

Planning and Policy Issues in Small-scale Forestry Development in Southern Aragua State, Venezuela

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Abstract In southern Aragua state, Venezuela—an area regarded as high priority for local and national development—important sources of income and traditions are related to a history of manufacturing wood products including furniture and woodcraft made of the native tree species *Samanea saman*. However, scarcity of wood has recently become a major constraint for people of Magdalena, putting at risk traditional knowledge and employment opportunities. Based on an integrated approach taking into account biophysical, ecological, social and technological issues, a broad group of potential tree species were assessed in a landscape-scale analysis to promote a plantation project. Analysis of policy implications is made in the context of national legislation, socio-economic, institutional and environmental issues. The role of research and communication to improve decision-making processes at all scales are also examined. At least three wood species (*Samanea saman*, *Acacia mangium* and *Gmelina arborea*) with a total of 37 sites and an aggregate area of approximately 26,600 ha (266 km²), were found to be potentially able to sustain a local development initiative for all five municipalities located in southern Aragua state. In terms of implementation, small-scale forestry (SSF) is viewed as a new policy shift for forest management according to the new national forest legislation where local development is a central element. SSF faces several constraints and faces a wide variety of political issues. Critical among these issues are: (a) how SSF approaches deal with legislation and land tenure regulations; (b) the creation of community-based forest enterprises based on simplified management plans, (c) a broad assessment of potential ecosystem services delivered by forest plantations; and (d) improving communication of research for decision-making. Decentralization

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and institutional strengthening are identified as two basic conditions for pursuing sustainable management.

Keywords Community-based enterprises · Ecosystem management · Local knowledge · Multiple land use · *Samanea saman*

Introduction

It is now widely recognized that forest resources, in both natural forests and plantations, are key elements to support national and regional economies, to improve people's livelihoods, and as mechanisms for biodiversity conservation and climate change mitigation (Mery et al. 2005). Public concern about forest-related issues is also increasing at all scales. This fact becomes more evident when considering that at least 25% of the world's population—an estimated 1.6 billion people—rely on forest resources for their livelihoods, and, almost 1.2 billion of these live in extreme poverty (Chomitz 2007). Since the world is facing continuous deforestation and degradation, severely affecting long-term stability of tropical forests, the regional trend in the tropics is towards increasing establishment of plantations and growing reliance on them as a source of industrial wood (Varmola et al. 2005). This fact has become more evident in Venezuela where nearly 80% of national roundwood production for year 2007 came from large scale plantations of Caribbean Pine (*Pinus caribaea*) and other exotic species including *Tectona grandis*, *Gmelina arborea*, *Acacia mangium* and *Eucalyptus* spp. (MinAmb 2008).

Small-scale forestry (SSF) constitutes an opportunity in many countries to provide goods and services that cannot be produced through industrial and large-scale operations and to promote poverty alleviation and development. Most forms of SSF embrace, in varying degrees, the concept of 'local benefits for local people' and are designed to provide multiple benefits from the forested lands (Harrison et al. 2002). However, a lack of reliable statistics about the contribution of SSF has become a major constraint to SSF development in tropical countries. For example, by one estimate, the contribution of forestry to employment is more than double that generally given in global statistics when the small-scale, community and informal sectors are included (ITTO 2007). In Venezuela, about 45% of the land is still covered by natural forests and there are nearly 800,000 ha of forest plantations (Torres-Lezama et al. 2009) but national experience in SSF is poorly documented.

Forest tenure rights, decentralization and devolution strategies are crucial for an adequate implementation of SSF. However, less than 25% of forest area in 30 of the most-forested countries in the world is designated for use by local communities, indigenous people, individuals or private firms (Sunderlin et al. 2008). In 2005, Venezuela's legislature passed a new law ensuring the land and property rights of indigenous peoples and communities. One of the effects is that approximately 0.7 M ha have been titled to indigenous communities in agricultural areas throughout the country (Sunderlin et al. 2008). However, there is an intense debate about whether these communities are managing the land in a sustainable manner and it is unknown if SSF is being applied in these areas (Torres-Lezama et al. 2008).

In the town of Magdaleno, in southern Aragua state, the use and production of wood-based goods has become a traditional socioeconomic activity for many years, especially using the indigenous tree species *Samanea saman* (Jacq) Merr (Leguminosae) (Fig. 1). For almost 80 years, people have been working with furniture and woodcraft production. Currently, about 100 carpentry and 200 other small workshops generate 5,000 direct jobs and at least 12,000 indirect jobs (FUNDACITE Aragua 2006). Recently, a severe scarcity of wood has become a major constraint to production. Notably, this area has suffered from high deforestation rates that have especially affected its southern region. From 1972 to 1990 nearly 170,000 ha of forest was lost, representing almost 25% of the state's land area (FAO 2000). This fact, along with strict protection policies for *S. saman*, which is classified as a vulnerable tree species (Llamozas et al. 2003), have considerably increased wood prices and undermined this traditional source of income for local communities. Although there was an increase in 'Samán' registered roundwood production in 2005 (MinAmb 2000), there has been an overall supply decrease in recent years (Table 1). At present, the main source of this species is secondary forests mostly located on private land outside of national forests reserves (Lozada 2007).

