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POSGRADO EN CIENCIAS BIOLÓGICAS

INSTITUTO DE INVESTIGACIONES EN ECOSISTEMAS Y SUSTENTABILIDAD

**ESTRATEGIAS DE MANEJO Y VALORACIÓN DE LOS RECURSOS NATURALES
EN LA REGIÓN COSTA SUR DE JALISCO, MÉXICO**

TESIS

QUE PARA OPTAR POR EL GRADO DE:

DOCTORA EN CIENCIAS

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M. en C. Ivonne Ramírez Wence

Directora General de Administración Escolar, UNAM

Presente

Por medio de la presente me permito informar a usted, que el Subcomité de Ecología y Manejo Integral de Ecosistemas del Posgrado en Ciencias Biológicas, en su sesión ordinaria del día **28 de enero de 2019**, aprobó el siguiente jurado para la presentación del examen para obtener el grado de **DOCTORA EN CIENCIAS** a la alumna **MONROY SAIS ANA SOFÍA**, con número de cuenta **512011998** con la tesis titulada **“Estrategias de manejo y valoración de los recursos naturales en la región Costa Sur de Jalisco, México”**, dirigida por el **DR. EDUARDO GARCÍA FRAPOLLI**:

Presidente: Dra. Patricia Balvanera Levy
Vocal: Dra. Yaayé Arellanes Cancino
Secretario: Dr. Alejandro Casas Fernández
Suplente: Dra. Barbara Ayala Orozco
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Sin otro particular, quedo de usted.

ATENTAMENTE
“POR MI RAZA HABLARÁ EL ESPÍRITU”
Cd. Universitaria, Cd. Mx., a 08 de marzo de 2019

DR. ADOLFO GERARDO NAVARRO SIGÜENZA
COORDINADOR DEL PROGRAMA



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A Randall, mi compañero de vida y aventuras,
por subir esta montaña conmigo.

*No element of nature is a permanent support for changing relations;
each receives its identity from its relations with others [...]*

*In the process of its genesis, each existent unifies the multiplicity of the world,
since it adds to the multiplicity an extra ser of relations.*

At the creation of each new entity “the many become one and are increased by one.”

- Prigogine y Stengers (1984).

Sobre la filosofía relacional de Alfred N. Whitehead en “El orden del caos”.

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Resumen

La relación que actualmente como sociedad tenemos hacia la naturaleza exhibe una fuerte degradación con consecuencias en el bienestar de las personas en distintas dimensiones. Sin duda, existe un trasfondo ético ya que estas relaciones se basan en ciertos valores hacia la naturaleza y lo que como sociedad consideramos correcto. Sin embargo, existen numerosos ejemplos que desafían esta relación de dominación de la naturaleza; sobre todo, aquellos que sus medios de vida se basan históricamente en la apropiación de la naturaleza de manera directa. Estudiar cómo se desarrollan las estrategias de vida en los contextos rurales y cuáles son los valores que existen sobre ciertos elementos de la naturaleza nos da pautas para adecuar nuestra gobernanza ambiental hacia una relación que no ponga en riesgo nuestra propia existencia y la de otros organismos. En este sentido, esta investigación analizó las estrategias de manejo y valoración de los recursos naturales y su relación con la gobernanza ambiental en la región Costa Sur de Jalisco, México. Se utilizó un enfoque interdisciplinario y se tomó como estrategia metodológica la comparativa entre casos de estudio compuestos por distintos núcleos agrarios con diferencias en tenencia de la tierra, tipo de núcleo agrario (ejido o comunidad indígena) y los ecosistemas presentes, a través de diversos métodos y herramientas mixtas. Los principales resultados muestran que las estrategias de manejo de recursos naturales están fuertemente marcadas por las condiciones del ecosistema (estacionalidad y disponibilidad de agua) y por diferencias en los derechos de la tierra dentro de los ejidos y que mayoritariamente representan estrategias diversificadas. A su vez la valoración de los recursos y de lo que se conoce como la parcela productiva muestra una importancia sobresaliente del agua sobre otros recursos como el bosque o monte y nuevamente diferencias entre personas con más o menos derechos sobre la tierra y entre tipo de núcleo agrario (ejido vs comunidad indígena). En una profundización sobre las estrategias de manejo y valoración de los recursos vegetales observamos que existen estrategias específicas para grupos de recursos que comparten ciertas características como si son silvestres o árboles. En conjunto existe una gran gama de recursos que atienden distintas necesidades. En cuanto a su valoración vemos una gran cantidad de recursos se valoran por sus contribuciones como alimento, pero que también recursos con contribuciones de regulación de agua, por ejemplo las higueras, destacan en su grado de importancia sobre otras. De manera general estas estrategias y la valoración de los recursos muestran una diversidad y multifuncionalidad del paisaje y de las vidas de los propios pobladores. En contraste cuando analizamos ciertos procesos de la gobernanza ambiental que tienen una direccionalidad de arriba hacia abajo observamos que esta diversificación en múltiples dimensiones (de recursos, actividades, en el tiempo, etc.) no es tomada en cuenta y que la visión de los gobiernos hace difícil alcanzar los objetivos de los manejadores de acuerdo a sus valores. Para una gobernanza ambiental más inclusiva y sustentable se alude a la necesidad de nuevos procesos institucionales que surjan desde lo local, pero con implicaciones más allá de estos, donde se puedan hacerse presentes otros valores de la naturaleza de distintos actores.

Abstract

The current relationship towards nature exhibit a strong degradation with consequences on human well-being on different dimensions. Without a doubt, there is an ethical background since these relations are based on certain values about nature and what we considered correct as a society. Nevertheless, there are many examples that defy this mainstream domination relation of nature; mostly by those people that historically sustain their livelihoods on the direct appropriation of nature. How this rural livelihood strategies develop and what are their values about certain elements of nature give us guidelines to adapt our environmental governance through a relation that does not put our existence and other living beings in danger. In this sense, this research analyzed the management strategies and valuation of natural resources along with their relation to the environmental governance in the South Coast of Jalisco, Mexico. The methodological approach was interdisciplinary, and the strategy was based on comparative case studies in agrarian nuclei with differences on land tenure, type of agrarian nuclei (ejidos and indigenous communities) and ecosystems, trough mixed methods and tools. Main results show that natural resource management strategies are strongly associated with environmental conditions (like seasonality and availability of water) and differences in land rights inside ejidos, also they mainly represent diversified strategies. Valuation of natural resources and the productive plot or *parcela* shows greater importance of water over other resources like forest, again with differences between people with more or fewer land rights and between the ejido and the indigenous community. When we deepen into the plant resources, we observed that specific management strategies exist for groups of resources that share some characteristics like wild plants or being trees, overall there is a great pool of plant resources that serve various necessities. Regarding their valuation, we saw that a great number of plants are valued by their food and feed contribution, but also plants that have water regulation contributions, like the case of fig trees, standout in their importance over other plants. Generally speaking, these strategies and natural resources valuation (including the plants) show landscape and livelihood diversity and multifunctionality. In contrast, when we analyze certain environmental governance process from a top-down direction this diversification in multiple dimensions (resources, activities, time, etc.) it is not taking into account and the vision of governments makes it difficult to achieve the goals of the managers according to their values. In order to have a more inclusive and sustainable environmental governance new institutional process from a bottom-up direction are needed, even though with implications beyond the local scale, where other values of nature from different stakeholders can be seen.

Capítulo 1. Introducción

A pesar de que en la ciencia se ha avanzado hacia una noción más integradora de la sociedad y la naturaleza, donde de manera conjunta conformamos sistemas socio-ecológicos, la crisis ambiental global no ha declinado en los últimos años e incluso se ha acelerado (Chapron et al. 2019). Actualmente, la relación que predomina como sociedad hacia la naturaleza nos pone en riesgo a nosotros mismos (algunos más vulnerables que otros) y a otras formas de vida (algunas más amenazadas que otras). Existe una relación de dominación hacia la naturaleza que ha generado consecuencias negativas a nivel planetario (Vitousek 1997). La relación que tenemos hacia la naturaleza se valida de manera cultural y social, por lo que es parte también de cómo nos relacionamos entre personas con los elementos de la naturaleza y qué es considerado como adecuado o no a través de valores (Chan et al. 2016). Además de los retos científicos y tecnológicos que esta crisis ambiental representa, surge un planteamiento mucho más ético de cómo debemos relacionarnos con la naturaleza y qué fines buscamos en esta relación (O'Neill et al. 2008).

Existen numerosos ejemplos que desafían la visión convencional de esta relación de dominación hacia la naturaleza; sobre todo, la de aquellas sociedades que basan sus medios de vida directamente en la apropiación de la naturaleza (Toledo et al. 2003, García-Frapolli et al. 2008, Moreno-Calles et al. 2011, González-Cruz et al. 2015). Muchas sociedades han evolucionado con su entorno (Gómez-Pompa and Kaus 1992, Levis et al. 2017) e interactúan con los ecosistemas en muchos casos de manera acoplada y sistemática. Esta interacción se plasma a través de estrategias específicas, definidas como “la construcción de un plan o esquema de operaciones conectadas para alcanzar objetivos específicos” (Toledo et al. 2003: 3). El estudio de estrategias desarrolladas en contextos particulares, en muchos casos producto de una interacción de cientos de años, es de gran importancia para el diseño de políticas de conservación en conjunto con el desarrollo sustentable de áreas rurales (Altieri 2002, Thompson et al. 2007, Chambers 2013). Estudiar y entender las lógicas subyacentes de estas estrategias campesinas evidencian los dilemas a los que se enfrentan los manejadores y cuáles son los principales elementos que limitan o fomentan el manejo sustentable.

Dentro de los distintos elementos de la naturaleza con los cuales interactuamos, los recursos vegetales son una base importante para muchas sociedades, cubriendo distintas necesidades humanas (Godoy and Bawa 1993, Altieri 2002). Las comunidades de plantas muchas veces son los elementos que dominan el paisaje y tienen importantes implicaciones en la conservación de otros organismos y actualmente sufrimos los efectos a escala planetaria por su degradación. Por si fuera poco, las plantas y su manejo determinan parte de la seguridad alimentaria dentro de muchas comunidades rurales (Fraser et al. 2010, Blancas et al. 2013). En México, la diversidad biocultural ha hecho posible el manejo de más de 1000 especies de plantas y la domesticación de cerca de 200, muchas de ellas cultivos de importancia mundial (Casas et al. 2007, Sarukhán et al. 2009). El manejo y la domesticación de los recursos vegetales son motivados por la valoración que estos recursos poseen en los contextos locales. Por esto consideramos que el manejo y la valoración de los recursos vegetales son un elemento fundamental de las estrategias campesinas.

La valoración de los recursos naturales pone en evidencia las disyuntivas que enfrentan las personas para alcanzar sus objetivos de manejo. Estas disyuntivas muchas veces surgen

porque existen distintas visiones y sistemas de valores en torno al manejo y gestión de los recursos, en muchos casos generando conflictos (Gunton et al. 2017, Pascual et al. 2017, Arias-Arévalo et al. 2018). En estos conflictos generalmente existe un dominio ontológico e invisibilidad de ciertos valores o visiones de la naturaleza (Sullivan 2006). En las distintas visiones que surgen sobre cómo encaminar el manejo de recursos el rol de las instituciones y el poder que dan forma a la valoración de la naturaleza y sus resultados son fundamentales, ya que las instituciones articulan ciertos valores a través de regulaciones (Kallis et al. 2013). Estas instituciones en las cuales la sociedad se organiza y moldea sus interacciones con la naturaleza a diferentes escalas representan una parte importante de los procesos de gobernanza ambiental (Díaz et al. 2015).

En México, uno de los actores protagónicos de la gobernanza ambiental y manejo de recursos son los núcleos agrarios: los ejidos y comunidades agrarias (Alcorn and Toledo 1998). Estas instituciones determinan la tenencia de la tierra y pueden ser considerados como una interfaz que media las relaciones entre componentes sociales y ecológicos dentro de los sistemas (Barnes, 2009). Muchas de las decisiones sobre el manejo de los recursos y su gestión recae en estas instituciones ya que cerca del 54% de la tierra en México, y cerca del 60% de todos los bosques, se encuentran en estos territorios (Skutsch et al., 2013; 2015). Sin embargo, la capacidad de tomar decisiones respecto a los recursos y el territorio no es equitativa para todos los miembros dentro de estos núcleos agrarios debido a las diferencias sobre los derechos de la tierra (Merino 2003, Appendini 2008). Comúnmente se han considerado a los núcleos agrarios como unidades homogéneas (Warman 1985), donde al interior todos sus miembros se comportan de la misma manera o solamente se han considerado a los poseedores de derechos sobre la tierra. Cada núcleo agrario representa una configuración particular de derechos sobre la tierra, sistemas de valores y estrategias de manejo de recursos que resulta indispensable estudiar cuando queremos hablar sobre la gobernanza ambiental.

El campo de los valores sobre la naturaleza se encuentra actualmente en un álgido momento, donde el auge de las visiones meramente económicas y sus instrumentos en política están siendo fuertemente cuestionados por no lograr transmitir y hacer visibles otras relaciones con la naturaleza (Chan et al. 2016, Pascual et al. 2017, Arias-Arévalo et al. 2018). Incluso los resultados esperados de la valoración económica de la naturaleza y sus instrumentos no han sido del todo efectivos (Corson et al. 2013). Por otra parte, la idea de excluir a las personas de los ecosistemas o ‘regresar a las barreras’ como ha denominado Sullivan (2006), no hace justicia a aquellos que han sido parte integral de los ecosistemas y dependen de ellos. Sin embargo, la necesidad de tomar medidas que respondan a la urgente necesidad de no acabar con los ecosistemas sigue vigente. El consenso es que el tema de los valores debe de ser central para el desarrollo de las políticas ambientales y las estrategias de manejo (Chan et al. 2016, Hejnowicz and Rudd 2017, Pascual et al. 2017, Tadaki et al. 2017), ya que al final son los valores los que se integran a los procesos de gobernanza ambiental a través de las decisiones (Kenter 2018). Sin embargo, cómo incorporar los valores y qué valores tomar en cuenta aún es una interrogante.

El entendimiento de los procesos de formación del valor de la naturaleza es considerado un aspecto crucial para la conservación de los ecosistemas y la biodiversidad (Kenter et al. 2016) ya que como sociedad tenemos la habilidad de generar un código moral respecto a la naturaleza (Piccolo 2017). Además, es importante resaltar que proveer elementos teóricos

para analizar y comprender modos alternativos de relacionarnos con la naturaleza, sus lógicas y estrategias desde distintos ángulos (económicos, sociales, ecológicos, entre otros) es crucial en aras de poder construir una gobernanza ambiental más inclusiva y sustentable. En este sentido nuestra pregunta de investigación aborda ¿cómo son las estrategias de manejo y la valoración de los recursos naturales en distintos núcleos agrarios y cuál es su relación con la gobernanza ambiental en la región costa sur de Jalisco, México? Nuestros supuestos generales son que existen diferencias en cuanto a las estrategias de vida y manejo de recursos naturales dadas por características de los contextos socio-ecológicos (i.e. tipos de ecosistemas presentes, sistemas de tenencia de la tierra, la historia de uso y conocimiento de los recursos), que a su vez determina una valoración de la naturaleza.

1.1. Objetivo general de esta investigación es:

- Analizar las estrategias de manejo y valoración de los recursos naturales en núcleos agrarios de la región Costa Sur de Jalisco y su relación con procesos de gobernanza ambiental.

1.2. Objetivos particulares son:

1. Caracterizar las estrategias de manejo de los recursos naturales que llevan a cabo diferentes tipos de manejadores en dos ejidos de la costa sur de Jalisco
2. Identificar el valor asignado a distintos atributos socio-ecológicos del paisaje dentro de las estrategias de manejo de recursos naturales en un ejido y una comunidad indígena de la región costa sur de Jalisco.
3. Caracterizar las estrategias de manejo de los recursos vegetales y su valoración en un ejido y una comunidad indígena de la región costa sur de Jalisco.
4. Analizar la relación entre estrategias de manejo y valoración de los recursos naturales en torno a la gobernanza ambiental de la región costa sur de Jalisco.

A continuación, se describe el contenido y estructura de esta tesis:

En el capítulo 2 se aborda el marco conceptual del proyecto y un esquema final que condensa y presenta los principales conceptos y sus relaciones. El capítulo 3 muestra el marco metodológico general, el diseño metodológico con los principales métodos de toma de datos y análisis, las unidades de análisis y el sitio y casos de estudio seleccionados. El capítulo 4 titulado “*Differences within similarities: farming strategies and natural resource management in two ejidos of Jalisco, Mexico*” aborda el primer objetivo particular; este capítulo caracteriza grupos de estrategias de acuerdo a características similares del manejo y de las actividades productivas realizadas en dos ejidos con ecosistemas distintos, identificando los principales elementos que marcan las estrategias campesinas. El capítulo 5 “*Exploring how land tenure affects farmers’ landscape values: evidence from a choice experiment*” aborda el segundo objetivo particular desarrollando una valoración a través de las preferencias de los campesinos por ciertos atributos socio-ecológicos del paisaje en un ejido y una comunidad indígena de la región; además, como consecuencia de los resultados obtenidos en el capítulo anterior, se prueba si entre campesinos con diferencias en derechos de la tierra encontramos valores diferentes. El capítulo 6 titulado “*Watering a relation: value and management of plant resources in two communities on the Coast of Jalisco*,

western Mexico” contempla el tercer objetivo particular del proyecto, donde se caracterizan las estrategias de manejo de los recursos vegetales considerados de mayor importancia por grupos de pobladores, además de los valores asociados que poseen estos recursos, en un ejido y una comunidad indígena. El objetivo cuatro se aborda en el capítulo 7 dentro de la discusión general de esta investigación donde a través de nuestros resultados de los distintos casos, nos centramos en las implicaciones hacia la gobernanza ambiental de la región. Finalmente, el capítulo 8 presenta las conclusiones de toda la investigación.

Capítulo 2. Marco conceptual

Uno de los elementos que integra un proyecto interdisciplinario es el marco conceptual, los conceptos contenidos nos ayudan a abordar e interpretar nuestro problema de investigación y a construir una explicación estructurada de la realidad (García 2006, Maass et al. 2015). En esta investigación aplicamos distintos niveles de análisis para abordar el problema de estudio, el cual gira en torno a la gestión y manejo de los recursos naturales que llevan a cabo las propias comunidades donde estos recursos se encuentran y por otro lado el valor asignado a distintos elementos de la naturaleza. La Figura 1 representa los grandes referentes conceptuales que se desarrollan en esta sección. Cabe señalar que este marco conceptual pretende tener un carácter integrativo, donde se parte de una aproximación general y posteriormente se va bajando la escala a otros niveles de entendimiento de cuestiones particulares. Este marco conceptual busca establecer una relación multinivel entre los conceptos, no jerárquica, donde cada nivel contiene propiedades emergentes, además de procesos de retroalimentación entre escalas.

Partiendo de una visión general, el primer referente conceptual es el de sistema socio-ecológico, el cual representa un conjunto acoplado entre los ecosistemas y la sociedad que se transforma mutuamente. Bajo este gran concepto se observan e interpretan las relaciones y procesos a otras escalas. Posteriormente, dentro del sistema socio-ecológico, nos centramos en ciertos procesos de gobernanza ambiental que están relacionados con aquellas instituciones que determinan las reglas y normas para el acceso y manejo de los recursos. Estas instituciones focales son los ejidos y comunidades agrarias, las cuales interactúan con otras instituciones gubernamentales y no gubernamentales a diferentes niveles. A continuación, las estrategias de manejo representan el nivel operativo del manejo de recursos naturales, aquel donde podemos observar y contrastar empíricamente nuestros supuestos. La valoración por su parte nos ayuda a entender la lógica detrás de las estrategias de manejo y las trayectorias que visualizan los manejadores de recursos, además de las disyuntivas a las cuales se enfrentan para alcanzar sus metas.

A continuación, se presentan los principales elementos del marco conceptual de esta investigación y cómo se estructuran las relaciones entre los mismos. Cada uno de los círculos de la Figura 1 se va detallando y explicando en las siguientes secciones y finalmente se presenta un esquema desarrollado con el contenido de estas cajas, los principales conceptos y sus relaciones en la Figura 2.



Figura 1. Principales referentes conceptuales dentro de la investigación representados en los distintos círculos y su organización de manera anidada, las líneas blancas representan la retroalimentación entre los distintos niveles. Fuente: elaboración propia.

2.1. Abordando la relación sociedad-naturaleza: el concepto de sistemas socio-ecológicos

Para el estudio y comprensión de las interacciones de los grupos humanos con los ecosistemas ha surgido el concepto de ‘sistema socio-ecológico’ (SSE). En este concepto el conjunto de elementos del ecosistema y de las sociedades que hacen uso de ellos son reconocidos como un sistema acoplado que funciona de manera sinérgica (Berkes and Folke 1998, Kay et al. 1999). Los SSE son sistemas abiertos y complejos, donde hay distintos flujos de materia, energía e información y los procesos que ocurren dentro de ellos no son lineales (García, 2006). Además, los SSE están compuestos de múltiples subsistemas y variables internas de manera anidada, análogo a los organismos vivos, en donde podemos observar procesos de autoorganización (Ostrom 2009). La capacidad adaptativa de los SSE determina su resiliencia, que es un elemento esencial para entender su permanencia dentro de cierto estado y sus límites, la cual está relacionada con la capacidad de afrontar la incertidumbre y el cambio (Folke et al. 2010).

Ya que una característica intrínseca de los SSE es su complejidad y abordar todas sus relaciones no es factible, es necesario trazar límites en las escalas espaciales, temporales y de las variables que queremos observar. Estos límites estarán en función de los objetivos o preguntas generales que se busca responder (García, 2006), representando un ‘recorte’ de la realidad (Maass et al. 2015). Una de las cuestiones indispensables para entender y explicar los SSE sin caer en aproximaciones simplistas es tener un ‘pensamiento sistémico’, donde el todo es más que la suma de las partes, y más que tener un ‘objeto’ de estudio, lo importante es entender las relaciones entre los objetos con la noción de que éstos son interpretados de manera previa y subjetiva (Maass et al. 2015). Además, es importante entender los procesos unificadores de las relaciones (Capra 1996).

Dentro del estudio de los SSE, algunos autores han considerado fundamental el hecho de cómo la capacidad de tomar decisiones conscientes de manera individual o colectiva

potencialmente pueden afectar positiva o negativamente el funcionamiento de todo el sistema (Ostrom 2011a, McGinnis and Ostrom 2014). Por esta razón un importante cuerpo del conocimiento en torno a los SSE se ha enfocado en cómo y porqué se toman ciertas decisiones y cuáles son los posibles efectos de las mismas sobre los ecosistemas. En este sentido, las decisiones de las comunidades locales desempeñan un papel clave en las condiciones de los ecosistemas y actualmente se reconocen como los principales responsables del manejo de los mismos (Toledo 1997, Berkes and Folke 1998, Castillo and Toledo 2000). Cuando nos centramos en el manejo de recursos naturales generalmente la dimensión de gobernanza suele ser menos relevante (Gerritsen, Rist, Morales Hernández, & Tapia Ponce, 2018). En nuestro caso consideramos que la dimensión de la gobernanza es central ya que el manejo de los recursos naturales es un proceso que se negocia entre actores con distinto poder e implica la creación de reglas e instituciones y su modificación a distintos niveles (Haller et al. 2016) con efectos en todo el sistema.

2.2. Las distintas caras de la gobernanza ambiental

El concepto de gobernanza ambiental se ha vuelto el eje de las discusiones académicas y políticas en torno al manejo sustentable de los sistemas socio-ecológicos (Berkes 2017). En esta investigación entendemos por gobernanza ambiental “una serie de procesos regulatorios, mecanismos y organizaciones a través de los cuales los actores políticos influencian las acciones y resultados ambientales” (Lemos & Agrawal, 2006: 298). Estos procesos regulatorios pueden entenderse como las instituciones, que son prescripciones que definen las interacciones entre las personas y el ambiente de manera estructurada (Ostrom 2005). En México, una institución fundamental de la gobernanza ambiental son los núcleos agrarios (ejidos y comunidades). Estas instituciones representan uno de los principales blancos de las distintas políticas ambientales, ya que poseen parte del poder en las decisiones sobre los recursos naturales (Skutsch et al. 2015, López-Bárcenas 2017). Este poder en los núcleos agrarios está repartido a través de una serie de derechos de propiedad, privados y comunes (Schroeder and Castillo 2012), a los distintos miembros que forman parte de estas instituciones. Estas instituciones, sus derechos de propiedad y sistemas de tenencia de la tierra son claves para entender el manejo de recursos ya que representan los procesos de gobernanza locales. Este abordaje se pauta también en el marco metodológico.

Sin embargo, los procesos de gestión y manejo de recursos generan antagonismos y tensiones, producto en parte de las distintas visiones que existen sobre el acceso y distribución de los recursos naturales (Castro, Hogenboom, & Baud, 2015). En estos procesos, se reconoce la marcada dicotomía que viene de la visión ‘desde arriba’ o de los gobiernos a las visiones ‘desde abajo’ o locales (Baud et al. 2011). Actualmente existe un debate acerca de cómo concebir y conseguir una apropiada política de conservación que pueda unificar las distintas visiones (Fletcher 2010). En este sentido, buscar formas de diálogo es fundamental para alcanzar una gobernanza ambiental justa, inclusiva y sustentable, en conjunto con las condiciones políticas para sostener estos acuerdos. Esto nos lleva a examinar cuáles son las lógicas subyacentes dentro de estas distintas visiones a fin de encontrar los puntos críticos que generan discrepancias en el manejo de los recursos. Estas distintas lógicas llevan implícitos los distintos valores sobre la naturaleza de diversos

actores (Castro et al. 2015), además de las visiones de cómo reflejar estos valores a través de acciones.

En general, también las aproximaciones teóricas han tendido a centrarse en una de las dos visiones de la gobernanza ambiental (i.e. los procesos locales o las políticas gubernamentales). Por un lado, tenemos el gran acervo de información que explica y fundamenta los principios básicos para la autogestión local de los recursos de uso común, en gran medida desarrollada a partir del trabajo de Ostrom (2011), que sintetiza los principios para el diseño institucional. Otros abordajes se han centrado en cómo los gobiernos a través del estado y sus discursos buscan encaminar a las personas hacia ciertas lógicas ambientales para alcanzar ciertos fines, definido como ‘ambientalidad’ (Agrawal 2005a, Fletcher 2010, 2017). El concepto de ‘ambientalidad’ surge de los planteamientos de Foucault sobre la ‘gubernamentalidad’ originalmente entendida como un tipo de lógica de gobernar o ‘conducir a los sujetos’ que posteriormente se expandió al entendimiento de múltiples formas de gobernar superpuestas (Fletcher 2017). En la práctica distintas ambientalidades de distintos actores compiten entre sí tratando de encaminar cierta estrategia de manejo de recursos naturales (Fletcher 2010).

Desde un punto de vista teórico y práctico surge la necesidad de entender los procesos de gobernanza ambiental desde un enfoque multidimensional que entienda las relaciones de los distintos actores y cómo modifican entre sí (Fletcher 2017, Büscher and Fletcher 2018). Con este propósito tomamos el concepto de ‘constitucionalidad’ que aborda las relaciones y negociaciones de poder en torno al manejo de los recursos, además de las estrategias de movilización para la creación de instituciones (Haller, Acciaioli, & Rist, 2016), que suma al enfoque sobre gestión de los recursos de uso común y principios del diseño institucional de Ostrom. En este sentido los procesos de constitucionalidad se basan en la elaboración de reglas ‘desde abajo’ donde se supera un papel solo participativo-pasivo de los actores locales en los procesos de gestión, donde se valida su creación y función en niveles superiores de gobierno (Haller and Merten 2018). Esto tiene que ver con conectar los distintos niveles en la creación de reglas, desde el nivel operativo y de elección colectiva y finalmente niveles de reglas constitucionales que determinan quién está en la posición para decidir quién decide (Ostrom, 2011), proceso que normalmente ha sido monopolizado por actores poderosos (Haller, Acciaioli, & Rist, 2016).

Creemos que es importante hacer evidente y confrontar los puntos clave las distintas lógicas dentro de la gobernanza ambiental y sus facetas en el territorio. Desde nuestra perspectiva, el manejo de recursos *in situ* y la lógica campesina a través de las estrategias de manejo de recursos naturales evidencian ciertos valores sobre la naturaleza y sus disyuntivas. Por otro lado, la lógica de los gobiernos y otros actores que se plasman a través de distintos programas e instrumentos políticos que inciden en estos mismos territorios. Por esta razón consideramos el estudio de las estrategias campesinas y de manejo de recursos un paso fundamental para entender los procesos de la gobernanza ambiental. A pesar de que esta investigación se desarrolló en un contexto regional específico llamado genéricamente la costa sur de Jalisco, mucho de lo que se diga sobre su gobernanza ambiental tiene relevancia en un contexto mucho más amplio como México o América Latina, a razón de la convergencia de las distintas ambientalidades que se llevan a lo largo y ancho de este territorio (Castro et al. 2015).

2.3. Las estrategias campesinas y de manejo de recursos: una mirada integrada en el manejo de ecosistemas

Las estrategias de manejo de recursos naturales se insertan dentro de las propias estrategias campesinas que realizan los hogares, donde existe una gran complejidad en la gama de actividades que llevan a cabo las personas con múltiples interacciones. Más allá de las actividades propiamente para generar ingresos, las estrategias campesinas están compuestas de otras actividades o incluso relaciones sociales que proporcionan sustento a la manera de vivir (de Haan 2000). Las estrategias campesinas de manera muy general se clasifican en tres grandes grupos: 1) aquellas orientadas completamente al campo; 2) estrategias mixtas con ciertas actividades dentro del campo y otras fuera del campo; y 3) estrategias que desarrollan actividades fuera del campo (Ellis 1998, Scoones 1998). Las dos primeras estrategias se relacionan directamente con el manejo de los propios ecosistemas y sus recursos. La tercera muchas veces surge a consecuencia de no poder desarrollar las otras estrategias o de la poca generación de ingresos de las mismas. El estudio de las estrategias campesinas y como se relacionan con el manejo de recursos permite trazar una trayectoria y sus posibles efectos en la resiliencia o vulnerabilidad del sistema socio-ecológico (Scoones 2009).

Nuestra aproximación a las estrategias campesinas considera al sistema natural como el sistema en el cual la sociedad se sustenta, además de poseer un papel en la modificación de componentes sociales. Existen una buena cantidad de argumentos de porqué considerar el papel de los ecosistemas y el manejo de recursos de manera preponderante en las estrategias campesinas. Dentro de estos argumentos tenemos que un estimado de 1.4 billones de personas en el mundo viven y trabajan en el campo en zonas donde muchas de las nuevas tecnologías agrícolas son poco útiles gracias a los ambientes tan heterogéneos y en muchos casos marginados (Altieri 2002). Además, existe fuerte evidencia de que cuando la disponibilidad a otros capitales como el humano, el financiero o el físico disminuye o alguna eventualidad amenaza los medios de vida de un hogar, esta tenderá a intensificar su dependencia sobre los recursos naturales (de Sherbinin et al. 2008). En muchos casos, dentro del contexto rural, la gente invierte o basa sus inversiones en aumentar sus recursos naturales como tierras y ganado (Salmerón, 2015).

