# Large Wood and Fish in the Upper Mississippi River


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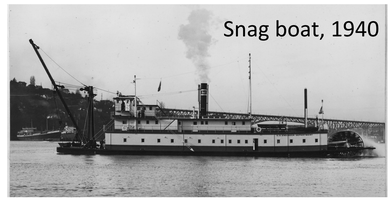
## Introduction

Snag removal on the Mississippi River began in 1824 to improve navigation (Angradi et al. 2010)

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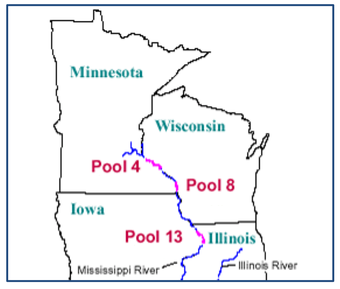
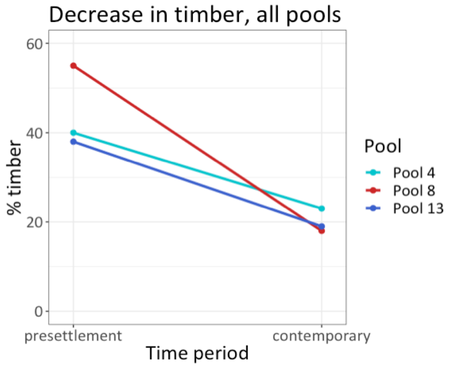
**Large Wood:** semi-permanent woody structure

Used in ecological restoration to create fish habitat

**USGS fish data:** Fish caught, wood, habitat, depth, revetment, etc. Three navigation pools.




Modified from Koel 1998




2000 UMRS Habitat Needs Assessment report

Less forested land in all three pools than before settlement

Erosion control, channelization, dams

## Conclusions

- Wood presence varies with source and transport variables: forest proximity, shoreline complexity, water depth
- Geomorphic impacts of wingdams and revetments may affect wood transport and deposition
- Bluegill and smallmouth bass: abundance at sites with and without wood significantly depend on aquatic habitat
- Black crappie, green sunfish, orangespotted sunfish, and white crappie: abundance significantly greater with wood presence overall
- Future research: temporal trends in wood distribution, estimates of size/quantity of wood
- Results may inform restoration strategies in the UMR

## Acknowledgements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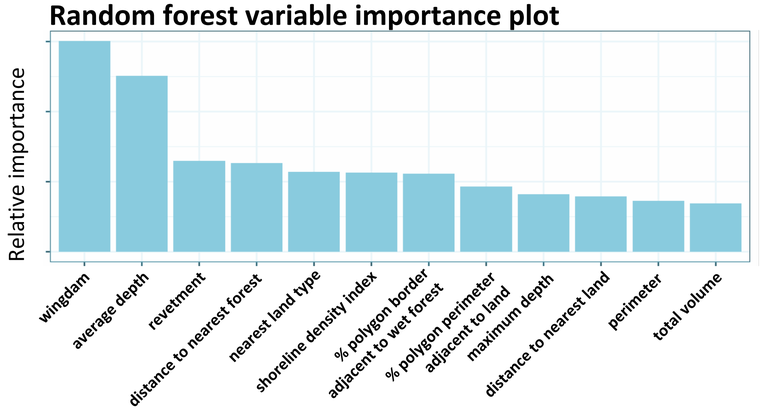
## Wood Distribution

### Methods

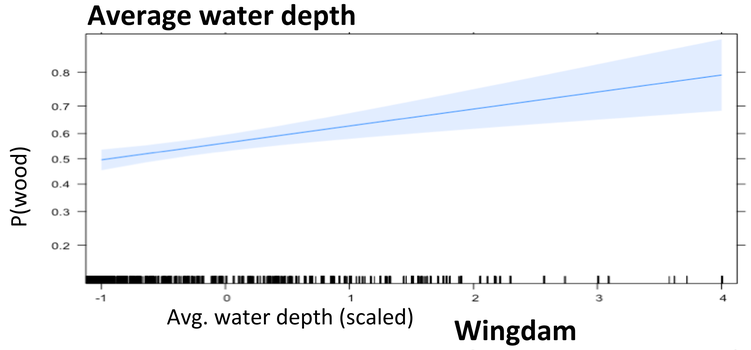
- Reduced ~40 variables to 13 focused on wood sources, transport, and storage
- Random forest modeling to determine variable importance
- Mixed-effects logistic regression to see **how** variables predict wood presence

