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Tradeoffs in the Policy Process in Advancing Climate Change Adaptation: The Case of Australia's Great Eastern Ranges Initiative

KELLY LEVIN* & BRIAN PETERSEN**
*World Resources Institute, Washington DC, USA; **Michigan State University, Kellogg Biological Station, Hickory Corners, MI, USA

ABSTRACT *The first continental-scale climate change adaptation strategy for biodiversity conservation has been adopted in Australia. The Great Eastern Ranges Initiative (GERI), aims to bolster the resilience of biodiversity by enhancing connectivity in eastern Australia for species migration in a changing climate. The Initiative is now being carried out on the ground, and is among the earliest national-level adaptation strategies for biodiversity conservation advanced by policymakers. In this paper we explore the implications of the rapid progression of the Initiative through the policy process, providing insights useful for decision makers advancing adaptation policies elsewhere in the future.*

Introduction

The first continental-scale climate change adaptation strategy for biodiversity conservation has been adopted by Australia. Entitled the Great Eastern Ranges Initiative (GERI) (herein referred to as "the Initiative"), this adaptation measure aims to bolster the resilience of biodiversity by enhancing connectivity in eastern Australia for species migration in a changing climate. The Initiative is now being carried out on the ground, and is among the earliest implemented adaptation strategies for biodiversity conservation advanced by policymakers. Despite the call for proactive adaptation strategies (Watson, 2005), given the projections of biodiversity loss due to climate change (Fischlin *et al.*, 2007), some have called the rapid advancement of the policy response into question.

The Initiative might not have faced such inquiry had policymakers dedicated resources to determining whether this strategy would be the most effective strategy for enhancing species resilience in a changing climate. Instead, once the problem of climate impacts to biodiversity had been identified, policymakers implemented the well-articulated plan of the GERI based on scientific evidence that creating corridors and connectivity across the landscape promotes biodiversity conservation. They did so, however, without devoting time or financial resources to performing scientific analyses of the Initiative's potential effectiveness in the context of connectivity promoting biodiversity conservation in eastern Australia

Correspondence Address: Brian Petersen, Kellogg Biological Station, Michigan State University, 3700 East Gull Lake Drive, Hickory Corners, MI 49060, USA. Email: briancp@msu.edu

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in response to a changing climate, or comparing it with that of other adaptations strategies. The rapid progression of the Initiative through the policy process raises critical questions that decision makers will face when advancing adaptation policies in other locations in the future: given limited resources for adaptation, and the desire for swift, proactive action, should resources be dedicated to evaluating the effectiveness of an adaptation option and comparing it with that of other options? Or should decision makers implement a strategy quickly based on existing understandings of how best to protect biodiversity in an effort to address the looming threat of climate change? Dedicating limited financial resources and time on comparing the promise of an adaptation proposal with that of other options could come at the expense of taking necessary actions in the short term. On the other hand, a more truncated policy process which skips an evaluation phase may divert funds from other interventions which may prove more effective. Balancing this tradeoff will be a key challenge to future adaptation efforts.

Early scholarship on the policy cycle suggests that policy advances in a stagiest approach: agenda setting, in which the problem is identified on the institutional agenda; policy formulation, in which policy tools are analysed for their effectiveness; decision-making, in which a policy option is chosen among others; policy implementation; policy evaluation; and, lastly, termination, if the policy is ineffective (Brewer & deLeon, 1983; Hessing & Howlett, 1997). Yet, the GERI policy process did not incorporate robust policy formulation and decision-making stages. The idealized steps of the policy cycle had not been embraced by decision makers, who did not pause for rigorous policy formulation and decision-making stages when advancing the GERI. Instead, policymakers moved forward with a landscape-level conservation intervention based on their knowledge of the increasing threat climate change poses to species and on scientific understanding that enhancing habitat connectivity will help species respond to climate change.

Recognizing that policy does not always proceed in a step-wise approach as the policy cycle theories suggest, scholars have since developed alternative theories of the policy process. However, scholarship on the policy cycle still plays a role in the policy sciences and has arguably been most influential in shaping the study of policy analysis, a prescription-based approach that designs courses of action to address problems. The policy analysis literature has embraced the policy cycle as a means to formulate policies, and, accordingly, suggests that decision makers approach problem solving in a step-wise manner, akin to the policy cycle stages: first identifying the problem, then analysing options, comparing and selecting a policy tool, and then evaluating the tool. Thus, our research not only informs the policy cycle literature by suggesting that theories of the policy process need to be revised; it also informs the field of policy analysis, and, by extension, the design of the decision-making process for future adaptation policymaking. Had the decision makers supporting the GERI embraced the principles of policy analysis, rigorous policy formulation and decision-making stages would have been incorporated into the policy process. This paper examines the implications of bypassing stages of the policy cycle when designing policy, and reflects upon how adaptation for biodiversity conservation would have been carried out differently had the Initiative followed the stages of the policy cycle as the policy analysis literature suggests. While there are likely many conservation co-benefits of the Initiative, we focus our attention on the Initiative as a climate change adaptation measure. Thus, our primary interest is identifying the implications of a strict adherence to the steps of the policy process for adaptation for biodiversity conservation in a changing climate.

