

Landscape Scale Ecological Connectivity: Australian Survey and Rehearsals

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Landscape scale ecological restoration and connectivity initiatives are gaining momentum in Australia and globally to protect and restore native vegetation and biodiversity. While these initiatives originated in response to habitat fragmentation and land use intensification they are increasingly framed within the discourses of climate change adaptation and ecological resilience. With a focus on initiatives over large landscape scales, this article directs attention to the social and institutional implications of this emerging, and poorly understood phenomenon. These initiatives represent a paradigm shift in conservation management in two ways: firstly, connectivity represents a move from a focus on “sites and species” to landscapes and processes; secondly, connectivity signifies a reconstruction of the role of government and non government organizations in conservation. While these initiatives show promise for integrated conservation management across multiple tenures, they face challenges of collaboration and communication across vast, diverse landscapes, communities and agendas. This article overviews emerging landscape scale initiatives in Australia and introduces a conceptual framework for thinking about social and institutional connectivity. While there is much debate concerning the science of connectivity, there is a distinct gap in our understanding of the requisite conditions for implementation. There is, however, existing research and practice on the social dimensions of natural resource management and conservation that could inform the implementation of connectivity initiatives.

Key words: connectivity conservation, social science, collaboration, cross-tenure management, natural resource management governance, scale.

INTRODUCTION

OVER the past decade we have witnessed a marked shift in efforts to conserve biodiversity in Australia. Previous efforts focused on managing “sites and species” to isolate islands of habitat from threatening processes driven by land use change and intensification, grazing pressure and resource extraction. However, protected areas, isolated and few in number, do not represent the diversity of ecosystems (Pressey 1994). Despite the significant contribution protected areas make to biodiversity conservation, they cannot exist in isolation from surrounding landscapes, as invasive species and other threatening processes ignore socially constructed boundaries. Indeed, these boundaries are inextricably linked to habitat fragmentation, a major driver of biodiversity decline (Saunders *et al.* 1991). Connectivity corridors, also known as biolinks, landscape linkages, greenways, shelterbelts, wildlife corridors, and ecological networks, seek to build on past efforts to address multiple processes that threaten biodiversity by taking a landscape scale approach. Despite the debate over the science of connectivity (see Simberloff *et al.* 1992, Williams 2008, Hodgson *et al.* 2009), there is now a major connectivity initiative in every state and territory. Consequently, the neglected social and institutional dimensions of connectivity must be considered. Landscape scale connectivity will inevitably encompass regional settlements, multiple land tenures and jurisdictions, requiring collaboration between a diversity of landholders and agencies. Connectivity, therefore, is also unavoidably about people. Despite its novelty in the conservation

arena, there are a number of “rehearsals for connectivity” that can usefully inform this emerging phenomenon. This article surveys connectivity initiatives in Australia, placing them in the context of the social and institutional challenges faced when managing large landscapes. A conceptual framework is introduced and the article draws together a distinct array of lessons from past and existing policy and practice in Australia.

Connectivity conservation involves the protection, retention and rehabilitation of natural connections among habitats within ecosystems at the landscape level (IUCN 2007). The concept of connectivity defies rigid definition, as it is scale, process and species dependent (Crooks and Sanjayan 2006). Landscape scale connectivity is the physical linkage of areas of native vegetation cover within a landscape (Lindenmayer and Fischer 2007). Although connectivity initiatives originated in response to habitat fragmentation and land use intensification (Hobbs 1992), they are increasingly framed within the discourses of climate change adaptation and ecological resilience (see Soulé *et al.* 2004, Mackey *et al.* 2007). Historical patterns of social-ecological interactions and institutional fragmentation also underpin the need for both social and ecological connectivity in Australian land management (Briggs 2001, Saunders and Briggs 2002). A dualism that separates people from nature and production from conservation has shaped post-colonial Australian landscapes. However, conservation outcomes at landscape scale will only be achieved where production, conservation and

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social aspirations are integrated (Binning and Fieldman 2000). The Government's Biodiversity Strategy (2010-2020) recognizes the need for a landscape scale approach and seeks to create a framework for off-reserve conservation, as well as establishing four continental scale linkages to improve ecological connectivity by 2015 (Natural Resource Management Ministerial Council 2010).

