Impacts of REDD+ in Mexico: Experiences of Two Local Communities in Campeche

Impactos de REDD+ en México: experiencias de dos comunidades locales en Campeche

Jovanka Špirić,[1] Ana Edith Merlo Reyes,[2]
Ma. Liliana Ávalos Rodríguez,[3] M. Isabel Ramírez[4]

Abstract

In 2010, the Mexican National Forestry Commission (Spanish acronym CONAFOR) implemented REDD+ early action activities in priority states, including Campeche. This article explores the impact of the forestry programs promoted under REDD+ on the diversification of household activities, benefit-sharing among local groups, and forest cover changes in two local communities in Campeche. It examines whether the design and implementation of these programs responded to local aspirations for equity and rural development by combining ethnographic and documental methods. In addition, it quantifies land-cover change (2013-2018) using high-resolution imagery and spatial analysis. It found no intracommunity equity or sustainable activity diversification resulting from the REDD+

[1] Corresponding author. Doctorate in Ecological Economics from the Universidad Autónoma de Barcelona, Spain. CONACYT researcher at the Centro de Investigaciones en Geografía Ambiental, Universidad Nacional Autónoma de México, campus Morelia, Mexico. Lines of interest: forest governance, REDD+, forest degradation, public policies, indigenous consultation. ORCID: https://orcid.org/0000-0001-5151-9468. Email: jspiric@ciga.unam.mx

[2] Master's in Geography from the Universidad Nacional Autónoma de México, Mexico. Ph.D. student at Grenoble Alpes University, France. Lines of interest: changes in land use and cover, environmental pollution, environmental governance. ORCID: https://orcid.org/0000-0002-1572-0866. Email: aemerloreyes@gmail.com

[3] Doctorate in Regional Development Sciences from the Universidad Michoacana de San Nicolás de Hidalgo, Mexico. DGAPA-UNAM postdoctoral researcher at the Centro de Investigaciones en Geografía Ambiental, Universidad Nacional Autónoma de México, campus Morelia, Mexico. Lines of interest: environmental legislation and policy, forest degradation, economic valuation, waste management, alternative energies. ORCID: http://orcid.org/0000-0002-8580-5873. Email: lic.ambientalista@gmail.com

[4] Doctorate in Geography from the Universidad Complutense de Madrid, Spain. Titular Researcher B at the Centro de Investigaciones en Geografía Ambiental, Universidad Nacional Autónoma de México, campus Morelia, Mexico. Lines of interest: land use, landscape ecology, forest climatology, environmental policy, community forest management. ORCID: https://orcid.org/0000-0002-6738-1165. Email: isabelrr@ciga.unam.mx

implementation. Deforestation for livestock and agricultural mechanization was the dominant process observed both in dense and open forests. Although it has not made the situation worse, REDD+ has yet to provide social benefits for these two communities. To be considered a viable option locally, the program design under REDD+ must combine the implementation of several sustainable productive activities over a longer period and provide net monetary benefits to all local groups.

Keywords: equity; forest policy; land-use change; REDD+; rural development.

Resumen

En México, desde 2010, la Comisión Nacional Forestal (CONAFOR) implementó actividades de acción temprana REDD+ en estados prioritarios, entre ellos Campeche. En este trabajo investigamos el impacto que han tenido los programas forestales promovidos bajo REDD+ en la diversificación de las actividades de los hogares, la distribución de beneficios entre grupos locales y sobre los procesos de cambio en las cubiertas forestales en dos comunidades de Campeche. Examinamos si el diseño y la implementación de estos programas respondieron a las aspiraciones locales de equidad y desarrollo rural combinando métodos etnográficos y documentales. Asimismo, cuantificamos los cambios en el uso del suelo entre 2013 y 2018 usando imágenes de satélite de alta resolución y análisis espacial. No encontramos equidad intracomunitaria o diversificación sostenible de actividades como resultado de dichos programas. La deforestación para ganadería y la mecanización agrícola fue el proceso dominante tanto en bosques densos como abiertos. En las dos comunidades analizadas, REDD+ aún no aporta beneficios sociales a nivel local. Para considerarlo una opción viable a esta escala, el diseño de los programas REDD+ debe combinar la implementación de actividades productivas sostenibles durante un periodo más largo y proporcionar beneficios monetarios netos a todos los grupos locales.

Palabras clave: cambio de uso del suelo; desarrollo rural; equidad; política forestal; REDD+.

Introduction

The Reducing Emission from Deforestation and forest Degradation, plus promoting conservation, sustainable management of forests, and

Jovanka Špirić, Ana Edith Merlo Reyes,
Ma. Liliana Ávalos Rodríguez, M. Isabel Ramírez

enhancement of forest carbon stocks (REDD+) is an international policy mechanism designed to deliver economic incentives —through carbon markets or conventional financial aid— to developing countries for their efforts in reducing land-use based greenhouse gas emissions (UNFCCC, 2010). REDD's initial idea was presented at the Conference of Parties 11 of the United Nations Framework Convention on Climate Change (UNFCCC) and only included avoiding deforestation and forest degradation. Its scope was subsequently broadened to include conservation, sustainable management of forest, and forest carbon stock enhancement, and it was renamed REDD+ (UNFCCC, 2005; 2007; 2010). The adoption of activities that do not directly reduce emissions allowed the participation of low deforestation countries and actors involved in land uses other than forestry. Over the years of international negotiations, REDD+ became concerned not only with climate change mitigation, i.e. carbon benefits, but also with the promotion of social (rural development and poverty reduction) and environmental benefits (biodiversity and ecosystem services), i.e. non-carbon benefits (Lederer, 2012).

To ensure non-carbon benefits, REDD+ activities must comply with seven broad safeguards: 1) complementarity, 2) transparency, 3) participation, 4) respect for indigenous and local communities' rights, 5) biodiversity and ecosystem services protection, 6) permanence of carbon reservoirs, and 7) emission leakage prevention (UNFCCC, 2010). In particular, safeguard five, biodiversity and ecosystem services protection, calls for ensuring that REDD+ is not used to convert dense forests to monocultures of fast-growing, exotic species, which are efficient for sequestering carbon dioxide (CO_2) but not for preserving biodiversity and ecosystem services or enhancing local communities' livelihoods (UNFCCC, 2010). Accordingly, REDD+ safeguards should primarily guarantee additional co-benefits by mitigating the risk of negative social and environmental impacts (Pasgaard et al., 2016). REDD+ countries can choose which approach to adopt: 1) the *effectiveness* approach, focused on CO_2 reduction as a means to achieve climate change mitigation, and guarantee no harm is caused to local people, or 2) the *equity or pro-poor* approach, considering REDD+ as an integrated rural development program affording local people net social benefits (McDermott and Schreckenberg, 2009; Bayrak and Marafa, 2016).

Hundreds of REDD+ projects and programs have been implemented at subnational levels (regional, state, and local) by a variety of actors (non-profit organizations, private companies, and governments) in developing countries (Sills et al., 2014; Sunderlin et al., 2015). These initiatives provide a range of monetary and non-monetary REDD+ benefits: 1) *rents* or *net benefits*, i.e. gross benefits minus the costs accruing from REDD+ implementation (transaction costs) and foregone revenues (opportunity costs), 2) *incentives* to promote desired behaviors or practices,

3) *compensations* to cover foregone revenues, and 4) *interventions* or specific policies and measures to create the legal, administrative, and technical conditions required for effective REDD+ implementation (such as strengthening local governance) (Gebara, 2010; Peskett, 2011; Luttrell et al., 2013). The type of benefits that will be available depends on the source of REDD+ funding. Market finance is more likely to reward actors based on their performance to reduce CO_2 emissions or increase CO_2 sequestration (Luttrell et al., 2013). These results-based payments require more significant upfront investments, limiting the participation of the poorest actors (Lee and Mahanty, 2009). Fund-based finance could allow a more flexible approach centered on input-based payments to implement activities assumed to impact forests positively (Luttrell et al., 2013), and have a greater potential to augment equity in REDD+ benefit-sharing (Peskett, 2011).

The debate about REDD+ benefit-sharing at the national level revolves around how benefits from international sources should be distributed among national governments and other actors (vertically) (Pham et al., 2013). In principle, clear carbon rights and policies that channel benefits to land-use actors should ensure that national governments do not pocket REDD+ funds (Peskett, 2011). Carbon rights, including those to exploit the financial benefits of forest carbon may be determined on the basis of existing property rights over forests. Nevertheless, the relation between forests and land tenure is not always straightforward. Even if people legally own the forest, they may not have the right to promote forest management oriented towards emissions reduction or carbon removal or benefit from the sale of the resulting carbon credits (Karsenty et al., 2014). Alternatively, benefits could go to: 1) actors achieving emission reductions, 2) low-emitting forest stewards, 3) the bearers of most of the REDD+ costs, or 4) the poorest actors (Luttrell et al., 2013).

The issue of REDD+ equity across local actors (horizontally), including intra-communal equity among multiple groups (Pham et al., 2013), has received less attention in national discussions. In theory, intra-communal equity could be enhanced by policies that target marginalized groups, whose participation could be hindered by their social conditions (such as gender, ethnicity, land endowment), and by promoting collective non-monetary benefits (such as schools and hospitals) to prevent monetary accumulation by powerful local groups (elite capture) (Mohammed, 2011).