The aim of this paper is not to pass judgment on decision makers implementing the GERI. Nor does this paper analyse the costs and benefits of one adaptation intervention versus another. Rather it explores the advantages and disadvantages of *different approaches to the policy process*—a deliberate assessment of policy alternatives prior to policy implementation or a more expedited process. We use the GERI as a case study to showcase the possible implications of navigating the policy process in an expedited fashion. Given that adaptation strategies, especially for biodiversity conservation, are in their infancy, the GERI provides a unique empirical example through which such issues can be further explored, perhaps with implications for future adaptation interventions.

Overview of Climate Change Impacts to Biodiversity Globally

Throughout the world, species levels are declining as a result of ecosystem degradation, pollution, overharvesting and other drivers of degradation (Millennium Ecosystem Assessment, 2005). Five major extinction events have occurred over the course of the past 600 million years, and have dramatically altered the total number and distribution of species across the globe (Raup, 1991). Evidence continues to mount that we are experiencing the sixth major extinction, the first attributed to human activities (Chapin *et al.*, 2006). Current extinction rates range from between 100 to 1000 times higher than historical background rates, and human activities in the past 50 years have caused more rapid change to levels of species diversity than at any time in human history (Millennium Ecosystem Assessment, 2005).

Among the factors leading to ecosystem transformation and species loss, climate change has recently emerged as a key driver (Fischlin *et al.*, 2007). Early manifestations of climate change impacts include range shifts of species moving towards the poles, as well as upwards in elevation at mid-latitudes, changes associated with seasonal spring advancement, extirpation of isolated populations, and have played a role in extinctions (Wake 2007; Parmesan & Yohe, 2003; Beever *et al.*, 2003; Pounds *et al.* 1999). In addition to direct impact on species, climate change has also had impacts on ecological processes. For example, in Australia, fires erupting in February 2009 were exacerbated by high temperatures and strong winds, and led to the destruction of 450 000 hectares of land (Fenner, 2009) and the deaths and injuries of millions of animals (Gelineau, 2009).

With regard to future impacts, long-term projections indicate that higher levels of atmospheric concentrations of greenhouse gases, and resultant warming temperatures and changes in precipitation regimes, could lead to notably different biogeographic patterns on the landscape (Saxon *et al.*, 2005) and risks to species (Fischlin *et al.*, 2007). For example, the recent Intergovernmental panel on Climate Change (IPCC) Fourth Assessment Report (Fischlin *et al.*, 2007) suggests that with an additional 1.5 to 2.5 degrees C of warming, 20–30% of species will be at a heightened extinction risk. Species that are particularly vulnerable will be those whose available habitat has been reduced as a result of climatic changes (Parmesan, 2006), as well as those with low thresholds to swings in climatic factors and those living in isolated populations. Perhaps most importantly, habitat fragmentation, over harvesting, pollution, invasive species, and other anthropogenic drivers of ecosystem degradation compound climate change impacts, increasing the potential for sudden and catastrophic shifts in ecosystems (Scheffer *et al.*, 2001). Novel ecological communities and conditions can be created (Hobbs *et al.*, 2006), potentially compromising species viability and presenting significant challenges to natural resource managers. Climate change can also lead to range shifts, at times crossing jurisdictional boundaries, which can undermine our current place-based, protected areas-based approach to conservation (Peters & Darling, 1985), requiring unprecedented collaboration among managers and jurisdictions.

Overview of Climate Change Impacts to Biodiversity in Australia

Biological richness sets Australia, the world's smallest continent and largest island, apart from most other countries and places it alongside 11 other mega diverse countries that collectively harbour over 60% of the world's biodiversity (Commonwealth of Australia, 1996). Australia's isolation from other continents, stable geology, and favourable climate have created the conditions for biota to flourish in 85 bioregions. The continent also has high levels of endemism, including 85% of plants, 93% of amphibians, 90% of reptiles, and over 1300 endemic vertebrates (Lindenmayer, 2007). Yet, much of Australia's biological richness is under threat and Australia has witnessed a dramatic loss of biodiversity over time (Australian Museum Online (AMO), 2008; Dirzo & Raven, 2003; Wilson, 1992).

Like many other places around the globe, Australia continues to witness declines in species diversity. The International Union for Conservation of Nature (IUCN) recently confirmed that one in five Australian mammals is at risk of extinction, the highest proportion of any developed nation (Cubby, 2008). Since European occupation, only two to three per cent of old growth eucalypt forests on the most productive soils still remain (Norton, 1996). Pulsford *et al*. (2003) note that the level of land clearing in Australia is exceeded by only four other countries globally and exceeded 565 000 hectares in 2000 (subsequent legislation has greatly restricted broad scale clearing). In addition to land conversion, other drivers, such as land degradation and introduction of invasive species, have also contributed to the current rate of species decline (Raven &Yeates, 2007).

