Horticulture Climate Change Action Plan

March 2009

Objective

The objective of the *Horticulture Climate Change Action Plan* is to commence answering the question – *"What are the Impacts of climate change on selected horticultural regions and production systems in those regions, and what Adaptation Strategies will be useful in addressing these impacts?"*

For individual growers, outcomes of the Action Plan can start to answer the question - *"What does climate change mean for my farm and my business?"*

Strategies

The three strategies identified for the horticulture industry are:

1. **Adaptation**
2. **Mitigation**
3. **Information, Awareness and Communication**

These are discussed in more detail below.

1. Adaptation

One of the desired adaptation outcomes for Australian horticulture is the existence of resilient and adaptive horticultural production systems which are less vulnerable to climate change and climate variability.

One of the priorities for Australian Horticulture in achieving this desired outcome will be to identify and build on successful strategies of adaptation by the horticultural sector to climate changes already experienced.

A question which actions, addressed by this priority will answer is, "Do horticulture producers (and their advisors) have appropriate tools and an understanding of climate change and variability issues, to avoid the risks and/or take advantage of the opportunities of a variable and changing climate?"

Desired Adaptation Outcomes for Australian Horticulture

- Resilient and Adaptive Horticultural Production Systems which are less vulnerable to climate change and climate variability.
- Improved industry resilience to changes in pest and disease incidence.
- Increased ability to capitalise on new market opportunities.
- Regionally specific climate change scenarios, which are relevant to managers of horticultural enterprises.
- Practical tools available to horticultural growers and their advisors to better manage climate change and climate variability.

Priorities for Australian Horticulture in Adapting to Climate Change

- Identify and build on successful strategies of adaptation by the horticultural sector to climate changes already experienced.
- Obtain regional climate change scenarios (downscaling) for all Horticulture regions (to 2030) – update as improved scenarios become available.
- Develop Impact Assessments for all or major commodities in these regions.
- Assess the Vulnerability of all or major regions and/or horticultural commodities and Identify current "at risk" production sites (regions) and/or industries.
- Identify the long-term (2030 and 2070) opportunities and threats to horticultural regions and cropping systems, as a consequence of climate change - long term adaptation.
- Develop (in consultation with growers and their advisors), Adaptation Strategies which are appropriate, practical, and economically sound.
- Review and/or develop where necessary, Best Management Practices (BMP) for horticulture, which include adaptation and mitigation components.
- Assess the economic benefits of agri-forestry in horticulture as well as the benefits it might bring for adaptation and mitigation.
- Document the effects of climate change for major overseas production regions, especially in those countries that are major competitors to Australian production.
- Identify additional export opportunities for Australian growers
- Identify alternative regions that may be suitable for production, to take advantage of these market opportunities.
- Investigate the "food miles" concept and the effects decisions on markets and production opportunities for horticulture.
- Develop horticulture specific forecasting tools that can be used for climate change and climate variability (especially temperature variability) related decision making at a farm and regional scale.

Some Questions which these Actions will answer

- Are we aware of, and do we understand the adaptation strategies which growers have successfully employed to manage their enterprises in an already changing climate?
- Do horticulture producers (and their advisors) have appropriate tools and an understanding of climate change and variability issues, to avoid the risks and/or take advantage of the opportunities of a variable and changing climate?
- Are current climate change scenarios sufficiently regionally specific to enable appropriate vulnerability assessments for horticultural commodities and/or production regions?
- What are the changes in distribution and abundance of pests, diseases and weeds under a changing climate?
- What are the impacts for managers of pests, diseases and weeds, of a changing climate?
- Are there new market opportunities (domestic and export) as a result of climate change effects in Australia and overseas?
- Are the current scenarios sufficiently regionally specific, for horticulture to respond appropriately with adaptation and mitigation strategies which are practical, effective and profitable?
- What are the tools, which are being used by managers of agricultural systems to manage climate risk, which can be improved/modified to have an application in horticulture?
- What is the level of understanding in the R&D community of the special research needs for farm management (decision support) tools in horticulture?

