



Australian Government  
Director of National Parks

AUSTRALIAN NATIONAL  
*Botanic Gardens*



Australian National Botanic Gardens  
Climate Change Strategy  
2010-2015





# Australian National Botanic Gardens

## Climate Change Strategy 2010-2015

### 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).

Botanic gardens, in partnership with herbaria, will play an increasingly critical role in ex situ plant conservation as climate change impacts on natural populations of plant species. The key focus of botanic gardens in addressing climate change includes:

- providing a safety net for plant species through living plant collections and seedbanks
- providing knowledge and expertise to support climate change research through horticultural and field-based research, plant species distribution and plant taxonomy
- providing opportunities for increasing community awareness and education about climate change (CHABG 2008).





The Australian National Botanic Gardens (ANBG) occupies a 90 hectare site on the lower slopes of Black Mountain in Canberra (Figure 1) surrounded to the north, south and west by Canberra Nature Park. The dry sclerophyll vegetation of the neighbouring Canberra Nature Park extends into the ANBG site. The ANBG contains the world's most comprehensive display of living Australian native plants.

Approximately one-third of the known flowering plant species that occur in Australia, and about half the known eucalypt species, are represented in the living collection. The ANBG is not expected to escape the likely impacts of climate change.

The *Australian National Botanic Gardens Climate Change Strategy 2010-2015* identifies the preliminary adaptation, mitigation and communication actions that ANBG staff and key stakeholders will need to implement to manage the consequences of climate change and reduce the carbon footprint of the site.

The strategy should be considered as a 'first step' and an adaptive tool subject to ongoing review. This allows for management responses to be amended to take account of improvements in the understanding of the implications of climate change on the ANBG.

This strategy is consistent with the *Parks Australia Climate Change Strategic Overview 2009-2014* (Director of National Parks 2009) and the *National Strategy and Action Plan for the Role of Australia's Botanic Gardens in Adapting to Climate Change* (CHABG 2008). The strategy also aims to complement the policies and actions outlined in the *Australian National Botanic Gardens Draft Management Plan 2010-2020* currently being finalised.

**Figure 1: Location of the Australian National Botanic Gardens**





## 2. Regional Climate Change Projections

The predicted effects of climate change in the Canberra region include a rise in temperature, more bushfire events and an increase in the frequency and intensity of droughts and severe storm activity (CSIRO 2007). A summary of these effects is provided in Table 1 (uncertainties shown in brackets).

**Table 1: Climate change scenarios for the Canberra region**

Climate change factor	Baseline (1975-2004)	2030 scenarios	2070 scenarios
Annual average temperature <sup>a, b</sup>	Max 24.4°C Min 11.1°C	+0.2°C (±1.8°C) <sup>a</sup> +1.3°C (±0.6°C) <sup>b</sup>	+0.7°C (±5.6°C) <sup>a</sup> +4.0°C (±1.7°C) <sup>b</sup>
Annual average days <0°C <sup>a</sup>	62 days	39-60 days	9-52 days
Annual average days >35°C <sup>a</sup>	5 days	6-13 days	8-42 days
Annual average days with very high or extreme forest fire danger <sup>a</sup>	23 days	26-29 days	28-38 days
Annual average rainfall <sup>a, b</sup>	633mm	-13% (±7%) <sup>a</sup> +4% (±11%) <sup>b</sup>	-40% (±20%) <sup>a</sup> +11% (±34%) <sup>b</sup>
Extreme rainfall events <sup>a</sup> (1 in 40 year 1-day rainfall event)	n/a	+7%	+5%
Annual average potential evaporation <sup>a, b</sup>	n/a	+1% (±13%) <sup>a</sup> +6% (±4%) <sup>b</sup>	+2% (±40%) <sup>a</sup> +17% (±13%) <sup>b</sup>
Extreme weather events <sup>a</sup>	-	Increasing frequency and severity of drought periods. Increasing frequency and intensity of storm activity.	
CO2 concentration <sup>b</sup>	353ppm	+165ppm	+365ppm

<sup>a</sup> CSIRO 2007

<sup>b</sup> Hyder 2008





### 3. Impacts of Climate Change on the Australian National Botanic Gardens

There is a degree of uncertainty regarding how some of these projections of climate change will affect the values of the ANBG. However, based on regional climate change projections the following impacts are expected.

#### **Heat stress and reduced water availability**

An increase in the incidence of days greater than 35°C may result in an increase in heat stress in the plants displayed at the ANBG. Heat stress in plants is likely to be exacerbated by reduced water availability (through more prolonged drought conditions) and increased potential evaporation. Unless this is offset by increased watering of the living collection there is an increased risk of plant mortality. Extended drought conditions may also lead to an increase in grazing and trampling pressure from both native animals (e.g. kangaroos) and feral animals (e.g. rabbits) that may take refuge on the site for food and water (Hyder 2008). Reduced water availability through drought has already placed a restriction on water use at the ANBG and increased the cost of water and maintaining the living collection.

