Mexican Common Property Forestry Institutions
Summary Report of a National Survey Project [1]

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Abstract

What is role of community in Mexican national policy? What does community governance mean? Despite its importance, a dearth of information on the institutional mechanisms with which Mexican communities manage and commercialize forests remains a serious obstacle to research and policy formation. A Ford Foundation report found that neither clear data exists on the extension of forests managed by Mexican communities nor types of management regimes. Informal estimates place communal forest land at 80% of Mexico's forests, but the level and scope of community timber production and ecosystem management efforts are uncertain although case studies and one empirical study reveal a full range of governance approaches and capacities for management and forestry production. These institutional variations are most likely to have both equity and efficiency consequences in conservation of forest stock and the distribution of benefits.

The National Community Forestry Project in Mexico seeks to amplify and sharpen our understanding of common property forestry institutions and management. This paper reports on Phase 2 of the project in which we conducted community level surveys in Durango and Michoacan. This phase frames Mexican community forestry management as a mode of governance distinct from the private firm or public bureau, where the Mexican agrarian community is a unit of analysis characterized by its history, individual members, resources, civic structure and property rights. We use political-economic and institutional approaches to focus on three key aspects of governance in Mexico's ejido and indigenous communities: 1) range of industrial organization in the wood products markets, 2) internal governance mechanisms for forest issues, and 3) ecological, social and economic impacts of production organization and governance characteristics. Findings for this sample reveal that as communities gain further downstream timber processing capabilities, populations sizes are smaller, some standard of living measures worsen, and decisionmaking patterns (e.g. structure, delegation, officials) follow patterns of internal governance rather than production capability. About half the sample used a community level mode of production while the other half used a sub-community level mode, like work groups or individuals assigned to parcels or volumes and then responsible for organizing extraction. The report provides perspectives on critical questions for Mexican community forestry such as livelihood strategies, sustainable modes of governance and the role of common property in national policies seeking to modernize and globalize.

1 Purpose and Scope of Study

1.1 Why study Mexican common property forestry?

Whether supported by long-standing common property rights or recent decentralization, community-based management of forest resources has become an important option in the design of natural resource management. Low estimates place 25% of forests in the twenty most forested countries under local control or ownership (Scherr, White, and Kaimowitz 2002). At the same time, community-based management remains a complicated institutional form. The functioning of common pool resource management systems relies on a complex set of relationships among individuals in the community with respect to resources, collective decision making mechanisms, local politics, socioeconomic characteristics of stakeholders and cultural factors (Arnold 1999; Jodha 1992). For this reason, some scholars have referred to common property regimes as arenas for the study of a broad spectrum of economic and social phenomenon (Dietz, Dolsak, Ostrom, and Stern 2002; Klooster 2000). The demand for more research on community-based management is high as policymakers struggle with finding new strategies to incorporate local stakeholders into long-term natural resource management goals.

This is hardly better illustrated than by Mexico's agrarian community structure and its national forestry policy efforts. Stated goals of Mexican forestry policy are to 1) introduce sustainable management of forest resources, 2) modernize the forestry industry and 3) alleviate poverty through economic development that channels forest resource benefits to rural communities (Segura 2003; IBRD 1997). Attaining these goals fundamentally depends on the institutional base of agrarian communities which control a vast majority of the nation's forests through common property land grants given as part of the reforms originating in the Mexican Revolution in the second decade of the 20th century, that redistributed hacienda holdings back to campesinos. This land is likely to remain under community control as the 1992 reforms to the Mexican constitution and, more recently, the 2003 forest law exempt temperate and tropical forests from privatization (Bray and Wexler 1996). That many areas of Mexico's worst deforestation lie where no commercial forestry activity occurs or where no forest management plan is in place (Deininger and Minten 2002; Bray, Merino-Perez, Negreros-Castillo, Segura-Warnholtz, Torres Rojo, and Vester 2003; Duran, Mas, and Velasquez 2005) suggests both a conservationist and commercially productive role for community forestry.

Despite its importance, a dearth of information on the institutional mechanisms with which Mexican communities manage and commercialize forests remains a serious obstacle to research and policy formation. A Ford Foundation report (Bray and Merino-Perez 2002) found that no firm data exists on the extension of forests management by communities in Mexico nor types of management regimes. Informal estimates place communal forest land at 80% of Mexico's forests but the level and scope of community timber production and ecosystem management efforts are uncertain. The report therefore identifies these as

crucial areas of research. Individual case studies and one empirical study in Oaxaca on industrial community forestry reveal a full range of capacities for downstream processing, or vertical integration, across communities, from selling stumpage to finished products hewn in community-owned sawmills (Antinori 2000; Merino and Alatorre 1997; Moros and Solano 1995). At each level of processing capability are further variations: community-level organizations, subcommunity-level work groups, parcelized forests, and unions of communities organized to share costs of technical services and capital investments. These institutional variations are most likely to have both equity and efficiency consequences in conservation of forest stock and the distribution of benefits. Before policy formulations can be made, more in-depth work is required to understand the institutional basis and social framework of this sector.

The project frames Mexican community forestry management as a mode of governance distinct from the private firm or public bureau, where the Mexican agrarian community is a unit of analysis characterized by its history, individual members, resources, civic structure and property. A fundamental concern is how different forms of collective action in timber production affect distribution of benefits (both monetary and nonmonetary) among local and nonlocal stakeholders. Numerous reports have cited the need for technical and business capacity as well as putting forth best practice standards for community forestry, as communities and development practitioners seek to support this sector. The broader goal is in explaining outcomes where decisionmaking powers over natural resources lie with local stakeholders but are intervened by the legal infrastructure, state agencies, political practices, and outside private actors with possibly greater market information, experience and political ties.

With the focus on collective action and the distribution of benefits, we dissect this concern into three main questions to guide the survey effort:

1. What is the extent of vertical integration of communities with commercially valuable forestland into the industrial forestry sector, that is, the formal market for timber for wood products?

2. What internal organizational adaptations and networks have communities created to encompass forestry management for timber and nontimber benefits?

3. How do communities generate and distribute benefits of forest management and harvesting, such as through the distribution of profits from timber revenue and adoption of forestry management practices?

1.2 Project history

The research grows out of a collaboration by FIU, CIDE, and UCB to fill this gap in information. Phase One of the project combined the state SEMARNAT permit files into

one database (see Antinori, Magana, Torres Rojo, Bray, and Segura (2004) for full description). Phase Two activities are the collection of original survey data from a sample of common property forest communities drawn from the Phase One data and research and analysis of that data. This report covers the activities of Phase Two.

1.3 Organization of report

This report summarizes the approach and basic findings of the Phase Two effort. The next section describes the underlying theoretical concepts used to answer key questions about common property forestry in Mexico. The following section explains the survey design and sampling techniques from the Phase One data. Section Four begins the summary of data from the surveys collected from 41 communities in Michoacan and Durango. An extensive amount of information was collected. This report only reports on basic results to give shape to the status and dynamics of community forestry. The intention of reporting these results is to point to areas for further research.

2 Models used

2.1 Collective decisionmaking and forestry institutions

Institutional economics acts as the theoretical framework to analyze the three focal questions in the introduction. Institutional economics at its core addresses collective decisionmaking problems over productive activities, with transaction cost minimization motivating the institutional choice and ultimately determining the overall social benefits of the activity. Transaction costs refer to the costs of negotiating, writing, monitoring and enforcing an agreement, be it social, political or economic. Problems in development economics, business management, climate change research and many other areas have been subjected to transaction cost analysis. We extend this approach to forestry management in Mexican communities where we are concerned with the role of collective action and contracting across organizational and governance modes and the impacts of choosing one organizational model over another or structuring contracts and social associations in a certain way. The impacts we consider are economic and environmental and social "performance" indicators. Each of the following subsections explains the institutional economic foundations employed to address the three focal questions.

2.2 Asset ownership and control

Forests owned by communities in common and public land reserved for community or indigenous groups are prevalent worldwide. Examples exist in Asia (e.g., Vietnam, Nepal,

India, China), Africa (e.g., Cameroon, Zimbabwe, Senegal), Europe (e.g., Romania, Bulgaria, Germany) and Latin America (e.g., Guatemala, Honduras, Chile, Nicaragua) (White and Sherr, Ribot, (Abraham and Platteau 2003). Timber harvesting occurs not only through leasing to outside private firms but by organized community production organizations. In many cases, the local right to harvest has only recently been given, as the state often granted timber licenses to private firms. The capitalization of this sector is uneven, as forestry frequently exists with local rural poverty. Reports have emphasized the underinvestment of the Mexican social forestry sector in particular. Often, groups of local residents with unspecialized expertise must overcome collective action problems to complete specialized tasks, either through their own means or with specialists from outside the local community. Understanding the determinants of the observed patterns of "industrial" forestry organization - that is, who are the buyers and suppliers of the production goods and services in these wood product markets - can shed light on the benefits and costs of collective action over forestry resources faced by these communities.

In much of the summary statistics in this report, we classify communities according to their level of processing capability as one of several ways to understand capabilities and constraints on common property forestry activities. Table 1 describes the classifications used based on end product sold by the community. End product sold is correlated with the ownership and control of assets but is not an exact substitute. To explore the importance of asset ownership and intangible benefits of controlling a production process, we drew on previous work in Antinori (2000) and Antinori and Rausser (2009) which adapt an incomplete contracting model (Hart 1995; Grossman and Hart 1986) to the Mexican common property forestry case. To explain the community's or sub-community group's level of engagement in forestry management and commercialization (i.e. vertical integration, or the tipos 1-4), they test the theory that the level of engagement depends on the importance of positive externalities for community's vertical integration into timber production. Positive externalities include:

- More control over channeling economic resources into community (e.g. jobs, profit, access to forest, possibly political capital)
- More control over integrated or complex aspects of ecosystem management (e.g. multiple use management, flexibility in management)

The model expresses conceptual similarities to the "theory of access" (Ribot and Peluso 2003) which emphasizes the capacity to benefit from things as opposed to a more narrow definition of access based on property rights alone. The concept is applied to value-chain analysis and access to natural resources. The capacity to benefit from things includes transaction costs, knowledge, wealth and political influence. In our approach, a property right is only one aspect of control. Ownership over something may give the owner the ability to do certain things only under certain circumstances.

Ordered logit regression analysis in the previous study in Oaxaca found that variables increasing the probability of vertical integration by the community were exogenous measures of human capital endowment, forest size and quality, social cohesiveness ("social capital"). We use this framework to guide the data collection process in other states covered in the present project to address the first question of community participation in the forestry sector.

Table 1: Community Classifications by End Product Sold

No sale	Communities with forests suitable for commercial production but which do not engage in any organized commercial harvest
Stumpage	An outside contractor pays for the right to harvest and extract timber on community land.
Roundwood	The community hires labor and capital to fell and harvest timber to be sold as roundwood.
Sawnwood	The community harvests the timber and transforms the wood into rough hewn boards or more finely processed lumber and plywood.
Secondary products	In addition to the above activities, the community operation makes finished or semi-finished goods, like doors, furniture, palettes, tool handles, and dried and treated wood for export.

The governmental programs, PROCYMAF and PRODEFOR, and the World Bank in its pilot project in Oaxaca use similar classifications to tailor funding and assistance programs to the perceived needs of communities at each level. These programs use only four levels of the classifications, eliminating the last category of secondary products and combining that with the sawnwood category. Antinori (2000) keeps these categories separate in the cross-sectional analysis of 42 communities in Oaxaca because the secondary product communities were distinguished by much higher capital inputs and technical expertise, setting these communities apart from other sawnwood communities.

A continuing point of consternation in discussions of the Mexican community forestry sector is the extent to which internal organization, level of processing and "success" are interchangeable. The Appendix records a variety of typologies created to examine the Mexican forestry sector, though more exist. An example of a typology that incorporates style of internal organization by Nahmad Sitton (2004) draws on characteristics of products sold, organizational capacity and participation in the production process. This social, economic and "communitarian" taxonomy speaks to the institutional complexity of this sector. Which taxonomy is used is a function of a study's goals and purpose. This report parses out these terms as separate descriptors and examines their implications separately.

Vertical integration would affect outcome measures if those measures depend on transaction costs affected by vertical integration (Forbes and Lederman 2008). For

example, vertical integration by the community may lead to better performance on a given ecological indicator if the ecological indicator depends on adaptive, ecologically significant, decisions and objectives that are more easily addressed by the community than by an outside independent private operator. The link may not be necessary, say, if one were able to separate the timber production activities from the activities which affect the ecological indicator, by monitoring or measuring or otherwise contracting for the separation of activities (say by restricting harvest areas effectively) so that it did not matter if the community or an outside operator harvested the timber. Thus, in this paper we examine the correlation (more formal econometric analysis purporting causation will be done in the future) between these levels of vertical integration as shown in Table 1 and outcomes displayed in later sections of the paper.

2.3 Internal governance

Vertical integration patterns map over configurations of internal organization and external relationships but not in a one-to-one pattern. Internal governance, as opposed to asset ownership, speaks to systems of accountability and transparency, which are related to asset ownership. But as shown later in the paper, communities at the same level of integration can have a variety of internal governance systems. As Rodrik (2004) maintains, "institutional functions do not map into unique institutional forms." Mexican forestry communities are no exception. A community selling stumpage may be successful and well-organized in terms of economic efficiency and equity if transaction costs are low, for example. We compare various social, economic and environmental outcomes against asset ownership as represented by vertical integration levels and by internal governance and by broader cross-scale linkages. The communities in the sample exhibit a dizzying array of institutional forms and external linkages, making the application of any one particular best practice model difficult. We hope to shed light on these various aspects of governance for a holistic view and with an eye towards shaping policy for rural development.

