

Papua New Guinea and the Pacific

Financial year	Regional expenditure	Percentage of total bilateral expenditure	Board target as percentage of expenditure
2004–05	\$6,332,358	22.5	>20%
2003–04	\$5,067,418	19.8	10–20%
2002–03	\$4,754,635	17.9	10–20%

ACIAR's programs cover five regions. Papua New Guinea and the Pacific Islands are grouped as one region. Outlays for the region have been rising in recent years to meet the priorities placed on the region by the Australian aid program. For the region, the Board and Minister have set an expenditure target of more than 20 per cent of our overall, annual bilateral research expenditure.

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Papua New Guinea

Active projects in 2004–05	38
AOP budgeted expenditure in 2004–05	\$3,330,000
Actual bilateral country expenditure in 2004–05	\$4,226,822
Bilateral country expenditure in 2003–04	\$3,346,297
Bilateral country expenditure in 2002–03	\$3,171,113

Ms Margaret Newman, ACIAR Country Manager, PNG and Solomon Islands



Key performance indicators	Performance 2004–05
<ul style="list-style-type: none"> Growth in program budget for PNG compared with 2003–04 	2004-05 budget at \$4.2 m, compared to 2003-04 budget of \$3.35 m
<ul style="list-style-type: none"> Increased emphasis on projects with effective technology transfer components, including commencement of at least two new projects involving NGOs 	One forestry project involves local NGO, OISCA; a second includes the Foundation for People and Community Development
<ul style="list-style-type: none"> Graduation of at least two more PNG John Allwright Fellows 	Two further PNG students graduated in 2004–05 through John Allwright Fellowships.
<ul style="list-style-type: none"> Development of a strategy for collaboration with NAQIA on quarantine aspects of fruit flies 	Strategy agreed with new collaborative project involving several PNG agencies under design, and proposed collaboration with NAQIA on: quarantine and surveillance training; and development of quarantine identification packages for fruit fly.
<ul style="list-style-type: none"> Inclusion of improved growth and yield modeling tools into national forest planning processes 	The draft PNG <i>National Reforestation Policy</i> includes development of a five-year national forest management programme to improve stocking. The <i>National Eco-forestry Policy</i> identifies lack of yield information as planning constraint.
<ul style="list-style-type: none"> Expansion of new and more effective payment system for smallholder oil palm producers 	A payment trial at Hoskins saw productivity increase by 90 per cent on blocks involved. Participants reported: utilisation of under-employed labour; greater financial security and more equal income distribution.
<ul style="list-style-type: none"> Pilot testing of new vegetable supply chains from the highlands to major lowland urban population centres 	PNG Fresh Produce Development Company conducted four airfreight marketing trials involving fresh produce from Eastern Highlands Province.
<ul style="list-style-type: none"> Documentation of the current and potential role of peanut production in smallholder farming systems 	The National Agricultural Research Institute conducted and published peanut farmers' survey covering four provinces, generating information on production, storage, utilisation, marketing systems and aflatoxin contamination.

Position

Papua New Guinea (PNG) is an important partner country for ACIAR, reflecting the long-term relationship between Australia and PNG. Australia's commitment to seeing PNG develop and prosper makes our nearest neighbour Australia's largest development partner, with a development cooperation program of more than \$300 million. The size and priority given by ACIAR to its program with PNG reflects this, with funding having increased significantly in recent years. Since 1998 ACIAR and AusAID have worked together to develop and fund a small set of projects of mutual interest. To enhance the adoption of research results, ACIAR involves the private sector and NGOs in applicable projects.





PAPUA NEW GUINEA

The Road Ahead

Australian Government
Department of Foreign Affairs and Trade
Economic Analytical Unit

ACIAR's program aims to address some of the formidable challenges in PNG's agricultural development. The country is a net food importer with high population growth. Village-based agriculture supports between 70 and 80 per cent of the population with domestic trading of fresh produce a very important source of cash incomes. ACIAR's strategy in PNG is to support applied technical and economic research to enhance smallholders' income. Root, plantation and horticulture crops, fish and forestry are focal points for research. Subjects include both export crops and domestically traded crops to generate smallholder income, and to support food security. Ensuring the continued sustainability of renewable resources, such as fisheries and forests, along with crop and livestock biosecurity are essential components of research. The PNG program also has a strong emphasis on capacity-building, both within projects and through postgraduate training for selected scientists involved in ACIAR projects.

