

## EMERGING MARKETS FOR TROPICAL LESSER-KNOWN SPECIES AND THEIR IMPACT ON SUSTAINABLE FOREST MANAGEMENT IN SOUTHEAST MEXICO

Rene Forster<sup>1</sup>, Benno Pokorny<sup>1</sup>, José Luis Zapata<sup>2</sup>

<sup>1</sup>University of Freiburg, Freiburg, Germany; far@uqroo.mx

<sup>2</sup>Universidad de Quintana Roo, Quintana Roo, Mexico, jzapata@uqroo.mx

One of the aspects that constrain forest management in the tropics is the limited number of tree species demanded by national or international markets. As such, promotion of lesser-known species (LKS) has been a recurrent recommendation. Nevertheless, market introduction of LKS has remained a difficult task. Beyond that, higher per hectare extraction through LKS has brought the concern of ecological/ silvicultural damage. Therefore, the questions have arisen of how LKS markets expand or contract and which is the impact of increased LKS use on forests.

In Southeast Mexico, forests are mainly owned by communities. Some of these communities have been involved in forest management for over 80 years. The present study analyzes the impact of markets on forest management. Building on silvicultural and regional forest production information, it presents the results of a survey to 75 ejidos and of qualitative interviews to foresters, timber traders, and industrial timber consumers regarding LKS markets and their impact on forest management.

Findings suggest that markets effectively have been an important driver for forest management, although its impact is mediated by regional and operation-specific factors. Marketing increases have allowed several communities to progressively improve silvicultural measures, whereas decreases have been an important factor for communities to leave forest management altogether, leaving forests in a state of “degrading fallow”. Increasing marketing opportunities have not led communities to reengage in forestry, hinting at important market entry barriers. LKS promotion needs to consider these aspects to become successful.

*Keywords:* lesser-known species, Mexico, sustainable forest management, forest product marketing, community forestry.

*Parole chiave:* specie meno conosciute, Messico, gestione forestale sostenibile, marketing del prodotto forestale, comunità.

<http://dx.doi.org/10.4129/2cis-rf-eme>

### 1. Introduction

#### 1.1 The potential of LKS markets for forest management

Silviculture in natural forests in the tropics is often seen as a difficult endeavor. Several authors have pointed out the problems that ecological complexity, stand structure of mature forests and climatic difficulties pose for silvicultural treatments (Rice *et al.*, 1997), and often pled for renouncing forest management altogether, or at least for carrying out forest management with strong modifications (Lamprecht, 1986; Wadsworth, 1997). Others have noted the huge challenges posed by distant markets, weak institutions and the constant threat of competing land uses (Agrawal and Yadama, 1997).

Among the silvicultural problems mentioned frequently is the low per-hectare volume that can be effectively extracted from forests, leading to high unitary extraction costs and low total incomes. Many species in tropical forests are being used well below their silvicultural potential, and are therefore call “lesser-used”, or, more frequently, “lesser-known” species (LKS). As the discrepancy among current production and silvicultural

potential may be large or low, no clear dividing line between LKS and highly commercial species exists.

Several initiatives have aimed at promoting LKS. Most efforts have gone into exploring and describing technological and working characteristics of LKS, and disseminating the results among potential users (see for example American Hardwood Export Council, n.d.; Echenique-Manrique and Plumtre, 1994; Instituto Nicaraguense de Recursos Naturales y del Ambiente, 1993). Relatively little has been done to understand the market dynamics that steer the acceptance or non-acceptance of timber species (Forster *et al.*, 2003). On the other hand, little information exists regarding the question of the concrete effects of market changes for LKS on forest management.

