Foreign Investments in the Forestry Sector as a Means of Increasing Community Resilience: Two Case Studies in Mexico

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Foreign investments in the forestry sector as a means of increasing community resilience: two case studies in Mexico

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SUMMARY

Community resilience is the sustained ability of a community to use available resources while responding to stress, as well as the ability to recover from adverse situations accounting for social vulnerability, environmental hazards, and economic conditions. As climate change increases risk and unpredictability for management and planning, understanding resilience is crucial. Focusing on Mexico, this work explores international forestry sector investments as a tool to increase resilience. This research uses interviews, surveys, and programmatic documents comparing two case studies to explore the impact of certain foreign investments on community resiliency. The resilience concepts measured include diversity, economic and ecological variability, social capital, tight feedbacks, innovation, governance overlap, and ecosystem services. Results show that such investments can increase community resilience by improving community management, resource utilization, and recovery ability in times of economic, social, or biophysical stress.

Keywords: forests, Mexico, sustainable forest management, investment, resilience

Investissements étrangers dans le secteur forestier comme moyen de faire croître la résistance communautaire: deux études-cas au Mexique

L. COOPER et E. HUFF

La résistance communautaire est la capabilité soutenue qu'a une communauté à utiliser les ressources disponibles tout en réagissant aux effets du stress, ainsi que son aptitude à se remettre de situations adverses se traduisant en vulnérabilité sociale, en dangers environnementaux et en conditions économiques. Alors que le changement climatique augmente les risques et l'imprévisibilité de la gestion et de la planification, comprendre cette notion de résistance est crucial. En se concentrant sur le Mexique, cette étude explore les investissements du secteur forestier international en tant qu'outil pour fortifier la résistance. Cette recherche utilise des interviews, des études et des documents programmatiques comparant deux études-cas pour explorer l'impact de certains investissements étrangers sur la résistance communautaire. Les concepts de résistance mesurés comprennent la variabilité économique et écologique, la variabilité, le capital social, les retours restreints, l'innovation, les chevauchements de gestion et les services d'écosystèmes. Les résultats indiquent que de tels investissements peuvent accroître la résistance communautaire en améliorant la gestion communautaire, l'utilisation des ressources et la possibilité de se relever à l'issue de périodes de stress économique, social ou biophysique.

Inversión extranjera en el sector forestal como un medio para aumentar la resiliencia comunitaria: dos casos de estudio en México

L. COOPER y E. HUFF

La resiliencia comunitaria es la capacidad sostenida de una comunidad para utilizar los recursos disponibles mientras que responde a factores de estrés, así como también la capacidad de recuperarse de situaciones adversas relacionadas con la vulnerabilidad social, las amenazas ambientales y las condiciones económicas. A medida que el cambio climático aumenta el riesgo y la imprevisibilidad para la gestión y la planificación, comprender lo que es la resiliencia es crucial. Usando México como punto focal, este trabajo explora la inversión internacional en el sector forestal como una herramienta para aumentar la resiliencia. Esta investigación emplea entrevistas, encuestas y documentos programáticos que comparan dos estudios de casos, para examinar el impacto de ciertas inversiones extranjeras en la resiliencia de la comunidad. Los conceptos de resiliencia medidos incluyen la diversidad, la variabilidad económica y ecológica, el capital social, la retroalimentación ajustada, la innovación, el traslape de gobernanza y los servicios ecosistémicos. Los resultados muestran que tales inversiones pueden aumentar la resiliencia de la comunidad cuando mejoran la gestión comunitaria, la utilización de los recursos y la capacidad de recuperación en momentos de estrés económico, social o biofísico.

INTRODUCTION

Forested landscapes face many threats, including changing climatic conditions, invasive insect and plant species, and land use conversion to agriculture and urban development (Liu *et al.* 2016, McDowell and Allen 2015). In many developing countries, the risks posed to forests are also risks to humans, many of whom rely on forests for their livelihood, drinking water, or a sense of spiritual and cultural wellbeing (Newton *et al.* 2016). Forests play an important role in resilience (e.g. Zemp *et al*. 2017), which is defined as the ability of systems to absorb disturbance and retain nearly the same function, structure, identity, and feedbacks (Walker *et al.* 2004). This definition of resilience is rooted in ecology (Hollins 1973) but includes recent advancements in adaptive capacity, which refers to an ability to assimilate and respond to changes, (Berkes *et al*. 2003, Engle 2011) and transformative capacity, which refers more explicitly to a paradigm, worldview, or fundamental systemic change in social systems (Wilson *et al*. 2013).

One important threat forests face is development, which often leads to permanent or semi-permanent changes to land use and land cover, for agriculture or infrastructure. Development is driven by economic growth that may result in environmental degradation, such as natural resource exploitation, pollution, or habitat destruction (Stern *et al*. 1996). The goal of many forest protection and management programs is to balance social-ecological resilience (both within the forest and in the broader landscape) with sustainable development and support of livelihoods (Agrawal 2009).

Another growing threat is climate change, which affects forests in primary and secondary ways. Primary effects of climate change include prolonged droughts, increased moisture, and increased numbers of severe weather events (e.g. hurricanes) all of which have been linked to increased tree mortality (Allen *et al*. 2010). Secondary effects of climate change include exacerbation of invasive insect and pest invasions due to warmer winters or drier summers (Ramsfield *et al*. 2016). It is likely that changing climatic conditions will lead to more stressed forests that are unable to maintain essential function and structure. Effects on forest-based economies are another secondary or tertiary impact of climate change in forested landscapes.

These changing climatic conditions have led to global policy formation, such as the 2015 United Nations Framework Convention on Climate Change (UNFCCC) member country adoption of the Paris Agreement. This agreement addresses climate change via mitigation (emissions reduction) and adaptation (addressing and responding to climate change impacts) recommendations (Iverson 2016, UNFCCC 2014). The agreement includes Article 5, which has key language for forests (as emissions 'sinks'), and Article 6, which establishes a new mechanism to reduce overall global emissions. In many developing countries, forest protection and management strategies require special policy and finance mechanisms.

Successful policy and finance mechanisms typically account for local level complexities, often directly engage local-level actors and stakeholders, and tap into local knowledge (Adger *et al*. 2009, Doughty 2016). Further, local actors and organizations are often better situated to develop and lead adaptation and resilience efforts because of their understanding of local dynamics and processes and long-term involvement with communities (Agrawal 2009, Doughty 2016). Doughty finds, for example, local actors have been able to "take charge of their own resiliency efforts" (pg. 2187), while Adger *et al*. (2009) point out that many already have experience making such changes to address climate change. That noted, while issues related to resilience and land degradation are often rationally understood by a governing body, the ability of a country to intervene, counter, or mitigate these issues are often limited by financial, expertise, and capacity constraints. In such cases, international finance may provide a catalyst for systemic change by introducing capital, oversight, and structure to resource management and poverty reduction efforts.

In adopting policies for forest management and conservation, Mexico has been perceived by the international finance community as a leader in climate change mitigation and adaptation (Ramírez 2014, Borrego 2018). Mexico has a relatively unique ability to both contribute to and receive climate change mitigation and resilience funding because it is both a developing country and an Organization for Economic Co-operation and Development (OECD) member (SEMARNAT-INECC 2016). Mexico has accessed international funding networks for countries with both forest management and human development issues because of the country's internal capacity to participate in negotiations, track and report emissions, and manage land and forests at multiple scales.