Achievements

Studies **to improve marketing systems** have shown how to better utilise the potential of growing vegetables year-round in the unique PNG highlands environment to supply domestic markets (see box). Trial shipments are under way to assess both the strengths and weaknesses of the market chain and the level of success in meeting consumers' expectations. The productivity of the cocoa, coconut and oil palm industries has increased by boosting the participation of youth and women. Past ACIAR research helped to increase women's participation in the oil palm industry in West New Britain Province, helped by the refinement of ownership and labour payment arrangements. Women received payment for collecting fallen palm fruit through a card scheme. Now this scheme is being extended to families, using a similar card. The new project is evaluating this success to determine key lessons, revealing that **productivity increased by an average of 38 per cent** across 90 per cent of the smallholder plantation blocks participating. The findings will guide efforts to launch pilot schemes beyond the original oil palm sector, particularly for coffee and cocoa.

The forestry sector is another where research is developing new markets by utilising indigenous resources. **PNG's forests have several species that are the source of valuable products**, but the country has limited capacity to exploit these sustainably, both in the smallholder and research sectors. One project is utilising essential oils found in some tree species. Villagers have long produced these oils for medicinal purposes by crushing leaves. The project has determined methods for bulk production and commercial sale, with several villages now selling to commercial markets. The additional returns have helped to build a school and improve community health through greater access to medicine and better hygiene.

Two other forestry projects are building up the capacity of the PNG Forest Research Institute—a part of the National Forest Service. One is developing planning techniques and improving databases built on information collected during project activities. The other is building capacity in the domestication of indigenous tree species. Researchers are **mapping the natural distribution of several species** and undertaking seed collection.



Brian Gunn

Tree climbers at the National Tree Seed Centre in Bulolo apply their tree climbing skills to collect seed off klinki pine.

Improving the supply of fresh produce

Jonah Waipek, like many farmers in the South Waghi Vegetable Producers Association, is yet to reap reward from the unique potential of Papua New Guinea's highlands. Soils in the highlands are rich enough to grow vegetables year-round. In a country where food security relies on imports, tapping this potential could increase food availability and provide incomes to smallholder farmers.

The main problem facing Jonah and his colleagues is not meeting demand, but finding markets for their produce. Much of what they grow—cabbage, taro, cassava, pumpkin, sweet potato, broccoli and tomato—is simply not sold. It is only on Fridays that the Association has a regular buyer. Each week the Kubutu Mine picks up a quantity of vegetables. These are picked the previous day, but often vegetables close to being ripe are included, rather than going to waste.

ACIAR has commissioned the University of Canberra to help determine how the Association, and other groups like it, can tap into existing markets. Project leader Professor John Spriggs has discussed the factors that prevent potential buyers, such as supermarkets, from working with highland producers. The main issue raised was reliability of supply.

For Jonah and the Association's other producers the real issues are infrastructure problems, both at the village level and beyond. The lack of a cool room facility makes preserving produce very difficult, and

poor communications and transport routes prohibit the growers from contacting buyers and delivering to them.

This information, together with input from extension workers, is being collated to develop a map of the marketing chains in the highlands. The result is a concept paper, designed to help key stakeholders throughout the system understand the possibilities for their industry. Already the Government and other groups with a role to play in developing markets have adopted the vision.

Work has now shifted to implementing the paper's key strategies. Jonah and his fellow farmers can look forward to tapping into markets on a more regular basis.



Geoff Allan

Smallholders sell their wares at the Yonki market, in the Eastern Highlands of PNG

Field trials to assess performance are under way, along with conservation strategies for two key species. They have also propagated some key species.

Fisheries resources are another potentially lucrative income generator. One project links in with research to increase available dietary protein and establish smallholder enterprises through **building capacity in inland pond aquaculture**. Surveys of between 300 and 400 farms, institutions and markets involved in the industry across seven provinces are in progress to develop a picture of the industry.

