



# El Colegio de la Frontera Sur

## Organización comunitaria para la conservación de mamíferos medianos y grandes en los ejidos Azinyahualco y La Esperanza, región Centro de Guerrero

Tesis

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Por

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## **Resumen**

La creación y mantenimiento de las áreas destinadas voluntariamente a la conservación (ADVC) es de gran relevancia para el futuro de la biodiversidad en México. Sin embargo, existen casos en los que este esquema de conservación se implementa desde una visión externa sin considerar la importancia de integrar la participación de los habitantes de dichas áreas. Este estudio se enfocó en caracterizar los procesos históricos y organizativos relacionados con la conservación voluntaria que se realiza en dos ejidos que presentan similitud de ecosistemas, ubicados en la Región Centro del estado de Guerrero. Para ello se identificaron elementos clave que permitieron fortalecer la organización comunitaria por medio de entrevistas semiestructuradas, observación participante y talleres participativos. Además, se evaluó la presencia, abundancia y estado de conservación de los mamíferos silvestres medianos y grandes por medio de monitoreo con cámaras-trampa dentro de las áreas de conservación. Esta información se relacionó con algunas características de la organización comunitaria y la percepción de la conservación biológica por parte de los pobladores del área de estudio. Se registraron 18 especies de mamíferos silvestres con cámaras-trampa y tres con observación directa; cuatro especies se encuentran en peligro de extinción y dos en categoría de amenazadas para México. Se identificaron tres diferentes usos de los mamíferos: comestible, medicinal y cultural. La presencia de los elementos identificados en la organización comunitaria permite mejorar las posibilidades de éxito en los objetivos de la conservación biológica y mantener la integridad de las comunidades locales en la toma de decisiones y la construcción de su territorio.

## Capítulo 1.- Introducción general

La sociedad contemporánea muestra un interés creciente en la conservación de la biodiversidad. De la cual forman parte los mamíferos que en muchos casos se encuentran en riesgo de extinción debido a la pérdida de su hábitat, la cacería sin control y el tráfico ilegal de especies (Di Bietteti, 2008; Lira, Briones y Gómez, 2014; Tejeda et al., 2014). Siendo los mamíferos como los grandes depredadores especies que regulan a otras poblaciones de presas, manteniendo un balance en los ecosistemas (Nuñez, 2002). Además de la importancia de especies que son dispersadoras de semillas, jugando un papel importante en la dinámica de la vegetación (Rumiz, 2009). Para lograr mantener de los peligros mencionados se han implementado.

Las Áreas Naturales Protegidas (ANP) han sido una de las principales herramientas gubernamentales para la conservación de la biodiversidad en México (Bello y Estrada, 2012; Durand y Jiménez, 2010; Elizondo y Merlín, 2009). Sin embargo, la creación de estas áreas puede deberse al interés de conservar ecosistemas, o bien, al interés gubernamental por cumplir los objetivos propuestos en las Metas del Milenio, actualmente objetivos del Desarrollo Sustentable promovidos por la Organización de las Naciones Unidas (ONU) (Bárcena, Cimoli, y Pérez, 2018). Aunado a lo anterior, los objetivos para los cuales se decretan las ANP no necesariamente coinciden con los objetivos de las políticas de conservación o con los intereses de grupos locales. Ferraro y Pattanayak (2006) mencionan que uno de los principales problemas radica en la forma en que se evalúa el éxito de las políticas de conservación. Siendo en muchos casos la extensión de superficie decretada como ANP el indicador para medir el éxito de estas instituciones. Sin considerar estudios sobre la salud de los bosques o poblaciones de fauna silvestre y la integración o la aceptación de los dueños del territorio con relación al decreto de creación de las ANP.



Comprendiendo el territorio desde el enfoque que plantea Haesbaert (2013) como una construcción social que se va adaptando a las condiciones actuales. Esta unidad espacial se reconstruye desde las personas que habitan y utilizan los bosques y la fauna silvestre. Incluso alcanzando a apropiarse de servicios como la belleza paisajística y simbolismo cultural como parte del territorio. Los estilos de vida de estos territorios comprenden elementos que se escapan del diseño de las políticas públicas de conservación. Estas últimas generalmente se circunscriben dentro de una visión sistémica occidental del ideal de conservación biológica, aislada de las necesidades de las personas locales (Durand y Jiménez, 2010).

### **Antecedentes**

Las ANP han tenido aceptación por parte de las comunidades locales. Siendo consideradas por el estado como una fuerte herramienta para la conservación de los ecosistemas (Rodríguez y Bracamontes, 2008; Martínez y Maximiliano, 2015). No obstante, los casos en los que no se han generado conflictos son menos numerosos que las críticas. Principalmente porque dichas áreas generalmente son decretadas sin incluir la participación de las comunidades locales (Durand, 2017; Peña, 2015).

Entre las alternativas de áreas protegidas en México se encuentra la certificación de las Áreas Destinadas Voluntariamente a la Conservación (ADVC). Donde la participación de las comunidades locales en la construcción de estrategias que norman dichas áreas es más evidente. Sin embargo, en muchos casos las ADVC no cuentan con información básica sobre la fauna que albergan, la cual es esencial para la identificación y aplicación de estrategias de manejo específicas hacia las diversas problemáticas que enfrentan estos refugios de biodiversidad. Por ejemplo, la presencia de grandes depredadores que requieren de amplias extensiones de hábitat y abundancia de alimento, al no tener presas suficientes pueden entrar en conflicto con ganaderos atacando fauna doméstica (Di Bitetti, 2008). Esta problemática puede solucionarse conociendo el estado poblacional de las presas, por las que otros depredadores también compiten. Si las presas disminuyeron por

factores de pérdida de hábitat o alguna enfermedad, sin tener esta información será más difícil proponer una solución efectiva. De igual manera, la identificación de las áreas de mayor importancia para la reproducción y crianza de las especies de fauna local, permitiría focalizar y optimizar los esfuerzos de conservación en menores superficies.

Entre los beneficios de las ADVC destaca el hecho de que sus residentes, como usuarios de los recursos naturales, reconocen las áreas conservadas como parte de su territorio. Por lo que existe participación de quienes aprovechan los recursos en la planeación e identificación de las principales problemáticas. Esto permite reducir amenazas que pudieran poner el riesgo la flora y fauna locales (Ballinas, 2019). Estas ADVC manejadas por comunidades rurales o propietarios privados han sido reconocidas por el aporte en bienes y servicios ambientales para la sociedad a escala local y global (Elizondo y López, 2009).

Peña (2016) reporta en comunidades de Oaxaca el desconocimiento de los propietarios de las ADVC sobre el proceso de certificación y duración de éstas, además de la motivación para certificarlas, situación que provocó conflictos internos entre quienes deseaban mantener la certificación y quienes no estaban de acuerdo. Considerando lo anterior, la delimitación de ADVC puede ser propuesta o aceptada por los propietarios, pero no implica que ellos tengan participación en la elaboración de reglas y normas, por lo que no se integra la visión local del territorio con los intereses del estado. Parte de este problema es debido a la falta de datos sobre cómo conciben los propietarios su territorio y sus recursos. Además, es frecuente que estos últimos no conozcan realmente todas las implicaciones del esquema de conservación que deciden adoptar, generando un choque entre el estilo de vida local y las metas de la conservación biológica.

Uno de los principales conflictos al crearse una ANP en cualquiera de sus modalidades es la limitación en el uso de los recursos naturales. Siendo la cacería una de las actividades que son sancionadas, aun cuando puede ser una práctica históricamente importante para los habitantes de las comunidades. Por ser una

fuentes complementarias de proteína en la dieta de personas que carecen de otros medios para obtener carne para el consumo (Herrera et al. 2019; Naranjo, López y Dirzo, 2010; Naranjo, 2018). Además, la cacería y captura de animales silvestres puede tener otros propósitos tales como el medicinal, peletero, ornamental y de compañía (Santos-Fita, 2013). Esta práctica no solo satisface al cazador sino que tiende a beneficiar a las familias e incluso a las comunidades enteras en eventos sociales, religiosos y políticos. Parte importante de la cacería es el elemento cultural y simbolismo de la relación entre humano y naturaleza, como una forma de ver el mundo (Santos, 2013; Herrera et al. 2018; Osorio, 2017). Esta relación tiene funciones de regulación motivando el respeto hacia la vida, por lo que al ser impuestas normas que chocan con las tradiciones y estilos de vida propios, generan conflictos al interior de las comunidades y las familias.

