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Hon Tim Mulherin MP
Member for Mackay

Minister for Primary Industries and Fisheries

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26 MAY 2009

The Honourable Dick Adams MP
Committee Chair
Standing Committee on Primary Industries and Resources
PO Box 6021
Canberra ACT 2600

Dear ~~Mr Adams~~ Dick

Thank you for your letter of 5 February 2009 concerning making a submission to the House of Representatives Standing Committee on Primary Industries and Resources inquiry into the role of government in assisting farmers to adapt to the impacts of climate change.

Climate change will have significant impacts on primary production and resource management. Adapting to the impacts happens at the ground level, so it is important to provide information and tools to help enable primary producers understand and manage those risks.

The Queensland Government has a long history of assisting primary producers understand and manage the impact of climate variability and change on their business. This is done through providing access to information on seasonal climate outlooks and on climate change, by supporting research into the impacts of climate on crops, pastures, water and other resources and by developing decision support tools.

The Queensland Primary Industries and Fisheries would like to make the attached submission on behalf of the Queensland Department of Employment, Economic Development and Innovation. The submission discusses our thoughts on how to assist farmers adapt to climate change and includes actions the Queensland Government has taken to assist farmers manage climate risks.

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I trust that this advice is of assistance.

Yours sincerely

TIM MULHERIN, MP
Minister for Primary Industries, Fisheries and Rural and Regional Queensland
Member for Mackay

Att (1)

Standing Committee on Primary Industries and Resources

- Role of Government in assisting farmers to adapt to the impacts of climate change-

Submission by the Queensland Department of Employment, Economic Development and Innovation

Terms of Reference

The Committee to inquire into and report upon:

- Current and prospective adaptations to the impacts of climate change on agriculture and the potential impacts on downstream processing.
- The role of government in:
  - augmenting the shift towards farming practices which promote resilience in the farm sector in the face of climate change;
  - promoting research, extension and training which assists the farm sector to better adapt to climate change.
- The role of rural research and development in assisting farmers to adapt to the impacts of climate change.

Current and prospective adaptation to the impacts of climate change

Climate change is one of the most significant challenges facing Australia's primary industries. This challenge is derived not only from the changing climate itself, but also the need for the sector to respond to the mitigation agenda. Although not specifically identified in the terms of reference, adapting to the impacts of changing policy to reduce greenhouse gas emissions will be important for the primary industries sector and some discussion on those activities are also included here.

It follows that farmers must take steps now to manage the impacts of all risks associated with climate change. Governments have a pivotal role to play in this regard.

Adapting to Climate Change Risk

The projected impacts of a changing climate for agriculture include reductions in productivity due to temperature and rainfall changes, the potential for increased extreme weather events such as cyclones, fires and drought, and increased biosecurity risks. Other important potential climate change impacts to agriculture include weed invasion, woody vegetation thickening, animal welfare and changes to crop/pasture growing seasons. Producers must be able to identify and plan for these changes, and where possible take steps to minimise their exposure to risk.

Australian farmers are past masters at improving productivity, despite climate risk. The key for this continuing is ensuring that information is available to farmers so that they can make business management and production decisions that are informed. Effective tools must also be available for the implementation of these business and production decisions, whether in the form of new production methodologies, new technologies, or an adjustment of business type.

Identifying climate change risks

Producers plan for climatic events, both favourable and unfavourable, through the use of weather forecasts, bio-economic modelling tools (see below under Government role) and experience. For instance, a range of commodity-specific forecasting models for climate change scenarios have been developed for use by producers.

Producers are also becoming aware of the changing climate risks due to climate change. In Queensland, seminars, workshops and general information via booklets and websites are raising the awareness of the potential impacts of climate change. However, more regionally focussed climate change projections would enable producers to better assess the likely impacts for their business and to manage those changed risks. Likewise, downscaled climate change projections are required to improve the confidence in the commodity specific forecasting of the impacts of climate change on industries and regions.

