

Section 3: Research and Development, Education and Training

“The collaboration has the capability to achieve the intended results.”

FFI CRC brings together key industry and research capacity to create and deliver a new generation of opportunities based on the wider use of perennial plants – Profitable Perennials™.

Strengths of the FFI CRC collaboration

The primary strength of the FFI CRC proposal is the comprehensive partnership of participants with capabilities covering the full spectrum of activities along a chain linking all aspects of its research through to commercialisation and adoption.

The impact of new perennial plant systems depends on rapid and comprehensive adoption. The partnership includes key private and public sector participants with adoption focus. Landmark has the largest network of private agronomists in the country and the FFI CRC provides capacity to link their efforts with four participating State primary industry agencies. The adoption capacity is further strengthened by the participation of the RDCs, with their industry level focus on grains, livestock and wood. The Kondinin Group delivers a sophisticated communication network that will provide accelerated awareness of new perennial plant opportunities.

The research task is complex and requires assembly of a wide array of skills and capabilities. FFI CRC will build on CRC Salinity's effective management of multi disciplinary research. The independent review confirmed its stimulation of researchers to embrace their roles in multi disciplinary teams and to integrate their research; and its impressive governance arrangements for their coordination and supervision.

Farmers and the wider industry have already been influential in the priority setting and planning of the research agenda of the bid and they will have further input into implementation.

FFI CRC will draw on, coordinate and focus relevant partner contribution in areas of:

- Analysis and knowledge of industry trends (RDCs, State agencies)
- Detailed knowledge of producer interests and priorities (Landmark, Kondinin Group, State agencies)
- Participation of farmers in research priority setting (RDC networks)
- Direct participation by producers in research (State agencies, CSIRO)
- Formal and informal review and feedback on research relevance and progress by farmers and groups (RDC networks, Landmark agronomists)
- Clear pathway to product testing and adoption (established RDC and industry networks of growers).

The RDCs provide a critical understanding and access to their industry stakeholders, networks and individual producers. This is supported by informal networks and communication channels associated with partners with dispersed networks of staff. Landmark and the State agencies are the key partners with this capability.

Research collaboration and integration

The large number of participants in FFI CRC has been drawn together by their conviction that Profitable Perennials™ offers a pathway to enhancing profitability of dryland farming while improving the natural resource base. The number of partners and their scale of commitment match the scale and complexity of the research and delivery challenge ahead. Meeting this challenge requires a high degree of collaboration and coordination, an important component of the role of FFI CRC. The planned integrated and focused research and delivery process will be achieved by drawing on the pool of expertise and infrastructure within the participants into multi-disciplinary and multi-organisational project teams.

Project activities will be embedded in programs linked to key agricultural industries (livestock, crop etc) ensuring continuity of effort from initiation of the research idea to adoption of products in the hands by end users. FFI CRC acknowledges, through its partner engagement, the changes taking place in 'near to market' aspects of agricultural innovation and particularly the expanding importance of agribusiness and other private sector interests in delivering profitable new systems. It also recognises the growing importance of regions (CMOs) in the near to market delivery of NRM outcomes. Their integration into projects will enhance collaboration and delivery of outcomes.

Managing technical and research risk

Rigorous research planning and management is a strength of CRC Salinity which will be built on in FFI CRC. Key elements of the process involve:

- Wide and continuous consultation with stakeholders
- Active and formal strategic planning supported by industry analysis
- Development of a research portfolio with a framework for explicit attention to balancing research risks
- Rigorous project development involving:
 - teams with emphasis on leadership, skills acquisition and balance (multi-disciplinary and multi-institutional)
 - Industry engagement and involvement in planning
 - Formal project development and documentation (emphasis on pre-experimental phase)
 - Pre-approval review with emphasis on alignment to the committed outcomes, research feasibility and impact
 - Board level oversight and formal project approval
- Regular review (internal and external) of operations, monitoring of progress and outputs (including provision for adaptation to deal with unanticipated outcomes and changing circumstances)
- Formal analysis of impact of outputs and outcomes.

A useful project development tool of in CRC Salinity has involved pre-experimental impact analysis (profit potential, scale of impact and environmental costs and benefits) in the form of a small pre-experimental project.

National collaboration and coordination

FFI CRC will provide efficient national coordination, following on from experience in CRC Salinity. Research investors such as the GRDC, MLA and AWI have used this capability to invest in circumstances where CRC Salinity has delivered national project management and co-ordination. Examples include Sustainable Grazing of Saline Lands and EverGraze, both of which are expected to continue in some form in FFI CRC. Many research initiatives planned for FFI CRC have relevance to most of southern Australia. However, some will have particular local specificity, generally based on climatic differences. Regional initiatives will generally

involve fewer partners, selected for regional relevance. The substantial CSIRO involvement contributes strongly to national collaboration because of its decentralised structure and institutional commitment to key national objectives.

Capability of participants in the collaboration

Perennial plants have a complex mix of forms and uses, with potential to utilise crops, pastures (herbs and shrubs) as well as trees. A particular focus will be on enhanced performance in saline parts of the landscape. While profitability will drive the uptake of new perennial systems, important opportunities and challenges can optimise associated NRM outcomes. Faced with this complexity, FFI CRC has the opportunity to draw on the special skills and capabilities of its partners to produce a focused initiative that creates valuable new products and farming systems.

The research planning process has involved detailed exchanges with partners to identify key scientists with the skills and leadership credentials to match areas of proposed activity and deliver the identified outcomes. This talented and experienced group has formed program teams, based on skills and interests. Multi-disciplinary and multi-institutional teams have been identified with the capability to deliver on the identified outcomes and now form the basis of the in-kind contributions being offered by partners (see SC4). The key individual scientists are identified on a program by program basis and their CVs included as support documents.