The overall goal of this study was to develop a forest plantation proposal to assure wood availability to sustain traditional furniture and woodcraft production in Magdaleno. Particular attention is paid to planning issues that should be met in order to achieve sustainable management for the southern part of Aragua state in Venezuela. National policies regarding legislation, institutional, social and environmental issues are analyzed to propose actions for sustainable management. Comments are also made about how SSF development could help to improve local livelihoods.



Fig. 1 Images of the traditional furniture and woodcraft production in Magdaleno town. Photos: Emilio Vilanova

Table 1 National roundwood production for *Samanea saman* from 1996 to 2006

Year	Volume produced (m ³)	Year	Volume produced (m ³)
1996	95,481	2002	60,361
1997	85,996	2003	23,279
1998	66,666	2004	17,843
1999	44,737	2005	71,268
2000	47,231	2006	57,639
2001	42,815	2007	37,130

Source: National roundwood production annual bulletins (MinAmb 2000, 2007, 2008)

The Study Site

The State of Aragua is located in northern central Venezuela between 9°15'10"–10°32'22"N and 66°32'53"–67°52'04"W. Aragua has a total surface area of 7,220 km² which represents less than 1% of the total area of the country (González 2000) (Fig. 2). The southern part of Aragua includes at least two distinct life-zones according to the Holdridge bioclimatic classification: Tropical Dry Forest (TDF) and Tropical Pre-mountainous Wet Forest (TPWF) (Ewel et al. 1968). Annual mean temperature (based on monthly averages) is close to 25°C for lowlands and between 18 and 20°C for northern mountainous areas; annual rainfall varies between 970 and 1,030 mm. However, a distinctive dry period can take place for almost 5 months per year, from December to April (Herrera 1995).

The total population is almost 1.5 M (6.3% of country's total population) with an annual growth rate of 2.4% (INE 2008). Five municipalities make up the southern part of Aragua state—Zamora, San Sebastián, San Casimiro, Camatagua and Urdaneta—with a total area of 4,627 km² (63% of Aragua state) (CAEA 2006). Approximately 13.7% of the Aragua state population lives in this region. At least 10% of the people are considered living in extreme poverty with scarcity of basic services such as public health, food provisioning and water supply (INE 2008). Zamora territory has the highest population density in southern Aragua state, due to the more diverse range of economic activities, including employment opportunities in Magdalena town and ease of access to Maracay, the state capital (Sáez-Sáez 2008).

Research Method

The research approach consisted of an integration of ecological, technological and social aspects. The method consisted of four stages as illustrated in Fig. 3, namely:

1. Collection of primary and secondary data for examining biophysical and socio-economic conditions, sources leading to an overall characterization of southern Aragua state. General elements as population distribution, employment and poverty were obtained. Ecological factors that could directly affect plantation growth and species performance (rainfall, evaporation, soil texture, drainage, pH, topography and air temperature) were also examined.

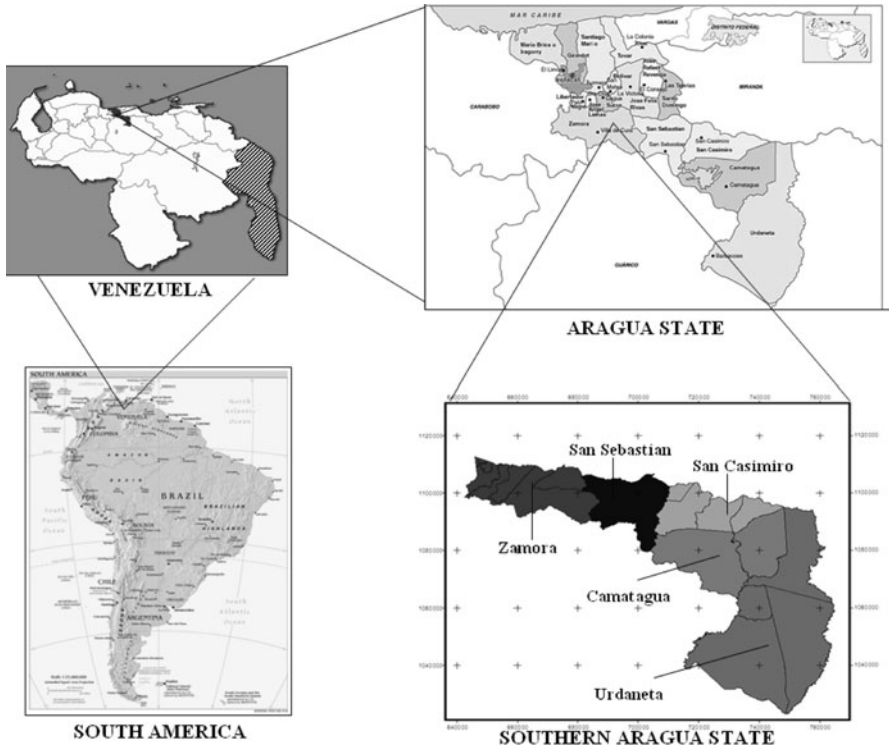


Fig. 2 Location of study site in Aragua state, Venezuela. *Note:* the Venezuelan map includes Guyanan territory (shaded area) claimed by Venezuela under the Geneva Agreement of February 7, 1966

