

# Hidden Watersheds: *Understanding Seasonal Ponds in a Landscape Context*

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Change



# Overview

- **Definition and Nomenclature**
- **Conservation/Management Issues**
- **Research**
  - **Multiscale drivers of distribution, hydrology, vegetation, invertebrates**
  - **Management experiments**
- **Application**

## WHAT IS A SEASONAL FOREST POND?

- **Palustrine (typically)**
- **<< 1 ha in area (100-2000 m<sup>2</sup>)**
- **Isolated within an upland forest matrix**
- **Closed (?) surficial hydrology**
- **Seasonally fluctuating water level**

# NOMENCLATURE

- VERNAL POOLS
- AUTUMNAL POOLS
- EPHEMERAL WETLANDS
- DEPRESSIONAL WETLANDS
- WOODLAND PONDS
- SEASONAL PONDS: NWI Classification

# Examples





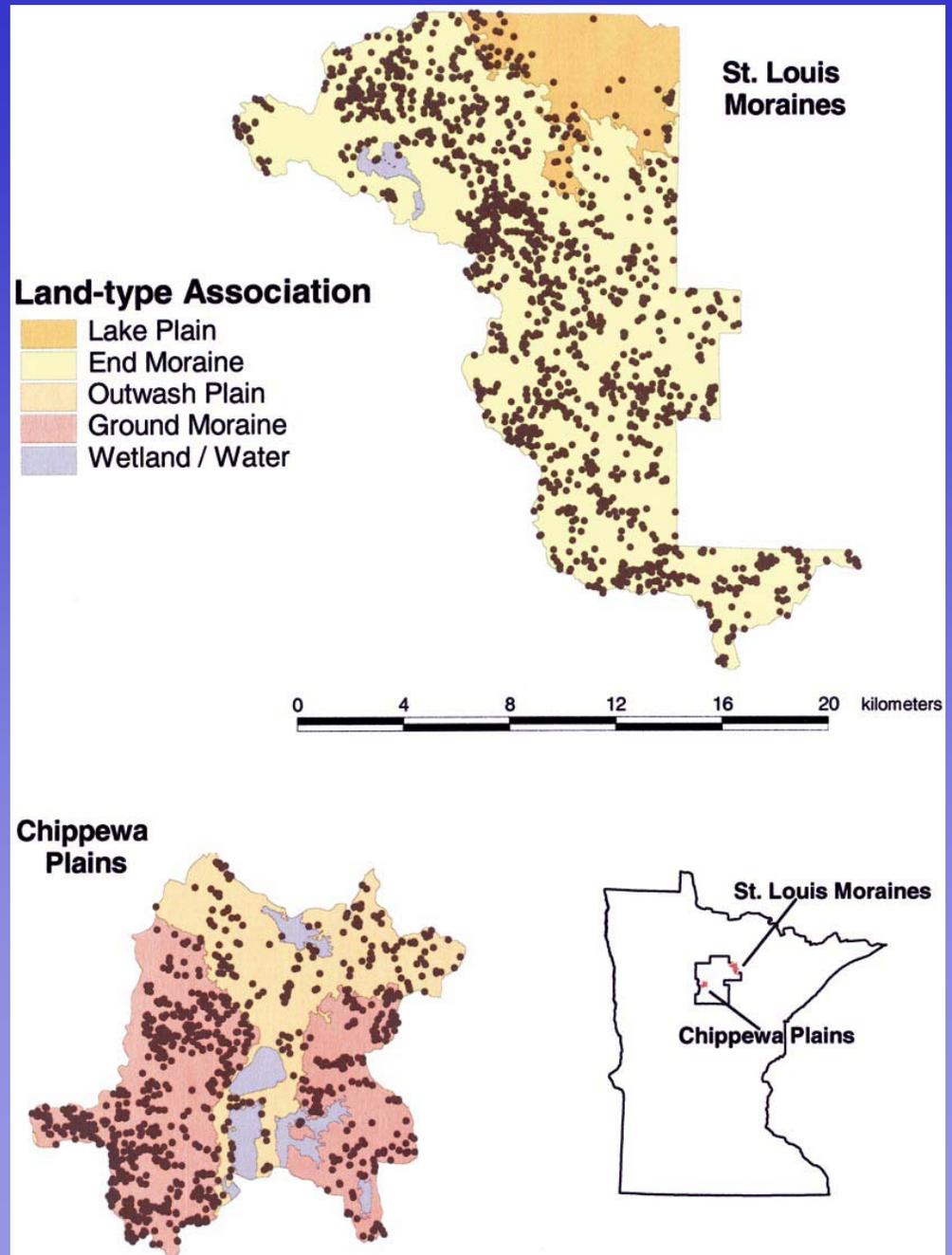






# Why the interest in seasonal ponds?

- Abundant
- Highly variable
- Poorly inventoried
- Poorly conserved



## Why the interest in seasonal forest ponds?

- Amphibian breeding habitat
- Biodiversity (species, ecosystems)
- Ground water recharge?