Sustainable management of PNG's waters is vital to their long-term health and ability to generate income for the national economy. **Two inter-related projects are focusing on the Gulf of Papua prawn fishery**. A model of this fishery integrating biological and economic data is in the latter stages of development. The related project is gathering biological data to assess the level of prawn stocks in the Gulf. The initial survey is gathering data on the characteristics of the fishery, size of catches and frequency at which vessels operate.



Geoff Allum

Tilapia cages in Yonki Dam; fish provide a valuable source of income as well as dietary protein

Two projects addressing **livestock management** are in progress. The first is examining how to reduce feed costs for broiler chickens. The industry, worth around A\$50 million a year, could increase profitability, especially amongst smallholder participants, if **local feed resources could be utilised to replace imported grains**. Cassava, sweet potato and palm kernel meal have all proven suitable to meet feed requirements of chickens. The research team has also collected data for current farm settings and feed costs. The second project, also active in Indonesia and the Philippines, has developed diagnostic and control methodologies for the disease Surra. In PNG the blood sample collection protocols developed are now in use by National Agriculture and Quarantine Inspection Service staff.

Agricultural research scientists need good skills to write their results for publication to ensure dissemination of research outcomes. A project to develop graduate courses in scientific communication has helped to enhance these essential scientific skills. A complete graduate course is now available at the University of Technology, Lae. More than **200 scientists are now enrolled and 70 have graduated**. Another five universities are helping to develop the course of four units. An extension of the project will support this process.

Support for the cocoa industry is being provided in several projects. The first, completed during the year, **evaluated new approaches to drying cocoa**. Mini-box dryers and solar dryers, alternatives to kilns that cause smoke damage to cocoa, were tested and the most effective used as benchmarks in drafting revisions to PNG's cocoa regulations and related legislation. Improved cocoa varieties are now being released after quality assessment. Staff members of the PNG Cocoa and Coconut Institute have received training to help bring identified improvements to smallholders. Training manuals written for the differing needs and approaches of men and women in applying the technology are now in use by extension agencies. A recently-commenced project is working to address another research need—**improved cocoa disease control by smallholder producers**.

Improved postharvest management of another important commodity—sago—has built on project outcomes to date by **identifying conditions most likely to lead to contamination** during storage. Moist conditions in bulk storage containers can allow fermentation (caused by microbes) resulting in contamination. Researchers are now trying to identify microbes and microbial metabolites involved in fermentation and determine optimum storage periods to limit contamination.

Protecting crops from pre-harvest threats is paramount. In 2003 **an outbreak of potato late blight**, caused by *Phytophthora infestans*, significantly reduced yields. A new project is investigating this outbreak in an effort to develop effective control.

A project active in PNG, Indonesia and Australia has mapped sugarcane

pests and diseases. Research has now extended to survey key areas to build up a comprehensive picture of pest and disease distribution. The causal agent of one disease, Ramu stunt, is being investigated and **screening for resistance** against a second disease, smut, is progressing. Results have been passed to quarantine staff in all three countries. Two pests of horticultural crops—*Oribius weevil* and the red-banded mango caterpillar—are under study. The damage caused by the weevil has been determined with **treatments to exclude adult weevils from some plants resulting in price premiums** of up to 200 per cent—despite these treatments only reducing adult populations (and their damage) by half. Citrus plants fared even better—previously unprotected plants that produced no fruit started to yield again. Host plants for *Oribius* species were identified and the role of roots as food for larvae determined. Seven *Oribius* species were identified as pests in PNG. Data on the **incidence of red-banded mango caterpillar** as a pest have been collected during the past fruit season. This revealed average losses attributed to the caterpillar of around 55 per cent, also that mango cultivars are susceptible. Work continues to learn more about its lifecycle and control using pheromones and chemicals.

The use of biocontrol agents against the invasive weed *Chromolaena odorata* continues to gain momentum in PNG. Dissemination of the gall fly as a biocontrol has produced a two-fold benefit. The **fly has now been released in 11 provinces** at 70 separate sites. Populations are now established at 63 sites and in many cases have spread to infested areas within a 40 kilometre range. Increased public awareness of the weed and the need to report locations where it has taken hold has assisted its continued management and guided the release of the gall fly.