Responding to climate change risks

Climate risk response strategies vary depending on the type of production undertaken and the resources available to the individual. Adapting to climate change is an extension of current strategies to manage climate risk. Approaches include:

- Investment in a network of farms across climatic zones to increase the likelihood of experiencing productive seasonal conditions. Properties are used on an opportunistic basis (i.e. beef and grains production).
- Investment in properties in varying regions to ensure continuity of supply all year (for example the Kidman Pastoral Company approach of owning properties from northern Australia to Adelaide to enable a staged progression from breeding to finishing for market, also reduced the company's exposure to climate risk as stock could be moved from drought-effected properties to properties experiencing better conditions). Such businesses will be the most resilient to climate variability including extreme events.
- Diversification of land use activity such as summer and winter cropping and mixed cropping.
- Diversification of income base outside of primary industries (off-farm employment, investments) or in emerging biodiversity and carbon sequestration opportunities.
- Investment in water use efficiency systems and production methods as well as water storage facilities to reduce drought risks.
- Investment in practices that are more suited to the future climate
- Investment in genetically improved crops and livestock
- Management of biosecurity risks through prevention and preparedness.

Adapting to mitigation demands

While not generally considered as a component of adaptation issues, the agricultural sector will also need to respond and adapt to emissions mitigation requirements, whether this be as a result of inclusion in the Carbon Pollution Reduction Scheme, or as a result of other market forces. Regardless, it is assumed that there will be a need to reduce emissions, particularly in high-emitting areas such as livestock industries. There may also be opportunities to sequester carbon dioxide.

Synergies exist between climate adaptation and emissions mitigation strategies, such as improvement to productivity, which increases business resilience to climate risk, as well as reducing the carbon footprint of production. This is particularly important in the emission intensive industries such as beef.

If agriculture is to be included in the Carbon Pollution Reduction Scheme, the industry needs to start preparing now to manage the potential impacts of the Scheme. Economic modelling suggests that the Scheme will have significant productivity implications for industries such as beef, if production changes are not made and emissions aren't reduced. ABARE (2009) modelling estimates that under the CPRS, production costs in the beef cattle and sheep meat industries will increase by 19.9% by 2030. Those increases are estimated to be 15.8% for wool production and 6.7% for dairy[1]. As the ABARE study includes an assumption that all competing countries include agriculture in an emissions trading scheme, these estimates are likely to be conservative.

If agriculture is not covered by the CPRS it is likely that there will be other market or government requirements for emissions to be reduced. The sector must therefore take steps now to 'adjust' to this situation.

At this time, the impacts of the CPRS on profitability need to be addressed through both mitigation efforts (R&D etc) but also an increase in productivity and management. Responses could be similar to those for managing climate change risk.

The role of government in augmenting the shift to towards farming practices which promote resilience in the farm sector in the face of climate change

The role of government in assisting farm sector to adapt to climate change impacts

Government can facilitate increasing the resilience of the farming sector to climate change through providing access to information, training, incentive based changes, supporting research on climate variability, climate change and impacts, and the development of adaptation and decision support tools.

Government's role in facilitating improved climate risk management include such opportunities and challenges as:

[1] ABARE 2009, Agriculture and the Carbon Pollution Reduction Scheme (CPRS):economic issues and implications. Issues insights 09.2

- Providing support and improved access to the interpretation of climate science including its interactions with biophysical processes to improve the knowledge of land managers, consultants, regional NRM officers, and departmental extension officers, on climate variability and the impacts of climate change;
- monitoring and evaluating the changes in levels of risks and suitability of adaptation responses to be extended to a range of agricultural industries, such as horticulture and cropping. For example, by providing supporting risk management frameworks in conjunction with the preparation of climate projections that include a qualitative and quantitative analysis of the likelihood of different outcomes;
- bioeconomic modelling for agricultural industries to assess the impact of climate change projections on enterprise economics and natural resource sustainability;
- supporting supply chain logistics, including infrastructure to ensure efficiency and to enable changes in what is produced;
- providing information on possible alternate land uses;
- investing in R&D into genetic improvement of crops and livestock to improve productivity and resilience to climate risks;
- investing in R&D into on farm management practices such as soil and water use management; and
- supporting biosecurity risk management in terms of preparedness and prevention, and appropriate responses to biosecurity risks (i.e. pest and diseases detection).