# Why the interest in seasonal ponds?

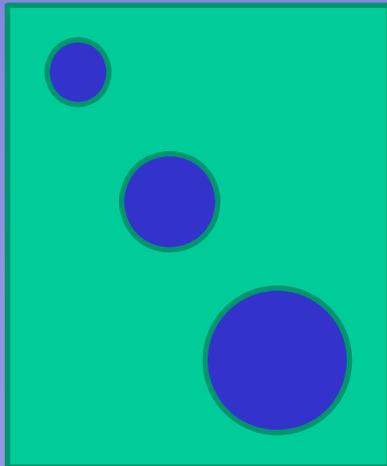
## Management Impacts

### **Direct**

- harvesting
- equipment

### **Indirect**

- small size
- edge/area

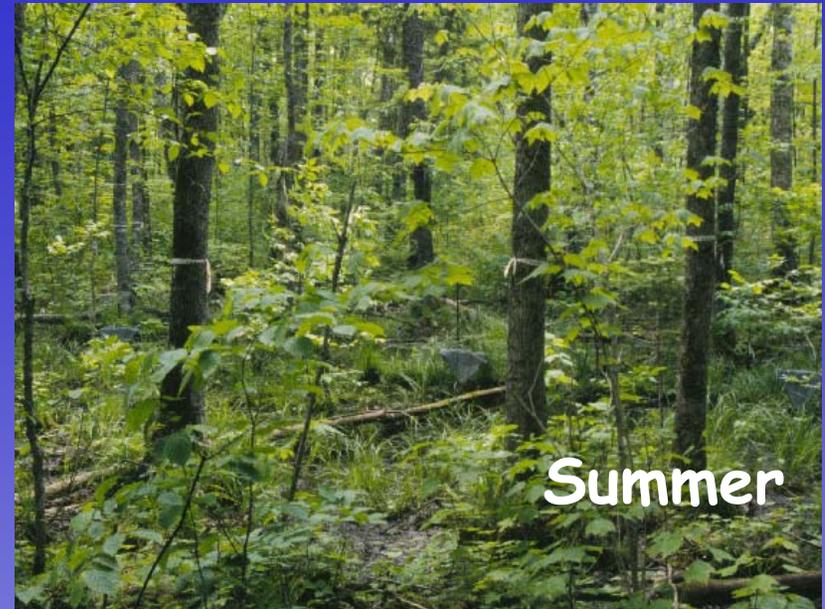


# Management Impacts

## Seasonality!



Where's the pond?



- Landscape importance
- Management impacts
- Limited understanding
- Need for research

# Seasonal Forest Pond Research at the Northern Research Station-USFS

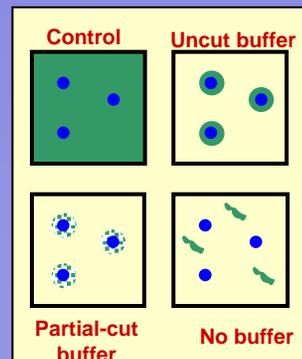
## Multi-scale drivers of pool characteristics & function

- Landscape abundance
- Plant community variation
- Invertebrate community variation
- Organic matter flux and processing



## Pond management experiments

- Time since upland harvesting
- "Riparian" buffer manipulation
- Particulate organic matter exclusion



# Multi-scale drivers of pool characteristics & function

(Landscape to local)

## *Hierarchy theory:*

Applied to landscapes, predicts that larger-scale features (geomorphology, soils, upland vegetation) constrain the structure and function of nested, smaller-scale features (seasonal ponds)

