económica y generan ingresos, aunque benefician principalmente a los terratenientes.

Palabras clave: gobernanza ambiental, reservas de la biósfera, estado de Morelos.

Received: October 17th, 2024 / *Accepted:* February 7th, 2025 / *Published*: October 22nd, 2025

How to cite: López-Medellín, Xavier; Brenner, Ludger y Condori Cordero, Samuel (2025). Wildlife management in a Mexican biosphere reserve: challenges for inclusive environmental governance. *Economía, Sociedad y Territorio, 25*: e2323. http://dx.doi.org/10.22136/est20252323

Introduction

The United Nations Educational, Scientific and Cultural Organization (Unesco) biosphere reserves (BRs) are protected areas (PAs) where participative governance is promoted to support adequate landscape management, equitable distribution of the derived economic benefits, and meaningful participation of the local resource users in decision-making (Brenner and Job, 2022). The term *community participation* is, however, a vague concept —open to varying interpretations— (Stone, 1989), which is impossible to outline in few lines. Public institutions and non-governmental organizations acknowledge it as a measure which aids bureaucrats and elites in getting information without compensating information holders, and in applying their environmental policies while avoiding severe opposition from local populations (Tosun, 1999). Community participation can range from manipulative to coercive, induced, passive, spontaneous, etc. (Tosun, 2006). However, in this article, it will be referred to as a more genuine form of participation, which requires the creation of opportunities that enable members of a community and the larger society to actively contribute to and influence the developmental process, therefore prompting equal distribution of the generated economic and social benefits (Tosun, 2006). Local participation should foster the collective construction of horizontal relations and avoid external intervention, emphasizing the self-determined organization of local communities (Iglesias Pérez and Jiménez Guethón, 2017). This genuine participation is of special significance in regions with rural populations where livelihoods depend on harvesting natural resources, and where the imposition of restrictions on their exploitation may be either inviable or rejected (Adams and Hutton, 2007).

In such settings, and particularly in BRs, it is of paramount importance to mitigate the —often conflicting— objectives and demands of actors interested in resource use and management through the promotion of strategies that enhance genuine participation by all the implicated actors in the establishment of conservation policies, day-to-day operation, and strategic management (Adams and Hutton, 2007; Brenner and De la Vega, 2014). However, the political-administrative structures and patronage practices common in Latin America and Mexico can limit the creation of new, more effective governance practices (Estrada Rodríguez, 2015). Furthermore, groups of individuals with more economic resources, knowledge or political positions might influence decisions and actions with social and environmental implications

(Bull and Aguilar Støen, 2016). More inclusive approaches can support environmental conservation and local economic development through comprehensive land use planning that defines specific areas for economic activities or strict measures of environmental protection (Unesco, 2008). Explicitly considering and mitigating contrary interests, and ensuring adequate mechanisms of representation, participation, and accountability tends to foster the establishment of inclusive and effective institutions that enhance trust-building and legitimate decision-making, and may reduce socioenvironmental disputes (Bull and Aguilar Støen, 2016). In this domain, various environmental paradigms, strategies, and policies have been proposed (Durand and Vázquez, 2011), but many attempts to foster more inclusive decision-making have failed (Gallina Tessaro *et al*., 2009).

Sustainable harvesting of natural resources as a way to encourage innovative area-based conservation has been promoted in Mexican BRs since 1997, by establishing environmental management units (UMAs, for its acronym in Spanish). These units serve the purpose of conserving ecosystems, providing long-term ecosystem services, and generating economic benefits from the harvesting of flora and fauna (Ley General de Vida Silvestre [LGVS], 2000). This public-based conservation policy explicitly aims to promote direct interaction and cooperation among various actors (the government, local populations, non-governmental bodies, the academia, the private sector) by strengthening local decision-making groups and/or institutions and creating positive attitudes toward environmental conservation (Semarnat, 2015). It also seeks to generate economic benefits for local communities by creating sources of income and employment based on wildlife harvesting (extractive and/or non-extractive) and the support of government subsidies (LGVS, 2000), which are measures and objectives that correspond to the proposed Lima Action Plan (Unesco, 2016).

UMAs operate on the basis of wildlife management devised for either private or communal lands or properties, under two modalities: a) extensive, in which an external "technician" (often a trained professional or experienced former government official/NGO staff) is formally in charge, aiming to promote the natural growth of the wildlife populations that will be exploited, and to preserve ecosystems and biodiversity; and b) intensive, where wildlife populations are directly managed in enclosed installations with or without access to open spaces (LGVS, 2000). UMAs work with management plans developed by consultants entrusted with tasks such as applying for

harvesting permits, registering the UMA, and monitoring wildlife and their surrounding ecosystems to ensure sustainable exploitation. Today, UMAs are often considered an innovative —though still top-down— strategy of participative environmental policies in all 44 Mexico BRs (Contreras Hernández, 2021), which responds to the national implementation of participative strategies suggested by the Madrid Action Plan as well as the Sustainable Development Goals by the United Nations. Their activities involve three key groups of actors involved in decision-making: a) federal government agencies; b) intermediaries (consultants, non-governmental organizations [NGOs]), who act as "brokers" between the government and the communities; and c) local communities that include *ejidatarios* (land rights holders and decision-makers in assemblies) (Condori Cordero *et al.*, 2023).

