

YFFReview



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Participatory Approaches to Ecological Restoration

A summary of a forum exploring participatory approaches to ecological restoration in rural communities of Mexico and Argentina

A Yale Forest Forum Event

September 28, 2006
Global Institute of
Sustainable Forestry

New Haven, Connecticut

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Marsh Hall, home of GISF, on the Yale University campus

The School's Global Institute of Sustainable Forestry continues this tradition, in its mission to integrate, strengthen, and redirect the School's forestry research, education, and outreach to address the needs of the 21st century and a globalized environment. The Global Institute fosters leadership through innovative programs, activities, and research to support sustainable forest management both domestically and worldwide.

In pursuit of these ideals, GISF has developed several programs to carry on the work of the Institute, including the Program on Private Forests, the Program on Forest Certification, The Forests Dialogue, the Program on Forest Physiology and Biotechnology, the Program on Forest Health, the Program on Landscape Management, and the Program in Tropical Forestry.

The Yale Forest Forum is now the convening body of the Global Institute of Sustainable Forestry. Through YFF, the Institute holds events at the Yale School of Forestry & Environmental Studies involving stakeholders from all sectors.

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YFR Review

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restoration in rural communities of
Mexico and Argentina

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Executive Summary



Ecological restoration, the application of ecological principles for recuperation of degraded ecosystems, has emerged as an important and diverse field of study in the environmental sciences in recent years. Peer-reviewed journals and university research programs on the topic were established in the latter half of the 20th century. However, people have been practicing various forms of ecological restoration for millennia in shifting agriculture and agroforestry systems.

Ecological restoration uses ecological methods to restore ecosystem integrity through human intervention. This begs the question, who causes the degradation and who participates in the restoration process? Leaving people out of the equation or refusing them entry into restored ecosystems has proven to be difficult. Scientists and natural resource professionals may not know enough about local natural systems and economies to carry out successful, long-term restoration projects. Therefore, due to its human connection, ecological restoration must involve people at all stages of the process and seek ways to prevent future degradation.

Recognizing lessons from past restoration projects and the successes of the community forestry movement, researchers in Hidalgo, Mexico and Misiones, Argentina realized that a participatory approach to ecological restoration would be needed to achieve success in impoverished rural communities who depend on natural resources for sustenance.

On September 28, 2006, the Yale Forest Forum and the Program in Tropical Forestry at the Yale School of Forestry and Environmental Studies hosted a forum entitled Participatory Approaches to Ecological Restoration Projects in Rural Communities: Case Studies from Mexico and Argentina. Researchers from Hidalgo, Mexico and Misiones, Argentina shared their success stories in ecological restoration with students and faculty. Each presenter provided a description of their project and what made it successful. The presenters then answered specific questions from the audience regarding restoration policy and community participation in reforestation and restoration projects.

María Raimunda Araújo Santana emphasized the need for ecological restoration to address problems of both degraded ecosystems and rural poverty. Scientific institutions in Mexico, such as the Forest Research Center at the National University of the State of Hidalgo, have only recently begun to involve people in research projects. Part of the success of this project was due to involving local people in the identification of the causes of degradation, and the objectives and methods of restoration.

Alfonso Suárez Islas' talk focused specifically on the methodology of species selection and regeneration with community participation in Hidalgo, Mexico. Identifying and involving key local informants and agencies proved to be one of the most important steps. Furthermore, soliciting feedback from participants allowed project collaborators to design a restoration plan that would be more readily accepted and utilized by the communities.

Beatriz Irene Eibl presented the complex situation of soil degradation due to intensive farming and plantation forestry in the impoverished border region of Misiones, Argentina. Successful restoration projects in this region have involved local communities through the selection of multiple-use species that provide financial returns to farmers—all while recuperating ecosystem integrity.

Héctor Alejandro Keller's work with the indigenous Guaraní peoples of Misiones, Argentina combined statistical methods used in botany with traditional knowledge to come up with a model for restoration of degraded forests of Guaraní villages. Interviews with community members were used to determine the frequency of use of certain plants and how these plants could fit into restoration objectives. According to the Guaraní, a good forest must have many useful and easily obtainable species.

Lessons learned from these case studies should be useful in the design and implementation of ecological restoration projects in these and other regions with similar ecological and socioeconomic conditions. The case studies presented here are still in their early stages of development and their continuing success depends on the dynamic interplay of participation and project implementation.

