Australian Government

Australian Centre for
International Agricultural Research

Adoption of ACIAR project outputs

2015

Adoption of ACIAR project outputs

2015

Editors:

David Pearce
Centre for International Economics

Andrew Alford
ACIAR

ACIAR
Research that works for developing countries and Australia

aciar.gov.au

2015

The Australian Centre for International Agricultural Research (ACIAR) was established in June 1982 by an Act of the Australian Parliament. ACIAR operates as part of Australia's international development cooperation program, with a mission to achieve more productive and sustainable agricultural systems, for the benefit of developing countries and Australia. It commissions collaborative research between Australian and developing-country researchers in areas where Australia has special research competence. It also administers Australia's contribution to the International Agricultural Research Centres.

Where trade names are used, this constitutes neither endorsement of nor discrimination against any product by ACIAR.

ACIAR ADOPTION STUDIES

ACIAR seeks to ensure that the outputs of the research it funds are adopted by farmers, policymakers, quarantine officers and other beneficiaries. As part of its efforts to monitor the outputs and outcomes of its projects, ACIAR commissions project leaders and participants to revisit projects 3–4 years after completion, and report back to ACIAR on the medium-term outcomes of the work. This series reports the results of these studies. Publications in this series are distributed internationally to selected individuals and scientific institutions, and are also available from ACIAR's website at <aciar.gov.au>.

Pearce D. and Alford A. (eds) 2015. Adoption of ACIAR project outputs 2015. ACIAR Adoption Studies Report No. 12. Australian Centre for International Agricultural Research: Canberra. 64 pp.

ACIAR Adoption Studies—ISSN 1832-1887 (print), ISSN 1839-6135 (online)

ISBN 978 1 925133 96 7 (print)
ISBN 978 1 925133 97 4 (PDF)

Editing by Biotext, Canberra
Design by Peter Nolan, Canberra

Cover: [left] Members of Nguni Farmers Cooperative, North West Province with some of their awards for herd performance (Photo: John Thompson); [top right] Small family sawmill sawing Acacia for furniture components near Danang, Vietnam (Photo: Michael Henson); [bottom right] An LGU technician (left) discusses vermicomposting with a farmer in Sugbongcogon, one of the Misamis Oriental satellite sites (Photo: Noel Vock).

Foreword

As part of its ongoing evaluation process, the Australian Centre for International Agricultural Research (ACIAR) periodically revisits a sample of past projects some time after their completion and critically appraises their outcomes. ACIAR commissions an appraisal of large projects 3–4 years after they are completed, to determine the level of uptake of the project outputs and gauge the extent of the projects' legacies. The appraisers study the outputs under three broad categories: the emergence of new technologies or practical approaches to tackle problems; the gaining of new knowledge that would lead to better understanding of scientific and socioeconomic aspects of agriculture; and the introduction of new models and frameworks to assist policymakers in reaching decisions that influence the environment of farmers and others along the market chain.

This report, the 12th in our series of adoption studies, documents the adoption results for seven ACIAR projects completed in 2010–11. They involved six individual partner countries: China (three projects), India, the Philippines, South Africa, Indonesia and Vietnam.

- Two food- and crop-related projects were appraised. The first involved improving wheat quality in Haryana State in India. The scientists sought innovative ways to encourage farmers to adopt practices that target productivity, quality and profitability. Surveys in 2014 showed that farmers now recognise the benefits of improved efficiency; gains include wider adoption of zero tillage, and more judicious application of nitrogen and micronutrients. The second project looked to develop profitable beef business systems for small-scale farmers in South Africa. Practical steps to raise the growth rates of breeds kept in communal herds and their carcass quality mean that their quality can now parallel that of commercial herds.
- There were two plantation forestry projects. The first provided teak growers in Indonesia with practical tools for silvicultural and timber marketing strategies to improve the economic benefits from their teak plantations. This has the potential for positive impacts on growers' livelihoods over the next 5–10 years. The second project aimed to lift the log value of sawn timber from plantation-grown eucalypts in China, Vietnam and Australia. Researchers developed and evaluated a range of destructive and non-destructive methods and tools to assess wood property traits in standing trees and felled logs. It is sobering to note that, whereas adoption of project results has been good in both Guangxi Province in China and the research area in Vietnam, Australian adoption has been poor as a result of restructuring and downsizing at key institutions.

- Two projects concerned with major land-use change in China focused on the long-term sustainability of the Conversion of Cropland to Forest and Grassland Program (CCFGP). The first project determined how to implement the program more efficiently, and the second sought ways to bring this about. The processes introduced have led to a significant break from past practices, which focused on a top-down approach.
- In the Philippines, many projects have tackled the problems of land degradation and poor livelihoods—but with limited success. The landcare approach pioneered in Australia has offered new encouragement. ACIAR work undertaken between 1999 and 2004 showed promise, and a follow-up project ran from 2004 to 2011. The work has led to the evolution of conservation farming systems that are progressively incorporating new crops—including fruit, vegetables and timber—alongside the traditional maize and rice. Further spinoffs are introduction of animal industries and development of new market opportunities.

The authors raise some timely lessons for ACIAR. I draw your attention to the summary in the authors' overview. They underscore the dynamic environment that our project personnel encounter in addressing the multitude of subjects and challenges implicit in our work.

Nick Austin
Chief Executive Officer, ACIAR

Contents

Abbreviations

ACIAR	Australian Centre for International Agricultural Research
ADO	agricultural development officer
ARC	Agricultural Research Council (South Africa)
BLGU	barangay local government unit
BPP	Beef Profit Partnerships
CCFGP	Conversion of Cropland to Forest and Grassland Program
CIFOR	Center for International Forestry Research
CI&I	continuous improvement and innovation
CRC	cooperative research centre
DAFF	Australian Government Department of Agriculture, Fisheries and Forestry
FDT	farmer demonstration trial
FEDRC	Forestry Economics and Development Research Centre (China)
ICRAF	International Centre for Research in Agroforestry
KVK	Krishi Vigyan Kendra
KyD	KaonafatsoyaDikgomo
LFPI	Landcare Foundation of the Philippines Inc.
LGU	local government unit
MLGU	municipal local government unit
NDA	National Department of Agriculture (South Africa)
NGO	non-government organisation
NLCA	Ned Land Care Association
NVS	natural vegetative strips

Overview

DAVID PEARCE AND ANDREW ALFORD

Introduction

This report summarises the adoption results for seven Australian Centre for International Agricultural Research (ACIAR) projects completed in 2010–11. The projects involved:

- six individual partner countries—China (three projects), India, the Philippines, South Africa, Indonesia and Vietnam
- two food- and crop-related projects—wheat in India and beef in South Africa
- two plantation forestry projects—teak in Indonesia, and eucalypt plantations in China and Vietnam
- two major land-use change projects in China
- a landcare systems project in the Philippines.

The outputs from the projects covered in this report were as diverse as these countries and research areas. They ranged from a comprehensive evaluation of major policy approaches (in China) to the development of a microcredit platform for smallholder teak farmers (in Indonesia). The projects produced a balance of technology, policy and knowledge outputs.

Most of the projects also involved capacity building in partner countries and institutions, ranging from formal university-based training to a variety of on-the-job training activities for technical staff, research scientists and farmers.

The six adoption studies covering the seven projects indicate medium to high levels of adoption of the project results, although in some cases adoption by final users was limited. In each case, the adoption results provide some useful lessons and observations.

What was discovered–project outputs

ACIAR's adoption studies classify outputs into three broad categories:

- **new technologies or practical approaches** for particular problems or issues—these are designed to be applied ultimately at the farm, processing or marketing level, or in some cases at the breeder level
- **new scientific knowledge or basic understanding** (pure or basic science) of the phenomena or social institutions that affect agriculture—these are designed as inputs into further research processes, ultimately to help develop practical approaches for smallholders, processors, wholesalers and retailers
- **knowledge, models and frameworks for policymakers** or broad-level decision-makers—these are not necessarily for use at the farm level but will influence the contextual environment in which farmers, processors, wholesalers and retailers must operate.

Given the diversity of ACIAR-funded research, there is considerable overlap between these categories, and many projects contribute to more than one of them. Table 1 summarises the outputs for the seven projects covered in this report.

New technologies or practical approaches were the major outputs of four of the projects. They were targeted both at the farm level and at the market chain for farm products.

New technologies and approaches at the farm level included:

- improved farmer understanding of the requirements for producing quality wheat (for chapatti) in India
- delivery of techniques for conservation farming in the Philippines
- continuous improvement programs for small-scale beef farmers in South Africa
- improved silvicultural practices for teak farmers in Indonesia.

Marketing-related technologies and approaches included:

- information on taking advantage of quality premiums for wheat farmers in India
- marketing and microfinance strategies for teak farmers in Indonesia.

New scientific knowledge was an important output of three of the projects. This included:

- knowledge of agronomic practices that lead to wheat with improved qualities for producing chapatti in India
- knowledge of the growth and carcass quality of indigenous southern African cattle breeds
- improved understanding of the relationship between silviculture, genetics and wood properties, for eucalypts in China and Vietnam.

Six projects also developed **knowledge or models relevant to policymakers**, including:

- a comprehensive analysis of a major Chinese policy initiative (in two ACIAR-funded projects)
- integration of landcare and beef partnership projects into policy development
- recommendations to change onerous regulations affecting teak smallholder growers.

Table 1 Summary of project outputs

Project	New technologies or practical approaches	Scientific knowledge	Knowledge, models and frameworks for policymakers
Land-use change in China			Analysis of costs and benefits of a major Chinese policy for conversion of cropland to forest and grassland Estimation of non-market environmental values Development of a 'reverse auction' methodology to allocate project funds Development of analytical techniques for policy analysis—unique approaches in the Chinese context Development of a bioeconomic model of policy impacts
Enhancing farm profitability in north-west India and South Australia by improving grain quality of wheat	Understanding of requirements for producing quality wheat (for chapatti) and opportunities for farmers to take advantage of quality premiums	Quantification of agronomic practices that lead to wheat with improved chapatti quality	Surveys to understand current levels of uptake Development of extension methods for practices that improve quality
Sustaining and growing landcare systems in the Philippines and Australia	Five key outputs relating to implementation of improved conservation farming systems inspired by a landcare ideology: soil conservation techniques, such as natural vegetative strips; more diverse cropping systems; new technologies, such as integrated pest management; incorporation of animal production systems; a range of new marketing innovations		Integration of landcare into extension programs of local government and non-government organisations Integration of landcare into legislative programs

continued ...

Table 1. (continued)

Project	New technologies or practical approaches	Scientific knowledge	Knowledge, models and frameworks for policymakers
Developing profitable beef business systems for previously disadvantaged farmers in South Africa	Beef Profit Partnership program, used to implement a continuous improvement and innovation approach for small-scale beef farmers	Knowledge of growth and carcass qualities of indigenous southern African cattle breeds Knowledge of the incidence of tenderness and marbling genes in South African cattle breeds Knowledge of genetic trade-offs between carcass and beef attributes, and fitness traits	Delivery of Beef Profit Partnership program to several layers of government to form the basis for ongoing policy development
Improving economic outcomes for smallholders growing teak in agroforestry systems in Indonesia	Improved teak growing, including silvicultural and marketing strategies, and a microfinance scheme to help teak smallholders with microcredit		Policy options at different levels of government to assist teak smallholders, including proposed revision of regulations for obtaining timber transport documents
Improving the value chain for plantation-grown eucalypts for sawn wood in China, Vietnam and Australia: silviculture and genetics		Improved understanding of the relationship between silviculture, genetics and wood property, including evaluation of wood quality assessment methods, understanding of the impacts of spacing, publication of key data	

Capacity development

Most of the projects reported here had explicit or secondary objectives to improve the capacity for research and development in partner countries. Table 2 summarises the capacity built and used in the projects.

Capacity development included both formal (university-level degrees), and on-the-job and informal training. Training ranged from advanced topics, such as choice modelling and the use of reverse auctions, to improvements in extension skills and traditional laboratory training.

Two of the projects included providing or improving research infrastructure—for example, providing wood quality assessment tools and developing farmer demonstration trial sites.

In most cases, the research capacity and research infrastructure developed under the projects continue to be used. The collaboration developed between organisations often remains in place, and staff skills and expertise developed through training continue to be used.

Table 2 Research capacity built by the projects

Project	Research capacity built	Research infrastructure developed	Continued use of capacity
Land-use change in China	Training in choice modelling and the use of reverse auction mechanisms, both informal and formal, for staff at the Forestry Economics and Development Research Centre		Trained staff members have been promoted to more senior positions. Capacity built continues to be used in policy analysis
Enhancing farm profitability in north-west India and South Australia by improving grain quality of wheat	Training of extension officers and farmers in the course of field days		Collaboration between extension officers and farmers continues to increase
Sustaining and growing landcare systems in the Philippines and Australia	Capacity development in farmer landcare groups Improved extension and leadership skills in extension professionals employed by government and non-government organisations		Practical landcare guides continue to be used
Developing profitable beef business systems for previously disadvantaged farmers in in South Africa	Capacity built in farmers, extension officers, technical staff and scientists through formal and informal training Training of two PhD students in Australia		Capacity continues to be used in the ongoing aspects of the Beef Profit Partnership project; many original personnel are now in senior positions
Improving outcomes for smallholders growing teak in agroforestry systems in Indonesia	PhD, Masters and undergraduate training	Development of farmer demonstration trial sites	Capacity continues to be used through ongoing collaborative research projects

continued ...