More broadly, government has traditionally had a role in supporting climate adaptation by:

- setting policies which facilitate adaptation;
- R&D&E: new technologies, new plant varieties etc.;
- appropriate investments in infrastructure to facilitate adaptation;
- regulating to allow the sector to realise the opportunities and manage the risks;
- providing fiscal incentives for adaptation (i.e. loan programs for business improvement);
- financial counselling; and
- leading and funding emergency and exceptional circumstances relief for droughts, floods and other climatic events.

These programs are being reviewed to ensure they facilitate rather than interfere with producers' ability to be prepared for current climate variability and risks, and for climate change.

Climate change risk preparedness

The Queensland Government considers that the historical divide between adapting to climate change and being prepared for climate variability is no longer appropriate, and that government should approach both issues as climate risk management. An example is drought preparedness. Drought policy could be included as part of climate

change adaptation and addressed under an overarching 'national climate change risk management policy'.

The Primary Industries Ministerial Council (PIMC) 2006 Drought Reference Group agreed that the focus should be shifted "from Exceptional Circumstances (EC) interest rate subsidies during drought, to improved drought preparedness measures", and identified the following initiatives:

- A seasonal index tool to assist with drought preparedness and management
- Enhanced information and extension and training services
- Drought preparedness and management grants
- Professional advice, viability, planning and training grants and
- Drought innovation grants.

While the detail of a final policy position and programs to be offered under the policy are yet to be agreed, it is likely that training programs aimed at helping producers develop climate risk management plans, and assistance with implementation of those plans is contemplated.

In 2007-08 Queensland Primary Industries and Fisheries provided $7.25 million in direct drought preparedness programs (for example extension and training programs outlined in the next section) and has also provided an estimated $1.5 million for the Farm Financial Counselling Service. The current Primary Industry Productivity Enhancement Scheme (PIPES) administered by QRAA also provides concessional loans that can be used by primary producers for a range of measures which improve farm productivity or profitability. PIPES is currently being reviewed.

The Queensland Government currently provides the following programs to assist producers identify seasonal climate risk:

- Development of the Southern Oscillation Index (SOI) phase system which has wide international adoption. This information provides three month seasonal forecasts and is disseminated through the LongPaddock website, rural press and ABC weather reports on radio and television.
- The Queensland Climate Change Centre of Excellence (QCCCE) is also undertaking further climate forecasting research such as developing the Seasonal Pacific Ocean Temperature Analysis-1 (SPOTA -1) which is intended to forecast summer rainfall by the end of the preceding wet season (nine to twelve month forecasts), an outcome very important for the beef industry.
- Seasonal Crop Outlooks for wheat and grain sorghum. These reports are also integrated into the National Agricultural Monitoring System (NAMS) and provide input into ABARE's Crop Report.

In addition to the statistical forecasts (eg: SOI phase and Spota-1), the Bureau of Meteorology/CSIRO's dynamic climate model Predictive Ocean Atmosphere Model for Australia (POAMA) is useful for producers, providing seasonal and interannual forecasts. It is under continual development, so producers are accessing the best available science. Access to both dynamic models such as POAMA and statistical models such as SOI phase system provides a broader understanding of the

uncertainties in the forecasts and allows producers to best judge the differences between these tools and how they may be applied to their business. Having a better understanding of the strengths and weaknesses of statistical and dynamic models enables them to better understand the uncertainties around the future climate risks.

The QCCCE is finalising regional climate change projections based on the CSIRO and BoM climate change projections for Australia[2]. This information will assist producers to understand the projected changes in climate for their region.

The Queensland Government is currently preparing a submission to the House of Representatives Inquiry into meteorological forecasting. The Inquiry's Terms of Reference discusses the efficacy of weather and climate forecasting, and innovations to address identified problems, in particular, forecast skill, access to information, improvement in relevance to decision makers, and adoption by the community. The importance of understanding the impact of climate variability on Queensland is discussed and opportunities for using weather forecasts for emergency responses are identified.

Understanding and managing climate impacts

Government can assist the farm sector understand the impacts of climate change on their industry by supporting R&D that links climate change projections with commodity specific models and assessments. Government also needs to support access to this information and assessment of the flow-on affects to other industries and downstream processing.

