Apple and Pear Australia Limited

Submission to Climate Change and the Australian Agriculture Sector Inquiry

March 2008

Executive Summary

- Apple and pear industry, valued at about $600 million at the farm gate, will be significantly impacted by climate change.
- The nine main Australian apple and pear growing regions are Stanthorpe in Queensland, Orange and Batlow in NSW, the Goulburn and Yarra Valleys in Victoria, Tamar and Huon Valleys in Tasmania, the Adelaide Hills in South Australia and the Donnybrook-Manjimup area in south west Western Australia. Many of these are in relatively marginal pome fruit regions (by international comparisons) and there is little scope to move the industries to cooler climates as global warming eventuates.
- In Australia, there are few other growing regions at higher latitudes or altitudes that would be suitable for the apple and pear industry.
- Already there is evidence that climate change is impacting on the apple and pear industries, with increased climate variability and reduced chilling hours, which are necessary for quality fruit production.
  - The Huon Valley of Tasmania has shown an increase in average minimum temperatures from 1950 of about 0.6˚C across both summer and winter.
  - At Orange, NSW, the winter (May to October) average minimums have also risen by 0.6˚C
  - The Goulburn Valley Victoria has experienced a decline in the average number of days with minimums below 7˚C indicating a reduction in winter chill units
- There are many impacts on the apple and pear industry that could occur from a warmer climate. These include:
  - Reduced winter chilling could result in an elongated flowering period that would result in a longer harvest period with more picks required, thus adding to costs.
  - Increased incidence of pests and diseases, requiring greater use of chemicals and having a strongly negative impact on organic growers.
  - Higher requirement for water, both for irrigation and possibly for evaporative cooling using overhead sprinklers.
  - A reduction in fruit quality and colour, reducing consumer value. The storage potential of fruit could also be diminished, reducing the availability of fruit outside of harvest season.
  - Increased energy requirements to cool fruit after picking and maintaining coolstores.
- This submission argues that there is a need for a national strategy to assist the apple and pear industry adapt to climate change.
- Assistance could be directed towards helping growers understand the source and level of carbon emissions from their orchard operations and then devising programs that would increase the ‘carbon efficiency’ of producing fruit, that is, produce more fruit for less carbon emissions.

Detailed Response

ia) Scientific evidence on likely future climate in pome fruit orcharding districts

In August 200,7 ***Perry Wiles,*** *Manager, NSW Climate Services Centre, Bureau of Meteorology wrote an article on climate change for the Australian Fruitgrower magazine. The following are the essential messages from that article.*

The Intergovernmental Panel on Climate Change Fourth Assessment Report (IPCC 4AR) provides a review of all published research and observations concerning climate change up to the end of 2005, and as such represents the consensus of our current scientific understanding of what is happening to our world.

Its basic conclusions are:

Global warming is unequivocally occurring – the global mean temperature has risen 0.74˚C in the last 100 years. The evidence is multi-faceted and compelling.

Based on climate modelling by many different scientific groups around the world, global mean temperatures are expected to rise by about a further 1˚C by 2020-29 and about 2 to 5˚C by 2090-99 (depending on our future $C0_2$ emissions).

There is now very high confidence (estimated at 90%) that the primary cause of this observed and projected warming is due to human emissions of greenhouse gases, primarily $C0_2$.

This is a broad-brush global picture but what does global warming mean for Australia's apple and pear industry? This is explored via three major apple and pear growing districts of Australia: the Central Tablelands region around Orange in NSW, the Goulburn Valley region of Victoria, and the Huon Valley in Tasmania.

The Observations

All three regions show an increase in mean temperatures of between 0.5 and 0.7˚C since 1950 (with a significant part of the rise occurring since 1970). This is broadly in line with the global picture presented in the IPCC4AR outlined above.

The story in relation to minimum temperatures is more complex as minimum temperatures are affected by many factors such as local topography, soil moisture, and the amount of overnight cloud cover.

The Huon Valley of Tasmania has shown an increase in average minimum temperatures from 1950 of about 0.6˚C across both summer and winter. During winter, at this location, there has been a reduction in the number of days with a minimum below 7˚C from 235 to 220 with a corresponding decrease in the chill hours received by the fruit trees which are essential for flowering and subsequent fruit set.