Climate change adds yet another threat to Australia's biota that will interact with other drivers of biodiversity loss (Dunlop & Brown, 2008; Hughes, 2003). The annual average temperature in Australia has already risen 0.8°C since 1910 (Collins, 2000 as cited in Andrew & Hughes, 2005), and is projected to increase by 1°C to 5°C by 2070 (CommonWealth Scientific and Industrial Research Organisation (CSIRO) & Australia Bureau of Meteorology, 2007). Warming temperatures have impacts to the water-holding capacity of the atmosphere, and some areas will get drier in Australia while others will become wetter. Since 1910, there has been a small increase in continental precipitation levels, especially in tropical regions and eastern New South Wales, with high variability as a result of El Niño Southern Oscillation. At the same time, areas in eastern Queensland, southern Australia, and south-western Australia have witnessed declines in rainfall. In the future, average annual rainfall is projected to decrease in the Southwest, Southeast and Queensland, while coastal areas in eastern Australia, as well as inland areas, could be subject to wetter summers (Suppiah *et al.*, 2007; Natural Resource Management Ministerial Council, 2004).

A significant amount of research has been performed on how climate change has and might impact Australia's species diversity (Garnett & Brook, 2007; Hennessy *et al.*, 2007). Climate change is projected to alter arrival times of some migratory bird species, with impacts on predator-prey relationships, shifting some species of birds' ranges southward, and resulting in local extinctions (Chambers *et al.*, 2005). Studies show that the rainforests of north eastern Australia are particularly vulnerable to climate change (Hilbert *et al.*, 2001). Climate change has the potential to affect rainforest structure (Ostendorf *et al.*, 2001), with possible effects on endemic vertebrates, which are projected to be at a significantly higher risk of extinction with an increase in temperature above 2°C (Williams *et al.*, 2003). Climate change impacts are not limited to vertebrates and will likely cause the loss of endemic alpine plant species (Pickering *et al.*, 2008). Climate change impacts have already impacted Australia's biodiversity and will undoubtedly prove disruptive to biodiversity long into the future. This reality has prompted policymakers and land managers in Australia to take bold actions. The following section turns its attention to the history of the Great Eastern Ranges Initiative, already underway in New South Wales, Australia.

Introduction to the Great Eastern Ranges Initiative

Given the impacts of climate change on biota that have already become manifest, as well as projected future impacts, adaptation measures will be necessary to enhance the resilience of species in a changing climate. Mitigation efforts will be critical; however, adaptation measures will prove necessary given the lag of climate impacts due to the thermal inertia of the oceans (Hansen *et al.*, 2005) and the lasting impacts of climate change irrespective of carbon reductions (Solomon *et al.*, 2009). The toolbox for adaptation measures is growing, and managers and scientists have already identified a number of different strategies for boosting species resilience in a changing climate.

One adaptation strategy— that of connectivity—has been identified as one of the most popular means for enhancing species resilience. Heller and Zavaleta (2009) identified increasing connectivity as the most common climate change adaptation recommendation put forth in the literature. The principles of landscape connectivity are not novel. Through the study of island biogeography, as well as remote and divided populations of species (Bennett, 1999), biologists have long established the consequences of population isolation on biota. Conservation principles have increasingly focused upon a more holistic, ecosystem-based approach to preservation, with some conservation biologists and natural resource managers turning their attention to the creation of biological corridors to connect fragmented landscapes. Over the past three decades, numerous conservation corridors have been established or conceptualized, including the Yellowstone to Yukon (Y2Y) Conservation Initiative, Mesoamerican Biological Corridor, and the Vilcabamba-Amboró Conservation Corridor (Bennett, 2004). These corridors have been designed to respond to a number of conservation needs including to stem overharvesting of natural resources, to meet the habitat needs of large carnivores, to contend with population growth, among others. Continued loss of biodiversity in Australia has led to calls for increased connectivity on large scales (Soulé *et al.*, 2004; Mackey *et al.*, 2008). The GERI represents one of several efforts to create connectivity at a landscape level. Several landscape-level conservation efforts that promote connectivity preceded the GERI—the Gondwana Link in south-western Australia, the Habitat 141 in southern Australia and New South Wales, and the Wild Country effort—and provide a scientific rationale for promoting connectivity (Mackey *et al.*, 2007).

Recently, those involved in corridor initiatives have also come to realize that their efforts could bolster the resilience of biota in a changing climate, and some have publicly noted such climate-related benefits of corridors in their outreach campaigns. However, until now, none of these initiatives had been designed with an explicit focus on climate. Yet, in February 2007, the Alps to Atherton Initiative was publicly launched in Australia, later renamed the GERI, in large part to address climate concerns (Worboys *et al.*, 2008). Connectivity has been employed as a conservation tool for stemming biodiversity decline in Australia for several decades, given the history of habitat fragmentation and insufficiency of protected areas for meeting long-term conservation goals (Soulé *et al.*, 2004), and scientists have recently identified creating landscape level connectivity as an appropriate climate change adaptation measure to protect biodiversity (Mackey *et al.*, 2008). While acknowledging the potential for the GERI corridor to mitigate other drivers of ecosystem degradation, the Initiative is being designed with the principle goal of bolstering species resilience in a changing climate, and to facilitate the migration of species and ecosystem range shifts to a more hospitable climate.

