Quantifying the Ecological Benefits of Lakeshore Restoration in Wisconsin

Vilas County Projects 2007-2020

Partners:
Michigan Technological University
Vilas County LWCD
WDATCP
WDNR Science Services & Forestry
Hanson's Garden Village
North Lakeland Discover Center
Found Lake Property Owners Association
Moon Beach Camp United Church of Christ
Lost Lake Residents
LSG Lake District & Residents

Photo by: D. Haskell

Acknowledgements

Research Scientist: Dan Haskell, Michigan Technological University
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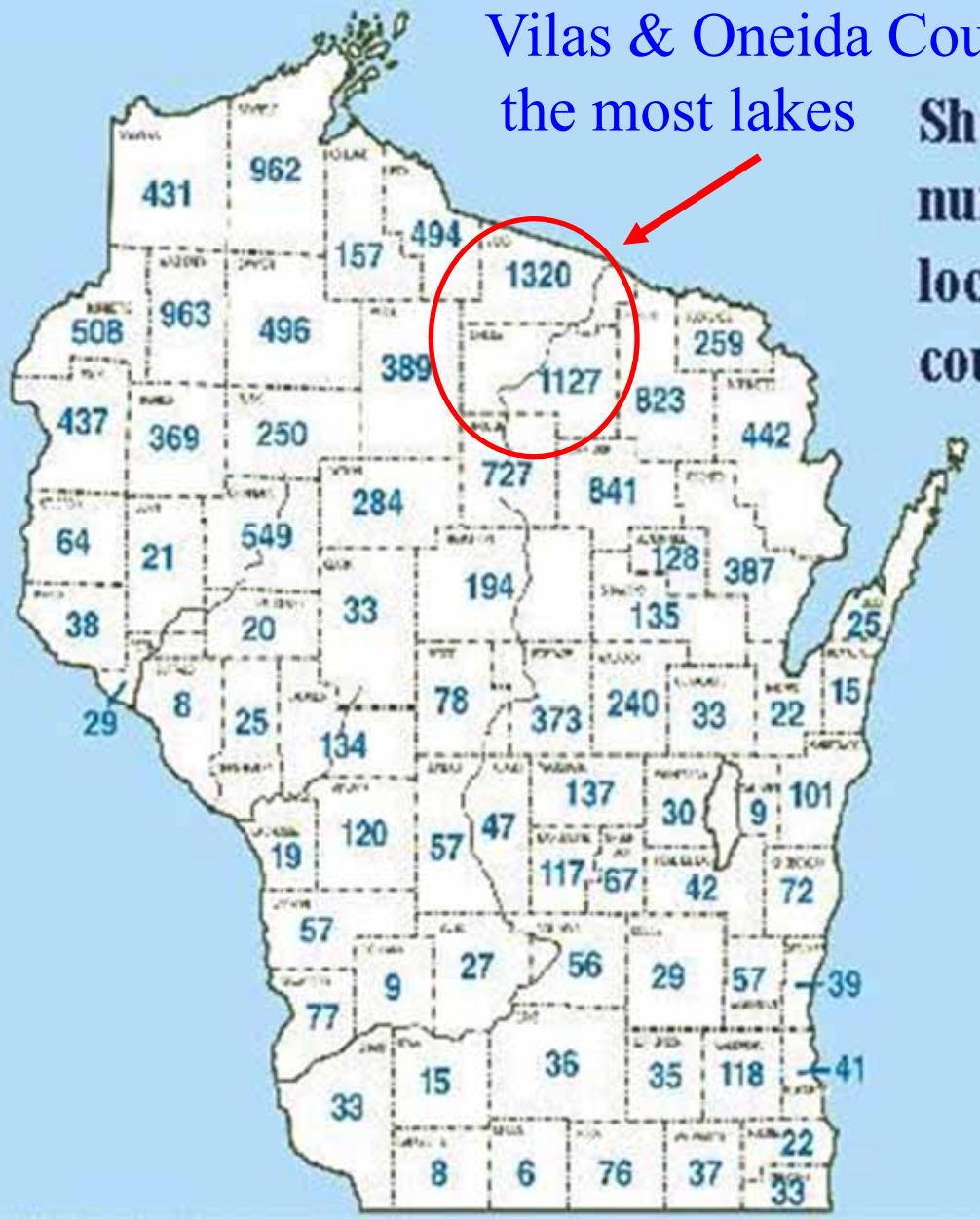
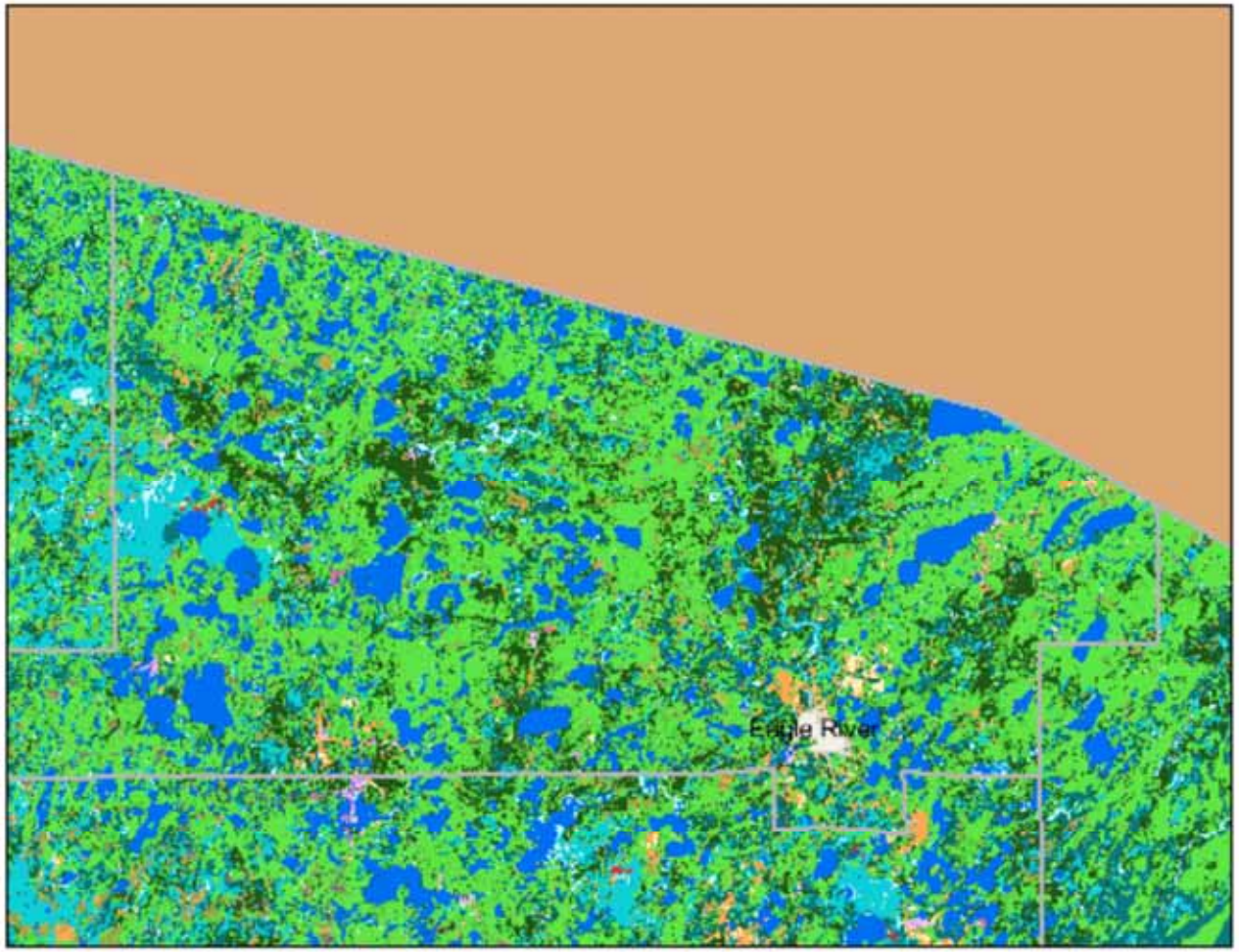
MTU Faculty: D. Flaspohler, C. Webster, J. Vucetich, C. Huckins
North Lakeland Discover Center Bird Club
Professional Support: B. Hanson, P. Goggin, C. Scholl, M. Wagner, S. Dehne, T. Daulton, J. Wilson,
Field Staff: D. Drekich, C. Mehls, D. McGary, T. Armstrong, M, Pytleski, A. Komar, M. Ferge. J. Links, E. Delcamp, M. Boehmeer, E. Bowen, Quita McSheehan, G. Milanoski
Data Management: B. Fevold
GIS: M. Woodford, B. Fevold
MTU Graduate & Undergraduate Students
The Residents of Found, Lost, Moon, LSG Lakes
UW-Trout & Kemp Research Stations
WDNR Forestry – Northern Highlands/American Legion SF