Marketing problems for LKS persist throughout the tropics. For a large majority of tropical forest owners, incomes from timber sales are the most important, and often, the only, form of monetary income. The possibilities of compensating forest owners for the positive externalities of their forests are receiving much attention, but the benefits for forest owners are still uncertain. By opposition, marketing of LKS offers clear options

for the improvement of forest-owner incomes as well as the possibility to improve silvicultural measures. The present study sets out to contribute to a better understanding of how LKS become inserted in markets and how these dynamics affect forest management. Mexico as a country is well suited for analyzing the relation of tropical forest production and market dynamics, as it not only possesses a relatively long forest management tradition, but also has experienced clear modifications on its regional, national, and external forest product markets. Mexico also has the particularity that most of its forest operations are community-owned, making the present study a study on the possibilities to introduce community forestry management from the perspective of LKS marketing.

### 1.2 Materials and methods

This paper builds on several complementary methods. In 2009 and in 2013, two surveys were carried out among the forest-owning communities. The first covered all 75 communities in the study region; the second was a random sample of the same universe, focused on detecting changes in these years. Thirty six expert interviews were carried out in 2012 and 2013 among representatives of forest-owning communities, foresters, logging entrepreneurs, wood traders, and governmental officers. The third instrument was archive and literature research. In public archives, the general production volumes and certain qualitative data were retrieved. In private archives, mainly in archives of community forest owners that also have established processing facilities, the evolution of individual production facilities was analyzed. To achieve the study goals, four basic analytical categories were established (see Figure 1) (see Porter, 1990).

### 1.3 Forests and forestry in Southern Quintana Roo

The study region for the present study is the Southern part of Quintana Roo, Mexico. It covers a surface of 1.2 million hectares, of which approximately 75% have a forest cover. Southern Quintana Roo receives around 1300 mm of rainfall per year, leading to several formations of semi-dry tropical forests, which differ in the height of canopy, the degree of deciduousness, and the seasonal floods to which they are or are not exposed (Schmook *et al.*, 2011). The dominant forest species are *Manilkara sapota*, *Brosimum allicastrum*, and *Swietenia macrophylla* (Pennington and Sarukhan, 1968). In the study region, more than 95% of forest surfaces are owned by local communities, officially called *ejidos*. These *ejidos* own between 1.000 and 60.000 ha of forests. From a silvicultural perspective, a central characteristic of these forests is high species heterogeneity. Over 260 forest species have been counted in the study region. Furthermore, the largest part of species never reaches a DBH beyond 35 cms, rendering them unsuitable for conventional industrial processing like sawing and peeling. By contrast, these species have a large canopy cover, which hinders regeneration of the highly commercial light-seeking species (Galletti and Janka, 1983).

Silvicultural efforts in Quintana Roo must be regarded as seminal, but some general ideas about needed treatments have appeared in the last thirty years. They normally refer to the possibilities to regenerate mahogany, but increasingly to other commercial species like tzalam (*Lysiloma bahamensis*). These species are light-seeking and require forest gaps of a certain size to regenerate and grow into the forest canopy. The gaps created by felling of mature trees are not enough to guarantee this growth. If the gaps are too small, they will close above the young trees, which then will stall in the forest, with uncertain results. Until now, foresters have used the log yards created in the forest to promote regeneration, natural or planted. While it has been calculated that these yards may yield enough volumes to maintain the density of light seeking species in the forest, it is obvious that the full potential of the forest will not be used in this way. Therefore, several paths have been considered. They all imply a higher extraction of LKS, specifically those that do not reach minimum cutting diameters and grow around the trees to be felled (Flachsenberg, 1991).

## 2. Results

### 2.1 A chronology of forest production in Quintana Roo

“Modern” commercial forest extraction in Southern Quintana Roo started as early as the 16<sup>th</sup> century, when British loggers based in different places of the Yucatan peninsula started the exploitation of logwood, a highly valued timber used for the fabrication of dies (Bulmer-Thomas and Bulmer-Thomas, 2012; Camille, 1996). In the late 19<sup>th</sup> century, the extraction of mahogany became an important economic activity in what today is Southern Quintana Roo, the study region. A third product would become important at the start of the 20<sup>th</sup> century: chicle, a resin used as the base for chewing gum (Konrad, 1987). While the production of logwood would fade out in the first decades of the 20<sup>th</sup> century, mahogany and chicle production increased for several decades. The first sawmills were established to process mahogany logs. Parallel to that, the extraction of lesser-known species for the production of railroad ties rose (Galletti, 1993).

