Research Note: Key project findings

This research note presents key findings of the ACIAR-funded CocoVeneer project FST/2009/062: *Development of advanced veneer and other product from coconut wood to enhance livelihoods in South Pacific communities.*

Large areas of mature coconut palms across the Pacific region are now considered senile and unproductive when compared to younger palms and newer varieties. To help generate an economic driver for replacing senile stems, ACIAR has funded two recent research projects. The Cocowood Project (2007-10) analysed the properties of coconut wood and processing technologies, identifying appropriate solid wood processing protocols and developing a range of products. The current CocoVeneer project (2012-16) aims to develop means to sustainably convert senile coconut stems into veneer and veneer-based products, and to produce complementary agricultural products for export or use in Pacific Island economies, particularly Fiji, Samoa and the Solomon Islands. The project supports economic development in these and other Pacific countries. More information about these projects is available at www.cocowood.net.

Introduction

This research note presents key findings of the ACIAR-funded CocoVeneer project FST/2009/062. The project team includes researchers and collaborators from the University of Tasmania, the Queensland Department of Agriculture and Fisheries (DAF), Pacific Community (SPC), the Fiji Ministry of Fisheries & Forests; the Ministry of Natural Resources and Environment, Samoa; the Solomon Islands' Ministry of Forestry and Research, and industry in Australia and Pacific Islands. Shown in Figure 1, the project's objectives include:

1. Identify the most promising product options for the veneer from coconut stem.
2. Provide viable protocols for effective and sustainable log supply.
3. Establish experimental veneer-peeling capacity in the South Pacific.
4. Determine the optimum processing parameters and protocols for peeling coconut stems and the properties of the recovered veneer.
5. Assemble a product suite and establish its characteristics.
6. Develop uses for the cortex and soft, central cores remaining after logging and peeling.

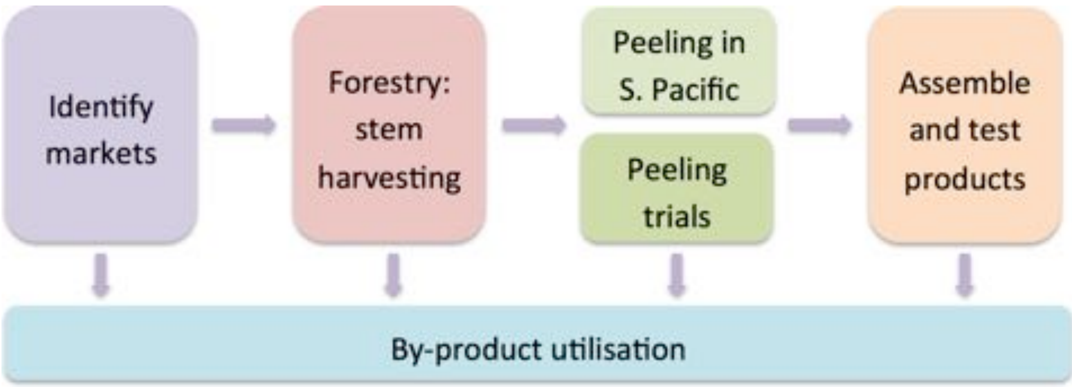

Figure 1: Relationship of project objectives

The issue with senile coconuts

Coconut plantations are a valuable economic and social resource for many communities and private estates in South Pacific Islands. However, many plantations are senile, have lost much of their vitality and productivity, and act as a major constraint on improved agricultural production. Yet, they present a significant opportunity for a sustainable increase in coconut wood production. In the three South Pacific countries in the project: Fiji, Samoa and the Solomon Islands, over 65,000 hectares of coconuts are believed to be senile. This is over 6.3 million senile stems. See Figure 2. With regular harvest, these stems represent a resource of over 64,000 m^3 of saw or peeler log per year for 50 years in Fiji alone, plus large amounts of coconut wood residues. If the harvested stems are replaced with productive palms, current net coconut productivity can more than double over time.

Figure 2: Senile coconut stand in Fiji

Figure 3: Harvesting coconut stems for trials in Fiji

The character of coconut wood

While senile coconut stems are potentially a valuable resource for wood production, their use for 'wood' products is unconventional due to the palm's properties. The coconut palm (*Cocos nucifera*) is not a true wood. As a monocot (grass) the vascular structure of the stem is largely different to that found in traditional timber products. The coconut stem has a high density zone towards the stem periphery while the inner zone is much lower in density due to a significant reduction in vascular bundles and an increase in parenchyma, a spongy, low-density tissue foam-like in texture. See Figure 4. With this soft inner core and large radial variation of properties, traditional sawn board production presents significant efficiency challenges. Peeling coconut stems for veneer and veneer-based products presented a potentially more efficient method of processing and using the stems. However, prior to this project, high density senile coconut stems could not be peeled into usable veneer and the properties of the recovered veneer and their variability were unknown.

Project outcomes

Senile coconut logs can be peeled.

High-density senile coconut logs with suitable preconditioning can be reliably peeled on spindle-less lathes operating with appropriate machine settings. The veneer produced differs from the material recovered from traditional wood species. Its minimum production thickness is 2 mm and its surface has a natural roughness that requires careful gluing and moderate sanding of the final product. With further commercial development, high quality veneer could be reliably produced in commercial production facilities and dried and handled using standard industry equipment.