Issue Introduction

The principal objectives of the Program in Tropical Forestry are research, education, and dissemination of information related to sustainable forest management and ecological restoration of degraded ecosystems in the tropics. Integral to the development and implementation of program activities is the active collaboration with colleagues from academic institutions in these areas. Academic opportunities for faculty and students from both Yale and counterpart institutions have been—and will continue to be—enriched greatly through this collaborative approach. Most importantly, the program aims to transfer the benefit of the accumulated knowledge directly (field work, workshops) and indirectly (training local forestry practitioners) to local communities by offering viable, sustainable, and economically attractive alternatives in tropical forest management.

The foremost challenge in tropical forestry is to find field-tested strategies that reduce extractive pressure on remaining intact forests and restore abandoned agricultural lands in such a way that preserves traditional livelihoods and provides attractive economic opportunities to local farmers. The establishment of native forest plantations on degraded agricultural lands is one strategy that promises to facilitate the recovery of biodiversity and ecosystem function and provide a steady source of income for local farmers. Two teams of researchers—in collaboration with colleagues from Yale—in Argentina (Province of Misiones) and Mexico (State of Hidalgo) have utilized a participatory approach in order to develop strategies for the establishment of native forest plantations that meet specific social, economic, and ecological concerns. In the forum conducted on September 28, 2006, *Participatory Approaches to Ecological Restoration Projects in Rural Communities of Mexico and Argentina*, two researchers from each project related the results of their research, and used their personal experiences to engage the Yale community in a dialogue about participatory approaches to ecological restoration projects as part of broader rural development efforts.

In both regions of these two countries of Latin America, the economic situation of rural communities remains immune to any progress that might be occurring in distant urban areas. The lack of economic

opportunity in rural areas has intensified the migration to urban areas and threatens traditional livelihoods. Participatory approaches to restoration and rural development actively engage local farmers in projects from the beginning to ensure their long-term commitment to the project. Participatory, bottom-up approaches reinforce democratic values such as elections and freedom of expression, as opposed to top-down approaches to development that perpetuate authoritarian relationships between local farmers and government officials. Participatory approaches to forest restoration and development foster the promotion of attitudes among citizens that are necessary to further entrench democratic values in Latin America, where political instability and social unrest have historically endangered the long-term survival of more democratic approaches to development.

Hidalgo, Mexico

The degradation of forest ecosystems in the State of Hidalgo has been a recent and fast-spreading phenomenon, as only 565,000 hectares of forest cover remain of the 1.5 million hectares of forest present in the State of Hidalgo in the 19th century. The cumulative impact of land-use change (agriculture, cattle, urbanization), unmanaged forest harvesting, forest fires, and pests has caused erosion and productive decline in forest soils, loss of biodiversity, further economic marginalization of rural communities, and the migration from rural to urban areas. In 2004, a team of researchers from the Autonomous University of the State of Hidalgo (UAEH), in collaboration with colleagues from Yale, initiated an ecological restoration research project with a strong emphasis on community participation. The research project consists of the following components:

- Analysis of ecosystem degradation: characterize and quantify the degree of degradation of the region's forest ecosystems;

- Community analysis of restoration of forest ecosystems: study the rural communities and their impact on the native forests;

Selection of species for use in ecological restoration projects: determine local knowledge of plant species and select those with the potential for use in the ecological restoration of forest ecosystems.

The current study, through participatory research, aims to integrate the information about the level of degradation of forest ecosystems in the region with that of the traditional uses and knowledge of forest species to develop viable strategies for future ecological restoration projects. Progress to date has been encouraging; land-use maps have been created and verified for several municipalities, various forest restoration activities have begun in three municipalities (reforestation, fire control, illegal logging monitoring, municipal forest nursery construction), and ecological information has been documented about several species with the potential for use in restoration projects.



Deforested hills in Huehuetla, Hidalgo, Mexico.

Misiones, Argentina

Extensive deforestation and forest fragmentation in the northeastern province of Misiones has reduced the quality and quantity of environmental services previously provided by native forests, such as local biodiversity, protection of water resources, and aesthetic values. Local communities rely primarily on the production of agricultural crops, such as soy, yerba mate, tobacco, and tea, and have become increasingly marginalized economically as their production has declined with the continued degradation of the surrounding ecosystems. As part of a long-term collaborative research effort between the School of Forestry at the National University of Misiones (UNaM) and Yale, native tree species plantations were established within densely-populated suburban areas of the province, such as the watershed of Arroyo Pomar near the town of Eldorado.