Wisconsin lakes by county



Vilas Landcover



Legend

- 24K County Boundaries
- Cities and Villages
- Village
- City
- WISCLAND Landcover
- High Intensity Urban
- Low Intensity Urban
- Golf Course
- General Agriculture
- Cranberry Bog
- Grassland
- Coniferous Forest
- Mixed-Wood Deciduous Forest
- Mixed Deciduous-Coniferous Forest
- Open Water
- Emergent-Wet Meadow Wetland
- Lowland Shrub Wetland
- Forested Wetland
- Barren
- Shrubland
- Cloud Cover
- Other

0 9 18 27 mi.

Scale: 1:487,150

Notes: Vilas County Landcover

Congratulations St. Germain

Elbert's Resort
AND CONDOS

St. Germain's Favorite Vacation Spot on Little St. Germain Lake

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St. Germain, WI 54558

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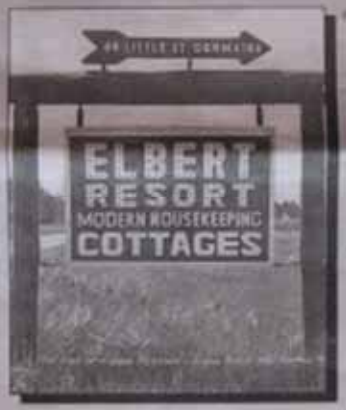