While the first question on vertical integration conceptualizes the community as a whole vis a vis other actors in the market, the second component analyzes the decisionmaking process among members of the community regarding forestry management and production. A few words are in order about the basic community governance structure. As described in Article 27 of the Constitution, community members are entitled to benefits generated by communal land. A democratic system of voting in the General Assembly on major allocative decisions gives teeth to this constitutional right. However, conservation management or commercialization of the forest requires marketing, production and silvicultural expertise not available to the general population. Therefore, pursuing forestry entails the ability to manage and market the resource while simultaneously maintaining the connection to the traditional governance system. This interplay of accommodating new roles for forest resources and traditional practices has been a fundamental feature of community forestry, not only in Mexico but also in other community and production

cooperatives around the world (Taylor 1996; Zusman 1992). Arzola, Fernandez, and Fernandez (1993) calls it the "permanent tension" within Mexican community forestry.

This balancing act manifests itself into a number of institutional variations across communities. Community managers must elicit support from the local population, where a key aspect in this process would be their relationship with the General Assembly (EDUCA 2001). Studies claim that where members have an active voice, one would expect the group to have greater ability in reaching stated objectives, be it productivity, sustainable resource management or economic development (Hoddinott, Adato, Besley, and Haddad 2001; Wittman 1995; Vitaliano 1983; Hirschman 1970; Manne 1965), thereby suggesting the link between collective decisionmaking characteristics and selected performance criteria. For example, Antinori and Rausser (2008) argue that communities' experience with parastatal leasing united community members in opposition, creating a form of social capital that facilitated the creation of community forestry enterprises. Of particular concern for devolution is the problem of local elites, or "covert privatization" (Klooster and Ambinakudige 2005). Political domination by local bosses, or *caciquismo* in Mexico, can hijack best efforts (Klooster 2000; Abraham and Platteau 2003) Kaimowitz et al. 1997). Other studies specific to Mexico corroborate the importance of the GA in this context (Merino and Alatorre 1997; Klooster 2000).

Ostrom (1990) describes levels of rulemaking as constitutional, collective or operational. The constitutional level makes the rules by which other rules are made and affects how the collective choice level will operate. The collective choice level refers to policy-making management and adjudication, while the operational level makes more everyday decisions such as appropriation, provision, monitoring and enforcement.

Internal organization is further mapped using the principal-agency framework common in the business literature to explore differences in performance across firms. The main thrust of the principal agency approach is that productive activities can minimize the transaction costs of moral hazard by their institutional choice (e.g. contractual relationships, ownership structures, formal or informal rules and norms). Fama and Jensen (1983) illustrate the implications of separating ownership of assets (e.g. forest) from control (decisionmakers over the forest, e.g. CBC acting on behalf of all members). They describe three main roles in productive organizations: risk bearing, usually accruing to the owners of capital, decision management and decision monitoring or control. How efficient an organization is at minimizing agency costs depends on the relationship of those in these three roles. Furthermore, these roles of risk bearing, decision management and decision monitoring are played by a diverse set of actors and mechanisms. The original paper by (Fama and Jensen 1983) applies the framework to open and closed corporations, financial mutual, nonprofit organizations and the Roman Catholic Church. We extend this framework into the realm of the governance literature to address the importance of transparency and accountability in community development as well as to the operations of a forestry enterprise (Fritzen 2007; Abraham and Platteau 2003).

The parallel with Mexican communities lies in the role which the communities play as

economic actor plus the role of community leaders as political agents for other members of the community. The adaptation to the Mexican case assesses how these roles are played out where the community is an economic, political and cultural entity where social sanctions and other mechanism of control may differ from the private business community.

Taking our cue from these studies, the survey maps key decisions affecting the distribution of resources in the community, with respect to who has decisionmaking authority, who granted authority to the decisionmakers to make those decision and which oversight mechanisms are in place for those decisions. Key decisions include choice of buyer, granting wage or dividend advances and distribution of dividends. The characteristics we consider for monitoring mechanisms to hold decisionmakers accountable are characteristics of the General Assembly and General Assembly meetings, reporting, selection of leaders, group sanctions, social capital (trust and networks), how decisions are made, third party engagement for access too information and oversight. The costs and benefits associated with the observed relationship among the stakeholders and decisionmakers are then compared against the economic and environmental impacts we consider as performance indicators. Comparison of performance measures across is then possible with respect to different relationships among the risk bearers and those who manage or control decisions.

2.4 Impacts of community forestry management

Despite claims that community-based forest management enhances wellbeing, it is increasingly clear that little systematic evidence illustrates when and where this connection occurs (Wunder 2001). Our project collects information to explore the role institutions play, as described in the first two research components, for measures of ecological, social and economic impacts.

A key point is to recognize the forest not just as common property but a resource generating public, private and impure public/private goods. The forest is held in common by the community members. Using the classification characteristics of rivalry and excludability in the literature, the forest is rival in use but nonexcludable among the members of the community. However, to outsiders, it is excludable, as community members actively and energetically guard and monitor their territorial borders. For community members, the timber revenues generate private dividends when profits are distributed among the membership. When revenues are invested in local development, infrastructure, for example, it generates local public goods. The forest is a pure public good when it generates ecosystem services of air, soil and water quality and existence value. Therefore, applying the institutional economics described above requires a clear statement of which goods and services we are discussing when we assess impacts. Revenue flows are important asset builders that in turn generate potentially greater individual income and wellbeing in the long term (Oliver and Shapiro 1997). Their identification within the context of the Mexican agrarian communities provide a first approximation of the level of flows generated by community forestry operations to the local community.

Our measures of ecological indicators describe both quantity and quality of forest stocks and flows. Stock measures include extent and density of standing forest, commercial viability, climate, slope, altitude, comparative degree of biodiversity, erosion and water quality. Flows of ecological benefits include harvest rates as determined by SEMARNAT records, foresters and the CBC/CBE. Additionally, investment in forest stock can be characterized as individual efforts in conforming to forest management rules agreed upon by the community. These rule conformance characteristics refer to actions at both the community and individual level to protect and maintain the forest.[1] In the present study, measures include existence and degree of conformance to limits on hunting, conservation reserves, degree of illegal logging and clearing forest land for agriculture or pasture, measures obtainable from community and forester surveys and checked by third parties.

In addition to the institutional characteristics noted in the previous two sections, we collect data on sources of heterogeneity among the community populations, as these are often considered in the literature as explanatory variables for collective action outcomes. Fieldwork, research and reviews of literature on Mexican community forestry informed the survey design to collect information on social differentials which may affect forestry decisions. These included members, the ejidatarios or comuneros, versus the nonmembers, the avecindados or the posesionarios. Only official members can vote in the assembly and receive monetary benefits generated from the commons. Other interests were divided between young and old, where the younger generation preferred investments in labor-saving technology while the older generation preferred social investment (Fernandez). Interests also differ according to wealth status in the community, say between those who own businesses that need timber as an input into production, and the rest of the community. Questions to identify these and other groups are included in the survey.

3 Survey Development

Survey development and data collection methodology is designed to support testing of theoretical research on common property and to answer basic empirical questions concerning Mexican community forestry.

3.1 Sampling

We used two sources of data as the population frame. First is a dataset compiled from the permit records maintained by the SEMARNAT state offices in ten of the most forested states in Mexico: Campeche, Chiapas, Chihuahua, Durango, Michoacan, Oaxaca, Puebla, Guerrero, Jalisco and Quintana Roo. SEMARNAT is the government agency responsible

[1] Empirical studies of rule conformance in natural resource management include Lam (1998), Bardhan (2000) and Fujiie, Hayami, and Kikuchi (2002).

for reviewing management plans and issuing permits for harvest for agrarian communities and small private landholders. As this dataset does not include communities with forests but no history of permits, the second source of data is the 2000 National Forest Inventory (NFI) to identify communities with area classified as forest (*bosque*) but not included in the permit database.

There is much theory and speculation that size of forest and degree of organizational ability explains observable impacts on environmental indicators as well as social and economic indicators for each community. Therefore, we constructed a random stratified sample based on measures of forest size and organizational characteristics. As no data pre-exists on organizational capacity, we use the categories of vertical integration as an indicator because of the investment level and organizational efforts represented in achieving downstream integration in the wood products industry. PROCYMAF and PRODEFOR both maintain information on type of communities. While definitions slightly vary, both closely follow the concept of vertical integration, that is, the range of production stages and steps carried out internally by the community under its own management. The categories in this case follow a linear advancement along the main production chain: 1) those with commercially viable forest but no commercial timber sales, 2) those selling stumpage rights to standing timber, 3) those harvesting timber and selling roundwood, and 4) those harvesting and processing timber into sawnwood. For forest size, we used the number of forested hectares as recorded in the SEMARNAT and NFI data. The no-sale type, for our purposes, includes communities in the SEMARNAT permit database whose last permit ended five or more years prior to sampling in addition to communities in the NFI database with forest cover but no harvest permits evident in the SEMARNAT database. This combined set of observations includes 4886 communities. Since our goal is to understand institutions and outcomes in communities where commercial timber is possible, if not present, we limited the population frame to communities with 300 hectares or more of forested hectares. This number is consistent with idea that a "commercially harvestable" forest would be one where a harvest was possible every five years or less, as judged by professional foresters on our team and consulting with other professional foresters. Eliminating communities with less than 300 forested hectares and those whose type is not recorded, we have a population frame of 2912 communities (Table 2). The difference between "forest" category and "commercially productive potential" became apparent during fieldwork and is further discussed below.

3.2 Survey sample

Our objective was to draw a random sample stratified by size of forest and by vertical integration level. With information on vertical information level established, we used Cochran's formula (Cochran 1963) for identifying strata cutoff points for forest size levels to identify "small" to "large". The underlying concept of the formula is to seek groupings of similar number which minimizes variance of the variable of interest (i.e., forest size)

Table 2: Survey Population and Mean Forest Cover, by Type

Type	Mean forest ha.	SD (linearized)	N
No sale	3377	351	1994
Stumpage	4820	359	483
Roundwood	6574	592	309
Lumber	16944	2396	126
Total	4543	281	2912

Source: Phase 1 data

Table 3: Forest communities stratified by size and vertical integration

Average hectares within strata	Tipo I	Tipo II	Tipo III	Tipo IV	Total
0.50	428	8	1	0	437
50.00	292	23	16	1	332
100.00	522	38	40	1	601
239.20	364	56	30	5	455
400.00	394	43	16	4	457
608.00	304	88	30	6	428
1,000.00	371	69	42	3	485
1,677.40	332	64	49	12	457
3,016.36	278	87	69	22	456
6,644.99	184	101	89	83	457
Total	3469	577	382	137	4565

Source: Phase 1 data

Table 4: Size stratification for sample selection

Size Strata	Tipo 1 (ha.)	Tipos 2+(ha.)
1	100-556	300-850
2	556-1357	850-2000
3	1357-3077	2000-4500
4	3077-6186	4500-9250
5	6186+	9250+

Source: Phase 1 data.

Table 5: Survey Sample by State

4-level Type	State								
	Durango			Michoacan			Total		
	Total	Sample	Col %	Total	Sample	Col %	No.	Col %	Cum %
No sale	136	4	14.3	143	3	23.1	7	17.1	17.1
Stumpage	140	10	35.7	120	6	46.2	16	39.0	56.1
Roundwood	68	9	32.1	15	3	23.1	12	29.3	85.4
Lumber	42	5	17.9	12	1	7.7	6	14.6	100.0
Total	290	28	100.0	147	13	100.0	41	100.0	

Source: Survey data

within each group (Table 3). We observed a very different distribution between the Type 1 identified through NFI database and those in the permit database, with the NFI Type 1s skewed to a much smaller size forest. We nevertheless combined the two sources of Type 1 communities and then stratified the Types 1's separately from the Type 2 and above (Table 4). Running the stratification exercise using six levels of strata gives the most even set of groupings for both the Type 1 set and the others. The stratification on Type 2's and above naturally selected 300 hectares as a cutoff point, further justifying our selection of limiting the sample to communities with 300 hectares or above.

We then performed a similar exercise for each of the states for which we had data and compared those state distributions against the total distribution. Durango, Michoacan and Chihuahua had distributions that most matched the total sample set and had observations in the full range of cells. We chose Michoacan and Durango as the most representative and cost-feasible states to survey. Because the Type 1s would overwhelm our survey efforts if we stuck strictly with the distribution, we capped the stratified sample of Type 1s to ten and then randomly selected a stratified sample of 31 from the Type 2-4s to arrive at a total sample of 41 in Michoacan and Durango (Table 5).

During fieldwork, it became apparent that many of the Type 1's did not fit the population frame. Chapter 1, Article 2.V of the *Reglamento de la Ley General de Desarrollo Forestal Sustentable* defines forest (*bosque*) as:

> *... vegetación forestal principalmente de zonas de clima templado, en la que predominan especies leñosas perennes que se desarrollan en forma espontánea, con una cobertura de copa mayor al diez por ciento de la superficie que ocupa, siempre que formen masas mayores a 1,500 metros cuadrados. Esta categoría incluye todos los tipos de bosque señalados en la clasificación del Instituto Nacional de Estadística, Geografía e Informática.*

A forest inventory would further categorize forest cover into areas low, medium and high productivity; however, this level of detail was not available for assembling the population frame. Because the vast majority of Type 1 data came from the NFI database, we verified the forest data for the Durango and Michoacan communities in our sample before including them in our sampling frame. Of the total 41 communities surveyed, 13 are from Michoacan and 28 from Durango. The data in this report refer to these 41.

3.3 Instrument development

An initial draft of the survey instrument was based on earlier work conducted in Oaxaca, Mexico on the control of forestry production in communal timber areas (Antinori 2000). This survey approach maintains core questions on institutional development of the community forester enterprises and the patterns of contracting between communities and downstream buyers but add more detailed question about decisionmaking processes of interest in a political-economic model described above. The relationship between the model's core components and the specific data collected in the survey instrument are shown in Figure 3.

3.4 Survey protocol

The procedure for administering a survey to a community included first seeking introductions to community authorities. They were presented with a introductory letter explaining briefly the project and contact information. The survey was to be conducted with at least three members of the community present, including the CBC. The survey is a community-level survey and is administered to the current CBC as the recognized head of the community responsible for such matters, though anyone from the community could respond to the questions during the survey. All answers are treated as confidential.