Local farmers are very interested in native tree species plantations and agroforestry systems, as they expect that the trees will provide valuable forest products (e.g., timber, fuelwood, fruits, and honey) and improve the environmental conditions of their neighborhoods, especially in terms of water quality and aesthetic values. The enthusiasm for native tree species systems has been encouraged through active participation of local people in the establishment and maintenance of plantations. In addition, Yale and UNaM researchers have been actively engaged with local farmers by conducting numerous workshops and short courses throughout the 17 years of collaborative research in the region.

Both projects presented in this review (Hidalgo, Mexico and Misiones, Argentina), although taking place in ecologically and culturally distinct parts of Latin America, share important commonalities garnered through their focus on community-based ecological restoration. Sharing these perspectives with the Yale community contributed to the enhancement of current understanding of how the dynamics of rural communities affect outcomes of forestry-related development projects.

Presenter Summaries

MARÍA RAIMUNDA ARAÚJO SANTANA

Universidad Autónoma del Estado de Hidalgo

Community Participation in Forest Restoration

Professor Maria Raimunda Araújo Santana works in rural areas in the State of Hidalgo, which is about 60 km north of Mexico City. Ms. Santana began her talk by pointing out that much deforestation has occurred since the 19th century, when Hidalgo was covered with 1.5 million hectares of forest. Currently, only 565,000 hectares of the original forest remain relatively intact. In addition, over 60% of these remaining temperate and tropical forests are either highly disturbed or fragmented.

Before the start of this project, local community participation in scientific research projects had been extremely low, mostly due to a lack of outreach from scientific institutions. In order for conservation and ecological restoration projects to be successful, these institutions need to involve the local rural communities. Moreover, other local institutions should also be included because they can help to facilitate communication with community organizations and provide access to secondary information.

In response to the need for ecological restoration and helping to alleviate rural poverty, the Forestry Research Center (CIF) of the National University of the State of Hidalgo (UAEH) initiated a participatory project for forest ecosystem restoration in Hidalgo in 2004 called Diagnostics of Degradation and Selection of Potential Woody Species for Restoration. In this project, people from the communities and municipal authorities of Valle de Tulancingo and Sierra Otomi-Tepehua have been enlisted to participate in the discussion of the causes of ecosystem degradation, its effects, and possible solutions.

These two geographic and cultural regions represent 13.8% of the land of the State of Hidalgo and 11.4% of its population. The natural and social conditions of these two regions are highly representative of the



“Creating a culture that values forests and forest management is necessary to restore forests.”

— María Raimunda Araújo Santana

state. People living in these regions rely mostly on agriculture, ranching, and forestry for their livelihoods. Their ethnic compositions are mostly mestiza (mixed ethnicity) with the presence of Nahuatl and Otomi-Tepehua indigenous groups.

Field work was initiated by conducting regional and community workshops. Identifying key informants and focal groups involved a series of interviews and meetings. From this process, four important groups emerged as key players: the federal and state governments (National Forest Commission (CONAFOR), State Council on Ecology, Secretary of Environment, and the Secretary of State), municipal representatives (Rural Development and the Ecology and Public Protection), Farms (private property and ejidos), and the Association of Forest Service Technicians of the Forest Research Center.

These working groups identified the main causes of ecological degradation to be slash and burn agriculture, over-grazing, illegal logging, forest fires, charcoal operations, open cast mining, unemployment, forest pests and disease, and lack of forest management plans. The most degraded communities suffer due to a mix of these causes, although illegal logging seems to be the most common threat. The results of this ecological degradation are soil erosion, climate change and loss of biodiversity and aquifer functioning.

The working groups also came up with a list of obstacles to ecological restoration objectives. A lack of community organization and interest by local authorities were cited as two major problems. Creating a culture that values forests and forest management was deemed necessary to restore forests. However, high unemployment remains a huge obstacle for restoration because people in need look to forested lands for economic opportunities.

Several of the communities employed various methods to initiate forest restoration. Public and private lands were used in the efforts, although

only local municipalities chose to build plant nurseries. Illegal logging and fire prevention measures were taken by implementing various forms of observation and reporting systems.