The central feature of the GERI is the development of a conservation corridor that stretches 2800 km north–south in eastern Australia (Figure 1). While ambitious in scope, the Initiative builds upon two existing corridors along the Great Eastern Ranges established over the course of 60 years of conservation history in Australia. The Great Dividing Range corridor currently runs along the Australian Alps, covering over 690 kilometres, and is located on the "spine" of the watershed from central Victoria to south-eastern New South Wales (NSW). The southern Great Escarpment corridor extends roughly 350 kilometres from Victoria to Queensland, and is located along a land feature that separates the tableland from the coast. However, the two corridors are incomplete; the designers of the GERI recognized several gaps in the landscape, as well as the possibility of extending the corridor to make it continental in scale (Pulsford *et al.*, 2003). If completed, the GERI would build upon the existing corridors to cover 28 degrees of latitude, include 14 bioregions, which contain the highest concentrations of bird and mammal diversity in the country, and cover water catchment areas of 63 rivers, some of which are the primary sources of water for the East Coast's major cities, including Sydney and Brisbane (Worboys *et al.*, 2008).

In a November 2006 meeting of the Environment Protection and Heritage Council of Australia and New Zealand, Bob Debus, Minister of the Environment for NSW, presented the Initiative, which was subsequently endorsed by the Ministers for the Environment of the Australian Capital Territory, the Commonwealth, Queensland and Victoria (Heritage Council of New South Wales, 2007). In February of 2007, Debus announced that the NSW Environmental Trust, a state-level independent statutory body that funds projects not ordinarily supported by government funding programs, awarded AUD$7 million over three years for the development of the portion of the corridor in the State of NSW, in part dedicated to streamlining conservation efforts and leveraging other sources of funding (Worboys *et al.*, 2008). While representatives from states in the corridor region other than NSW had voiced their support in 2006, the Initiative is currently focused on the development of the NSW portion of the corridor; other state governments have yet to commit financially and to implementation. Those involved in the corridor continue to advocate at both the ministerial and agency levels for the expansion of the Initiative to other states (Department of Environment and Climate Change NSW, 2007), and an Interstate Government Agency Working Group has been established for discussion and the future development of proposals for consideration by the Environment Protection and Heritage Council (EPHC) of Environment Ministers (Department of Environment and Climate Change, 2008). However, given the implementation challenges in some states— i.e. unlike NSW, Queensland has not historically protected much of the land in the region that is mapped to become part of the corridor— the Initiative may be limited to NSW in the short term.

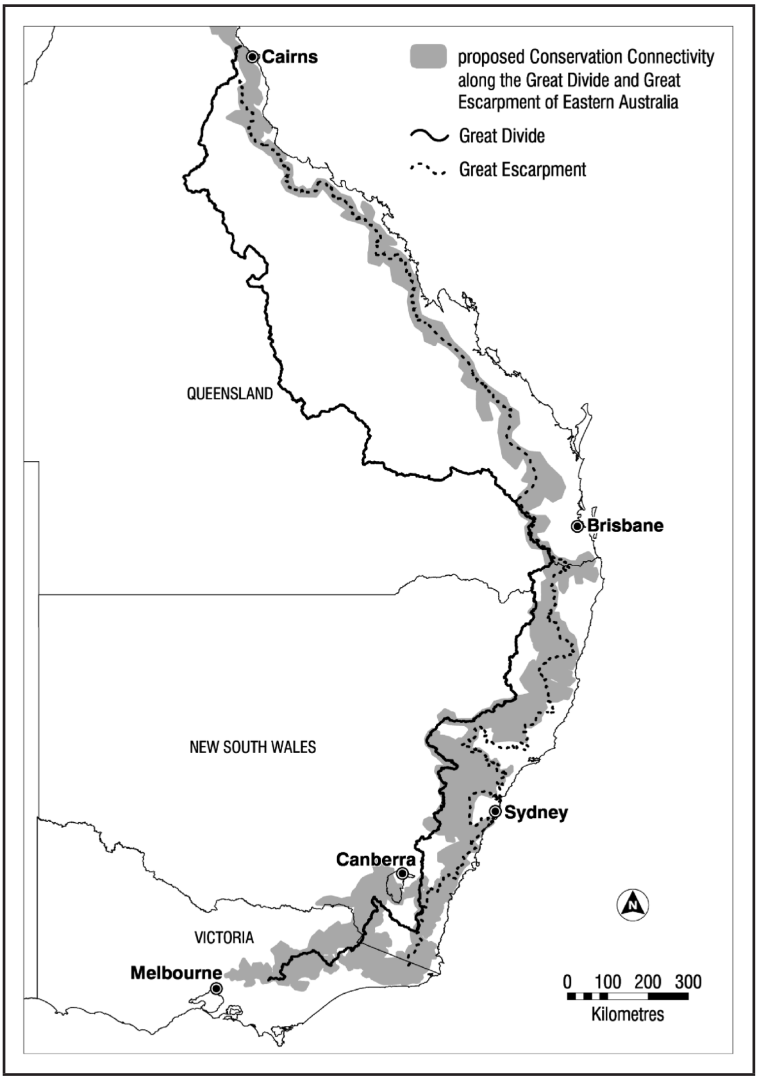

Figure 1. Map of the area included in the Great Eastern Ranges Initiative. Used with permission from the New South Wales Department of Environment, Climate Change and Water and the Great Eastern Ranges Initiative.

