

Key Findings:

An Assessment of the Vulnerability of Australian Forests to the Impacts of Climate Change

Australia's forests cover a large area of the nation (approximately 20%, depending on definitions), support a high and unique biodiversity and form the basis for several important industries. Climate change has the potential to impact upon forests by causing:

- Changes in species distributions;
- Changes in community composition;
- Changes in forest structure;
- Disruption of biotic processes that provide ecosystem services.

For plantations and farm forests, climate change may lead to increased exposure to weeds, disease and pests, and changes in the suitability of plant species for the areas in which they are traditionally grown.

Potential effects of increasing carbon dioxide and climate change

Anthropogenic climate change is caused by increasing concentrations of greenhouse gases in the atmosphere,

particularly carbon dioxide. Carbon dioxide (CO₂) has a direct effect on plant physiology, with implications for Australia's forests. Increased atmospheric CO₂ concentrations increase photosynthesis which in turn should increase biomass and hence tree productivity.

At the same time, climate change has the potential to affect Australia's forests through changes in rainfall and temperature and, in some locations, changes in wind storm occurrence. But the impact of climate change, and of changing concentrations of CO₂ on forests and their inhabitants is not so simple, with precise responses being species dependant and no single factor working in isolation. The interaction of factors is not well understood. For example, increased atmospheric CO₂ is known to increase water-use efficiency, but whether in Australia's forests this will result in less water use by plants or simply an increase in leaf growth and the same water use is yet to be determined.

Key policy recommendations from this assessment

Create a vision of the future adapted forest

- Forest management needs a clear management goal for adaptation under climate change.

Recognise the role of forests in mitigation

- Implement mitigation policies that recognise the role of forests in carbon management. This includes setting a price on carbon.

Invest in decision-making tools and research

- In order for governments to make informed decisions about the best adaptation strategies, they will require effective decision-making tools.

Coordinate efforts at the national level

- While the impacts of climate change will differ among regions, many adaptation responses will cross regional and state borders. This will require national coordination.

Promote co-benefits of forests

- There is scope to expand and coordinate programs to maximise the multiple benefits from forests.

Audit impacts and respond when needed

- Monitoring changes in and impacts on Australia's forests is essential. This activity must include inbuilt markers or trigger points at which new or changed adaptation actions should occur.

Understand and respond to community concerns

- The support and confidence of the wider community will be important for successful implementation of planned adaptations, particularly if innovative policy or legislative changes become necessary.

Invest in targeted research

- There are many uncertainties and research gaps that are important to address in order to support and improve the adaptation response of forest managers to climate change. These must be addressed through a carefully targeted research program.

Predicting the future: gazing into a crystal ball?

We rely on climate models for information on how climates may evolve in the future under increasing atmospheric concentrations of greenhouse gases. Model-based 'projections' of future climates contain many uncertainties due, for example, to our incomplete understanding of all the natural processes involved, the inability of climate models to fully capture all the processes we do understand, and lack of knowledge around how human societies and economies will evolve into the future.

Taking these uncertainties into account, we have a good understanding of how temperatures and sea level will change in the current century. Our understanding of trends in rainfall and windstorm is much less certain – with respect to rainfall, we cannot even be sure whether rainfall amounts will increase or decrease.

This being the case, we cannot make a precise assessment of the future status of Australia's forests. What we can do is assess the vulnerability of these forests, taking into account what we know about plant or species sensitivities to exposure, and the future evolution of human pressures and climate.