Table 2. (continued)

Project	Research capacity built	Research infrastructure developed	Continued use of capacity
Improving the value chain for plantation-grown eucalypts for sawn wood in China, Vietnam and Australia: silviculture and genetics	Formal training, including 1 PhD, 3 MSc and 1 Honours project	Provision of wood quality assessment tools to participants, including Pilodyn tools, mechanical borers and acoustic tools	Trainees continue to work in the field in the region. Other project participants have subsequently completed PhDs using data and methods from the project, and continue to be involved in research work in relevant areas

Uptake of research and development outputs–progress along adoption pathways

Most of the projects had a number of different objectives and outputs. Summarising the often complex adoption outcomes for a range of projects is difficult and involves an element of judgement. For the summary in Table 3, a four-level classification scheme has been used (as in previous adoption reports).

In this classification scheme, the lowest level of adoption is *0*—that is, no uptake of the results by either initial or final users of the outputs of the project. One project had no adoption of some of the project outputs (although there was low to medium adoption of other project outputs).

The next level of adoption is *N*—that is, some uptake by initial users but not by final or ultimate users of the research. Three projects had some outputs in this category (although other components had higher levels of adoption).

The next level of adoption is *Nf*—that is, uptake by initial users and some uptake by ultimate users. Three projects had at least some outputs in this category. For example, the land-use change project in China resulted in some adoption of the reverse auction methodology as a mechanism for distributing funds.

The highest level of adoption is *NF*—that is, use by initial and final users. This was achieved in five projects, for at least some components of the projects.

Table 3 Current levels of adoption of key project outputs

Project	New technologies or practical approaches	Scientific knowledge	Knowledge, models and frameworks for policymakers
Land-use change in China			*NF*—research was used as a basis for continuing with the cropland conversion policy, generating quantifiable benefits to China *Nf*—some adoption of reverse auction methodology in distributing funds
Enhancing farm profitability in north-west India and South Australia by improving grain quality of wheat	*N*—adoption limited by lack of incentives in marketing system		
Sustaining and growing landcare systems in the Philippines and Australia	*NF*—for soil conservation techniques, such as natural vegetative strips; more diverse cropping systems; new technologies, such as integrated pest management *N*—for incorporation of animal production systems; a range of new marketing innovations		*NF*—for integration of landcare into extension programs of local government and non-government organisations *N*—for integration of landcare into legislative programs
Developing profitable beef business systems for previously disadvantaged farmers in in South Africa	*NF*—for Beef Profit Partnership program	*O* to *N*—for knowledge of growth and carcass qualities of indigenous southern African cattle breeds *Nf*—for knowledge of genetic trade-offs between carcass and beef attributes, and fitness traits	*NF*—Beef Profit Partnership program contributed to ongoing policy development in several layers of government
Improving outcomes for smallholders growing teak in agroforestry systems in Indonesia	*NF*—for silvicultural and marketing strategies *Nf*—for microfinance aspects		*NF*—for many policy aspects, including revision of timber transport regulations

continued ...

Table 3. (continued)

Project	New technologies or practical approaches	Scientific knowledge	Knowledge, models and frameworks for policymakers
Improving the value chain for plantation-grown eucalypts for sawn wood in China, Vietnam and Australia: silviculture and genetics		*N* to *NF*—varies by country and institution. Techniques developed by the project are mostly used by researchers in subsequent projects	

Note: Level of uptake is summarised as high, medium, low or none using the following abbreviations:

NF Demonstrated and considerable use of results by initial and final users

Nf Demonstrated and considerable use of results by initial users but only minimal uptake by final users

N Some use of results by initial users but no uptake by final users

O No uptake by either initial or final users

Factors contributing to the adoption of project outputs

Many factors underlie particular adoption outcomes:

- Knowledge
  - Do the final or ultimate users *know* about the project outputs?
  - Is there *continuity* of staff in organisations associated with adoption, leading to ongoing transfer of knowledge?
  - Are the outputs *complex* compared with the capacity of users to absorb them? (Do users have a sufficient knowledge base to support adoption?)
- Incentives
  - Do users have sufficient *incentives* to adopt the outputs?
  - Does adoption of the outputs increase *risk or uncertainty* for the users, thus reducing incentives to adopt?
  - Is adoption either *compulsory* or indirectly *prohibited*? (Are there extreme forms of incentives or barriers?)
- Barriers
  - Do potential users face *capital or infrastructure constraints*, limiting their ability to fund adoption of the outputs?
  - Do potential users of the outputs face *cultural or social constraints* on adoption?

Table 4 summarises some of the major factors affecting adoption for the projects reported here.

Relatively high levels of adoption of some outputs appear to have been driven by strong economic incentives, such as improved production and incomes (for example, for beef farming in South Africa).

Relatively low levels of adoption of other outputs resulted from factors such as lack of incentives in the marketing chain, changes in policies towards particular products, and risk aversion.

Table 4 Summary of factors influencing adoption and impact

Factor		Key findings
Knowledge	Do potential users know about the outputs?	Farmer-to-farmer learning processes and deployment of farmer facilitators were key drivers of adoption in the landcare project in the Philippines and the teak project in Indonesia. Widespread exposure of findings was important in the successful adoption of policy outputs from the Chinese land-use change project
	Is there continuity of staff in organisations associated with adoption?	Not identified as an issue in these projects
	Are outputs complex compared with the capability of users?	Availability of technical experts was important in adoption of outputs from the Chinese land-use change project
Incentives	Are there sufficient incentives to adopt the outputs?	In India, there is little opportunity for farmers to be rewarded for quality wheat outcomes, resulting in little incentive to adopt practices that improve the quality of wheat. For the eucalypt projects in China and Vietnam, policy attitudes have a significant impact on adoption. Policy relevance of the Chinese land-use research was essential to its overall adoption
	Does adoption increase risk or uncertainty?	Not identified as an issue in these studies
	Is adoption compulsory or indirectly prohibited?	Not identified as an issue in these studies
Barriers	Do potential users face capital or infrastructure constraints?	The existing marketing system in India constitutes a barrier to adoption for quality wheat research
	Are there cultural or social constraints on adoption?	Implementation of novel approaches such as microfinance faces cultural and social barriers. Cultural differences in the value chain for beef in Africa were a constraint to adoption

Lessons learnt

The results from the adoption studies reported here provide a number of lessons for ACIAR-funded projects.

Timeliness in policy research

In the land-use change project in China, the ability to respond rapidly to an emerging policy question was essential to the success of the project. Although it is difficult to plan for this in advance, flexibility in establishing a project proved crucial.

Time for dissemination of new ideas

Interestingly, although responding quickly to an emerging policy is important, it can also create a tension if the project policy analysis involves techniques and approaches that are unfamiliar in the host country.

Philosophical issues in policy projects

The land-use change project in China highlighted the importance of broader philosophical issues in policy deliberations. The involvement of the general public view on environmental issues (through the application of choice modelling) was seen as innovative in the Chinese context. So too was surveying and including individual households in broad policy decision-making.

These features of the research project marked departures from the classical 'command and control' policymaking that is typical in China. Described by the Chinese collaborators as the 'market approach', the 'bottom-up approach' or even a focus on 'democratic processes', these elements of the research were a significant breakaway from conventional (Chinese) research and policy thinking. Although the Chinese collaborators welcomed the opportunity to develop their methodological skills, this change in the fundamental approach to research and policy appears to have left the most lasting impression from the project. The subsequent shift towards recognition of the importance of households in the ongoing success of policy may also have profound impacts.

Farmer-to-farmer exchange visits and farmer facilitators

Farmer-to-farmer exchange visits and farmer facilitators proved to be very effective in the landcare project in the Philippines. There is a trade-off, however, in that exchange visits can be expensive and time-consuming. In general, farmer facilitators may require some form of compensation, although many are happy to volunteer their services in exchange for information.

Measuring, monitoring and evaluation

Lack of attention to measuring , monitoring and evaluation following the completion of ACIAR-funded projects has limited the ability to demonstrate benefits to the broader industry and governments.

Understanding household constraints

The South African beef project found that understanding the motives, attitudes and constraints of the household is at least as important as the technologies offered to the smallholder. This understanding was used as the basis for subsequent ACIAR-funded projects concerned with 'adoption science'.

Thinking about appropriate technologies

The eucalypt project was established under the presumption that wood sawing in the partner countries would follow Australian lines—that is, adaptation of milling of large-diameter native forest logs to smaller-diameter plantation logs. In hindsight, project participants considered that it might have been better to focus the research on Chinese and Vietnamese value chains, which were already developing technologies for smaller-diameter logs.

Participatory action approach

The teak project in Indonesia found that the participatory approach, where research and capacity-building aspects of the projects were combined, was particularly effective in increasing adoption.

Land-use change in China (ADP/2002/012 and ADP/2007/055)

JEFF BENNETT[1]

Project numbers	ADP/2002/021 ADP/2007/055
Project titles	ADP/2002/021: Sustainable land-use change in the north-west provinces of China ADP/2007/055: Improving the efficiency of land-use change in China
Collaborating institutions	Australian National University (ANU); Victorian Department of Sustainability and the Environment; China National Forestry Economics and Development Research Centre (FEDRC); Sichuan Forestry Department; Peking University
Project leaders	Australia: Professor Jeff Bennett (ANU) China: Professor Lei Zhang (FEDRC)
Project duration	2002–11
Funding	ADP/2002/021: $909,287 total (ACIAR contribution $499,571) ADP/2007/055: $603,173 total (ACIAR contribution $384,773)
Countries involved	People's Republic of China
Commodities involved	Rice, wheat, fruits, forest products, sheep and goat products
Related projects	ADP/2002/021

1 The assistance of Dr Xuehong Wang in the preparation of this report is gratefully acknowledged.

Motivation and aims for the project

Concerns in Chinese policy circles about the long-term sustainability of the Conversion of Cropland to Forest and Grassland Program (CCFGP) were instrumental in motivating this research. Given the extent of investment of public funds, the amount of land being converted and the impact on farmers' livelihoods, a more rigorous assessment of the program was required to assist with policy adjustments. Specifically, guidance was required on the application of advanced policy assessment methodologies to collect quantitative evidence on the performance of the CCFGP. As well, the project collaborator—the Forestry Economics and Development Research Centre (FEDRC) of the Chinese State Forestry Administration—sought staff training and reputational enhancement for itself and its staff through collaboration with the Australian project partner, the Australian National University.

The first phase of the research consisted of an economic assessment of investment in the CCFGP across four case-study counties in two provinces. Impacts of the program on farm livelihoods, the environment and flooding in the Yellow River were estimated and compiled into a full social cost–benefit analysis.

Revegetated slopes, Bin Xian. (Photo: Jeff Bennett)

A key finding of the first phase was that the CCFGP could be implemented more efficiently. To follow up on that conclusion, the second phase had the goal of developing and evaluating an alternative, more efficient mechanism for delivery of CCFGP funds. The ensuing research work involved the development of a 'reverse auction' for landholders seeking program funds, development of a biophysical model of the relationship between CCFGP-funded management actions and environmental outcomes, estimation of non-market environmental values, and allocation of funds on the basis of a cost–benefit assessment. The collaborative team was extended for the second phase to include Peking University, and the Victorian Department of Sustainability and the Environment.

Throughout the research work, numerous provincial and county forestry agencies provided assistance.

Outputs–what the project produced

Sixteen research reports and selected presentations produced under the two phases of the project were made available on the project's website.[2]

The project also yielded six papers published in refereed international journals. A book that presented the findings of the first phase of the project was published by Edward Elgar Publishing, and a Chinese language version of the book was published by Chinese Economics and Science Publishing House. In addition, two chapters on the project research were published in other books.

The research findings were presented to two symposia at the conclusions of each phase. The audiences attending were diverse and included key policy officials.

Project participation improved the capacity of a range of individuals and organisations. The FEDRC improved its ability to conduct economic assessments. This was achieved through staff members receiving specific training in techniques such as non-market environmental valuation and the design of market-based auction mechanisms, and broader experience in organisational capacity and presentational skills. The systematic and scientific research processes used in the project were key to the FEDRC's development of approaches to new research tasks. In addition, the approach used in the research to investigate policy impacts at the household and individual levels was a significant break from past practice, which was focused on a 'top-down' approach.

The project field trips, and staff attendance at formal and informal courses at the Australian National University were important in developing the skill base of project collaborators. Since the project's completion, FEDRC staff involved have secured internal promotions or have advanced to other positions.

Capacity was also developed at the provincial and county levels, including experience in interagency liaison and the conduct of data collection exercises involving an extension element. Because of the project's direct dealing with farming households (more than 700 in total), there was also an injection of economic literacy at the local farm level.

2 <https://crawford.anu.edu.au/people/academic/jeff-bennett/sustainable-land-use-change-in-china>

Adoption–how the project outputs are being used

The symposium conducted at the end of the first phase of the research was critical in communicating the findings of the project to key policymakers. Through exposure to the findings, these policymakers were instrumental in the decision to maintain the CCFGP in 2007 after the initial stage of the program. The guidelines for expansion of the CCFGP after 2014 were drafted with reference to the project's findings, as set out in the Chinese language book published from the research work.

Following the second phase of the project, staff from Sichuan Forestry Department delivered training on the reverse auction process to the staff at 10 county forestry bureaus. Since this training, funds (¥160 million per year) are now allocated between county forestry demonstration sites across the province using a reverse auction scheme. However, the use of the reverse auction method to allocate funds under the CCFGP has not continued because of difficulties in implementing the process when the original policy is still operating in adjacent areas.

The general research philosophy of the project to approach policy assessment from the perspective of farmers and households has been adopted more widely by the FEDRC, and at the provincial departmental level. The project has also led to wider recognition of the importance of communicating results between research organisations and policymakers.