Although information of extracted volumes and the destiny of production in that time are scarce, it can be said that in the 1960s, LKS species as a group were already produced in considerable volumes, often surpassing the volumes of meliaceae, which had stalled on around 40,000 m<sup>3</sup> a year (Fig. 2).

While mahogany was being overexploited, the total extracted volume of all species remained below silvicultural potential. The total yearly production in the region reached approximately 110,000 m<sup>3</sup> a year, meaning an average extraction of less than 0.2 m<sup>3</sup>/ha on the forest surfaces designated for extraction at that time (approximately 600,000 ha). The years after 1981 show a different picture (Figure 3). With strong production variations, past production levels were maintained in the 1980s, but a falling trend started in 1988, which continued throughout the 1990s and the new

century. Dividing the general trend into individual productions, it can be said that in these years, a complete conversion of LKS-productions occurred. The two main productions at the beginning of the 1980s, railroad ties and plywood, became insignificant in this time. By contrast, new production types emerged, namely the production of LKS lumber, posts, and charcoal.

### *2.2 Explaining production trends*

In the following, the degree to which the described production trends were determined by market factors will be explored. To this purpose, the above described production trends will be analyzed through the lens of interviewed experts, departing from the categories laid out in the analytical frame: the resource attributes, the attributes of regional production and trade, the form of market insertion, and the structure and demand attributes of target markets. Due to limited space, only two production trends can be explored here. For an extended text version, please contact the main author.

### *2.3 Railroad ties*

The greatest loss in production volumes in the last thirty years was in the railroad tie production. Railroad ties were the most important regional LKS product in the 1970s and 1980s, often exceeding 50,000 m<sup>3</sup>/year log equivalents. Production declined in the 1990s, disappearing in the new century. Railroad ties were produced in many ejidos of the study zone. Several studies have shown positive impacts of this production, in silvicultural terms (Flores, 1991) as well as in social terms (Hostettler, 1992).

The regional organization of railroad tie production and trade was strongly determined by the main client, the national railroad company. This government-owned company had a de facto monopoly in all long-distance railroad transport, and as such, was the only important buyer for ties at a national level. A two level structure had been set up to provide the company with ties. Ferronales, the national railroad company, distributed regional orders among several second-level ejido organizations, called Uniones de Ejidos.

These Uniones de Ejidos would then distribute the orders among ejidos. Ejidos then would distribute this amount among their members. Prices would be set by Ferronales according to cost-studies, and often adjusted to inflation rates from one year to the other. No money was advanced for the tie cutters, only for the transport of ties. The whole market structure changed when Mexican governments adopted neoliberal policies in the 1980s and 1990s. An important element of these policies was the privatization of several state-held companies. Ferronales, too, was listed for privatization and sold to private companies. As these companies started to buy railroad ties, the rules changed radically. Instead of fixed prices that were reviewed every year, ties were now bought through bidding, confronting communities to large wood processing companies in other Mexican regions.

Additionally, producers were now expected to take over several supplementary production steps in the tie production, most notably, the impregnation and the leveling and boring of the ties. Furthermore, the new

companies expected the delivery of ties at the railway stations, leaving road transport to the suppliers. Finally, new quality standards were introduced.

Communities were ill-prepared regarding most of these changes. They had depended on a buyer that practically had taken over the product at the community site and that had carried out most operational and administrative tasks. In this case, market changes were so radical and so fast that ejidos were without a chance to continue supplying ties. Beyond that, no efforts whatsoever were made by governmental entities to increase the ejido possibilities to adapt to the new circumstances.

### *2.4 Posts*

In the growing touristic centers in the Northern part of Quintana Roo, a large number of rustic constructions, like beach huts, cabins, verandahs, piers, and large palm roofed halls, used as restaurants, meeting point, receptions, etc., is being built. In earlier years, the materials for these constructions, mainly posts and roofing material were informally sourced from the immediate hinterland of touristic cities like Cancun. With increasing state control over timber transport, informality ceased, and the demand went south, were the communities with officially sanctioned forest management plans are located.