El contexto agrario mexicano se ha caracterizado por la predominancia de la agricultura familiar y de autoconsumo (Álvarez-Grzynowska & Gerritsen, 2013; Castillo & Toledo, 2000; Toledo & Barrera-Bassols, 2017). Los impulsos tecnológicos propiciados durante la Revolución Verde, realmente no beneficiaron a los pequeños campesinos en áreas remotas (lo que constituye la mayoría del campesinado en México) (Altieri 2002). Después de la aplicación de las políticas neoliberales y reformas al artículo 27 en México, muchos de los procesos colectivos donde el capital social jugaba un papel crucial actualmente son mucho menos relevantes (Schroeder and Castillo 2012, López-Bárcenas 2017). Hoy en día el campesinado mexicano está caracterizado por la desarticulación de la organización comunitaria y una alta migración (Moya 2012). Con excepciones importantes y ejemplares de manejo comunitario de los recursos naturales (Bray and Merino 2004), la mayoría de los ingresos que las familias campesinas perciben provienen del manejo individual de sus recursos o tierras, donde si bien existen reglas colectivas, la mayoría de las decisiones son tomadas de manera individual y familiar. Estas estrategias campesinas se sustentan

fuertemente en los procesos de apropiación de la naturaleza a través del manejo de recursos (García-Frapolli et al. 2008). Como señala Toledo (2013) en las economías rurales el proceso de apropiación es mucho más intenso que los demás procesos como el de transformación o consumo, lo cual está asociado al tipo de economía que desarrollan.

2.4. Las estrategias de manejo de recursos naturales y la apropiación de la naturaleza

La apropiación de la naturaleza tiene que ver con la incorporación, transformación y significación de elementos del ecosistema para articularlos a los procesos sociales y económicos a través del trabajo (Toledo 1990, 2008, Toledo et al. 2003, Toledo and Barrera-Bassols 2008). Dicha apropiación se desarrolla e inserta siguiendo una cierta estrategia, la cual se define como “la forma particular en que cada familia reconoce, asigna y organiza sus recursos productivos, su trabajo y su gasto monetario con el objeto de mantener y reproducir sus condiciones materiales y no materiales de existencia” (Toledo y Barrera-Bassols 2008: 55). También es reconocido como la aplicación de un plan internalizado ligado a operaciones o acciones (prácticas de manejo) para lograr una meta específica con valor heurístico (Toledo et al. 2003). Estas estrategias constituyen parte del portafolio que los individuos y hogares poseen ante el cambio e incertidumbre (Ellis 1998, Scoones 1998).

En México, el concepto de las estrategias de manejo de los recursos naturales ha sido mayormente utilizado para comprender la lógica y relación entre las comunidades indígenas y sus intercambios con la naturaleza (Barrera-Bassols & Toledo 2005; García-Frapolli et al. 2008a; Toledo et al. 2003; Toledo 1992, 2008). En este sentido, el conocimiento ecológico tradicional, el cual lleva consigo el entendimiento de los procesos ecológicos y su incorporación a través de la cultura ha generado el gran acervo o diversidad biocultural¹ del país (Toledo & Barrera-Bassols, 2008). En numerosos estudios etnoecológicos se ha hecho evidente que el principal objetivo de las estrategias de manejo campesinas es maximizar las opciones disponibles para garantizar la subsistencia y minimizar el riesgo e incertidumbre (Toledo et al. 2003, Blancas et al. 2016, Rangel-Landa et al. 2016).

Los intercambios o flujos ecológicos (con la naturaleza) y los económicos (con el mercado), en muchos casos dan lugar a una producción no especializada basada en el principio de la diversidad de recursos y de prácticas productivas a través del ‘uso múltiple’ o diversificación (Toledo & Barrera-Bassols, 2008). La diferentes actividades que realizan las personas, los distintos roles dentro de la familia y la multifuncionalidad del espacio-tiempo forman parte del espectro de las llamadas ‘estrategias diversificadas’ (Ellis 1998; Renting et al. 2009; van der Ploeg et al. 2009; Gerritsen 2010). Por su parte, la diversidad biológica puede identificarse también a distintas escalas (ecosistemas, comunidades, especies, poblaciones, genes) y estas escalas deben concatenarse dentro del análisis de las estrategias de vida en función de entender la resiliencia de los sistemas socio-ecológicos

¹ La diversidad biocultural se refiere a las relaciones y la variedad exhibida que existe entre la diversidad biológica y la diversidad cultural en distintas regiones del mundo, por ejemplo, la diversidad lingüística, genética, de poblaciones y ecosistemas (Loh and Harmon 2005).

(Toledo et al. 2003; Barrera-Bassols y Toledo 2005; García-Frapolli et al. 2008). El uso múltiple del paisaje agrícola tiene implicaciones para los campesinos además de la propia sustentabilidad en términos de provisión y mantenimiento de servicios ecosistémicos y de la seguridad alimentaria a distintos niveles (Renting et al. 2009).

El estudio de las estrategias de manejo de recursos que se han desarrollado en contextos particulares y en muchos casos heredado durante siglos, actualmente son consideradas como alternativas viables de desarrollo, combate a la pobreza y seguridad alimentaria en el ámbito rural (Altieri, 2002; Chambers, 2013; Thompson et al., 2007; Thompson & Scoones, 2009). La complejidad en las decisiones de los campesinos hacen evidente cómo las estrategias y sus prácticas de manejo varían enormemente conforme a los propios valores, conocimientos, proyectos y objetivos, en conjunto con las condiciones ambientales (Vuillot et al. 2016). A pesar de que hay una condición estructural (contexto) que determina parte de la trayectoria de las estrategias sobre el paisaje, se reconoce que los valores individuales y prioridades son de gran relevancia en establecer diferencias en el manejo del paisaje y los recursos (Gravsholt Busck 2002). En este sentido, indagar sobre los valores nos ayuda a entender el porqué de las estrategias de manejo y a comprender la lógica campesina.

2.5. La valoración y procesos de formación de valor de la naturaleza

Existen distintas taxonomías y definiciones para entender los valores y valoración de la naturaleza (Tadaki et al. 2017). En un sentido acotado la palabra valor se asocia a “algo que tiene importancia” y la valoración al encuentro entre aquello que tiene valor y quien lo valora (Himes and Muraca 2018). Dentro de las clasificaciones de valores sobre la naturaleza, una de las mayores distinciones son los valores instrumentales o utilitarios, en contraste con los valores intrínsecos o deontológicos (Sagoff 1998, Pascual et al. 2017). Los primeros nos hablan de aquellos valores que poseen elementos de la naturaleza en función de dar un bienestar o una utilidad para el ser humano; los segundos nos hablan del valor inherente de los propios sistemas de vida como un bien en sí mismo que no están en función del ser humano. Más recientemente se ha incorporado el concepto de ‘valores relacionales’, los cuales tienen que ver con la idea de una ‘adecuada’ relación con la naturaleza generando bienestar (Chan et al. 2016). Estos valores relacionales nos ayudan a deshacer la dicotomía entre lo intrínseco y lo instrumental y pensar en un gradiente más amplio con respecto a los valores de la naturaleza. Los valores relacionales a pesar de ser antropocéntricos no son instrumentales y en general son producto de la interacción cercana con el objeto de valor, se asocia con el “sentido de pertenencia” o el “cuidado de la naturaleza” (Himes and Muraca 2018). Estos valores relacionales son de gran importancia cuando queremos entender las relaciones de las comunidades locales con la naturaleza.

Los valores se definen culturalmente como resultado de procesos sociales (Kenter et al. 2015, 2016, Irvine et al. 2016) y no responden a solamente a la agregación de los valores individuales. Por esta razón existen valores opuestos o contrastantes asociados a ciertas cosmovisiones u ontologías (Kenter et al. 2015, Cooper et al. 2016, Pascual et al. 2017). Los valores son dinámicos y cambian o se readaptan constantemente resultado de la experiencia continua, y los cambios en un tipo de valor pueden tener efectos en otro (Pascual et al., 2017). El valor de la naturaleza es difícil de conocer y estimar ya que

depende muchas veces de cuestiones intangibles e incommensurables (Martinez-Alier 1993). Sin embargo, podemos tener indicadores que nos hablen de distintos aspectos de los valores, como son los principios, prioridades, las preferencias y las medidas de los mismos (Pascual et al., 2017); contemplando que nunca podremos llegar a tener El valor de la naturaleza.

Los valores que los campesinos poseen sobre la naturaleza y su efecto en la toma de decisiones, son cruciales para la comprensión de las estrategias campesinas (Gravsholt Busck 2002, Feola and Binder 2010). Los campesinos realizan un ordenamiento del paisaje basado en la valoración local de los recursos naturales (Gerritsen 2010), donde se relacionan cuestiones físicas del propio recurso, además de sociales y económicas de los propios manejadores. Independientemente del valor económico o monetario, existen otros aspectos que juegan un papel importante en las decisiones de los campesinos, como es el prestigio y la tradición (Willock et al. 1999, Schmitzberger et al. 2005). Contrastar la valoración local de los recursos con las estrategias campesinas nos lleva a comprender las disyuntivas que los manejadores enfrentan entre lo que buscan y las presiones tanto sociales como ecológicas (Kennedy et al. 2009). Como punto de partida es importante reconocer que las visiones y valores sobre la naturaleza son eminentemente plurales, lo cual en muchas ocasiones genera conflictos (Gunton et al. 2017, Pascual et al. 2017, Arias-Arévalo et al. 2018). Esta pluralidad se encuentra dentro de comunidades como entre ellas y además entre los distintos actores que están relacionados con la gobernanza ambiental de los mismos territorios.

Actualmente se reconoce que es necesario llevar a cabo valoraciones plurales y la integración de los distintos valores para la toma de decisiones (Chan et al. 2016, Pascual et al. 2017, Tadaki et al. 2017, Jacobs et al. 2018), sin embargo, aún no es claro que aproximaciones pueden resultar útiles para entender los valores en contextos particulares. Los procesos de valoración son herramientas que hacen visibles valores específicos, pero pueden oscurecer otros ya que todas las metodologías de valoración tienen ‘puntos ciegos’ hacia ciertos tipos de valores (Jacobs et al. 2018). Por esto, cualquier proceso de valoración debe integrar un ejercicio reflexivo sobre los valores obtenidos (Tadaki et al. 2017). Muy comúnmente los valores han sido reducidos o representados a través de medidas económicas resultado en la monetización de la naturaleza (Adams, 2014; Gunton et al., 2017; Rincón-Ruiz et al., 2014; Silvertown, 2015;). El argumento a esto es que las medidas económicas y monetarias es lo que se necesita para informar la toma de decisiones (e.g. Ehrlich, 2008; Sukhdev, 2011). Los resultados e interpretaciones reduccionistas de ciertas metodologías de valoración son consecuencia de una apreciación conceptual de los valores de la naturaleza a su vez reduccionistas. El problema no es utilizar una valoración económica y obtener medidas económicas, sino interpretar esas medidas como el valor real de la naturaleza y desarrollar instrumentos de política en torno a ellos solamente, lo cual puede llevar incluso a resultados no deseados (Neuteleers and Engelen 2015).

Recientemente se han generado álgidas discusiones sobre replantear las aproximaciones conceptuales sobre los valores de la naturaleza (Chan et al. 2016, Cooper et al. 2016, Kenter et al. 2016, Pascual et al. 2017, Tadaki et al. 2017, Kenter 2018). Mucha de esta discusión se ha fomentado a partir de la creación del Panel Intergubernamental de Biodiversidad y Servicios Ecosistémicos (IPBES) que reconoce que los distintos valores de la naturaleza son uno de los elementos centrales para poder tener una visión más inclusiva y

pluralista que informe y apoye la gobernanza ambiental (Díaz et al. 2015). Su aproximación a los valores se relacionan con las distintas contribuciones que puede tener la naturaleza en dimensiones materiales, no materiales y de regulación, su efecto en el bienestar humano, además del valor intrínseco de la naturaleza (Pascual et al. 2017, Díaz et al. 2018). Uno de los conceptos clave es el de las contribuciones de la naturaleza a las personas que tiene su origen en el marco de servicios ecosistémicos, pero ha tenido cambios significativos en su conceptualización. Sin embargo, algunos autores sugieren que los valores de la naturaleza son el elemento central para poder entender el amplio espectro de las relaciones con la naturaleza y que los conceptos de servicios ecosistémicos o contribuciones de la naturaleza deben ser subsidiarios (Kenter 2018). Este tipo de discusiones no son triviales ya que implican la adopción de una *episteme* que finalmente informa acciones de conservación en torno a la biodiversidad de manera global en contextos donde el conocimiento y las experiencias sobre la naturaleza pueden ser simplemente otras (Sullivan 2006).

2.6. Un marco conceptual integrado

Aquí se presenta el marco conceptual integrado de esta investigación, resultado de los conceptos abordados y sus relaciones. El concepto más incluyente es el de sistemas socio-ecológicos, el cual contempla (como lo señala su nombre) un abordaje sistémico de los componentes sociales y ecológicos y las relaciones entre ellos. Dentro de los sistemas socio-ecológicos, el entendimiento de los procesos de gobernanza ambiental a través de los actores locales y las distintas ambientalidades, son el siguiente elemento de análisis en términos de la escala. Posteriormente, el estudio profundiza en las estrategias campesinas que incluye el manejo de los recursos naturales. Aquí, el proceso de diversificación dentro de las estrategias a distintas escalas tanto sociales como ecológicas es crucial para conocer cómo los manejadores responden a la incertidumbre del propio sistema socio-ecológico. Para el entendimiento de estas estrategias es importante considerar los flujos de entrada y salida del sistema que representan el motor de las mismas. El ciclo de las estrategias se basa en tomar decisiones, llevando a cabo prácticas que idealmente conducen a los objetivos de los manejadores. Esta relación se materializa a través de procesos de apropiación que se basan en los conocimientos ecológicos que resultan en la transformación del paisaje y el acervo de la diversidad biocultural. Finalmente, la valoración de la naturaleza es el elemento más fundamental y transversal con los otros niveles del marco conceptual. En este nivel los valores de la naturaleza son resultado de interacciones tanto sociales como de relaciones con distintos aspectos de la naturaleza, creando distintas cosmovisiones que se superponen. Los valores que pueden surgir pueden ser intrínsecos, instrumentales o relacionales. Es imposible conocer estos valores en abstracto, pero podemos tener proxis a través de distintas metodologías de valoración las cuales pueden hablarnos de principios, preferencias, prioridades, sabiendo que hay cuestiones incommensurables y otras que podemos medir. Los principales conceptos y sus relaciones expuestos aquí se muestran en la Figura 2.

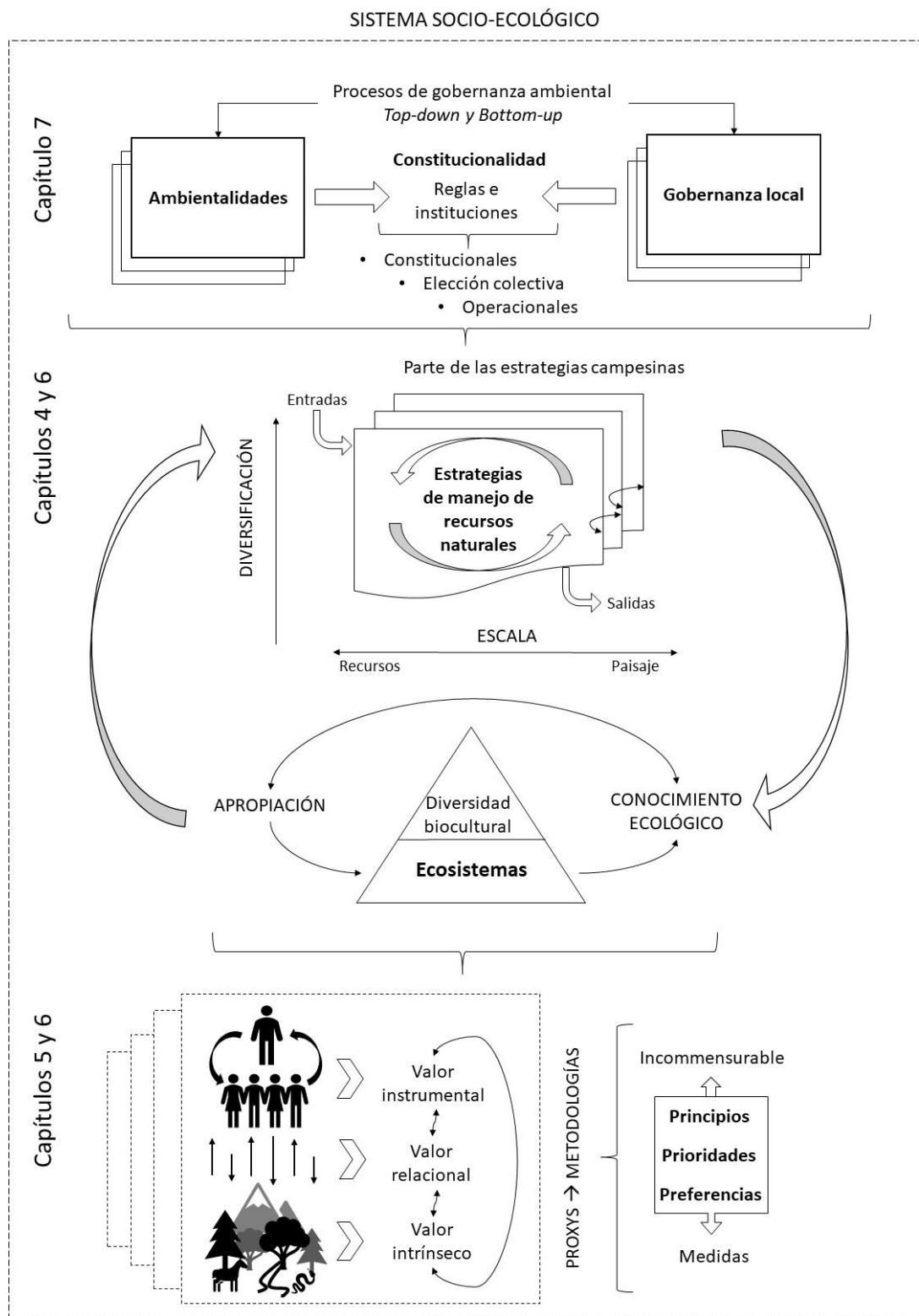


Figura 2. Esquema del marco conceptual que representa el contenido de los principales referentes (Figura 1), sus relaciones y los capítulos de la tesis donde se abordan principalmente. Fuente: elaboración propia.

Capítulo 3. Marco metodológico

El marco metodológico engloba la metodología, métodos y técnicas para alcanzar el objetivo general de la investigación. La metodología se puede considerar como “una estrategia de conquista, de acecho, de navegación, de construcción de determinados objetos de estudio mediante el uso de diferentes técnicas y la aplicación de diversos métodos para lograr un objetivo teóricamente plausible” (Maass, Amozurrutia, & González, 2015: 357). Esta investigación se considera eminentemente interdisciplinaria, por ende, el uso de métodos múltiples se consideró un mejor recurso (Poteete et al. 2012).

3.1. Estrategia metodológica

Fundamentalmente, la estrategia de esta investigación se basó en distintos casos de estudio comparativos dentro de una misma región, donde para cada uno de los capítulos empíricos se utilizaron distintos métodos para contrastar el fenómeno de estudio (i.e. manejo y valoración). Los estudios de caso se definen como “una indagación empírica que investiga un fenómeno contemporáneo en su contexto y vida real, especialmente cuando los límites entre el fenómeno y el contexto no son claros” (Yin 2003: 13). En muchas ocasiones los estudios de caso implican diversos niveles análisis, con distintas unidades, donde cada nivel

está relacionada con un fenómeno central sustantivo o teórico (Yin 2003, Poteete et al. 2012). Los casos se conceptualizan como unidades empíricas o constructos teóricos, donde el ‘caso’ representa la última unidad de análisis porque dicha unidad ofrece una interpretación empírica para el estudio teórico (Newing 2011). Para nuestro estudio, esta última unidad de análisis es el propio sistema socio-ecológico conformado por cada uno de los núcleos agrarios. Dentro de estos núcleos agrarios existen otras unidades de análisis de manera anidada que se desprenden de las dimensiones social y ecológica, existiendo interacciones entre las distintas dimensiones (Figura 3).

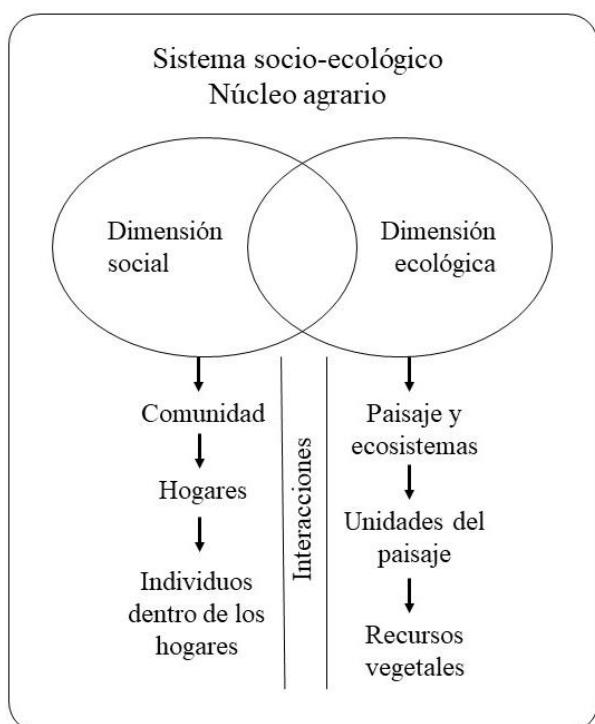


Figura 3. Unidades de análisis de la investigación. Fuente: elaboración propia.

En este sentido, nuestra última unidad de análisis conformada por los ejidos y/o comunidades indígenas (también llamadas comunidades agrarias), como estructuras de gobierno en sí mismas y sistemas de tenencia de la tierra, ofrecen la oportunidad de observar las diferencias en torno al manejo y valoración de recursos naturales. Además, las

diferencias dadas por los derechos de propiedad tanto entre núcleos agrarios como dentro de ellos son un elemento que representa un acercamiento empírico que aporta a la teoría del mismo tema (Schlager and Ostrom 1992). Por su parte, las diferencias en los ecosistemas dentro de algunos de nuestros casos de estudio, robustecen el marco de sistemas socio-ecológicos, el cual ha carecido de explicaciones causales sobre cómo los procesos ecológicos y biofísicos detonan o conducen aspectos de la gobernanza ambiental (Epstein et al. 2013, Monroy-Sais et al. 2016).

En cuanto a las diferencias entre los ejidos y comunidades indígenas, es importante resaltar que los ejidos forman la mayoría de los núcleos agrarios en el país, siendo poco más del 90% (Skutsch et al., 2015), por lo cual resultan sumamente relevantes para entender el manejo de los recursos naturales. Además, algunas particularidades sobre los ejidos es que tiene un número fijo de miembros o *ejidatarios* establecido al momento de la asignación de la tierra, los cuales también conforman la Asamblea (la autoridad máxima del ejido). El ‘derecho’ de ser ejidatario se puede heredar o incluso vender, sin embargo, la tierra legalmente no puede dividirse. Además, en los ejidos podemos encontrar otras figuras legales representadas por personas con tierras (parcelas), pero sin derechos sobre la zona común y sin voto en las Asambleas, llamados *posesionarios*. También personas sin tierra y sin derechos, llamados *avecindados*. Si bien los ejidatarios en muchos casos ahora son minoría en proporción a las demás figuras, representan una élite ya que toman decisiones con respecto a muchos asuntos relacionados con el ejido, generando diferencias en el acceso a los recursos que resulta importante investigar.

En el caso de las comunidades indígenas (producto de la restitución de tierras a las comunidades prehispánicas), los *comuneros* son las personas que legalmente tienen los derechos sobre la tierra y la autoridad para decidir de manera conjunta a través de la Asamblea. A diferencia de los ejidos, en las comunidades indígenas existe la capacidad de incorporar más miembros, por ejemplo, todos los hijos de comuneros, pudiendo dar como resultado una menor estratificación al interior de las comunidades y un acceso más equitativo a los recursos. Además, muchas de las comunidades indígenas desarrollan su estrategia de manejo de recursos con base en un importante capital social (Merino 2003) y son producto de un importante conocimiento ecológico que ha perdurado por cientos de años (Toledo et al. 2003). Sin embargo, también pueden existir élites dentro de las comunidades indígenas y no necesariamente un manejo sustentable de los recursos. Pocos estudios han contrastado estas dos formas de tenencia de la tierra y observado los efectos de las diferencias internas en relación al manejo, ya que han estado históricamente centrados en las figuras que legalmente tienen la mayoría de los derechos de propiedad (Barnes 2009).

3.2. Diseño metodológico

Para los casos de estudio comparativos es importante también una descripción del contexto que rodea al fenómeno central utilizando herramientas tanto cualitativas como cuantitativas, para dar mayor robustez (Zaidah y Zainal 2007). Para estas comparativas es posible utilizar múltiples métodos, ya que se considera que puede darse una mayor apreciación sobre la complejidad de las estructuras que originan ciertos procesos ayudando al rastreo detrás de las correlaciones, además de reconocer la importancia del contexto. Se

aplicó un diseño concurrente de métodos mixtos con el propósito tanto de la complementariedad como la triangulación, donde distintos métodos son utilizados para responder una misma pregunta (Newing 2011), para este propósito se puede obtener datos cualitativos que se analizan de manera cuantitativa o viceversa. En la Tabla 1 se muestran los objetivos de cada uno de los capítulos, los casos de estudio comparados, los métodos y herramientas en la toma de datos y cómo se llevó a cabo el análisis de los mismos.

Tabla 1. Diseño metodológico de la investigación de acuerdo a los distintos objetivos particulares de los casos empíricos.

| | Objetivo particular | Casos de estudio | Métodos y herramientas de toma de datos | Métodos de análisis de los datos |
|-------------------|--|------------------------------------|--|--|
| Capítulo 4 | Caracterizar las estrategias de manejo de recursos naturales de los hogares en dos ejidos. | Edijo Ranchitos Los y ejido Pabelo | Entrevistas semi-estructuradas que cubren los distintos aspectos y elementos de la estrategia campesina y de manejo de recursos naturales. | Análisis cuantitativo de agrupación o “cluster” de las distintas estrategias realizadas. Análisis de coordinación principal (PCoA) para identificar las principales variables de cada estrategia. |
| Capítulo 5 | Valorar atributos de la estrategia de manejo en un ejido y una comunidad agraria. | Ejido Pabelo y CI* Cuzalapa | Método de preferencias declaradas a través de cuestionarios de decisión sobre la valoración de atributos de la parcela. | Análisis a través de modelos logit condicional (CL) para determinar las preferencias o valoración por cada atributo de la parcela en el ejido y comunidad indígena. |
| Capítulo 6 | Caracterizar y valorar el manejo los recursos vegetales en un ejido y una comunidad agraria. | Ejido Pabelo y CI Cuzalapa | Dos talleres participativos, uno en cada comunidad para caracterizar el manejo de los recursos vegetales considerados de mayor importancia y valorarlos. | Análisis de agrupación para identificar las estrategias de manejo, posteriormente un análisis de redundancia parcial (RDA) para establecer la relación entre valor y manejo de los recursos vegetales. |

*CI: Comunidad indígena

3.3. Sitio y casos de estudio

La región conocida como Costa Sur de Jalisco es una zona de marcada vocación agrícola, pecuaria y forestal, que se caracteriza por su biodiversidad, así como por los grupos indígenas nahuas que habitan en algunas partes de la sierra (Gerritsen 2010). En la región se encuentran dos importantes Reservas de la Biosfera, la Reserva Chamela-Cuixmala (RBCH) y Sierra de Manantlán (RBSM). La tenencia de la tierra se encuentra repartida entre propiedades privadas, además de un número importante de núcleos agrarios. Con base en la explicación previa sobre la estrategia metodológica, dentro de esta área de estudio nuestros tres casos fueron el ejido de Ranchitos, el ejido de Pabelo y la comunidad indígena de Cuzalapa (Figura 4). Las diferencias e idoneidad de la selección de los casos se explican en cada uno de los capítulos. Resulta relevante la experiencia de investigaciones previas en estas comunidades las cuales han ayudado a comprender aspectos sobre la historia ambiental, procesos colectivos en el manejo de los recursos comunes (Schroeder and Castillo 2012, Cohen Salgado 2014, Monroy-Sais et al. 2016).

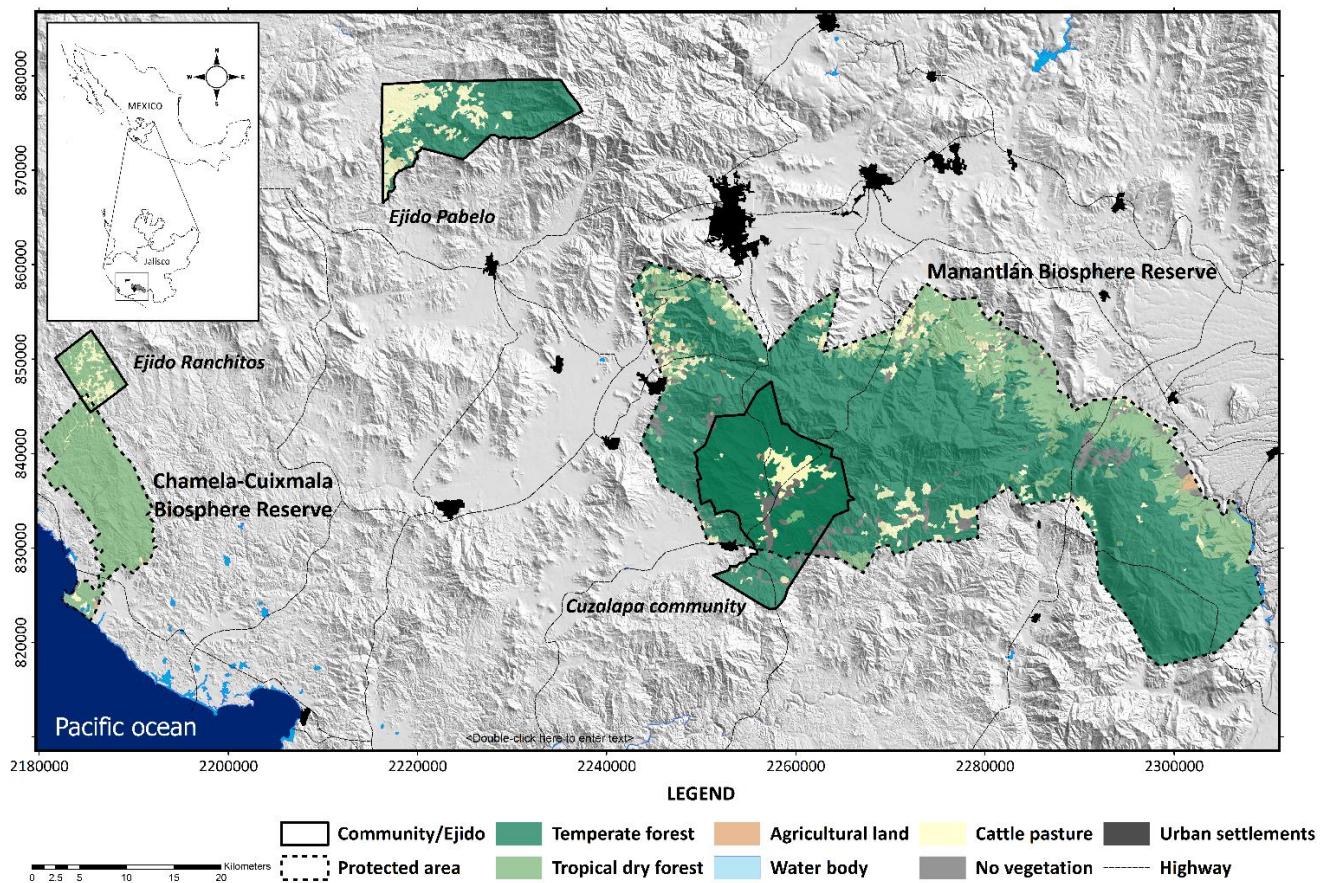


Figura 4. Mapa del sitio de estudio y los distintos casos, resaltando también las áreas naturales protegidas.

