FUTURE FARM
INDUSTRIES CRC

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"Inquiry into Role of Government assisting Australian farmers to adapt to impacts of climate change"; House of Representatives Standing Committee on Primary Industries and Resources

The Commonwealth Government needs to very quickly rethink institutional arrangements for investing in Australian agriculture's ability to cope with climate change. The arguments put by a growing number of critics will not be countered effectively by current funding promises. The Government has a number of policies and programs operating in parallel and lacks coordination to achieve the three big outcomes it has laid down:

1. Preparedness for drought
2. Adaptation to climate change
3. Participation in the Carbon Pollution Reduction Scheme (CPRS)

For farmers, separation of these policies makes little sense. Drought and climatic variability are early expressions of climate change. As a threat to their businesses, impact of climate change sits alongside declining terms of trade, natural resource limitations and impact of agriculture's likely inclusion in the CPRS. Successful farm enterprises will be built on farming systems and technology breakthroughs that sustain productivity growth under a changing climate, without trading off food and water security or natural resource values.

To achieve this will require ramping up Government's R&D investment over several years, while better coordinating policies and funding programs so that research and development, training and extension are 'under one roof'. Agribusiness services, agricultural R&D corporations (RDCs) and Cooperative Research Centres (CRCs) have critical roles to play in this quest for better integration.

In this submission to the House of Representatives inquiry into the role of government assisting Australian farmers to adapt to the impacts of climate change, the Future Farm Industries CRC (FFI CRC) Ltd will provide a vision for a more adaptive and resilient dryland agriculture and outline how the Commonwealth Government can make far better use of its existing institutions to set agriculture on a 30 year path of sustained innovation, technology development and practice change to cope with climate change.

The Future Farm Industries CRC recommendations are:

1. Establish the **Australia's Farming Future** program as an ongoing investment subject to regular reviews and strategy redirection, including:
    a. A new capacity to support policies with R&D covering adaptation to drought, climatic variability and climate change, and emissions reduction and mitigation of greenhouse gasses – all in the context of productivity improvement and sustainable natural resource management;
    b. Reinforcing its capacity to integrate R&D, training and path to adoption components – with a 30 year view for innovation and capacity building
    c. Increasing its R&D component to $100m in 2009/10 and subsequently toward a peak of, say, $400m according to its performance and capacity to deliver.
    d. Placing its accountable investment with the agricultural R&D corporations (RDCs) under the **Climate Change Research Strategy for Primary Industries** (CCRSPI) and establish agreed boundary conditions – risk profile, return on investment, public good outcomes (national interest), and level playing field for the private sector.

2. The **Department of Agriculture, Fisheries and Forestry** (DAFF) should retain Australia's Farming Future office to administer funding, communicate priorities, and conduct reviews. The office should have an account manager located within each RDC.
    a. CCRSPI to become the primary source of feedback and intelligence to DAFF and the Commonwealth Government, within an adaptive management framework.

3. The funds for R&D, training and path to adoption for drought, adaptation and emissions reduction in agriculture must be quarantined from the other big climate change funding programs

Prospective Adaptations to Impacts of Climate Change

Farmers, Australian agriculture and food production face challenging times. Global markets are uncertain in the face of stalled trade negotiations and the potential resurgence of protectionism under the guise of national financial stimulus and climate change policies. Current impacts of increasing drought frequency and greater climatic variability will give way to the sustained impact of climate change. There are ongoing constraints to natural resource use and now the likely impost of climate change policy.

To exacerbate this climate of uncertainty, there has been a recent slowing of productivity growth – the mainstay of agriculture's ability to adapt to declining terms of trade and natural resource degradation (Nossal et al. 2009).

Providing solutions for Australian agriculture through the development of new farming systems and innovative Profitable Perennials™ technologies to address these multiple threats is the research focus of Future Farm Industries CRC Ltd (FFI CRC). See **Attachment A** – FFI CRC's source document: http://www.futurefarmcrc.com.au/documents/080228_FFICRC_Sourcedocument_FINAL.pdf .