The main hurdles for this development were of bureaucratic nature. Forest management had for long time worked under the premise that only trees with a minimum diameter of 35 cms could be extracted. The new market required trees that were well below this diameter. As described above, most species in the region never reach diameters beyond 35 cm dbh. It took several years before the official forest authorities accepted the required changes in forest management plans. While the market for posts prefers certain species above others, especially when speaking of posts with lengths above 10 m, most species with a specific gravity beyond 0.7 will be taken. Therefore, this market is able to absorb a large number of species. As such, it is a market that allows several forest operations to implement certain silvicultural measures.

This market can be said to have grown "naturally". No promotion measures were developed, no technological backstopping occurred, nor has there been an engineering support for the rustic construction, for example regarding hurricane resistance, and neither has there been an effort to make the whole value chain more efficient, for example through improved felling, logistics or transportation.

As such, it is not surprising that production has stagnated on a relatively low level, well below the regional silvicultural possibilities.

## **3. Result summary**

Changes in production volumes normally have several different drivers. These influences are recapitulated in Table 1.

As can be seen, markets do have an important influence on production levels. Nevertheless, it is obvious that

demand alone without the mediating agency of ejidos and other regional actors would not be enough to increase forest production.

### *3.1 Effects on forest management*

Here, the impact of markets on forest management is explored. In the region, there are several possible effects of markets on forest management, which are summarized in table II. An increase in market pressure or market opportunities will normally lead to increased forest production, but an increased forest production does not necessarily lead to an improved forest management/ improved conditions of the forest, but also to its deterioration. The same can be said of market pressure decreases. Improvements and deterioration at the level of the forest resource or forest management may be different according to the cause. Market increases may lead to overexploitation, whereas market decreases might entail land-use changes or the division of the community forests among individual community members.

Due to the chosen methodology, not all of these paths could be considered in the present study. Instead, the main tendencies at the level of forest management were defined, and their relation to changes in production explored. At the regional level, two opposing ground tendencies have characterized forest management in the last four decades. On the one hand, communities with forest management plans have continuously improved their management practice. On the other hand, a large number of ejidos has abandoned forest management during this time lapse. The reduction of ejidos involved in forest extraction has been constant, but increased after 1989. Of 75 ejidos, only 15 were never engaged in forest extraction. 14 aborted forest extraction before 1980. After 1989, another 34 ejidos left their engagement in what had become formal forest management. Figure 4 depicts the later phase.

This curve resembles the production decrease shown in Figure 3. In both curves, the descent starts at the end of the 1980s, and continues to fall throughout the years. It was shown that the volume contraction can be explained to a large degree through market drivers. In the next step, the impact of forest production changes on the evident changes in forest management has to be analyzed.

### *3.2 Impact of forest production increases*

This path has been implemented in two ways. First, increased market incomes of forest ejidos allow carrying out supplementary silvicultural measures. Second, the increased extraction of posts for construction, or their utilization for charcoal production may directly be used as a silvicultural measure to improve the regeneration possibilities of helophytic species, as described above. Regarding the first point, most interviewees in currently active ejidos agreed that the increased incomes were an important benefit from LKS marketing. These incomes in part covered operational fix costs and in part were distributed among community members. Second, interviewees mentioned benefits in form of wages. The demand of LKS wood increases labor requirements in a region where cash income possibilities are rare. All

these elements increased the communities' interest in improving silvicultural measures.

As of the silvicultural impact of LKS extraction, there are clear differences among ejidos. As mentioned above, there exists a consensus about the necessity to create larger gaps in the forests in order to be able to promote the regeneration of highly commercial species, in particular, mahogany. There are clear differences among community forest operations regarding this goal. While some ejidos have achieved extracting posts where also the industrial timber is extracted, most ejidos regard these two operations as independent, therefore not receiving the silvicultural benefit of post extraction.