A suite of four projects aims to introduce improved varieties and better management strategies for **staple foods and income-generating crops**. Sweet potato provides around 30 per cent of total food calories in PNG. New varieties with some resistance to drought and increased yields have become available and are now being tested for their suitability prior to multiplying the best varieties for broader distribution. A similar project aimed at introducing improved peanut cultivars has introduced and tested high-quality lines from the ICRISAT collection that yield between 50 and 100 per cent above currently used varieties.

The link between magnesium (Mg) in volcanic soils and oil palm growth is being investigated, and **links established between low soil Mg levels and low tissue Mg** in adult trees. Tests to alleviate the deficiency are under way.

The use of clonal propagation of coconut to introduce improved disease-free germplasm has moved a step closer through a new protocol for raising seedlings. Scientists have successfully tested the viability of using transplants of germinated zygotic embryos (from fertilised cells). **Methods to improve the establishment and growth** of such embryos have also been developed.



Neil Hollywood

A combination solar kiln dryer developed for cocoa in PNG



R.Desmier de Chenon

A gall fly to control the spread of *Chromolaena* has been released widely in PNG



Coconut palms in Fiji

Pacific Island countries

Active projects in 2004–05	25
AOP budgeted expenditure in 2004–05	\$2,090,000
Actual bilateral country expenditure in 2004–05	\$2,105,536
Bilateral country expenditure in 2003–04	\$1,721,121
Bilateral country expenditure in 2002–03	\$1,583,522

Key performance indicators	Performance 2004–05
<ul style="list-style-type: none"> • New projects address emerging priorities agreed at formal priorities consultation held in December 2003 	Seven new projects commenced in 2004–05 and two scoping studies were undertaken, each of which address agreed priorities.
<ul style="list-style-type: none"> • Growth in budget for Pacific Islands compared with 2000–2003 levels 	Increase in Pacific budget in 2004–05 (\$2.1 m) compared with 2003–04 (\$ 1.72 m).
<ul style="list-style-type: none"> • Mini-project concept in fisheries research trialled and expanded 	Mini projects concept proven with three mini-projects complete, two in progress and three at late pipeline stage.
<ul style="list-style-type: none"> • Initiation of three new project/contract activities in Solomon Islands 	Three projects designed and implemented in Solomon Islands: sustainability and profitability of village sea cucumber fisheries, feeding village poultry; and improvement of plant protection.
<ul style="list-style-type: none"> • Initial sea cucumber mass release trials completed and hatchery technology transferred to several countries 	Final mass release trials in progress with hatchery technology transferred to Australia and discussions progressing for PNG.
<ul style="list-style-type: none"> • Two short-course training activities held to address identified needs 	Training workshops in fish nutrition and on taro pest identification held in Fiji.

Position

ACIAR's program with the Pacific Islands has expanded significantly in recent years. Addressing some of the major agricultural factors constraining socio-economic development will help to build a stable and economically viable Pacific region. Subsistence agriculture predominates in Pacific Island countries. Resources are limited—exports of commodities such as sugar, fruits and vegetables, spices, forestry products, and fish and marine resources are major income sources. Licensing of foreign fishing fleets to allow access to exclusive economic zones also provides revenue.

ACIAR's strategy in the Pacific addresses the significant challenges of developing markets for these products and enhancing smallholder income. Research focal points include the implications of World Trade Organization (WTO) accession, quarantine and bio-security issues and product quality, along with scales of production and the remoteness of export markets. Projects emphasise technologies appropriate to smallholders, the institutional uptake and dissemination of such technologies and the adoption of a mix of value-adding, cash-generating and marketing outcomes that also enhance sustainability. Many projects yield results that are applicable to, and disseminated across a number of countries.



Warwick Nash

The release of juvenile sea cucumbers produced in hatcheries is seen as the quickest way to rebuild stocks.

Achievements

Fishing and marine resources are vital to economies of many Pacific Island nations, while providing food and income to smallholders. ACIAR has a number of fisheries projects active in the Pacific. Several are **targeting the sustainable utilisation of species**, through aquaculture and restocking depleted fisheries. Two projects are examining methods of restoring depleted sea cucumber and trochus populations. Methods for growing tropical sea cucumber (initially focusing on sandfish) have been developed, using fine mesh nets for growing-out juveniles in earthen ponds. This has significantly improved survival rates and numbers. Tagging techniques and plastic mesh enclosures are allowing sea pens to be used to improve the management of stocking densities. **Trials releasing up to 9000 juveniles** into such pens, prior to release into ocean fisheries are helping to refine growth methods to restock wild depleted areas.

