

# Lakeshore Habitat Restoration in the Northern Highlands Ecological Landscape

Wisconsin Lakes Partnership  
April 19, 2018

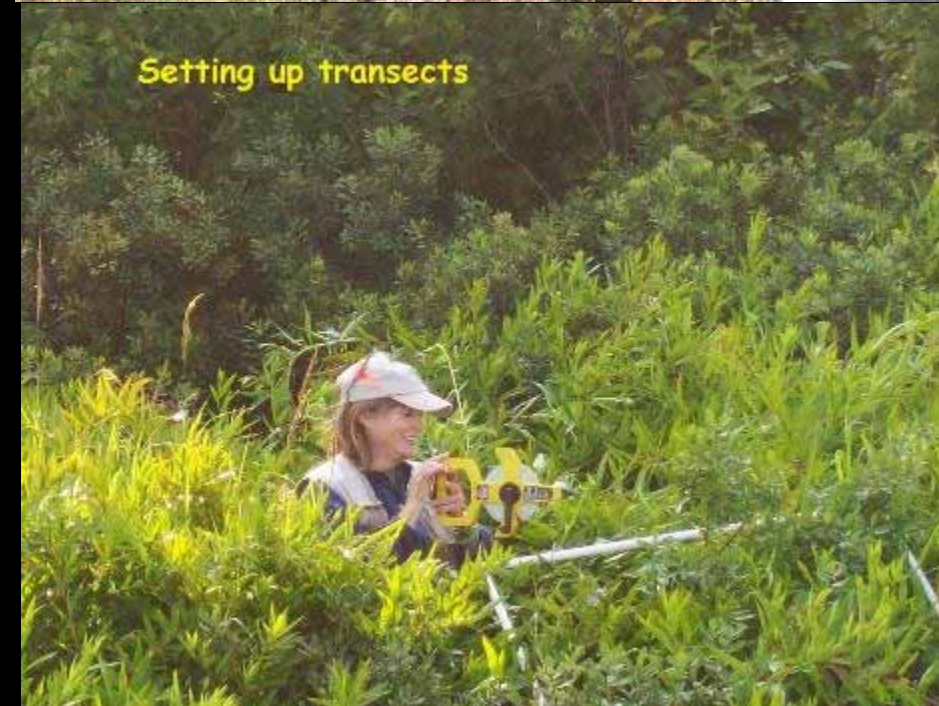


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Setting up transects









# SILENCE OF THE LOONS

Summer is here and the car is loaded: swimsuit, sun-block, junk fiction, fishing tackle. Forget the map—you already know where you're going: All Points North.

To ask why seems needless. Tell a friend you're headed North and they'll understand. We all seek refuge, solace, recreation. To feel the sun after a refreshing dip in any one of 12,400 lakes. To wonder at flowers and eagles and not a few fish. Many of us are reenacting treasured recollections of youthful summers, pungent memories that linger like the sweet aroma of pine. We seek a primal tonic to offset our urbane existence, a calling loon at sunset to remind us what wild is and what wild does and why wild is good.

This is not merely a road trip; it is a pilgrimage.

Problem is, it's also a mass migration. Some Fridays, it seems like every car in the upper Midwest is bolted for some secret North Woods Shangri-la. If you

haven't noticed the bumper-to-bumper traffic, the "FOR SALE" signs and the boomtown persona permeating the North, you really need a vacation. For the last three years, virtually every northern county has watched its tax base soar annually by double digits, a veritable pace car for statewide economic growth. A billion tourist dollars change hands here every year.

Driving north on Highway 51, the first billboard comes 15 miles south of Stevens Point. Two-foot-high blue letters announce WATKINSON PARCELS. That's all, plus a small logo and a toll-free number: 1-800-898-1111.

John Taylor, a Menomonie native, answers the phone. "Business is fantastic," he enthuses. "As well it should be. Four Seasons Realty specializes in buildable waterfront lots, a seller's market. It is unbelievable right now. Within the last five years, the price has just skyrocketed."

PAUL BUNYAN AND HIS MIGHTY AXMEN MERELY RAVAGED THE NORTH WOODS.  
WILL RECREATIONAL SPRAWL KILL IT? BY ERIK NESS

PHOTOGRAPHED BY RICHARD BEAUCHAMP

Erik Ness writes frequently about environmental issues for Milwaukee Magazine.



BRATS-BEER  
AHEAD to NOON  
3 P.M.