On the other hand, negative impacts on the forest resource were not mentioned. The main case regarding this point would be the production of tzalam, whose levels have reached silvicultural potential in some ejidos, and the risk of overexploitation becomes real. Nevertheless, here, a set of forest management institutions is in place at several levels that prevent such an option or at least make it difficult.

### *3.3 Impact of forest production decreases*

Production decreases seem to be related to the abandonment of forest management by several ejidos. The survey did not allow quantifying this relation, as respondents in ejidos, especially young, could not determine clearly the main reason their communities had had to abandon forest extraction/management. Nevertheless, from these explanations and from qualitative interviews, four distinct exit paths can be identified. In some cases, these paths overlap in one ejido.

Contracting demand: several ejidos, especially smaller, were very dependent on railroad tie or LKS plywood log production, and, when demand for these products collapsed, were not able to switch to other products.

- Overharvesting: in some ejidos, extraction was not sustainable, and sooner or later led to the exhaustion of mahogany.

- Internal conflicts: for several ejidos, the exit came with internal conflicts over the handling of forest extraction.

- State penalties: as the state's coercive power and its willingness to exercise it against ejidos increased in the 1990s, several ejidos got penalties for even small malpractices. Often, the penalty was a production ban of several years (five to ten), after which an ejido had to repeat all steps to get forest management approved from the state, confronting entry barriers that no ejido was able to surmount.

This means that while market had an important impact on the exit of communities from forest management, this was not the only factor. Nevertheless, an educated guess would lead to approximately 60% of ejidos having abandoned forestry because of market problems.

Abandoning forestry had several impacts on community forests. Normally, it implied the breakdown of institutions that had regulated the access and intensity of forest use. Therefore, very often a kind of "internal open-access" space evolved, which each community member entered to obtain own products, leading to an informal overexploitation of the remaining stocks. Furthermore, in

the 1990s, many communal assemblies voted for dividing the community forest into individual parcels, which then were often treated as agricultural surfaces.

#### 4. Discussion and conclusions

Markets do have an impact on forest management. In the present study, this impact is positive, this is, market growth leads to better forest management, while market contraction leads to its weakening. This impact is not direct, but mediated by several factors. Neither is this impact consistent: the characteristics of the market itself as well as the characteristics of the forest operation modify the effects of markets. External actors may have a crucial importance for the form a community inserts in markets, and therefore, on their benefits or damages. Growing marketing possibilities do not necessarily have the opposite impact as decreasing marketing possibilities. While market contraction forced several communities to give up forest management, market increases did not allow new communities to enter this activity.

This could be related to the dimension of change-market-related contractions of production were clearly larger than market-related production growths - but most probably are also related to market entry barriers which cannot be surmounted at present. At the regional level, the impact of markets is mediated by several factors. The central mediating factor for the study region and the study time is a set of forest management institutions that, while far away from working perfectly, prevent increases in marketing possibilities from leading to overexploitation. While these institutions are in place for market-related increases, there are no institutions in place to prevent the negative outcomes of market-related decreases, as these negative outcomes are much more difficult to grasp and to control.

At the individual ejido level, two parameters seem central to understand the impact of markets. On one hand, the resource endowment of a community sets a central key for its forest management potential. To translate this potential into a real engagement in forest management, the community's agency becomes important.

Table 1. Production drivers.

<i>Product</i>	<i>Production Tendency</i>	<i>Driver</i>
Mahogany	Stabilizing at a low level	Past overuse Export markets allow better prices for lumber
Railroad ties	Imploded at regional level	Profound market changes in the wake of neoliberal reforms that led to product requirements which ejidos could not fulfill
Plywood	Strongly reduced at regional level	Increased imports in the wake of new trade policies that led to the closure of plywood mills
LKS lumber	Growing in ejidos that own sawmills	Market growth Increasing market proficiency of regional producers and traders Some international demand for certified lumber
LKS posts	Growing in larger ejidos	Governmental control of markets: increasing penalties on informally produced posts benefits ejidos with management plans
Charcoal	Growing in some ejidos	Increasing national and international demand Stagnating production in several important producer regions Foresters in the region are convinced this is a necessary product for successful silviculture Slow acceptance of charcoal production from permit-issuing authorities

Table 2. Alternative impacts of markets on forests.

