Submission No: 23
Date Received: 29-05-08
Secretary:

WET TROPICS MANAGEMENT AUTHORITY

29 May 2008

The Secretary
Standing Committee on Climate Change, Water, Environment and the Arts
House of Representatives
Parliament House
PO Box 6021
CANBERRA ACT 2600

Dear Committee Secretary

Inquiry into climate change and environmental impacts on coastal communities

Thank you for providing the Wet Tropics Management Authority with an opportunity to make a submission on the terms of reference for the above mentioned inquiry.

Background

The Wet Tropics of Queensland World Heritage Area (WHA) is a large 894,420 ha component of the 1,976,000 ha Wet Tropics bioregion which extends from near Cooktown in the north to near Townsville in the south and borders the Great Barrier Reef World Heritage Area along a considerable part of the coastline.

The Queensland and Commonwealth Governments established the Wet Tropics Management Authority (Authority) as a small, independent organisation with a responsibility to oversee the management and protection of the WHA. The Authority is directed by an independent Board nominated by the Commonwealth and Queensland Governments which reports to both Governments through a Ministerial Council. The Authority administers its responsibilities under the *Wet Tropics World Heritage Protection and Management Act 1993* and the statutory *Wet Tropics Management Plan 1998*.

Introduction

Far North Queensland's Wet Tropics region's economy depends largely on tourism generated from the attraction of its two natural heritage areas. The region has experienced a steady increase in population, which has averaged higher than the national growth rate. Urban water demands are likely to continue increasing along with population, and will be focused on the urban growth nodes along the coast.

Models developed by Marine and Tropical Science Research Facility (MTSRF) researchers from CSIRO and James Cook University show that the region's forests and the services they provide are highly sensitive to climate change [1, 2, 3]. The location and extent of rainforests is determined by rainfall and its seasonality while the type of rainforest and many of the organisms found within them depend upon narrow temperature ranges. Climate change is expected to not only result in severe adverse impacts on habitats and wildlife within the WHA but also impact

Wet Tropics Management Authority
PO Box 2050
CAIRNS Qld 4870
Telephone: (07) 4052 0501
Email: Andrew.Maclean@epa.qld.gov.au

upon the environmental goods and services the WHA provides. For example, the supply of a secure and safe water supply which in turn supports the quality of life of residents; ensures good public health and fosters economic growth and development of the region.

Queensland's Wet Tropics region is characterised by the highest rainfall in Australia creating the perception by many in the community that water planning is not a critical issue for the region. However, a range of water supply challenges face the region's coastal communities including:

- Water supply for most urban centres along the coast depends on run-of-river flows [4].
- Current water supply sources are at or approaching full commitment especially when environmental flows are factored in.
- The region's average population growth rate, particularly along the coastal belt, is higher than the national average [5].
- The region is a leading tourist destination which inflates the regional population particularly during the 'dry season' when run-of-river flows are at their minimum capacity [5].
- Populations may move from drier areas in Australia to areas of higher rainfall, such as Queensland's Wet Tropics region as climate change impacts become more pronounced in more marginal agricultural parts of Australia.
- Climate change impacts on the hydrology of the region are likely to be significant [4].

The above factors could well result in an increased demand for additional water storages and supplies, which could consequently threaten the integrity and values associated with the WHA.

Climate change projections for Queensland's Wet Tropics region

Predicting the magnitude, rate and spatial pattern of climate change is very complex and scenarios for areas as small as the Wet Tropics region contain a high degree of uncertainty. Nevertheless recent models predict:

Temperature

- Increases in maximum temperatures from the current average maximum temperature of 28.9 °C of between 0.3 °C to 5.2 °C for the period 2030 to 2070 [6].
- Increased frequency of extreme temperature periods (classified as days above 35 °C) from the current annual average of three days to up to 41 days by 2070 [6].