Urgent/immediate recommended priorities for Australian Horticulture in Adapting to Climate Change:

1. Work closely with CSIRO scientists to obtain regional climate change scenarios (downscaling) for all Horticulture regions (to 2030) – update as improved scenarios become available.
2. Assess the vulnerability of all or major regions and/or horticultural commodities; identify current "at risk" production sites (regions) and/or industries; and identify the long-term (2030 and 2070) opportunities and threats to horticultural regions and cropping systems, as a consequence of climate change (long term adaptation).
3. Review and/or develop where necessary, Best Management Practices (BMP) for horticulture, which include adaptation and mitigation components (short term adaptation).
4. Document the effects of climate change for major overseas production regions, especially in those countries that are major competitors to Australian production, and identify additional export opportunities for Australian growers.

2. Mitigation

Two of the desired mitigation outcomes for Australian horticulture are reduced greenhouse gas emissions from horticultural production systems, and profitable horticultural production systems which contribute to greenhouse gas abatement.

Two of the priorities for Australian Horticulture in mitigating greenhouse gasses are to determine the contribution ("Carbon Footprint") which all horticulture (and specific regions and commodities) make to N2O and CO2 emissions, and to identify and promote horticulture specific Best Management Practices (BMP) which minimise N2O and CO2 emissions, and at the same time promote the simultaneous goals of productivity, sustainability, adaptability and abatement.

Two of the questions which actions addressed by this priority will answer are, "Do we understand how to reduce greenhouse gas emissions from horticulture cropping systems?" and "Are current fertilizer management practices in horticulture appropriate for managing N2O emissions?"

Desired Mitigation Outcomes for Australian Horticulture

- Reduced Greenhouse Gas emissions from Horticultural Production systems.
- Profitable horticultural production systems which contribute to greenhouse gas abatement.
- More energy efficient horticultural production and marketing systems.
- Increased ability to capitalise on consumer perceptions and new market opportunities.
- Cost effective biofuel usage and production in horticulture.
- Biosequestration applicable to horticultural cropping systems.

Priorities for Australian Horticulture in Mitigating Greenhouse Gasses

- Determine the contribution ("Carbon Footprint") which all horticulture (and specific regions and commodities) make to N2O and CO2 emissions.

- Develop on-farm measures of N2O and CO2 emissions (indicator tools for GHG emissions), which are scientifically consistent and verifiable for measuring greenhouse gas emissions from each of the cropping systems and regions of horticultural significance.
- Identify and promote horticulture specific Best Management Practices (BMP) which minimise N2O and CO2 emissions, and at the same time promote the simultaneous goals of productivity, sustainability, adaptability and abatement.
- Identify the gaps in our understanding and the ability of current BMP's to sufficiently mitigate greenhouse gasses.
- Assess Controlled Traffic/Minimal Till systems in vegetable production systems for energy efficiency as well as issues associated with reduced greenhouse gas emissions.
- Assess the economic benefits of agri-forestry in horticulture as well as the benefits it might bring for adaptation and mitigation.
- Review and/or develop where necessary, Best Management Practices (BMP) for horticulture, which include adaptation and mitigation components.
- Investigate the "food miles" concept and the effects decisions on markets and production opportunities for horticulture.
- Develop on-farm measures of energy use (energy audit tools) that identify areas where cost reductions and environmental benefit can be obtained.
- Assess the potential cost efficiencies of bioenergy and renewable energy sources for the horticultural sector.
- Investigate the profitability of bioenergy crops as alternative and rotation/fallow crops in horticulture cropping systems

<u>Some Questions which these Actions will answer</u>

- What contribution does horticulture in Australia make to greenhouse gas emissions?
- Are they different for each commodity/cropping system?
- Are they different for each production region?
- Do we understand how to reduce greenhouse gas emissions from horticulture cropping systems?
- Are current fertilizer management practices in horticulture appropriate for managing N2O emissions?
- Can soils under horticultural crop management be net sequesters of Carbon?
- What opportunities exist for horticulture to become more energy efficient on farm?
- What opportunities exist for horticulture to become more energy efficient along the supply and demand chain?
- Are there new market opportunities (domestic and export) as a result of climate change effects in Australia and overseas?
- Are consumers willing to preferentially purchase "low carbon" fruit and vegetables?
- Can horticultural cropping systems play an important role in emissions trading?
- Are there any crops which can be grown as part of horticultural production systems which can have economic benefits to farmers, whilst providing a feedstock for biofuel production?
- Can horticultural cropping systems play an important role in emissions trading?
- Can horticultural cropping systems play an important role in biosequestration and emissions trading?