For more than two decades, the World Bank has been supporting the forest sector as well as climate change adaptation and mitigation in Mexico. The scope of this support has evolved to respond to specific needs, beginning with institutional support during the launch of the National Forestry Commission (CONAFOR) in the 1990s (World Bank 2003) and piloting standalone programs such as the Community Forestry and Payment for Environmental Services projects (World Bank 2018a, 2018b) in the 2000s.

One of these funding sources, the Forest Investment Program (FIP), part of the Climate Investment Funds (CIF) portfolio, aims to address rural poverty, reduce deforestation and degradation, and support healthy forest product economies that feature Sustainable Forest Management (SFM). The FIP supports developing countries' efforts to reduce emissions from deforestation and forest degradation by providing financing for forest management reforms and public and private investments for forest owners, with a focus on communally-held land. The FIP finances efforts at a broad programmatic scale to address underlying causes of deforestation and forest degradation and to overcome barriers that have hindered past efforts (CIF 2009). Many investment projects in Mexico, such as the FIP, consider key social (e.g. addressing potential impacts on indigenous communities) and environmental (e.g. protection of natural habitats) safeguards (CIF 2011). However, these programs are seldom evaluated using a holistic framework (Ferraro and Pattanayak 2006, Miteva *et al.* 2012), such as community resiliency indicators.

Forests and forest industry in Mexico

In Mexico, 65 million hectares are classified as commercially viable forest, with just over 8% of the forest cover under some form of protection (Torres-Rojo *et al*. 2016, World Bank 2017). In the 1990s, Mexico experienced the second-highest overall deforestation rate across countries in Central and South America. Forested land decreased from 35.6% in 1990 to 33.74% in 2015, reflecting a loss of nearly 3.7 million hectares of forests and rainforests in those 25 years (World Bank 2017). There continue to be high forest degradation rates (Segura 2000). While agriculture and forestry have declined as a percentage of GDP (from 7% in 1990 to 3.6% in 2016), they remain an important source of employment at 13.5% of the total workforce (UN Data 2017, World Bank 2017). Torres-Rojo *et al*. (2005) estimate that forestry work provides over 70% of local paid employment in some places. Mexico's rapidly growing economy demands increasing timber consumption but continues to import timber in spite of the country's abundant forest resources. Currently, most production in Mexico is small-scale and distributed across the country, and many of these operations are dated and inefficient. This creates a gap in the ability to meet local and regional demands for timber, resulting in a market disconnect between supply and demand, potential employment benefits, and subsequent poverty-reduction (Segura 2000, Skutsch *et al*. 2015).

The majority of Mexico's forests (61%) are collectively-held land by *ejidos* and communities (Torres-Rojo *et al*. 2016, Cubbage *et al*. 2015, World Bank 1995, Taylor 2005). *Ejidos* are a system of collective land tenure and governance of groups that previously did not have land but were granted property rights by the government. *Comunidades* are indigenous communities that have received formal recognition and title to their traditional and/or established lands. When referring to both groups, this paper will refer to 'rural communities'. As many rural communities have substantial forest land holdings, this tenure system creates both unique challenges and opportunities for forest management for timber and other ecosystem services. Community Forest Enterprises (CFEs) are partnerships formed within or between rural communities to engage in cooperative business endeavours such as operations, working forests management, and market access (Cubbage *et al*. 2015, Hodgdon *et al*. 2013). Officially, 990 CFEs operate in Mexico (Cubbage *et al*. 2015) although many have limited functions and in a large number of cases, timber extraction is simply contracted out to commercial companies (Ellis *et al.* 2015). There are a number of issues critical to long-term success in Mexican forestry, including identification, deployment, and monitoring of best practices, and foreign investments to build capacity have a potentially strong influence.

There has been research exploring the specific dynamics of communal forestry in Mexico (Bray 2010, Boyer 2015), and analysis on the role of certification and production (Cubbage *et al*. 2015), but there is little work that specifically examines the role of international investments in deployment of sustainability practices, capacity building, well-being, and resilience across communally held land in Mexico. This research aims to identify how international investments influence the economic, political, environmental, and cultural aspects that contribute to resilience and well-being in peoples' lives.

As in early study in this domain, this paper used a qualitative case study approach and resiliency indicators in Mexico to examine two 'best case scenarios' that demonstrate how foreign investment can build capacity and foster community resilience. 'Best cases' were selected since these could serve as a model for other interventions. Specifically, our objectives were to 1) describe the timeline and approach for foreign investment in Mexico's forestry sector 2) identify factors that contribute to resilience in forest-based communities and forest-based economies, and 3) determine which factors were present in two successful rural communities and which may contribute to long-term success.

METHODS

National forest sector investment analysis

To meet Objective 1, interviews with government officials were conducted with CONAFOR and international funding institutions, including the World Bank and the Interamerican Development Bank (IDB). Project databases were accessed and reviewed and Mexican policies and stated objectives at the agency were analysed (e.g. CONAFOR and Ministry of the Environment). A timeline for major investments with direct impacts on the forestry sector was determined, with a focus on synergies between funded projects across institutions, for example improving joint land management conservation and productivity objectives.

Case selection

To meet Objectives 2 and 3, case studies were sought that would allow in-depth community resilience exploration. Partners at the CIF FIP nominated several states, and after consultation with CONAFOR, two sites were selected that differed ecologically (mesic vs. xeric) and geographically (northern vs. southern), representing locations that were deemed 'successful' in leveraging foreign funds to improve community resilience. The nominated pilot projects were in the Yucatan, Quintana Roo, Jalisco, Oaxaca, and Durango. Criteria for final selection of the two cases were: contrasting biophysical conditions, prior evidence of poverty and gender imbalance, and presence of partners and stakeholders. The Oaxaca and Durango cases were selected with final approval from all project partners as these sites represent a diverse range of social and ecological factors.

Description of study sites

Site 1: State of Durango (northwestern region)

Durango has the second-lowest population density in Mexico (INEGI 2017) yet is considered the most important state for timber production (Taylor 2005). While vast open plains

support cattle ranching and agriculture here, the altitude rises into the largely forested southwest mountainous region. In recent decades, this region of Durango has also been supported by multi-investor international funds, such as the *Transforming Management of Biodiversity-rich Community Production Forests* project (GEF 2018), which has an overarching objective of implementing biodiversity conservation while improving operations and profitability of CFEs, and the Forest Investment Program (FIP), which supported training, learning exchanges, technical support, and loans for improved equipment.

The *ejido* of San Pablo was selected for further study. San Pablo was created in 1936 and, after two territory expansions in 1965 and 1979, covers nearly 35 000 hectares today. There are 230 *ejido* members, led by a 30-member advisory council. Forestry is the most important economic activity, with 80% of the community working permanently in forestry related activities. The *ejido* is a member of the CFE Pino Real Forest Corporation (*Corporación Forestal Pino Real* in Spanish), which was formed in 2012 across three *ejidos* (San Pablo, La Ciudad, and Vencedores) to consolidate technology and wood harvesting capacity, improve organizational structure, reduce transaction costs, and improve market access. All three *ejidos* are certified by the Rainforest Alliance in the Forest Stewardship Council (FSC) program. Interviews and field visits took place only in the San Pablo and La Ciudad communities. The tree species mix in Durango is dominated by pine (*Pinus)* and oak (*Quercus*).

Since 2002, the territory has continuously maintained 12 000 hectares of FSC-certified forests and is projected to continue steadily increasing. San Pablo has reforested an average of 60 hectares annually since 2001, sourcing seedlings from their tree nursery, which produces more than 200 000 native plants per year. The Forest Management Plan (PMF in Spanish), has planned for a total of 2 100 hectares for restoration. There are 11 different conservation areas with an area of approximately 40 to 50 hectares, divided by hydrological, biodiversity, or forest ecosystem values. The community has received financial support to improve forest management, conserve high-biodiversity areas, boost business planning abilities, and expand legal wood extraction (Table 2).

