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Policy language in restoration ecology

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Abstract

Relating restoration ecology to policy is one of the aims of the Society for Ecological Restoration and its journal *Restoration Ecology*. As an interdisciplinary team of researchers in both ecological science and political science, we have struggled with how policy-relevant language is and could be deployed in restoration ecology. Using language in scientific publications that resonates with overarching policy questions may facilitate linkages between researcher investigations and decision-makers' concerns on all levels. Climate change is the most important environmental problem of our time and to provide policy makers with new relevant knowledge on this problem is of outmost importance. To determine whether or not policy-specific language was being included in restoration ecology science, we surveyed the field of restoration ecology from 2008 to 2010, identifying 1,003 articles, which we further examined for the inclusion of climate change as a key element of the research. We found that of the 57 articles with "climate change" or "global warming" in the abstract, only two identified specific policies relevant to the research results. We believe that restoration ecologists are failing to include themselves in policy formation and implementation of issues such as climate change. We suggest that more explicit reference to policies and terminology recognizable to policymakers might enhance the impact of restoration ecology on decision-making processes.

Key words: policymaking; research implications; scientific communication; climate change

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Introduction

Relating scientific research to policy is a continual challenge. Restoration science can be useful in the making and refining of public policies, in addition to providing guidance to practitioners in the field (per Cabin et al. 2010). The Society for Ecological Restoration (SER) has targeted "advising international organizations with policy and legislation" (http://www.ser.org/about.asp) as one of its chief goals, and the Aims & Scope of the society's flagship journal, *Restoration Ecology*, places the journal "at the forefront of a vital new direction in science, ecology, and policy" (http://www.blackwellpublishing.com/aims.asp?ref=1061-2971). Restoration ecologists surveyed by Cabin et al. (2010) likewise identified developing political support for restoration science as a desirable SER objective. Yet looking at the articles published in *Restoration Ecology* from 2008 to 2011, few tackle policy as their main theme: only 18 articles out of 500 have any form of the words politics/policy in the abstract and only two have it in the title. Although instructions for the "Implications for Practice" section of articles ask authors to think about how practitioners could implement the findings, they do not ask authors to think about whether their findings might have implications in the policy realm (http://www.wiley.com/bw/submit.asp?ref=1061-2971) and thus this section generally contains only technical field recommendations. Although scientists may have particular policies in mind as relevant to their research, the pages of *Restoration Ecology* are not conveying this explicitly.

As an interdisciplinary team of researchers in both ecological science and political science, we have struggled with how policy-relevant findings could be deployed in restoration ecology. Pointing out the implications of scientific research for policy questions may facilitate linkages between researcher investigations and decision-makers' concerns on all levels, from local practitioners to regulatory agency specialists to interstate-level policymakers. Language

matters because scientific information will be incorporated into environmental policy only when stakeholders perceive the information as credible (scientifically adequate), salient (strongly relevant), and legitimate (respectful of the stakeholders' values and beliefs) (Cash et al. 2003; Clark et al. 2006). Concepts such as "biodiversity" and "sustainable development" have found their way into policy statements at national and international levels giving them wide relevance (Noss 1995; Callicott et al. 1999), thus general policy concepts might provide a common language forged between policymakers and scientists.

Issue salience, which was first used by social scientists to explain voting behavior, refers to how important an issue is for shaping a public policy agenda (Wlezien 2005; Clark & Holliday 2006). Issues occupy points along a spectrum of saliency, ranging from high visibility to not appearing at all (Pralle 2009). Once an issue has entered political discourse, we can say that it did so because it has saliency, i.e., it is relevant to the decision-making process—even though we may not understand how or why it gained that status without further investigating the links between the ideas, social and political contexts, and media coverage of the issue.

Linking the relevance and implications of research to salient issues using commonly understood language is critical to increasing the impact of restoration research on policy. For example, if research findings have implications for "ecosystem services" policies, the article could indicate how the results are relevant. This does not mean that the scientist must necessarily take a normative stand on a particular policy option, but rather could state how the research is applicable to policy concerns. There has been extensive debate about the proper role of scientists in conservation policymaking (e.g. Brussard & Tull 2007; Lackey 2007). These authors caution that scientists must be careful to they present research so that it informs policy but does not advocate one policy over another because doing so may raise questions about the validity of the science. However, as Scott et al. (2007) note, scientific findings need

to be brought to the attention of policymakers. Scientists need to link policy problems to the information that provides solutions (Cortner 2000).