<u>Urgent/immediate recommended priorities for Australian Horticulture in Mitigating Greenhouse Gasses</u>

1. Determine the contribution ("Carbon Footprint") which all horticulture (and specific regions and commodities) make to N2O and CO2 emissions, and develop on-farm

measures of N2O and CO2 emissions (indicator tools for GHG emissions), which are scientifically consistent and verifiable for measuring greenhouse gas emissions from each of the cropping systems and regions of horticultural significance.

2. Identify and promote horticulture specific Best Management Practices (BMP) which minimise N2O and CO2 emissions, and at the same time promote the simultaneous goals of productivity, sustainability, adaptability and abatement, and identify the gaps in our understanding and the ability of current BMP's to sufficiently mitigate greenhouse gasses.

3. Information, Awareness and Communication

Two desired awareness outcomes for Australian horticulture is a clear understanding of climate change and climate variability issues by stakeholders in horticulture, and horticulture producers and their advisors having sufficient understanding of climate change and climate variability issues to be able to make appropriate risk management decisions.

Two of the priorities for Australian horticulture for informing growers, scientists, politicians and the community are to develop information products which promote horticulture specific messages to the community as well as to stakeholders in horticulture, and develop and disseminate specific information to raise awareness in the most vulnerable industries and regions.

A question which these actions addressed by this priority will answer is, "Do horticulture producers (and their advisors) have appropriate tools and an understanding of climate change and variability issues, to avoid the risks and/or take advantage of the opportunities of a variable and changing climate?"

<u>Desired Awareness Outcomes for Australian Horticulture</u>

- A clear understanding of climate change and climate variability issues by stakeholders in horticulture.
- Horticulture producers and their advisors having sufficient understanding of climate change and climate variability issues to be able to make appropriate risk management decisions.

<u>Priorities for Australian Horticulture for informing growers, scientists, politicians and the community</u>

- Develop information products which promote horticulture specific messages to the community as well as to stakeholders in horticulture.
- Develop and disseminate specific information to raise awareness in the most vulnerable industries and regions.
- Communicate climate change issues to growers and their advisors, by taking (making) opportunities to present climate change information (including results of R&D) and engaging in discussions and motivating to consider the implications of climate change for their businesses, society and the environment.
- Communicate scientifically based information on observed climate trends, climate change projections and possible impacts to key industry sectors.

<u>Some Questions which these Actions will answer</u>

- Do we know which commodities and/or regions are most at risk from climate change?

- Are horticulture growers and their advisors aware of the implications of climate change to their industries and businesses?
- What are the important messages which will increase climate change awareness amongst stakeholders in all horticulture industries?
- Do horticulture producers (and their advisors) have appropriate tools and an understanding of climate change and variability issues, to avoid the risks and/or take advantage of the opportunities of a variable and changing climate?

Urgent/immediate recommended priorities for for informing growers, scientists, politicians and the community

1. Develop information products which promote horticulture specific messages to the community as well as to stakeholders in horticulture.
2. Communicate scientifically based information on observed climate trends, climate change projections and possible impacts to key industry sectors raise awareness in the most vulnerable industries and regions.

Background

Nature of the problem

To date there has been limited research into climate change and climate variability in the Australian horticulture sector, in comparison with the extensive R&D conducted in broad-acre agriculture and the grazing industries. In 2005/06 HAL funded the project – "VG05051: Scoping Study - Climate Change and Climate Variability - Risks and Opportunities for Horticulture". This one-year scoping study focused on the gathering of knowledge on work already undertaken in the area of climate variability and climate change, and the potential for the Australian vegetable industry to capitalise on tools and programs currently available.

The Final Report "Climate Change and Climate Variability – Risks and Opportunities for Horticulture" identified key issues and provided recommendations specifically for the vegetable industry, including conclusions for the horticulture industry as a whole. In summary, the steps in addressing climate change in horticulture in Australia should include identifying those industries and/or specific locations which are most at risk from climate change, followed by the development of adaptation strategies for those industries and regions at risk. At the same time, climate variability (particularly temperature) will continue to challenge managers of horticultural supply and demand chains (production and marketing). Forecasting tools need to be developed, with the requirements of horticultural industries and managers specifically in mind.

