

The Australian Alps to Atherton (A2A) Connectivity Conservation Area: a national response to climate change

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Introduction

The area from the Australian Alps in Victoria to Atherton in Queensland (A2A) is essentially natural and unfragmented for 2800 north-south kilometres along sections of both the Great Dividing Range and the Great Escarpment of Eastern Australia (the great eastern ranges). In human terms, this natural connectedness has always been there. However, there are national scale threats to A2A from climate change, clearing and fragmentation. A vision to conserve these interconnected lands to help conserve native species and to respond to these threats is described here.

A2A connectivity conservation

Connectivity conservation along the great eastern ranges (A2A) is a national response to mitigate the impacts of climate change. It is a vision supported by the ACT, NSW, Queensland and Victorian Governments, it has been publicly announced in February 2007 and there is a national co-ordinating committee established to facilitate its introduction. In 2007, the NSW Environmental Trust allocated \$AUD7 million dollars for a three year program to facilitate the NSW section of A2A. A small secretariat has been established, and implementation of this work is progressing (Pulsford and Worboys 2008). A2A is a lifeline of interconnected natural ecosystems which can help maintain ecosystem function including altitudinal and latitudinal movements of species during climate change caused biome shifts. The A2A connectivity conservation area warrants special conservation attention given its great age and its high concentration of species.

About A2A

From a naturalist's perspective, the great antiquity of A2A's ecosystems is remarkable at both a continental and global scale. Once formed, the elevated A2A lands have maintained interconnected ecosystems for more than 80 million years (White 1994, Johnson 2004). In addition, Australia was isolated from other continents 45 million years ago and has migrated from southern latitudes to its present location during that time. Australia was a giant Ark of life during this migration and included its own distinctive evolutionary and adaptive processes and unique ecological settings (White 1994, Lindenmayer 2006, Mackey et al. 2008). It was (essentially) tectonically stable during this period and climate fluctuations were the key evolutionary change factor.

The ecosystems of A2A did experience marked climatic and evolutionary changes to their ancient Cretaceous Gondwanan flora and fauna. This included the establishment of continent wide rainforests during the early Tertiary and then drying, and modernisation of Australia's flora, with the contraction of rainforests to moister island refugia along A2A in the mid to late Tertiary (White 1994). The very recent past witnessed quite variable climates including an intense cold and dry period just 30,000 years ago, warming, and the development of woodland and forest vegetation communities along A2A (White 1994). Many examples of the older flora and habitats can still be found along A2A and contribute to its high species diversity and high endemism.

An A2A inheritance

Australia is one of the 17 mega (biologically) diverse countries of the world and has the world's largest number of endemic vertebrate species (1350) due to its long evolutionary isolation (Lindenmayer 2006). Many of these species are concentrated along A2A (DEH 2005) making it one of the most biodiverse areas for the country (Mackey et al. 2008a). A2A spans 28 degrees of latitude and includes 14 of Australia's 85 bioregions. It includes the highest concentration of bird species in Australia with 429 species in south-east Queensland and 428 species in north-eastern NSW; the richest concentration of Australia's mammal species; and one of the two great concentrations of Eucalyptus and Acacia for Australia (NLWRA 2002). It is currently under review for potential listing as Conservation International's 35th global biodiversity hot spot (Mackey et al. 2008a). A2A includes catchments of 63 of Australia's easterly and southerly flowing rivers and is the source of water for Australia's four east coast capital cities, Brisbane, Canberra, Melbourne and Sydney. It is a significant area and many protected areas have been established including three World Heritage Sites. The A2A connectivity conservation area interconnects these protected areas and helps protect habitats and maintain ecosystem functions.

A vision for A2A

The broad vision for A2A is to work with people to conserve the natural connectivity of Australia's natural environments found along the Great Divide and Great Escarpment of Eastern Australia from Atherton in Queensland to Victoria's section of the Australian Alps. These natural lands have "always" been interconnected. The challenge is to keep them this way, and active connectivity conservation management is critical to this vision (Mackey et al. 2008a, Worboys et al. in prep). The alternative, habitat destruction, fragmentation of natural lands and the isolation of protected areas through thousands of individual actions will contribute to species extinctions along A2A and the sixth great extinction event of Earth (IUCN 2004).