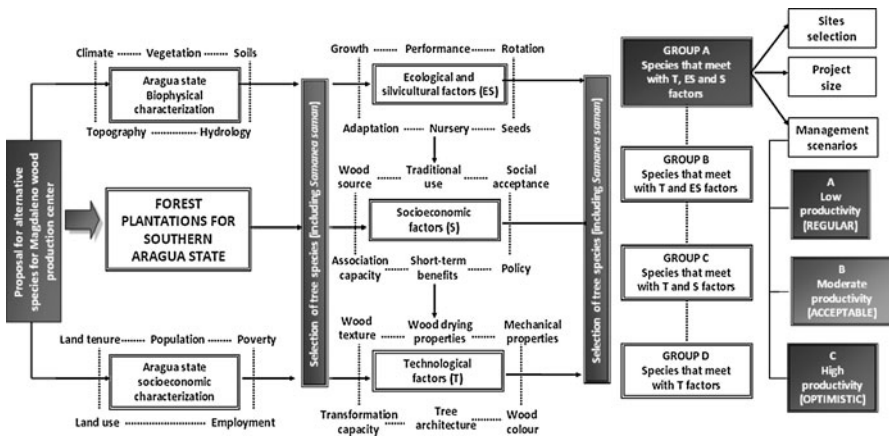


Fig. 3 Methodological approach to development of a small-scale forestry project in southern Aragua state, Venezuela

2. Selection of the most suitable species that could serve as alternatives to *Samanea saman* for wood production in all five municipalities comprising the study site. The natural distribution of 150 native tree species (listed by Veillon 1994) was considered. Because national wood production relies heavily on large-scale plantations, suitability of naturalized species was also assessed. Technological factors (wood mechanical and drying properties, color, texture) were also incorporated into the filtering process for suitable species. This information was obtained from Vilela (1969) and a study performed during this research by the National Laboratory of Forest Products (LABONAC). Next, ecological and silviculture factors of species (seedling production, growth rates, rotation period) were incorporated into the analysis based on published data in order to improve species selection process (CAB 2005, Boshier and Cordero 2004).
3. The project size in terms of annual roundwood production was calculated as 43,200 m³, based on actual timber needs and potential future expansion. Data about timber needs in Magdaleno were collected from 21 sawn-timber distribution centres (10% of the total). Finally, a rapid survey of social perceptions of local inhabitants about forestry and agroforestry relevance for local livelihoods and of acceptance of selected species was performed. This assessment included structured and informal surveys conducted with representatives of governmental institutions and community leaders in all five municipalities. Informal dialogue and discussions were also very useful during this stage.
4. A process of site selection was performed for all five municipalities of southern Aragua. A landscape-scale selection of potential sites for planting was undertaken using a geographical information system (GIS). Information about political and legal restrictions for establishment of forest plantations was then used to filter the selection of sites. This process involved a review of current land-use maps, land tenure regimes and regional development policies concerning agriculture and forestry planning. The effects of current land legislation, particularly the *Ley de Tierras y Desarrollo Agrario (Lands and Agrarian Development Act)* over a potential plantation project, were also considered. Only sites with a minimum of 10 ha or more were considered in the analysis. Three scenarios were tested, defined in terms of potential yield and growth of selected species, viz. low, moderate and high, with five combinations of species and management for each scenario, to offer a broad set of possibilities for decision-making and policy shaping. A more detailed explanation of last two stages of the study is reported in Torres-Lezama et al. (in prep.).

Results and Discussion

Selected Species for Tree Plantations in Southern Aragua

Initially, a total of 15 potentially suitable species for a plantation project in southern Aragua state were identified. This total includes 12 native species and three species

Table 2 Groups of selected species for plantations in southern Aragua

Group A (T-S-ES)	Group B (T-ES)	Group C (T-S)	Group D (T)
<i>Acacia mangium</i>	<i>Tectona grandis</i>	<i>Hura crepitans</i>	<i>Centrolobium paraense</i>
<i>Gmelina arborea</i>	<i>Enterolobium cyclocarpu</i>	<i>Inga alba</i>	<i>Vitex capitata</i>
<i>Samanea saman</i>	<i>Hymenaea courbaril</i>	<i>Albizia caribaea</i>	<i>Tabebuia spectabilis</i>
	<i>Pseudosamanea guachapele</i>	<i>Tabebuia rosea</i>	<i>Enterolobium schomburgkii</i>

considered as naturalized in Venezuela that at least meet with one of the three factors considered. The complete list of these factors is presented in Fig. 3. In addition, depending on how closely selected species met the ecological and silvicultural (ES), social (S) and technological (T) requirements, four groups of species were formed as a preliminary step before the site selection process was made (Table 2).