There is a large amount of climate information available to grazing and cropping industries, but much of this is not in a form which is useful to horticulture. There is an opportunity to develop and disseminate climate information with specific application to the horticulture sector.

The Scoping Study identified the following climate change priority issues worthy of investigating:-

- What are the climate change impacts for the most vulnerable crops and regions?
- How vulnerable are horticultural crops and regions to climate change?
- Where are the knowledge gaps preventing adaptation to climate change?
- What are the potential adaptation strategies for crops and regions?
- What are the costs and benefits of these adaptation strategies?

- How practical and acceptable are these strategies and what is the capability of industries and individual growers to implement these strategies?
- What are the barriers to adoption?

For horticultural industries to successfully adapt to increasing temperatures and changing rainfall patterns, there will be a need to understand the impact of climate change on specific regions and cropping systems, how vulnerable these regions and cropping systems are, and then develop both pre-emptive and reactive adaptation strategies or options.

Research undertaken

There is a focus on understanding how to improve the management of climate variability from a horticulture perspective, with an emphasis on temperature variability. A review was conducted (AH06019) of 27 projects previously funded by the Managing Climate Variability Program (MCVP) across a range of agricultural industries, of which 15 projects provided information or were capable of delivering an outcome which could have application in horticulture.

Currently the limitation on the use of tools for managing climate variability in horticultural industries is the lack of climate science understanding that addresses the lead-time and season length requirements of horticultural industries. The combination of long season (3 months) and short lead-time (zero), which are appropriate for other agricultural industries, is a significant constraint to the use of forecasting tools in horticulture, where a much shorter season length (several weeks to one month) and a much longer lead-time (3 to 4 months), would be much more useful. Given a sound forecast system that meets the requirements of the industry the appropriate tools can be produced.

There are no forecast systems based on the Southern Oscillation Index (SOI) and Sea Surface temperatures (SST) which have been extensively tested for longer lead-times and shorter seasons.

There are many tools which have been developed for the management of rainfall variability, but none which address the need for a greater understanding of temperature variability. Temperature variability is the main parameter which affects the performance of most horticultural crops.

Major research findings and industry outcomes

Tools used in managing climate variability, have in the main been designed and constructed for a specific purpose and for a specific agricultural or pastoral industry. None of these tools have been designed specifically with any horticultural industry or application in mind. Some examples:

- Bureau of Meteorology (BOM) – Seasonal Temperature Outlook – http://www.bom.gov.au/climate/
- LongPaddock – http://www.longpaddock.qld.gov.au/
- Madden Julian Oscillation (MJO) – http://www.apsru.gov.au/mjo/ or http://www.bom.gov.au/climate/tropnote/tropnote.shtml
- AgClimate - http://www.agclimate.org/
- Rainman StreamFlow version 4. - http://www.dpi.qld.gov.au/rainman/
- Southern Oscillation Index (SOI) – http://www.bom.gov.au/climate/glossary/soi.shtml or http://www.longpaddock.qld.gov.au/SeasonalClimateOutlook/SouthernOscillationIndex/index.html or

http://www.longpaddock.qld.gov.au/SeasonalClimateOutlook/RainfallProbability/index.html

- Sea Surface Temperatures (SST)
  http://www.longpaddock.qld.gov.au/SeasonalClimateOutlook/SeaSurfaceTemperature/index.html
- The Predictive Ocean Atmosphere Model for Australia (POAMA) is a state-of-the-art seasonal to inter-annual seasonal forecast system based on a coupled ocean/ atmosphere model and ocean/atmosphere/land observation assimilation systems – Experimental Products are available on the web - http://poama.bom.gov.au/experimental/poama15/map_rt.html - the "Monthly Spatial Map Forecasts" provide temperature forecasts, as a spatial output for all of Australia.

Different predictive system delivering forecasts with a longer lead time and short season length, which are required for horticulture, are more likely to be achieved using dynamical modelling techniques than previous statistical methods used in other agricultural industries. For this to occur, horticulture needs to engage with climate scientists developing these newer systems, and provide them with details of the specific climate dependant needs of horticulture in Australia.

Future climate change will deliver impacts to horticulture as a consequence of increasing temperatures and changes to rainfall patterns. The most easily accessed and managed adaptation strategies will be employed and are currently being employed by growers, and these will be the use of more adaptable cultivars and a range of cultural practices which enable growers to maintain current production in current locations – i.e. adapt to the 'new' climate in the current location. This will be driven in the first instance to maintain profitability through market timing, market access and market share.

