

RIVER RESTORATION

Restoration—“active human intervention and action to renew and restore degraded, damaged, or destroyed ecosystems and habitats.”

Restoration projects include:

- Dam removal
- Flow alteration. E.g., releasing water via dams to modify downstream projects
- Sediment manipulation. E.g., adding sediment to rivers that are sediment starved
- Habitat alteration. E.g., placement of large wood debris
- Riparian alteration. E.g., invasive plant removal or native plant planting.

Most restoration projects are small scale, short time period, with no monitoring.

Common stated goals:

- Enhance water quality
- Manage riparian zones
- Improve in-stream habitat
- Fish passage
- Bank stabilization

Unstated goals?

- Aesthetics. Make a stream look more visually appealing.
- Satisfaction. Restoration is a concrete activity where people can take action.
- Education
- Community-building

River restoration is a huge business with unknown success.

In the United States alone, river restoration:

- Since 1990, an average of >\$1 billion is spent on river restoration
- Uncertain success
 - 10% of projects were assessed
 - Of those assessed, few actually met goals
 - E.g., 2 out of 78 studies actually observed increased invertebrate diversity associated with restoration.

Why is river restoration challenging?

- One of the fundamental challenges of restoration is that rivers are always changing. How do we restore for dynamics? Sediments should be moved downstream, river channels should move around. . .
- Ambiguous targets for restoration? Often the goals of restoration are mixed (make the stream look pretty or have more salmon).
- River systems are connected. Restoration may do nothing if the upstream is screwed up.

Does restoration enable degradation?

- Restoration can provide the appearance of fixing problems without addressing root cause.
- The Canadian Fisheries Act and US Clean Water Act allow habitat degradation to occur if there is compensation or mitigation. In Canada, area of compensation was only suitable in 14% of reviewed cases.
- Restoration costs enormous amounts of resources. These resources might be used more effectively to address root causes.
- Restoration and development are now very tightly financially connected. Now restorers have a financial stake in continued degradation.
- Jon and his mom wrote a paper that raised the possibility that restoration can enable degradation, analogous to enabling behavior in the lives of addicts (Moore and Moore 2013).

A WAY FORWARD?

1. **Try to not degrade habitats. Degradation may be irreversible on short time scales.**
2. **Process-based restoration.** (Beechie et al. 2010)
 - Restore the rates of physical, chemical, and biological processes that create and sustain river ecosystems.
 - For example, process-based restoration would not dump sediments into a river, but rather would remove the upstream dam that is trapping sediments.
 - This seeks to address the root cause of the degradation, rather than the symptom.

Four principles of process-based restoration

- A. Target the root cause of degradation
- B. Tailor restoration to the local systems, such as the flow regime. Thus, restoration should be based on understanding the historic dynamics of the system.
- C. Match spatial and temporal scale of restoration to the system.
- D. Be realistic and explicit about expectations. Process-based restoration will take a long time.