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# Climate change impacts on biodiversity in Australia

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## 3.9 Impacts of global warming on the Snowy Mountains

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The Snowy Mountains contain the largest area of contiguous subalpine and alpine habitats in Australia. Other subalpine and alpine habitats occur as relatively isolated areas in the mainland Victorian Alps, and in the Central Highlands and higher peaks of island Tasmania. The large Snowy Mountains' area presents a unique opportunity to monitor regional changes attributable to global warming. Even a modest warming ('best case scenario' of only +0.6°C by 2070) will result in a 39% reduction in the area that receives 30 days of snow per year in the Snowy Mountains (Whetton 1998). Seasonal cover of snow is a major determinant of the animals living in the subalpine and alpine areas of the Snowy Mountains (Green and Osborne 1994, 1998).

There has been a significant decline in mean snow cover at Spencers Creek, as measured at the Snowy Mountains Hydro-electric Authority snow course (Osborne et al. 1998). The snow course has been visited weekly through the snow season since 1954. Examination of the data by decade shows a total of 2283 metre-days of snow in the 1960s, with a 20% reduction to the 1970s (1843 metre-days) and a further 10% reduction to the 1980s and 1990s (1655 and 1706 metre-days respectively). The last five years, occurring in the warmest decade of the century (Australian Bureau of Meteorology), had the lowest five-year average metre-days of snow of the series: 7.5% less than the previous lowest five years and 53% less than the highest five years (Green and Pickering 2002). For fauna sensitive to depth and extent of snowcover, this decline might be expected to be reflected in changes in its distribution.

Mammals and birds have responded to this 30% reduction in snow cover over the last 45 years. There is an increased penetration of feral mammals into alpine and high subalpine areas, and there is a prolonged winter presence of browsing macropods. The only three species of native mammal to increase in abundance with altitude are affected adversely by years of shallow snow. Birds are less constrained by altitude, but among migratory species there has been an observable change in timing of arrival in the mountains, with earlier arrival in the 1980s and/or 1990s compared to the 1970s. Of 11 species for which good data exist, seven arrived in the mountains at least a month earlier in the 1980s/1990s than in the 1970s. The implication of these trends is that predicted impacts of global warming on snow cover will result in a significant change in distribution of animal communities both geographically and through time.

To test this hypothesis, ongoing research is looking at:

- weekly recording of snow depth at the Whites River snow course (it has been recorded monthly since 1954). Whites River is close to long-term fauna-monitoring sites and is in marginal snow conditions at 1680 m. This area is expected to respond more quickly to changes than the snow course at Spencers Creek.
- date of ice breakup and September ice depth at Blue Lake. In the past thirty years there has been a two-month difference in the date of ice breakup. It has ranged between late October and mid December.
- snow depth, percentage snow cover, percentage of open flowers, and bird species

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present at seven 1 ha stations, 50 m apart altitudinally, from 1350 to 1650 m, on Disappointment Spur, and at a further two stations at 1600 m and 1650 m. This study is done four times a month from mid-August to mid-October and aims to document the relationship between snow duration, plant phenology and bird migration. Tracks of macropods are also recorded and are related to snow depth and extent and proportion of uncovered shrubs.