Emerging Connectivity Conservation Initiatives

Diverse connectivity initiatives exist across Australia. A desktop survey found 12 very large (i.e., 700–3000 kms) initiatives (see Fig. 1) and approximately 20 smaller scale (i.e. 50-200 kms) initiatives underway or proposed. These numbers are approximate, as many large proposals have been put forward with little action, and many smaller initiatives may exist which do not receive widespread publicity. This article will focus on large landscape scale initiatives, as their scale distinguishes these initiatives from prior corridor efforts and is illustrative of a shift in the focus of conservation to the "landscape scale". By large, the scale proposed for these "social experiments in conservation" (Robin forthcoming) is in the order of thousands of kilometres. For example, the vision of the Great Eastern Ranges covers 2800 kms, from the Victorian Alps to the Atherton Tablelands in Queensland (NSW DECC 2007). Gondwanalink

proposes to link over 1000 kms from the south west corner of Western Australia to the Nullarbor Plain (Gondwanalink undated).

Internationally there are prominent, long-standing examples of large scale connectivity initiatives. A recent review found over 200 ecological networks, corridors and comparable initiatives in 102 countries (Bennett and Mulongoy 2006). Yellowstone to Yukon (Y2Y) is the most famous, spanning 32000 km in length, covering five US states, four Canadian provinces and territories, and the traditional territories of 31 First Nations groups (Chester 2006). Y2Y has inspired acronym-themed efforts across North America (see Table 1) and Australia. The Great Eastern Ranges was formerly known as the Alps to Atherton (NSW DECC 2008), and the Bunya Biolink has recently received funding from Caring for Our Country (CfoC) to work within the Birdsville to (Hervey) Bay corridor in Queensland (Australian Government 2009). There was talk of a Broome to Bamaga corridor (Northern Australia) (Williams 2008) and the Arafura to Alice (Springs) corridor (Northern Territory Government 2008) was recently renamed Ecolinks (Northern Territory Government 2009). Other prominent international initiatives are listed in Table 1 (see Worboys *et al.* 2010).

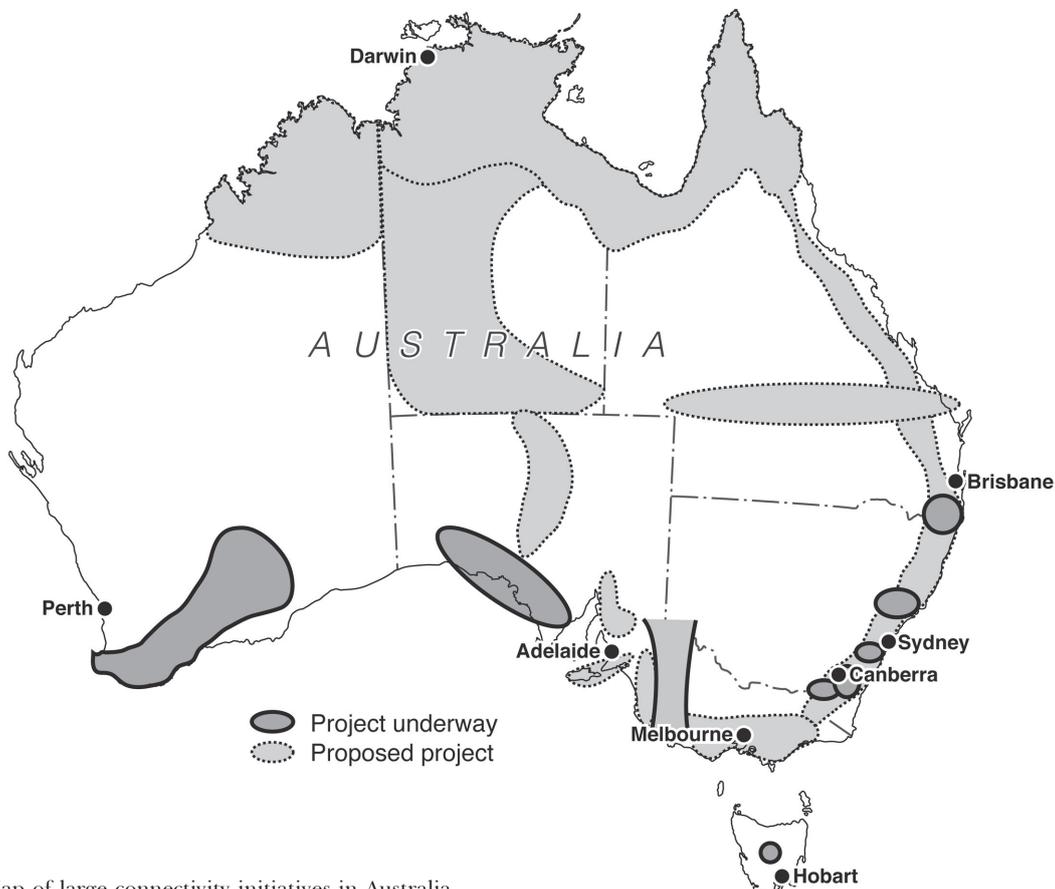


Fig. 1. Map of large connectivity initiatives in Australia.