3.5 Pretests

A series of three pretests refined the survey instrument and protocol. The first pretest was conducted in three communities in Durango during November 2004, including a Type 2, Type 3 and Type 4 community. This was followed by a survey training seminar among enumerators and research team members in Mexico City at the Survey Design Center at UNAM. The second round of pretests in two communities, a Type 2 and a Type 3 community, was then held in Michoacan in late November/December 2004. The third and final pretest was conducted in Michoacan in August 2005 in two communities, a Type 1 and a Type 4 (which was later recategorized to a Type 3). At the end of this process, the team edited and produced a final draft of the survey instrument. This final pretest placed the length of time necessary to administer the survey as between 3-4 hours on average.

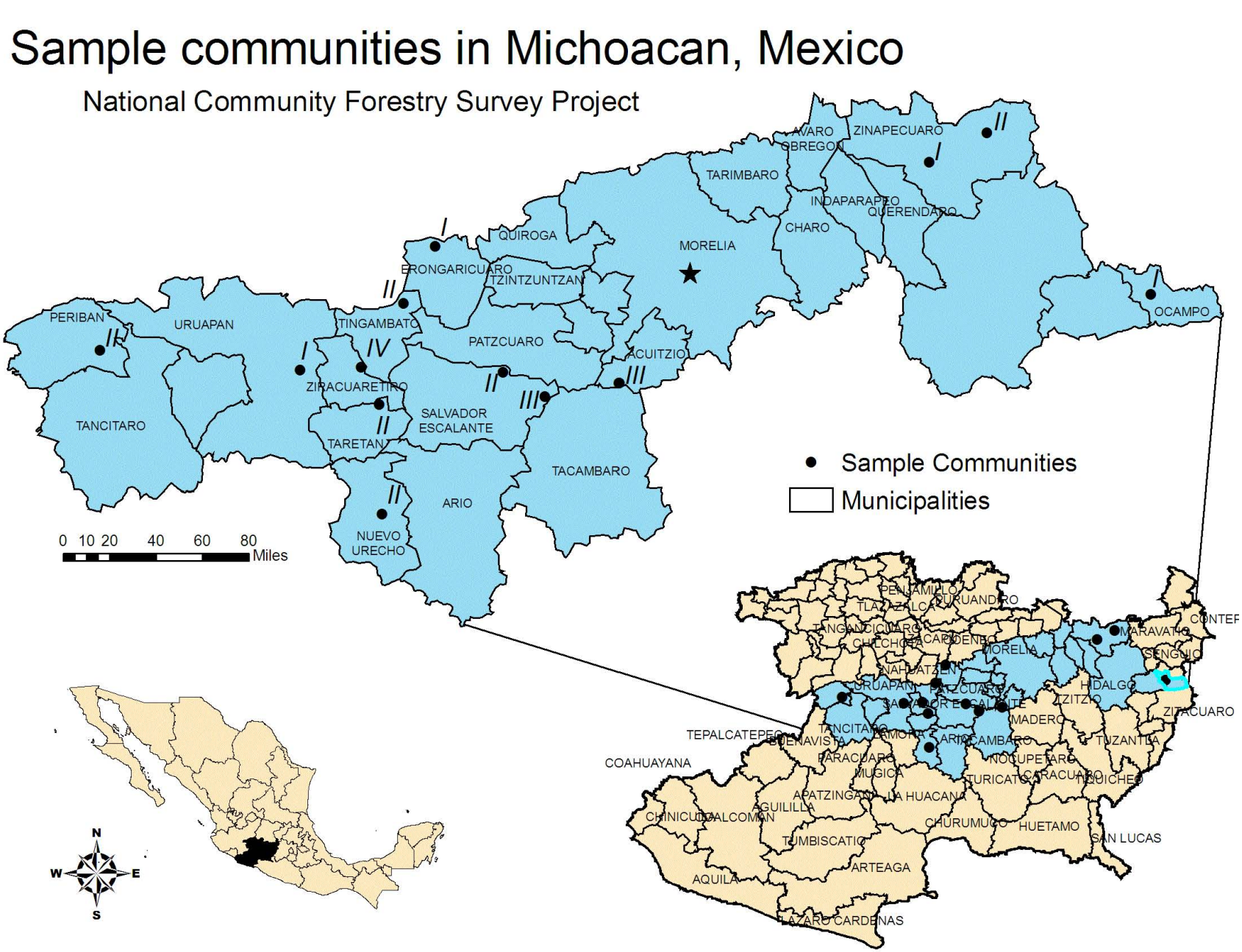

Figure 1: Michoacan sample communities by type

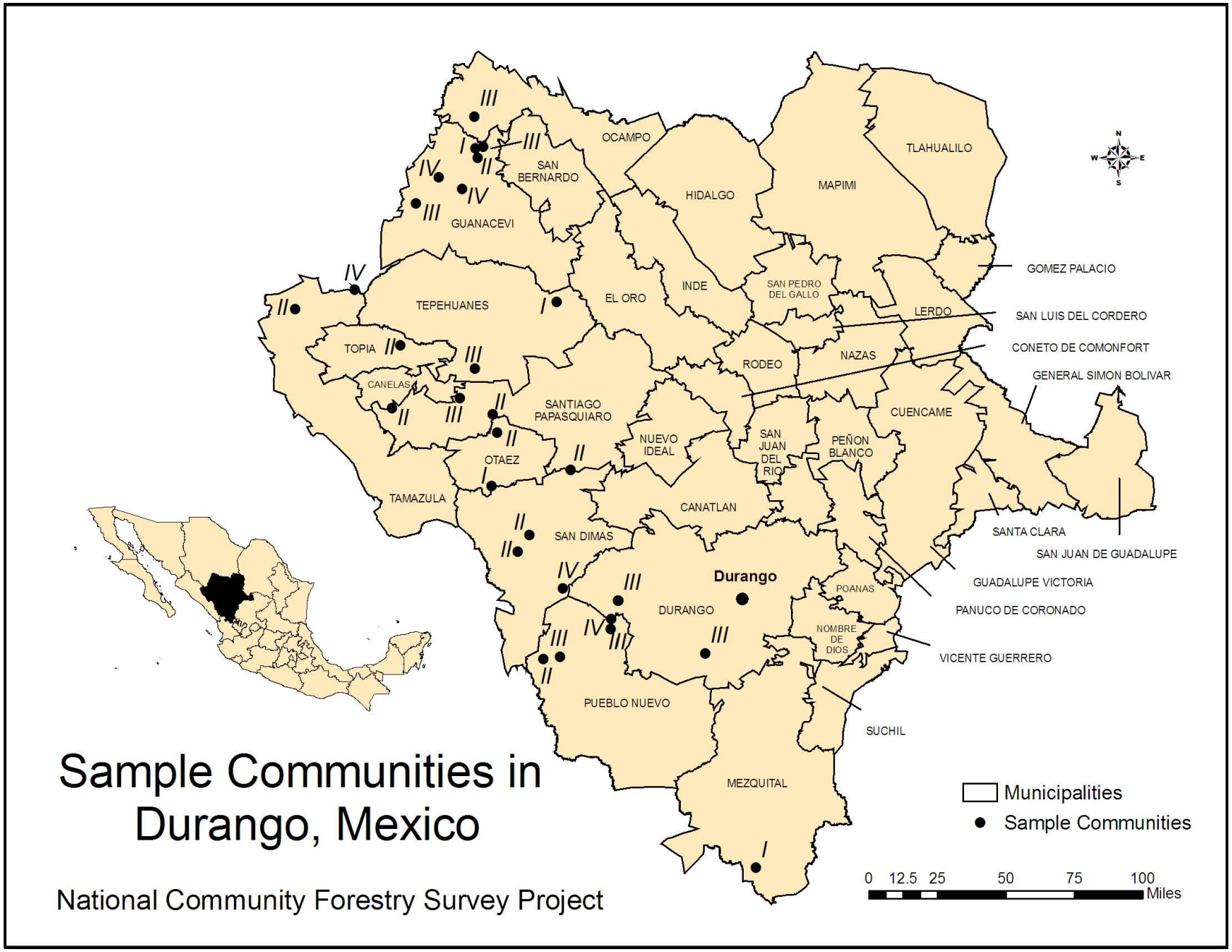

Figure 2: Durango sample communities by type

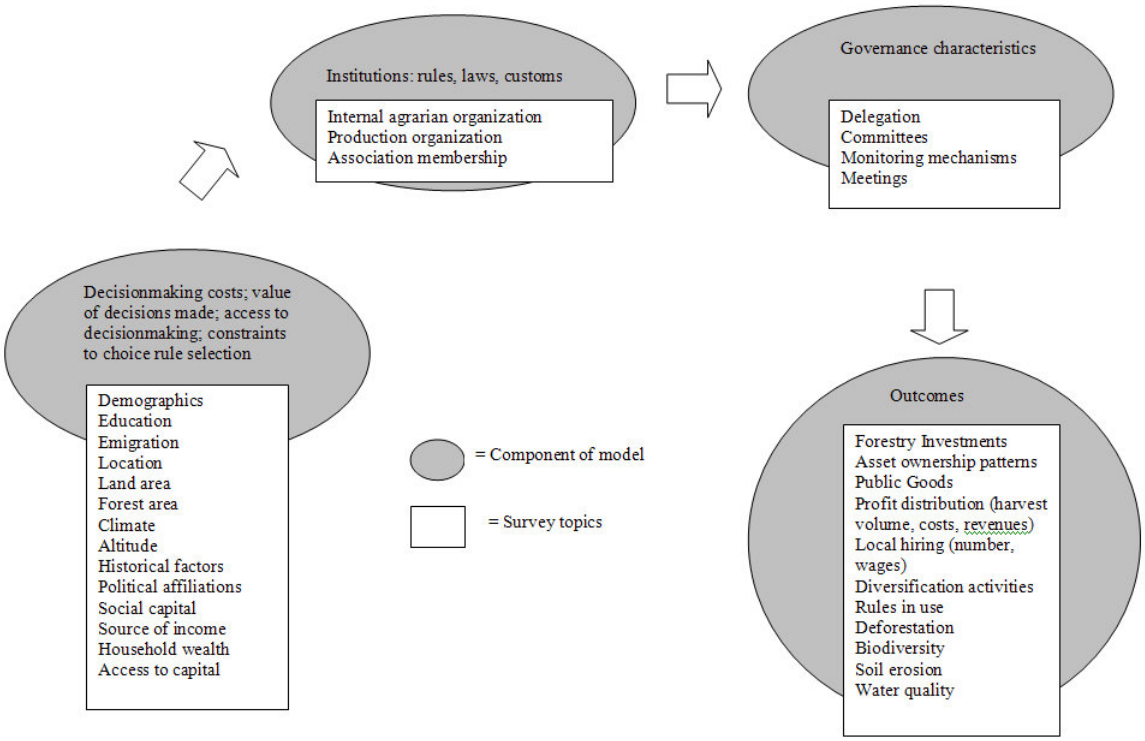

Figure 3: Link between theory and survey

3.6 Use of previously collected data

In addition to the survey instrument collecting original data, we also supplemented community-level information with INEGI 1990 and 2000 Census data on population, demographics, employment, education and standard of living. The measures on material goods, housing materials and cooking fuel have frequently been used as poverty or income indicators and we will employ them in a similar manner. To supplement resource data, we collected measures on topography, general vegetation coverage, altitude, annual average rainfall and temperature. Finally, foresters for each of the communities provided data on levels of actual harvest volume, in contrast to the data on authorized volume available from the SEMARNAT database.

3.7 Follow-up verification

All the data was checked by the enumerators and then by another reviewer to identify and clarify any inconsistencies or missing information in the survey. As necessary, follow-up visits were made wherever possible, or phone calls directly to community members who were present at the survey interview or to other informants to verify the information.

A formalized effort was made to determine the quality of the survey responses by a grant for specific follow-up case studies which were conducted by a masters student at the University of California. Four communities were chosen from the survey sample to be case study communities. The case studies served various purposes. First was to review the original survey in each case study community over a period of a week, thus allowing ample time for verification of the survey responses and giving a barometer of how well survey responses, often collected in a one-day visit, reflected "reality" as seen after a longer stay and wider discussions. Second was to verify and amplify our information on how internal interests varied regarding the allocation of forestry benefits. Since future analysis assesses how interest groups affect decisionmaking, the case studies allowed a wider ranging discussion among a heterogeneous set of community residents (e.g. members, nonmembers, men and women) to explore different perspectives on forest use and management. Third, the student focused on internal organization so that we have a more in-depth view of communities which organize production with work groups or are individually organized.

The follow-up case studies verified that much of the data was correct. One exception was that one community classified as a work group community actually represents a historical anomaly where the state combined several separate villages into one indigenous community for purposes of titling as an agrarian community. Each village has a separately identifiable forest and makes its own decisions about harvesting, so this community's organizational mode is reclassified as "other". Otherwise, the case studies (reported in Fransen (2008) and Antinori and Fransen (2008)) deepened our understanding of the dynamics of internal forestry decisionmaking.

4 Profile Data

The following subsections explain the institutional settings in Mexican community forestry, production organization and internal governance, and social, economic and environmental impacts of interest in this research. Frequently we summarize the data by vertical integration as a form of industrial organization and by type of internal organization and linkages with external forestry associations. The subsections explain which data was collected in the survey and how it applies to the research questions.

4.1 Basic characteristics

4.1.1 Settlement

Legal sanctification of Mexican agrarian communities often came much later than the actual settlements. The constitution adopted after the Mexican Revolution sought to redistribute land back to peasants. Comunidades and ejidos are the two categorization of agrarian communities which fall under these rules. Members of comunidades have provided proof that they existed as a settlement prior to the revolution. Therefore, many comunidades have indigenous origins and are often called comunidades indigenas. Members of ejidos have come together to petition for a title to a specified land area, though this group of people may not have been living in the same locale for any length of time. Our sample includes nine comunidades and 32 ejidos. Twenty percent of the total number have populated their current location for more than 100 years. The formal titling process for recognition as ejido or comunidad began slowly after the revolution and picked up its pace in the thirties. The mean year for receiving formal status and land titles as an agrarian community is 1959, with little difference for ejidos and comunidades.