In 2008, Mexico entered REDD+ Phase 1: Readiness (UNFCCC, 2010), and formulated the National REDD+ Strategy (2017-2030) (Spanish acronym ENAREDD+). This strategy is designed as a set of productive and conservation activities from forestry and agriculture to promote *sustainable rural development* (CONAFOR, 2017a). The ENAREDD+ milestones to be achieved by 2030 include 1) zero net deforestation rate,

2) significant reduction in forest degradation rate, 3) increase in carbon stocks by expanding forest areas under sustainable management, regeneration, and conservation, 4) conservation of biodiversity and other environmental services, 5) development of the social and economic capital of rural communities, and 6) adoption of the best sustainable production practices throughout rural landscapes (CONAFOR, 2017a: 48).

In Mexico, property rights over carbon stocks and gains resulting from conservation, reforestation, or sustainable forest management ('plus' activities) are held by both *formal rights-holders* and *legal land possessors*. Formal forest rights-holders are small, individual, private property owners or members of collective land tenure systems (agrarian communities and *ejidos*). Legal land possessors are community members with land yet lacking the whole bundle of rights to determine its access and use. However, any monetary income from the commercialization of carbon credits will be received by the government, redirecting it to local forest owners and possessors through public programs (CONAFOR, 2017b).

To test the feasibility of REDD+ Phase 2: Implementation on the ground (UNFCCC, 2010), in 2010, the National Forestry Commission (Spanish acronym CONAFOR) implemented REDD+ early actions (Spanish acronym ATREDD+) in regions experiencing high deforestation rates in the states of Jalisco, Oaxaca, Chiapas, Yucatán, Quintana Roo, and Campeche (CONAFOR, 2015). The forestry sector was the first to align and harmonize its existing policies and programs with REDD+ objectives and design new ones, such as the Special Program for each early action area (CONAFOR, 2017a). Early REDD+ implementation is supported by the Emission Reduction Initiative (2018-2023) (Spanish acronym IRE), designed to test REDD+ Phase 3: Results-based payments. The resulting carbon credits from avoided deforestation and forest degradation will be sold to the Forest Carbon Partnership Facility's (FCPF) Carbon Fund (CONAFOR, 2017a). During the first three years, implementation of IRE activities will be supported by government subsidies. From the third year onwards, the corresponding FCPF payments will be transferred to the national fund and subsequently to the subnational funds in proportion to the CO_2 emissions reduction of each region or state. Finally, REDD+ payments will reach local beneficiaries through public subsidies (CONAFOR, 2017b; FCPF, 2015).

It is essential to incorporate the promotion of non-carbon benefits into the design and implementation of REDD+ policies, considering the links between economic, environmental, and social aspects of land-use change (Lawlor et al., 2013). Accordingly, the overall REDD+ effectiveness should be understood as the extent to which policies target the drivers of deforestation and forest degradation; support conservation, sustainable management, and the forest carbon stock enhancement of native forests;

and promote the improvement of rural economies of all local forest-dependent groups (Vatn and Vedeld, 2011).

Studies on REDD+ implementation at the local level have focused principally on individual REDD+ pilot projects, finding insignificant social outcomes and only moderately favorable carbon outcomes (Sunderlin et al., 2017; Duchelle et al., 2018; Milne et al., 2019). In Mexico, studies on early implementation focus on state and regional levels and conclude that REDD+ has failed to meet its objectives due to policy inertia, insufficient budget, and the need to strengthen the capacities of local forest owners (Deschamps et al., 2015; Trench et al., 2018; Almanza et al., 2020). In the Yucatán Peninsula, Ellis et al. (2020) reported that REDD+ failed to reduce deforestation at the municipal level yet revealed potential successes in local communities with low deforestation rates and community forest management.

Ethnographic research providing nuanced accounts of early REDD+ implementation on the ground, including its local impacts and outcomes, remains scarce in Mexico. Local-scale ethnographic methods could help characterize the subtler socio-political dynamics, to reveal fundamental constraints on REDD+ application, and suggest key insights for practitioners on how to adapt policies with bottom-up feedback (Matland, 1995; Milne et al., 2019).

This research uses a combination of documents and qualitative ethnographic data, and spatial analysis to examine the social impacts of REDD+ in two communities in the state of Campeche: Xmabén and La Mancolona. In particular, we looked at whether local households' activities were diversified, taking advantage of the forestry programs offered in the national REDD+ approach. In addition, we examined whether diversification responded to the preferences and aspirations for REDD+ activities and benefits distribution of different local groups. Our results provide insights into local social impacts and forest cover and land-use dynamics during the early stages of REDD+ implementation that could inform national policy processes in Mexico.

Local case studies

The communities of Xmabén and La Mancolona are located in two neighboring municipalities: Hopelchén and Calakmul, in the state of Campeche (Figure 1). Both communities had been involved in ecosystem conservation activities, for which they received economic compensation, but differ as regards productive activities, type of land tenure and organization (Méndez-López et al., 2015).

Figure 1. Location of Xmabén (Hopelchén) and La Mancolona (Calakmul), Campeche, Mexico
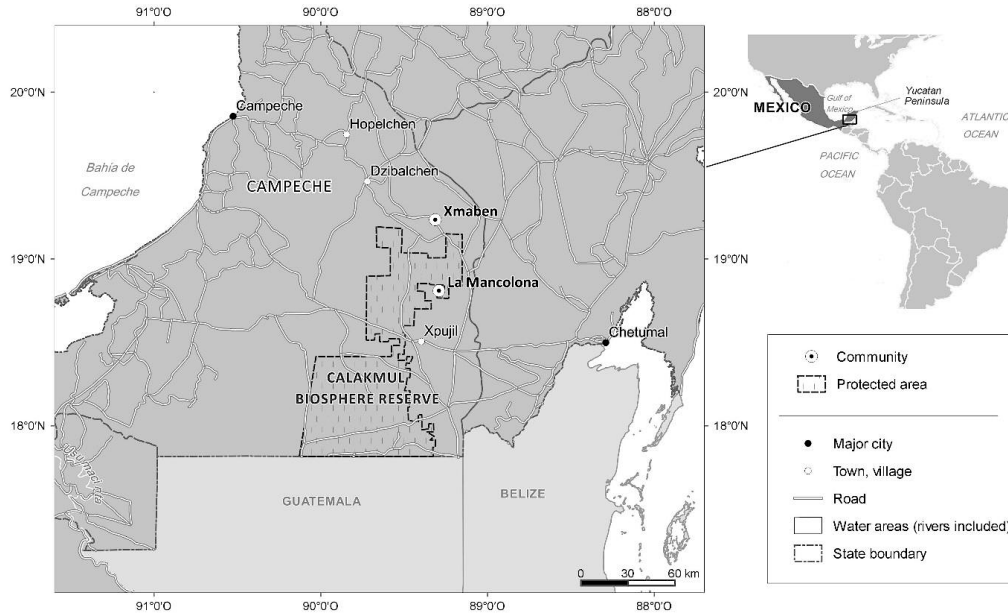
Source: compiled by the authors with cartographic data from the Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO), Global Administrative Areas database (GADM), and Digital Chart of the World (DCW), 2016.

Xmabén

Xmabén is in the municipality of Hopelchén, and 14 kilometers north of the Calakmul Biosphere Reserve (CBR) (Figure 1). The community, founded in 1861, was recognized as an *ejido* in 1929. It has approximately 250 households and 1 300 inhabitants of Yucatec Maya origin (CONSERVCOM, 2010a). Only 216 people (11 women) are *ejidatarios*, landholders who share rights over 31 725 collectively managed hectares (Méndez-López et al., 2015). Adult male community members without land rights (non-rightsholders) are known as *comuneros* (n = 96 households). Most non-rightsholders have obtained usufruct contracts on up to two hectares of agricultural *ejido* land in exchange for community work. In 1999, the *ejidatarios* sold 5 669 ha to industrialized Mennonite farmers (Porter-Bolland et al., 2008).

The *ejido* assembly leads the internal organization of Ejido Xmabén. It is run by the *ejido* commissariat (*comisariado ejidal*), comprising three representing officers (the *ejido* commissary, secretary, and treasurer) elected every three years in addition to a three-member surveillance council. Xmabén has had formal internal regulation since 2004 and a land management plan since 2006. A municipal commissary (*comisario municipal*) and his secretary are the auxiliary municipal authorities in charge of the village.

Between 2000 and 2010, the expansion of agricultural areas due to federal agricultural and livestock programs (Spanish acronym PROCAMPO and PROGAN) were the main deforestation drivers (CONSERVOM, 2010a). During the period 2004-2009, Xmabén participated in a federal Hydrological Service Payments program (Spanish acronym PSAH) (Méndez-López et al., 2015). As a result of the history of *ejido* land-use, in 2010 it included dense forests (82 %), secondary open forests locally known as *acahuales* (8 %), *milpas*[5] and mechanized agriculture (6 %), and livestock grazing (4 %).[6] Beekeeping is also a significant economic activity within forested areas (Porter-Bolland et al., 2008).

La Mancolona

La Mancolona is in the municipality of Calakmul, within the CBR buffer zone (Figure 1). The community is currently inhabited by approximately 480 people distributed among 90 households (Méndez-López et al., 2015). The inhabitants are Maya-Tzeltal migrants from Chiapas, who were relocated twice before settling in their current location in 1992 (CONSERVCOM, 2010a). Due to the changes to Article 27 of the Mexican Constitution in 1992, the community was granted individual property deeds rather than *ejido* status (CONSERVCOM, 2010a). The community includes 5 200 ha divided among 98 small private properties, 33 of which are owned by women (CONSERVCOM, 2010c). The male non-rightsholders (29) are locally known as *pobladores*.