Existen comunidades rurales de México que no tienen ADVC certificadas; sin embargo, tienen áreas que por medio de sistemas de regulación internos como los acuerdos, normas y creencias (Aguilar, 2011), realizan un manejo sustentable de la fauna silvestre sin la intervención de una autoridad externa como lo refiere Ostrom (2000) en algunos casos para el manejo de bienes comunes. Si bien existen casos en los que la regulación externa ha tenido éxito (CAPRI, 2010), generalmente no es indispensable este tipo de intervenciones para asegurar el éxito en conservar la biodiversidad de esa área. La motivación en la organización es clave (Crozier y Friedberg 1977; Ostrom y Ahn 2003), porque los individuos que deciden participar e invertir tiempo en las actividades colectivas tienen un interés que se puede alinear con el resto de individuos que buscan alcanzar beneficios a corto o largo plazo. Si en algún momento se pierde o se cumple este interés, el individuo no tendrá razones para participar o seguir las normas que se establecieron dentro del colectivo (Crozier y Friedberg 1977). De forma similar, la confianza de los individuos de que obtendrán un beneficio al participar e invertir tiempo en una organización juega un papel clave para evitar que la participación se vea reducida, como lo menciona Ostrom y Ahn (2003) en su concepto de Capital Social. Este elemento permite que el individuo

considere que la inversión de tiempo tendrá algún beneficio equitativo; por el contrario, si no hay confianza no habrá certeza de que su inversión tendrá beneficios haciendo que deje de participar (Crozier y Friedberg 1977).

El ejido puede considerarse un colectivo que se organiza para resolver conflictos que surgen tales como la defensa del territorio, amenazas naturales y otras actividades cotidianas. Por ejemplo, problemáticas del manejo de bienes comunes. Para comprender como es la organización en el esquema de ejido es necesario conocer su estructura. La máxima autoridad en este sistema legal es la asamblea de ejidatarios. La cual está compuesta por ejidatarios inscritos en el padrón oficial del Registro Agrario Nacional (RAN). La asamblea de ejidatarios tiene como representante a la mesa ejidal, integrada por tres miembros (comisariado ejidal, secretario ejidal y el tesorero ejidal) nombrados por la asamblea. La mesa ejidal es reconocida legalmente ante dependencias gubernamentales, siendo intermediaria entre estos dos actores (ejido y estado). Aquí la confianza juega un papel importante debido a que se debe transmitir los intereses reales de la comunidad. Una toma de decisión por parte de la mesa ejidal sin la consulta del ejido podría disminuir la confianza. Por lo que es necesario una organización que permita tomar acuerdos internos, de lo contrario las normas que establezcan algunos miembros de la organización pueden generar conflictos. Esta estructura legal no es la única forma de organizarse en el ejido, existen otras formas de organización al interior que no se rigen bajo otras instituciones del estado. Por ejemplo, la construcción de un padrón de ciudadanos o ejidatarios que son reconocidos bajo los términos de la comunidad, permitiéndoles elegir quienes pueden participar en la toma de decisiones, sin la intervención de normas externas cita. Ante el estado esta forma de organizarse no tiene validez legal, sin embargo, al interior de la comunidad los acuerdos y normas que se establecen bajo este esquema tienen validez. Por ello los elementos antes mencionados de confianza y motivación tienen un gran peso en la apropiación de los compromisos que se establecen para resolver problemas y necesidades como, por ejemplo, la conservación de la fauna silvestre local.

El análisis de estos elementos permite evaluar la eficacia del manejo que se implementa en ambas ADVC en el área de estudio. Sin un manejo adecuado, las poblaciones animales pueden estar en riesgo. Por tanto, el objetivo del presente estudio fue identificar la relación entre la disponibilidad, el uso y las acciones de manejo observadas y propuestas para mamíferos medianos y grandes en dos ejidos ubicados en la región centro de Guerrero. Estos ejidos fueron seleccionados para este estudio debido a que ambos han establecido ADVC colindantes entre sí, por lo que comparten características físicas similares como: el clima, gradiente altitudinal, tipos de vegetación, fauna y flora. Aunado a esto, ambos ejidos comparten el interés por conservar parte de sus bosques remanentes. Particularmente, se seleccionó al ejido Azinyahualco por el reconocimiento a nivel microregional como una comunidad modelo por sus acciones de conservación, y además encabezó la defensa de agua con 12 ejidos durante un conflicto con el gobierno del Municipio de Chilpancingo de los Bravo, demostrando interés por la defensa de sus recursos naturales y capacidad de organizarse internamente y con otras comunidades. En el caso de La Esperanza destaca el hecho que sus habitantes iniciaron un proceso de conservación de una parte del ejido aproximadamente en la década de 1990, delimitando una zona de conservación por iniciativa de los más viejos. Esta área ha tenido procesos que han involucrado cambios en la administración de la reserva, la cual comenzó por acuerdo de la asamblea ejidal. En 2011 cambiaron los participantes en la elaboración del reglamento de la ADVC con el decreto de Reserva Estatal, lo cual involucró modificaciones en las normas que se habían establecido y su ausencia en el diseño del nuevo reglamento de la ahora reserva estatal.

Estos dos ejidos han tenido procesos diferentes en la historia de sus áreas de conservación, pero comparten metas de conservación de sus bosques. A partir de lo anterior se formularon las siguientes preguntas de investigación: 1) ¿Cómo afectan los procesos organizativos de cada comunidad en los resultados esperados en cuanto a conservación de su biodiversidad?; y 2) ¿Los procesos organizativos

de estas comunidades han tenido algún impacto positivo en la fauna de las áreas de conservación?. La falta de información biológica acerca de la fauna silvestre que existe dentro de los ejidos fue otro problema asociado a estas preguntas.

Para resolver estas preguntas se considerando como objetivos de este estudio lo siguientes:

1. Identificar el uso de los mamíferos medianos y grandes disponibles en la ADVC de los ejidos Azinyahualco y La Esperanza, Guerrero.
2. Identificar elementos de la organización comunitaria que influyen en la toma de decisiones para el manejo de la fauna silvestre, en los Ejidos Azinyahualco y La Esperanza, Guerrero.
3. Evaluar la disponibilidad de los mamíferos medianos y grandes a través de su abundancia en las ADVC de Azinyahualco y La Esperanza, Guerrero.

**Capítulo 2.- Artículo sometido a la revista Tropical conservation science:  
Linking community organization and wild mammal conservation: A case  
study from central Guerrero, Mexico**

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**Abstract**

This study investigates elements involved in the processes of building community norms that favor effective results for wild mammals' management in two rural communities of central Guerrero state, Mexico. To achieve this objective, semi-structured interviews, participatory workshops and participant observation were used. Additionally, camera-traps were used to monitor the management areas for one year, which allowed recording the presence and abundance of ecologically important medium and large-sized mammal species in the study area. This information was used to analyze the conservation status of focal mammal species in both communities. This analysis allowed us to identify key elements in the construction of community regulations favoring successful environmental conservation. This work highlights the importance of conducting studies integrating biological conservation methods with community members' goals regarding the maintenance and care of their territory.

**Keywords:** camera trapping, community conservation, community agreements, subsistence hunting. Areas Voluntarily Devoted to Conservation.

Introduction

Recently, society has shown greater concern and interest in biodiversity conservation worldwide (Rands et al. 2010). Previous studies show that many large mammal species are threatened, largely due to habitat loss, overhunting and illegal trafficking (Di Bitetti 2008, Briceño et al. 2011). The creation and maintenance of Natural Protected Areas (NPA) have been proposed to protect those species and the ecosystems where they persist. Protected areas are usually created and managed by government institutions, generally with little or no participation of local communities. This lack of communication and coordination between agencies and local communities has led to crippling conflicts in many NPAs (Durand 2010).

The Areas Voluntarily Devoted to Conservation (AVDC) emerge as an effective conservation alternative. AVDCs have been found to contribute environmental goods and services to societies on both local and global levels, in areas managed by indigenous communities or private owners (Bello and Estrada, 2012; Elizondo and Merlin, 2009), wherein residents participate in the design of strategies regulating these areas and influencing the success of wildlife conservation. It is worth mentioning that a growing number of ejidos (communal lands granted by Mexico's federal government to poor farmers for their subsistence) have certified AVDCs in which local inhabitants have had very limited participation in their creation and management (Peña, 2015). The preservation of important areas for biodiversity is maintained through ejidos that defend their territories against the threats of a growing individualism fragmenting the collectivity and weakening the values and norms that prevent the expansion of the capitalist scheme (Durand, 2017). The individual appropriation of natural resources is the antagonist to social collectivity and therefore seeks its division (Harvey, 2004). These social conflicts and divisions within ejidos and other communities do not only derive from external factors but also from the lack of trust and common objectives among community members, and they harm the continued adherence to local norms for adequate environmental management (Crozier and Friedberg, 1977; Ostrom and Ahn, 2003).