#### **Increased fire risk and storm damage**

The expected increase in the number of days greater than 35°C and the number of days with very high or extreme forest fire danger is likely to increase the risk of fire on Black Mountain. Fire is most likely to threaten the southern and western boundary of the site. An increase in the frequency and intensity of storm events is likely to increase damage to the living collection through increased erosion, direct plant damage and increased chemical runoff (Hyder 2008).

#### **Reduced frost damage**

A reduction in the number of nights below 0°C is expected to lead to less frost damage to plants in the living collection and a reduction in the demand for polyhouses to protect frost sensitive plants. It is also possible that a greater range of species may be able to be grown in the living collection with milder minimum temperatures (Hyder 2008).

#### **Visitor impacts**

An increase in the annual average temperature and the number of days greater than 35°C is likely to impact on visitor comfort and satisfaction. More extreme weather events such as high winds or intense storm activity will increase the risk of tree and branch damage which increases the risk of injury to both ANBG visitors and staff. ANBG staff may restrict visitor access on days of extreme fire danger and intense storm activity. Any changes in visitation patterns may impact on any on-site commercial operators.

#### **Buildings and infrastructure**

More extreme climatic conditions are likely to place increased pressure on garden infrastructure which may lead to an increase in infrastructure maintenance costs. Increased erosion caused by more intense storm activity may impact on infrastructure such as garden paths and roads. An increase in the number of very high to extreme forest fire danger days may result in an increased fire risk to buildings which may necessitate the need to relocate existing infrastructure assets from high risk areas.





## 4. Recommended Management Actions

The recommended management actions 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

Plant flowering times and seasonality of natural populations of plant species is a key indicator of the response of an ecosystem to the effects of climate change. Botanic gardens have significant expertise and knowledge in the area of seasonality which can significantly contribute to our understanding of the implications of climate change on natural systems and assist managers to prepare and implement effective response options. The ANBG is well positioned to provide leadership in climate change research and education with its strategic partnerships and unique collection of resources (comprised of an expansive living collection from across Australia and a significant national herbarium).

Recommended Management Actions		Timeframe
4.1.1	Secure resources to contribute to long-term monitoring programs on plant phenology.	Ongoing
4.1.2	Undertake an Australian Research Council supported investigation into how climate change will affect the reproductive ecology and demography of Australian alpine flora in collaboration with the Australian National University and the University of Queensland.	By 2012
4.1.3	Continue to work in partnership with CSIRO, through the Centre for Plant Biodiversity Research, to develop accessible baseline taxonomic data to support climate change research in Australia.	Ongoing
4.1.4	Continue to work in partnership with CSIRO on research into the impacts of climate change on invasiveness in grassland ecosystems.	Ongoing
4.1.5	Continue to contribute Australian Virtual Herbarium data to the Atlas of Living Australia to provide foundation data to better understand the biogeography of climate change.	Ongoing
4.1.6	Develop a program of horticultural research to better understand the implications of climate change on the living collection.	By 2013



#### 4.2 *Implement adaptation measures to maximise the resilience of our reserves*

The future condition of the ANBG in the face of climate change will depend on a range of factors such as the rate and associated impacts of climate change itself, the resilience of the living collections to cope with environmental change and the level of resources allocated to manage the site. The resilience of the ANBG is ultimately dependent on the availability and affordability of a long term water supply and the selection of appropriate species to be displayed in the living collection.

Recommended Management Actions		Timeframe
4.2.1	Undertake a consultation process to review the living collection and set broad future directions for its management.	By 2010
4.2.2	Develop a project plan to implement the National Plant Information System.	By 2011
4.2.3	Continue to improve water use efficiency by implementing key actions of the Water Management Strategy 2008-12 such as: <ul style="list-style-type: none"> <li>- the completion of the upgrade of water infrastructure to provide non-potable water for irrigation of the living collection</li> <li>- the automation of remaining manual taps with piccolo controllers</li> <li>- replacement of old irrigation pipes and the installation of more soil moisture sensors and check and ball valves</li> <li>- building staff capacity in irrigation management through targeted training programs.</li> </ul>	By 2012
4.2.4	Continue negotiations with ACTEW to source an additional non-potable water supply to irrigate the living collection.	By 2013
4.2.5	Continue to implement existing feral and native animal monitoring and control programs.	Ongoing
4.2.6	Continue to monitor and control weed populations.	Ongoing