La Mancolona only has auxiliary municipal authorities and currently does not have a local land-use plan. Nevertheless, its inhabitants consider themselves a community, and as in *ejidos*, hold assemblies with all the adult members of the community, both women and men, with and without rights to the land (Méndez-López et al., 2015). The self-appointed communal authorities include a commissary, a secretary, a treasurer, and three local community members who act as local policemen. The community assembly is the highest local authority. The community lacks an internal regulation document but uses the compendium of proceedings from previous assembly sessions and a list of the municipal authorities' fines. The community infrastructure within the village is available to all inhabitants, who must provide maintenance services through community work (CONSERVCOM, 2010b).

Between 2000 and 2010, forest clearing for livestock production, supported by PROGAN, was the main driver of local deforestation (CONSERVCOM, 2010a). In 2010, village land comprised forests (83 %) and

---

[5] The traditional slash-and-burn agriculture system that includes intercropping maize, beans, and squash.

[6] An estimate from CONSERVCOM (2010b), excluding the area owned by Mennonites.

Jovanka Špirić, Ana Edith Merlo Reyes,
Ma. Liliana Ávalos Rodríguez, M. Isabel Ramírez

acahuales (9 %), *milpas* (4 %), pasture (3 %), and urban areas (1 %) (CONSERVCOM, 2010c). La Mancolona people are organized into productive activities groups such as allspice (*Pimenta dioica*) production and beekeeping. A group of men and women participate in the local ethno-eco-tourist center and a tree nursery associated with the CBR.

Methods

Ethnographic data

A series of qualitative techniques were used to determine whether household subsistence and income-generating activities were sustainably diversified with REDD+. Ethnographic data were collected in 2013 during the first author's doctoral project, and as part of several research projects undertaken between 2017-2019 (see Acknowledgements).

HOUSEHOLD INTERVIEWS

A series of structured interviews were conducted with households to identify local livelihood activities and preferences regarding REDD+ activities and benefits. In 2013, 39 of 251 households in Xmabén (27 with land rights and 12 without), and 38 of 90 households in La Mancolona (26 with land rights and 12 without) were interviewed. In the former, 70 % of the respondents were men and 30 % women; in the latter, 60 % were men and 40 % women. The structured interviews used a list of set questions presented in the same way to all respondents to obtain quantitative and qualitative data (Newing, 2011).

The interview guide comprised two sections: first, a questionnaire with short, set, closed-ended questions eliciting information on specific, quantifiable variables defined in advance (Newing, 2011) to determine household livelihood strategies (income sources, subsistence activities, main crops, and government program support). To analyze the change in strategies, in 2019, the questionnaire was repeated with 25 households in La Mancolona, 15 with land rights and 10 without (14 men and 11 women). We used SPSS (Statistical Package for the Social Sciences) to generate descriptive statistics of the household socio-economic data.

The second section of interview guide included a list of open-ended questions on the issues surrounding the benefit-sharing from REDD+. We asked our respondents to suggest acceptable activities to support forest preservation and recovery and stop forest loss. This was followed by questions on four key REDD+ activity design topics: 1) concrete practices, 2) participants and beneficiaries from those activities, 3) type, frequency, and timing of benefits, and 4) contract duration.

KEY INFORMANTS' INTERVIEWS

In 2013 and 2017-2019, a series of semi-structured interviews with key informants were conducted to understand the local socio-economic and biophysical contexts in Xmabén (9) and La Mancolona (9). They included local authorities and productive activity group leaders and representatives. An interview guide with open-ended questions was designed on the following topics: major community events, government and non-government support, and community/group organization, needs and conflicts. Although respondents were allowed to expand on the issues, the guide helps maintain the focus on the topics of interest. The initial answer to each question was followed up with further questions or requests for comments to encourage a conversation (Babbie, 2006; Newing, 2011).

Interview transcripts were analyzed using the scissor-and-sort technique (Stewart et al., 2006). The first step involved assigning codes to sections within the transcript corresponding to the topics explored in the interviews. In the scissor part of the technique, the different sections assigned with a same code were cut out. In the sort part, these sections were grouped together. Finally, an interpretative analysis of the groups of text sections assigned with a same code was performed.

FOCUS GROUPS

A. BENEFIT-SHARING SCENARIO-BUILDING

In 2013, the data on activities and benefit-sharing obtained in the second section of household interviews was analyzed while the interviewers were still in the field. Its results were used to structure focus group questions. First, qualitative responses were grouped into themes. Second, the four most common themes for each of four key REDD+ activity design topics were combined into four hypothetical *REDD+ scenarios* to be discussed in focus groups to test preferences regarding REDD+ activities, benefits, and distribution. Finally, the qualitative content analysis of interviews with key informants was used to refine the design of the scenarios.

B. FOCUS GROUP IMPLEMENTATION

Focus groups are designed to hold a guided discussion with several individuals on a particular topic (Onwuegbuzie et al., 2009; Newing, 2011). In this case, they were used to explore various community groups' preferred combinations of REDD+ activities and benefit-sharing. The REDD+ scenarios were discussed in four focus groups per community: rights-holders, non-rightsholders, women, and authorities. Focus groups were separated to encourage participation by women and non-rightsholders, whose views and priorities are often overlooked in REDD+ discussions (Onwuegbuzie et al., 2009; Enright et al., 2013). In Xmabén, 21 people (including five women)

Jovanka Špirić, Ana Edith Merlo Reyes,
Ma. Liliana Ávalos Rodríguez, M. Isabel Ramírez

participated: 10 with land rights, six without, and five as authorities with rights. In La Mancolona, 24 people (including eight women) participated: ten with land rights, eight without and six as authorities with rights.

The four REDD+ scenarios were presented to the focus groups' participants, who ranked them according to their personal preferences (Newing, 2011). Each participant was asked to rank the scenarios from the most to the least attractive using numbered cards. Group preferences were calculated using the following three-step procedure: 1) each scenario was assigned 3, 2, 1, or 0 points according to their placing in the individual ranking (1st, 2nd, 3rd, or 4th), 2) the total points assigned to each scenario were calculated adding all participants' votes, and 3) the totals for each scenario were compared, and those with the highest and lowest sums being considered the most and least preferred, respectively (see Supplementary Material). The ranking was discussed with the focus group participants, and then the exercise was repeated.

C. FOCUS GROUPS ANALYSIS

Both quantitative and qualitative procedures were used to analyze the information from the focus groups. First, the results of the second ranking were used to determine the final group preferences. Overall community preferences were calculated from the groups' preferences using the same procedure. Second, a qualitative data analysis of the focus group transcripts was performed using the scissor-and-sort technique (Stewart et al., 2006). The codes were assigned to the sections in the focus group transcripts corresponding to the four key REDD+ activity design topics. The different sections assigned the same code were cut out (scissored), grouped (sorted), and interpreted.

Document analysis

The official documents, operation rules, and databases of all government forestry programs were reviewed to identify those eligible for Hopelchén and Calakmul's municipalities, and implemented in Xmabén and La Mancolona during the period 2010-2019. These included existing programs and new ones specially designed for REDD+ early action implementation.

The operating rules of the programs were analyzed using the following criteria: program aims and contribution to REDD+ objectives; specific activities and practices promoted; time-frame of the program; type of economic benefits (incentives, rent or compensation; monetary or in-kind; individual or collective); the amount of these benefits; target population; and target ecosystem.

Spatial analysis

Spatial analysis was used to complement ethnographic methods to identify the diversification of local activities during the early REDD+ implementation. Satellite images from 2013 and 2018 were analyzed to identify and quantify forest cover and land use changes. We used multispectral satellite images SPOT 5 from 2013, and Sentinel from 2018, both with a spatial resolution of 10 meters and processing level 2A, and a mixed-method of image segmentation (Spring software, v. 5.4.3) and visual interpretation to generate the land-use/land-cover map from 2013. The minimum mappable area was 0.2 ha. The 2013-2018 land-cover change was analyzed with a visual interdependent interpretation procedure (FAO, 1996), updating the polygons from 2013 with the 2018 image. The resulting maps were verified with ground checkpoints. Finally, one map was superimposed over the other to measure the differences in the area of each category presented in the transition matrix.

The forest-change processes 2013-2018 were classified and quantified for each community: 1) deforestation—forests converted to farmland or other non-forest uses, 2) degradation—dense forests became shrub vegetation, *acahuales* or open forest, 3) forest recovery—a forest redensification trend in previously disturbed areas, and 4) revegetation— farmland or other non-forest uses changed to an initial forest secondary succession. The processes when land cover categories remained in the same state along the observed period were defined as 1) conservation—dense forest remained unchanged, 2) forest degradation permanence—open forest stayed in the same category, and 3) farmland permanence—pasture and agricultural lands remained in the same category or were reconverted from one to the other.

The polygon of the Xmabén *ejido* was downloaded from the National Agrarian Register (Spanish acronym RAN) webpage and did not include the village comprising private properties. The polygon of La Mancolona was delimited using information and spatial data from official adjacent data polygons and included the village.