In the Orange district of NSW, the winter (May to October) average minimums have also risen by 0.6˚C although this increase in minimum temperatures was not observed in the summer months. At this location there has been little change in the number of days with minimums below 7˚C. The Goulburn Valley area of Victoria shows the least change in minimums with no strong trend in either the annual or winter average minimums, though there has been a decline in the average number of days with minimums below 7˚C from about 215 to just below 200 indicating a reduction in winter chill units.

Trends in rainfall are also complex as Australian rainfall is highly variable on a year-to-year basis but, as we are beginning to understand, also on a decade-to-decade basis, with abrupt "step-like" changes apparent in the records.

In southern Australia, including Tasmania and Victoria there has been a significant and relatively abrupt decline in autumn and winter rainfall in the last ten years related to an increase in mean sea level pressure which has been inhibiting the fronts and storms in the westerlies that bring much of our winter rain from reaching southern Australia. (A similar decline occurred more than 30 years ago in south-west of Western Australia, just after the start in rapid global temperature increase and still continues.) Drier conditions set in NSW around 2000 with about a 20 per cent decline in NSW average annual rainfall. While there is some evidence that the decline in southern autumn/winter rain may be related to human

induced climate change, it is not yet certain that these recent declines in rainfall, particularly in NSW, can be attributed to human caused global warming, or whether they are just an expression of the natural variability of Australian rainfall on the decadal timescale (or perhaps a combination of both).

The Projections

As well as looking at trends climate scientists also seek to project future climate change through the use of climate computer modelling based on possible future emission scenarios. These models are much better at capturing the broad-global scale than the more localised national or regional scale. They also deal better with temperature than rainfall, where there is often considerable disagreement between models. With that caveat in mind what is expected for Australia, and in particular for those regions where apples and pears currently grow?

The CSIRO in 2001 published a set of Australian regional projections based on the outputs of the then available climate models. These projections indicate a warming by 2030 of between 0.4 to 2.0˚C in average annual temperatures over most of Australia (less in coastal areas and in Tasmania) and between 1 to 6˚C by 2070. The warming is expected to be less in winter, with a 1 to 4˚C projection range for Tasmania and Victoria, and 1 to 5˚C range for the Orange district of NSW. The ranges are due to both differences between models and also to a range of possible emission scenarios – the lower end if we significantly curtail emissions, the higher end for 'business as usual'. The overall message is clear, however, while there will undoubtedly be much year to year variation with occasional cooler years, we can expect over time for temperatures to continue to rise.

In relation to rainfall, the picture in the CSIRO projections is not as clear-cut due to lack of consensus between models. The projections for 2070 range from a significant decline to a small increase in autumn rainfall affecting Tasmania and Victoria (where a definite decline has already been observed), and similarly from a significant decline to a marginal increase in winter and spring rainfall in NSW and Victoria (with Tasmania showing a range from a small decline to a significant increase in winter rain, but a similar range to NSW and Victoria in spring). These large ranges reflect significant differences between the models when it comes to rainfall projections, extending to even the direction of the trend and highlight the fact mentioned above that rainfall is one of the parameters that the climate models do least well.

The Potential Impacts

What are the potential impacts likely to be for the apple and pear industry?

The most obvious impact for pome fruit such as apples and pears will be the expected continued rise in temperatures and hence a reduction in chilling hours. This is a particular issue for the Australian apple and pear industry because there is little scope for adapting through relocation. As the CSIRO's Kevin Hennessy said in an article over a decade ago "… the overall effects on horticultural production in Australia may be greater than in many temperate regions of the northern hemisphere due to the marginal nature of some fruit growing areas and the lack of extensive higher altitude or higher latitude regions where chilling requirements may continue to be met under warmer conditions." With little 'room to move' the main adaptive strategy available would seem to be moving to varieties that have a lower chilling requirement.