3.1.1. *El ejido Pabelo*

El ejido de Pabelo se localiza en el municipio de Villa Purificación en la parte alta de las cuencas de los ríos Cuitzmala y San Nicolás. Tiene una población de aproximadamente 1,073 habitantes y 272 hogares, (INEGI, 2010), existen 164 ejidatarios, 151 poseedores y alrededor de 20 a 40 vecindados (información local). Existe una alta migración tanto de ejidatarios como de otros pobladores sobre todo hacia Estados Unidos por la falta de fuentes de trabajo. El ejido tiene una superficie de 14,347 hectáreas, la zona parcelada comprende alrededor de 8,047 ha, y la zona común cerca de 6,300 ha, alrededor de 6,841 ha son áreas transformadas principalmente de pastizales inducidos y 7,506 ha áreas boscosas de distintos tipos de vegetación principalmente en la zona común. Los ecosistemas presentes son: bosque de pino, bosque de encino, bosque de pino y encino, bosque mesófilo de montaña, bosque de galería y bosque tropical subcaducifolio; además de vastas áreas de pastizales inducidos, algunos cultivos y vegetación secundaria. Esta heterogeneidad de tipos de vegetación se debe en parte al gradiente altitudinal que va desde los 600 msnm hasta los 2400 msnm. La precipitación media anual oscila entre los 1500 mm y se dispone de agua superficial en la mayoría de las parcelas. El área común se encuentra repartida internamente y de manera informal entre algunos ejidatarios para utilizarse como “agostadero” (sitios donde el ganado puede alimentarse de la vegetación natural). El reparto

de beneficios y gestión de las actividades forestales se da de manera comunitaria entre los ejidatarios. Otras actividades que se realizan en esta zona son: aprovechamientos forestales, el Pago por Servicios Ambientales, pesca, recreación, cacería, obtención de recursos maderables y no maderables. La principal actividad productiva en el ejido es la ganadería.

3.1.2. El ejido Ranchitos

El ejido de Ranchitos se localiza en el municipio de La Huerta en la cuenca del arroyo Chamela y pertenece a la zona de influencia de la Reserva de la Biósfera Chamela-Cuixmala. Tiene una población de aproximadamente 112 personas y 25 hogares (INEGI, 2010). Lo conforman un total de 3,350 hectáreas y 54 derechos ejidales, pero es común que dentro de un mismo hogar exista más de un derecho ejidal (Salmerón, 2015). Durante el estudio, en la localidad existían 21 hogares con derechos ejidales, 3 hogares de posecionarios y 5 de avecindados. Alrededor de la mitad de los ejidatarios viven en otros centros de población cercanos o se encuentran en Estados Unidos. La zona parcelada comprende alrededor de 1,500 a 1,700 ha, y la zona común cerca de 1,300 a 1,500 ha. El ecosistema dominante es el bosque tropical caducifolio, a su vez la zona parcelada tiene importantes remanentes de bosque. Se encuentra en un gradiente altitudinal de 160 msnm y una precipitación media anual de 750 mm en un patrón muy aleatorio. En su conjunto, las áreas de bosque representan alrededor 2,580 ha del ejido y alrededor de 770 ha son áreas trasformadas, principalmente pastizales inducidos, además de otros usos incluyendo el agrícola y zonas urbanas. La zona común se encuentra repartida internamente e informalmente en su totalidad, prácticamente no hay procesos colectivos de manejo en estas áreas (Schroeder and Castillo 2012). Las ganancias del aprovechamiento forestal se reparten individualmente y cada ejidatario se beneficia cuando el aprovechamiento se realiza en su área de bosque. Las principales actividades en este ejido son la ganadería, la agricultura y la extracción forestal. También se llevan a cabo actividades como: pesca, fabricación de ladrillo, cacería, extracción de recursos maderables y no maderables y otras actividades no relacionadas con el campo (Cohen 2014; Ugartechea 2015).

3.1.3. Comunidad indígena Cuzalapa

Por su parte, Cuzalapa es considerada una de las localidades más antiguas de la región Costa Sur de Jalisco (Estrada-Gutiérrez and Gerritsen 2011), pero fue declarada oficialmente comunidad indígena en 1950 con 251 comuneros y un total de 24,057 hectáreas. Más de la mitad de su territorio se localiza dentro de la zona de amortiguamiento de la RBSM que constituye una zona con restricciones sobre el uso de la tierra; además un 10% restante se encuentra en la zona núcleo (Gerritsen, 2010). Esta zona además es reconocida por el hallazgo de uno de los parientes silvestres del maíz el *Zea diploperennis* lo que ha sumado esfuerzos de conservación (Benz et al. 1994). Su población total es de alrededor de 1,560 habitantes. Existen varios tipos de vegetación como: bosque de encino, bosque de pino, bosque de pino y encino, bosque mesófilo de montaña, bosque de galería, bosque tropical caducifolio y vegetación secundaria, además de zonas donde se practica la agricultura y la ganadería. A su vez, existe un marcado gradiente altitudinal que va desde los 400 msnm hasta los 2600 msnm. A pesar de ser una comunidad indígena de origen nahua, ha habido un proceso de cambio cultural en las últimas décadas (Gerritsen 2004, 2010). Actualmente la población se dedicada principalmente a la agricultura de maíz

(temporal y de riego) y a la ganadería. El paisaje en Cuzalapa se conforma de zonas de cultivo de maíz y, sobre todo, de pastizales para ganadería, entre fragmentos de bosque de diferentes tamaños. Existe un aproximado de 19,326 hectáreas de bosques. En los bosques también se lleva a cabo el programa de PSA hidrológicos.



A: Paisaje de una parcela sembrada con pasto en Cuzalapa con la zona boscosa y montañosa detrás durante la temporada de lluvias. B: Paisaje de una parcela con pastos para el ganado en Pabelo en una zona con relieve accidentado, se puede observar algunos árboles tolerados y la zona montañosa y con bosque más denso a lo lejos, también en la temporada de lluvias. C: Actividad de valoración en el taller sobre recursos vegetales en Cuzalapa en una mesa de mujeres. D: Actividad de valoración en el taller sobre recursos vegetales en Pabelo en una mesa de hombres ejidatarios.

Capítulo 4.

Monroy-Sais, S., García-Frapolli, E., Mora, F., Skutsch, M., Casas, A., Gerritsen, P. R. W., Cohen-Salgado, D. and Ugartechea-Salmerón, O. A. (n.d.). The effect of land tenure and ecosystems on the management of natural resource: a case study in Jalisco Mexico. *Ecosystems and people*, (under review).

The effect of land tenure and ecosystems on the management of natural resources: a case study in Jalisco, Mexico

Abstract

The analysis of resource management strategies is considered relevant for conservation and sustainable use of biodiversity. Ejidos are the most important land tenure institutions in Mexico that grant access to resources inside the communities. Although there has been recognized that the internal structure of the ejido creates different social groups, there have been few studies that explore their resource management strategies. This study aims to characterize natural resource management strategies in two ejidos in a highly biodiverse region in the southern coast of Jalisco, Mexico, considering all land tenure figures inside the ejido. Taking the household as the unit of analysis, we conducted 55 semi-structured interviews tackling different aspects of their productive activities and natural resource management. Using cluster and ordination analyses we generated a household typology, while linear models allowed us to identify the particular variables differing among groups. We were able to establish four different farming strategies which were strongly associated with land tenure differences and the type of ecosystem that the households manage. We consider this information is key to understand how to enhance more diversified strategies that can sustain both ecosystems and livelihoods.

Key words:

Household strategies, land tenure, ejidos, social-ecological systems, Mexico.

1. Introduction

Most ecosystems on the Earth have been consciously managed and modified by humans throughout the history (Gómez-Pompa and Kaus 1992, Bush et al. 2015, Levis et al. 2017). Most forests, even those which are considered ‘pristine’, are in fact the result of the interactions between society and nature (Bush et al. 2015). According to Toledo et al. (2003: 3) people do not interact with ecosystems spontaneously, but rather carry out specific ‘strategies’ which can be defined as “internalized plans connected to operations or actions for achieving specific goals: it is the art of designing and directing operations”. Natural resources management strategies denote a mode of proper appropriation of ecosystems (Toledo et al. 2003). Such strategies includes the way in which families make management decisions in certain political, socioeconomic and ecological conditions, with specific responses to local conditions (van der Ploeg 1990, Gerritsen 2004). The notion of natural resources management strategy takes a more preponderant role of the ecosystems in the development of the rural life than the traditional livelihood approach where usually this is portrayed just as ‘natural capital’ with an utilitarian function (Binder et al. 2013). The study of natural resources management strategies developed in particular contexts is important for designing more comprehensive and sustainable development along with

conservation policies in the rural areas (Altieri, 2002; Chambers, 2013; Thompson et al., 2007; Thompson & Scoones, 2009).

Another important trait for these strategies is the institutional setting in which households and resources are embedded (Ellis 1998, Scoones 1998, 2009, Marsh 2003). Several studies have found relations between land tenure and natural resources management strategies, for example: uneven access to land and degradation (Niazi 2003); land tenure and differences on diversity of agroforestry species (Segnon et al. 2015); land tenure and empowerment to resource conservation (Luoga et al. 2005); land tenure and land use outcomes on farms (Carr 2008); land tenure ambiguity and consequences on resource management (Perz et al. 2014); customary land tenure systems and equitable and sustainable livelihoods (Batterbury et al. 2015). In the Mexican countryside, *ejidos* are one of the most important institution in the management of natural resources (Alcorn and Toledo 1998, Barnes 2009). The *ejido* as a land tenure institution can be described as an ‘interface’ that mediates the relationship between social and ecological components of the social-ecological systems (Barnes 2009).

Although organization behind *ejidos* existed before the Mexican Revolution, during the twentieth century they formally emerged as an outcome of the land redistribution policies (Knowlton & Orensanz, 1998; Perramond, 2008). Nowadays, about 54% of all land in Mexico, and 60% of all forests, fall within these territories or similar land holding systems (Skutsch et al. 2013, 2015). The analysis of management strategies practiced within *ejidos* is important in terms of conservation and sustainable development (Castillo et al. 2005, Cohen Salgado 2014). However, the majority of studies on strategies in Mexico have focused on natural resources management at the community level (Alcorn and Toledo 1998, Toledo et al. 2003, García-Frapolli et al. 2008). The intra-community differences between household access to resources regarding the land tenure figures and the resulting differences in natural resources management strategies within communities have been little studied. Although these differences between land tenure figures has been pointed by several authors (Taylor and Zabin 2000, Appendini 2008, Radel et al. 2010, Moya 2012, Torres-Mazuera 2013, Skutsch et al. 2015, López-Bárcenas 2017) there are no empirical studies that address how these differences manifest on natural resources management strategies. As stated by Barnes (2009: 395) “focusing only on *ejidatarios* does not tell the full story of land tenure and land use on an ejido”.

In the *ejidos*, the number of landholding members or *ejidatarios* is mostly fixed since the *ejido* foundation and cannot easily be changed; these members also constitute the Assembly (the highest authority of the *ejido*). Each *ejidatario* has certain rights over land: they have been allocated a plot for land cultivation, and rights over communal lands. Communal lands (often the most forested areas of the *ejido*’s territory) remain under communal management and their benefits may be used for communal purposes or be divided between the *ejidatarios* (Warman 1985, Schroeder and Castillo 2012). Also in many cases communal lands are informally plotted representing internal arrangements, but this is not legally recognized by the government (Moya 2012). The right to be an *ejidatario* can be inherited by one descendent only or even sold, but the land cannot legally be sub-divided into more plots. In addition to the *ejidatarios*, there are other recognized figures present in the *ejido*, including people who have been allocated land (plots) for cultivation (usually much smaller than those of the *ejidatarios*), but without rights regarding the common lands and votes in

the Assembly. These people are called *posesionarios* (those who possess) and are often the non-inheriting descendants of *ejidatarios*. Furthermore, there are people without productive land and without rights, called *avecindados* (those who settle) who have only a house plot (*solar*) within the *ejido*. Thus today, *ejidatarios* may represent a minority in many *ejidos*, but form a controlling elite because through the Assembly they make most of the decisions over the territory and resources. Due to reforms in the agrarian law in 1992, now *ejidatarios* can sell all or part of their land parcels to other *ejidatarios* or even to outsiders causing large differentiation in the area held by each *ejidal* family.

In the Chamela-Cuixmala region of the state of Jalisco, Mexico, around 40% of the territory is under the tenure of *ejidos* (Pérez-Escobedo 2011). From former studies, we know that drastic transformations of the ecosystems in this region have taken place over the last century as a result of agriculture expansion and exploitation of forests, driven mostly by regional and national policies (Castillo et al. 2009). On the other hand, in the last decades scientific research has emphasized the great ecological value and high biodiversity in the region (Ceballos et al. 1999, Noguera et al. 2002, Maass et al. 2005), given rise to the creation of the Chamela-Cuixmala Biosphere Reserve (CCBR). However, the preservation of the ecosystems is still in constant conflict with extensive farming and tourist development (Maass et al. 2005, Castillo et al. 2009, Riensche et al. 2015). Two *ejidos* of the Chamela-Cuixmala region were selected according to characteristics explained in the next section with the aim of characterize their natural resources management strategies. The questions we are asking are: 1) if the *ejido* (as a land tenure institution) creates differential access to resources to households within communities leading to a range of different strategies and impacts on the surrounding ecosystems; and 2) how the type of ecosystems present mold natural resources management strategies, mirrored in the agricultural systems. We consider that this information could play an important role in the context of policy design of development and conservation efforts in the region and in similar contexts.

2. Study area and cases

The Chamela-Cuixmala region has been delimited mostly by researchers studying ecological watersheds (Figure 1). It comprises an area of 6400 km² and the San Nicolás, Cuixmala and Purificación river watersheds (Maass et al. 2005). In the region we find very different development patterns; along the coast, where tourism and intensive agriculture take place, conditions are different from those of the uplands, where extensive livestock farming is dominant. Also, there are very few indigenous communities, with the two *ejidos* selected being composed mainly of mestizo people (Regalado 2000, Castillo et al. 2009). We selected our cases to highlight contrasting relevant characteristics (Yin 2003, Newing 2011), considering land tenure and ecological conditions as the main phenomena surrounding the cases (Eisenhardt 1989).

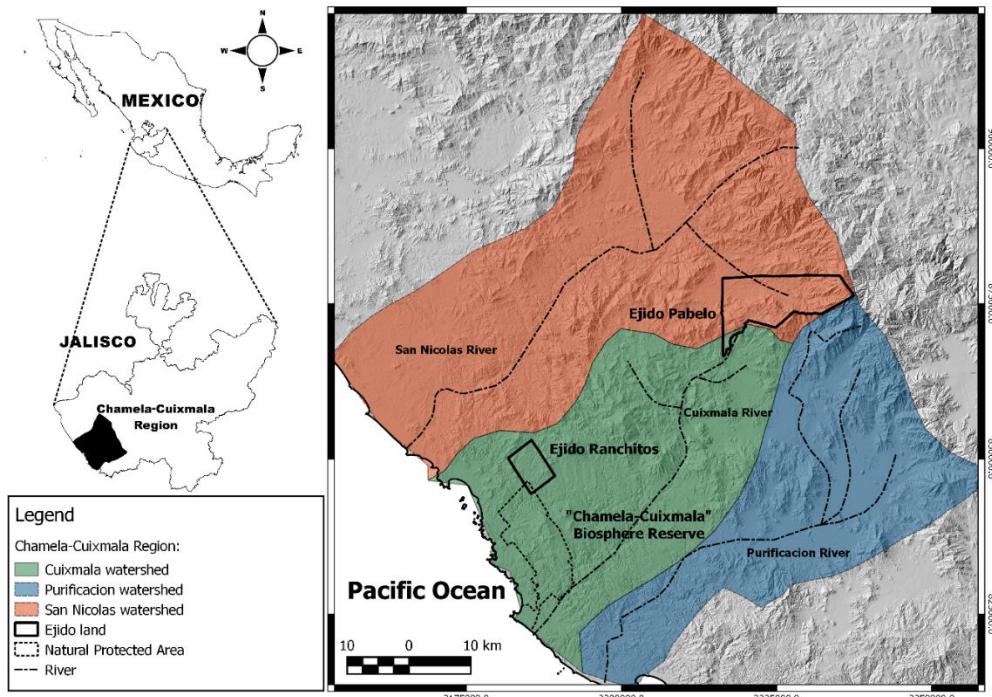


Figure 1. Map of study area, the Chamela-Cuixmala region, the three watersheds and the Biosphere Reserve. Location of the study sites: the *ejido* Pabelo and *ejido* Ranchitos.

2.1. The *ejido* Pabelo

The *ejido* Pabelo is in the municipality of Villa Purificación in the upper part of the Cuitzmala and San Nicolás Rivers basins (Figure 1). It was one of the first ejidos founded in the region around 1938 where there used to be big ranch or *hacienda* dedicated to cattle ranching. It has a population of approximately 1,073 inhabitants and 272 households (INEGI, 2010). There are 164 *ejidatarios*, 151 *posesionarios* and around 20 to 40 *avecindados* (local information), some of this are private landowners that have properties outside the *ejido*. The principal agricultural activity is cattle ranching, but there are high levels of migration (mostly to the United States), involving both *ejidatarios* and others, caused by the lack of alternative sources of employment. The *ejido* has an area of 14,347 hectares, of which 8,047 ha is in the form of individual plots and 6,300 ha is communal land. Around 6,841 ha are covered by induced grassland (transformed areas originally forested), while 7,506 ha are made up of pine forest, oak forest, pine and oak forest, cloud forest, riparian forest and tropical semi-deciduous forest, mostly in the common area (Table 1). In addition, there are some cropping areas and some secondary vegetation (natural forest on regeneration process). This heterogeneity of vegetation types is due in part to the elevation gradient (600 to 2,400 m). Annual average precipitation is approximately 1500 mm, and permanent rivers and streams flow through many of the plots. The common area is internally divided in an informal manner between some of the *ejidatarios*, who use it as *agostadero* (sites where the livestock can feed on the forested areas). The distribution of benefits and the administration of forestry activities are handled by the *ejidatarios* through

the Assembly. Other activities performed in this common area include firebreaks, monitoring and area delimitation for the payment for environmental services project, fishing, recreation, hunting, and extraction of timber and non-timber resources like mushrooms, soil, fruits or fodder.

2.2. The ejido Ranchitos

Ranchitos is located in the municipality of La Huerta in the basin of the Chamelea river and in the area of influence of the Chamelea-Cuixmala Biosphere Reserve (Figure 1). The *ejido* was founded in the year 1968 by people who came from other places prompted by a government program to establish new settlements in places considered ‘hostile’ or difficult to access (Castillo et al. 2005). Population is approximately 112 people in 29 households (INEGI, 2010). It has an area of 3,350 hectares, of which 1,900 ha consist of individual plots and the urban settlement, and the common area being around 1,450 ha. There are 54 *ejidatarios*, with at least one *ejidal* right, three households of *posesionarios* and five of *avecindados* (Ugartechea-Salmerón 2015). Many of the *ejidatarios* (20) however live outside the territory of the *ejido*, in other nearby population centers or in the United States. The elevation is about 160 m and the annual average precipitation is nearly 750 mm, falling in a very random pattern. Forest areas, mainly tropical deciduous forest, represent approximately 2,580 ha of the *ejido*, and around 770 ha are transformed areas, mostly induced grasslands, in addition to other uses including agriculture and urban zones (Table 1); the plotted areas retain important forest remnants. The common area is internally and informally completely divided between individual *ejidatarios*, and is used for cattle and commercial forestry; essentially, there are no strong collective management processes in these areas (Schroeder and Castillo 2012). The earnings from forestry are divided individually, and each *ejidatario* benefits from timber exploitation in his/her area of forest. The main economic activities in the *ejido* are cattle ranching, agriculture and forest timber extraction. In addition, activities such as fishing, brick making, hunting, extraction of timber and non-timber resources and other non-farm activities like commerce or construction are carried out by local people (Cohen Salgado 2014, Ugartechea-Salmerón 2015).

Table 1. Comparative characteristics of population and territorial extension between the two case studies

| Ejido | Total population | Number of households | Total area | Forests* | Transformed areas | Main vegetation types ^a |
|-----------|------------------|----------------------|------------|---------------------------|-------------------------|------------------------------------|
| Pabelo | 1,073 | 272 | 14,347 ha | 7,506 ha (90% CA, 10% PA) | 6,841 ha (100% PA) | PF, OF, POF, CF, RF, TSF |
| Ranchitos | 112 | 29 | 3,350 ha | 2,580 ha (40% CA, 60% PA) | 770 ha (40% CA, 60% PA) | TDF, TSF |

*Percentages representing the input to this vegetation type from the CA: common area, and PA: plot area. ^a PF: pine forest, OF: oak forest, POF: pine and oak forest, CF: cloud forest, RF: riparian forest, TSF: tropical semi-deciduous forest, TDF: tropical deciduous forest.

2.3. Landscape and plot configuration in Pabelo and Ranchitos

According to the main characteristics and elements occurring in landscapes and plots, we schematized the typical plot in Pabelo and Ranchitos (Figure 2). There are some elements shared in both ejidos: vegetation patches, sources of water, pasture and forage and useful trees scattered. Also, plots are divided into paddocks that farmers use to keep the cattle for a certain time (between 15 days to 1 month) depending on the area and the season. The typical plot in Pabelo (Figure 2a) has certain features like perennial rivers or streams and riparian forest alongside to protect river flow. Also, patches of oak forest are common, because oaks are very useful species for fences and firewood. This ‘typical plot’ in Pabelo varies in topographic conditions and altitude, which determine which kind of vegetation and species are present. The landscape in Pabelo is made up of big productive areas for cattle ranching on large expanses of pastures which dominate the low elevations and less sloping terrain, with forested areas at the high elevations and on steeper terrain.

Plots in Ranchitos (Figure 2b) are differentiated by having bigger patches of tropical deciduous forest in various successional stages due to the rapid regrowth of this forest type. Also by having watering holes, because of the low availability of natural water sources; even so, most farmers in Ranchitos need to bring water to their animals by vehicle in the dry season (from April to June). Another characteristic is the areas for maize cultivation, which are mostly dedicated to cattle feed. The landscape in Ranchitos represent a mosaic in which the tropical deciduous forest is dominant but actively managed and where the pastures are more scattered due to the amount of work needed to maintain them. These different landscape and plot configuration also imply that farmers need to perform different activities around the year. In both ejidos maintenance activities for the pastures like ‘clearing’, applying herbicides and sowing are performed. The productivity of the pastures in Pabelo is enough to feed the cattle through the year while in Ranchitos farmers use the natural vegetation in the rainy season to feed the cattle to keep the pastures for the dry season.

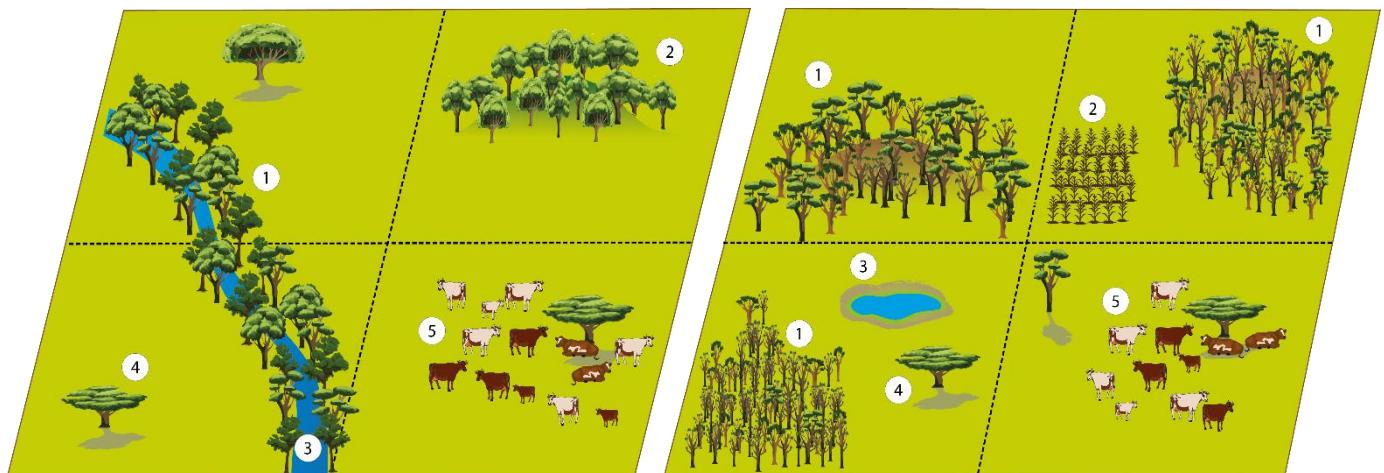


Figure 2a (left) The typical plot in Pabelo. 1: Riparian forest. 2: Oak forest remnants. 3: Permanent rivers or streams. 4: Useful trees. 5: Cattle. Figure 2b (right) The typical plot in Ranchitos. 1: Tropical deciduous forest in different successional stages. 2: Maize cultivation. 3: Watering hole. 4: Useful trees. 5: Cattle.

3. Methods

3.1. Data collection

Permits for research were granted from the ejidos and municipality authorities. We considered the household the best unit of analysis (Eakin 2003). We performed semi-structured interviews with households, addressing topics like productive activities, family unit characteristics and management of natural resources, among others (see Appendix A). Context specific questions were asked about natural resources management strategies, also based on variables found to be important defining strategies in other studies in the region like reciprocal labor, amount and type of land, plant resources and different activities performed (Gerritsen 2004). We had two levels of information about the strategies. The first level involves all those actions or elements of the household strategy both within and outside the plot, which may or may not involve resource management. The second level of information was about activities and elements related specifically to natural resource management (Table 2). For us these two levels are part of the same strategy, where the management of natural resources is an integrated part of the household strategy. With regard to resource management, we consider the plot as the space where many of the family decisions materialize since this represents the base of their productive system (Ugartechea-Salmerón 2015). Interviewees were randomly selected in both communities, including in the sample different groups of residents in both ejidos: ejidatarios, posesionarios and avecindados. In total, 26 interviews were carried out in Pabelo in the three main localities and 29 in Ranchitos in the only one locality. The interviews in most cases involved more than one member of the household; commonly the head of the family and the holder of land rights were men, except for 4 cases, 2 in each ejido, where women were the head of the family. In addition, field observations of plots were performed with some interviewees to identify specific characteristics of ecosystems and management practices.

3.2. Data analysis

We coded the information in a database with 53 socio-ecological variables used to characterize the natural resources management strategy of the households (Table 2). Not all the information from the interviews was included in the final database because there was lack of information of some informants, for example on earnings from productive activities. Also, qualitative information was grouped by theme and used for interpreting the results and grounding aspects of the discussion. To delineate strategies among households we performed a cluster analysis on the socio-ecological variables. Cluster analysis was done using the average or UPGMA method on a Gower dissimilarity matrix calculated from the database. The optimal number of clusters was defined using a silhouette plot, as the number minimizing the negative silhouette widths (Borcard et al. 2011).

Table 2. Variables on which data was coded and the type of variable

| Family unit | Productive activities | Other expenses and income |
|------------------------------------|---|-----------------------------------|
| Age of interviewee (cont) | Farming (b) | Extra labor for ranching (b) |
| Figure within the <i>ejido</i> (c) | Cattle ranching (b) | Extra labor for crops (b) |
| Place of origin (b) | Agriculture (b) | Family labor (b) |
| Family in the U.S. (b) | Forest activities (b) | Daily wage labor (b) |
| Family members (d) | Business and services (b) | Extra labor from comrades (b) |
| Adults (d) | Day laborer (b) | Receives government support (b) |
| Minors (d) | Reciprocal labor (b) | Number of government supports (d) |
| Students (b) | Salaried work (b) | Communal areas benefits (b) |
| Housekeeping (b) | Total number of activities (d) | Remittances (b) |
| Management of resources | | |
| Hectares of plots (cont) | Heads of cattle (d) | Farm crops (b) |
| Hectares of pasture (cont) | Perform occasional cattle sale (b) | Self-consumption crops (b) |
| Hectares of crops (cont) | Perform specific season cattle sale (b) | Market crops (b) |
| Hectares of forest (cont) | Minimum annual sale of cattle (d) | Orchard cultivation (b) |
| Pasture ratio (cont) | Maximum annual sale of cattle (d) | Cultivation of useful plants (b) |
| Crops ratio (cont) | Produce milk and cheese (b) | Number of useful plants (d) |
| Forest ratio (cont) | Sale milk and cheese (b) | Use firewood and poles (b) |
| Provision services (b) | | Perform clearcutting (b) |
| Regulation services (b) | | Backyard animals (b) |
| Cultural services (b) | | |

(b) binary variable, (c) categorical variable, (cont) continuous variable, (d) discrete variable.

To visualize the clustering and to identify the most important socio-ecological variables defining the groups, we performed a Principal Coordinate Analysis (PCoA) based on the same Gower dissimilarity matrix. This ordination analysis shows the basic structure of a multivariate dataset in the form of continuous axes, highlighting the variables that have the greatest importance in defining such structure, as well as the relative position of the entities (Borcard et al. 2011). The first two ordination axes were extracted and plotted, and the clusters were projected simply by identifying them with different colors.

Finally, to identify which variables differ among groups we fitted generalized linear models (GLMs) using the group as the predictive variable, allowing us to contrast all groups. However, as the two *ejidos* had no equal representation across the resulting groups, with two of the groups having no representatives at Ranchitos (Table 3), a potential confounding effect could arise. Therefore, we fitted a second set of GLMs using only the information from the two groups represented in both ejidos and including *ejido* and its interaction with group as additional predictors to control for their effects. Type I ANOVA tests (for continuous variables, F tests) and deviance tests (otherwise, Chi-square tests) were performed, with *ejido* being tested first in the second set of models. All the analyses were performed using basic routines in the R language (R Core Team 2016). Gower distance was calculated using the function ‘gowdis’ in the ‘FD’ library (Laliberté et al. 2014), silhouette plots were obtained using the ‘silhouette’ function in ‘cluster’ library (Maechler et al. 2016), and the PCoA using the ‘dudi.mix’ in the ‘ade4’ library (Dray and Dufour 2007).

4. Results

4.1. Natural resource management strategies

Cluster analysis suggests the existence of four groups of household natural resources management strategies (numbered 1 to 4). Figure 3 show the main variables dividing these groups, Group 1 and 2 with small or no plots and no agriculture and crops, Group 3 and 4 with medium to large plots and agriculture and crops. Of the 53 variables analyzed within the four groups, 35 proved to be significantly different between at least two of the four groups, most of them from resource management. For the GLMs between groups 2 and 4 there was a significant effect of the group in 31 variables after controlling for *ejido* effect. Five variables showed an effect of the *ejido* but no group effect, and only one variable (number of activities) showed interaction effect between *ejido* and group. Complete tables with statistical and p values from both tests (those of the four groups and between groups 2 and 4) are shown in Appendix B. On the other hand, certain elements of the strategies were found almost without exception across households and groups: the work of housewives, productive activities and the presence of family members in the United States. Overall, the main use of plots was for pasture (67.7%), followed by forest (28.1%) and finally crops (4.1%). We provide a description of each group below, and Table 3 summarizes information on each group and the whole sample of households.