All pictures circa 1944

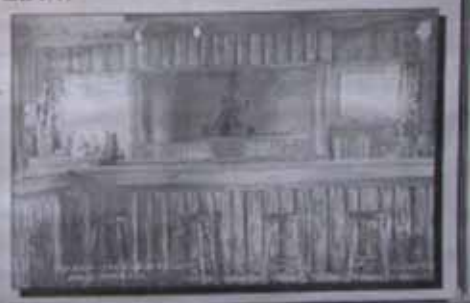
Tom & Katie's Place

At Elbert's Resort
1056 Elbert Rd. #20
St. Germain, WI 54558
(715) 479-1567

Tom & Katie Fowler
Owners

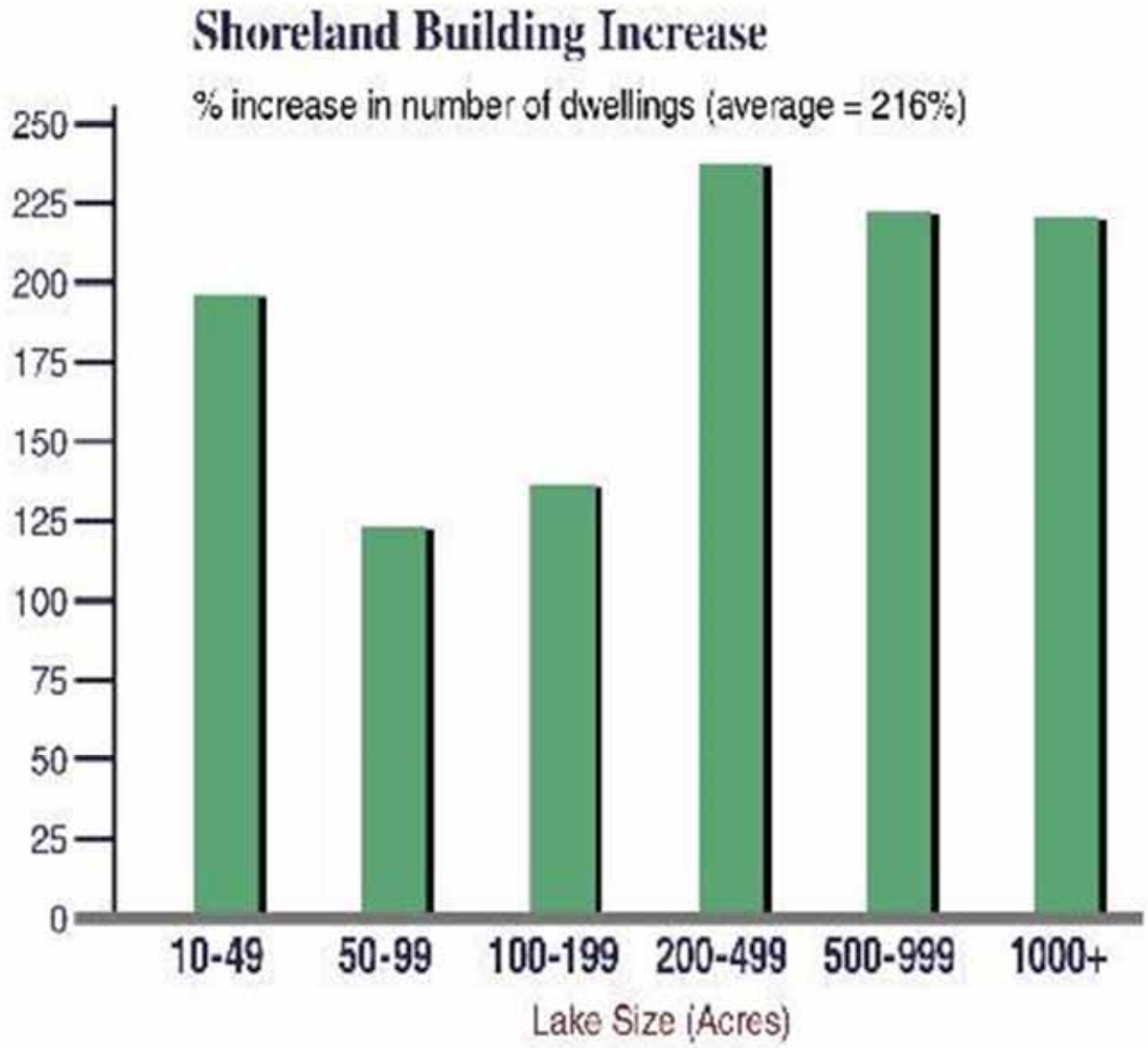
A favorite pit stop on the Bi-State Trail. Located on the West Bay of Little St. Germain Lake

Tom and Katie Fowler welcome you to their friendly fun bar. Serving pizza and sandwiches. Some room and daily drink specials. Open all year around. Accessible by car, boat or snowmobile.



Intense human use of Vilas Co. lakes has occurred during <1% of lakes' existence – however measured change is dramatic!

Shoreland building increase, 1965-1995

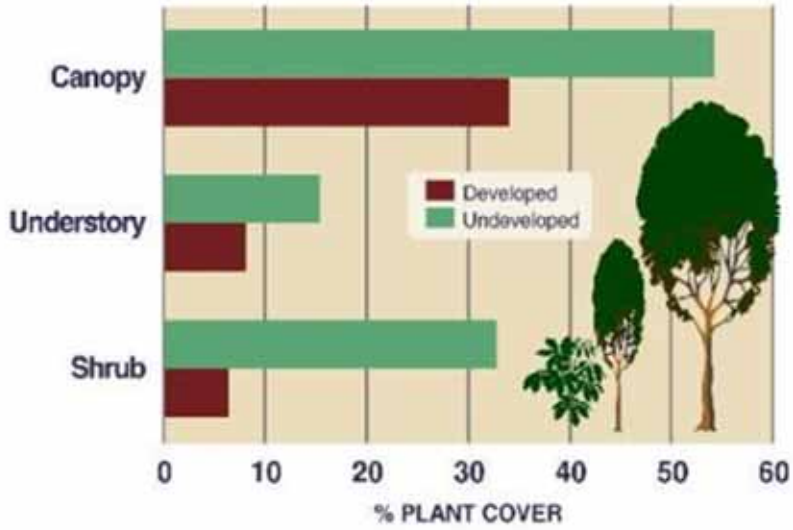


Research Findings (1990s)
Current Wisconsin Shoreland Management Rules (NR 115)
do not protect critical fish and wildlife habitat –

<u>Shoreline development densities (52 homes/mile) are too high!</u>

Shoreland plants trends

What has Happened to Shoreland Plants?