In Samoa and Vanuatu the key stakeholders in trochus fisheries have worked to consolidate research areas as Marine Protected Areas (MPAs) for trochus. This parallels the work of West Australian Aboriginal groups restocking trochus on reefs near Broome. Three **sites are now established for trochus research** in Vanuatu and three also in Samoa. In Vanuatu the MPAs have aided in stock recovery with juvenile trochus densities increasing by an average of 70 per cent over pre-brood stock release, 12 months after brood stock were released. In Samoa staff at the AusAID-funded aquaculture facility have been trained in technologies for spawning trochus, with juveniles released for the first time.

Sustainable **aquaculture of several species is under way** through mini-research and development projects undertaken as part of a broader ACIAR project also involving the Secretariat for the Pacific Community, the WorldFish Center and Queensland Department of Primary Industries and Fisheries. These mini-projects are targeting specific constraints in aquaculture industries by introducing the results of past ACIAR research. Commercial and farm-made feeds for tilapia and freshwater prawns in PNG and Fiji and testing of the viral status of black tiger prawns in Fiji are two examples. In Solomon Islands community groups are learning how to harvest post-larval coral reef fish and invertebrates for culturing and for sustainable wild capture. Already some villages have adopted the new approaches and are supplying fish and lobster to local exporters. Further extension activities are being planned, using a project-developed basic manual.

Developing black pearl aquaculture in Kiribati continues, following on from last year's successful mini-harvest of cultured pearls. Longlines that hold between 4000 and 5000 oysters have been deployed at three other locations in Kiribati to test the approach. In Tonga spat (juvenile oyster) production has continued **with hatchery production techniques now the responsibility of local staff**. A manual on culturing pearls has been developed and is now being distributed to project partners, including Solomon Islands where earlier research now supports a fledgling industry.



Warwick Nash

A team of four divers spent two weeks installing 12 sea pens, which allow the entry of predators, but limit the migration of sandfish juveniles



Paul Southgate

A selection from the first harvest of cultured pearls from Kiribati.



TKL/Lim

Crops provide the bulk of staple food in Pacific Island countries; stallholders at Suva markets, Fiji

Licence fees paid by foreign fishing vessels to Pacific Island countries for entering exclusive economic zones (EEZ) are an important income source. A project is seeking to **maximise available returns** without threatening the sustainability of fisheries. The access fees are paid for the right to fish migratory tuna stocks. A bioeconomic model has been developed and a series of stock numbers run to assess fishing fleet efforts. This is enabling more accurate assessment of achievable access fees. Information gathered on catch and location is helping to determine the level of catch within and outside the EEZs.

Crops provide the bulk of staple food in the Pacific Island countries. A project operating with support from the Secretariat of the Pacific Community (SPC) aims to develop the unique plant resources of the Pacific by **building technical capacity** and establishing common ground between nations. An associated activity has been the development and publication of a *Directory of Plant Genetic Resources in the Pacific Island Countries and Territories*, which also includes information on germplasm held outside the Pacific.



TKL/Lim

Taro is an important food staple throughout the Pacific

Taro is one such important food staple. Research to improve the capacity of **quarantine services to diagnose taro diseases** is complete and diagnostic tests are available for all known taro viruses. As a result taro germplasm can be virus-indexed before it is transported. Virus surveys have been conducted in Vanuatu, Samoa, American Samoa, Fiji, PNG, Solomon Islands and New Caledonia. Samples from Micronesia and the Cook Islands have also been collected and indexed. The result is a clear picture on virus distribution. PNG and Solomon Islands were found to have the most diverse taro germplasm in the region. These two countries will be the focus for collecting material to incorporate into breeding programs, including the AusAID TaroGen project.

Field trials for a control agent against taro beetle continue. A potential control agent has been identified and **a protocol for culturing the agent established and tested** to ensure its regular production. Trials are now needed to determine the effectiveness of this agent in broader-scale field settings.