Site 2: State of Oaxaca

The State of Oaxaca has roughly 13% (7 million) of Mexico's forested hectares (World Bank 1995) and the second highest percentage of indigenous population at 48% (Millán *et al.* 2008). Forests cover over 70% of Oaxaca, with climatic zones covering both tropical and temperate forests, some considered of very high importance in conservation due to high numbers of endangered species (SEMARNAP 2000). Oaxaca is in southern Mexico and nestled amongst mountains linking the Gulf of Mexico to the Pacific Ocean. It supports many CFEs across a region of climatic conditions and forest ecosystem types and the state is well-known in Mexico and globally for its biodiversity (Chapela 2005).

In Oaxaca, upwards of 90% of forests are communally held (Millan *et al.* 2008). The community can trace its origins to the Zapoteca civilization (Chapela 2012). Today, there are approximately 265 families with a total population of nearly 1 800 people that are considered community members. The territory of the indigenous community San Pedro el Alto is just under 30 000 hectares, 26 000 of which are working forests. Forestry dominates major economic activities (80%), alongside ranching (12%), agriculture (6%), and commerce (2%) (Antinori 2005). The vegetation in San Pedro el Alto reflects the cooler climate and higher altitude (7 200 feet above sea level), with a species mix predominantly of pine (*Pinus*), juniper (*Juniperus*), oak (*Quercus*), and alder (*Alnus*). The community has maintained FSC certification in all working forests since it was first certified in the early 1990s.

Among other activities, international financial support has encouraged forest conservation and protection practices which have become an important part of community forest management in San Pedro el Alto (Table 3). A specific example includes the now standard practice of erosion control techniques during and following harvesting, such as rows of berms from harvesting residue. They also employ a variety of silvicultural treatments including *Arboles padres* (parent trees) or natural regeneration, selection techniques, and the operation of a community native tree species nursery to supplement natural regeneration.

Data collection

Objective 1 was met by gathering program documents for all forest investment programs administered at case study sites. Internet searches, and interviews with program directors and executing agencies were used to find relevant documents. Objectives 2 and 3 were met using an inductive approach based on two contrasting case study sites (Patton 1990) to better understand resiliency. At each site, data was collected in three ways, 1) Telephone and in-person interviews with a total of 31 interviews, including meetings in Mexico and in Washington, DC, 2) A survey, administered in-person and through internet on a web-based platform called Qualtrics, collected a total of 45 responses, and 3) Observational field notes during a visit to each case study site. A different interview guide was written for each stakeholder group including foreign aid officials, governmental agencies, private sector investors, community leaders, and community members. Interview topics focused on foreign investment, institutional capacity, regional management strategies, participation of indigenous and rural communities, and financial access. Interviews were conducted over the phone and in person, depending on availability, and lasted between 45 minutes and one hour. Interviews were conducted privately without supervisors or other community members present, particularly important with potentially vulnerable subjects (e.g. women). All subjects were guaranteed anonymity in all reports, unless they wished for their statements to be used in connection with their position.

The same survey was administered to individuals across stakeholder groups asking about their knowledge, values, and awareness of sustainable forest management, climate change

TABLE 1 *Resiliency indicators and their definitions*

Indicator	Definition
Acknowledging Slow Variables	Variables that are slow to change, associated with thresholds or tipping points
Diversity	Diversity is promoted and sustained in all forms (social, ecological, institutional, economic)
Ecological Variability	Variability is embraced rather than trying to control or reduce it
Ecosystem Services (ES)	Ecosystem services are identified, quantified (when possible), and included in policy
Innovation	Investments are made in new technologies and approaches
Modularity	Modularity is defined as the ability for different parts of the system to operate autonomously
Overlap in Governance	Redundancy in institutions (number, mission, responsibilities, power)
Social Capital	Promote the interconnectedness and relationships networks that exist between people with an emphasis on reciprocity, varied skillsets, and a sense of comradery (bonding) as well interconnectedness among communities and interaction with broader world (bridging)
Tight Feedbacks	Results of system changes are quickly evident and understood, allowing for adaptation

Source: Adapted from Walker and Salt, 2006, Dekker and Uslaner, 2001

TABLE 2 *FIP Investments in* ejido *San Pablo, Durango from 2012–2017*

Investment Area	Total FIP Investment (USD)	% of total	Examples
Management Practices	86 200	62%	Supported activities to improve forest ecosystems by applying best practices to preserve or improve the forest and protect areas that may be affected by grazing or farming activities (2012, 2014, 2015, 2016)
			Supports timber management and to expand legal wood extraction
Technical Support	10 474	7%	Internet in forest communities (2015)
Certification and Accreditation	10 500	8%	Support for national or international certification in sustainable forest management (2012, 2014, 2015)
Training	19 468	14%	Support for learning exchanges in other communities (2012)
			Training on developing and implementing proper management programs (2012)
Capacity Building	10 989	8%	Support to purchase office furniture and computer equipment as well qualified specialist in administration, production, or marketing of forest enterprises and supply chains (2016)
Ecosystem support (e.g. conservation, degradation)	2 145	2%	Support to study degraded areas and possible remediation (2012)
TOTAL	139 777		

impacts, and forestry investment. The survey was emailed to stakeholders acting in a professional capacity (e.g. agency and aid group officials) and administered in person to community leaders and community members. Interview data was triangulated with observational field notes and with key documents via a content analysis.

Data analysis

Data was assembled in NVivo (Version 11.2.4, QSR International) and analysed with thematic coding procedures. First, in vivo codes were created from document and interview text. Next, thematic codes were developed from these codes. In addition to emergent themes, the data were coded based on 9 pre-determined resiliency indicators (Table 1, Walker and Salt 2006, Dekker and Uslaner 2001). Although there are many ways to understand and measure resiliency, these indicators appear most commonly in the literature pertaining to natural resource management and a social-ecological systems approach. We sought evidence of SMART criteria (Specific, Measurable, Attainable, Realistic, and Time-sensitive) when evaluating outcomes of foreign investment (Shahin and Mahbod 2007). However, the foreign aid programs did not incorporate this framework into their mission, objectives, implementation, or evaluation protocols, so we were not able to evaluate community resilience in this way. Instead, the resilience indicators are linked to the perceptions and opinions of interview and survey respondents, rather than observable measures. Codes were checked between two raters and discrepancies were discussed and resolved.

TABLE 3 *FIP Investments in rural community San Pedro el Alto, Oaxaca from 2012–2017*

Investment Area	Total FIP Investment (USD)	% of total	Examples
Management Practices	59 360	57%	Promotion of community forestry practices and approaches (2015)
			Management practices with timber production and conservation of biodiversity (2014)*
			Supports timber management and production (2015)
Technical Support	6 148	6%	Development of technical and managerial capacities for the production and marketing (2015)
Certification and Accreditation	7 420	7%	Support for the accreditation process in national or international certification in sustainable forest management (2015)
Training	4 505	4%	Learning seminars between communities (2014)
Capacity Building	2 226	2%	Workshops and courses on capacity development (2014)
Ecosystem support (e.g. conservation, degradation)	23 850	23%	Management practices with timber production and conservation of biodiversity (2014)*
TOTAL	103 509		

*Value of this investment was split between both Management and Ecosystem Support investment areas

RESULTS

Investment in Mexico's forestry sector has steadily increased since 2010, with a spike of investment in the recent year 2017–2018 (Figure 1). Investment has been made through a combination of grants and loans, some of which will phase out in the coming year, 2019.