On Eagle  
caught  
prunt



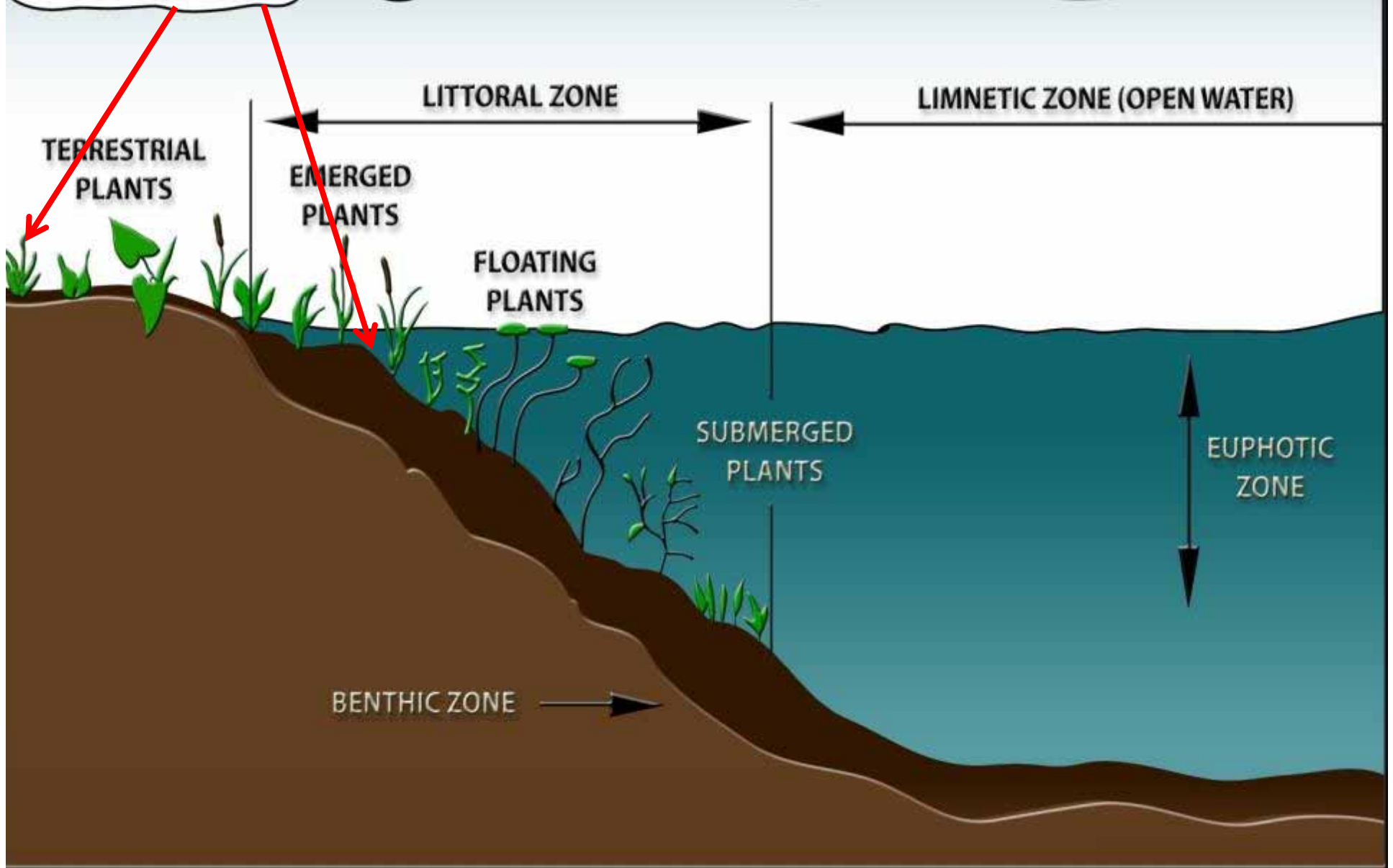


Photo by: D. Haskell





# LAKESHORE HABITAT ZONE





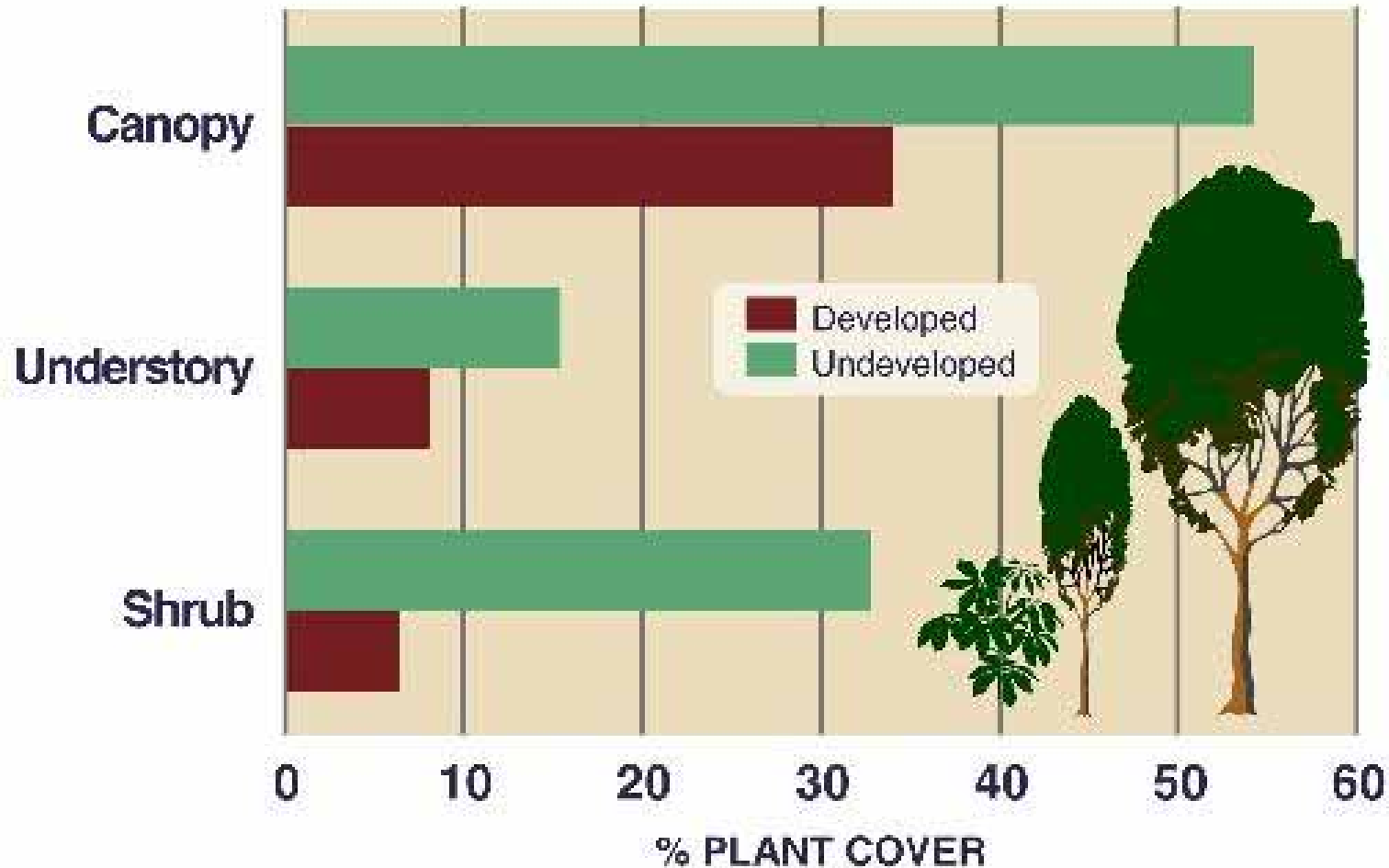
**Research Findings  
(1990s)**

**Current Wisconsin  
Shoreland Management  
Rules (NR 115)  
do not protect critical  
fish and  
wildlife habitat –**

**Shoreline development  
densities  
(52 homes/mile)  
are too high!**



## What has Happened to Shoreland Plants?



# Shoreland green frog trends

From: Woodford, JE and Meyer, MW (2002)  
Biological Conservation. 110(2):277-284.

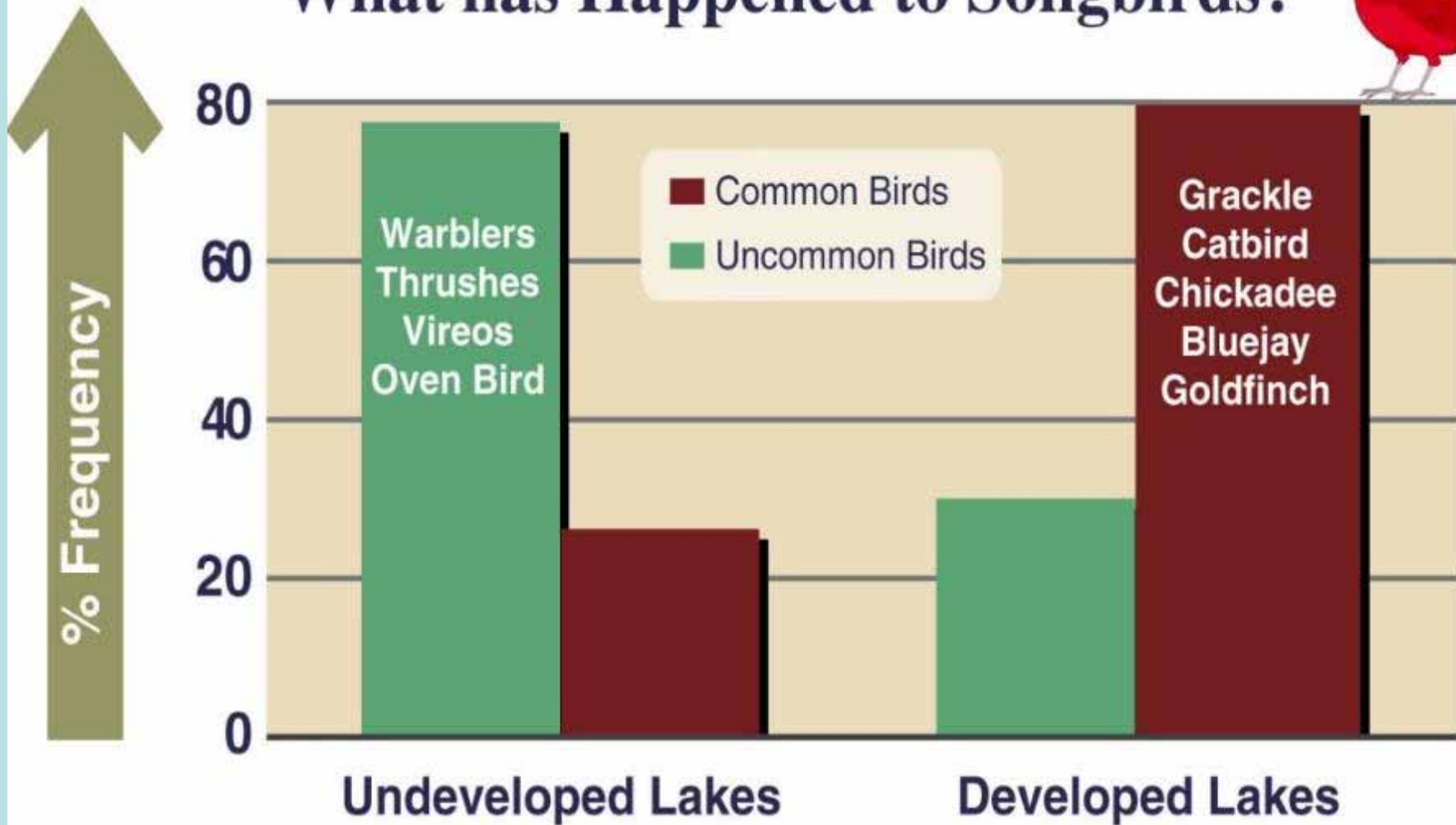




# Shoreland bird trends

From: Lindsay, AR et al. (2002)  
Biological Conservation 107: 1-11.