Since the first UMAs were established 25 years ago, more than 12,000 have been registered by Mexican authorities. Currently, they cover at least 38.7 million hectare, or 19.6% of the national territory (Semarnat, 2015). Their operation and success vary according to the disparities in land tenure (either social or private), as well as the demand for certain wildlife species. In northern Mexico, where private tenure prevails, UMAs have proved to be an effective conservation tool for local populations and hunting associations since they attract US hunters by offering valued trophies; meanwhile, in central and southern Mexico, social tenure prevails (communal or *ejidos*), and UMAs have not been as successful, seeing that the received income has to be distributed among several families, and some of the local species are not as attractive for hunters (Gallina Tessaro *et al.*, 2009). In the state of Morelos (located in central Mexico), 242 extensive UMAs (equal to 32% of its land) have been established, and no fewer than 25 of them are located in the Sierra de Huautla biosphere reserve (SHBR), as a means to foster sustainable wildlife harvesting through controlled hunting of the white-tailed deer (*Odocoileus virginianus*) (Semarnat, 2015). Active hunters include both locals, who hold usufruct rights (*ejidatarios*), and fee-paying (relatively wealthy) visitors.

The SHBR has a population of 23,930, who reside in 31 communities in a region marked by high levels of poverty. Local people depend —to varying degrees— on income prompted by leisure hunting and wildlife harvesting. The white-tailed deer is a highly esteemed resource, since its meat is part of their traditional diet (Juárez Mondragón *et al.*, 2015). Since UMAs are compatible with the normative paradigm of the Unesco BRs, the SHBR seems an appropriate setting for analyzing the outcomes of government policies designed to implement an explicitly inclusive regime of environmental governance, which determines the conditions of access to natural resources and

participation in decision-making related to extractive activities and the distribution of incomes (Andrade, 2016). Thus, assessing such outcomes of UMAs provides useful insights when it comes to evaluating environmental policies that strive to implement participative strategies and instruments in internationally promoted PAs, such as BRs.

Several analyses of the actors' participation in UMAs in central and southern Mexico have identified crucial shortcomings, namely, limited social participation, inadequate distribution of benefits, poor coordination among actors in UMA operations, and decision-making based on unreliable data concerning harvesting practices (Gallina Tessaro, 2012). The authors of those studies suggest improving the effective participation of all relevant actors and ensuring continuity in management, stricter enforcement of regulations on wildlife harvesting, and a more effective monitoring of wildlife species and their habitats. Further research, however, highlights successful UMA operations that have generated alternative sources of income and increased wildlife populations (López-Medellín *et al.*, 2017; Juárez Mondragón *et al.*, 2015).

There is little information regarding governance-related issues that could foster or hamper inclusive environmental conservation through the establishment of UMAs in Mexico's 187 PAs, including 44 BRs. Thus, it is unclear how UMAs, being key elements of place-based environmental policies, are adapted to and implemented in local communities. Buda Arango *et al.* (2017) analyzed the performance of some UMAs that produce plants in biosphere reserves in Chiapas (southern Mexico), and concluded that certain conditions like the access to markets, land tenure certainties, capital and labor force within communities, as well as the trust and reciprocity between participants are paramount in creating income opportunities for communities. However, little is known about the spectrum of involved actors and the outcomes of decision-making processes at distinct spatial and organizational levels, since most research has focused —exclusively or primarily— on conflicts between government agencies and local communities, while paying little or no attention to the crucial role of "brokers", who connect these two groups of actors during the implementation of environmental policies on the ground. It is, therefore, important to analyze their role to better understand the factors that facilitate (or limit) meaningful, effective participation by local communities. There is also little information regarding the economic benefits generated by UMAs and how they are distributed in local populations, both issues of crucial importance for the acceptance and inclusive management of the UMAs. A deeper understanding of these issues would

contribute to the research in the field of environmental governance in general, and of BR management in particular.

Against this background, the achievements and drawbacks of UMAs that are currently operating in an internationally recognized PA, the Sierra de Huautla biosphere reserve (SHBR) were analyzed by focusing on broad decision-making processes and the accords and/or procedures created to foster economic, environmental, institutional, and social development by promoting the inclusion of local communities (Brenner and De la Vega, 2014). The study draws on Kooiman's (2003) concept of *governance*, conceived as the set of processes that determine interactions among actors. In this approach, governance determines both the context and the manner in which specific actors make decisions and exercise power to achieve their goals. Governance, in addition, usually entails normative and ethical notions concerning the exercise of participative democracy among actors, and the equitable distribution of benefits (Brenner and De la Vega, 2014). Thus, environmental governance (EG) interrelates general goals, specific objectives, and outcomes regarding the sustainable use of natural resources directly with interactions among local resource users, government agencies, consultants, NGOs, and the academia (Barriga *et al.*, 2006). But EG is also concerned with the cooperation and conflicts between society (including local communities) and government agencies, regarding natural resource management. In a normative perspective, EG should be based on a set of regulations, traditional practices, and local institutions, historically involved in local environmental management (Pineda-Vázquez *et al.*, 2019).

Environmental governance is not, however, limited to government policies and actions, for it also considers the local actors who exercise control over their lands and harvest their resources (Delgado *et al.*, 2007). It conceives, as well, that such processes include distinct actors interested in formulating, designing, and executing practices that configure the access to —as well as the use, control, surveillance, management, and harvesting of— natural resources (Hogenboom *et al.*, 2012). EG can only achieve legitimate, transparent, and effective mitigation of conflicts of interests through transparent processes of negotiation that resolve disputes over key issues like resource harvesting and conservation, the distribution of benefits, and the sustainable exploitation of natural resources (Ortega Argueta and Contreras Hernández, 2015). Moreover, EG must establish legal and institutional frameworks to apply the new rules that usually entail restrictions on the use of those resources. However, because this may affect the potential of local populations for economic

development, it can spark conflicts between local inhabitants and government authorities at different levels (Brenner and Job, 2022).