About connectivity conservation areas

Connectivity conservation areas are natural lands that are not part of the public, private or community protected area systems (Worboys 2008). They are neither protected areas nor are they the extremely large, remaining wild areas of Earth. Large scale connectivity conservation areas (like A2A) are the most effective (Bennett 2003) and are typically tens of kilometres wide and hundreds (if not thousands) of kilometres long and they interconnect many protected areas. Large connectivity areas are important to people, and may include public, community, leasehold, and private lands. They may be where people live, derive their livelihood, and may be of special significance for cultural and spiritual reasons, such as many parts of A2A which are of

special significance to indigenous Australians. Connectivity conservation areas cannot be established without the support and involvement of people and this involvement is discussed in detail elsewhere (Worboys et al. 2009 in prep).

Types of connectivity

Scientists recognise that connectivity conservation may include four distinct types of connectivity and these are (Lindenmayer and Fischer 2006, Mackey et al. 2008a):

- 1) Landscape connectivity, which recognises core protected areas that are interconnected by large, naturally vegetated areas;
- 2) Habitat connectivity, where the natural interconnected landscape retains opportunities for species to move selectively by using preferred habitats;
- 3) Ecological connectivity, where the natural landscape permits species to contribute to ecosystem diversity and ecosystem function such as a birds transferring rainforest tree seeds across a landscape with their droppings; and
- 4) Evolutionary connectivity, where the interaction of species with the broader environment permits adaptive and evolutionary changes.

Connectivity conservation areas also help to maintain (Mackey et al. 2008b):

- 1) Ecological functional populations of highly interactive species in the landscape;
- 2) The habitat needs of highly dispersive fauna;
- 3) Natural fire regimes; and
- 4) Natural hydro-ecological regimes.

Connectivity conservation areas are more than just corridors for the movement of species.

Climate change and connectivity

The Intergovernmental Panel on Climate Change in 2007 identified that A2A, from the Australian Alps to at least southern Queensland will be affected by drying (IPCC 2007). As a consequence, species may (Mansergh and Cheal 2007; Mackey et al. 2008a):

- 1) Just deal with the hotter (and potentially drier) conditions because of their inherent ability to deal with a wide range of environmental conditions;
- 2) Alter their genetically permissible physical responses to the changed conditions;
- 3) Adapt (in an evolutionary sense) to the new conditions;
- 4) Move to new areas;
- 5) Survive in refugia areas; or
- 6) Simply die out as a species at that location.

A commonly accepted model for species that move is for them to move southward (latitudinally) or up-mountain (altitudinally) or both in response to hotter conditions (Dunlop and Brown 2008). Connectivity conservation helps maintain these opportunities.

The NRS and connectivity conservation

In responding to climate change, the first priority for Australia is for it to thoroughly finish its National Reserve System (NRS) (Gilligan 2006; Worboys and Lockwood 2007; Mackey et al. 2008b). The second priority is to strategically conserve Australia's remaining native vegetation for its connectivity values, its contribution to ecosystem function and water supplies and for its "green carbon" values (Mackey et al. 2008c). A2A would form one of the nation's high priority connectivity conservation initiatives. Given the climate change imperative, protected area

establishment and connectivity conservation initiatives may need to be implemented concurrently.

A2A connectivity conservation management

A2A has always been naturally interconnected. The challenge will be to keep it that way and to retain its naturalness. Protected areas, connectivity conservation and active connectivity management at a national scale will all be needed to help maximise opportunities for A2A ecosystems to continue to function, to reduce threats, to increase resilience and for species to survive (Worboys 2007, Worboys et al. in prep).

Conclusion

A2A connectivity conservation is a grand vision to conserve naturally interconnected ecosystems along the great eastern ranges from the Australian Alps in Victoria to Atherton in Queensland to help species survive the threat of climate change. This can be achieved through the completion of the National Reserve System along A2A and concurrent conservation of large scale natural lands that interconnect such protected areas. This national conservation response will involve the people of A2A and Australia and governments' working together in the interest of conserving multiple species and helping to mitigate what is forecast to be the sixth great extinction of Earth.

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