Only the three species listed in Group A fitted all of the selection criteria. This list naturally included *S. saman*, which formed the basis of the selection criteria. The relevance of two naturalized species (*A. mangium* and *G. arborea*) along with the traditional *S. saman* could be considered as an unexpected result. As the social survey revealed, people tend to accept fast-growing species above indigenous species. Short rotations periods and a widespread use of these two species in several regions of the Venezuelan western plains were acknowledged by most of the people consulted. Three native and one naturalized species (*Tectona grandis*) comprise group B. Although *T. grandis* satisfies the ES and T criteria and is reported as a source of substantial national roundwood production, people expressed reluctance to extensive use of this species for traditional activities in southern Aragua state. Groups C and D commonly share an important lack of enough ecological and silvicultural information about these species on which to evaluate their suitability. Consequently, only Group A has been included in the planning. However, it is recommended that species of Group B be subjected to a pilot plantation test, and that Group C and D species be included in a research program to assess ecological response and growth performance. This could include a study carried out to assess performance of existing trees of this species.

Selected Sites for Tree Plantations in Southern Aragua

In the process of site selection almost 26,600 ha were identified with satisfactory conditions to sustain a plantation project using the selected species of group A. The spatial scale and distribution of sites is highly variable among the five municipalities of southern Aragua, resulting in at least 68% (18,340 ha) of total surface suitable for *G. arborea*, 28% (7,686 ha) for *S. saman* and 4% (575 ha) for *A. mangium*. Considering the minimum area requirement for planting sites (10 ha) a total of 37 sites were found, as illustrated in Fig. 4. Flatter areas especially below 600 m are more suitable for *Gmelina arborea*. These sites are located mainly over soils with a high clay content and relatively high fertility. Also, this species could be more suitable on areas with a moderate to high rainfall levels (1,000–1,200 mm per year).

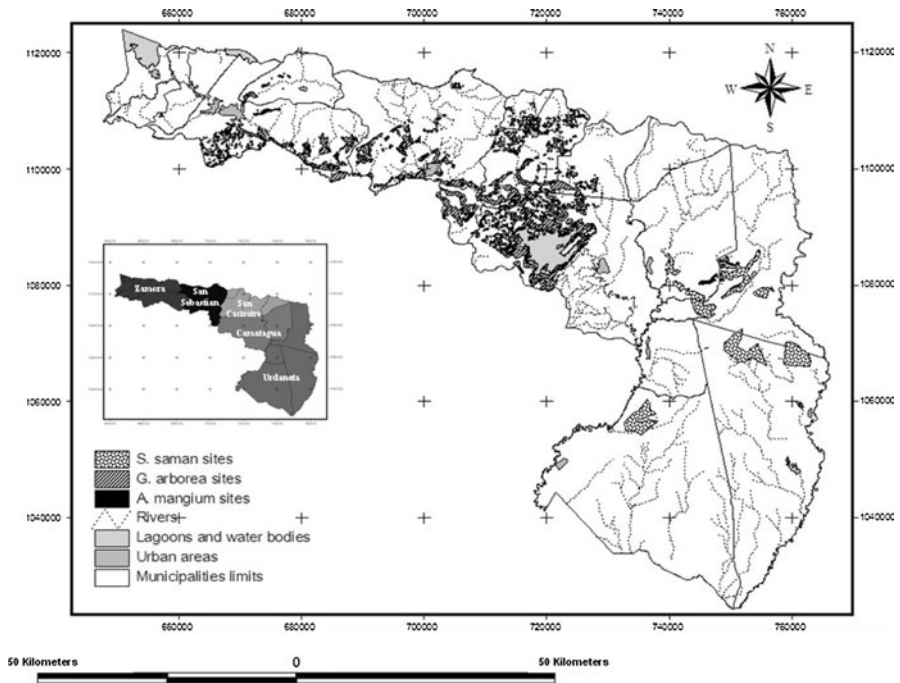


Fig. 4 Location of potential plantations sites for Group A species in southern Aragua state, Venezuela

Comparatively, *S. saman* and *A. mangium* could perform well on drier areas located mostly in Zamora and Urdaneta municipalities. More information about conditions of each site in the context of plantation proposal is presented elsewhere (Torres-Lezama et al. in prep).

General Conditions to Enable Small-scale Forestry Management in Southern Aragua

One of the key requirements in this planning process was ensure a constant flow of timber resource to the processing groups of Magdaleno town to sustain traditional activities. In order to fulfill this goal, it is considered that a wider spatial spread of tree planting is necessary and, consequently, all five municipalities of southern Aragua were included in the proposal. Still, a first general condition to consider is how the current regulatory environment influences policy-making and how science can contribute to the decision process.

