

Utilizing Education for Monitoring the Restoration of a Low Elevation Forest Ecosystem

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Abstract

Educators continue to realize the depth of ecological learning that can be derived from rebuilding degraded landscapes and habitats. The educational value of restoration is deeply rooted in the process of restoring ecosystem. North Cascades Institute is beginning to explore the juncture where ecological restoration, long-term monitoring, and education intersect. Volunteer monitoring programs have increased dramatically during the last decade because funding for professional monitoring has decreased, the need for more data has grown, and the number of scientific monitoring methods that have been adapted for citizen use has increased. North Cascades Institute stands at this juncture with the National Park Service, the University of Washington, Western Washington University, and Seattle City Light—initiating an enduring legacy of native landscape study, education, research, and long-term ecological monitoring.

Ongoing site restoration at the new North Cascades Environmental Learning Center adjacent to Lake Diablo in North Cascades National Park provides an excellent opportunity to incorporate and determine successful educational interventions for monitoring the effects of a restoration project. This project focuses on how North Cascades Institute utilizes education for monitoring restoration. Presented are ways to combine, design, and implement restoration monitoring techniques and restoration education initiatives for the public. This project links education as being an important contribution to restoration efforts of an impacted forest site with a residential environmental learning center. Design and implementation are based on the following questions:

- How does education contribute to monitoring the effectiveness of a restoration project and vice versa?
- What consists of appropriate education interventions for monitoring an ecological restoration project?
- How does one assess the outcomes of a volunteer restoration monitoring project?

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Site Description

The situation at the North Cascades Environmental Learning Center is unique. The center, located in North Cascades National Park, involves damage to natural systems, and will require restoration efforts for the immediate vicinity of the facility. The National Park Service manages the land on which the Center is located that requires such restoration. Housed, in its Marblemount nursery, are 22,000 native plants that will be part of the restoration efforts. Construction of the North Cascades Environmental Learning Center comes from Seattle City Light and is part of an environmental mitigation package required by federal regulations for relicensure of three hydroelectric dams on the Upper Skagit River in Northwest Washington State. Approval of resources for use in education as mitigation was a first for the Federal Energy Regulatory Commission.

The Environmental Learning Center consists of twenty-two acres of mixed Douglas Fir/Lodge Pole forests adjacent to Diablo Lake. The facility is confined to a five acre footprint damaged by past development (small lodges, a restaurant, and boat house). Current construction of the Environmental Learning Center and recreational use contribute impact as well.

Three acres around the periphery of the site (similar forest compositions) are to be restored collaboratively by Park staff and University of Washington researchers. This site has also been damaged from the Environmental Learning Center construction.

Role of Education in Restoration Monitoring

The educational value of restoration is deeply rooted in the process of restoring the ecosystem. When learners engage in real projects with real scientists and professionals, transformative learning takes place. Education is about identifying what different audiences need and how to design a program that works for both the project and the selected audiences. North Cascades Institute responded to the need for restoration to occur at the Environmental Learning Center by designing and implementing restoration education programs for the site and incorporating restoration monitoring into new and existing programs. An important goal of volunteer monitoring is the facilitation of an educated and articulate constituency that includes all stake holders, and encourages those stakeholders to share responsibility for development and implementation of strategies to maintain and enhance biological conservation efforts. This is an extensive, on-going process that considers stakeholders, partners, and our program audience. Rather than being passive absorbers of knowledge, these learners are apprentices actively participating and interacting with peers and mentors (Glazer 1992). Participants receive training centered on the theory and practice of ecological restoration including: restoration methods, field journal skills, site analysis, native plant, seed, and soil ecology, and monitoring protocols. Citizen monitoring promotes a sense of stewardship by providing an opportunity for volunteers to perceive the connections between the natural world and the human community. Volunteers provide the service of collecting information that may be used by various agencies in biological conservation decision making.

Educating the public by using volunteers to monitor the environment is not a new idea. For more than one hundred years, the National Weather Service has trained volunteers to report daily measurements of rainfall and air temperature throughout the country. Since the early 1900's volunteers have also provided a national network of observations

on bird populations through the National Audubon Society's Christmas Bird Count and the U.S. Fish and Wildlife Service's Bird Banding Program (Lee 1994).

Volunteer monitoring programs have increased dramatically during the last decade because funding for professional monitoring has decreased, the need for more data has grown, and the number of scientific monitoring methods that have been adapted for citizen use has increased. Volunteer collected data serves various purposes including: educating local communities about their watershed, identifying forest communities in need of restoration, tracking long-term trends in forest ecology within a watershed (Middleton 2001). These programs that utilize volunteer monitors are as diverse as the landscapes they restore. Few long term and detailed restoration narratives are well documented in the literature. The Environmental Learning Center and the monitoring of the surrounding forest will serve as a model for studying a place and for integrating those studies into adjacent public lands. By involving a large number of students and community volunteers, the North Cascades Institute and its partnering agencies will develop a long-term database, displaying years of collection and results.

