

## A CLIMATE OF OPPORTUNITY - Summit Paper

### Comments from the North Central Catchment Management Authority

The North Central Catchment Management Authority (CMA) develops and implements a regional catchment strategy aiming for sustainable land and water use, improvement of ecosystem health and productive primary industries. Climate is seen as one of the region's five primary assets and as part of the specific management actions and targets. The North Central CMA is seeking to "mainstream" climate issues into regional strategies. This approach aims to "respond to the challenge of climate change by helping the North Central region take responsibility for net greenhouse gas emissions, by developing an improved understanding of the impacts of climate change and thereby enabling actions that improve the resilience of natural systems and primary industry in the face of climate change." (NCCMA, 2003). It has recognised the importance of adapting to climate change in its 2003–2007 strategy (NCCMA, 2003).

Regional projections of climate change produced by CSIRO suggest that the region will become warmer and drier, with an increased incidence of drought and higher potential evaporation, leading to reductions in runoff and water supply. These changes are for climate change without mitigation, based on the SRES greenhouse gas emission scenarios and projections of global warming from IPCC (2001). Regional patterns were obtained from a range of climate models using methods described in Whetton et al (2002).

The processes threatening the natural asset-base result from both past and present actions. Reducing the impact of these threats will require major changes in land-use over the next 20 years if agricultural production is to remain viable. The impact of climate change and the likelihood of increased temperatures, increased drought frequency and more intense, episodic rain events, will place further stress on an already compromised landscape.

The North Central CMA (CMA) has a strong commitment to reducing greenhouse gas emissions and improving the resilience of natural ecosystems as well as agricultural and other land uses in the face of climate change as outlined in the North Central Regional Catchment Strategy (RCS).

A number of key actions have been identified to support this goal including:

- s Develop an understanding of the implications of climate change scenarios for management of dryland and irrigated land and associated assets and services by 2008.
- s Develop farming systems and management practices that increase resilience in the face of climate variability and climate change by 2008.
- s Assess the implications for climate change scenarios for flooding, water way management and riparian and wetland health and develop management response by 2008.

The successful implementation of the North Central RCS is largely dependent on key NRM interventions, which aim to improve the condition of land, water and biodiversity. While NRM planning, implementation and monitoring is based on "best available knowledge and practice" the regional implications of climate change are currently poorly understood at both the landscape level and the landholder level. Of significant interest to our region is gaining a better understanding of the interplay between adaptation and mitigation measures. Three major themes within the catchment where adaptation and mitigation issues are expected to coincide are:

- o **Agriculture:** Agriculture is potentially one of the largest sources of greenhouse gases within the region and is also expected to be affected by climate change, largely through increased temperatures, increased atmospheric CO<sub>2</sub> and reduced rainfall. The mitigative capacity of the regional agriculture and agricultural soils is unexplored but may be substantial when compared to emissions.
- o **Built environment:** Warmer temperatures will increase demands for cooling through the use of air conditioners which then raise emissions, greatly increasing peak energy demand as a proportion of baseload demand. The provision of standing energy becomes more expensive because of the need to provide the capacity to supply a large peak load relative to baseload. Joint measures to ameliorate building temperatures while lowering energy demand will reduce the demands for capital if peak and baseload energy supplies can be kept within limits. Overhead transmission of electricity also becomes less efficient in warmer climates, increasing the benefits of a local capacity for power generation compared to remote sources.
- o **Carbon sequestration through revegetation:** Revegetation is seen as providing a suite of benefits for biodiversity, salinity amelioration and timber production, but it is also realised that long-term plantings

will be affected by climate change as will flora and fauna, land and water degradation from salinity and rates of timber production.

Two of the most important resources in the region are water and carbon. Water provides significant agricultural yield and maintains important wetlands. Carbon stocks in both soil and vegetation reflect the health of both the surface and subsurface environment. Salinity is one of the most serious regional land degradation issues. Vegetation clearing during the past 150 years has contributed to a substantial dryland salinity problem as well as leaving a number of ecological vegetation classes at well below sustainable levels for maintaining ecosystem health and biodiversity (NCCMA, 2003). Loss of biodiversity is seen as the cause of many of regions natural resource management problems, reducing landscape resilience and capacity for regeneration.

Carbon sequestration through greenhouse-related conservation plantings is planned and ongoing across a range of organisations both public and private including the North Central CMA. Co-benefits of such plantings are expected to come from added biodiversity and amelioration of dryland salinity (NCCMA, 2003). Joint assessments of climate change and revegetation show that replacing grasslands with forest will contribute to future reductions in runoff (Herron et al., 2002). This implies that the joint management of adaptation and mitigation as part of land-use management will involve trade-offs between carbon and water.

Work led by Dr. Roger Jones from CSIRO in collaboration with Geoff Park from the North Central CMA has observed that:

- Climate change will reduce runoff, streamflow and ultimately, water supply, due to lower rainfall and higher evaporation. Even where rainfall does not change significantly, higher potential evaporation will still contribute to net decreases in runoff.
- Revegetation will reduce runoff independently of climate change, but will add to the losses caused by climate change.
- Salt fluxes will decrease in absolute terms but in-stream salt concentrations may increase. This is counter to the conclusions for the entire Murray Darling Basin of Beare and Heaney (2001) who conclude that reduced rainfall will reduce the salt flux sufficiently for water quality to improve by 2070. These different conclusions may be due to differences in models, location and scale, and require further investigation.
- Areal screening shows that the benefits of revegetation for biodiversity, commercial forestry and dryland salinity rarely coincide in any one place. More often there are benefits for two out of three, indicating that trade-offs are needed.
- The spatial distribution of positive and negative changes and of interactions between the different fluxes shows that solutions need to take account of biophysical heterogeneity. However, we are not yet able to quantify the interactions between the three fluxes of water, salt and carbon under climate change at the local or catchment scale.