In recent years, a growing social and political complexity regarding land tenure focused mainly for food production shaped how management and policies occurred in the region. Political and economic incentives for agriculture have increased, but consistent pressure for urban and industrial land-use continues as the population keeps growing in Aragua state (Sáez-Sáez 2008). Given that financial support for national forest management is low (Carrero and Andrade 2005; Torres Lezama et al. 2008), it is

urgent to build capacities for education and extension to develop a social structure strong enough to sustain small-scale forest management in southern Aragua state, based on results of this study. This could help to improve understanding between scientists and policy-makers and highlight how small-scale forestry development could improve local livelihoods and gain the environmental benefits of planted forests (recreation, watershed protection, habitat creation). Notably, this proposal aims to fit into a people-oriented social forestry management, including a multiple-product and holistic way for sustainability.

Policies for Small-scale Forest Management in Southern Aragua

Four areas of policy may require attention if plantation forestry in Aragua is to progress. Legal, socio-economic, institutional and environmental issues which will need to be considered for implementing the plantation plan devised above are examined.

Legal Issues for Small-scale Forestry

Since 2008 a new national forest law established a restructured framework for sustainable management of all forest ecosystems, including plantations. In 1992, the national government issued a decree to reserve 10% of the country's territory (9.3 M ha) for the establishment of forest plantations. However, almost a decade later, the acting government approved the *Ley de Tierras y Desarrollo Agrario (Lands and Agrarian Development Act)*, which restricts forest plantations to the poorest land-use categories. The Act has some contradictions regarding forest plantation management, which constitute a serious limitation for the national forest sector (González et al. 2004; Torres-Lezama et al. 2008). Plantations are restricted to land categories VII and VIII, which include land with severe restrictions linked to fertility, erosion and topography. In southern Aragua, at least 35% of the land fits into these types, due in particular to high slope conditions. In addition, strong legal limitations to logging operations continue in areas where slope exceeds 30%.

The new forest law defines a new role for plantation management, classifying afforestation and reforestation initiatives for conservation and commercial purposes. Plantations with conservation purposes are officially assigned to the environment ministry while production forestry is managed through the agriculture ministry, resulting in administration and institutional conflicts. In order to facilitate a SSF framework, a comprehensive analysis of national policies that directly affect natural forests, forest plantations, and other wooded lands (agroforestry, trees outside the forests) should be undertaken in the context of new forest legislation. In Venezuela, national forest policy needs to be supported with an adequate legal structure. This would avoid conflicting legal provisions that so far have impeded investment by the public and private sectors into forestry.

In the last two decades, in many Latin American countries, including Venezuela, national governments have been taking on new roles, with a strong emphasis on their normative and controlling functions (Haltia and Keipi 2000). However, many of these policies tend to neglect complex realities and local working rules, both

formal (i.e. legislation) and informal (i.e. customary practices) that individuals and organized social groups use in making their decisions for land access and forest use (Pacheco et al. 2008).

A well-balanced participation between the public and private sectors and a well-designed policy of incentives is needed to promote the implementation of SSF management, not only in southern Aragua but throughout rural areas of Venezuela. An opportunity for SSF remains because the current forest law established a novel policy for incentives for new socio-productive mechanisms favouring small-scale operations. This policy also includes the encouragement for social participation and empowerment through economic incentives including tax concessions and financial support. A similar proposal of incentives for small-scale forestry was included in a forgotten National Forest Plan (MPD 2002) and is again included in the new forest legislation.

Social and Economic Issues for Small-scale Forestry

Reforestation projects, especially in the tropics, typically have a wide range of impacts regarding especially threats to biodiversity, water supply and soil fertility. The establishment of plantations affects not only the landscape and environment but also local communities (Cossalter and Pye-Smith 2003). Consequently, priority should be given to an analysis of current laws and regulations that determine land-use patterns on public and private land, in order to reach a regional agreement that supports social acceptance of SSF projects, providing a more open process of information exchange between all stakeholders.

About 10% of the southern Aragua population lives in extreme poverty. This social group has to be the primary target for economic policy supportive of small-scale forestry with selected species and on selected sites. Employment opportunities related to forest products and services could assist in poverty reduction and in sustaining livelihoods in this area (Nair 2007). FAO guidelines for Market Analysis and Development (MA & D)—described by Lecup and Nicholson (2006) and ITTO (2007)—provide a promising approach to deal with the social complexity related to the creation of community forest-based enterprises (CFEs). In order to facilitate CFEs, several conditions are required: (a) a multiple-product strategy incorporating roundwood production, agroforestry management and non-timber forest products; (b) restructuring of land tenure; (c) promotion of new political institutions, and (d) a shift in economic decision-making from the household to the collective level, aimed at greater participation in the market economy.