The Queensland Government has developed a range of commodity-specific forecasting models which can be run with climate change projections (and seasonal climate outlooks) to assess the impacts of climate variability and change. These commodity-specific models include:

- decision support software for irrigated crops;
- a modelling tool for rice to look at the impacts of climate variability on rice production;
- a beef forecast model to assess the impacts of climate change on gross margins and profitability of cattle properties and regions;
- research into the impact of climate change on regional scale wheat yields and adaptation options, using a shire scale modelling approach; and
- rainfall, pasture growth and fire maps (historical and forecast).

The Queensland Government provides the following decision support tools to help producers manage climate risk and assess impacts and adaptation options:

- Whopper Cropper, APSIM, APSFarm, and YieldProphet decision and discussion support tools helps producers make crop management decisions based on the likely seasonal conditions;
- Rainman, which allows users to calculate chances of monthly and seasonal rainfall;

[2] CSIRO and Bureau of Meteorology, 2007 Climate Change in Australia http://www.climatechangeinaustralia.gov.au/

- DroughtPlan helps producers develop profitable and sustainable grazing strategies to manage for rainfall variability. DroughtPlan comprises a number of products including BB-Safe, Graze On, Pasture Supply and Demand Evaluator, and the Assessing Your Livestock Management Option;
- Breedcow and Dynama designed for managers of extensive beef production systems;
- AussieGRASS is a system for assessing, monitoring and forecasting the condition of Australia's extensive grazing lands. AussieGRASS is a key component of NAMS;
- GRASP and Enterprise modelling framework that enables bio-economic modelling of climate change impacts in the beef pastoral industry;
- Provision of climate change adaptation workshops, seminars and presentations, using a participatory approach;
- FLOWCAST is a powerful research software to generate and evaluate seasonal climate forecasts for a range of hydrological, meteorological and agronomic variables. It has been designed for scientists, water managers, and agricultural decision makers who have sufficient background knowledge in climate and its drivers;
- Risk Management Matrix approach for the rangelands which uses CSIRO climate change projections for 2030 and translates this into terms (e.g. impacts, adaptation and vulnerability) that can be readily be applied to management and decision-making for the grazing industry. The Risk Management Matrix provides a robust process to address the complexities of climate change impacts for the grazing industry. The risk management approach considers a range of impacts including the biophysical resource, rural communities and public policy; and
- FORAGE - Framework for Online Report Generation – a web-based system which generates, analyses and distributes information relating to climate and pasture condition at user-specified locations.

Due to Queensland's leadership in climate change adaptation, the Queensland Government was awarded the Chair of Adaptation Sub Group of the COAG Climate Change and Water Group. Through the Adaptation Sub Group, Queensland contributes to the development and implementation of climate change impacts and adaptation initiatives and to the development of a national framework on climate change adaptation.

Improved sustainability and reliability of water supply

Climate change will affect water supply from runoff and groundwater. Historical rainfall data are used in modelling rainfall and runoff to support water resource planning, but it now needs to include the potential climate change impacts. Queensland will be using potential changes to rainfall, evaporation and temperature from relevant climate change projections to model runoff and assess water supply reliability for water users and the environment in response to climate change. Future Water Resource Plans (including 10 yearly reviews) will take account of the most current climate change research and projections. Groundwater flow models will also incorporate relevant climatic data to reflect the potential changes to groundwater availability.

Regional Water Supply Strategies will encompass planning for the likelihood of more variable and extreme climatic conditions including severe droughts that are expected due to the forecast impacts of climate change.

The Queensland Department of Environment and Resource Management (DERM) also provides support to improve water use efficiency and encourage irrigators to adopt sustainable irrigation management practices and increased productivity, through programs such as the Rural Water Use Efficiency Initiative (RWUE) and South East Queensland (SEQ) Irrigation Futures.

Reliable access to water for irrigation needs to be facilitated through federal and state water plans, policies and initiatives.

The role of government in assisting farm sector to adapt to mitigation efforts

Government has a role to play in preparing the farm sector to the impacts of the CPRS and/or other mitigation policies and market drivers:

- Education and information dissemination on the CPRS;
- Investment in R&D to identify mitigation options;
- Investment in R&D to boost productivity and management;
- Identifying measurable sequestration options for the sector that 'count' under the CPRS; and
- Ensuring that government policies take into account the broader economic implications of mitigation requirements for the sector.