The business plan for 2007–2010 for the Initiative's development in NSW is indicative of the future direction of the corridor. The mission for the Initiative is "to engage the NSW community, including state government agencies and local government, landowners, industry representatives, community groups and researchers in an effective long-term partnership to conserve, connect, protect and rehabilitate plant and animal habitats and catchments of the great eastern ranges of Australia along the 1200 kilometres of the NSW section" (Department of Environment and Climate Change NSW, 2007). Accordingly, the corridor by no means limits itself to public lands. Engagement with private landowners is a critical component of the corridor development. Land will not be acquired by governments; nor will participation be mandatory. Instead, landowners will be approached by organizations partnering with the Initiative and asked whether they would be willing to participate voluntarily. The focus of the Initiative, and of the creation of conservation mechanisms and incentives, is “aimed primarily at private landowners” (Department of Environment and Climate Change NSW, 2007), and is quite different from the corridors previously established along the Great Dividing Range and the southern edge of the Great Escarpment that relied heavily upon public land acquisition.

In the short term, the GERI is targeting private landowners through voluntary conservation agreement programs, as well as two pilot programs— the Kosciuzko to Coast partnership pilot program and Slopes to Summit partnership pilot program. Funding for the two pilot programs has been allocated for raising awareness, community participation, provision of incentives for improving natural resource management, and encouragement of voluntary conservation agreements, among other activities (Department of Environment and Climate Change NSW, 2007). In the long term, the GERI has a vision “for the ecosystems of Australia’s great eastern ranges to be healthy and connected from the Australian Alps to Atherton (and beyond) . . . ” (Department of Environment and Climate Change NSW, 2007). While the NSW portion is the focus of current efforts, its success will be judged in the context of the larger Initiative.

The Great Eastern Ranges Initiative’s Advancement through the Policy Cycle

The GERI has received media attention within the country as a result of a publicity campaign (Woodford, 2007; McMahon, 2007). While press has focused on the novelty and ambition of the plan, some questions have been raised within the conservation community regarding whether this adaptation strategy represents the most effective means of addressing conservation in light of climate change. Some also wonder if the Initiative should have been evaluated against other adaptation strategies. Those who have called the Initiative into question note that there are scant resources for adaptation and limited capacity to address the problem of species loss due to climate change. Some have questioned whether species will be able to successfully move along the corridor, whether there are barriers to movement, and when climate change will be too rapid for species migration. They have also expressed fears that the advancement of one adaptation strategy could detract from other efforts that could enhance resilience of biota in a changing climate.

Policy could have advanced along a more prescribed step-wise approach, with analysis of the policy option’s effectiveness and comparison of the policy option with others before adoption and implementation of the Initiative. Instead, given the call for proactive, precautionary actions to address climate impacts to biodiversity, policymakers in NSW who advanced the GERI did not formally assess the prospect for the corridor effectiveness to bolster the resilience of Australian species in a changing climate, or to evaluating the Initiative against other adaptation strategies (Table 1).

As mentioned above, connectivity had been employed as a conservation tool in the Australian context and internationally for some time, and policymakers were guided by the general principles of biodiversity degradation due to ecosystem fragmentation and the emerging trends of species migration in a changing climate. This policy process has important implications for future efforts elsewhere. Failure to formally compare alternative approaches could lead to advancing a policy measure that is either ineffective or less

Table 1. Steps of the policy cycle.

The GERI's Advancement through the Policy Cycle
Agenda setting → Policy formulation ⟶ Decision-making ⟶ **Policy implementation** ⟶ **Policy evaluation**
Had the GERI Advanced According to Policy Analysis Principles
Agenda setting ⟶ **Policy formulation** ⟶ **Decision-making** ⟶ **Policy implementation** ⟶ **Policy evaluation**

effective than alternatives. Moreover, the omission of the evaluation stage could limit the role of science after the agenda setting stage, ultimately undermining the legitimacy of the effort in the minds of the public. However, evaluation of multiple interventions could take time and resources away from policy implementation. And given imperfect information regarding how species will respond in a changing climate, it is possible that decision makers may not be well positioned to resolve which interventions are most effective in the long term. Both strategies—an expedited policy process and a protracted policy process—have benefits and costs. Our aim is not to judge the policy process embraced by GERI decision makers; rather we have a much more modest agenda: to highlight the implications of selecting a particular approach.

Scholarship on the policy cycle is helpful context for evaluating the development of the GERI. In the 1950s, Lasswell introduced an approach to studying public policy, which catalysed an influential "policy sciences" literature (Lasswell, 1956; Lasswell, 1951). Considered a "stagiest approach" (Parsons, 1995) in which policymaking was delineated into distinct phases, the decision process was mapped into stages (Lasswell, 1972). Several iterations of the policy cycle have since modified Lasswell's delineation of the policy process (e.g. see deLeon & Kaufmanis, 2001; Brewer & deLeon, 1983). While there are differences among scholars' interpretations, the policy cycle is seen to consist of the following broad stages, as mentioned above: agenda setting; policy formulation; decision-making; policy implementation; and policy evaluation.