There is pressure on the Mexican government at the global level to comply with the objectives proposed in the Millennium Goals and the Sustainable Development Goals promoted by the UN (Naciones Unidas, 2018). Thus, AVDCs are established and managed under similar criteria used for NPAs, which complicates the owners to appropriate conservation processes in their territories. This generates conflict, especially when there are restrictions on the extraction of natural resources for the subsistence of local inhabitants, such as hunting or harvesting firewood and wild medicinal plants.

These problems arise from poorly designed government environmental projects and leads to their incorrect evaluation (Ferraro and Pattanayak, 2015), because they are considered successful if large areas are incorporated into a category of protection without taking into account their effectiveness. An example of this insufficiency in the Mexican state of Guerrero is that AVDCs lack information about the status and ecology of their wildlife species, even though such information is fundamental for decision making (Cervantes et al. 1994). Similarly, most AVDCs have little or no information about local traditions and systems of wildlife management and the motivations driving or limiting biodiversity conservation (Bello and Estrada, 2012). This is the case of *Los “Olivos”* State Reserve and “*El Borbollón, La Pandura, and Yerbabuena*” AVDCs (named because of the three places that integrate it), in within ejidos La Esperanza and Azinyahualco in the central region of Guerrero.

The settlers of ejidos Azinyahualco and La Esperanza have reported early encounters of mammals such as jaguar (*Panthera onca*), ocelot (*Leopardus pardalis*), and Northern tamandua (*Tamandua mexicana*), among other threatened species (SEMARNAT, 2010; IUCN 2019). Despite this, there is no monitoring of fauna and the extent of subsistence hunting in the region is unknown. However, there are species used for meat, such as the white-tailed deer (*Odocoileus virginianus*), collared peccary (*Pecari tajacu*), White-nosed coati (*Nasua narica*) and other mammals used for medicinal purposes, such as the Virginia opossum (*Didelphis virginiana*). This lack of information has caused local authorities from

Azinyahualco and La Esperanza to express their concern and commitment to community conservation, which represents a potential benefit to both ejido residents and local wildlife populations (Naranjo et al. 2004).

Information about mammals in AVDCs is not the only element necessary for community conservation in ejidos; it is also essential to know and understand local peoples' experiences and the issues that motivated their interest in conservation. To analyze the degree of organization, Ostrom and Ahn (2003) proposed the concept of social capital. This conceptualization takes into account factors such as networks of allies, the norms established with sanctions for noncompliance or benefits for participation, the common aim that motivates participation, compliance with agreements, and trust that is built within. However, some elements escape this conceptualization, such as the symbolism within the relationship of the human being with nature and the identity constructed through historical processes. The analysis of these elements would facilitate testing the effectiveness of local management in both AVDCs considered in this study. Without proper management, animal populations would be at risk. With this concern in mind, our aim was to identify and analyze the primary social and biological elements involved in the construction of conservation norms and their role in wild mammal management and use in ejidos Azinyahualco and La Esperanza.

## **Methods**

### **Study area**

The State Reserve "Los Olivos" is located within ejido La Esperanza, approximately 82.9 km southwest of Chilpancingo, the capital city of Guerrero state (Figure 1). This reserve has a semi-warm, humid climate in the lower parts, and a temperate, humid climate in the upper parts (INEGI, 2008). Vegetation types according to Miranda and Hernandez X (1963) are lowland sub-deciduous tropical forest, and pine-oak forest. The altitudinal gradient ranges from 950 to 2,000 m above sea level. The soils are of volcanic and sedimentary origin (INEGI, 2005)

The AVDC "El Borbollón, La Pandura y la Yerbabuena" is located within ejido Azinyahualco, 77.6 km from the state capital (Figure 1) and does not have access to public transportation. Its inhabitants depend on private vehicles. The climate is similar to that of Los Olivos reserve. The main vegetation types are pine-oak forest, and lowland sub-deciduous tropical forest. This area is in a contact zone between igneous and sedimentary rocks (INEGI, 2005) Its altitudinal range goes from 1,000 to 2,000 m above sea level. In both communities, the primary economic activity is agriculture, being corn, beans and tomatoes the historically primary crops. Ejido La Esperanza (pop=610) has an area of 3,880 hectares, 25.5% of which are under protection. Ejido Azinyahualco (pop=323) comprises 1,888 hectares, 70.7% of which are protected. (INEGI, 2010)

### **Data collection and analysis**

Forty semi-structured interviews (twenty in each community) with guiding questions on guiding questions were applied to investigate aspects of the benefits for conservation, uses of mammals, rules and agreements and sanctions. Were applied to men and women in an age range of 30-89 years in ejidos Azinyahualco and La Esperanza (Tarres, 2013). individuals were selected who were willing to be interviewed by informed consent. The interviews were recorded. An effort was made to apply the interviews to each person separately to encourage greater sincerity among the interviewees. Later, the audio of the interviews was transcribed into Word format and analyzed using Aquad 7.5.6 software. Three categories were established: conservation, uses of mammals, and community organization. The conservation category was broken down into the subcategories of community benefits of conserving and conservation activities. Within the uses category, we identified the subcategories of medicinal, food, and cultural use of mammals. In the community organization category, we subcategorized into acts of participation, coexistence, and rules or agreements.

Two open invitation workshops were held in each ejido. The first workshop was on local fauna, where the photographic and video records of each species observed

through the photo-monitoring process were presented to community members. During the presentations, participants were asked about the uses of mammalian species and frequency with which they were observed. At the end, participants were asked if the wildlife was important to them. This information was recorded in a field diary to compare between what had been recorded in the interviews and what the participants commented during the workshop.

To document the presence of medium and large-sized mammals in the ejido AVDCs of La Esperanza and Azinyahualco, the photo-trapping method was used with 23 Cuddeback E2 cameras that were deployed with a minimum spacing of 500 meters between each device (Figure 2) during one year (July 2018 to July 2019) in different vegetation types, covering most of the area of the AVDCs (2,318 ha). Specialized field guides were used to identify medium and large mammal species (Reid 2009; Ceballos and Oliva 2005; Aranda 2012). Once classified, the photographs were processed with ecological analysis software available from the Small Wild Cat Conservation Foundation (<https://smallcats.org/resources/>), which yielded data on photographic record frequencies and activity patterns for each species.

To estimate the index of relative abundance, the error bias when counting the same individuals several times was reduced by considering only consecutive photographs of individuals of the same species separated by over 60 minutes, which were regarded as independent photographic records. In the case of gregarious species, in photographs where more than one individual was observed, the number of independent records considered was equal to the number of individuals observed in the photographic event (Lira-Torres and Briones-Salas 2012). We used the formula  $RAI = (IRS / SE) \times (1000)$ , Where: RAI= relative abundance indices, IRS= independent records of a species, SE= sampling effort (number of cameras per day of monitoring). To standardize relative abundance values, they were converted into units of photos/1000 trap-days.

## **Results**

## Uses of mammals

The interviewees identified three species as the most frequently hunted for food: the white-tailed deer (*Odocoileus virginianus*), mentioned by 34 participants (85% of the total), the collared peccary (*Pecari tajacu*), mentioned by 19 (47.5%), and the white-nosed coati (*Nasua narica*), cited on 12 occasions (30%). However, the latter two were hunted as second options in case that no deer were found. Other mammals mentioned were hunted less frequently, such as the grey squirrel (*Sciurus aureogaster*), raccoon (*Procyon lotor*), nine-banded armadillo (*Dasypus novemcinctus*), Virginia opossum (*Didelphis virginiana*), and birds such as the long-tailed wood partridge (*Dendrortyx macroura*), and the West Mexican chachalaca (*Ortalis poliocephala*). Four interviewees mentioned that the Mexican tree porcupine (*Sphiggurus mexicanus*) meat was delicious, but it was rarely eaten because of the scarcity of this mammal.

In terms of food uses, white-tailed deer were used for household subsistence, but it was also used for some special celebrations such as school graduations, where meals were provided for family and close friends. Another type of event cited by the residents of both ejidos was a special meal to welcome politicians or government officials who have contributed to the community or with whom they can solicit support. At these meals, white-tailed deer meat has been traditionally served; however, the collared peccary meat can also fulfill the purpose of the encounter.

Mammals were also used for medicinal purposes. Twenty-seven (67%) interviewees mentioned that the Virginia opossum meat was prepared in broth without salt as a treatment for skin pimples, a condition common before the 1980s and that is now rare. Another medicinal species recorded in eight interviews was the white-nosed coati, whose fat was used as a treatment for coughs and skin inflammation. Also, the ingestion of coati's nose was mentioned as a remedy for scorpion stings. To a lesser extent, some people mentioned that nine-banded armadillo's fat was also used for the treatment of cough and inflammation. Using puma's fat (*Puma concolor*)

was cited by two people (5%) as a remedy for rheumatism, while the same number of respondents mentioned eating roasted squirrel meat as a remedy for dysentery.