Table 1. International Connectivity Conservation Initiatives (Worboys *et al.* 2010)

Europe	Cantabrian Mountains Pyrénées-Massif Central-Western Alps Great Mountain Corridor The Appenines (European Alps to the Mediterranean)
North America	Algonquin to Adirondack (A2A) (A2A 2009) Baja to Bering Sea (B2B) (Morgan <i>et al.</i> 2005)
Africa	Greater Virunga Landscape Greater Cederberg Biodiversity Corridor
Asia	Maloti-Drakensberg Transfrontier Conservation and Development Programme Terai Arc Landscape Project
Central/South America	Mesoamerican Biological Corridor Andean Páramo Corridor

Within the large-scale proposals, smaller scale connectivity initiatives are underway or the construction phase is completed. In many cases, it is anticipated that these efforts will be scaled up. For example, Habitat 141 on the Victorian-South Australian border encompasses a number of smaller successful connectivity initiatives. The most well-known is Project Hindmarsh, a network of four projects in the Shire of Hindmarsh in Victoria. Project Hindmarsh involved the roadside revegetation of 100kms of “gaps” between the Big and Little Deserts. Supported by National Heritage Trust funding, Project Hindmarsh was a collaborative venture of The Hindmarsh Landcare Network, a collective of 14 Landcare and Friends Groups, Wimmera Catchment Management Authority, Victorian Department of Natural Resources and Environment, Shires of Hindmarsh and Wimmera and Greening Australia (Dodds 2000). Through a series of “Community Planting Weekends” involving thousands of volunteers organized by Greening Australia, a corridor between the Big and Little Deserts was completed in 2006. The focus in the region has shifted to Habitat 141, a 50 year initiative aiming to restore links over 700 km straddling the Victorian and South Australian borders from “the outback to the ocean”, and into NSW (Habitat 141 undated). An unresolved and fundamental question for initiatives like Habitat 141 is the degree to which the method and approach taken for smaller scale projects can be up-scaled both spatially and temporally. This question is likely to remain central to the research agenda for, and practice of, connectivity conservation for years to come.

Partnerships and Models

Connectivity conservation advocates an integrated approach to land use planning to minimize conflict between economic development and conservation while maximizing potential for species survival. This is achieved through strategic designation of core protected areas, buffer zones and compatible land use and human settlement within a biologically defined region or subregional space; analogous to a UNESCO biosphere reserve scaled up (Sanderson *et al.* 2006, p.625). Connectivity initiatives are framed by three basic concepts: a system of

interconnected properties; strategic management to achieve conservation objectives; and collaboration between multiple landowners and agencies (Levitt 2004). These aims mirror that of biosphere reserves, however they lack the explicit focus on development, education and research (see UNESCO 1986). With similarly ambitious goals to connectivity conservation, it is telling that many biosphere reserves do not live up to the theoretical aims of the programme (Price 1996, IUCN 1998, Schliep and Stoll-Kleemann 2010). Despite the emphasis placed on the importance of local participation and place based arrangements (Francis 2004), stakeholder participation in decision making in biosphere reserves is often low (Schliep and Stoll-Kleemann 2010). Given the shared aims of these initiatives, the literature on increasing local participation in biosphere reserves (Ishwaran *et al.* 2008, Stoll-Kleemann and Welp 2008, Edge and McAllister 2009, Stoll-Kleemann *et al.* 2010) is instructive in the context of connectivity conservation, as is the broader literature on the role of people in parks (see O’Riordan 2002, West *et al.* 2006). These ideas will be discussed in further detail below, with particular reference to Australian experience.