4.1.2 Land and forest area

In our sample, the no-sale and lumber groups have the largest land areas; however, average forestland increases with vertical integration (Table 6). The difference in average forest hectares is not statistically significant between any of the groups. In contrast, the full permit database covering ten states (n=2912)[2] shows a significant difference in average forested hectares between each group (Table 2). Therefore, we cannot reject the relationship between scale effects and vertical integration in large samples.

[2]Test includes communities with over 300 hectares and type identifiable.

Table 6: Mean forest hectares by type

Type	Mean (ha.)	SE
No-sale (n=6)	2048	(677)
Trees (n=17)	4330	(1280)
Roundwood (n=12)	6128	(1989)
Lumber (n=6)	11722	(4337)
Total (n=41)	5636	(1124)

Source: Survey data

4.1.3 Proximity to population centers

Two types of indicators approximate distance to population centers: 1) hours to state capital (including transportation means necessary) and 2) hours to any other population center of 500 people or more. There is a nonlinear pattern for distance to population centers, with the no-sale and the lumber groups the farthest, followed by the roundwood and, finally, the stumpage group on average closest to population centers. The pattern is slightly switched for distance to the capital city, with the lumber and no-sale groups farthest and the stumpage and roundwood groups closest. The result is consistent with an interpretation that greater distance from population centers increases the contractual hazards of timber marketing as well as decreases opportunity costs for those farther away. For those able to commercialize their forest, these factors argue for own production (Antinori and Rausser 2008).

4.1.4 Demographics

Demographic data captures important measures of heterogeneity and and population size that may affect measures of social cohesion and a group's overall ability to coordinate collective action. Although population size has ambiguous affects on deforestation (Kaimowitz and Angelsen) it is one of the most widely used indicators. Olson's hypothesis is that collective action becomes more difficult as population size becomes "too large". Our data from the survey and INEGI censuses provide this information.

The "no sale" communities have the largest average population size, followed by the stumpage group. The lowest population size is the roundwood group. The size correlates with Olson's hypothesis that larger size discourages collective action required for organized production, in this case (Table 7). However, noting that the stumpage group has the closest proximity on average to population centers, other factors may be in play (Table 8). Proximity to population centers offers employment and therefore raises opportunity costs and lowers several transaction costs such as search, information and transportation.

Table 7: Population

End Product	Mean population 2000			Population change 1990-2000 (%)		
	Durango	Michoacan	Total	Durango	Michoacan	Total
None (n=6)	395	2019	1207	-12	52	20
Stumpage (n=16)	217	2368	889	9	21	13
Roundwood (n=11)	181	382	214	-32	-16	-29
Lumber (n=6)	243	3571	798	-26	20	-18
Total (n=39)	229	1884	734	-13	23	-3

Source: INEGI

Previous study found evidence suggesting that proximity lowers specificity of investments in timber, thus raising the probability of outside contracting for production services (Antinori and Rausser 2008). Further analysis will shed light on the relative importance of these effects.

Some support for the idea of "social cohesion" as a unifying force is given by the percentage of families whose household head is an official community member (ejidatario or comunero) where the no-sale group has the lowest average. The nonmember families may include *posesionarios* and *avecindados* who may be related to the official members of the community, and they are also a source of labor for forestry operations.[3] However, all communities reported having 60% or more of their official members residing in the community with the lumber group and, surprisingly, the no-sale group, having the highest percentages.

We have wide variations between the two states. Using available data from INEGI, Durango has much smaller population size than Michoacan. Notably, overall population sizes are shrinking in the Durango communities, with only the stumpage group showing positive population growth. Michoacan has a positive average growth rate except for the two roundwood communities (one observation dropped). Ejidatarios/comuneros also make up less of the local resident population in Durango than in Michoacan (data not shown).

Almost half of the communities have indigenous language speakers. Yet, the percentage is relatively small, and decreases with advancement along the production chain of timber processing. Population sizes are greater on average in communities with indigenous speakers, evidence of the still strong presence of indigenous culture in agrarian communities. A higher percentage of community members make up the populations of non-indigenous speaking communities though the percentage of members actually residing in the community are relatively the same. This information calls for reflection on the types

[3]Posesionarios live in community with a plot for the house and an agricultural parcel. They are typically children of ejidatarios but lack voting rights in the General Assembly. Avecindados live in the community with a plot only for the house and have not voting rights.

Table 8: Demographics

	Mean			
	Hours to pop. center	Population 2000	Members (%)	Resident members (%)
End Product				
No-sale	0.90	1,046	50	77
Stumpage	0.48	943	76	62
Roundwood	0.68	0.08	70	68
Lumber	0.93	798	70	72
Indigenous speaking				
No (n=22)	0.79	297	74	65
Yes (n=19)	0.52	1200	63	68

Source: Survey data, INEGI

of indicators we use and how we interpret cooperation based on cultural origins and practices as sometimes distinguished in ejidos versus indigenous communities.

4.1.5 Literacy and education

The no-sale and roundwood groups appear to be the low performers in literacy in our sample. Literacy indicators include (among other available variables) the percent of 6-14 year olds who can read and write Spanish and the percent of 15 years old and over who are "literate". For the former, the percentages from Census 2000 data start from a high base of 78% across the four types of communities. Growth rates between 1990 and 2000 were positive for the stumpage and lumber groups but negative for the no-sale and roundwood groups. Literacy rates in 2000 among 15+ year olds is 83% and above, though the growth rates since 1990 are the lowest for the no-sale and roundwood groups.

The education patterns show a low level of education in general in the sample communities, with percentages ranging from 15-31% who are 15 or older and have finished primary school and have some post-primary education. The percentage of 15+ year olds with no instruction declines with level of integration. Yet the roundwood group has the lowest percentage of persons that count with post-primary or post-secondary. This suggests that we should consider the need to consider training and capacity building directed at those who do not have levels of education.

Table 9: Literacy

Type	Mean			
	Literacy 6-14, 2000	Change 90-00	Literacy 15+, 2000	Change 90-00
No-sale	0.82	-0.05	0.83	0.06
Stumpage	0.84	0.41	0.85	0.17
Roundwood	0.78	-0.01	0.85	0.06
Lumber	0.84	0.04	0.89	0.08
Total	0.82	0.16	0.86	0.11

Source: INEGI 2000

Table 10: Education

End Product	Mean			
	No instruction	Post primary	Post secondary	Prof.
No-sale	0.20	0.20	0.02	0.01
Stumpage	0.21	0.22	0.02	0.01
Roundwood	0.12	0.14	0.01	0.01
Lumber	0.08	0.34	0.02	0.01
Total	0.17	0.21	0.01	0.01

Source: INEGI

4.1.6 Sources of income

Data on sources of income for the families in each community are collected to inform the research analysis on land use, sources of wealth, preferences and opportunity costs. The responses are given as percent of families regularly receiving income from that sources in the last year, as shown in Table 11. Sixty percent or more of families in communities with forestry operations receive income from forestry. In the communities with forestry operations, private businesses which consume community wood to make a secondary or final wood products are also a possibility. Among the forestry production categories, the lumber group has significantly smaller percentage of families who engage in this type of business, presumably because that business is dominated at the community level.

Agriculture and livestock are the other main sources of income, with no significant differences across groups. However, stumpage community members most often receive income from agriculture while the no-sale community families most often receive income from livestock. The latter finding may be worth closer analysis, as livestock grazing may be associated with deforested areas. Nontimber forest products rarely generate income though they may be collected for subsistence use. The roundwood communities report no families receiving income from nontimber products while stumpage community families most often receive nontimber income. The presence of stores in the community, as separate from other types of local business, is most frequent in the lumber and no-sale group. This data has been used as an indicator of a general level of local income in a community. Finally, the no-sale commuters are statistically significantly larger than those who commute to work from the forestry production communities. Information on the dependence on remittances is given is a separate set of questions.

4.1.7 Household wealth

The income and well-being measures fall into categories of basic public goods, like schools, electricity, access to running water and drainage systems, to personal assets like televisions and automobiles.

The INEGI 2000 Household Census data provide us with information on household infrastructure like the percent of households in a community with electricity, drainage, running water, primary cooking fuel as gas or fuelwood, and housing materials. While not all differences in means are significant, we find a general decline in these wealth indicators with increasing wood production and processing capacity. Any contribution which value-added activities are making are not strongly apparent through these measures. We calculated an aggregate measure - the average of percent of households with electricity, running water, drainage and gas as a primary cooking fuel - and tested for differences in mean between groups. A significant break (at the 5% level) occurs between the stumpage and roundwood group. By state, the difference is especially strong in Michoacan where the

Table 11: Sources of Income (Mean Percent of Households)

Type	**Forestry**	**Private-F**	**Private-O**	**Private-I**	**NTFP**	**Agri**	**Livestock**	**Stores**	**Commute**	**Other**
None (n=6)	0.00	0.00	1.00	0.37	0.33	16.67	35.10	5.17	49.17	0.55
Stumpage (n=17)	62.97	6.34	4.86	0.50	8.77	30.67	23.21	4.60	8.97	5.50
Roundwood (n=12)	77.52	3.58	0.34	0.26	0.00	11.35	29.93	4.55	18.29	0.00
Lumber (n=6)	79.00	0.40	1.20	0.40	1.40	10.80	21.00	6.20	16.17	0.00
Total (n=41)	60.23	3.83	2.52	0.40	3.93	20.25	26.65	4.88	18.64	2.47

Source: Survey data

percent of households using gas stoves as a primary fuel drops significantly between the stumpage and roundwood groups.

A few other comparisons are also interesting. The aggregate measure distinguishes the forestry production versus the non-production communities, with the latter scoring higher in this wealth measure on average. Finally, Figure 4 shows a regional variation. The same measure calculated for Oaxaca with the previous survey sample of timber producing communities shows an opposite, increasing trend in infrastructure with vertical integration. Why the reverse pattern in northern v. southern samples? Is vertical integration in Oaxaca contribute to greater local infrastructure development?[4] Further analysis will look into these questions.

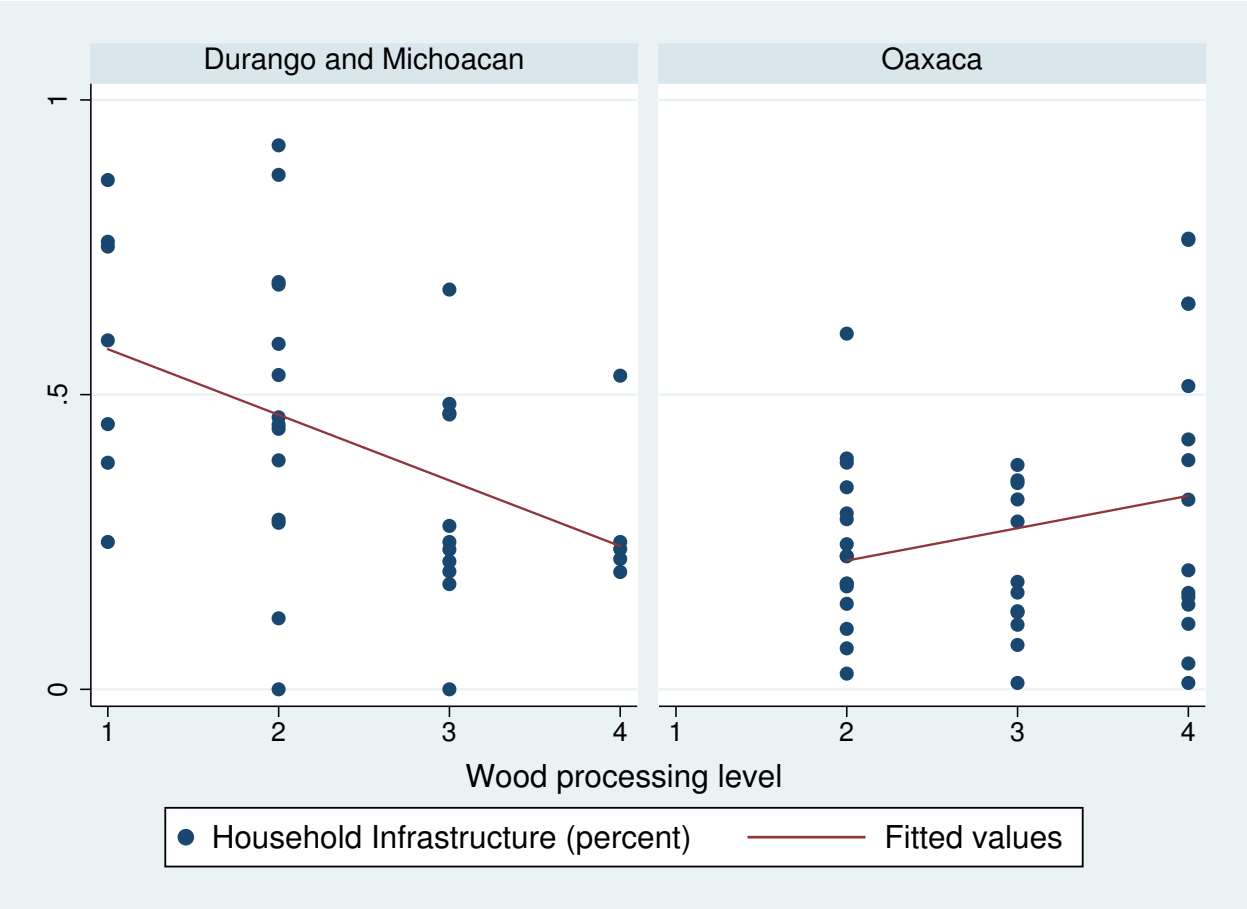

Figure 4: Household Infrastructure: Oaxaca v. Durango/Michoacan by Vertical Integration

The survey provides binary data on other public services, like schools and health clinics. Little statistically significant variation exists in the sample to in having schools, internet,

[4]These same measures taken at their 1990 levels were not found not significant in explaining vertical integration in Oaxaca (Antinori and Rausser 2008).

libraries, mail service and health clinics, though some frequencies decrease with vertical integration.