Results

Forestry programs for early REDD+ implementation

Since the implementation of ATREDD+ in 2010 and until 2019, five federal forestry programs were implemented in Hopelchén and Calakmul, Campeche, all aligned with REDD+ objectives (Table 1). ProÁrbol (2010-2012) was CONAFOR's overarching program, promoting a broad spectrum of forest activities, human and social capacity building, and social and technical studies for conservation. In addition, the Special Program for the

Jovanka Špirić, Ana Edith Merlo Reyes,
Ma. Liliana Ávalos Rodríguez, M. Isabel Ramírez

Sociedad y
Ambiente

Yucatán Peninsula (PEPY) (2012-2016) included other specific activities such as fire prevention, agroforestry, silvopastoral systems, and *acahual* management. At the same time, the Community Forestry Development Project in Southern States (Spanish acronym DECOFOS) (2012-2015) provided support for workshops, seminars, technical studies, and technology transfer for strengthening local capacities to undertake activities supported by PEPY. From 2014-2018, the National Forest Program (Spanish acronym PRONAFOR) was implemented in parallel to PEPY, supporting all previously mentioned forestry activities until it was replaced by the new umbrella program for Sustainable Forest Development (SFD) in 2018.

**Table 1. Forestry programs and activities eligible
for early implementation in Hopelchén and Calakmul
municipalities (2010-2019), Campeche, Mexico**

Activities	ProÁrbol (2010-2012)	PEPY (2012-2016)	DECOFOS (2012-2015)	PRONAFOR (2014-2018)	SFD (2018-ongoing)
Payments for Ecosystem Services (PES)	X, M	X, M		X	X, M
Forest restoration and reforestation	X, M			X	X, M
Timber and non-timber products	X, M	X, M		X, M	X, M
Studies and technology transfer	X, M	X, M	X, M	X, M	X, M
Local forest governance	X, M	X, M			X, M
Fire prevention		X, M			
Workshops and seminars			X, M		X, M
Tree nurseries			X, M		
Agroforestry		X, M	X, M	X, M	X
Silvopastoral systems		X, M			
Acahual management		X, M			X, M

Source: compiled by the authors. Abbreviations: X- Xmabén (Hopelchén), M- La Mancolona (Calakmul).

FOREST ACTIVITIES IMPLEMENTED IN XMABÉN

A variety of forest activities covering a full range of REDD+ objectives were implemented in Xmabén during the investigated period (Annex 1). In 2011, the *ejido* signed a five-year contract with the PSAH to preserve 5 631 ha of dense forest. Additionally, a private organization funded conservation of 1 424 ha of forest for three years. *Ejidatarios* organized into groups of 10 participated in firebreak opening, deadwood removal, and surveillance, according to the management plan they drew up during the first year of the contracts. The annual cash income was divided equally among the *ejidatarios*, leaving them net monetary benefits. A small sum was set aside as a community emergency fund. In 2013, the *ejido* signed a new five-year PES contract for the conservation, restoration, and sustainable management of

69 ha of forest surrounding a small body of water. Due to the small area supported, it was locally known as the enlargement of the existing PSAH area.

Xmabén also participated in two reforestation programs. In 2010, 100 ha of open forest affected by fire were reforested with local timber and fodder tree species. In 2011, reforestation was performed as a complementary activity in the PSAH area. Only *ejidatarios* were the direct participants and beneficiaries. The cash payment for the reforestation and maintenance of reforested areas was just enough to cover the transaction costs of forest gap opening, soil preparation, tree planting, dead plant replacement, furrow digging, weed control, and fertilization. The following year, this program was canceled due to the failure to submit an annual report to CONAFOR.

From 2012 onward, reforestation was only performed in the annually harvested areas, as part of the requirements of the 20-year harvesting permit of 2 644 ha obtained in 2010. Forest regrowth in harvested areas was supported with funds for thinning and pruning. The *ejido* was selling roundwood, but had plans to certify its timber, supported with money to contract technical assistance. However, this process was not completed due to internal *ejido* administration problems. In 2016, forest harvesting was suspended after being perceived as being unprofitable.

In 2013, the *ejido* received funding to reactivate a community tree nursery to produce native plants for local reforestation and commercialization. However, this attempt failed due to internal administration conflicts. In an attempt to diversify productive activities, a group of 10 *ejidatarios* received funds and technical assistance to establish citrus tree agroforestry systems in degraded forests (15 ha). In 2014, the amount offered by this program was reduced by 40 %, which was not sufficient to cover transaction costs (such as training, technician salaries, plants, and fertilizers), and the *ejidatarios* decided not to participate.

The strengthening of local forest governance was supported by the P-Predial document (2012), the workshops to modify the *ejido* regulations (2013-2014), and the community forest promoter (2015). However, only the forest promoter position (a young *ejidatario* tasked with supporting *ejido*'s authorities in community forestry development) was rated successful. However, this was merely a one-year position. The *ejido* assembly did not approve the new versions of the internal regulations because only the local authorities and the contracted technician participated in its drafting. Consequently, the *ejido* had to refund the corresponding sums to CONAFOR. The formulation of P-Predial, a five-year community forest development plan to align the implementation of all forestry subsidies and promote territorial planning, was also unsuccessful.

During the period 2016-2019, no forestry program was implemented in Xmabén, except for the second PES contract concluded in 2018. Key

informants suggested that since the problem with reforestation (2012) and internal regulation (2013) programs, the *ejido* had been reluctant to participate in forestry programs. Furthermore, local perception was that CONAFOR intentionally limited the list of activities eligible for implementation in Xmabén.

FOREST ACTIVITIES IMPLEMENTED IN LA MANCOLONA

In the period analyzed, PES was the only forestry activity undertaken in La Mancolona (Annex 1). In 2010, a group of 38 community members combined their forested plots (25-90 ha each) to obtain 1 631 ha compensated for by the PSAH program with a five-year contract. In 2016 a second five-year contract was signed by 20 community members for a biodiversity service payment of 454 ha. The activities, performed on each plot by its landowner, included firebreak opening, deadwood removal, surveillance and construction of water containers for wild animals, etc. Except for the plant purchase contract with CONAFOR in 2011 and 2012, there was no other support for community tree nursery operation or local reforestation activities. One of the reasons for the low number of programs implemented was the PEPY fund reduction in 2014. Additionally, from 2017 to 2019, Calakmul municipality was ineligible for REDD+ funds and IRE implementation because of its low deforestation rates.

Community preferences for REDD+ scenarios

The hypothetical scenarios designed with the information obtained in household interviews encompassed the four central activities locally perceived as achieving the REDD+ carbon objectives: 1) reforestation, 2) agroforestry/silvopastoral systems, 3) agricultural mechanization, and 4) forest carbon PES (Table 2).

Table 2. REDD+ scenarios designed and discussed in Xmabén and La Mancolona, Campeche, Mexico

| Scenario	Activities	Direct participants and beneficiaries	Type of compensation	Frequency and timing	Contract duration (in years)
Xmabén					
1	Reforestation of *acahuales* (50 ha) with melliferous trees	Ejidatarios	Collective, cash payments and in kind (plants, equipment)	Annually, ex-ante	5
2	Silvopastoral system with forage grass (1 ha) and trees (0.25 ha)	Ejidatarios	Individual in kind (equipment and organic agricultural supplies)	Annually, ex-ante	3

3	Agricultural mechanization (< 2 ha)	*Ejidatarios* and *comuneros* with usufruct agreement	Collective in kind (small tractors); individual in kind (organic agricultural supplies, native seeds)	Annually, ex-ante	5
4	Forest carbon PES	Ejidatarios	Individual cash payments	Annually, ex-ante and ex-post	20
La Mancolona					
1	Reforestation of *acahuales* with timber species (0.25 ha)	Landowners and *pobladores* with usufruct agreement	Individual cash payments and in-kind (plants and equipment)	Annually, ex-ante and ex-post	5
2	Agroforestry with melliferous trees and allspice (0.5 ha)	Landowner	Individual cash payments; communal infrastructure	Annually, ex-ante	7
3	Agricultural mechanization	Landowners and *pobladores* with usufruct agreement	Collective tractor; individual cash payments and in kind (organic agricultural supplies, native seeds)	Annually, ex-ante	5
4	Forest carbon PES	Landowners	Individual cash payments	Annually, ex-ante and ex-post	20

Source: compiled by the authors.