The interviewees commented on cultural use. Both Azinyahualco and La Esperanza residents believe in the properties of the "bezoar stone" which are accumulations of indigestible substances that conglomerate to form stones that are sometimes harvested from the viscera of the white-tailed deer. According to interviewees, the bearer of this stone will be guaranteed success while hunting this mammal. However, it must be handled with care because the hunter may be attacked by another white-tailed deer. Respondents of both communities commented that since the construction of the road in the 1950s for La Esperanza and later in the 1990s to Azinyahualco, consumption of wild meat and medicinal use of wildlife decreased because they had access to butcher shops and pharmacies with medicines.

### **Community organization**

In Azinyahualco, the interviewees mentioned only one founding family, *Los Anota*; 11 male siblings settled the lands that now make up the ejido in the 1910s and over time the village grew. In contrast, while La Esperanza was founded in the same decade, it was settled by diverse families from different towns of the municipality of Mochitlán, Guerrero. The main economic activity in both ejidos is agriculture, although some inhabitants have cattle or goats as a means of emergency savings. The cattle roam free and the specimens are checked after some weeks or when a head will be sold.

Agreements are made during community meetings that all inhabitants can attend, although not everyone has a voice in this arena. In Azinyahualco, the interviewees mentioned the ejidatarios (original members of the ejido who received land rights) officially listed on the Agrarian National Registry (ANR) and the so-called "citizens" who are ejidatarios' children recognized as adults by the community once they stop living with their parents. At this point, they request a piece of land and are expected to participate in economic contributions and "fatigues" (community workdays). In La

Esperanza, the inhabitants have classified the ejidatarios in the ANR's records and created an internal list of those they also call ejidatarios. For the latter to be recognized as ejidatarios, they must apply for this title to the general assembly (community meeting), which then evaluates if their collaboration in collective contributions and “fatigues” meets the community’s standards. One of the benefits of being on this list is the opportunity to be considered for job offers made to the ejido by government programs, like the Temporary Employment Program (TEP) or the Environmental Services Payments (ESP) program.

In both ejidos, community members mentioned regulations that prohibit hunting within the conservation areas. In the case of La Esperanza, inhabitants started conserving part of the ejido in the 1990s. However, the only decision taken was to prohibit deforestation and until 2011 hunting was prohibited. This was not because of internal agreements but rather was decided by the authorities who planned the state legislation which prohibits hunting or the extraction of fauna and flora within the limits of the State Reserve. Interviewees commented that they accepted these norms and an expansion of the conservation area where the soil was not suitable for cultivation on the basis of the promise of projects that would benefit the ejido. During the fieldwork, clearings for bean (*Phaseolus sp.*) cultivation in tropical forest vegetation inside La Esperanza State Reserve were observed, where four interviewees (20%) said they knew about this, recognizing that there was no authority to control hunting. All those interviewed said that hunting did not take place in the conservation area, but only outside of it.

In the case of Azinyahualco, the ejidatarios established internal agreements through the assembly for the control and use of fauna, which determined a hunting ban for all species within the conservation area. In the rest of the ejido, hunting was permitted, although hunting of white-tailed deer was regulated, so it was accepted in exceptional cases. For example, events where food is prepared to receive politicians who offer some benefit to the community. In other special circumstances, a member of the ejido requests a hunting permit from the assembly, and the assembly

determines whether to grant it on the condition that it is a male during the season that the females are not suckling fawns. Two interviewees from this community (10%) commented that they should completely prohibit hunting in the ejido and on small neighboring properties. When species harm crops, they may be slaughtered, but few take advantage of the meat. In La Esperanza, an organization was observed to carry out a land rotation for agriculture, in which three areas are changing. Each year a meeting is held to vote on whether the farmers should continue to plant in the same area or switch into another area. The reason for this rotation is the absence of fences between crops, which only exist on the outer perimeter to protect them from livestock. In the area that is no longer sown, the fences are kept open. Therefore, if someone sows, his crop may be damaged by livestock.

The two ejidos have had different collaborative networks in which external advisors have offered different levels of advice regarding various activities. The constant participation of biologists and technicians in Azinyahualco was a variable not present in La Esperanza, since interviewees commented that they lacked follow-up help with the projects they had become the benefactors of, which had resulted in their failure. For example, they mentioned two Wildlife Conservation Management Units (WMUs) for white-tailed deer, of which one is now closed, and the other appears to be following the same way. Also, a project for tilapia (*Oreochromis* sp) breeding ponds was attempted twice, but without success.

An important element in the organization is the monitoring of the application of rules they establish. In the case of La Esperanza, six interviewees (30%) mentioned that they had established regulations for the control of garbage, but there was no one to regulate or impose the sanctions. For this lack of regulation, people did not consider compliance important. In this ejido, they elect the authorities every three years as stipulated in the agrarian law and only ejidatarios can take office in the NAR's records. An assembly must be held to change the placeholders of the different authorities which many ejidatarios avoid attending because it is seen as a burdening obligation to hold the position that serves the community. Attendance implies being



able to be elected and obliged to carry out the responsibility that prioritizes the well-being of the ejido.

In Azinyahualco, a different situation arose, in which, although the ejidatarios did not seek the position, they attended the assemblies, where individuals were nominated and the assembly voted for the person it considered best prepared to assume the representation of the ejido. As of 2013, the position had become of interest in seeking votes before the assembly for a change in authority, which had led to the formation of two political groups that proposed their own lists. In 2019, a change was observed in the monitoring of some regulations in which six interviewees (30%) said they had lost confidence in the authorities to solve the ejido's problems. This has caused a certain amount of disorder and division in the community.

Five different religious denominations were identified in La Esperanza. Catholicism was the only religion at the time the ejido was founded; later, in the early 1980s, Jehovah's Witnesses and other groups arrived in the community to spread their beliefs. Recently, the Pentecostal religion of the Morelos headquarters and the Pentecostal religion of the Ocotito headquarters have been established there as well. The members of the latter two denominations are considered independent because they use different teaching methods. Similarly, in the early days of Azinyahualco, only the Catholic religion was practiced, until 1980 when missionaries came to the ejido to spread protestant religions.

The residents of both ejidos referenced the organization of the celebrations for the patron saint of *señor de Chalma* in Azinyahualco and the celebrations of the Nativity for the Virgin Mary in La Esperanza. These events were the only examples of coming together across religious divisions. In the case of Azinyahualco, these festivities ceased when the Catholic religion disappeared from the ejido. Three interviewees said that there was a meal held for two consecutive years with savings from the ESP program and one interviewee mentioned that it was in commemoration of Hurricane Ingrid and Tropical Storm Manuel in 2013. This meal was held in the community's sports field and the whole town took advantage of the complimentary meal, but it has

not been held again. On the other hand, in La Esperanza, the celebrations were reduced from three days to only one. Previously, people from other towns attended to accompany the holy days. Currently, each group holds its separate festivities and social gatherings and there is no other type of inclusive community gathering except for the Mother's Day festivities (May 10). The differences between the ejidos can be seen in Table 3. The religious fragmentation present in La Esperanza marks a division in local society. For example, there are two Pentecostal temples that are not associated as the same religion; the difference they mentioned was the in their teaching methods. This perspective of being part of a group different from the others generates a lack of the identification of oneself as part of a larger community.

### **Mammal abundance**

During the year of sampling with camera-traps, an effort of 5,103 trap-days was achieved, getting 3,536 photographs of which 1,447 contained images of 18 species of medium and large-sized mammals (Table 1). In addition, we recorded three more species by direct observation (*Mustela frenata*, *Lontra longicaudis*, and *Sylvilagus cunicularius*). Analysis using the Small Wild Cat Conservation Foundation's Sweetcam software yielded the Relative Abundance Index (RAI) of the species identified in each conservation area (Table 2). In Azinyahualco, the species with the highest RAI were the white-nosed coati (23.2 photos/1000 camera-days), collared peccary (22.8), ocelot (*Leopardus pardalis*) (7.8), and white-tailed deer (5.4). The Northern tamandua (*Tamandua mexicana*) (0.4), raccoon (0.9), and Mexican tree porcupine (0.1) were recorded in the reserve of this ejido. These species were not recorded in the reserve of La Esperanza. However, in the latter, the ringtail (*Bassariscus astutus*) (0.2) was observed, which was not photographed in the Azinyahualco reserve. In La Esperanza, the species with the highest RAI were the squirrel (8.8), coati (7.8), opossum (5.8), puma (4.8), and armadillo (3.0; Table 2).