Sustainable land management

Government can encourage better land management to increase resilience to the future impacts of climate change. It will also better prepare the farm sector for greenhouse gas mitigation policies in the rural sector.

In Queensland, DERM and stakeholders developed the Delbessie Agreement in 2007, which provides a practical basis for the Government to work with lessees on reversing declining land conditions and addressing the threat of increasing climatic variability, in balance with assuring the ongoing viability of rural communities. A combination of regulatory and incentive based approaches is being used to engage lessees so that by 2020, over 50 percent of Delbessie Agreement leases will have land management agreements. Land management agreements will describe natural and physical characteristics and environmental values of the land, record the agreed condition of the land, identify any land degradation issues, (for example resulting from such practices as overstocking) and establish agreed management outcomes for identified issues and strategies for addressing them.

The Delbessie Agreement provides incentives for lessees to sustainably manage and build the resilience of their land to deal with the impacts of a changing climate while encouraging the adoption of adaptation measures to address best practice land and animal management.

The role of government in providing other support

Incentives

Incentives to manage climate risk should replace existing drought assistance which currently encourages producers not to prepare for drought. Incentives to encourage producers to be prepared for climate extremes include:

- Regional climate change workshops to build producers understanding of climate variability and change, the likely impacts and adaptation options
- Training and support to develop climate risk management plans
- Grants, tax concessions or other incentives to improve climate risk preparation, such as infrastructure to increase water and fodder storage capacity.

The impacts of greenhouse gas emissions reductions incentives would need to be assessed in a holistic way to prevent perverse incentives, for example care needs to be taken with encouraging carbon planting, due to its impact on biodiversity and water and the long term conversion of land to carbon farming from agriculture.

Community support and assistance

Adapting to climate change and extreme climatic events requires leadership and social support and networks in rural communities. Counselling and chaplain services, mental health providers, sports and social clubs, emergency service providers and voluntary support groups in rural communities are required to maintain the capacity of rural communities.

Government can support producers and communities to adopt preparedness measures to build resilience to drought. This is particularly important due to the warmer and drier conditions projected for much of Australia. Producers and communities need to better prepare for drought through the uptake of climate risk preparedness and adaptation practices, and government programs need to be oriented towards providing appropriate incentives (such as those discussed above) to achieve this aim.

Education and Training

Education and training has played an essential role in supporting adaptation to climate variability in the primary industries sector. The 'Managing for Climate' workshops are designed to build producers understanding of the drivers of climate in Queensland and how to understand weather maps and seasonal forecasts and to assist in decision-making. The workshops include an explanation of the Southern Oscillation Index (SOI) by a climatologist and how its use when making major management decisions can improve the management of risks and hence profitability.

The QCCCE has provided industry specific workshops on climate change projections, impacts and adaptation across Queensland to build on the Managing for Climate workshops and assist producers to understand the risks associated with climate change. They have also worked specifically with the beef and sheep industry to develop the Risk Management Matrix, a tool for producers to assess the risks from climate change on the various aspects of their business and to develop adaptation options to manage those risks.

A range of drought risk management workshops are also offered including:

- 'Assessing Your Livestock Management Options' a workshop to help producers plan for and manage drought;
- 'Decision Trees' a technique and workshop process to evaluate the key elements of a drought management decision-the uncertain events (e.g. duration of drought), the tactics (sell, agist, feed) and the pay-offs for each event/tactic combination; and
- 'Drought plan - managing for climate variability' which has been developed, with the help of producers, to provide activities and products that integrate climate variability with farm decision making and property management planning.

Such programs could be used as a template for introducing producers to regionally based climate change impacts assessments derived from climate models. This would be aimed at helping producers understand climate change forecasts, seasonal forecasts, and how they might be used in their business. Workshops could also be used as an opportunity to disseminate R&D outcomes, to inform production decisions in light of the climate forecasts.

The role of government in promoting research, extension and training which assists the farm sector to better adapt to climate change

Research, extension and training underpin the ability of the farm sector to adapt to climate change and to respond to the changing mitigation requirements, both government and market driven. Government support for all of these is essential.