Although some scientists may think pointing out the policy implications of research findings is futile because policymakers do not consult research, studies of policymaking behavior have shown otherwise (Amara et al. 2004; Rigby 2005; Rudd 2011). Policymakers have been shown to use science in three ways: to identify new issues (conceptual), to identify solutions to previously known problems (instrumental), and to support established positions (symbolic) (Amara et al. 2004; Rudd 2011). The most extensive study of policymakers to date, which surveyed 833 individuals at various Canadian governmental agencies, found that over 40% of the respondents considered university research moderately important, very important, or decisive in all three utilization categories (Amara et al. 2004). Studies also indicate that policymakers are more likely to use research if it has an "actionable message" aimed at the policy audience (Lavis et al. 2003; Rigby 2005). While big policy questions cannot be entirely answered through individual research projects, systematic reviews combining evidence can be particularly useful in high-level policy decision-making (Pullin 2009).

The case of restoration and climate change

Climate change is currently considered by many to be *the* environmental issue of the 21st century, since the climate is changing rapidly and environmental consequences may be significant (IPCC 2007). Climate change-related declines in species populations are increasingly common (Thomas et al. 2004), and climate change may become the greatest global threat to humans and biodiversity within the next few decades (Leadley et al. 2010). An enquiry in the database Web of Knowledge (http://apps.webofknowledge.com/: Topic = climate change, Web of Science Categories = environmental sciences, excluding publication

year 2013) shows that the percentage of papers published in environmental sciences on the topic climate change increased substantially over a decade: from 2% in 2000 to 14% in 2012. Considering the importance of framing ecological research within contemporary efforts to address climate change and the role that scientific articles may play in linking science with policy, we more closely examined whether or not climate change policy was visible within the scientific literature of restoration ecology.

Do restoration ecologists use language that might resonate with climate change concerns in order to bolster linkages with policy formulation, implementation or adaption? Using the list of journals targeting restoration from Aronson et al. (2010) and the authors' knowledge of the field, we screened for potential journals with restoration articles in the period 2008–2010. We identified 18 journals that had more than 10 articles containing "restoration" in the abstract, resulting in a set of 1,003 articles (Table 1). Although containing the word "restoration" in the abstract did not guarantee that the article was *about* restoration, it meant that the author identified restoration as an important component of the research. All searches were performed using each journal's web hosting search engine, which allowed searching only the abstract.

We identified a subset of articles that include the term "climate change" or "global warming" in the abstract (57 articles). Looking at those papers more closely, practitioners appeared to be a common target audience, with papers focused on restoration techniques appropriate under climate change, such as seed banking, marsh reconstruction, and fire management. Formal policies were named in only two cases: the EU Birds and Habitats Directive and Natura 2000 network (Verschuuren 2010); and the global conventions on Biodiversity, Climate Change, and Desertification (Blignaut et al. 2008). In these two cases where specific policy instruments are named, the lead researchers were not restoration ecologists: Verschuuren is a specialist in international public law and Blignaut is an

environmental resource economist, although Blignaut had one restoration ecologist as a co-author. How policies might be developed or modified in light of climate to incorporate the latest ecological restoration science is essentially absent. Although restoration scientists may not have findings relevant to setting overarching policy on CO_2 emission totals, they likely to have results that should affect how measures like the EU Water Framework Directive and Convention for Biodiversity Aichi Targets are implemented in light of climate change, but this kind of implication is not brought into focus in the articles. While climate change policy and adaption to climate change at everything from local to global levels is discussed openly in other venues, particularly journals targeted at the social sciences, restoration scientists are not often bringing their specific ecological knowledge into those discussions.

Making the message clear

As currently written, restoration ecology articles are scholarship that communicates primarily with other scientists and restoration practitioners. Although intra-scholarly community communication is vital to research development, restoration outcomes are greatly influenced by social and political pressures (Baker and Eckerberg, 2013). Restoration scientists have important messages for those who shape climate change and other policies, but they may not be making that linkage as explicit as they could in their journal articles.

In a recent editorial piece, Holl (2010) pleaded with authors submitting articles to *Restoration Ecology* to consider why an international audience would be interested in their work. She outlined five questions to consider when "framing" papers, focusing on how work in one specific locality can be made relevant to those working in other geographies, ecosystems, and sociopolitical contexts. The results of our survey suggest that the "framing" also needs to include policy implications. The "loading-dock" model of science, in which scientists produce knowledge and deliver it with the expectation that users will find and use it,

seems inadequate in a rapidly changing world where there is increasing need for science-informed policy (Cash et al. 2006). While we recognize that publication in a scholarly journal is not the only or even the best way to reach policymakers with research results, clear identification of politically salient issues like climate change is, frankly, an easy way to increase the likelihood of science-informed policies. Referencing specific policies or laws related to the research is an even more direct way of speaking to policy concerns.