Management at the SHBR involves top-down, federal conservation policies mediated by "brokers", who often are consultants seasoned in creating and managing UMAs in lands where local communities are used to applying traditional regulatory practices, but where other influential actors (consultants, academic institutions, civil organizations) are also present. This constellation provides an opportunity to gain insight into how EG in Unesco UMA-based BRs performs at different decision-making levels that involve actors who often have conflicting interests and unequal power resources, which might hamper equitable sharing of benefits due to those interests, but also to biased power relations at the local level (Tran *et al.*, 2020). In such settings, it is crucial to identify the key actors who participate in federal environmental policies that are "tailored" to fit the local contexts and then implemented on the ground, since UMAs are designed and implemented by external agencies (brokers), and thus, local communities and their traditional ways of governing natural resources are often ignored (Salerno *et al.*, 2020). This analysis is important for international conservation policies due to the huge number and extension of the UMAs currently operating in Mexico's PAs.

Based on a comparative study, the evidence obtained is then synthesized during field research in four communities with extensive UMAs, firstly by approaching local authorities to request their permission to perform interviews in their communities. Then, different groups of actors involved in environmental management were identified and interviewed, focusing on the forms of resource use and the distribution of obtained (or pursued) benefits, as well as the conflicts that might occur. Our research questions were:

1) How and with what results are environmental wildlife-harvesting-based policies implemented in communities in a Unesco BR?

2) What groups of actors are involved in decision-making processes and how do they interact?

3) What factors foster/limit effective participation in decision-making and economic benefits by local communities?

We now proceed to describe both the study area and the methodology applied, before addressing the decision-making processes, actors involved, and economic benefits and their distribution, which are the foci of this paper. This description is followed by a discussion of our findings and concluding remarks.

http://dx.doi.org/10.22136/est20252323

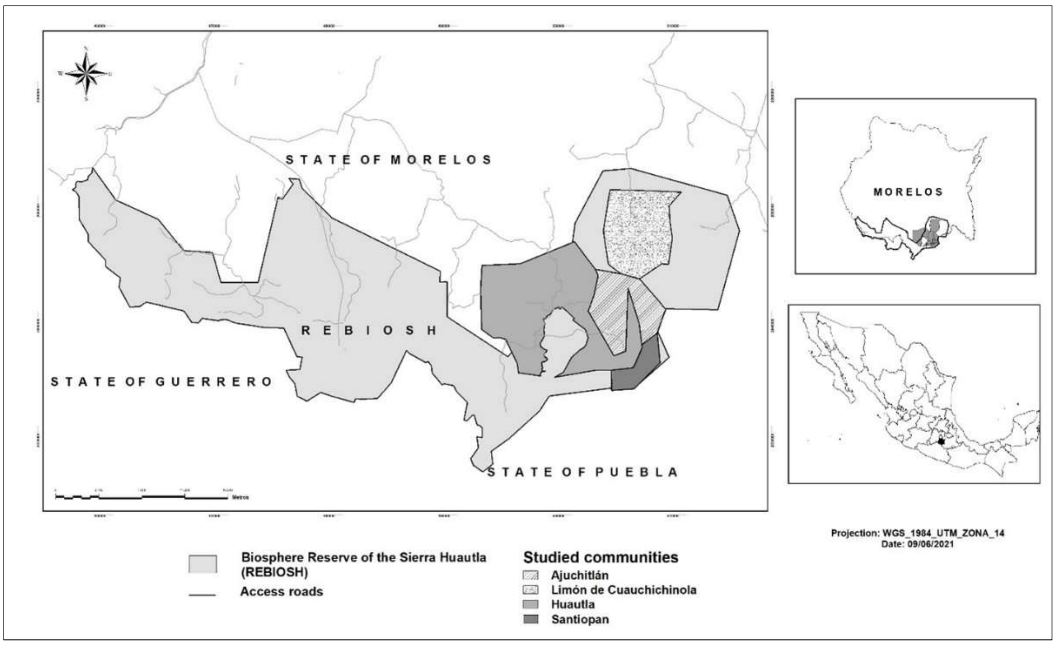
Study area

With an extension of 59,030.94 hectare, and an altitudinal variation of 700 to 2200 meters above sea level, the SHBR was created in 1999 to protect the most extensive remaining tropical deciduous forests in the state of Morelos. It is located some 150 kilometers south of Mexico City (map 1), where it protects one of the most endangered ecosystems in the country (Osorio Beristain, 2012). The SHBR is home to 31 communities with a total population of 23,920. The area is highly-marginalized, due to poor access to health, transportation, and educational services. Employment opportunities are limited and depend heavily on natural resource exploitation and ecosystem services (Conapo, 2021). Since hunting is a traditional practice still widely used to obtain high-protein foods, several UMAs have been created since 1997 to promote sustainable hunting of the white-tailed deer (*Odocoileus virginianus*), a species now broadly propagated in the region due to long-term conservation measures that have led to wildlife recovery (López-Medellín *et al.*, 2017). However, populations vary considerably in the reserve, depending on the extent of poaching by various neighboring communities (Juárez Mondragón *et al.*, 2015).

Our research focused on the four communities where the first UMAs were created: Santiopan, El Limón de Cuauchichinola, Ajuchitlán, and Huautla (map 1). The total population is approximately 1300, with 377 *ejidatarios*, 90 *avecindados* (locals with no formal land rights who are excluded from formal, collective decision-making), and their families. The *ejido* assembly is the supreme institution in most agrarian communities in Mexico. Only legally-recognized *ejidatarios* can participate in assemblies. All accords reached there are binding on all *ejidatarios*. Our study area covers 16,689.66 hectare (almost entirely declared as UMAs), of which 78% has tropical deciduous forest cover. UMAs were established between 1997 and 2002 with the aid of external consultants, and in accordance with official regulations.