Water Chemistry  
Organic Matter Flux

**Hierarchical  
Ecosystem  
Classification**

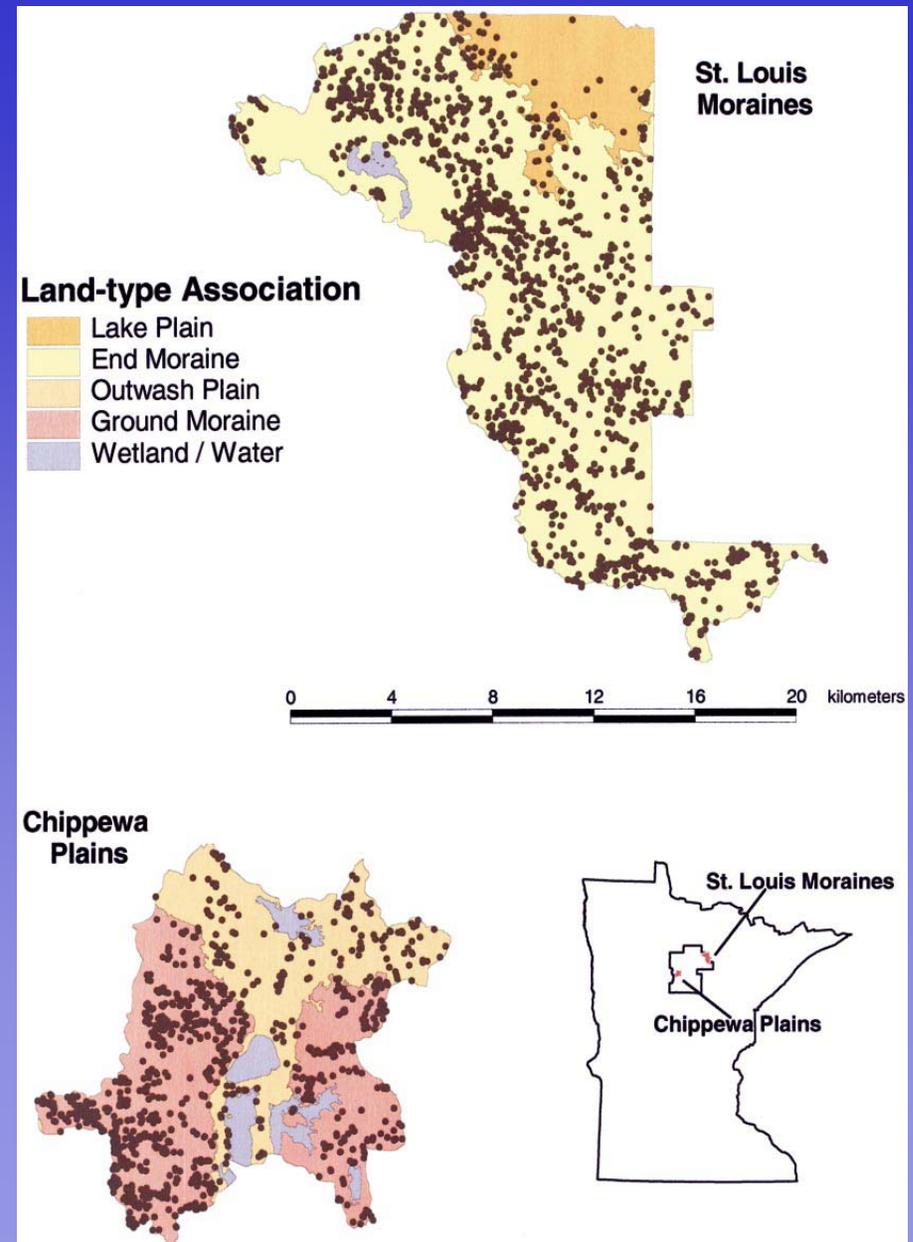
Plant, Amphibian, Invertebrate  
Communities

