



Editorial

An American naturalist's impressions on Australian biodiversity and conservation

Introduction

On July 5–7, 2001, a symposium entitled 'Biodiversity Conservation in Freshwaters' was held in Canberra, Australia, as one in a series of Fenner Conferences on the Environment. Speakers addressed root causes for the imperiled state of freshwater biodiversity in Australia, and the resulting management challenges. Clearly, Australian wetlands and watersheds, already scarce, have come under assault in recent decades from increased water usage by humans and the introduction of exotic species. Speakers representing management agencies and academic units within Australia generally were saddened and alarmed over the decline of Australian biodiversity, and by a perceived inadequacy to date of governmental and societal responses to the problem. At the close of the conference, organizers asked the handful of biologists visiting from overseas for our initial reactions to the Australian conservation experience, and how the challenges might compare to those on our own continents. Here are some of my impressionistic thoughts.

History of continental impacts

As first appreciated by Sclater (1858) and Wallace (1876), Australia and North America are two of the planet's six primary biogeographic provinces. During the past 80 million years, the extreme geographic isolation of Australia has promoted the evolutionary radiation there of many characteristic biotic groups, including marsupial mammals, corvid-like birds (Sibley and Ahlquist 1986), and eucalyptus and acacia plants (Brown and Lomolino 1998). Humans first colonized Australia about 56 000 years ago, and shortly thereafter may have extirpated most of the continent's native megafauna (land animals weighing more than 45 kg) (Roberts et al. 2001). In North America, a similar mass extinction followed the much later arrival of humans there, about 13 000 years ago (Alroy 2001).

Thus, people have long impacted the indigenous biotas on both landmasses. Furthermore, following the arrival of Europeans on both continents in the last few centuries, the pace of environmental modification has accelerated tremendously and now threatens many kinds of creatures, both large and small.

The Fenner Conference kicked off my second three-week-long visit to Australia, the first having been 10 years earlier. Although brief, these two trips included wildlife excursions through the eastern and central portions of the continent – New South Wales, Tasmania, Queensland, South Australia, and the Northern Territory (including the interior near Alice Springs, and Arnhem Land). On both occasions, I fell in love with Australia's ebullient native fauna and flora, the country's relatively unspoiled natural landscapes, and, most of all, the uncrowded feel of the continent. To a natural historian born and raised in the congested United States (Awise 2002), my first impression is that Australia's land and nature are as untrammled as those in North America may have been approximately 150 years ago – impacted and far from pristine, but not yet fully overwhelmed by human presence.

Current landscape impressions

Of course, Australian biodiversity is under heavy siege from human activities (Flannery 1995; Low 1999). With regard to aquatic habitats, conservation issues highlighted at the Fenner Conference were the urgent need to protect Australia's imperiled river drainages and aquifers, to properly identify and manage freshwater biodiversity on regional as well as local scales, and to control the introduction and spread of non-indigenous species such as carp that often wreak havoc on native wildlife and ecological processes. Problems also abound in the terrestrial realm. For example, one response to the limited availability of agricultural land in Australia has been to forage cattle across much of the continent, and this has transformed the land. Feral and exotic species such as cats, rats, mice, goats, rabbits, and foxes also have had a huge impact by predated or competing with native wildlife. Interestingly, some Australian scientists have been especially active in promoting the release of genetically modified (GM) organisms as a potential means to control exotic pests. For example, GM viruses have been engineered to serve as a vector for transgenes that induce rabbit sterility (Hood et al. 2000).

Despite the serious scientific and social challenges that conservation efforts in Australia clearly face, I could not help but conclude, during the Fenner Conference and in my travels, that the Australian natural environment and its native flora and fauna remain in far better shape than those in most of North America. In much of the continental US, remnants of nature tend to be confined to small pockets in a human-dominated landscape, whereas in Australia, nature more often tends to be the basal matrix in which islands of overt human modification are embedded. I say this not to diminish any sense of urgency or commitment to Australian conservation initiatives. To the contrary, by comparing human population pressures on the two continents, I hope to remind Australians about how much natural richness they currently retain (and potentially stand to lose), the timeliness of the task, and the likely eventual outcome if Australia follows the historical paths of overpopulation and environmental

disregard that too often characterized North American societies. Sadly, in the US in particular, great ecological opportunities were lost during the critical 19th and 20th centuries as the country directed its considerable capitalistic energies on shortsighted plunder, heedless of the continent's environmental heritage as well as its future needs.