Map 1

SHBR: Study area and local communities (*ejidos*)



Note: Santiopan, 952.84 ha, (80% UMA); El Limón de Cuauchichinola, 3977.66 ha (100% UMA); Ajuchitlán, 2842.95 ha (100% UMA); Huautla, 8750.15 ha (100% UMA).

Source: own elaboration based on *ejido* limits.

1. Methodology

To gather information on the establishment and operation of these UMAs, semi-structured interviews were carried out with *ejidatarios*, aiming to record their perception of the decisions made on management-related issues, the benefits generated, as well as their distribution, perceived problems, and resolutions (or lack thereof). The focus was on *ejidatarios* themselves, since only they have the authority to speak and vote in the communal decisions made at assemblies. Representatives of federal government agencies related to the UMAs: Semarnat (Secretariat of Environment and Natural Resources), Conafor (National Forestry Commission), Profepa (Federal Attorney for Environmental Protection), and one academic institution, the Cibyc (Center for Biodiversity and Conservation Research) of the Universidad Autónoma del Estado de Morelos (which co-administers the BRs with the Conanp [National Commission of Protected Natural Areas]), were also interviewed, as were the representatives of local consulting firms that deal with the paperwork

required to register the UMA, monitor wildlife populations, request harvesting permits, commercialize products, and apply for funding.

A total of 52 interviews were held from January 2018 to October 2019: 46 with local residents, four with the official agencies Semarnat, Conafor, Profepa, and Cibyc, and two with consulting firms (which manage all of the analyzed UMAs) (see ESM 1). All interviews were recorded after obtaining the interviewee's consent. The audio tapes were transcribed in full for qualitative analysis using ATLAS.ti (Muñoz Justicia and Sahagún Padilla, 2017). Excerpts were taken and 174 codes were inductively defined, divided into families and subfamilies: benefits (environmental, social, economic); perceived problems (lack of interest, lack of resources, poaching, insecurity, ineffective management, overharvesting); agencies (presence, participation, performance); activities performed (communal surveillance, local rule enforcement, community assemblies); and the work of the consultants (activities, presence, recommendations, communication, trust) (See ESM 2 for the description of code families and subfamilies). These extracts were used to illustrate the findings (Muñoz Justicia and Sahagún Padilla. 2017).

2. Results

First, issues related to decision-making among the key actors (government agencies, consultants, other intermediaries, and the *ejidatarios*) will be addressed. Then, the analysis will focus on the economic benefits generated by the UMAs and their distribution.

2.1. Government agencies

The Semarnat is the main federal agency in charge of developing and implementing policies to protect Mexico's natural resources, in coordination with subordinate bodies such as the Conafor and the Profepa. It promotes environmental management in conjunction with both state and municipal governments and the private sector. UMAs belong to a set of departmental policies, specifically the Program for Wildlife Conservation and Productive Diversification, which has operated (since 1997) to integrate strategies of environmental, social, legal, and economic wildlife management, promote social participation, and generate economic incentives. Thus, the Semarnat

plays a key role in policy design and defines the general rules for implementation and all the associated procedures.

As a subordinate agency, the Conafor is in charge of developing, supporting, and promoting the conservation, restauration, and productive exploitation of ecosystems. It provides the services of professional consultants and supports *ejidos* during the establishment and operation of UMAs by paying the consultants' fees, hiring staff, and conducting productive diversification studies, among other activities. Therefore, the Conafor plays an important role in decision-making by controlling the funds needed to implement and operate the UMAs. "We have been supporting the management practices of the UMAs, like establishing management plans, building water stations for wildlife, cleaning riverbeds, putting up live fences, monitoring wildlife…" (interview with a Conafor official).

The Profepa, another dependency of the Semarnat, is entrusted with enforcing environmental laws and regulations. However, several studies (Durand and Vazquez, 2011) have questioned its capacity to effectively enforce regulations. This agency also participates in organizing, training, and certifying local environmental "surveillance committees", formed to support its operations on the ground. These committees are created to foster positive, informed, responsible participation by local communities in monitoring wildlife harvesting. They also attempt to implement local decisions on specific management issues (Cueto García and Brenner, 2021), such as the duration of hunting seasons. "We have a national system of surveillance committees. They are the Profepa´s eyes. Their task is to look out for environmental violations of environmental laws and notify us. They do not have inspection faculties, nor can they carry weapons" (interview with a Profepa official).

2.2. Intermediary parties/consultants

Professional consultants (endorsed and paid by the Semarnat, locally known as *técnicos*) function as intermediaries —or "knowledge brokers"— between federal agencies and local communities. They became essential for implementing national environmental policies on the ground (at the request of *ejido* assemblies) and for seeking government or private funding to create, develop, and manage the UMAs. Consultants also provide technical assistance to *ejidatarios*, perform wildlife monitoring activities, elaborate management plans, and process the paperwork that government agencies require. Finally, they participate in assemblies where they inform local people on issues concerning

the UMA, and coordinate with authorities at different levels. "We link communities and financing sources to establish and operate the UMAs. The community pays us indirectly, if we can find and secure funding, [that] pays our salaries. Our policy is not to charge communities, but to be paid for our work" (interview with a consultant).