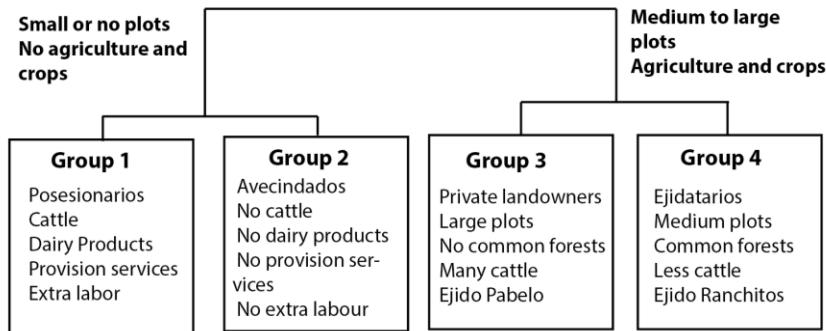


Figure 3. Four groups of the cluster analysis and the main variables that define the divisions between groups.

Group 1 ‘Posesionarios with cattle specialization’: This group consists mostly of *posesionarios* households. The central productive strategy and principal activity of the group is raising and commercialization of cattle. The households of this group generally do not grow crops. It is the group that recognizes the greatest number of useful wild plant species and includes these within its strategy. The plots are distinguished by having large expanses of pastures and forests. Within this strategy group, many households require extra labor, paying wages to non-family members to perform various activities. Furthermore, reciprocal unpaid work between members of the same group is common. As *posesionarios*, the households of this group do not receive the benefits of belonging to the *ejido*, such as the possibility of using the common areas and the financial benefits from timber and the non-timber forest products.

Group 2 'Day laborers or off-farm workers': This group is mostly comprised of households of *avecindados*. People of this group do not possess land or have very little, which implies not having cattle, crops, provisioning services, milk or cheese production, among other features. This strategy depends largely on daily wage work and the performance of activities outside the family farm, such as labor on other farms or in commerce. This strategy is the only option for households that do not have their own farms. On average, they are involved in fewer types of activities per household (3.7) than households in the other groups (3.9 to 4.7). The households within this group receive less government economic support than the other strategies. Furthermore, they do not receive the benefits of the management of common areas, and few of them work on forest activities (33.3%), although with permission from *ejidatarios* or *posesionarios* they can access to some subsistence forest resources like firewood.

Group 3 'Private landowners': This group is comprised mainly by families that possess private properties outside of the *ejido*. One of the main characteristics of this group is the large expanses of land that they possess as compared to the other groups, with both forest and pasture for cattle. They also have some areas destined to crops production. Of the four groups, this one receives the largest amount of government support of all types. The major economic income of these households comes from the sale of large quantities of cattle every year. This group is important in terms of resource management, since in total its lands amount to 657 ha, more than the lands in Group 1 and 2 together, an important proportion of these (around 50%) being forests. Their forests are also used for cattle ranching from natural vegetation and they can have commercial forestry or programs of payment for environmental services from the government.

Group 4 'Diversified ejidatarios': This group is mostly composed of families of *ejidatarios* and includes almost 50% of the entire sample. This group utilizes a more diversified strategy, performing various activities (ranching, agriculture, forest activities and day labor). The forest activities involve the extraction of wild timber species with a legal management plan in the common areas. The plots include both forest and pastures as well as areas for crops of diverse types. It is a heterogeneous group, since it includes households with moderate quantities of land as well as large ones close to those of Group 3. It is worth mentioning that the households of this group complement their strategy with the production and commercialization of products derived from cattle ranching, such as milk and cheese; in addition, they receive benefits granted by the *ejido* related to the management of the common areas.

Table 3. Summary of strategies' characteristics of the different groups and the total of the households of the sample from the interviews.

| | | Group1 | Group2 | Group3 | Group4 | Total |
|-----------|--------------------|--------|--------|--------|--------|-------|
| Ejido *** | Ranchitos | 0 | 5 | 0 | 24 | 29 |
| | Pabelo | 12 | 7 | 5 | 2 | 26 |
| Figure*** | Avecindados | 0 | 10 | 0 | 0 | 10 |
| | Private landowners | 1 | 0 | 3 | 1 | 5 |
| | Ejidatarios | 2 | 2 | 1 | 22 | 27 |
| | Posesionarios | 9 | 0 | 1 | 3 | 13 |

| | | | | | | |
|-------------------------------------|-----------------------------------|-------------|-------------|--------------|-------------|-------------|
| Family unit | Average head of the family age | 51.6 (15.8) | 46.2 (18.7) | 39.0 (10.2) | 53.6 (15.8) | 49.9 (16.3) |
| | Average family members | 3.1 (1.4) | 3.9 (1.6) | 4.0 (2.3) | 4.1 (1.9) | 3.8 (1.7) |
| | Average minors within the family | 1.0 (1.4) | 1.4 (0.9) | 1.6 (2.1) | 1.4 (1.3) | 1.3 (1.4) |
| | Average adults within the family | 2.2 (0.7) | 2.5 (1.0) | 2.4 (1.1) | 2.6 (1.3) | 2.4 (1.1) |
| | Family in the US (%) | 91.7 | 75.0 | 80.0 | 88.5 | 85.5 |
| Productive activities | Farm activities (%)*** | 100.0 | 66.7 | 100.0 | 100.0 | 92.7 |
| | Cattle raising (%)*** | 91.7 | 16.7 | 100.0 | 92.3 | 76.4 |
| | Agriculture (%)*** | 25.0 | 16.7 | 100.0 | 96.2 | 63.6 |
| | Forest activities (%)** | 33.3 | 33.3 | 40.0 | 80.8 | 56.4 |
| | Commerce and services (%) | 33.3 | 50.0 | 20.0 | 30.8 | 34.5 |
| | Day laborer work (%) | 66.7 | 83.3 | 40.0 | 57.7 | 63.6 |
| | Reciprocal work (%)* | 58.3 | 50.0 | 40.0 | 15.4 | 34.5 |
| | Salaried work (%) | 0.0 | 25.0 | 20.0 | 7.7 | 10.9 |
| | Average number of activities | 3.9 (1.2) | 3.7 (1.5) | 4.6 (1.5) | 4.7 (0.9) | 4.3 (1.3) |
| Natural resources management | Total amount of plots (ha) | 394.0 | 120.5 | 657.0 | 1647.5 | 2819.0 |
| | Average plot (ha)*** | 32.8 (55.6) | 10.0 (23.3) | 131.4 (97.0) | 63.4 (43.5) | 51.2 (58.6) |
| | Average grasslands (ha)*** | 15.4 (12.1) | 3.23 (7.62) | 77.5 (58.5) | 45.3 (39.2) | 32.5 (39.1) |
| | Average crops (ha)*** | 0.1 (0.2) | 0.0 | 3.3 (2.3) | 2.5 (2.2) | 1.5 (2.1) |
| | Average forest (ha)* | 7.3 (46.6) | 4.9 (11.5) | 50.6 (47.2) | 15.6 (13.6) | 16.8 (29.3) |
| | Grasslands ratio (%)*** | 73.0 (22.2) | 61.7 (30.1) | 60.2 (10.3) | 64.5 (24.7) | 67.7 (32.7) |
| | Crops ratio (%)*** | 2.9 (7.2) | 0.0 | 5.4 (5.2) | 4.8 (4.2) | 4.1 (5.0) |
| | Forests ratio (%)*** | 24.4 (22.6) | 37.2 (19.6) | 34.4 (12.9) | 26.7 (21.8) | 28.1 (21.7) |
| | Average number of useful plants** | 14.5 (6.6) | 8.5 (3.1) | 13.6 (7.3) | 8.6 (4.7) | 10.3 (5.7) |
| | Average heads of cattle*** | 21.5 (14.0) | 0.91 (2.61) | 115.6 (99.2) | 26.0 (17.9) | 27.7 (42.4) |
| | Average annual sale of cattle*** | 5.50 (7.40) | 0.12 (0.43) | 18.4 (11.7) | 4.3 (3.9) | 4.92 (7.27) |
| | Perform clearcutting (%) | 25.0 | 8.3 | 20.0 | 34.6 | 25.5 |
| Other expenses and income | Cultivate orchards (%)* | 91.7 | 91.7 | 60.0 | 100.0 | 92.7 |
| | Use firewood and poles (%)*** | 66.7 | 50.0 | 100.0 | 100.0 | 81.8 |
| | Self-consumption crops (%)*** | 25.0 | 16.7 | 100.0 | 100.0 | 65.5 |
| | Produce milk and cheese (%)*** | 41.7 | 0.0 | 100.0 | 73.1 | 52.7 |
| | Extra labor (%)*** | 75.7 | 8.3 | 100.0 | 57.7 | 54.5 |
| | Payment of daily wages (%)*** | 66.7 | 8.3 | 100.0 | 34.6 | 41.8 |
| | Common areas benefits (%)*** | 16.7 | 8.3 | 20.0 | 80.8 | 45.5 |
| | Remittances (%)* | 66.7 | 50.0 | 20.0 | 84.6 | 67.3 |
| | Receive government support (%)*** | 66.7 | 16.7 | 100.0 | 53.8 | 52.7 |
| | Number of government supports*** | 1 (0.9) | 0.2 (0.4) | 1.6 (0.5) | 0.6 (0.6) | 0.7 (0.7) |

(%) Percentage of households of the sample or group. ***, **, * Variable significantly different between at least two groups with a $p < .005$, .01 and .05, respectively. The data between parentheses shows the standard deviations.

Ordination analysis showed that along continuous axes summarizing socio-ecological variation in household characteristics (Figure 4), individuals from the same group are closest to each other. There are however no clear cutting divisions, but rather households are located along a continuum. The first axis of the PCoA shows a main differentiation between two strategies: households without cattle, without provisioning services, and commonly having small plots or no land at all (on the right in Figure 4, mostly from Group 2); and those who practice cattle ranching, use provisioning services, and have an associated amount of land and pasture (on the left in Figure 4, mostly from Groups 3 and 4). The second PCoA axis reveals a striking partitioning between the two ejidos, with most

households from Ranchitos taking positive values along this axis, and most from Pabelo having negative values. Other variables that are relevant, but that have less discriminating power, include: the presence of crops in the plots, crops designated for self-consumption, milk and cheese production and the payment of daily wages to laborers. Overall, the axis or the principal components 1 and 2 explain 30.7% of the data variation. Interestingly, all the analysis suggests grouping is strongly associated with land tenure figure: *ejidatario*, *posesionario*, *avecindado* or private landowner.

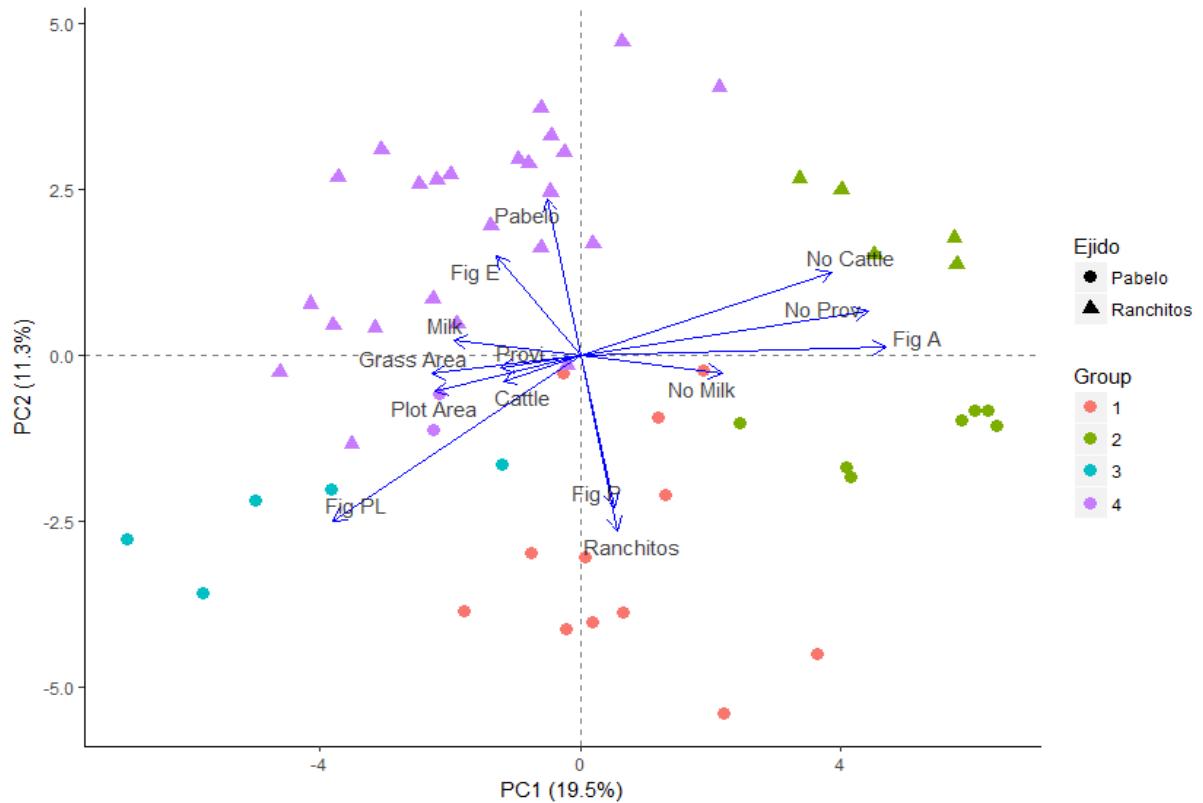


Figure 4. Ordination analysis, differentiating the groups from the cluster analysis. The main variables are also observed on the two axes, these are: Fig A: *avecindados*; Fig E: *ejidatarios*; Fig PL: private landowners; Fig P: *posesionarios*; No Cattle: without cattle; Cattle: with cattle; No Prov: no provision services from plots; Prov: Provision services from plots; Plot Area: total hectares of plot; Grass Area: total hectares of grasslands in the plot; No Milk: no milk or cheese production; Milk: milk and cheese production.

5. Discussion

This study shows that households can be differentiated into groups according to specific characteristics of their natural resource management strategies, despite the heterogeneity of

socio-ecological contexts within and between the communities analyzed. We were able to establish four distinct groups of strategies which are: 1) *posesionarios* with specialization in cattle raising, 2) day laborers or outside farm workers, 3) private landowners, and 4) diversified *ejidatarios*. We now discuss this groups in light of three main aspects that we consider influential in the shaping of management strategies: 1) land tenure, 2) the role of ecosystems, and 3) the diversification of strategies.

4.1. Heterogenous strategies through land tenure and access to resources

One striking result of our analysis is that the household groups identified through the cluster analysis match almost exactly with the household land tenure characteristics, suggesting that this constitutes one of the main drivers of the natural resources management strategy. This does not mean that having land is the only way for households to develop a strategy, but heterogeneous strategies come up as a result of differences in land access. In our research, Group 1 are mostly *posesionarios* without *ejidal* rights who are excluded from participating in the Assembly and from the use of resources and other benefits of the common areas. We suggest that in response to this situation, they have developed alternative mechanisms of interchange, such as reciprocal labor for complementing their strategies. These mechanisms have also been documented in other studies in the region (Gerritsen 2001). *Avecindados* (mostly Group 2) have little formal power to manage resources as a consequence of the institutional structure of the *ejido* and can experience social exclusion (Appendini 2008). Additionally, they are not engaged in collective strategies and receive unequal distribution of the benefits (e.g. from government support programs). It has been pointed out that the resilience and adaptability of the *ejido* institution can be hindered by the inflexibility and often non-participatory governance structure that it holds (Barnes 2009). However, while *ejidatarios* have the formal rights to make decisions about land resources, non-*ejidatarios* can form a pressure group and modify decision making dynamics, especially if they outnumber the *ejidatarios* (Braña and Martínez 2005, Moya 2012). This aspect is meaningful since in Mexico around one-third to one-half of the households in *ejidos* are not *ejidatarios* (Skutsch et al. 2015).

If we observe the four types of strategies within the ordination (Figure 2), we see a strong social differentiation gradient, where towards one extreme we have the strategy of the people without land (Group 2) and towards the other extreme are the large landowners (Group 3). In between, most of the households have some land but may be either specialized or diversified (Groups 1 and 4). This social differentiation is clearly related to the rights and the access of households to different resources determined by local institutions (Ellis 1998, DFID 2001). The two *ejidos* present some interesting differences: in Ranchitos almost all the households are *ejidatarios* and fall into Group 4; and social differentiation is much less than in Pabelo, where there are many families without rights or land, and there are also large landowners. In Ranchitos, younger sons of *ejidatarios* and almost half of the *ejidatarios* live outside the *ejido* and this may be due to the low returns from farming. A productive system with such levels of water restriction and low productivity has meant that the younger generations are looking for less land-based labor options outside the *ejido*, which results in less *posesionarios* and *avencidados* and lack of

private landowners. Also, pointed out by Schroeder and Castillo (2012) that this condition in Ranchitos could have favored a more cooperative institutional structure among *ejidatarios*. Although it is not the angle of this study, there is also a huge differentiation between rights granted to women or men in our study. This is not surprising since this is the case of most ejidos in Mexico where women are acknowledged to have very limited rights over land and resources (Barnes 2009, Ruiz Meza 2009).

4.2. The ecosystem as a conditioner of strategies

Another relevant result from the classification of strategies is the particular *ejido* to which each household belongs. We suggest this differentiation is at least partially due to differences in the biophysical and ecological conditions between the two *ejidos*, which may condition the productive activities that can be implemented. This has been indicated by some authors as the ‘system of strategies’ or the ‘farming style’, which refers to the relationship between the human groups in a specific region and their surroundings, creating a spatial identity (van der Ploeg 1990, de Haan 2000, Gerritsen 2004, Cochet 2015). Through the comparison of plots in both *ejidos*, it is shown that plots in Pabelo have available water throughout the year in permanent streams. Hence, we see that in Pabelo there is a greater tendency towards cattle raising and more pasture areas all year (Groups 1 and 3). Conversely, the *ejido* of Ranchitos is found in an ecosystem with a high climatic variability, where the cattle activity requires much more effort and investment (financial and human). In fact, livestock activity in many of the Ranchitos households, as Ugarthechea-Salmerón (2015) shows, is practiced with financial losses to those households that have few hectares and small herds. Added to this, the rate of secondary succession of forest in the Ranchitos is more accelerated than in other forest types (Mora et al. 2016), which means that this growth must be cleared from the pastures every year, implying a large amount of work. These differences have also important consequences in maintaining a specifically designed biodiversity in the managed sites (Schmitzberger et al. 2005, Casas et al. 2007, Moreno-Calles et al. 2011).

In relation to the uses and rights over forests and their resources, each strategy has certain features. For instance, the private landowners (Group 3) possess the largest quantity of forest per household (up to 77 hectares), and more independency in their management decisions. On the other hand, the *ejidatarios* (mostly Group 4) have rights over the communal forest areas, with collective strategies that can give rise to a large number of benefits and products (Knox and Meinzen-Dick 1999). These are important, since each *ejidatario* has the equivalent of 38 ha of forest in Pabelo and 26 ha in Ranchitos. *Posesionarios* (mostly Group 1) only possess what forest remnants are found inside their plots, but interestingly they recognize on average the largest number of useful plant species, apparently because the restricted access to the communal forests forces them to optimize the management of useful plant species within their own plots. *Avecindados* (mainly in Group 2) have the least access rights to forest resources, such as provisioning services. Here we see that benefits (economic or by specific resources) derived from forests are not equally distributed among the different strategies, as shown in other studies (Morton et al. 2016). It is interesting to see that the better-off groups are the ones that benefit most

from forest in our case, a point also demonstrated in a global study of 8000 households which showed that the income stemming from natural resources and forest is up to five times higher in the households with greater resources (Angelsen et al. 2014).

4.3. Strategy diversification as a socio-ecological system outcome

The diversification of management strategies in the two *ejidos* occurs in different ways. In Ranchitos, the diversification largely occurs within the household strategy (i.e. most households carry out more diversified strategies), while in Pabelo a more marked gradient of strategies and productive specialization exists. In addition, the diversification within each strategy as well as between strategies takes place on different scales that come from the productive activities and sources of incomes, as well as the landscape and uses of natural resources. Even at the individual level and the plots, productive activities and conservation practices for the vegetation and resources are spatially mixed, for example in the riparian forest in Pabelo. This is especially evident in the strategies of the most diversified *ejidatarios* in Group 4 where there is a balance between market-oriented activities and the activities of subsistence, together with the temporary migration of family members; the livestock for its part represents savings and a way of maintaining monetary liquidity (Ugartechea-Salmerón 2015). This diversification at different scales is directly related to the resilience that households have in the face of uncertainty and changes in the socio-ecological system (see Barrera-Bassols & Toledo, 2005; García-Frapolli et al., 2013; García-Frapolli et al., 2008; Gerritsen, 2010; Toledo et al., 2003), since they provide range of solutions and resources to deal with different situations (Chapin et al. 2009, Speranza et al. 2014).

Understood in an integrated manner, the different strategies are complementary or co-strategies, which help mobilize the factors of production or capitals (land, work and capital) within the socio-ecological (Gerritsen 2004). For example, most of the land is held by *ejidatarios* or private landowners (mainly Groups 3 and 4) and in turn they need additional labor from the *avecindados* to develop their strategy (mainly Group 2). Furthermore, the work outside the community and the migration of family members to the United States is an important feature for all strategies to raise capital. Although, this migration can have important consequences on natural resource strategies, for example committing less in agricultural activities like maize and increasing land for pasture (Schmook and Radel 2008, Radel et al. 2010). We can say that in any specific place the different strategies are interrelated with each other and to the ecosystems that sustain them (Chapin et al. 2009). In these sense, each *ejido* institution has different spatial, historic and social relations, it is a unique setting that shape the social-ecological system. This is important since most governmental programs are designed with the logic one-size-fits-all overlooking social and ecological differences (Ostrom 2009, Brondizio and Le Tourneau 2016). Enhance diversity of institutional settings is considered an important asset to improve social systems adapted to ecological contexts and biodiversity (Janssen, Anderies, & Ostrom, 2007; Monroy-Sais et al., 2016; Ostrom, Burger, Field, Norgaard, & Policansky, 1999).

4. Conclusion

According to our research, the natural resources management strategies we characterized are directly related to differences in the biophysical and ecological conditions, access to land and the social position of the head of household as regards rights within the *ejido* institution. Finally, with these results we hypothesized that land tenure differences inside communities can be one of the main drivers of different natural resource management strategies, with important consequences on biodiversity and conservation, as well as the socioeconomic performance of farmers. This is a first attempt to highlight how differences in land tenure inside *ejidos* may condition natural resources management strategies, although, in order to probe this hypothesis more studies with different *ejidos* are required. These two *ejidos* also enable us to see that ecosystems are strong determinants of strategies, although minimized in some approaches and studies. In this sense, public policies can play a very important, but not determining, role in pushing farmers towards a more diversified strategy or towards a more specialized one. If integrated management is sought, new policies and institutions have to be created with social and environmental coherence, where farmers of all types within the *ejidos* are considered participants and jointly decide on the management of their territory.

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Capítulo 5.

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Article

Exploring how land tenure affects farmers' landscape values: evidence from a choice experiment

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Abstract: Values play an important role in farmers' land management decisions, becoming increasingly relevant when designing environmental policy. One key element that influences farming decisions is the land tenure under which farmers and their land are embedded, which represents different sets of rights for farmers. Therefore, the aim of this study was to elicit farmers' values placed on the social and ecological attributes of the landscape and to determine how these values vary according to differences in land rights. We performed this exercise in the two most important land tenure systems in rural Mexico. We carried out a choice experiment to understand preferences for different landscape attributes such as vegetation cover, surface water, terrain slope and type of property. Then, we probed how these preferences change according to the land rights that farmers hold. We found that surface water was consistently the most important landscape attribute. However, there were clear differences that were related to land rights for some values, for example, vegetation cover. Institutional mechanisms like boundary rules and conflicting values are part of the explanation of these differences. These results provide a bridge to understand farmers' management decisions, and in the future, to improve sustainable development.

Keywords: *Ejidos*, agrarian communities, Jalisco coast, natural resources, management decisions, stated preferences.

1. Introduction

There is an increasing consensus that values should be considered when designing environmental policy and management strategies [1–4]. When it comes to farming, values play an important role in farmers' decisions related to landscape management [5–7]. However, across the landscape ensemble, it is difficult to understand the values of critical natural resources (e.g., forests, rivers, fauna, etc.), and people value nature in plural and sometimes conflicting ways [2,8,9]. This is important, because often, there is public interest in the outcomes of management strategies with respect to nature and their resources [10]. Some public demands on farming include biodiversity conservation, food safety, food quality, and the provision of environmental amenities; however,

these demands can be contradictory [11]. Understanding farmers' preferences for different elements of the natural world can help to prioritize conservation actions [12] and enhance agricultural development and sustainability [13].

Some studies have shown that landscape elements are valued by farmers according to the roles that they play in the farming strategy [13–16]. Landscapes are the result of interactions between the natural elements (climate, geomorphology, water, vegetation, fauna), the actors that modify that nature, and the institutional and social context in which these actors are embedded. An agrarian landscape is also a series of repetitive and representative elements that are laid out in a similar way showing an agrarian structure [17]. In many parts of Mexico, this agrarian structure is made up by the aggregation of *parcelas*, which has no accurate translation, but for practicality, we will call it plot. This plot is far more complex than the traditional productive plot; it is a small representation of the landscape as a whole, i.e., a mosaic of cultivation areas, forests, and grasslands, among other elements, that is managed by a household that has its land rights. This landscape mosaic represents a human mechanism that, theoretically, helps to maintain and even increase biodiversity [18,19].

Land tenure (who owns the land and who has the rights to use it) is considered a key issue in the maintenance of ecosystem services [20,21], but it is also important for the decisions that farmers can make. Land rights refer to bundles of rights, ranging from access, use, and exclusion, to alienation [22]. These rights represent permissions and restrictions regarding the use and management of the land. Recently, some studies have acknowledged that land tenure arrangements can have effects on the value that farmers place on the landscape, creating heterogeneous sets of values even in local areas [23,24]. Nevertheless, few studies have incorporated land rights to understand the value attributed to landscape elements or the heterogeneity of values existing between and within communities.

The aim of this study was, firstly, to elicit values through preferences in social and ecological attributes of the landscape that are considered crucial for sustainable management. We elicit the farmers' landscape values from two land tenure systems in the Southern coast region of the state of Jalisco, Mexico. In this region, as in many others around the world, the preservation of ecosystems and their services is in constant conflict with development processes [25–27]. We also aim to determine how these values vary depending on the land rights that farmers hold. We expected to find differences in the sets of values between farmers related to their level of access to manage the land and its resources. In the following lines, we present an important background to describe land tenure in rural Mexico and the approach used for the study. Secondly, we present our study cases and the choice experiment method used and its results, which are later discussed.

1.1. Land tenure in rural Mexico

The Mexican Constitution recognizes three forms of rural property: private, *ejido*, and agrarian communities. *Ejidos* and agrarian communities (ACs) are institutions with a mixed system of land tenure between communal and private [28,29]. About 54% of all land in Mexico and around 60% of all forests fall within these land tenure institutions [30,31]. Both were created as outcomes of the Mexican Revolution (1910–1917) involving process of land restitution of pre-Hispanic origin in the case of ACs, and land redistribution to landless peasants in the case of *ejidos*. ACs and ejidos have a common governance structure, in which decisions and rules are made by an assembly comprised of recognized members; in *ejidos*, these members are the *ejidatarios*, and in ACs, these are *comuneros*, although other agrarian subjects with other rights can be found in *ejidos* and ACs [32].

While differences between these two land tenure institutions are complex and often unclear in the legislation [33], we focus on the differences with respect to land rights and the legal capacity to create more land rights. For ACs, land rights are granted to *comuneros*, and the creation of more

land rights to all the descendants of *comuneros* is possible; it is also possible to found non-*comuneros*. For their part, *ejidos* have a fixed number of land rights granted to *ejidatarios*, and they can only pass on these rights to one descendant; the non-inheriting descendants of *ejidatarios* often become *posesionarios* (those who possess land). *Posesionarios* are people who have land for cultivation but do not have rights regarding the common lands and do not vote in the assembly. People without productive land and without rights are the *avecindados* (those who settle). These agrarian subjects make up different land tenure 'statuses' in ACs and *ejidos*.

For this study, we associated the agrarian subjects or 'land tenure status' within the *ejido* and the AC with their corresponding land rights (Table 1). Since *ejidatarios* and *comuneros* have much in common regarding their land rights, we designated them as having community land rights (CLR), which includes rights to use an individual plot and rights to benefit from communal land as well as the right to participate and vote in the assemblies [22]. In the case of people with land but without voting rights, we designated them as having partial land rights (PLR). In the *ejidos*, they are the *posesionarios*, and in ACs, they are non-*comuneros*. The final category is landless people who usually work for a wage on other people's land or share land for periods of time for subsistence agriculture. In *ejidos*, they are *avecindados*, and in ACs, they are also non-*comuneros*.

Table 1. Land tenure status and its associated land rights from agrarian communities (ACs) and *ejidos*

| | Land tenure status | Land rights and their limitations | Other rights | Designation of land rights |
|----------------------|---------------------|--|--|---|
| Agrarian Communities | <i>Comunero</i> | Owning a plot and can benefit economically or with other resources from common lands. | Have a vote and a voice in the assembly; motions are accepted by majority vote. Can hold management positions. All descendants can become <i>comuneros</i> . | Community land rights (CLRs) |
| | <i>Non-comunero</i> | May be given plots or be landless. Do not benefit from common lands but can usually obtain forest resources (firewood) with permits. | Do not have a vote or a voice, although they can be present at assembly meetings. Cannot hold management positions. | Partial land rights (PLRs) and Landless |
| <i>Ejidos</i> | <i>Ejidatario</i> | Owning a plot and can benefit economically or with other resources for common lands. | Do have a vote and a voice; motions are accepted by majority. Only one descendant can become an <i>ejidatario</i> . Can hold management positions. | Community land rights (CLR) |
| | <i>Posesionario</i> | Owning a plot but do not benefit from common lands. Can usually obtain forest resources (firewood) with permits for their use. | Do not have a vote or a voice, although they can be present. Cannot hold management positions. May be able to become <i>ejidatario</i> if a position becomes free. | Partial land rights (PLR) |
| | <i>Avecindado</i> | Landless and do not benefit from common lands but | Do not have a vote or a voice, although they can be present. | Landless |

usually can obtain forest resources (firewood) with permits for their use.

Cannot hold management positions. May be able to become *ejidatario* or *posesionario* if a position becomes free.

2. Methodology

2.1. Study site and cases

The Southern coastal region of Jalisco, Mexico has experienced a convergence of local indigenous populations with groups from other places in the country [34,35]. Moreover, in the last century, there have been drastic transformations to the ecosystems as a result of agricultural expansion and the exploitation of forests [27]. On the other hand, scientific research has emphasized the great ecological value and high biodiversity that many ecosystems in the region possess [26,36–38]. This has given rise to the creation of two important biosphere reserves: the Chamela-Cuixmala Biosphere Reserve (CCBR) and the Sierra de Manantlán Biosphere Reserve (SMBR). We worked in two communities in this region: the AC of Cuzalapa and the *ejido* of Pabelo (Figure 1). Due to their differences (history, location of the AC inside the SMBR and origin), the study of these communities allowed for a comparative case study analysis where the phenomena of interest (i.e., land tenure) is contrasting [39].