A multi-pronged strategy was implemented to accomplish restoration goals. A seed collection program was established for the nurseries in cooperation with producers and project collaborators in order to obtain seeds from high value trees, such as cedar (*Cedrela odorata*) and walnut (*Juglans mollis*). Project collaborators were trained in nursery techniques and care so that they in turn could educate members of their communities on how to operate the nursery. Where possible, natural regeneration of the forests was encouraged. Project collaborators helped land owners and communities to identify important areas of natural regeneration.

During the project, many community groups became interested in exploring other economic options from the forest. A community organization of women was formed to produce and sell medicinal plants. Project collaborators then responded by organizing courses in medicinal plant production and preparation. For example, a course in plant drying techniques was offered because many community members lacked knowledge in this area. In addition to using traditional knowledge and generating income, the cultivation of medicinal plants decreases pressure on the forests and allows them to be used recreationally.

Participatory approaches to ecological restoration allow for a better understanding of the relationship between rural communities and degraded forest ecosystems. Integrating restoration programs with municipal authorities is complex due to the lack of a working forest resource management plan. However, community members know the local natural resources and that is why they have become interested in resource conservation for future generations. Researchers should therefore consider community participation in forest ecosystem restoration programs as a means to increase the chances for success.

**ALFONSO SUÁREZ ISLAS**

Universidad Autónoma del Estado de Hidalgo

Participative Selection of Woody Species for Restoration of Forest Ecosystems

Professor Alfonso Suárez Islas started his talk by pointing out that forest ecosystem degradation remains one of the main environmental challenges facing Hidalgo. Hidalgo is very rich in forest ecosystem types, including semi-arid, temperate, montane and lowland tropical rain forests, encompassing a range of ecosystems that are representative of the country of Mexico as a whole. This variety of ecological conditions offers a unique set of challenges and assets in restoring forests and finding economic opportunities for local communities.

The study areas of the participatory restoration project conducted by National University of the State of Hidalgo (UAEH) include a dry scrub oak forest, a temperate pine-oak forest, a cloud forest, and a lowland tropical rain forest. Each forest has a distinct climate, which makes species selection and establishment for restoration objectives of utmost importance.

Local knowledge is a valuable package of experience about management and use of natural resources. It should be considered along with modern scientific methods to solve the current ecological crisis. This project developed a methodology for selection of woody species with potential for forest restoration, based principally on local knowledge and participation.

The establishment of study areas was based on topography, soils, climate, roads, and local social, political and economic organization. Before beginning major restoration work, it was important to identify and include experienced local people to help run training programs. In the selected communities, a series of workshops and field-walks were organized. Workshops covered introductory concepts of forest ecosystem

“Local knowledge is a valuable package of experience.”

— Alfonso Suárez Islas

restoration and discussions on selecting native woody species with potential for restoration. Participants in the workshops then grouped the species into two categories. One group of trees was identified as catalytic species, which create favorable conditions for the establishment of vegetation and might bring propagules from nearby seed sources. The second category includes scarce and endangered species which form populations with a low number of trees that might be at risk of extinction. In fact, many of these species are on the “red list” maintained by the Secretary of Environment and Natural Resources (SEMARNAT). These were selected as the second group due to their ecological and economic importance. Information on the selected tree species was then analyzed along with their technical criteria.

In every step of the process suggestions from local participants were incorporated. Feedback sessions held after each workshop or field walk allowed communities to take charge of the restoration projects and helped the University researchers to adapt the restoration strategies to better serve the needs of the communities. Community participation in methodology increases self confidence of people, because it includes the experience and knowledge of local farmers.



Maguey (*Agave atrovirens*) growing in a participating farm in Atotoniles, Hidalgo, Mexico.



“The selection of economically useful plants helps farmers to make money as landscapes are restored.”

— Beatriz Irene Eibl

BEATRIZ IRENE EIBL

Universidad Nacional de Misiones

Native Species of the Misiones Forest: Multi-Purpose Use and Conservation

Professor Beatriz Irene Eibl has been working on forest restoration using native trees since 1989. The forests of Misiones, Argentina are part of the Atlantic Coastal Forest Ecoregion, which comprises severely threatened tropical and subtropical forests that span parts of Argentina, Paraguay, and Brazil. The Upper Paraná Atlantic Forest used to cover 472,000 square kilometers, of which about 37,000 remain. Much of the remaining forest is in a region of Misiones located between Paraguay and Brazil. Misiones is considered a priority zone for conservation because it has the greatest area of continuous forest in Argentina (>30% of total provincial area).