***Predicting pool  
abundance within  
landscape ecosystems  
(Subsections, LTA, LT)***

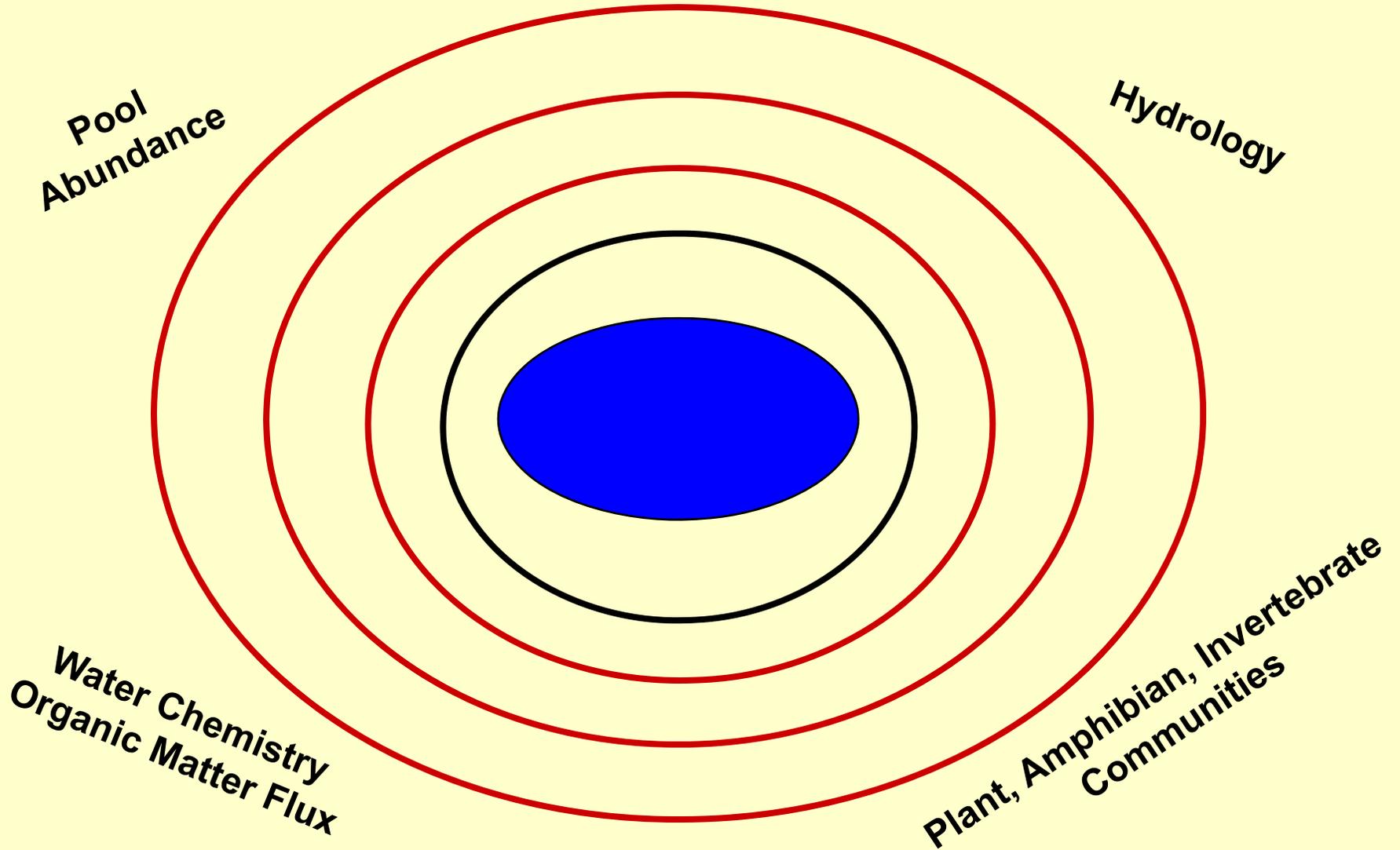
**-LTA (glacial landform)  
is predictive**

**Plant & Invertebrates:  
-Multi-scale predictors: LTA to NPC**

**Tools to predict pond  
abundance and  
characteristics over scales  
relevant to management  
using existing spatial data**