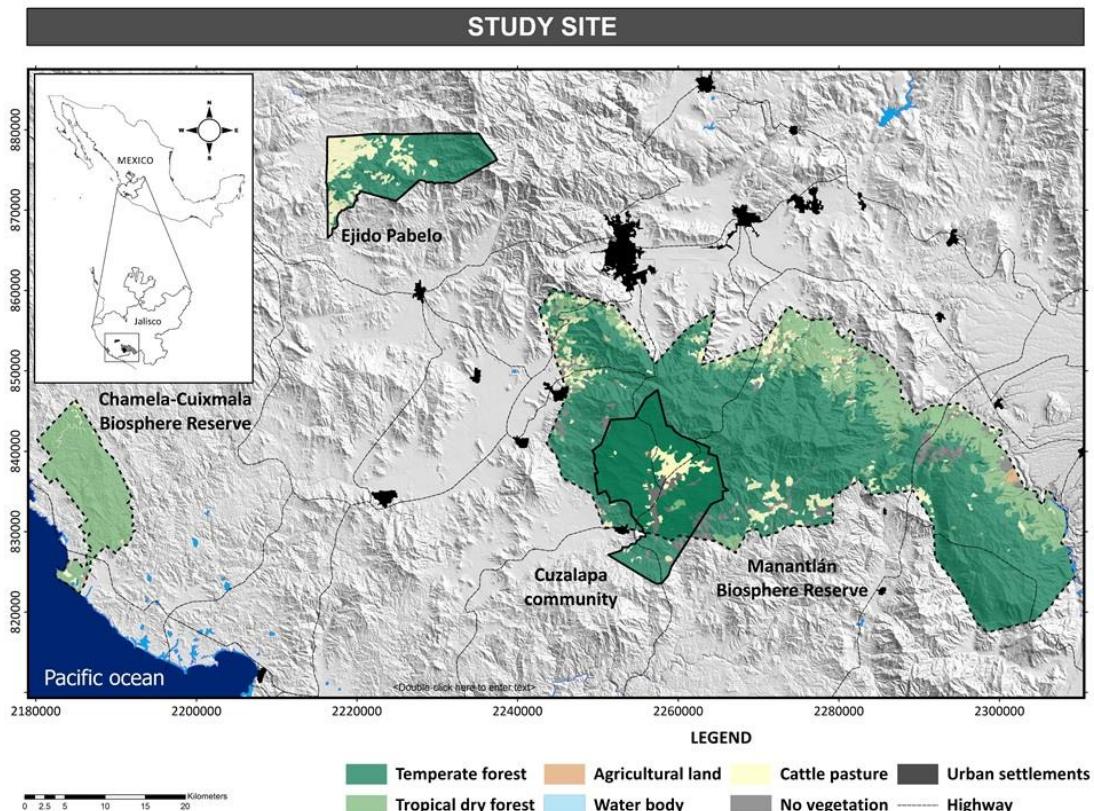


Figure 1. Map of the study site and cases, the *ejido* Pabelo and the agrarian community of Cuzalapa, with the main land uses/cover and the biosphere reserves.

These two communities have similar biophysical characteristics and highly biodiverse ecosystems. Cuzalapa has around 1560 inhabitants [40]; it is considered to be of Nahua origin and one of the oldest communities in the region, although there has been a process of cultural change and now, the current majority are not considered indigenous [34,41]. There are approximately 261 *comuneros*, and, on average, the family size is four to five members; this means that approximately one-third of the families do not have *comunero* status. In Cuzalapa, it is usual to find *comuneros* without land as well as sale or rental of land for long periods. Also, some farmers share lands for cultivation with landless people [42]. Many locals that have land for cultivation or plots are not *comuneros* (having partial land rights). The total area is approximately 24,000 ha, of which around 80% is forest. Most of this area is within the SMBR, 65% is in the buffer zone, and 10% is in the core area. This implies that there are continuously enforced restrictions on both the clearance and use of forests that fall within the reserve. The main productive activities are subsistence agriculture and cattle ranching. Recently, some of their communal forests have entered the payment for environmental services (PES) program.

The *ejido* of Pabelo is in the upper part of the Cuitzmala and the San Nicolas River basins (Figure 1). It has a population of approximately 1073 inhabitants [40] and approximately 272 households. There are 164 *ejidatarios*, 151 *posesionarios*, and around 20 to 40 *avecindados* in the *ejido*. Some households hold more than one *ejido* right, while some *ejidatarios* do not live in the *ejido*. The *ejido* has an area of 14,347 ha, of which around 60% is covered by forest. The main productive activity is cattle ranching, and there are high levels of migration, mostly to the United States. The common forest area is internally divided in an informal manner between some of the *ejidatarios* who use it as pastureland. The distribution of benefits and the administration of forestry activities are handled by the *ejidatarios* through the assembly. Part of their common forest is in the PES program too.

2.2. Stated preferences and choice experiments

We used a choice experiment (CE) to assess farmers' valuation of the landscape. The CE is a stated preferences method that seeks to capture the total economic value of a good being valued [43]. Stated preference valuation are popular methods for goods outside the market [21]. They have been designed to measure the intensity of individuals' preferences in quantitative ways, very often in terms of willingness to pay (WTP). CEs have been used to understand farming decisions [44] as well as many other environmental goods [45]. A CE takes a good (e.g., the landscape) and breaks it into pieces or attributes (e.g., vegetation, rivers, slopes) to understand the value of these pieces. People choose between goods with different characteristics made by the attributes differences (e.g., levels of vegetation: deforested or forested) to capture the marginal welfare values associated with these differences in the good expressed in coefficients or WTP [43]. Performing a CE also entails a ranking of the different attributes and attribute levels included in the design obtained by the absolute numbers or the size effect of each coefficient. This allows the priorities of people to be recognized to determine if these priorities are the same across different groups of people. CEs give the opportunity to understand some of the trade-offs and to gain insight into different attributes of environmental goods for decision-making [46–48].

2.3. The choice experiment design and its attributes

Five landscape attributes were included in the CE: 1) vegetation cover (three levels), 2) terrain slope (three levels), 3) water availability (three levels), 4), type of property regime (two levels), and 5) the price (six levels). Each level represented the variation of the attribute; these are presented in Table 2. The attributes and levels included and valued in the experimental design of CEs are often

those most likely to be affected by policy decisions [43]. In the current study, these attributes were selected based on previous local studies about farming and natural resource management strategies in both communities [34,42,49,50] as well as a pilot study with farmers in nearby locations of the same region ($n = 36$).

Table 2. The attributes and levels for the choice experiment design.

| Attributes | Vegetation Cover | Terrain Slope | Surface Water | Type of Property | Price |
|------------|---------------------|--------------------|------------------|------------------|--------------------------|
| Levels* | <i>All forested</i> | <i>Very sloped</i> | <i>Permanent</i> | <i>Mixed</i> | \$130,000 to \$1,400,000 |
| | Half-forested | Sloped | Seasonal | | |
| | All deforested | Plain | No water | | |

* The levels of each attribute in italics are the reference levels (dummy variables) against which the other attributes were estimated in the models and represent the Alternative-Specific Constants (ASCs).

These attributes were considered due to their relevance to biodiversity conservation and their integration with farmers' productive strategies [49]. In the case of the terrain slope, this attribute determines different opportunity costs for agriculture production, with plain terrains being frequently highly valued. We also included the social attribute of the type of property regime to see if people prefer private properties or a mixed property regime between communal and private, as *ejidos* and ACs are. Finally, we included the surface water attribute as it was recurrently mentioned by respondents in our pilot survey. Our payment vehicle for this CE was the price of the plots; the price range was also inquired about in the pilot survey.

For an optimal design, we used an orthogonal main-effects array to reduce the number of combinations of attributes. The candidate array had 36 different choice combinations of the attribute levels, which were also divided into six blocks with six decision events per block to minimize the task for each respondent. Every decision event was made up of a choice of purchase between two alternative plots of 10 ha with different characteristics and an opt-out option (buy neither). An example of one of the 36 choice cards is presented in Figure 2. For the design of the choice experiment and cards, we used the package 'support.CEs' in R [51].

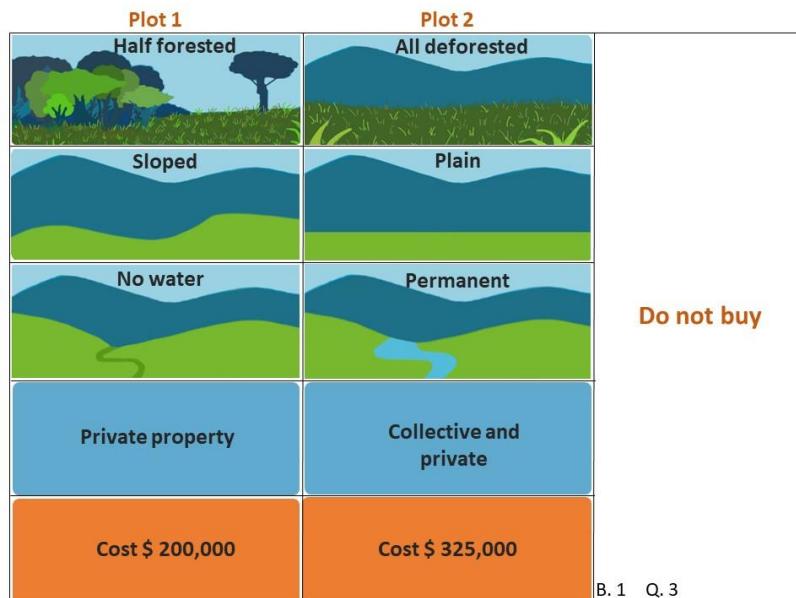


Figure 2. Example of one of the 36 choice cards with different plot characteristics presented to respondents.

2.4. Survey

A team of five previously trained people conducted the surveys over a period of 15 days. A total of 199 surveys were taken, 101 in Cuzalapa and 98 in Pabelo. The participants in the main localities of these two communities were randomly selected. To ensure accuracy in the information, we asked to survey the head of the family where possible. In the CE exercise, the respondent was introduced to a hypothetical situation where they were asked, if they had the money, would they be willing to pay for one of the alternative plots presented? Respondents were also asked about their current management practices and productive activities on their lands (if applicable) as well as other sociodemographic aspects and their land rights (Supplementary Material S1). The sample size was determined by multiplying the choice events by the number of respondents [51]; in our case the result of this operation was 1194.

2.5. Econometric model and estimation

CE allows people's interests and values as stated in choice situations to be elicited [52]. This technique is used to estimate attribute utilities based on an individual's response to combinations of multiple decision attributes [45,53]. The theory assumes that the total utility of a good (U) for a given person i choosing option j is derived from the observed utility (V) that the attributes of the good possess (Z), the specific characteristics of the person (S), and a random component or unobserved utility (ϵ):

$$U_{ij} = V(Z_j, S_i) + \epsilon(Z_j, S_i).$$

The good with the highest utility will also have the highest probability of being chosen [52]. Logistic regressions can be used to estimate the probability that one alternative is selected over another [54], where the error terms are assumed to have a Gumbel distribution or type 1 extreme value. Based on this model foundation, we fitted conditional logit (CL) models to assess the value of each attribute level following Aizaki [51]. CL models predict the probability of an individual i making a particular choice j from the choice set as a function of the set of attributes included in the CE. Model coefficients quantify the value given to each attribute level relative to an alternative specific constant (ASC), a combination of attribute levels that constitute the baseline for valuation. Furthermore, monetary figures or the WTP for the non-monetary attributes can be obtained by the next function, $-b_{nm}/b_m$, where b_{nm} is the estimated coefficient of the non-monetary attribute and b_m is the monetary attribute coefficient or payment vehicle, in our case, the average price of the plots people are willing to pay for, using the Krinsky and Robb method [51].

In order to calculate the relative differences between the five attributes included in our CE (vegetation cover (VEG), terrain slope (TER), water availability (WAT), type of property (PRO), and the price (PRI)), we fitted the following model:

$$\text{logit}(p_{ij}) = \text{ASC}_i + VEG_{ij} + TER_{ij} + WAT_{ij} + PRO_{ij} + PRI_{ij} + \epsilon_{ij}. \quad (\text{MODEL I})$$

To assess whether the values of attributes included in MODEL I were affected by differences in the land rights of the respondents, we fitted a second model for each community including the interaction of land rights (LR) with landscape attributes as follows:

$$\text{logit}(p_{ij}) = -_i^{ASC} + -_i^{VEG} * VEG_{ij} + -_i^{TER} * TERR_{ij} + -_i^{WAT} * WAT_{ij} + -_i^{PRO} * PRO_{ij} + -_i^{PRI} * PRI_{ij} + LR * (-_i^{VEG*LR} * VEG_{ij} + -_i^{TER*LR} * TERR_{ij} + -_i^{WAT*LR} * WAT_{ij} + -_i^{PRO*LR} * PRO_{ij} + -_i^{PRI*LR} * PRI_{ij}) + -_i \text{ (MODEL II)}$$

Models were fitted using the function 'clogit' in the 'support.CEs' library of R [51], and models were fitted independently for the two communities.

Given the complexity of MODEL II and because not all the interactions included may be relevant, we proceeded to reduce this model using an information theory approach [55]. We fitted all the possible subsets of models from MODEL II that included one to five different interactions between LR and the attributes included in the CE. The selected best models were those that minimized the Akaike Information Criteria (AIC). Alternative models with a difference in AIC (ΔAIC) of <2 to that of the best model were also considered [55]. Model reduction was done using the function 'dredge' in the 'MuMIn' library for R [56]. Finally, to assess whether the best model was significantly better than the simplest model with no interactions (MODEL I), we performed a likelihood ratio test that contrasted the two models for each location.

3. Results

3.1. Socioeconomic and demographic characteristics of the sample

The main characteristics of the sample are presented in Table 3. Both communities had similar samples according to the ages and genders of the interviewees, although the most frequent age interval in Cuzalapa AC was from 41 to 50 years, and in Pabelo *ejido* was from people older than 60 years. On average, the household unit was composed of four to five members in Cuzalapa and three to four in Pabelo. In both communities, around 61.8% of the household units had children and/or young members (less than 21 years old). Also, in both communities, the great majority of the respondents had some level of primary school education, with a lesser group having undergone secondary education.

Table 3. Demographic, socioeconomic, and plot characteristics of the sample.

| | AC (n = 101) | Ejido (n = 98) | All (n = 199) |
|--------------------------|-----------------|-------------------|------------------|
| <i>Age (years)</i> | | | |
| 20–30 | 15 | 18 | 33 |
| 31–40 | 15 | 17 | 32 |
| 41–50 | 29 | 18 | 47 |
| 51–60 | 22 | 18 | 40 |
| >60 | 20 | 27 | 47 |
| <i>Gender</i> | | | |
| Male | 59 | 47 | 106 |
| Female | 42 | 51 | 93 |
| <i>Family unit</i> | | | |
| Family members (μ) | 4.4 (2.0) | 3.6 (1.7) | 4.0 (1.9) |
| Children/young (%) | 62 | 61 | 62 |
| <i>Education</i> | | | |
| None | 7 | 6 | 13 |
| Primary | 59 | 67 | 126 |

| | Secondary Higher | 25 | 19 | 44 |
|------------------------------|---------------------|----|----|-----------|
| | | 10 | 6 | 16 |
| <i>Land rights</i> | | | | |
| Community land rights | | 37 | 32 | 69 |
| Partial land rights | | 38 | 21 | 59 |
| Landless | | 26 | 45 | 71 |
| <i>Productive activities</i> | | | | |
| Cattle raising (%) | | 47 | 54 | 50 |
| Agriculture (%) | | 68 | 37 | 53 |
| Day laborer (%) | | 17 | 27 | 22 |
| Housewife (%) | | 26 | 39 | 32 |
| Non-farm (%) | | 29 | 19 | 24 |
| <i>Land area *</i> | | | | |
| 0 ha ¹ | | 29 | 39 | 68 |
| 1-5 ha | | 19 | 9 | 28 |
| 6-25 ha | | 25 | 18 | 43 |
| 26-60 ha | | 13 | 11 | 24 |
| >60 ha | | 10 | 12 | 22 |
| <i>Plot characteristics</i> | | | | |
| Have pasture (%) | | 85 | 97 | 91 |
| Have crops (%) | | 89 | 53 | 71 |
| Have forest (%) | | 60 | 58 | 59 |
| Have river/stream (%) | | 94 | 86 | 91 |

*These intervals are based on what the local people consider to be very little land, little land, enough land, a lot of land. Fourteen respondents did not indicate their land amount¹. The number of landless people does not equal the number in the zero-hectares category, because some people share land for periods of time.

As would be expected, landless respondents formed a larger proportion of the sample in the *ejido* than in the AC, but surprisingly, the proportion with partial land rights was higher in the AC. Together, landless people and those with partial land rights greatly outnumbered those with full community land rights in both communities. In regard to productive activities, in Cuzalapa, agriculture is the most common activity, followed by cattle raising, while in Pabelo, cattle raising is the most important. The modal group with respect to individual land holdings was 6–25 ha, but the biggest population group by far had 0 ha in both communities. Finally, among people with land in Cuzalapa, 94% had rivers or streams flowing within their plots and 89% had some crops, 85% had some pasture, and 60% had some forest. In the Pabelo *ejido*, 86% had rivers or streams flowing within their plots, 97% had pasture, 52% had crops, and 58% had forest. From these results, it is evident that, in Cuzalapa, people are much more agriculturally-oriented, and in the Pabelo *ejido*, they are more oriented towards livestock production, although, as the figures show, the plots are multi-functional.

3.2. Preferences for landscape attributes

Table 4 shows the resulting models for Cuzalapa AC and Pabelo *ejido* respectively. These models show that surface water availability was the most valued attribute. In both the AC and the *ejido*, not having water had the greatest negative effect (disutility) on plot preference, while having

just seasonal water was also negatively valued, albeit not as strongly. The other attributes came after water availability and their ranking depended on the community.

Table 4. Conditional logit models from the AC and the *ejido*.

| | | Cuzalapa (Agrarian community) | | | Pabelo (Ejido) | | |
|-----------------------|----------------|-------------------------------|-----------------|------------|--------------------|-----------------|------------|
| Attributes | ASC | Rank | Coef (SE) | WTP | Rank | Coef (SE) | WTP |
| | | nr | 2.74 (0.23)*** | 4,152,690 | nr | 3.14 (0.27)*** | 2,564,650 |
| Vegetation Cover | All forested | | | | | | |
| | Half-forested | 5 | 0.17 (0.13) | | 7 | -0.02 (0.18) | |
| | All deforested | 6 | -0.12 (0.15) | | 3 | -0.44 (0.19)* | -366,480 |
| Terrain Slope | Very sloped | | | | | | |
| | Sloped | 4 | -0.28 (0.16) | | 6 | -0.04 (0.19) | |
| | Plain | 7 | 0.06 (0.15) | | 5 | 0.05 (0.18) | |
| Surface Water | Permanent | | | | | | |
| | Seasonal | 2 | -0.95 (0.13)*** | -1,450,290 | 2 | -1.28 (0.15)*** | -724,520 |
| | No water | 1 | -2.51 (0.19)*** | -3,814,540 | 1 | -3.70 (0.27)*** | -2,275,490 |
| Type of Property | Mixed | | | | | | |
| | Private | 3 | -0.45 (0.11)*** | -693,630 | 4 | -0.23 (0.13) | |
| Price (units = 1000) | | -0.0006 (0.0001)*** | | | -0.001 (0.0002)*** | | |
| Model information | | | | | | | |
| Adj. Rho ² | | 0.3 | | | 0.39 | | |
| AIC | | 923 | | | 784 | | |
| BIC | | 963 | | | 823 | | |
| Events | | 606 | | | 588 | | |
| Valid n | | 1818 | | | 1,764 | | |

The results of each level and attribute in the form of a ranking, including estimated coefficients with their standard errors and the willingness to pay (WTP). *, **, *** = significance levels at 95%, 99%, and 99.9%, respectively. The WTP presented has a confidence interval of 95%, or otherwise no confidence interval is presented. All WTPs are expressed in Mexican pesos (MXN) for a plot of 10 ha. ASC = Alternative-Specific Constant.

The type of property had a statistically significant effect on farmers' valuation in the AC, with private property being negatively valued, i.e., respondents preferred plots with a mixed property regime. In the *ejido*, private property was also considered a disutility, although it was not statistically significant. On the contrary, the vegetation cover significantly affected valuation in the *ejido* but not in the AC (Table 4). In the *ejido*, both half-deforested, and fully deforested plots had negative values (significant in the case of full deforested plots). The AC coefficients for half-deforested and fully deforested plots were not significant. The terrain slope showed no significant effect on valuation, although plain terrain was valued positively. The price had a negative and significant effect on valuation. Finally, the ASC had a very positive and significant value, since the baseline plot had some preferred state of the attributes, for example, permanent water.

3.3. The effects of different land rights on the preferences of landscape attributes

We found significant interactions between different land rights and the valuation of some landscape attributes. Relevant models from different interactions between land rights and attributes with delta values (ΔAIC) that were <2 are presented in Appendix A. The best reduced models with

the most significant interactions for both communities are presented in Table 6. In addition, these models were significantly different from the models without interactions at $p < 0.001$. The effect of land rights varied between communities. For the AC, land rights significantly affected the value of vegetation cover, terrain slope, and price; while for the *ejido*, it only affected the valuation of vegetation cover.

Table 6. Preferences of landscape attributes from the AC and the *ejido* related to different land rights.

| Attributes | Cuzalapa (Agrarian community) | | | | Pabelo (Ejido) | | |
|------------------|-------------------------------|------|---------------------------|------------------|----------------|--------------------|------------|
| | ASC | Rank | Coef (SE) | WTP ^a | Rank | Coef (SE) | WTP |
| Vegetation Cover | All forested | nr | 2.81 (0.24)*** | 3,554,900 | nr | 3.17 (0.28)*** | 2,561,240 |
| | Half-forested: | 10 | 0.18 (0.15) | | 3 | -1.07 (0.38)*** | -863,930 |
| | CLR | | | | 5 | 0.36 (0.29) | |
| | PLR | | | | 7 | -0.08 (0.36) | |
| | Landless | | | | 4 | -0.44 (0.19)* | -357,660 |
| | All deforested: | | | | | | |
| | CLR | 3 | 1.02 (0.31)*** | 1,295,250 | | | |
| | PLR | 6 | -0.37 (0.23) | | | | |
| | Landless | 7 | -0.32 (0.36) | | | | |
| | Very sloped | | | | | | |
| Terrain Slope | Sloped | 8 | -0.28 (0.16) | | 9 | -0.03 (0.19) | |
| | Plain: | | | | 8 | 0.03 (0.18) | |
| | CLR | 11 | 0.07 (0.31) | | | | |
| | PLR | 9 | 0.21 (0.23) | | | | |
| | Landless | 4 | -0.63 (0.35) ⁺ | | | | |
| Surface Water | Permanent | | | | | | |
| | Seasonal | 2 | -1.04 (0.14)*** | -1,315,970 | 2 | -1.29 (0.15)*** | -1,043,590 |
| | No water | 1 | -2.66 (0.20)*** | -3,366,790 | 1 | -3.76 (0.27)*** | -3'032,880 |
| | Mixed | | | | | | |
| Type of Property | Private | 5 | -0.52 (0.12)*** | -659,720 | 6 | -0.23 (0.13) | |
| | Price (units = 1000): | | | | | -0.001 (0.0002)*** | |
| | CLR | | -0.0007 (0.0003)* | | | | |
| | PLR | | -0.0004 (0.0002) | | | | |
| | Landless | | -0.0004 (0.0003) | | | | |
| | Model information | | | | | | |
| | Adj. Rho ² | | 0.32 | | | 0.39 | |
| | AIC | | 900 | | | 777 | |
| | BIC | | 966 | | | 825 | |
| | Events | | 606 | | | 588 | |
| | Valid n | | 1818 | | | 1764 | |

The results of each level and attribute in the form of a ranking, including estimated coefficients with their standard errors and the willingness to pay (WTP). ⁺, *, **, *** = significance levels at 90%, 95%, 99%, and 99.9% respectively. ^a For the WTP in the AC, we used the coefficient of price for the people with CLR. All WTP are expressed in Mexican pesos (MXN) for a plot of 10ha. ASC = Alternative-Specific Constant.

For both communities, the most important attribute was surface water, where the absence of permanent water on plots was considered a great disutility or had a negative valuation by farmers. Regarding the vegetation cover, completely deforested plots in the AC had contrasting valuations between people with common land rights (CLR) and both landless people and those with partial land rights (PLR). People with CLR had a positive and very significant valuation of fully deforested

plots, while landless and PLR people gave them a negative valuation, although this was not statistically significant. In the *ejido*, the valuation of fully deforested plots had a negative value for all land rights. Regarding the valuation of half-deforested plots, the *ejido* showed significant differences between land rights; people with CLR and landless people had negative valuations for half-deforested plots, but this was only significant for CLR people, while people with PLR had a positive valuation which was not significant either. In the AC, we did not find significant coefficients for half-deforested plots.

The attribute referring to the type of property (mixed inside the community versus the private property outside) showed a very significant negative valuation for private properties by residents of the AC with regard to properties inside the community. The respondents from the *ejido* also gave a negative valuation to private property plots, but this was not significant. For the attribute terrain slope in the AC, differences were found between land rights, where landless people had a negative valuation of plain plots, and no significant coefficients were found in the *ejido*. For the price in the AC, people with CLR had a more negative valuation than people with other land rights; this implies that these people cannot be included in the calculation of WTP, which was therefore based only on the coefficient of the CLR people.

Finally, the ASC had very significant and positive values, which did not vary between people with different land rights; the ASC was higher in the AC than in the *ejido*, which means that together, the reference levels of all of the attributes were viewed as a bigger utility in the AC than they were in the *ejido*. From the ranking, it is interesting to observe that priorities were not the same within each community (i.e., between different land rights), although the first and second ranks showed no differences between communities or within them. Finally, the fit measures from both communities improved from the models without interactions; yet, the *ejido* had better fit measures for the Adjusted Rho square.

4. Discussion

This research shows the associations between farmers' economic values to some social and ecological attributes of the landscape. We found that some of these values vary according to the land tenure status of the respondents as they represent differences in land rights, as we expected. Moreover, the results highlight the surface water availability as the most important landscape attribute for farmers considered on the CE, both across the two communities and across land rights. Interestingly, other attributes, such as vegetation cover and type of property, showed great heterogeneity between and/or within communities. Below, we examine these findings in more detail and propose some explanations while suggesting some directions for future research. Finally, we discuss the methodology implications and limitations of this study.

4.1. Different values derived from land rights

Our study demonstrates that the land tenure status of a respondent and their associated land rights influences their values concerning the landscape. Some of the differences arise at the community level, i.e., between the AC and the *ejido* land tenure system; however, other differences can be found within the communities, between those with full communal land rights and those who have partial land rights or are landless. One of the most evident differences found in our valuation exercise was related to vegetation cover. In general terms, deforestation in the *ejido* is a disutility, while in the AC, it represents a utility and received a positive valuation. We suggest that these differences may be partially due to land rights restrictions (use and withdrawal) in the AC imposed by the biosphere reserve, which have led to a situation where already deforested plots become highly valuable and are intensely used by farmers [57]. In such cases, people within

protected areas have less room to maneuver when deciding how to manage their natural resources, creating conflict around the use of natural resources [58]. This dilemma is also interpreted as being the result of conflicting values [2], i.e., those driving conservation vs. those driving land management strategies.

In addition, differences in values observed for vegetation cover (all deforested for the AC and half-deforested for the *ejido*) become more acute when comparing within communities. In this case, people with full communal land rights (i.e., *ejidatarios* and *comuneros*) have different values from those with less rights. We relate this result to the privileges of authority that *ejidatarios* and *comuneros* can have, which includes information access and decision power, since they make important community decisions regarding land use [59,60]. Also, the direct benefits of governmental programs, such as payments for environmental services, are granted mostly to people with communal land rights. By not participating in the assembly, people in the other land tenure status (i.e., *posesionarios*, *avecindados*, non-*comuneros*) seem to hold different values concerning the landscape and its attributes. These intra-community differences are sometimes overlooked when, in fact, the internal social situation (land allocation, quality of the land) is far from egalitarian as a result of boundary rules [61]. The ability to make management decisions is restricted to a relatively small group and this institutional mechanism can accentuate inequalities [29,62].

The type of property to which the land is attached is also associated with different values between communities. For example, the AC showed negative values for plots with a private property regime outside the community. This could imply stronger traditional bonds and associated benefits within the AC, probably due to the historic basis and origins in which traditional management is based, meaning social land tenure. For example, it is notable that in the AC, there is common use of reciprocal labor and land sharing for those who are landless [63]. Some more recently created *ejidos* with a different organizational set-up might not carry such a strong sense of community and may not reject private property so strongly [28]. Interestingly, we did not find any differences between the land tenure status of respondents regarding the property regime, which means that even when farmers have fewer rights over the land, there is a tendency to prefer the mixed regimes (i.e., a combination of collective and private rights). For most communities, the joint social capital is important, even though private properties could provide more freedom to farmers' management decisions and actions.

4.2. Value of landscape attributes and management implications

One more result to highlight from this CE is that water availability is the main priority among valued landscape attributes, which holds across the different communities and land tenure statuses of respondents. For the farmers in our study, most of the value of the landscape was based on this attribute, and lack of a permanent water source resulted in the greatest disutility for them. We believe that this result relates to the farmers' productive management strategies, which are strongly linked to agriculture and livestock production. These management strategies have high water demands and large economic losses may occur when this attribute is scarce [64]. As shown in other studies [65,66], surface water is recognized as one of the most important assets in a community's valuation of the landscape. However, farmers do not perceive this attribute in isolation. To maintain water flows, many farmers leave riparian forest and forest patches in their plots and even use operational rules to preserve them [67]. However, this may not be the case for all farmers due to a lack of awareness on how their agricultural practices contribute to land and water degradation [68].

In the case of the vegetation cover, this attribute is perceived as a transformable characteristic of the plots depending on the needs of each farmer. This means that values could easily change depending on the circumstances, as we see in differences between communities and land tenure status. In the *ejido*, in terms of land rights, there is greater freedom to transform the land cover to the specific needs of the farmer, making it easier to deforest their plots. This is consistent with the idea that the institutional context has a great influence on values [2]. However, the results of the valuation of vegetation cover did not match what was observed in the field, that is to say, the *ejido* has less forest than the AC but holds greater negative values for deforestation, while the opposite is true in the AC. Thus, we suggest that to improve integrated ecosystem management, it is important to reinforce the information and programs that bind the different landscape attributes and their functions, for example, the dependence of water quality and quantity on vegetation cover and the threshold of this resource at the watershed scale [26,68]. These results are important to lead efforts on conservation and to integrate people from the communities with those efforts [69], also becoming an opportunity for collective action between different actors [28].

In the case of terrain slope, we could not find very significant relationships with farmers' values. One hypothesis is that people are used to managing sloped terrains and develop their productive strategies in these landscapes because it is a given attribute that cannot easily be changed, even though, in practice, plain terrains have larger opportunities and returns from agriculture [57], and the most sloping and distant terrains are the most preserved and have the least opportunity costs [67].

Finally, it is important to note that priorities are not always the same between communities and within them; other analyses concerning farmers' landscape decisions have shown them to be very heterogeneous, even within localized areas [13]. Our study also showed commonalities regarding to farmers' priorities, as it is the case with water availability. Thus, we believe that identifying farmers' and local people's priorities is essential in terms of good policy design and conservation, since these priorities and values have direct effects on natural resource management and biodiversity.

4.3. Methodological implications and limitations

Given that valuation processes are tools that make visible specific values, any valuation process should include a reflexive exercise [1]. This exercise can also allow the possibilities and limitations of the study to be understood.