Threats to biodiversity in Misiones include an extreme degree of forest fragmentation and degradation due to the expansion of agriculture and the unsustainable exploitation of local native forests. Poaching and illegal harvesting of trees and other plants threaten ecological integrity within the forests.

One of the ways to transform land and biodiversity into high value economic systems is to convert them to a productive system, such as a farm. In Misiones, indigenous peoples have traditionally practiced subsistence agriculture for hundreds of years. However, the soils are fragile and degrade easily under modern intensive agricultural methods. Farmers have ended up losing biodiversity and experiencing more poverty as a result.

Despite some of the degradation that agriculture has caused, tobacco and pine plantations are very important economic activities in the region. Thus private companies and conservationists must work together to combine conservation and production efforts.

The Global Strategy for Plant Conservation's (GSPC) objectives for 2010 include the conservation of biodiversity and sustainable use of plants with benefits to local communities. Strategies for the conservation of endangered species include ex-situ and preferably in-situ methods. Seed banks, herbaria, botanical gardens, and nurseries are important for storage and for understanding the ecological requirements of plants. Protecting key areas as well as restoring degraded lands will help to maintain local biodiversity in the areas of its origin. Long term conservation of natural resources can only be achieved through their sustainable use. Creating awareness and building the capacity of local people so that they can be the stewards and beneficiaries of these natural resources is one of the most important strategies in this program.

Perhaps the first step in achieving the GSPC objectives is assessing what the community needs. Some problems associated with the unsuitable use of land are soil compaction, erosion, and the invasion of grasses. Part of the Trinational Green Corridor strategy for this large area of remnant forests is to re-link them via ecological restoration in order to protect soil and water resources. In Misiones, native trees are used to restore remaining degraded forests if possible. University managed seed banks provide seed, expertise in germination requirements, and nursery production of seedlings for these projects. The benefits of microclimate amelioration under tree plantations and natural regeneration allow any degraded area to be restored. All that is needed are productive seeds, seed dispersers and time. These, coupled with the selection of genetically and phenotypically diverse species that have multiple uses, allow people to benefit from restoration.

How can economic value be given to biodiversity? The selection of economically useful plants helps farmers to make money as landscapes are restored. The needs of farmers require special attention because they are the ones who implement the restoration projects. Their preferences may include trees for timber, but they also favor species that can supply

medicine, essences, honey, and ornamental plants. However, if farmers want trees for non-timber uses such as honey, the technical and economic assistance is very limited. For example, farmers can only receive assistance from the provincial government for honey trees if the trees are sent to a saw mill at rotation age.

For their restoration projects, Universidad Nacional de Misiones researchers seek collaboration with private industry in addition to national and provincial support. For example, researchers are currently working with over 8,000 small farmers in agreement with private tobacco companies, such as Tobacco North and Particulares, to implement sustainable use programs in order to improve quality of life of farmers associated with tobacco planting projects fostered by the companies.

Special care is taken with endangered species in restoration ecology. Efforts are made to restore endangered species, both for their ecological function and economic utility, by promoting natural regeneration through the use of healthy remnant seed plants. Through conservation and education in sustainable use practices, degraded ecosystems can be restored while benefiting farmers and their communities at the same time.



Reforestation of degraded hills with a native species, *Pinus greggii*, in Atotonilco, Hidalgo, Mexico.

HÉCTOR ALEJANDRO KELLER

Universidad Nacional de Misiones and Universidad Nacional del Nordeste

Plant Resource Diversity in a Mbya Guaraní Community

Professor Héctor Alejandro Keller offers a unique approach to the restoration of forest ecosystems in Misiones. Not only does he bring the technical skills of a forester and botanist, but also the observation and cultural integration of an anthropologist. This combination of disciplines is what has allowed for his continued work with indigenous Guaraní communities of Misiones, Argentina for many years.

The Guaraní peoples of South America have a history of migrating throughout the continent looking for rainforests in response to population increases and climate changes. For example, the Mbya-Guaraní group moves periodically from west to east going from Paraguay to Brazil, crossing through Misiones, Argentina. Since 1990, human activities in the Atlantic Forest have led to a drastic decline in natural forested area. Exotic trees, such as those of the genus *Pinus*, have replaced much of the native forest. Forests have also been cleared for tobacco and other annual crops. The remaining forest fragments have been degraded because of excessive logging, which modifies their plant composition.