The program development team has been coordinated by Dr Mike Ewing who is internationally recognised for his expertise in pasture breeding and farming systems innovation. Appointed acting program leaders have a proven track record in CRC Salinity. Dr Dave Masters, Dr Anna Ridley and Professor David Pannell are all national leaders in their fields. Mr John Bartle is widely recognised nationally for his expertise in innovative forestry initiatives while Mr Ken Wallace provides strong leadership in catchment level management through his expertise in biodiversity and water management. Dr Richard George combines expertise as a hydrologist with an unmatched understanding in Australia of saline land management. Mr Scott Glyde is new to the management group and will lead the education and training initiatives. The wide skills, interests and networking of this team individually and as a group provides the basis for cohesive management. All members of this group have substantial time allocated to the CRC (50-100%) which will allow them to deliver the leadership and management of programs.

Plant innovation (herbaceous pasture and crops and new wood sources and industrial uses)

FFI CRC has world class intellectual and physical infrastructure covering all relevant aspects of plant breeding. Partners SARDI and DAFWA provide world leading genetic resource centres including relevant collections of herbaceous perennial plants (native and exotic in origin) and DEC has similarly collected and preserved Australian native woody perennials. In addition, DAFWA and CSIRO have the cereal-breeding capabilities to produce cultivars of novel cereals (salinity-tolerant combined with waterlogging-tolerant and perennials). FFI CRC partners have a track record of establishing powerful international linkages that deliver freedom to operate with exotic germplasm, access to advanced breeding material which shortens the path to cultivar release, and breeding methodologies and techniques that improve the rate and extent of genetic progress. New cultivars of a diverse array of perennial plants will be produced, building on research in CRC Salinity (including species of the genus *Lotus*, *Melilotus*, *Medicago*, *Cichorium*, *Panicum*, *Fescue*, *Dactylis*, *Eucalytus*, *Acacia* and *Atriplex*).

Breeding efforts will be supported by studies in plant physiology by UWA and CSIRO. While breeding efforts will be linked to existing infrastructure and skills, new plants will be field-tested in target environments by regionally dispersed staff of the four State agriculture agencies.

New perennial plants need to be embedded in farming systems and, in the case of woody perennials also, into emerging industries.

A key capability in farming systems research is the need to deliver reliable general conclusions from relatively few sites where technologies are tested and demonstrated. The use of models is fundamental to such work. CSIRO is a vital source of expertise in modelling pasture, crop and tree growth. Along with DPI Vic, CSIRO is the source of expertise in water use and catchment modelling which is vital to predicting the NRM consequences and impact of new perennial-based farming systems. Understanding and predicting the economic consequences of such systems is central to the capabilities of FFI. Participants in this area are UWA, DAFWA and NSW DPI. DPI Vic has a well established record in social investigations linked to changing agricultural land use and these skills will be available to FFI.

Animal innovation

Livestock research is a central plank of proposed farming systems and strong partner input from MLA (meat) and AWI (wool) provided direct input to these efforts as well as linking related research efforts. The four State agriculture agency partners as well as the CSU, UWA and CSIRO will deliver skills such as animal nutrition, animal reproduction and behaviour. In addition, they have special skills in livestock grazing management. Optimum utilisation strategies of new forages (herbaceous perennial, saltland species and shrubs) will often require detailed specification resulting from studies of the interaction between livestock and the feed source.

Saltland farming systems

Specific focus will be on developing profitable ways of using saltland including identifying the appropriate mix of engineering and plant based approaches. State agencies in WA and SA deliver strong capabilities in the management of saline land, a response to the high incidence of salinity. Animal production systems offer the best opportunity to profitably manage saline land in the short term, in which CSIRO and CSU have world class scientific capabilities. In the Murray-Darling Basin salinity centres most on water quality and NSW DPI, DPI Vic and CSIRO provide strong capability in analysis and problem solving here.

Natural resource management

This objective is strongly supported by the engagement of state agencies with responsibility for NRM as well as important research capacity from CSIRO Sustainable Ecosystems. In addition, UWA in partnership with DPI Vic in particular, delivers extensive capabilities relevant to policy development that has potential to greatly enhance policy impacts. These initiatives will be greatly enhanced by the involvement of North Central Catchment Management Authority (CMA), a supporting participant, and other CMOs.

Private and public sector adoption

FFI CRC has recognised the potential offered by public/private partnerships in technology transfer and will further develop the relationship with Landmark pioneered in CRC Salinity. It will extend its partnerships to include the Kondinin Group which has strong experience in rural industry communication and information flow. These key capabilities offered by private sector partnerships are central to the scale of potential influence and the opportunity for rapid two-way communication with the pipeline connecting research to adoption. The effectiveness of extension activities will depend heavily on training capability, which is a clear strength of NSW DPI with complementary capacity in other state partner agencies.

The RDC partners (AWI, MLA and GRDC) have key interest and expertise in paths to adoption and have established producers networks and publications in which research highlights can be featured and training initiatives into which emerging knowledge can be incorporated.

In addition to marketing the CRC products, agribusiness can make an important contribution to the R&D phase. Through their wider industry contacts they are often able to provide input concerning the direction or nature of research. Enecon is a participant with interests in bio-energy. It is constantly scanning the national and international landscape for alternative energy opportunities. Their collaboration will deliver intelligence on the best opportunities for new woody perennial crops and these insights are likely to strongly influence R&D directions, such as breeding for woody crops. Landmark has a network of agronomists in constant contact with its regionally dispersed client bases. They have a finely tuned awareness of market conditions and dynamics (competing technologies, changes in input prices and returns, trends in attitudes to risk), all relevant to decisions on R&D priorities and directions.

Capacity building and training including postgraduates

The four participant universities have strong track records in postgraduate training and in all cases there is commitment to provide industry co-supervisors for CRC-supported students. UWA offers specialised expertise in farm level and environmental economics as well as a range of plant-based sciences and animal production. Adelaide is strongly represented in soil science and spatial analysis while CSU has key research participation in animal production and rural sociology. Melbourne brings expertise in crop and pasture systems (production and economics), plant genomics and development, weed risk analysis and woody plant systems.

Benefits of collaboration after Commonwealth funding ceases

Major collaborative effort will build a new platform for agricultural innovation based around wider exploitation of perennial plants. The participants in FFI CRC will be able to further build and refine elements of this platform beyond the CRC because of their participation. FFI CRC will build their research capability so that benefits continue to flow for 20 to 30 years (modelled from the platform) and further improvements and refinements.

