

Editorial: Domesticating native tree species for development in small island nations

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ROLE OF FORESTS IN DEVELOPMENT

Forests play a key role in development in addition to the multiple roles they play in providing products for subsistence lifestyles and livelihoods for an estimated 1.6 billion people (Belcher 2005). They are often abundant in developing countries that have few other assets, are renewable if managed wisely, and can provide the capital and help build the skill base for other enterprises. However, the track record of developing countries with tropical forests in managing a transition to sustainable forest management is poor. Many forests have been overcut, and then poorly regenerated or converted to other land uses, and there are, sadly, too few illustrations of the way in which forests can play a significant and sustainable role in development (Salim and Ullsten 1999). Thus it is important to continue to work collaboratively to find ways to improve forest management and to develop value-adding forest industries that source logs from forests and plantations that are managed sustainably.

SMALL ISLAND NATIONS

The difficulties associated with sustainable forest management are compounded in small island states, where there are several challenges including barriers to market mechanisms, lack of infrastructure, logistical challenges of moving logs and timber between islands or overseas, and in some cases, severe weather (e.g. cyclones). These small nations may also have relatively small Forestry Departments with few resources to support the development of sustainable forest industries. Frequently, transaction costs in small island states are higher than in comparable continental nations, particularly with regard to trade. Typically, capital costs are higher, transport is slow and expensive, and economies of scale are harder to achieve. However, the durability of some tropical timbers means that with appropriate treatment and handling, they can be stockpiled, stored, and consolidated into container-sized shipments, conferring some advantages over other traded products. Thus value-added timber products can be attractive as an export industry for small island states where land use pressure is modest. However, to realize the greatest benefits of a timber industry, it is important to develop appropriate silvicultural systems to encourage the development of high quality logs as well to develop national capacity to add value in-country, and to export processed timber rather than logs.

NEED FOR PLANTATIONS

Global experience of timber exports from island nations reveals a depressing record of over-exploitation and under-investment in both reforestation and plantation development. In many cases island nations have seen little benefit from the pillage of their natural resources. Thus any attempt to foster the development of a sustainable timber industry should be underpinned by appropriate investment in silviculture, wood processing and forest policy. Any plans to harvest residual native forests should be guided by appropriate silviculture and growth studies, and supplemented with afforestation. Equally, plantation development efforts should be informed by species trials and domestication research, as well as by growth modelling and capacity building.

Many plantation development efforts are hampered by poor choice of species, so the need for thoughtful species selection and careful species-site matching cannot be overstated. Species selection should take into account potential growth rates and stem form, the capacity of the species to cope with local environmental factors as well as wood quality considerations such as easy of processing, durability, and market acceptance. An advantage of indigenous species is that consumers may already be familiar with the timber and the species should be well adapted to the local environment.

DOMESTICATING SUITABLE NATIVE SPECIES

Domestication is the process of taking a wild species, bringing it into cultivation and then improving the desired characteristics of the species (Leakey and Tomich 1999, Nichols and Vanclay 2012). For most tree species it usually involves identifying good seed sources from within the natural population and then developing appropriate propagation and silvicultural practices. For the most valuable timber and fibre species, the domestication process involves systematic characterization of genetic variation within the natural population, development of efficient mass propagation techniques, intensive genetic improvement and testing of wood properties programs and improved silvicultural and utilisation techniques. Domestication is an ongoing process in which genetic and cultivation enhancements are improved progressively and made available to those growing the trees. In small developing countries where resources are limited, choices need to be made about which species to prioritize for domestication and which

elements of the domestication process are likely to return the greatest immediate benefits.

DEVELOPMENT ASSISTANCE TO HELP DRIVE THIS PROCESS IN DEVELOPING NATIONS

Many developing countries lack the resources and capacity to undertake the research and development associated with domesticating native and exotic species for plantation development. Over the years, many donors have provided support to developing countries for forest research, both directly and through multilateral partnerships such as the Center for International Forestry Research and the World Agroforestry Centre. In the case of Australia, for the past thirty years most of this has been provided through the Australian Centre for International Agricultural Research (ACIAR). ACIAR's mission is to enhance the productivity and sustainability of agricultural systems, for mutual benefit, through international research partnerships.

ACIAR works with developing countries to identify opportunities that have a clear research question. It then supports collaborative research programs linking research institutions in Australia and overseas to address these issues, strengthen local capacity and promote adoption of the research outcomes. Over the years, a considerable portion of ACIAR's forestry research projects have focussed on domestication of native and exotic tree species to enhance livelihoods and improve environmental and economic development outcomes in the partner countries. ACIAR's long-term investments enable sustained research and can enable insights not accessible in short-term research projects (e.g., Griffin 1988, Gregorio et al. 2012).

In the right circumstances, donor investment in tree domestication research can provide very high returns. An impact assessment (Fisher and Gordon 2007) found that investments by ACIAR in *Eucalyptus* and *Acacia* domestication research activities over a 13 year period in Vietnam provided a high return on investment (estimated at 32%), despite the long lag time before the benefits were realised. The research into tree domestication and improved plantation management in Vietnam has resulted in almost one million hectares of plantations based on Australian germplasm and thousands of farmers planting improved genetic material.

Vanuatu: an interesting case study

Vanuatu, a small Pacific Island nation with about 80 islands and 220,000 people, makes an interesting case study on the benefits from tree domestication research. Forests and trees are of great importance to the livelihoods of communities in many Pacific countries and subsistence farmers have planted trees in a variety of agroforestry systems for hundreds of years. In Vanuatu, all forests are owned by custom landowners.

In the 1990s and early 2000s, an average of 35,000 m³ of sawlogs from native forests was harvested and processed in sawmills in Vanuatu each year. One of the most important

species was a native tree known locally as whitewood (*Endospermum medulosum*) and local processors developed markets for value added products in Japan (Viranamangga et al. 2012). The Department of Forests raised whitewood seedlings and encouraged landowners to replant after logging, but very little reforestation occurred. One enterprising saw-miller established 270 hectares of whitewood plantations and commenced harvesting in 2011 when the trees were 17 years old. Insights from this experience guide current research (Viranamangga et al. 2012). The Vanuatu National Forest Policy sets a goal of establishing 20,000 hectares of commercial plantations and while there is some community interest in growing whitewood the current area of planted whitewood is only about 350 hectares.

Despite this history of using trees little research has been done on the domestication of important native timber species. Two of ACIAR's forestry projects in Vanuatu, with a combined investment of A\$1.2 million over five years, are researching the growth and management of whitewood and the improved availability of whitewood germplasm. Whitewood is a fast growing hardwood species in the natural forest that is well suited to plantation and agroforestry situations and is able to survive cyclones without major damage. Improved knowledge of whitewood silviculture should enhance the benefits to both the landowners who grow the trees and the processing industries that will utilise them.

This special issue deals with a diverse series of insights derived from these ACIAR projects in Vanuatu, covering the constraints (Aru et al. 2012), establishment (Grant et al. 2012b, Smith et al. 2012), silviculture (Glencross et al. 2012, Grant et al. 2012a), genetics (Doran et al. 2012, Settle et al. 2012) and marketing opportunities (Viranamangga et al. 2012).

CONCLUSION

Many small developing countries including island nations such as Vanuatu have the potential to have a viable domestic forest industry based on planted wood. But in order to achieve this, there needs to be a structured approach to the domestication of suitable species. A modest investment in forest research programs can provide the necessary information and suitable germplasm to implement a planted forest program. In order to achieve such a domestication program, countries like Vanuatu need assistance from donor countries. The papers in this special issue demonstrate the benefits from collaborative research on tree domestication.

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