Rehabilitating and using bamboo forests in Peru

An innovative ITTO project has launched a sustainable development initiative to improve the livelihoods of communities using bamboo

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Vegetable steel: Workers load recently harvested bamboo onto a truck for transport to a construction site in Aramango District, Amazonas, Peru. *Photo: J. Takahashi, PERUBAMBU*

South America is rich in woody bamboo species, and Peru has its fair share. Given its biological, physical, chemical and mechanical properties and relative abundance, bamboo has enormous potential to contribute to Peru's socioeconomic development—bamboo forests cover 3.6 million hectares (ha) of the country, which is about 3% of the total land area (INRENA 1996).

The largest areas of bamboo in Peru are in the south; bamboo resources are smaller in extent in the high forests of the central and north regions but more biodiverse, consisting of more than 60 species (Takahashi and Ascencio 2004), most of them not yet studied. High rates of deforestation continue in those regions, mostly due to the expansion of the agricultural frontier. Peru's current deforestation rate is estimated at about 182 000 ha per year, increasing by an estimated 10% per year, especially in the San Martin and Amazonas regions (formerly called departments) in the central north of the country. The GDP per capita in those regions was S/.2695 (US$969) and S/.2709 (US$974), respectively, in 2013, which was only about one-tenth the GDP per capita in Lima (S/.25 748, or US$9262) in that year (INEI 2013).

Despite their low economic status, San Martin and Amazonas have significant potential for rapid socioeconomic development, including through the sustainable use of bamboo. For example, they have good road access and communication with a large number of rural and native communities (including 146 Awaruna communities), and small farmers are interested in the sustainable harvesting and processing of bamboo, particularly *Guadua angustifolia*.

Project to promote sustainable use of bamboo

ITTO project PD 428/06 Rev.2 (F) was financed by ITTO with counterpart funding from PERUBAMBÚ in cooperation with Peru's National Institute for Natural Resources (INRENA) and the regional governments of San Martin and Amazonas. The project's strategic objective was to promote the rehabilitation, management and sustainable use of bamboo in Peru's central north. The project aimed to produce three main outputs: 1) the training of local communities in techniques for the rehabilitation, management and sustainable use of bamboo forests; 2) the rehabilitation and reforestation of 200 ha of forest using bamboo species; and 3) the socioeconomic development of local communities based on their active participation in project activities and resultant economic benefits.

Bamboo resources in the project area

Natural bamboo formations and plantations were identified in the district of El Milagro (Utcubamba Province) and the districts of Aramango and Imaza (both in Bagua Province) in the Amazonas Region. In general terms, these bamboo formations, often managed by single families, are small in size and there is insignificant connectivity between stands, with the exception of old bamboo plantations, and they range in area from 0.5 ha to 5 ha. The bamboo forests are small due to the rapid expansion of the agricultural frontier, particularly for the production of rice, which has become the major commercial crop in the district of Bagua (also part of Bagua Province). The biggest loss of natural bamboo

Rich forests: In the project area, natural forests containing bamboo stands could sustain annual harvests of 1750–2275 culms per ha. *Photo: J. Takahashi, PERUBAMBU*

formations to rice cropping has occurred in the San Martin Region, except in remote areas belonging to native communities and in the Atumplaya Bamboo Protection Forest.

Production potential and value

A forest inventory in the Amazonas and San Martin regions, combined with studies on bamboo diversity in the forests of the area and on the physical and mechanical properties of bamboo culms, all conducted under the project, indicated that natural and planted forests of *Guadua angustifolia* and other similar bamboo species have an average harvestable capacity of 50–65% of total mature stems, with productivity levels similar to those found in Asia, such as in Anji County, Zheijiang Province, China. *Guadua* is known as "vegetable steel" because of its extraordinary physical and mechanical properties, which make it suitable for construction and furniture manufacturing, among other potential applications that are yet to be studied. In the project area, natural forests containing bamboo stands could sustain annual harvests of 1750–2275 culms per ha. In 2009, 6-metre culms were selling at US$0.75–US$1.00, meaning that the communities could obtain US$1312–2012 per ha per year from bamboo harvesting, in addition to their regular income from other activities.

The application of adequate drying and preservation techniques using environmentally friendly products could increase the value of culms, other parts of which could also be marketed for various uses, at US$0.25–0.30 per culm. Therefore, the income that the local communities could have received in 2008 as a result of the direct use of bamboo resources and improvements in the production chain was US$2000 per ha per year. Rehabilitating degraded areas and increasing the value-added component of craft production could boost income to more than US$3000 per ha per year, similar to the amount invested per ha by the project over its lifetime.

Taxonomic studies

The main objective of the taxonomic studies was to identify bamboo varieties with the morphological characteristics of *Guadua angustifolia*. In the project area, there are at least three *Guadua angustifolia* biotypes, which were identified using molecular microsatellite markers (Posso et al. 2012). It was determined that the genetic variability of the biotypes in Peru is higher than that found in Colombian biotypes, leading to the identification of two new *Guadua* species in Peru (Londoño 2013).

Training strategy

The project developed an intervention, dissemination and training strategy in coordination with the technical authorities of the regional and local governments in the project area. The training of local rural communities, who mostly live in poverty, was carried out through training workshops focused on field practices and the development of skills in sustainable bamboo management and harvesting, as well as the identification of silvicultural and economic characteristics of plots containing bamboo stands. It was demonstrated that bamboo forest stands established in agroforestry systems in their early stages of development and then grown as dominant forest species can be more profitable than any other annual or biannual agricultural crop. Thus, small farmers showed a preference for this resource over other reforestation alternatives with forest tree species.