FFI CRC's goal is Profitable Perennials™ adopted on 7.5 million hectares or 13% of southern Australian farmlands, by 2030 to become the foundation for fundamental change in livestock and cropping enterprises augmented by new biomass production to the benefit of farms, regions and landscapes.

Why Profitable Perennials™? Their plant growth habit better mimics the proven adaptability of native plant systems through effective conversion of rainfall to plant energy, and ultimately food, fibre, and a healthier environment. Their incorporation into profitable farming systems can provide ecosystem services including enhanced biodiversity, cleaner water, prevention of soil erosion and overcoming soil constraints such as salinity and acidity. We know this from the work of FFI CRC's predecessor – the CRC for Plant-based Management of Dryland Salinity (CRC Salinity), which since 2001 has shown the ability of perennial pasture and forage plants to cope with adverse seasons.

Under the banner of *Profitable Perennials™ for Australian Landscapes* FFI CRC is developing new perennial cultivars for incorporation into innovative grazing and cropping systems to make livestock and grain enterprises more sustainable. Under the entirely new EverFarm® initiative FFI CRC is developing short rotation woody crops (starting with oil mallees) that will diversify farm income into bio-energy and bio-sequestration enterprises, and add to the resilience of mixed crop-livestock farming and wheatbelt communities. See **Attachments B and C** – FFI CRC's latest issues of Future Farm magazine (farmer success stories with perennials) and Focus on Perennials (research-in-progress reports):
http://www.futurefarmcrc.com.au/documents/FFIssue2final.pdf;
http://www.futurefarmcrc.com.au/documents/FOPIssue7.pdf

Well adapted and profitable farm businesses of the future may have five Profitable Perennials™-based farming systems or 'technology complexes' to choose from, depending on their rainfall zone, economic region and dominant farm enterprise. These are:

Farming Systems

1. EverCrop®: For six wheatbelt zones perennial plants will be incorporated into crop rotations, through phased or companion cropping, to make grain production more resilient to the multiple threats of climate change, escalating input prices, and herbicide resistance. There will be novel rotations on the more capable soils ranging from pasture cropping with new drought tolerant perennial legumes (see **Attachment D**), to alley cropping with saltbush.

2. EverGraze®: For specialist livestock farmers in higher rainfall areas their grazing systems will be much more productive from a combination of perennial pasture cultivars with complementary growth patterns under rotational grazing. Early results show up to 50% increase in production is possible. Within years farmers will have the choice of high and low input systems, the latter getting best value from native perennial grasses, and may well be using a combination of both to best adapt to climate change.

3. New Woody Crops: Specialist cropping, livestock or mixed farmers will have an additional, new enterprise based on woody crops located in harmony with the still dominant crop or grazing enterprises. The current constraint to a viable oil mallee industry – a cost efficient biomass harvester, is now being tackled by FFI CRC (see **Attachment E**). With its commercialisation in 2010-11, farmers will be able to choose between harvesting biomass for energy related products and bio-sequestration of carbon, according to price and farm priorities.

The EverFarm® initiative brings these three farming systems together as a whole farm proposition, no matter in which zone or region the farm is located. It distinguishes the work of FFI CRC from the important, technologically focused work of our participating R&D providers and other joint ventures. Under EverFarm® FFI CRC will:

- Develop profitable and resilient farming systems and enabling technologies that will meet climate change and carbon reduction policy challenges;
- Develop bio-energy and carbon sequestration options using woody crops;
- Model their biological and economic performance under different climatic scenarios; and
- Prepare these new technologies for adoption through farmer participation in research, training (EverTrain®), new agribusiness services and supporting extension services.

EverTrain® is a new national training program, backed by the resources of the NSW Department of Primary Industries and AWB Landmark, with accredited and non-accredited courses. Currently, a course on understanding soil carbon is being offered.

Technology Complexes

4. Enrich: For farm locations and land types now marginal to profitable cropping, farmers will be able to choose from a number of climate-adapted, deep-rooted perennial shrubs as part of a more resilient, permanent grazing system (see **Attachment F**).
5. Salt land systems: Farmers will have a wider range of profitable options for salt-affected land too. Ground-breaking work is under way on better salt tolerant pasture plants, enhanced performance of livestock on saltbush based pastures (the Enhance project) and on salt and water-logging tolerant wheat.

