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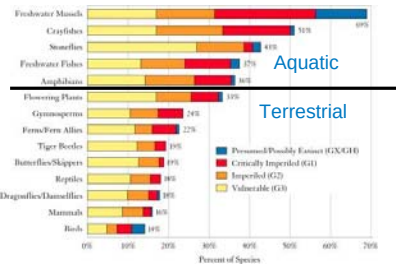
004 EPA STAR Graduate Fellowship Conference *Next Generation Scientists—Next Opportunities*

redictive modeling of stream ecosystem processes: can we assess the integrity of stream ecosystems directly?

Overview

e Clean Water Act (CWA) of 1972 ovides a mandate to "restore and aintain the chemical, physical and biological integrity the Nation's waters."

espite 32 years of the CWA, eshwater ecosystems remain ghly endangered.



treams ecosystems provide variety of essential ecosystem rvices (*e.g.*, water purification, pporting fish populations).

ecently, more emphasis has been placed on the biological, ther than the strictly chemical, components of water quality.

ll biological assessments of water quality focus on measuring rious aspects (indicators) of the stream community (fish and/or acroinvertebrates) and using the results to infer the degree to hich biological integrity has been retained.

hile we suspect that there is a relationship between the state the biological community and the degree to which critical eam ecosystem processes remain intact, the question has ver been directly addressed.

he overall aim of my research is to answer this question.

Research Strategy

I use the Reference Condition Approach (RCA) to evaluate whether there is a correlation between biological integrity as estimated using species composition and ecosystem function as estimated using leaf litter decomposition rates. Leaf litter decomposition is a critical ecosystem process in streams.

The Reference Condition Approach

The RCA involves 4 basic steps:

1) Measure the value of a biological indicator at a large number of relatively pristine ("reference") streams to quantify the range of natural variability.
2) Use multivariate statistics in combination with environmental data to generate a range of expected values for the indicator in the absence of impairment.
3) Compare the indicator value observed at the stream you're interested in with the expected range of values.
4) If the observed value falls outside of the range predicted to occur in the absence of impairment, we infer that the stream is biologically impaired.

- Macroinvertebrate data have been collected from over 200 reference streams and 250 grazed streams in Montana, Idaho, Wyoming and Utah.

- I used the RCA to develop a statistical model that predicts the macroinvertebrate species composition of unimpaired streams from their environmental characteristics.

-The model indicates that 51% of the grazed streams are biologically impaired (*i.e.*, their Species compositions are significantly different from that expected in the absence of impairment).

What about ecosystem function?

- I measured leaf litter decomposition rates in 48 of the reference streams and 15 of the grazed streams.

- Decomposition rates vary substantially between streams, with no overall differences between grazed and ungrazed (reference), or between impaired and unimpaired streams.

- Although environmental data can account for 65% of the natural variability among reference streams, that is not sufficient to allow the prediction of decomposition rates.

Based on these preliminary results, we cannot conclude that biological assessments provide an accurate assessment of ecosystem function.

- More data are needed to determine whether we can use the RCA to assess directly the functional integrity of stream ecosystems.

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