There was a high degree of change in both Durango and Oaxaca between 2010 and 2017 across multiple metrics, confirmed via document content analysis and field observation. In Durango, the number of employees in the forestry sector, number of female employees, cubic meters processed, financial returns, and FSC-certified hectares all increased (Table 4). In Oaxaca, the same metrics increased except the number of FSC-certified hectares. Market opportunities expanded to both national and international exports in both locations and new products were produced by 2017.

Perspectives on climate change and sustainable forestry affirmed that across all sectors and affiliations, most people were convinced climate change is happening, although fewer at the *ejido* and NGO level were convinced that the cause was primarily anthropogenic (Table 5). While participants working in NGOs and academia reported they were knowledgeable about forest management, *ejido* members did not feel they knew much about sustainable forest management (20%). Nevertheless, 80% of respondents felt that sustainable forest management was becoming more important.

Resiliency indicators[1]

The following section identifies the primary indicators and sub-indicators used in the analysis, as well as specific coded examples of each. See table 6 for a breakdown of these indicators with data from study locations.

Acknowledging slow variables

Forests are inherently slow growing and management strategies take decades to show results. One community member noted "with (the forest), it is such a slow relationship" (Operations, Executing agency, Durango), evidence of 'Long-term Thinking'. 'Intergenerational Considerations' included concerns with sustainable forest management, and planning for growth opportunities that will attract younger generations. Surveyed individuals felt climate change will have dangerous impacts either currently or as soon as the next 5–10 years (Table 5), indicating that climate change introduces new threats and uncertainties into intergenerational planning of resource management. Despite this, interview respondents shared beliefs that adaptive approaches and good management could lessen this impact and provide long-term forest sustainability and economic productivity.

Diversity

The *Diversity* indicator includes both 'Ecological Diversification' and 'Economic Diversification' sub-indicators. 'Ecological Diversification' was noted by community leaders and members as an increased emphasis on biodiversity from governmental agencies. In Oaxaca's San Pablo el Alto, reforestation drew from their native species nurseries, however, there were only a few species grown there. It was not clear if reforestation would mimic the diversity of natural forests in the area. There was also a growing emphasis on protection of ecologically diverse areas, which required analysis of biologically rich and important areas. Further examples of

[1] Quotes from respondents are provided with context information in the following format: (Affiliation, Organization, State in Mexico).

FIGURE 1 *Current and Tentative Investment in Mexico's Forest and Land Sectors, 2010–2022*[2]

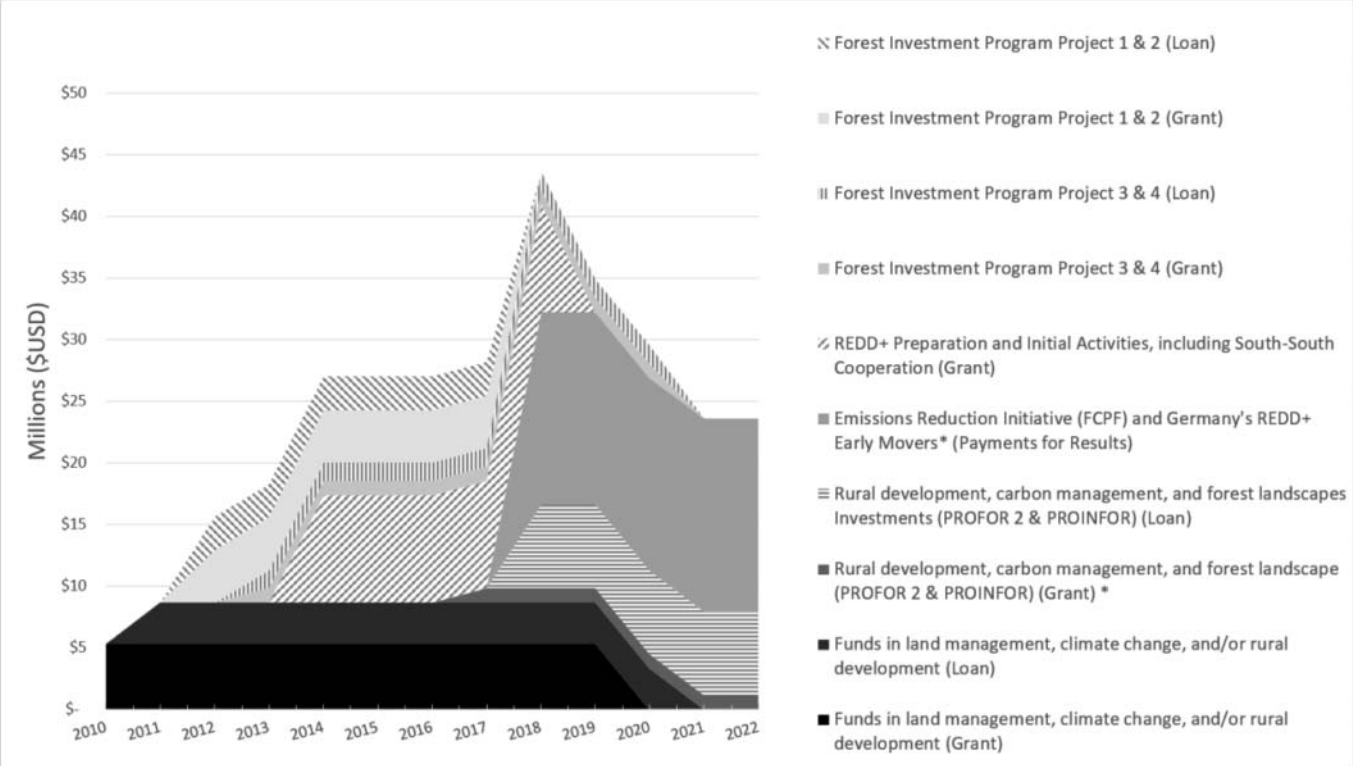

TABLE 4 *Percent change between 2010 and 2017 of business and production indicators for two community forest enterprises*

	Durango	Oaxaca	Details
Number of employees in timber processing and product production	567%	108%	Durango large increase reflects launching completely new business activities
Number of female employees	1 (2010) to 19 (2017)	6 (2010) to 22 (2017)	Wide range of positions, including Director roles
Perceived and actual forest sector market opportunities	Local and regional market to include national and international exports	Local and regional market to include national and international exports	Creation of and participation in business associations, in networking, and with larger businesses
Cubic meters (m^3) processed per year	35%	100%	Includes implementation of management plans with more intensive silviculture
Types of products to market	2010: Sawn logs 2017: Finished products like moulding, pallets, garden fences, kindling	2010: Sawn logs 2017: Sawn logs and processed wood	Increased domestic: Boards and processed wood International export: Molding, pallets, fences, kindling
Financial returns	187%	50%	Durango: Average annual profit sharing returns at the household level Oaxaca: Overall increase in returns for timber sales
FSC-certified Hectares	23%	0%	Note: 100% of Oaxaca's working forests already certified

Source: Community Forest Enterprise data, *Pino Real* in Durango, and *Dimensiones Oro Verde*, Oaxaca

[2] * denotes inclusion of tentative funds in FIGURE 1

TABLE 5 *Climate change perspectives grouped by affiliation within forestry sector*

Affiliation	% of respondents completely convinced climate change is happening	% of respondents that believe climate change is caused primarily by humans	% of respondents believing the forests have a high impact on climate change	% believing climate change will have a high impact on forests	% that believe they know "A lot" about sustainable forest management	% that believe sustainable forest management is more important now than 5 to 10 years ago
Academia	100%	100%	100%	100%	100%	100%
Ejido/Community/CFE	87%	60%	33%	53%	20%	80%
Social enterprise (NGO)	100%	66%	66%	100%	100%	100%
Finance	89%	89%	67%	89%	22%	89%
Government	88%	75%	75%	88%	44%	94%

Source: Survey responses, May 2017

ecological diversity include an experimental orchard and organic garden for fruit and vegetable production.