## What has Happened to Songbirds?



Source: Wisconsin Dept. of Natural Resources

The Wisconsin Lakes Partnership



# Furbearer Abundance and Diversity Lower on Developed Lakes



**From: Relationship between Carnivore Distribution and Landscape Features in the Northern Highlands Ecological Landscape of Wisconsin. Haskell et al. 2012. American Midland Naturalist.**





**Lakeshore Habitat Restoration** uses native trees, shrubs, and groundcover, along with natural and biodegradable materials (biologs, delta-lock bags, sediment logs, soil lifts, woody material), to mitigate development impacts by reducing lakeshore erosion and improving aquatic and wildlife habitat quality from OHWM to >10 meters inland.



# Lakeshore habitat restorations (>2000 meters of shoreland) occurred on 5 developed lakes in Vilas County at which long-term wildlife and habitat monitoring was implemented.





# Measures of Success

**Lakeshore Habitat Restoration will be considered a successful management practice if 10-year post-planting survey results demonstrate:**

- Increased native plant abundance and diversity
- Improved wildlife habitat quality
- Increased wildlife abundance and diversity
- Reduced surface water and nutrient run-off

**Best Management Practices** - Survival and growth of restored native vegetation and erosion control effectiveness is also monitored to develop cost/effective management recommendations in the Northern Highlands







# Five Lakeshores restored and matched with reference lakeshores

## High-Development:

- Found
- Moon
- Lost
- LSG
- Crystal

## Low-Development:

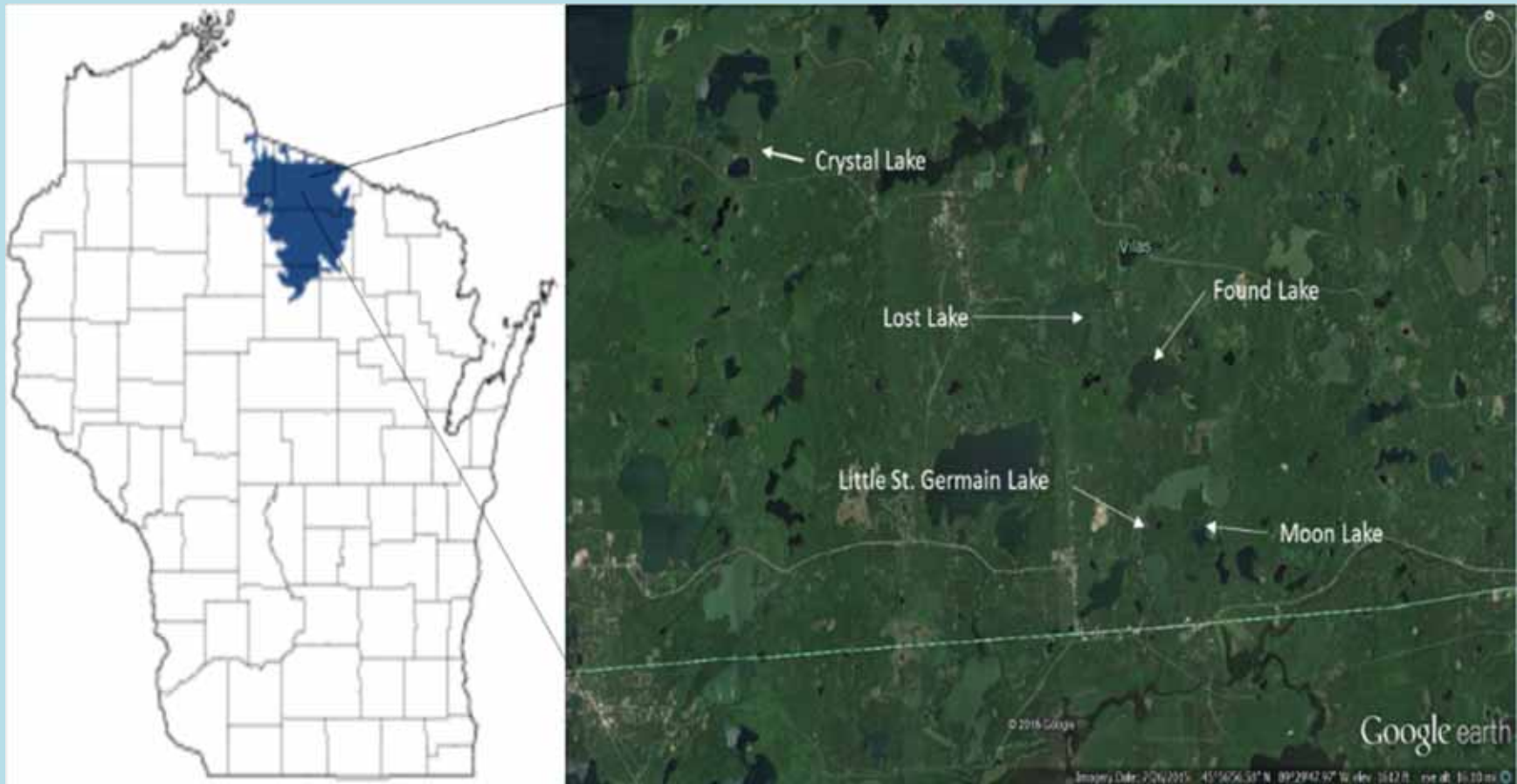
- Escanaba
- Jag
- White Sand
- Star
- Starrett

## Lakes were paired by:

- Surface size
- Water Chemistry
- Lake Type (drainage, seepage, spring)
- Substrate



# Targeted lakeshores for restoration within NHEL

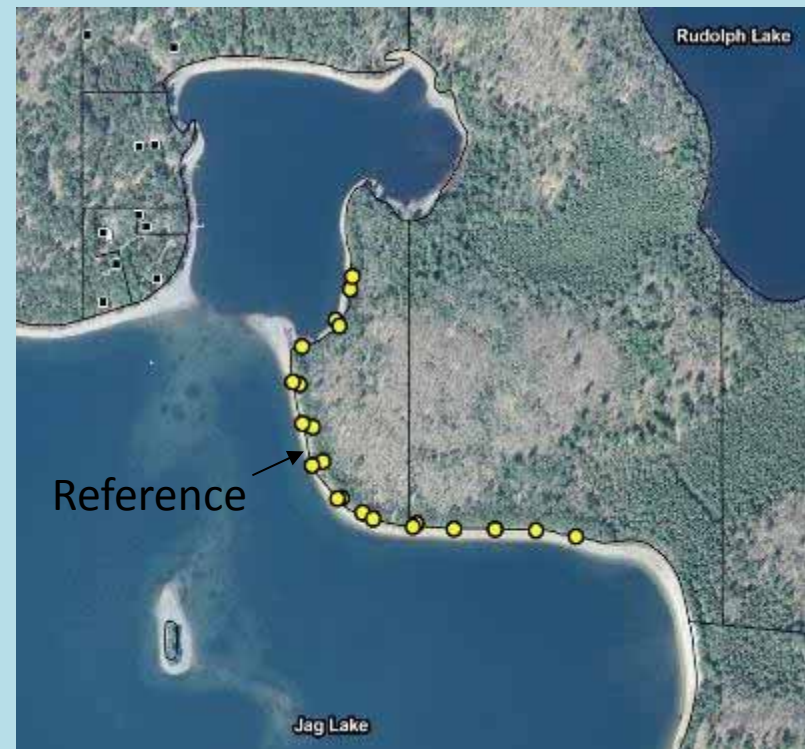


# Vegetation plot location using GIS

Moon Lake  
Control & Restored



Jag Lake  
Reference



Maps created by B. Fevold



# Establishing habitat plots

- Landowners contacted for permission
- 10 x 10 m plots set up adjacent to shoreline for long term monitoring
- Plots approx. 50 m apart
- Data collected concurrently on matched sites



# Restoration Efforts

- 26 private properties on Found, Moon, Lost, LSG Lakes & Crystal (public)
- $\approx$ 40,000 ground cover plants (100 spp.)
- $\approx$ 8,000 shrubs (30 spp.)
- $\approx$ 800 trees (20 spp.)
- $\approx$ 15,000 m of fence (deer enclosure)
- Plant density based on WI-BioTech Note 1



