

Collaborative research to enhance benefits and livelihoods from forests

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The Non-legally Binding Authoritative Statement of Principles for a Global Consensus on the Management, Conservation and Sustainable Development of All Types of Forests (Forest Principles) calls for a strengthening of the contribution of science and research in advancing sustainable forest management, as well as the development and application of scientific and technological innovations that can be used by forest owners and indigenous communities to that end.

Over the past 30 years, the Australian Centre for International Agricultural Research (ACIAR) has been investing in international forestry research, predominantly in the Asia-Pacific region. ACIAR's forestry programme facilitates collaborative research by Australian and international forest scientists with developing country scientists, to build capacity and enhance the contribution made by sustainable forestry to livelihoods and economic development in partner countries.

ACIAR has facilitated significant advances in scientific knowledge and transfer of Australian tree germplasm, enabling the widespread adoption of Australian species in plantations in China,

Viet Nam, Indonesia, Laos, India, Thailand and southern Africa. In more recent years, ACIAR's forestry projects have been located in Indonesia, Papua New Guinea, Viet Nam, Laos and several Pacific Island countries. These projects focus on adding value to local and introduced species, developing non-timber forest products and supporting forest industries and agroforestry to benefit small landholders.

Improved management of tropical forests

In many places, tropical forests are the only forest resources available to local communities and therefore there is an urgent need for research to assist communities in managing them. In Papua New Guinea (PNG), ACIAR has conducted collaborative research on improving the contributions that secondary forests make to national and local economies by developing appropriate strategies for their management and marketing. These include enhancing PNG's network of permanent forest



Image: Tony Bartlett

Papua New Guinea farmer with 10-month-old balsa trees



Image: Julian Fox, University of Melbourne

Landowners in Papua New Guinea conducted participatory forest inventory research

inventory plots and analytical capacity, developing community-based forest assessment and management planning capabilities with four communities and modelling the possible financial outcomes.

The project developed innovative individual-tree growth models that can be used in combination for forests with virtually any species mixture or size structure. These models were used to calculate changes in merchantable volume and carbon stocks over time in different forest types. The research demonstrated that commercial timber resources in most secondary forests are recovering, with above-ground woody biomass recovering at an average sequestration of $1.12 \text{ ton C ha}^{-1} \text{ yr}^{-1}$, and that it will therefore take about 75 years to return to the pre-harvest carbon stock. Forest scientists can now calculate the impacts of different forest management scenarios on carbon sequestration using PNG forest inventory data, rather than having to use default values from the Intergovernmental Panel on Climate Change's reports.

Another finding was that community-based small portable sawmill operations can be profitable if they process about $1,000 \text{ m}^3 \text{ yr}^{-1}$ of logs into sawn timber, which can be sold within 100 km of the mill without the need to construct roads. The work undertaken to develop forest management plans for four community forests, together with the improved information on carbon sequestration rates and profitability of small sawmill operations, provides these communities with the ability to decide how to manage their forests sustainably.

Better returns from plantations

About half of Viet Nam's plantations are comprised of Australian tree species of *eucalypts*, *acacias*, *casuarinas* and *melaleucas* and about one third of the plantations are owned by smallholder farmers. In some areas, more than 65 per cent of the total annual income of poorer households is derived from forestry.

Since 1989, ACIAR has supported the development of these plantations through research on species selection, genetic improvement,

plantation productivity and, more recently, plantation silviculture. ACIAR's impact assessment modelling found that its A\$1.5 million investment in plantation productivity research in Viet Nam has delivered benefits with a net present value of around A\$129 million. About two thirds of these benefits flow to consumers via lower prices but the rest go to the producers, including large numbers of smallholder farmers, who have planted the better quality genetic material. On average a farmer growing *acacia* pulpwood on a 7-year rotation would get an extra $11 \text{ m}^3 \text{ ha}^{-1}$ of product to sell as a result of this collaborative research. Smallholders can achieve greater income and make more informed decisions on whether to grow short-rotation pulpwood or longer-rotation sawlogs.

Some smallholder plantations can be grown on short rotations in conjunction with agricultural crops. In PNG, farmers are growing balsa plantations on a five-year rotation. Following a decline in productivity due to the introduction of seed of poor genetic origin, research is being conducted to improve the availability of high-quality balsa germplasm. It is anticipated that this collaborative research will increase yields by at least 75 per cent and thereby generate an additional revenue of PGK5,900 per hectare for farmers.

Adding value to plantation-grown wood products

Viet Nam has a very substantial wood processing sector, which includes pulp and panel mills as well as thousands of small and medium-sized wood manufacturing enterprises. Its furniture industry is now the fifth largest contributor to exports, but the industry currently relies



Image: Tony Bartlett

Australian and Vietnamese researchers carried out thinning trials on four-year-old *Acacia mangium* trees



Image: Tony Bartlett

Vietnamese researcher with one-year-old *Acacia mangium* clone



Image: Tony Bartlett

Farmers in Viet Nam have benefited from the production of sliced veneer from 9-year-old *Acacia mangium* trees



Image: Tony Bartlett

Teak-based agroforestry system near Luang Prabang in Laos

on imports of 4 million m³ of hardwood timber each year. At present, almost all of Viet Nam's plantation timber is processed into pulp or reconstituted panel products. New technologies, such as spindle-less lathes and veneer slicers, do not require logs as big as those for sawn timber, giving rise to an emerging interest in veneer production.