'Economic Diversification' further encompasses 'Employment and Business Opportunities' and 'Market Information and Value'. For 'Employment and Business Opportunities', examples were found in both case study communities, and resulted in a clear and marked increase in employment both directly to forestry-related activities and in additional opportunities that were possible in part because of forestry revenue as initial capital. In Durango, such additional opportunities included eco-tourism, rental cabins, recreational zip lines, and tours of key geologic structures like caves and a climbable 'rock garden'. The protected forests nearby provided the motivation to run these eco-tourism enterprises and, in some cases, harvesting revenues provided initial capital. However, the enterprises were not well advertised and poor infrastructure (e.g. roads) may discourage visitors. In Oaxaca, the community leaders and government agency representatives mentioned that after foreign investment in forestry, the increased capital flowing through the sector led to investment in a spring-fed water bottling business, a fuel station, and a bus line provided both income and transportation.

'Market Information and Value' is leading diversification of products because of more informed business planning decisions, from planting to production. For example, an event called the Forest Expo takes place every two years and directly connects producers with consumers, including large international companies that can make direct agreements with CFEs (Business development, *Ejido*/CFE, Durango).

Ecological variability

A respondent mentioned that, "current strategies [in both Durango and Oaxaca] are not only dedicated to timber timber production, they also focus on the care of biodiversity, flora, and fauna" (Operations, Executing agency, Durango). Therefore, an 'Including Ecological Considerations' sub-indicator was used to identify when specific acknowledgement and planning steps were taken to incorporate such factors, which have become prevalent in recent years (Project implementer, Executing agency, Durango). 'Including Ecological Considerations' also results in flexibility to address and anticipate ecological issues – or even leverage them – for example, by selecting certain species for planting or harvesting ahead of a blight (Forest technician, *Ejido*/CFE, Durango).

Ecosystem Services

The sub-indicator 'Direct Ecosystem Service Benefits', includes ecosystem service outcomes related to biodiversity, water, and timber and non-timber forest products, among others. Interviewees from within and outside the communities were able to link improved forest management to benefits like clean water in the case of the San Pedro el Alto community, or in ecotourism featuring birdwatching in conservation areas of La Ciudad (Governing official, Community/CFE, Oaxaca). Further, these activities supplement other international and national funds in direct payments for ecosystem service schemes, including in watershed management, which the San Pedro el Alto community was able to take advantage of as well.

Innovation

International funds creating 'New Finance Opportunities' results in access and opportunities for finance that did not previously exist, in particular for rural communities and CFEs. These funding sources were previously deemed too risky by larger banking institutions and showed CFEs to be valuable investments, even at small amounts (Project Implementer, Executing agency, Mexico City). Equipment purchased with foreign investment resulted in profound changes for CFEs and communities, via reduced destruction from forestry practices and access to new markets with additional products (Operations, Community/CFE, Oaxaca).

'Transforming and Breaking Rigid Connections and Behaviours' was found across a range of factors including the creation of a CFE, awareness and conservation values, transformations in forest management, transformations in income and earnings, in equity particularly for women, in community

dynamics and wellbeing, in employment, and transformations of future scenarios (Administrator, Community/CFE, Oaxaca; Project implementer, Executing agency, Durango; Forest engineer, Executing agency, Durango).

For 'Women and Indigenous', multiple respondents emphasized being able to provide for their households and plan for bright futures for their children, with access to education and all basic needs met. There was even a feeling of genuine career excitement from some interview subjects, describing the important leadership role they had in their community in the forestry sector (Administrator, Community/CFE, Oaxaca). However, this was directly specified as a condition of this investment, so cannot be attributed to all investments, generally. The site visits and analysis found female employees from high-ranking leadership positions to manual and assembly work (Administrator, *Ejido*/CFE, Durango).

'Young and Innovative Professionals' was evidenced both in practical implementation of international investment projects, including funds from the World Bank, IDB, and the Global Environmental Fund (GEF), and in interviews with the executing agencies, government, and the rural communities. At the communal level, respondents noted the impact that training courses had on young workers and professionals, particularly the emphasis on community, equality, and sustainability (Governing official, *Ejido*/CFE, Durango). However, they also noted that young people from the communities still desired to leave the community and that more must be done to retain young professionals in these rural areas. The presence of new workers entering the executing agencies (including women) was notable, particularly in CONAFOR and FINDECA. These individuals not only had new career opportunities implementing such projects, they received training aligned with values and objectives of that funding, for example, in gender and climate change issues. Involvement in international projects has both prestige and a certain influence on the individual professional. As another example, CONAFOR supported an employee working on internationally-funded projects to earn a master's degree in forest engineering, which may not have been possible without international support (Forest engineer, Executing agency, Durango).

Modularity

Examples of 'Organizations and Executing Agencies' in Mexico's forests include USAID, UNREDD, multi-lateral development banks (MDBs), and European development organizations (e.g. Norwegian Government to create a national Monitoring, Reporting and Verification system). With a high degree of central organization through CONAFOR, Mexico has been able to assemble these activities to build on one another without being overly dependent on a single source of funding or project. Moreover, the FIP program structure encourages modularity at the executing agency level by utilizing different executing agencies for financing, outreach, and implementation of distinct funding pools. For example, National Development Finance (FND in Spanish) is responsible for one of the four FIP projects, called "Financing Low Carbon Strategies in Forest Landscapes while FINDECA for another ("Support for Forest Related Micro, Small, and Medium-sized Enterprises (MSMEs) in Ejidos and Communities") (Project Implementer, Executing agency, Mexico City). Instead of developing the CFEs with a singular high-level vision in a centralized manner, the process unfolds more organically, resulting in greater buy-in and long-term support within the rural communities themselves, boosting resiliency outcomes.

'Careful Investment' was seen in *ejido* and community planning, executing agencies implementation, and FIP planning and program documentation. Depending on the size and development level of the rural communities, they were eligible for different program funds, which resulted in careful assessment of rural communities' capacity and growth and offered unique support approaches for each community. Communities conscientiously accepted support, seeing that they are handled well and fit into larger community goals, and investments were acquired incrementally. The communities themselves, as indicated in various interviews, were reserved with investments because of the steady availability of financial support opportunities, they did not need to reach beyond their upfront needs in each financial assistance application (Operations, Executing agency, Durango).

Finally, the land management system in Mexico distributes risks and benefits through the mosaic of communally-held land instead of centralized landholders by large companies, resulting in modular 'Communities as Units'. CFEs and rural communities are then able to tap distinct parts of the value chain, instead of all competing for the same, limited raw timber markets. International funds can build capacity directly at the *ejido* level. Within the rural communities, modularity was also found in the separation of community and CFE. The *ejidos* themselves changed their counsels every three years through a democratic process, resulting in issues of cohesiveness for longer-term planning which CFE agreements can overcome. As an example, the Durango-based Pino Real CFE consisted of three *ejidos* and the resulting modular model allowed for productivity and governance fluctuations within the member *ejidos* (Operations, Executing agency, Durango).

