Fish Community Assembly across Riverine Systems of East-Central Texas

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Stream communities are structured by biotic and abiotic processes that vary in strength across multiple spatial scales (Figure 1). At the watershed scale, topography, anthropogenic land use, spatial relationships, and dams and outlets create gradients that organize the fish community. At the local scale, environmental variables such as flow regime and anthropogenic land use change shape the functional and taxonomic diversity in fish communities. Examining community organization from a functional trait perspective provides insights to species performance and allow one to predict their responses along environmental gradients. This study will examine the role of local and watershed-level environmental variables on the structure and function of stream fish communities within East-Central Texas. Specifically, this study will concentrate on the relationship of fish community and environmental variables at the watershed and local scale and conduct a species occupancy model of flow dependent fish species to examine the following hypotheses. **H1)** Fish assemblage composition will be correlated to environmental variables at the watershed and local-reach scale. **H2)** Aspects of locomotion, feeding, and life history functional traits of the fish assemblage will be correlated with habitat descriptors such as flow regime characteristics. **H3)** Changes in composition of flow-dependent fish species will be explained by changes in land use and flow regimes.

Methods

This study will be conducted during the summer seasons (May to August) of 2020 and 2021 within watersheds of the Brazos, Neches, Sabine, and Trinity. Selected streams will lie within four major ecoregions in Texas including the Cross Timbers, East Central Texas Plains, Texas Blackland Prairie, and the Western Gulf Coastal Plains, which provide a broad range of geographic coverage, land uses, and streams. For each study site, watershed scale variables (e.g. land use cover, topography) will be calculated using ArcGIS. Within each stream reach, all available in-stream habitat will be sampled using a Smith-Root backpack electrofisher and a seine net, while local habitat variables (e.g. substrate composition, canopy cover, *in-situ* water parameters) will be quantified. Representatives of each fish species present will be and preserved for measurement of functional traits associated with locomotion, feeding, habitat preference, and life history.
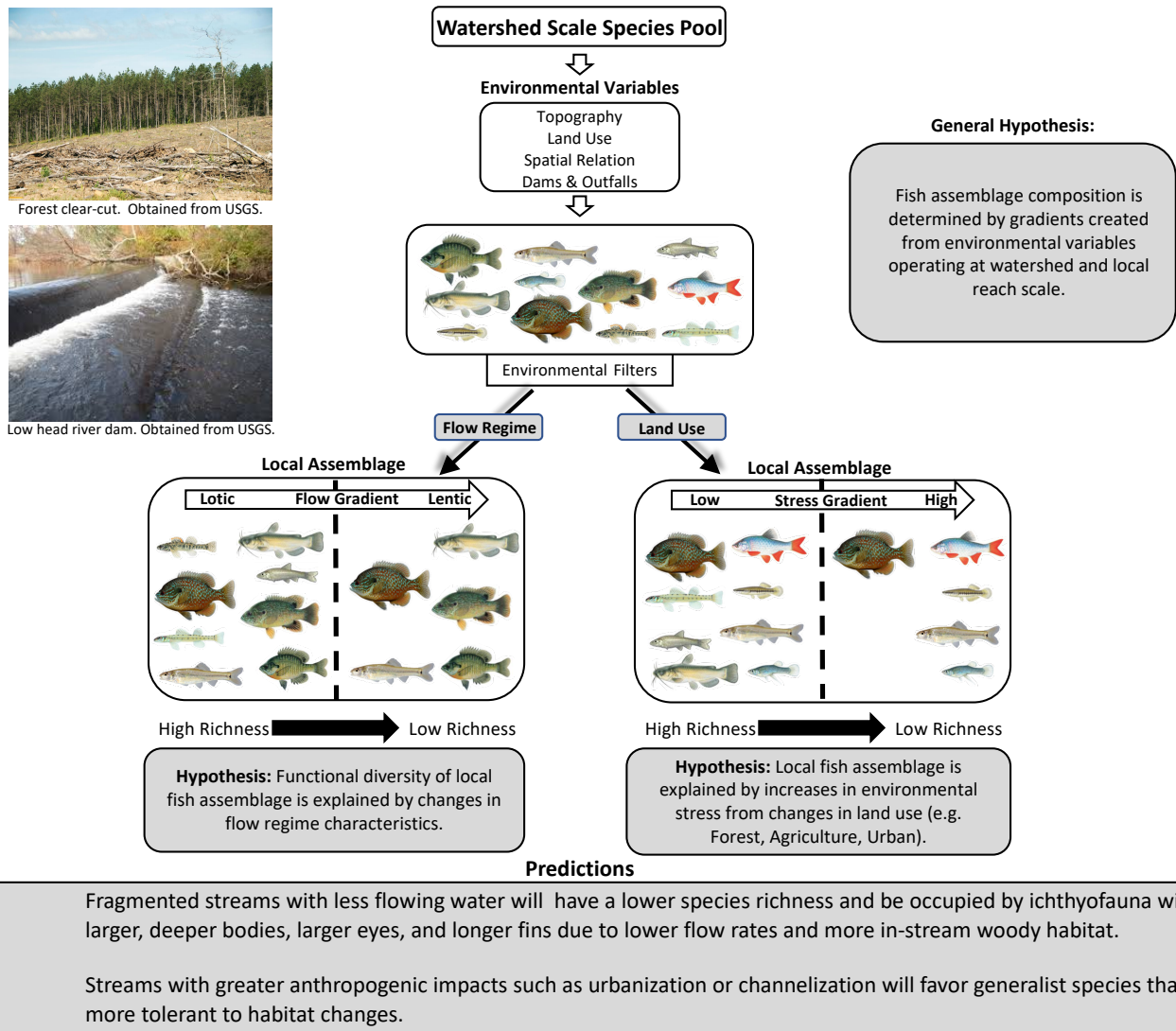
Watershed Scale Species Pool

Environmental Variables
Topography
Land Use
Spatial Relation
Dams & Outfalls

Forest clear-cut. Obtained from USGS.

Low head river dam. Obtained from USGS.

Environmental Filters

General Hypothesis:

Fish assemblage composition is determined by gradients created from environmental variables operating at watershed and local reach scale.

Flow Regime

Land Use

Local Assemblage

Lotic   Flow Gradient   Lentic

High Richness → Low Richness

Hypothesis: Functional diversity of local fish assemblage is explained by changes in flow regime characteristics.

Local Assemblage

Low   Stress Gradient   High

High Richness → Low Richness

Hypothesis: Local fish assemblage is explained by increases in environmental stress from changes in land use (e.g. Forest, Agriculture, Urban).

Predictions

- Fragmented streams with less flowing water will have a lower species richness and be occupied by ichthyofauna with larger, deeper bodies, larger eyes, and longer fins due to lower flow rates and more in-stream woody habitat.

- Streams with greater anthropogenic impacts such as urbanization or channelization will favor generalist species that are more tolerant to habitat changes.

Fig. 1. Stream communities are structured by gradients of environmental variables occurring across different spatial scales.

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