Rainfall

- Changes in rainfall of -5% to +15% for December to February, and -15% to +5% for March to November by 2030 [7]. This would suggest overall drier conditions for the region.
- Rainfall is expected to increase slightly in the wet season depending on the state and frequency of ENSO (El Niño-Southern Oscillation) and to decrease markedly in the late dry season [7].
- Increased frequency of El Niño events causing lower rainfall and longer dry seasons [8].
- Rainfall variability is expected to be higher from year to year, especially for the wet seasons.

- Increased frequency and severity of extreme weather conditions such as heat waves, floods, droughts and destructive storms [8].

- Tropical cyclones are projected to increase in maximum intensity but show little change in their region of formation or number [7].

- A rise in the altitude of the cloud-base. This rise is predicted to retard the "cloud stripping" (see Box 1) ability of the region's upland rainforests, which derive up to 30% of their total annual precipitation from intercepting the cloud layer [9], thus reducing the input of water with serious impacts on hydrology, ecosystem processes and biodiversity [10].

Coastal areas

- A rise in sea levels of up to about 90 cm by 2100 [8].

- Increased intensity of oceanic storm surges resulting from a combination of rising sea level and more severe cyclones [11].

Box 1

Cloud Stripping (*Occult Precipitation)*

High altitude rainforests which are immersed in cloud for a large proportion of the time 'strip' considerable amounts of moisture from passing clouds. Researchers from CSIRO Atherton have found that, in some months of the year, up to forty per cent more water is harvested out of the clouds than is measured as rainfall in a standard rain gauge. They found that the region's high altitude rainforests behave like giant sponges, capturing large volumes of water directly from clouds, which they then release slowly throughout the year. This process is now believed to be of great importance both in feeding stream systems and to the maintenance of stream flows throughout the dry season.

The process is considered significant to the overall water budget of the region, especially in terms of water recharge during the dry season. For the upland rainforest, cloud-stripping contributes up to 70 per cent of the total water input into the forest system during the drier months. During the wet season, high rainfall masks the importance of cloud stripping which nonetheless still contributes 10-20 per cent of the total water input into the upper catchments [9].

Under current climate conditions, cloud stripping occurs in rainforests above 600 m asl. With every degree of warming the base of the cloud condensation layer is predicted to rise by an average of 100 metres. By 2050, we may expect temperatures to be 1-3 ° C warmer than today which equates to a rise in the effective cloud stripping condensation layer from 600 to 900 m asl. With 3 ° C of warming, the effective cloud stripping area in the Wet Tropics will decrease by as much as 40% [9]. What this will mean for absolute water yields remains unknown except to conclude that water yields will be lower, especially in the dry season.

Summary

To summarise the implications of these climate model projections for the Wet Tropics region:

The Wet Tropics can expect a warmer drier future. Although wet season rainfall is likely to increase for most years, this will be countered by an increase in the frequency of El Niño years resulting in reduced wet season rainfall during these El Niño periods. The region is likely to experience more intense rainfall events including higher cyclone intensities (average wind speed may increase by 10-20%). Sea levels are rising and an increase in the area affected by storm surge is expected.

The water balance of forested catchments in the Wet Tropics is expected to change. Temperatures are predicted to increase by 1-3° C by 2050, with corresponding increases in evaporation and transpiration. Rainfall is expected to increase slightly in the wet season depending on the state and frequency of ENSO and to decrease markedly in the late dry season. Rainfall variability is expected to be higher from year to year, especially for the wet seasons.

The cloud stripping process is expected to be become progressively less effective resulting in less water yield from this process in the dry season.

Expected impacts from climate change on the water supply of coastal communities

Freshwater Flows

- An increase in the frequency of El Niño years will reduce summer wet season flows.
- Reduced rainfall in the dry season as a result of increased evapotranspiration and decreased cloud stripping will reduce winter flows.
- Greater seasonality in freshwater flows (variable in the wet season, lower in dry season).
- Greater inter-annual variability in flows (due to frequency of extreme events).

Cloud stripping

- Reduction in areas of the forested landscape where the cloud stripping process can occur (40% reduction in effective area with 3 °C of warming).
- Less cloud stripping in the dry season and generally reduced rainfall and cloud cover.
- Changes to vegetation type may change the water stripping capacity of upland rainforest.