The type of work done by QCCCE includes developing tools to assist sheep and beef producers assess and manage the risks from climate change. The Risk Management Matrix is a participatory approach and has proved to be a useful tool to: (1) effectively assess the complexity in the grazing system; (2) handle uncertainty in the climate projections; (3) be used by extension personnel with land managers in regional areas; (4) identify a more comprehensive range of adaptations than are typically explored by scientists which provides a practical and realistic assessment of risk and vulnerability; (5) help facilitate a better understanding on the influence humans play in changing the climate; and (6) bridge the disconnect between science and the knowledge required for informed and effective on-ground.

With some initial training, the matrix can easily be operated by a range of stakeholders, extension officers, natural resource officers and scientists to better prepare different regions and ecosystems for the changing climate. The process has the potential to be modified and used in other industries (e.g. wine, horticulture, cropping) and sectors (e.g. health, transport, infrastructure). A simplified version of the matrix approach was also used in regional planning in far north Queensland with the tourism industry to identify likely impacts of climate change and options for adapting to those impacts. In these examples, the process did not include risk assessment, but was found to be a helpful process for people with limited knowledge of climate change to look at the likely impacts and adaptation options.

Government also needs to support the evaluation and continual improvement of these tools to ensure their on-going relevance to industry.

Research undertaken by the Queensland Government which contributes to work under the National Agriculture and Climate Change Action Plan 2006-2009 includes:

- Investigating whether reductive acetogens from kangaroo foregut contents can reduce methane emissions from cattle;
- Exploring the potential to grow the sorghum industry, and its downstream application for biofuels;
- Collaborative projects to build understanding and capacity to work on climate change issues (e.g. Class 1 weed invasion post-Cyclone Larry) and a potential collaboration to explore a range of new/emerging climate change modelling tools on invasive species;
- Sorghum and maize breeding programs which have developed cereals with superior yields under drought conditions;
- Climate Change Action Plan for Horticulture which lists priority actions for adapting to climate change and for research and development;
- The Queensland Primary Industries and Fisheries (QPIF), Land and Water Australia and Horticulture Australia Ltd project, "Critical thresholds ('tipping points') and climate change impacts/adaptation in horticulture (2009-2011) to develop a clear and defined understanding of how climate change will impact horticultural cropping systems and businesses;
- The Australian Vegetable Industry through Horticulture Australia Ltd, and QPIF, funded the project, "Vegetable Industry Carbon Footprint Scoping Study - Discussion Papers and Workshop; and
- The QPIF and Horticulture Australia Ltd, project "Understanding and Identifying the Threats and Opportunities for the Banana Industry Posed by Climate Change".

The Queensland Government has made significant progress building national research and development partnerships with an interest in climate change impacts and adaptation including:

- a new phase of the collaborative Agricultural Production Systems Research Unit (APSRU IV) which brings together a number of national and international agencies;
- the Commonwealth Government's Climate Change Research Strategy for Primary Industries (CCRSPI);
- a joint project with the CSIRO to assess the impacts of climate change in the Murray Darling Basin; and
- A collaborative project with MLA, CSIRO, Northern Territory DPI, and Western Australia Ag in the northern Australian beef industry that will develop regional climate change forecasts, assess impacts, and develop adaptation responses.

The Queensland Government provides extension and training for seasonal climate outlooks, climate change projections and drought risk management as described above.

The role of rural research and development in assisting farmers to adapt to the impacts of climate change

The Queensland Government considers that a coordinated national Research and Development program for climate change adaptation is pivotal to ensuring that Australian agriculture remains profitable in light of climate variability and mitigation requirements.

The focus of R&D needs to be about minimising the negative impacts from climate change and mitigation policies and maximising opportunities from these. It needs to be an integrated approach and look at the flow-on effects of changes to production to downstream industries or changing land use to the regional economy, community and environment. This approach is further supported when issues such as competing land use, increased marginal agricultural land due to climate changes, land use change (biofuels, forestry etc) are taken into account. R&D investments need to ensure the biggest return.

