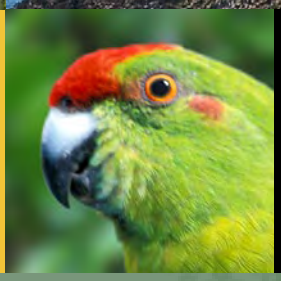
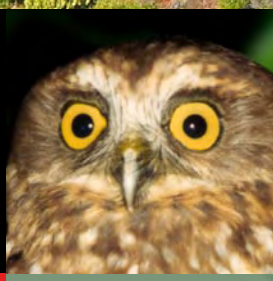
Australian Government
Director of National Parks



Norfolk Island National Park & Botanic Garden

Climate Change Strategy 2011-2016



Norfolk Island National Park and Botanic Garden

Climate Change Strategy 2011-2016

1. Background

The Intergovernmental Panel on Climate Change Fourth Assessment Report concluded that human induced climate change is expected to have a discernable influence on many physical and biological systems. The resilience of many ecosystems is likely to be exceeded over the course of the twenty-first century and approximately a quarter of all plant and animal species are likely to be at increased risk of extinction if increases in global average temperature continue to match current projections (IPCC 2007).

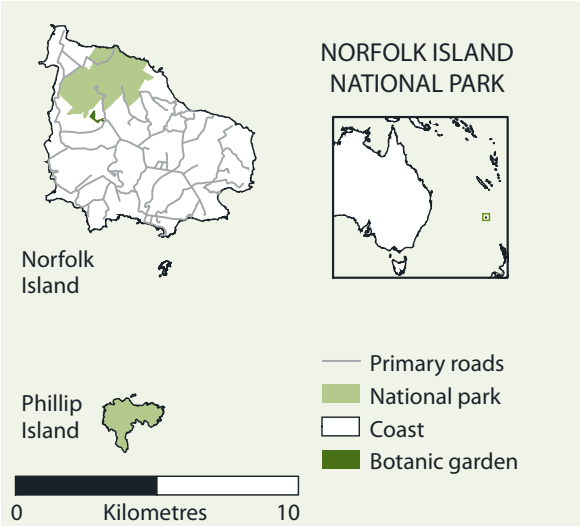


Figure 1: Location of Norfolk Island National Park and Botanic Garden

Norfolk Island is located in the South Pacific Ocean approximately 1,700 kilometres east of Sydney and 1,100 kilometres north-west of Auckland, New Zealand (Figure 1). The island provides an important link between tropical and temperate oceanic island environments and provides vital habitat and breeding areas for migratory seabirds and endemic species with limited distribution (Director of National Park 2008).

Norfolk Island National Park and Botanic Garden were established in 1986 and consist of Mt Pitt and surrounds (493 hectares), Phillip Island (197 hectares) and the Norfolk Island Botanic Garden (5.5 hectares). The park and garden support a number of species that are listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999* including 46 plant species, five species of land snails, five bird species and two reptile species. There are also 40 listed migratory bird species found in the park. The park and garden also contain species such as the Norfolk Island pine (*Araucaria heterophylla*) which, while not listed, are significant because of their contribution to landscape values, role in the island ecosystem and cultural values placed on them by the Norfolk Island community.

The *Norfolk Island National Park and Botanic Garden Climate Change Strategy 2011-2016* recommends the preliminary adaptation, mitigation and communication actions that are required to manage the consequences of climate change and reduce the carbon footprint of the park. The strategy is consistent with the policies and actions of the *Norfolk Island National Park and Botanic Garden Management Plan 2008-2018* and the objectives identified in the *Parks Australia Climate Change Strategic Overview 2009-2014*.

Climate change is a long-term issue and this strategy is an incremental 'first step' to what must be a long-term and enduring response.


This strategy is an adaptive tool subject to ongoing review, and management responses will be amended to take account of improvements in the understanding of the implications of climate change for the park and garden.