The two communities differed in the way they prioritized REDD+ scenarios. For example, in Xmabén, people were more inclined towards productive activities, whereas in La Mancolona preferred combining production and conservation (Figure 2). Similarly, preferences for the scenarios differed between the local groups within the communities (Figure 3).
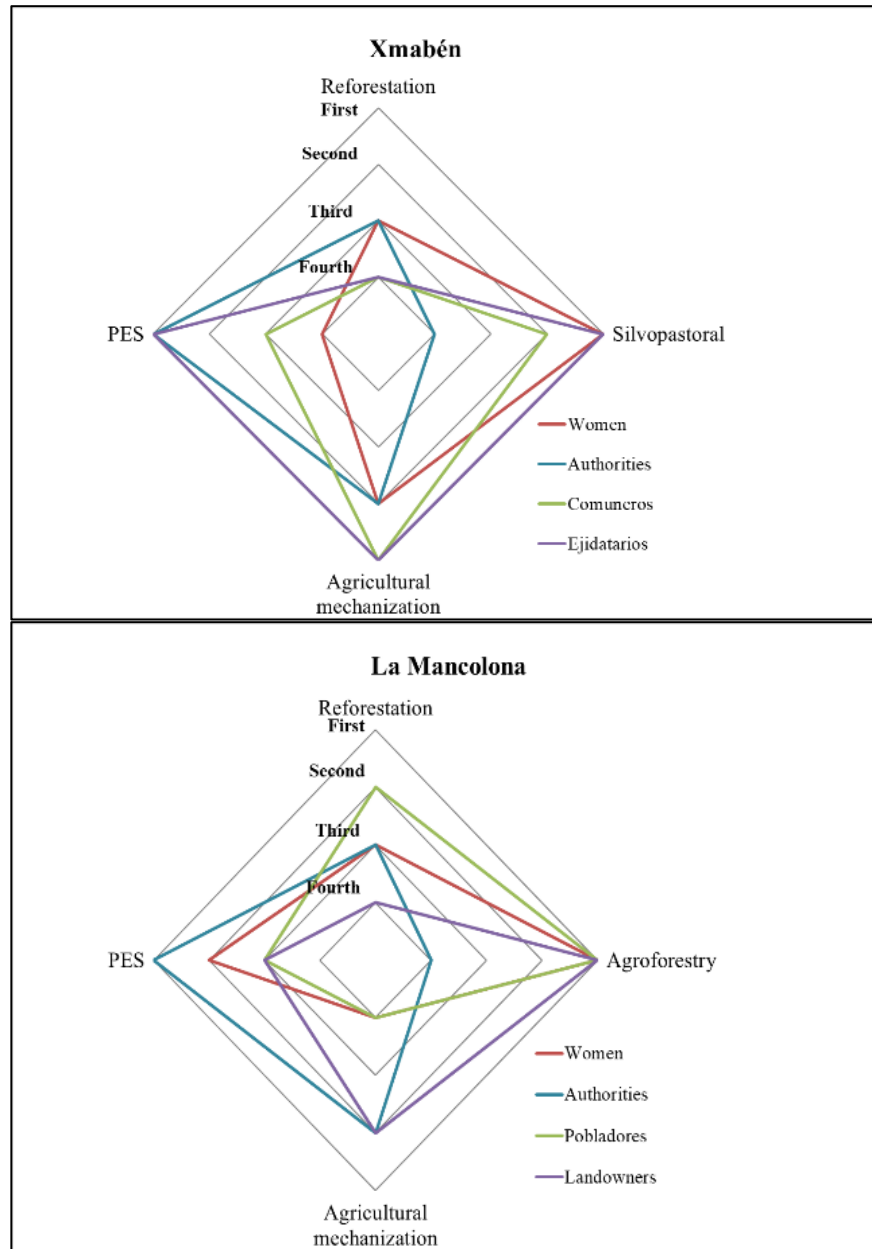
**Figure 2. Local community preferences for REDD+ scenarios,
Xmabén and La Mancolona, Campeche, Mexico**
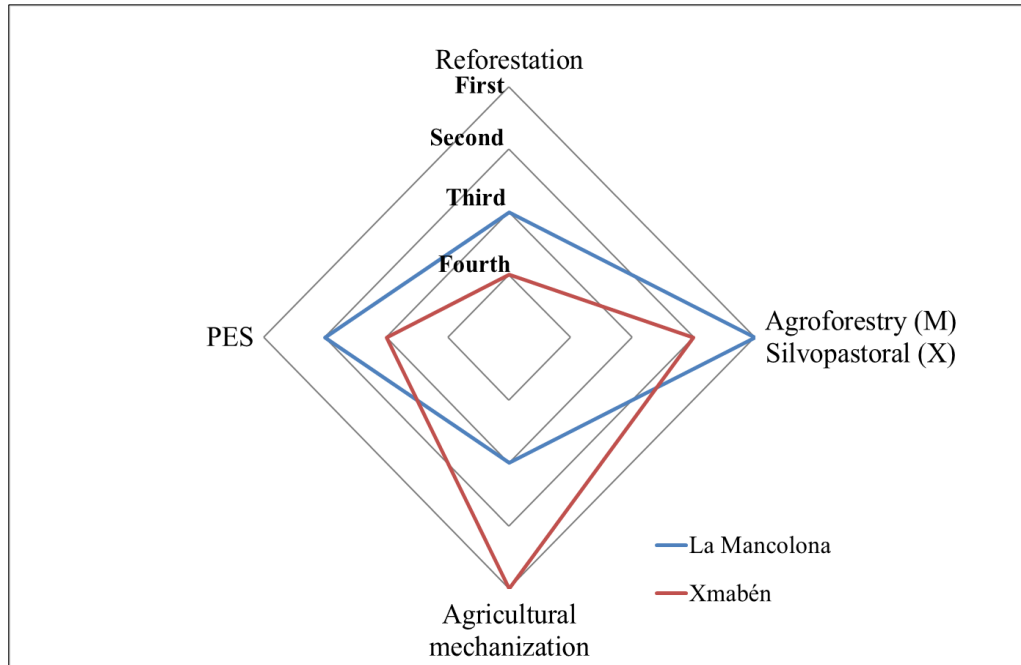
Source: data from focal groups. Abbreviations: PES- Payment for Ecosystem Services, X- Xmabén, M- La Mancolona.

**Figure 3. Local group preferences for REDD+ scenarios,
Xmabén and La Mancolona, Campeche, Mexico**

Source: data from focal groups. Abbreviations: PES- Payments for Ecosystem Services, X- Xmabén, M- La Mancolona.

LOCAL GROUP PREFERENCES FOR REDD+ SCENARIOS IN XMABÉN

Scenario 1: Reforestation was the least preferred in Xmabén owing to the ineffectiveness of previous reforestation, and because the *ejido* did not have a large enough area to be reforested under a collective contract, merely small

patches of burnt forest surrounding the *milpas*. Focus groups participants thought melliferous species were not scarce in local forests, and that REDD+ should provide them with beekeping equipment and hives instead. *Comuneros* did not like the reforestation scenario, since they could not participate, even as workers, in the community tree nursery because the *ejidatarios* run it. Regarding the problems with the tree nursery fund administration, the *ejidatarios* suggested that loans would be a more suitable type of benefit for its operation than subsidies.

Scenario 2: The silvopastoral system was among the most preferred in Xmabén because livestock production was thought to contribute most to household income. Focus groups participants appreciated that this scenario included support in equipment to optimize the use of agricultural residue as livestock feed. The women' group added that silvopastoral activities should be supported for at least ten years or until planted fodder trees mature. Only the authorities' group considered the proposed improvements unrealistic, particularly the stall-feeding and limiting livestock production area, because of local grazing practices on open pasture.

Scenario 3: Agricultural mechanization was the most preferred activity in Xmabén, arguably due to the favorable conditions for it and its positive impact on household economy and subsistence. Because the *ejido*'s productive zone is limited in size and unevenly divided, *ejidatarios* were against allowing *comuneros* to participate in this scenario. Some of them even suggested land parcellation and privatization to increase the control of each family's areas. Authorities added that support for mechanized agriculture should last 20 years, which would allow them to buffer low-yield years.

Scenario 4: Forest carbon PES was perceived as the best way to continue receiving revenue for the well-preserved *ejido*'s forests. However, focus groups participants complained about low payments and the hunting ban, since bushmeat is an important food source. They also requested that any future REDD+ conservation activity should guarantee that targeted forests would always remain in their property. Only the *comuneros* did not like this scenario because they could not participate in its activities.

LOCAL GROUP PREFERENCES FOR REDD+ SCENARIOS IN LA MANCOLONA

Scenario 1: Reforestation was also the least preferred in La Mancolona. However, the focus group participants did not dislike reforestation, but considered agroforestry to be more efficient and profitable in areas of less than 5 ha. Local authorities considered reforestation should only be performed as a complementary income-generating activity in PES areas. Only *pobladores* showed a preference for this scenario because it would allow them to participate directly through usufruct agreements.

Scenario 2: Agroforestry was among the most preferred in La Mancolona, since planting native melliferous and allspice trees supports beekeeping, which all local groups practice. These trees also provide timber and non-timber forest products. Focus groups participants liked the fact that this scenario included six year contracts. *Pobladores* valued the fact that this activity included the community infrastructure as a benefit. At the same time, the authorities thought it was unfair that those who did not invest their time and money in reforestation should enjoy the benefits.

Scenario 3: Agricultural mechanization was one of the least preferred. The authorities and landowners perceived that mechanization would increase productivity, and reduce the use of fertilizers and costs of day laborers (mostly *pobladores*). They considered that there would be no problem for various households to share a tractor. However, funds for agricultural supplies, seeds, equipment, and technical assistance should be provided over longer contract periods. Women and *pobladores* mentioned the unfavorable biophysical conditions for mechanized agriculture in the community. They suggested that improved manual land cultivation would be a more appropriate alternative, enabling them to participate directly in agricultural production.

Scenario 4: Forest carbon PES was considered a logical continuation of current conservation activities. However, payment should be pegged to the annual inflation rate. Women liked the positive impact of forest cover preservation on beekeeping, but were concerned that firewood collection would be limited. Although landowners approved of 20-year contracts, they voiced their concern that the government might expropriate their forests. Only *pobladores* disliked the PES scenario because they could not participate in it.

Local REDD+ impacts

LOCAL ACTIVITIES IN XMABÉN

In 2013, the households interviewed in Xmabén identified four productive activities as their principal source of subsistence and monetary incomes: traditional agriculture, beekeeping, livestock production, and mechanized agriculture. Traditional agriculture was primarily practiced for subsistence. In turn, beekeeping was the main income-generating activity, engaged in by half the households, followed by large livestock production, practiced by a third of our sample. Mechanized agriculture for maize was practiced by half of the households sampled for subsistence and monetary income. Several families reported raising sheep and agroforestry for citrus fruits as income-generating activities. All the *ejidatario* families engaged in forest harvesting to obtain a monetary income.