Similar to the biosphere reserve model, many connectivity initiatives recognize the need to promote the role of people in the landscape. The planning document for the East West corridor of South Australia’s NatureLinks programme calls for “[t]he active involvement of all people in a corridor that enhances their social, economic and cultural wellbeing” (Government of South Australia 2009) and the catchphrase of the Great Eastern Ranges is “a continental scale lifeline to engage people with nature” (NSW DECC 2007). The emphasis placed on people in nature aims both to rally a network of partners for the initiatives and to allay fears this is another effort by the “wilderness mob” to lock up vast tracts of land. The connectivity movement appears to have learnt from the backlash against the ideals of wilderness, yet the language surrounding the concept remains, leading to a tension between the desire to “restore wild nature” by connecting people with nature. It is too early to assess the impact of these initiatives on the social,

economic or cultural wellbeing of regional Australia, however an important lesson to garner from protected area management is for consistency with community values and goals (Worboys *et al.* 2005).

In Australia, collaborations involve players across the public-private spectrum — individual landholders, Landcare Groups and Networks, government departments, Catchment Management Authorities (CMAs), NRM Boards, state national parks agencies, and different non government organizations (e.g., Bush Heritage, TWS, Greening Australia, The Nature Conservancy, Birds Australia). The Australian Government is now promoting a partnership approach to conservation, in recognition that the goals of Australia's National Reserve System and Biodiversity Strategy cannot be realized by governments alone (NRM Ministerial Council 2005, Australian Government 2008, National Biodiversity Strategy Review Task Group 2009). Moreover, the Government acknowledges that conservation strategies must be integrated across the landscape: encompassing formal protected areas, World and National Heritage listed sites, as well as complementary land uses on public and private land (Commonwealth of Australia 2008). Given the emphasis placed on connectivity in the landscape, partnerships will need to include atypical stakeholders as management crosses multiple land tenures and uses. While the enormity of the challenge this type of collaborative venture involves should not be understated, these initiatives present an opportunity for integrated, cross tenure land management.

Visions and Goals

The Y2Y vision has received significant attention and promotion as a leading example of connectivity conservation internationally. The presentation and elaboration of this vision plays on iconic images of Yellowstone National Park and the Yukon Territories while incorporating the mission of the initiative and its scientific principles (Chester 2006). Despite its iconic status a lack of clearly defined goals and objectives has hindered the progress of Y2Y (McGregor 2003). Although this suggests problems with Y2Y itself, it also speaks to the challenge of turning a large landscape vision into substantial outcomes on the ground. In Australia, considerable effort has focused on development and promotion of grand visions and goals for the larger projects to captivate audiences and rally support from the community, landholders and funding agencies. This is particularly important, given that much of the on-ground works for connectivity initiatives have been restricted to small manageable pieces within larger landscapes.

With scarce funding for conservation, marketing and branding are seen as critical to the viability of these initiatives (see Buckley 2008).

Visions focus on people connecting and restoring landscapes. There are high expectations: South Australia's "NatureLinks" programme envisages "[p]eople working together to enable the species and ecosystems . . . to continue to survive, evolve and adapt to changing climatic conditions" (Government of South Australia 2009). NatureLinks, an ambitious programme embedded within the Government's Strategic Plan set a target to have five well-established corridors by 2010 (Government of South Australia 2007). However, the management plans were only released early in 2010, which begs the question as to how "well-established" these corridors actually are on the ground. Distilling on-ground action from rhetoric is important when working towards ambitious and intangible goals across large spatial and temporal scales. Gondwanalink has a slightly more focused vision of "[r]econnecting the bushland across 1000 km of country from the tall wet forest in the far south western corner of Australia to the semi arid woodlands on the edge of the Nullarbor Plain" (Gondwanalink undated). This vision is underpinned by eight restoration goals to ensure species mobility and ecological resilience in response to past degradation and future climate change. While all the initiatives emphasize the role of people within the landscape, the Great Eastern Ranges makes an explicit link between "healthy and connected ecosystems" and the "long-term economic, social, cultural and spiritual wellbeing of the community" (NSW DECC 2007). With such an ambitious spatial and temporal scope this initiative, and others like it, are in danger of becoming nebulous and difficult to pin down. Bridging the gap between a grand vision and strategy for implementation will be an ongoing challenge for connectivity initiatives. Moreover, as these initiatives gather momentum the number of players will increase and so too the complexity of governance and management.