2. Regional Climate Change Projections

In general, the Southwest Pacific region may experience a rise in air and sea temperature (although rising at a lower rate than global average temperatures), sea level rise, variation in the amount and pattern of rainfall and changes in the frequency and intensity of extreme weather events such as cyclones and droughts. A summary of climate change effects is provided in Table 1. As the science of climate change develops, more accurate and precise projections may be added.

More specific climatic conditions are not available for Norfolk Island at this time.

The Bureau of Meteorology and CSIRO through their research partnership with the Centre for Australian Weather and Climate Research are in the process of formulating regional climate change projections for the Pacific region (encompassing Norfolk Island) through the Pacific Climate Change Science Program. The program is being managed by the Department of Climate Change and Energy Efficiency in collaboration with AusAID. The Pacific report is due for release in June 2011 and will include projections for temperature, rainfall, wind, evaporation, humidity, sunshine, sea level, ocean salinity and acidification, tropical cyclones and other extreme weather events.

Table 1: Climate change scenarios for the Southwest Pacific region

Climate change factor	Baseline (1975-2004)	2030 scenarios	2070 scenarios
Sea level rise [a]	0	+17cm	+50cm
Annual average temperature	Max 22.4ºC [b] Min 20.9ºC [b]	+0.45ºC to +0.82ºC	+0.80ºC to +1.70ºC [c]
Annual average rainfall	1,301mm[d]	-3.9% to +3.4% [c]	-8.23% to +6.7% [c]
Extreme weather events	-	Increasing frequency and intensity of droughts and cyclonic activity	
CO_2 concentration [a]	353ppm	+165ppm	+365ppm

a Hyder 2008
b Bureau of Meteorology 2010a
c Mimura et al 2007
d Bureau of Meteorology 2010b


3. Impacts of Climate Change on Norfolk Island National Park and Botanic Garden

Norfolk Island National Park and Botanic Garden contain terrestrial ecosystems that may be threatened by the effects of climate change. The key threats of climate change to the park and garden include the potential for altered species composition in a fragmented and isolated landscape, and the increased incidence of fire and storm events. While there is considerable uncertainty as to the magnitude and timing of climate changes and the extent to which these changes may affect the natural, cultural and economic values of the park and garden, the following impacts may be expected.

Increased incidence of fire events

A rise in annual average temperature and sporadic rainfall patterns may lead to longer dry periods and increase the possibility of fire in the park. While wildfires have not occurred in the park to date (Director of National Parks 2008), the wet rainforest ecosystems of the park would be fire sensitive and may not recover from a hot wildfire.

The western section of the park (130 hectares) is currently designated as a forestry zone. Eucalypt plantations have been established in just over one-fifth of the forestry zone. Eucalypt species, unlike many of the rainforest species on Norfolk Island, are known to carry hot fires and hence may increase likelihood and intensity of wildfire in the park. Additionally, steep terrain in many parts of the park may exacerbate fire activity as fires burn faster upslope than on flat ground (Bushfire CRC 2009). Replacement of eucalypt plantations with native species may reduce the risk of damaging fires in the park.

Increased storm intensity and frequency

Rainfall projections for the South Pacific under various climate change scenarios are highly variable. In general, models indicate only a marginal increase or decrease (less than 10%) in annual rainfall over most of the small islands in the region (Mimura 2007). There is a high probability that the frequency and intensity of rainfall events will rise, particularly over the summer months (Mimura 2007).

While the precise influence of climate change on the frequency, intensity and tracking of regional cyclonic activity remains uncertain, as a guide cyclones are expected to increase in intensity by an estimated 10-20 per cent (Watkins Consulting NZ 1999). There has been a doubling in the number of category 4 and 5 storms in the Southwest Pacific from the period 1975-1989 to the period 1990-2004 (Mimura 2007).