Surveying farmer households. (Photo: Jeff Bennett)

Impact–the difference the project has made or is expected to make

Impact assessment focused on two key outcomes of the project: the continuation of the CCFGP after 2007 through to 2014, and the use of the reverse auction method for allocating funds at the provincial level between competing districts.

The research project had a direct influence on the decision to continue the CCFGP from 2007 to 2014. The benefits of the CCFGP are therefore at least partly attributable to the research work. These benefits include improved farm livelihoods, and improved air, water and biodiversity conditions. An offsetting cost is the reduced availability of irrigation water. Even if the project's findings were responsible for only 5% of the decision to continue the CCFGP, their net present value (at a discount rate of 5%) of around A$350 million is far in excess of the roughly A$0.5 million spent by ACIAR on the research.

The cost savings generated through the use of the reverse auction method by the Sichuan Forestry Department were estimated to be approximately 20% of the total amount spent. Assuming that the decision to use the auction method could be 50% attributable to the project, the present value (using a 5% discount rate) of the benefit resulting from the cost savings is estimated to be A$5 million. This is well in excess of the ACIAR costs of funding the second phase of the project (A$0.4 million).

The project's impacts were especially important because the research results were delivered at the times when they were most relevant. The good connectivity between the research team and the policymakers was also vital in ensuring the relevance of the research work. However, the speed with which the research project was implemented and the innovative nature of the approaches taken meant that the process of assimilating the methods used and the findings produced was compressed. This presents a research conundrum: policy research needs to be developed in a timely fashion, but the introduction of new thinking can take time.

Perhaps the most profound impact of the project will come through the introduction of the 'bottom-up' approach to research. The subsequent shift in policy analysis towards recognising the importance of the household in the ongoing success of policy initiatives, including the CCFGP, will have impacts on policy formulation as well as assessment.

Enhancing farm profitability in north-west India and South Australia by improving grain quality of wheat (CIM/2006/094)

DAVID COVENTRY

Project number	CIM/2006/094
Project title	Enhancing farm profitability in north-west India and South Australia by improving grain quality of wheat
Collaborating institutions	The University of Adelaide; Rural Solutions SA (part of Primary Industries and Regions South Australia); Directorate of Wheat Research, Karnal; Chaudhary Charan Singh Haryana Agricultural University, Hisar
Project leaders	Australia: Professor David Coventry India: Dr Randhir Singh Poswal
Project duration	1 July 2007 – 30 June 2011
Funding	$742,703 total (ACIAR contribution $455,575)
Countries involved	India, Australia
Commodities involved	Wheat, rice, cotton, pearl millet, cluster bean
Related projects	SMCN/2000/089, SMCN/2002/032,SMCN/2004/033

Motivation and aims for the project

There is concern that wheat grown in Haryana using traditional practices is now not a profitable venture. The reason is squeezed margins resulting from the low, mostly static base price given by the Minimum Support Price scheme and increasing input costs. Profitability is the key motivation for wheat farmers in Haryana, and their aim is to harvest maximum yields. Although genetics and technology have greatly improved in Haryana, recent data suggest that yields are now either stagnant or even declining.

The majority of the wheat grown in India is consumed as traditional Indian flat bread (chapatti). Quality is important to consumers, and many are willing to pay more for better-quality chapatti flour. However, farmers do not specifically target quality outcomes because their wheat is mostly sold with no segregation and no premium. With emerging change in the agricultural commodity market in India, now is the time to explore ways of increasing farmer profitability through raising awareness about market opportunities based on wheat quality. A major goal for this study was to develop understanding of the requirements for producing wheat that meets high-quality chapatti standards, and to explore opportunities for farmers to take advantage of specialist market opportunities.

The majority of wheat harvested in India is used to make chapattis. Quality is important for the consumer who is prepared to pay a premium for 'best-quality' chapatti flour. (Photo: David Coventry)

As a precursor to this project, two project staff visited Haryana, supported by the Australia–India Council and the Crawford Fund (South Australian branch). These visits provided the opportunity to identify where technology inputs were required in the wheat production system and to increase understanding of the wheat marketing value chain. This 4-year ACIAR project was then designed as a multidisciplinary project. It combined local farming systems expertise in Haryana with Australian expertise, and included wide collaboration between agronomists, soil scientists, cereal chemists, plant scientists and extension specialists from the Krishi Vigyan Kendra (KVK; from Chaudhary Charan Singh Haryana Agricultural University) and the Department of Agriculture (Haryana).

The focus of this project was developing innovative approaches to engaging farmers in extension of technologies suited to their districts, primarily addressing wheat quality. The project aimed to maximise the practical impact at the farmer field level by using on-farm experiments and demonstrations established at locations with different wheat-based rotations. This involved the integration of best agronomic management practices (varieties, tillage, and nutrient and water management) that target productivity, quality and profitability.

Outputs–what the project produced

Two extensive surveys were undertaken (in 2008 and 2010) to provide current information on the agronomic inputs, and associated economic and social factors, in wheat production in Haryana. The survey data for agronomic inputs, plus the findings from regionally based field experiments, show that there is an opportunity to improve the yield in all areas of Haryana by improving the efficiency of the practices used. The project's farmer survey showed that the increasing cost of inputs is the highest concern among farmers. The project's research therefore had a focus on raising awareness among researchers, extension agents and farmers of the substantial cost-saving benefits of zero tillage and increased nutrient input efficiencies.

The survey work showed that about 16–20% of farmers and consumers were involved in direct marketing or purchasing of the wheat harvest via local markets, and these transactions often involve quality considerations. There is concern that traditional agriculture with wheat as the main winter crop is not a profitable venture because of squeezed margins that have resulted from the low and mostly static support price given by the government. At present, wheat cultivation earns farmers a meagre annual profit of about R20,000–24,000 (A$4,000–4,800) per hectare. Farmers indicated that they are looking for options to improve production efficiency or to diversify systems in ways that would increase profitability.

The best grain yields obtained in these experiments were 5.5-6.0 tonne/hectare (t/ha). These yields are consistent with the decade-long 'attainable yield' identified for wheat in rice–wheat rotations for Haryana. Grain yields using zero tillage were similar to yields using the traditional cultivation-based method in the rice–wheat and cotton–wheat regions, but were 2–5% better in the pearl millet/cluster bean regions. Zero tillage allows earlier wheat sowing and a longer duration of the crop. The survey data confirmed that, where rice–wheat is the main crop rotation (e.g. Kaithal and Kurukshetra), there are high levels of adoption of zero tillage, with one-third of farmers in Kaithal using the zero-till method for seeding wheat. In contrast, where cotton was the monsoon crop (Sirsa) and where pearl millet/cluster bean was the monsoon crop

(Mahendragarh and Rewari), no farms in the survey practised zero tillage. Given the large cost savings associated with not undertaking the four cultivations used in traditional farmer practice, the best-practice treatment (including zero tillage and nutrient management) was always the most profitable.

The highest grain yields were obtained when the nitrogen (N) fertiliser was applied in a three-way split (seeding, early tillering and first-node stage), and this always provided the highest protein, grain hardness and chapatti quality. Currently, the recommendation for farmers is to apply N fertiliser at 150 kg/ha of N; this involves a two-way split schedule (one-third basal and two-thirds at the first irrigation). In separate experiments in the rice–wheat system (Karnal region sites), where Greenseeker was used, there were savings in N fertiliser of about 25 kg/ha of N, with similar grain yield, protein and grain hardness to that provided by using the recommended 150 kg/ha. This result highlights that farmers may be overfertilising their wheat, and that there are opportunities for improving nitrogen use efficiency and profitability.

The findings were communicated in each year of the project at field days at each of the sites and through state-wide media. In total, 44 field days and visits were conducted since 2008. The programs were attended by 4,175 farmers. Seven training programs involving Department of Agriculture agricultural development officers (ADOs) were organised for 178 people, with 'train the trainer' as the focus.

Large crowds of farmers attended the many field days held at the farm-based experiment and demonstration sites. (Photo: David Coventry)

Adoption–how the project outputs are being used

There is no doubt that the project has been important in facilitating more collaborative engagement with the ADOs and farmers who have adopted zero-till technology. There are now 21,000 zero-till machines in Haryana, covering an area of 0.576 million ha. Awareness within the farming community of the success of this technology has made it easier for neighbouring farmers to observe and adopt the technology. The quantitative and qualitative surveys in 2014 show that farmers are recognising the opportunities for improving wheat productivity in all areas of Haryana by improving the efficiency of their practices. This involves both more and wider adoption of zero tillage, and the targeted use of micronutrients, including nitrogen.

The project generated understanding about what constitutes the very best chapatti quality in wheat grain and how the chapatti quality of wheat can be improved by agronomic management. However, although these improved agronomic practices have been increasingly adopted as a result of the project, there is still little opportunity for farmers to be rewarded for quality outcomes. The majority of wheat in 2014 is still sold without segregation, and for most farmers it is unlikely that an improved quality outcome will be a motivator without some financial recognition. The Haryana Department of Agriculture believes that segregation on a large scale will become more feasible when the highest-standard quality attributes are available and recognised in high-yielding varieties, not just the current benchmark varieties (C-306 and WH-283). In the rice–wheat system, farmers are more concerned about high wheat yield, with only a few farmers (about 2%) expressing an interest in growing quality wheat. Realistic market opportunities exist for premium chapatti wheat in the south-west areas, particularly closer to New Delhi, where WH-283 is grown on about 10% of farms.

The most pressing concern expressed by farmers in the focus group meetings is that wheat farming with the traditional rotations, using current practices, is rapidly becoming unprofitable. The experience of farmers is that the zero-till package advocated for Haryana does not have any yield penalty. Indeed, the likely outcome from using zero tillage rather than a system involving multiple cultivations is a small yield gain. The overall reduction of inputs associated with using zero tillage means that this is the most economic approach to wheat cultivation; in the rice–wheat districts, the practice is now well established. As seen in the 2014 survey, adoption of zero-till technology in the rice–wheat areas is extensive and increasing, with more than 50% of farmers now using either zero tillage or rotary-till machines (rotavator). Farmers comment on the benefits with regard to yield, input costs and water savings, which help the wheat cope with warmer March–April temperatures by making more soil water available late in the season. Farmers also uniformly reported that there was no additional cost associated with herbicide inputs. Overall, they did not experience difficulties with understanding and adopting a relatively complex and multicomponent technology. As well, the recent banning of the burning of rice stubbles in Haryana is forcing a change of practice for some farmers—in particular, their use of the rotavator.

At the time of the 2008 and 2010 surveys, there was little awareness and little uptake of zero-till technology in the pearl millet/cluster bean–wheat rotation areas or cotton–wheat areas. Zero-till technology was actively advocated in these non-rice areas from the outset of project CIM/2006/94, and the project's experiments showed that zero tillage can lead to a small (up to 5%) yield improvement. The low initial uptake was due mostly to either a lack of knowledge of the technology or the belief that it would not work on the sandier soils of the region. Heavy monsoon-crop stubbles are less of an issue in the pearl millet/cluster bean–growing areas, so it is likely that the zero-till innovation can be adopted quickly in these areas as the economic benefits are recognised with accumulation of knowledge. An increase in farmers' use of, and understanding of benefits

from, zero tillage in these non-rice areas is supported by the data from the 2014 survey, which showed that about 30–35% of farmers now using zero tillage. The observation of progressive farmers who have started trialling zero tillage in the cotton-growing areas is that the cotton sticks do not cause problems with the wheat sown but break down just as quickly with this practice. The machinery that these farmers use for direct seeding of the wheat into the cotton residue is identical to that used in the rice–wheat districts.

In the areas that had recently adopted the zero-till practice, the farmers indicated that they obtained their knowledge of zero tillage initially from the field days and demonstration sites associated with the project. It was clear that there was very strong recall of the messages provided by the project, in terms of the need to use an integrated agronomic package.

Impact–the difference the project has made or is expected to make

It was evident from the meetings that there were increases in net returns from best practice compared with previous practice. In the rice–wheat districts, even farmers who elected to keep using traditional cultivation practice still nominated cost savings and yield increases as the benefits of using zero tillage. This shows that exposure to, and awareness of, zero tillage is now endemic. Farmers at the Bhangu meeting (near Sirsa), where cotton–wheat is the main rotation, were very aware that those who were using zero tillage were pioneering the adoption of this technology. The awareness of the opportunities provided by zero tillage was high with this group of farmers. An observation at this early stage in adoption is that more herbicides will be required following the cotton crop.

Tigra village is in the far south-west of Haryana, where two large field days were held in 2008 (200 attending) and 2009 (300 attending). All attending the focus group meeting in Tigra were now using zero tillage and said that this was a direct outcome of the project. Bawal, like Tigra, is a region where pearl millet/cluster bean is the main rotation with wheat. Here, a poor farmer who is in his second year of using zero tillage said that he had an initial problem with sowing too deep in his first crop, but the final result on this 2 ha was his highest yield ever, with 4.9 t/ha. Before this, his best yield had been 4.3 t/ha. In the 2014 season, he has sown his entire farm (2 ha) using zero tillage, and he said 'this is the best type of technology for poor farmers'.

The farmers expressed their appreciation that field experiments and demonstrations had been conducted in their district, and said 'this is the only way you can have confidence in the new technology'. They also expressed the view that such demonstrations should be continued, if possible. They all were aware that a primary focus of the project was chapatti quality and best agronomy practice, and they were aware of the opportunities that could be provided by the introduction of special quality markets, but they said that they were not yet ready to take the risks themselves in developing these markets. Farmer involvement was integral throughout the project from its inception, with active involvement in the widely dispersed farm-based experiments, and demonstrations and field days. The farmers also highlighted the role of the 'technology champion' in the success of the project.