In this case, the study covered only a fraction of the values that farmers can have in relation to the landscape and their practices. In addition, there can be social, expressive, and intrinsic values from farming [70]. In our case, the values that were mostly considered were economic or instrumental values; however, farmers usually recognize more than the profits they can get when choosing between the different alternatives, showing their fulfilling identities or 'sense of place' [63,69,71]. These 'deontological values' can hardly be captured by economic valuation exercises [72] although they constitute the basis of societal value systems. We recognize that our approximation to the landscape and its attributes was coarse. It is important that we do not forget that other attributes can play a role in decisions regarding resource management for farmers. However, our simplification of the landscape and its attributes included what we believe are the most fundamental issues for farmers and decision-making in the region. In addition, by dividing the landscape into its different attributes or pieces, the synergies from its elements were less evident. In this exercise, it is necessary to return to the unity of the social-ecological system. Values are constantly constructed and have feedback from our everyday experiences, defining relations

between people and nature [71]. In this sense, understanding the process of value formation and not only the values itself is important.

Contrary to many of the valuation inquiries with CEs or other valuation tools, this research did not set out a quantitative measure of WTP to be possibly applied to taxation or a contribution policy. Rather, it tried to show the importance of a landscape's attributes and the management implications of the presence or absence or of these attributes. Although our CE method used monetary figures as a payment vehicle, other results can be highlighted, for example, the ranking of attributes and the differences between priorities and land tenure status. In many valuation exercises, values are reduced only to measures resulting in the monetization of nature [9,10,73,74] under the argument that monetary measures are what we need to inform decision-making [75,76]. This approach has been referred to as *value monism*, while the alternative is referred to as *value pluralism* [2]. Both the methods and the solutions need to incorporate different schemas beyond chrematistic approaches, yet value pluralism remains elusive in practice [8]. This task represents a challenge for developing new ways of thinking, reflecting, and communicating the value of nature using common and novel approaches to valuation.

5. Conclusions

This study provides a glimpse into some differences between farmers' valuations of landscape attributes as a result of differences in their land rights. In accordance with our expectations, differences in right bundles within and between communities that allow or restrict actions were shown to influence landscape values, although, it was possible to find some shared landscape values, like water availability, for farmers across the two communities and across land rights. These differences and commonalities are critical to understanding value dynamism and its possible implications for natural resource management. They also allow the integration of land rights and land tenure, a key element of the Mexican governance system, and the rural context through an institutional setting.

Furthermore, differences within communities require a deeper understanding of their causes and consequences in order to build strong links between sustainable livelihoods and natural resource management. In this regard, it is important for top-down approaches and policies to recognize the existence of different social groups within the rural context. In addition to the acknowledgement of the resources or attributes of the landscape that are evidently critical to farmers and shared among social groups, such as surface water, it is important to also recognize the particularities associated with other attributes of the landscape, like vegetation cover. Our results could have substantial implications for the design of local or regional conservation policies and represent a first step towards eliciting plural and shared values from farmers in a highly biodiverse region.

Supplementary Materials: The following are available online at www.mdpi.com/xxx/s1, Survey format S1: Choice experiment questionnaire.

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Appendix A. Interaction models with Delta values <2 from both communities.

| Attribute levels | AC | | | | Ejido |
|--------------------------|-------------------|--------------------|--------------------|--------------------|--------------------|
| | Model 1 | Model 2 | Model 3 | Model 4 | Model 1 |
| ASC | 2.81 (0.24)*** | 2.82 (0.24)*** | 2.85 (0.24)*** | 2.83 (0.24)*** | 3.17 (0.28)*** |
| Half-forested | 0.18 (0.15) | 0.17 (0.26) | 0.16 (0.15) | 0.17 (0.15) | |
| Half-forested: CLR | | | | | -1.07 (0.38)*** |
| Half-forested: PLR | | | | | 0.36 (0.29) |
| Half-forested: Landless | | | | | -0.08 (0.36) |
| All deforested | | | | | -0.44 (0.19)* |
| All deforested: CLR | 1.02 (0.31)*** | 1.04 (0.31)*** | 1.04 (0.31)*** | 0.99 (0.31)** | |
| All deforested: PLR | -0.37 (0.23) | -0.37 (0.23) | -0.37 (0.23) | -0.36 (0.23) | |
| All deforested: Landless | -0.32 (0.36) | -0.55 (0.34) | -0.55 (0.34) | -0.35 (0.36) | |
| Sloped | -0.28 (0.16) | -0.29 (0.16) | | | -0.03 (0.19) |
| Sloped: CLR | | | 0.40 (0.29) | 0.49 (0.31) | |
| Sloped: PLR | | | -0.60 (0.23)* | -0.58 (0.24)* | |
| Sloped: Landless | | | 0.60 (0.34)+ | 0.43 (0.37) | |
| Plain | | 0.08 (0.16) | 0.07 (0.16) | | 0.03 (0.18) |
| Plain: CLR | 0.07 (0.31) | | | 0.27 (0.33) | |
| Plain: PLR | 0.21 (0.23) | | | 0.09 (0.24) | |
| Plain: Landless | -0.63 (0.35)+ | | | -0.46 (0.38) | |
| Seasonal water | -1.04 (0.14)*** | -1.01 (0.14)*** | -1.02 (0.14)*** | -1.03 (0.14)*** | -1.29 (0.15)*** |
| No water | -2.66 (0.20)*** | -2.64 (0.19)*** | -2.69 (0.20)*** | -2.69 (0.20)*** | -3.76 (0.27)*** |
| Private property | -0.52 (0.12)*** | -0.51 (0.11)*** | -0.52 (0.12)*** | -0.52 (0.12)*** | -0.23 (0.13) |
| Price | | | | | -0.001 (0.0002)*** |
| Price: CLR | -0.0007 (0.0003)* | -0.0007 (0.0003)** | -0.0008 (0.0003)** | -0.0008 (0.0003)** | |
| Price: PLR | -0.0004 (0.0002) | -0.0004 (0.0002) | -0.0004 (0.0002)+ | -0.0004 (0.0002)+ | |
| Price: Landless | -0.0004 (0.0003) | -0.0002 (0.0003) | -0.0001 (0.0003) | 0.0003 (0.0003) | |
| Model information | | | | | |
| logLik | -435.37 | -437.57 | -435.77 | -434 | -377.2 |
| AICc | 901.01 | 901.34 | 901.82 | 902.34 | 778.6 |
| ΔAIC | 0 | 0.32 | 0.8 | 1.32 | 0 |

The results of each level and attribute in the form of estimated coefficients with their standard errors. +, *, **, *** = significance levels at 90%, 95%, 99%, and 99.9% respectively.

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Capítulo 6.

Monroy-Sais, S., García-Frapolli, E., Mora, F., Skutsch, M., Gerritsen, P. R. W. and Casas, A., (n.d.). Watering a relation: value and management of plant resources in two communities on the Coast of Jalisco, western Mexico. *Human Ecology*, (under review).

Watering a relation: value and management of plant resources in two communities on the Coast of Jalisco, western Mexico

Abstract

In Mexico, biocultural diversity has promoted the management of around 1000 plant species and the domestication of more than 200. Plant management is related usually to their importance for local people; nevertheless, studies that address plants values in broad terms are scarce. This research explores the relation between different types of values attributed to plants and their management in different socio-ecological contexts. We performed two workshops focused on the most valuable plant resources for people, within two contrasting communities in Jalisco, Mexico. The plant management of 180 plant resources were characterized through a cluster analysis; afterward, the relation between management and values was examined through a partial redundancy analysis. We found that plant management represent three main strategies within a gradient of complexity. The relation between the resource's values on the type of management was significant, finding a wide spectrum of values, within material, non-material and regulatory dimensions, differing among communities and groups of people.

Key words: biodiversity conservation, ejidos, indigenous community, plant management, values.

1. Introduction

Societies, both traditional and modern, base an important part of their sustenance on plants, which contribute in multiple ways to satisfy human needs (Godoy and Bawa 1993, Altieri 2002). In Mexico, biocultural diversity has made possible management of more than 1000 plant species and domestication of nearly 200 species, several of them being important crops throughout the world (Casas et al., 2007; Sarukhán et al., 2009). Understanding factors and processes influencing human decisions about how and why to manage plant resources provides theoretical elements for analysing historical processes that originated management and domestication, as well as the continuous innovation that is crucial for designing sustainable management strategies of plant resources (Blancas et al., 2010; Blancas et al., 2013; Gaoue et al., 2017; Rangel-Landa et al., 2016).

Natural resource management involves different processes such as use, conservation, protection and restoration of species and ecosystems (Casas and Parra 2017). A wide spectrum of interactions with plants species can be identified within a gradient of forms and intensities of management. Several authors (Blancas et al., 2010, 2013; Bye, 1993; Caballero, 1994; Casas et al., 1996) agree that these interactions include the following main categories: 1) regulated harvest or gathering of plants found in the wild, 2) tolerance of such plants amid cultivation or grazing areas, 3) their promotion or enhancement, 4) their protection, 5) *ex situ* transplanting, and 6) sowing or planting. The absence or the insufficiency of management practices with regard to threatened species, or to those with restricted distribution, may determine loss in population numbers or even whole species (Blancas et al. 2013). If these species are subject to a commercial demand, the pressures

can increase; above all if the resource's use occurs in wild populations (Rangel-Landa et al. 2016).

Plant resources have a broad spectrum of values also. Most values are related to the contributions that resources may have in material, non-material and regulatory dimensions (Díaz et al. 2018). It has been observed, for example, that plant resources with cultural values do not necessarily have economic values and practical uses (Reyes-García et al., 2006). Different types of values can be conferred to plants; for instance, regulation of processes, utilitarian and economic values, aesthetic values, intrinsic values, among others (Godoy & Bawa, 1993; Moreno-Calles et al., 2014; Reyes-García et al., 2006; Turner, 1988). Values are culturally defined, and result from social processes (Kenter et al. 2015, 2016, Irvine et al. 2016), and for this reason opposite or contrasting values associated with different worldviews or ontologies can be found (Kenter et al. 2015, Pascual et al. 2017). Such ontologies can reflect different types of human understanding and different ways of relating to nature. Even within a given community local people do not use and value plants equally (Camou-Guerrero et al., 2008). Nowadays, understanding values and the processes of value construction is considered a crucial aspect for biodiversity and ecosystems conservation (Kenter et al. 2016).

Values could affect intentions as regards management of specific elements of nature (Raymond and Kenter 2016), and inconsistencies between values and management of nature can evince trade-offs by managers. Therefore, exploring the relation between plant management and plant values could be helpful to understand the motives and the aims of local people and difficulties in reaching those motives. Nevertheless, studies directed towards understanding species' values in a broad sense, and not only in the utilitarian dimension, are scarce. In this sense, the purpose of this study was to document the spectrum of values that people recognize in important plant resources and the effect these values have with the different forms of management. In order to analyze also how such values emerge we investigated these aspects in two specific rural socio-ecological contexts: an indigenous community and one non-indigenous community called *ejido* in the south coast region of Jalisco in Mexico. We hypothesized that certain management strategies of plant resources would be related to their values, molded by the socio-ecological contexts. Finally, we believe that results of this study could help the search for conservation strategies and the sustainable use of biodiversity.

2. Methods and case studies

2.1. Study area and case studies

The south coast region in the state of Jalisco, Mexico is recognized for their high biodiversity where two biosphere reserves are found: the Chamela-Cuixmala Biosphere Reserve (CCBR) and the Sierra de Manantlán Biosphere Reserve (SMBR) (Figure 1). People of the region live mainly from agricultural, livestock-raising and forestry activities. Land property can be private, but mainly is distributed to agrarian nuclei: *ejidos* and Indigenous Communities. Indigenous Communities have a pre-Hispanic origin and represent land restituted to indigenous groups. *Ejidos* emerged after the Mexican Revolution and represent land redistribution processes. Both ejidos and Indigenous

Communities have a mix system of property rights, they have some collective and private rights over the land and resources (Schroeder and Castillo 2012); usually forest have collective rights and agricultural areas are private. Commonly land rights are held by the head of the household, that are mostly men. Inside both communities it is common to found people with marked differences in land ownership and rights, in a gradient from full community land rights to landless people (Monroy-Sais et al. 2018). We studied the cases of the *ejido* of Pabelo and the indigenous community of Cuzalapa (Figure 1). These communities have many ecological similarities but contrasting social characteristics considered in the selection of the sites such as environmental history, production activities and the land ownership.

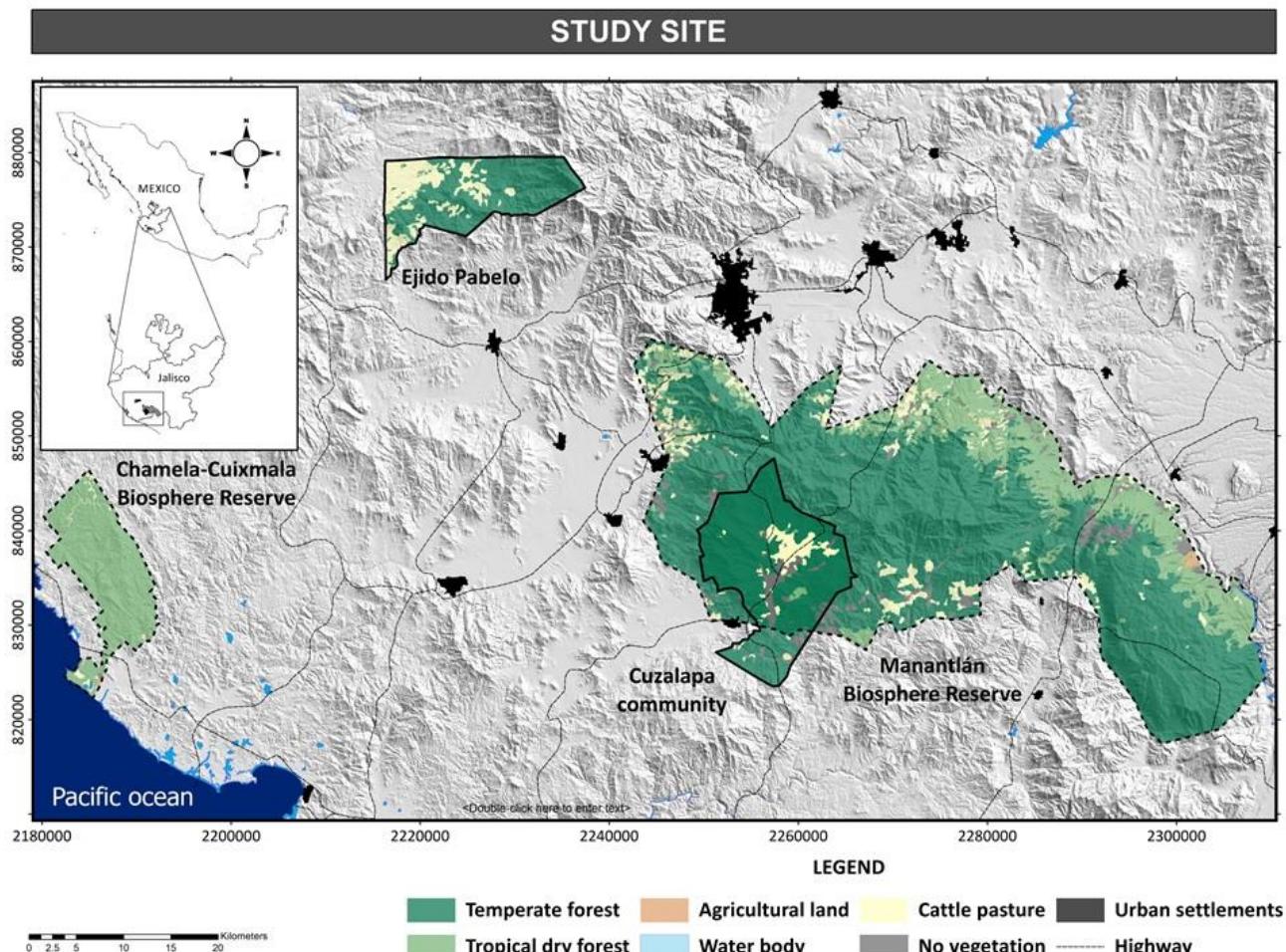


Figure 1. Location of the study area and the location of the study sites: the indigenous community of Cuzalapa and the ejido of Pabelo ejido. The main types of vegetation and soil uses, as well as the Chamela-Cuixmala and the Sierra de Manantlán reserves, are also shown.

The Indigenous Community Cuzalapa is considered one of the oldest localities of the south coast region of Jalisco (Estrada-Gutiérrez and Gerritsen 2011), with a total of 24,057 ha. More than half of its territory is located inside the buffer zone of the SMBR, which means that there are restrictions regarding land use. Cuzalapa's total population is approximately 1,560 inhabitants. In spite of being an indigenous community of Nahua origin, in the last

century there has been an acculturation process (Gerritsen 2004, 2010). Currently, the population mainly works farming maize (seasonally and with irrigation) and raising cattle. The *ejido* of Pabelo was founded in 1938 and has an area of 14,347 ha. Livestock raising has become the dominant activity; nevertheless, diversified management of the landscape and the resources is maintained (Monroy-Sais et al., 2016). In both communities there are the following types of forests: pine forest, oak forest, pine-oak forest, cloud forest, gallery forest and subtropical deciduous forest, as well as induced grasslands, crops and secondary vegetation (Monroy-Sais et al. 2016). Also, both communities have some forests set aside for conservation through a payment for ecosystem services program.

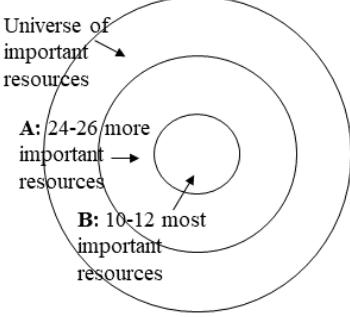
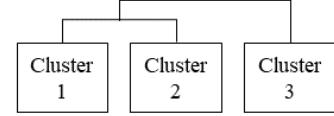
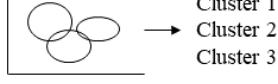
2.2. Data collection

We carried out two workshops, one in each community, to gather data about plant species' values and its associated management. We grouped participants according to differences in land ownership and gender, in order to explore differences of values among groups. In total 42 participants attended the workshops; the composition of the work sessions is shown in Table 1. The workshop was divided into two sections: the first addressed the management of plant resources that were considered most important by each group of participants, and the second centered on the valuation of the resources, as described below. The types of information gathered are summarized in Figure 2.

Table 1. Groups that took part in the workshops in each of the communities and the characteristics of the participants.

| Group | Site | Gender | Participants | Group characteristics |
|--------------|-------------|---------------|---------------------|--|
| Group 1 | Pabelo | Men | 7 | With productive lands and communal forests |
| Group 2 | Pabelo | Women | 4 | Without own productive lands |
| Group 3 | Pabelo | Men | 9 | With productive lands |
| Group 4 | Pabelo | Women | 5 | With productive lands and communal forests |
| Group 5 | Cuzalapa | Women | 7 | Members of agroecological cooperative |
| Group 6 | Cuzalapa | Women | 7 | Without own productive lands |
| Group 7 | Cuzalapa | Men | 3 | With productive lands and communal forests |

Figure 2. Framework of the methodological design

| Data collection and sources | Information obtained and variables | Data analysis |
|---|---|---|
| <p><u>Workshops</u></p> <p>1. Pueblo ejido (4 groups). 2. Cuzalapa community (3 groups).</p> <p>Each group:</p>  <p>A data: 180 plant records B data: 79 plant records</p> | <p><u>Management variables (27)</u></p> <p>For A and B: Seasonal availability (b). Place: agricultural plots (b), orchards (b), forests (b). Abundance (o): very sparse to very abundant (1 to 4). Management forms: sowing seeds (b), transplantation (b), protection (b), enhancement (b), tolerance (b), regulated harvest (b), simple harvest (b). Number of management forms (d). Useful parts: trunk/branches (b), leaves (b), fruits (b), roots (b), flowers (b), bark (b), other (b). Number of useful parts (d). Management intensity: maintenance activities (b) selective management (b), collective regulations (b), tools (b). Sum of management intensity (d).</p> <p><u>Valuation variables (18)</u></p> <p>For A and B: Ranking (d). Commercial value (b), local commercialization (b), regional commercialization (b), outside commercialization (b).</p> <p>For B: Regulation contributions: habitat creation (d), climate (d), detrimental organisms (d), freshwater quantity (d), air quality (d), soil formation and protection (d). Material contributions: energy (d), food and feed (d), materials (d), medicinal (d), merchandising (d). Non-material contributions: physical and psychological experiences (d). Number of contributions (d).</p> | <p><u>Cluster analysis:</u> With management variables for A data</p>  <p><u>Linear discriminant analysis (LDA) and reclassification :</u> 3 Clusters against ecological characteristics for A data: wild (b), naturalized (b), exotic/cultivated (b), tree (b), shrub (b), herb/creeper (b).</p>  <p><u>Partial redundancy analysis (RDA):</u> Valuation variables explaining management while controlling groups for B data:</p> <p>management = f(value group)</p> |

Notes: (b) binary variable, (o) ordinal variable, (d) discrete variable.

Plant resources management. Firstly, each group was asked to mention all the plant resources considered important, and between 24 and 26 of the most important were selected by each group for further analysis (in total 180 plant resources were nominated) ('A'). For the plant resources selected, management was characterized by the participants using the variables of type and intensity proposed by Blancas et al. (2013), in addition we recorded plant abundance as perceived by people, the parts used and the places where they are found, in total 27 variables of management were explored (Figure 2).

Plant resources valuation. The valuation of resources occurred in two stages also. The first was the assignment of a ranking of importance of the 24 to 26 resources previously listed by each group of participants, the commercial value and marketing location. The second stage consisted of taking the 10 most highly ranked resources (the 'most important') of each group and qualitatively examining the values assigned to each of these resources ('B'). We performed this by asking "why are these resources important?". These values were later classified and quantified in accordance with their different contributions to the people: material, non-material and regulatory following Díaz et al. (2018).

Finally, information about each plant's taxonomic identity was sought from previous studies and plant collections (Vázquez et al. 1995, Ruiz Villarreal 2016, Monroy-Sais et al. 2016), and its name was validated in the on-line databases of 'The Plant List' (www.theplantlist.org).

2.3. Data analysis

In order to identify general plant resources management strategies, a cluster analysis was performed. The information referring to the 27 management variables relating to the 180 records of plant resources was coded and a management matrix constructed, after which a Gower's dissimilarity matrix was calculated. Clustering was performed on this matrix using the average method (Borcard et al., 2011). The final number of clusters was selected through visual examination of the dendrogram to identify consistent clusters (Borcard et al. 2011). The preliminary results of this classification suggested that clustering could be driven, partially, by some ecological characteristics of the resources (their life form and origin). To test such a match, we performed a linear discriminant analysis (LDA); and results were also used to consider reclassifying particular plant resources in the final clusters where there were inconsistencies (negative values of silhouette widths and the prediction of the assignment of cluster). Finally, ANOVAS and contingency tables were performed to identify the variables that differ statistically between clusters.

To assess the influence of valuation on plant resource management, we performed a partial redundancy analysis (RDA). First, a valuation matrix was constructed with 18 variables corresponding to ranking, commercial value and the number and type of different contributions referred to the 79 plant resource records considered the most important when the valuations of all groups are included (Figure 2). Then RDA was done using the management matrix as response and valuation matrix as predictor, while controlling for the effect of a third matrix including the groups of participants (Table 1). RDA calculates canonical axes, resulting from linear combinations of the explanatory variables that best describe the variation of the response matrix (Borcard et al. 2011). These axes were represented in a bidimensional graph called 'triplet'. A variance partitioning procedure was implemented in order to assess how much of the total variance in the response matrix (management) was explained by the predictor and controlling matrices (value and group, respectively). Permutational analysis of variance (ANOVA) was used to assess the significance of both predictor types and value variables. All the analyses were performed using the software R.

3. Results

Within the 180 records mentioned in the two communities, a total of 89 different resources are represented. Some of these correspond to more than one species or variety, for example, the forage grasses (four species); therefore, in total we estimate that these 89 resources represent around 106 species belonging to 44 families (Supplementary Material 1). In addition, some of these resources are groups of species of the same genus, as in the case of the oaks (*Quercus* spp.), or the fig trees (*Ficus* spp.), which would significantly increase the number of species. Of the 89 resources mentioned, 25 are shared between the two communities, 33 are exclusive to Cuzalapa, and 31 are exclusive to Pabelo.

In general, most of the plant resources that were listed are wild tree species, and had a marked seasonality as regards availability, and most were perceived as 'sparse'. These plants are distributed more or less evenly between cultivation plots, house orchards and forests. A high proportion are treated with advanced forms of management, such as direct planting with seeds, transplanting and enhancement. However, the most common form of management is protection. The most commonly used parts of the plant are the fruits,

followed by the leaves and the trunks or stems. In terms of management intensity, the majority of the resources have a selective management (some varieties are preferred). For almost half, tools are used for their extraction and maintenance, and around one quarter are subject to collective regulations. Nearly half of the resources have a recognized commercial value, with the majority of them being sold locally within the communities themselves.

3.1. Classification of plant management strategies

Through the classification analysis, three clusters were identified in terms of management. Subsequently, within the LDA this grouping was tested with respect to how it reflected the resources' ecological characteristics (life form, wild state, naturalized or exotic). With the results twenty-two plant records were reclassified after inconsistencies between the LDA and cluster analysis, corresponding to 12% of the total records. In this way, the final result is that cluster 1 corresponds to cultivated plants that are not found in the wild and that are mostly subject to advanced forms management (deliberately seeded, selected for propagation). Cluster 2 is related to wild species with a more incipient management (mainly protection). Finally, cluster 3 includes trees that are found in the wild subject to more advanced forms of management and domestication (deliberately propagation and tolerance in cultivation areas) (Table 2). The majority of management variables were significantly different between the clusters as shown by the ANOVA and contingency tables (Table 2). We did not find significant differences for gender in the three clusters, but we did for community type (*ejido* and indigenous community) and for the group of participants.

Table 2. Total number of plant resources mentioned and those corresponding to each of the classified clusters and their characteristics.

| | Total | Cluster 1 | Cluster 2 | Cluster 3 |
|--------------|----------------------|------------|-----------|-----------|
| Origin | 180 | 74 | 56 | 50 |
| | Wild*** | 105 (58.3) | 0 | 55 (98.2) |
| | Exotic/cultivated*** | 74 (41.1) | 74 (100) | 0 |
| Life form | Naturalized*** | 20 (11.1) | 19 (25.6) | 1 (1.7) |
| | Tree*** | 116 (64.4) | 35 (47.2) | 31 (55.3) |
| | Shrub** | 25 (13.8) | 12 (16.2) | 13 (23.2) |
| Availability | Herb or creeper*** | 39 (21.6) | 27 (36.4) | 12 (21.4) |
| | Seasonal*** | 106 (58.8) | 44 (59.4) | 17 (30.3) |
| | Abundance*** | | | 45 (90.0) |
| Place | Very abundant | 47 (26.1) | 27 (36.4) | 5 (9.0) |
| | Abundant | 46 (25.5) | 24 (32.4) | 16 (28.6) |
| | Sparse | 60 (33.3) | 20 (27.0) | 22 (39.3) |
| | Very sparse | 27 (15.0) | 3 (1.7) | 13 (23.2) |
| Management | Agricultural plots** | 104 (57.7) | 50 (67.5) | 22 (39.2) |
| | House orchards*** | 101 (56.1) | 71 (95.9) | 8 (14.2) |
| | Forests*** | 101 (56.1) | 13 (17.5) | 46 (82.1) |
| e | Planting*** | 65 (36.1) | 47 (63.5) | 2 (3.5) |
| | Transplanting*** | 67 (37.2) | 47 (63.5) | 6 (10.7) |
| | Enhancement*** | 63 (35.0) | 49 (66.2) | 6 (10.7) |
| | | | | 8 (16.0) |

| | | | | | |
|----------------------|----------------------|-------------|-----------|-----------|-----------|
| | Protection | 99 (55.0) | 42 (56.7) | 24 (42.8) | 33 (66.0) |
| | Tolerance*** | 61 (33.8) | 6 (8.1) | 15 (26.7) | 40 (80.0) |
| | Regulated harvest*** | 23 (12.7) | 0 | 13 (23.2) | 10 (20.0) |
| | Simple harvest*** | 29 (16.1) | 4 (5.4) | 21 (37.5) | 4 (8.0) |
| | Sum of management*** | 2.3 (1.1) | 2.6 (1.1) | 1.5 (0.8) | 2.5 (1.0) |
| Parts used | Trunk or stems*** | 70 (38.8) | 17 (22.9) | 32 (57.1) | 21 (42.0) |
| | Leaves*** | 107 (59.49) | 55 (74.3) | 20 (35.7) | 32 (64.0) |
| | Fruits*** | 114 (63.3) | 58 (78.3) | 7 (12.5) | 49 (98.0) |
| | Root | 17 (9.4) | 5 (6.7) | 9 (16.0) | 3 (6.0) |
| | Bark*** | 37 (20.5) | 2 (2.7) | 12 (21.4) | 23 (46.0) |
| | Flowers | 13 (7.2) | 5 (6.7) | 7 (12.5) | 1 (2.0) |
| | Other | 14 (7.7) | 4 (5.4) | 8 (14.2) | 2 (4.0) |
| | Sum of parts*** | 2.0 (1.0) | 1.9 (1.0) | 1.6 (0.9) | 2.6 (1.1) |
| Management intensity | Maintenance*** | 80 (44.4) | 62 (83.7) | 11 (19.6) | 7 (14.4) |
| | Selective management | 107 (59.4) | 40 (54.0) | 40 (71.4) | 27 (54.0) |
| | Regulations | 47 (26.1) | 13 (17.5) | 20 (35.7) | 14 (28.0) |
| | Tools | 84 (46.6) | 32 (43.2) | 30 (53.5) | 22 (44.0) |
| | Sum of intensity* | 1.7 (1.1) | 1.9 (0.9) | 1.8 (1.2) | 1.4 (0.9) |

*, **, *** Significant at $p < 0.05$, < 0.01 , < 0.001 , respectively. Variables are expressed in total of resources and percentages between parentheses, except for sum of management, sum of parts and sum of intensity expressed on average and standard deviation between parentheses.

Cluster 1 “Cultivated plants with advanced management”. This is the cluster with the largest number of plant resources (74), and includes species like avocado (*Persea americana*), maize (*Zea mays* subsp. *mays*), soursop (*Annona muricata*) and mint (*Mentha spicata*). Around 80% were mentioned in the Pabelo *ejido*. All these resources are widely known cultivated plants that are not found in the wild but have been domesticated in other places. In addition, around 25% are naturalized resources. Within this group of resources, the most common life form is trees. Approximately 70% are perceived as abundant or very abundant in the communities, and around 60% have a seasonal availability. More than 95% of these resources are found in the house orchards; and 70% in agricultural plots. The most common management strategy is enhancement, but to a similar extent planting and transplanting; this indicates their advanced management. The fruits of around 80% of these resources are used, as well as their leaves (approximately 70%); on average, two parts of each plant are used. In a little more than 80% of the plants, maintenance such as pruning or fertilization occurs. Furthermore, selective management is performed in around half of the resources and tools are employed for their extraction; this tells us that their management is also intense.

Cluster 2 “Wild plants with incipient management”. In this cluster, a total of 56 plant resources are found; some of them are: the pine (*Pinus* spp.), oak (*Quercus* spp.), madroño (*Arbutus occidentalis*, *A. xalapensis*) and lechuguilla (*Agave maximiliana*). Nearly 65% were mentioned in the Cuzalapa indigenous community. Except for one case of naturalization, purslane (*Portulaca oleracea*), all the plants are wild species. The most common life form is trees. Seventy percent were available all year, as with the oak (*Quercus* spp.). The majority of these resources are perceived as sparse (39%), although

29% are considered abundant. Nearly 80% of the resources are found in forests and around 40% in agricultural plots. The most common management form is protection, followed by simple harvesting and tolerance, which indicates a more incipient management compared to the other clusters. The trunks and stems of around 70% of these resources are used, followed by their leaves (35%). Selective management occurs in a little more than 70% of the resources and emphasizes the use of tools and collective regulations.