According to key informants, the *ejido*'s decisions had been oriented toward productive activities in recent years. In 2014, the *ejido*'s management plan was changed to include more areas for productive activities. They

explained that the increase in land area under pasture was due to the fact that livestock production is a family-based activity practiced as a savings strategy. Moreover, it was supported by the federal livestock productivity program (Spanish acronym PROGAN). In turn, agricultural mechanization has been financed by state and municipal governments and incentivized by the proximity of the Mennonite community. In other words, *ejidatarios* enter into land or sharecropping rent contracts with Mennonites or grant contractual licenses to undertake farming operations with their machinery. In 2017, the *ejido* began selling off 4 066 ha of forest land to its Mennonites neighbors.

FOREST COVER AND LAND-USE CHANGE IN XMABÉN

From 2013 to 2018, deforestation was the main forest-change process, due to the expansion of pasture (1 078 ha), and traditional agriculture (*milpas*) and mechanized agriculture (461 ha). Forest degradation occurred on 73 ha. Minor revegetation and recovery processes took place on 71 and 20 ha, respectively. However, most of the dense forest was preserved in the same state (26 622 ha) (Table 3).

Table 3. Land cover transition matrix, Xmabén
from 2013 (rows) to 2018 (columns), Campeche, Mexico

2013 Cover type	2018 Cover type					Total ha 2013	% 2013
	DF	OF	P	TA	MA		
DF	26 622	73	689	327	26	27,737	89.0
OF	20	725	389	86	22	1 242	4.0
P	0	62	1 667	67	9	1 805	5.8
TA	0	7	9	261	3	280	0.9
MA	0	2	0	0	87	89	0.3
Total ha 2018	26 642	869	2 754	741	147	31 153	
% 2018	85.5	2.8	8.8	2.4	0.5		100.0

Shaded areas represent forest-change processes: upper right = deforestation; upper middle = forest degradation; lower middle = revegetation; left = recovery

Source: compiled by the authors. Abbreviations: DF- Dense Forest, OF- Open Forest, P- Pasture, TA- Traditional Agriculture, MA- Mechanized Agriculture.

LOCAL ACTIVITIES IN LA MANCOLONA

In 2013, the households interviewed in La Mancolona identified four productive activities as their principal source of subsistence and monetary income: traditional agriculture, beekeeping, allspice agroforestry, and livestock breeding. The *milpa* was the main subsistence and income activity

engaged in by most households. Beekeeping was the second most important income generating activity, practiced by a fifth of the families. Allspice production and livestock shared third place, although in total more families engaged in allspice agroforestry. In addition, PSAH subsidies, working in a tree nursery, or as day laborers in PSAH areas were the main income-generating activities for non-rightsholders.

The results from 2019 suggest that the *milpa* remains the main subsistence income activity for the majority of households. Although the Direct Field Support-PROCAMPO requires constant land area sowing per year, in 2019, several families reported selling the surplus of their maize produced in *milpas*. Beekeeping shared second place with allspice production as a source of financial income. More families reported performing allspice agroforestry for selling in 2019 than in 2013. From 2014-2019, the Special Food Security Program (Spanish acronym PESA) supported allspice producers (all women) with drying yards in La Mancolona.

In 2019, mechanized agriculture was reported by several households as one of the main productive activities. However, none of the families lived solely off this activity, and mainly cultivated maize for subsistence on areas of less than 1 ha. The municipal agriculture authorities supported land preparation for the establishment of mechanized agriculture. The low percentage of households practicing livestock remained unchanged during the period investigated. Nevertheless, in 2019, the average pasture area per household increased by 7 ha, while the number of cows decreased in comparison to 2013. Livestock production and beekeeping in La Mancolona was supported by PROGAN. No household mentioned the tree nursery, PSAH subsidies or daywork as its source of income in 2019. Instead, a few non-rightsholders families reported living mainly off artwork commercialization.

FOREST COVER AND LAND-USE CHANGE IN LA MANCOLONA

In the period investigated (2013-2018), both pasture and traditional agriculture expanded in La Mancolona over open and dense forests, respectively. Consequently, deforestation was the dominant process, with 349 ha of forest lost. Other forest change processes were barely observable during this period. However, in this community, traditional agriculture includes small, interspersed parcels of mechanized agriculture not observable in our spatial analysis. As in Xmabén, most of the forest in La Mancolona was conserved (4 202 ha) (Tabla 4).

**Table 4. Land cover transition matrix, La Mancolona
from 2013 (rows) to 2018 (columns), Campeche, Mexico**

2013 Cover type	2018 Cover type					Total ha 2013	% 2013
	DF	OF	P	TA	U		
DF	4 202	4	90	116	3	4 415	84.9
OF	3	235	97	43	0	378	7.3
P	0	4	170	4	0	178	3.4
TA	0	0	1	196	5	202	3.9
U	0	0	0	0	28	28	0.5
Total ha 2018	4 205	243	358	359	36	5 201	
% 2018	80.8	4.7	6.9	6.9	0.7		100.0

Shaded areas represent forest change processes: upper right = deforestation; upper middle = forest degradation; lower middle = revegetation; left = recovery.

Source: compiled by the authors. Abbreviations: DF- dense forest, OF- open forest, P- pasture, TA- traditional agriculture, U- urban.

Discussion

We explored whether the household subsistence and income-generating activities in Xmabén and La Mancolona, Campeche were sustainably diversified as a result of the forestry programs during the early REDD+ implementation and also whether these programs reflected local groups' preferences. Although ENAREDD+ adopts a pro-poor approach and sustainable livelihoods have been acknowledged by the FCPF, the design of forestry programs implemented since 2010 has primarily focused on achieving carbon effectiveness. Conversely, local communities mainly expect to improve their livelihoods with REDD+. The focus groups' discussions suggested that local people preferred REDD+ activities that contribute to household income over those that reduce emissions or promote conservation. During the period investigated, the forestry programs implemented supported all the REDD+ activities suggested by the local communities (except mechanized agriculture), but their design was not optimal.

Despite the communities' preference for productive activities, IRE focuses on avoiding deforestation and forest degradation, and PES is the central mechanism of REDD+ in Mexico. The focus on passive conservation was criticized for being ineffective in encouraging local people to preserve their forests in the long term (Kelly, 2019). Moreover, both communities perceived PES as economically unsustainable and agreed that in the future, PES-like initiatives should include 1) longer contracts to assure the

continuity of forest conservation (the forest area sold by Xmabén was previously under PES), 2) higher payments to cover transaction costs, 3) inflation-adjusted payment increases, and 4) fewer restrictions on firewood collecting and hunting.

Both communities also agreed over their perception of the ineffectiveness of the reforestation activities implemented until 2010. Indeed, since 2012, reforestation has not appeared as a separate component in the forestry program operating rules, and instead has been included in forest harvesting or PES areas, which was rated as positive by the communities. Agroforestry and silvopastoral systems were among the most preferred activities in both communities. However, these activities were not practiced (La Mancolona) or were unsuccessfully implemented (Xmabén) because payments were insufficient to cover transaction costs, let alone provide any net benefits.

REDD+ payments were planned as incentives disbursed ex-ante to cover incremental costs. Accordingly, REDD+ activities were not supposed to provide further net economic benefits to local people, except those that would potentially be accrued from their implementation (such as timber, non-timber forest products, water quality and bushmeat) (Karsenty et al., 2014). However, for that to occur, and as repeatedly suggested in focus groups, more than one-off annual support and local planning would be required.

Although local people preferred individual monetary benefits disbursed ex-post in a single annual installment, they were also willing to accept in-kind benefits disbursed ex-ante, but only as a means of supporting individual agricultural activities. Benefits can also be dispensed over time to guarantee the continuation of actions (Gebara, 2010). A combination of these three approaches could be more effective in keeping participants in long-term REDD+ activities (Hite, 2015). Monetary incentives do not prevent elite capture (Mohammed, 2011). However, rights-holders in both communities disapproved of community infrastructure, describing it as free-riding by non-participants.

While some authors (such as Pham et al., 2013) have suggested that a communal tenure system is more compatible with collective responsibilities than individual private tenure, the results of our research suggest that this might not always be the case. *Ejidatarios* from Xmabén share a common property regime but have shown signs of disappointment about sharing responsibility and working collectively. This explains why several households are pursuing commons privatization and why tree nursery, forest harvesting, and local governance programs have been unsuccessful (see Torres-Mazuera, 2015 for more details on these processes). The fact that productive activities are implemented individually could be another reason why they were preferred overall in Xmabén.

Jovanka Špirić, Ana Edith Merlo Reyes,
Ma. Liliana Ávalos Rodríguez, M. Isabel Ramírez

In fact, the rationales applied to forestry and other productive activities differ. In the case of forestry activities, *ejidatarios* think that they, as legal land rights-holders, should be the only ones eligible for collective REDD+ activities, and that their contributions should be equal, so that they should receive the same amount of benefits. This is in line with the national REDD+ design, in which only *ejidatarios* and landowners or possessors are eligible to participate in forestry programs. Therefore, according to Luttrell et al. (2013), Mexico's REDD+ design follows the legal rights benefit-sharing rationale based on the libertarian principle of distributive justice. Because non-rightsholders could not participate directly or indirectly in PES, they disliked this activity.

