ECONOTES:

Implications of climate change on biodiversity

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CLIMATE projections indicate ongoing increases in global average temperatures, changes to rainfall patterns and extreme events. These changes must be included in conservation planning and management to avoid or reduce species extinction and ecosystem disintegration.

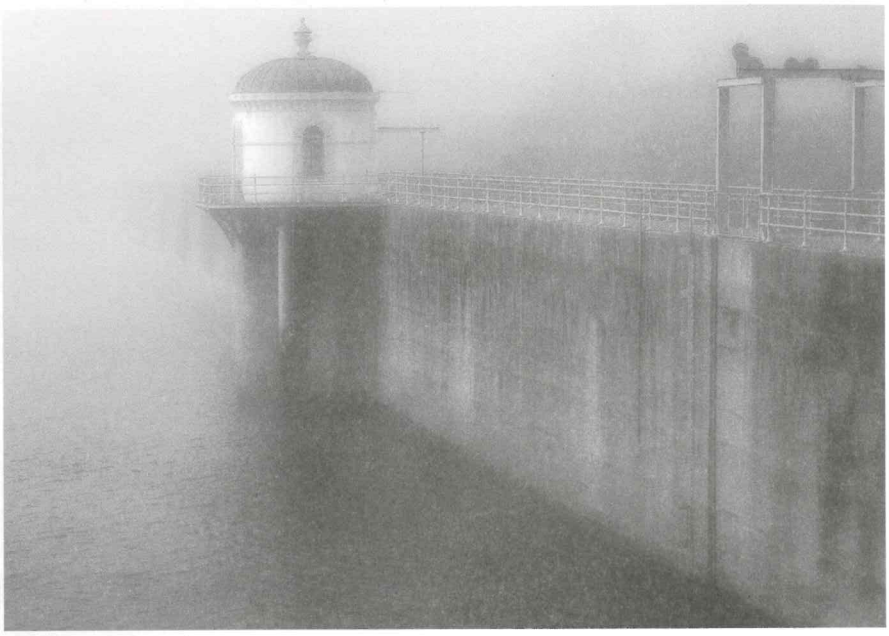
Climate is a fundamental factor in the distribution of plants, animals, habitats and ecosystems. It largely determines water availability and ambient temperatures that are critical in determining plant life-stages such as germination, flowering and seeding, and for animal habitat and food sources.

Natural climate variation has always helped drive changes and processes in natural systems and biodiversity, including influencing biological evolutionary processes such as speciation and extinction. However, significant and rapid changes in global climate have been caused during the past century by emissions mainly from fossil fuel use, agriculture and land clearing.

Average temperatures in the south-west of WA have increased since 1900 and early winter rainfall has reduced since about 1975 (see trend maps at www.bom.gov.au/cgi-bin/silo/reg/cli_chg/trendmaps.cgi). These changes have resulted in less stream runoff, lower wetland and groundwater levels and less soil moisture available to the region's ecosystems. Other aspects of climate change, such as sea-level rise, flooding, heat waves, storms and drought, have been experienced but few specific impacts have been recorded on natural systems. The effects of associated factors, such as increases in atmospheric carbon dioxide levels, are little understood.

What changes may we expect?

Ecological principles suggest climate change will alter the composition and structure of certain ecosystems, with some species becoming more dominant and others rarer or even extinct. Invasive species are likely to thrive and poor dispersers will be threatened. Many indirect effects will occur as climate change affects fire regimes, salinity, dieback and other diseases. Ecosystem function and services, such as water quality and quantity, would be affected. Impacts on marine species will be complicated by increasing marine acidity as marine waters absorb carbon dioxide.



Reduction in rainfall has led to the reduction of stream flow into our water supply dams. Mundaring Weir in the spring. Photo – Richard Tonkin

How do we manage for climate change in the future?

Managing for biodiversity now requires that an uncertain future rate and magnitude of local and regional climate change be included in reserve system, ecosystem and species conservation planning. There are three major strategies for dealing with climate change.

Reduce emissions

WA's net emissions can be reduced by protecting existing vegetation and broad-scale revegetation – both already important goals of nature conservation programs. If human-induced greenhouse gas emissions could be immediately reduced to zero, the rate and magnitude of climate change would be reduced. However, climate change would continue for hundreds and possibly thousands of years because of the time needed for climate systems to respond and for carbon dioxide and other greenhouse gases to be removed.

Increase resilience

Increasing ecosystem resilience to climate change involves reducing existing threats and pressures on ecosystems and ensuring ecosystems and their components have an opportunity to disperse to new locations or adapt to new climate conditions. Managers need to understand the risks and to have the capacity to expand programs to ensure conservation areas contain key refuges and core areas under present and projected climate conditions.

Establish off-reserve protection

Establishing off-reserve protection for species that cannot survive in their current locations and are unable to disperse to new appropriate locations will require knowledge about climate and biodiversity thresholds. This will involve experimental determination of climate thresholds for WA species; detailed surveys and monitoring of changes to species distribution and ecosystem composition over time; climate impact modelling and verification; and projection of these findings against existing biodiversity protection measures including reserve system design. Existing off-reserve conservation programs need to be reviewed to ensure they will be capable of dealing with the challenges of prospective species loss under climate change.