Human population pressures

Australia and the continental United States are strikingly similar with respect to total geographic area (7.7 and 7.8 million km², respectively), latitudinal arrangement (mostly 15–40° S vs. 25–45° N), and even general physical layout (Figure 1). In Figure 1, I have inverted and subdivided the US to make its latitudinal orientation and general climatic regimes directly comparable to those of the Australian continent and its five geo-political regions shown. Human population figures for these corresponding geoclimatic regimes on the two continents are compiled and compared in Table 1.

In each region, the numbers tell the same story. In the low-latitude central zone (region II), Darwin is Australia's only metropolitan center (70 000 inhabitants), whereas in the corresponding region in the US, about 60 cities exceed 50 000 residents. The largest of these include Dallas (1.8 million), Houston (1.6 million), and San Antonio (0.9 million).

In the vast western zone (region I), Perth is Australia's primary municipality (1.1 million people), but several even more populous urban areas are situated within the western US, including Los Angeles with 8.9 million inhabitants. In the high-latitude central zone (region V), Australia's only major city, Adelaide (1.0 million), is dwarfed by Chicago (2.8 million), which itself is but one of many metropolises in that region. In the eastern temperate zone (region IV), New South Wales and Victoria are by far the most populous Australian states, yet their total of 10.7 million citizens is little more than the 7.3 million people who inhabit New York City alone, which is just one of several dense epicenters in a quasi-continuous megalopolis extending from Boston to Washington, DC and beyond.

In short, by Australian standards, the United States is remarkably crowded. In the year 2000, 281 million individuals were crammed within US boundaries, or about 14 times more people than in all of Australia. The states of Texas and New York, with 20.9 and 19.0 million residents, respectively, each have about as many citizens as live on the entire Australian continent (19.6 million), and California alone houses nearly twice that many (33.9 million)! Overall, population densities on the two continents average about 36.1 vs. 2.5 people, respectively, per km².

In terms of human impact on the natural environment, this disparity in population densities has striking consequences. Many examples could be cited. On both continents, a splendid eastern peninsula juts far into tropical or subtropical oceans. Australia's Cape York is a sparsely inhabited wilderness; America's Florida Peninsula

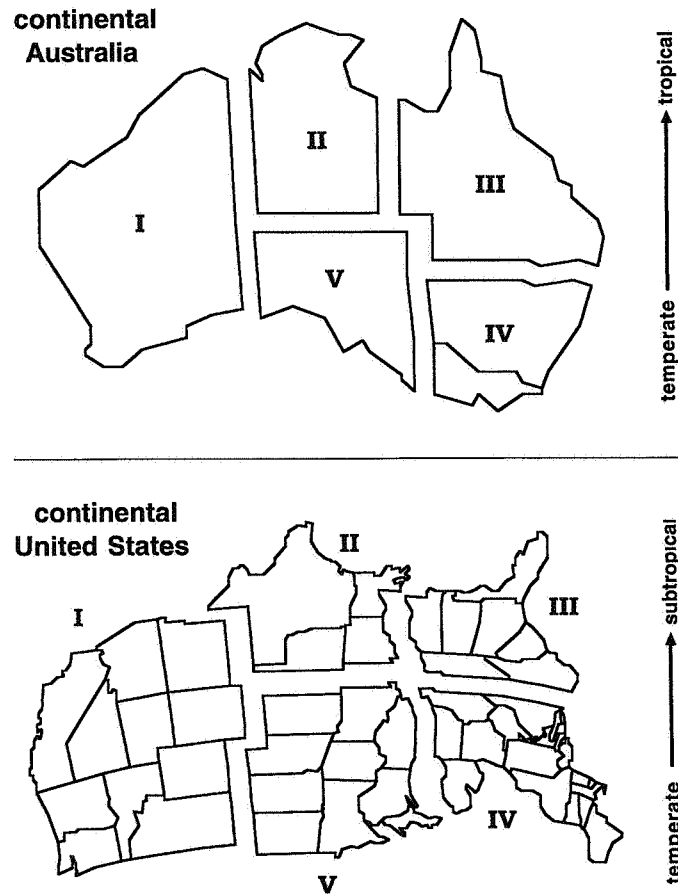


Figure 1. Five political and geoclimatic regions of continental Australia (above) and their analogous counterparts in the continental United States (below). The five Australian regions are as follows: I, Western Australia; II, Northern Territories; III, Queensland; IV, New South Wales and Victoria; V, South Australia. Both maps have the same vertical orientation with respect to latitude.

is rimmed with condominiums, crisscrossed by congested highways, and packed with 16 million people vying (for space and water) with what little remains of the native wildlife that inhabited the area 150 years ago. In the western subtropical zones of Australia, the Kimberley coastline remains mostly natural, whereas analogously situated southern California is nearly blanketed by Los Angeles and San Diego. The land and biota of the Australian outback seem almost pristine in comparison to those of the North American heartland, where long ago the native grasslands and prairies were converted to monocultural landscapes of wheat, corn, and soybeans.