The jaguar (*Panthera onca*) was photographed from February to May, with a RAI of 1.0 in La Esperanza and 0.4 in Azinyahualco; a healthy, robust male was observed (Figure 3). Another large cat recorded in both reserves throughout the year was the

puma with a RAI of 4.8 in La Esperanza and 0.6 in Azinyahualco. An overlap was detected in the jaguar and puma presence in the months and sites that were photographed. However, a difference was found in the hours they were photographed (Figure 4). Three species of medium-sized cats were recorded. In Azinyahualco, the ocelot was the third most abundant species with a RAI of 7.8, the margay (*Leopardus wiedii*) was 1.7, and the jaguarundi (*Herpailurus yagouaroundi*) was 0.6. In La Esperanza, the RAI of ocelot was 2.8, margay was 2.2, and the jaguarundi was 0.6 (Table 2). In the workshop on local fauna, participants from both ejidos commented that they were unaware of three of the species photographed, the first was the pygmy spotted skunk (*Spilogale pygmaea*), which had a higher RAI in La Esperanza (2.0) compared to that obtained in Azinyahualco (1.2), recorded in an pine-oak forest. The second was the jaguarundi, which was also observed in pine-oak forests. The third was the ringtail (0.2), of which only one record was obtained in La Esperanza.

## **Discussion**

### **Changes in mammal use**

Diachronic changes in wildlife use were identified in ejidos Azinyahualco and La Esperanza. In the early days of both communities, hunting was less frequent than it is today. This practice increased during the first *Guerra Cristera*, an armed uprising of Catholic militants against Mexico's army supporting a federal government ban on religious practices from 1926 through 1929 (Avitia 2006; Meyer 2007). During that period, the rebel groups that the interviewees called "the pronounced" or "the opponents", set fires in crops and homes, and killed domestic animals in the villages. This forced the inhabitants to take refuge in caves they found in nearby mountains during the conflict because of constant attacks. Food shortages plagued the people and caused an increase in wildlife meat consumption.

With the end of the *Guerra Cristera* in 1929, as people returned to their communities and pre-war practices, wildlife use declined. Nonetheless, hunting of white-tailed

deer, collared peccary, white-nosed coati, nine-banded armadillo, Virginia opossum, and raccoon continued. This preference of species for food consumption is similar to what Figueroa et al. (2017) reported for the state of Chiapas. It is likely that medium-sized mammals such as opossums and armadillos are still of interest, although less frequently, while white-tailed deer and collared peccary are more difficult to hunt but have more meat. The interviewees also mentioned the collared peccary, white-nosed coati, and raccoon as species that damage crops and are hunted to avoid such damage and consume the meat. In La Esperanza, these species continue to be harvested; however, Azinyahualco residents mentioned that they rarely use the meat of hunted species for crop damage control.

The use of the "deer stone" has persisted in both ejidos. This belief is mentioned by Llamas and Ariza (2019) in Guerrero by Tlapanecos, in the Yucatan peninsula by Mayas, and in Puebla by Nahuas. Beliefs in the "deer stone" are strongly linked to good fortune for hunting and are also related to "the lord of the animals" or "lord of the mount" by the Tlapanecos of Guerrero (Dehouve, 2007) and for the Mayas of Yucatan ("owner of the deer"; Herrera et al. 2018). The "lord of the deer" can punish hunters who do not comply with his rules, thereby preventing them from hunting excessively. In the case of Azinyahualco and La Esperanza, the inhabitants do not link this legend to a deity, but it functions as a mechanism for regulating wildlife through beliefs, as pointed out by Aguilar et al. (2011), who assert that respect or fear of supernatural punishment puts pressure on the hunter. It is noteworthy how this belief or "idea" (as mentioned by some interviewees) persists even though it is not related to the religions currently practiced in both communities. As such, deer hunting is not only for meat consumption but also as part of a mystical tradition that seeks to show respect for nature.

The tradition of the hunted deer ritual was observed by six interviewees (15%, N=40). This practice consists of laying out the hunted deer in the courtyard with flowers around it and smoking it with copal. The ritual was carried out in both ejidos, although in La Esperanza two interviewees mentioned that they stopped doing it

because hunting was prohibited in the reserve. They could not display the deer in the patio, so they had to cut it up in the bush and keep the meat in backpacks so as not to be reprimanded; here the imposed new laws impacted this tradition. Although in the present study it was not possible to identify its meaning, Dehouve (2008) and Osorio (2017) suggested that this tradition goes beyond merely extracting a natural resource, involving a symbolic and social construction showing respect for the life of the deer which can be part of a regulatory system in which hunting is only done if necessary. In Azinyahualco, one interviewee mentioned the reason why they performed a ritual on the white-tailed deer, telling the following story:

"They say they are human beings; on one occasion a man hurt a deer and followed him, he went into a cave, but it was no longer a deer, it was a man, he was wounded and since that time he stopped hunting. So, when they kill a deer, that's why they put flowers on it... they stopped doing that long ago, because you don't believe in that anymore."

This testimony relates the deer to a human being and thus the ritual resembles a person's funeral in which they place candles and flowers around a body. It is also mentioned that the hunter stopped hunting deer and that the local people stopped practicing this ritual because they stopped believing in these stories, possibly since the change of religion in the community. Thus, belief-based regulation systems seem to play an important role in reinforcing formal and informal arrangements for wildlife conservation in our study area.

### **Community organization and conservation**

Historically, ejidos Azinyahualco and La Esperanza were founded in a similar fashion. However, the appropriation of conservation practices of their natural resources had different asynchronous processes that generated their own perspectives and conceptualizations. This is similar to the findings in Chiapas by Cano (2017), who observed interest in conservation practices from particular perspectives with different results. These visions depend on the processes in which

the community is being built. Haesbaert (2013) described how territories are conceived of from different realities and problems, generating diverse responses. For example, in Azinyahualco there was a group of people in the early 2000s who noticed the decrease in water in the ejido because of unregulated logging; from this event, the group of inhabitants tried to convince the town to stop selling wood, which was the ejido's main economic activity. However, this group did not convince the rest of the ejidatarios until 2000, when a group of biologists from the Autonomous University of Guerrero arrived to give talks on the importance of forests. This initiated a process of appreciation for other services and an appropriation of the commitment to care for and monitor forests and wildlife. On the other hand, during the 1980s in La Esperanza, the knowledge and experience of the older people allowed them to identify the clearing of the upper part of the river as a problem. However, they did not identify the importance of fauna which resulted in the empty forest syndrome (Robinson and Redford, 1991) in which there is forest cover without fauna.

These decisions marking the beginning of conservation processes are differentiated by the presence and absence of allies as mentioned by Ostrom and Ahn (2003). These allies play an important role in strengthening social capital. Their constant presence in Azinyahualco allowed for persistence and continuity in the conservation organization. This contrasts with La Esperanza, where the abandonment by allies has led to the failure of projects such as the UMAs. This has also impacted the confidence of the inhabitants of La Esperanza, who will have to invest time and effort again in future projects, even if they rarely perceive benefits from doing conservation. The norms and agreements that the inhabitants of the study area have built within the assembly were responses to visible problems. However, these agreements are not relevant if they do not incorporate the participation of residents, which allows their interests and concerns to be considered. This situation generates a perception of lack of inclusion among residents, which affects another element linked to compliance with the rules: trust. This element is a key point that influences other aspects of social capital, as proposed by Ostrom and Ahn (2003), as well as Crozier

and Friedberg (1977). These authors identified a rupture among the members of an organization when they did not have confidence in receiving fair benefits for the investment of their time; this is the case with participation in efforts and norms that regulate the resources. For example, in the norms established by the inhabitants of Azinyahualco and La Esperanza, only the first was observed to be in compliance. In La Esperanza, the responsibility for compliance with the agreements lies with the ejido authority as mentioned by four interviewees.

On the contrary, compliance with agreements and recommendations by health center personnel on the disposal of garbage was observed in Azinyahualco. Why was there follow-up here but not in the other ejido? Although it is a norm suggested by outsiders, the inhabitants of Azinyahualco mentioned that they know that garbage can generate water pollution, harming their health and that of the forest, but they also mentioned that it gives a bad image of how they live and how they are organized, expressing themselves not only as isolated individuals, but referring to a community. According to Melucci and Massolo (1991), a shared interest in a common problem is not the only aspect necessary for the generation of unity within an organization. The process that leads to community organization also has weight on the way that subjects connect within a group. This notion was manifested in community members' comments on the identity that they have as an ejido, as a community, and not just as isolated individuals.

From the vision of social capital, it is possible to characterize how something is collectively built. Nonetheless, this study shows dynamic processes in the interactions of the ejidatarios within the construction of norms and agreements (Melucci & Massolo 1991), and that there is a constant and collective renegotiation that goes beyond seeing them as finished units. As mentioned by Cano (2017), the concepts of "ejido" and "community" cannot be considered as finished projects but rather as constructs that are constantly being redefined and maintained by community members. Both ejidos have undertaken the interest in conserving their forests since the designation of their territories and each with specific results in which

external collaborators have been fundamental factors as catalysts that can orient decisions with experiences that have been successful in other localities.

