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Knowledge a key ingredient for PNG food security

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Papua New Guinea (PNG) is a land of diversity, home to hundreds of ethnic groups who between them speak 848 different languages. Its geography ranges from extensive coral reefs, to dense lowland rainforest, to snow-capped peaks more than 4 kilometres above sea level. It is one of the world's least explored countries, and also home to some of the world's poorest communities.

Credit: Tom Greenwood

PNG's development challenges are similarly diverse. Climate change threatens to further spread disease such as malaria; sea level rise threatens low-lying coast and islands; the exploitation of timber, minerals and other natural resources is having negative social, economic and cultural effects; and a growing, mobile population is putting a strain on resources and leading to the emergence of poverty-stricken urban ghettos.

CSIRO's Dr James Butler is one of a number of Australian scientists advising PNG's government and its people on how to best meet these challenges, and prepare the nation for a more prosperous and sustainable future.

'The worry overall is that Papua New Guinea is not progressing in terms of human development indicators as fast as other Pacific nations,' says Dr Butler.

'This is a big concern because it means somehow or other we're getting it wrong.'

PNG's economy is highly dependent on aid, especially from Australia, so there is an incentive for us to help the nation be become more self-sustaining Its geographic proximity to Australia means that issues affecting PNG may ultimately affect Australia.

Population growth and internal migration are putting pressure on resources in many parts of the country. Additionally, in some regions, large areas of biodiverse forest are being decimated for timber or agriculture. In other areas, 'resource

booms' of mining and gas extraction are attracting international investors; this draws in large numbers of workers from other regions, causing overcrowding and conflict with locals.

Restoring traditional practices may not only help Papua New Guineans to meet these challenges, but could also empower local communities – particularly women – and preserve cultural heritage. Women grow more than 85 per cent of the nation's food.

Credit: Tom Greenwood

Through a collaborative research and training project – supported by Australian Government funding and coordinated by trainers from Charles Darwin University working with PNG's National Agricultural Research Institute and the PNG Women in Agriculture for Development Foundation – women are being encouraged to improve their methods of cultivating native, leafy greens.

Many traditional vegetables, such as *aibika* ('slippery cabbage' or *Abelmoschus manihot*), have been found to be higher in protein and essential nutrients than introduced vegetables.

The women are also being shown how to identify and develop new markets and promote wider consumption of these native plants.

Charles Darwin University lecturer in horticulture, Tania Paul, says earlier research had found that local women were using money from selling the leafy greens to buy more expensive, less nutritious vegetables such as carrots and cabbage.

'Women are trying to do the best things by their family but they're not really understanding what they have, so we wanted to shift their thinking to show that what they grow is good for their family,' says Ms Paul.

Credit: Forest and Kim Starr under CC BY 2.0

Many women harvest traditional vegetables from the wild, but land pressures mean these sources are dwindling. The women face further challenges in getting their product to market because of competition and lack of transportation, so they invariably accept lower prices for their goods.

'We are trying to improve the propagation methods and seed quality so they can propagate them themselves: there could be better and better varieties. Some varieties are more palatable and preferred in the markets,' Ms Paul says.

Ms Paul's research team is also looking at how the women can pre-prepare the vegetables to make them more attractive to urban supermarkets and consumers, and even provide recipes to help people learn how to cook the vegetables.

'There is a push to focus on women in agriculture because they are highly represented in the low end of the agricultural sector,' adds Ms Paul 'They're doing all the work and growing, but not getting much benefit.'

Coffee is another crop that offers great potential for local communities, but has been grown in such a way that prevents growers from maximising returns.

CSIRO plant nutritionist and soil scientist, Dr Michael Webb, has been researching coffee growing in PNG, but his particular interest is the nutrient cycles of coffee gardens, and how these might be improved. Unlike oil palm, which is generally grown in plantations, coffee is often grown in close proximity to, or within, village food gardens.

The coffee 'cherry' includes a thick, fleshy skin around the bean that is quite high in nutrients, but must be removed before the coffee bean can be processed.

'Sometimes it's just left where it's pulped and not used, or it might end up in a stream, or other farmers will use it on their vegetables, while other farms will put it back on the coffee,' says Dr Webb.

With funding from the Australian Centre for International Agricultural Research (ACIAR), researchers from Curtin University, the PNG Coffee Industry Corporation and the PNG National Agriculture Research Institute are hoping to find out more about this valuable potential fertiliser so they can help locals improve crop yields.

'They've been growing coffee for about 50 years, but it's not like the food-garden systems they've been growing for 7000-10,000 years,' Dr Webb says.

'I don't think [the coffee-cherry pulp's potential is] completely understood by everyone. So we try and look at what its value is in terms of fertiliser equivalence, and try to [engender] a better understanding that this is a valuable part of your management of this coffee garden system, so that it's not wasted.'