The Wilderness Society's (TWS) WildCountry Project represents the most ambitious and far-reaching vision. WildCountry claims to present a "forever plan for Australia's environment" (The Wilderness Society 2005). The initiative focuses on protection and restoration of ecosystems at a landscape scale, and its vision melds notions of a sustainable future for "our children" in combination with "cutting-edge science". WildCountry focuses on five regions: Gondwanalink (WA), East Meets West (SA), Habitat 141 (VIC, SA, NSW), Northern Australia (WA, NT, QLD) and Cape York (QLD). Given the breadth of coverage, this initiative adds

significant momentum to the push for connectivity conservation, as TWS has put significant funding into promoting the initiative. WildCountry includes a Science Team comprised of leading landscape ecologists and conservation biologists. As it actively promotes science and research based action to underpin the legitimacy of the vision, it is an interesting example of the changing relationship between science, values and advocacy. However, compelling as these visions may be, the practice of preventing fragmentation and conserving connectivity presents enormous challenges (Crooks and Sanjayan 2006).

A Framework for Social and Institutional Connectivity

The social context of connectivity initiatives will be fundamental to their success (Williams 2008). If landscape scale connectivity is the aim, it stands to reason that each project would benefit from identifying the social and institutional factors that need to be considered; followed by the instrumental, social and institutional dimensions of a successful project. These can be distilled in a conceptual framework to organize thinking about the elements of connectivity conservation (Fig. 2). (1) In finding a coherent point of departure into

the largely uncharted territory of theorizing and implementing connectivity conservation, this framework provides specification of factors which will facilitate the progress of this agenda. While not a definitive list, nor a model to be rigorously tested, refined and proven, the framework offers a lens through which to access existing literature and practice.

The instrumental goals of connectivity in Fig. 2 are to enhance resilience, conserve biodiversity and create viable production landscapes. These goals relate to changes in the biophysical landscape that will be achieved through changed practice (by landholders, NGOs and government agencies) on the ground. Institutional change will be required to realize these instrumental goals. Relevant areas to be addressed include public-private partnerships for conservation, consideration of property rights and land tenure, administrative structures for landscape scale management, and incentive mechanisms for private land conservation. Lastly, changes in the institutional arrangements and the practices of landholders, NGOs and government agencies cannot occur without broader social change. The rhetoric of connectivity conservation suggests a shift in the relationship between people and nature and the desire to integrate conservation and production this is a significant departure

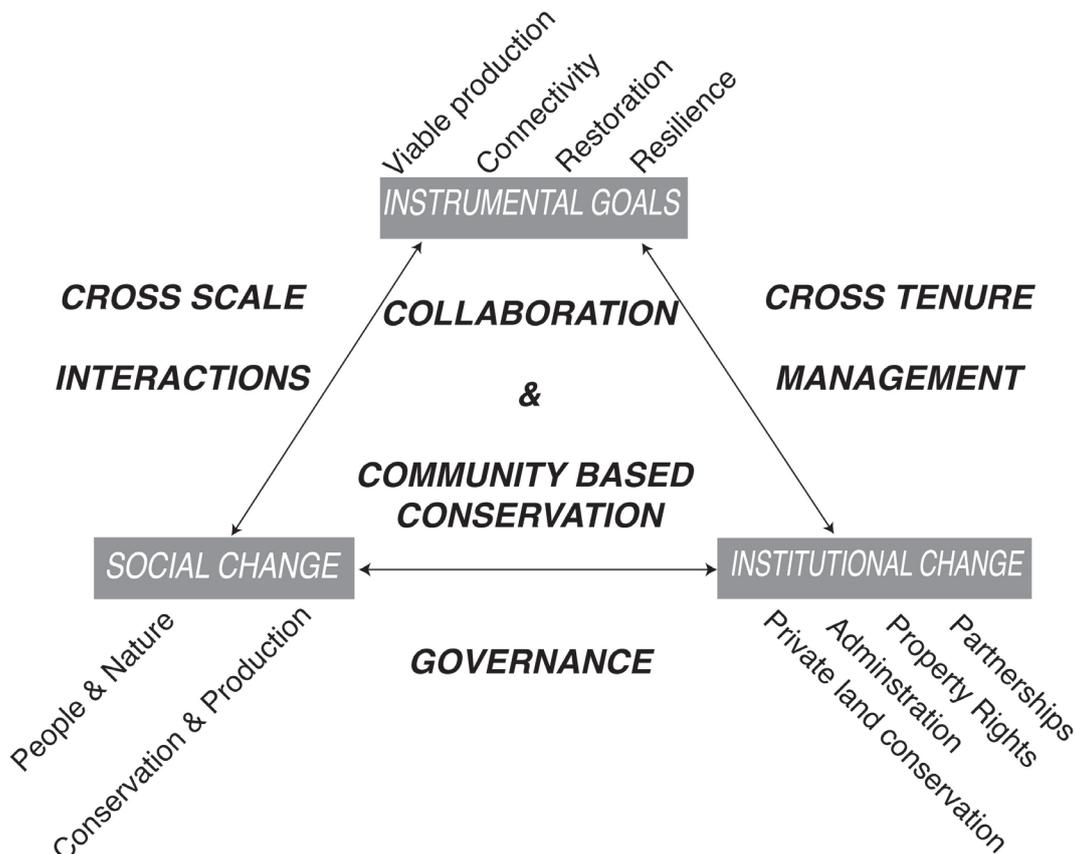


Fig. 2. Conceptual framework for connectivity conservation.