### Results

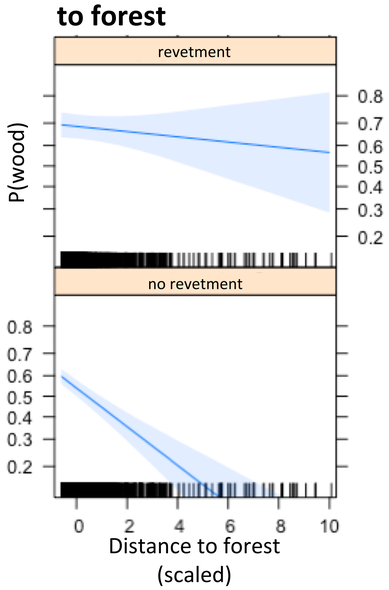
**Random forest variable importance plot**



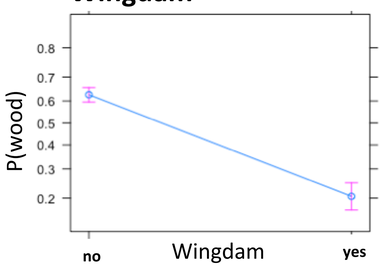

**Average water depth**



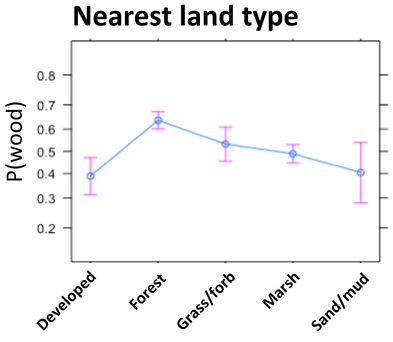

**Revetment & distance to forest**




**Wingdam**




**Nearest land type**



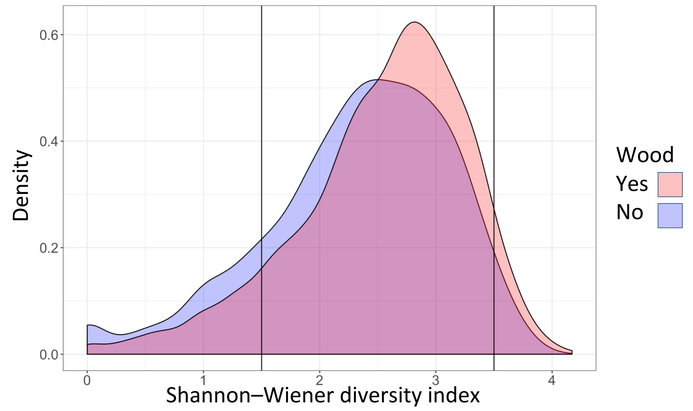

## Fish and Wood

### Methods

- t-tests to evaluate wood vs. fish community measures: richness, abundance, Shannon–Wiener diversity index
- Quasi–Poisson regression to see **how** aquatic habitat and the presence of wood affect fish abundance by species

### Results

**Density plot of Shannon–Wiener diversity in all pools**




Shannon–Wiener Diversity: $t(4025.3) = -9.78$, $p < 0.001$
Species abundance: $t(4260.2) = -5.309$, $p < 0.001$
Species richness: $t(4113.4) = -13.952$, $p < 0.001$

All significantly greater when wood is present

**Multiplicative impact of wood on abundances**

| Common Name | Backwater Contiguous Shoreline | Impounded Shoreline | Main Channel Border Unstructured | Main Channel Border Wing Dam Area | Side Channel Border | Wood main effect |
|---|---|---|---|---|---|---|
| Black crappie | 1.229 | 0.826 | 1.427 | 1.850 | 1.772 | 1.308 |
| Bluegill | 1.135 | 0.605 | 0.588 | 1.091 | 0.986 | 0.995 |
| Green sunfish | 2.966 | 0.662 | 0.567 | 2.973 | 0.675 | 1.863 |
| Largemouth bass | 0.958 | 0.823 | 0.679 | 1.253 | 0.885 | 0.893* |
| Orangespotted sunfish | 2.865 | 12.700 | 1.374 | 0.578 | 2.167 | 2.771 |
| Rock bass | 0.910 | 1.588 | 0.853 | 0.343 | 0.917 | 0.967 |
| Smallmouth bass | 1.357 | 1.091 | 0.652 | 0.874 | 0.699 | 0.776 |
| White crappie | 4.439 | 2.583 | 2.229 | 6.937 | 1.906 | 4.139 |

All colored values are significant at the .01 level except 0.893* which is significant at the .05 level

**Blue** = significant increase in abundance when wood is present

**Red** = significant decrease in abundance when wood is present

**Interaction effects of habitat and wood on bluegill abundance**