Inquiry into rural skills training and research

House of Representatives Standing Committee on Agriculture, Fisheries and Forestry

CSIRO submission

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Acronyms used

APSRU	Agricultural Production Systems Research Unit
ATFI	Australian Tropical Forest Institute
BCG	Birchip Cropping Group
CRC	Co-operative Research Centre
CRRIQ	Centre for Rural Research and Innovation Queensland
CSE	CSIRO Sustainable Ecosystems Division
CSIRO	Commonwealth Scientific and Industrial Research Organisation
EPA	Queensland Environmental Protection Agency
ICT	information and communication technologies
IVCF	Internal Venture Capital Fund
JCU	James Cook University
NAPSWQ	National Action Plan for Salinity and Water Quality
NHT	Natural Heritage Trust
NRM	natural resource management
QDPIFF	Queensland Department of Primary Industries, Forestry and Fisheries
SDI	Queensland Department of State Development and Innovation
TLJV	Tropical Landscapes Joint Venture
UQ	University of Queensland

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Background

Maintaining and enhancing the skills base in rural and regional Australia is well recognised as a critical driver for economic prosperity, environmental sustainability and the ongoing viability of regional communities.

While the increasing pace of technological change and environmental understanding has made the delivery of relevant and far-sighted rural education and research services even more important, the provision and availability of education and research services in non-urban areas remains a challenge.

CSIRO's geographic spread across urban and rural Australia enables it to bridge the divide between on-the-ground farm and rural activities, agribusiness, educational services and government policy makers at both State and Federal level. Our submission is designed to provide an overview of the current position and highlight opportunities for change.

CSIRO's Role and Relevance to the Rural Skills Issues

CSIRO's functions are set out in the Section 9 of the SCIENCE AND INDUSTRY RESEARCH ACT (1949) (see Appendix 1). Many of these functions are relevant to the Inquiry into Rural Skills Training and Research and include:

Research and Application of Research (a primary objective for CSIRO under the Act)

- Carry out scientific research for industry, the community and national objectives;
- Facilitate application or utilisation of results of such research.

Training (a secondary objective for CSIRO under the Act)

- Train researchers in association with tertiary-education institutions;
- To establish and award fellowships and studentships for research.

Dissemination of information (a secondary objective for CSIRO under the Act)

- To collect, interpret and disseminate information relating to scientific and technical matters;
- To publish scientific and technical reports, periodicals and papers.

Approximately 40% of CSIRO's research and development portfolio is directed towards economic and environmental performance of Australia's rural regions in fields of relevance to the Standing Committee on Agriculture, Fisheries and Forestry. This portfolio represents an annual investment of about $220M of CSIRO's appropriation income matched by a further investment of approximately $150M from external sources such as industry and rural research corporations. CSIRO's interest in the issue of rural skills extends from the availability of scientific skills relevant to the needs of Australia's rural industries and regions through to the availability of skills in rural industries and communities necessary for the uptake and application of CSIRO's research outputs.

Forces shaping the needs for and availability of rural skills

CSIRO recognises a number of forces are shaping the current availability of rural skills and the likely need for additional or different skills into the future. In this section we explore these issues as a foundation to subsequent sections where we outline CSIRO's current activities and opportunities for additional contributions.

We examine these issues in terms of:

- the availability of rural research skills (e.g. for recruitment within CSIRO);
- the availability of other professional and para-professional skills in rural industries and regions;
- the availability of capacity within rural communities to engage effectively in dialogue and decision making that enhance rural livelihoods and sustainability; and
- the capacity for uptake and application of research innovations.

Rural research skills

The decline in the number and academic standard of students attending Australian universities to study agricultural subjects has created a flow-on effect for CSIRO Divisions with rural research

activity; in short, there is a very limited supply of suitably skilled research scientists emerging from higher degree programs run by the Australian tertiary sector.

While the supply of Australian-trained rural researchers in agriculture or natural resource management has become increasingly restricted, the demand for skilled professionals has continued to grow. In particular, CSIRO has struggled to recruit staff with well-developed skills in research innovation and a capacity to operate in cross-disciplinary teams. Biological or physical scientists with a depth in one or more disciplines, a capacity to work in partnerships with social and economic researchers, and an ability to deploy their skills and knowledge in real-world situations continue to be in short supply. CSIRO has attempted to fill positions via increased emphasis on international recruitment. International recruitment brings with it many positives and is a necessary feature of globally competitive research institutions; however, CSIRO believes it needs to be balanced with a healthy flow of Australian-trained higher degree graduates to ensure maximum effectiveness of our research and educational institutions.