Another impact of warming, particularly rising minimum temperatures, is expected to be a decreased incidence of frost. As apples require frost-free conditions once the buds begin to open there may be some benefits in this. However, the situation is likely to be more complex. For example, if rising minimums are accompanied by greater variability there may be an increased risk of unexpected frost at critical times.

A secondary, but nevertheless significant, potential impact of warming temperatures on horticulture would be expansion in the ranges of diseases and pests, such as fruit fly, that are now limited by temperature. While presumably being open to various possible management and control strategies, these would no doubt add to the costs of production.

Finally, it is not yet certain that warming will necessarily lead to reduced rainfall but there is a significant possibility that it will, especially in southern Australia where autumn/winter rainfall does seem to have declined. In any case, warmer conditions will increase water requirements while also increasing evaporative losses, putting pressures on water availability for irrigation, as indeed has been the case in the current drought.

Meeting the challenge

All in all, climate change poses a significant challenge to Australian agriculture, not least the apple and pear industry. What can be done? Well basically there are 3 parts to any reasonable response:

- **Awareness** – staying up to date with what's happening both globally but also in the local production areas
- **Mitigation** – support and encourage attempts to lower greenhouse gas emissions.
- **Adaptation** – preparing sensibly for the changes we are likely to face. Given there is still a deal of uncertainty associated with the projections, this is where a risk management approach can be of value. For the apple and pear industry adaptation will most likely include, for example, the development at an industry level and utilization at a local level of cultivars (either new or existing) with lower chilling hour requirements and greater pest and disease resistance.

ib) Future climate effects on current pome fruit orcharding practices

There are many anticipated impacts of a warmer climate on current apple and pear fruit orcharding practices.

Winter chill

During winter many deciduous trees including apples, pears and stonefruit 'add up' the degree of coldness in order to determine when it is safe to initiate bud development and flowering. If winter chill is marginally below that required, then the duration of flowering is spread out from a week to many weeks. This leads to problems with crop load management needing increased numbers of thinning sprays as well as a very spread-out harvest with more picks required, increasing the cost of harvest. If there is a substantial lack of winter chilling then it is possible that trees will fail to enter bud development resulting in no flowers and potentially tree death.

Fruit set

We do not know the impact of a warmer climate on pollen viability. It is known that in some deciduous fruit crops such as apricots, if there is insufficient chill, then despite good flowering, fruit set is low resulting in poor yields of fruit. This indicates poor pollination and has an adverse effect on orchard viability.

The Bee industry

Bees are essential in deciduous fruit industries for pollination of the flowers. Currently most growers employ the services of the bee industry to perform this task. Of note is that fruit crops are poor honey producers, evidenced by the fact that 'apple honey' has never been developed as a product. If climate change leads to extended and poor flowering then the rate of honey collection per week from the hives will be reduced and the impact of this on the provision of pollination services by the honey industry is not known.

Water use

In a hotter, potentially drier climate, evaporation and transpiration will be increased leading to increased demands for irrigation and increased water use per hectare. Water has become a valuable resource and is often not available when required. This increased requirement for water, if water is expensive or not available, would lead to reduced orchard viability.

Sunburn

If a warmer and drier climate is associated with increased sunshine then this could lead to an increase in the incidence of sunburnt fruit. This significantly reduces the value of the fruit so it needs to be controlled by either evaporative cooling or a sunscreen application to the crop.

Skin damage

Unfortunately there is little information on the impact of global warming on wind. If there is an increase in wind strength then this will result in an increase in the appearance of limb

marks and result in lower pack outs of quality fruit. This will be reflected in increased grading costs and decreased gross income to growers.

Fruit colour

Consumers exhibit a preference for highly coloured fruit and modern varieties are being continually selected for superior colour development. It is well known that cold nights are essential for full colour development, however, it has already been documented that global warming has led to increased minimum night temperatures and that these temperatures are going to increase in the future. This is having a negative impact on fruit colour which will get worse with time and is causing Australian fruit to be at a lower competitive position compared to its competitors, who have access to elevated growing regions or higher latitudes, in the global fruit trade. One way to overcome this is with fruit colouration chemicals, such as Alar, however, the consumers have already exhibited a strong reaction against the use of these materials so this is not desired in the marketplace. This leaves the use of reflective cloths on the orchard floor, however these are expensive and have high operational costs to lay out and pick up.

