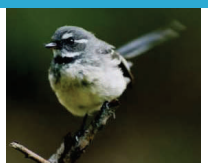
NCCARF
National Climate Change Adaptation Research Facility
Adaptation Research Network
TERRESTRIAL BIODIVERSITY





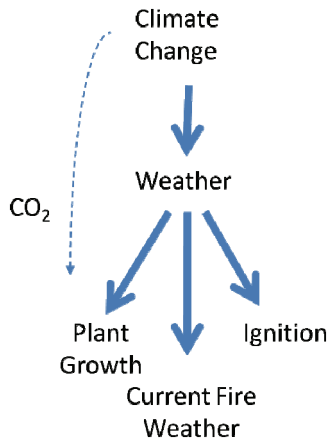
INFORMATION SHEET SIX

Climate Change, Fire and Terrestrial Biodiversity

Climate change will affect fire regimes in Australia through changes to temperature, rainfall, humidity and wind – the fire weather components - and via complex effects of changing moisture regimes and elevated atmospheric CO_2 on fuel loads.

Although many Australian plants and animals are tolerant of individual fires, increases in frequency and severity of fire - changes to *fire regime* - may have a variety of negative impacts on biodiversity with some habitats and species likely to be more adversely affected than others.

This information sheet explains how climate change will interact with fire regimes across Australia, potential consequences for biodiversity, and implications for decision makers in terms of adaptation strategies.



Simplified diagram of the major drivers of fire and interaction with climate change.

Potential Impacts of Climate Change on Fire Regimes in Australia

Australia is a fire-prone continent. However, regional fire regimes vary across Australia because of variation in four drivers, each of which may be affected by climate change - biomass growth; the availability of biomass (plant material) to burn; fire weather and ignition.

Each of these can be thought of as a 'switch'- each switch needs to be 'on' for fire to propagate across the landscape. Fire regimes in different regions are constrained by different switches. In the savannas they are limited mainly by the fuel mass and ignition. In contrast, in temperate forests fire regimes are constrained by fuel moisture, and the occurrence of suitable fire weather.

Fire weather indices such as the Forest Fire Danger Index (FFDI) consider factors including temperature, relative humidity, rainfall, wind speed and a drought factor. Over much of south-eastern Australia FFDI has increased by 10-40% in the past decade.

Models predict further increases in the severity of fire weather as the climate becomes warmer and drier. For example, by 2050, under a high emissions scenario, an increase of up to 65% in the incidence of 'very high' or 'extreme' fire danger days is predicted in some regions, such as south-eastern Australia.

Climate Change and Fuel Loads

The impact of climate change on fuel load - the amount of plant material available to burn - is complex. Elevated atmospheric CO_2 may enhance vegetation production and thereby increase fuel loads, but declines in annual moisture availability, already occurring in southern Australia and projected to decline further, may decrease long-term vegetation production and decrease fuel loads. Drought may also decrease the moisture content of fuel, increasing potential rates of spread of fire.

Scenario modeling for the forests of the Sydney basin region indicate that long-term effects of climate change on litter fuel mass are likely to be weak-to-modest, whereas the potential changes to fuel moisture are likely to be substantial.

The interaction of fuel load - the amount of vegetation available to burn, and climate change is extremely complex (© L.Valentine).

Regional Variation

The potential impacts of climate change on Australian fire regimes will vary regionally. In tropical savannas, climate change is unlikely to have major effects on area burned and fire frequency, because the primary climatic and fuel drivers of fire (see above), determined by the annual wet-dry climate, are not very variable throughout the year and changes to rainfall are expected to be relatively low. In arid regions, drought and fire weather are essentially non-limiting on an annual basis, and landscape scale fires will continue to be limited to periods following above-average rainfall, even under climate change scenarios.

However in southern sclerophyll dominated vegetation, where both overstorey and understorey are dominated by woody plants, the primary effect of climate change on fire regimes will stem from projected increases in the frequency of occurrence of days of extreme fire weather, which has the potential to increase both fire intensity and area burnt, and to shorten the intervals between fires.

Predicted changes to fire regimes could negatively impact nectivorous species which prefer long unburnt habitat, such as the honey possum (© L. Valentine)

Climate Change, Fire Regimes and Biodiversity

Australian plants and animals have evolved in conjunction with recurrent fire and are not adapted to, or sensitive to, fire *per se*, but to particular aspects of the regime. Some species are sensitive to the intensity of individual fires; others to fire frequency.

Changes in these regime components, as a consequence of climate change, will therefore have impacts on biodiversity. There may be increased risks to both interval- and intensity-sensitive species, as a consequence of changed climate and changed fire regimes. Fire regimes will also interact with other stressors, such as invasive species, or declining moisture. Interactions will be complex, and are not yet well-understood.

Climate change will probably have the most significant impacts on both the fire regimes and biodiversity of sclerophyll dominated vegetation such as the forests of south-eastern Australia and south-west Western Australia. Impacts of changing fire regimes on biodiversity in tropical savannas and arid shrublands are more likely to be indirect and driven by the spread of exotic grasses rather than changes in fire weather or fuels.

Some vulnerable terrestrial fauna species could suffer an increase in predation following fire due to reduction in foliage and ground cover. The endangered Leadbeaters possum and threatened western ringtail possum have been indentified as vulnerable to wildfires and the terrestrially nesting little penguin has also been found to be highly vulnerable to climate change related fire.

Prescribed Burning

Prescribed burning is used as a management strategy to reduce fuel loads, and thereby decrease the potential for extensive wildfire. Prescribed burning may be used to reduce risks to a suite of landscape assets such as life and property, and biodiversity. Climate change may alter the window of opportunity for safe application of prescribed fire. Climate change may also affect the effectiveness of prescribed burning in achieving its objectives.

Implications for Managers and Decision-makers

The impacts of climate change on fire regimes in Australia are uncertain. Managing fire regimes to reduce risk to property, people and biodiversity under climate change will therefore be challenging.

Monitoring of patterns in fire weather, fuels and fire history will be imperative in planning for the future. Management decisions should also recognise that future fire regimes will also be affected by other factors, including exotic species and land-use change, that may affect fuel loads. There needs to be an enhanced research effort on the complex interactions between fire, biodiversity, people, fuel management and land -use change, to help meet these challenges.

Appropriate management actions for terrestrial biodiversity will differ among regions, species and communities, but may include regimes that aim specifically to manage fuel accumulation, such as prescribed burning and control of weedy invasive species. Fire regimes should also be managed to enhance habitat heterogeneity.

The potential vulnerability of key species to changes in fire regime should be investigated and the life history and other attributes of focal species should be taken into account.

About the Adaptation Research Network for Terrestrial Biodiversity

The Adaptation Research Network for Terrestrial Biodiversity is one of eight research networks administered by the National Climate Change Adaptation Research Facility. It is hosted by James Cook University in Townsville, north Queensland.

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For more information on the Climate Change Adaptation Research Facility and other Research Networks, please visit www.nccarf.edu.au

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