Other professional and para-professional skills

The level of technology deployed in rural industries and regions continues to grow. Leading farmers make use of sophisticated services in crop and animal science. Increasingly the private agri-business sector is supporting advanced monitoring, planning, decision support and contracting services. There has been a trend for State agencies to reduce their involvement in provision of rural extension services, particularly on a direct one on one basis. In some regions private agri-industry has grown to fill this gap but this has not always been the case.

The regulatory environment in which rural industry operates has also become more complex, generating additional demands for skills in environmental assessment for planning approvals, occupational health and safety, accreditation of industry practices in relation to food safety or environmental performance.

Capacity of rural communities.

Additional demands are being placed on rural communities to engage in local planning and decision making. Further, communities are increasingly expecting to participate in planning and decision making that affects their region and future. These phenomena are well advanced in relation to natural resource management and environmental protection, which is increasingly characterised by community-based governance mechanisms (e.g. catchment management or regional NRM boards). This is placing additional demand for skills in rural leadership, community facilitation, organisational governance as well as knowledge in issues of natural resource management.

While information and communication technology (ICT) services to rural areas still lag behind those available in urban areas, any consideration of the future needs for and supply of skills in rural areas must acknowledge the potential for ICT to play an increasingly important role.

CSIRO's current contributions

CSIRO currently contributes to Australia's needs for rural skills training and research via a diverse range of mechanisms. The network of CSIRO physical and experimental sites located in rural regions supports these contributions. Examples are outlined below.

Formal collaborations with Universities

CSIRO has an extensive set of formal (and informal) collaborative activities with Australia's tertiary-education sector. In total, CSIRO staff co-supervise over 550 higher degree students and a large proportion of these research students are working in areas relevant to future research skills for rural Australia. In many of these student projects, CSIRO provides the opportunity for the student to engage in practical research activity of direct relevance to the economic and environmental challenges facing rural Australia. In addition to this role in joint supervision of research students, CSIRO is increasingly becoming involved in formal joint ventures with Universities to provide the foundation for a more deliberate and strategic joint research and capability building effort. Some current examples (not intended to be comprehensive) include:

- a partnership with the University of Queensland and Queensland government agencies in the Centre for Rural Research and Innovation Queensland (CRRIQ). (see Appendix 2 for more details);
- a joint venture with James Cook University with the objective of strengthening the institutional capacity in research and training around issues concerned with the sustainable management of tropical landscapes (see Appendix 2 for more details);
- a partnership with University of Tasmania to support the development of research skills in marine science;
- a partnership with Charles Sturt University in Wagga Wagga on land and water management;
- the "Riverlink" partnership linking CSIRO research activity in the Sunraysia district of Victoria with post-graduate programs at La Trobe University;
- Rangelands Australia, an Australia-wide initiative committed to building capacity for a strong future for Australian rangelands by providing relevant and practical learning opportunities, is being supported via a number of postgraduate scholarships and CSIRO staff have had input into course design and content (http://www.rangelands-australia.com.au/); and
- the University of New England (Armidale, NSW) is using the decision support package, GrassGro, which helps farmers make decisions about their agricultural enterprises, in its teaching program.

Co-operative Research Centres (CRCs)

CSIRO works collaboratively with other CRC partners to deliver specialised knowledge to rural communities. This involves establishing close relationships between the project team and the people, businesses, community groups and institutions that make up a community. Key CRC partnerships of high relevance to the issues before this inquiry include: Cotton CRC, CRC Sustainable Production Forestry, CRC Irrigation Futures, CRC Plant Based Management of Dryland Salinity, CRC Rainforest, CRC Tropical Savannas, CRC Desert Knowledge; CRC Rice; and eWater CRC.

Formal training for clients (practical skills) – practitioners (farmers, agri-industry, NRM groups)

CSIRO research has produced a range of decision support products for rural industries and is involved in the formal training of potential users of such products – frequently private agri-industry consultants or public extension staff. Examples include:

- Decision support software packages including CottonLOGIC, VineLOGIC, GrazFeed, maNAge-rice and maNAge-wheat, and 'Lime and Nutrient Calculator' that assist farmers in making best management practice decisions for their enterprises. For example, GrazFeed has been the basis of much knowledge transfer about grazing animal nutrition that is taught in PROGRAZE courses – about 5000 graziers have attended such courses.
- GrassGro is used extensively at the University of New England in teaching undergraduates a systems approach to grasslands management. This is about training the next generation of informed farmers and extension and research workers. Eight other universities are now following this example. The tools are also used for postgraduate work.