from a worldview that separates human systems from natural systems. Without people working together, connectivity initiatives will go nowhere (Lovett *et al.* 2008), thus collaboration and community based conservation are central to the framework. Around the edge are three suggested pillars of a successful, large scale collaborative venture: multi-scalar governance; cross scale interactions; and integration across tenures and jurisdictions. While these may seem obvious, due consideration of social and institutional dimensions of NRM, restoration and conservation are continually reported as lacking (Bellamy *et al.* 2002, Bennett and Mulongoy 2006, Lovett *et al.* 2008, Williams 2008). Moreover, observation of prominent initiatives in Australia has shown that they are still struggling with the complexity of the issues covered in this framework. (2) Until these dimensions are incorporated into the design and implementation of conservation initiatives from the outset, social researchers will continue to reiterate these points.

This framework is intended to facilitate thinking about connectivity. It is not to suggest that these elements can be addressed in isolation; rather, they should be understood as necessary and complementary aspects of the bigger picture.

Rehearsals for Connectivity

While landscape scale connectivity initiatives are ambitious, when compartmentalized, it is clear that these are not new ideas in environmental or resource management. Connectivity conservation may be the first time these approaches have been integrated in single large initiative; however Australia has had rehearsals for these aspects of connectivity and with that, considerable knowledge and experience to draw on. The following briefly reviews prior research and practice in these social and institutional imperatives for connectivity conservation.

Community Based Conservation

Landscape restoration is a major collective endeavour in Australia, typified by community stewardship movements like Landcare and Friends of... groups (Carr 2002). Centred in an ethic of place, community based conservation is underpinned by the premise that local populations have a greater interest in and knowledge of local context, and can effectively manage resources through local institutions (Brosius *et al.* 1998). Local level institutions learn and develop the capacity to respond faster than centralized agencies (Folke *et al.* 1998), and there is a growing recognition that networks and local groups are effective mechanisms for conservation. However, community building

strategies that form and maintain relationships, create an identity for a project and maintain project momentum are critical to collaborative ventures (Carr 2002, Pretty and Smith 2004, Duxbury *et al.* 2008), yet they are often neglected in NRM and integrated catchment management (ICM) (Bellamy *et al.* 2002).

By placing local contributions within a larger picture (Lovett *et al.* 2008), connectivity purports to give conservation on private land greater purpose (Pulsford, in Woodford 2008). However, the spatial and temporal scale of these initiatives could, in the absence of tangible results, dilute the power of a larger picture. An important lesson from ICM is the need to celebrate achievements along the way (Bellamy *et al.* 2002). Thinking back to the visions presented above, a "forever plan to connect people and landscapes" means that a project will not be completed in an individual's lifetime and its scope extends beyond what they know and can experience within their region. Working with voluntary stewardship groups in Australia, Carr (2002) found that members have little attachment to goals and visions that they did not participate in creating or that are written in language that is inaccessible to the group. Moreover, the experiential learning aspect of participating in a stewardship group is far more important than working towards an abstract goal set at the outset of a project (Carr 2002). These findings have also been stressed in the context of incentive mechanisms for native vegetation conservation (Binning and Fieldman 2000), ICM (Bellamy *et al.* 2002), riparian restoration (Duxbury *et al.* 2008) and biodiversity conservation (Williams and Price 2008). Goals and visions perform an important role in motivating action and measuring progress; however the highly ambitious goals and visions of connectivity conservation will be difficult to evaluate and monitor progress against, and larger initiatives may lose connection with individuals working on the ground.