The social assessment carried out during this study revealed the lack of a well-designed structure for marketing timber products. Therefore, the case of Magdaleno could be considered an informal form of productive associations because the local realities are mostly supported by familiar and customary traditions that have been taking place for nearly 80 years. Currently there is no experience on formal CFEs in Venezuela, hence the development and planning of this kind of economic structure, based on a market economy, will need to be analyzed carefully. Macqueen (2007) argued that small forest enterprises and their associations can help to enhance quality of life but face some challenges, including:

1. the need for a closer connection between decision-makers that allocate forest resources, control business registration and taxation, control procurement and export policies and compile statistical data on businesses and market trends;
2. better representation of small forest enterprises in decision-making at national and regional scale;
3. stronger networks that link small forest enterprises with financial and business development services. New initiatives are needed to build market access for small forest enterprises.

In the case of southern Aragua a process of collection and assessment of information is necessary on four basic areas of a CFE development: (1) market and economy, here focusing on how local and national demand influences production and wood prices; (2) resource management and environment, to develop integrated management plans where biodiversity and other ecosystem services are included; (3) social and institutional issues, to know how to promote local associations and partnerships; and (4) science and technology, to detect key issues for research and improve communication of results (Lecup and Nicholson 2006). This information needs to be collected at three levels, namely the international and national level, state and municipality, and community and village levels. This process of assessment to develop CFEs aims to identify potential products and develop markets that will provide income to local communities, to improve social cohesion among stakeholders, to define how plantation management will deal with biodiversity issues, and to design a mechanism to make possible an effective communication of research.

Institutional Issues for Small-scale Forestry

A weak institutional capacity persists in many areas of the Venezuelan forestry sector. In spite of new instruments for assigning institutional functions regarding forest management, conflicting ministerial interests and weak institutional coordination have hampered forest conservation and development of the forestry sector. Implementation and sustainable management of forest plantations through a small-scale forestry approach for southern Aragua state is clearly a complex task involving institutional efforts and capacity development and needs to be part of an integrated land-management plan. National Forest Programs (NFPs) and other management structures can provide a potential link for development of strategic alliances and synergies needed to reach consensus and political agreements supporting SSF management in the state.

An additional issue closely related to the institutional framework for CFE development is the need of a long-term strategic alliance involving all forestry-related institutions including NGOs, private and public companies, and research institutions. Special attention is required to informal arrangements such as customary property rights or and other pre-existing rules for community forest management that have not been codified in law. In the process of enterprise development, a systematic monitoring process is needed over those related issues that are critical for linking CFEs with potential buyers of wood and other forest products and services. These include

quality improvement, timber certification and development of an effective administration and market procedures (Donovan et al. 2008).

An important institutional issue that frequently is forgotten for community forest management, especially in Latin America, is that local people face serious challenges dealing with technical requirements imposed by national and regional institutions (Sabogal et al. 2008). Highly complex management plans and excessive legal documentation often are perceived by communities as an impediment to forest management. Successfully SSF management for southern Aragua state requires revision of current management rules and identification of strategies to create or strengthen the institutional framework to facilitate effective local participation in decision-making and, at the same time control and regulate management activities.

Environmental Issues for Small-scale Forestry

Poorly planned and managed plantations can have negative environmental impacts. Alteration of biodiversity and a threat to water resources (e.g. impacts on water quality and quantity) and soil fertility are the most commonly mentioned effects (Cossalter and Pye-Smith 2003; Schirmer 2007). Negative environmental effects can be reduced considerably if the selected species match the social factors (as considered in this study), and management is appropriate, including adequate selection of seed sources, nursery and plant production control, and planning of silvicultural treatments during rotation periods.

A concern over biodiversity conservation has arisen in Venezuela during the last decade, imposing constraints on forest management. However, the potential for plantations to contribute to biodiversity conservation and provide ecosystem services has been often underestimated. Forest plantations for southern Aragua could provide ecosystem services including soil and water conservation and climate change mitigation through carbon sequestration. Additionally, based on an ecosystem approach, plantations could become a strategic component of restoration of degraded land and considerably reduce human pressure over remnant natural forest in southern Aragua.

An environmental policy requires a broad assessment of potential ecosystem services provided by forest plantations, and public awareness of how people perceive the concept of ecosystem services and gather information about the impact on local livelihood. This could lead to a strategy of payment for environmental services (PES) in integrated land-use planning for southern Aragua. An additional plan is to address indirect drivers of ecosystem change over the longer term by incorporating ecosystem services in poverty reduction strategies, national economic and development plans and country assistance strategies.

Other Critical Issues: Management Plans and the Role of Research

Major social and economic changes have increased the pressure on natural resources in tropical countries and have strongly affected the relationship between people and their environment. Hence for this proposal, planning will require the application of an adaptative management strategy which basically refers to a structured, iterative

process of optimal decision-making and monitoring (following Holling 1978). This process of permanent assessment of how SSF is functioning will also require consistent communication between researchers and other stakeholders involved in management.

Administration and management processes require a tool or plan strong enough to address the conditions of natural resources being managed, and flexible enough to deal with temporal variation in ecological, social and economic conditions. Simplified management plans offer an opportunity for a gradually building process of learning and local experimentation to define criteria and indicators for monitoring.