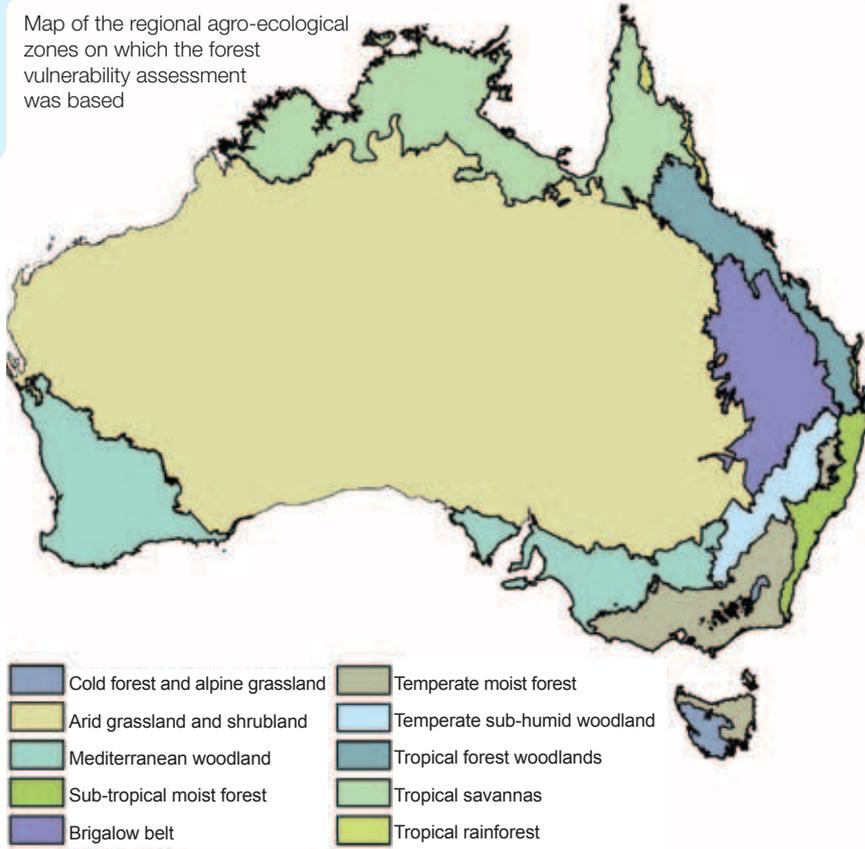
Results from this assessment

This assessment has identified several key areas of vulnerability among Australia's forests, based around a regional scheme of agro-ecological zones. Decrease in forest growth is expected in the Mediterranean Woodlands and Tropical Savannas. Elsewhere growing conditions could improve. This is particularly likely for southern regions such as the Cold Forest and Alpine Grasslands, Temperate Moist Forests, Temperate Sub-humid Woodland and Sub-tropical Moist Forests. Vulnerability will be increased by particular pre-existing conditions:

- Those forests with existing stresses. Vulnerable regions include the Mediterranean Woodland (e.g. persistent drought) and Brigalow Belt (e.g. tree clearing and habitat loss) regions;
- Forests with unique or high biodiversity and cool climate specialists. Particularly vulnerable regions include the Subtropical Moist Forests, the Tropical Forests and Cold Forest and Grassland regions;
- Forests with the highest exposure to extreme events. Highly vulnerable regions will be Tropical Savannas, Tropical Forest Woodlands and Tropical Rainforests exposed to severe storm events. In addition Mangroves could be highly vulnerable because of sea level rise;
- Existing plantations with species in long rotation periods (e.g. some eucalypt species). If recently planted, the growing conditions may become less suitable;

- Any reserves with inadequate or poor management. These areas could be vulnerable to introduced species, disease and degradation if management is poor or is limited.

Despite gaps in knowledge, it is clear that the impacts of climate change on Australia's forests have critical implications: forests will change with both increases and decrease in growth predicted. In addition to new climate stressors, existing stressors will be worsened. These changes are likely to increase the already high cost demands of maintaining forests for both production and conservation.



About this study

The Forest Vulnerability Assessment was undertaken under the management of the National Climate Change Adaptation Research Facility.

It provides governments, natural resource managers and the business sector with an improved understanding of current knowledge of the likely biophysical and socio-economic consequences of climate change for Australia's native and planted forest regions; an assessment of the vulnerability of Australian forests from the perspective of both resource use and of ecosystem services – identifying particularly vulnerable forests and the communities in major forest areas; an understanding of what is already being done in Australia with regard to understanding and managing climate related risk in relation to forests, and guidance on key gaps to assist climate change adaptation.

The study will be available online at www.nccarf.edu.au



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