In Misiones, there are nearly 5,000 Guaraní in 75 communities. They have concentrated their communities in fragments of forest in the Green Corridor and the Yabotí Biosphere Reserve (YBR). The first forum for the incorporation of the Guaraní point of view in the management plan of the Yabotí Biosphere Reserve occurred in July 2006. This was an important meeting between the communities of the YBR and the provincial government. Representatives from nine Guaraní communities of the YBR, the Ministry of Ecology, and the School of Forest Sciences participated. During the discussions at the forum, the Guaraní communities made it clear that their principal requirement was to stop the degradation of the forest.



“Guaraní communities made it clear that their principal requirement was to stop the degradation of the forest.”

— Héctor Alejandro Keller

Excessive and poor logging operations by timber companies around the Guaraní communities of Teko'a Yma, Kapi'i Yvate, Takuaruchu and the settlements of Barra Chica have many negative impacts, one of which is the loss of plant resources. During logging operations, many residual trees are damaged by felling and skidding. These poor logging practices damage vines and alter the understory due to the creation of large gaps. Later, many damaged trees die and the area becomes more open, which leads to the invasion of exotic grasses and bamboo. The bamboo cover makes the regeneration of forest difficult until its natural cycle ends (roughly 30 years). These changes lead to the formation of a degraded forest. A report by Professor Keller two years ago on this situation led to a cessation of logging on 8,000 hectares next to three Guaraní villages through governmental resolution 533.

Forest scientists typically work with species that yield timber and non-timber forest products of commercial value. Much of that type of work is more technical in nature. In order to work with communities such as the Guaraní, forest scientists must also understand traditional or daily use. Therefore, the study consisted of both floristic and ethnobotanical studies. Through field surveys and personal interviews to identify what plant resources are most important to the communities, plants were grouped into medicinal, domestic, personal, magical, ritual, and miscellaneous uses, as well as weaponry, tools, food, crafts, construction materials, and firewood. According to the Guaraní, a good forest must have many useful species, and these must be obtained easily.

By recording what species are most useful to the people and later locating those species in degraded, secondary, marginal, and primary forests, it was found that the diversity of resources of traditional uses was greater in non-altered areas (e.g., primary forests and marginal forests near water courses). The Guaraní also plant medicinal or fruit species in or near villages when they do not frequently occur in forests. This knowledge is highly useful in restoration of degraded areas because rarer, frequently used species can be emphasized, while

species that are frequently used with higher natural occurrence near the communities can be given lower priority. An example of this application is the planting of medicinal species that were used to recover a degraded area in order to strengthen the availability of medicinal resources in the Takuapí village.

The success of restoration projects in Guaraní villages was dependent on applying appropriate scientific methodologies and traditional knowledge. Forest scientists had to learn how to understand traditional planting methods and uses for plants, and then apply their technical knowledge to restore forests in ways that recovered biodiversity and satisfied the needs of the communities. Through this combination of technical expertise, traditional knowledge and building community partnerships, ecological restoration projects can benefit biodiversity and provide for future generations of people.



Restoration of degraded municipal lands in Arroyo Pomar, Eldorado, Misiones.

Discussion Summary

Following is a summary of the panel's responses to questions raised by the audience.

Maria Raimunda Araújo Santana

Question: There are very few women in the pictures included in your presentation. Do you take any actions to promote the participation of women in the workshops?

Santana: Yes. When we started the work in the communities, we invited women to the workshops, but we observed that the women are often preoccupied with taking care of their children while their husbands attend the meetings. Women who attend the workshops are also interested in different aspects of restoration projects than men, such as those involving medicinal plants. Hopefully, you saw the pictures of the women in that part of the presentation. Since we started using medicinal plants in restoration projects, the participation of women has increased.

Alfonso Suárez Islas

Question: What are some of your funding sources? I'm also wondering, does your government provide funding for incorporating native species in your projects? Because it seems more expensive than working with exotic species.

Islas: Our project was financed by the University of the State of Hidalgo. Governmental institutions, such as the National Forestry Commission (CONAFOR) provide economic resources for the establishment of forest plantations, such as those planted for restoration with commercial purposes. There are two common situations in which native species are used in plantations. In the first case, many native species are used, however, the quantity of the species used is restricted considering the great variety of ecosystems and the specific site requirements of each species. In the second case, the government strongly supports plantations

with well-known exotic species, such as *Gmelina arborea*, *Tectona grandis* and various species of *Eucalyptus*, although they also include native species like *Swietenia macrophylla*, *Cedrela odorata* and many Pine species. I believe that there are still many things to investigate and do with native species so that they can be planted at a larger scale in the country.

