Functional Diversity of Aquatic Plants as a Predictor of Invasion Damage Costs

Rationale and Background

Aquatic invasive plants generate substantial and recurring economic costs through management, infrastructure damage, and loss of ecosystem services. While these impacts are often attributed to species identity or invasion extent, less attention has been paid to whether the *functional ecology* of invasive plants systematically predicts economic damage. Functional traits governing growth form, reproduction, biomass accumulation, and environmental tolerance strongly influence ecological dominance, resistance to control, and recovery following disturbance, yet these traits are rarely evaluated in relation to damage costs.

Functional diversity theory provides a powerful framework for linking species traits to ecosystem processes and outcomes. Applying this framework to aquatic plant invasions allows movement beyond species-level descriptions toward mechanistic explanations of why some invasions consistently incur higher damage costs than others. Comparing invasive and native aquatic plants within a shared functional trait space enables identification of trait combinations associated with damage costs, rather than assuming invasiveness alone drives economic impacts. This approach has the potential to improve invasion risk assessment and protection of aquatic ecosystems.

Objectives and Research Questions

The primary objective of this project is to determine whether functional traits and functional diversity of aquatic plant species predict the occurrence of damage costs associated with invasion. Specifically, this research asks: 1) Do aquatic invasive plants occupy distinct regions of functional trait space relative to non-invasive aquatic plants? 2) Are certain functional traits or trait syndromes associated with disproportionately high damage costs? 3)Are species associated with damage costs more likely to receive management investment?

Study Design and Methods

We will compile a functional trait dataset for a broad suite of aquatic plant species, including both invasive and native taxa, using existing databases (e.g., InvaCost, GloNAF) and primary literature. Traits will include growth form, reproductive strategy, dispersal mode, biomass accumulation potential, tolerance to environmental variability, and response to disturbance. Damage cost data will be assembled from published sources, management records, and practitioner reports. Due to the two-month research timeline, damage costs will be assessed as presence/absence rather than magnitude. Trait-based analyses will quantify functional diversity, identify trait syndromes, and model damage cost occurrence as a function of species-level traits.

Expected Outcomes and Significance

This research will identify functional traits and trait combinations that predict damage costs associated with aquatic plant invasions. By explicitly linking functional ecology to economic outcomes, the project will support proactive invasion risk assessment, inform prioritization of early detection and rapid response, and guide management strategies tailored to functional characteristics of target species.