Importantly, the distribution of these enterprises does not compromise food or water security. FFI CRC's bio-economic modelling favours wide-spaced bands of short harvest cycle (3-5 years) woody crops taking up 6 -16% farm area, in medium-low rainfall environments. Herbaceous perennials do not intercept surface water flow significantly in these environments. The Enrich and Enhance options will support profitable production not previously attainable on the more marginal lands.

In combination with EverTrain® FFI CRC's path to adoption strategy focuses on the capacity of Australia's public and private sectors to sustain R&D effort and service farmers, through:

- preparing and informing next users of the knowledge arising from innovation and R&D - namely leading farmers, farm research groups and the service sector;
- developing the role of private enterprise in partnership with agribusiness companies; and
- building science capability at the post-graduate level.

All the work described under *Profitable Perennials™ for Australian Landscapes* is being carried out by FFI CRC, an incorporated joint venture under the Commonwealth Government's CRC Program. The way we go about our work is consistent with our views about how the Government could best employ its resources to assist farmers adapt to climate change.

- We are a collaboration of the key research investors and research providers supporting and influencing Australian agriculture across a spectrum of disciplines from soil science and plant breeding, to economics and biodiversity.
- We are also a collaboration of education providers, including four of Australia's leading universities, as well as extension providers across four states, including the agribusiness and farm service provision sector.
- We set about industry engagement and farmer participation from the outset, and employ pre-experimental economic modelling to prioritise and align our R&D to needs without compromising innovation.
- We place a lot of weight on sustainable farm practices, including maintenance of natural resource condition and enhancing biodiversity values, with path to outcomes strongly focused on adoption and profitability of farm businesses.
- The farming systems/technologies described above are being developed by FFI CRC under the Profitable Perennials™ brands to bring focus to farmers' and landholders' pursuit of

drought preparedness, climate change adaptation and emissions reduction in an integrated way.

Most importantly, we have mapped out a path for full adoption of our research outcomes, innovations and technologies by farmers over 20-30 years from 2006:

1. EverCrop® farming systems and technologies - 5.25 m ha
2. EverGraze® farming systems and technologies 1.47 m ha
3. New woody crops 100,000 ha
4. Enrich 600,000 ha
5. Salt land systems 850,000 ha

Other Practices and Technologies

Finally, and of critical importance, FFI CRC is mindful that it's farming systems and 'technology complexes' will not be the whole story. We cooperate with other developments where linked to Profitable Perennials™ technologies, although we believe some may not deliver to expectations. Under rigorous R&D investment analysis of potential benefits many initiatives will be shown to have more modest outcomes and be slower to build than currently claimed.

FFI CRC comments on three technology paths for dryland agriculture – no till cropping, molecular biology or genetic modification and bio-sequestration or soil carbon

No till cropping: No till cropping, controlled traffic farming and precision agriculture are adapting well to dryer seasons and reducing risks of crop failure. Mechanical and chemical technologies today are radically different from minimum tillage systems of the past, and even more effective at exploiting rainfall. FFI CRC's EverCrop® will accommodate these continued technological developments and factor in the changing opportunity cost of introducing perennial plant phases in crop rotations.

Molecular biology: Biotechnology breakthroughs are uncertain, long term and expensive. This research is constrained by large economies of scale and slow returns on investment. Only global well established crops are benefiting from the large investment needed, yet in recent years global funding has declined. Nevertheless FFI CRC is making significant gains in its plant breeding work, such as salt and water-logging tolerant wheat. We will assist GM ventures by identifying species and genotypes with elite drought tolerance, a prerequisite for identifying and sourcing the most useful genes for wider application through GM programs.

Soil carbon: Currently extravagant claims are being made for plant and soil sequestration of carbon and the potentially profitable enterprises they may provide for farmers. Yet after much research there is still not sufficient understanding of soil carbon dynamics or veracity of sampling protocols to take a policy position on bio-sequestration. FFI CRC is cooperating with partner organizations to measure soil carbon changes under Profitable Perennials™ technologies such EverGraze®.

The Role of Government

First, let's examine the current approach of the Commonwealth Government.