Education efforts are vital for linking information and application of scientific research, agencies in need of restoration, and the public. The Learning Center site provides an excellent opportunity to learn whether education interventions help contribute to successful site restoration from a multi-stakeholder restoration initiative. Restoration monitoring identifies mediating factors through which education efforts might maintain or improve ecological integrity on sites for determining restoration outcomes. Purcell, Friedrich, and Resh's quasi-experimental assessment of a stream restoration project indicate further that including an evaluation of human perceptions of both those involved in restoration work and those experiencing the effects of the restored sites resulted in the site being restored, (Purcell 2002).

Education facilitates the understanding of the history, flows, and complexities of one's bioregion. One could argue that restoration cannot occur without seeking to understand the relationships between people and ecosystems. Studies indicate that people involved in ecological restoration work have demonstrated an increase in ecological behavior, consisting of actions that contribute toward environmental preservation or conservation (Bowler et.al 1999). Failure to achieve clarity on these social aspects will hinder ecological restoration's potential to generate healthy relationships between people and the land, thus hindering the overall success of the site being restored (Higgs 1997). This project addresses the technical and cultural realms of monitoring restoration greatly contributing to understanding of restoration outcomes.

Project Design and Deliverables

The purpose of the restoration monitoring is to track how native plant and soil communities and the habitats they support, are restored. Research will seek to increase understanding of early succession processes and the response to soil restoration techniques. Education practices are also part of the research. The purpose of using volunteer monitors is to involve members of the community in understanding, protecting, and restoring this ecosystem. Two restoration research project sites at the Environmental Learning Center will be utilized; an open 'meadow' site and a forest understory site. The project will evaluate the responses of seedling transplants of forest

understory, soil biota, moisture and nutrients present to soil amendment and mulch treatments. The following site factors will be monitored by both the public and scientists:

- Vegetative—seed bank, percent cover, root/shoot biomass, species composition, canopy cover, environmental stressors
- Soil—decomposition rate of litter fall, soil invertebrates, structure
- Disturbances such as invasive species, social trails

Restoration education deliverables include:

Restoration Education Monitoring Plan

When planning restoration projects, monitors should examine forest composition, historical role of disturbance such as fire and floods, riparian and floodplain vegetation, and soil and plant compatibility. Participants are trained to help professionals with collecting needed data. This monitoring plan links regional scientists, universities, community planners, volunteers, and students, and provides a data repository for project partners. It contains several layers, intending to capture the complexities of the forest community and its relationship to other communities (soil, vegetation, wildlife, and climate). Furthermore, it will include a database and an interactive web site allowing all participants to track the results of the project and share information with others.

Restoration Stewards

Modeled on North Cascades Institute's stewardship programs, Restoration Stewards will form a nucleus for an on-going community of constituents for restoration at the North Cascades Environmental Learning Center. To help accomplish a thorough and successful restoration education project while building community support of restoration in the region, community volunteers will be recruited to assist with monitoring throughout the project's duration. Volunteers will be incorporated into the restoration work, including: planting, mulching, seeding, collecting seed, removing non-native plants, monitoring of soil and water conditions, plant growth, plant diversity, and presence of wildlife. To understand the forces affecting a forest ecosystem, people must understand the concept of a watershed. They also must understand the vital role each of us plays in the recovery and maintenance of forested ecosystems. Volunteers play important roles in the restoration of this low elevation forest community including:

- Convening a community forum to discuss restoration
- Advising project leaders during the planning process
- Educate fellow community members about restoration
- Provide labor for project implementation and maintenance projects

The restoration work provides a forum for an on-going discussion about how we monitor and relate with our lands. This is what separates education from volunteer labor—building partnerships with other agencies and the public to help protect local ecosystems. This is why a restoration stewards program is important for monitoring restoration efforts.

Restoration Resource Guides

A valid project stems from a valid plan. This involves understanding the story of the site. By its very nature ecologic restoration addresses the study of all components of the ecosystem and adjacent communities. This leads to understanding what constitutes successful restoration and preservation of ecosystems. As a result, it allows for a broad

array of projects to fit the learning needs and interests of participants. For example, they will include models, principles, and practices of restoration monitoring and ecological restoration, readings on the benefits and possibilities of volunteer restoration monitors, and a resource bibliography on current research, web sites, and local opportunities to participate in restoration activities. Creating restoration resource guides provides background information for teachers, environmental education instructors, community leaders, and students.