Evenness of harvest

A problem with a warming global climate, as described above, is its effect on the duration of flowering. A long flowering period is reflected at harvest in a long harvest period where additional picks are needed to ensure that only fruit of the desired maturity is harvested. This adds considerably to the cost of harvesting, placing our orchards at an economic disadvantage to competitor country orchards where often only one harvest is required.

Fruit Quality

Growers maintain that the flavour of some apple varieties is markedly improved after the first frost has occurred. If this observation is correct, then with warmer nights, the frosts will be delayed till after fruit harvest such that Australian fruit will be poorly flavoured compared to competitor country fruit available on export markets. This will have a negative impact on the reputation of Australia as a producer of quality product and will lead to lower returns to growers for these fruit.

Fruit storage potential

Fruit that has been stressed, by any means such as heat, drought, water logging etc, during the growing season has poor storage characteristics. This is due to several reasons including during the time of stress, photosynthesis is shut down and the tree has no spare carbohydrates for the fruit to use for cell wall development. This will result in fruit that does not have enough cellular integrity to survive storage and transport to distant markets. Hence, for apples, they may not be available to the consumer for 12 months, as is currently enjoyed.

Biennial bearing

A feature of deciduous fruit crops is biennial bearing where a large crop in one season will inhibit flower development so there will be few flowers in the following season leading to low crop yields the following year. If one winter is not quite cold enough resulting marginal winter chill units then there will be poor fruit set, leading to low crop loads and increased vegetative vigour. This will stimulate excessive numbers of flowers for the following season initiating a biennial bearing pattern that would need to be managed by growers.

Localised Variety Production

Each cultivar of apple and pear has its own specific ideal growing conditions. Growers have learnt over the years what cultivars perform well in each district. For example, Tasmania does not grow good Granny Smith apples as the season is not hot enough but they grow good Jonagolds, which cannot be grown on the mainland where it is too hot. In an environment of global warming this will result in a slow shift in the climate in each growing district that will impact on the ideal varieties that can be grown in that district necessitating continuous assessment and replanting to the most suitable cultivar.

Pests

Warmer conditions will have significant effects on the orchard ecosystem including many orchard pests and potentially their predators. There will be movement of warm climate pests, notably fruit flies, from warmer production areas to areas that are currently free of these pests. This would necessitate additional pesticide applications targeting this pest and potentially affects market access for fruit to export countries such as Japan.

For other pests such as codling moth and light brown apple moth, it is anticipated there would be an increase in the number of breeding cycles per year. These pests emerge from their over-wintering forms in spring, lay eggs and then die. The eggs simultaneously hatch and develop into adults leading to the second breeding cycle. This continues at a rate determined by temperature and in warm seasons, there are more cycles per season. As the number of insects in an orchard increases with each breeding cycle an extra cycle will lead to a substantial increase in insect pressure. This has a compounding effect in that the extra cycle also leads to an increase in the number of insects that over winter and hence to an increase in the number of insects present in the first breeding cycle in the following spring. As many of the chemicals used to control these pests are banned in export countries, as are the presence of live insects in consignments, this would have a negative impact on the export of fruit out of Australia.

Diseases

As for insects, plant diseases grow, multiply and infect at faster rates in warmer weather. Hence with global warming there would be an increase in the incidence, severity and spread of orchard diseases that will need to be controlled. This would have a very negative impact on the growing organic industry, which lacks good disease control chemicals. In addition, as for insecticides, many of the chemicals used to control these diseases are banned in export countries, as are the presence of the diseases in consignments. This would have a negative impact on the export of fruit out of Australia.

Chemical Applications

While the effect of global warming on temperature is well documented and future trends can be accurately forecast, the impact on future rainfall and wind is poorly understood. If the climate becomes wetter and/or more windy, then the number of environmentally friendly chemical application days will be reduced. Conversely, as described above, the number of chemical applications required with a warmer climate to control pests and disease would increase. Hence the number of days to apply chemicals to control the increased number of pests and diseases may be reduced making it more difficult to control these pests and diseases.