Long-term benefits will also take the form of new approaches to agricultural research and adoption. Two key elements being pioneered and likely to continue are: the integration of production and natural resource initiatives in the delivery of benefits from agricultural land; and the closer linkages being forged between public research providers and agribusiness.

Commercial release of outputs

Rapid and extensive uptake of complex new technologies requires a number of elements. The most important is the appropriateness of the technology in meeting needs of potential users. The industry connection to partners substantially reduces the risk of unfocussed R&D efforts. Their strong regional representation allows for technologies to be adapted for the specific demands of regional. Profitability of new technologies is a key element in user judgement of appropriateness of technologies. The consortium has strong capabilities to predict the potential for profit advantage of its R&D and to demonstrate these advantages to rural businesses once they become established technologies.

Rapid access to new knowledge and products is central to commercial uptake. The private public partnership has been designed to enhance this flow. Products such as cultivars will move rapidly into the hands of commercial distributors and marketer but will be supported by information and training capacity originating in the public sector.

Research and Development Strategy Programs

Key challenges

Simply put, the challenge facing the FFI CRC is to develop Profitable Perennial™ technologies (plants and systems) that will be rapidly adopted, driven by their profit advantage compared with existing options. Associated with this adoption will be benefits to the natural resource base, and the challenge is to design the new systems in ways which maximise these benefits.

The full complexity of this challenge arises because of the need for:

- Multiple perennial technologies to meet the wide array of circumstances within and between farms (variation in climate, soils, current technologies, competing new technologies, social circumstances and context etc)
- Limits to perennial adaptation and application (perennial plant species, forms etc vary widely in their adaptation and therefore their patterns of potential use)
- Timeliness of response (developing and comprehensively testing the plants and systems rapidly enough to meet end user and investor expectations while dealing with long running systems)
- System complexity (manage the conflicts between profit advantages from input intensification and technical and financial risk associated with more complex systems)
- Systems integration (need to evaluate new perennial technology as components of wider systems)
- Profit and natural resource trade-offs (best profit opportunities for perennials might not match)
- Adoption drivers (large profit advantages will result in rapid adoption but for smaller advantages the rate and extent of adoption will depend on information flow to potential users).

Recognition of these challenges has been fundamental to the strategy for FFI CRC and its structure that involves:

- Focus of efforts based on
 - commercial impact potential (concentrate research efforts on those opportunities identified as having greatest benefits if successful with strong emphasis large per hectare profit advantages and large potential scale of application)
 - analysis of best opportunities to link profit and natural resource advantages with emphasis on water and biodiversity enhancement
 - clearly defined products to be delivered by the research.
- Embrace system complexity
 - recognise that new plants generally need new systems requiring integration of plant improvement and system development
 - new perennial systems are embedded in wider bio-physical and economic landscapes
 - based on our capacity to understand and model the complexity to generate general understanding from our research.
- Balance research portfolio
 - short term opportunities will generally be adaptation of systems or opportunities created by CRC Salinity
 - highly innovative initiatives with substantial profit benefits but which have longer delivery lead time and risks
 - profit and industry-driven initiatives integrated with NRM initiatives that influence system design.

- Emphasise delivery
 - establish relevance by early stage engagement with stakeholders and end users
 - identify the products that will be the focus for commercial partner engagement
 - recognise that rate and extent of adoption will depend on information flow from public and private extension.

Research Program Structure

The structure of the research program is focused to produce industry relevant outputs that will change the nature of farming, create new industries and inform the management of catchments.

- Three programs focus on key elements of the farm enterprise
 - Future Livestock Production
 - Future Cropping Systems
 - Farming Saline Landscapes
- One program will deliver a farm enterprise base for new industries
 - New Woody Crop Systems
- Three programs concentrate on enterprise risk mitigation through management of catchments
 - Biodiversity and Water
 - Farming Saline Landscapes
 - Economic, Social and Policy Analysis.

All will be supported by an Education and Training Program and a Commercialisation and Utilisation Program.

The strong emphasis on industry linked programs is designed to support the development of industry-ready products. Potential cross-program linkages and linkages between Profitable Perennials and their NRM implications will be captured and integrated at the project level. The importance of economic drivers will result in participation of researchers with economic analysis skills being embedded in most projects.

National and International linkages:

FFI CRC is national in scope (southern, temperate Australia) and will have an international profile in its focused arena of interest.

National initiatives will involve workshops on subjects of main scientific interest (at least one a year) and FFI CRC organised conferences every second year. This activity will be supported by strong communications initiatives, featuring a quarterly newsletter (based on 'Focus on Salt' with its circulation of 6,000) detailing scientific activity and progress within the CRC. In addition, it will generally support its partners in maintaining good scientific communication and networking.

International linkages will be both formal project partnerships and less formal collaborations. FFI CRC will build on existing close relationships with:

- INIA Uruguay – collaboration in breeding key *L. corniculatus*
- Swedish Institute of Agriculture – salt tolerant grasses
- N.I. Vavilov Institute of Plant Industries, Russia – perennial plant genetic resources
- Land Institute, USA – breeding perennial cereals
- University of Sussex, UK – salt tolerant breeding
- University of Alicante Spain – perennial legume development

- Washington State University – breeding perennial cereals
- Experimental Institute for Forage Crops, Lodi, Italy – perennial legumes and grass improvement.

In addition FFI CRC will:

- Support international travel to and from Australia for workshops and conferences of relevance. A specific initiative will be support for the 2nd International Salinity Forum to be held in Australia in 2008
- Financially support students as part of the Education and Training program, to undertake parts of their postgraduate training overseas where valuable
- Direct publication of research results to international journals, given the advantages that this delivers in enhanced two way flow of information relevant to FFI CRC research initiatives.

Research and Development Programs

Future Livestock Production (Program 1)

The viability of livestock production in Australia depends on ability to maintain or enhance profitability, under pressure from negative terms of trade. There are subsidiary challenges associated with maintaining the health of the natural resource base, dealing with market demand for 'green' production systems and the realities of a variable and changing climate. The extent and complexity of this challenge demands that, in looking for solutions, we explore beyond incremental change, to technologies that offer substantial potential for profit improvement.