Yam is another important crop but high soil fertility and good nutrition is needed for substantial yields. The final series of field trials that examined the impacts of the addition of nitrogen and phosphorus to soils planted with yam are now concluding. **Positive responses in yields have been identified.** In one location zinc deficiency was ameliorated by application of chicken manure. And a new project commenced in Tonga to develop improved management of powdery mildew and viral diseases that have threatened the squash industry, a valuable source of export income.

Research in several Pacific Island Countries and also in PNG is studying how zoonotic diseases affect animals by reducing productivity. These

diseases can also be transferred to humans and are an increasing problem in villages in PNG and the Pacific. The antibody detection test developed last year is now available to PNG authorities for field testing and use. Surveys of affected areas have revealed that in PNG *Leptospira species* can infect humans and significantly contributes to cattle infertility. This is despite vaccination, suggesting that an optimal vaccination strategy is needed to boost its effectiveness. In Fiji the researchers determined the role of village dogs as carriers of zoonotic diseases and they are now establishing strategies to manage outbreaks by vaccinating dogs to break the transmission cycle before humans are infected.

Utilising animal waste safely and effectively has **the potential to reduce water-borne infection** and increase soil nutrient levels. Community groups involved in the project are learning to improve their environment by developing skills in managing waste and determining negative impacts on local waterways. They have also learnt to collect data to feed into the bio-economic model developed by project researchers.

Assessing groundwater resources on Kiribati has led to greater understanding of freshwater use. The depth and dimensions of the freshwater lenses on Tarawa are being determined, particularly to gauge their sustainability during drought. A **drought warning system** based on recent and historic rainfall data and water use is possible. Strategies to reduce pumping of freshwater have been developed, along with the identification of sustainable levels of water pumping during normal weather cycles. These help ensure that the transition zones that separate fresh and salt water are protected. A system to model these water dynamics, AtollScape, has also been developed.

Smallholders need to tap into commodities markets in order to generate incomes. In several projects scientists are exploring avenues for **sustainably exploiting horticulture and forestry resources**. In Samoa (and in Aboriginal communities in far-north Queensland's Cape York Peninsula) researchers are assessing the marketing strengths and opportunities of remote communities. Interviews with key stakeholders are revealing the nature of commodities produced and the means of developing horticulture to meet market needs. This information will help the building of extension services in both countries. A second project is also operating in far north Queensland and in Vanuatu to develop improved management of sandalwood trees—producers of valuable sandalwood oil. **Harvesting the oil** provides a valuable income source, but the resource base is declining. New



Tony Jansen

ACIAR project leader Phil Glatz with a village woman taking food scraps to feed poultry near Buscarate in Malaita Province, Solomon Islands

research is seeking to improve current plantations and develop better management techniques for local industries in both countries.

A project now concluding in PNG and Solomon Islands has studied the potential for domesticating indigenous trees and shrubs to harvest food and other products. The canarium nut is one such resource that can be sustainably exploited for both food and medicinal purposes. Management options for harvesting the nut have been developed and refined. One issue to emerge was the importance of **managing Intellectual Property** through patents to protect the rights of traditional owners. These issues were addressed in a training course held in the Solomon Islands as part of the project.

A project to support the build-up of **forest health surveillance systems** in Fiji, Samoa, Tonga and Vanuatu is now concluding. The main focus has been training to introduce improved methods and techniques, reinforced through practical, on-the-ground survey applications. The project has raised awareness of the need to monitor forests and plantations for pest and disease evidence and outbreaks, leading to the establishment of forest health surveillance units in each country.

Two projects have examined key economic issues relating to agriculture and global trade implications in Fiji. The first has developed an econometric model of the sugar industry to determine **likely impacts of global trade** reforms. Most data have now been entered into the model, allowing the identification of improvements needed at the farm and mill level. Such information is necessary to keep the industry competitive as the global sugar market changes. The second project, also examining implications of trade reform, aims to provide policy makers with sustainable options for land-use development. A number of key policy makers from government and non-government sectors, together with land owners and tenants, participated in a workshop to begin disseminating project findings. Data gathered through both the workshop and surveys will be used to develop the economic model and draw a fuller picture of land-use changes and pressures from trade reform.



Roger Leakey

The canarium nut can be sustainably exploited for both food and medicinal purposes



AusAid

Solomon Islands- cocoa and copra furnace.