It is about to release a drought policy with greater emphasis on preparedness for drought. It will support this policy with the re-vamped FarmReady Program, to provide farmers with training support. There may be some synergy with funded projects in the Caring for Country program's theme of resilient farm practices.

The Commonwealth Government has two R&D funding initiatives relevant to adaptation to climate change. The Primary Industries Adaptation Research Network (PI ARN) is one of eight themes funded in the National Climate Change Adaptation Research Facility (NCCARF). It is managed by Land and Water Australia and linked to the Climate Change Research Strategy for Primary Industries (CCRSPI), which is a joint initiative of RDCs, the Primary Industries Steering Committee (PISC) and CSIRO. Active network building, coordination of research investment and further capacity building is about to occur. Adaptation is one of three themes in the Climate Change Research Program (CCRP) (others are emissions reduction and soil carbon). Decisions on projects are rolling out now. These two initiatives (PI ARN, CCRP) are in different ministerial portfolios (Climate Change; Agriculture, Fisheries and Forestry).

The Government has a policy position on how agriculture will be treated under the proposed Carbon Pollution Reduction Scheme (CPRS). It will decide in 2013 whether and how agriculture will be covered with entry into CPRS, if it occurs, not before 2015. Meanwhile, the Government has made it

clear that metrics and technologies for agricultures' emission reduction need to improve. CCRP funding decisions are supporting this priority.

This three-pronged approach looks impressive; however, the threat of policy and program failure is very real. This claim is based on FFI CRC's understanding of how innovation, technological change, research and development and improved outcomes occur in dryland agriculture, and on the poor track record of Commonwealth Government funding programs in getting these outcomes. The claim will be substantiated in the rest of this submission.

Critique of Australian Government's Approach

Farmers' path to adoption of new practices for drought preparedness, climate change adaptation and compliance with emissions reduction measures is much longer than the Government realises.

Australian agriculture has a track record of innovation and productivity growth exceeding other sectors of the economy, at least until recent years (Mullen and Crean 2007). For broadacre agriculture the annual rate of productivity growth has been 1.5% over 30 years with a peak of 3.6% per annum in the 1990s. In recent years it appears to have slowed with droughts having an impact (Nossal et al. 2009). Even at this rate of improvement it takes about 10 years to see a 20% lift in productivity and 20 years to see a 50% improvement, which puts into perspective the pace of change in a well performed sector.

Also there is growing recognition that climate change adaptation measures, such as cropping systems that use water more effectively, can potentially reduce future production losses and that enhancing productivity will be a key to this adaptation (Gunasekara et al. 2007).

New knowledge and technology has been a major driver of productivity growth, and institutional or public good R&D has been an important and consistent source of this innovation (Mullen and Crean 2007). Extension and education are also important factors (Productivity Commission 2005). Research investment leading to productivity growth has a time lag of about 25-35 years (Mullen and Crean 2007, Pardey 2009).

In summary, it is likely to take 30 years for widespread adoption of farming systems changes that will effectively adapt to climate change and that the bulk of the R&D will be from public or institutional investment. Even then ongoing R&D is critical to sustained productivity growth, adaptation to climate change and efficiency in emissions reduction or capture.

Investment in R&D is not large enough, not long enough and not sufficiently allocated to new profitable solutions for farmers.

The Commonwealth Government has allocated $46.2 million over four years from 2009 for the Climate Change Research Program (CCRP) under the Australia's Farming Future Initiative, and $1.3 million for the Primary Industries Adaption Research Network (PI ARN) from NCCARF. These are the only Commonwealth funds dedicated to R&D on agricultural adaptation, although the project managers under these programs were required to leverage these funds with their own resources. The total funding, including RDCs, State agencies, CSIRO and universities is not known to FFI CRC but is likely to be in the vicinity of $100 million for the period 2009-10 to 2012-13.

At the time of writing this submission, the proportion of CCRP funds to adaptation research is not known; however, a substantial amount has gone to three areas that of themselves don't explore new technologies and farming systems for adaptation:

1. Emissions reduction and soil carbon sequestration;
2. Measurement of stocks and flows of Greenhouse gases; and
3. Coordination of research activity in the CCRP themes of soil carbon, emissions reduction and adaptation.