Restoration Education Advisory Group

Advisory groups provide discussion and guidance while establishing the restoration and monitoring plan for integration into educational programs. The advisory group will provide a wealth of local knowledge and experience and coordinate with appropriate groups. The group will be recruited from a regional mixture of restoration, education, and wilderness preservation specialists. The Northwest has a diversity of river and trail stewardship groups, but very few have begun to focus on low elevation forest restoration and its relationship with wilderness areas. The idea is to create a monitoring plan that can integrate with regional groups to provide cross-country, cross-border ecosystem comparisons. An advisory committee helps on the following aspects of the program:

- Provide direction for curriculum development and review
- Field test activities
- Help with development of teacher workshops
- Evaluation of the program
- Solicit and support funding opportunities for programs
- Provide guidance for identification of overall program goals, objectives, and audience

Assessment Strategy

Scientists from governments, industry, and academia recognize the need for an educated public to ensure the success of their restoration projects. The role of the restoration scientist is to provide technical support, reference site information and assist in project design. The educator provides the why behind the what, assists participants in making the connection to place, tells the story of the site, and oversees the project implementation. The participant's role is asking questions, assist in project implementation, and take the lessons learned back to his/her community. Participants in the restoration project will assess their understanding, perceptions, and actions toward the restoration activities through specific journal activities and questionnaires implemented pre, during, and post facilitated restoration monitoring. The restoration monitoring will not succeed unless these groups work together. Their collective information will be used by North Cascades Institute and National Park staff to determine the effectiveness of the monitoring and what constitutes successful ecological restoration outcomes.

How Restoration Monitoring Enhances Educational Programs

Understanding ecosystem complexity includes cultural and social components. As Frank Egler says, "Nature is not more complicated than we think, nature is more complicated than we *can* think," (Gayton 1998). Education lowers negative effects of human activities on ecosystems, thus enhancing physical, chemical, biological, and cultural processes by

which systems recover from disturbance. Principles on how people learn indicate that participatory activities, such as engaging in the practice and application of ecological restoration, provide richer and more prolonged opportunities for thinking about how one's actions are affecting the land (Brown 1998).

Restoration practices draw people into learning ecology through doing. Education initiates understanding and connection to place. Both education and restoration activate an exciting, participatory response toward comprehending the ecosystem matrix from which we emerged as a sentient, acting species. Both apply theory with practice. Our approach stems from our belief that the best way to restore environments and ensure sustainable communities is through education, encouragement, and empowerment of children and adults. Unprecedented growth and opportunity for field-based education for our region is at hand. An eye toward the past, present, and future of the site as it relates to human and natural history can be integrated into an ongoing 'restoration story', (Handbey 2004).

Conclusions and Questions

In response to the global challenge of conservation and sustainable use of the earth's biological resources, the *Convention on Biological Diversity* relayed the significance of public education, training, and awareness. The Global Biodiversity Strategy published by World Resource Institute, World Conservation Union, United Nations Environment Program, and *Caring for the Earth* support environmental education initiatives that enable humans to take a role in meeting challenges of monitoring for biodiversity. We believe the same actions are appropriate when regarding degraded and damaged ecosystems in need or restoration. This education initiative for the restoration monitoring of a low elevation forest community is part of a larger restoration plan for the North Cascades National Park and will be integrated into a diversity of North Cascades Institute Programs. Incorporating education into ecological restoration plans and projects will help identify the best way to incorporate future audiences who could and should benefit from studying and monitoring the success of restoration. The success of restoration monitoring programs is largely due to knowledgeable educators in both restoration practices and how to effectively coordinate and get the best out of participants. Thus, we leave you with two questions. What does a restoration monitoring education project in your community look like? If you find your community lacking in such a project, question its absence and consider the benefits of an engaged and educated community.

The second question relates to the role of education within ecological restoration monitoring. What are the benefits and challenges of each? What problems can education solve for restoration and vice versa? The example of the North Cascades Environmental Learning Center is meant to expand thinking when practicing the art and science of restoration monitoring. Expand your commitment to ecological restoration to include education. While many restoration programs exist we have yet to fully realize the outcomes of such community monitoring endeavors. It is the educator's job to translate knowledge and insights about ecological restoration. The more effectively we can translate the sometimes arcane world of restoration ecology and its relevance to issues of local concern, the more likely society will value restoration initiatives as a keystone for ecological understanding and problem solving. Assuring appropriate ecological restoration practices and protocols requires that restorationists and educators work

together to monitor project effectiveness. Collective decisions by the scientific, management, and educational realms of restoration work in the North Cascades are more likely to be honored and implemented than those that are made unilaterally.

As more educational objective assessments of restoration outcomes are made, researchers will not only gain new scientific insights but also help determine which restoration monitoring practices work best, thereby contributing to more effective ecological restoration. Believe in restoration for maintaining and enhancing ecological and cultural integrity. Believe in education as a catalyst for maintaining relationships with people and ecosystems in perpetuity. Combine, design, and participate in fusing the juncture where ecological restoration and education intersect. The magnitude of our growing environmental crises reinforces and necessitates strong restoration monitoring programs. We extend the invitation for restoration monitoring to welcome education into its home.

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