Many scholars have noted that that the policy process is more complex than a stagiest approach purports, and its utility for prescribing a policy process is perhaps overstated. For example, Lindblom (1959) writes, with regard to policy formulation and decision-making stages:

> [The] method of simplification of analysis is the practice of ignoring important possible consequences of possible policies, as well as the values attached to the neglected consequences. If this appears to disclose a shocking shortcoming of successive limited comparisons, it can be replied that, even if the exclusions are random, policies may nevertheless be more intelligently formulated than through futile attempts to achieve a comprehensiveness beyond human capacity. Actually, however, the exclusions, seeming arbitrary or random from one point of view, need be neither.

Nonetheless, it has been recognized as a useful heuristic for understanding policy development. Most significantly, the policy cycle literature and stagiest approach have been instrumental in shaping a new subfield of the policy sciences: policy analysis. As mentioned above, policy analysis has applied the stages of the policy cycle to problem solving

(Hessing &Howlett, 1997). Below we review how the GERI was advanced through the policy process, and we reflect on whether the principles of policy analysis were fulfilled (Table 2).

Agenda setting is the first stage of the policy cycle when the problem is identified by policymakers. In the case of the GERI, this occurred when the problem of biodiversity loss to climate change was identified by decision makers. During the second stage, policy formulation, policy options are supposed to be delineated and evaluated. Evaluation can be performed through cost-benefit analyses or other techniques, and often require both scientific input and weighing of various actors' norms. While some sort of policy formulation stage was paused at briefly in advancing the Initiative, policymakers did not perform any robust evaluation of the Initiative. Resources were not devoted to gathering scientists or performing cost-benefit analysis, and, thus, policymakers did not dwell on this stage of the policy process before the Initiative was launched in February of 2007. It is interesting to note that in October 2007, the Department of Environment and Climate Change NSW, on behalf on the interstate agency working group between Australian Capital Territory (ACT), the Commonwealth, NSW, Queensland, and Victoria, commissioned a paper on the scientific principles of the corridor, perhaps in part to gain legitimacy. However, this paper has yet to be finalized and published. Moreover, given the timing, this step did not delay advancement of the Initiative through the policy process, as funding has already been devoted to the Initiative's implementation. Also, while those involved in drafting the Initiative's vision submitted proposals to the Commonwealth Environment Research Facilities for funding to evaluate key threats to connectivity and direct/indirect impacts of climate change and identify management options for ameliorating threats to biota, government officials did not choose to fund such studies.

The next stage, decision-making, is when a policy proposal is selected among others and adopted. Comparison of policy options is a critical step in the decision-making stage of the policy cycle. The GERI was not chosen among multiple adaptation strategies. While there were other adaptation options available to decision makers, the GERI was advanced in the absence of rigorous comparison efforts to measure its effectiveness against that of other adaptation measures.

Next, the policy is implemented, and in its final stage, the policy is evaluated or monitored (Hessing & Howlett, 1997). The GERI advanced from agenda setting to implementation without dedicating resources and time to rigorous policy formulation and decision-making stages. The following section discusses an alternative path: advancing the GERI according to the steps delineated by policy analysis scholars, namely prescribing the stages of the policy cycle into a decision-making process.

Had the Great Eastern Ranges Initiative Advanced According to Policy Analysis Principles

Had the GERI advanced according to policy analysis principles, the agenda setting stage would not have differed, as the problem of biodiversity degradation due to climate change had been identified on the institutional agenda. During the policy formulation stage, policymakers would have devoted resources to collecting more input from scientists and other stakeholders and to assessing the costs and benefits of moving ahead with the Initiative. As Dunlop and Brown write (2008):

Table 2. GERI advancement through the policy approach compared to process of traditional policy analysis approach.

Steps of Policy Analysis	Description of Policy Analysis Step	The GERI's Advancement through the Policy Cycle	Had the GERI Advanced According to Policy Analysis Principles
Agenda setting	The problem is identified by policymakers.	This stage occurred when the problem of biodiversity loss to climate change was identified by decision makers.	The agenda setting stage would not have differed from the way in which the GERI was carried out.
Policy formulation	Policy options are delineated and evaluated.	While some sort of policy formulation stage was paused at briefly in advancing the Initiative, policymakers did not perform any robust evaluation of the Initiative. Resources were not devoted to gathering scientists or performing cost-benefit analysis, thus, policymakers did not dwell on this stage of the process.	Policymakers would have devoted resources to collecting input from scientists and other stakeholders and to assessing the costs and benefits of moving ahead with the Initiative.
Decision-making	A policy proposal is selected among others and adopted.	The GERI was not chosen among multiple adaptation strategies. While there were other adaptation options, the GERI was advanced in the absence of comparison efforts to measure its effectiveness against that of other adaptation measures.	A comparison of adaptation strategies would been performed, reducing uncertainty regarding whether the GERI is the most promising course forward.
Policy implementation	The policy tool is implemented.	Implementation of the GERI is underway in the jurisdiction of NSW.	The implementation stage would not have differed from the way in which the GERI was carried out.
Policy evaluation	The policy is evaluated through monitoring or other means.	Because the GERI is in its infancy, it has yet to move to a policy evaluation stage.	It is difficult to determine how evaluation of the GERI would have differed, given that the GERI has yet to advance through this stage.

