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Perspectives

A 10-year ecosystem restoration community of practice tracks large-scale restoration trends

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Abstract

In 2004, a group of large-scale ecosystem restoration practitioners across the United States convened to start the process of sharing restoration science, management, and best practices under the auspices of a traditional conference umbrella. This forum allowed scientists and decision makers to interact in a new type of setting, with science being presented from a perspective that informed ecosystem restoration decisions, and decision makers articulating their decision needs in a manner that informed the types of science questions that needed to be addressed. From that beginning, a core ecosystem restoration practitioner group has formed a community of practice that continues to build and maintain momentum for this type of ecosystem restoration engagement. In the fall of 2013, this community of practice became permanently organized as the Large-scale Ecosystem Restoration Section within the Society for Ecological Restoration. Over the past decade, this community has evaluated and expanded upon ecosystem restoration themes ranging from defining and measuring success, adaptive management, adaptive governance, and linking science with management decision-making. Current and future themes include novel ecosystems, ecosystem goods and services, urban ecosystem restoration, and climate change and ecosystem resilience.

Keywords: community of practice; restoration practitioners; large-scale ecosystem restoration

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1. EVOLUTION OF A COMMUNITY OF PRACTICE FOR LARGE-SCALE ECOSYSTEM RESTORATION

In 2004, an effort was undertaken to bring together engineers, managers, planners, policy-makers and scientists — all identifiable as restoration practitioners — at the first National Conference on Ecosystem Restoration[1] (NCER) under the leadership of the U.S. Geological Survey and the U.S. Army Corps of Engineers. This forum focused initially on a number of large-scale, federally funded ecosystem restoration projects in the United States (including Glen Canyon, Everglades, San Francisco Bay/Delta, Chesapeake Bay, Great Lakes, Louisiana Coastal Area, Puget Sound, and the Upper Mississippi River), with ecosystem restoration practitioners from other ecosystems welcome. The overall objectives of these efforts were to disseminate information regarding large-scale ecosystem restoration efforts, so that those efforts would be more prominent in practitioners' thoughts, and incorporated into their research considerations and plans, and to help foster information and knowledge exchange on large-scale ecosystem restoration. The forum started with some fundamental questions for ecosystem restoration practitioners, such as "Are there local, regional and national policies guiding restoration?" Additionally, these conferences presented information on important restoration trends and real-time results. The conference was considered "successful" from an information sharing perspective such that the organizers committed to holding biennial conferences in the future to continue dialogue and expand discussions on restoration themes.

Recognizing a need for long-term sustainability of the conference and its purpose, within five years (at the 3rd National Conference), conference planners focused on identifying a long-term organizational path forward, exploring governance options ranging from forming a stand-alone organization to merging with another society. The impetus was to identify a self-supporting entity that included more restoration programs, organizations, and academic communities to support efforts to reach a greater number of restoration practitioners. At this point the National Coalition for Ecosystem Restoration was formed and formal conversations about the fate and organizational structure of NCER were initiated.

Between 2009 and 2011, NCER engaged the Society for Ecological Restoration[2] (SER) and America's Great Waters Coalition (a newly formed coalition, existing independently from NCER)[3] (Ulrich, 2012). By 2013, NCER members had reached agreement with the Board of SER and a new SER Section, the Large-scale Ecological Restoration Section (LERS) was formed. As the LERS umbrella organization, SER is dedicated to reversing ecological degradation and restoring the earth's ecological balance for the benefit of humans and nature. Their guiding principles are that ecological restoration: is an engaging and inclusive process; requires the integration of knowledge and practice; is relevant and essential to the formation and implementation of related federal and state policy by elected officials and policymakers; and is practiced locally with global implications.

The mission of the LERS community of practice is to:

- advance public education and enlightenment concerning large-scale ecosystem resources;
- provide a forum for an interchange of ideas, approaches, lessons learned, and data developed relevant to planning, policy, science, and engineering of large-scale ecosystem restoration;
- develop and encourage large-scale ecosystem restoration as a discipline by supporting student education, curriculum development, and research; and
- encourage and evaluate the educational, scientific, engineering, and technological development and advancement of all branches of large-scale ecosystem restoration and practice.

Over the past decade, this large-scale ecosystem restoration communication effort has focused on a large range of thematic topics; here we outline some of the larger historical themes and outline some future directions for the new LERS Section of SER. This community of practice has also engaged in a number of additional themes not presented here, including examining funding trends and restoration implementation trends (Hassett *et al.*, 2005).

1 http://conference.ifas.ufl.edu/ecosystem/index.html

2 http://ser.org/

3 http://greatwaterscoalition.org/

2. TRACKING A DECADE OF RESTORATION THEMES

2.1 DEFINING SUCCESS

Defining ecosystem restoration "success" was an initial main theme a decade ago, since the definition of actual restoration goals and objectives would allow for adaptive management of restoration projects, as well as determining if funding appropriated toward those projects was being efficiently prioritized. In part, this focus was a function of the relative young age of many of the federally funded restoration projects a decade ago. The other major driver of this was the first forum focused on identifying similarities and differences across projects throughout the U.S. — often through sessions that brought examples from different restoration programs. For example, in Everglades restoration, a large part of this dialogue focused on whether defining success involved achieving a 'Xerox reduction' of the original ecosystem, or success defined through a 'cookie cutter' approach by restoring a particular habitat or parcel of land to historical ecosystem attributes (USACE & SFWMD, 1999).