Energy

Hot fruit has a very short storage life and coldrooms are used to extend the shelf life for the marketing period. The energy used to initially cool fruit is related to the initial fruit temperature. A higher air temperature at harvest will result in hotter fruit to be cooled and this will need more energy than currently consumed. Then once the fruit is cooled a higher air temperature will lead to increased heat incursion into the coldroom, which would need increased refrigeration to be removed. Both these aspects of increased air temperature would lead to increased energy costs and potentially create a need for larger refrigeration plants.

Adverse Climate Events

There is some evidence that global warming is leading to an increase in adverse climate events such as hail, flood, cyclones etc. If there is an increase in the number of these adverse events at critical times in the production cycle, it could lead to more frequent major loses of crops. For example, it may be that now, one in six crops suffers a major loss. With increased adverse events, this could increase to one in four crops. A problem is that for perennial fruit producers, the costs of production do not disappear if the crop is lost. For example, a frost in spring will eliminate the crop but the trees will still need the same level of management for the following two seasons till the next harvest of fruit. This causes major cash flow problems to affected orchards.

ic) Future climate effect on possible future industries

The pome fruit industries are currently focussing on achieving international competitiveness at the farm gate level through intensive orchard techniques. This, along with changes in the varieties that are grown, would be the major development within the industry. There are currently many orchards in Australia that have already achieved what is considered world's best practice.

However, the trading environment in which the pome fruit industries operate would be vastly different.

It is likely that in the next few years, protocols would be developed that allow apples to be imported into Australia from countries that have up to now been excluded because of biosecurity and quarantine issues.

Along with the intensification of orchards, one strategy the Australian industry is likely to develop to counter the international competition in the domestic market is to export more produce into speciality and niche markets. There would be strong international competition for those markets and the relative abilities of countries to adjust to climate change would impact on how countries compete.

Most competitor countries would have no issues with winter chill as their industries are at higher latitudes and in many cases at higher altitudes. Australia's climate is more marginal for pome fruit production and it does not have the same ability to adjust to climate change by moving orchards to more suitable locations.

Despite that, there would still be strong demand for home grown pome fruit as consumers want assurance that their food is grown with full consideration of consumer safety and environmental impacts under proper legislative controls.

In that likely environment, all the issues identified in 1b) would be likely impacts as well.

ii) The need for a national strategy to assist pome fruit orcharding to adapt to climate change

There is a need for a national strategy to assist the Australian pome fruit industry to adapt to climate change.

There is a need for each industry to determine which key areas would be most impacted by climate change and therefore are in most need of attention, and then devise programs that would ameliorate the impacts.

A prime example is a national strategy could be directed towards helping growers understand the source and level of carbon emissions from their orchard operations and then devising programs that would increase the 'carbon efficiency' of producing fruit, that is, produce more fruit for less carbon emissions.

Other examples include; it may be determined that breeding for reduced winter chill requirements is needed, or it may be that growers will need overhead irrigation for evaporative cooling, larger sprayers to spray entire orchards on the few calm days, wind breaks, more bees, more reflective cloth etc.

All these aspects need to be investigated to develop a cogent, cost effective strategy at the national and regional levels that addresses climate change issues and helps to support an important and viable pome fruit industry.

iiia) The adequacy of the existing drought assistance and exceptional circumstances programs to cope with long-term climatic change.

Drought assistance is not often available to pome fruit growers due partly to the selling cycle of the businesses. Fruit is sold over two financial years so even in a severe drought year, a grower could achieve a reasonable income due to the selling of a substantial proportion of the last year's harvest.

It would possibly take three years of disastrous drought in a row before the majority of growers would be eligible for drought assistance.

The existing drought assistance measures do provide a 'life-raft' for real disasters and many growers have appreciated the interest rate subsidies, special one-off assistance packages and particularly the support from local rural counsellors who help guide farmers through the difficult times.

However, as a measure to cope with the adjustments required because of long-term climate change, we believe the existing measures are not appropriate or adequate.