#### 4.3 *Reduce the carbon footprint of our reserves*

Activities such as water and electricity use, transport, design and development of new infrastructure and waste management all contribute to the carbon footprint of the ANBG. The ANBG currently collects data on its carbon footprint as part of an annual sustainability reporting process. A comprehensive understanding of the ANBG's carbon footprint will allow performance to be measured and improved over time. The ANBG aims to reduce greenhouse gas emissions from operational activities (such as energy use, transport and waste management) to 10% 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 (including lighting, heating and cooling), waste, water and support infrastructure (e.g. insulation) across all buildings, vehicles and equipment used at the gardens.	By 2012
4.3.2	Develop an environmental management plan for the site that identifies actions to reduce the carbon footprint of garden infrastructure and the impact on carbon emissions associated with each mitigation action.	By 2012
4.3.3	Continue to implement sustainable transport options including car pooling to off-site meetings, procurement of energy efficient vehicles and minimising long-haul travel using telecommunication options.	Ongoing
4.3.4	Develop a waste monitoring system and set targets to improve waste management.	By 2011





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

Climate change will have an impact on many communities, industries and stakeholders across Australia and they will need to mitigate their carbon footprint and adapt to the projected changes. The ANBG will work with local communities and stakeholders to identify and support proactive measures to reduce the negative impacts of climate change and to adapt where climate change induced impacts are unavoidable. The increase in frequency and intensity of extreme weather events will necessitate the development of risk control measures to protect life, infrastructure and the values of the ANBG.

Recommended Management Actions		Timeframe
4.4.1	Protect biodiversity from the adverse effects of climate change by coordinating a distributed National Seedbank Network to ensure efficiency of seed collection efforts and to input into global efforts after 2010.	By 2010 then ongoing
4.4.2	Develop strategic partnerships with user groups of seed banks such as species recovery programs.	Ongoing
4.4.3	Work with neighbours (e.g. Australian National University, CSIRO, ACT Parks and Conservation, Black Mountain Tower) and relevant disaster management agencies to test emergency response plans and capacity to react to extreme weather events.	Ongoing
4.4.4	Conduct an infrastructure risk assessment to identify risks from climate change impacts and extreme weather events as part of the ongoing Risk Watch Program.	Ongoing
4.4.5	Work with the Australian botanical community to document past and future distribution of Australian plants.	Ongoing



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

Climate change is a global issue affecting all aspects of our community and it is vital we share our knowledge with stakeholders, government bodies and the general public. This will ensure that stakeholders and the public are informed about potential climate change impacts and the management directions that are being taken. This also ensures that efforts between government agencies, scientific researchers and the community are well coordinated. The ANBG already has an ongoing program of community engagement through a broad range of education, botanical information, interpretation and community awareness activities to which climate change implications and responses need to be incorporated.

Recommended Management Actions		Timeframe
4.5.1	Develop key climate change and biodiversity messages and marketing approach for use by all botanic gardens in conjunction with the Department of Climate Change and Energy Efficiency.	By 2010
4.5.2	Develop a pilot or demonstration citizen-based science project linked with the phenology program as a focus to facilitate collaborative action.	By 2011
4.5.3	Develop a climate change training and capacity building program for the public.	By 2011
4.5.4	Strengthen and extend existing relationship between the Australian Network for Plant Conservation (ANPC) and botanic gardens and herbaria, to ensure effective skills and knowledge transfer to plant conservation practitioners throughout Australia, particularly to regional and community-based groups.	Ongoing
4.5.5	Develop and trial a climate change education programme for visiting school groups.	By 2011
4.5.6	In partnership with the Community Information Unit (Department of the Environment, Water, Heritage and the Arts), develop the ANBG as a community shopfront for climate change, biodiversity and related information and publications.	By 2011
4.5.7	Disseminate information to visitors and the community on actions the ANBG is implementing to reduce the ANBG's carbon footprint.	Ongoing

## 5. Implementation and Review

The *Australian National Botanic Gardens Climate Change Strategy 2010-2015* is to be implemented over a five year period. The strategy is consistent with the *Australian National Botanic Gardens Draft Management Plan 2010-2020* (currently being finalised). 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 and changes in policy direction.



## References:

- Council of Heads of Australian Botanic Gardens (CHABG) 2008. *National Strategy and Action Plan for the Role of Australia's Botanic Gardens in Adapting to Climate Change*. Commonwealth of Australia, Canberra, Australia.
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Note: This strategy sets out the preliminary actions and tools necessary to manage the consequences of climate change at the Australian National Botanic Gardens. While the Australian Government 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 or policy direction.

This strategy should be cited as:

Director of National Parks 2010. *Australian National Botanic Gardens Climate Change Strategy 2010-2015*. Commonwealth of Australia, Canberra, Australia.

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