We have a number of measures from the survey on household wealth in terms of livestock and materials goods, like cars, telephones and house size. Rather than report individually, we look for patterns using principal component analysis and find that factors formed around 1) sheep, having 0-3 cows and 0-3 pigs, 2) having over 50 cows and over 50 chickens, and 3) having a car, cell phone, a house with two levels and running water. Scoring these three factors and then taking averages, the material goods factor decreases as vertical integration increases. Durango scores more poorly in material goods, with a negative average scorings, while only the roundwood and lumber groups have a negative average in Michoacan. Furthermore, there is a strong correlation between this factor and INEGI collected data on percent of families using fuelwood, gas stoves and degree of municipality marginalization. The factor correlates negatively (ρ = -0.70) with fuelwood use, positively with gas stove use (ρ = 0.71) and negatively with higher degrees of marginalization (ρ = -0.21), as would be expected, providing a degree of coincidence between survey and secondary, government-collected data.

4.2 Development of Community Forestry Institutions

For the communities which commercialize their forestland by selling stumpage, roundwood or more processed material, the survey mapped the internal governance structure and decisionmaking processes regarding these forestry operations. Below is a brief historical overview of forester activity in all the communities in the sample and, for communities which are currently selling their timber resources in some form, a description of their internal organization for forestry management and production.

4.2.1 History of forestry activity

Forestry has had a long history in Mexico. The survey covers generally the last 50 years, based on recall of the community members present at the survey interview. This includes a representation of both concessioned and non-concessioned forests. Of the communities which currently commercialize their timber resources, about half in each category of stumpage, roundwood and lumber have been part of a concessioned area in the past, starting in 1950 and onward (with one community reporting a concession which initiated in 1917). In addition, a little over half of all the communities in the sample (24 out of 41), including the no-sale group, have worked with private firms in the past. The earliest date is 1940, though occasionally community interviewees indicated that forestry activities had occurred even earlier but could not recall specific time periods.

The evolution of community integration since the concession era ended shows considerable fluctuation in end product sold over time, not always in a progressively forward manner.

Table 12: Integration and De-integration History

	No-sale	Stumpage	Roundwood	Lumber
Forwardly integrated				
Sell stumpage (in past-check)	-	-	5	5
Sell rw (in past-check)	-	-	-	5
Retrograded				
Sold stumpage in past (and now don't)	5	-	-	-
Sold rw in past (and now don't)	2	4	-	-
Sold lumber in past (and now don't)	1	6	7	-
Sold processing equipment in past (and now don't)	0	3	2	1

Source: Survey data

At least five of the no-sale group have sold stumpage in the past, showing that they may be occasional timber sellers, possibly because their forestland is not large enough to support timber sales every year (Table 12). Some of the more integrated communities started their introduction into the timber market by selling stumpage and then eventually integrated forward, while other more integrated communities have de-integrated for a period of time and then sold a more downstream product. However, most of the roundwood communities had never sold stumpage in the past but started off their own forestry activity by extracting the timber themselves and selling roundwood. Fourteen of the no-sale to roundwood communities have had sawmills in the past which they no longer operate. Reasons for the switch in level of operations varied widely but the most frequent responses are issues with management capacity, re-organization, and having enough timber that year to sell or process. One informant explained how the switch in end product sold year to year fits into a livelihood strategy. Referring to one community with a sawmill and machinery for secondary products, the community has frequently switched from selling stumpage one year and selling processing material another depending on the need for cash. The processed material presumably yielded about the same profits as selling stumpage, so that the decision depended on the need for an *anticipo* or the advance payment that stumpage buyers will offer but not buyers of processed material. If the *anticipo* is not needed that year by community members, they will incur the upfront costs of salaries and other costs and process the timber. We suspect that this strategy is used by other communities.

4.2.2 Internal organization for timber production

Even though forestland is officially held as common property, different levels of organizations within the community itself can exist to extract resources. To be sure, communities most frequently organized timber production activities at the community

level, that is, any contracting, sales, extraction and processing occur with decisionmakers who represent the entire community, usually the CBC. However, other organizational models have emerged. Their basis has been historical practices in managing the forest, more recent federal policy changes and, given evidence in our survey, internal dissatisfaction with community-level organization. The 1992 agrarian reforms allowed more types of production organizations to form within the agrarian communities, opening up institutional possibilities.

Levels of production organization found in the survey sample are primarily two kinds, work group and individual. Table 13 shows the distribution of the production models across states and a statistically significant distinction between Durango and Michoacan. Work groups are much more prevalent in Durango, while individual informal parcelization has a stronger presence in Michoacan. The summary statistics show that frequency of division decreases with greater vertical integration although one lumber community in the sample has subcommunity level extraction operation. Larger forest size is also negatively correlated with production division. However, the individual arrangements and some of the work group arrangements were formed prior to the 1992 reforms, reflecting the flexibility of community forester practices regardless of formal laws.

The forestry management plan in all cases, regardless of extraction and processing organization, is done at the community level, that is, there is one management plan per community (except in rare cases). In a typical scenario, the forester will assign the authorized volume to the community in any given year and delineate the areas where harvest is to occur. The manner of dividing up the volume among work groups or individuals is left to the internal workings of the community. Often, members hold a lottery to assign areas of harvest, as the areas differ in accessibility and quality of timber, though everyone is assigned an equal volume. Once these areas are assigned, it is left to individuals or work groups to arrange harvest and sale of timber.

Usually, volume, not land, is divided among the membership. However, a few cases claim to have permanent parcels based on historical, individual access patterns for resin production, or a distinct constitutional history. *Colonias* for example were formed in the fifties resulting form federal policies to encourage land settlement and cattle ranching. In these cases, each founding member was allotted 50 hectares, regardless of whether the land was agricultural or forest. Our sample includes a case of community which had been created from five previously distinct communities. Each "sub-community" still considers itself more or less separate from the unified body so that each carried out timber activities according to their own practices, although one management plan applied to the entire unified community.

The degree of formalization of these subgroups varies across communities, as would be expected. Some work groups form along family lines, by convenience or simply around who people think can get the best terms of trade. Consequently, group size can change each year. Under individual harvesting, individuals are responsible for harvest and business arrangements. Groups or individuals hire amongst the community for extraction. For example, one community with "individual" organization employed a total of ten chainsaw

Table 13: Internal Organization Types

	Community N=26	Work group N=5	Individual N=10
State			
Durango	21	4	3
Michoacan	5	1	7
Pearson chisq prob. = 0.01			
Mean formation date	1980	1996	1987
End product sold:			
No sale	4	0	2
Stumpage	11	1	5
Roundwood	6	3	3
Lumber	5	1	0
Post-association membership	6	5	2
Pearson chisq prob. = 0.002			
Past maladministration	8	4	7
Pearson chisq prob. = 0.01			

Source: Survey data

operators for about 50 community members in the last completed harvest prior to the survey. Sales proceeds go directly to each group member net of direct costs paid by group leaders or to individuals.

Most seemed to have formed because of dissatisfaction with community level governance. In fact, a dummy variable for significant "maladministration" in the past is significantly correlated with non-community-level organization. At least two of those cases specifically dated the event as prior to the switch in organizational form rather than occurring under the subcommunity form of production.

There is as yet little evidence that the economic and environmental impacts of sub-community level management organization are different than community-level organization (Antinori and Fransen 2008).

The existence of these other forms poses a challenge to cross-scale linkages, say with foresters who must spend additional time coordinating with community members, and second-level organizations which seek representation from the community. While frequency of membership in forestry associations is fairly evenly distributed among each organizational mode, all the work group communities formed work groups *after* joining the association they are currently a member of. The work group form, as opposed to the individual mode, has been problematical in sending community representatives to association meetings (Taylor 2003). Most (80%) of both community-level and

individual-level harvesting had their current production mode prior to joining the association. This shows that individual forms of production do not compete with the usual governance of common property activities in the communities, whereas work groups introduce additional layering of decisionmaking that is not completely hierarchical to community-level governance.

4.2.3 Management

The overall view of these communities is that few have a governance system more elaborate than the traditional *cargo* system. The number of committees increases with vertical integration, showing more division of labor; however, this distinction decreases when we consider that most positions are dually held by the CBC or JV, reducing the effective number of positions in the community. This structure is a practical choice by the communities but highlights the need for training and outreach to cover business and ecological management skills. About 45% of the communities compensate the CBC and JV for their time. For all communities, the CBC and JV serve for 3 years.

Organizational structures can also include both internal and external actors to gain additional expertise or act as oversight. Three (a no-sale, stumpage and a lumber community) have a council of advisors apart from the regular cargo positions. The Consejo Forestales (CF), where they exist, follow the *cargo* pattern. They serve 3 years and receive no payments. Only two, a stumpage and a lumber type, have *caracterizados*, that is, respected members of the community who act as overall advisors or counsels in community matters. In neither case are they paid, and they have a more or less indefinite post.

For the forestry activities, all the communities have Jefes de Monte. These are foremen to oversee extraction and in all cases are members of the community appointed by the CBC or CV and themselves overseen by the CV or STF. The duration of their post varies from 1-3 years or for an indefinite period. About five were unpaid positions, while the rest (9) are paid either by the community or in one case by the buyer.

The documenter, responsible for measuring wood volume extracted and transported, has more variation in supervision and pay. All but one are members of the community and appointed, for 1-3 years or for an indefinite period. They are supervised by the CBC, CV, STF, contractor, or parcelero or a combination of those. They obtained the post by appointment by the community assembly, parcelero, work group, or contractor, and paid by the community, buyer, work group or parcelero.

4.2.4 Decisionmaking

Ostrom (1990) describes three levels of rulemaking: the operational levels, collective choice level and constitutional level.[5] The constitutional level sets the rules for the collective choice level, which in turn sets the rules for the operational level. Our survey questions on decisionmaking patterns focuses mainly on the operational and collective choice levels, as the higher levels are more or less set and would not vary across communities. The questions trace the decisionmaking process for several key decisions in forestry management which ultimately affect the level and distribution of income and benefits from forestry activities, namely the choice of buyer, exchange price, wage or reparto advances and volume harvested. The processes described refer to who makes those decisions, who authorized that person or body to make those decisions, and what forms of oversight exist over decisionmakers.

We find that decisionmaking patterns are distinguished not by vertical integration level but by organizational mode, that is, whether the forester operations are organized at the community or sub-community level discussed above. Consistent with economic organizational theory (Fama and Jensen 1983), decisionmaking powers follow the governance structure. Take for example the question of who is authorized to make decisions about the distribution of revenues from forestry sales. Most of the communities which fully manage and operate collectively report that the General Assembly (GA) makes this decision. In those which operate in a parcelized fashion or in work groups, the flow of funds is handled by the work group leaders or the individual parcel holders. Neither does the CBC become involved in this decision, though he is in a several community-level operations. However, this mode of organization implies a collective choice and an operational choice. The GA initially approved the decision to allow production at the sub-community level, implicitly allowing the change in decisionmaking responsibilities which goes with that particular production model. One may also say that the GA constitutionally had the choice to make a collective decision to change their internal practices.

Likewise, the GA and CBC have the responsibility of negotiating a sales price with buyers in collectively-managed communities while parcel holders or group leaders make the decision in these divided communities. Yet even in divided communities, there is a variation in decisionmakers. The work group communities are spread out in mentioning the CBC, PST, Jefe de Grupo, and the *Asamblea de Grupo* as actors in authorizing the price at which their product could sell. In the parcel cases, the GA is also noted with frequency. Even though these subgroups are responsible for harvesting their allotments, some of these subgroups still coordinate as a community in agreeing to prices or in making agreements with buyers.

Advances on wages or *repartos* are part of the livelihood strategy associated with

[5]Other work (Ostrom 2005) includes a fourth level called the meta-constitutional level, which sets the rules for the constitutional level.

community forestry (e.g. Wilshusen). The CBC, rather than the GA, is more often responsible for authorizing advances in collectively managed communities, though the GA was the second most frequent response. In several instances, interviewees explained that the CBC has to either clear or report the advance in GA meetings. Among the five work group communities, both the *Jefe de Grupo* and the CBC are mentioned as decisionmakers for this decision. Finally, *parceleros* deal directly with buyers to arrange advances. In one example of the interaction of different levels of interaction on this practice, the buyer might discuss a request for an advance with the CBC, presumably to gain more information on the individual and make the accounting consistent. The buyer then deducts the advance at the end of the payment cycle from any *repartos* or wages (say, in stumpage communities) owed to that individual.

Most communities regardless of internal management system said that the PST is responsible for authorizing harvest levels, as per state mandated rules and the requirement of a management plan. However, some communities noted that the GA (or work group leader or parcelero) also has a role in authorizing the harvest, either in approving the plan or adjusting the harvest to less than the total allowable cut.

In collectively-managed operations, the General Assembly is most often the locus of choosing a buyer. Buyers make a proposal and the GA votes whether to accept the bid. The CBC is noted in a few cases along with the GA as decisionmakers. It should be noted that often community authorities respond to this question in terms of final decisionmaking. This does not preclude the role of the CBC or another actor, like the PST, in bringing the buyer to the GA forum. In work groups, the work group leader is directly responsible for choosing a buyer, while the individual parcel holders choose under the temporary parcel system. The PST is least involved in this phase, and many PSTs in follow-up interviews confirmed that they are mostly not part of this process.