Overlap in governance

This indicator was reviewed at: 1) 'Executing Agencies', 2) 'Increased National Capacity and Inter-Agency Connectivity', 3) 'Local Level', and 4) 'Nesting and Redundancy in Institutions'. *Executing Agencies* play an important role in supporting rural communities, in information dissemination, and in capacity building for sustainable community management by overseeing technical aspects (Operations, Executing agency, Durango). CONAFOR leads connections between investment funds and rural communities with a strategy of sustainable forest management including conservation actions, restoration, and production. This provides technical assistance, planning support, and improved institutional capacities to uphold the law, including standards and regulatory improvements.

Increased national capacity and inter-agency connectivity
Though an inter-agency analysis is beyond the scope of this research, project documentation and interviews showed a successful communication and shared-goal strategy in place, not least because there are specific mandates for coordination of forest policies and rural development (Operations, Executing agency, Durango). While the Ministry of Environment and Natural Resources of Mexico (SEMARNAT) is responsible for natural resources including forests, CONAFOR has the specific role of managing and monitoring forests, and directly engaging stakeholders, particularly through the 2025 Strategic Forest Plan (FIP 2011).

Though respondents noted there are varying degrees of sustainability in regard to local level forests management, there was a sense of confidence in local level sustainable management but uncertainty that sustainable management is occurring at the regional or national level (Forest technician, Community/CFE, Oaxaca). It was clear that international investments have rewarded good steward communities and are actively encourage environmentally responsible behaviour.

For 'Nesting and Redundancy in Institutions', it was both observed and stressed by respondents that such a redundancy took the form of scaled and nested organizations, which created clarity and consistency for increasing sustainable forest management. Additionally, with layers of governance, stakeholders had access to scales of resources, checkpoints, tools, and approaches. For example, forest certification, national laws, and internationally funded projects often had similar or even the same stated targets. In fact, forests in Mexico have been identified as a matter of national importance and security from the Office of President, resulting in regional plans fitting into national plans, and local plans fitting into regional plans. However, some respondents identified a need for consistent messaging and goal alignment, as there can be confusion about where to look leadership and financial opportunities.

Social capital
There was strong evidence of bonding social capital (intra-community), but less evidence of bridging social capital (inter-community). Bonding social capital was evident in: 1) 'Gender Dynamics and Perspectives', 2) 'Inclusion,' 3), 'Leadership Support and Development', 4) 'Livelihoods', 5) 'Networks for Learning and Communication', 6) 'Technical Assistance and Professional Expertise', and 7) 'Traditional Knowledge (TK)'. Bridging social capital was evident in 5) 'Networks for Learning and Communication.

'Gender Dynamics and Perspectives' represented a particularly important and visible sub indicator. As the FIP program language included an emphasis on women and indigenous populations, the change for women was both visible and easily discussed by most interviewees. Community members described "increased awareness" (Governing official, Community/CFE, Oaxaca) related to gender and how "more and more women are getting work in relation to industrial jobs" (Administrator, Community/CFE, Oaxaca). The women themselves highlighted the importance of these opportunities and training in transforming not only their individual lives, but their sense of security and in diversifying incomes streams at the household level. Women were present at all levels in the CFEs in this study, including leadership positions.

The role of 'Inclusion' as a key sub-indicator is because of its prevalence as a core concept of the primary international investment studied, the FIP. The FIP is designed to include forestland owners in financial, technical assistance, training, and market opportunities that previously were not available to them. This is particularly visible in the FIP projects which created dedicated financing line for communities and *ejidos*, with the project "Support for Forest Related Micro, Small, and Medium-sized Enterprises (MSMEs) in Ejidos and Communities" being for entities just getting started or with fundamental training needs in business management.

Examples of 'Leadership Support and Development' can be found in placement of technicians in rural communities, training for women in leadership roles, executing agency support and training, hosting students and young people during vacation months, and peer learning including intercommunal exchanges. For example, the San Pedro el Alto community in Oaxaca, hosted an expert sawmill technician from Durango. Overall, this leadership support increased resilience because it results in a wide range of individuals and professionals thinking about planning, sustainability, risks, and management making them able to make critical and knowledgeable decisions.

In terms of 'Livelihoods', improvements took many forms, including household income, education, sense of security, governance, transportation, technology, business acumen, and even pensions for the elderly (Governing official, Community/CFE, Oaxaca). One respondent noted that recent years had shown "a breakthrough" for rural communities in regard to benefits to the community from management and market access changes. (Business development, *Ejido*/CFE, Durango). In San Pedro el Alto, forestry revenues have resulted in benefits such as a central municipal building, ambulance and health care centre, multiple levels of education (preschool, elementary, and high school), a church renovation, and even a water treatment plant (in construction). In Durango, capital for forest activities resulted in more income, access to education, and a transition to motor bikes from bicycles (Project implementer, Executing agency, Durango).

'Networks for Learning' were able to bring awareness and ability to implement financial and sustainable forest management. FIP funding, for example, supported a wide range of trainings and workshops on topics like gender issues, silvicultural, business management skills, and reduced impact logging. Peer learning and influences between rural communities had a word-of-mouth effect, for example when one community successfully maintained forest certification and tapped new markets because of that certification, nearby communities not only became more interested but had a practical, local example.

'Technical Assistance and Professional Expertise' played a key role at multiple scales and in various professional development areas and sectors, for example in forestry and in

finance. One core example is in the approach and philosophy of CONAFOR, who developed a mechanism to embed technicians in *ejidos* and communities until they can eventually solve their own issues and "will no longer be part of the technician program" because they can effectively leverage resources and expertise (Project Implementer, Executing Agency, Durango). The rural communities were able to work directly with the professional experts in finance through executing agencies, like FND and FINDECA, who could assist with planning and investment decisions and undertake a cost-benefit analysis.

'Traditional Knowledge (TK)', defined as the knowledge, know-how, innovations, and practices of indigenous and rural communities, sustained and passed between generations can improve long-term acceptability and viability of investments and improve sustainability and climate adaptation outcomes (Huambachano 2015, IASG 2014, WIPO 2010). Despite the attention to education and training in many international investments, particularly in the FIP, inclusion of different perspectives and in particular traditional knowledge received little emphasis. For example, TK does not appear prevalently in FIP program documents nor is there an emphasis on a process to address grievances. As this research only focused on individuals directly related to the forestry sector, other community voices were not encompassed in interviews or surveying. However, a number of interviewees pointed out that "the reluctance in the localities is very strong, (which is) totally social" (Operations, Executing agency, Durango). While another respondent described the need to "change the mentality of people, of some properties or *ejidos* want to continue maintaining ancestral management and not to enter a management [strategy] that is intensive" (Business development, *Ejido*/CFE, Durango). It appears that some community members felt that the increased harvesting was "very extreme or intensive" (Forest technician, *Ejido*/CFE, Durango), to which the forest professionals would explain that they need to "show people that they are doing good management, they need to see results, that it is not something wrong, that it has a purpose" (Forest technician, *Ejido*/CFE, Durango). This highlights some possible tensions regarding new management approaches within the community, which may be rooted in the lack of traditional knowledge and values being incorporated into planning and management processes.

Tight Feedbacks

The final major resilience indicator is *Tight Feedbacks*, which allows detection of issues before thresholds are crossed. For example, forest loss, degradation, and fire weaken or destroy the forest structure, and are immediately visible and provide quick information to forest owners. Subtle degrees of degradation are more difficult to observe, and a system of tight feedbacks boosts ability to identify and respond to changes. Four major areas were identified: 1) 'Acknowledging Risk', 2) 'Protecting Assets', 3) 'Including Adaptation Concepts', and 4) 'Certification'.