Interviewees commented that the first consultants (active in the 1990s and early 2000s) failed to fulfill the terms of mutual accords, thus hampering trust-building. But cooperation with the following advisers was more effective and mutually beneficial. Community surveillance committees trained by those consultants began operations shortly afterwards, reporting violations to the *ejido* assemblies so they could more effectively sanction perpetrators (e.g., by excluding them from the UMA or subsidiary programs). As a result, relations between *ejidatarios* and consultants improved considerably and both parties have profited from their cooperation, in both economic and social terms. "There was another consultant, but we fired him. Then this one came and really supported us. We've been working together for 12 years. He explains [everything] carefully if we have questions. He gets paid, [with] money from the projects" (interview with an *ejidatario* de El Limón de Cuauchichinola*).*

Though by no means uninterested participants, consultants provide information to local authorities and offer training that enhances local people's capacities for environmental management. "Natural management, [involves] strategies that are already written or can be implemented technically, but if social issues aren't resolved, things won't work, no matter who the consultant is. Everything must be handled through the assembly, the highest authority in the community" (interview with a consultant).

In addition to the consultants, the Cibyc participates —indirectly— in decision-making, as it co-administers the SHBR through an accord with the Conanp. This academic institution provides the necessary funds to implement development programs, distributes information to communities, and conducts applied scientific research. Along with the Conanp, it encourages local residents to participate in conservation measures, such as sustainable economic activities and wildlife monitoring. The Conanp designs and executes most of the subsidiary programs with the Cibyc, acting as both a support and advisory institution, although one that has no say in managing the UMA, since it is not part of local communities.

2.3. Local communities

All communities in the SHBR are organized around the assembly, the key decision-making platform at the local level. Its chair (*comisariado*) has executive faculties, serves as the community's legal representative, is responsible for executing and enforcing agreements reached at the assembly, and acts formally on behalf of the community. The General Wildlife Law explicitly recognizes the traditional decision-making processes, but also the *ejidatarios* as legitimate landowners who enjoy permanent, shared usufruct rights, as well as individual property. Thus, the creation and management of the UMAs are formally ruled by the decisions of the assembly, though within the legal and administrative framework defined by the Semarnat and implemented by the Conanp. This means that only the *ejidatarios* —and not the *avecindados*—, are entitled to participate in formal decision-making at the local level. Similarly, the *ejidatarios* are the only beneficiaries of both the government and NGO subsidies. Regarding UMA management, consultants report to the assembly when funds become available; thus, they serve as an essential link between federal institutions and local communities, since the latter are rarely able to access funds on their own due to the complex administrative procedures involved. However, decisions on whether or not to seek funding are made exclusively by the local communities.

Our interviewees mentioned two types of decision-making regarding the operation of UMA operation: decisions made "locally" (*i.e.*, by the assembly), and those taken "externally" (that is, by government agencies). As a result, decisions regarding who can participate in UMA-related activities, and the distribution of benefits, are made locally, though generally in collaboration with the consultants. In contrast, communities have virtually no say in the design of government policies or their implementation procedures. Interviewees further said the information on support programs, funding, and details on harvesting or hunting quotas (among other important issues) is typically conveyed to them by the consultants. "Working together on their crops has helped gain their trust, as has given them advice on topics related to the UMAs. We're respectful toward the assemblies' decisions. They decide on how to sell hunting permits, or whether to let *avecindados* participate" (interview with a consultant).

Generally speaking, the UMAs do not leave a wide margin for decision-making at the community level regarding implementation and operations, but do generate some limited social and economic benefits for the inhabitants.

2.4. Limited benefits generated by the UMAs

As shown by Brenner and Bosch (2016), the revenues generated by leisure activities tend to foster community involvement in sustainable wildlife management, so income from hunting is a key factor for the long-term success of these UMAs. In the study area, economic benefits are obtained mainly through the sale of hunting permits to visitors. Interviewees stated that the *ejidos'* authorities prefer to sell permits (authorized by the Semarnat on a regular basis) to visiting hunters, generally for $5000 to $8000 MXN per deer (about $280 to $450 USD), a considerable amount in the marginalized study area. Income, however, varies widely among these communities, as some local authorities do not set a minimum price and sell permits for less than $5000 pesos. Profits also depend on the moment the Semarnat issues hunting permits. Several locals have complained they often arrive late in the hunting season (November 25th to February 12th, when only adult males can be hunted), leaving little to no time to offer them to well-funded, non-local hunters. Although permits can be sold to both *ejidatarios* and *avecindados*, revenues rarely exceed $500 pesos (~$28 USD, i.e. less than what the Semarnat charges for issuing them). Interviewees mentioned that it is often impossible for them to sell all the permits to visiting hunters. Leisure hunting, however, does benefit the *ejidos*, as the meat obtained is usually distributed among all members of the hunting party.

It is important to note that the Semarnat has issued relatively few permits (see table 1). From 2013 to 2018, the UMA at El Limón de Cuauchichinola obtained 10-17, while Ajuchitlán received 8-10 from 2015 to 2018. Huautla got 15 per year, and Santiopan received the fewest (only 5-6 from 2015 to 2018).

Table 1

Number of hunting permits granted every year per community

Community	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*
Santiopan	ND	ND	5	Closed	6	6
El Limón de Cuauchichinola	10	12	12	12	15	17
Huautla	15	15	15	15	15	s/d
Ajuchitlán	Closed	Closed	8	8	10	10
Total	**25**	**27**	**40**	**35**	**46**	**33**

Note: ND = no data

Source: own elaboration based on UMA reports to the Semarnat (Semarnat, 2013-2018).

Assuming that all permits were sold to non-local leisure hunters (a rather optimistic scenario), Santiopan would have received $4700-$7600 USD in three hunting seasons; El Limón de Cuauchichinola, $24,000-$38,500 USD in six seasons; Huautla, $24,700-$39,500 USD in five seasons; and Ajuchitlán, $10,000-$16,000 USD in four seasons. Thus, the total generated revenue UMA-generated revenue in the entire study area ranged from $63,500 to $101,500 USD.