A question is whether any one decisionmaking model provides more accountability and more equal distribution of benefits. This question is explored in the section below on distribution of benefits. In addition, Antinori and Fransen (2008) indicate that economic and environmental impacts in these "decentralized" communities is not systematically worse. The impact depends on the performance measure in question. Survey data and follow-up household level interviews suggest that the reason for the re-organization was to improve management (Fransen 2008; Antinori and Fransen 2008). As long as decisionmaking powers are balanced by a form of control mechanisms over the decisionmakers, decisions that are responsive to membership needs can be made. Production at the work group or individual level does not completely relieve the subgroup from community responsibilities. Almost all of the individually organized production operations pay some form of retribution to the community. In work groups it is less clear, though a portion may be alloted on a regular basis to the local school. Furthermore, these models do not necessarily correlate with specific levels of vertical integration. Therefore, various forms of internal organization are possible across each of the levels of integration, though community-level organizations predominate at the lumber and secondary product

stages.

4.2.5 Associations and NGOs

Relative to other regions in Mexico (for example, Oaxaca), few NGOs operate in this sample (only 2 out of the 41, and one was in a type 1 community), despite these state's importance to forestry resources. Michoacan is home to the Monarch Reserve and other ecological attractions, while Durango is one of the top timber producing states in Mexico.

On the other hand, forestry associations have a rich history in Mexico and have played a major role in shaping the community forestry sector. A forestry association in our study included any grouping which the interviewees identified themselves as a grouping of communities to address some aspect of forestry. The associations in the sample include technical associations to share forestry services, political associations, production cooperatives and the recently created Unidades de Manejo Forestales run by CONAFOR. Antinori and Garcia-Lopez (2008) provide a detailed analysis and historical background of these associations using the survey data. Here we note the main points.

Affiliation with a forest association or union of other ejidos and communities is predominant across the sample. Out of 41, 32 belonged to some type of union of forest ejidos, with membership probability rising with vertical integration. Durango counts with significantly more instances of associations membership than Michoacan (Table 14). Since the historical motivations leading to the creation of forestry associations includes complex relationships to political movements, a continuing line of study is how political movements differed across the Mexican states. For example, in the Oaxaca study, less than half of the sample (13 out of 44) communities belonged to a forestry association, where membership significantly increased with vertical integration. Of the 32 FAs identified in the current sample, thirteen are products of community effort. These bottoms-up organizations show no significant difference in frequency across states.

All of those in a forestry association in the past related to removal or resistance against parastatal practices are now members of a forestry association. In addition, ones who were not members of these past associations are more likely to be in a "top-down" organization now.

We tested the impact of association membership against various environmental and economic indicators. The differences are somewhat less than expected, though the analysis is preliminary. For example, those who are members in an association that provides marketing services do not necessary receive a price premium for their product. Those in an association providing environmental training or services do not necessarily exhibit "better" forestry management practices. However, association membership has a positive impact on reinvestment in forestry and some public goods (Antinori and Garcia-Lopez 2008). In addition to these impacts, further study includes an assessment of how association

Table 14: Forestry Association Membership

	Nonmembers	Members	Total
N	9	32	41
Avg. forest ha.	1123	6946	5636
SE	(262)	(1358)	(1124)
Parastatal-era assoc.*	0	13	13
Pearson chi2 Pr = 0.02			
	Association Membership N=32	Bottom-up N=13	Top down N=19
State			
Durango	26 (93%)	12	14
Michoacan	6 (46%	1	5
Pearson chi2 Pr = 0.001			
End Product			
No commercial		2 (33%)	
Stumpage		14 (82%)	
Roundwood		10 (83%)	
Lumber		6 (100%)	
Pearson chi2 Pr = 0.03			
Parastatal-era Assoc. membership	13/31 (42%)	5	8
Pearson chi2 Pr = 0.01			

Source: Survey data

membership is integrated into the community governance structure and decisionmaking processes.

4.3 Production

The survey covered many details of production, including harvest levels authorized and cut by species, labor and capital and forestry services. We present only a snapshot of some of the data.

4.3.1 Volume

In an earlier phase of the project, the permit data from the ten states showed a declining trend in authorized volume for pine species, the most important of commercial species in Mexico. Figure 5 displays the average volume against the total number of permits to

community territories. The decline is steady since 1991. In the same period, the number of permits have increased, reaching a peak in 2001, and then decreased. Even if we consider that more permits may have been issued after we collected the data around 2005, the decline in average authorized pine volume and decline in total number of permits to communities is still apparent. One possibility is that initially large communities apply for a permit, while communities with smaller forest resources organized more slowly. The reason for continuing decline in number of communities with permits is still unclear (note: compare to world prices).

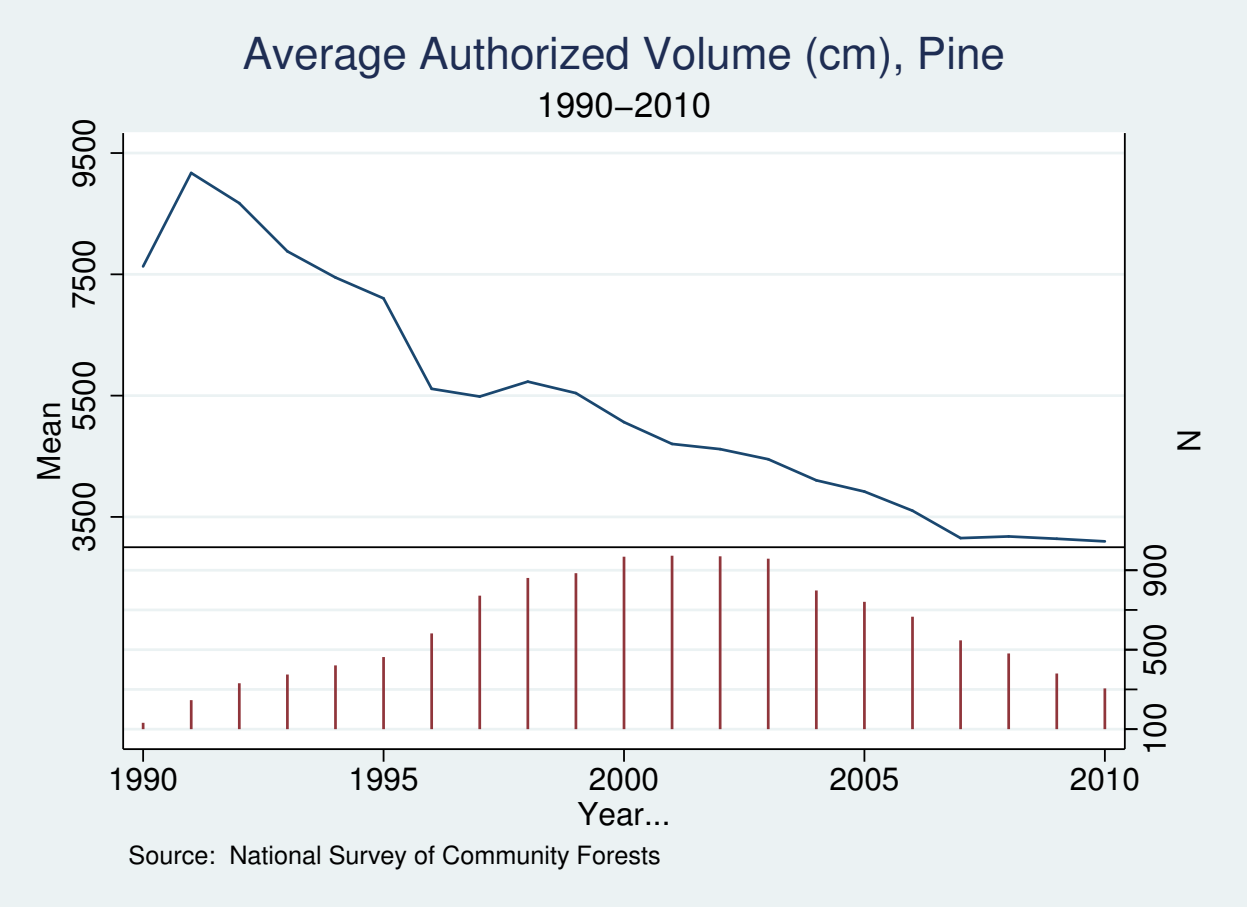

Figure 5: Authorized timber volume, pine (m^3)

How do the sample communities compare with the overall trend? Table 15 shows authorized volumes from the permit database for the years 2000 and 2005. Few communities in the database had matching data for both years, so the percent changes show changes in overall group averages.[6] The 41 sample communities reflect the trends for the rest of the communities in their state and vertical integration group, except for the

[6]The Phase 1 typological classification is maintained for the sample communities for consistency even if the community was later classified as a different type.

Table 15: Average authorized pine (m^3) for Durango and Michoacan: All v. sample communities

	Durango			Michoacan		
	Stumpage	Roundwood	Lumber	Stumpage	Roundwood	Lumber
2000-All						
N	73	60	29	85	14	9
Mean	4638	4769	18326	1708	1779	9994
sd	5031	4318	23810	1464	1870	20663
2005-All						
N	46	39	24	69	13	7
Mean	4824	3865	16930	1084	1681	13601
Sd	3950	2700	22005	1187	1646	24199
Change	4%	-20%	-35%	-36%	-6%	36%
2000-sample						
N	8	10	6	3	3	2
Mean	4913	3331	11886	3072	938	608
sd	4048	4095	9209	1652	324	308
2005-sample						
N	7	6	5	3	3	1
Mean	3341	2069	10198	1531	862	329
Sd	2936	1253	8172	1176	377	–
Change	-32%	-38%	-14%	-50%	-8%	-46%

Source: Phase 1 permit data.

Durango stumpage communities which overall had a slight increase in authorized volume on average in contrast to the decrease among the sample stumpage communities, and the large overall increase for Michoacan lumber communities in contrast to the one sample observation for this group. Otherwise, the sample communities reflect the decreasing trend in authorized volumes. Future study can verify these trends with updated information which verifies the vertical integration of the community in the permit database and matching years.

Comparing the authorized versus the actually harvested levels, all averages are somewhat less than the authorized levels except for the roundwood group in Michoacan. If we focus on group averages (where more than one observation point is available), we find that Durango on average comes closer to harvesting 100% of its authorized volume each year than Michoacan. All the Durango averages are above 90% of the authorized amount. As a group, the roundwood harvest the highest percentage of allowable cut than the other groups. Where the volume actually cut was less than 100% of the allowable level, communities across groups tended to state lack of demand and lack of commercial wood - possibly implying that not all of their harvestable wood was commercially desirable - as reasons. The stumpage group tend to state lack of demand, while the lumber group gave

both reasons. In considering trends in harvest levels, most communities thought they would only be able to harvest less timber in the future, consistent with the declining production trend.

4.3.2 Prices

The price at which products are exchanged are an agreement between the buyers and sellers. Considering that various governance characteristics might improve the bargaining power of the communities, we compare the deviation from the mean price for the product sold. For example, we might expect more highly integrated communities to have more market information and flexibility in contracting and therefore to have better prices for their products. Likewise, communities selling their timber by subgroups may be expected to receive better prices if the division sought to improve management operations and achieve more flexibility in contracting. A measure was created by calculating the difference between either the community's stumpage or roundwood price per cubic meter and the average for that category of product. The more integrated communities and the communities that produce by subgroup levels have higher averages, that is, price premiums. However, we found that among this dataset, the variances in prices are so wide that the differences in means between integration levels of form of organization are not statistically significant. Quite likely, other factors must be considered in explaining price differences, such as location and specific contract agreements.

4.3.3 Employment

One of the benefits cited for community forestry is access to local employment opportunities. Indeed, one of the sticking points causing resistance to parastatals was the practice of hiring more experienced workers from distant locations outside the community rather than hiring and training locally except for the most basic of tasks. Our data on employment refers to the last harvest season before the survey to ground the responses in actual occurrences. Table 16 shows total employment by occupation. Technical work refers to taking inventories, clearing brush to prevent fires and other silvicultural treatments, and marking trees for the next harvest. The sum excludes the professional forester, which is generally one professional per community. Reforestation refers to workers hired to replant trees and tend to nurseries. This category is the largest as various government programs mandate and fund reforestation in communities. Large groups are sometimes organized to carry out re-planting projects. While some of this work is paid, it should be noted that a community might organize a particular reforestation effort as a *tequio/faena* or community service project which is unpaid but counts towards members fulfilling their duties to the community. Logging refers to loggers, their assistants, transport of timber, road work to maintain or create logging roads. Finally, milling, the smallest category refers to work in sawmills and with other equipment to produce secondary products. The data does not

Table 16: Total employment by occupation

Occupation	Sum (n=41)
Technical	578
Reforestation	947
Logging	793
Milling	264
Total	2582

include the managerial team, either as specified under the *Usos y Costumbres* practices (e.g. the CBC and JV) or those selected to manage forestry activities (e.g. JM, Jefe de Patio, Jefe de Aserradero).

Figure 6 compares average local as compared to total employment across vertical integration levels and forest size. Surprisingly, the no-sale group has as much employment on average as does the stumpage group, and all employment is local employment, whereas the stumpage group has the largest gap between average local and total employment. Outside contractors tend to hire from outside the community more often, explaining this gap. The roundwood group hires almost all workers from the local population, while the lumber group, with then highest average local and total workers, has a lower percentage of local workers on average, possibly due to the increased specialization and expertise required on some machinery.

By size of forest, the smallest size strata has the largest average local and total, due to the large reforestation efforts in this group. Otherwise, employment on average increases with the size of the forest.

4.3.4 Finance

Only seven of the forty-one communities sampled received credit from commercial banks, including rural development banks (BANRURAL, FINRURAL, and FIRA). Where credit was obtained, funds were applied mainly to working capital and machinery. For example, one community received credit to purchase a crane (*grua*), two received credit to purchase sawmill equipment, and one for "other" type of machinery. Of these seven, some have received credit more than once. Low reliance on credit markets is consistent with the Oaxaca study, where only three communities used bank credit in the five years previous to the survey (in 2000) and all credit funds were applied to equipment (Antinori 2000).