Reforestation with bamboo

A total of 246 ha of degraded lands of very-low-income families were reforested with bamboo under the project, mostly divided into plots of 0.5–5 ha each and distributed throughout 15 districts in the Amazonas and San Martin regions. In addition, training and monitoring activities were carried out for the rehabilitation and management of 13 950 ha of natural bamboo forests in native community areas, such as the native community of Yarau in the Awajun District, Rioja Province, San Martin. Seven nurseries were established for the production of organic bamboo seedlings (i.e. free of pesticides and inorganic fertilizers) in exchange for labour and transport provided by project beneficiaries.

Capacity building

Local capacity building for primary bamboo processing began with the training of community members in Aramango District, Amazonas, in basic techniques for the construction of housing as part of a program to build a facility called MINCABAMBÚ (7 m high and covering 350 m^2) entirely with bamboo. Local communities now use MINCABAMBÚ as a bamboo training and processing centre, the only facility of its kind in Peru. In this centre and in other local offices, the project provided training in basic furniture- and craft-manufacturing techniques. A wide range of craftspeople, farmers and members of native communities and other settlements participated in these activities, including women and youth living in poverty—women account for 47% and 45% of the economically active population in the Amazonas and San Martin regions, respectively.

The project directly trained at least 300 people in its target area, and, on this basis, the number of direct and indirect project beneficiaries was close to 5000 people, comprising family members (2000 people); community users of bamboo for housing, household utensils and agricultural purposes (2000); manufacturers of bamboo handicrafts for commercial purposes (150); timber loggers, who received information on the sustainable management of tropical forests (250); bamboo distributors (50); builders (50); and other local farmers and craftspeople (250).

Other important project beneficiaries were the technical staff of the General Directorate of Forestry and Wildlife (*Dirección General Forestal y de Fauna Silvestre*—DGFFS) and the professional staff of national, regional and local institutions involved in forest and natural resource research. Staff members were involved directly in the project's research activities and contributed their local knowledge and experience to the attainment of the project's specific objectives. At the same time they benefited from direct access to training on techniques for the rehabilitation and sustainable management of forests with bamboo stands.

Commercial potential in Aramango

Aramango District has one of the largest *Guadua angustifolia* bamboo forests in the region, and most of it occurs close to the paved road that links Aramango to the provincial capital. To assess the present and future potential of bamboo forests in Aramango, an inventory was carried out in more than 90% of the plots present in the area. It was determined that the 86 plots belonging to project beneficiaries covered a total of 76 715 ha; these are harvested for commercial purposes, but fewer than 50% are adequately managed. For all plots, the number of shoots and green, mature and over-mature culms was assessed in a representative sample of 5% of the area of each plot, randomly divided into 100 m² subplots. A preliminary projection of the production of bamboo culms found that 50% would be available for harvesting by 2012 and that the annual potential value of trade in culms from about 100 ha of forest exceeded US$500 000 in 2013, assuming an average price in 2012 of US$0.50 per m per culm (10 cm in diameter x 6 m in length). Moreover, culms with a diameter of 12.5 cm are now being sold for as much as US$0.54 per m, while the same type of culm in 2009 sold for US$0.75–US$1.00 per 6-m culm; in other words, the price of bamboo culms has increased by as much as 400% due to the project's promotion and demonstration of the potential of this product and improvements in the quality of culms extracted from managed forests. Elsewhere in the project's area of influence, prices for bamboo canes increased by 600% as a result of improvements in the bamboo production chain.

These results have attracted the attention of local and national authorities, who are now interested in pursuing the production of forest resources other than traditional timber species. This interest led to the approval of technical standard E.100-Bamboo (with the active involvement of PERUBAMBÚ) for bamboo construction in the public and private sectors. The establishment of this technical standard enables the development and implementation of government construction projects such as housing, schools and healthcare centers, which previously exclusively used brick and mortar, concrete and iron.

Learning by doing: Local capacity building included community training in house construction techniques as part of a program to build MINCABAMBÚ.
Photo: J. Takahashi, PERUBAMBU

More than 246 hectares in Amazonas and San Martin were reforested with bamboo; the sustainable commercial—and hence economic—potential of this area in the medium term was estimated by the project at US$5880 per ha per year. This forest resource is also highly environmentally friendly given its capacity for carbon sequestration, erosion control and water resource management.

Consolidating project results

The project successfully promoted the biological and physical–mechanical properties of bamboo and enabled participants to greatly increase the prices they obtain for their bamboo canes. The project has motivated local communities and authorities to consider bamboo as a suitable material for the rehabilitation and reforestation of degraded forestlands in areas at high risk of erosion and forest-cover loss. It will be necessary to continue activities to meet the requirements of those communities that did not benefit from this phase of the project and which have repeatedly requested technical and financial support from the project implementers.

The rehabilitation and reforestation program can contribute to the economic and environmental development of both the Amazonas and San Martin regions, although it requires further consolidation. The development of technologies for the management of bamboo resources and the processing of bamboo into value-added products will enable Peru to strengthen its conservation of moist tropical forest ecosystems and consequently the conservation of the biodiversity they contain.

References

INEI (National Institute of Statistics and Information Technology) 2013. Available at: www.inei.gob.pe.

INRENA 1996. *Guía del mapa forestal del Perú*.

Londoño, X. 2013. Two new Guadua species for Peru (*Poaceae: Bambusoideae: Bambuseae: Guaduinae*). *J. Bot. Res. Inst. Texas* 7(1): 145–153.

Posso, A.M., Muñoz, J.E. & Londoño, X. 2012. *Estudio genético con marcadores microsatelites de tres ejemplares de Guadua angustifolia recolectados en el Perú*. ITTO project PD428/06 Rev.2 (F).

Takahashi, J. & Ascencio, D. 2004. *Bamboo inventory in Peru*. Final report submitted to GTZ.