Cluster 3 “Wild trees with advanced management”. A total of 50 plant resources were classified in this cluster, including the fig tree (*Ficus spp.*), mojote (*Brosimum alicastrum*), nance (*Byrsonima crassifolia*) and nogal (*Juglans olanchana, J. major*). These were mentioned in a similar way in both communities; all of them are wild trees, and many have been domesticated in the region. It is interesting that 90% have seasonal availability, around 60% are perceived as sparse or very sparse, but also 30% are perceived as very abundant. Mostly, they can be found in forests (84%), though also in cultivation plots (64%), and in orchards (44%). The most common management form is tolerance, but protection, sowing and transplanting are also common. On average these resources are treated with two or three management forms, which shows that they are subject to more advanced management. In almost all these resources (with one exception), the fruits are used; in nearly half, the use of leaves, bark, trunk, and branches stands out; in other words a greater number of parts per plant are used compared to those in cluster 1 and 2. In almost half of the resources, selective management is performed, and tools are also used for their extraction.

3.2. Valuation and management of the plant resources

The first part of the valuation, which considered the 180 plant resources based on the ranking, commercial value, and the local, regional or outside commercialization did not distinguish statistically between the clusters. This indicates that within the all three management clusters there are some highly valued plant resources. In Table 3, the resources that were ranked highest the first place in each community and by its different groups are shown. For the commercial value, we also found that nearly half of the resources are similarly commercialized in the three clusters, most of them at the local scale.

Table 3. Resources ranked in first place in each community and group, the cluster to which they belong, and their scientific name.

| Group | Community | Common name | Cluster | Scientific name |
|---------|-----------|-------------|---------|--------------------------------------|
| Group 1 | Pabelo | Zacate | 1 | Various genera of the Poaceae family |
| Group 2 | Pabelo | Oak | 2 | <i>Quercus spp.</i> |
| Group 3 | Pabelo | Avocado | 1 | <i>Persea americana</i> Mill. |
| Group 3 | Pabelo | Fig tree | 3 | <i>Ficus spp.</i> |
| Group 4 | Pabelo | Maize | 1 | <i>Zea mays</i> L. |
| Group 5 | Cuzalapa | Mojote | 3 | <i>Brosimum alicastrum</i> Sw. |
| Group 6 | Cuzalapa | Fig tree | 3 | <i>Ficus spp.</i> |
| Group 7 | Cuzalapa | Maize | 1 | <i>Zea mays</i> L. |

When examining the values of the most important resources of the ranking, a total of 12 values from different contributions were found. These values had material, non-material and regulatory dimensions. An additional value included in the material dimension was the monetary value. Regarding the type of contribution, the material contributions were the most numerous with 254 recorded values, then those of regulation (54), and finally non-material contribution with 9 mentions. Within the material dimension, food and feed value of the resources was the most important with 126 records, followed by medicinal value with 63. In addition, within the food and feed value itself, 10 different contributions were documented: for example, nutritive, for specific dishes, drinks or fodder. For the regulation dimension, climate was the most mentioned value with 23 records. With respect to the non-material dimension, only aesthetic value was mentioned. The range of associated values by resource was 1 to 10 and 4 on average, with the pine (*Pinus* spp.) being the resource with most values attributed, these encompassing all three dimensions.

The results of the partial RDA performed with the 79 most valued plant resources show a significant relation between valuation of the resources and the management they present, controlling for the effect of the group of participants (Table 4). The two main canonical axes of the variation explained by the model are presented in Figure 3.

Table 4. Variance partitioning associated to RDA analysis. P values refer to permutational ANOVA tests.

| | Degrees freedom | of R squared | Adjusted squared | R p value |
|--------------------|------------------------|---------------------|-------------------------|------------------|
| Valuation | 17 | 0.35672 | 0.17744 | p<.001 |
| Group | 5 | 0.12028 | 0.06002 | p<.001 |
| Val + Group | 22 | 0.45532 | 0.24133 | p<.001 |
| Residuals | --- | --- | 0.75867 | --- |

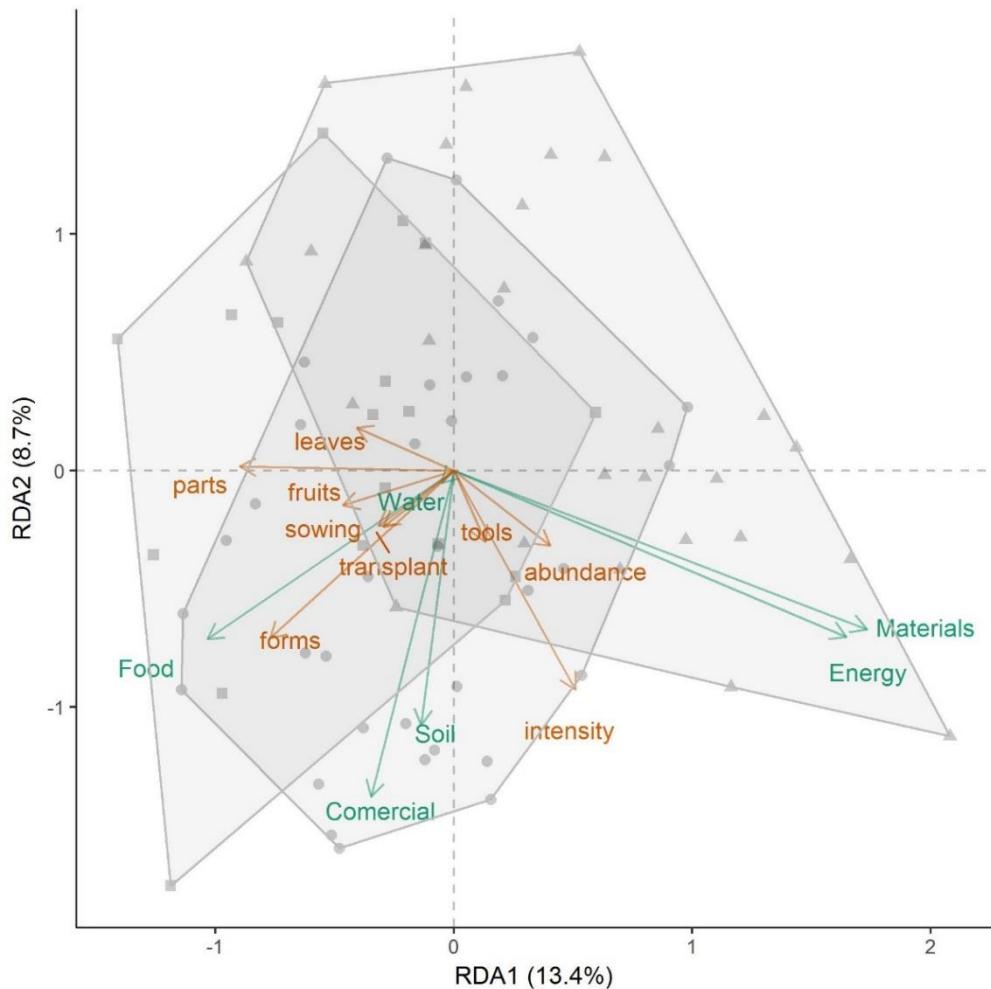


Figure 3. RDA triplot with the two main canonical axes showing the valuation variables (green) and their relation to the management variables (orange), differentiating the three management clusters delimited by polygons: cluster 1 (squares), cluster 2 (triangles) and cluster 3 (circles) summarized in Table 2.

Within the first axis of variation, towards the right we can observe values of the resources associated with the supply of energy and materials, many of these resources belonging to the cluster 2 and employing less advanced management. Nevertheless, these are also associated with management intensity since many of these resources are subject to collective regulations, selective management and specific tools, as with the oaks or pines, which are also considered more abundant. Conversely, toward the left of the first axis, we find the food and feed values, also values from regulatory contributions like water maintenance. In general, these resources have an advanced management in different forms such as sowing and transplanting where various parts of the resource are used, specially their fruits and leaves. Also, clusters 1 and 3 are more oriented to this side of the axis. Within the second variation axis, a separation is shown between resources with commercial value (at the bottom) but also regulatory contributions like soil maintenance.

4. Discussion and conclusions

4.1. Assigned values and management of plant resources

Our results show that the management of plant resources consists of similar strategies for sets of resources that share certain characteristics, such as place of where they can be obtained or seasonality. On the other hand, the type of value assigned to plant resources has an influence, partial but significant, on their management, and this differs between social groups. The three resource clusters possess plants which are considered of high value, and clusters cannot be ranked in terms of importance. This leads us to propose that the diversification in the incorporation-appropriation of resources with a range of different contributions helps to deal with uncertainty and to cover a wide gamut of needs within local livelihood strategies. As other investigations have indicated (Barrera-Bassols & Toledo, 2005; García-Frapolli et al., 2008; Rangel-Landa et al., 2016; Toledo et al., 2003), these strategies connect ecological and economic processes and represent an array of possibilities in different situations, buffering ecological, social and economic uncertainties within the rural communities and helping to maintain local biodiversity (González-Cruz et al., 2015; Moreno-Calles et al., 2011).

Within the management strategies, a marked gradient exists from the most managed resources (cluster 1), to the plant resources with an intermediate state of management (cluster 3), and those plant resources that have more incipient management (those of cluster 2). In this sense, the plants found in cluster 2 can be considered more vulnerable associated with less developed and complex management strategies and utilitarian values and extractive uses. Although, collective regulations for their conservation hold, representing more passive but certainly important management forms (Casas and Parra 2017). A large number of plant resources of clusters 1 and 3, above all those that are associated with food values, with seasonal availability or that contain commercial value, depend on certain management practices to assure their continued provision. These practices tend to be more complex than gathering or harvesting, and include sowing, transplanting or enhancement. As Blancas et al. (2010) and Rangel-Landa et al. (2016) have noted, this pattern can be explained as a strategy to decrease risk of declining supplies. Therefore, the management strategies of cluster 3 are noticeable because these represent domestication processes and conservation of the local biodiversity.

Values from food and feed contributions of the resources were the most frequently mentioned in the two communities, which shows that resource diversity that related to local culinary tradition is of great importance. The resources with nutritive value help to ensure food sovereignty and security in the communities and represent an important part of diversified livelihoods (Barrera-Bassols and Toledo 2005). They are also associated with commercial values and more complex management forms. In our case many of the resources with food values are also found to have medicinal value. A strong connection between agrobiodiversity, nutrition and human health occurs in the communities studied, as noted in other cases by Heywood (2013). In spite of the modernization and related changes in Mexico's food systems, a large quantity of local plants are still consumed within the rural communities (Mapes and Basurto 2016).

Contributions to the maintenance or regulation of ecological processes that resources provide, such as the quality and quantity of groundwater, are evidently perceived to be of great importance. For example, in the case of the fig tree (*Ficus* spp.), people of both communities assign a high value to these resources (ranking it in first place). These resources are in turn protected and conserved through collective agreements and regulations of the ecosystems in which they occur (Blancas et al. 2013, Rangel-Landa et al. 2016, Monroy-Sais et al. 2016). On the other hand, resources such as the mojote (*Brosimum alicastrum*) and pines (*Pinus* spp.) which offer a wide spectrum of values that encompass various dimensions are also abundant in the area. It has been suggested that the “ecological salience” of a resource (the abundance in a territory of a cultural group) is a factor which may explain the higher importance or significance that such resources are attributed in the cultural context (Turner 1988). In this sense, we would expect more shared knowledge and common management strategies relating to species that are abundant and have higher scores on values and uses than those species that make fewer or less important contributions and which have a more restricted distribution.

4.2. The construction of resources values

In our results, resource values and management forms indicate important differences between the two communities and between the different groups of participants. We believe that these differences represent various needs and perceptions related to social and cultural differences such as history and ecological knowledge, land ownership, gender and the development of certain productive activities. For example, in Cuzalapa we found that there is a greater appreciation of local wild resources, while in Pabelo many valued resources have been domesticated from other places and are widely known. From our perspective, this result is related to the ample traditional ecological knowledge within indigenous communities like Cuzalapa that has been extensively documented by others (Farfán-Heredia et al., 2018; Moreno-Calles et al., 2011; Toledo et al., 2003). On the other hand, in Pabelo, a more recently created community with people from different regions, it is noticeable that many of the important resources have different origins too. Also, within communities, access of certain resources (i.e. forests, agricultural plots or orchards) and consequently the use, shape the motives and values of plant resources. These differences in land rights are known to be key factor in determining resources valuation and management strategies (Monroy-Sais et al., 2018; Moreno-Calles et al., 2016).

Another contrasting characteristic between the groups that could influence plants values relates to their gender. For example, in the case of the mojote (*Brosimum alicastrum*), for one of the groups of participants in Cuzalapa that are part of a cooperative called “Color de la Tierra” (color of the land) this tree was mention as the most important resource. This cooperative integrated by women give an added value to seeds of this tree by processing the product and later commercializing it; this in turn represents not only an important part of their income and basis of a productive agroecological system, but also a reshaping of the roles of those women in the community (Estrada-Gutiérrez and Gerritsen 2011). Gender can be a source of intercultural valuations and management in many communities due to, for example, labor division (Camou-Guerrero et al. 2008). In addition, it is possible to observe that the institutional context (i.e. the presence of the SMBR) is playing an important role by fostering conservation projects like the cooperative. This institutional

context has been acknowledged to be highly relevant in articulating natures' values (Brondizio et al., 2009; Pascual et al., 2017).

The recent approach of nature's contributions to people proposed by Díaz and collaborators (2018) in which the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) relies, was useful to characterize why plants are important in these contexts. Although, the monetary contribution that resources can provide to the household economy, significant in our study, was not incorporated. Also, in our study people did not mention to a great extent non-material contributions such as "learning or inspiration" or "psychological or physical experiences". We believe that these types of values might require other approximations and methodologies, since valuation methodologies tend to elicit particular values and have blind spots for others (Jacobs et al. 2018). Furthermore, in many ontologies nature is not separated from people, thus the borders between the different value dimensions are not that clear. For example, in the case of the fig trees (*Ficus* spp.), to which great importance was attributed to their regulation contributions, these values are interlocked with non-material dimensions associated with beliefs, since in other studies local residents commented that this tree is inhabited by "beings who take care of the water" (Flores-Díaz and Maass 2008). As our results show, it is common that values are interconnected, and through traditional ecological knowledge, the value of resources is strengthened and diversified, making the relationship with resources and ecosystems closer.

Finally, we can say that the attribution of value is a complex process in which different elements (ecological, social and cultural) combine to determine the overall value of each plant species. The values of these resources as well as the forms under which they are managed are however not static but are constantly being reinterpreted (Kenter et al. 2016, Pascual et al. 2017). Also, certain highly valued resources are shared both among groups of a community and between communities, which confers them a high sociocultural value. This type of study can help to understand complexities in the valuation of nature beyond simple economic dimensions and may be helpful in the design of conservation or sustainable use policies.

Supplementary material

| Common name | Cientific name | Family | Life form |
|-----------------------|--|----------------|-----------|
| 1 Aguacate | <i>Persea americana</i> Mill. | Lauraceae | Tree |
| 2 Ahuiloche | <i>Vitex mollis</i> Kunth | Lamiaceae | Tree |
| 3 Albahaca | <i>Ocimum basilicum</i> L. | Lamiaceae | Herb |
| 4 Anona | <i>Annona longifolia</i> Sessé & Moc. | Annonaceae | Tree |
| 5 Arrayán | <i>Psidium sartorianum</i> (O. Berg) Nied. | Myrtaceae | Tree |
| 6 Berenjena/Pasiflora | <i>Passiflora edulis</i> Sims | Passifloraceae | Creeper |
| 7 Bonete | <i>Jacaratia mexicana</i> A. DC. | Caricaceae | Tree |
| 8 Cabeza de negro | <i>Annona purpurea</i> Moc. & Sessé ex Dunal | Annonaceae | Tree |
| 9 Café | <i>Coffea arabica</i> L. | Rubiaceae | Shrub |
| 10 Capitana | <i>Verbesina greenmanii</i> Urb. | Asteraceae | Shrub |

| | | | | |
|----|-------------------------|---|-----------------|---------|
| 11 | Capulín | <i>Ardisia compressa</i> Kunth | Myrsinaceae | Tree |
| 12 | Capulín | <i>Prunus serotina</i> Ehrh. subsp. <i>serotina</i> | Rosaceae | Tree |
| 13 | Carambolo | <i>Averrhoa carambola</i> L. | Oxalidaceae | Tree |
| 14 | Cedro | <i>Cedrela odorata</i> L. | Meliaceae | Tree |
| 15 | Chayote | <i>Sechium edule</i> (Jacq.) Sw. | Cucurbitaceae | Creeper |
| 16 | Chilacayote | <i>Cucurbita ficifolia</i> Bouché | Cucurbitaceae | Creeper |
| 17 | Chiles | <i>Capsicum annuum</i> L. | Solanaceae | Herb |
| 18 | Conguerán | <i>Phytolacca rugosa</i> A. Braun & C.D. Bouché | Phytolacaceae | Herb |
| 19 | Conguerán | <i>Phytolacca icosandra</i> L. | Phytolacaceae | Herb |
| 20 | Cuajiole | <i>Bursera simaruba</i> (L.) Sarg. | Burseraceae | Tree |
| 21 | Cuata/Cuate | <i>Eysenhardtia platycarpa</i> Pennell & Saff. | Fabaceae | Tree |
| 22 | Durazno | <i>Prunus persica</i> (L.) Batsch | Rosaceae | Tree |
| 23 | Encino | <i>Quercus</i> spp. | Fagaceae | Tree |
| 24 | Estafiate | <i>Artemisia ludoviciana</i> subsp. <i>mexicana</i> (Willd. ex Spreng.) D.D. Keck | Asteraceae | Herb |
| 25 | Fresno | <i>Fraxinus uhdei</i> (Wenz.) Lingelsh. | Oleaceae | Tree |
| 26 | Frijol | <i>Phaseolus vulgaris</i> L. | Fabaceae | Herb |
| 27 | Garañona/Griñona | <i>Satureja macrostema</i> var. <i>laevigata</i> (Standl.) McVaugh & R. Schmid | Lamiaceae | Shrub |
| 28 | Guajes | <i>Leucaena esculenta</i> (Moc. & Sessé ex DC.) Benth. | Fabaceae | Tree |
| 29 | Guajes | <i>Leucaena macrophylla</i> Benth. | Fabaceae | Tree |
| 30 | Guámara | <i>Inga laurina</i> (Sw.) Willd. | Fabaceae | Tree |
| 31 | Guamuchil | <i>Pithecellobium dulce</i> (Roxb.) Benth. | Fabaceae | Tree |
| 32 | Guanábano | <i>Annona muricata</i> L. | Annonaceae | Tree |
| 33 | Guayaba | <i>Psidium guajava</i> L. | Myrtaceae | Tree |
| 34 | Guazima | <i>Guazuma ulmifolia</i> Lam. | Malvaceae | Tree |
| 35 | Helecho | <i>Dryopteris rossii</i> C. Chr. | Dryopteridaceae | Herb |
| 36 | Hierbabuena | <i>Mentha spicata</i> L. | Lamiaceae | Herb |
| 37 | Higuera | <i>Ficus insipida</i> Willd. | Moraceae | Tree |
| 38 | Higuera | <i>Ficus goldmanii</i> Standl. | Moraceae | Tree |
| 39 | Higuera | <i>Ficus obtusifolia</i> Kunth | Moraceae | Tree |
| 40 | Higuera | <i>Ficus membranacea</i> C. Wright | Moraceae | Tree |
| 41 | Hilama | <i>Annona reticulata</i> L. | Annonaceae | Tree |
| 42 | Hongos | <i>Not identified</i> | Not identified | Herb |
| 43 | Huitapil/Guitapil | <i>Cecropia obtusifolia</i> Bertol. | Urticaceae | Tree |
| 44 | Jaqinicuil/Juaquiniquil | <i>Inga eriocarpa</i> Benth. | Fabaceae | Tree |
| 45 | Jengibre | <i>Zingiber officinale</i> Roscoe | Zingiberaceae | Herb |
| 46 | Laurel | <i>Cinnamomum hartmannii</i> (I.M. Johnst.) Kosterm. | Lauraceae | Tree |
| 47 | Laurel | <i>Litsea glaucescens</i> Kunth | Lauraceae | Tree |
| 48 | Laurel | <i>Nectandra salicifolia</i> (Kunth) Nees | Lauraceae | Tree |
| 49 | Lechuguilla | <i>Agave maximiliana</i> Baker | Asparagaceae | Shrub |
| 50 | Lengua de venado | <i>Chromolaena oerstediana</i> (Benth.) R.M. King & H. Rob. | Asteraceae | Shrub |
| 51 | Lima | <i>Citrus limetta</i> Risso | Rutaceae | Tree |
| 52 | Limón | <i>Citrus × limon</i> (L.) Osbeck | Rutaceae | Tree |
| 53 | Madroño | <i>Arbutus occidentalis</i> McVaugh & Rosatti | Ericaceae | Tree |

| | | | | |
|----|--------------------|---|-----------------|---------|
| 54 | Madroño | <i>Arbutus xalapensis</i> Kunth | Ericaceae | Tree |
| 55 | Maíz | <i>Zea mays</i> L. subsp. <i>mays</i> | Poaceae | Herb |
| 56 | Mango | <i>Mangifera indica</i> L. | Anacardiaceae | Tree |
| 57 | Marota/Cocolmeca | <i>Smilax domingensis</i> Willd. | Smilacaceae | Creeper |
| 58 | Mojote | <i>Brosimum alicastrum</i> Sw. | Moraceae | Tree |
| 59 | Mora | <i>Conostegia xalapensis</i> (Bonpl.) D. Don ex DC. | Melastomataceae | Shrub |
| 60 | Mora | <i>Miconia albicans</i> (Sw.) Steud. | Melastomataceae | Shrub |
| 61 | Nance | <i>Byrsonima crassifolia</i> (L.) Kunth | Malpighiaceae | Tree |
| 62 | Naranjo | <i>Citrus sinensis</i> (L.) Osbeck | Rutaceae | Tree |
| 63 | Nogal | <i>Juglans major</i> (Torr.) A. Heller | Juglandaceae | Tree |
| 64 | Nogal | <i>Juglans olanchana</i> Standl. & L.O.Williams | Juglandaceae | Tree |
| 65 | Nopal | <i>Nopalea cochenillifera</i> (L.) Salm-Dyck | Cactaceae | Shrub |
| 66 | Nopal | <i>Opuntia ficus-indica</i> (L.) Mill. | Cactaceae | Shrub |
| 67 | Orégano | <i>Origanum vulgare</i> L. | Lamiaceae | Herb |
| 68 | Orégano | <i>Majorana hortensis</i> Moench | Lamiaceae | Herb |
| 69 | Oreja de becerro | <i>Clusia salvini</i> Donn. Sm. | Clusiaceae | Tree |
| 70 | Ortiguilla | <i>Urera caracasana</i> (Jacq.) Gaudich. ex Griseb. | Urticaceae | Shrub |
| 71 | Otate | <i>Otatea acuminata</i> (Munro) C.E. Calderón & Soderstr. | Poaceae | Shrub |
| 72 | Oyamel/Pinabete | <i>Abies jaliscana</i> (Martínez) Mantilla, Shalisko & A. Vázquez | Pinaceae | Tree |
| 73 | Palma de coyul | <i>Acrocomia aculeata</i> (Jacq.) Lodd. ex Mart. | Arecaceae | Tree |
| 74 | Palo dulce | <i>Diphysa floribunda</i> Peyr. | Fabaceae | Tree |
| 75 | Palo dulce | <i>Eysenhardtia platycarpa</i> Pennell & Saff. | Fabaceae | Tree |
| 76 | Papayo | <i>Carica papaya</i> L. | Caricaceae | Tree |
| 77 | Parota | <i>Enterolobium cyclocarpum</i> (Jacq.) Griseb. | Fabaceae | Tree |
| 78 | Pinguica | <i>Arctostaphylos pungens</i> Kunth | Ericaceae | Shrub |
| 79 | Pino | <i>Pinus</i> spp. | Pinaceae | Tree |
| 80 | Piña | <i>Ananas comosus</i> (L.) Merr. | Bromeliaceae | Herb |
| 81 | Plátano | <i>Musa</i> spp. | Musaceae | Shrub |
| 82 | Primavera | <i>Handroanthus chrysanthus</i> (Jacq.) S.O. Grose | Bignoniaceae | Tree |
| 83 | Quelite machucador | <i>Not identified</i> | Not identified | Herb |
| 84 | Quelites | <i>Not identified</i> | Not identified | Herb |
| 85 | Retama | <i>Calea urticifolia</i> (Mill.) DC. | Asteraceae | Shrub |
| 86 | Roble | <i>Quercus</i> spp. | Fagaceae | Tree |
| 87 | Rosa Morada | <i>Tabebuia rosea</i> (Bertol.) Bertero ex A.DC. | Bignoniaceae | Tree |
| 88 | Rosal | <i>Rosa</i> spp. | Rosaceae | Shrub |
| 89 | Ruda | <i>Ruta graveolens</i> L. | Rutaceae | Herb |
| 90 | Salvia | <i>Hyptis albida</i> Kunth | Lamiaceae | Shrub |
| 91 | Sávila | <i>Aloe vera</i> (L.) Burm.f. | Asphodelaceae | Herb |
| 92 | Sidra | <i>Not identified</i> | Not identified | Creeper |
| 93 | Taray | <i>Salix microphylla</i> Schltl. & Cham. | Salicaceae | Tree |
| 94 | Tepeguaje | <i>Lysiloma acapulcense</i> (Kunth) Benth. | Fabaceae | Tree |
| 95 | Tomatillo | <i>Physalis philadelphica</i> Lam. | Solanaceae | Herb |
| 96 | Tomatillo | <i>Physalis gracilis</i> Miers | Solanaceae | Herb |
| 97 | Vaca gorda | <i>Not identified</i> | Not identified | Herb |

| | | | | |
|-----|---------------|--|---------------|--------|
| 98 | Verdolagas | <i>Portulaca oleracea</i> L. | Portulacaceae | Herb |
| 99 | Yaca | <i>Artocarpus heterophyllus</i> Lam. | Moraceae | Tree |
| 100 | Zacate | <i>Andropogon gayanus</i> Kunth | Poaceae | Herb |
| 101 | Zacate | <i>Brachiaria</i> spp. | Poaceae | Herb |
| 102 | Zacate | <i>Hyparrhenia rufa</i> (Nees) Stapf | Poaceae | Herb |
| 103 | Zacate | <i>Panicum maximum</i> Jacq. | Poaceae | Herb |
| 104 | Zapote blanco | <i>Casimiroa watsonii</i> Engl. | Rutaceae | Tree |
| 105 | Zapote negro | <i>Diospyros nigra</i> (J.F.Gmel.) Perrier | Ebenaceae | Tree |
| 106 | Zarzamora | <i>Rubus</i> spp. | Rosaceae | Creper |

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Capítulo 7. Discusión

Las estrategias de manejo y valoración en relación a la gobernanza ambiental en la Costa Sur de Jalisco

En esta investigación caracterizamos distintas estrategias de manejo de recursos naturales e identificamos los principales elementos que influyen en las diferentes estrategias. A su vez, realizamos una valoración sobre aspectos del paisaje y los recursos vegetales identificando cómo los valores varían para distintos grupos y contextos socio-ecológicos. Tanto la caracterización de estrategias como la valoración se realizó a través de casos de estudio. La siguiente discusión se basa en contrastar los resultados de los casos de estudio de esta investigación y cómo estos iluminan aspectos sobre la gobernanza ambiental en un contexto más amplio. La primera sección discute los principales procesos que moldean las estrategias de manejo de recursos naturales y la lógica campesina que contienen los valores sobre la naturaleza y su pluralidad. Posteriormente, la segunda sección habla de la lógica de los gobiernos en torno a los mecanismos ambientales que operan en los mismos territorios o distintas ‘ambientalidades’ y las discrepancias que surgen entre estas dos lógicas. Finalmente, la última sección se presenta una propuesta sobre la estrategia de gobernanza ambiental que tome en cuenta las distintas visiones.

7.1. La lógica campesina: el manejo, sus condicionantes y valores

7.1.1. Diversificación, adaptación y conocimiento ecológico

Dentro de esta investigación y de manera reincidente el proceso que permea de manera generalizada la lógica campesina es la búsqueda y materialización de la diversificación de las estrategias a diferentes escalas. Por ejemplo, en el capítulo 4 existe una amplia gama de actividades productivas que las familias realizan dando lugar a distintos tipos de estrategias que se relacionan entre ellas o son ‘estrategias acopladas’ generando un gradiente en torno especialización y diversificación. También la mayoría de los hogares desarrollan estrategias diversificadas que se pueden observar en el paisaje donde se da un ensamblaje y complementariedad de varios procesos que abarcan el manejo *sensu lato*, no solo de ciertos recursos. Por su parte, en el capítulo 6 existe una apreciación por una gran variedad de recursos vegetales que contribuyen en diversas maneras al bienestar en dimensiones materiales, no materiales y de regulación, por ejemplo, contribuciones alimenticias, de calidad del aire y agua y apreciación estética. Esto a su vez genera un gran acervo de recursos manejados de diversas maneras. Esta diversificación dentro del paisaje, recursos y las estrategias campesinas han sido ampliamente documentadas en ayudar a la reducción del riesgo y lidiar con la incertidumbre dentro de los propios sistemas socio-ecológicos (Ellis 1998, Assan et al. 2009, Blancas 2013, Heywood 2013, Cochet 2015).

En este sentido, los campesinos, como elementos integrales de estos sistemas socio-ecológicos buscarán adaptarse a las variaciones o cambios socio-ecológicos generando conocimiento, creando nuevas estructuras para controlar la variación o inestabilidad

(Prigogine and Stengers 1984). Esto lleva ineludiblemente al aumento de la complejidad de los sistemas y a mayor diversidad de manera general. Evidentemente, esto es un proceso dinámico, ya que continuamente hay inestabilidades en el sistema que llevan a la reorganización o adaptación constante (i.e. cambio climático, fluctuaciones del mercado, crecimiento poblacional, globalización, etc.). Esto genera diversificación de prácticas, de unidades del paisaje, de recursos y de procesos institucionales, entre otros (e.g. Toledo et al. 2003, García-Frapolli et al. 2008, Moreno-Calles et al. 2011, González-Cruz et al. 2015, Rangel-Landa et al. 2016, Monroy-Sais et al. 2016). Es el juego de la persistencia y el cambio en acción (Holling 1973, 2001).

El conocimiento ecológico tradicional, en muchos sentidos también social, que se genera en estos sistemas, puede ser entendido como la biblioteca viva de las relaciones con la naturaleza. Además, también se generan relaciones entre las personas de la comunidad, a través de reglas y normas compartidas, por ejemplo, en el capítulo 6 donde numerosos recursos vegetales poseen regulaciones colectivas para su aprovechamiento. Este conocimiento es indudablemente específico del contexto (Berkes and Folke 1998, Berkes et al. 2000b). Esta biblioteca de relaciones además marca ciertas pautas del manejo de ecosistemas, ya que se basa en qué priorizar y qué acciones realizar con determinada apropiación de la naturaleza desarrollando cierta estrategia (Toledo et al. 2003). Es por eso que existe una estrecha relación entre el conocimiento, las prácticas y los valores de la naturaleza (Berkes et al. 2000a, Kollmuss and Agyeman 2002, Toledo et al. 2003, Toledo and Alarcón-Cháires 2012). El conjunto de relaciones entre grupos humanos y naturaleza son una huella digital única en el mundo, obviamente con similitudes entre grupos y ecosistemas, pero nunca puede existir un ensamble de relaciones idéntico. Al igual que los propios ecosistemas, acoplados a través de los ciclos entre lo ecológico y lo social (Holling 2001).