For technical services, 32 out of 33 responses said the community paid for the plan, with 18 of these receiving assistance from SEMARNAT or CONAFOR. On average, communities pay 65% of the cost of the management plan.

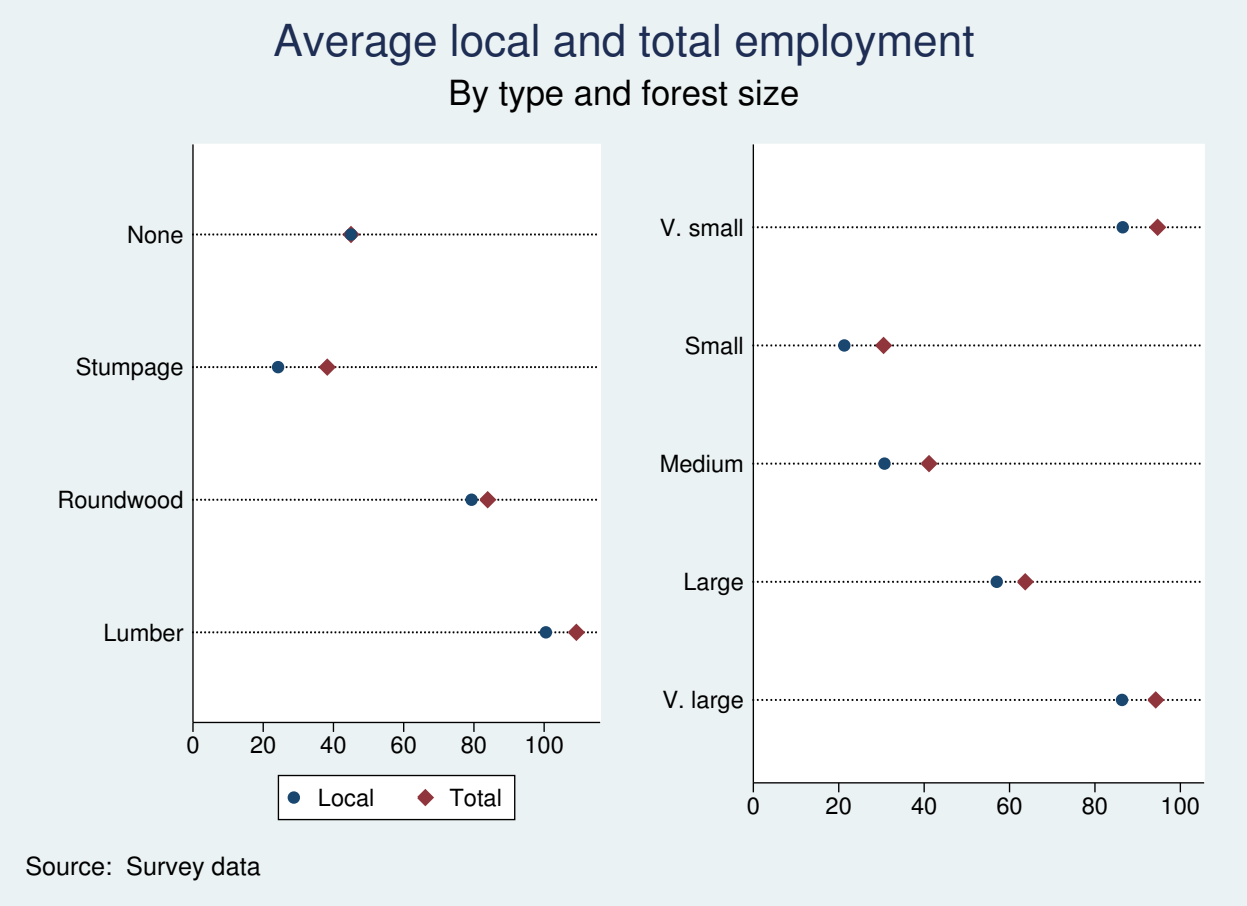

Figure 6: Total employment

Government programs have tended to emphasize public goods and human capital and less physical or working capital needs of production. The main forestry programs related are described in Table 17. PRODEFOR funded about 6500 projects among the permit holders captured in the Phase 1 database for ten Mexican states. About 4000 of those projects are for management, mainly thinnings, fire prevention, and management plans.[7] Consequently, all except five communities in the Durango/Michoacan sample have received assistance from a government program for primarily reforestation, fire prevention and other management activities. Only three cited government assistance in acquiring machinery for secondary processing.

[7]One community may account for more than one project, so less than 6500 different communities received funding.

Table 17: Government Forestry Program Objectives

PRONARE	(SEMARNAT, Sedena, Sedesol, Sagar, SEP) reforestation
PROCYMAF	(SEMARNAT-CONAFOR) institutional capacity, technical assistance, funding for management plans, form advisory councils within and among communities.
PRODEPLAN	(SEMARNAT-CONAFOR) plantations
PRODEFOR	conservation, restoration and modernization of industrial activities, technical support.
PSAH	Pago de Servicios Ambientales y Hidraulicos For forest communities which can show "additionality", that is, forestland would be cleared but for the PES program.

4.4 Choice over forestry benefits

In this subsection, we consider a set of measures which represent collective choice, either directly or indirectly, among the community and which affect the size and distribution of forest benefits. The full extent to which outside actors, like community association leaders, government agencies, NGOs and STFs, affect the measures will be considered in future research. We continue to report statistics across community type, internal organization and association membership.

4.4.1 Investments in forest activities

Investments in forestry can have ambiguous affects for enjoying the benefits of maintaining forestry operations, depending on a person's relationship to the community and the operations themselves. Workers through their wages are more likely to benefit from reinvestments if the investment assures the continued viability and therefore employment capacity of forestry activities, unless the investment is labor-saving. We venture to assume that in community forestry operations, the investments in capital mainly allow the same or more labor to be hired. Nonworker, community members maintain access to benefits through reinvestment when the investments assure the continued operation and therefore payoffs should profits shares be disbursed. The benefit in this case may be longer term and more uncertain, as the choice to disburse and the amount of dividends is decided upon yearly.

Survey questions asked whether any investments back into forestry operations had occurred in the last five years. Expenses characterized as reinvestment into forestry operations include management plans, roads, trucks, cranes, tractors, secondary processing equipment, and investments in diversified activities.

The most frequent investments are in roads, followed by a management plan. Road investment tended to occur on a yearly basis. The more vertically integrated roundwood

Table 18: Frequency of Investments

End Product	Mean						
	Forest Study	Plan	Roads	Trucks*	Secondary	Diversify	Any investment
None	0.14	0.14	0.14	0.14	0.00	0.00	0.43
Stumpage	0.00	0.38	0.31	0.00	0.06	0.19	0.62
Roundwood	0.08	0.50	0.58	0.08	0.17	0.25	0.92
Lumber	0.17	0.00	0.67	0.33	0.50	0.17	0.83
Internal organization				Mean			
Community	0.12	0.38	0.46	0.15	0.19	0.19	0.81
Work Group	0.00	0.40	0.40	0.00	0.20	0.20	0.80
Individual	0.00	0.10	0.30	0.00	0.00	0.10	0.40
Forestry associations				Mean			
Nonmembers	0.00	0.25	0.25	0.00	0.00	0.00	0.50
Members	0.10	0.34	0.48	0.14	0.21	0.24	0.79
Total	0.07	0.32	0.41	0.10	0.15	0.17	0.71

Source: Survey data

*Includes trucks, tractors and cranes.

and lumber groups invested more often in secondary processing and tractors, trucks and cranes. The forestry association members consistently invested more across all the categories of investment mentioned (statistically significant). There were no investments in market studies, scientific inventory equipment or management studies, indicating possible areas for improving services to communities.

As a further simplification, a dummy variable indicates whether investment in any category occurred. This dummy is positively correlated with vertical integration and membership in a forestry association but negatively correlated with sub-community-level management, raising a question of long term impacts of decentralized operations.

4.4.2 Local public goods

Access to local public goods is open to member residents and resident nonmembers alike, as all can attend school, church and celebrations equally, for example. Overall, the greatest frequency of public investments from forest revenues went to schools, followed by the church and fiestas. These often form the core of the community. It is a widespread custom to have the school count as an ejido/comunero member in the division of *repartos* each

year, so that they school gets the equivalent of what each individual receives in any division of forestry profits.

To see if a pattern emerges as communities advance along the value-added chain of forestry production, we summarize the frequency of investments by vertical integration group. The no-sale group tend not to invest churches as much as the overall average, while the roundwood groups reflected the overall averages fairly well. Slight differences emerge for the stumpage and lumber groups who tend to invest in medical supplies or services more often, and the lumber group which more often invests in the *palacio municipal*. Further analysis will explore whether these results indicate that roundwood communities as a group are focusing more than other groups on financing production activities at the cost of foregoing public goods investments. Finally, a variable was constructed to record the instance of investments across the categories of public goods, with higher values indicating a broader range of investments. The calculations shows that the range of public goods investment increases by vertical integration.

Analyzing the data by internal organization, public goods investments for the non-community-level organized observations are more restricted to the schools and the church, with almost all investing in schools, consistent with the custom of allotting a *reparto* to the school, and only two for the church. That is, the range of public investment is more limited to traditional contributions to church and school.

Those in a forestry association more frequently responded that they invest in public goods, across the types of public goods mentioned. They especially tended to invest significantly more often than non-forestry association communities in schools. Despite the access to grants as a main benefit of association membership, most public goods investments are still funded by forestry revenues, though grants may have eased ability to spend on public goods.

4.4.3 Profit-sharing

The dividends (*repartos*) paid out to individual community members sometimes form the sole other source of income aside from government programs. Therefore, it is a critical factor in community life. Paying out dividends works differently depending on the internal organization of the communities' forestry operations. At the community level, the administration (usually the *Comisariado*) is responsible for paying dividends to members after costs and other allotments have been made. In work group communities, the work group leader most often distributes profit shares after costs are paid and an amount is paid to the community-level fund. In the individually parceled communities, individuals are most often responsible for arranging production activities, and then keep the residual flows after costs and any required community allotments are made. All except three community-level organized communities reported the practice of paying out dividends to individual members. All work groups paid out such dividends. Four of the seven

Table 19: Local Public Goods Investments (Count)

	School	Water	Buildings	Church	Celebrations	Medical	Grants	Pension	Other
End Product									
None	2	0	0	0	1	1	0	0	2
Stumpage	8	1	1	4	3	4	0	0	6
Roundwood	11	0	1	4	3	1	0	0	2
Lumber	5	2	1	3	1	1	0	0	0
Total	26	3	3	11	8	7	0	0	10
Internal organization									
Community	18	2	2	9	8	7	0	0	8
Work group	4	1	1	1	0	0	0	0	1
Individual	4	0	0	1	0	0	0	0	1
Total	26	3	3	11	8	7	0	0	10
Invest every year?									
Community	13	0	0	6	8	3	1	0	1
Work group	3	0	0	0	0	0	0	0	0
Individual	3	0	0	0	0	0	0	0	0
Total	19	0	0	6	8	3	1	0	1
Forestry Associations									
Non-members	4	0	0	3	2	2	0	0	4
Members	22	3	3	8	6	5	0	0	6
Total	26	3	3	11	8	7	0	0	10

Source: Survey data

individually-organized production communities reported not paying dividends, possibly because the concept is tied to a community-level disbursal and does not apply when funds are directly handled by parcel holders.

Dividends vary across communities and within communities between years, depending on the harvest year. In our sample, the dividends ranged from 1197-58,000 pesos. Those with forestry activities who report paying dividends do so each year. By vertical integration type, on average each member in a stumpage community receives 10,000 pesos; roundwood, 30,000 pesos; and lumber, 21,000 pesos. By internal organization type, the community organized on average received 19,000 pesos in the last pay-out, the work group members received 16,000 pesos and the individually organized received 30,000 pesos.

4.4.4 Protection of forest resources

The final set of impacts explored in this report are environmental. An extensive set of questions explores environmental impacts from several angles. We considered nontimber products and harvesting, rules and sanctions concerning collection of nontimber forest products, measures taken to reduce impact of harvesting and timber processing, measures to reduce erosion and soil contamination and to protect habitat, perceived changes in environmental quality, and collective practices regarding conservation. Here we summarize collective practices, perceived changes in environmental quality and peer monitoring.

Table 20 shows conservation practices by vertical integration level, internal organizational level and membership in a forestry association. These practices are grouped in this table to represent "rule conformance" or an action where individuals can choose to act cooperatively or noncooperatively with either formal or informal rules. The represented here are mainly those set by the community or practices are supported by a set of rules representing a mix of both local community and government conservation decisions. For example, clandestine timber harvesting refers to collection wood products, including firewood, without a permit. Yet, this activity is historically well sanctioned y communities protective of their territorial land rights and common property benefits. Fire control practices may include outside federal assistance when it is coordinated with the community as well as responsiveness and coordination among individual community members (Antinori and Rausser 2007).

Several differences appeared statistically significant by internal organizational level but not by vertical integration. Work groups are significantly more likely to state problems with clandestine harvesting of timber resources and individual harvesting organization is associated with statistically more opening of forest areas in the last five years, usually for agriculture or grazing. While all types of communities reported contraband harvesting of timber or nontimber products from the forest - that is, resources collected without community permission - the severity of contraband harvesting was statistically significantly stronger in the less integrated communities. Across all groups, most respondents said that persons from neighboring communities were responsible for the contraband, or by both

Table 20: Conservation Practices

VI level	**Clandestine timber harvesting**					**Illegal NTFP**	**Clearing**	**Fire Prep.**
	% yes	Origin			Degree			
		internal	external	both	(0 lo, 3 hi)	% yes	(0 lo, 4 hi)	(1 lo, 5 exclt.)
None	0.67	0	3	1	2.00	0.33	0.67	4.00
Stumpage	0.29	1	2	2	0.76	0.24	0.71	3.67
Roundwood	0.25	0	1	2	0.42	0.27	0.17	4.00
Lumber	0.17	0	1	0	0.17	0.17	1.33	3.83
Internal organization								
Community	0.19	0	4	1	0.50	0.23	0.46	3.90
Work group	0.40	0	0	2	0.80	0.60	0.40	4.00
Individual	0.60	1	3	2	1.40	0.11	1.20	3.57
Forestry association								
Nonmembers	0.50	1	3	2	1.33	0.08	0.67	3.88
Members	0.24	0	4	3	0.52	0.32	0.62	3.84
Total	0.32	1	7	5	0.76	0.25	0.63	3.85

Source: Survey data

internal and external agents. There is some tendency for non-collectively organized groups to be less functional for forming fire prevention strategies and practices, but the difference is only significant at the 11% level. Those in a forestry association are more likely to have less problems with timber contraband and more problems with nontimber contraband harvesting, but the differences are not quite significant at the 10% level.