	<i>Variable</i>		
	<i>Market pressure/ opportunities</i>	<i>Forest production</i>	<i>Impact on forests/ forest management</i>
<i>Possible direction of change</i>	Increase →	Increase ↗	Improve - New communities engage in forestry - Improvements in forest management - Improvements in other resource-related variables Deteriorate - Overexploitation - Extraction-related degradation
<i>Possible direction of change</i>	Decrease →	Decrease ↘	Improve - Non-directed ecological restoration - Reduced impact of logging Deteriorate - Communities abandon forest-management - Land use changes - Forest property division - Silvicultural stagnation

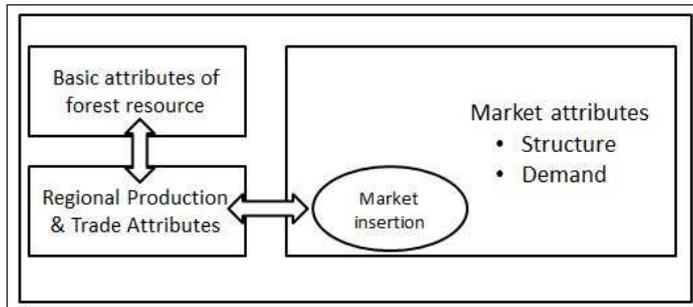


Figure 1. Conceptual Model.

Figure 2. Round wood production Quintana Roo 1959-1981 [m<sup>3</sup>]. Source: Cesar Dachary and Arnaiz Burne (1983).

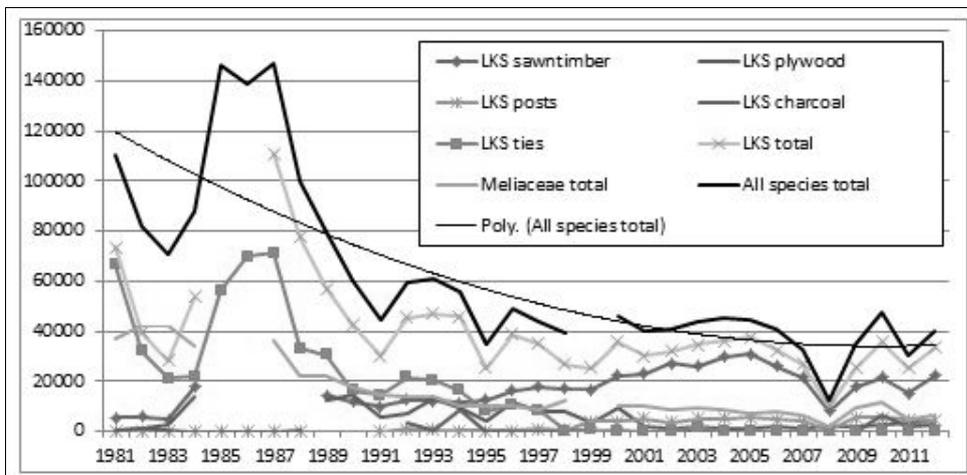
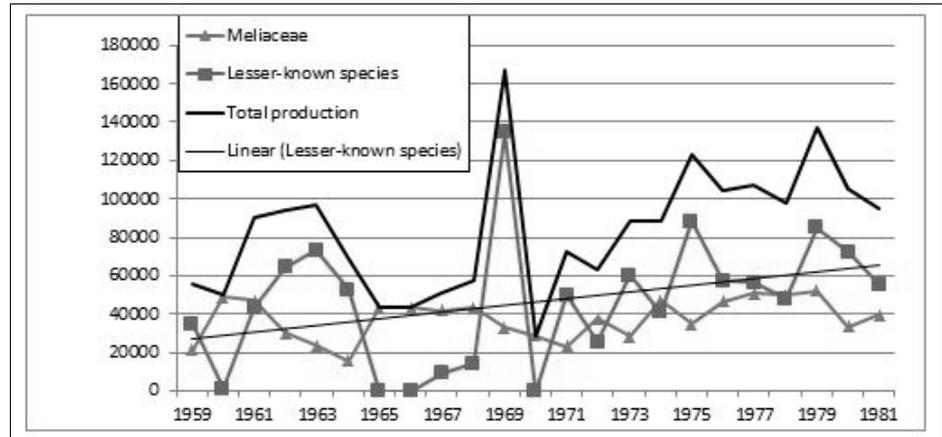