Income distribution from hunting permits varies depending on each community's practices. In El Limón de Cuauchichinola, revenue is distributed evenly among all the individuals who participated in managing hunting activities. In contrast, earnings in Ajuchitlán are used for either covering the operating expenses of the *ejido* administration (travel, stationery, communications) or for purchasing equipment such as shovels, ropes, construction materials, or weighing machines for cattle. In Huautla and Santiopan, revenues cover the expenses of the *comisariado*.

With respect to non-monetary (social) benefits, UMAs have strengthened the internal organization of the *ejidos* through the emergence of specialized working groups. Most of those units have been trained to enhance local capacities for monitoring wildlife more effectively. Interviewees stated that the assemblies divide *ejidatarios* into working groups that perform distinct activities (surveillance, wildlife monitoring, hunting assistance, cooking, lodging). Most *ejidatarios* in Ajuchitlán and El Limón de Cuauchichinola currently participate in activities related to the operation of their UMAs, and have been involved in their operations from the beginning. Interviewees from Huautla and Santiopan mention temporary involvement in various activities, such as hunting and/or temporary jobs and other subsidiary programs. They stated that the activities performed by the surveillance committees, along with community-based conservation activities, have led to an increase in the population of deers and of other wildlife species that, in turn, might lead the Semarnat to authorize more hunting permits for future seasons. Another sign of progress is that the economic benefits are now managed more transparently, under the supervision of the assembly. "…well, [the community] is more organized now, before everybody went their own way, but now the assembly says what's to be done and it's done by all the community" (interview with an *ejidatario*, El Limón de Cuauchichinola).

Despite the aforementioned, several additional factors limit the real impact of these benefits. These include unequal distribution, inconsistency in annual wildlife harvesting quotas, and non-compliance with agreements made at assemblies. Santiopan was one of the first communities to register a UMA (1997) and interviewees there said that, initially, there was more interest and motivation among the *ejidatario*s to participate in its operations, but that this had

recently diminished. They also stated that serious conflicts had occurred with poachers from nearby communities outside the SHBR, whom they hold accountable for the decline of the deer population in their lands, a fact that prevents them from obtaining additional hunting permits. This situation also affects surveillance and law enforcement, as *ejidatarios* from Santiopan prefer to avoid violent disputes with their neighbors.

Interviewees in Huautla highlighted the scant participation of *ejidatarios* in hunting and subsidiary programs, mentioning that almost 30% of them did not participate in implementing the UMA system because, a few decades ago, the majority of men were working in mining activities that generated most of the community's income, complemented by earnings from the exploitation of local resources like seasonal agriculture, extensive cattle-ranching, and the traditional harvesting of flora and fauna. When the mine closed, some men took work as carpenters, blacksmiths, or merchants, or lived on money sent by relatives who had migrated to the United States; hence, they had little interest in UMAs, for they judged it would not provide any considerable amount of income.

Another issue that emerged during the interviews includes the fact that, although training is offered to all residents (both *ejidatarios* and *avecindados*), only the *ejidatarios* already working for the UMAs tend to participate. Interviewees observed that training activities were more frequently available upon the creation of UMAs, now occurring only sporadically and being offered to the *ejidatarios* by government agencies or NGOs. They stated those activities were not performed on a regular basis, despite the fact that ongoing training is established in the UMA's management plan. Other interviewees said that various training courses were held at first, but none had been offered as of recently. "…lately they haven't been training us, but when the one who supported us used to come, he taught us how to hunt and to excel in it, but now there's no training" (an interviewee in Santiopan).

Many interviewees criticized the lack of coordination between local and government institutions, citing that this had worsened from the start of UMA operations on. In their view, Semarnat and Conanp officials and staff initially visited the communities regularly, but they no longer do. Only the Conafor still supports communities with subsidiary programs on a regular basis. This federal agency also fosters local participation by holding meetings to provide information on diverse initiatives and programs. "…the previous authorities never mentioned what they did or if there was any economic [support]. Now, since we're authorities [the new *comisariado*], we got $32,000 pesos ($1650 USD) and informed the assembly on resources, their use, and the amount received from hunting" (an interviewee in Ajuchitlán).

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3. Discussion

For the sake of clarity, this section will address our research questions in the same order they were mentioned in the introduction. Regarding the first question (How and with what results are environmental wildlife-harvesting-based policies implemented in communities in a Unesco BR?), it became clear that government agencies are still leading actors who largely control the management of deer hunting, using UMAs as a key tool, applied by the government's environmental institutions in a top-down manner. Provided that national environmental policies are implemented by centralized federal institutions, UMAs are expected to be efficient in varying environmental, social, and economic contexts. Hence, it comes as no surprise to learn that they have not been designed to adapt to varying needs of heterogenous collective actors, such as local communities. UMAs are the result of traditional, centralized, sectorial policies, so they are not guided by a flexible strategy that could foster genuine local participation in the conservation programs or attend to specific needs and priorities. Consequently, they tend to exacerbate disparities between local communities and government when it comes to policy implementation on the ground, a problem also observed by Jardón Medina *et al.* (2017). Furthermore, local communities are not significantly involved in the establishment of UMAs, as these units depend mostly on government agencies and consultants for their operations. These issues have been highlighted in numerous case studies conducted in Mexican BRs (see, for example, Durand and Vázquez, 2011; Durand *et al.*, 2014; Buda Arango *et al.*, 2017; Brenner and Job, 2022).