Trade-offs between these different processes will need to be managed if the different risks: climate-related, loss of biodiversity, salinity and agricultural are to be managed successfully. Although regional emissions are targeted to decrease, this is not guaranteed and global emissions and concentrations of CO<sub>2</sub> will increase in any case. Climate change will reduce water supply, as will sequestration and allied revegetation efforts. Changes in water supply will need to be adapted to. Reduced rainfall and revegetation will also lead to reduced salt discharge to the surface but the net impact on water quality remains uncertain. Revegetation is expected to enhance biodiversity.

In terms of combining mitigation and adaptation as they affect sequestration, the following issues have not yet been dealt with:

- Fire and drought – drier climates and increased fuel loads will promote fire, placing sequestered carbon in vegetation at risk. Currently that risk is borne by the owner of the carbon, and financial instruments are not yet in place to insure against that risk.
- CO<sub>2</sub> fertilisation – increases in atmospheric carbon dioxide will increase the growth rates of vegetation unless offset by substantial reductions in rainfall and frequent drought. Vegetation will also become more drought tolerant. There is also some evidence that more efficient shallow-rooted vegetation will increase deep infiltration rates when soil moisture is high, contributing to salinity. On the other hand, deep-rooted and biodiverse vegetation should be able to make use of increased soil moisture in higher growth rates.
- Reduced water supply – the purchase of water rights may be required before plantations can be established, to compensate for the loss of water elsewhere in the catchment. This would provide a cost that may partially or wholly counterbalance the financial benefits of selling carbon.

- Species selection – large changes in climate may affect the choice of species to be planted or may send existing vegetation into decline, meaning that it acts as a source rather than as a sink. Key plant species may also need to be established in specific locations to anticipate the migration of animal species or other plants under climate change.
- Weeds and pests – changing patterns of weed and pest invasion may also affect tree survival. At present a whole cohort of Forest Red Gum, *Eucalyptus blakeleyi*, is dying throughout central and eastern Victoria, ostensibly through insect attack (Gibbons and Boak, 2002) but a warming climate and persistent drought conditions may be an underlying cause.

The various policy and economic instruments available also affect the viability of sequestration options. A number of programs are addressed in NCCMA (2003), and many of the national and state strategies affecting natural resource management are being implemented through the North Central CMA, who are required to integrate these with their regional strategies. This will serve to maximise the benefits of these programs if their aims are supported by underpinning science that can help address some of the different trade-offs.

Financial and social instruments also need to be investigated further, as does risk communication so that these issues are more widely understood within the community. Socio-economic change is also a factor. For example, the trend is to smaller farms engaged in so-called lifestyle farming. These farms increase the number of dams in the catchment which leads to reductions in regional runoff. They provide benefits in terms of outside income from commuters, but these commuters then emit more greenhouse gases travelling to town and work but also plant trees.

Although there are clear links between adaptation and mitigation as it affects the carbon sequestration, an integrated approach is needed – not just to integrate adaptation and mitigation – but to integrate a broad range of issues affecting natural resource management under climate change.

## Summary

The North Central Catchment Management Authority has been active in the climate change arena for over 8 years. The North Central CMA has been described as being the most progressive of all the catchment management authorities in the states of NSW and Victoria with regard to climate change (Jones et al, 2007). Climate is one of the asset chapters covered in the North Central CMA RCS, and the 'Regional Response to Climate Change – Native Revegetation Action Plan, 2003' could be considered one of the pioneering climate change action plans that was developed well ahead of its time (i.e. established before the big carbon market movement).

We have already completed a number of climate change initiatives, such as:

- Replanting Victoria 2020, 2000
- Regional Response to Climate Change Revegetation Action Plan, 2003
- Climates, Catchments and Communities Conference, 2004
- Growing Trees for Carbon and Conservation in North Central Victoria, 2005
- Climate Change Impacts and Adaptation in North Central Victoria, 2006
- Practical Adaptation to Climate Change in Regional NRM, 2007 (SKM)

This year we have completed a number of new initiatives such as:

- Ecosystem Risk – Impacts of Climate Change;
- North Central CMA Climate Change Programme – reaching carbon neutral; and
- Research Development Knowledge: Climate Change in Irrigated Landscapes.

In April 2007 the North Central CMA Board agreed on a Climate Change Policy, that in summary covers

- Reaching carbon neutral status;
- Understanding and communicating impacts of climate change on natural resources; and
- Supporting greenhouse strategies, including carbon offsets, that are inline with CMA strategies and plans.

Climate change provides a series of challenges and opportunities for landscapes such as ours which is dominated by conventional agro-ecological systems. Their ability to withstand system shocks, such as forecast rises in temperature and reductions in rainfall has been compromised by the legacy of past intervention. The issues, actions and initiatives outlined above are all directed at increasing the resilience of our landscapes and if successfully implemented would buffer our ecology, economy and community in the face of climate change.

## References

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