These are important areas of work and go some way to addressing other parts of our critique. However, this initial allocation of CCRP funds is skewed away from innovation in adaptation.

It is our understanding that CCRP was heavily over-subscribed and that many of the successful projects received less than half the funds sought. About 75% of the total funds have been allocated in the first year of a four year program leaving little flexibility for addressing adaptation research.

The PI ARN under NCCARF brings another dimension to future adaptation R&D. It focuses on network building and through this process coordinated priority setting and R&D investment, presumably from existing sources. This will tap into the planning and coordination of major R&D organisations under the Climate Change Research Strategy for Primary Industries (CCRSPI) referred to earlier. However, FFI CRC knows from first-hand experience that these R&D funders (RDCs) and R&D providers are already heavily leveraged and have limited capability to strategically allocate resources to new activity.

In this context FFI CRC has framed its Climate Change Research, Education and Adoption Strategy to apply additional research activity to the farming systems and technology complexes it has under development. These extend from adaptation to climatic variability, to carbon bio-sequestration and emissions reduction. However and most importantly the planned research, extension and training activity will include fully calibrating the EverFarm® system through plant and animal-based R&D, conducting whole farm bio-economic modelling for agri-climatic regions, and building capacity to do these things in the service sector as well as on-farm. This vision of total integration of innovation, technology development and farming systems changes for broadacre agriculture is not reflected in the Commonwealth Government's R&D funding programs.

This critique recognises that there is good work being done, there is competent science capacity and a track record of innovation. Agriculture has shown that it can sustain strong productivity growth, sufficient to adapt to external constraints such as declining terms of trade and degradation of natural resources. Now Australian agriculture faces the many dimensions of climate change and the question is whether this track record of economic adjustment can be translated into continued growth.

Commonwealth Government agencies administering funding programs for land use change have failed to achieve high rates of adoption by farmers. There is compelling evidence for this, and that a primary reason is lack of profitable options for farmers.

This issue has been most thoroughly explored in dryland salinity management in the same agricultural zones where FFI CRC's work is targeted. For more than 10 years, there has been mounting evidence that recommended plant-based solutions and regional catchment management plans are not and will not achieve the salinity mitigation outcomes claimed over that time (NDSP 2004). The evaluation of salinity outcomes from regional investment under the National Action Plan (NAP) for Salinity and Water Quality concluded that NAP investment had not contributed to large-scale land use change and by itself was unlikely to, due to the lack of best practice options (SKM 2006). As a result of advice from the CRC Salinity (FFI CRC's predecessor), governments of Australia agreed to a national policy change for salinity management that put more emphasis on prioritising assets at risk and on rigorous analysis of net benefits before deciding and targeting investments, with strategic funding of R&D to develop new technologies as a high priority part of the mix

Why is this experience relevant? When it comes to farm-level adoption of new practices managing climate change impacts has the same characteristics as dryland salinity:

- They are intractable and diffuse source pollution problems. It is only in rare circumstances that farm actions or lack of them can be attributed to change in the trend line for their negative impacts. Where responses are measurable the benefits they bestow will be observed decades after the actions were taken.
- The lack of profitable technical options for farmers render useless the most commonly used public policy instruments – extension and incentives (Pannell 2006, 2009).

The Commonwealth Government cannot afford to repeat the mistakes with dryland salinity by funding incentives and extension programs without making sufficient headway in technology development on the path to profitable options for farmers.

There is looming institutional failure with successive Commonwealth government's approaches to investing in sustainable agriculture and natural resource management outcomes. Its programs are dependent on Canberra based officers administering funds to contracted projects. These officers are funds administrators without the authority or technical capability to perform the risk managing investor role. The high number of consultancies commissioned by Commonwealth agencies provides stark evidence that they are not able to engage the agriculture sector first hand and adopt the more effective partnership approach.

This Government, in particular, understands the importance of tapping science expertise and is prepared to target its funding to institutions where those scientists reside. This is good to a point.