Rural communities and individuals were found to be 'Acknowledging Risk' from climate, fire, pests, disease, market changes. Respondents discussed fire concerns in Durango and Jalisco, illegal harvesting, and risks to ecosystems and their services including water provision, flora, and fauna. There was reference to the community "waking up" to the precise risks in their geographic area and undertaking efforts to mitigate that risk (Governing official, Community/CFE, Oaxaca). Some concern was expressed about the high risk and the inevitability of climate change, noting that without changing management practices their efforts could be undermined, saying that, "if (the forest) is not conserved and you have climate change, there will come a time, even with the activities we do, that it will be destroyed" (Project implementer, Executing agency, Durango).

'Protecting Assets' included risk identification, signage installation, and structured monitoring and reporting systems. Watching for fire, stopping illegal logging, even adding fences to protect from livestock addressed problems for natural regeneration in Durango "so there are fences so that animals do not enter" (Forest technician, Community/CFE, Durango).

Due to the emphasis on climate change, 'Adaptation Concepts' was an important indicator. For example, multiple community members and forest technicians commented on a recent drought in Durango, and they pointed to their sustainable management practices, supported by training from international investments, that resulted in trees surviving "because of (new techniques) and all the practices we do" (Forest technician, Community/CFE, Durango).

'Certification', primarily with Forest Stewardship Council (FSC) by the Rainforest Alliance, creates tight feedbacks due to additional scrutiny by third-party verifiers. Community members reported this as an important source of information stating, "the commitment was really re-set with each annual audit" and resulted in greater security, and the "main beneficiary of that security is the *ejido*" (Forest technician, Community/CFE, Durango). Once communities became certified, they managed to keep up the certification: one community in Oaxaca has done so for nearly two decades (Governing official, Community/CFE, Oaxaca). On the other hand, the added cost of certification and slow or disappointing financial returns in some cases have also created a feedback wherein some forest owners elect to not maintain their certification (Cubbage 2015).

DISCUSSION

This case study applied a resiliency indicators framework to understand how foreign investment may have helped to increase community resilience in two case study communities in Mexico. These cases were identified as successful examples, with high community resilience. Generally, it was found that foreign investment increased community resilience in Mexico's forestry sector. The most important and frequently found positive indicators were *Modularity*, *Innovation* and *Bonding Social Capital*. Recent years show a clear increase in ability to harvest and process wood. However, with training and sustainable forest management practices, including forest certification and protection of high biodiversity value conservation zones, such activities were able to increase production

TABLE 6 *Resiliency indicators as described by the interview data, with associated quotes*

Resiliency Indicator	Sub-Indicator	Evidence
Acknowledging slow variables	Long-term Thinking	"It is the sequence of treatments that will give us the long term. . .regulation. So, what we are looking for in this long term is that we have an orderly forest, that is the goal. We started with this management program with this aim in 2008, and it will conclude in 2068." (Forest technician, *Ejido*/CFE, Durango)
	Intergenerational Considerations	"They think not only of them(selves) but also of their children and the children of their children, maintaining the forest so that it is always giving them resources because it is where they live." (Business development, *Ejido*/CFE, Durango)
Diversity	Ecological Diversification	"There are 11 different conservation areas with an area of approximately 40 to 50 hectares, divided by their hydrological, fauna, or forestry potential." (Biologist, Executing agency, Durango)
	Economic diversification (Employment and Business Opportunities & Market Access, and Value)	"Various micro-enterprises have been created in the community such as the bus line of San Pedro el Alto, technical forestry and community forestry and the sawmill, ... the community pharmacy, community store, the water purifying and bottling plant, and we also have a gas station." (Governing official, Community/CFE, Oaxaca)
		"Every two years . . . the forestry expo occurs nationally in Guadalajara. With this, *ejidos* that already started companies go to that expo and offer their products." (Business development, *Ejido*/CFE, Durango)
Ecological Variability	Including Ecological Considerations	"The company is not only dedicated to what is the use of wood, they also focus on the care of biodiversity, flora, and fauna in the community." (Governing official, Community/CFE, Oaxaca)
	Planning for the Future	"In forests, plantations, biodiversity, we must be very careful because it is the future of the family." (Forest technician, *Ejido*/CFE, Durango)
Ecosystem Services (ES)	Directly Values and Results in ES Benefits	"The current CFE program is not only dedicated to what is the use of wood, they also focus on the care of biodiversity, flora and fauna, which is in the community." (Governing official, Community/CFE, Oaxaca)
Innovation	New Finance Opportunities	"I have been linked to CONAFOR since 2008, and I have seen that it has been growing in different incentives with different support, with different programs, there has been a range of opportunities for *ejidos*, indigenous communities, smallholders." (Forest engineer, Executing agency, Durango)
	Equipment	". . .The equipment has improved. It's not so much in the harvest because the extraction is still the same as a long time ago. It is in the wood processing activity where there is more technology – it has improved on that and it has been significant." (Forest technician, *Ejido*/CFE, Durango)
	Transforming and Breaking Rigid Connections and Behaviours	"Many communities or *ejidos* are beneficiaries (of investments). They are small properties, mostly *ejidos* and communities that, for example, had nothing else to do with the management program, they just sold their wood. And from that time, because of CONAFOR, they have gotten involved in industry and certification . . . . yes, we have seen a breakthrough." (Business development, *Ejido*/CFE, Durango)
	Women and Indigenous	"At the other sawmill there are many women working, there are women who are working where the pendulum and handling the saw. And since the administration there is a woman, it is important. Yes, there are more women; more and more women are getting work in relation to industrial jobs." (Administrator, Community/CFE, Oaxaca)
	Young and Innovative Professionals	"The training courses taught have had an impact on the community, especially among young people." (Governing official, *Ejido*/CFE, Durango)
Modularity	Executing Agencies	"Those involved include National Development Finance (FND) responsible for FIP3, FINDECA has been responsible for FIP4 credit program, the Mexican Fund for the Conservation of Nature (FMCN) is responsible for the technical assistance and accompaniment part of the FIP4, and oversight from both the World Bank and Multilateral Fund of the Inter-American Development Bank (IDB)." (Executing agency meeting, Mexico City)

