Does *where* matter more than *how*?: Spatial context alters the efficacy of urban stream restoration for biodiversity recovery

Bryan L. Brown (Virginia Tech)
Chris M. Swan (UMBC)
Brett Tornwall (Virginia Tech)
Why do we find, what we find, where we find it?
Headwaters

Isolation

Local factors
(environment) dominant

Mainstems

Highly connected

Regional factors
(dispersal) dominant

Brown and Swan 2010.
Journal of Animal Ecology

Swan and Brown 2014.
Ecography
Substrate Manipulation

Flume Experiment
**Headwaters**
- Isolated
- Community structure a product of local factors

**Mainstems**
- Well-connected
- Community structure a product of both local and regional (dispersal-driven) factors

**General Prediction** = Headwaters will respond more strongly to manipulations of local habitat
Substrate Manipulation: METHOD

Predictions

• HEADWATERS = different heterogeneity treatments -> different communities
• MAINSTEMS = heterogeneity treatment has little effect
Design = 3-way factorial

- Substrate complexity (local factor)
- Dispersal rate (regional factor)
- Source pool (network structure)

General Predictions
- Both HW and MS will show evidence of habitat filtering
- HW will respond more strongly to dispersal
- Little response from MS to dispersal
Flume Experiment
Substrate Manipulation

Conclusion: Manipulations of local factors matter more in headwaters

Flume Experiment
Substrate Manipulation

Flume Experiment

Restoration Survey
Predictions

- HEADWATERS = respond to restoration
- MAINSTEMS = resistant to restoration
- STABILITY = restoration increases temporal stability in headwaters only

(Brown 2003, 2007)
Restoration Survey: RICHNESS

Macroinvertebrate Taxon Richness

Headwaters

Mainstems

- Spring
- Summer
- Fall
- Winter
Restoration Survey: Community Similarity

$p = 0.034$
Restoration Survey: Community Similarity
Headwaters
- Isolation
- Local factors (environment) dominant

Mainstems
- Highly connected
- Regional factors (dispersal) dominant

Swan and Brown 2014. Ecography
Conclusions: Implications for Restoration

• If biodiversity is a focus, then restorations of habitat will be more effective in smaller streams

• In larger streams or rivers, manipulations of connectivity may be very effective

Major Caveats

• Not all restoration projects share the same goals

• Differences very strong in Spring and Summer, not as strong in other parts of year
Brett Tornwall: graduate student, Brown Lab, Virginia Tech

Dr. Christopher Swan: Associate Professor, University of Maryland, Baltimore County
Contributing Students

Charlie Wahl (grad), UMBC
Brett Tornwall (grad), VT
Tara Wiley (grad), UMBC

Maxim Girshevsky (UG), VT
Brent Warner (UG), VT
MaryCatherine Douglas (UG), VT
Alicia Peters (UG), UMBC

Funding

National Science Foundation (DEB-1025958)
Virginia Tech
University of Maryland, Baltimore County
Clemson University