At present, most current dialogue is evolving away from the basic question of "What is success?" towards adaptively redefining "How do we successfully restore an ecosystem?" One example of this type of dialogue surrounds the work of the Mississippi River-Gulf of Mexico Watershed Nutrient Task Force. This Task Force is designed to facilitate the cooperative actions of federal agencies, states, and tribes within the Mississippi/Atchafalaya River Basin to reduce the size of the Gulf hypoxic zone, while protecting and restoring the human and natural resources of the Mississippi River Basin ("the Coastal Goal"). Early efforts to do so have fallen far short of goals the Task Force set (Mississippi River/Gulf of Mexico Watershed Nutrient Task Force, 2008). In 2013 a number of aspects of the program were reevaluated, including the need to explore the benefits of supplementing the Coastal Goal with other, more readily achievable, incremental measures to track nutrient reduction activities and nutrient load reduction results towards addressing the longer-term restoration goal (Mississippi River/Gulf of Mexico Watershed Nutrient Task Force, 2013). This represents a different scale of discussion among practitioners for articulating restoration goals than smaller, but not less important, restoration projects (*e.g.* Matthews *et al.*, 2009). One potential future area this discussion thread may take may be how to define success for novel ecosystems (see below).

2.2 ADAPTIVE MANAGEMENT

Adaptive management (AM) has been a long-standing theme for this group of restoration practitioners. Adaptive management in ecosystem restoration focuses on developing a structured approach to address uncertainties, test hypotheses, and link science to decision making to allow for making adjustments to restoration implementation in order to improve the probability of restoration success. Much of this dialogue has focused on authorities and establishing frameworks for implementing adaptive management under existing regulatory authorities, individual agency mandates, and with complicated interagency organizational structures. This discussion thread has involved an extensive dialogue between scientists, planners and managers, including discussion on how to implement new policy and guidance such as that from the National Research Council (National Research Council, 2004), the U.S. Department of Interior (Williams *et al.*, 2007), and the U.S. Army Corps of Engineers (USACE, 2009). One example of the importance of the LERS community of practice is in emphasizing the sharing of lessons learned such as the development and articulation of the key AM lessons learned from the first decade of Everglades restoration (*e.g.* LoSchiavo *et al.*, 2013). Because establishing AM frameworks takes a long period of time, AM will continue to be a major theme for this group of practitioners with future focus on completing the adaptive management feedback loop to adjusting restoration implementation to improve success.

2.3 ADAPTIVE GOVERNANCE

Adaptive governance has been a recurring theme. The role of adaptive governance (Folke *et al.*, 2005; Olsson, 2006) is to establish and promote frameworks by which decision-makers can discuss, identify, and approve decisions to adjust management policies, plans, and actions. As the discussion on AM has evolved over time, most restoration programs have recognized the challenges with implementing AM within their existing management and planning structures (*e.g.* Chadzon *et al.*, 2009; Calmon *et al.*, 2011). As a result a number of senior scientists, planners, and managers brought detailed focus to the need to advance adaptive governance. Scholz and Stiftel (2005) defined five critical challenges for governance models: 1—representation; 2—deliberative process design; 3—scientific learning; 4—public learning; and 5—problem responsiveness. Governance models can be a complex topic (*e.g.* one adaptive governance challenge is implementing AM with clear linkages between science and management) and likely to remain a theme for LERS in the future. LERS will also need to focus on overcoming significant challenges to effectively implementing adaptive governance; among them the all-too-prevalent political fragmentation of authority, as well as determining how policy makers can develop and use scientific knowledge effectively.

2.4 LINKING SCIENCE WITH MANAGEMENT DECISION MAKING

The interface between science and management has been an undercurrent theme for the past decade of this group. Early on, this forum helped create an atmosphere that fostered collaboration between restoration scientists and managers to work beyond a mentality of "If the managers would just get out of the way or listen to what the scientists say to do, we would be restoring ecosystems faster" and "pointy-headed scientists don't produce anything useful." The focus then became a two-part dialog: 1—"What science information do the decision makers need?"; and 2—"What is the management relevance/

implication of the science?" For the Everglades restoration example, practitioners leveraged the NCER community to help advance their work on communication tools, advancing from the early calls for effective science to be brought to the restoration planning table (*e.g.* Harwell, 1998) to specific indicators that are used by policy makers in making large-scale ecosystem restoration decisions (*e.g.* Doren *et al.*, 2009; Smith, 2011; USACE & SFWMD, 2011). The future direction of this theme with LERS may include exploring principles of strategic communication, based upon three pillars: message; audience; and vehicle (the communication format) to inform a broader audience of decision-makers (*e.g.* agency program and technical managers, Congress and state legislatures, and the general public).