> . . . Careful assessment of the possible risks as well as advantages of connectivity may be warranted before substantial efforts are made to increase connectivity . . . Such monitoring and experimentation will be necessary to identify situations where connectivity is beneficial or not.

Had the Initiative followed the stages of policy analysis strictly, policymakers would have likely employed the use of climate modelling and/or other assessment tools, such as scenario building and expert analysis, in an effort to gauge the degree to which the corridor was consistent with projected range shifts in a changing climate, given uncertainties regarding climate impacts to species. For example, some question whether Australian species will make use of the corridor in a changing climate, given that many species are not long-distance migratory species but are instead specialized to small niches, in contrast to the large migratory carnivore species which the Y2Y corridor was established for. For those species that do witness range shifts, migration success will depend on availability of viable habitat, species establishment and post-migration population growth and, therefore, on dispersal regimes as well. The timing of migrations can have concomitant impacts on predator-prey relationships for migratory species, potentially compromising population viability in novel habitats.

Had a robust policy formulation stage been performed, it would have likely assessed whether linkages would foster exotic species dispersal (Procheş *et al.*, 2005; Wilson *et al.*, 2005) or introduce novel threats, such as fire (Dunlop & Brown, 2008). It would also have likely assessed the degree to which isolated populations, for example those restricted to high latitudes, would have benefited from such an initiative. Additionally, uncertainty regarding how much habitat is required to maintain a viable corridor may have been reduced, as the Initiative is focusing its attention on voluntary agreements with private landowners.

In the decision-making stage, comparison of adaptation strategies may have reduced uncertainty regarding whether the Initiative is the most promising course forward. A comparison of policy options would have enabled decision makers to determine whether resources would be best spent on the corridor, or on acquiring new reserves, boosting connectivity, folding climate change concerns into existing protected areas management schemes, or other adaptation strategies. It is possible that the GERI would eventually focus upon multiple types of interventions: beyond connectivity, looking towards countering habitat loss, fragmentation and degradation and protecting and restoring large-scale ecological processes. However, the business plan suggests a focus upon connectivity in the short term. The decision-making stage would have also identified other landscapes to conserve or a range of management priorities other than connectivity. Also, the decision-making stage could have led to revisions to the GERI proposal. While a basket of adaptation strategies would be most effective in bolstering resilience of biota in a changing climate, the reality of finite funding and time, and a limited political agenda, could result in an adaptation measure being advanced at the expense of others. For example, a proposal to complete and manage the National Reserve System (NRS) in Australia, a network of almost 9000 protected areas covering 11.5% of the continent, in light of climate change has been put forward, with the publication of the report, "Implications of climate change for Australia's National Reserve System: A preliminary assessment" (Dunlop & Brown, 2008). The authors argue that acquisition of more reserves, as well as diverse habitat, is the most promising way forward to protect species in a changing climate. If the Initiative were to compete for funding with the NRS, and resources could only be dedicated to one project, a more robust decision-making stage may have been able to assess the potential of the Initiative versus that of integrating climate concerns into the NRS, or other adaptation measures. While the ideal prescription to contend with climate impacts to biodiversity would likely be to adopt multiple adaptation strategies for various biographical conditions, scant resources and limited time may preclude the advancement of a basket of adaptation options.

The implementation stage would not have differed from the way in which the GERI was carried out, given that the Initiative is being implemented in NSW with government support. And regarding the evaluation stage, because the Initiative is in its infancy, there has yet to be any evaluation of the on-the-ground effectiveness of the Initiative. Thus, it is difficult to determine how the evaluation of the Initiative would have differed had the GERI advanced according to principles of policy analysis.

Tradeoffs in Adaptation Strategies

As with any policy approach, the expedited policy progression embraced by the GERI has both costs and benefits. Please refer to Table 3. To be clear, we have not performed an analysis of the policy options that decision makers had at their disposal when considering adaptation measures for biodiversity in a changing climate. It is very possible that had decision makers embraced the stepwise policy process, they would have chosen to

Table 3. Advantages and disadvantages of truncated and elongated policy processes.

Type of policy process	Examples of advantages	Examples of disadvantages
Truncated	• Advances implementation quickly • Can be guided by existing scientific knowledge • If coupled with adaptive decision making, can be adjusted with new information • Can be embraced in jurisdictions with scant resources for policy evaluation	• Compromised legitimacy given lack of deliberate process • Failure to consider alternatives, some of which may prove more effective • Could detract resources from other interventions • Not appropriate for a developed nation with resources to perform policy analysis
Elongated	• Could enhance ability of decision makers to choose most effective intervention(s) • Could lead to greater legitimacy, given more deliberate process • Could enhance the role of scientists and other experts in the policy process, leading to a science-based policy choice	• Could lead to “paralysis by analysis” or the “perfect being the enemy of the good” • Given scientific uncertainty, there could be limits to evaluation of alternatives • Could require more financial, time, and technical resources, perhaps at the expense of implementation • Could lead to delay of implementation

implement the GERI regardless. However, the truncated policy process did limit discussion of other interventions and may have compromised the legitimacy of the effort. Some would argue that it is more important to perform the policy and scientific analysis required in the decision-making stages, especially as such capabilities exist in Australia and early decisions on adaptation could shape later efforts within and beyond Australia.