Funding structures for research already encourage this kind of thinking. Many grant sources such as EU Framework Programme 7 require applicants to explain the social relevance of the research, just as "broader impacts" must be detailed in proposals to the U.S. National Science Foundation. Some scientists may be treating these sections of applications as a necessary evil, or they may be less interested in communicating their findings to a policy audience than to their scientific peers. The connections to policy issues become weaker as the scientific process moves from grant application to scholarly publication, but this need not be the case.

We are not saying that *all* restoration ecology science has an "actionable message" for policymakers—practitioners and other scientists are legitimate audiences—but we believe there are more policy-relevant recommendations already inherent in ongoing restoration research that could be highlighted. One practical suggestion would be for *Restoration Ecology* as the leading venue of scientific work on restoration to create a special section or paper category dedicated to policy issues, which would perhaps spur more two-way communication with policymakers and encourage policymakers to look more often at restoration science for guidance on policy making, implementation, and adaption. Another suggestion is to encourage authors to focus one of the "Implications for Practice" items on policy implications if it is appropriate. Restoration ecologists should be encouraged to work more collaboratively

with colleagues in the social sciences to identify policies that could be affected by their scientific results.

Although social interest in environmental issues is high, natural scientists continue to face difficulties providing information to the public and decision-makers in ways that resonate with their understandings of important issues. Groffman et al. (2010) encourage ecologists to become active communicators, specifically turning to new communication tools outside of academia to reach target groups. At a more basic level, we believe restoration ecologists need to be aware of the language they use in scientific communication and actively identify how their research findings could affect policies in the face of climate change.

Implications for practice

- Restoration ecologists should be aware how their scientific results could and should be incorporated into policy decisions.
- Working collaboratively with social scientists would aid in identification of specific local, regional, and even global policies that could be affected by restoration science.
- Restoration ecology scientific publications could better incorporate policy-relevant concerns such as climate change.
- Journals interested in restoration should encourage two-way communication between scientists and policymakers to help integrate scientific results into policy practices.

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Literature Cited

Amara, N., M. Ouimet, and R. Landry. 2004. New evidence on instrumental, conceptual, and symbolic utilization of university research in government agencies. Science Communication **26**:75-106.

Aronson, J., J. N. Blignaut, S. J. Milton, D. Le Maitre, K. J. Esler, A. Limouzin, C. Fontaine, M. P. de Wit, W. Mugido, P. Prinsloo, L. van der Elst, and N. Lederer. 2010. Are socioeconomic benefits of restoration adequately quantified? A meta-analysis of recent papers (2000–2008) in *Restoration Ecology* and 12 other scientific journals. Restoration Ecology **18**:143–154.

Baker, S. and K. Eckerberg. 2013. A policy analysis perspective on ecological restoration. Ecology and Society **18**(2): 17. http://dx.doi.org/10.5751/ES-05476-180217

Blignaut, J., J. Aronson, M. Mander, and C. Marais. 2008. Investing in natural capital and economic development: South Africa's Drakensberg Mountains. Ecological Restoration **26**:143-150.

Brussard, P. F. and J. C. Tull. 2007. Conservation biology and four types of advocacy. Conservation Biology **21**:21–24.

Cabin, R. J., A. Clewell, M. Ingram, T. McDonald, and V. Temperton. 2010. Bridging restoration science and practice: results and analysis of a survey from the 2009 Society for Ecological Restoration International meeting. Restoration Ecology **18**:783–788.

Callicott, J. B., L. B. Crowder, and K. Mumford. 1999. Current normative concepts in conservation biology. Conservation Biology **13**:22–35.

Cash, D. W., W. C. Clark, F. Alcock, N. M. Dickson, N. Eckley, D. H. Guston, J. Jäger, and R. B. Mitchell. 2003. Knowledge systems for sustainable development. Proceedings of the National Academy of Sciences of the United States of America **100**:8086–8091.

Cash, D. W., J. C. Borck, and A. G. Pratt. 2006. Countering the loading-dock approach to linking science and decision making. Science, Technology, & Human Values **31**:465–494.

Clark, W. C., and L. Holliday. 2006. Linking knowledge with action for sustainable development: the role of program management. National Academies Press, Washington, D.C., USA.

Clark, W. C., R. B. Mitchell, and D. W. Cash. 2006. Evaluating the influence of global environmental assessments. Pages 1–28 in R. B. Mitchell, W. C. Clark, D. W. Cash and N. M. Dickson, editors. Global environmental assessments: information and influence. MIT Press, Cambridge, Massachusetts, USA.