Photos by D. Haskell



## Methods:

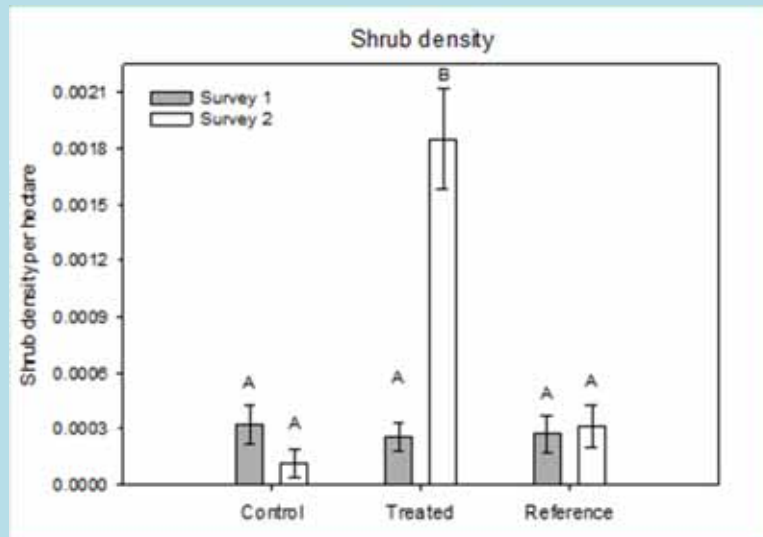
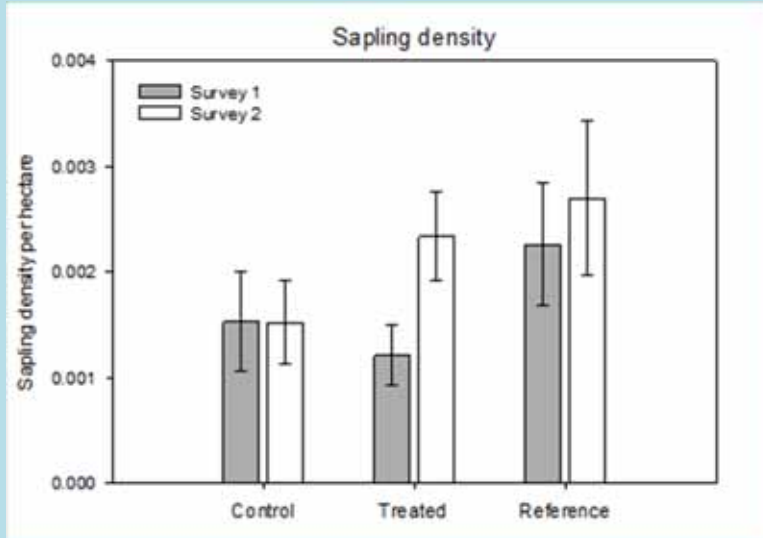
### Habitat measurements made prior & post restoration activities

- Live saplings and shrub  $\geq$  30 cm in height but having  $\leq$  5 cm DBH
- Visual Obstruction Density (VOD) to estimate the percent cover at four different height categories (0-0.3 m, 0.3-1 m, 1-2 m, 2-3 m)
- Woody Habitat (logs & snags)



Photos: D. Haskell

# Results: sapling and shrub stem density increased

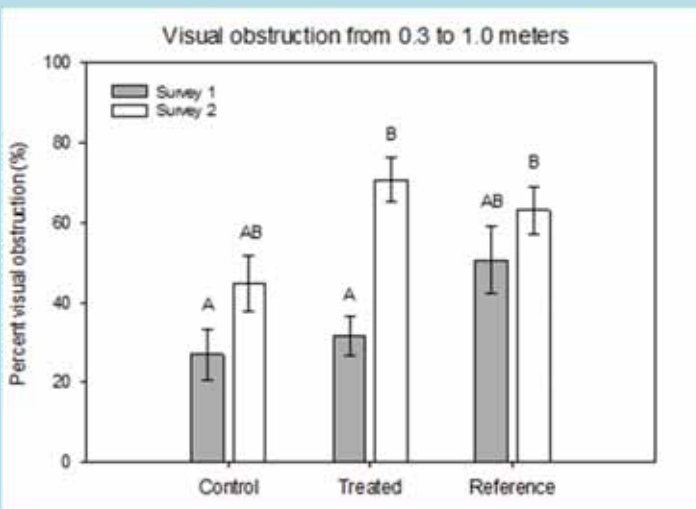
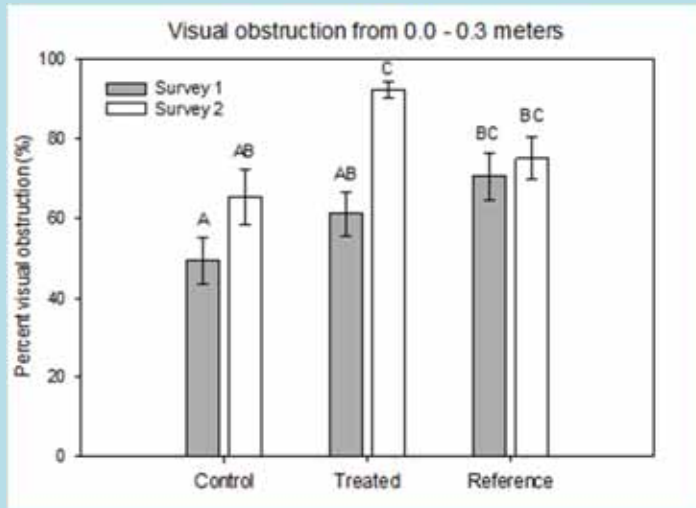


Photos: D. Haskell



# Results:

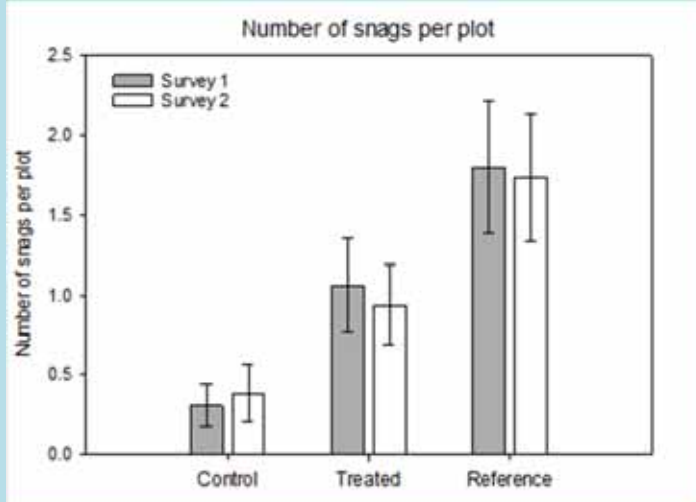
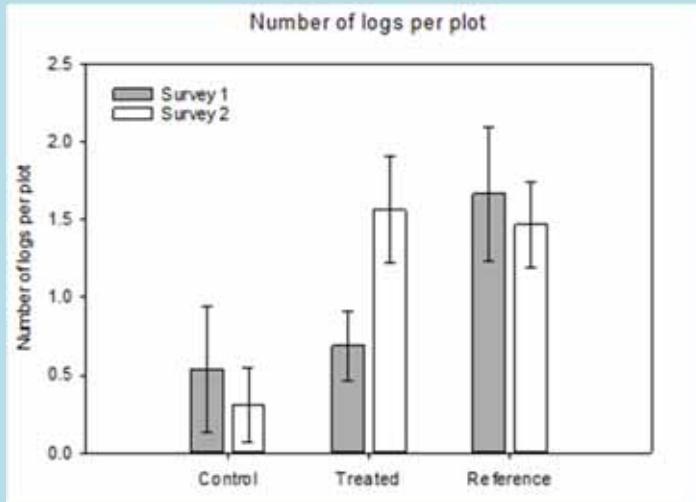
## VOD (0-1m) increased significantly at restored sites



Photos: D.Haskell

# Results:

## Logs increased on restored sites



Photos: D. Haskell



# Summary

- These results suggest that changes in understory habitat conditions associated with restoration treatments may increase the similarity of habitat features for understory dwelling wildlife.
- Large structural changes (tree density, size, and diversity) will require more time, but improving understory conditions and diversity are a requisite first step.

# Recommendations for habitat restoration

- Future restoration consider increasing sapling densities comparable to references sites
- Augmentation of woody habitat
- Long term monitoring of restoration should be part of the restoration plan and strategies to further this goal should be tested.