New systems based around Profitable Perennials™ offer the potential for such a shift. The innovative approach offered by the Future Livestock Production Program (FLPP) is to identify and develop new perennial plants that can be managed to create a new feed availability profile at the paddock and farm level. This feed base can then be analysed and managed to create opportunities for more intensive livestock production systems. CRC Salinity has pioneered this approach with EverGraze (*More livestock from perennial\$*) whose objectives are set to produce a 50% increase in farm profit and 50% reduced leakage to groundwater. FLPP will expand application of this approach to other environments and production systems, for instance use of new shrub systems in mixed farming in 'Enrich'. Stretch targets will be set in all cases (generally in the range 30-50%) to link research activity to major system innovation delivering both profit and NRM dividends. In addition Enrich will identify and exploit natural chemicals from perennial plants to reduce inputs of animal medications and treatments as a practical way to deliver 'green' production systems.

Research Products

- 1.1 EverGraze Plus – More livestock from perennial\$ and More livestock from native perennial\$ grasses in the high rainfall zone (>500 mm)
- 1.2 Forage cultivars (chicory, lotus or perennial Medicago) – from PastureSearch
- 1.3 New acid tolerant perennial forage cultivars – from PastureSearch
- 1.4 A new herbaceous forage for the warm season, summer dominant or high rainfall zone with a commercially released management and utilisation package - from PastureSearch with application in EverGraze
- 1.5 Enrich – new shrub-based livestock production system for landscape and natural resource health in the low/medium rainfall zone
- 1.6 New shrub cultivar (Atriplex) – from Florasearch.

Central to the approach being applied by FLPP is the ability to have focused but integrated project teams with skills covering aspects including pasture breeding, agronomy, livestock production, NRM (mainly related to hydrology) and bio-physical and economic modelling. FLPP has a team with an established track record of innovation and collaboration. They provide the opportunity for drive substantial industry change through their combined efforts.

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Dr Joe Jacobs	Department of Primary Industries, Victoria
<i>Key Researchers</i>	<i>Organisation</i>
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Dr Brian Dear	Department of Primary Industries, New South Wales
Ms Angela Avery	Department of Primary Industries, Victoria
Mr Paul Sanford	Department of Agriculture and Food, Western Australia
Dr Greg Lodge	Department of Primary Industries, New South Wales
Dr Phillip Vercoe	The University of Western Australia
<i>Private Sector Participants</i>	
Australian Wool Innovation, Meat and Livestock Australia and Landmark	

Future Cropping Systems (Program 2)

The challenge facing Future Cropping Systems Program (FCSP) is to introduce a profitable perennial component into existing annual plant-based production systems, while delivering a substantial profit and natural resource enhancement dividend. Most of Australia's crops are grown on farms that mix crop and livestock enterprises. The area devoted to such system is approximately 35mha with less than half this area cropped annually. Lucerne, the most widely used perennial in the cropping zone is grown on less than 3 m hectares, providing wide scope for substantially increased use of perennial pastures when appropriate plants and systems are identified. The environmental diversity of situations across Australia in areas where mixed crop/pasture based livestock systems are practical (low and high rainfall Mediterranean and warm seasonal wet/dry) drives the need for multiple perennial based systems, each with their associated drivers and constraints.

Profit will be the primary driver of change, both in the short and longer term. The program will use bio-economic modelling of integrated crop-based systems to focus its investment targets and then to demonstrate the profit advantages of the new systems as they emerge. FCSP will have a balance of short (system modification and adaptation) and longer term (system innovation and creation) outputs and products from its activities. It will focus on increasing the extent and performance of perennials in the non-crop element of the mixed farm systems with profit coming from increases in both crop and livestock performance. FCSP will also scope the potential of a highly innovative option – development of a perennial cereal crop. Activities will include:

- New systems incorporating perennials that have more productivity and salinity and/or hydrological benefits, tested through participatory research
- System development and enhancement with perennials focusing on situations where these perennials are commercially available or near to market
- Salt and water-logging tolerant wheat, perennial wheat, drought/grazing tolerant forage legumes.

Research Products

- 2.1 EverCrop – new farming system in each of 3 agro-climatic zones
- 2.2 Drought tolerant forage legume cultivar – from PastureSearch
- 2.3 EverCrop Decide – new crop systems analysis tools that integrate production and conservation objectives
- 2.4 Feed grain quality salt/waterlogging-tolerant wheat
- 2.5 Salt/waterlogging-tolerant wheat suitable for biofuel
- 2.6 Breeding material for bread quality salt/waterlogging-tolerant wheat
- 2.7 Prospectus for development of perennial wheat

The FCSP team has capacity to identify gaps in current farming practice and the imagination and systems analysis skills to overcome them with superior farming systems built on innovative technologies. This work, reviewed to be of international standard, will be done in partnership with the well organised industry networks and farmer groups. The main NRM driver in this program is dryland salinity, but we are mindful that its relevance, on- and off-site impacts and urgency, varies in different regions. We will encompass other water-related environmental issues where relevant, with multiple natural resource benefits unified through minimising the negative hydrological footprint.

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Key Researchers	Organisation
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Dr Michael Francki	Department of Agriculture and Food, Western Australia
Dr Phillip Larkin	Commonwealth Scientific & Industrial Research Organisation
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Private Sector Participants	
Grains Research and Development Corporation, Meat and Livestock Australia and Landmark	

New Woody Crop Industries (Program 3)

The CRC Salinity focused on screening prospective native woody species for crop and product potential. A short list of promising species and products suitable for wheatbelt conditions has been generated. Commercial interest in woody biomass resources has increased strongly, coinciding with major changes in global markets favourable to large volume woody biomass production and utilisation, e.g. climate change, CO₂ emissions control and escalating energy costs. The challenge facing the New Woody Crop Industries Program (NWCIP) is to overcome impediments to commercial performance of biomass supply with a cost structure to meet anticipated increased demand.