Production of various forms of knowledge-based products for dissemination

CSIRO has a long history of working closely with rural industries and communities to deal with issues related to managing and transfer of information. This research aims to design, develop and pilot training programmes for the use of leading-edge information technologies to allow Australian farm businesses to better deal with climate, market and environmental risks through the use of decision support systems.

Dissemination of research results currently occurs through a variety of mechanisms such as:

- the provision of written support material on research outcomes tailored to rural audiences including farmers and agronomists;
- media releases that are often picked up by the rural media; and

- the CSIRO websites which provide a range of information to assist the rural community understand and adopt research results relevant to them.

Informal alliances - learning in action

The value of "learning in action" partnerships has been increasingly recognised in research as an effective means to increase the relevance and impact of research on "real-world practice". In such partnerships, researchers and practitioners work closely with one another, research knowledge and practical knowledge grow side by side, and both researchers and practitioners learn from the exercise. Current "learning in action" partnerships are being undertaken with farmer groups, industry sectors, catchment and conservation groups and authorities, or, in a more limited number of cases, with local government institutions.

Some examples include:

- CSIRO is involved in significant collaborative projects to service the plantation sector in the rural regions of southeast SA, southwest VIC, southwest WA, southeast QLD, and Tasmania. The vast majority of these projects explicitly encompass an extension component to ensure rapid uptake and impact.
- CSIRO has on-going informal partnerships with Australia's leading farmer groups. These groups are owned and managed by farmers, frequently engage professional or para-professional staff, undertake research and extension activity and are playing an increasingly important role in sustaining innovation and fostering partnerships with the formal research sector. An example of such a relationship with the Birchip Cropping Group (BCG) is described in Appendix 3.

Additional activities relevant to rural skills training

CSIRO is engaged in a number of other activities that, whilst relevant to the issue of rural skills, don't fit neatly under the categories provided above. These include:

- Summer studentships (24 students participated in the CSIRO Plant Industry 2004-2005 summer studentship program, drawn from a variety of rural areas across States)
- The Australian Rural Leadership Program is supported by CSIRO. In 2004 CSIRO Sustainable Ecosystems supported a scholarship for one staff member as well as one for an indigenous Australian. In 2005 another staff member will participate with CSIRO's support (http://www.rural-leaders.com.au/).
- CSIRO's regional facilities actively cooperate with local schools to provide work experience for secondary pupils. In some cases this represents the only local opportunity for students to gain experience working in an R&D environment. Feedback over the years has indicated that the decision of some individuals to follow a scientific career was a direct consequence of work experience provided through this program.

Indigenous livelihoods

CSIRO is working to enhance the delivery of extension services to indigenous communities to support sustainable livelihoods, particularly in the development of native foods, land management, rainforest management and is particularly active in the Northern Territory and North Queensland. Partnerships with Charles Darwin University, James Cook University and the Desert Knowledge CRC are significant in this regard.

Women and new technologies in natural resource management

CSIRO recognises that sustainable rural communities are made up of people with diverse skills and backgrounds. In the past, agricultural industries and rural communities have not given full recognition and consideration to the training and skills enhancement needs of all sections of these communities. In one CSIRO project, for instance, we work with rural women to boost their participation in natural resource management through the use of new knowledge based technologies. This includes a pilot study on impediments to and opportunities for women's use of technology in rural areas.

CSIRO's future strategy

The traditional concepts of a linear progression from research to development to extension are increasingly being replaced by a more dynamic interaction between all parts of the knowledge and innovation chain – public research agencies, educational institutions, private agri-business, self-organised rural industry groups and a broad set of community organisations. In addition, the rapid developments in the information and communications technology environment are likely to continue to have a profound impact on rural areas, in terms of access to training and research services and in access to knowledge. As a result CSIRO believes that the rural skills needs and strategies of the future are likely to be different from those of the past.