Beatriz Eibl

Question: Does your government provide funding for the use of native species in your projects? It seems that a lot of governments would rather work with exotic species. Why isn't all restoration done with native species?

Eibl: The government almost never gives funds for working with native species because they require a specific set of recommendations about silvicultural treatments. Now we have these recommendations for them. We have a list of some [native] species with silvicultural recommendations for seeds. For example, some of the recommendations give the specific amount, quality and variety of seeds, as well as the spacing and other environmental conditions they require. About eight years ago, we started proposing multiple-use species and that is when the government started giving some funding, because the people started telling us that they needed more economic options because they only knew about these [exotic] species. The government also did not have information on native species. So from our research we had all of this information about the silvicultural requirements for these native species and their multiple uses, and the government understood that the people needed more options and was supportive because we had information on the multiple uses of these species.

Question: Do you take care of your initial plantings that are growing among the grassy fields?

Eibl: Yes. We cut the grass around the restoration plants to assist their establishment, but we do not remove the grass from any place else because it does have some benefits, such as preventing soil erosion and protecting from frost damage. Some natural regeneration also comes up among the grass that provides habitat for other plants and animals, such as bees, which we need to pollinate some of our restoration plants.

Héctor Alejandro Keller

Question: I notice that the degraded forests and the intact forests each have some uses. Was every species found in the degraded forests also found in the intact forests or would it be better for the people to have some intact forest and some degraded forest so that they could have a wider diversity of materials to use? Would it be beneficial to have a variety of types of forest?

Keller: Yes. The Guaraní people are farmers who practice slash and burn agriculture and also manage different ecosystems that have different types of plants. It is always important for them to keep some intact forest because there are some species of plants that cannot be found in cultivated or degraded areas. Basically, there are species that cannot be found in severely altered areas. It is also important to keep intact forests around for sources of seeds and other resources that cannot be found in the degraded forests or cultivated areas.

Question: Do you prioritize the uses of the plants in terms of quantity and quality?

Keller: Yes. One way that we do that is by noting the frequency that a certain plant is mentioned in the survey of uses. Additionally, sometimes

certain families or individual species of plants are used more than others and we are able to recognize the importance based on the frequency of use of that family or individual species. However, we do not typically prioritize the plants per se because some plants, such as those used in magic, may not be of as much importance to us, but they can be very important for indigenous people. So we rely on the statistical methods from economic botany to calculate the importance of a plant based on frequency of use or mention.



Degraded lands in Atotoniles, Hidalgo, Mexico.



Presenter Biographies

MARIA RAIMUNDA ARAÚJO SANTANA, MSci.

María Raimunda Araújo Santana is a professor and researcher at the Centro de Investigaciones Forestales, Universidad Autónoma del Estado de Hidalgo (Center for Forest Research, National University of the State of Hidalgo) in Tulancingo, Hidalgo, Mexico.

Raimunda Santana has an MSci. in Tropical Forests and Conservation of Biodiversity from the Centro Agronómico Tropical de Investigación y Enseñanza (Tropical Agricultural Research and Higher Education Center; CATIE), Turrialba, Costa Rica, 2001, where she studied products derived from fiber and wood from secondary forests used for the manufacture of crafts in the market of Masaya, Nicaragua; she has also a BS in Tourism and a specialization in traditional peoples of the Amazon, both from the Universidade Federal do Pará, Brazil.

As part of the activities stemming from an agreement between Yale University and the National University of the State of Hidalgo, she has a joint research project with Dr. Florencia Montangini of the Yale University School of Forestry and Environmental Studies called the Institutional Research Program (PII) of the National University of Hidalgo, Mexico. Ms. Araújo has also recently coauthored a paper, Evaluation of Forest Ecosystem Degradation in regions II and XIII of the State of Hidalgo and Selection of Species for its Restoration, in collaboration with Alfonso Suárez Islas and other researchers from the National University of the State of Hidalgo.

ALFONSO SUÁREZ ISLAS, MSci.