Since 2010, ADO staff have been encouraged to become much more involved in technical extension rather than just service extension. This has involved greater use of print media and television, with the aim of getting the latest technology to farmers. The ADOs have monthly meetings with KVK, and each ADO staff member has six or seven villages to look at. Another component of the ADO work is involvement in on-farm demonstrations; this is known as the 'laboratory to land' program, and the work is now merged with the KVK

role in extension. All the farmers say that their preference is to source this 'higher knowledge'; in the past, their contact was mostly farmer to farmer. Now farmers are using their mobile phones more proactively to obtain information directly from the sources of information, such as university scientists. Overall, the farmers in the progressive farmer groups recognised the role now being played by the ADOs, but also they highlighted the role of the technical experts (the 'technology champions').

Some social difficulties associated with adopting this new technology were raised, particularly in the areas where there was little previous exposure. One farmer (Bawal) said that 'other farmers are making a joke of me'; another farmer said that he was 'receiving negative input from my neighbours, with some neighbouring farmers saying we should not be using this technology in this region, as it is not suited to our soils'. Some other farmers said that they were being 'pressured by contract tractor operators, who were very worried to lose business and were aware of the long-term negative outcome for them from farmers' adoption of this practice'.

A common observation of the progressive farmers is that their wheat yields are no longer incrementally increasing. Given that Haryana (and Punjab) farmers are the most technology progressive in the country, the gap between current yields and best possible yields in these states is smaller than in other states, and many farmers are currently achieving the best possible attainable yields. A concern expressed by these farmers is that eventually wheat farming with traditional rotations using current practices will become unprofitable. For the many farmers who are not at the current yield potential, there is still room to move to bridge the yield gap, and India can continue increasing total wheat production while this gap exists. However, it is conceivable that within the next decade, unless the current yield plateau is lifted, the total annual yields for Haryana and the Punjab will reach a ceiling. This has huge ramifications for the overall food security of India. There is no doubt in the minds of the farmers that issues associated with climate change and atmospheric pollution (ozone and black carbon) are affecting the yields they now obtain for wheat and rice.

Regarding climate change, irrespective of the location in Haryana, the farmers commented on climate change and its effects on crops. They said that the higher spring (March–April) temperatures are having negative effects on crop yields, and that they are aware that the climate that once was very steady, with only gradual and predictable changes, is now noticeably more changeable. The farmers were particularly aware of the problem of air pollution and the permanent brown cloud, and expressed the view that this has affected the growth of all crops. The farmers also said that, although much of the pollution is not produced in their districts, they are aware that it crosses from other districts. They also said that their animals are being affected and now have more diseases; with their wheat crops, they now see that 'even with more dry matter production, there still is the same or less yield'.

Finally, the farmers believe that they have considerable knowledge and that this knowledge should be recognised in the development of special requirements for their farming systems. Unanimously, they supported the bottom-up approach, using the farming systems research approach that was introduced for the first time in their region with this project.

Sustaining and growing landcare systems in the Philippines and Australia (ASEM/2002/051)

NOEL VOCK

Project number	ASEM/2002/051
Project title	Sustaining and growing landcare systems in the Philippines and Australia
Collaborating institutions	Queensland Department of Primary Industries and Fisheries; University of Queensland; World Agroforestry Centre (International Centre for Research in Agroforestry); Southeast Asian Ministers of Education Organization (SEAMEO) Regional Centre for Graduate Study and Research in Agriculture; Catholic Relief Services Philippines; University of the Philippines Los Banos (National Crop Protection Centre); Landcare Foundation of the Philippines Inc
Project leaders	Australia: Noel Vock Philippines: Dr Arnulfo Garcia
Project duration	1 July 2004 – 30 June 2011
Funding	$3,164,144 total (ACIAR/AusAID contribution $2,164,420)
Countries involved	Philippines, Australia
Commodities involved	Maize, rice, timber trees, fruit crops, vegetable crops, beverage crops, forage crops, industrial crops
Related projects	ASEM/1998/052, ASEM/2009/044, ASEM/2011/061 Motivation and aims for the project

The Philippines suffers from significant soil erosion and land degradation problems as a result of its steep slopes, highly erodible soils, heavy rainfall, forest clearing and intensive cropping practices. Adding more pressure to these problems are the issues of high population growth, extreme poverty, insecure land tenure and poor access to services by the country's predominantly rural population.

Many projects have attempted to address the problems of land degradation and poor livelihoods, but with limited sustained success. The landcare approach, pioneered in Australia and subsequently developed independently in the Philippines, offered new promise in tackling these issues from a more holistic perspective. Between 1999 and 2004, an ACIAR project evaluated the landcare approach for improving adoption of conservation farming practices at three sites in Mindanao. The project showed significant impact, including the adoption of conservation measures by up to 65% of farmers, and protection of up to 25% of susceptible farmland. The project also had significant impact on social capital through membership of landcare groups, development of farmer knowledge and skills through the training provided, and reshaping of institutional approaches.

Although there was some evidence of impact of the landcare process on the economic livelihoods of farmers, this could not be fully evaluated. The motivation for this new project was to further develop and evaluate these economic and broader livelihood impacts, while maintaining progress in the development and evaluation of conservation farming technologies, social capital and institutional involvement.

Members of the Lantapan PAGLAMBU marketing cluster harvest a sweet pepper crop on a member's farm. (Photo: Noel Vock)

The new project ran from 2004 to 2011 in three distinct phases. The first and largest phase (2004 to 2007) had three primary objectives targeting the three core project sites of the previous project (Claveria, Lantapan and Ned) and two new sites (Bohol and Agusan del Sur). These objectives were to sustain adoption of conservation farming systems; evaluate the landcare approach for improving and diversifying cropping systems and livelihoods; and strengthen institutional support structures, such as landcare groups, municipal landcare associations and local government extension agencies. The smaller second phase (2007 to 2009) had two primary objectives: to further develop and evaluate diversified livelihoods, and enable the Landcare Foundation of the Philippines Inc. (LFPI) to evolve, and take on defined roles and responsibilities for the broader development of landcare in the country. The even smaller third phase (2009 to 2011) was largely targeted at improving institutional ownership and securing the future of the LFPI as the landcare lead agency.

Of the seven agencies involved in the project, four (International Centre for Research in Agroforestry, SEAMEO Regional Centre for Graduate Study and Research in Agriculture, Queensland Department of Primary Industries and Fisheries, and University of Queensland) were partners in the previous project. Catholic Relief Services and the University of the Philippines Los Banos became involved through their active involvement in research areas of mutual interest, some of which overlapped the landcare sites. The LFPI became involved during the second phase, following close collaboration throughout phase 1.

Total external funding for the project totalled A$2.1 million, with ACIAR contributing approximately 60% and Australia's aid program (AusAID) 40%.

Outputs–what the project produced

The major outputs of the project were as follows.

Technical

Maintenance and further evolution of conservation farming systems (mainly natural vegetative strips—NVS—and agroforestry) established during the previous project in the core sites (primary output); establishment of NVS (and potentially agroforestry) in new sites as a first step in a conservation farming and diversified cropping system (primary output).

More diverse and productive cropping systems, incorporating vegetables, fruit, timber and other crops alongside the staple crops of maize and rice (primary output).

Incorporation of innovative new technologies—such as integrated pest management, integrated crop management, biofumigation, use of vermicast and supplementary organic fertilisers, irrigation, and protective cropping—into crop production systems to improve returns (primary output).

More diverse and secure farm livelihoods through incorporation of animal production systems and other income-generating activities into farmer businesses (secondary output or by-product output, as the project focus was on cropping systems).

New marketing innovations—such as cluster marketing, better postharvest handling, and market chain intelligence—to improve returns and reduce market volatility (primary output).

Policy

- Integration of landcare into the extension programs of local government units (LGUs) and non-government organisations (NGOs) operating in project areas (primary output).
- Integration of landcare into the policy and legislative programs of LGUs operating in project areas (secondary or by-product output).

Capacity building

- Improved capacity of farmers to make better business decisions (primary output).
- Active and self-reliant farmer landcare groups, municipal landcare associations and landcare farmer trainer groups (primary output).
- A robust and effective lead agency for landcare in the form of the LFPI (primary output).
- Improved research and extension skills, and knowledge of personnel involved in the project (by-product output).
- Refinement of the landcare extension model in providing an effective and efficient method for addressing the livelihood issues of smallholder farmers in the rural uplands (by-product output).

An LGU technician (left) discusses vermicomposting with a farmer in Sugbongcogon, one of the Misamis Oriental satellite sites. (Photo: Noel Vock)

Adoption–how the project outputs are being used

Farmer adoption results presented below are based on a survey sample of 84 farmers across the four study sites (Claveria, Lantapan, Ned, Bohol)—this was a representative sample from approximately 3000 target farmers. Some satellite sites in Misamis Oriental were also briefly studied.

Technical outputs

- Maintenance and further evolution of conservation farming systems (such as NVS and agroforestry) established during the previous project:
  - At core sites, 54–90% of farmers across the sites have adopted and maintained NVS. In some cases, NVS were not required because of flatter land, but, in a small number of cases (less than 15%), farmers had removed their NVS for economic reasons, or because they had leased their land to larger farmers or corporate companies for plantation crops.
  - In the new Pilar (Bohol) site, 25–50% of cultivated sloping land is now protected by NVS as a result of the project and the subsequent support of the LGU.
  - In core sites, more than 65% of farmers who had adopted agroforestry as part of their NVS system by the end of the project are maintaining their involvement in agroforestry. The International Centre for Research in Agroforestry (ICRAF) – Sustainable Agriculture and Natural Resource Management Conservation Agriculture with Trees program is credited with helping to maintain the agroforestry momentum since the end of the project.
  - Almost all farmers have expanded or enhanced their conservation farming systems (practices include composting, minimum or zero tillage, crop rotation, mulching and green manuring).
- More diverse and productive cropping systems incorporating vegetables, fruit, timber and other crops alongside the staple crops of maize and rice:
  - Across the sites, there has been 100% adoption of a mixed cropping system and improvements in it since the end of the project. Farmers have adopted one or more of the following: plantation crops (banana, pineapple), fruit trees (durian, mango, guava, calamansi, jackfruit, lanzone, mangosteen), timber trees (falcata, bagras, mahogany), forage crops for animals (napier grass, setaria grass, legumes), vegetables (sweet pepper, sweet corn, cabbage, lettuce, pechay, beans, squash, tomato, eggplant, sili green, okra, bitter gourd, onion, carrot, cauliflower, Chinese cabbage, potato, garlic), other food crops (coffee, cacao, cassava, ginger, ubi, sugarcane) and industrial crops (bamboo, rubber).
  - Diversified cropping systems have been confirmed to be more productive, but there is some ambivalence about the extent of income change as a result of the productivity. Farmers are unanimous in the view that, although increases may be small in absolute terms, they are large in relative terms, and result in significant income and livelihood enhancement, particularly in key areas for farmers such as their ability to obtain better education for their children.
  - In the new Pilar (Bohol) site, at least 25% of farmers who interfaced with vegetable technologies first at a backyard level have now moved into commercial vegetable production. Importantly, most of the farmers interviewed now see vegetable production as their main source of cash income.

- Other agencies involved in the joint project effort include ICRAF, Department of Agrarian Reform – SEAMEO Regional Centre for Graduate Study and Research in Agriculture, University of the Philippines Los Banos, ACIAR (integrated crop management project) and the Department of Agriculture/LGUs.

- Incorporation of innovative new technologies—such as integrated pest management, integrated crop management, biofumigation, use of vermicast and supplementary organic fertilisers, irrigation, and protective cropping—into crop production systems to improve returns:
  - Some technologies introduced by the project have been widely adopted (and continue to expand), but some have declined significantly. Vermicomposting is the most common new technology adopted, with 30–50% of farmers adopting the practice; many more are in the pipeline. A high percentage of farmers (around 75%) are using organic fertilisers, in most cases as a transition to vermicomposting.
  - Other well-adopted technologies introduced by the project include involvement in nursery production of vegetable and tree seedlings (both communal and individual nurseries), use of herbicides for weed control (to reduce the extent of tillage), use of plastic mulch, and use of non-chemical pest control techniques such as biopesticides, attractants and nets.
  - Technologies in decline include biofumigation (declined from more than 20% of Lantapan farmers at the height of the project to virtually zero in 2014) and protected cropping (declined from 90% of Lantapan farmers during the project to less than 20% in 2014). Farmer feedback suggests that adoption of these more complex, expensive and higher-risk technologies requires a different approach by research and extension agencies.
- More diverse and secure farm livelihoods through incorporation of animal production systems and other income-generating activities into farmer businesses:
  - This was not a primary focus of the project, but linkages that the project established with LGUs, NGOs and other agencies enabled farmers to be interfaced with some non-cropping technologies and subsequently adopt them. These include supplementary small animal production (mainly poultry—including native chickens—pigs, goats and fish), collection and selling of tree seeds to nurseries, and production and selling of worms for vermicomposting.
  - Other spin-offs are improved access of farmers to the services of LGUs and other agencies, such as participation in carabao (water buffalo) dispersal programs.
  - The general farmer consensus is that most of these opportunities would not have been available to them without the project's leverage.
- New marketing innovations—such as cluster marketing, better postharvest handling, and market chain intelligence—to improve returns and reduce market volatility:
  - Of three marketing clusters formed under the project at the core sites, only one (PAGLAMBU cluster at Lantapan) was fully functional in 2014. PAGLAMBU is cluster marketing predominantly sweet pepper and cabbage directly to eight different markets, including wholesalers, supermarkets, processors and restaurants. The cluster has continued to expand production and marketing volume from approximately 40 tonnes per year in the latter stages of the project to approximately 200 tonnes per year in recent years. Significantly, studies show that prices across a range of commodities are 75–300% higher than for conventional marketing to local traders. Credit for much of the momentum since the end of the project goes to University of the Philippines Mindanao, a collaborator during the project.