CSIRO has three key elements of strategy moving forward in the area of rural skills training and research, namely:

- Continuation and expansion of formal partnerships with the tertiary-education sector, targeting key gaps in the rural research skills mix. While these partnerships could potentially involve any Australian university, there will be an inevitable focus on those located in regional areas where the supply of research skills does not meet the demand. The examples discussed in this paper of sustainable landscape management (with James Cook University) and indigenous livelihoods (with Charles Darwin University) are good examples of such foci
- Continuation and expansion of relationships with the private sector agri-business groups engaged in the delivery of customised "knowledge-based" service delivery with rural industries. CSIRO's role would be in the development and support for advanced decision support approaches and in the development of appropriate quality control and accreditation procedures. The private sector's role would be in the one-on-one delivery of knowledge based support, based upon a commercially sustainable business model.
- Continuation and expansion of a suite of innovative partnerships with rural industry and community groups. These partnerships would go beyond a narrow "extension", "technology transfer" or "decision support" paradigm, and represent a new frontier for how research institutions can partner with these groups to enhance the relevance and impact of the research. We expect information and communications technologies to play an increasingly important role in supporting these partnerships, both in terms of access to knowledge products and services and remote access to leading researchers and research teams.

Recommendations

CSIRO recommends that the Committee adopt a broad view of skills and training that can meet the needs of Australia's rural areas. While the "knowledge and innovation system" needs to remain firmly based upon our formal educational institutions, we see an increasing role for public research organisations, private agri-business, community-based natural resource management bodies and other rural industry bodies to contribute to future rural skills and training.

Explicit recognition of the value of partnerships with R&D organisations, such as CSIRO, could be more strongly developed in future government programs such as NAPSWQ, NHT, FarmBis, Regional Partnerships, and so on. With the boundaries between formal research and practical action increasingly blurred by participative research approaches, CSIRO recognises opportunities to contribute to rural skills through its involvement as a partner in such programs. There may be a case for enhanced support from government for skills training at a community level in new technologies and natural resource management systems. While CSIRO would not see its role being to deliver such training, it does see it has a role in piloting innovative technologies, materials and approaches in practice situations, prior to wider application via other training mechanisms.

In terms of the availability of higher level agricultural and natural resource management research skills, CSIRO sees that focused partnerships with the University sector as the most constructive way forward. The Cooperative Research Centre (CRC) program has been one formal means of establishing and supporting such partnerships and CSIRO sees value in continuing support from government for this program. In addition, CSIRO will continue to direct its resources into partnerships with universities in areas of perceived need.

Appendix 1

Science and Industry Research Act (1949) Section 9 - Functions of the Organisation

(1) The functions of the Organisation are:

(a) to carry out scientific research for any of the following purposes:

(i) assisting Australian industry;

(ii) furthering the interests of the Australian community;

(iii) contributing to the achievement of Australian national objectives or the performance of the national and international responsibilities of the Commonwealth;

(iv) any other purpose determined by the Minister;

(b) to encourage or facilitate the application or utilisation of the results of such research;

(ba) to encourage or facilitate the application or utilisation of the results of any other scientific research;

(bb) to carry out services, and make available facilities, in relation to science;

(c) to act as a means of liaison between Australia and other countries in matters connected with scientific research;

(d) to train, and to assist in the training of, research workers in the field of science and to co-operate with tertiary-education institutions in relation to education in that field;

(e) to establish and award fellowships and studentships for research, and to make grants in aid of research, for a purpose referred to in paragraph (a);

(f) to recognise associations of persons engaged in industry for the purpose of carrying out industrial scientific research and to co-operate with, and make grants to, such associations;

(h) to collect, interpret and disseminate information relating to scientific and technical matters; and

(j) to publish scientific and technical reports, periodicals and papers.

(2) The Organisation shall:

(a) treat the functions referred to in paragraphs (1)(a) and (b) as its primary functions; and

(b) treat the other functions referred to in subsection (1) as its secondary functions.

Appendix 2

Examples of CSIRO – University Joint Ventures

Centre for Rural and Regional Innovation Queensland

The Centre for Rural and Regional Innovation Queensland (CRRIQ) was formed in 2001 as an unincorporated joint venture between the University of Queensland and the Queensland Department of Primary Industry, Forestry and Fisheries (QDPIFF). CRRIQ's mission is to provide knowledge, training and creative ideas that will enhance the development of social, economic and environmental capital across rural Australia. The genesis of CRRIQ emerged from a recognition that serious problems continue in sustainable land management practices and that a paradigm shift is needed in the mindset that dominates land management thinking, enabling the removal of institutional barriers for change.

The CRRIQ partners have identified four critical challenges facing rural and regional Australia:

1. building resilience;
2. innovative responses;
3. grappling with new forms of governance; and
4. removing barriers to change.