Despite their limited participation in policy design and their strong dependence on government funding, local communities play a crucial role in day-to-day management. Since the communities in the SHBR differ in key attributes (e.g., number of inhabitants, ratio of *ejidatarios* to *avecindados*), operative decision-making depends largely on —and is ruled by— assemblies, which determine who will benefit from the revenues. As we have shown, UMAs may include only *ejidatarios* and categorically exclude *avecindados* (witnessed in three BRs by Brenner and Job, 2022), while others may allow them to benefit to varying degrees (Gallina Tessaro, 2012). To make conservation more inclusive, decision-makers must acknowledge the vital role of all locals, particularly in areas where biodiversity is to be conserved. This means that *avecindados* should be included in UMA management. It is widely acknowledged that, considering the needs of all local

inhabitants, respecting local institutions that are important for conservation, and fostering the effective participation of all parties interested in conservation activities are necessary steps to achieve long-term environmental conservation (Tran *et al*., 2020). In order to achieve these goals, it is crucial to empower local communities, as they should have a say in both decision making and policy implementation (both of which evenly involve all actors), all of which would foster a stronger and a more socially-balanced environmental governance (Dawson *et al*., 2024).

Consultants are other crucial actors due to their role in promoting, developing, and operationalizing the centralized environmental policy tools of UMAs to "adapt" them to specific local contexts and circumstances. Thus, they act as efficient, key facilitators who bridge the cultural and organizational gaps between government institutions and local communities. As Brenner and Bosch (2016) stated, consultants often act as "knowledge brokers" who benefit local communities (and, of course, themselves) by contributing strongly to the feasibility of implementing environmental policies, though this may imply that local communities develop dependency on the networking capacities and external goodwill of consulting firms. These external brokers "tailor" their networks to the local contexts and implementation needs, being valuable components that might contribute to the implementation of biodiversity conservation policies (Loch *et al*., 2024).

However, it is fair to say that UMAs have largely failed to fulfil the normative paradigm of Unesco BRs in terms of fostering participatory resource management, where local communities have a decisive, independent say in planning and management issues. The strong dependence on external consultants and government agencies reflects the traditional approach of centralized, government-controlled biodiversity conservation in Mexico that impedes the emergence of the kind of inclusive, multi-stakeholder decision-making that could lead to genuine community-led UMA management in BRs. This is an issue present in many BRs across the planet (see Van Cuong *et al*., 2017). Irrespective of the regions, types of ecosystems, and conservation policies, it has been argued that one way to foster the involvement of local communities is to strengthen and enhance collective action, cooperation, and reduced conflicts (Dawson *et al*., 2024).

Regarding the second research question (What groups of actors are involved in decision-making processes and how do they interact?), it is important to mention that four groups interact in distinct contexts and at different levels: federal government agencies, consultants, *ejidatarios*, and *avecindados*. Government institutions control the conceptualization, design, and execution of

environmental policies (including regulation enforcement) related to the conservation and sustainable exploitation of most natural resources in the SHBR and other PAs in Mexico. These institutions cooperate with (and depend on) consultants, who function as intermediaries between the government and communities, while offering their remunerated services to both *ejidatarios* and official institutions. Thus, as Méndez Méndez (2023) notes, their skills, efforts, and resources are crucial to the communities' efforts to obtain and manage funding and subsidies. Moreover, as knowledge brokers, consultants "translate" government regulations, subsidiary programs, and management requirements (usually written in highly technical language) to colloquial terms that local people can understand. They also advise assemblies on regulating access to natural resources and fostering the coordination required to perform management-related tasks. If communities deem the consultants trustworthy, their work can result in environmental and social benefits, as locals are much more likely to collaborate with them and accept their advice. We coincide with Cash *et al.* (2003) in arguing that, if the relevant stakeholders perceive the information and advice given as credible, salient, and legitimate, those contributions can effectively influence the evolution of local responses to public issues.

The *ejido* assemblies negotiate and establish agreements with institutions, both governmental and private, to benefit their communities and serve as potential spaces for deliberation on how to assess funding options. They can also foster more genuine, effective participation by *ejidatarios* and *avecindados*; a scenario that coincides with research conducted by Torres Mazuera and Recondo (2022). However, the fact that only locals who hold formal usufruct rights (*ejidatarios*) benefit from government funding and subsidies, impedes more inclusive participation and the acceptance of conservation policies, as has been observed in BRs located in southern Mexico (Caballero Salinas *et al.*, 2021). The lack of representation of marginalized groups inhibits the ability to implement conservation policies that benefit all communities evenly. In this context, it is imperative to conceptualize "nature" and how to conserve it, because it influences the way we include or exclude the communities in conservation, and hence, the outcomes of conservation on wildlife and people (Morales *et al.*, 2022).

During our field work in the SHBR, we found that decisions on environmental management are not unilaterally imposed by the most powerful actor (government institutions), but worked out in a complex setting, in which four groups of actors interact in distinct —sometimes conflicting— contexts, as they seek to assert their respective claims. Although some actors emerge

as more powerful than others (e.g. technicians vs. *ejidatarios* and government officials vs. *ejidatarios*), each one gets to participate in some stage and at some level of the decision-making process. Despite the considerable influence of government agencies and consultants, each community has been able to establish specific rules that govern and structure social interactions, including community-level organizations. A similar scenario has been observed in studies of several community-based conservation programs in Namibia, where diverse national policies have been modified markedly by local institutional arrangements (Mbdizo *et al.*, 2021).