- However, there are some problems with the PAGLAMBU cluster, particularly the high debt levels being carried by farmers as a result of poor management of group finance from Bukidnon Cooperative Bank. This continues to temper the obvious farmer enthusiasm for the clustering concept.
- Claveria banana cluster has abandoned its marketing function but still has a very strong involvement with the LGU on farmer training, particularly farmer field schools. An interesting recent development is a program being pioneered jointly between the municipal local government unit (MLGU), the barangay local government unit (BLGU), Poblacion Landcare Group and Alter Trade to produce and market organic bananas in Japan. This may resurrect some components of the banana cluster.
- Ned vegetable cluster is currently not operating as a marketing cluster, although 5 of its 19 members remain involved in collective marketing under an informal marketing collaborative, dealing directly with off-site buyers.

Policy outputs

- Integration of landcare into the extension programs of LGUs and NGOs operating in project areas:
  - In Claveria, there is clear evidence of improved integration of landcare into the MLGU's Office of the Municipal Agriculturist, including allocation of one dedicated agricultural technician to the landcare program; allocation of P500,000 to the Claveria Land Care Association (CLCA) for construction of a vermicomposting facility, accreditation to the Municipal Council, capacity building for members on funds acquisition, and training in cacao, coffee and banana production; and commitment to an Agricultural Training Institute–funded program for training in high-value crop production for landcare groups. In addition, the MLGU has maintained its commitment under the previous project to provide an ongoing budget of P50,000 per year to each of its 24 barangays.
  - In Lantapan, there is similar evidence, including appointment of a dedicated focal person for landcare within the Municipal Agricultural Office, allocation of an annual budget for landcare, provision of P200,000 to one of the landcare groups to maintain 15 ha of a 50 ha agroforestry farm on a joint LFPI-ICRAF project site, embedding of landcare principles and landcare organisations into a major river restoration program with the National Power Corporation to reduce siltation in its hydroelectric scheme, and provision of five rain shelters to the PAGLAMBU cluster in the period 2011–14.
  - In Ned, there have been promising developments with the BLGU and MLGU from a low base. They include the BLGU's recommendation for the Ned Land Care Association (NLCA) to be the primary partner with the Department of Agriculture regional office in a project worth P2.6 million for the development of coffee production and processing; and the involvement of NLCA members in the Ned barangay being selected as the only barangay in South Cotabato to be involved in the large foreign-funded Mindanao Sustainable Agrarian and Agricultural Development Program.
  - In Pilar (Bohol), perhaps the most extraordinary example of institutionalisation of landcare in an LGU is through the Pilar Dam Program, which began in 2008. This involves an annual budget allocation of P220,000; deployment of 198 barangay farmer technicians (BAFTECHs), each delivering extension services to 25 members of small sitio-based landcare groups; incentive mechanisms for both BAFTECHs and outstanding farmer innovators; and a unique concept of promoting sustainable farming practices, enhanced food security and improved nutrition from the household level upwards. The program continues to expand—in 2014, it included an annual program budget of P1 million. The next stage will incorporate household production of native chickens; integration of landcare into the LGU's

farmer field school training curricula for rice, corn and high-value crops; and greater sophistication of the BAFTECH program, including household monthly meetings of landcare groups organised by the BAFTECHs, bi-monthly meetings of a BAFTECH Municipal Federation, and a bi-annual BAFTECH Congress.

- Integration of landcare into the policy and legislative programs of LGUs operating in project areas:
  - The LFPI and landcare entities are involved in two regional development councils, four provincial development councils, and seven municipal and barangay development councils across Mindanao and the Visayas.
  - An innovative new ordinance in Lantapan provides incentives for farmers adopting or investing in sustainable farming systems. This has been accompanied by the creation of a special Municipal Environment and Natural Resources Office and staff to oversee implementation of the policy, and promotion of environmental programs. The ordinance is now being studied by Bukidnon provincial Environment and Natural Resources Office as the basis for incentive-based schemes in neighbouring municipalities.
  - Existing ordinances in Claveria and Pilar are not effectively implemented because of poor monitoring or lack of political support.

Capacity-building outputs

- Improved capacity of farmers to make better business decisions:
  - This output is enabling continuing direct involvement of farmers in market chain intelligence and development through the marketing clusters.
  - The range of linkages with external agencies has expanded, so that farmers have a wider potential range of new business opportunities. A typical network at the core sites now consists of 8–12 different agencies, comprising government agencies, NGOs, private agribusinesses, research agencies, academia, foreign donor projects and finance organisations.
  - Farmers can make better use of finance through cooperatives, banks and specialist microfinance organisations, such as the successful collaboration between the NLCA and the Integrated Cooperative Towards Unified Service in Ned.
- Active and self-reliant farmer landcare groups, municipal landcare associations and farmer training groups:
  - The number of active landcare groups has declined from more than 400 at the start of the project to fewer than 50 now. However, farmers in general still identify as members of landcare groups, even though the majority of groups are inactive. Inactivity is largely the result of other farmer group entities—such as cooperatives, clusters, landcare associations and 'informal' farmer collaboratives—taking over the main functions of landcare groups.
  - Where landcare groups are still active, some effective services are being provided. An example is the Poblacion Landcare group in Claveria, which manages a historical allocation of P5,000 per year to each of its 10 subchapters on behalf of the Claveria MLGU, and liaises with the BLGU on managing a farm on BLGU-owned land for banana production and sucker dispersal, with all the income going to the group.
  - In Pilar, the 198 small sitio-based landcare groups formed under the Pilar Dam component of the project are all still active.

- In San Isidro, landcare groups were crucial in recently accessing funding and support from the Philippines–Australia Community Assistance Program to reconstruct sustainable livelihoods in the wake of the devastating 2013 earthquake.
- Only one of the three municipal landcare associations—Ned LCA—is still active, but there are current plans by the Claveria MLGU to reactivate CLCA.
- All five farmer training groups established during the project are no longer active.

- A robust and effective lead agency for landcare in the form of the LFPI:
  - The LFPI has significantly increased its project portfolio from one project (with a value of A$20,000) in 2004 at the start of the landcare project to 10 projects (with a value of more than A$800,000) in 2014.
  - There is increasing international recognition by project proponents and funding agencies of the vital role that the LFPI can potentially play in community consultation, community organisation and farmer training. This is supported by the LFPI's engagement in this role in six current projects, plus its selection as lead Philippines project partner in the new ACIAR conflict area extension project.
  - Staffing has increased significantly from 1 full-time and 2 part-time staff members in 2004 at the start of the project to 18 full-time and 5 part-time staff members in 2014, located at seven locations across Mindanao and the Visayas.
  - The LFPI is represented on development councils at the regional, provincial, municipal and barangay levels, as well being the community service organisation representative on the Misamis Oriental Provincial Development Council, a member of the Provincial Mining Regulatory Board, and a member of the Cagayan de Oro City Disaster Risk Reduction Management Council.
  - There is increasing advocacy of landcare concepts to higher levels of government, NGOs, academia and other development agencies, through project and institutional collaborations.
  - The LFPI has increased internal stability, through better strategic planning, communication and organisational procedures.
- Improved research and extension skills, and knowledge of personnel involved in the project:
  - Technical and extension skills in staff of associated LGU and NGO agencies have increased significantly.
  - There is evidence of ongoing professional networking between landcare and extension personnel—both informal networking (where personnel are helping and supporting each other in new and existing projects) and formal networking (such as the Philippines Landcare Network, which has met once since the completion of the project).
- Refinement of the landcare extension model in providing an effective and efficient method for addressing the livelihood issues of smallholder farmers in the rural uplands:
  - Success of the trial of the landcare extension concept in the conflict-affected community of Malisbong in western Mindanao was a key factor in facilitating the development and approval of the ACIAR Mindanao Agricultural Extension Project in other conflict-affected areas of Mindanao. This large A$1.5 million project commenced in 2014 with the LFPI as the principal Philippines partner.

– A book produced by the project and published by ACIAR in 2009, '*Landcare in the Philippines: a practical guide to getting it started and keeping it going*', continues to be instrumental in providing potential landcare developers with an understanding of the model and its application in community development. The book is still in demand. More than 750 copies are now in the hands of individuals and agencies throughout the Philippines.

Based on farmer capacity and famers' linkages with sources of support, adoption of improved farming systems is expected to continue. This is made more likely by the LFPI being a robust and active advocate, and maintaining some presence (albeit limited in some sites) in supporting the pioneer landcare efforts. There are also good prospects for adoption beyond the target group, because the LFPI regularly uses the sites to showcase landcare to other farmer and LGU groups. However, continued adoption is contingent on a number of factors, including:

- the extent of the impact of large corporate farming, particularly in Claveria and Lantapan, where there is a risk that conservation structures such as NVS, installed by smallholder farmers, will be erased to make the land more amenable to the operation of large farm machinery
- a decline in the pool of farmers regarded as landcare adopters as a percentage of total farmers, reducing the potential landcare adopter influence
- continuing support for the market clusters from agencies such as the University of the Philippines Mindanao
- special support to farmers in the adoption of complex, costly and high-risk technologies such as biofumigation
- continuing support from LGUs in the face of increasing volatility of political administrations.

Factors that significantly contributed to adoption included the emphasis on farmer-to-farmer learning processes, particularly farmer exchange visits; deployment of farmer facilitators; project staff facilitating change rather than leading or imposing change; a focus on building social capital as well as providing technical support; valuing and developing good partnerships; a focus on improving the marketing system as well as the farm production system; getting farmers more involved with LGUs; effective use of groups; and continually evaluating the process being used via an action research model.

Two factors that hampered adoption were the level of debt still being carried by some of the PAGLAMBU cluster members, as a result of poor management of group microfinance; and the lack of effective integration of agroforestry, particularly fruit trees, into the NVS system at Ned.

Impact–the difference the project has made or is expected to make

Six beneficiaries of adoption under the project were identified:

- targeted farmers at the project sites
- other farmers and residents of target barangays and municipalities
- agribusiness and other service providers in target barangays and municipalities
- LGU institutions in target barangays and municipalities

- the broader community in Mindanao and the Visayas
- the LFPI.

Of these, the primary project target beneficiaries were identified as targeted farmers at project sites, agribusinesses and other service providers, LGU institutions, and the LFPI.

The only groups identified who may have been negatively impacted were local traders, who may lose business as farmers become more market orientated and deal directly with off-site buyers; and smaller local farm input suppliers, who may lose business if farmer groups elect to purchase supplies in bulk directly from larger off-site suppliers.

Key impacts can be summarised as follows:

- **Increase in farmer incomes as a result of more productive and diversified farming systems.** Although it was difficult to determine the actual level of the increase in income, surrogate measures were able to provide an indication of the impact. For example, some farmers stated that they were now able to send their children to high school and college, previously an unattainable dream. From these surrogate measures, it was concluded that income increases may have been relatively small in absolute terms, but, because they were coming from a very low base, they were large in relative terms from the perspective of the farmers. This is generally consistent with the results of a survey of more than 100 farmers completed during the project in 2008, which showed that, while the the absolute increase in median cash incomes of farmers who had adopted landcare farming systems was small, their incomes were 60–80% higher than that of non-adopters, and this increase was highly significant to the farmers themselves.
- **Increase in farmer incomes as a result of market clustering.** The market clusters, although their sustainability has varied, showed clear economic benefits to farmer members. A detailed analysis in the Lantapan PAGLAMBU cluster showed that their prices for a range of vegetable commodities were 75–300% higher than what would have been achieved via normal marketing channels. Although this does not translate directly into a similar increase in returns because of the higher costs of collective marketing, feedback from farmers confirmed a premium in returns of 30–100%. An indication of how farmers view the situation is that, despite major debt problems flowing from poor management of group microfinance, farmers remain committed to the cluster while they progressively work through their debt problems.
- **Increase in farmer self-motivation and self-reliance.** Examples include the ongoing technical and marketing progress made by Ned farmers through the NLCA, in relative isolation and despite a range of worsening conditions, including poor road access and land conflict. A creditable measure of their capacity is their recent selection by the BLGU to be the primary partner with the regional Department of Agriculture in the implementation of a P2.6 million coffee production and processing scheme, in which the NLCA will have complete responsibility for managing the processing facility. Similarly, Claveria farmers have shown significant capacity to broker new opportunities, such as the joint program with the MLGU, the BLGU, Poblacion Landcare Group and Alter Trade to produce organic bananas and market them in Japan.
- **Enhancement of social capital.** The linkages that these isolated farming communities have with external contacts and information sources are now much stronger. This is confirmed by the fact that a typical network of external agency linkages now includes 8–12 agencies, compared with the situation before the project when there were almost no external linkages. In addition, external agencies supporting the clustering approach have lauded the value of the project's prior building of social capital through landcare groups, now considered an essential prerequisite for successful group marketing.

