Using biological and habitat metrics to determine the effectiveness of TMDLs: A Case Study
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Goals and Objectives

Goals
- Summarize and link watershed-based cleanup efforts to responses in biological communities (macroinvertebrate and periphyton)
- Develop a method for estimating human disturbance based on parcel-scale land uses within watershed

Objectives
- Collect baseline macroinvertebrate, periphyton, habitat, and water quality data for the characterization of macro- and meso-vertebrate monitoring stations
- Create a method for identifying human disturbance based on parcel-scale land use within watershed
- Use baseline data to develop watershed-based biological indicator metrics and a biotic integrity model

Methods

Data Collection
Biological and physical assessments were conducted in 2009 and 2010 at nine stations in the Deschutes River Watershed. Initial and endpoint biological metrics were collected from these locations. Baseline and endpoint biological data were selected for each monitoring location, and baseline data were used to test biological metrics for responsiveness to the least and most disturbed sites (Figures 1 & 2).

Agglomerative hierarchical clustering analysis (Struyf et al., 1996) using 3 log-transformed biological data was used to identify potential biological thresholds in relation to LDI

Calculation of Landscape Development Intensity Index

The Landscape Development Intensity Index (LDI) is a cumulative index of the degree of disturbance at a point within a watershed. The LDI is based on the cumulative area of disturbed land within a watershed. It is calculated using the following formula:

\[ LDI = \sum_{i=1}^{n} \left( A_i \times C_i \right) \]

Where:
- \( A_i \) is the area of disturbed land in the ith land parcel
- \( C_i \) is the cumulative area of disturbed land within the watershed

Landscape Development Intensity Index (LDI) scores were calculated for each monitoring station using the LDI values for the least and most disturbed monitoring locations.

Results for the periphyton TITAN analysis indicate a negative relationship between the ratio of Incorporate BMPs into LDI scoring procedure and link to changes in biological and habitat conditions used in IBI index development were selected based on LDI scores.

Lines on the Deschutes River Watershed Land Use Analysis map indicate least and most disturbed monitoring stations. Least and most disturbed monitoring stations were selected based on LDI scores.

Conclusions

- Clustering results are consistent with the LDI analysis for identifying land use disturbances.
- Using biological and habitat metrics, the LDI analysis for identifying land use disturbances.
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Next Steps
- Further strengthening the watershed model by incorporating other parameters, such as riparian width and habitat.
- Evaluate the model to identify land use disturbances.
- Develop relationships between response metrics and source land-use type.
- Develop methods to account for the effect of natural variation in biological communities.
- Incorporate appropriate statistical methods to test changes in biological and habitat conditions over time.

References

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