Nowadays, forest research requires a range of scientific disciplines to consider fully all the ecological, social and economic dimensions of management. In the case of small-scale forestry, where many social aspects are involved, the analysis of socio-economic issues is another critical element. This raises the relevance of improving research techniques and approaches to detect fully long-term attitude and behavior modifications. Special attention to the role of communication is needed to create and maintain the interest of policy-makers in scientific results.

Finally, political agreements are urgently needed between all research institutions and public and private sectors related to forest management. National government represented in the Environmental Ministry, Land and Agriculture Ministry and National Reforestation Company need to be included in this process of dialogue and negotiation. Important contributions from private companies with a long tradition in plantation management in Venezuela—including Smurfit Kappa Cartón de Venezuela, Desarrollos Forestales San Carlos S. A. and Terranova de Venezuela S. A.—could also provide input and improve planning and management.

Conclusions

A large proportion of forest plantations in many parts of the tropics have been established on degraded or abandoned agricultural land which is often characterized by low productivity. An illustrative case is represented by southern Aragua state, in which current development is mostly based on agriculture and cattle-raising with generally low productivity. To guarantee the continuity of important sources of income and traditions related to wood products such as furniture and woodcraft made of *Samanea saman*, a small-scale forestry approach is presented in this paper as an opportunity in the context of a multiple-based management.

A more decentralized planning system represents a sound option to achieve local integration, to develop local capacity for management and to improve decision-making. However, a more in-depth analysis at the local-scale is needed to assess fully specific experiences in which a comprehensive examination of socio-economic issues could be used to generate strategic information for future planning and management.

The small-scale forestry approach advocated here—embracing all activities related to forest ownership, plantation management, legislation, institutional participation and enterprise creation—faces serious challenges for successfully

implementation. Integrated planning and policy approaches can contribute to social and economic development by offering decision-makers a range of options for sustainable development of southern Aragua.

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References

- Boshier D, Cordero J (2004) Manual de Árboles de Centroamérica. Proyecto Oxford Forestry Institute (OFI)—Centro Agronómico Tropical de Investigación y Enseñanza (CATIE). Available in: <http://herbaria.plants.ox.ac.uk/adc/manual/manucapitulos.asp>. Accessed Feb 2006
- CAB International (2005) Forestry Compendium CD. Wallingford-Oxfordshire, UK
- Carrero O, Andrade V (2005) La contribución de las actividades del sector primario y secundario de la cadena forestal al PIB de Venezuela en los últimos 50 años y su relación con algunas variables macroeconómicas. *Revista Forestal Venezolana* 49(1):39–47
- Chomitz K (2007) At loggerheads? Agricultural expansion, poverty reduction, and environment in the tropical forests. A world bank policy research report, Washington DC
- Comisión Agraria del Estado Aragua (CAEA) (2006) Programa 1: Actividad 4: Diagnóstico del Catastro y Uso de las Tierras del Estado Aragua, con base a la información disponible. Maracay, Venezuela
- Cossalter C, Pye-Smith C (2003) Fast-wood forestry myths and realities. Centre for International Forestry Research (CIFOR), Bogor, Indonesia
- Donovan J, Stoian D, Poole N (2008) Global review of rural community enterprises: the long and winding road to creating viable businesses, and potential shortcuts. Tropical Agricultural Research and Higher Education Center (CATIE) Technical Series. Technical Bulletin no. 29. Collection no. 2. Turrialba, Costa Rica
- Ewel JJ, Madriz A, Tossi A (1968) Zonas de vida de Venezuela. Memoria explicativa sobre el mapa ecológico. Ministerio de Agricultura y Cría, Caracas, Venezuela
- FAO—Forest Resource Assessment (2000) Bibliografía comentada: cambios en la cobertura forestal Venezuela. Working paper 39, Rome
- Fundación para la Ciencia y la Tecnología del estado Aragua (Fundacite-Aragua) (2006) Ministerio de Ciencia y Tecnología, Gobierno del estado Aragua. Sistema de Información Geográfica del estado Aragua (SIGA). Available in: <http://siga.sian.info.ve/>. Accessed Feb 2006
- González RD (ed) (2000) Atlas Geográfico Histórico del estado Aragua, 3rd edn. coleccionable de todos los estados de Venezuela. El Aragueño, Maracay, Aragua, Venezuela
- González R, Plonczak M, Stock J (2004) Plantaciones Forestales e Industrias Asociadas en Venezuela: Aspectos Socio-económicos. *Revista Forestal Venezolana* 48(2):111–117
- Haltia O, Keipi K (2000) Financiamiento de inversiones forestales en América Latina: el uso de incentivos. In: En Keipi K (ed) Políticas forestales en América Latina. Banco Interamericano de Desarrollo (BID), Washington, DC
- Harrison S, Herborn J, Niskanen A (2002) Non-industrial, smallholder, small-scale and family forestry: what’s in a name? *Small-scale forest economics. Management and Policy* 1(1):1–11
- Herrera H (1995) Estudio a gran visión para el proyecto de desarrollo agroforestal del sur del Estado Aragua. Consultor independiente. Fundacite Aragua internal report. Maracay, Venezuela
- Holling CS (ed) (1978) Adaptive environmental assessment and management. Wiley, Chichester
- Instituto Nacional de Estadística (INE) (2008) Censo de población y viviendas 2001. Available in: <http://www.ine.gob.ve/poblacion/censopoblacionvivienda.asp>. Accessed 28 May 2008
- ITTO (International Tropical Timber Organization) (2007) Community based forest enterprises: their status and potential in tropical countries. Technical Series 28. Yokohama