### **Relationship of the organization with the fauna**

In our study, top predators like the jaguar and the puma were observed sharing spaces from February through June, which coincides with previous findings (Estrada, 2008). However, our results in this aspect contrast with those of Nuñez et al. (2001) in Jalisco. This was possibly because of a lower abundance of prey in their area of study as these authors reported competition of the two felids with hunters for the same species. The lack of segregation of puma and jaguar suggests that good prey populations persist in our study area, as observed by Estrada. (2008). This was reflected in the absence of predation of domestic fauna except for one case in La Esperanza approximately eight years ago. This may be because cattle owners often go for long periods without seeing their animals since they are so far away from the working areas. Thus, they are easy prey within the territories of large predators.

The species that the interviewees mentioned as the most harmful were the collared peccary, white-nosed coati, and raccoon (Table 2), similar to what was found by Briceño et al. (2011), and Lira et al. (2014). For the first two species, the abundance indices recorded in Azinyahualco were among the highest compared to the other species. This can be related to what was cited by 11 interviewees (55%), who stated that those mammals were currently less interesting prey for hunters. This finding differs from that of Tejeda et al. (2014), who observed that these same species were used more frequently for meat consumption because they were hunted in crops used as “feeder-traps” (Santos, 2013). In the case of Azinyahualco, even when coatis and raccoons were hunted for crop damage control, they were rarely eaten, so populations that do not approach the crops continued to grow.

Abundance indices for peccaries and coatis were not high in La Esperanza compared to the other species (Table 2), possibly because of a higher hunting frequency than that recorded in Azinyahualco. These mammals are still hunted



frequently, both for consumption and for crop damage control. The raccoon was also cited as the most damaging species in crops; however, it presented one of the lowest RAIs. This could be due to the preference of this carnivore for other types of disturbed habitat close to rivers, so the probability of it being recorded would be lower than that of the other species. The nine-banded armadillo had an intermediate RAI compared to the other species which were not recorded as commonly hunted or harmful in Azinyahualco. This differs with what Lira et al. (2014) reported in Oaxaca, where this armadillo was most frequently hunted for its meat and for damage control. This difference may be explained by the presence of predators such as ocelot, margay, puma, and jaguar in Azinyahualco, which may regulate the armadillo population.

The number of mammal records in Azinyahualco was greater than that observed in La Esperanza. This may be related to reports that in both ejidos there was a reduction in wildlife, but in Azinyahualco there was an increase in wildlife sightings near homes after conservation measures were implemented. In the case of La Esperanza, hunters commented that they had to travel greater distances to encounter their prey. There is a possibility that a source-sink system described by Naranjo and Bodmer (2007) exists in the study area. This is a process in which populations of some hunted animals probably come from the Azinyahualco reserve into La Esperanza, being the first a refuge for limited numbers of them. The white-tailed deer had a higher RAI in Azinyahualco compared to La Esperanza. Although both ejidos prohibited hunting in their reserves, Azinyahualco had more compliance with the rules and the assembly agreed on hunting regulations. In addition, demographic pressure was higher in La Esperanza. These factors, among others, made it more likely that white-tailed deer were hunted in La Esperanza.

### **Implications for conservation**

As demonstrated in this study, the title of voluntary conservation does not ensure that an AVCD area it is truly voluntary. This can cause grievances or impositions that result not only in the failure of conserving certain areas, but also increases the

negative practices affecting them. Thus, the knowledge of the processes through which conservation actions were generated is key to identifying weaknesses in the practices and strategies aimed at preserving wildlife with voluntary conservation schemes. In the case of ejido La Esperanza, several key elements were observed: 1) intermittent support from external advisors made conservation projects less likely persistent; 2) the current norms of the state reserve were established by an external administration, which did not include the participation of residents; 3) there was fragmentation in the local society, which made solidarity difficult in cases of participation for collective benefits; 4) the process in which the concept of conservation was developed has been focused on project management, which can lead to welfarism (Figure 5). These elements were related to following the norms that regulate wildlife hunting and agreements to control logging within the area; which was reflected in a lower abundance of wildlife in its AVDC. The identification of these elements constitutes an opportunity to strengthen the points mentioned above, which will allow better results in wildlife conservation within this community. In contrast, in ejido Azinyahualco, we found elements (Figure 5) opposed to those mentioned above: 1) constant support from external advisors has served as a catalyst in the ejido's commitment to continue conservation; 2) regulatory norms have been established through ejido assemblies without imposing any external actor; 3) there is good social cohesion which incites participation and appropriation of the commitments made as an ejido; 4) the concept of conservation has been assimilated through a process of awareness in which the community recognizes the importance and value of its flora and fauna. These elements are linked to the monitoring of norms that regulate the extraction of mammals. The points mentioned above may explain the greater abundance of species targeted by hunters; thus, the conservation status of medium and large-sized mammals within the Azinyahualco AVDC is better than that of La Esperanza.

These findings show that the abundance of fauna in ejido Azinyahualco is influenced by territory-building processes and the planning of conservation strategies. This

allows for the generation of adaptive management plans that do not impose authoritarian restrictions but rather facilitate horizontal agreements among the residents of each community to appropriate the norms and agreements established in the assemblies. These factors greatly increase the chances of success in conservation within the studied communities.

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**Tables.**

**Table 1.** List of medium and large-sized mammal species recorded during one year using camera traps in the Areas Voluntarily Devoted to Conservation (AVDC) of Azinyahualco and La Esperanza, Guerrero. It includes their conservation status according to the NOM 059-2010 (Mexican official norm of endangered species) and the UICN Red List.

Common name	Scientific name	Estatus NOM	Use	UICN category
Ringtail	Bassariscus astutus			Least Concern
American hog-nosed skunk	Conepatus leuconotus			Least Concern
Nine-banded armadillo	Dasyus novemcinctus		Meat consumption and cure for coughs	Least Concern
Virginia opossum	Didelphis virginiana		Cure for skin pimples	Least Concern
Jaguarundi	Herpailurus yagouaroundi	Threatened		Least Concern
Ocelot	Leopardus pardalis	Endangered		Least Concern
Margay	Leopardus wiedii	Endangered		Near Threatened



White-nosed coati	Nasua narica		meat consumption, and treatment for coughs and scorpion stings	Least Concern
White-tailed deer	Odocoileus virginianus		Meat consumption	Least Concern
Jaguar	Panthera onca	Endangered		Near Threatened
Collared peccary	Pecari tajacu		Meat consumption	Least Concern
Northern raccoon	Procyon lotor		Meat consumption	Least Concern
Puma	Puma concolor		Cure for rheumatism,	Least Concern
Grey squirrel	Sciurus aureogaster		Cure for dysentery	Least Concern
Mexican tree porcupine	Sphiggurus mexicanus		Meat consumption	Least Concern
Pygmy spotted Skunk	Spilogale pygmaea	Threatened		Vulnerable

Northern tamandua	Tamandua mexicana	Endangered	Least Concern
Grey fox	Urocyon cinereoargenteus		Least Concern

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**Table 2.** Relative abundances of medium and large-sized mammals recorded in the Areas Voluntarily Devoted to Conservation of Azinyahualco and La Esperanza, Guerrero, Mexico.

Scientific name	Azinyahualco		La Esperanza	
	Number of photographs	Relative abundance indices (photos/1000 trap-days)	Number of photographs	Relative abundance indices (photos/1000 trap-days)
Bassariscus astutus	0	0	1	0.2
Conepatus leuconotus	9	1.1	4	0.8
Dasypus novemcinctus	11	1.3	15	3
Didelphis virginiana	41	5	29	5.8
Herpailurus yagouaroundi	5	0.6	3	0.6