Yet, had the GERI advanced according to the policy analysis principles, it likely would have paused at each stage of the policy cycle for a more protracted amount of time. Such a policy process would have required more financial, time, and technical resources, perhaps at the expense of the implementation of the Initiative itself. Proponents of the expedited GERI process also point to the general agreement within the scientific community of the importance of connectivity and of the looming danger climate change poses to biodiversity as sufficient reason to move quickly. Also, protecting biodiversity in light of climate change makes policy analysis difficult in the best of circumstances and impossible in some cases, given uncertainties about future climate change, climate impacts to biota, and the effectiveness of adaptation strategies. And, therefore, efforts that might have gone towards implementation of interventions could have been dedicated to more and more analysis, potentially leading to the "perfect being the enemy of the good" and a delay in action. For this reason, many have called for a "learning by doing" process for adaptation, given how little we know about the efficacy of interventions.

Conclusion

In this paper, we have turned our attention to the GERI, the first continental-scale adaptation initiative for biodiversity conservation in a changing climate, in an effort to shed light on the implications of following a hastened policy process, avoiding policy analysis principles, when advancing adaptation. By exploring the emergence of the GERI, as well as scenarios of future adaptation policymaking, we identified potential positive and negative outcomes of two approaches to adaptation decision making: (a) advancing adaptation without following policy analysis principles, akin to the GERI; and (b) advancing adaptation by following policy analysis principles. Our analysis highlights some of the issues that policymakers will be confronted with when deciding the best strategy for adaptation decision-making, as well as when facing the tradeoffs of advancing adaptation measures and performing evaluation of the intervention. Given uncertainties regarding how climate change will play out and the unique complexities policymakers will face in establishing adaptation efforts beyond Australia, this analysis does not seek to recommend either truncating or following a more deliberate policy process. Rather it identifies the tradeoffs of both approaches in an effort to shed light on the hurdles that decision makers will increasingly face when prioritizing adaptation interventions.

Given the thermal inertia in the climate system, and the climate impacts already committed to, adaptation measures will be necessary to enhance the resilience of both human-built and natural systems in a changing climate. This study has focused on biodiversity protection in a changing climate, but the same complexities and tradeoffs will likely emerge when contending with climate impacts to other sectors. As funding becomes available through the levy on Clean Development Mechanism credits under the Kyoto Protocol, as well as other financing streams for adaptation, decision makers across the globe will face difficult decisions regarding how adaptation interventions. The GERI provides the first empirical example of the implementation of a large-scale adaptation effort for biodiversity conservation in a changing climate, and one that was adopted proactively. While circumstances in other countries will warrant processes tailored to individual situations, the adaptation policy process adopted for advancing the GERI will aid decision makers elsewhere in identifying the tradeoffs associated with a strict adherence to policy analysis principles. The GERI case study raises several key questions that will likely emerge in any adaptation policymaking process, including: How should adaptation activities be prioritized? Should resources be spent on evaluating the potential effectiveness of various adaptation measures or comparing the promise of one adaptation initiative with that of another? And how possible is it to do so, given the dynamism of climate change? If decision makers cannot possibly conceive of all policy alternatives and implications of actions, due to information deficits and limited intellectual capacities, as Lindblom (1959) suggests, do rigorous policy formulation and decision-making stages truly exist? And if not, what constitutes a thorough study of alternatives? How can adaptive decision making aid in addressing the shortcomings of a truncated policy process, i.e. through continuous policy adjustment in the event that interventions are not effective or novel information presents itself? Adaptation initiatives around the world remain in their infancy, leaving these questions unanswered. Given the lack of empirical examples of adaptation, there is also a deficit of scholarly literature that can provide lessons for future adaptation activities by assessing and explaining the emergence of adaptation thus far. This study seeks to help fill that void.

Australia has experienced substantial biodiversity loss and climate change portends even more. The GERI was designed to enhance the resilience of Australian wildlife to contend with changes in temperature, precipitation, fire, water resources, and other climate impacts. The GERI is unique in advancing a proactive approach and follows conservation principles that have been long established in contexts throughout the world. Often, decision makers are paralysed by the uncertainty regarding climate impacts to biota and the effectiveness of various adaptation strategies. Even if driven to address the problem, decision makers may be drawn to a more protracted policymaking process. However, the developers of the GERI initiative did not pause for rigorous policy-formulation or decision-making stages, akin to the policy analysis steps; instead, they forged ahead in the face of uncertainty. We refrain from expressing judgment on whether the GERI policy process was the appropriate one; instead, we have dedicated this paper to outlining the tradeoffs of the GERI's proactive, hastened policy process. The GERI has just begun to be implemented on the ground and its future and potential for effectiveness remain uncertain. Yet, at the very least, it already provides scholars and decision-makers with an empirical example of a landscape-scale adaptation strategy for biodiversity conservation. The lessons of the GERI policy process will no doubt be helpful in guiding the advancement of other future adaptation strategies for conserving biodiversity in a changing climate.

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