Sin embargo, a pesar de exista este conocimiento, no significa que el manejo dentro de nuestros casos de estudio sea necesariamente sustentable. De manera agregada, las estrategias pueden estar encaminadas a una rentabilidad económica, por ejemplo, en el caso de Pabelo, donde la mayoría de las estrategias de manejo promueven la ganadería extensiva, fomentando la deforestación de las parcelas. En el caso de Ranchitos, los campesinos tienden a estar más diversificados, pero es consecuencia de las fuertes restricciones en el sistema productivo por la falta de agua. También, la diversificación entre estrategias es resultado de la estratificación social y el acceso a los recursos, como observamos mayormente en el caso de Pabelo. Las estrategias de manejo poseen cierta trayectoria (Radel et al. 2010) y estas trayectorias se relacionan con la resiliencia y sustentabilidad de todo el sistema socio-ecológico. A pesar de que los campesinos se adaptan, no necesariamente se encaminan a un estado deseado del sistema. Es importante reconocer que existe esta capacidad de adaptación, la cual es nutrida con la experiencia diaria y es un importante sustento para encaminar un manejo sustentable y promover una mejor gobernanza ambiental donde necesariamente se requieren otros actores.

7.1.2. Condicionantes en las estrategias de manejo de recursos naturales

Cuando se observa a detalle la diversificación dentro de las estrategias de manejo vemos que existen elementos que juegan un papel fundamental en cómo se desarrollan, los cuales

determinan eventuales trayectorias dentro de las estrategias. Por una parte, los propios ecosistemas establecen límites biofísicos a las actividades productivas que se pueden realizar y de los flujos que pueden obtener de los ecosistemas. Se puede decir que son la ‘cancha’ de las estrategias. Esto es evidente en el capítulo 4 donde las estrategias de manejo claramente se diferencian de acuerdo al tipo de ecosistema en el que se desenvuelven. Por ejemplo, aquellos hogares que desarrollan su estrategia con fuertes restricciones de acceso al agua en el bosque tropical seco se ven limitadas en las actividades agropecuarias. Como resultado, los hogares extienden su estrategia fuera del campo con actividades no agropecuarias. También, en el capítulo 6 el manejo de una gran cantidad de recursos vegetales se relaciona con los ecosistemas presentes ya que muchos de ellos se encuentran en estado silvestre. El preponderante papel de los ecosistemas no es de sorprender, sin embargo, en mucha de la literatura sobre estrategias y medios de vida, suelen no considerarse las dinámicas ecológicas (Binder et al. 2013).

En buena medida también los derechos de la tierra y sus recursos (i.e. los sistemas de tenencia de la tierra) ejercen una influencia en la diversificación de las estrategias, muchas veces generando cuellos de botella. Esto tiene que ver con las instituciones presentes en torno al acceso los recursos, en nuestro caso primordialmente los núcleos agrarios: ejidos y comunidades indígenas. Por ejemplo, los distintos grupos de estrategias que surgen de acuerdo a la figura que representan en cada ejido (i.e. ejidatario, poseedor o avecindado) con diferencias en los derechos en el acceso a la tierra se observa claramente en el capítulo 4. También, en las estrategias de manejo de recursos vegetales, se observa cómo grupos de manejadores que poseen derechos sobre la tierra diferenciados valoran y manejan recursos particulares en el capítulo 6. Varios estudios demuestran que los derechos sobre la tierra y recursos son un punto clave para entender las interacciones entre componentes sociales y ecológicos (Niazi 2003, Luoga et al. 2005, Carr 2008, Segnon et al. 2015, Batterbury et al. 2015). En México se ha observado que las formas de la tenencia de la tierra implican además formas de organizar el paisaje y sus sistemas de manejo (Moreno-Calles et al. 2016).

De manera general, tanto los ecosistemas como los sistemas de tenencia de la tierra establecen un acceso a una gama de recursos, con los cuales los hogares desarrollan su estrategia. Las interacciones y modificaciones que surgen entre los ecosistemas y los sistemas de tenencia de la tierra son claves para la abordar la gobernanza ambiental (Ostrom and Nagendra 2006, Ostrom 2009). Es relevante señalar que la rigidez de las propias instituciones puede llevar al colapso de los sistemas socio-ecológicos (Holling 2001) ya que no permiten la adaptación a las distintas circunstancias cambiantes. Finalmente, es importante identificar y reconocer estos condicionantes ya que tiene implicaciones en la propia resiliencia socio-ecológica y modificaciones en estos condicionantes pueden tener un efecto directo sobre las estrategias campesinas y de manejo de recursos.

7.1.3. Pluralidad de valores y valores compartidos

Dentro de nuestro estudio fue posible observar también que a nivel de los propios manejadores y hogares hasta el nivel comunitario existe una gran diversidad de valores sobre la naturaleza y los distintos recursos. Sin embargo, también fue posible identificar

ciertas prioridades comunitarias o valores compartidos sobre la naturaleza. Por ejemplo, dentro del capítulo 5 sobre la valoración del paisaje observamos que atributos como la cobertura de la vegetación poseen una valoración muy heterogénea de acuerdo con variaciones en los derechos de la tierra, tanto dentro de las comunidades como entre ellas; sin embargo, el atributo de disponibilidad de agua dentro de las parcelas resultó prioritario de manera generalizada. También, en el capítulo 6 sobre los recursos vegetales observamos que los valores pueden ser muy variados entre distintos grupos sociales como hombres o mujeres incluso para un mismo recurso; pero también, recursos como el mojote (*Brosimum alicastrum*) o la higuera (*Ficus spp.*) destacaron en la mayoría los grupos. Estos resultados nos hablan de cómo los valores son altamente dinámicos y responden a contextos específicos, pero que en algunos casos es posible tener consensos que podríamos considerar como parte de los valores socioculturales.

Estos resultados tienen una doble implicación, por una parte, la importancia de reconocer e incluir los valores plurales e incluso dispares dentro de la toma de decisiones, ya que las valoraciones que no toman en cuenta esta pluralidad son poco legítimas (Kenter et al. 2016). Algunos autores (e.g. Arias-Arévalo, Gómez-Baggethunb, Martín-López, & Pérez-Rincón, 2018; Kenter et al., 2016; Pascual et al., 2017; Spangenberg & Settele, 2016) han señalado que al no tomar en cuenta los diversos valores dentro de la toma de decisiones sobre la naturaleza se pueden generar tensiones que eventualmente devienen en conflictos y un manejo inadecuado. Estos mismos autores sugieren llevar a cabo procesos deliberativos para la negociación y reconocimiento de estos valores y sus prioridades, además de la integración de diversos valores en la toma de decisiones. Nuestra investigación exploró la diversidad de valores en relación a diferencias en derechos sobre la tierra mayormente, sin embargo, diferencias entre género, educación, edad, u otras diferencias pueden ser fuente de la pluralidad de valores, por lo que sería importante explorarlas. Por otra parte, es posible que el punto de partida en la construcción de la gobernanza ambiental sean aquellos valores compartidos o valores socioculturales (Irvine et al. 2016, Kenter 2016, Kenter et al. 2016) ya que representan los intereses en común donde los distintos actores pueden converger y tener disposición a participar.

7.1.4. Los tipos de valores, las metodologías y sus implicaciones

En cuanto a los tipos de valores sobre ciertos elementos de la naturaleza mayormente encontramos aquellos que cubren aspectos prácticos sobre la utilidad de los recursos, pero también de aspectos intangibles como el valor estético o incluso funciones del ecosistema. Por ejemplo, en el capítulo 6 sobre los recursos vegetales destacaron los valores alimenticios que tienen muchas de las plantas consideradas de mayor importancia dentro de las comunidades estudiadas. También fue interesante encontrar que existen recursos vegetales donde confluyen una gran gama de valores, tal es el caso de las especies de pino valoradas por aspectos materiales como proveer energía, inmateriales como valor estético y de regulación del clima o mantenimiento del suelo. En tratar de aproximarnos a los valores que poseen los campesinos sobre ciertos elementos de la naturaleza fue evidente que la dualidad entre lo intrínseco y lo instrumental no es operativa ya que cada valor existe en un sistema de valores que nos habla de la relación con la naturaleza como un todo. Por ejemplo, se pueden aprovechar especies de encino por su valor para proveer leña, para ello existen regulaciones colectivas para su aprovechamiento que marcan los límites en función

de proteger un ‘bien’, lo cual establece una relación entre el recurso y las personas. Al agregar el conjunto de relaciones pueden hacer evidente los valores trascendentales o meta-valores (Kenter 2018) y así podemos tener una visión más amplia de la propia ontología y axiología de cierto grupo de personas. En este sentido una aproximación ‘relacional’ puede iluminar un mayor espectro de valores sobre la naturaleza (Chan et al. 2016, Pascual et al. 2017), esta visión relacional puede hacer evidente el lugar en el que nos situamos respecto a la naturaleza.

Los valores obtenidos sobre los aspectos estudiados de la naturaleza representan solo una fracción de los valores que pueden poseer las personas. Por ejemplo, en el capítulo 5 sobre la valoración de las parcelas y sus atributos, encontramos que el valor del agua sobrepasa incluso el valor monetario de las parcelas. Como mencionan Jacobs y colaboradores (2018), las metodologías para eliciar valores tienen un peso importante en el resultado sobre los valores que surgen y estos tienen implicaciones en las decisiones. Es importante considerar que la valoración que tengamos de la naturaleza siempre será incompleta y que la incommensurabilidad en muchos casos es un aspecto crucial (Martinez-Alier et al. 1998). Es posible que para poder abarcar una mayor gama de valores sobre la naturaleza sea necesario más de una aproximación metodológica (Pascual et al. 2017, Arias-Arévalo et al. 2018, Jacobs et al. 2018). Sin embargo, generalmente el único lenguaje de valor sobre la naturaleza que se habla dentro de las políticas es el monetario a través de una lógica mercantil. Podemos decir que las comunidades se enfrentan a disyuntivas entre formas de valorar la naturaleza, ante este dominio ontológico de estos valores (Martinez-Alier et al. 1998). No es que se rechacen completamente las valoraciones económicas y monetarias, pero se debe ser consciente de las consecuencias y posibles modificaciones a los sistemas de valores existentes y dónde estas valoraciones son pertinentes (Kallis et al. 2013).

7.2. La lógica de las políticas públicas: la gobernanza ambiental desde arriba

A pesar de resaltar la lógica campesina en el manejo de los recursos, ésta no tiene una completa interpretación si no se observan los procesos macropolíticos y económicos que están detrás (Fletcher and Büscher 2017, Büscher and Fletcher 2018). Como espejo de las políticas públicas y de actores más allá de lo ‘local’ vemos como surgen discrepancias en el manejo de los recursos naturales y los ecosistemas. Por ejemplo, nuestros resultados muestran que existe lo que se ha llamado como “la brecha de los valores y el comportamiento” (Kennedy et al. 2009) donde encontramos discrepancias entre lo que los manejadores valoran y sus acciones; en el ejido Pabelo se valora más la vegetación, pero existe mayor deforestación; por su parte en la comunidad indígena de Cuzalapa se valora menos la vegetación pero existe una mayor cobertura forestal. Esto puede tener distintos orígenes, puede suceder que no exista la capacidad de actuar de acuerdo a los valores que poseen las personas, pero también puede deberse al aparato institucional que moldea muchas acciones que son permitidas para los propios manejadores (Kennedy et al. 2009) como creemos que sucede en el caso de Cuzalapa por estar dentro de una Reserva de la Biósfera. Este desacoplamiento además no surge de una lógica ‘única’, sino que es resultado de las múltiples ambientalidades materializadas en un mismo territorio (Fletcher 2017). La propia evolución o cambios en términos de las distintas ambientalidades se puede

observar en los distintos instrumentos de política ambiental que han surgido a través del tiempo en un determinado territorio. En este sentido, los instrumentos e incentivos de conservación que se implementan en el ámbito rural reflejan y refuerzan ciertos valores de la naturaleza ya que cada instrumento tiene una lógica implícita.

Dentro de la región, el más antiguo de los esquemas de conservación es el de las áreas naturales protegidas a través de la modalidad Reservas de Biósfera; dos importantes Reservas de Biósfera se encuentran en este territorio y Cuzalapa posee más de la mitad de su territorio dentro de la Reserva Sierra de Manantlán. Estas ambientalidades implican que se adopten estrategias de vida y manejo de recursos compatibles con la conservación concebida por los gobiernos, además de regular las acciones dentro de los planes de manejo. Estos esquemas en general generan conflictos distributivos por el acceso a los recursos (García-Frapolli et al. 2009) ya que existe poco involucramiento de las comunidades locales en las decisiones de manejo. Desde nuestra perspectiva esta ambientalidad asume que por sí mismas las personas son incapaces de conservar el medio ambiente y se ejercen instrumentos de ‘comando y control’ por el gobierno (Fletcher 2017). Además, busca la internalización de actitudes ambientales por las personas, en lo que se conoce como ‘ambientalidad disciplinar’ (Agrawal 2005a, 2005b). Aquí se acentúan los valores intrínsecos de la naturaleza y de los propios procesos biológicos y ecológicos; sin embargo, se reconocen poco los valores relacionales de las propias comunidades con sus ecosistemas y su dependencia de estos. En el caso mexicano, muchas ANP’s además buscan incentivar los proyectos de manejo sustentable comunitarios, que para algunos autores es otra cara de una ambientalidad neoliberal (Sullivan 2006), ya que son poco participativos de manera genuina (Haller et al. 2016).

Podemos decir que actualmente la ambientalidad neoliberal es dominante en muchos de los esquemas y programas que incentivan la conservación desde arriba (Fletcher 2010). La forma de ambientalidad neoliberal establece que puede existir una autorregulación por parte del mercado incorporando a la economía el capital natural (Sullivan 2014). En la región, uno de los programas más representativos de esta ambientalidad es el Pago por Servicios Ambientales (Fletcher and Büscher 2017), el cual se lleva a cabo tanto en Pabelo como en Cuzalapa. Básicamente, estas lógicas resaltan los valores meramente instrumentales de la naturaleza, generando la “mercantilización de la naturaleza” (Kallis et al. 2013, Neuteleers and Engelen 2015). Esta visión ha sido criticada por varios autores ya que puede alterar los valores locales y las relaciones con la naturaleza (Sullivan 2006, 2014, Singh 2015); por ejemplo, los valores morales o éticos con respecto al cuidado de la naturaleza. Esta ambientalidad neoliberal ha demostrado no generar los resultados esperados en términos de conservación de la naturaleza, además de consecuencias sociales como la posibilidad de acumulación de capital (Corson et al. 2013, Fletcher and Büscher 2017). En nuestros casos de estudio, es aún muy temprano para saber si esta es la situación, pero sería importante estudiar las implicaciones de este tipo de programas y ambientalidades. Puede ser que este tipo de esquemas bajo ciertas configuraciones de gobernanza sean posibles y adecuados (Muradian et al. 2013), pero actualmente se prescriben sin tener consideración de los contextos donde se implementan.

Aunado a esta ambientalidad neoliberal, cambios en las formas de tenencia de la tierra también favorecen la propiedad privada y poco a poco van cediendo otras formas de propiedad como la comunal. Como lo expresa Torres-Mazuera (2013), la idea del ejido

como forma de tenencia de la tierra originalmente *sui generis* (fundamentalmente comunitaria, asociada a la lucha por la tierra en la revolución), se ha ido transformado en una forma de tenencia *ad hoc* primordialmente neoliberal. Varias de estas transformaciones se han generado producto de las reformas al artículo 27 constitucional y su instauración a través del programa PROCEDE. Aunque no se ha generado una completa desaparición de las estructuras comunitarias, si ha devenido en su transformación (Moya 2012, Schroeder and Castillo 2012). A partir de estas reformas también nuevos sujetos agrarios se reconocen y se valida un tipo de ‘estratificación’ al interior de los ejidos, dada por las diferencias en los derechos agrarios o derechos sobre la tierra y sus recursos². Por lo tanto, también los distintos sujetos agrarios que ahí pueden encontrarse son afectados por estas ambientalidades y poseen distintos valores, como observamos en el capítulo 5. En general, las políticas de conservación o políticas ambientales invisibilizan a los sujetos que no son poseedores de derechos agrarios como posibles protagonistas del manejo de recursos y ecosistemas, en algunos casos acentuando inequidades internas (Merino 2003, Appendini 2008).

Finalmente, estas ambientalidades también se entrelazan con otras lógicas gubernamentales arraigadas como las de la ‘Revolución Verde’ donde la productividad del campo se lleva a costa del ambiente. Esto es reflejo de las políticas sectoriales que en México tienen poco diálogo y consenso sobre la dirección del desarrollo rural del país (Cano-Castellanos and Lazos-Chavero 2017). Además, para las políticas públicas existe una división entre lo productivo y la conservación del ambiente, donde cada uno sucede en espacios claramente delimitados y a ciertas escalas. Esto en la práctica es poco operativo y no es visto de la misma manera por los campesinos, como se discutió en la primera sección. Además, esta cronología de ambientalidades pareciera que busca también transformar a los manejadores de ‘productores’ en ‘conservacionistas’, teniendo poco en cuenta las propias aspiraciones o lógicas de manejo de ecosistemas locales. Es este desacople de las escalas de manejo de los recursos naturales y los valores sobre estos los que producen tensiones y manejo inadecuado de los sistemas socio-ecológicos (Cumming et al. 2006, Lazos-Chavero 2015). Por su parte, cada vez más los valores de la naturaleza que ‘cuentan’ son los que han sido definidos fuera de los contextos locales y muchas veces no corresponden a los valores del sitio. En palabras de Sullivan (2006:108) “lo que determina el valor tiende a ser localizado cada vez más en otra parte” [que aquella donde se encuentra el objeto del valor] y al hacer presente estos valores se invisibilizan otros.

7.3. Buscando el diálogo: algunas propuestas para la estrategia de gobernanza ambiental

Hemos puntualizado cómo las distintas visiones sobre la gobernanza y el manejo de recursos producen tensiones y generan discrepancias y dilemas para los propios actores locales. Ahora bien, ¿existen posibilidades de diálogo entre estas múltiples visiones muchas veces conflictivas y contrastantes? Desde nuestra perspectiva, es posible establecer un

² Aunque desde el reparto agrario posterior a la Revolución Mexicana existieron acaparadores de tierra y realmente no significó un reparto equitativo como se pretendió, la Reforma Agraria en lugar de tratar de aminorar este fenómeno de alguna manera lo institucionalizó al crear las formas legales de ‘posesionario’ y ‘avecindado’ dentro de los ejidos, además de favorecer la compraventa de tierras.

diálogo que pueda tomar en cuenta las condiciones y valores de cada contexto para la gobernanza ambiental a través de procesos de constitucionalidad que aluden la innovación institucional y la posibilidad de que otros valores sobre la naturaleza se expresen. La constitucionalidad trae a la mesa la importancia del diseño y desarrollo de las instituciones comunitarias para el manejo de recursos de uso común desde lo local pero con implicaciones más allá de lo local (Haller et al. 2016). También trata de moverse más allá del análisis de las subjetividades o ‘ambientalidades’ impuestas desde arriba para tomar en cuenta la agencia de actores locales y la creatividad en la creación de instituciones (Haller, Acciaioli, & Rist, 2016). A continuación señalamos algunos puntos que consideramos claves de la teoría existente y cómo se conjugan en el contexto de nuestro sitio de estudio.

De la condensación de una serie de casos de estudio (Haller et al. 2016, Belsky and Barton 2018, Eid and Haller 2018, Gambon and Rist 2018, Gerber 2018, Haller and Merten 2018, Ochoa-García and Rist 2018) sobre los procesos de constitucionalidad seis precondiciones parecen detonar estos procesos: 1) percepciones locales sobre la necesidad de creación de nuevas instituciones; 2) capacidad de involucramiento en procesos participativos que abordan asimetrías de poder; 3) instituciones preeexistentes para la acción colectiva; 4) agentes catalizadores externos; 5) conocimiento local y la innovación; 6) reconocimiento y apoyo de niveles superiores de gobierno o estado. A través de los procesos de constitucionalidad se genera una gobernanza ambiental híbrida (Lemos and Agrawal 2006) entre distintos actores (gobiernos, agencias, mercados, academia, sociedad civil, comunidades) que adquieren configuraciones particulares en cada contexto. En este sentido, si observamos nuestros casos de estudio, muchos de estas precondiciones se encuentran presentes, por ejemplo, los puntos 3 y 5, en algunos casos el 4; el siguiente paso sería explorar qué elementos serían necesarios para poder detonar los procesos de constitucionalidad.

También los procesos de constitucionalidad delinean una naturaleza evidentemente transdisciplinar; sin embargo, por su corta trayectoria aún falta estudiar y comprender los posibles aportes y sinergias de otras áreas del conocimiento. Creemos que áreas como la agroecología y etnoecología puede ofrecer sustento teórico y enriquecer los alcances de la constitucionalidad, al menos en nuestros sitios de estudio. Dentro de la agroecología no solamente es importante el aspecto de la innovación tecnológica y el conocimiento ecológico, también se menciona que es necesario el cambio institucional y de las relaciones de poder (Gonzalez de Molina 2013, Toledo and Barrera-Bassols 2017). Además, tomar en cuenta los principios de los sistemas socio-ecológicos o sistemas complejos en la constitucionalidad, lleva a fortalecer los ciclos de retroalimentación y aprendizaje de las instituciones a través de canales abiertos de comunicación desde distintos sectores, creando sistemas de información, conocimiento y comunicación (Maass et al. 2015). Desde la teoría de sistemas el concepto de constitucionalidad compagina también con el de ‘panarquía’ donde la sustentabilidad está relacionada con “la capacidad de crear, probar y mantener la adaptabilidad” (Holling, 2001: 399) dentro de los sistemas socio-ecológicos.

Desde nuestra perspectiva, la constitucionalidad concibe un desarrollo primordialmente endógeno, el cual busca partir de los ecosistemas y recursos locales, además de las capacidades de los actores rurales para desarrollar modelos de apropiación basados en sus propios valores (Gerritsen and Gutiérrez-Estrada 2010). Hacer presentes estos valores en otros espacios más allá de lo local implica comprender cómo surgen y de dónde surgen,

utilizando distintas metodologías para cubrir los ‘puntos ciegos’ (Jacobs et al. 2018). Una propuesta para hacer visibles estos valores e incluso las contradicciones entre actores son las valoraciones diversas (deliberativas, económicas, socioculturales, biofísicas), donde los valores incluso se pueden construir, descubrir y reflejar a través del diálogo y negociación entre distintos actores a fin de tomar decisiones, incluyendo las dimensiones morales y éticas (Raymond et al. 2014, Kenter et al. 2016, Pascual et al. 2017). Al final son los valores sobre la naturaleza los que se integran a los procesos de gobernanza ambiental a través de las decisiones (Kenter 2018).

La gobernanza ambiental en la región presenta grandes retos, por ejemplo, la desconfianza de muchas comunidades locales hacia las distintas autoridades, resultado de la historia de despojo, el acaparamiento de la tierra y desigualdad (Lazos-Chavero 2015). A pesar de que en años recientes ha habido intentos de realizar una gestión más integral del territorio, aún existen tendencias sectoriales, centralizadas y jerárquicas (Cano-Castellanos and Lazos-Chavero 2017). Nuestros casos de estudio reflejan muchos de los problemas que enfrenta la gobernanza ambiental en muchas regiones del país marcadas por sucesos muy similares a los de la Costa Sur de Jalisco, donde las asimetrías de poder y acceso al manejo de los recursos generan intereses muy heterogéneos. Sin embargo, en nuestros casos también se vislumbran ejemplos de procesos de constitucionalidad donde la revalorización de recursos y creación de instituciones *ad hoc* para su gestión es posible (e.g. Alvarez-Grzynowska & Gerritsen, 2013; Gerritsen & Gutiérrez-Estrada, 2010; Monroy-Sais et al., 2016; Schroeder & Castillo, 2012). Dentro de estos ejemplos, vemos cómo en la región se han generado alianzas entre distintos actores y niveles de gobierno en la gestión de recursos estratégicos llevando a la innovación institucional.

Al igual que las propias estrategias de vida y manejo de los recursos naturales dependen de una diversificación en función de la resiliencia socio-ecológica, de igual manera se alude a la necesidad de procesos institucionales diversificados para moverse más allá de las ‘panaceas’ (Ostrom and Cox 2010). La creación de nuevas instituciones que conecten distintos intereses ‘de arriba’ y ‘de abajo’ puede permitir que se expresen valores sobre la naturaleza que se encuentran subyugados (Martinez-Alier 2014) o que aún no han sido creados. Para que surgan y permanezcan los procesos de constitucionalidad son necesarias plataformas de intercambio entre las distintas visiones sobre la gobernanza ambiental (Gampon and Rist 2018). Actualmente muchas de las ideas y propuestas de la gobernanza ambiental se yerguen bajo la bandera de la ‘sustentabilidad’; sin embargo, muchas veces representan ambientalidades impuestas, por lo que es importante repensar críticamente las lógicas y valores subyacentes. Promover y preservar una diversidad institucional que ayude a mantener un abanico de soluciones de los sistemas sociales a un amplio rango de contextos ecológicos puede ser igual de importante que conservar la biodiversidad misma (Fletcher, 2010; Janssen, Anderies, & Ostrom, 2007; Monroy-Sais et al., 2016; Ostrom, Burger, Field, Norgaard, & Policansky, 1999). Desde nuestra perspectiva, una nueva gobernanza ambiental no puede ser descrita en términos genéricos, tiene que ser descrita e inventada en cada contexto socio-ecológico, asumiendo la diversidad en un sentido amplio, diversidad de visiones, valores sobre la naturaleza y diversidad de formas de vida.

Capítulo 8. Conclusiones

En esta investigación caracterizamos las estrategias de manejo de recursos naturales y vegetales a través de distintos casos de estudio. También realizamos una valoración sobre ciertos atributos socio-ecológicos del paisaje y posteriormente una valoración sobre los recursos vegetales. Como era nuestra expectativa encontramos diferencias tanto en las estrategias de manejo como en la valoración de acuerdo a los contextos socio-ecológicos, marcadas fuertemente por los sistemas de tenencia de la tierra y los ecosistemas presentes. El acceso diferenciado a los recursos tiene un trasfondo histórico en cómo han ido cambiando los núcleos agrarios, que ha devenido en marcadas diferencias en los derechos sobre la tierra. Los distintos sujetos agrarios tanto en ejidos como en comunidades agrarias adaptan sus estrategias campesinas a los recursos que tienen acceso donde existe una relación entre las distintas estrategias a manera de ‘estrategias acopladas’ en un mismo sitio. Las distintas estrategias poseen portafolios de actividades productivas las cuales moldean el paisaje y el manejo de los recursos. Consideramos que estas diferencias dentro de los núcleos agrarios y entre ellos requieren más investigaciones y más profundas para entender sus causas y consecuencias en torno a la gobernanza ambiental y el manejo sustentable de los recursos.

Estas diferencias en la tenencia de la tierra y sus derechos tienen un efecto en qué y cómo se valoran ciertos aspectos del paisaje dentro de los núcleos agrarios. Por ejemplo, en el caso de la vegetación, la cual posee una valoración altamente heterogénea de acuerdo a diferencias en estos derechos. Además, sujetos agrarios con más derechos sobre los recursos tienen también más información y poder en la toma de decisiones, lo cual modifica los sistemas de valores. En este sentido, consideramos que la valoración sobre ciertos atributos del paisaje y los ecosistemas es altamente dinámica y puede modificarse a su vez. Por otra parte, encontramos que existen recursos críticos para todos los campesinos de la región sin tener en cuenta las diferencias el tipo de tenencia de la tierra, como es la disponibilidad de agua. Recursos altamente valorados como éste pueden representar puntos de coalición para distintas instituciones y actores en la región que ayuden a construir una mejor gobernanza ambiental.

En cuanto a los recursos vegetales observamos que el valor que poseen es un proceso que responde a una combinación de las características intrínsecas del recurso (su abundancia, ciclo de vida, estado silvestre o cultivado) y de qué manera contribuyen al bienestar de las personas en distintas dimensiones (alimenticio, estético, material, medicinal). Recursos vegetales con contribuciones alimenticias destacaron en cantidad, pero también recursos con contribuciones de regulación, especialmente calidad y cantidad de agua fueron importantes. Además, estos valores son variables de acuerdo a las necesidades de cada persona o grupos de personas, por ejemplo, existen diferencias significativas entre las plantas que valoran las mujeres y los hombres. Esta combinación de necesidades, posibilidades y características del recurso dan lugar a decisiones de manejo y estrategias específicas. Los valores y el manejo de los recursos vegetales tienen un significado muy dinámico, que es constantemente reinterpretado; además, vemos que los límites entre los valores instrumentales, intrínsecos y relacionales no son del todo claros y existen traslapos entre ellos. Consideramos que esto es un proceso concatenado donde a través del

conocimiento ecológico tradicional el valor de los recursos se refuerza y diversifica, haciendo la relación entre el recurso y los ecosistemas más cercana.

La lógica campesina dentro de las estrategias a nivel de actividades productivas, manejo del paisaje, así como de recursos específicos como las plantas, está permeada por procesos de diversificación a distintas escalas. En general, el manejo incorpora la diversidad misma de los ecosistemas en ciertos espacios, y la productividad agrícola y transformación de los ecosistemas en otros. A pesar de haber ciertos productores más especializados, la gran mayoría se basan en diversificar tanto sus actividades como el paisaje y los recursos. En este sentido, el paisaje es multifuncional en el espacio y tiempo, ayudando a incorporar la incertidumbre de los sistemas socio-ecológicos que son altamente complejos. Esta lógica campesina contrasta muchas veces con la lógica de los gobiernos y la manera en la que operan en los mismos territorios, buscando muchas veces desmantelar esta multifuncionalidad. Detrás de estas lógicas externas se encuentran procesos macropolíticos y económicos que buscan modificar las decisiones de los manejadores, por ejemplo, en torno a la conservación de los ecosistemas. Además, cada proyecto, programa o política refleja una carga de valores sobre la naturaleza que muchas veces genera discrepancias en cómo deben manejarse los recursos.

Desde nuestra perspectiva, la gobernanza ambiental tiene que poder adecuarse a los distintos contextos socio-ecológicos, asumiendo la diversidad de visiones, valores sobre la naturaleza y diversidad de formas de vida. En este sentido es crucial promover a su vez la diversidad institucional que ayude a mantener un abanico de soluciones de los sistemas sociales a un amplio rango de contextos ecológicos. En estas nuevas configuraciones institucionales se debería dar cabida a todos los sujetos agrarios dentro de las comunidades; para esto los sistemas de tenencia de la tierra necesitan ser flexibles y con la capacidad de modificar y negociar sus propias estructuras. Dentro de estas nuevas negociaciones las valoraciones sobre la naturaleza de los distintos actores deben estar presentes. Para esto es necesario tanto metodologías de valoración como soluciones que incluyan distintas dimensiones del valor y no solo económico. Esto representa un desafío para desarrollar nuevas maneras de pensar, reflejar y comunicar el valor de la naturaleza utilizando distintas aproximaciones. Esto es necesario en medida que queramos hacer posibles y visibles relaciones con la naturaleza más éticas.

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