If climate change impacts exceed growers adaptation capacity at a specific location, then a southward shift of production, following the southward shift of agri-climatic zones, is more likely to occur if growers are to maintain current crop production and profitability through appropriate market timing, market access and market share.

Most of the anticipated climate changes point towards the need for a very high standard of crop management in order to respond to the challenges that expected changes pose. Industry and farm managers will need to distinguish between 'old climate expectations' and 'new climate realities' in determining and implementing new adaptation strategies or options.

Previous assessments of climate change adaptations have been made for agricultural industries other than horticulture. One of the general conclusions from these analyses is that the best defence against future climate change is to continue to develop the capacity and knowledge to manage our response to climate variability more effectively.

Climate change is occurring and there are two options; ignore it in the hope that it will go away and accept the consequences; or develop strategies to adapt to and manage the impacts of climate change.

Climate Change in Australia

Most of the anticipated climate changes point towards the need for a very high standard of crop management in order to respond to the challenges that expected changes pose. Industry and farm managers will need to distinguish between 'old climate expectations' and 'new climate realities' in determining and implementing new adaptation strategies or options.

Climate affects Australian horticultural industries in a range of ways through impacts on industry location, plant growth, pest and disease risk and product quality (Howden, et al., 2003). Amongst many other considerations, management and infrastructure decisions attempt to account for these climatic effects and risks. Such decisions will usually use the historical climate as a guide to future conditions, as there are no scientifically validated or published tools available which have been designed specifically with the requirements of horticultural industries in mind.

There is increasing evidence that human activities are already changing the global climate, and that more change seems likely. Consequently, historical conditions may become increasingly less pertinent as a guide to industry activities or industry adjustment.

Vulnerability to climate change is a function of the impacts of climate change on regions or farming systems, and the adaptive capacity of the farming systems in these regions. i.e. a particular region or farming system would be considered to be highly vulnerable to climate change, if there is little or no capacity to adapt to (or negate the effects of) the impacts of future climate change.

Vulnerability = Impacts – Adaptive Capacity

The IPCC defines vulnerability as "The extent to which climate change may damage or harm a system" (IPCC, 2001). A vulnerable system is one which is sensitive to changes in climate variables (impacts) and a system which is not able to readily adapt (low adaptive capacity) (Olmos, 2001).

Rainfall

Since 1900, Australian annual average rainfall shows a moderate increase (7.9mm/decade), but it is dominated by high year-to-year variability (Smith, 2004). While north-eastern Australia has become wetter since 1950, much of eastern and southern Australia has become drier. This is due to a weakening or southward shift of the frontal systems that bring most rain to these regions (Marshall, 2003). Rainfall intensity in eastern Australia has increased from 1910 to 1998, but has decreased in the far southwest of Australia (Haylock and Nicholls, 2000) over this same time period. Over New South Wales, extreme daily rainfall intensity and frequency has decreased from 1950 to 2003 (Hennessy et al., 2004b). The frequency of tropical cyclones in the Australian region has decreased since 1967 (Hennessy et al., 2004c), along with an increase in cyclone intensity, possibly as a result of a shift in areas of formation. Explosively developing cyclones, including east coast lows off the New South Wales coast, have increased between 1979 and 1999 (Lim and Simmonds, 2002).

There appear to be many potentially significant impacts of climate change on horticultural industries, some of which may be positive, some negative. It will be essential in reducing

the impact of climate change, that a clearer understanding of what these impacts are, and that management strategies be identified and implemented to either offset the negative impacts, or to take advantage of positive responses. Previous assessments of climate change adaptations have been made for other industries (e.g. Howden et al., 2003). One of the general conclusions from these analyses is that the best defence against future climate change is to continue to develop the capacity and knowledge to manage our response to current climate variability more effectively.

Temperature

Australian annual mean temperatures have increased by 0.9oC since 1910, with significant variations from region to region (CSIRO, 2007; Smith, 2004), with night-time temperatures increasing faster than daytime temperatures. Night-time (minimum) temperatures have particularly risen sharply in the northeast of Australia. There are also trends from 1957 to 2003 of increasing frequency in hot days (35oC or more) of 0.08 days per year and a decreasing trend in cold nights (5oC or less) of 0.16 nights per year (Hennessy et al., 2004a).