Nevertheless, a few *pobladores* in La Mancolona lived mostly on paid jobs in PSAH areas in 2013, but none in 2019, probably because a much smaller area was supported by the second PES contract. In the case of productive activities, a different logic was used. All local actors—regardless of their rights to the land—should be able to participate and benefit from REDD+ in keeping with the time and work they have invested in the activities. This rationale promotes the input-based, merit-based principle of social justice (Mohammed, 2011; Luttrell et al., 2013). Although the program design could include non-rightsholders as potential beneficiaries, the final decision about who will participate is decided by rights-holders and regulated by usufruct agreements.

It is therefore not surprising that the *Sembrando Vida* (Planting Life) program was welcomed by both communities in 2019. This program supports the establishment of agroforestry systems combined with traditional *milpa* cultivation, lasts five years, and includes individual monetary support disbursed monthly, which is perceived as sufficient for covering transaction costs and provides net benefits. In addition, it allows for the direct participation of non-rightsholders with usufruct contracts or, indirectly, as day laborers. However, being the Ministry of Welfare's progam, Sembrando Vida is mainly designed to achieve social wellbeing. It does not include carbon objectives, and operates independently from the national REDD+ policy.

Our findings that willingness to implement REDD+ activities will be dependent on local perceptions of non-carbon benefits corroborate the results of previous studies (Rakatama et al., 2019). Furthermore, in Xmabén, other income-generating alternatives were considered more attractive, which led to the expansion of the productive activities area and land sale, reinforced by both policy (state government subsidies) and non-policy factors (the proximity of the Mennonites) (Ellis et al., 2017). Conversely, the inhabitants of La Mancolona had fewer opportunities for pursuing agricultural activities due to the location within the CBR's buffer zone and were more interested in forestry activities. Our results therefore

confirm those of Loaiza et al. (2015) that communities experiencing more deforestation, yet with fewer options for income, are less willing to participate in REDD+ than those that have conserved their forest yet have fewer alternatives.

This brings us back to the carbon effectiveness focus of REDD+ in Mexico and its impact on intra-communal equity. IRE municipalities were selected based on their high deforestation rates. This means that, at least in the initial results-based payments phase, communities will be paid for not clearing their forests (Xmabén), but not for continuing to conserve them (La Mancolona) (Bayrak and Marafa, 2016). Nevertheless, in both Xmabén and La Mancolona, the results of our spatial analysis suggest that the main forest-change processes are deforestation for pasture followed by forest clearance for traditional and mechanized agriculture. Whereas in Xmabén these changes predominantly occurred in dense forests, in La Mancolona, pastureland was mainly opened up in *acahuales* and agriculture in dense forests.

Forest degradation was not widespread during our period of analysis. However, both areas of traditional agriculture (shifting cultivation) and open forests (fallow) form part of the *milpa* cycle, and their impact can be regarded as forest degradation (Morales-Barquero et al., 2015). In turn, the establishment of pasture and mechanized agriculture represents a more permanent change (deforestation) due to the investment made in machinery, agricultural inputs and work contracts. Mechanized agriculture is a new activity in La Mancolona. However, as currently implemented, it cannot be considered sustainable activity diversification. To be sustainable, it must include specific inputs and technologies such as small-scale machinery, organic supplies, and native seeds (Angelsen and Kaimowitz, 2001; Scoones, 2009).

Conclusions

The comparison of local communities' preferences with the objectives and design of the national REDD+ and forestry programs highlighted differences in how social benefits are conceptualized. In the communities investigated, the implementation of REDD+ has not yet resulted in sustainable activity diversification or intracommunity equity. REDD+ forestry programs did not provide locally viable sustainable alternatives to the main income-generating agricultural activities. The reasons for this include suboptimal program design, budget, and policy targeting, as well as local communities' internal conflicts. However, it is advisable to support agricultural mechanization, agroforestry, and silvopastoral systems with REDD+, particularly now that the policy integration process under IRE more actively includes the agriculture sector. Although they did not make the situation

worse, REDD+ forestry programs have yet to provide social benefits at the local level. To be considered a viable option locally, the REDD+ program design must combine the implementation of several sustainable productive activities over a longer period and provide net monetary benefits to all local groups.

REDD+ policies and measures should recognize, explore and respond to different local benefit-sharing perspectives to design ways to benefit marginalized groups within the community that are acceptable to the local authorities and landowners. This would not only improve REDD+ acceptance among local people but also its overall effectiveness. Our study is one of the few to investigate the local impacts of REDD+ in Mexico by combining ethnographic, documental, and spatial methods. Although our results cannot be generalized, they could serve as a model for future studies to explain the complexity of REDD+ implementation on the ground and establish connections across scales between local people, their forests, and national public policies.

Acknowledgements

References

Almanza Alcalde, Horacio; Satyal, Poshendra; Soto Sánchez, Alma Patricia, and Pskowski, Martha (2020). "Conflictividad en la implementación temprana de REDD+ en México". *Sociedad y Ambiente*, 22, pp. 152-179. https://doi.org/10.31840/sya.vi22.2092

Angelsen, Arild, and Kaimowitz, David (eds.) (2001). *Agricultural Technologies and Tropical Deforestation*. New York, USA: CABI Publishing, 420 pp.

Babbie, Earl (2006). *The Practice of Social science Research*. USA: Wadsworth, 305 pp.

Bayrak, Mucahid Mustafa, and Marafa, Lawal Mohammed (2016). "Ten Years of REDD+: A Critical Review of the Impact of REDD+ on Forest-Dependent Communities". *Sustainability*, 8, 620 pp. https://doi.org/10.3390/su8070620

CONAFOR (Comisión Nacional Forestal) (2015). "Intervention model in REDD+ Early Action areas". México: CONAFOR.

CONAFOR (2017a). "Estrategia Nacional REDD+ 2017-2030 (ENAREDD+)". http://www.enaredd.gob.mx/wp-content/uploads/2017/09/Estrategia-Nacional-REDD+-2017-2030.pdf

CONAFOR (2017b). "Emissions Reduction Initiative (IRE) Document. ER Program. Mexico". http://www.conafor.gob.mx:8080/documentos/docs/51/7523Documento%20de%20la%20Iniciativa%20de%20Reducci%C3%B3n%20de%20Emisiones.pdf

CONSERVCOM (Conservación comunitaria) (2010a). "Informe del Proyecto". http://ddd.uab.cat/pub/butcoodesfas/butcoodesfas_a2011m9/index.html

CONSERVCOM (2010b). "Cartel uso de suelo Xmaben". España: Universidad Autónoma de Barcelona.

CONSERVCOM (2010c). "Cartel uso de suelo Mancolona". España: Universidad Autónoma de Barcelona.

Deschamps Ramírez, Paulina; Zavariz Romero, Beatriz, and Zúñiga Pérez-Tejada, Ivan (2015). *Review of REDD+ Implementation in Mexico. Analysis of the Special Programs in REDD+ Early Action Areas. CCMSS.* México: Consejo Civil Mexicano para la Silvicultura Sostenible, 38 pp. https://www.ccmss.org.mx/wp-content/uploads/2015/06/ENG-Revision-PEATREDD.pdf

Duchelle, Amy; Simonet, Gabriela; Sunderlin, William, and Wunder, Sven (2018). "What is REDD+ achieving on the ground?". *Current Opinion in Environmental Sustainability*, 32, pp. 134-140. https://doi.org/10.1016/j.cosust.2018.07.001

Ellis, Edward; Romero Montero, José; Gómez, Irving; Porter-Bolland, Luciana; Ellis, Peter (2017). "Private Property and Mennonites are Major Drivers of Forest Cover Loss in Central Yucatan Peninsula, Mexico". *Land Use Policy*, 69, pp. 474-484. https://doi.org/10.1016/j.landusepol.2017.09.048

Jovanka Špirić, Ana Edith Merlo Reyes,
Ma. Liliana Ávalos Rodríguez, M. Isabel Ramírez

Ellis, Edward; Sierra-Huelsz, José Antonio; Ortíz Ceballos, Gustavo Celestino; López Binnqüist, Citlalli, and Cerdá, Carlos (2020). "Mixed Effectiveness of REDD+ Subnational Initiatives after 10 Years of Interventions on the Yucatan Peninsula, Mexico". *Forests 11*(9), 1005. https://doi.org/10.3390/f11091005

Enright, Adrian (2013). *REDD+ Compensation Packages in Lam Dong Province, Vietnam: Assessing the Preferences of Forest Communities.* London: IIED. https://pubs.iied.org/sites/default/files/pdfs/migrate/G03699.pdf

FAO (Food and Agriculture Organization) (1996). "Forest Resources Assessment 1990. Survey of Tropical Forest Cover and Study of Change Processes". Rome, 130 pp.

FCPF (Forest Carbon Partnership Facility) (2015). *The Carbon Fund. ER-PINs in FCPF Pipeline.* https://www.forestcarbonpartnership.org/er-pins-fcpf-pipeline

Gebara, Maria Fernanda (2010). Benefit-Sharing Mechanisms for REDD: How to Equitably Share Benefits Among Forest Managers? OCTF and CIFOR.

Hite, Kristin (2015). *Benefit Sharing and REDD+: Considerations and Options for Effective Design and Operation.* Washington, D.C., USA: USAID-Supported Forest Carbon, Markets and Communities Program.