# Adding Downed Woody Material (DWM) to Lakeshore Restorations

Haskell et al. 2012. Variation in soil temperature, moisture, and plant growth with addition of downed woody material on lakeshore restoration sites. *Restoration Ecology* 20:113-121





# Removal of DWM on Sandy Soils



Photo by: D. Kloefer



# Woody Material Test Plots

25% DWM Coverage



0% DWM Coverage



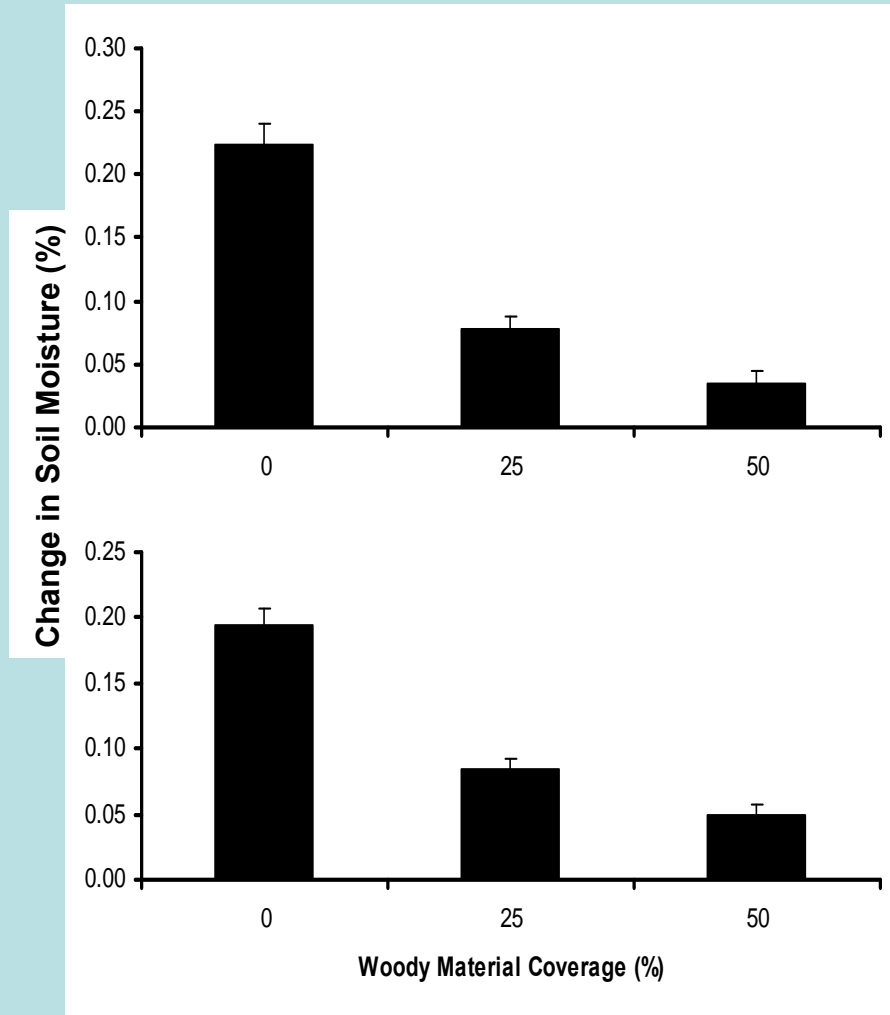
50% DWM Coverage



Photos by Dan Haskell

# Soil Moisture Results

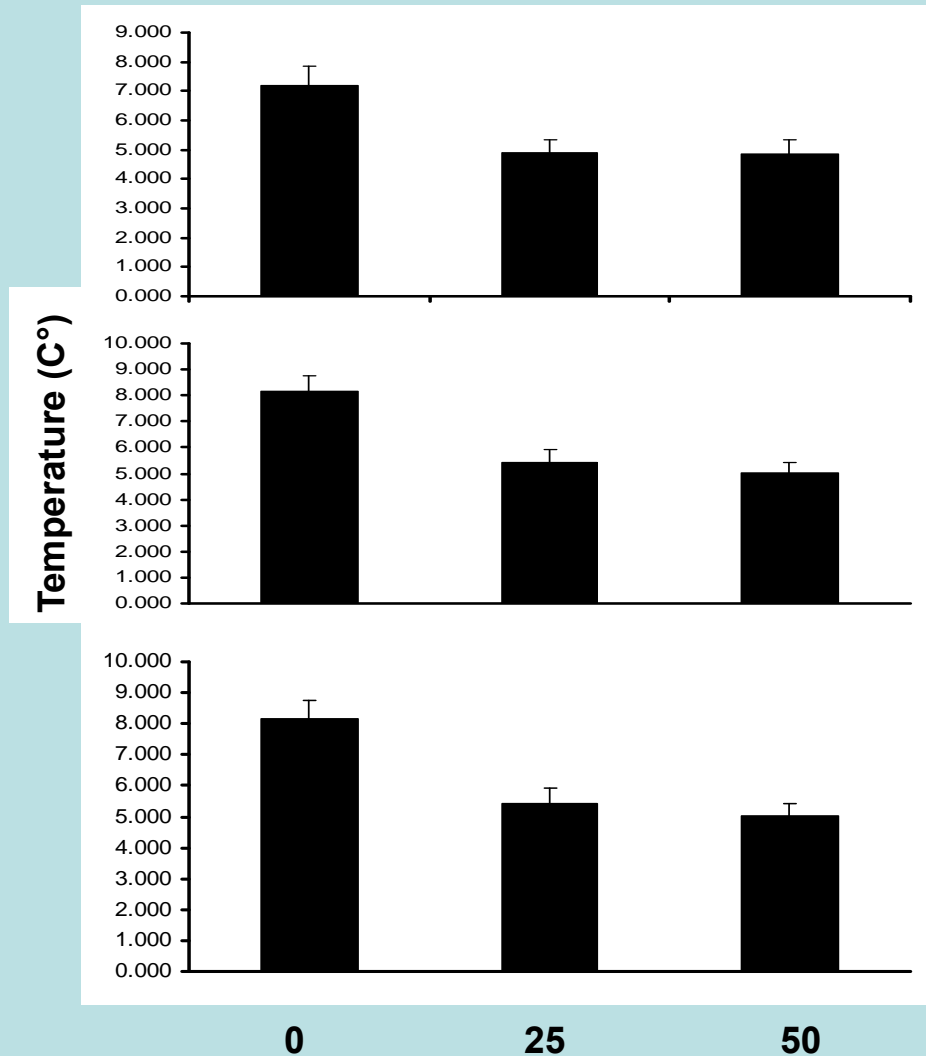
- **July:**  $n = 25$ /treatment
- 0% DWM plots had higher % change in moisture.
- ( $P = <0.001$ )
  
- **August:**  $n = 34$ /treatment
- 0% DWM plots had higher % change in moisture.
- ( $P = <0.001$ )