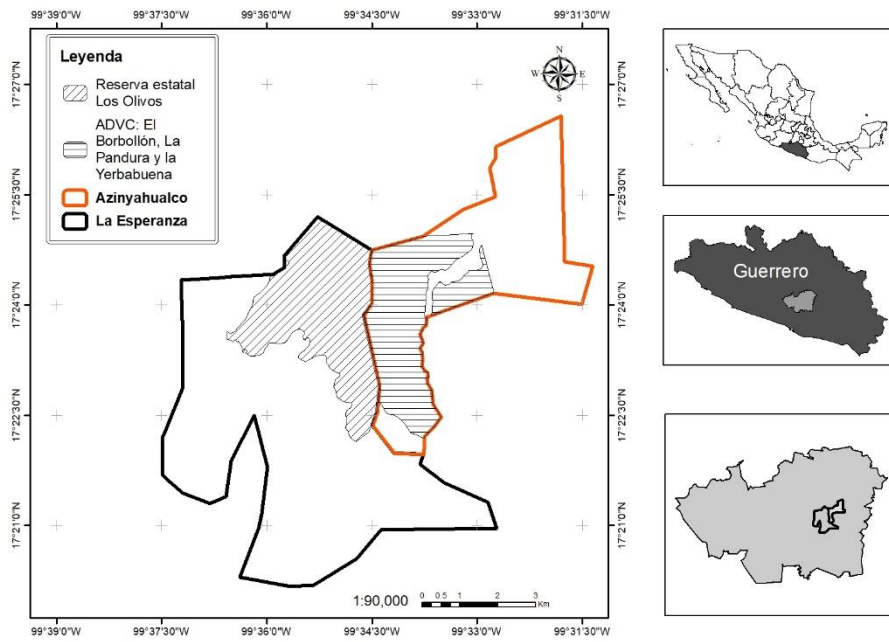
Leopardus pardalis	64	7.8	14	2.8
Leopardus wiedii	14	1.7	11	2.2
Nasua narica	190	23.2	39	7.8
Odocoileus virginianus	44	5.4	11	2.2
Panthera onca	3	0.4	5	1
Pecari tajacu	187	22.8	14	2.8
Procyon lotor	7	0.9	0	0
Puma concolor	5	0.6	24	4.8
Sciurus aureogaster	39	4.8	44	8.8
Sphiggurus mexicanus	1	0.1	0	0
Spilogale pygmaea	10	1.2	10	2
Tamandua mexicana	3	0.4	0	0
Urocyon cinereoargenteus	1	0.1	4	0.8
Total	634		151	

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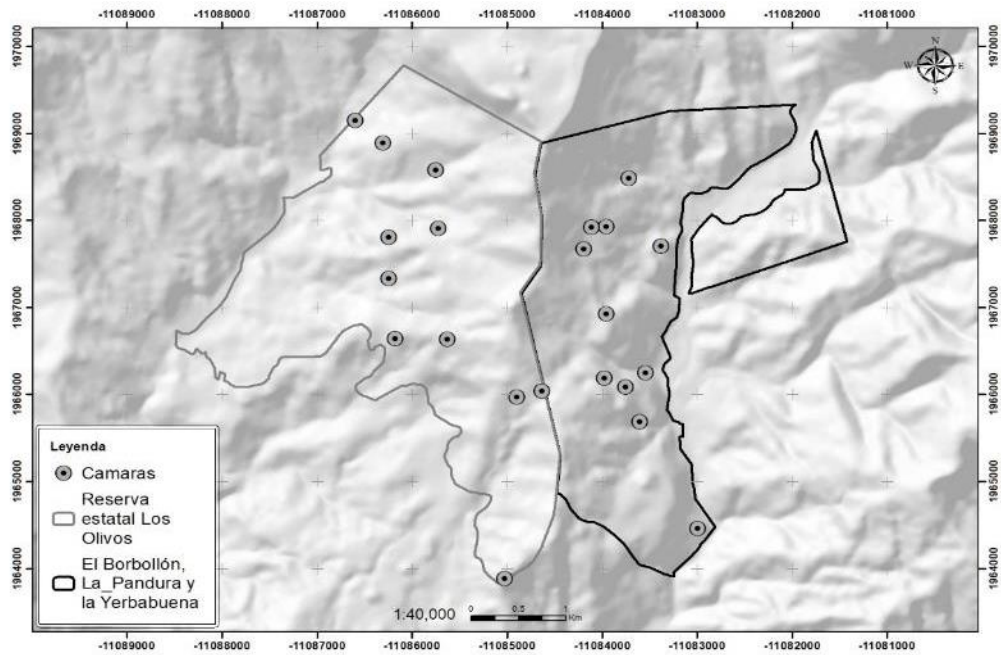
**Table 3.** Sociodemographic characterization of Azinyahualco and La Esperanza, Guerrero, Mexico.

	Azinyahualco	La Esperanza
Productive activity	Agriculture (corn and beans)	Agriculture (corn and beans)
System of organization	Own system	Own system
Religion	Two religions	Five religions
Origins	Founded by the Anota family	Founded by different families from various villages
Conservation concept	Maintains ecosystem services and generates jobs	Generates jobs
Time spent conserving forests	Around 20 years	Around 30 years
Commitment with norms	Very respected	Not very respected
Relative abundance of mammals	Greater abundance	Lower abundance
Status of the Conservation Area	Low disturbance	Disturbed by agricultural activities

**Figures.**



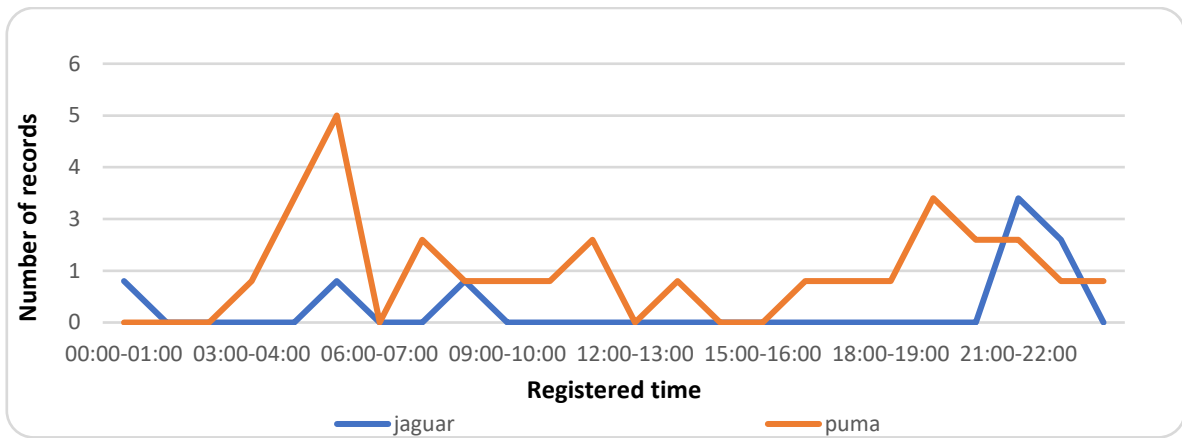
**Figure 1.** Location of ejidos Azinyahualco and La Esperanza, Municipality of Chilpancingo, Guerrero, Mexico.



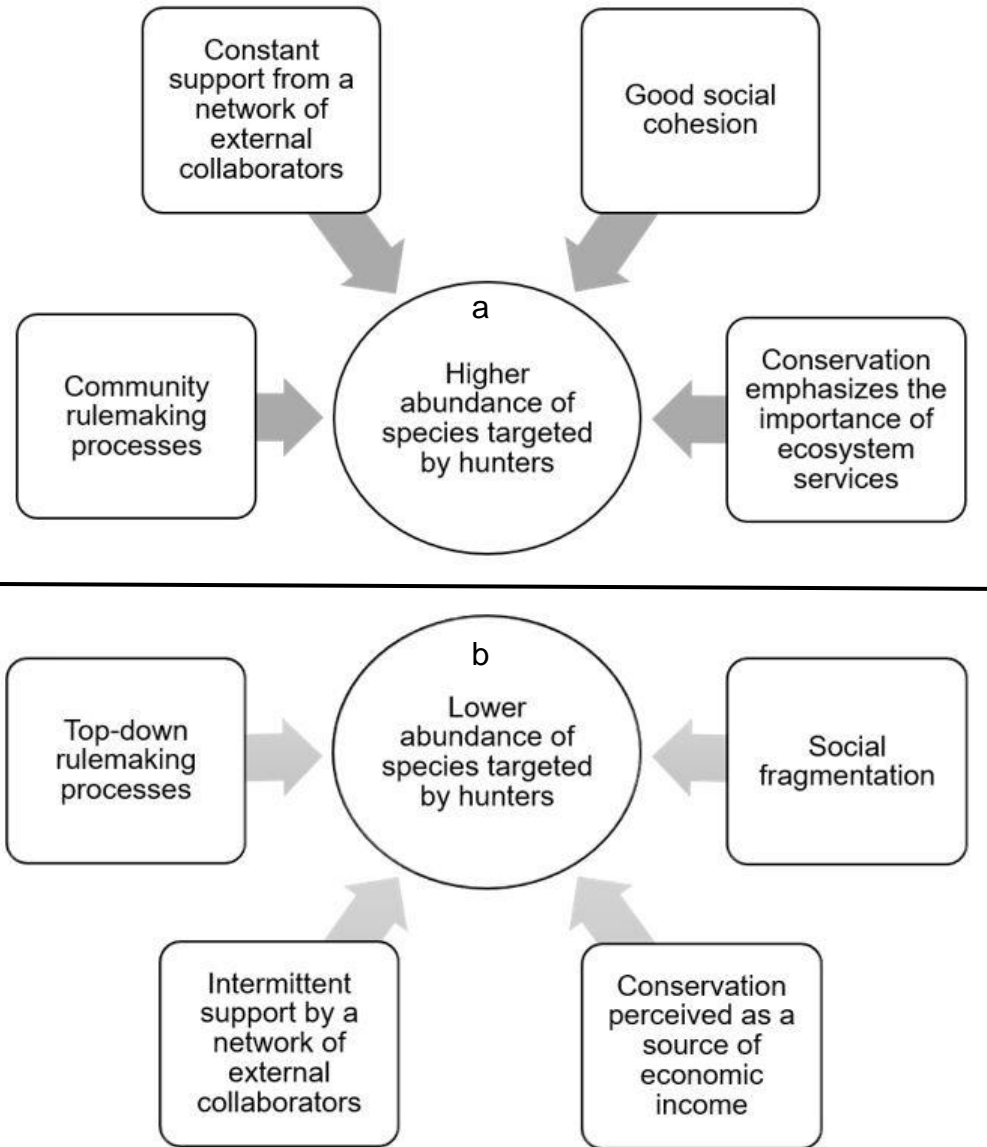
**Figure 2.** Location of monitoring stations deployed in different vegetation types of the Azinyahualco and La Esperanza Conservation Areas, Guerrero, Mexico.