Community institutions distinguished by end product sold or by internal production organization did not have any affect on the patterns of change in ecosystem, as viewed by the survey respondents (Table 21). Questions on changes in water quality, forest cover and abundance of wildlife produced a range of answers among the sample. However, categorizing communities on whether they are members of a forestry association yielded statistically significant answers, with those in forestry associations more often reporting improvement in both forest cover (over the last 10 years) and wildlife abundance (over the last 5 years), as displayed in Figure 7. Those communities in forestry association more often reported having more forest cover and more wildlife than years before. Future research will explore the kinds of programs these communities participated in and the connection to the perceived changes in the ecosystem.

Table 21: Changes in Environmental Quality

VI level	**Forest cover** (1 <, 4 >)	**Water quality** (1 hi, 4 lo)	**Species abundance** (1 >, 4 gone)
None	2.83	2.67	2.67
Stumpage	2.76	2.65	2.65
Roundwood	3.25	2.42	1.92
Lumber	3.00	2.67	2.17
Internal organization			
Community	2.96	2.62	2.35
Work group	3.00	2.20	2.20
Individual	2.90	2.70	2.50
Forestry association			
Nonmembers	2.67	2.58	2.83
Members	3.07	2.59	2.17
Total	2.95	2.59	2.37

Source: Survey data

The community members are generally protective of their claim to forest resources. The most common answers to whether people monitor their peers taking resources from the forest are “siempre” y “mucho”. And most said that it would be probable or very probable that someone would denounce another if they observed a rule violation. Table 22 shows that there is some tendency for more integrated and the community-organized production communities to report on each other. In cases where they said that someone would

probably not report a violation, the reasons given were fear of doing so or an expected empty responses where nothing would happen.

Communities hold *faenas*, or voluntary civic duty among community members, for fire prevention (dig trenches, buffer zones, etc) between 1.1 and 2 times a year on average, across integration groups. Fire brigades and inspection tours are the most common forms of fire prevention, though some are in an area monitored by fire towers. All said that these measures had worked fairly well to excellent.

5 Conclusions

The purpose of this paper has been to summarize data from the National Forestry Survey Project in Mexico. This paper focuses on the unique survey data from Durango and Michoacan as Phase 2 of this project. The description presents strictly associations as a preliminary assessment of trends and patterns across communities, mainly using end product sold as a convenient way to differentiate communities. Other groupings are possible and used occasionally in this summary.

A few of the main points from the data are:

- Significant regional variations in population size and trends, household wealth, internal organization and forestry networks. Population growth is lower, with a particularly marked decrease in Durango from 1990 to 2000, where populations of each community tend to be smaller in general than in Michoacan.
- For basic community characteristics, as vertical integration increases, population sizes within each community tend to decrease, with greater percentage of members as part of the population.
- Among the communities harvesting timber, the more integrated ones tend to be further from town or market centers and conventional standard of living indicators from the Census 2000 data tend to decrease.
- Communities show a strong presence of indigenous culture, as about 50% have residents who speak the local indigenous language. These communities tend to be larger on average than those without indigenous speakers.
- Decisionmaking responsibilities follow not a pattern of vertical integration, which is defined as most advanced end product sold, but patterns of internal governance, showing variations of governance possible within each vertical integration type. The impact on economic and environmental "performance" indicators are mixed.

Table 22: Peer Monitoring

VI level	Monitoring					Reporting Probability				
	Always	Often	Sometimes	Rarely	Never	Very	Good	50-50	Unlikely	Not
None	1	2	1	1	0	0	3	1	0	1
Stumpage	4	6	2	2	3	8	4	1	2	2
Roundwood	6	4	0	1	0	8	1	0	2	0
Lumber	3	0	2	1	0	0	4	0	1	1
Internal organization										
Community	8	9	5	4	0	12	9	2	1	2
Work group	3	1	0	0	1	3	0	0	2	0
Individual	3	2	0	1	2	1	3	0	2	2
Forestry association										
Nonmember	5	3	1	1	1	3	4	0	2	2
Member	9	9	4	4	2	13	8	2	3	2
Total	14	12	5	5	3	16	12	2	5	4

Source: Survey data

- NGOs as external players are scarce in this sample. In Durango, there is a strong presence of forestry associations as political and economic player relative to other regions of Mexico. While communities with long histories of forestry are in both bottoms-up and top-down inter-community organizations, communities with shorter histories are being incorporated into mainly top-down (i.e. government-initiated) organizations.
- Livelihood strategies are apparent in the use of wage advances and choice of vertical integration. The choice of end product sold can change within a community from year to year, where equipment may remain idle if a lesser processed product is sold.

This overview points to further questions and lines of analysis. Among these are:

- With authorized volumes declining over time for many communities, and many communities harvesting most of their authorized levels of harvest, where will gains in productivity come from? Greater efficiency in production over the same forestland would increase volumes sold but requires adoption of new practices.
- What explains the increase versus decrease in well-being indicators with vertical integration in different regions of Mexico and how does this pattern relate to livelihood strategies? While the data show that forestry plays an important role in the livelihood strategies of these communities, further details are needed on the tradeoffs at the individual level and the community level in balancing management decisions.
- If the different governance structures of communal and sub-communal levels of production organization can exist, what institutional (formal or informal) characteristics do they share that allows them viability? Are there other forms of institutional change which are possible in the current system? How can further options be explore?
- What are sources of constraints on investments in this sector? Is it government policy, internal governance structure, bargaining power vis a vis the private sector or a combination of all?
- What institutional role can associations play in supporting the economic, social and environmental objectives for forestry management?
- How can programs be designed to accommodate the different community characteristics, including population and well-being factors as well as internal organization, and maintain advantages of common property forest tenure.

Beyond the descriptive statistics, we explored how benefits are associated with institutions: vertical integration level, internal organization for production and intra-community forestry

associations. We found mixed patterns consistent with the view that institutions are endogenous, that is, they depend and are explained by other factors. The institutions themselves may represent an optimal choice given constraints of the situation. Increasing vertical integration, for example, does not mirror "quality" of community forestry but reflects an economically feasible choice. This view allows for the possibility that "good" contracts are possible if the balance of power between negotiating parties in a timber sale and forestry management is balanced. How that is achieved is the subject of future research into the contractual environment and political context. Furthermore, internal organization modes may not be inherently good or bad but reflect a cost-minimizing, or optimizing with constraints, decision. An institutional approach would look beyond these modes at the distribution of assigned authority, ability of stakeholders to make corrective measures for their leadership and other governance characteristics that affect the allocation of benefits flowing form the forest resource. With this view, we aim to shed light on the questions of how to support community forestry as an economic sector. Future work will explore these issues.

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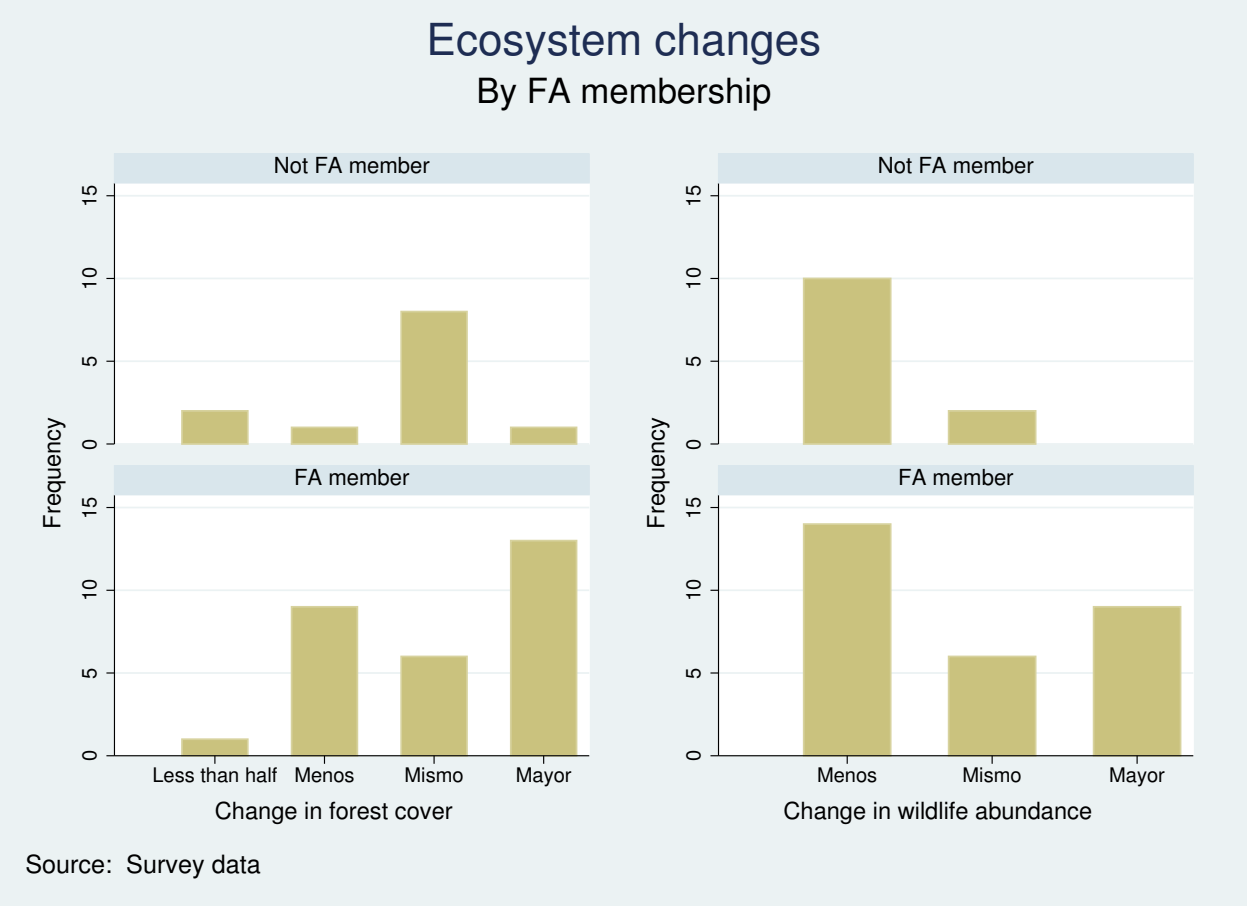

Figure 7: Ecosystem Changes by Inter-Community Association

A Comparison of Typologies

Table 23: World Bank Typology

Type 1	Communities/ejidos with no forest management or extraction activities or plans
Type 2	Communities/ejidos that sell standing timber (rentistas).
Type 3	Communities/ejidos with forest enterprises who sell harvested wood but have no other processing capacity.
Type 4	Communities/ejidos that process as well as harvest their own wood.

Source: IBRD (1997).

Table 24: PROCYMAF II Typology

Type 1	Potential producers
Type 2	Producers who sell stumpage
Type 3	Producers who sell primary timber material
Type 4	Producers with transformation and commercialization capacity

Source: SEMARNAT and CONAFOR (2004).

Table 25: Ownership and Control Typology

Type 1	Communities with commercially harvestable forestland but which do not participate in timber market
Type 2	Communities which contract with outside operators to extract timber material. Labor is paid by the outside contractor. Machinery is usually brought in by outside contractor.
Type 3	Communities which contract services to extract timber and sell material as roundwood. Labor is usually hired from within the community but workers from outside the community may be contracted. Chainsaws may be owned by the individual workers or the community.
Type 4	Communities which contract services to extract and sell sawnwood. Usually the sawmill is owned by the community but the sawmill may also be owned in common with other communities or rented.
Type 5	Communities which contract services to sell sawnwood and transformed secondary or finished wood products, like tool handles, furniture, doors, and moldings. Usually, milling and processing machinery is owned by the community but may be owned in common with other communities or rented.

Source: Antinori (2000).

Table 26: Internal Organization and Management Typology

Description	% as of 1993
Comunidades y ejidos que han consolidado una organizació interna fuerte y han logrado mantener o incrementar el ritmo de crecimiento del recursos forestales	4.0 %
Comunidades y ejidos que no han logrado consolidar su organizació interna y no han podido mantener la calidad de su recurso forestal	27.5 %
Comunidades y ejidos con problemas internos fuertes y significativa degradación de sus recursos forestales	68.5 %

Source: Madrid (1993).

Table 27: Example of Anthropological Typology

Successful and well-organized communities	Organized for the extraction of wood and transformation of intermediate industrial products and which make formal use of the forest.
Limited success and organization	sell roundwood, sawnwood and refined wood, with collection points in the communities or nearby urban centers. They have a medium or large sawmill, machinery for tool handles and a crate-making capacity.
Technical problems and medium level of organization	Have small and less efficient sawmill and sell *tablas* (rough hewn logs) on the community site.
Intermediaries for raw material and less organized	Sell roundwood; may also collect and sell fuelwood and nontimber forest products; constructs and maintains roads.
Rentistas and without organization	Do not have resources or experience as other communities; contract clauses set by buyers; sell stumpage at less than market value; little technical knowledge or market knowledge and no funds to invest in equipment.
Out of formal market	Extract only for informal markets - domestic use and regional markets; no relation with formal industrial forestry.

Source: Nahmad Sitton (2004).