- **Enhancement of health and welfare.** Although anecdotal, there is evidence that the innovative Pilar Dam program in Bohol has significantly affected the health and welfare of its approximately 5,000 farm households. Feedback from both farmers and LGU staff suggests that the households have improved knowledge and a better outlook, and are more resilient and secure in terms of their food sourcing and food security.
- **Maintenance of conservation farming systems**. The study showed that 54–90% of farmers have maintained (or improved) their conservation farming systems based around NVS and agroforestry. This means that there has been no net loss of farmland protection compared with the situation at the start of the project. Recent adoption of additional conservation and soil improvement practices, combined with the more advanced agroforestry systems now in place, suggests that the impact of the conservation systems, both on-site and off-site, may now be greater in real terms. In Pilar, 25–50% of sloping land is now protected by conservation systems as a result of the project.
- **Stronger LGU ownership**. This was evident in the allocation of dedicated landcare staff, increased allocation of funding and other resources, joint development of new innovations and technologies, and investment in policy and legislative instruments. A particularly significant example of LGU ownership was at the new site of Pilar (Bohol), where the LGU embraced the landcare concept to an extraordinary level and devised the Pilar Dam program, one of the most innovative local government programs ever seen in the Philippines.
- **A new landcare ordinance.** The Lantapan ordinance, conceived in 2009 by the MLGU with inspiration from the project, provides incentives for farmers adopting or investing in sustainable farming systems. Its impact is relevant not only for farmers, but also at the institutional level, as shown by the creation of the special Municipal Environment and Natural Resources Office and staff to oversee implementation of the policy, as well as promotion of environmental programs in general. The fact that the Bukidnon provincial Environment and Natural Resources Office is now studying the Lantapan policy, as the basis for incentive-based schemes in neighbouring municipalities, is a significant flow-on impact.
- **Stronger and more robust lead agency.** The project's development of the LFPI as the lead Philippines agency for landcare is having impacts on a wide range of project delivery and advocacy roles in Mindanao and the Visayas. Indicators include the LFPI's current project portfolio of 10 projects funded by six different donor agencies, with a budget of P32 million (A$800,000), and the deployment of 18 full-time staff. The development of the agency has facilitated its leading role in the ACDI/VOCA-funded CoCoPAL project, where it was involved in providing training services to more than 6,000 farmers. It also has a principal partner role in the new ACIAR project on improving extension services in conflict-affected areas of western Mindanao.
- **Better agribusiness opportunities.** Improvements in farmer income and diversity of livelihoods have provided agribusinesses with significant new business opportunities, which in turn affect local employment, infrastructure and provision of services. Examples include the involvement of the Integrated Cooperative Towards Unified Service and the Bukidnon Cooperative Bank in local finance, and the chain of services supporting the market clusters (farm input suppliers, produce consolidators, transport services, marketing services).

Developing profitable beef business systems for previously disadvantaged farmers in South Africa (LPS/1999/036)

GARRY GRIFFITH

Project number	LPS/1999/036
Project title	Developing profitable beef business systems for previously disadvantaged farmers in South Africa
Collaborating institutions	Australia: Cooperative Research Centre (CRC) for Cattle and Beef Quality; Meat & Livestock Australia/LiveCorp Joint Program; Northern Pastoral Group of Companies South Africa: Agricultural Research Council; Animal Improvement Institute; provincial departments of agriculture of Limpopo and North West; National Department of Agriculture, Forestry and Fisheries; agribusiness organisations such as feedlotters association; several cattle breed societies
Project leaders	Australia: Dr Bernie Bindon and Dr Heather Burrow (CRC for Cattle and Beef Quality) South Africa: Dr Michiel Scholtz (Agricultural Research Council)
Project duration	1 January 2001 – 31 March 2008
Funding	$6,688,793 total (ACIAR contribution $1,451,917)
Countries involved	Australia, South Africa
Commodities involved	Beef cattle
Related projects	AS2/1996/149

Motivation and aims for the project

South African and Australian livestock geneticists, meat scientists and animal production scientists have long collaborated in joint research projects, and had discussed emerging issues in the South African beef industry at national and international conferences and workshops. After South Africa's landmark election in 1994, more emphasis on agricultural development was directed to what was then called the previously disadvantaged communities. With the new government intent on raising small-scale and emerging cattle farmers out of poverty, the scene was set for the design of a joint research program to address the the critical issues facing this sector. Additionally, in Australia, the beef industry had been the recent recipient of a cooperative research centre (CRC), and an expanding group of scientists and economists wished to continue to work together, and expand their skills and experience.

The total number of cattle controlled by small-scale and emerging farmers was estimated at around 5 million. The production systems used by the emerging farmers were inferior in all measures of animal and financial performance, and the advent of a large feedlot sector in South Africa in the 1970s meant that markets generally available to emerging farmers were restricted to local butchers or meat required for local festivities.

Members of Nguni Farmers Cooperative, North West Province with some of their awards for herd performance. (Photo: John Thompson)

These markets were both unpredictable and unreliable. Further, several hundred thousand weaner steers and tens of thousands of tonnes of beef were imported each year to satisfy South Africa's rapidly expanding domestic demand for beef.

Apart from improving herd productivity, it was argued that small-scale and emerging farmers needed to enter the well-defined commercial markets to improve profitability. However, very little was known about the characteristics of the cattle raised by emerging farmers, so buyers from the commercial sector were reluctant to purchase these animals; even if they did purchase them, offer prices were much lower than market prices.

It was hypothesised that, if it could be demonstrated that animals bred by the small-scale and emerging farmers were able to compete with respect to the traits required for feedlot entry, opportunities would be created for these farmers to sell into the commercial beef markets and, therefore, to substantially increase their profitability. It was also hypothesised that these opportunities had to be considered in the context of the resources available to small-scale and emerging farmers. Ways of empowering small-scale farmers had to be found for significant progress to be made.

In Australia, beef producers were increasingly using crossbreeding as one of their management options, but, in the tropical north, options were limited by the poor adaptation of the European breeds most commonly used in crossbreeding programs. Sanga breeds from southern Africa have carcass and meat quality attributes that are of similar quality to those of British breeds. These African breeds are much better adapted to the stressors of tropical environments than the European breeds and hence provide opportunities for beef producers in northern Australia to improve beef quality, while retaining adaptation to environmental stressors.

The project had five components:

- developing the resource-poor farmers and their networks
- developing the role of the cattle and improving their performance through the South African commercial beef system
- providing the means for ongoing genetic and non-genetic improvement of beef cattle in the tropics and subtropics worldwide
- preserving the gains in social infrastructure and training built up in the project, and transferring the carriage of further expansion of the project to local, provincial and industry management and leadership
- publicising the key information emanating from the experimental work that the carcass attributes of indigenous cattle are equal to, or better than, those of conventional, exotic breeds reared under conditions of high-input agriculture.

Outputs–what the project produced

Technical

The project had four main technical outputs:

- New knowledge and data about the growth and carcass quality attributes of a number of tropically adapted indigenous southern African breeds and cattle from collaborating small-scale and emerging farmer herds. The results showed that growth rates and feed efficiencies of steers from emerging and

communal farmer herds paralleled those from commercial herds. They entered the feedlot at a lighter weight than commercial cattle, but, during the feedlot period, grew as well and had similar feed conversion ratios, to achieve acceptable, although lighter, carcass weights. The incidence of disease was low in all experimental steers, and was no different between commercial, emerging and communal herds. Meat quality analyses indicated small or no differences between herd types or breeds in carcass and meat quality attributes. Detailed results were reported in the international literature.

- New knowledge and data about the incidence of marbling and tenderness genes in South African bulls. Results showed that southern African breeds have a high frequency of the favourable form of the calpastatin (tenderness) gene, but a much lower frequency of the calpain (tenderness 2) gene. The breeds also have a very low frequency of the favourable form of the TG5 marbling gene, even though some of these breeds have been tested in Australia and the United States as being high marbling breeds. These results were also reported in the international literature.
- New knowledge and data about the genetic trade-offs between carcass and beef quality attributes of beef cattle on the one hand, and key fitness traits—such as reproductive performance and adaptation to harsh environmental stressors—on the other. The impacts of selecting for carcass and beef quality attributes, feed efficiency, adaptation to tropical environments and female reproduction were determined and reported as estimates of genetic parameters for all traits. Many publications have arisen from this research.
- New knowledge about the effectiveness of a continuous improvement and innovation (CI&I) approach to empower small-scale and emerging farmers to improve the profitability of their beef businesses during the course of the project, and to provide a platform for the project's farmers to continue improving their profitability beyond the life of the project. This component of the project achieved outstanding success, with overall improvements in beef profitability and productivity by the small-scale and emerging farmer partners. In 2006, the project's farmers received about 95% of the published commercial market prices for comparable animals, whereas, in 2001, their sale prices were about half those of commercial cattle prices. They showed evidence of improved reproduction rates, higher numbers of sale animals and lower pre-weaning mortalities, at levels close to the performance for established commercial farmers.

Policy

A CI&I 'hub' was established as part of the sustainability strategy for the 1-year extension of the Beef Profit Partnerships (BPP) component of the project during 2006–07. Following the project final forum, an in-depth presentation of the BPP results was made to the National Department of Agriculture (NDA), which immediately asked the BPP team to prepare and submit a proposal to expand the BPP network to other provinces. Funding was approved later that year, which resulted in the recruitment of seven technical officers servicing seven provinces as part of the BPP sustainability plan. These positions were located within the Agricultural Research Council (ARC). The BPP philosophy was effectively adopted as a key principle for the massive beef empowerment project at the NDA, called 'massification of livestock'.

Capacity

The key capacity outputs developed through the project were as follows:

- Institutionalisation of the project's BPP/CI&I methodology in South Africa means that these processes are now used for decision-making at almost every level of the cattle industry: by emerging farmers, who use the process to choose between new production or marketing opportunities or new technologies; by the

extension and technical staff, who use it to choose how and where to allocate their efforts for greatest impact; and by the project leaders and managers, who use it to choose how and where to focus staff and financial resources for greatest impact.

- A broad range of training materials was developed and refined during the project. These were made available in electronic and printed formats through the 'hub'. During May–June 2007, 3 weeks of intensive workshops were held at Irene at different levels of understanding, culminating in a Master Class in CI&I funded by Australia's Crawford Fund.
- Two PhD students associated with the project (both ARC researchers—Dr Nkhanedzeni Baldwin Nengovhela and Dr Tshilidzi Percy Madzivhandila) were trained at the University of Queensland and the University of New England (Australia), respectively, as recipients of John Allwright scholarships. Dr Madzivhandila had earlier completed a Masters thesis at the University of the Free State on the BPP component of the project.
- In South Africa, as part of the experimental work, several of the technicians involved were trained in various experimental procedures. For example, three ARC technicians were trained to collect real-time ultrasound beef quality records. ARC molecular geneticists were also trained in the use and interpretation of DNA test results based on South African cattle breeds.
- Significant scientific capacity was also built in Australia as a result of the project's research. Much of this was in conjunction with work done in various phases of the Beef CRC, and some of the outcomes from that work are reported in CRC publications.

Cattle owned by Kromspruit Farmer Cooperative, North-West Province. (Photo: John Thompson)

Adoption–how the project outputs are being used

Technical and policy

- New knowledge and data about the growth and carcass quality attributes of a number of tropically adapted indigenous southern African breeds and cattle from collaborating small-scale and emerging farmer herds. The extent to which this information has been used in the industry is unclear. In the project extension period in 2006–07, there were reports that feedlots were employing buyers specifically to work with the small-scale and emerging sector, and to source cattle from these farmers for feedlots. However, there were also reports that major players in the commercial cattle market were still negative about the potential role of cattle from the small-scale and emerging sector to meet commercial market specifications. No objective data on this issue are available. Thus adoption seems to have been minor at best. This was one of the reasons that the follow-up ACIAR project has taken an alternative path of building value chains and markets for high-quality grass-fed products from the small-scale and emerging sector, rather than relying on feedlot finishing.
- New knowledge and data about the incidence of marbling and tenderness genes in South African bulls. Results were delivered directly to cooperating breeders and key stakeholders, particularly those based in northern Australia and South Africa.
- New knowledge and data about the genetic trade-offs between carcass and beef quality attributes of beef cattle on the one hand, and key fitness traits—such as reproductive performance and adaptation to harsh environmental stressors—on the other. Initially, results were delivered directly to cooperating breeders and key stakeholders, particularly those based in northern Australia and South Africa. Widespread communication of the results to the cattle industry in general was delayed until the full extent of trade-offs from selection (arising from the direction and magnitude of relationships between the various groups of traits) was understood. The widespread release of results to the Australian and international beef industry, and their integration into education and delivery packages for use by extension specialists is now underway. For example, these genetic parameters have been incorporated into the genetic evaluation delivery systems in Australia and South Africa, and therefore have been fully adopted by registered users of BREEDPLAN. In Australia, BREEDPLAN-registered bulls make up about 35% of the male breeding herd.
- New knowledge about the effectiveness of a CI&I approach to empower small-scale and emerging farmers to improve the profitability of their beef businesses during the course of the project, and to provide a platform for the project's farmers to continue improving their profitability beyond the life of the project. Significant new funding to expand the BPP project to the other provinces was provided by the NDA and the Australian Government Department of Agriculture, Fisheries and Forestry (DAFF) in 2006; new legislation for the establishment of KaonafatsoyaDikgomo (KyD)—the new animal improvement scheme for emerging cattle farmers—was declared in 2007; and funding was further extended in 2012. At present, 16 full-time technicians and 36 interns assist the KyD team every year. This effort has seen a massive growth in the number of small-scale and emerging farmer involved in the scheme. Anecdotally, project managers say that almost 12,000 farmers have signed up for the KyD scheme, although the number recorded in the official INTERGIS database is only 8,275. The CI&I tools embedded in the BPP/KyD scheme have been rolled out into a number of other agricultural industries in South Africa and into a number of other countries in the Southern African Development Community.