Alfonso Suárez Islas is currently a professor at the Center for Forest Research, National University of the State of Hidalgo in Tulancingo, Hidalgo, Mexico, where he researches tropical forest restoration ecology and agroforestry.

Mr. Suárez Islas earned his Master of Science in Tropical Agroforestry at CATIE. For his thesis project, he worked with indigenous groups of

Talamanca in Costa Rica on the sustainable extraction and use of certain timber species that regenerate naturally in cocoa and banana plantations. His interests in community forestry have also led him to Veracruz, Mexico, and back to his home state of Hidalgo, giving him nearly ten combined years of community forestry experience in forests of North and Central America.

Additionally, Mr. Suárez Islas has considerable experience in multiple use forest management and has participated in many conferences on sustainable forest management and community forestry throughout Mexico and Costa Rica. He does not limit his work to the academic realm, however, and has organized agroforestry courses for municipalities and private foresters of Hidalgo. His most recent publication, *Selection of Woody Species for the Restoration of Forest Ecosystems Based on Rural Knowledge*, was written in collaboration with Ms. Araújo Santana and others.

BEATRIZ IRENE EIBL, MS

Beatriz Irene Eibl is a professor in the School of Forest Science at the Universidad Nacional de Misiones (National University of Misiones) in Misiones, Argentina. She has done extensive work on ecological restoration of degraded areas for more than twenty years, including research on regeneration of trees and seed germination both in natural and laboratory conditions. Her work on seed storage and germination has made her one of leading experts on climatic conditions for the germination requirements of native trees of the region.

She has published many articles on the multiple uses of native timber trees in agroforestry systems, and several others related to her work on the rehabilitation of degraded lands, natural regeneration and seed germination. The basis for her presentation in this Yale Forest Forum was taken from her most recent publication, *Rehabilitation of Degraded Lands in Misiones Argentina*, which is a collaboration with Dr. Florencia Montagnini.

Ms. Eibl has also worked with community members on the protection of rivers in urban areas and researching multiple uses for forests and forest products. She serves as a technical advisor to an endangered plant committee in Misiones and several local national parks and reserves. She is also a peer reviewer for two national journals in Argentina. Her work in Misiones has led to much international recognition, which has allowed her to collaborate on projects with partners from England, Indonesia, and the United States.

HECTOR ALEJANDRO KELLER

Hector Alejandro Keller is pursuing a PhD in natural resources at the Universidad Nacional del Nordeste (National University of the Northeast) in Corrientes, Argentina. His thesis, *Ethnobotanical Assessment of Plant Communities Used by the Guaraní People of Misiones (Valoración Etnobotánica de Comunidades Vegetales Empleadas como Fuente de Recursos por Comunidades Guaraníes de Misiones)*, is the result of many years of collaboration with the Guaraní of Misiones. He is in charge of courses on Plant Morphology and Systematics in the School of Forest Science at the National University of Misiones, where he teaches ethnobotany and continues anthropological and ethnobotanical studies with the Guaraní. He is currently working with the Guaraní and rural communities of Misiones on the production of medicinal plants. Some of Mr. Keller's other research focuses on the use of herbaceous plants as indicators of environmental impact.

Two of his most recent publications exemplify the diversity of his work with plants and people. The presence of *Doryopteris lomariacea* (Pteridaceae, Pteridophyta) in Argentina (*Bonplandia* 15(3-4):143-148. 2006) details the first official confirmation of the occurrence of the fern species, *Doryopteris lomariacea*, in Misiones, Argentina. In the same issue of *Bonplandia*, he examines medicinal plants used by poor farmers living in the Yabotí Biosphere Reserve in Misiones (*Bonplandia* 15(3-4): 125-141. 2006).

Resources for More Information

Centro Agronómico Tropical de Investigación y Enseñanza (Tropical Agricultural Research and Higher Education Center; CATIE)
www.catie.ac.cr

Center for International Forestry Research
www.cifor.cgiar.org

Community Forestry International
www.communityforestryinternational.org

EcoTeas
www.ecoteas.com

Food and Agriculture Organization of the United Nations–Forestry
www.fao.org/forestry

Forests Are Forever
www.forestsareforever.org

Society for Ecological Restoration International
www.ser.org

Universidad Autónoma del Estado de Hidalgo (National University of the State of Hidalgo)
www.uaeh.edu.mx

Universidad Nacional de Misiones (National University of Misiones)
www.unam.edu.ar

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www.unne.edu.ar

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