Collaboration and Governance

The alliances formed to drive connectivity represent a spectrum of public and private stakeholders, and are evidence of the shifting dynamic of players associated with conservation. Success of these alliances depends on how they are organized, governed and funded. Governance of connectivity initiatives warrants consideration by the alliances themselves and broader research and policy communities as part of a broader change in the way we govern and manage natural resources in Australia. Community based catchment management signified a fundamental shift in the role of government from administrator of policy to enabler and facilitator (Bellamy *et al.* 2002). In emerging

Australian initiatives, negotiation between government and non government players is a substantial challenge. The role of government varies across the spectrum: SA's Naturelinks and NT's Ecolink are government driven, the WA government is largely absent from Gondwanalink, the NSW government provided a catalysing role for the Great Eastern Ranges Initiative, while Habitat 141 is attempting to form alliance where the NGOs and the various government players (SA Department of Natural Resources, Parks Victoria, VIC Department of Sustainability and Environment and the NRM bodies in the region) are equal. Success will hinge on the capacity of these alliances to accommodate diverse expectations and motivations of players working collaboratively towards a vision that does not compromise core aspirations of individual players (Wondolleck and Yaffee 2000). Alliances should build upon relative strengths of each party so that, together, they can achieve what they cannot alone. Institutional relationships that delineate roles and responsibilities of parties will enhance the capacity of alliances (Binning and Fieldman 2000, Sanderson *et al.* 2006), and evenly distribute power between landholders and agencies (Bergmann and Bliss 2004) as well as NGOs.

There is much literature and practice outlining principles of environmental governance (Lemos and Agrawal 2006, Lockwood *et al.* 2009), citing trust, integrity, inclusivity, transparency, accountability, flexibility, reciprocity and communication as foundations of good governance and collaboration (Wondolleck and Yaffee 2000, Bellamy *et al.* 2002, Thomson and Pepperdine 2003, Duxbury *et al.* 2008). Governance should facilitate work towards shared values and goals while creating mechanisms to deal with diversity and conflict (Thomson and Pepperdine 2003, Schliep and Stoll-Kleemann 2010). Collaboration requires strong leadership, particularly in dispersed networks is challenged by spatial scales which separate actors across a landscape (Folke *et al.* 2005). However collaboration must not rely solely on the strength of one or two key individuals. Institutionalizing collaborative management will enable a project to maintain momentum after key individuals move on (Fitzsimmons and Westcott 2008), while building individual and institutional capacity (Bellamy *et al.* 2002, Carr 2002).

While it is useful to identify general characteristics, governance arrangements will be dependent on the context, history and goals of an initiative. Within this diversity, a common challenge is presented by managing at the landscape scale: how to accommodate multiple agents (across three levels of government and the policy sectors within those levels, the market

and civil society) in coherent governance arrangements that span spatial and temporal scales. Appropriate governance mechanisms are a major challenge for the implementation of connectivity initiatives, and have been a central focus and struggle for the major initiatives in Australia. Governance remains a largely unresolved and poorly theorized aspect of connectivity conservation.

Cross Scale Interactions

While the thinking and planning of landscape scale conservation occurs across multiple scales, management involves individual action on smaller scales: farm, paddock, or public land parcel (Saunders and Briggs 2002). The rhetoric and practice of emerging connectivity initiatives may be centred on local people working towards a big vision; however there is an inherent tension between the scale of the vision and local scales of action. The challenge for this movement is to accommodate for horizontal (across space) and vertical (across levels of organisation) interactions across and within multiple scales. Effective mechanisms should enable participants to generate information at various scales and to share that information across scales (Anderson and Ostrom 2008), thus governance and communication are fundamental to success. Multi-level governance requires engagement of all parties in design, development and delivery of a governance system (Lockwood *et al.* 2009) that extends beyond negotiation at various levels to encompass the transformation of relationships between various levels and a renegotiation of power relations (Gorg 2007).

Managing across scales is an ongoing challenge (Folke *et al.* 1998), yet Australia has experience in managing large landscapes. The vast expanse of Australia's rangelands has demanded thinking at this scale (Robin forthcoming), and ICM has taught us about nesting levels of governance and participation across scales (Bellamy *et al.* 2002). The Lake Eyre Basin Initiative is one example, where local participation was nested under a basin-wide committee to coordinate management across multiple jurisdictions and scales (Dore *et al.* 2003). Regionalization of Australian NRM provides an example of nested environmental governance (Lockwood *et al.* 2009) of international note.