# MULTI-SCALE (Landscape to Local)



## Detritus-based foodwebs

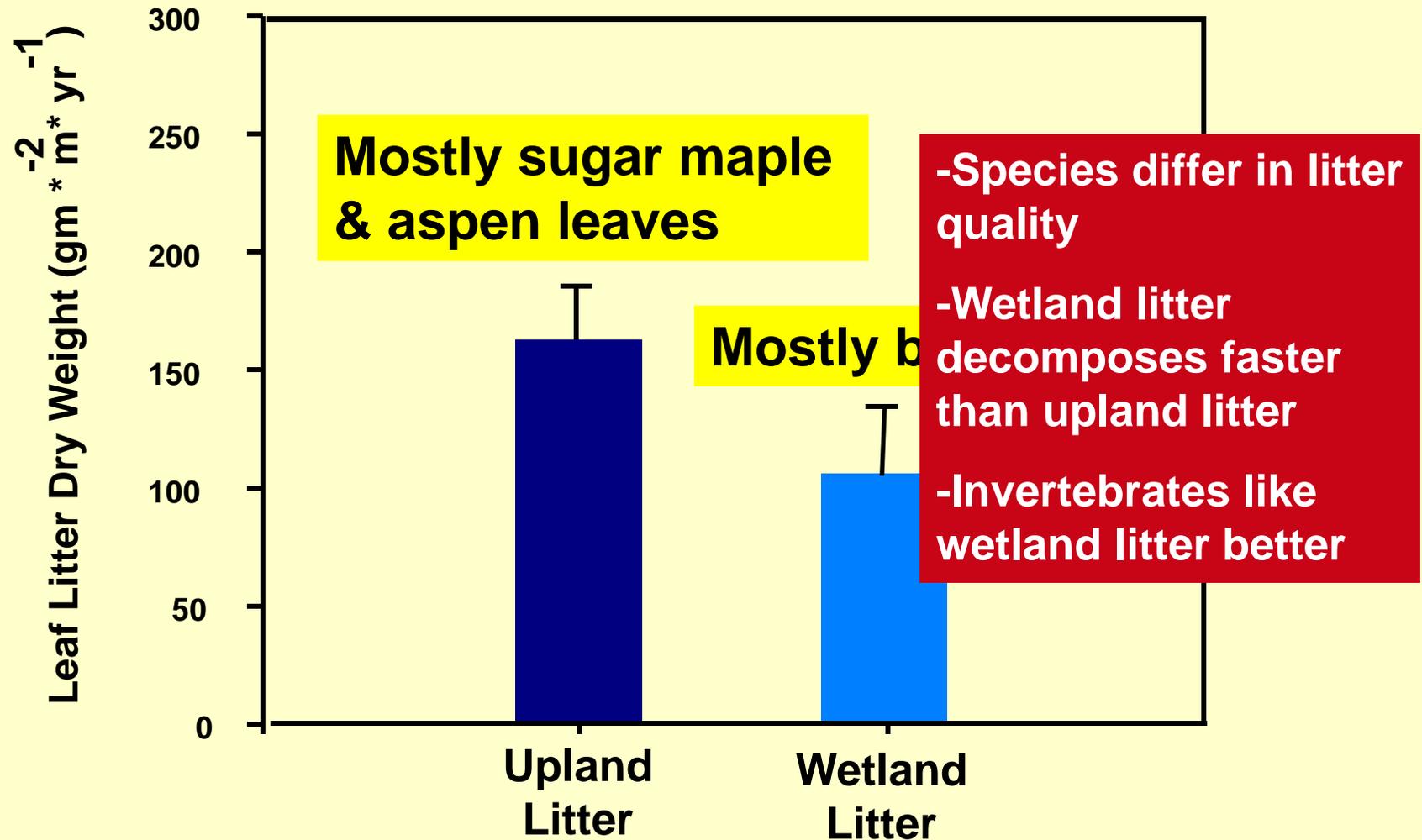


**What is the contribution of upland litter to ponds?**

**Do litter quality differences between upland and wetland species influence decay?**

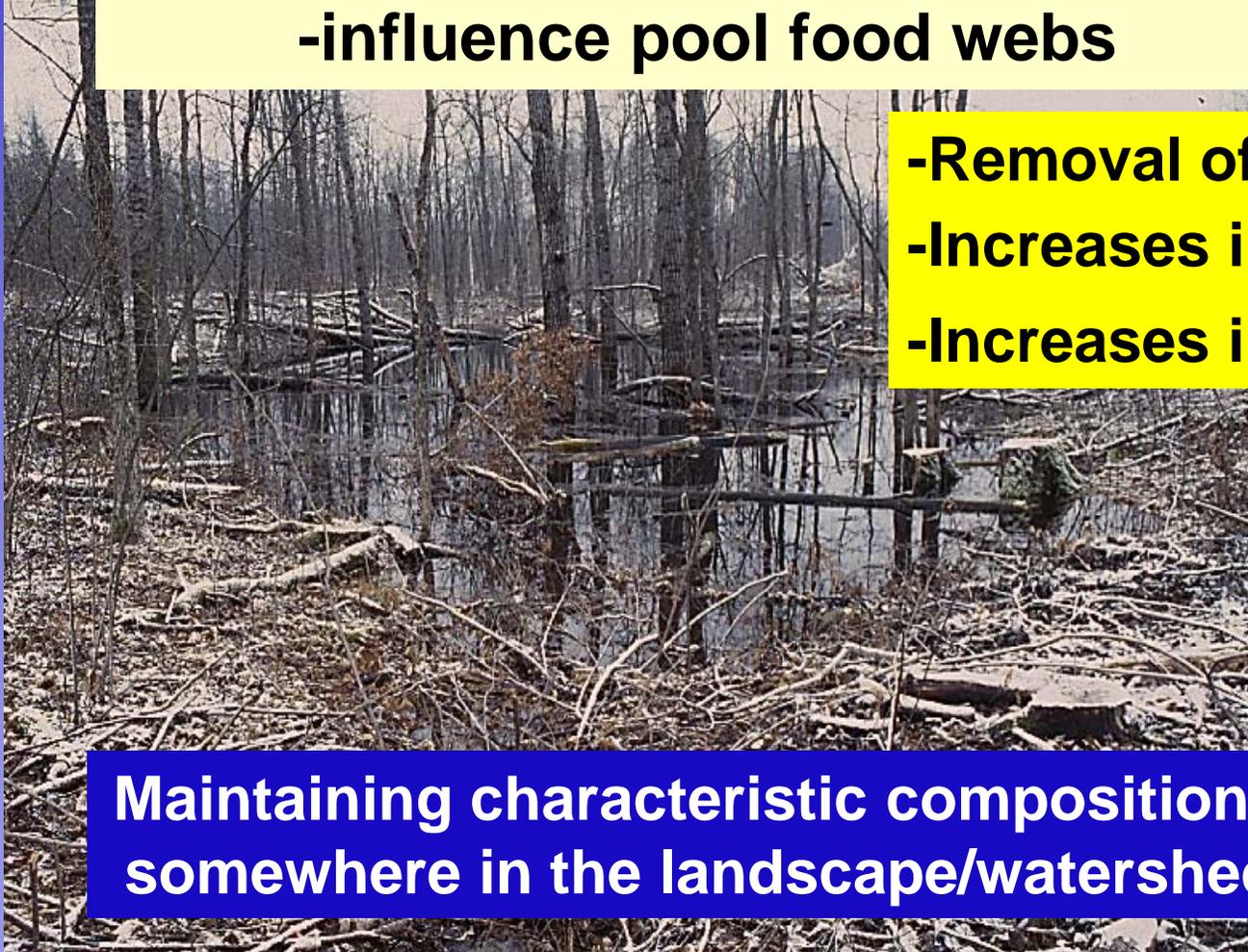
**Do organisms care?**

# Sources of Litter into a Pond



## **Implications: Management disturbance**

- alter forest composition**
- change litter sources and quality**
- change seasonal food availability**
- influence pool food webs**



- Removal of black ash**
- Increases in sugar maple**
- Increases in aspen**

**Maintaining characteristic composition of pond litter somewhere in the landscape/watershed is important**

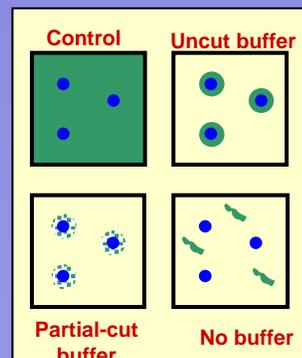
# Seasonal Forest Pond Research at the Northern Research Station-USFS