Accordingly, CRRIQ targets four interrelated dimensions across and along which change needs to occur: Reading country, Entrepreneurial community development, Stewardship and Livelihoods. It aims to address these challenges by:

1. building capacity for innovation;
2. fostering innovative rural community development;
3. supporting and fostering new and emerging ideas.

The nature of involvement by CSIRO Sustainable Ecosystems (CSE) in CRRIQ is to invest in R&D and capacity building via a joint investment portfolio including:

- QDPIFF-UQ-CSE research projects;
- PhD scholarships program;
- Shared contribution (0.33) to the funding of the CRRIQ Director.
- Participation in CSE IVCF (via joint CSE-UQ-QDPIFF proposals);
- Joint supervision of postgraduate students;
- Contribution of CSE staff to course development; and
- Participation of CSE staff in CRRIQ training activities (on a fee for service basis).

Activity in each of these areas focus on the following core issues of importance to rural and regional Australia:

- Capacity building for innovation;
- Innovative and entrepreneurial rural development; and;
- Creative thinking for possible futures

Tropical Landscapes Joint Venture (TLJV)

CSIRO is negotiating with James Cook University (JCU), the Queensland Department of State Development and Innovation (SDI) and the Queensland Environmental Protection Agency (EPA) regarding co-location at the Australian Tropical Forest Institute (ATFI) in Cairns. Included within the ATFI is the proposed Tropical Landscapes Joint Venture – a research alliance between JCU and CSIRO drawing on CSIRO's ecological expertise, and JCU's unique position as a tropical research university of excellence.

The initial program areas proposed for TLJV are:

- Enhanced NRM planning and management for contested coastal landscapes
- Sustainable coastal production systems
- Sustainable coastal communities

Appendix 3

Learning in action – the CSIRO partnership with the Birchip Cropping Group

Birchip Cropping Group (BCG) is a leading example of a farmer owned and managed institution that aims to advance the interests of rural communities and industries through direct involvement in research and development. The BCG is a farmer-driven agricultural organisation operating as a not-for-profit incorporated association, conducting applied research and extension on all the major crops grown in the region. The Group aims to investigate the critical success factors that ensure sustainable and profitable crop production systems. Improved viability of local rural communities is also a priority.

The BCG has trial sites at several locations in the Mallee, Wimmera and North Central regions, covering all the major soil types and climate zones. The Group has 500 farm business members. These members direct the focus of all trial and extension activities through a Trials Subcommittee consisting of farmers, technical and industry representatives. A manual of trial results, distributed free to 6000 farmers in four states has been the BCGs definitive publication.

Over the last five years, CSIRO Sustainable Ecosystems has developed its relationship with BCG via the following projects.

"Yield Prophet" is a participatory research project with farmers that aims to improve the capacity of grain growers to deal with between season climate variability in their management of annual crops. Yield Prophet is an on-line crop production model designed to provide grain growers with real-time information about the crop during growth. Its primary output is the forecast of yield probabilities based on the simulation of crop production from pre-sowing until harvest.

To assist in management decisions, growers enter inputs into a simple web interface at any time during the season to generate reports of projected yield outcomes showing the impact of crop type and variety, sowing time, nitrogen fertiliser and irrigation.

In 2005, Yield Prophet will be capable of simulating wheat, barley and sorghum crops, and the soil water and nitrogen balance of fallows. It uses the Agricultural Production Systems Simulator (APSIM), a mathematical model of crop growth developed by the Agricultural Production Systems Research Unit (APSRU).

CSIRO's capacity to contribute to the real world issues facing a group like BCG has been developed over the last 12 years through its participatory research in the farming systems arena. This research has grown out of the Agricultural Production Systems Research Unit (APSRU) alliance with Queensland state agencies and universities to work on an agricultural simulation for decision making. APSRU provides a significant research capability in Australia on agricultural systems analysis and simulation, and its members add skills which span scales from landscape and catchment, to farm and fields, to organisms.

The FARMSCAPE project has been notable in forging a new approach to farming systems research that combines:

- on-farm monitoring to ensure local relevance
- computer simulation to feasibly explore alternative management possibilities,
- and discussion that combines the perspectives of farmers, advisers, and researchers.

After seven years of action research to create an approach to computer-aided planning and decision-making that 'works' in farm management practice, current research focuses on developing (1) sustainable institutions for delivery of FARMSCAPE tools and services and (2) better theoretical understanding of the interface between systems research practice and farm management practice.

http://www.bcg.org.au/

http://www.apsim.info/apsim/

http://www.farmscape.cse.csiro.au/farmscape/