ACIAR is researching the production of veneer and engineered wood products from small diameter plantation logs and linking of certified timber to high-value markets. Fast-growing eucalypt and *acacia* logs can be used for the production of veneer, provided they have appropriate log and wood quality. This research aims to help smallholders achieve higher prices for their plantation timber, leading to reduced demand in Viet Nam for hardwood logs sourced from primary forests in other countries.

In Laos, up to 50,000 hectares of predominantly teak-based plantations have been established over the last twenty years, primarily by small landholders. ACIAR's research in Laos has focused on enhancing teak log quality and improving the quality of furniture made from plantation timber, through better knowledge of timber properties and applying appropriate processing, drying and manufacturing systems. Working collaboratively with local researchers and nine sawmills and furniture factories, the capabilities, weaknesses and opportunities of the individual participating companies were assessed. Methods were developed and training held to make production processes more efficient, reduce wood waste and improve the health and safety of the employees.

Agroforestry systems

In northern Laos, ACIAR's teak agroforestry project has established trials of teak grown with other high-value agricultural crops, such as paper mulberry, bananas, pineapples, broom bush and 'Job's tears', to generate cash income during the early years of a teak plantation. Most of these agroforestry systems are being established on land formerly subject to shifting cultivation. This project has already demonstrated

good results with important information on growth rates, financial returns and farmers' motivations for planting teak and other species. Landowners are benefiting from additional income from the sale of products in the short term with the promise of a long-term revenue stream from the sale of teak logs within 20 years.

In PNG, ACIAR's agroforestry projects are fostering the adoption of commercial high-value tree growing and firewood production by landowners. Landowner decision-making has been assessed in relation to incorporating commercial trees into existing agricultural systems and community-based plant nurseries have been developed. Trials of potential fuelwood species with coppicing characteristics have been established in different regions and the production of charcoal from different species is being explored. To tackle the problem of poor availability of high quality tree seedlings, research is being conducted on improving the quality and availability of seedlings through seed collections locally and overseas, vegetative propagation and the development of teak seed stands and nurseries. Participatory rural appraisals have been conducted in a number of regions to assist local communities in identifying the most highly valued local tree species for inclusion in the project.

In Indonesia the expansion of smallholder teak growing faces various impediments, including inferior wood quality due to poor silviculture, inability of farmers to wait for teak returns and low log prices for smallholder-grown teak. An ACIAR project, managed by CIFOR, aimed to improve the livelihoods of smallholder teak growers through research on introducing and adapting silvicultural technologies, the development of financial incentives and improved market access for smallholder teak growers. Project activities,



Image: Tony Bartlett

Communities in Papua New Guinea undertook participatory research to identify the highest-value local tree species



Image: Tony Bartlett

Solomon Islanders process *Canarium* nuts using traditional methods

such as farmer visits and training, establishment of on-farm demonstration trials and the development of a silvicultural manual, have improved farmers' knowledge and capacity to implement better practices.

Thinned and pruned teak trails resulted in a 60 per cent increase in diameter growth and a 124 per cent increase in height growth over a two-year period. The project led to the establishment of a microfinance institution to enable farmers to borrow against the value of their planted teak trees. In the Gunungkidul region where the project operated, most farmers allocated about 10 per cent of their land to growing teak under a 'tegalan' rain-fed agroforestry farming system. Surveys found that 70 per cent of farmers at project sites had increased knowledge of appropriate teak silviculture and about 50 per cent had been applying these skills. Farmers who were able to retain their trees until they reached diameters of 30-40 cm received 13 times the value for their trees of those who sold their trees at diameters of less than 20 cm.

Increasing livelihoods from non-timber forest products

Most forest-dependent people or communities utilize a variety of non-timber forest products, which offer considerable potential for increasing livelihoods. In the Pacific, ACIAR has conducted research to support the growth of the sandalwood industry in Vanuatu and the *Canarium* nut industries in PNG, Solomon Islands and Vanuatu.

In the past 15 years, Vanuatu has developed domestic sandalwood oil processing facilities and has encouraged landowners to plant sandalwood in their gardens and in plantations. ACIAR's research has analysed oil concentrations from natural sandalwood trees from six different islands and found that only two of these populations have oil contents that meet the international standard. A research programme is being conducted to enhance the production of germplasm from these populations. On average, landowners who are currently participating in the sandalwood industry sell about 120 kg of sandalwood each year and receive about \$A1,000 in revenue, which is used to meet a variety of domestic needs.

Indigenous nut trees of the *Canarium* genus grow in south-east Asia and the Pacific and local people have used these highly nutritious nuts in their subsistence lifestyles for generations. These trees also produce high quality timber and can be grown in and around traditional gardening areas. ACIAR has been conducting research on the production of high-yielding plants that begin flowering after four years and also on the processing of these nuts and the development of higher value products, such as coated nuts and blended foods. This will enable the development of high-value products for sale in urban and export markets. It is estimated that potential markets in Vanuatu and the Solomon Islands could be worth more than \$A1million each year, while an export-focused market in PNG would be worth many times this amount. While local people understand how to process the nuts for local consumption, research is needed on how to manage local processing in a manner that ensures high-quality nuts can be delivered from remote locations to value-adding processing facilities.

Collaborative forest research is both an essential component of sustainable forest management and a very effective mechanism for generating enhanced benefits for forest owners, forest-dependent communities and people engaged in forest industries. ACIAR's work in a number of countries clearly demonstrates that these enhanced benefits can be achieved throughout the broad spectrum of forestry, including management of native forests, plantation growing, wood processing, agroforestry and utilization of non-timber forest products. In addition, this approach to supporting forestry research develops local capacity and establishes lifelong friendships and networks between the research partners.