Capacity

The capacity developed in the ACIAR project is being used effectively in the ongoing institutionalisation of BPP/CI&I approaches and methods in South Africa and across southern Africa.

Many of the key ARC personnel in the BPP project are now in senior management positions in the ARC. They actively promote the BPP/CI&I approach through the organisation and other government agencies, and seek further investment opportunities to test and develop the methodology. The small-scale and emerging farmers who were trained in CI&I during the project are going from strength to strength. Many are still actively involved in farmer teams, using CI&I, and measuring their herd and financial performance. Many nominate for the Emerging Beef Farmer of the Year Award; some have won the award, and some have done so well with their herd improvement that they have graduated from the KyD Scheme to the full National Beef Improvement Scheme. All of these farmers promote the notion of BPP/CI&I to their peers.

It could be argued that the recent focus on the development of cooperatives by a number of government agencies (in particular, DAFF and the South African Department of Trade and Industry) has also been a spin-off from the ACIAR project, in that it has a direct emphasis on effective business development in the small-scale and emerging sectors. However, although a large number of cooperatives have recently been established, it is still early days, and it is not possible to determine how effective those cooperatives are or will become.

Impact–the difference the project has made or is expected to make

Most of the impact from this project has centred around the BPP component. Within a short time, it was evident that practice change was occurring rapidly and effectively, and that the small-scale and emerging farmers in North West and Limpopo provinces were making use of the support offered to improve their cattle herds and to take on the idea of beef cattle as a business. By 2005, farmers had dramatically improved their herd performance, were producing more weaners of heavier weights and were achieving close to market prices for their stock. Monthly income for a typical farmer was some 15 times higher than before the project commenced. This additional income or profit was redistributed back into the villages in the North West and Limpopo provinces that had signed up to the BPP project. Anecdotally, this was used for expenses such as children's education and family medical expenses first, and then reinvested into the cattle business.

A major evaluation was undertaken in 2007 as the project was being wound up. Based on data recorded by the BPP farmers, the project increased revenue to the project's emerging farmers by more than 1.95 million rand (R) over the period 2001–06. The average was more than R16,000 per farmer team per year. It is estimated that the BPP project increased profits to the subset of farmer teams that measured gross margins by more than R236,000 from 2002 to 2006, with the average being around R7,500 per farmer team per year. If the same average improvement was achieved across all BPP farmer teams, the total improvement in gross margin would be about R800,000 between 2002 and 2006. Therefore, about 40% of the additional revenue generated by the project would be expected to be retained as additional profit to the participating farmers.

Unfortunately, during the period of rapid growth of the scheme, there was a lack of attention to entering the underlying descriptions of the beef businesses that had signed up for the scheme into the INTERGIS database. As well, the strong focus on calculation and recording of gross margins by BPP/KyD members has not been maintained since funding of the project ceased. However, using the previous set of assumptions for the data

that are currently available on KyD members, an annual benefit of R20 million is calculated for the current 3,492 members who have full records on the INTERGIS database. If the same average values applied to the other KyD members who are listed on INTERGIS (a total of 8,275 members), the aggregate annual increase in profit would be R47 million. These very large (albeit conservative) numbers indicate that the BPP/CI&I/KyD methods are achieving impacts that have not previously been documented in other projects based on small-scale beef farmers.

In relation to the subsequent BPP project in Australia as part of the Beef CRC, an evaluation in 2012 suggested that the sum of the estimated annual improvements in profits of BPP members, compared with their regional peers, as measured by survey data from the Australian Bureau of Agricultural and Resource Economics and Sciences, is almost $27 million over the 6 years to 2011–12.

The BPP project was also implemented in New Zealand by Meat and Wool NZ but in a different way. No directly equivalent data have been made available to allow comparisons as above, but Beef and Lamb NZ (the successor organisation to Meat and Wool NZ) has continued to invest in the process and has stated that it is achieving the objectives set by Beef and Lamb NZ to serve as a vehicle for practice change and increased profit.

In relation to the experimental outputs, despite the statistically valid results showing comparable performance of the indigenous cattle breeds in meeting feedlot growth and carcass quality criteria, anecdotal reports indicate that these cattle are still not widely sourced as feeder cattle. A focus on the motives, attitudes and constraints of the household is at least as important as the nature of the technologies offered in the smallholder and emerging farmer context. For example, most small-scale farmers choose not to castrate male cattle or dehorn their calves because of potential mortalities and morbidities arising from these procedures; no price incentives are offered for castrated and dehorned cattle relative to prices for entire, horned cattle; farmers are used to selling their cattle at older ages and hence obtaining higher prices than for weaners sold into the feedlots; and farmers often lack the cash flow to retain ownership of their cattle through a feedlot finishing period. This has prompted an explicit focus on the 'adoption science' aspects of smallholder behaviour in the subsequent ACIAR project (LPS/2005/036).

Improving economic outcomes for smallholders growing teak in agroforestry systems in Indonesia (FST/2005/177)

DEDE ROHADI, TUTI HERAWATI AND TIEN LASTINI

Project number	FST/2005/177
Project title	Improving economic outcomes for smallholders growing teak in agroforestry systems in Indonesia
Collaborating institutions	Indonesia: Center for International Forestry Research (CIFOR); World Agroforestry Centre (International Centre for Research in Agroforestry); International Center for Applied Finance and Economics Institut Pertanian Bogor; Forestry Research and Development Agency; District Government of Gunungkidul, Yogyakarta Australia: School of Resources, Environment and Society, Australian National University
Project leaders	Dr Dede Rohadi (CIFOR)
Project duration	1 May 2007 – 31 May 2011
Funding	$1,345,710 (ACIAR contribution $790,114)
Countries involved	Indonesia, Australia
Commodities involved	Timber (teak)
Related projects	FST/2008/030, FST/2012/039

Motivation and aims for the project

Teak is among the most valuable timber species in Indonesia; it is used mainly for furniture. In Indonesia, this timber is produced from about 1.2 million hectares of industrial plantations of a state-owned company (Perhutani) and millions of smallholder plantations. Whereas the supply of teak from the industrial plantations has declined by 21% since 2007 (Perhutani 2008) to 431,517 m^3 in 2013 (Perhutani 2014), the supply from smallholder plantations is increasing. Smallholder teak plantation therefore plays an increasing role in supporting furniture industries in the country, and providing income opportunities for farmers.

However, to move forward as more commercial businesses, smallholder teak plantations in Indonesia are facing various impediments, including:

- low quality of timber as a result of poor silviculture
- lack of capital to invest in teak planting and an inability to wait for the duration of a teak rotation before obtaining returns
- limited access to market information and linkages, leading to prices that are well below market rates, with high transaction costs for timber merchants
- unfavourable policies in smallholder teak production and marketing.

This project addressed these impediments and aimed to improve the economic benefits for the teak growers in Indonesia through three main objectives:

- improving returns for smallholder teak producers by introducing and adapting silvicultural technologies
- providing incentives for smallholder participation in profitable teak production by identifying and designing financing schemes
- enhancing market access by smallholder teak producers.

The project, which was undertaken during 2007–12, was funded by ACIAR with a total research budget of A$810,114; it was implemented in Gunungkidul District, Province of Yogyakarta. The project was led by the Center for International Forestry Research (CIFOR) and involved several research institutions at international, national and local levels: the World Agroforestry Center (International Centre for Research in Agroforestry—ICRAF), the Australian National University, the Forestry Research and Development Agency, the International Centre for Applied Finance and Economics Institut Pertanian Bogor (InterCAFE-IPB), and the Kelompok Kerja Hutan Rakyat Lestari (Pokja HRL)—a consortium of NGOs under the District Government of Gunungkidul, Yogyakarta. All of the partner organisations were involved from the beginning of preparation of the research proposal.

Outputs–what the project produced

The project produced some technical and policy outputs, and built capacities among project beneficiaries. The technical outputs were described in technical reports (the final project report was published by ACIAR, and 11 unpublished technical reports complemented the final report), four policy briefs, three datasets and a survey questionnaire, three journal articles, eight conference papers, a manual book (in English and Bahasa

versions), four posters, five newsletters, three media releases and a video film. The policy outputs were produced in the form of four policy briefs, which were presented to the relevant policymakers at district level (the District Government of Gunungkidul), national level (the Ministry of Forestry) and global level (the boards of trustees of CIFOR and ICRAF).

The technical outputs addressed various problems experienced by smallholder teak growers in running their teak plantation businesses. The project provided farmers with practical tools on silvicultural and timber marketing strategies to improve the economic benefits from their teak plantations. It also provided farmers with a microfinance scheme and an institution model to help them access microcredit. On the policy front, policy briefs produced by the project covered policy and intervention options for policymakers at the local, national and global levels for improving the performance of smallholder timber plantation businesses. Among these project recommendations, some proposed follow-up actions have been delivered to the local government of Gunungkidul District. The project also proposed a revision of government regulation to simplify procedures for smallholders to obtain timber transport documents and reduce their transaction costs in marketing timber.

Besides the technical and policy outputs, the project has strengthened the capacity of individuals, groups and institutions, particularly at local and national levels. The project has increased the knowledge, skills and networks of these beneficiaries. At the local level, the project has trained about 1,200 personnel—mostly smallholder teak farmers in the district of Gunungkidul—particularly in the application of silvicultural techniques and marketing strategies for their teak plantations. The project also established six farmer demonstration trials (FDTs) as learning tools for farmers to practise good silviculture techniques. The project trained a number of farmers in operating a microfinance institution (LKM Gunung Seribu) to apply microfinancing schemes for teak growers. In addition, the project developed business networks for collaboration between farmer groups, government agencies and private timber companies.

Teak logs produced from small holder plantations. (Photo: Dede Rohadi)

In the context of research and development, at least 29 project personnel from seven institutions gained valuable experiences in conducting cooperative research to plan, implement, evaluate and report on various project activities. Their research knowledge and skills have improved through activities such as designing research methodology; undertaking surveys, focus group discussions, cross visits and training; establishing demonstration trials; analysing data; and writing reports. The project also supported several project team members and non-members in completing their studies. Seven people completed PhD programs, one person completed a Masters program, and two students completed undergraduate programs. All of these people were supported by the project through their involvement in the project activities, and access to data and information produced by the project.

Adoption–how the project outputs are being used

Project outputs have been used by project researchers and farmers in various ways at village, district, national and global levels. At the village level, the knowledge and skills from the project have been used by farmers to improve their teak plantation management and timber marketing strategies. Based on responses from surveyed farmers (74 farmers in total, comprising 24, 28 and 22 respondents on silviculture, microfinance and marketing aspects, respectively), the uptake of project outputs by farmers surveyed averaged 64%. Uptake of silviculture practices was higher (75%) than uptake of microfinance (57%) and marketing (59%) aspects.

Various levels of adotpion of project ouputs can be identified. Adoption level 3 (AL3) refers to considerable adoption by both farmers who participated in the project and farmers outside the project (non-participant farmers), indicating an impact on the broader farming community. Survey responses on silviculture outputs showed that 21% of farmer respondents identified as non-participants who have made considerable use of silviculture outputs from the project (AL3); 29% were project participant farmers who have made considerable use of silviculture outputs (adoption level 2—AL2); 25% were participating farmers who have only made some use of silviculture outputs (adoption level 1—AL1); and 25% of farmers had not taken up project silviculture outputs (adoption level 0—AL). The adoption of silviculture aspects was indicated by an increase in farmers' knowledge and skill in implementing some silviculture techniques, such as using high-quality seedlings, and applying thinning and pruning on their teak trees. The use and adoption of project facilities and intermediate outputs of the silviculture aspect—that is, the FDTs and the manual book for managing smallholder teak plantations—were limited to some farmer groups. The adoption rate is expected to increase in the future as a result of the existence of trained farmers and extension officers, and the continuing use of FDTs in future research activities.

The adoption rate of microfinance outputs can be categorised as *Nf*: the outputs were considerably adopted by initial users and to some extent by final users. Farmer responses to the survey can be categorised as 3% non-participant farmers making considerable use of outputs relating to microfinance (AL3), 43% of project participant farmers making considerable use of these project outputs (AL2) and 11% of project participant farmers making only some use of these outputs (AL1); the remaining 43% had not taken up the project microfinance outputs. The bookkeeping techniques introduced by the project were satisfactorily adopted and practised by a farmers' group savings and credit association. The adoption of the microfinance institution model was still challenging and needs more intensive extension activities.

The adoption of marketing outputs can be categorized as *NF*: the project outputs were considerably adopted by both initial and final users. Farmer responses to the survey were distributed as 23% AL3, 13% AL2, 23% AL1 and 41% AL0. Respondents stated that their market awareness had improved, and some farmer groups have developed market linkages with industries. The linkage between farmer groups and industries was demonstrated by the practice of supplying certified teak logs from farmers' groups to furniture industries.

At the national level, the project results were widely accepted by different parties, especially by policymakers in government institutions. The project recommendation to simplify regulation for the smallholder timber trade was well received by the Ministry of Forestry, and a new regulation (no. 30/2012) simplifies the procedures for smallholders obtaining timber transport documentation. At a broader level, many of publications produced by the project have been cited in scientific papers and used by policymakers. Various project outputs, both published and unpublished materials, have contributed to the pool of knowledge on smallholder timber plantations.

The adoption rate is expected to increase in the future when better silvicultural practices by farmers produce better growth and stem quality in their teak stands. In particular, it is anticipated that farmers will be more motivated to invest in good silviculture practices once they realise increased economic benefits from their timber selling. The intensity of the extension program implemented by the extension agencies will be the main driving factor for increasing the adoption of various project outputs at the farm level.

