Incorporating decision analysis and predictive design into stream restoration: The Stream Project

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Overview

Project Goal:

- Link stream restoration preferences, objectives, and actions in transparent and predictive decision-analysis framework
  - Uncertainty and risk evaluation
  - Tools for assessment and design
  - Incorporate stakeholder preferences and social benefits
Goals of Talk

• Share motivation for the Stream Project
• Describe vital elements and project structure
• Discuss the distribution plans
Why?

• Stream restoration is widely practiced
• Many different objectives – need to evaluate tradeoffs
• Link between objective and action is weak
• Uncertainty is neglected
Consider Typical Project Objectives

- Project will reduce sediment and nutrient loadings
  - By how much? At what cost?
  - Is there a cheaper alternative?
- Project will provide instream habitat
  - Is habitat limiting?
  - What are the odds of population recovery?
  - What is it worth?
- Project will provide a stable, natural channel
  - What is that?
  - Is it consistent with other objectives?
We can do better

- Understanding of streams and their ecosystems is improving
- New tools are available
- Science and engineering skills of practitioners continue to improve
- Stream Project will assemble the tools and provide a decision framework
There is plenty to build on …

<table>
<thead>
<tr>
<th>Group</th>
<th>Year</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>Working Group</td>
<td></td>
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<tr>
<td>US Army Corps of Engineers</td>
<td>2001</td>
<td>Hydraulic Design of Stream Restoration Projects</td>
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<tr>
<td>US Army Corps of Engineers</td>
<td>2001</td>
<td>Channel Restoration Design for Meandering Rivers</td>
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Key elements of the Stream Project:

#1 Interdisciplinary Interaction

#2 Objectives Linked to Actions

#3 Integrated Toolbox

#4 Unifying Case Studies
#1: Interdisciplinary Interaction

Stream Project

Natural Sciences

Engineering

Decision Analysis

Practice
#2 Objectives Linked to Actions

- Specific, quantifiable objectives explicitly linked to design choices
  - support tradeoff analysis
  - adaptive management
  - effective learning by doing

- Range of Objectives
  - Infrastructure protection
  - Decrease transport of nutrients/sediment
  - Recover endangered aquatic population
  - Improve aesthetics or recreational opportunities
#3 Integrated Toolbox

- Assessment of watershed and reach scale controls
- Quantify sediment and hydrologic drivers
- Predict physical, biological, and geochemical response to design manipulations
- Decision analysis for evaluating design alternatives
#4 Unifying Case Studies

- Apply framework and tools to diverse restoration projects
- Demonstrate the importance of the watershed context

Minebank Run, Baltimore County, MD
Stream Project Framework

Objectives

Goals

Assessment

Site Properties

Design

Actions

Decision Analysis

Design Acceptable?

NO

YES

Work toward restoration action

Non-stream restoration action
Stream Project: Chapters

1) Introduction
2) Objectives driven framework
3) Principles and strategies for ecosystem lift
4) Hydrology
5) Sediment
6) Fluvial geomorphology
7) Hydraulics
8) Sediment transport
9) Channel dynamics
10) Water quality
11) Energy and productivity
12) Physical habitat
13) Social value
14) Vegetation design
15) Decision analysis methods
16) Monitoring and adaptive management

Watershed Context

Site Dynamics: Assessment and Design

Making Decisions and Learning
Scalable Toolsets

<table>
<thead>
<tr>
<th>Required Information</th>
<th>Chair</th>
<th>Bike</th>
<th>Scooter</th>
<th>SUV</th>
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- Do you have predictive tools you would like to share with us? Send us your tools and suggestions to info@streamproject.org
Distribution

- Printed manual with digital toolset
  - Draft underway
  - Final by July 2012
- Website: StreamProject.org
  - Coming in 2012!
- Training Workshops
  - Short courses at regional stream restoration conferences 2011-2012
What the Stream Project will NOT do for you

- Provide a ‘cookbook’ approach to stream restoration
- Circumvent engineering analysis and judgment
- Provide all the background you need
- Recommend reach scale restoration if the problem is at the watershed scale
- Eliminate stream restoration failures
What the Stream Project can do for you

• Help set the appropriate objectives given the site / watershed attributes and constraints
• Predicatively and transparently link objectives → site attributes → restoration actions
• Provide a range of scalable tools that quantify uncertainty
• Provide a bases for tradeoffs among objectives and between costs and benefits
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<thead>
<tr>
<th>Name</th>
<th>Affiliation(s)</th>
<th>Specialties</th>
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</thead>
<tbody>
<tr>
<td>Peter Wilcock - Director</td>
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<td>multi-dimensional modeling, instream habitat</td>
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Questions?

Email us: info@streamproject.org
Timeline

2010

*Project initiated*: Team assembled

Objectives-driven framework defined

*Meeting*: Common vision established

Scope of tools defined

*Meeting*: Chapters outlined and case studies

Draft chapters written & assembled

2011

*Meeting*: Evaluate draft manual and toolset

Application of Stream Project to case studies

Short courses regional meetings

2012

*Meeting*: Assemble final manual and software

Final editing and software testing