**Figure 3.** Male jaguar (*Panthera onca*) in healthy condition photographed during camera-trap monitoring in La Esperanza, Guerrero, Mexico.



**Figure 4.** Jaguar (*Panthera onca*) and puma (*Puma concolor*) timetable chart of activity in Azinyahualco and La Esperanza, Chilpancingo de los Bravo, Guerrero, Mexico.



**Figure 5.** Relationship between the analysis of relative abundance of wild mammals and the characteristics of the organization and vision of conservation observed in ejidos Azinyahualco (a) and La Esperaza (b), Guerrero, Mexico.



### **Capítulo 3.- Conclusiones generales**

Las ADVCS tiene un gran potencial para poder preservar la biodiversidad de Méxicio, sin embargo deben establecerse con estudios que contempnen las Actividades y visiones de como definen su territorio. Por lo que es importante relizar estudios multidisciplinarios que integren de manera conjunta informacion de ciencias exactas y ciencias sociales. Esta integracion de informacion debe realizarse en conjunto de los habitantes de la comundiades para establecer el plan de manejo de ADVC. Dentro del alcance de este estudio se puede relacionar y considerar que existe un impacto clave en la conservacion de mamiferos medianos y grandes cuando existe una organizacion fuerte entre los habitantes.

Si bien la razón principal que motivó a destinar áreas de conservación a través de los acuerdos de asamblea en los ejidos Azinyahualco y la Esperanza fue el recurso agua, también el hecho de que sus pobladores percibieran una disminución de la fauna silvestre ha sido parte de las señales que impulsaron la conservación local, como se demuestra en los resultados obtenidos del monitoreo con cámaras-trampa. La presencia de grandes depredadores como el jaguar y el puma, indican que hay suficientes presas en la región para su alimentación, además de que no se registraron problemas de depredación de ganado. Por lo tanto, los trabajos de conservación que han realizado los ejidos considerados en el estudio han dado resultados positivos. Además de la presencia de especies que se encuentran catalogadas en peligro de extinción por la NOM-059-SEMARNAT, destaca la importancia de la participación en actividades y planeación para la conservación que realizan los ejidatarios de Azinyahualco y La Esperanza.

Esta participación se diferenció entre ambos ejidos, debido a que tienen distintos procesos por los cuales han pasado, como el seguimiento por parte de aliados externos que han encaminado enfoques particulares. Por ejemplo, el ejido La Esperanza logró gestionar proyectos de UMA de venado cola blanca. Sin embargo, la falta de seguimiento por parte de los técnicos fue parte clave en que no

se tuviera éxito en la reproducción de venados. De la misma manera, la falta de comunicación con profesionistas que auxiliaron con el decreto de su Reserva Estatal, generó una falta de organización que permitiera obtener mejores resultados en las actividades de la misma, dado que demostraron tener organización en temas de agricultura al tener días establecidos para quemas y rotación de terrenos. En el caso del ejido Azinyahualco, el proceso fue continuo con aliados externos que impulsaron una visión de conservación por servicios ecosistémicos. Apropiándose del compromiso por mantener los bosques, realizando actividades por “fatiga” o “fajina” para mantener protegida su área de conservación, a pesar de los daños causados por los huracanes.

Otro factor que ha permitido continuar con la conservación dentro de estas comunidades ha sido la confianza en que la inversión del tiempo y esfuerzos en “fatigas” tendrá beneficios. Ya sea de manera individual o de forma colectiva, pues han construido un sistema propio para denominar “ciudadanos” o “ejidatarios”, quienes serán beneficiados por proyectos que se ejecuten en el ejido. Este sistema refuerza la participación comunitaria; sin embargo, si no se perciben beneficios por la participación se puede perder motivación en las actividades, o bien, invertir tiempo en planes que no tendrá los resultados esperados.

La visión de certificar ADVC para poder recibir proyectos también genera problemáticas al proporcionar una forma de asistencialismo por la conservación, desvinculando el interés por preservar el bosque o la fauna. Desviando el enfoque hacia beneficios económicos, en este caso la apropiación por el territorio tiende a tomar otras connotaciones a las de la relación hombre naturaleza, pues se traza un vínculo con apoyos o beneficios económicos. En este punto es importante la participación de los aliados que pueden realizar procesos participativos en los cuales se establezca un flujo de información de dos vías, que permita integrar el conocimiento local con la información de los aliados. Si se puede considerar a los aliados como se observó en Azinyahualco, la constancia en el impulso logró una apropiación local de la conservación, no solo manteniendo la visión de los apoyos

que se pueden solicitar, sino una visión de beneficios que los residentes consideraron de suma importancia (e.g. el agua) por ser principalmente agricultores.

Se puede concluir que en la implementación de ADVCS se recomienda la recopilación de información sobre la forma en que los residentes del área de estudio perciben la conservación. Así como las actividades que están realizando las comunidades con interés de certificar parte de su territorio como ADVCS. Lo anterior con la finalidad de construir planes de manejo que permitan identificar la existencia de problemas reales o reconocer planes de manejo construidos a través de las experiencias propias de los habitantes locales y que han funcionado para cumplir con los objetivos de sustentabilidad. Esta integración debe contemplar puntos clave como los siguientes: (1) Confianza, como un elemento que permitirá la participación en actividades comunitarias en la construcción de acuerdos y normas internas diseñadas para fortalecer la conservación, así como la apropiación de estos acuerdos; (2) Aliados apropiados, como fuente de enlace con proyectos que estén encaminados realmente a beneficiar los intereses locales y auxiliar en problemáticas que pueden ser nuevas para los ejidatarios; (3) Experiencias, que pueden provenir de otras comunidades o profesionistas y pueden fomentar las oportunidades de resolver dichas problemáticas; (4) Tejido social, el cual al fragmentarse en la comunidad puede generar inconformidad por las normas que se establecen, o sobre la regulación que se implemente sobre el territorio. Puesto que influye en el elemento clave de la confianza. Sin una cohesión en la organización se ve mermada la confianza y la participación, así como el interés por los objetivos comunes de la población en general.

Los resultados de este estudio permiten formular nuevas preguntas sobre los posibles cambios en el estado de conservación de ambos ejidos. En el caso de Azinyahualco, su trayectoria en la conservación es reconocida a nivel regional, puesto que lideró una lucha por el agua contra la capital del estado de Guerrero, además de organizarse para evitar la tala de bosques fuera de su territorio, pero con importancia en la captación de agua para la región. Sin embargo, de acuerdo a

lo que mencionaron algunos entrevistados, este ejido actualmente está pasando por un proceso en el cual la participación comunitaria se ha reducido debido a las autoridades en turno, que han perdido la confianza de muchos residentes en cuanto a la administración de los asuntos del ejido, sin los informes que tradicionalmente hacían autoridades anteriores. Una organización que ha logrado y ha sido reconocida regionalmente está enfrentando una fractura en organización, pero ¿Cuál fue el detonante? ¿Coincide con los desastres naturales Ingrid y Manuel, o con la salida del líder debido a esta contingencia? ¿Ambos factores impactaron en el cambio de intereses de los habitantes del ejido y deterioraron su identidad comunitaria?

En un estudio con mayor alcance de tiempo y recursos se podría evaluar a largo plazo el impacto que tiene la organización comunitaria en las poblaciones de mamíferos que se encuentran en las áreas de conservación voluntarias, permitiendo dar un mayor peso a las conclusiones de este estudio o refutar lo analizado aquí.

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