The probability of increased frequency and intensity of soil erosion due to extreme rainfall events is expected to increase. Flooding and erosion may be exacerbated by periods of drought preceding rainfall events. Super-saturation may occur where soils have been subjected to rainfall of very high intensity over short periods (days), or frequent rainfall periods over relatively short durations (several days or weeks) (Watkins Consulting NZ 1999). Changes in wind patterns, storms and cyclones have the potential to alter the wave action experienced in the Southwest Pacific (New Zealand National Institute of Water and Atmospheric Research 2008). This may influence the pattern of coastal erosion and the movement of near-shore sediments in coastal zones. The precise impacts of coastal erosion will vary depending on the location of the coastline and whether it is exposed to, or sheltered from, the altered oceanic swell.

Biodiversity impacts and arrival of new species

Norfolk Island may experience a rise in mean temperature but will warm at a lower rate than projected global increases. Higher annual average temperatures may affect triggers for life cycle events and the distribution of suitable habitats for a range of species.


While the impact on individual species is currently unknown, the small projected change in temperature is likely to mean that many species are able to adapt to the change.

Climate change may change the species composition of communities and ecosystems such as remnants of subtropical rainforest, palm and tree fern forest, hardwood forest and Araucaria-dominated forest. The small size of many of the forest remnants may heighten their sensitivity to extreme weather events. Invasive weeds and pests will be more likely to establish due to increased disturbance and less suitable conditions for local species (Dunlop and Brown 2008). A rise in temperature may increase the spread of pest species by influencing individual growth rates and extending the length of the optimal growing season due to favourable weather conditions commencing earlier in the year (Watkins Consulting NZ 1999). New arrivals may also be native species that extend their range in response to change in climatic conditions. These species may have an impact on existing resident populations.

Studies have shown that yearly and seasonal rainfall in the South Pacific is largely controlled by the El Nino-Southern Oscillation (ENSO). Extremes of the hydrological cycle such as droughts and floods are common during the El Nino and La Nina phases of ENSO respectively, and are likely to be enhanced with global warming (Trenberth et al. 2003 as cited in IPCC 2007). Increased variability in rainfall patterns may differentially affect species and ecosystems. The sporadic rainfall patterns and protracted drought of El Nino may lead to significant landscape changes by increasing vegetation mortality caused by water stress. In the park and garden, moist gully ecosystems and water sensitive species may be adversely affected. However, most plants could be expected to benefit from or at least cope with higher annual rainfall (Watkins Consulting NZ 1999). The ability of plant species and communities to survive such events will be dependent on a number of factors including the intensity and duration of rainfall, moisture content of soils prior to rainfall, wind shear and maturity of the plants at the time of exposure (Watkins Consulting NZ 1999).

Impacts on adjacent oceanic ecosystems

The sea level surrounding Norfolk Island is expected to rise due to increases in global average sea level. Rises in sea level, ocean acidification and sea surface temperature may adversely affect marine food chains. Temperature and current changes at lower trophic levels may alter the abundance and distribution of small pelagic fish, which form the staple food source of many native seabird species. Some seabirds may be able to rapidly shift their distributions depending on restrictions to habitat requirements at particular life stages such as availability of nursery areas, feeding and breeding grounds (Hyder 2008).

Visitor impacts and human health

More extreme weather events may increase the risk of injury to both park visitors and staff. Extreme storm events may force the park to close in order to protect visitors.

While populations of disease carrying insect species may become more prevalent under a warmer and wetter climate, it is uncertain whether these species will spread from tropical latitudes to Norfolk Island (Watkins Consulting NZ 1999) to affect visitor health and enjoyment of the park.

Buildings and infrastructure

More extreme climatic conditions may place pressure on the resilience and suitability of park infrastructure which may have implications for infrastructure maintenance costs. There is a possibility that storms will adversely impact the track network in the park and affect other infrastructure including roads, power, telecommunications and drainage.

4. Recommended Management Actions

The recommended management strategies align with the five objectives of the *Parks Australia Climate Change Strategic Overview 2009-2014* outlined below.

1. To understand the implications of climate change.
2. To implement adaptation measures to maximise the resilience of our reserves.
3. To reduce the carbon footprint of our reserves.
4. To work with communities, industries and stakeholders to mitigate and adapt to climate change.
5. To communicate the implications of, and our management response to, climate change.