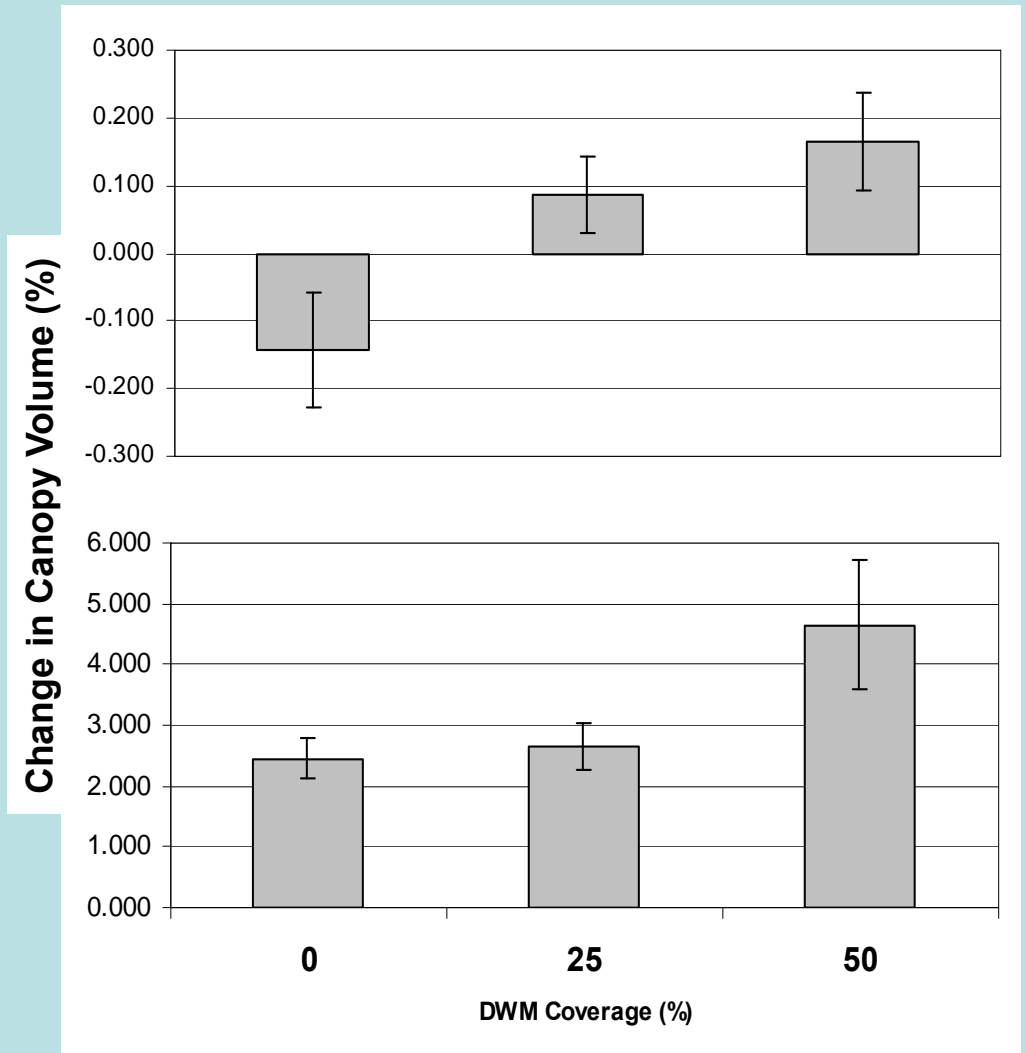
# Difference Between High & Low Soil Temp

- **June:** 0% DWM plots had a greater difference in temp. ( $P = 0.005$ )
- **July:** 0% DWM plots had a greater difference in temp. ( $P = <0.001$ )
- **August:** 0% DWM plots had a greater difference in temp. ( $P = <0.001$ )



# Shrub Change in Canopy Volume (%)

- **Snowberry** (*Symphoricarpos albus*):
  - negative growth in 0% DWM ( $P = 0.015$ )
- **Sweet Fern** (*Comptonia peregrine*):
  - no significant difference ( $P = 0.264$ )





# Discussion DWM

- DWM lessened daily variation in soil temp and moisture
- DWM can improve growth of plants
- The addition of DWM should be considered in restoration project
- May take decades for DWM to occur naturally on human altered sites
- **WOOD IS GOOD**



# Gravel Culture vs. Potted Shrubs & Trees



**Gravel Culture Shrubs & Trees**



**Potted Shrubs & Trees**



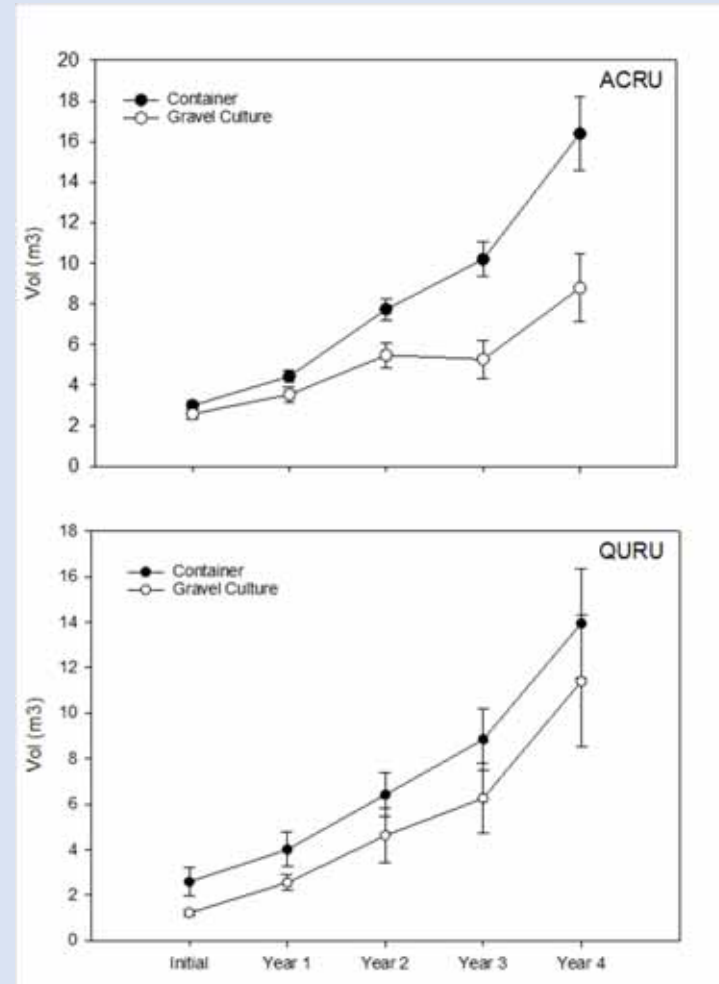
# Tree and Shrub comparison study > bare root gravel culture plants versus 3-5 gallon containers



- Bare root is grown in an experimental gravel culture medium that is well-watered
- Paired with container stock of same species
- Planted in same shoreland area
- Marked/tagged for long-term monitoring
- Pairs were followed 4-5 years for growth rates and survival
- Will gravel culture materials be a more cost effective source for plantings with similar results as containerized plants?

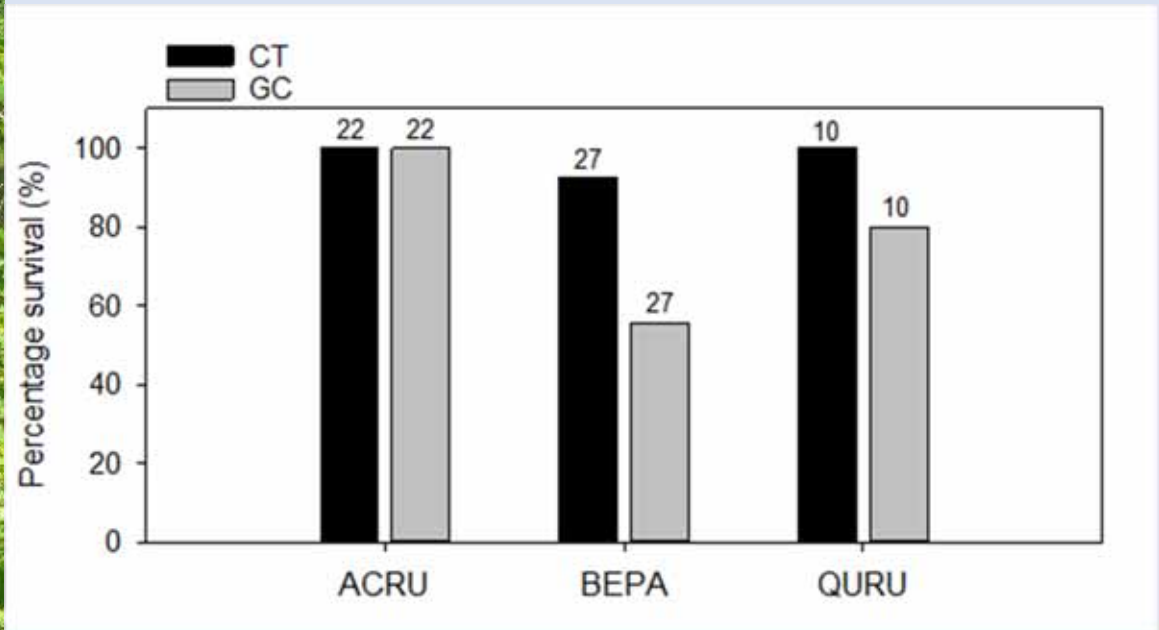
# Results: Hardwood GC vs CT Growth Rates

Haskell et al. In press. Restoring hardwood trees to lake riparian areas using three planting treatments. Restoration Ecology (accepted Feb.21, 2017)





# Results: Hardwood GC vs CT Survival



Survival of GC Hardwoods after four years

# Gravel Culture Results

- *Gravel Culture shrub species: Red-osier dogwood and ninebark initially grew at a rate similar to containers. However removing the deer fence year 3 had a big affect on this component of the project.*
- *Conifer trees species: White spruce, white pine were equal in growth and survival compared to container. White cedar had positive growth but slower than container, survival was equal to container, but was heavily browsed.*
- *Northern red oak showed equal growth rates compared to container, red maple and paper birch showed positive growth over time but slower than container.*
- ***Gravel Culture Stock is a cost-effective alternative to container stock for many tree and shrub species used in lakeshore habitat restoration in the Northern Highlands – with the exception of red pine and snowberry.***



# Evaluation of Active vs. Passive Lakeshore Habitat Restoration: Crystal Lake Campground



# Why Mow? Let it Grow!

A "no-mow" approach can be a great way to restore the shoreland. "No-mow" saves time, effort, and money. Native plants often grow in wet or shady areas. When mowing stops, native habitat returns.