Seasonal climate forecasting

One of the best defences against the impacts of future climate change is to continue to develop the capacity and knowledge of producers and government to inform our response to climate variability more effectively. Climate forecasting is a vital tool in managing the challenges of a changing and increasingly variable climate. The Queensland Government has a long history of promoting the development and extension of climate forecast information.

There is a need to for regional climate change forecasts to inform medium and long range planning decisions and to enable a better understanding of risks for the farm business due to future climate change. There needs to be more investment in short to medium term seasonal forecasting relevant to particular locations, sectors and industries so that it can be readily incorporated into management and decision-making. For example is irrigation likely to be a bigger requirement or less viable? Do I need bigger dams or to change my enterprise from cropping to pastoral etc.

The Queensland Government is currently preparing a submission to the House of Representatives Inquiry into meteorological forecasting, as discussed above.

Improved local seasonal forecasts are therefore required to give confidence to investment decisions. Current three-month forecasts provide some use for short term planning horizons, but reliable multi-season forecasts extending beyond three months are also required for decision making by farmers. For example, northern cattle producers enter the dry season in the knowledge that the grass currently available is all they will have until the next wet season. Knowledge of the prospects for the next wet season at the end of the current wet season (for example nine to twelve months in advance) would greatly aid in producers' decision making processes regarding stocking rates, cattle sales and purchases and other aspects of their climate risk management plans (for example, property investment and infrastructure, early agistment).

Improved short term weather forecasts are required to realise opportunities and avoid loss from unfavourable weather conditions. Prospects for temperature, hail, rainfall events including rainfall intensity are also useful.

Regional climate change projections

Regional climate change forecasts must be accessible. Producers must be able to find easily accessible information that can be easily incorporated into their business plans. The PIMC has developed the national Agricultural Monitoring System (NAMS) to assist with the operations of the EC program. Perhaps this system could be modified to be of use to producers. Otherwise other web based services, such as Queensland's LongPaddock website or the SILO website could be enhanced. Private sector providers, such as Weatherzone or Eldersweather, could also be used.

To support the dissemination and understanding of regional climate risk information there is a need for up-skilling of general 'climate literacy' among all stakeholders. For example to ensure that the relevant government information resources available are fully utilised by all parties, training programs for regional departmental and NRM extension staff in climate science and risk management is necessary.

Biosecurity

Climate change may suit the invasive characteristics of agricultural pests, weeds and diseases through warmer conditions generally and disruption caused by climate hazards. Biosecurity risks include invasion of weeds into cyclone devastated regions, southern expansion of pest species due to increased temperatures and pressure to grow crops for bio-fuels using 'weedy' species. There is also the risk that management decisions are based on outdated pest risk assessments that may be inadequate in light of a changing climate. The Queensland Biosecurity Strategy recognises this and commits to addressing the issue through the associated Biosecurity science action plan. There will be a particular focus on research into factors influencing biosecurity in tropical areas, including climate change.

Biosecurity surveillance and response therefore needs to be continued. In light of the potential increased biosecurity risks resulting from climate change, it is important that investment is in accordance with a risk management framework. The extent of the biosecurity challenge requires a whole of community response.

Enhanced decision support tools

Decision support software tailored to the producer's individual production system, soil-type, cultivation practices and incorporating more reliable seasonal forecasts are required.

Although the Queensland Government has made considerable investment in tools for pastoral and broadacre industries, little is currently available for horticulture. This is an historical artifact as horticultural producers, more reliant on irrigation, were considered largely drought proofed in the past, a misconception that has proven to be false in the most recent, prolonged drought. For horticultural growers to be able to

make superior management decisions in the face of climate variability and now climate change, Decision Support Tools which provide forecasts of temperature up to 6 months in advance (long lead times), for periods of one week to one month (short season lengths) are required. No such tools are currently available.

The development of climate change and drought preparedness modules that can be integrated into Farm Management Systems and Grazing Land Management programs could ensure a whole farm integration of climate change drought preparedness into management processes consistent with sustainable and profitable long term returns. A climate change module is now included in Grazing Land Management.

Seasonal forecasting information together with farm decision making software could be incorporated into an upgraded National Agricultural Monitoring System to ensure accessibility.