Cross Tenure Management

Different regulatory arrangements applied to different land tenures create issues for landscape scale conservation (Binning and Fieldman 2000). Present day remnant vegetation patterns are the product of historical land use patterns and tenure arrangements (Lunt and Spooner

2005), and different property rights regimes which governed the landscape wherein land-holders were required to clear land (Williamson *et al.* 2003). Where geographically relevant, connectivity conservation initiatives must address perverse incentives on pastoral land tenure and address issues of tenure security for private land conservation. Tenure embodies legal property rights, implied or prescribed land use and rules of access, but also deep-seated values of ownership, motivation and expectations. For those initiatives which cover the rangelands, a sleeper issue in efforts to turn pastoral estates over to conservation is the requirement that pastoral leases remain stocked (Sattler and Taylor 2008). A shift in values is required to reconceptualize property rights in multiple-use forms on publicly owned, privately leased lands (Bellamy *et al.* 2002), including a reassessment of mining exploration rights, which remain valid on private protected areas (Figgis 2004). The security of land set aside to facilitate connectivity merits consideration, as the declaration of a mine will swiftly and significantly undermine the considerable effort required to redirect land-use practices. Adjusting property rights is not a straightforward matter of policy instrument choice, but an institutional change with deep social, economic and ecological implications (Connor and Dovers 2004). Creating an integrated approach to management of the Murray-Darling Basin has plagued governments since the 19th Century and that argument is far from over (Connell 2007).

Australian Governments have created a series of border-crossing strategies other than the well-known arrangements in the Murray-Darling, on the Reef, in the Alps, and for groundwater underlying state boundaries. Key lessons are the importance of flexible institutional arrangements with clear goals and objectives that are inclusive of diverse community voices (Crabb 2003). Crabb also pointed to the importance of mid-level interactions between people, claiming that "good arrangements need good people" (2003, p.252). There are many lessons to be drawn from ICM, which seeks to treat watersheds in a coordinated rather than fragmented fashion. However, while catchments are a good spatial basis for managing water and salt, they are not necessarily suited to economic planning, community development or biodiversity. At a finer scale, the celebrated Landcare movement encouraged collective efforts at a logical social scale: the rural district. The foundations of collaboration and stewardship established through Landcare provide a vital platform for connectivity conservation to build upon. The challenge here is for an overarching vision, or larger entity to delicately enter into a regional landscape without steamrolling smaller groups

and initiatives. Another emerging phenomenon that shows promise in straddling boundaries are conservation management networks (CMNs). Australia's eleven CMNs are collaborative, "tenure-blind" ventures that seek to address integrated conservation objectives (Binning and Fieldman 2000). Something missing in many previous initiatives that cross tenures or jurisdictions has been serious attention to dimensions of culture, politics, institutions and policy. Given the explicit focus on connecting people as well as landscapes, these dimensions must be seen as fundamental to the implementation of connectivity initiatives.

CONCLUSIONS

The long established boundaries of land tenure and jurisdiction that define Australian landscapes are of little interest to species and ecological processes. Sustainable management requires integration across the whole landscape rather than the current piecemeal approach to managing sites and species (Saunders and Briggs 2002). This is what makes connectivity initiatives at once appealing and challenging. The promise of an integrated, landscape scale initiative protecting and restoring ecological processes is captivating; however it requires shifts in thinking and management in response to very large challenges. Recognizing that boundaries can frustrate attempts to sustainably manage environments is not new. Likewise, principles of community based conservation and environmental governance are not unknown, and these "rehearsals for connectivity" provide insights into necessary conditions for collaborative management at smaller scales.

Managing at landscape scale is more than just small writ large: up-scaling will bring increased complexity and challenges yet to be identified. Some steps have been taken, but to date the move is largely restricted to making the scientific case and constructing and promoting grand visions. There is less detail to be found around how these visions can be implemented in a world in which institutions, both formal and informal, are the key means whereby humans achieve goals and reconcile differences. Partnerships are the only way large scale initiatives are going to succeed. Given this, more effort needs to be given to negotiating group dynamics, effective project management and articulating roles and responsibilities of the groups (Lovett *et al.* 2008). The next stage must be to pay attention to issues broader than landscape ecology: building the institutional capacity of collaborative ventures, the enabling detail of policy processes, inter-agency and government structures, and legal questions of property rights. Despite the promise offered by con-

nectivity initiatives, without serious consideration of their social and institutional context, these grand visions may remain an aspiration.

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Endnotes

- 1) This framework was devised from the stated aims and goals of prominent connectivity initiatives in Australia and a synthesis of connectivity conservation literature
- 2) This article is part of ongoing research investigating three prominent initiatives in Australia and North America using standard qualitative research techniques such as interviews, participant observation and document analysis.