Non-native plants can invade disturbed areas. They rob native plants of nutrients and light. Planting natives reduces the chance of invasion. "No-mow" areas should be monitored for invasive plants.



## Other options:

"No-mow" is just one way to restore the shoreland. Some areas, such as thick lawns, require a little more preparation. Black plastic can act like an oven, burning out the existing grass. In some cases, an aquatic-safe herbicide is needed. Seeding or planting native species may quicken your results.



## Did you know...

80% of the plants and animals on the Endangered Species List live all or part of their lives near the shore. (NOAA)





# “Passive Restoration” With Fence and Irrigation



**Before**



**After**



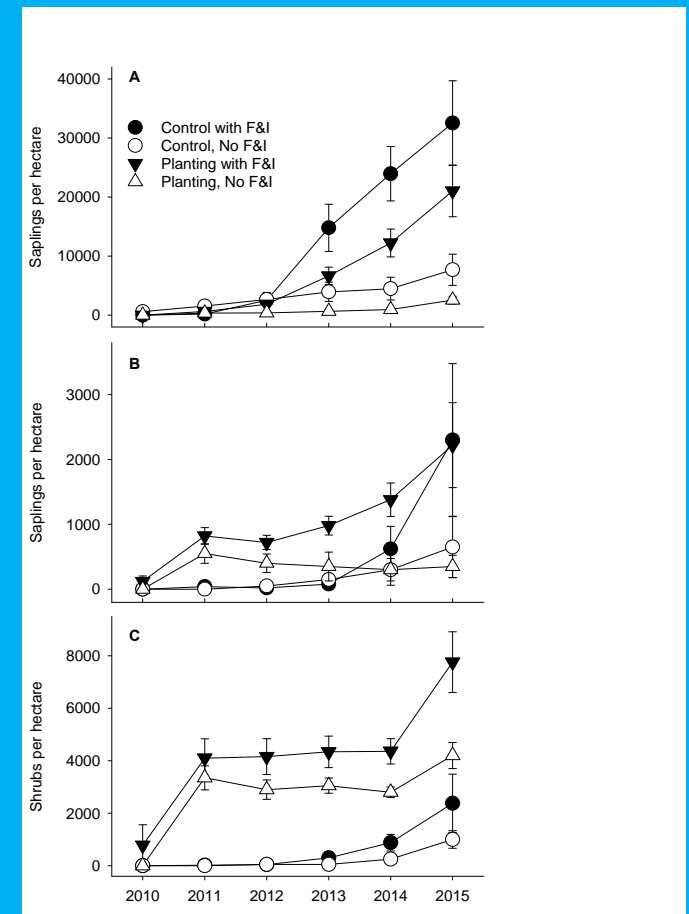
# “Active Restoration” with Fence & Irrigation





# Crystal Lake Results

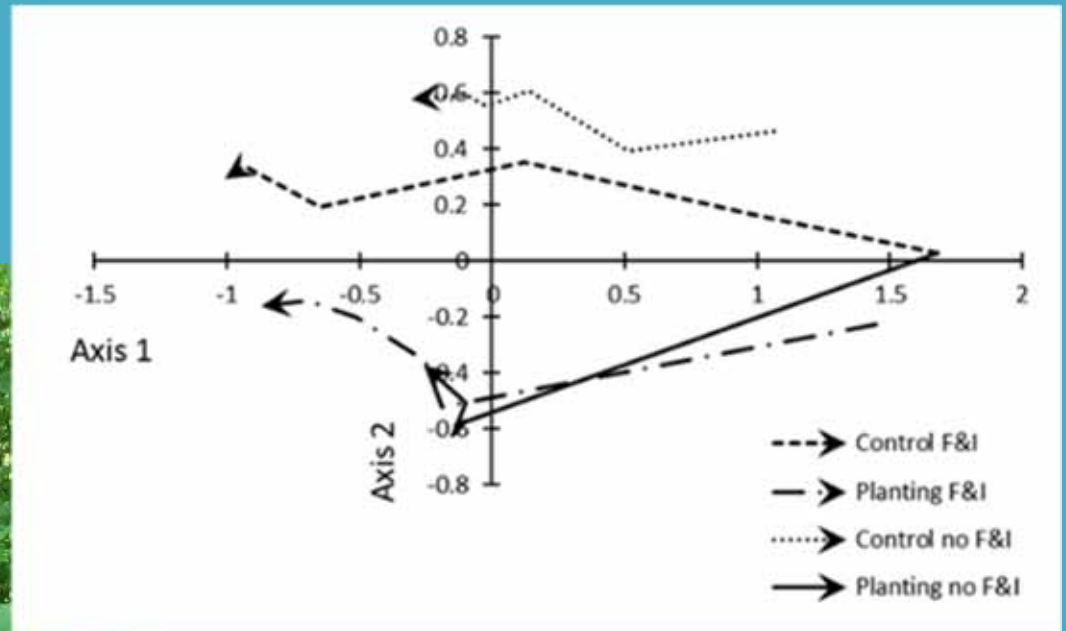
- If Seed Bank present a “natural recovery” can be efficient
- If a shrub component is desired than “active restoration” may be needed
- Irrigation & Fence should be used



**Preliminary ordination analysis shows both passive and active restoration result in similar lakeshore habitat improvement over time - provided presence of a viable seed bank, deer fencing, and irrigation.**



Photos by D. Haskell





# Bioengineering Techniques For Erosion Control

- Biologs
- EnviroLok Bags™
- Coconut Erosion Mat
- Sediment Logs
- Tree Drops
- Water Retention Ponds (Rain Gardens)