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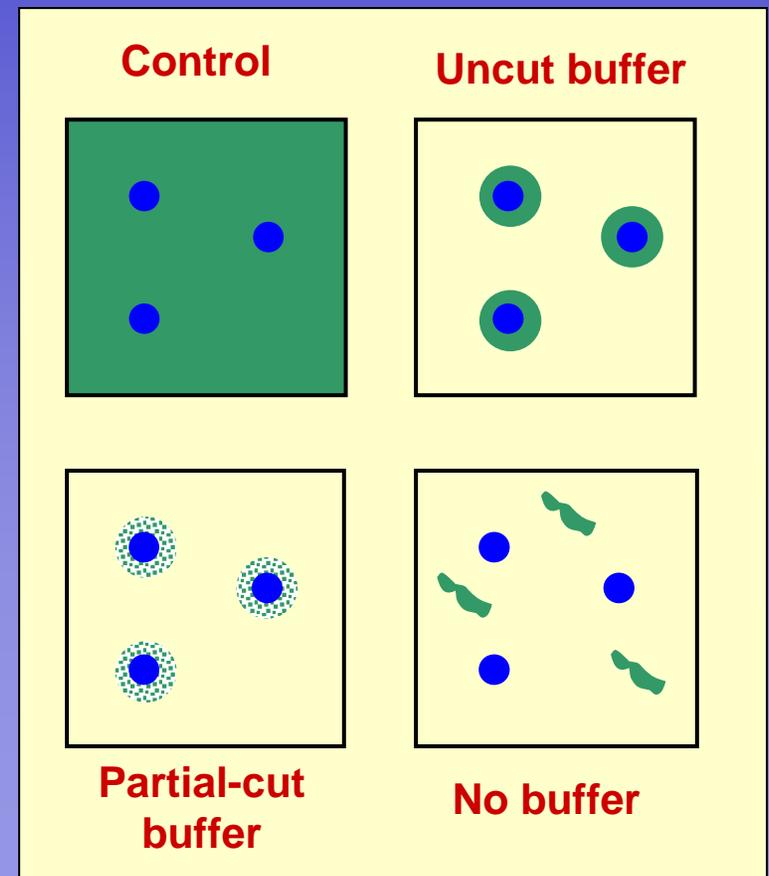