A major issue with the existing drought and exceptional circumstances programs is that assistance tends to go to the more marginal farmers who in reality often do not have a long-term, viable future in the industry. The growers who take more management steps to minimise the impact of droughts, hail storms and other adverse condition rarely get support, even in the most severe of years.

The apple and pear industry believes that preparing the whole industry for climate change would offer the best assistance as the more progressive growers would also gain some benefit from the support. It is these growers who are most likely to be larger, more efficient and more aware of the need to change and who would lead the change to reduce the impacts of climate change and reduce the impact the orchard is making to climate change.

Assistance to the industry to understand carbon impacts and how to increase the 'carbon efficiency' of the industry and to examine the other likely impacts of climate change and develop programs to counter the changes, would have the best chance of creating a vibrant, responsive and responsible world class apple and pear industry in Australia.

Background to APAL

Apple & Pear Australia Limited (APAL) is the peak industry body representing the interests of commercial apple and pear growers in Australia in matters of national importance including regulation and legislation, marketing, research and development.

It has a key influence on the direction of research and development and the marketing and promotions strategies designed to advance the Australian apple and pear industry, domestically and internationally. These activities are funded through levies paid by each apple and pear grower in Australia. The funds and many of the activities are administered through Horticulture Australia Limited in close association with APAL.

APAL also represents the industry on agri-political issues, including campaigning to protect the Australian pome fruit industry against quarantine risks posed by unsafe imports.

In addition, APAL manages a number of trademarks internationally on a commercial basis - most notably the **Pink Lady™** and **Sundowner™** trademarks, which allows growers worldwide to sell premium quality apples from the Cripps Pink and Cripps Red apple varieties at a premium price.

Industry background

Apples and pears are grown in all six Australian states, (not in the Northern Territory). The major apple and pear producing areas are Stanthorpe in Southern Queensland, Orange and Batlow in New South Wales, the Goulburn Valley in Victoria and Southern Victoria, Huon Valley in Tasmania, Adelaide Hills in South Australia and the Perth Hills, Donnybrook and Manjimup regions in Western Australia. In addition, there are many small pockets of apple and pear production in each state.

Victoria is Australia's largest producer of apples and pears, generally producing more than 30 per cent of the nation's apples and close to 90 per cent of the nation's pears - mostly from the Goulburn Valley area around Shepparton. New South Wales and Western Australia are the next largest apple producing states.

The main apple varieties grown traditionally have been Red Delicious and Granny Smith (55 per cent of production in 1998/99). However, newer varieties such as Gala, Fuji, Cripps Pink (which may be sold using the trademark brand name Pink Lady™) and Cripps Red (which may

be sold using the trademark brand name Sundowner™) now account for more than 40 per cent of production.

Apple and pear exports have declined in recent years due to global pricing pressures however there remains a focus on the premium markets for Pink Lady™ in the UK as well as other opportunities for a range of varieties in Sub-Continental Asia.

Australia, in relation to other Apple and Pear producing countries, represents around 0.8 per cent of world production of apples and 1.4 per cent of world pear production.

The spread of apple producers around Australia provides consumers with an excellent range of high quality product year in, year out. The dispersed nature of production reduces the risk of supply volumes and quality being impacted by adverse weather events.

Apple and pear orchards in Australia are still dominated by family run businesses and range in size at the smaller end of the scale from around 10 hectares up to the larger enterprises in excess of 200 hectares. Approximately 1300 farms are engaged in commercial apple and pear production and as is common right across agriculture 20 per cent of the businesses produce 80 per cent of the product. Cooperative packing and marketing businesses exist in two important growing regions – Batlow and Lenswood. Other areas rely on large commercial packing/marketing businesses and individual packing operations on orchards. Some of the larger enterprises are quite vertically integrated, some involved at the input level in producing nursery trees while others extend into commercial packing and marketing and supermarket category management operations.

Producers have made significant improvements in quality assurance systems to support traceability of product from retailer back to the farm gate. Coupled with the integrated pest management systems widely employed within orchards and the strict management over maximum residue limits for agrichemicals consumers are now enjoying apples and pears of higher quality and with greater assurance of food safety issues than ever before.

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