Dr Butler says the first law of development is that projects must be owned by local people, or they will fail. 'It's about linking capacity-building of local people, in other words, giving them the ability to make their own decisions and make their own way, with technological and social innovations that help them do that –like payments for ecosystems services

that encourage coral reef conservation; like birth control; like internet access that can enable people to work from their islands.'

CSIRO tropical ecologist, Dr Dan Metcalfe, has been working on a collaborative project – involving Charles Darwin University, WWF-Australia, the Fly River Provincial Government, and the Northern Australian Indigenous Land and Sea Management Association (NAILSMA) – that is helping communities in the Fly River delta to identify more sustainable livelihood options.

'Currently the main financial opportunities are clear-fell logging or mining, neither of which are sustainable for local communities in the medium to long term,' says Dr Metcalfe, principal research scientist at CSIRO Land and Water.

'They destroy a lot of the cultural understandings in communities by fragmenting them, a lot of the men go away to work, it changes village dynamics, and if the environment isn't managed carefully, you can get really significant impacts downstream, such as poor water quality, sediment deposition, changes to flooding regimes and impacts to fisheries.'

When Dr Metcalfe and colleagues investigated the plant biodiversity of the region's rainforest and savannah systems, they discovered that the forests contained some extremely valuable timber species; the sort that might fetch upwards of $1000 per stem.

'The overseas logging companies who were operating in that area were tending to come in and pay trivial amounts per hectare, so they're basically ripping off the communities who don't understand the market value of what they're standing on,' says Dr Metcalfe.

Credit: Tom Greenwood

The researchers proposed an alternative business model – to work with the locals to develop well-managed, sustainable logging as an alternative to clear-felling, removing selected trees while retaining the structural and biological diversity in the vegetation.

'Instead of the chopping the trees down and then growing yams on it for a few years, it is understanding that selective replanting or encouraging of particular trees to grow back into those systems would potentially give a sustainable income stream in the medium to long term, which you can't do if you just allow it to turn into scrub.'

This has the added benefit of preserving the extraordinary biodiversity that represents the local people's storeroom, larder, and medicine chest.

'These are people are economically poor but resource-rich, and the so-called development options that are being offered by the west at the moment in terms of mining and logging increase their economic prosperity but reduce their resource riches,' says Dr Metcalfe.

'Those economic benefits are short-lived, but losing those biodiversity resources, medicines, cultural significance and so on – once it's gone, it's gone forever.

Population control the urgent priority for PNG islands

Population growth rather than climate change is the more pressing concern for people living in PNG's Milne Bay Province at the south-east of the country, according to a recent study led by Dr James Butler and published in the international peer-reviewed journal, Marine Policy.

CSIRO's James Butler talks about his work on climate futures and adaptation strategies for the people of Kimbe Bay, West New Britain Province, PNG.

Credit: CSIRO

Almost 95 per cent of Milne Bay Province is ocean. As for most of PNG, communities largely depend on their immediate surrounds for everything from fresh water and food (from fishing, village gardens or wild harvest), to traditional medicines and materials. These so-called 'ecosystem goods and services' not only sustain human life, but also offer opportunities to trade for other kinds of goods, or for cash.

Through a series of workshops held throughout the province, the research team provided information to local stakeholders about projected impacts of climate change – for example, inundation of low-lying islands and coastal lands, ocean acidification that will damage coral reefs and reef fisheries, and loss of food crops due to drought.

Participants agreed the worst impacts of climate change may not start to be widely felt throughout the region until mid-century. The consensus was that the more imminent threat is population growth – which is already putting pressure on food crops, fisheries and the environment in general.

Once they'd prioritised the threats, workshop participants identified the best strategies for meeting future challenges – starting with population control, and including improved garden and farm productivity, and education on more sustainable fisheries management.

These strategies will also equip the population to adapt to more severe climate change impacts in future. The researchers believe there is a 20–30 year 'adaptation window' for PNG to address population growth in the region, 'which otherwise will continue to erode the capacity of communities and ecosystems to cope with potentially extreme climate impacts after mid-century'.

For Dr Butler, the study proved the value of combining local stakeholders' knowledge with science to plan for the future and protect PNG's rich marine biodiversity

This participatory approach has since been refined as part of the Australian Government's contribution to the Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security .

In Kimbe Bay, West New Britain Province, CSIRO has developed and evaluated a social learning process that encourages multiple stakeholders to make better decisions about planning future livelihoods.

'We acknowledge that to solve the problems of the communities and to make them more adaptable for the future, it's not just science that matters – local knowledge and regional understanding of issues is equally important,' says Dr Butler.

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