"The best estimate of annual warming over Australia by 2030 relative to 1990 is about 1.0ºC for the mid-range emissions. Warming will be a little less in coastal areas and a little more inland. The pattern varies little seasonally, although warming is less in winter in the south. The range of uncertainty due to differences between models is about 0.6ºC to 1.5ºC for most of Australia, with the probability of the warming exceeding 1ºC by 2030 being 10-20% for coastal areas, and more than 50% for inland regions." Department of Climate Change (2007). Mean temperature change is likely to be greatest inland and least on the coast. Most warming is expected to occur in spring and summer, and least in winter.

Climate change is occurring and there are two options; ignore it in the hope that it will go away and accept the consequences; or develop strategies to manage climate change.
All horticultural crops are sensitive to temperature, and most have specific temperature requirements for the development of optimum yield and quality (Deuter, 2008).

Climate change will impact horticultural commodities and regions through all of the following:-

- Changes in the suitability and adaptability of current cultivars as temperatures change, together with changes in the optimum growing periods and locations for horticultural crops
- Changes in the distribution of existing pests, diseases and weeds, and an increased threat of new incursions
- Increased incidence of physiological disorders such as tip burn and blossom end rot
- Greater potential for downgrading product quality e.g. because of increased incidence of sunburn
- Increases in pollination failures if heat stress days occur during flowering
- Increased risk of spread and proliferation of soil borne diseases as a result of more intense rainfall events (coupled with warmer temperatures)
- Increased irrigation demand especially during dry periods
- Changing reliability of irrigation schemes, through impacts on recharge of surface and groundwater storages
- Increased atmospheric CO2 concentrations will benefit productivity of most horticultural crops, although the extent of this benefit is unknown
- Increased risk of soil erosion and off-farm effects of nutrients and pesticides, from extreme rainfall events
- Increased input costs – especially fuel, fertilisers & pesticides

- Additional input cost impacts when agriculture is included in an Emissions Trading Scheme (ETS)

With increasing temperatures, and changes to rainfall patterns which are currently uncertain, the simplest adaptation strategies will be employed and are currently being employed by growers. These adaptation options are likely to be closely associated with management options already well understood by growers (Howden et.al., 2007). These are the use of more adaptable cultivars and a range of cultural practices which enable growers to maintain current production in current locations – i.e. adapt to the 'new' climate in the current location. This will be driven in the first instance to maintain profitability through market timing, market access and market share.

If climate change impacts exceed growers adaptation capacity at a specific location, then a southward shift of production following the southward shift of agroclimatic zones is more likely to occur if growers are to maintain profitability through appropriate market timing, market access and market share (Kingwell, 2006).

Climate Change and Adaptation Strategies

With increasing temperatures and changes to rainfall patterns which are currently uncertain, the simplest adaptation strategies (autonomous and assisted adaptation) will be employed and are currently being employed by growers. These will be the use of more adaptable cultivars and a range of cultural practices which enable growers to maintain current production in current locations – i.e. adapt to the 'new' climate in the current location. This will be driven in the first instance to maintain profitability through market timing, market access and market share.

If climate change impacts exceed growers adaptation capacity at a specific location, more transformational adaptation responses will be required. A southward shift of production following the southward shift of agri-climatic zones is then more likely to occur if growers are to maintain profitability through appropriate market timing, market access and market share.

Flexibility has been the key to adaptation in horticulture to date, and is likely to continue to be an important component of adaptation strategies as climates continue to change. Growers have been able to manage climate variability reasonably well, although major improvements could be made if tools to assist with the management of climate variability, both temperature and rainfall, were designed specifically with the needs of horticultural growers and industries in mind.

The current drought has provided opportunities for some growers who have been able to shift production to where water for irrigation is available. Those who have done this successfully will be in a much better position to also manage climate change successfully.

The following are desirable climate change adaptation outcomes for horticulture, which are consistent with the adaptation strategies suggested by other researchers (ABARE, 2007) :-

- Resilient and adaptive horticultural production systems which are less vulnerable to climate change and climate variability
- Improved resilience to changes in pest and disease incidence
- Increased ability to capitalise on new market opportunities

- Regionally specific climate change scenarios, which are very relevant to managers of horticultural enterprises
- Practical tools available to horticultural growers and their advisors to better manage climate change and climate variability.

