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Post-Restoration Monitoring: A Primer

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Post-Restoration Monitoring
Terminology and techniques
What should restoration monitoring include?
Example - River restorations on the Upper Mississippi River Basin
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Assessing Success in NRDA-Associated Restorations

Restoration Monitoring Basics

Monitoring should be performed to determine if the goals of the restoration have been met.

Complexity of the restoration dictates the design and intensity of the monitoring program.

Generally ties back to the damaged resource and determines if ecosystem services have been recovered

Should be developed concurrently with restoration plan

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Reference Sites

- A point of advanced ecosystem development that lies somewhere along the intended trajectory of the restoration.

- The restored ecosystem is eventually expected to resemble the attributes of the reference, and project goals and strategies are developed in light of that expectation.

- Often developed using multiple reference sites to develop normal bounds of ecosystem variability

- May require different reference sites for different ecosystem components (e.g., bird vs plant communities) as well as historical ecosystem data

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Goals…

Goals are the ideal states, conditions and attributes an ecological restoration effort attempts to achieve.

The basis for all restoration activities - and the basis for project evaluation.

Examples of Goals for Ecosystem Restoration

- **Characteristic indigenous species assemblages**
- **Physical environment that sustains these species**
- **Normal ecosystem functions for state of development**
- **Ecosystem is resilient to normal stress events**
- **Self-sustaining, persisting and/or changing through succession with maturation and changing envt.**

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…and Objectives

Objectives are the specific end results of actions taken to support project goals. **Goals are attained with the completion of specific objectives.**

A variety of actions, treatments, and manipulations is needed to accomplish each objective.

<u>Examples of Objectives in Restorations</u>

- **Removal of roads, buildings, landfills and wastes**
- **Addition of lime, fertilizer and organic matter to soil**
- **Use of prescribed burns to support plant assemblages**
- **Removal of invasive species interfering with recovery**
- **Protection of distant habitat for an impacted species**
- **Cultural objectives: education, community involvement**

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Performance Standards

***The specific methodologies and materials deemed necessary to meet objectives*.**

Examples of Performance Standards

- **Use of particular plant species, strains or regional variants**
- **Elimination of undesirable/invasive species**
- **Grading and elevational characteristics of tidal wetlands**

Performance Criteria

***Used to evaluate the measurable/observable results of restoration activities that tie back to the objectives*.**

Examples of Performance Criteria

- **75% survival of transplanted vegetation**
- **90% coverage for revegetated areas after 3 years**
- **Occurrence of avian species 3/5 years with 75% nesting**

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Corrective Actions / Adaptive Management

The response taken based on monitoring findings

Corrective Actions are modifications in methods or objectives in responses to outcomes of restoration activities

Adaptive Management is a more formal *iterative* approach for more complex restorations – entails the modification of objectives and techniques to better meet the goals of the restoration

In both cases, the restoration goals do not change, rather the methods used to attain the goals are modified based on events in the field.

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Restoration Milestones

Critical restoration components whose completion represents important points in the restoration

- Implementation - The completion of site engineering / modification and planting of vegetation
- Goal-specific milestones - tie back to project goals

Monitoring Context

The means by which attainment of goals is assessed and reported

Comparison to reference site(s) attributes

Pre- vs Post-Restoration Comparison

Inclusion of Control Comparisons – Without Restoration

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Monitoring of Ecological Restorations

Restorations Types Dictate Monitoring Needs

Restoration of Damaged Habitats and Ecosystems

Monitoring plans developed during restoration planning

Define *Performance Criteria* and *Monitoring Milestones* that reflect objectives and goals of the restoration

Describe how performance criteria will be assessed – quantitative measures or qualitative observations

Create a monitoring schedule - who is responsible?

Define, as best as possible, minor and major corrective actions and their triggers

Define requirements for completion and final reporting

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Monitoring of Ecological Restorations

Land Acquisition or Exchange

- Resource is so damaged site restoration is not pursued
- Alternative site chosen to replace lost ecosystem services
  - Sites with demonstrated ESs of similar value to lost site need confirmation of stability of resources
  - Others may need restoration to provide replacement of full ESs – similar to full site restorations

Building or Replacement of Facilities

- Implementation fulfils goals of the project
- Completion to Performance Standards must still be documented

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Why the concern? Why monitor at all?

Success Criteria and Monitoring of River Enhancements in the Upper Mississippi River Basin – **O'Donnell and Galat 2008**

Surveyed 70 restoration project mgrs. to determine if their projects:

1 - Set project success criteria

2 - Monitored once completed

3 - Evaluated monitoring data

4 - Disseminated final data

Assessing project success and potential for adaptive management were it needed

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Success Criteria and Monitoring of River Enhancements in the Upper Mississippi River Basin - Findings -

~2/3rds lacked quantitative criteria necessary to assess ecosystem trajectory once restoration activities were complete

Project success often referenced the project implementation process – the amount and area of work completed

Though biological monitoring occurred in most projects, few incorporated before and after assessments or control comparisons

Only 20 of 70 projects (< 30%) could provide a sound determination of biological effectiveness caused by project implementation

Majority of those that monitored provided data in reports to agencies or funders and not in publically accessible formats

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Evaluating & Reporting Monitoring Results

Process data from monitoring efforts and determine if site characteristics meet performance criteria and standards.

Assess shortcomings of findings and determine the need for corrective actions and adaptive management

Once site has returned to baseline or is on an appropriate trajectory toward reference conditions, sign off on completion, describing any long term site care & assessment needs and who is responsible for them.

Publish a summary of the work in a manner that is accessible to other researchers and the public (Factsheets), and in web-based resources or publications –

For example – The Global Restoration Network

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