Karsenty, Alain; Vogel, Aurélie, and Castell, Frédéric (2014). "Carbon rights", REDD+, and payments for environmental services". *Environmental Science & Policy*, 35, pp. 20-29. https://doi.org/10.1016/j.envsci.2012.08.013

Kelly, John (2019). "Village-Scale Reserves in the Forest Frontier Regions of Chenes and Calakmul, Mexico". *Journal of Land Use Science*, pp. 1-18. https://doi.org/10.1080/1747423X.2019.1648578

Lawlor, Kathleen; Madeira, Erin; Blockhus, Jill, and Ganz, David (2013). "Community Participation and Benefits in REDD+: A Review of Initial Outcomes and Lessons". *Forests*, 4, pp. 296-318. https://doi.org/10.3390/f4020296

Lederer, Markus (2012). "REDD+ Governance". *WIREs Climate Change*, 3, pp. 107-113. https://doi.org/10.1002/wcc.155

Lee, Erica and Mahanty, Sango (2009). Payments for Environmental Services and Poverty Reduction: Risks and Opportunities. Bangkok: RECOFTC.

Loaiza, Toa; Nehren, Udo, and Gerold, Gerhard (2015). "REDD+ and Incentives: An Analysis of Income Generation in Forest-Dependent Communities of the Yasuní Biosphere Reserve, Ecuador". *Applied Geography*, 62, pp. 225-236. https://10.1016/j.apgeog.2015.04.020

Luttrell, Cecilia; Loft, Lasse; Gebara, Maria Fernanda; Kweka, Demetrius; Brockhaus, Maria; Angelsen, Arild, and Sunderlin, William (2013). "Who Should Benefit from REDD+? Rationales and Realities". *Ecology and Society*, *18*(4), 52 pp. http://dx.doi.org/10.5751/ES-05834-180452

Matland, Richard E. (1995). "Synthesizing the Implementation Literature: The Ambiguity-Conflict Model of Policy Implementation". *Journal of Public Administration Research and Theory*, *5*(2), pp. 145-174. http://dx.doi.org/10.1093/oxfordjournals.jpart.a037242

McDermott, Maria, and Schreckenberg, Kate (2009). "Equity in Community Forestry: Insights from North and South". *International Forestry Review*, *11*(2), pp. 157-170. http://dx.doi.org/10.1505/ifor.11.2.157

Méndez-López, María Elena; García-Frapolli, Eduardo; Ruiz-Mallen, Isabel; Porter-Bolland, Luciana, and Reyes-Garcia, Victoria (2015). "From Paper to Forest: Local Motives for Participation in Different Conservation Initiatives. Case Studies in Southeastern Mexico". *Environmental Management*, *56*(3), pp. 695-708. http://dx.doi.org/10.1007/s00267-015-0522-0

Milne, Sarah; Sango, Mahanty; Phuc, To; Wolfram, Dressler; Peter, Kanowski, and Maylee, Thavat (2019). "Learning From 'Actually Existing' REDD+: A Synthesis of Ethnographic Findings". *Conservation and Society*, 17(1), pp. 84-95. http://doi.org/10.4103/cs.cs_18_13

Mohammed, Essam (2011). Pro-Poor Benefit Distribution in REDD+: Who Gets What and Why Does it Matter? REDD Working Paper. London, England: IIED.

Morales-Barquero, Lucia; Borrego, Armonia; Skutsch, Margareth; Kleinn, Christop, and Healey, John Robert (2015). "Identification and Quantification of Drivers of Forest Degradation in Tropical Dry Forests: A Case Study in Western Mexico". *Land Use Policy*, 49, pp. 296-309. https://doi.org/10.1016/j.landusepol.2015.07.006

Jovanka Špirić, Ana Edith Merlo Reyes,
Ma. Liliana Ávalos Rodríguez, M. Isabel Ramírez

Newing, Helen (2011). Conducting Research in Conservation: A Social Science Perspective. Abingdon, England: Routledge, 376 pp.

Onwuegbuzie, Antony J.; Dickinson, Wendy B.; Leech, Nancy L.; Zoran, Annmarie G. (2009). "A Qualitative Framework for Collecting and Analyzing Data in Focus Group Research". *International Journal of Qualitative Methods*, *8*(3), pp. 1-21. https://doi.org/10.1177/160940690900800301

Pasgaard, Maya; Sun, Zhanli; Müller, Daniel, and Mertz, Ole (2016). "Challenges and Opportunities for REDD+: A Reality Check from Perspectives of Effectiveness, Efficiency and Equity". *Environmental Science and Policy*, 63, pp. 161-169. https://doi.org/10.1016/j.envsci.2016.05.021

Pham, Thu Thuy; Brockhaus, Maria; Wong, Grace; Dung, Le Ngoc; Tjajadi, Januarti Sinarra; Loft, Lasse; Luttrell, Cecilia, and Mvondo, Samuel Assembe (2013). *Approaches to Benefit-Sharing: A Preliminary Comparative Analysis of 13 REDD+ Countries.* Working Paper 108. Bogor, Indonesia: CIFOR, 69 pp.

Peskett, Leo (2011). Benefit-Sharing in REDD+: Exploring the Implications for Poor and Vulnerable People. Washington, D.C., USA: World Bank and REDD-net.

Pham, Thu Thuy; Brockhaus, Maria; Wong, Grace; Dung, Le Ngoc; Tjajadi, Januarti Sinarra; Loft, Lasse; Luttrell, Cecilia, and Mvondo, Samuel Assembe (2013). *Approaches to Benefit-Sharing: A Preliminary Comparative Analysis of 13 REDD+ Countries.* Working Paper 108. Bogor, Indonesia: CIFOR, 69 pp.

Porter-Bolland, Luciana; Sánchez-González, Maria Consuelo, and Ellis, Edward (2008). "La conformación del paisaje y el aprovechamiento de los recursos naturales por las comunidades mayas de La Montaña, Hopelchén, Campeche". *Investigaciones Geográficas*, 66, pp. 65-80.

Rakatama, Ari; Iftekhar, Sayed, and Pandit, Ram (2019). "Perceived Benefits and Costs of REDD+ Projects under Different Forest Management Regimes in Indonesia". *Climate and Development*, *12*(5), pp. 481-493. https://doi.org/10.1080/17565529.2019.1642178

Scoones, Ian (2009). "Livelihoods Perspectives and Rural Development". *Journal of Peasant Studies*, *36*(1), pp. 171-196. https://doi.org/10.1080/03066150902820503

Sills, Erin; de Sassi, Claudio; Jagger, Pamela; Lawlor, Kathleen; Miteva, Daniela; Pattanayak, Subhrendu, and Sunderlin, William (2014). "Building the Evidence Base for REDD+: Study Design and Methods for Evaluating the Impacts of Conservation Interventions on Local Well-Being". *Global Environmental Change*, 43, pp. 148-160. https://doi.org/10.1016/j.gloenvcha.2017.02.002

Stewart, David; Shamdasani, Prem, and Rook, Dennis (2006). *Focus Groups: Theory and Practice*. Thousand Oaks, Ca, USA: Sage.

Sunderlin, William; Sills, Erin; Duchelle, Amy; Ekaputri, Andini; Kweka, Demetrius; Toniolo, Angélica; Ball, Steve; Doggart, Nike; Pratama, Christy; Padilla, J.T.; Enright, Adrian, and Otsyina, R.M. (2015). "REDD+ at a Critical Juncture: Assessing the Limits of Polycentric Governance for Achieving Climate Change Mitigation". *International Forestry Review*, *17*(4), pp. 400-413.

Sunderlin, Wiliam; De Sassi, Claudio; Ekaputri, Andini; Light, Mara, and Pratama, Christy. (2017). "REDD+ contribution to well-being and income is marginal: the perspective of local stakeholders". *Forests*, 8(4), pp. 125. http://dx.doi.org/10.3390/f8040125

Torres-Mazuera, Gabriela (2015). "Mantener la ambigüedad de lo común: los nuevos y disputados sentidos del ejido mexicano en la era neoliberal". *Revista Colombiana de Antropología*, *1*(51), pp. 27-51.

Trench, Tim; Larson, Anne; Libert Amico, Antoine, and Ravikumar, Ashwin (2018). Analyzing Multilevel Governance in Mexico: Lessons for REDD+ from a Study of Land-use Change and Benefit Sharing in Chiapas and Yucatán. Working Paper 236. Bogor, Indonesia: CIFOR, 91 pp. https://www.cifor.org/publications/pdf_files/WPapers/WP236Trench.pdf

UNFCCC (United Nations Framework Convention on Climate Change) (2005). *Reducing emissions from deforestation in developing countries: approaches to stimulate action*. https://unfccc.int/resource/docs/2005/cop11/eng/misc01.pdf

UNFCCC (2007). *Report on the second workshop on reducing emissions from deforestation in developing countries*. http://unfccc.int/resource/docs/2007/sbsta/eng/03.pdf

UNFCCC (2010). *The Cancun Agreements*. http://unfccc.int/resource/docs/2010/cop16/eng/07a01.pdf

Vatn, Arild and Vedeld, Paul (2011). *Getting Ready! A Study of National Governance Structures for REDD+*. Noragric Report No. 59. Department

of International Environment and Development Studies, Norwegian University of Life Sciences, UMB. 34 pp. http://www.umb.no/statisk/noragric/noragric_report_no._59.pdf