3. CURRENT AND FUTURE THEMES

Here we highlight a few areas of current and future themes this community of practice are likely to engage, including novel ecosystems, ecosystem goods and services, urban ecosystem restoration, climate change and ecosystem resilience, and sustainability. However, these themes are not intended to be exhaustive. The new LERS section of the Society for Ecological Restoration is working to identify additional themes and this may include the call to develop thorough reviews of congruence or mismatches between the practitioner community and the academic literature for a particular theme (*e.g.* advancing synthesis work from Holl *et al.*, 2003 and Doyle & Drew, 2008).

3.1 NOVEL ECOSYSTEMS

Most ecosystems are now sufficiently altered in structure and function so as to qualify as novel ecosystems; systems that include different species and functions require us to change how we approach conservation, restoration and environmental management (*i.e.* such systems may be effectively immune to traditional, practical restorative efforts) (Seastedt *et al.*, 2005; Hobbs *et al.*, 2009). An ongoing dialogue among practitioners regarding the ecological, ethical, social, cultural, and political natures of novel ecosystems will be central to determining how to intervene in them effectively and responsibly.

3.2 ECOSYSTEM GOODS AND SERVICES

Valuation of ecosystem goods and services is a difficult and sometimes controversial undertaking and the literature is replete with example valuations (*e.g.* MEA, 2005). Ecologists and economists have often been criticized for trying to place a monetary value on nature often in the absence of credible data to back up the attempt, and recent research has focused on clarifying final (actual) ecosystem services with ecological-based functions that provide an indirect benefit (*e.g.* Johnston & Russell, 2011). Nonetheless, federal and state agencies charged with protecting and managing natural resources often make difficult spending decisions that involve cost-benefit analyses that should include the monetary value (benefit) of the natural resources being protected or restored. Therefore, an ongoing discussion regarding ecosystem economic valuation will prove to be useful in advancing related policies and activities that protect or restore ecosystems and their services. One recent example is the call for attention to ecosystem goods and services as a part of the scientific effort to understand the impact to the Gulf of Mexico after the *Deepwater Horizon* oil spill in 2010 (National Research Council, 2013).

3.3 URBAN ECOSYSTEM RESTORATION

Ecological restoration often aims to recreate past (*i.e.* 'pre-settlement') ecosystem conditions; a goal that is effectively impossible in urban areas where human activities have eliminated that possibility in most cases. Urban ecosystem restoration may also involve a different type of attention to utilizing regulatory tools (*e.g.* Lord *et al.*, 2002). Drawing on past efforts, and upon the results of ongoing and future research, a future objective of our work can be to help project managers determine what kind of restoration is desirable and possible in an urban setting.

3.4 CLIMATE CHANGE AND ECOSYSTEM RESILIENCE

The intersection between the dynamism of climate change and ecological impacts (*e.g.* Harris *et al.*, 2006; National Research Council, 2008) and activities by natural resource managers (*e.g.* Scarlett, 2010) is a current area getting significant attention. Addressing climate change, including the focus on enhancing ecosystem resilience and development of climate adaptation plans (CEQ, 2011; U.S. Army Engineer Institute for Water Resources, 2013a, 2013b) in restoration efforts will likely remain a large theme for this group of restoration practitioners.

4. SUSTAINABILITY AND LARGE-SCALE ECOSYSTEM RESTORATION PRACTITIONERS

All large-scale ecosystem restoration programs emphasize the importance of maintaining longevity in effort, commitment, resources and science monitoring. Many tie long-term objectives to maintaining ecosystem resilience, improving ecosystem services, and improving sustainability of the natural system. Similarly, maintaining and enhancing a community of practice increases the chance for long-term, sustainable ecosystem restoration efforts. Sharing lessons learned across programs, providing guidance to new programs, and fostering scaling of important restoration practices to restoration programs of different sizes will be invaluable for sustainability of restoration science (*e.g.* LoSchiavo *et al.*, 2013). With potential decreases in funding and/or increasing demands for resources to be spread across multiple restoration programs, scientists, practitioners, planners and managers engaged with the work of the LERS Section of the Society for Ecological Restoration will better anchor their arguments to provide longevity, and ultimately sustainability of their restoration efforts. LERS aims to

contribute towards other "restoration knowledge hubs" (Menz *et al.*, 2013).

5. CONCLUSIONS

The large-scale ecosystem issues that society faces today are multi-jurisdictional, multifaceted, intergenerational and interconnected, and none will be adequately solved, let alone understood, unless the scientific community embraces a way of thinking, planning and implementing that also is multi-jurisdictional, multifaceted, intergenerational and interconnected. The new LERS section of the Society for Ecological Restoration stands poised to facilitate the development of just such a perspective, by advancing public education, providing a forum for information exchange, supporting student education, curriculum development, and research, and nurturing the development and advancement of all branches of large-scale ecosystem restoration and practice.

6. ACKNOWLEDGEMENTS

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