- Lecup I, Nicholson K (2006) Community-based tree and forest product enterprises: market analysis and development. Revised Booklet B introduction: defining where you want to end up. FAO, Rome. Available in: <ftp://ftp.fao.org/docrep/fao/009/j8712e/j8712e00.pdf>. Accessed 15 May 2008
- Llamozas S, Duno de Stefano R, Meier W, Riina R, Stauffer F, Aymard G, Huber O, Ortiz R (2003) Libro Rojo de la Flora de Venezuela. PROVITA, Fundación Polar, Fundación Instituto Botánico de Venezuela, Conservación Internacional, Caracas, Venezuela
- Lozada J (2007) Situación actual y perspectivas del manejo de recursos forestales en Venezuela. *Revista Forestal Venezolana* 51(2):195–218
- Macqueen DJ (2007) Connecting small enterprises in ways that enhance the lives of forest-dependent people. *Unasylva* 58(228):1–7
- Mery G, Alfaro R, Kanninen M, Lobovikok M (2005) Changing paradigms in forestry: repercussions for people and nIn: Mery G, Alfaro R, Kanninen M, Lobovikok M (eds) *Forest in the Global Balance: Changing Paradigms*. IUFRO World Series Volume 17, Helsinki
- Ministerio del Ambiente (MinAmb) (2000) Anuario de estadísticas forestales 1995–2000. Ministerio del Ambiente y los Recursos Naturales, Caracas, Venezuela
- Ministerio del Ambiente (MinAmb) (2007) Anuario de estadísticas forestales 2006. Ministerio del Ambiente y los Recursos Naturales, Caracas, Venezuela
- Ministerio del Ambiente (MinAmb) (2008) Anuario de estadísticas forestales 2007. Ministerio del Ambiente y los Recursos Naturales, Caracas, Venezuela
- MPD (Ministerio de Planificación y Desarrollo) (2002) Plan nacional de desarrollo forestal (propuesta). Ministerio de Planificación y Desarrollo, Caracas, Venezuela
- Nair CTS (2007) Scale, markets and economics: small-scale enterprises in a globalizing environment. *Unasylva* 58(228):3–10
- Pacheco P, Barry D, Cronkleton P, Larson A (2008) The role of informal institutions in the use of forest resources in Latin America. CIFOR, Forests and Governance Programme No. 15/2008. Bogor
- Sabogal C, de Jong W, Pokorny B, Louman B (eds) (2008) Manejo forestal comunitario en América Latina: Experiencias, lecciones aprendidas y retos para el futuro. CIFOR–CATIE, Belém, Brazil
- Sáez-Sáez V (2008) Estado Aragua. In: GEO-Venezuela: Geografía de la División Político-Territorial del País. Número 5–Capítulo, vol 40. pp 422–487. Fundación Empresas Polar, Caracas, Venezuela
- Schirmer J (2007) Plantations and social conflict: exploring the differences between small-scale and large-scale plantation forestry. *Small-scale Forestry* 6:19–33
- Sunderlin W, Hatcher J, Liddle M (2008) From exclusion to ownership? Challenges and opportunities in advancing forest tenure reform. Rights and Resources Initiative, Washington DC
- Torres-Lezama A, Ramírez-Angulo H, Vilanova E, Barros R (2008) Forest resources in Venezuela: current status and prospects for sustainable management. *Bois et Forêt des Tropiques* 295(1):21–33
- Torres-Lezama A, Vilanova E, Ramírez-Angulo H (2009) Guiding principles for small-scale forestry in a watershed of the Venezuelan Andes: constraints and opportunities. *Small-scale Forestry* 8(1):77–93
- Varmola M, Gautier D, Lee DK, Montagnini F, Saramäki J (2005) Diversifying functions of planted forests. In: Mery G, Alfaro R, Kanninen M, Lobovikok M (eds) *Forest in the global balance: changing paradigms*. IUFRO World Series, vol 17. Helsinki, pp 117–136
- Veillon JP (1994) *Especies forestales autóctonas de los bosques naturales de Venezuela*, 2^a edn. Instituto Forestal Latinoamericano, Mérida, Venezuela
- Vilela JE (1969) Estudio Tecnológico de 144 maderas de la Guayana Venezolana. Programa Ministerio de Agricultura y Cría (MAC)—FAO. Universidad de Los Andes. Laboratorio Nacional de Productos Forestales, Mérida, Venezuela