Of course, native landscapes and biodiversity are impacted not just by human numbers *per se*, but especially per capita resource consumption and patterns of land-use practice. Despite the environmental pressures of an exploding US population over the last 150 years, greater foresight surely would have short-circuited many of the

Table 1. A comparison of human populations in five analogous geoclimatic regions (as defined in Figure 1) of Australia and the United States.

	Number of people ^a (millions)	Number of cities with >50 000 people ^b	Population per km ²
Region I			
Australia	1.9	7	0.8
USA	61.4	178	19.8
Region II			
Australia	0.2	1	0.1
USA	31.4	59	27.4
Region III			
Australia	3.7	7	2.1
USA	49.2	66	53.7
Region IV			
Australia	11.5	48	14.3
USA	100.5	172	81.0
Region V			
Australia	1.5	7	1.5
USA	37.0	71	22.2
Total			
Australia	19.6	70	2.5
USA	281.4	546	36.1

^a US Census Bureau (2000 census) and Australian Bureau of Statistics (2001 census).

^b Minimal estimate, based on *Cosmopolitan World Atlas* (1996).

ecological crises that North America now faces. Today, we can only wish that our forebears had seen a need to set aside more extensive nature reserves, to cherish rather than pillage the land and its wildlife, to stem the introduction and spread of exotic species, to conserve non-renewable resources (ranging from topsoils to natural landscapes to underground aquifers), to manage renewable resources (such as forests, grasslands, and wetlands), to place wise restraints on commercial fishing practices, to promote clean air and water, and to think and plan in advance on patterns of urban development. Timely action could have ameliorated many of the detrimental impacts of humanity on the natural environment, on ecological processes and services, and ultimately on our own well-being.

Societal outlooks

From my travels, I have the distinct but perhaps naive impression that Australian sensibilities (both within and outside of government) are sometimes far ahead of the US on such matters, notably in the realm of urban development. For example, Sydney is Australia's most populous city (3.5 million), but its citizens have set aside, within an hour's travel, no less than seven biodiversity-rich federal parks. These include Royal, the world's oldest national park, formally recognized in 1879 (four years before

Yellowstone Park was so designated in the United States). By contrast, to reach the nearest substantial parks under federal protection, a New Yorker must travel about 500 km (to the Shenandoah National Park in northern Virginia, or Acadia in Maine). Another striking contrast involves our nations' capitols – the carefully planned city of Canberra, richly perfused with parklands and open spaces, and surrounded by thinly populated countryside, exudes a nature-friendly ambience that bears little resemblance to the crowded urban aura of Washington, DC.

Perhaps it is merely historical circumstance and good fortune that thus far have preserved much of Australia's biotic and scenic richness. An arid interior and a paucity of major rivers has meant not only that Australia's aquatic biodiversity is inherently low (in comparison to North America), but also that human occupancy of the region has been constrained. Ironically, from the standpoint of native ecology and natural environments, the relative scarcity of freshwater habitat in Australia (a situation often lamented at the Fenner Conference) may prove ultimately to be the continent's ecological salvation.

Conclusions

With respect to population size and associated environmental pressures, my impression is that Australia today is approximately where North America found itself in the year 1850, when the US population stood at 23.1 million. Had wise environmental practices been promoted in North America beginning then, imagine the relative ecological paradise we could have inherited today – a far healthier continent with myriad accessible and uncrowded parks, a greater abundance of native wildlife, deep agricultural soils unimpoverished by decades of mismanagement and erosion, sustainable fisheries, diverse as well as productive forests and grasslands, open space, clean and abundant surface and ground waters, better-planned cities, and so on.

The good news for Australia is that it is not yet too late to promote and save the continent's ecological well-being. Now is the time for thoughtful environmental planning and action by the Australian citizenry and by governmental leaders. Please do not repeat North America's mistakes!

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