4.1 Understand the implications of climate change

A good knowledge of the implications of climate change is necessary to enable Parks Australia to prepare and implement an effective response. Given the uncertainties of climate change at a local scale, and our current knowledge gaps, the task of improving our understanding will be an on-going effort. Understanding how various natural and cultural elements of the landscape may respond to changing climatic conditions, and designing long term research and monitoring programs to inform management responses are priorities.

	Recommended Management Actions	Timeframe
4.1.1	Identify critical knowledge gaps in baseline data and identify priorities for further research or integrated monitoring programs to study the causes and effects of landscape change, how these processes interact and how effects vary across the park.	By 2012
4.1.2	Identify a set of baseline ecological parameters to effectively monitor the effects of climate change.	By 2013
4.1.3	Establish and implement a monitoring program for parameters identified in Action 4.1.2 that are not already targeted in existing long term monitoring programs. Methods used to monitor the effects of climate change must have appropriate sensitivity to detect changes. Monitoring program should have explicit measures for communicating outcomes between land managers, researchers and the general community. Information should be used to guide management decisions.	By 2014
4.1.4	Revise relevant sections of this climate change strategy based on regional climate change predictions arising from the Pacific Climate Change Science Program.	By 2012
4.1.5	Continue to improve data management and the technical capacity of park staff (e.g. GIS, remote-sensing and field monitoring skills).	Ongoing
4.1.6	Investigate the feasibility of making seeds from the Norfolk Island Botanic Garden available to the Australian National Botanic Gardens through the Centre for Plant Biodiversity Research, or similar organisation, to support climate change research.	By 2011

4.2 Implement adaptation measures to maximise the resilience of our reserves

The condition of the natural and cultural values of the park is dependent on the rate of climate change itself and the resilience of the park to adapt to the change. A focus of park management is to reduce the impact of existing and potential threats to the park such as feral pests and weeds. This will maximise the resilience of species and communities to adapt to the additional challenges brought about by climate change and to enable ecological and evolutionary processes to continue.

Given oceanic isolation, it is uncertain whether the park will display a greater or lesser degree of resilience to climate change than other reserves on the Australian mainland. Notwithstanding the level of resilience, the park needs to be managed within the broader landscape of Norfolk Island, in partnership with park neighbours, in order to maximise opportunities for changes in the distribution of species and populations.

	Recommended Management Actions	Timeframe
4.2.1	Continue to implement targeted weed and feral pest monitoring and control programs to maximise the resilience of species and habitats in the park (MP 4.3)	Ongoing
4.2.2	Identify species and habitats where impacts from feral pests and exotic weeds are likely to be exacerbated by climate change and revise existing feral pest and weed management programs accordingly.	Ongoing
4.2.3	Investigate the feasibility of removing eucalypt plantations that are likely to contribute to a fire event.	By 2013
4.2.4	Cooperate with Norfolk Island fire agencies to ensure that fire response plans are in place and effective. (MP 4.5.6)	Ongoing
4.2.5	Continue collaboration between the park and the Norfolk Island Administration to ensure coordination of weed and feral management.	Ongoing

Norfolk Island National Park shares a plant nursery facility with the local government. Here thousands of native plants are propagated for planting in areas under rehabilitation within the park and across the island.

4.3 Reduce the carbon footprint of our reserves

The park adopts environmental best practice principles for resource use in the park. These principles are consistent with the need to conserve the park's natural and cultural resources, and meeting broader commitments to reduce greenhouse gas emissions, reduce water use and minimise the potential impacts associated with waste management.

Park operational activities such as transport, electricity use, development of new infrastructure and waste management all contribute to the park's carbon footprint. Land management activities such as revegetation projects and pest management also have implications for the carbon cycle. It is necessary to better understand the impact of land management activities (including carbon sequestration) on the size and nature of the park's carbon footprint to allow performance to be holistically measured and improved over time. Careful management of these activities can help to reduce overall emissions.