Recovered veneer can be used for products

The veneer produced can be used for a range of architectural and structural products. Optimum veneer utility and value is likely to be achieved by batching the veneer by colour and density, and grading it in line with a standard adapted to suit coconut veneer's particular properties and market characteristics. To assist industry with this, a draft grading standing has been proposed. The veneer produced can be reliably glued onto a substrate, or made into plywood, LVL or similar veneer-based products. The most profitable markets for these products are likely to be in architectural surfaces, linings and joinery. However, uses may be found for all recovered material by combining coconut veneer with wood veneers in composite structural products.

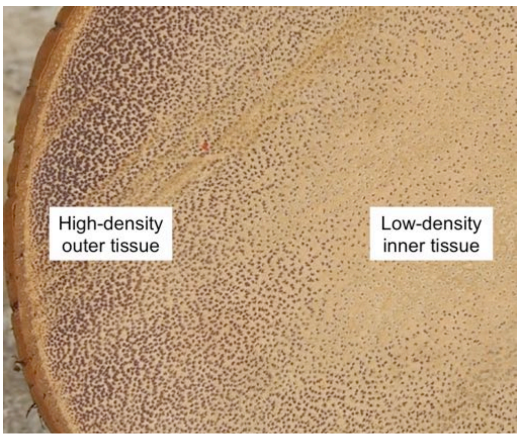

Figure 4: Mature coconut stem showing variation in vascular bundle density

Figure 5: Harvested coconut stems being peeled using a spindle-less lathe

Figure 6: Peeled coconut veneer displays significant colour diversity from dark to light/pale brown

Figure 7: Coconut laminated veneer lumber (LVL) being tested for stiffness and strength.

The coconut veneer value chain is is likely to be financially attractive.

Economic modelling of the coconut veneer value chain indicates that it is likely to be financially attractive for existing veneer industry producers and potentially additional small-scale processing facilities to develop a viable coconut veneer industry. The modelling also indicates that larger scale processing options may be viable as the industry develops and grows.

Uses for harvest and processing residues were developed.

While producing saw and peeler logs, coconut stem harvesting will produce large quantities of residue on the harvest sites and concentrated volumes at processing facilities. Given this, a robust by-products suite is needed. Coconut biochar was produced from residue chips but agricultural field trials were inconclusive. However, the use of coconut palm residues for fuel, particularly for industrial use and electricity generation bodes well, provided demand can be developed and transportation costs are acceptable. Further, the composting of harvest residues for soil amendments appears to be a cost effective means of utilising coconut palm harvesting residues. Little additional investment is required to generate a product that could be directly beneficial to local communities through increasing local agricultural productivity.

Log supply from communities needs support.

Fragmented community ownership of many coconut estates presents a risk to regular and adequate log supply and this may prove to be a significant impediment to establishing a coconut veneer value chain. Support processes need to be developed that encourage communities to critically assess and then renew their coconut estates in an orderly manner, and, by doing so, provide a reliable log supply to a growing coconut veneer-based industry. Extension tools providing guidance on community planning, and sustainable log harvest were developed to help address this risk. They included a a Guide to Community Development of Estate Coconut Renewal Plans and Guidelines for Harvesting Coconut Palms.

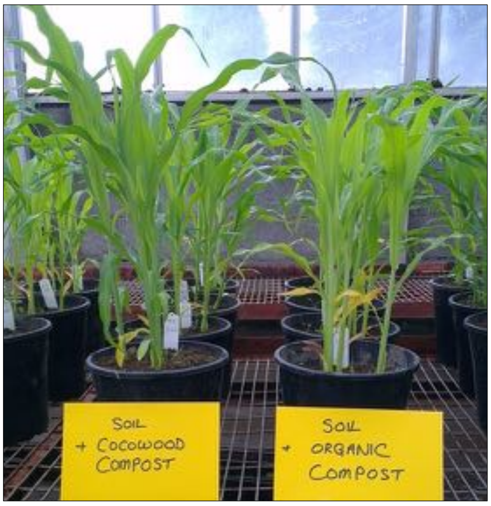

Figure 8: Sweet corn growth in coconut compost incorporated with soil, compared to a commercially available compost.

Figure 9: Coconut compost incorporated with soil, compared to soil and compost with vermiculite in pea growth trials.

Figure 10: Cocoveneer lather in Fiji

Figure 11: Adjusting the lathe blade at Suva, Fiji

Research capacity was developed.

In addition to these technical and extension outcomes, the project sought to establish independent research capacity in veneer-based wood production. A rotary veneer processing equipment suite was established at the TUD facility in Suva, Fiji, and key staff were trained in its operation. This facility can be the base for future work on coconut and other small diameter wood resources in the region.

Further information

Technical reports detailing the methodologies and outcomes of each research area were produced and are available with other support outputs at www.cocowood.net.

Figure 12: Inspecting peeled coconut veneer

Figure 13: Inspecting peeled coconut veneer

Contact for further information

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The project team includes researchers and collaborators from the University of Tasmania, the Queensland Department of Agriculture and Fisheries (DAF), the Secretariat of the Pacific Community (SPC), the Fiji Ministry of Fisheries & Forests; Forest Research and Development Section; Forestry Division, Ministry of Natural Resources and Environment, Samoa; Ministry of Forestry and Research, the Solomon Islands, and industry in Australia and Pacific Islands. The project supports economic development in Fiji, Samoa and the Solomon Islands and includes activity in market and value-chain assessment, log harvesting, veneer production and product manufacture, and the development of viable uses for coconut residues at the harvest site or the production facility. More information about the project is available at www.cocowood.net.

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