Figure 3. Round wood production Quintana Roo 1981-2012 [m<sup>3</sup>]. Source: Anuario estadístico de la producción forestal (several years).

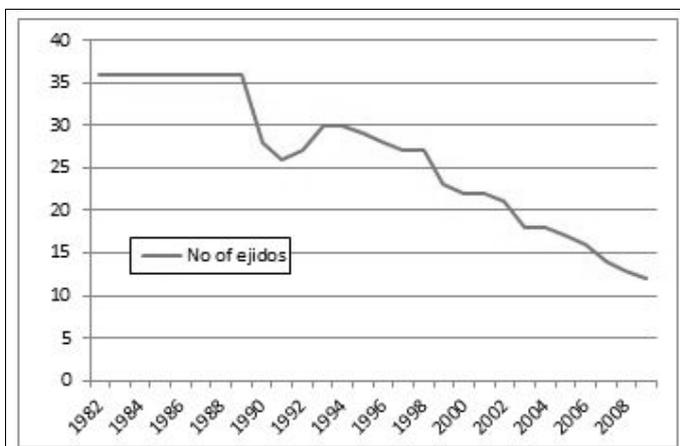


Figure 4: Number of Ejidos Involved in Forest Extraction. Source: survey.

## RIASSUNTO

### **Mercati emergenti per specie tropicali meno conosciute e loro impatto sulla gestione forestale sostenibile nel sud est del Messico**

Uno degli aspetti vincolanti la gestione forestale nei tropici è il numero limitato di specie botaniche richieste dai mercati nazionali ed internazionali. Per questo, la promozione all'uso di specie meno conosciute è spesso raccomandata. Tuttavia, l'introduzione delle specie meno conosciute ai mercati e' rimasto un compito difficile. Inoltre la maggiore estrazione per ettaro causata dal taglio aggiuntivo delle specie meno conosciute ha causato preoccupazione per possibili danni ecologici/silvicolturali. Quindi sorge la domanda di come occorrono l'espansione e la contrazione del mercato delle specie meno conosciute e quale sia l'impatto sulle foreste di un uso elevato di specie meno conosciute. Nel sud est del Messico le foreste sono appartenenti a comunità Alcune di queste comunità sono coinvolte nella gestione forestale da oltre 80 anni. Questo studio vuole analizzare l'impatto dei mercati sulla gestione forestale. Contando su informazioni inerenti alla silvicoltura e produzione forestale regionale, raccoglie i risultati di un sondaggio fatto su 75 ejidos (comunità) e interviste qualitative a operatori forestali, commercianti del legno e industriali del legno riguardanti il mercato di specie meno conosciute e l'impatto di questi nella gestione forestale. Ricerche suggeriscono che i mercati sono effettivamente stati importanti strumenti per la gestione forestale, anche se il loro impatto e' stato mediato da fattori regionali dipendenti da operazioni specifiche.

Aumenti nel marketing hanno permesso a molte comunità di migliorare progressivamente misure di silvicoltura, mentre una diminuzione ha contribuito a spingere le comunità, a lasciare completamente la gestione forestale, lasciando le foreste in uno stato di degrado e abbandono.

L'aumento di opportunità di marketing non ha indotto le comunità a rilanciare l'afforestazione, suggerendo importanti barriere di rientro. La promozione delle specie meno conosciute necessita di tenere conto di questi aspetti perché possa avere successo.

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