However key science institutions (CSIRO, universities) have no path to farmer adoption and limited industry engagement. Farmer behaviour change is not their mandate and there are no accountable paths to adoption activities. State agencies have traditionally had agricultural extension services alongside R&D capacity but these have declined so severely that traditional information sources tapping public good R&D no longer exist. Catchment management authorities and regional NRM bodies are not a substitute. They now face uncertain times, don't have R&D capacity aren't geared for farm-level advice on production solutions. The agribusiness sector has a growing capacity to technically service farmers but can't be expected to carry out public good functions if they don't improve their profit bottom line. Today, farm research groups and farm consultants are the best placed to fill this void, but 'next user' programs such as that of FFI CRC are needed and these are beyond the means of major R&D institutions.

We know that best practice in translating R&D to farmer adoption requires early participation of farmers and early engagement of industry in research conduct. For more complex technologies which characterise drought preparedness, climate change adaption and emissions reduction, more creative and sustained programs are needed. The current approach of government funding R&D and training support independently, without incorporating path to adoption activities, will exacerbate the predicted institutional failure.

So, how can the Commonwealth Government more effectively translate its policy objectives and allocated funds to a form of program management that sets about maximizing net benefits through more direct engagement with the agriculture sector and managing risk in the public interest?

In fact, the Commonwealth Government has two institutional forms that are quite capable of doing this and have been generally successfully for over 20 years – RDCs and cooperative research centres (CRCs). RDCs are structured to manage investment more effectively with program managers closer to farmers and industry. CRCs are structured to manage R&D, training and path to adoption, including commercialisation of R&D, in an integrated way.

Both institutional forms have been regularly evaluated and their success and good returns on investment demonstrated. Under the current evaluation framework for RDCs, a randomly selected 32 projects have returned an estimated $11.00 for each dollar expended, and on the input side each dollar of government funding is matched by $1.50 from industry (Council of RDC Chairs 2008). The recent evaluation of CRCs by the Productivity Commission, re-working numbers from earlier studies with a more conservative method, estimated that there was an aggregate increase n economic output of 51 cents for every dollar of the Commonwealth's CRC Program funds (O'Kane 2008). Again this is a substantial return on investment.

FFI CRC argues that the Commonwealth reverts to current best practice in how it invests climate change program funds in R&D and path to adoption activities that will improve adaptation to climate change in the longer run through real change in farm businesses. Rather than administer funding programs direct to project managers in the absence of industry-credible program managers, it should put its funds through RDCs. They have a strategy for planning, priority setting and coordination (CCRSPI) and established program managers with science, industry and field experience.

RDCs in turn could follow their best practice in commissioning projects with R&D providers and collaborative ventures such as CRCs that are uniquely set up to combine R&D, path to adoption with commercialisation elements in an environment that fosters innovation and public-private partnerships.

In this way Commonwealth Government investment in drought, climatic variability and climate change outcomes become part of the mainstream innovation, problem-solving, technology development, productivity growth and structural adjustment that has been the basis of Australian agriculture's success over the past 60 years – and no longer an add-on activity.

If FFI CRC's arguments that climate change adaptation research funding is increased over the next few years and sustained long enough to get 30 year outcomes are accepted, then the Commonwealth Government should change structurally its relationship with RDC investment management. As the policy keeper and major funder it will set strategic directions and make mid-course corrections from time to time according to evaluation and reporting of progress, and changed external circumstances. However to have a more responsive and stringent adaptive management cycle it is suggested the government adopt an account management institutional form with its fund administrators located with RDCs where possible.

Finally, there is a risk that this integrated approach to drought preparedness, climate change adaptation and mitigation, and productivity growth in agriculture is destabilised by the dynamics in other climate change mainstream and sectoral programs. Current leveraged investment of about $100 million pales alongside large and important programs like clean coal, carbon capture and storage, housing insulation. Outside of the agricultural R&D and adoption cycle there are large investments into to better modelling of climate change and prediction of its impacts. Again this is important but may claim priority over development of solutions. For these reasons and to ensure intergration so strongly advocated in this paper FFI CRC recommends that funds for R&D, training and path to adoption for drought, adaptation and emissions reduction in agriculture are quarantined from the other big climate change funding programs

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