Parks Australia will aim to reduce greenhouse gas emissions from park operational activities (such as energy use, transport and waste management) to 10 per cent below 2007-08 levels by mid 2015.

	Recommended Management Actions	Timeframe
4.3.1	Undertake a carbon emissions audit (consistent with ISO14064-1) that considers energy use, waste, water and support infrastructure (e.g. insulation) across all buildings, vehicles and equipment used in the park.	By 2012
4.3.2	Develop an environmental management plan for the park that identifies actions to reduce the carbon footprint of park operations and the level of carbon emission reductions associated with each mitigation actions.	By 2012
4.3.3	Until an environmental management plan is developed (as per Action 4.3.2), investigate the feasibility of establishing a stand alone renewable power system for the parks hut on Phillip Island.	Ongoing
4.3.4	Investigate opportunities for the park to participate and capitalise on future carbon trading schemes.	Ongoing

4.4 Work with communities, industries and stakeholders to mitigate and adapt to climate change

The Norfolk Island community and economy rely on the park and garden to attract tourists and provide essential ecosystem services. The park will work with local communities and stakeholders to reduce the negative impacts of climate change and to adapt where climate change impacts are unavoidable.

The possible increase in frequency and intensity of extreme weather events will necessitate the development of risk control measures to protect life, infrastructure, natural and cultural values of the park. The park will work in partnership with local disaster management and emergency service agencies to plan for, and coordinate a response to, potential extreme weather events.

	Recommended Management Actions	Timeframe
4.4.1	Continue to reassess risks and amend or develop appropriate emergency management policies (e.g. fire ban and landslide policies) as required.	Ongoing
4.4.2	Continue training of field staff to ensure improved response capability and operational management of park incidents.	Ongoing
4.4.3	Hold joint exercises with relevant disaster management agencies to test emergency response plans and capacity to react to extreme weather events as appropriate.	Ongoing
4.4.4	Conduct an infrastructure risk assessment to identify assets at risk from climate change impacts and extreme weather events. Assessment should recommend assets requiring upgrading, relocation or those unsuitable in the future climate change environment.	By 2013

The volcanic soils of Norfolk and Phillip islands are fragile to erosion. Here a white oak has a tenuous grip on the slopes of Phillip Island after vegetation on the Island was stripped by rabbits, pigs and goats originally introduced for hunting and as a food source for Norfolk Islanders. The last rabbit was removed from Phillip Island in 1988.

4.5 Communicate the implications of, and our management response to, climate change

Climate change is a global issue affecting all aspects of the Norfolk Island community and it is vital we share knowledge with stakeholders, government bodies and the general public. Communication will ensure that efforts between government agencies, scientific researchers and the community are well coordinated.

	Recommended Management Actions	Timeframe
4.5.1	Support the maintenance of publicly available information on the Parks Australia website for climate change policies, strategies and other documents relevant to the park.	Ongoing

5. Implementation and Review

The *Norfolk Island National Park and Botanic Garden Climate Change Strategy 2011-2016* will be implemented by Parks Australia staff (both on and off island) over a five year period. While the strategy is consistent with the *Norfolk Island National Park and Botanic Garden Management Plan 2008-2018*, implementation of the recommended management actions is subject to budgetary and resource constraints. The strategy will be reviewed on a rolling basis to take account of new information or changes in policy directions.

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Prepared by: Director of National Parks

Note: This strategy sets out the preliminary actions and tools necessary to manage the consequences of climate change at Norfolk Island National Park and Botanic Gardens. While the Director of National Parks is committed to acting in accordance with the strategy, the attainment of objectives is subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the strategy due to changes in knowledge and policy direction.

This strategy should be cited as:

Director of National Parks 2011. *Norfolk Island National Park and Botanic Garden Climate Change Strategy 2011-2016*. Department of Sustainability, Environment, Water, Population and Communities, Canberra, Australia.

This strategy is available from the Department's web site at: environment.gov.au/parks/climate.html

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