TABLE 6 *Continued*

Resiliency Indicator	Sub-Indicator	Evidence
	Separating the *ejido* from the business (CFE)	"The *ejidos* do not have sufficient consistency because every three years they change their legal representation, which generates a level of distrust. For that reason we constituted ourselves as a company." (Administrator, Community/CFE, Durango)
	CFEs consisting of different *ejidos*	"(The CFE) has a sawmill and . . . it is formed of the ejidos of La Ciudad, San Pablo, and Vencedores. Different regions come together to form this association." (Forest technician, *Ejido*/CFE, Durango)
Overlap in Governance	Executing Agencies	"In addition to these resources, financial agencies and non-governmental organizations (NGOs) will complement national REDD+ efforts during the entire FIP lifespan. NGOs have a key function in accompanying local communities and are particularly relevant in disseminating information and in developing local capacities for forest community management." (FIP, 2011, pg. 31)
	Increased National Capacity and Inter-Agency Connectivity	"The creation of CONAFOR attracted very significant support creating an important critical mass together with other agencies with responsibilities in the forestry sector and . . . is responsible for, among other things, the implementation of the 2025 Strategic Forest Plan." (FIP, 2011, pg. 27)
	Local Level	"The *ejidos* in Mexico are all composed of a general Assembly and they have an intermediate structure called an advisory council who . . . are the ones that promote all that kind of changes, both in the organization and in forest management." (Forest technician, *Ejido*/CFE, Durango)
	Nesting and Redundancy in Institutions	"Forest conservation was identified by Mexico's President . . . as a matter of national importance and security. That had a high impact and since then the federal government policies have been more directed to conservation and maintaining from a sustainable perspective . . . to achieve a sustainably managed forest but also to have the vision to conserve them." (Operations, Executing agency, Durango)
Social Capital	Gender Dynamics and Perspectives	"At first it was difficult for me to work with only men . . . but over time they now respect me. Because I am the only woman, I have to assert myself a little – I'm not saying that's because this position treats them poorly or has more power. . . Now as a woman, and being my (young) age, I feel very grateful to be here and have the opportunity to learn about new technologies and new ways of handling wood." (Administrator, Community/CFE, Oaxaca)
	Inclusion	"Strengthen financial inclusion of agrarian units with varying levels of technical assistance and capacity building within their teams, especially in low productivity areas." (Project implementer, Executing Agency, Oaxaca)
	Leadership support and development	"(CONAFOR) manages (the forest) to develop a mechanism that allows the technician to get involved in the problems of an *ejido* community. So that, after a while, it will no longer be the (responsibility) of the program, but (the community) they will know how to leverage resources themselves to solve a problem." (Operations, Executing agency, Durango)
	Livelihoods	"In general terms people already live better than 15 to 20 years ago: they have more access to education, workers no longer use a bike, they use motorbikes, it is a breakthrough and hugely important to their family economy." (Project implementer, Executing agency, Durango)
	Networks for Communication and learning	"Some have become aware, but there are people who do not go to the mountain and do not see the results. We must give through diffusion the understanding of how things are." (Forest technician, Community/CFE, Durango)
	Technical assistance and professional expertise	"Basically, we offer them the support so that (communities) can hire that specialized person to carry out the study so they can be informed and properly registered with the Secretary of Environment and Natural Resources (SEMARNAT) and the national forest registry." (Operations, Executing agency, Durango)

TABLE 6 *Continued*

Resiliency Indicator	Sub-Indicator	Evidence
	Traditional knowledge	"(The community) does not understand how some forest treatments types can make it produce more. We call it intensive management –you remove trees so that they grow and have less competition. If people are not accustomed to harvesting so many trees, then that is a challenge. It is necessary to make people aware of the changes that are leading the forest management. Specifically, it is the people who live in the *ejidos* who must be made aware that the forest can produce more and is sustainable." (Forest technician, Community/CFE, Durango)
	Training and knowledge sharing	"We, as technicians, have been given a course on forest management. The sawmill people courses on care and use of protective equipment, and their importance. The courses are depending on the needs. There are also administrative courses for administrative staff. . . . . A lot. Support has contributed to greater knowledge. We have also received courses on pests, to know how to attack or face that problem." (Technical support director, NGO, Durango)
Tight Feedbacks	Certification	"The *ejido* has been certified under FSC since 2002 and we have never lost the certificate. So, the commitment is really re-established with each annual audit. . . .There are several things that lead us to the same thing, it is to have security, and the main beneficiary of that security is the *ejido*." (Community presentation, Durango)
	Including Adaptation Concepts	"In 2011 it rained 40% of what it normally rains . . . so it was particularly dry, and yet the plants are completely alive. That's because of everything that was put on the forest floor and all the practices we do." (Forest technician, *Ejido*/CFE, Durango)
	Protecting Assets	"National and international funding sources often include specialized technical studies for the incorporation of areas degraded by disturbances and anthropogenic disturbances, ... and participatory surveillance committee, then as we do to create that awareness, people are doing those actions to protect their resources." (Operations, Executing agency, Durango)
	Acknowledging Risk	"There have been substantial changes in forest management, in the care of all other resources as we have mentioned - water, flora and fauna - which are so important because, as there are species that are about to disappear, there are others that are in danger, others are in extinction, all in category of risk, and the community is waking up." (Governing official, Community/CFE, Oaxaca)

Source: Adapted from Walker and Salt, 2016, interview and survey responses May 2017

while also implementing environmental safeguards. Indicators that were lacking included *Traditional Knowledge* and *Overlap in Governance*. Generally speaking, the term Traditional Knowledge is not included in any of the reviewed FIP program or project documents. There is growing evidence that integrating traditional knowledge into forest management can lead to improved social-ecological outcomes (Emery *et al.* 2014, Lake *et al.* 2017). Overlapping governance was evident in the redundancy between national policies like National Strategy for Sustainable Forest Management (ENAIPROS), national agencies (e.g. the Secretary of Environment and Natural Resources), the regional and local deployment of CONAFOR), and the local and autonomous rural communities. For example, certification, national laws, and internationally funded projects often had similar or the same stated targets, bolstering clarity and consistency for increasing sustainable forest management, and therefore increased resilience. With layers of governance, stakeholders had access to multiple and complementary resources, monitoring assistance, and support networks. However, there were communication gaps as local level actors were unclear how their actions were supporting or contributing to national level objectives.

According to our respondents, there was increased income in both rural communities, professional development in different sectors and positions within those sectors, as well as increased opportunities for indigenous people and women. These improvements all build community resilience, a key ingredient in societal-level sustainability (Magis 2010, Walker 2004). Diversification supports long-term community economic resilience through new careers, revenue streams, skills, and ideas. Overall, foreign investment supports slow and continual progression to a new regime, one which can better absorb disturbances and experiment with new equilibriums as it changes (Walker and Salt 2006). The distributed mechanization, training, natural resources, and professional perspectives has resulted in management of working forests in these case study communities that can deliver ecosystem services, economic wellbeing to rural communities, wood products, and climate change benefits.

There are several limitations of this study. First, the cases selected represent 'best-case scenarios' with high community resilience, to demonstrate what resiliency indicators have led to this success. Therefore, results cannot be generalized to other rural forest-based communities in Mexico or to communities receiving other sources and types of foreign investment. Although we examined the influence of specific program investment (e.g. FIP), we could not use their indicators for success in part because they were not SMART criteria (Shahin and Mahbod 2007). Instead, we used resiliency indicators as a way to explore characteristics of the forest investment in two exemplary cases to understand how investment could lead to improved community resilience. It is suggested that program goals always incorporate SMART criteria to aid in evaluation.

Future research could test the benefits of directly incorporating 'Traditional Knowledge (TK)' and values into management planning in these projects. Bliss (2000) found that incorporating community objectives into management is critical, even if they are not entirely congruent with the best silvicultural ideas of technical service providers. Finding practical and realistic approaches to bring traditional values and knowledge into internationally supported projects could build social capital, improve diversity, and contribute to governance overlap (Agrawal 2009). Another avenue in need of further research is better understanding the differences between success rates amongst communities, as many rural communities experience less progress than those highlighted in this paper. Interview responses suggested that internal organization and governance are key barriers in lower performing areas. Additional research could inform approaches to better support these communities in these topics. Finally, a pre- and post- test design on communities designated to receive funding (but that have not yet) with control group communities (who will not receive funding) would be ideal for evaluation, particularly if SMART criteria are used.

CONCLUSIONS

This case study explores the role of foreign investment in supporting community resilience in two regions of Mexico. Due to the qualitative nature of the research and the sample limitations, it is not possible to clearly attribute outcomes from specific investments. However, this analysis demonstrates how foreign capital, in addition to investing in durable goods for rural communities, allows communities to access new markets, improve resource management, build supply chains, and train community members. Because these funds are used in line with national climate change mitigation, sustainability, and human development objectives, they are contributing to larger programmatic efforts that extend beyond the specific investment. What is needed is a systematic analysis of social-ecological resilience before and after such investments are made to the forestry sector to determine where the most improvements are needed and achieved, and how such funds are leveraging existing resources to improve all resiliency indicators.

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