We aim to develop woody perennials systems that will address three key performance parameters: i) provide a sink for surplus water from adjacent agricultural land; ii) be profitable; and iii) deliver biodiversity protection/enhancement and other improvements in NRM.

The impediments to rapid commercial development are:

- Genetics: selecting of superior cultivars from the vast native genetic resource and breeding superior varieties
- Water availability and yield: woody plants have large water-use potential and create large soil-water deficits, but clever planting design is required to enable them to maximise capture of additional water and thereby maximise yield
- Harvest: low cost biomass cannot be produced from short-cycle (shrub) crops without a low-cost harvester.

NWCIP will build on existing genetic improvement activities to bring superior varieties of the most promising species to market in the shortest possible time. It will model the natural processes of surface water redistribution after rainfall on agricultural land to predict how much water is available for woody crops, and couple this to growth models to predict yield. The program will become a respected knowledge broker in harvester development and lead preparation of a business case to win funds for development.

Research Products

- 3.1 Wyalong' mallee seed – from Florasearch
- 3.2 Prospectus for prototype commercial harvester for short-cycle woody crops
- 3.3 Client feasibility reports for biomass supply and processing industry investment
- 3.4 Prediction capability with woody crop production from farm layouts with access to variable water inputs.

The program team will integrate delivery of its knowledge to commercial developers in the form of commercial feasibility assessment of specific regional project proposals across southern Australia.

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<i>Key Researchers</i>	<i>Organisation</i>
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Enecon Pty Ltd, Renewable Oil Corporation and The Oil Mallee Company	

Farming Saline Landscapes (Program 4)

Our objective is to have 2,400 producers (25% of the farmers suffering from salinity) using 'best bet' technologies on over 350,000 ha of saline land, to increase their whole-farm productivity by over 10%, by 2014. The program will achieve this objective by researching and developing revegetation, water, soil, animal, crop and pasture management practices that are: (a) compatible with enterprise and regional demands; and (b) able to overcome the landscape, soil and water constraints of a range of environments. Particular emphasis will be placed on working with commercial partners and developing practices that are demonstrably profitable. The intellectual property generated will be packaged into training courses, services and physical products and commercialised.

Central challenges to the program are:

- Identification of additional agriculturally useful salt-tolerant plants (building on efforts in CRC Salinity)
- Strategies to manage water and preclude salt build up at the soil surface integrating engineering and plant options
- Strategies to maximise the impact on profit from the integration of salt land production into wide farming systems
- Develop saline production systems that are robust enough be used in highly variable saltland environments
- Understanding of how adoption and commercialisation of saline land farming practices can be achieved.

Research Products

- 4.1 HIGHPak – improved performance livestock and pasture management packages for saline land
- 4.2 New salt-tolerant pasture legume and grass cultivars – from PastureSearch
- 4.3 New salt-tolerant halophytic shrub cultivars – from Florasearch
- 4.4 National Saltland Service Centre – a vehicle for the delivery of new tools, products and services
- 4.5 SALT CAP – land capability assessment tool for plant-based saline land management
- 4.6 SALTDecide – hydrological modelling tool to measure the impact of water management using integrated plant-based and engineering interventions both on-site and off-site

This program aims to develop and commercialise a suite of profitable farming practices for the various classes of saline land across Australia. The research team includes many of the key scientific resources available in Australia in this specialised area and it is linked to strong capacity in farming systems and technology adoption.

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Dr Phillip Nichols	Department of Agriculture and Food, Western Australia
Private Sector Participants	
Australian Wool Innovation, Meat and Livestock Australia and Grains Research and Development Corporation	

Biodiversity and Water (Program 5)

The challenge faced by the Biodiversity and Water Program (BWP) is to link strategies and actions for managing agricultural land to its implications for biodiversity enhancement and water management. The CRC provides a unique opportunity for natural resource scientists to work collaboratively with agriculturalists, economists, sociologists and other specialists to deliver multiple benefits from farming landscapes. Apart from the major direct benefits arising from biodiversity and potable water, the program recognises that natural resource degradation is a significant direct cost and risk to the profitability of agricultural enterprises. Consumer responses to off-farm adverse environmental impacts also threaten market share.

Delivery of natural resource benefits will be greatest if they are linked to profitable changes in agricultural systems. Core work of the program will centre on developing:

- Management and decision packages that promote farming systems that integrate production and biodiversity
- Catchment models and management strategies for new perennial vegetation systems that maintain water quantity in priority water supply catchments, while improving water quality.

The risk-based decision tools and assessment products developed by the program will make an important contribution to policy development and decisions at catchment-scales with implications for farm enterprises in various geographic zones, and assist the development and application of market-based instruments. These tools and products will be developed to take into account climate risk and variability.

Research Products

- 5.1 Management and decision packages that promote farming systems that integrate production and biodiversity outcomes.
- 5.2 BioRisk – risk-based decision tool for managing hydrology to achieve biodiversity targets and improved production.
- 5.3 CAT Plus – catchment decision tool for perennial vegetation strategies to protect water resources in catchments.
- 5.4 Risk assessment products and management strategies to protect biodiversity from weeds and genetic pollution and to minimise weed control costs.

Much of the research work will be undertaken with target practitioners such as farmers, CMOs and government agencies. Thus the tools and packages developed will directly address existing problems. This approach will not only lead to focused, applied research, it will form a major pathway for adoption of the strategies and tools developed by BWP.

The ability to collaborate within the CRC with other programs that have vital expertise – such as Farming Saline Landscapes and Economic, Social and Policy Analysis – will play an important role in the Biodiversity and Water Program's success.

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<i>Private Sector Participants</i> Meat and Livestock Australia	

Economic, Social and Policy Analysis (Program 6)

This program plays a crucial role in advancing the commercialisation and utilisation of the CRC's research outputs. Economic modelling, conducted in collaboration with biological and physical scientists, will help to direct biological research in directions that are most likely to yield high commercial and economic benefits, and consequently likely to be widely utilised. It will provide information of crucial importance for promoting the transfer of CRC technologies to commercial landholders. It will allow improved NRM by quantifying trade-offs between economic and natural resource outcomes. It will contribute to the evaluation of CRC impacts.