Estuarine and coastal areas

- Due to its low elevation combined with possible decreases in freshwater flows, the Wet Tropics' coastal belt is at high risk of salt water contamination of its fresh surface and ground water supplies which may affect the quality of freshwater sources currently tapped for urban and agricultural purposes [12].

Recommendations

Long term water needs and supply forecasting for the coastal communities in the Wet Tropics needs to include the effects of climate change including its impacts on cloud stripping.

Urban centres along the Wet Tropic's coast should apply demand management initiatives and per capita water consumption targets on the basis of worst case climate change impact scenarios.

Decisions on water allocation and use should become more precautionary. Consideration of climate change should be incorporated in all levels of water resource planning.

Governments and water management bodies in the region should develop demand management policies for regional water resources incorporating a broad range of initiatives such as:

- Education and communication;
- Introduction of permanent water conservation measures across the community;
- Incentives for commercial water conservation; and
- Investigation of opportunities to recycle water.

Water management for the coastal communities of Queensland's Wet Tropics should consider predicted increases in variability and decreases in total river flow, to ensure that environmental flows are maintained in the region's waterways and wetlands.

References

[1] Krockenberger, A. K, Kitching, R. L. and Turton, S. M. (2003) *Environmental Crisis: Climate Change and Terrestrial Biodiversity in Queensland.* Rainforest CRC, Cairns.

[2] Hilbert D, Ostendorf B and M Hopkins (2001). Sensitivity of tropical forests to climate change in the humid tropics of north Queensland. *Austral Ecology* **26(6)**: 590-603.

[3] Williams S, Bolitho E and S Fox (2003). Climate change in Australian tropical rainforests: An impending environmental catastrophe. *Proceedings of the Royal Society of London Series B* **270**: 1887-1893.

[4] NRW (2008). Far North Queensland Regional Water Supply Strategy. Queensland Department of Natural Resources & Water, Brisbane.

[5] DIP (2008). Far North Queensland Draft Regional Plan 2025. Queensland Department of Infrastructure and Planning, Cairns.

[6] Australian Greenhouse Office (2004). Climate Change in the Cairns and Great Barrier Reef Region: Scope for an Integrated Assessment.

[7] Suppiah, R., Macadam, I & Whetton, P.H. (2007). Climate Change Projections for the Tropical Rainforest Region of North Queensland. Unpublished report by CSIRO Marine and Atmospheric Research to the Marine and Tropical Sciences Research Facility. Reef and Rainforest Research Centre Limited, Cairns.

[8] Walsh K, Hennessy K, McInnes R, Page K, Pittock A, Suppiah R and P Whetton (2001). *Climate Change in Queensland Under Enhanced Greenhouse Conditions: Third Annual Report, 1999-2000.* CSIRO Atmospheric Research, Aspendale, Victoria.

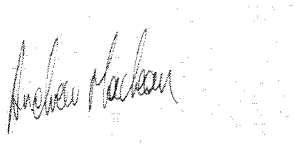
[9] McJannet D and Reddell P (2004). A comparison of the water balance of mountain rainforests in Australia with that of pasture and coastal rainforests. 2nd International Symposium on Tropical Montane Cloud Forests. (Eds) Juvik J, Bruijnzeel L, Scatena F and P Bubb.

[10] Still, C. J., Foster, N. F. & Schneider, S. H. 1999 Simulating the effects of climate change on tropical montane cloud forests. *Nature* **398**, 608-610.

[11] McInnes, K.L., Walsh, K.J.E. & Pittock, A.B. (2000). Impact of sea level rise and storm surges on coastal resorts. CSIRO Tourism Research.

[12] Crimp, S., J. M. Balston, et al. (2003). A study to determine the scope and focus of an integrated assessment of climate change impacts and options for adaptation in the Cairns and Great Barrier Reef region. Canberra, Australian Greenhouse Office.

Yours sincerely



Andrew Maclean
Executive Director