# Seasonal pond buffer experiment

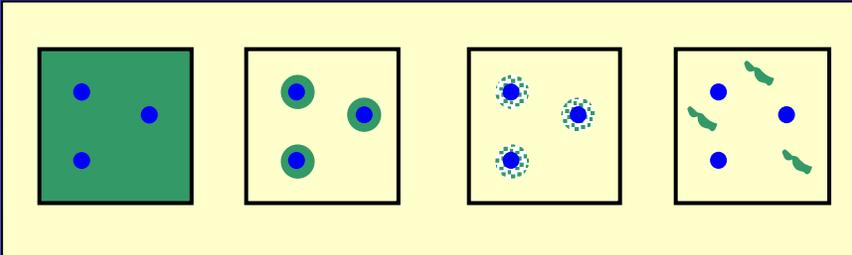


-Evaluation of MFRC guidelines

songbirds, plants,  
invertebrates  
hydrology, CPOM flux



# Seasonal pool buffer experiment: some results

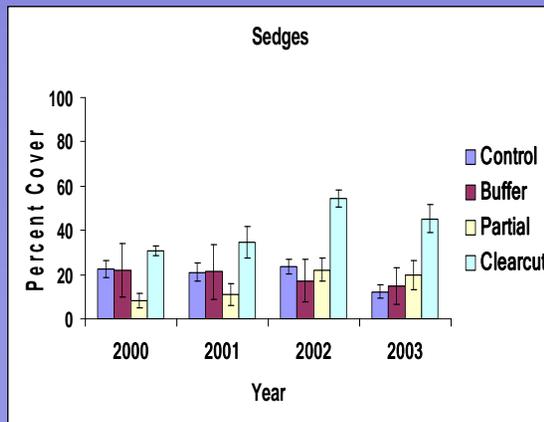


Litter input is reduced

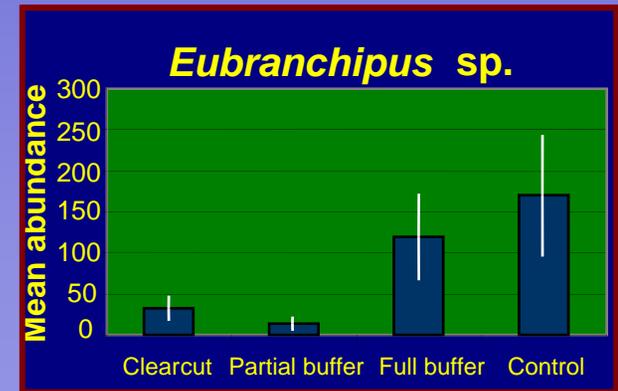
Buffers  
blow down



Sedges increase  
with no buffers

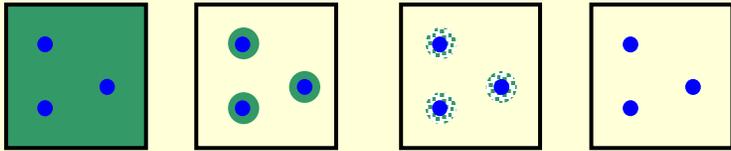


Why?  
Hydrologic  
Alteration?

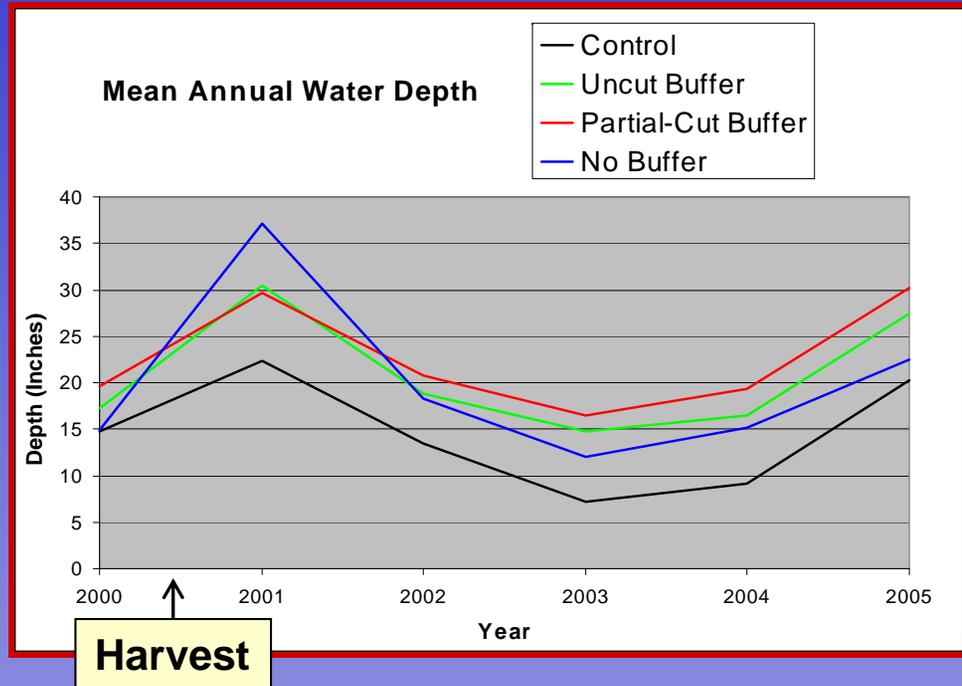


Fairy shrimp  
abundance is altered

# Seasonal pool buffer experiment: *Hydrologic Response*



## Depth increases with removal



Also:

-Hydroperiod >> with removal

-Bioaccumulation of THg and conc. of MeHg >> with hydroperiod (*Brooks et al. Wetlands 2012*)

# Implications

- **A number of characteristics are altered by adjacent forest management in the short term**
- **Many characteristics may recover after harvest of adjacent upland forest (<10yrs)**
- **Cumulative amount of ponds in young forest in landscapes becomes important**
- **Hg bioaccumulation warrants more study**
- **Direct impacts still important (buffering against direct impacts)**

# CONCLUSIONS

- A theoretical framework exist for understanding linkages of seasonal ponds to upland forests at multiple scales (*applied-hierarchical ecosystem classifications*).
- Small size, abundance, and dry phase increase potential for interaction of seasonal ponds with the upland forest.
- Management/conservation strategies for seasonal ponds must account for these linkages; *e.g., threshold levels of ponds within young forest in landscapes*

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