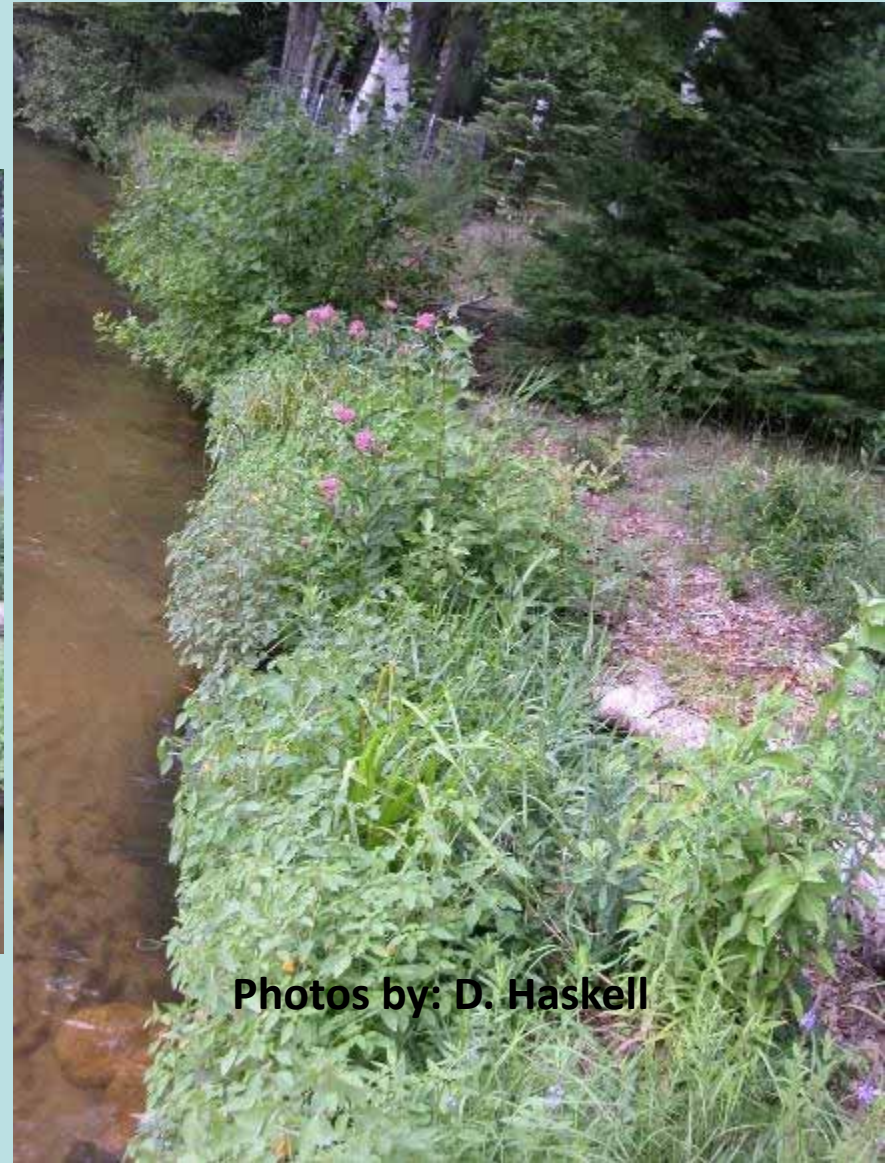
# Installation of Bio-Logs



Photos by: D. Haskell



# Bio-logs One Year Later



Photos by: D. Haskell



## Erosion control method > biologs / Enviro-lok® bags





# EnviroLok™ Bags



Photos A & B: before EnviroLok™ bags were installed.  
Photos C & D: after EnviroLok™ were installed on Moon Beach during the spring and summer of 2009.



# EnviroLok™ Bags 2011





# Before EnviroLok™ Bags



Photo by D. Haskell



# After EnviroLok™ Bags



Photo by D. Haskell



# Erosion Before

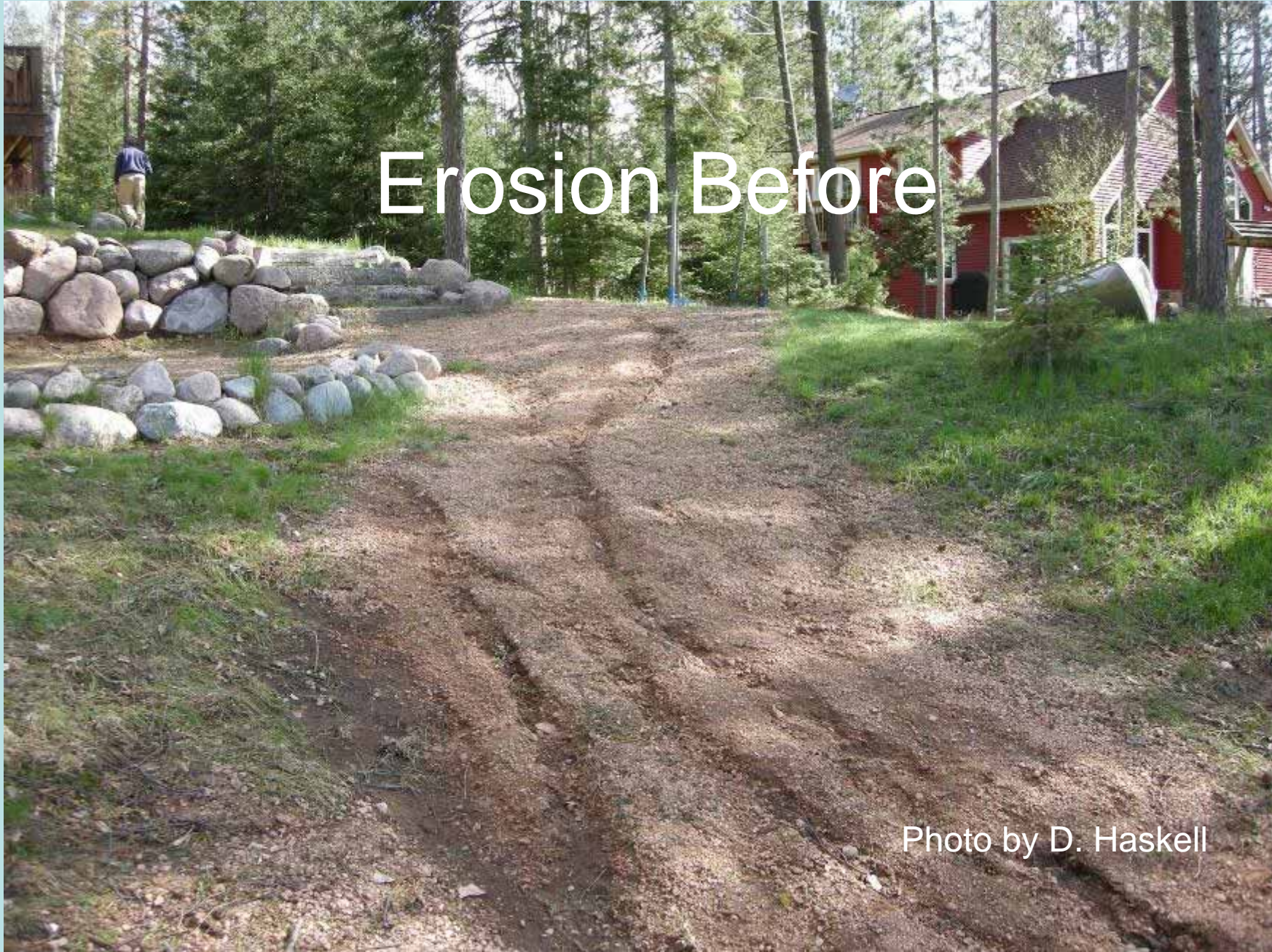


Photo by D. Haskell



# Erosion After













# Wisconsin Lakeshore Restoration Project Conclusion

- Restoration increases habitat structure
- The addition of DWM positively influence plants
- Gravel Culture plants can be used in restoration projects
- Natural recovery can be a cost effective alternative
- Bioengineering reduces erosion
- Bridges gap between property owners and agency personnel
- Provides ecological and aesthetic value

# Lessons learned > deer/rabbit browse protection - fencing & repellents

Protection of plants for 3-5 years with temporary fencing and repellents is essential to establishment of the native plantings





# Lessons learned > plantings and watering

- Drought conditions through most of first season and part of the 2<sup>nd</sup> year as well
- Some difficulty with access to water—had to pump from lake which made it more costly and time intensive
- The amount of time and resources needed to have adequate watering take place was underestimated
- Difficult site conditions—harsh exposure, 'sugar' sand soil, steep slopes (up to 45°)



# Lessons learned > costs

- Preliminary cost breakdowns are between ~\$50 and \$100 per linear foot of restored buffer back 35-feet
- Costs in part dependent on the amount of involvement from landowners, staff labor support, who does the design work, erosion control installation, plantings, fence building, and watering regime over time
- Fencing and erosion control techniques can be costly and logistically challenging
- County cost-share programs and WDNR Lake Grant Program (lake protection/Healthy Lakes) can assist





## Lessons learned > landowners

- Written agreements, photographs, and detailed property maps are key tools
- Landowner maintenance of projects are vital to restoration success over the long-term
- Finding willing landowners to participate in the lakeshore restoration process is a continuing issue
- “Trusted neighbors” are effective local champions of lakeshore restoration projects.





## Lessons learned > working with nurseries & contractors

Having a nearby source of native trees, shrubs and groundcover that will tolerate tough conditions (hot, dry, sugar sand, shade, browsers) is critical. Select native plant species that are proven work horses, namely sedges, grasses, and rushes.





# Shoreland numbers for Wisconsin

- 47,162,014 meters of shoreline on our inland lakes  
(data from WDNR Hydro IV database on 1:24,000 sources)  
or over 29,304 miles

- Shoreland restoration needs to be an available option for any Wisconsin landowner willing to give it a try



**Private sector partners are now ready to offer solutions to neighbors with lakeshore habitat restoration needs in the Northern Highlands.**







## Acknowledgements

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# Questions?



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NOVA Ecological  
Services



Wisconsin Department of  
Agriculture, Trade and Consumer Protection

