Pooled Monitoring Initiative's Restoration Research Award Program

Project Title

Vertebrate Community Response to Regenerative Stream Conveyance (RSC) Restoration as a Resource Trade-Off

Lead Entity

Mark Southerland, PhD, Tetra Tech

Partners

University of Maryland Center for Environmental Science—Chesapeake Biological Laboratory

The Pooled Monitoring Initiative pools resources to support scientists who answer key restoration questions posed by the regulatory and practitioner communities. The research teams then provide the answers back to those who asked the questions for direct application. The goal of the program is to answer these key restoration questions that serve as a barrier to watershed restoration project implementation.

Questions? See cbtrust.org/grants/restoration-research/

Research question(s)

This study addresses the question—What are the trajectories of the vertebrate communities (fish and herpetofauna) after degraded streams are restored as Regenerative Stream Conveyances (RSCs) or stream-wetland complexes.

We defined the possible trajectories as (1) degraded reference condition and (2) minimally-disturbed reference conditions (single-thread streams and stream-wetland complexes) for Coastal Plain aquatic vertebrate communities, using a literature review and data from Maryland Biological Stream Survey (MBSS). We then compared the results of sampling in 11 streams that have been converted to RSCs (with time since construction ranging from 2 to 17 years) to 8 references in each of the three types: low-quality single streams, high-quality single streams, high-quality stream wetlands.

Issue addressed

This study assessed the trade-offs in stream restorations using the RSC or restored stream-wetland technique. Specifically, it quantified the aquatic vertebrate community changes that should be expected from RSC restorations implemented in lowland Coastal Plain streams with nutrient-rich waters, so that appropriate goals and valuations can be developed.

Project findings

- RSC fish communities were more similar to low-quality single streams than to high-quality single streams or stream wetland complexes
- Fish diversity in RSCs was lower than in high-quality sites and decreased in RSC restorations with higher conductivity and lower dissolved oxygen
- Sensitive fish species found in high-quality references (e.g., creek chubsucker, fallfish, madtoms, lampreys) were absent from RSCs and low-quality sites

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Project findings continued

- Fish indices of biotic integrity (IBIs) were also lower in RSCs than in high-quality reference sites, but may be higher than in low-quality reference sites
- While RSCs recreated the physical habitat conditions typical of high-order stream wetland complexes in low-order reaches, they did not attain the levels of dissolved oxygen, conductivity, and flow found in high-quality sites
- Herpetofauna diversity showed few patterns between RSCs and reference types, except for higher frog abundance in RSCs than references
- Overall, vertebrate uplift in RSCs appears to be constrained by continuing poor water quality

Recommendations

These results should help practitioners and regulators develop realistic expectations of biotic resource changes that occur when defined-channel stream systems are transformed into less-defined stream wetland complexes (i.e., RSCs) in urban-suburban settings. While RSCs may increase the abundance of frogs, they should not be expected to result in fish communities comparable to minimally degraded streams or stream-wetland complexes, where the levels of dissolved oxygen, conductivity, and flow found in high-quality sites are not present. It is possible that fish communities in RSCs will become more diverse over longer periods than considered in this study (i.e., decades) or that variation in RSC designs can significantly increase fish diversity. Future study should address (1) the maturation of RSCs over time, (2) providing connections to or introductions of source fish populations, and (3) whether RSC designs can ameliorate or overcome the constraints of poor water quality found in this study.

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Why does this study matter?

Stream restorations in general, and RSCs specifically, have been shown to reduce downstream contributions of nutrients and sediment, where upstream loads are high, but not necessarily to improve within stream biological integrity. Virtually no studies have been done on how RSCs affect vertebrate communities of fish and herpetofauna. To accurately set goals for RSCs and weigh the tradeoffs between pollution reduction and ecological uplift, a conceptual model for vertebrate trajectories in RSCs and evidence supporting those trajectories (both provided by this study) are needed.

What should we do with this information?

Stream restorations of any design often result in some level of tradeoffs between different resource management goals (e.g., nutrient reductions vs protecting upland forest). Therefore, regulators should consider the trajectories of fish and herpetofauna communities expected from RSCs and weigh the tradeoffs in their decisions. Permittees should recognize the trajectories of fish and herpetofauna communities expected from RSCs and consider the role of RSCs in their programs. Practitioners should review the trajectories of fish and herpetofauna communities expected from RSCs and work to develop designs that will move these trajectories closer to desired reference conditions.

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What will the end-user (regulator/manager and practitioner) do with this information?

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For more information:

To read this study's final report, please visit the Chesapeake Bay Trust's Pooled Monitoring Restoration Research landing page (https://cbtrust.org/grants/restoration-research/) or click here.

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