Impact–the difference the project has made or is expected to make

The project has great potential for economic impact on smallholder teak plantations in the medium and longer terms (about 5–10 years). This positive impact for farmers is anticipated as a result of 1,200 well-trained farmers who have adopted (64% uptake of project outputs) good silviculture practices, microfinance schemes and better timber marketing strategies developed by the project. The impact could be increased by the existence of a significant number (33%) of these trained farmers who voluntarily engaged in disseminating project results. Some farmer groups have practised collective marketing by supplying Forestry Stewardship Council–certified teak to furniture manufacturers. Besides the higher price premium (as much as 30% compared with uncertified timber), this collective marketing approach has increased the capacity of farmer groups to manage their collective assets, and develop mutually beneficial cooperation between farmer groups and furniture manufacturers.

Over the past few years, the area of smallholder teak plantations in Gunungkidul District has increased by 46%, from 28,675 ha in 2008 to 41,954 ha in 2013. Accompanied by better timber management practices, this increase in smallholder timber plantations will benefit the wider community in Gunungkidul District and allow the district to become an important supplier of teak wood to furniture industries in the region.

The revised policy on smallholder timber trade regulation has resulted in intended and unintended impacts. The revised regulation has simplified the procedure for obtaining timber transport documentation. This has lowered the transaction costs and provided greater opportunities for teak growers to obtain higher farm-gate prices from brokers. An unintended impact of this regulatory revision has been difficulty for the District Office of Forestry and Estate Crops in monitoring statistics for timber trade and production. Governments now need to allocate a modest budget to monitor timber production and trade from the district area.

The project increased the research capacity of the individual scientists and research institutions who were involved. It also strengthened research collaborations among research institutions, and developed networks between research institutions and senior decision-makers and policymaking organisations, including national and local government institutions, universities, and international and national NGOs, through their involvement as Project Advisory Group members. The project also contributed to raising the importance of smallholder timber plantation issues in the national and global research agenda.

The future impact of this project will be higher when markets recognise and reward improved smallholder timber quality. A higher selling price for better-quality timber will motivate farmers to apply better silvicultural practices. Strong commitment from governments, especially in providing intensive training programs for more smallholder growers in Indonesia in the use of project outputs, will increase the impact and benefits arising from the project. The project provided useful lessons for ACIAR as a funding agency by demonstrating the effectiveness of an action research approach to increase the adoption of project outputs and subsequently smallholder impacts.

References

Perhutani 2008. Naskah Rencana Jangka Panjang Perhutani 2008–2012. At <https://transformpht.files.wordpress.com/2010/05/naskah-rjp-2008-2012.pdf>, accessed 5 May 2015.

Perhutani 2014. Statistik perum Perhutani tahun 2009–2013. At <https://app.box.com/s/a8dsohnu4fec3o5kfc4f>, accessed 5 May 2015.

Improving the value chain for plantation-grown eucalypts for sawn wood in China, Vietnam and Australia: silviculture and genetics (FST/1999/095)

MICHAEL HENSON

Project number	FST 1999 095
Project titles	Improving the value chain for plantation-grown eucalypts for sawn wood in China, Vietnam and Australia: silviculture and genetics
Collaborating institutions	Australia: State Forests of New South Wales; Queensland Department of Employment, Economic Development and Innovation China: Guangxi Forest Research Institute; China Eucalypt Research Centre; Hunan Provincial Forestry Department; Chinese Academy of Forestry Vietnam: Forest Science Institute of Vietnam
Project leaders	Australia: Michael Henson (State Forests of New South Wales) China: Chen Shaoxiong (China Eucalypt Research Centre)
Project duration	1 July 2005 – 31 December 2009
Funding	$2,017,806 total (ACIAR contribution $677,613)
Countries involved	People's Republic of China, Vietnam
Commodities involved	Forestry
Related projects	FST/1999/042, FST/2001/021

Motivation and aims for the project

This project aimed to improve understanding of the levels of variation in key wood properties with changes in silviculture and genetics, and, in turn, the impact on log value in plantation-grown eucalypts in Vietnam, China and Australia. The project developed and evaluated a range of destructive and non-destructive methods and tools to assess wood property traits in standing trees and felled logs. It worked closely with the associated ACIAR project FST/2001/021 to which it provided logs characterised for wood properties that were used in sawing and veneer trials. A large part of the project was providing training to project participants in the assessment, analysis and interpretation of wood property data.

Outputs–what the project produced

The project completed comprehensive growth and wood quality assessments in six genetic and three silvicultural trials across a range of eucalypt species in the three partner countries. Relationships between acoustic velocity and key structural wood properties were developed in a range of species. Correlations between pilodyn pin penetration and basic density were also developed. Tools—including Pilodyns, Fakopps and mechanical core borers—were provided to project participants in China and Vietnam. One key result of the project was the development of a method for evaluating variations in dimensional stability (collapse and shrinkage) using small sample blocks.

Seat Components made from Eucalypt Plywood in Dongmen, Guangxi (Photo: Xiang Dongyun)

Wood property data generated in the project were used to develop improved eucalypt germplasm in the three partner countries, and significantly improved the understanding of the impact of silviculture on key wood property traits. Data from this project have been used to support key molecular genetic studies in Eucalyptus pilularis and E. urophylla. At least 13 peer-reviewed journal articles and 20 conference presentations have been published based on work completed in this project.

One of the key outcomes was capacity building in partner institutions through a combination of formal and on-the-job training. During the project, one PhD, three MSc and one undergraduate Honours project were completed. Work completed as part of the project also contributed to a range of postgraduate degrees that were obtained in China after completion of the project.

Adoption and impacts of project outputs

During the project, significant changes occurred in forest policy and the area of hardwood plantations in each of the three partners countries. These changes have significantly influenced the degree of adoption of project outputs in these countries:

- Significant expansion of the eucalypt plantation estate in Guangxi, China, occurred as a result of government policy and marker signals. In contrast, there has been a decline in eucalypt plantation area in other Chinese provinces (Guangdong, Hunan and Fujian) in recent years, as a result of environmental concerns and a series of severe climatic events. The market for eucalypt logs has also changed dramatically since the project commenced, with a rapid expansion in the veneer market across China and the ability to produce veneer sheets from small-diameter logs (>6 cm small-end diameter) using cheap spindleless lathes.
- The Vietnamese hardwood plantation area has significantly expanded. The increase has been dominated by short-rotation Acacia plantations to feed the export woodchip market.
- A decline in the hardwood sawmill industry in Australia, coupled with a lack of policy commitment and a financing crisis in the hardwood plantation sector, has led to a decrease in interest in eucalypt sawlog plantation management in Queensland and New South Wales.

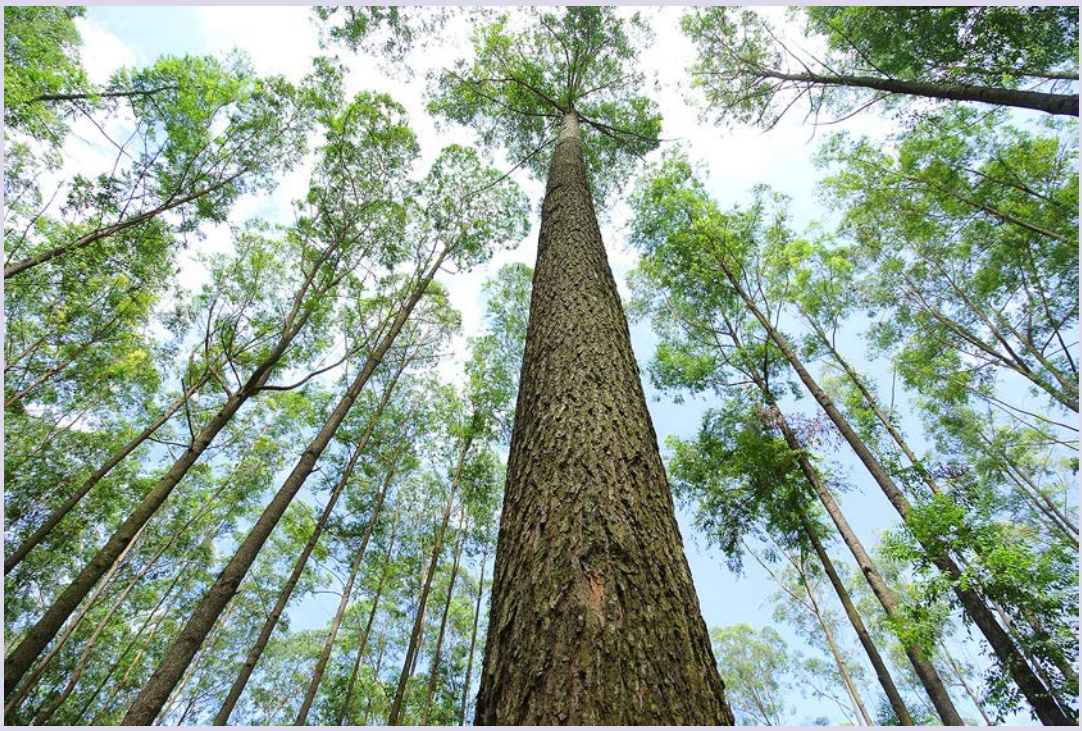
Adoption of the project results has been greatest in Guangxi Province in China, where government policy is directly supporting the development of longer-rotation eucalypt plantations. Many of the methods and techniques for wood property assessment evaluated in the project are still being used across a range of new and existing eucalypt species in the province. Uptake of results in other provinces of China has been less because of a refocusing of activities away from Eucalyptus to higher-value premium timber species in key government-funded institutions.

Adoption to date in Vietnam has been good, with the continued use of wood quality assessment methods and tools across a range of Acacia and Eucalyptus breeding populations. In Australia, adoption has been poor; this is partly the result of the Australian institutions involved in the project restructuring and downsizing their research and development efforts.

Both Vietnam and China (specifically Guangxi Province) are focusing more effort on the development of longer-rotation Eucalyptus and Acacia plantations. This is to address environmental concerns associated with short-rotation tree crops and increasing labour costs, as well as to improve the local 'value add' component of the industry. It is envisaged that the level of adoption of this project's results and its impact will increase with time as Vietnam and China adopt longer-rotation hardwood plantations.

In both Vietnam and China, the focus is (and will be) genetic improvement. Little effort seems to be placed on optimising the silvicultural management of the plantations to improve log value. This situation may have been improved if the project had established a series of long-term silvicultural trials in the partner countries. Such trials were originally included in the project, but were dropped as a result of budget constraints.

The completion of a joint mid-term review of FST/1999/095 and FST/2001/025 would have benefited both projects by refocusing the work and strengthening the cooperation between the projects in their later years. Both projects were developed based on the Australian experience of a eucalypt sawlog industry developed on large native forest logs transitioning to smaller and younger regrowth and plantation logs. As a result of this focus, an opportunity was missed to work more with the rapidly developing veneer industry in China using small plantation eucalypt logs. This industry is now the dominant market for plantation-grown timber in China and is rapidly expanding into Vietnam. The techniques, know-how and knowledge developed in FST/1999/095 could assist the industry to capture increased value, which will be required to offset increasing labour costs.



Eucalyptus cloeziana in Dongment, Guangxi (Photo: Michael Henson)

Reports in the Adoption Studies Series

McWaters V. and Templeton D. (eds) 2004. Adoption of ACIAR project outputs: studies of projects completed in 1999–2000. Australian Centre for International Agricultural Research: Canberra.

McWaters V., Hearn S. and Taylor R. (eds) 2005. Adoption of ACIAR project outputs: studies of projects completed in 2000–2001. Australian Centre for International Agricultural Research: Canberra.

McWaters V. and Davis J. (eds) 2006. Adoption of ACIAR project outputs: studies of projects completed in 2001–2002. Australian Centre for International Agricultural Research: Canberra.

Gordon J. and Davis J. (eds) 2007. Adoption of ACIAR project outputs: studies of projects completed in 2002–2003. Australian Centre for International Agricultural Research: Canberra.

Pearce D. and Davis J. (eds) 2008. Adoption of ACIAR project outputs: studies of projects completed in 2003–2004. Australian Centre for International Agricultural Research: Canberra.

Pearce D. and Templeton D. (eds) 2009. Adoption of ACIAR project outputs: studies of projects completed in 2004–2005. Australian Centre for International Agricultural Research: Canberra.

Pearce D. and Templeton D. (eds) 2010. Adoption of ACIAR project outputs: studies of projects completed in 2005–06. Australian Centre for International Agricultural Research: Canberra.

Pearce D. and Templeton D. (eds) 2011. Adoption of ACIAR project outputs: studies of projects completed in 2006–07. Australian Centre for International Agricultural Research: Canberra.

Jilani A., Pearce D. and Templeton D. (eds) 2013. Adoption of ACIAR project outputs: studies of projects completed in 2007–08. Australian Centre for International Agricultural Research: Canberra.

Pearce D., Jilani A. and Templeton D. (eds) 2013. Adoption of ACIAR project outputs 2013. Australian Centre for International Agricultural Research: Canberra.

Jilani A., Pearce D. and Alford A. (eds) 2015. Adoption of ACIAR project outputs 2014. Australian Centre for International Agricultural Research: Canberra.

Pearce D. and Alford A. (eds) 2015. Adoption of ACIAR project outputs 2015. Australian Centre for International Agricultural Research: Canberra.

Adoption of ACIAR project outputs 2015

ACIAR

aciar.gov.au