Social research will also provide guidance for the CRC in its pursuit of new farm technologies that can be widely utilised. It will help the CRC understand social changes going on in rural areas that have implications for proposed new industries. These changes include farm-ownership turnover, demographic changes, the growth of non-commercial land ownership in some rural areas, and the dramatic growth of farm sizes in other areas. It will provide insights to scientists wishing to target their extension to regions, farming systems, or farmers for which new technologies are most appropriate and most adoptable.

Research Products

- 6.1 Adoptability index – assessment tool for the potential adoption of FFI CRC products.
- 6.2 NRM Investment Framework – decision tool for selection of priority NRM investments.
- 6.3 Farm business/NRM simulation game (extension of 'Salty Business').

The new technologies and systems developed by the CRC will interact with government policies for their impact, especially in relation to NRM. Existing NRM policies are deficient in a number of respects, including their handling of the boundary between commercial and natural resource outcomes. The CRC will build on the very strong policy analyses conducted in CRC Salinity, and will extend policy analysis tools beyond salinity into other areas of NRM.

<i>Program Leader</i> Professor David Pannell (To 30 November 2007) Dr Bill Malcolm (From 1 December 2007)	<i>Organisation</i> The University of Western Australia The University of Melbourne
<i>Key Researchers</i> Dr Rick Llewellyn Professor Alan Curtis Dr Bob Farquharson Dr Anna Ridley	<i>Organisation</i> Commonwealth Scientific & Industrial Research Organisation Charles Sturt University Department of Primary Industries, New South Wales Department of Primary Industries, Victoria
<i>Private Sector Participants</i>	

Education and Training Strategy/Program

An effective Education and Training Program will make a critical contribution to the FFI CRC's capacity building objective. Key elements of education and training are:

- Establishment of a nationally accredited training program for agribusiness and wider client networks, and
- Provision of industry ready science professionals for engagement with the wider research community, an important element in the 'pathway to adoption' for FFI CRC products.

In addition, postgraduate research will deliver a significant contribution to the body of knowledge generated by all research programs, and to the development of innovative new farming systems.

<i>Number of expected post-graduate enrolments (commencements) for each year</i>						
2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
15	20	15				

The strategies we have developed for delivery of education and training are:

- A comprehensive postgraduate education program encompassing industry supervision of research students, accredited training in generic leadership skills, together with postdoctoral opportunities and access to conference and travel assistance will provide a cohort of industry ready FFI CRC graduates with capacity to influence contemporary Australian farming practices.
- A national program of accredited (Australian Qualification Framework) training in FFI CRC and NRM will be established. Extension specialists within Landmark and other influencers linked into adoption networks will have the opportunity to undertake this training. Program graduates will inform knowledge networks sustained by other support activities. Many graduates will be embedded within FFI CRC research programs, forming a key link in the programs' path to adoption and two way communications between research activities and industry.
- A number of innovative education projects will be developed including:

- Provision of accredited training in NRM for PhD students
- Post graduate level short courses that promote interdisciplinary knowledge for graduates employed in agribusiness and within wider client networks
- Coordination of an internship program that will enhance the industry readiness of our research graduates, and provide opportunities for industry participants to participate in research.

5.2 Program Leader Mr Scott Glyde	Organisation Charles Sturt University
Key Staff Deb Slinger – Department of Primary Industries, New South Wales John Powell – Future Farm Industries CRC Daryll Richardson – Future Farm Industries CRC	
Private Sector Participants Landmark and Kondinin Group MLA, GRDC and AWI Primary Industry and NRM agencies	

Governance Arrangements

The Core Participants will incorporate a research company limited by guarantee to focus on effective utilisation and commercialisation processes that maximise adoption rates to achieve FFI CRC outcomes. This will include forming a Members Council to represent members' interests. The council will appoint a nine-member, skill-based board and be given responsibility for delivering the strategic direction for the company. The board will have an independent chair and a majority of industry or members independent of the research providers. The nature of engagement will be determined in accordance with the strategic fit of Core Participants, supporting participants and other stakeholders (figure 4). The strategic direction and purpose of the company is determined by members and embodied in the Commonwealth Agreement as reflected in the participants' agreement and company constitution for implementation under the direction of the board. The participants' agreement will set out the governance arrangements and objectives (meeting the objectives of the CRC Programme and partner investment) for contracting supporting participants and key responsibilities will be passed through from the Commonwealth Agreement. Members will meet annually in accordance with normal governance practice.

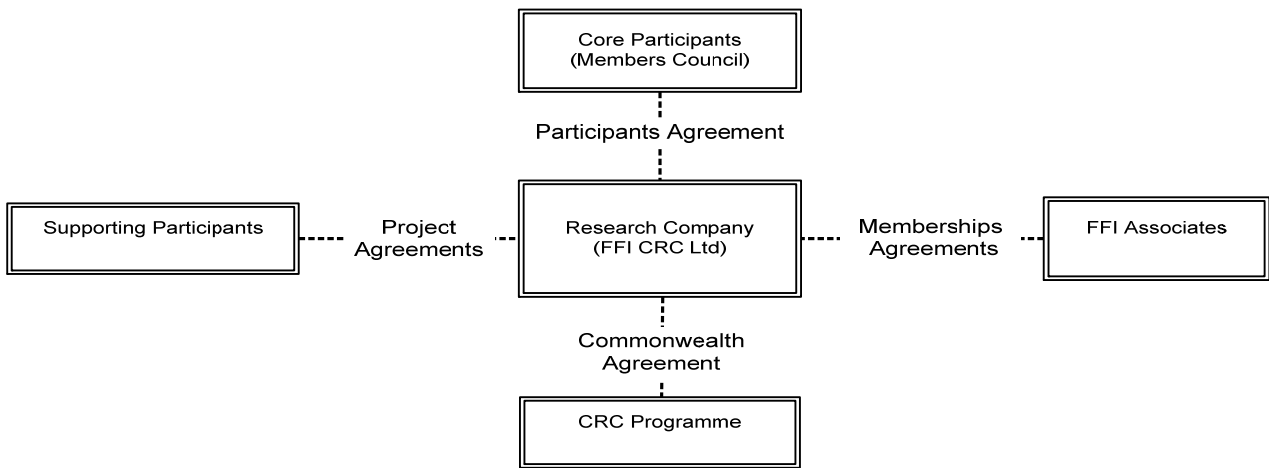


Figure 4. Relationship of partners to the Research Company

Governance arrangements will include a formal process for industry engagement in project development and management. This will be the foundation of a close, two-way link between industry and the conduct of R&D, education and training, and commercialisation and adoption. Flexibility will be retained to commercialise key products via tender or expression of interest processes if the existing commercialisation infrastructure of participants, including our strategic supporting participants, is not suitable. Supporting participants and new commercial partners will be engaged through project agreements with the CRC company.