Turning to the third research question (What factors foster/limit effective participation in decision-making and economic benefits by local communities?), several issues stand out. Clearly, cooperation and the maintenance of good relations among government institutions, consultants, and *ejidatarios* are crucial when it comes to UMA promotion and management. Indeed, these two elements have been identified as key factors for successful environmental conservation, since they increase political influence and external recognition by creating multi-scale, sectorial partnerships and promoting social capital among actors through the development of respect, trust, and reciprocity (Tran *et al.*, 2020). As other authors have shown (see, for example, Feist *et al.*, 2020), collaborative management and power sharing between local people and government authorities is likely to foster the inclusion of the former, as they can exercise their rights and fulfill their respective responsibilities. As Kruijf *et al.* (2021) suggest, changes in how the actors' roles and competencies are defined are required in order to enhance mutual respect and trust, ensure fair policy processes, and achieve knowledge production and transformative changes. It is, therefore, important that government agencies fulfill the agreements forged with communities through the efforts of consultants, because distrust and/or unfulfilled commitments can easily discourage local inhabitants from getting involved in government programs and impede trust-building among actors. In the case of deer hunting in UMAs located in the study area, one element that emerged as crucial was the timely delivery of hunting permits, as this would increase income for local communities and foster greater cooperation and participation.

Institutional arrangements that allow local communities to fully participate in conservation programs and govern their resources would very likely encourage greater cooperation and enhanced outcomes. As Mbdizo *et al.* (2021) suggest, it is important to identify reliable sources of funding provided by donors like multilateral organizations, NGOs, foundations, and universities, in order to obtain more funds to strengthen community involvement in biodiversity conservation. Strategic

collaborations and partnerships can strengthen linkages among science, policy, and management, and improve the adaptive capacities of those institutions to address challenges, both ongoing and emergent (Alsip *et al.*, 2021).

Consultants can help strengthen internal community organization and foment collective work. Interviewees stressed that consultants should respect the decisions made by assemblies as much as to strive to understand local needs. According to our interviews, locals tend to trust the consultants' abilities, which means that trustworthiness, cultural empathy, and professional capabilities are pivotal features that consultants who seek to involve local people in a meaningful manner, set viable management goals, and assign clear roles to those involved in UMA management should have.

Finally, it is clear that strong local authorities and institutions are necessary to encourage local people to participate in environmental management. Since community-based conservation relies on collective action and self-governance of common-pool resources, strong leadership tends to enhance local support, as other studies have shown (see, for example, Salerno *et al.*, 2021). This kind of leadership can support effective decision-making processes that create and enforce socially-binding arrangements regarding collective problems. Therefore, influential *comisariados* and community assemblies are important assets when it comes to organizing working groups, contacting hunters, and obtaining reasonable benefits from deer hunting in UMAs located in the study area.

Regarding the limitations of our study, we recognize that the communities in the area are not representative of all UMAs involved in hunting activities on BRs in Mexico. Thus, additional, comparative research is needed. It is also imperative to explore and analyze the mechanisms used to evaluate the outcomes of implemented strategies to improve the social, economic, and environmental results of environmental policies for local communities. Finally, we were unable to interview *avecindados*, as they are usually not involved in UMA management, a fact that might have somewhat biased our results.

Conclusions

This research contributes to the knowledge regarding the implementation of UMAs designed to include local communities in sustainable wildlife harvesting in a Unesco BR. Although these UMAs have failed to foster genuine participation in broad decision-making processes and protected area management, we found that they contribute to economic diversification and to the generation of

additional income, even though the benefits obtained accrued, first and foremost, to the holders of usufruct rights, leaving much of the local population on the outside as sheer spectators. An equitable inclusive governance should be understood as the means to improve conservation outcomes and prevent biodiversity loss. This involves the full recognition and integration of the rights and roles, as well as the contributions of local communities in governance. A widespread and integrated paradigm shift is needed in order to move from participatory conservation as a norm to a better understanding of what equitable government comprises and why it is paramount for environmental management in BRs. Thus, we recommend that the authorities reconsider the focus of UMAs and either improve/modernize or use different policies that are more inclusive and efficient in terms of local participation and benefit distribution considering all local people and groups when implementing inclusive environmental policies on the ground. Social justice cannot be accomplished by states, NGOs and the private sector alone, when local communities have no say in the matter. It is therefore important to promote the self-management capacities of communities to reduce the strong dependency on technicians (at least in the long run), to simplify the operative procedures, and to improve transparency in the management carried out by government institutions. Further advice includes the separation of formal usufruct rights from participation in UMA-related activities, which would foster a more even distribution of the generated benefits. These transformations involve wide-ranging participation in processes and practices at all levels, extending from government offices to the territories of local communities. In addition, deep-rooted conflicts and historical injustices should be addressed accordingly to place communities and their assemblies at the core of decision-making in order to contribute to long-term, effective, and socially-balanced environmental conservation.

A noteworthy limitation in our case study is that the specific decision-making processes at the actor´s level could not be addressed in detail. Therefore, we suggest that future research should focus on the processes, mechanisms, and forms of organization according to which these actors make their decisions and influence the functioning and outcomes of UMAs. It is also important to focus on the roles and perceptions of locals lacking formal usufruct rights. Additional research regarding the role of consultants in fostering the sustainable use of natural resources is also required, particularly in Mexican and Latin American BRs. In this context, multi-stakeholder platforms in which the needs and demands of all interested parties are considered might be suitable for generating greater economic benefits for local communities, while simultaneously strengthening the

participation of local and non-local stakeholders in conservation efforts. Academic institutions should also provide more information on diverse approaches to involving and strengthening local institutions as well as human capital.

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Curricular reviews

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http://dx.doi.org/10.22136/est20252323

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