Integration with other agricultural climate change plans

NACCAP

The National Agriculture Climate Change Action Plan (NACCAP) - www.daff.gov.au/__data/assets/pdf_file/0006/33981/nat_ag_clim_chang_action_plan2006.pdf was developed for the Natural Resource Management Ministerial Council in 2006. The NACCAP focuses on research and development to build knowledge, solutions and tools that will assist managers to deal with the impacts of climate change. The outcomes sought are practical methods of climate change adaptation and mitigation for all of Australian agriculture. The NACCP was developed with four (4) Focus Areas – Adaptation; Mitigation; R&D; Awareness and Communication.

For simplicity, this Horticulture Climate Change Action Plan has incorporated the R&D Focus Area into both the Adaptation and Mitigation areas – leaving specific Actions which Australian Horticulture needs to address under three (3) Focus Areas – (1) Adaptation, (2) Mitigation, (3) Information, Awareness & Communication.

CCRSPI

HAL is involved in the Climate Change Research Strategy for Primary Industries (CCRSPI).

The strategy has been developed and aims to answer these questions:

- What is happening with climate change?
- What does it mean for primary industries, businesses and regions?
- What can we do about climate change?
- How can we best prepare for future climate change?

The strategy includes Six Themes (under two sub-headings):
Underpinning Research

1. Understanding Future Climates
    - What it will do: Understand how climate change will influence the future of Australia's primary industries – both long-term and seasonal forecasts
    - What it will not do: Support industry-specific scenarios
    - Rationale for collaboration: Expensive, long-term, consistency of models, identification of primary industry output requirements
    - Relevance to horticulture: HIGH
2. Managing Emissions
    - What it will do: Identify options for primary industries to manage and reduce emissions while supporting the development of production systems with low emissions
    - What it will not do: Directly influence Government climate policy or enforce adoption of or develop industry-specific tools
    - Rationale for collaboration: Similarities in measurement, reporting and issues such as soils, offsets, biofuels, reduced energy use
    - Relevance to horticulture: HIGH/URGENT
3. Preparing Industries

- What it will do: Improve understanding of the timeframes and implications of climate change to inform adaptation strategies
- What it will not do: Tailoring of practices to specific industries or delivery of extension programs
- Rationale for collaboration: Info sharing, coordinate investment in topics such as pest, disease and weed risk and elevated CO2
- Relevance to horticulture: MEDIUM

Enabling Research

4. Accessing Information
    - What it will do: Establishment of info 'hubs' for information relating to climate change
    - What it will not do: Replace existing websites or communication programs
    - Rationale for collaboration: Encourage awareness and debate, identify gaps, consolidation and consistency of reporting
    - Relevance to horticulture: MEDIUM
5. Facilitating Change
    - What it will do: Improve understanding on how to best encourage and drive practice change/adaptation responses to climate change
    - What it will not do: Deliver practice change on-farm
    - Rationale for collaboration: Share success stories, link researchers to industries, consolidate social research
    - Relevance to horticulture: MEDIUM
6. Linking Decision Makers
    - What it will do: Promote partnerships between policy, industry and researchers to better align research
    - What it will not do: Lobby Governments
    - Rationale for collaboration: Inform future priorities, promote debate, improve linkages and increase investment
    - Relevance to horticulture: MEDIUM

Benefits of collaboration through CCRSPI for primary industries:

- Access to ideas, inputs to policy
- Access and exchange of information, including existing high quality research data
- Increase research capacity and long-term relationships between partners – continued access to this capacity for primary industries
- Reduce duplication of RDE activity
- Along the RDE value chain, linking researchers to end users
- Enabling cross sector and cross region issues to be addressed
- Identify who is best able to 'lead' research programs

HAL

The vision of the HAL Environment Portfolio is to: *By 2010, Australian horticulture will be recognised internationally for its widespread adoption of commonly agreed good management practices, which both conserve and enhance the natural resource base and promote a long-term viable industry.*

This includes empowering industry leaders, facilitating meaningful partnerships, encouraging innovation and adoption of research, informing policy and positioning the industry. Specifically for the area of climate change/variability the three strategies are Adaptation, Mitigation, and Awareness and Communication.