The management of the CRC will comprise a Chief Executive Officer, Research Director and Commercial Director (figure 5). Seven program leaders will be 40% or 20% cash funded appointments, in addition to their in-kind research roles, to maximise the focus of the CRC on achieving outcomes.

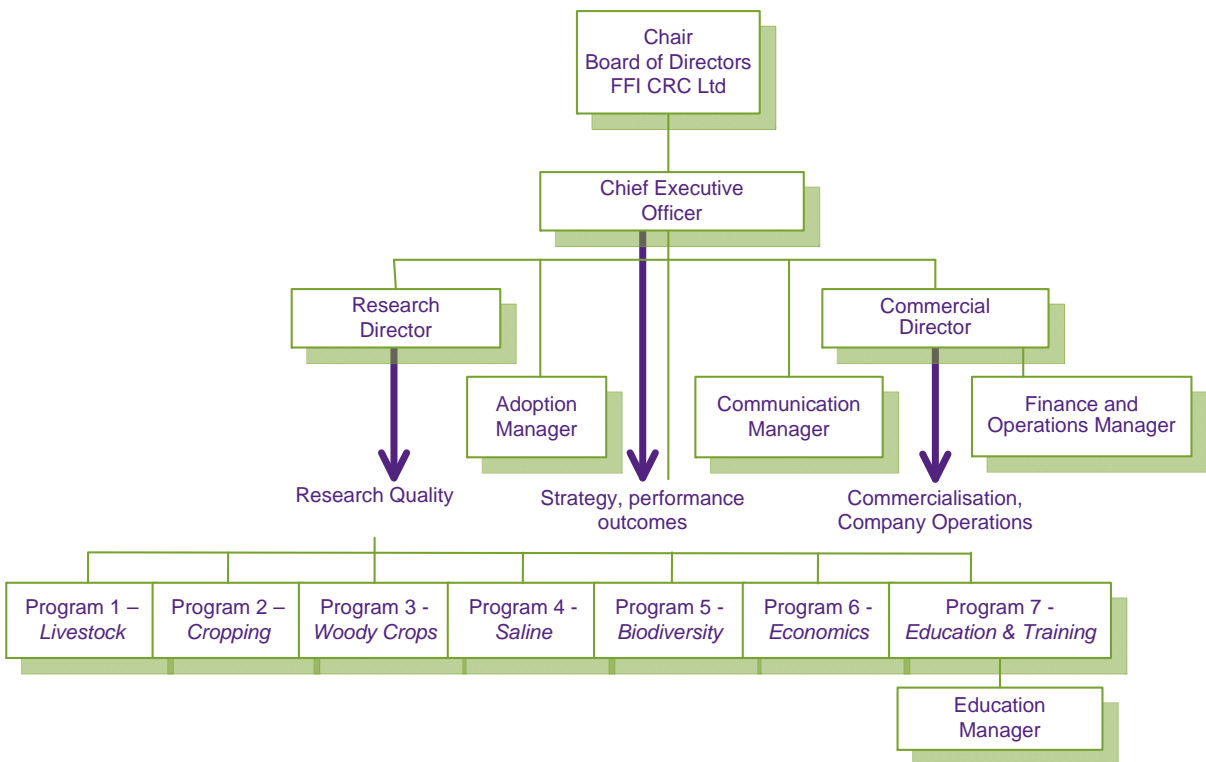


Figure 5. FFI CRC Organisation Chart

The FFI CRC participants have appointed Mr Andrew Inglis as Chair. Mr Inglis has strong board experience including Chair of GRDC and Plant Health Australia, Deputy Chair of ABB Grain, and Director of AWB Ltd. Also, he is the Deputy Chair of the CRC for Australian Weed Management. Mr Kevin Goss has been appointed Chief Executive Officer. He has held senior executive appointments for 17 years, including Deputy Chief Executive, Murray-Darling Basin Commission; he has been a Board member of three CRCs and was Chief Executive Officer and Board member of CRC Salinity.

Managing Transition from CRC Salinity

Overall wind-up arrangements

Preparations began in early 2007 for the wind up of CRC Salinity with the completion of a Wind Up Plan submitted to the CRC's Board meeting in February 2007 once the successful FFI CRC bid was confirmed.

The Governing Board of CRC Salinity and its committees has begun a critical assessment of its research, education and training, and commercialisation and utilisation activities to determine, at the end of the grant period, which will be completed or assigned to CRC participants. This assessment, overseen by the Board's Finance and Audit Committee, will result in a specific Board policy to address ongoing collaborative opportunities and custodial arrangements for knowledge assets.

Most CRC staff are employed by participant organisations and project budgets provide for their residual entitlements.

CRC Salinity is an unincorporated joint-venture with its headquarters at The University of Western Australia (UWA). The participants in the FFI CRC have agreed that it will continue to be headquartered at UWA and the University continues to provide accommodation and corporate services.

Senior staff members of CRC Salinity were assigned acting roles in the planned management of FFI CRC to ensure smooth transfer of operations. The independent FFI CRC Board of nine directors, including an Executive Director, was appointed in July 2007 to coincide with the official launch of the new CRC.

CRC Salinity has made excellent progress against milestones in the Commonwealth Agreement as confirmed by the independent review. It is addressing any matters required under the Agreement in the terms set out in the wind-up plan and is being managed as a dedicated activity and budget line within Year 1 of the operation of the FFI CRC.