Cortner, H. J. 2000. Making science relevant to environmental policy. Environmental Science & Policy **3**:21–30.

EEA. 2010. The European environment — state and outlook 2010: synthesis. European Environment Agency, Copenhagen, Denmark.

Groffman, P. M., C. Stylinski, M. C. Nisbet, C. M. Duarte, R. Jordan, A. Burgin, M. A. Previtali, and J. Coloso. 2010. Restarting the conversation: challenges at the interface between ecology and society. Frontiers in Ecology and the Environment **8**:284–291.

Holl, K. D. 2010. Writing for an international audience. Restoration Ecology **18**:135–137.

IPCC. 2007. Fourth Assessment Report: Climate Change 2007 (AR4). Intergovernmental Panel on Climate Change, Cambridge, UK.

Lackey, R. T. 2007. Science, scientists, and policy advocacy. Conservation Biology **21**:12–17.

Lavis, J. N., D. Robertson, J. M. Woodside, C. B. McLeod, J. Abelson, and the Knowledge Transfer Study Group. 2003. How can research organizations more effectively transfer research knowledge to decision makers? Millbank Quarterly **81**:221-248.

Leadley, P., H. M. Pereira, R. Alkemade, J. F. Fernandez-Manjarrés, V. Proença, J. P. W. Scharlemann, and M. J. Walpole 2010. Biodiversity scenarios: projections of 21st century change in biodiversity, and associated ecosystem services. Secretariat of the Convention on Biological Diversity, Montreal, Canada.

Memmott, J., M. Cadotte, G. Kerby, E. J. Milner-Gulland, and M. J. Wittingham. 2010. Putting applied ecology into practice. Journal of Applied Ecology **47**:1–4.

Millennium Ecosystem Assessment. 2005. Ecosystems and human well-being: biodiversity synthesis. World Resources Institute, Washington, D.C., USA.

Milner-Gulland, E. J., J. Barlow, M. W. Cadotte, P. E. Hulme, G. Kerby, and M. J. Whittingham. 2012. Ensuring applied ecology has impact. Journal of Applied Ecology **49**:1–5.

Noss, R. F. 1995. Ecological integrity and sustainability: buzzwords in conflict? Page 60–76 in L. Westra and J. Lemons, editors. Perspectives on ecological integrity. Kluwer Academic, Dordrecht, The Netherlands.

Pralle, S. B. 2009. Agenda-setting and climate change. Environmental Politics **18**:781–799.

Pullin, A. S., T. M. Knight, and A. R. Watkinson. 2009. Linking reductionist science and holistic policy using systematic reviews: unpacking environmental policy questions to construct an evidence-based framework. Journal of Applied Ecology **46**:970–975.

Rigby, E. 2005. Linking research and policy on Capitol Hill: insights from research brokers. Evidence & Policy **1**:195-213.

Rudd, M. A. 2011. How research-prioritization exercises affect conservation policy. Conservation Biology **25**:860-866.

Scott, J. M., J. L. Rachlow, R. T. Lackey, A. B. Pidgorna, J. L. Aycrigg, G. R. Feldman, L. K. Svancara, D. A. Rupp, D. I. Stanish, and R. K. Steinhorst. 2007. Policy advocacy in

science: prevalence, perspectives, and implications for conservation biologists. Conservation Biology **21**:29–35.

Thomas, C., A. Cameron, R. Green, M. Bakkenes, L. Beaumont, Y. Collingham, B. Erasmus, M. Ferreira de Siqueira, A. Grainger, and L. Hannah. 2004. Extinction risk from climate change. Nature 427:145-148.

Verschuuren, J. 2010. Climate change: rethinking restoration in the European Union's Birds and Habitats Directives. Ecological Restoration **28**:431-439.

Wlezien, C. 2005. On the salience of political issues: the problem of the 'most important problem'. Electoral Studies **24**:555□579.

Table 1. Journals identified as containing at least 10 articles with "restoration" in the abstract, 2008–2010.

Journal Name	Articles
AMBIO	13
Biological Conservation	70
BioScience	16
Conservation Biology	24
Ecological Applications	68
Ecological Economics	20
Ecological Engineering	62
Ecological Management & Restoration	25
Ecological Restoration	73
Environmental Management	50
Forest Ecology & Management	108
Freshwater Biology	34
Frontiers in Ecology and the Environment	14
Journal of Applied Ecology	72
Journal of Arid Environments	34
Journal of Environmental Management	24
River Research and Applications	51
Restoration Ecology	245