Completion of Current Research (include IP arrangements).

The *Two Year Operating Plan* specifically provides for:

- Peak research activity being completed at the end of Year 6
- Scaled back research activity in Year 7 (2007-08) with a focus on closure activities – commercialisation and utilisation, communication and extension, custodial arrangements for databases, publication and final reporting
- These activities extending into 2008-09 if necessary.

While the majority of CRC Salinity's projects will terminate in Years 6 and 7, several research projects will continue under the direction of the incorporated FFI CRC, if successful, with UWA acting as agent. These research activities have the RDCs committed to FFI CRC as major collaborators, and are important opportunities strategically aligned with this Stage 2 application. Project contracts with the RDCs will provide for two scenarios – with and without FFI CRC.

CRC Salinity has sound IP arrangements in place in preparation for wind-up and handover:

- All projects have been subject to Board approved plans, with contracts for externally funded projects, that specify Background IP and shares for Project IP
- There is a clear IP management policy and the IP register is up to date.

At the Board's February 2007 review, this policy will be revised to focus on transfer of IP to the new CRC, if successful, or to core participants in the existing CRC according to Project IP shares. Nearly all will be core participants in the new CRC and have indicated that they will make similar arrangements regarding background and centre IP.

Completion of commercialisation and utilisation activities

The *Two Year Operating Plan* provides for a significant shift in internal priorities across Years 6 and 7, from research activities to commercialisation and utilisation, or path to adoption activities. For instance, two-year projects have been commissioned to synthesise knowledge from R&D into extension, training and communication products, and to focus on cultivars for release. These include:

- Publication of five 'prospect statements', each providing the business case for farmer adoption of a key plant-based option for managing dryland salinity. The first is Lucerne Prospects, due for release in August 2006
- A new 'Increasing the effectiveness of lucerne extension' project in collaboration with the Grains R&D Corporation
- A new business plan for the 'Salinity management through agribusiness' project in collaboration with the Landmark Company
- New 'national extension leader' and 'salinity training project' activities
- Initiating and sponsoring the 2nd International Salinity Forum, to be held in Adelaide 2008, which will showcase CRC Salinity's work nationally and internationally
- Continuation of SALT magazine and Focus on Salt newsletter to 12,000 subscribers

The review of herbaceous perennials breeding and development projects in 2005 identified 10 opportunities for cultivars to be transferred to commercial breeding or for commercial release. These will be completed by the end of Year 7.

The major projects to be continued under FFI CRC, if successful, have commercialisation/utilisation activities built in from the outset.

Completion of education and training program

Program 1 – Communication and Education, has been managed so that all postgraduate education and undergraduate course development will be completed by Year 7, with sufficient budget provision in the *Two Year Operating Plan* for scholarships and other expenses. There is a policy to assist the transition from postgraduate education to career placement, involving exit interviews as part of an evaluation and a database for follow-up as part of an expanded 'transition to early career' activity in FFI CRC, if successful.

Independent review of achievements

The Independent Review Panel has concluded that the existing Centre's outcomes will make a significant contribution to Australia's industrial, commercial and economic growth, in addition to substantial un-costed contributions to environmental sustainability. Application of technologies developed by the Salinity CRC will have a significant positive impact on the serious problem of dryland salinity in the agricultural landscape, delivering substantial benefits, particularly in regional Australia, and well-above commercial return on the taxpayer investment.

In forming its independent conclusions, the Panel considered a detailed Benefit/Cost Analysis (BCA) undertaken by the Centre on a "set of relatively important or successful projects" together with the results of an independently conducted survey of users and stakeholders. The BCA shows that the net benefit of the Salinity CRC will be of the order \$0.5 billion based

on conservative methodology. For comparison, the total cost of the CRC will be \$186 million over seven years.

The major outputs of the Salinity CRC are (*with Independent Review Panel comments*):

- EverGraze, a new livestock production approach from perennials in high rainfall recharge zones to reduce recharge and increase profitability – Net Present Value (NPV) of \$38.1 million. *EverGraze has also built on existing networks and has been described as an “outstanding” project. While its use is restricted to areas with a small dryland salinity risk, the comprehensive and strategic approach to constructing a farming system is to be commended and can have wider application. It is a good example of systems research, and any student exposed to this program will be a great asset to agriculture.*
- Novel land management technologies for Sustainable Grazing on Saline Lands (SGSL). The BCA provided a NPV of \$24.6 million – *engaged farmers well, again successfully building on existing networks and is being adopted.*
- Lucerne systems development and acid tolerance – NPV of \$23.7 million – *“has made very impressive progress” and “is timely and appears promising”.*
- Developing herbaceous perennials for new farming systems, such as EverGraze – NPV of \$115 million. *“The introduction and selection of a range of plants suitable for recharge areas has generated a large range of options.”*
- Florasearch identifies new woody perennial options for use on low and medium rainfall farms – NPV of \$170 million.
- Catchment Analysis Tool (CAT) used to analyse farming enterprises which are able to adopt the EverGraze system along with an economic analysis tool developed within DAFWA – *this combination of analyses may well be unique worldwide, and is leading to novel mixed (crop and grazing) farming systems that are being adopted.*

The focus of the current CRC is the management of dryland salinity through the use of perennial plant-based farming technologies. *The Independent Review Panel considers that the CRC is now firmly established on sound foundations with an important research program, high quality professionals, and impressive governance, management and accountability systems. Centre outputs are now starting to demonstrate the potential of what has been put in place. The Panel’s view is that this organisation and its people will undoubtedly deliver on this potential.*

Independent reviewers

Dr John Passioura, FAA, Honorary Research Fellow and formerly Chief Research Scientist, CSIRO Plant Industry, Chair of Review Panel

Mr Denis Hussey, Consulting Economist, formerly MD of ACIL Consulting; Head of Policy Division, Commonwealth Department of Primary Industry and Deputy Director Bureau of Agricultural Economics

Mr Neil Young, Farmer and Member of the Western Panel of GRDC