Source: Wisconsin Dept. of Natural Resources

The Wisconsin Lakes Partnership

From: Elias, JE and Meyer, MW (2003) Wetlands 23: 800-816.

b) SHORELINE	Mean % Shoreline (2SE) Undeveloped	Developed
Trees**	38.8 (6.77)	29.5 (6.15)
Shrubs***	66.7 (6.98)	28.0 (6.62)

c) AQUATIC	Mean % Cover (2SE) Undeveloped	Developed
Floating**	15.7 (5.50)	5.8 (2.54)
Shrub	1.8 (2.34)	0.4 (0.50)
Narrow-leaved emergent	1.2 (1.17)	1.4 (1.14)
Broad-leaved emergent	0.9 (0.71)	1.6 (1.21)
Submergent	14.0 (5.85)	3.9 (2.21)
Isoetid	1.7 (1.16)	0.8 (0.81)
Unvegetated***	65.0 (7.48)	85.5 (3.73)

Table 1. Mean percent cover of vegetation and percent coniferous component and 2 standard errors (2SE) in structural layers in the upland (a), mean percent and 2 standard errors (2SE) of shoreline covered by overhanging trees and shrubs (b), and mean percent cover and 2 standard errors (2SE) of aquatic vegetation types (c) at undeveloped (reference) and developed sites, Vilas and Oneida Counties, Wisconsin, 1997. '**' and '***' indicate significance at $p < 0.01$ and $p < 0.001$, respectively, Mann-Whitney U tests.

a) UPLAND	Mean % Cover (2SE) (N = 84) Undeveloped	(N = 97) Developed
Canopy***	55.4 (5.30)	40.1 (4.94)
Subcanopy***	22.0 (3.93)	12.1 (2.60)
Understory***	34.5 (5.41)	17.4 (4.13)
Ground	66.4 (6.28)	63.0 (5.96)
	Mean % Coniferous Component	

Table 2. Percent of undeveloped and developed sites showing relative amount of coarse woody debris in upland, shoreline, and shallow water transects, Vilas and Oneida Counties, Wisconsin, 1997. '***' indicates $p < 0.001$ for the chi-square test of independence.

	% Transects With Coarse Woody Debris None	Sparse	Abundant
Upland***			
Undeveloped	1.2	24.1	74.7
Developed	60.0	29.5	10.5
Shoreline***			
Undeveloped	1.2	32.1	66.7
Developed	54.2	31.2	14.6
Shallow water***			
Undeveloped	7.6	26.6	65.8
Developed	58.3	24.0	17.7

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

Table 2
A comparison of lake attributes (physical characteristics), house and cottage density, green frog abundance, habitat fragmentation, and amphibian species richness among 12 developed and 12 undeveloped lakes in northern Wisconsin

	Developed lakes ($n=12$)	Undeveloped lakes ($n=12$)	Paired t-test ($t=$)	P-value
Lake area (ha)	46.7 (range = 11.2–160.0)	46.5 (range = 6.4–144.8)	0.09	NS
PH	6.8 (range = 5.3–7.8)	6.8 (range = 5.7–7.5)	0.21	NS
Alkalinity (ppm)	11.5 (range = 1.0–48.0)	13.1 (range = 1.0–57.0)	0.08	NS
Total shoreline perimeter sampled (km)	43.3	44.9	0.51	NS
House or cottage density (per 100 m of shoreline)	1.3 (0.48)	0.179(0.24)	8.56	<0.001
Green frog population (per 100 m of shoreline)	1.02 (1.66)	2.3 (2.06)	2.77	0.02
Suitable habitat (%)	0.66 (0.23)	0.82 (0.20)	2.83	<0.02
Green frog population (per 100 m of habitat)	1.49 (1.03)	2.60 (1.92)	2.24	<0.05
Habitat fragmentation D ($\ln D$)	23.42 (1.77)	22.24 (2.66)	2.47	<0.05
Amphibian species richness	5.08 (1.44)	5.08 (1.16)	0.01	NS

NS = not significant.

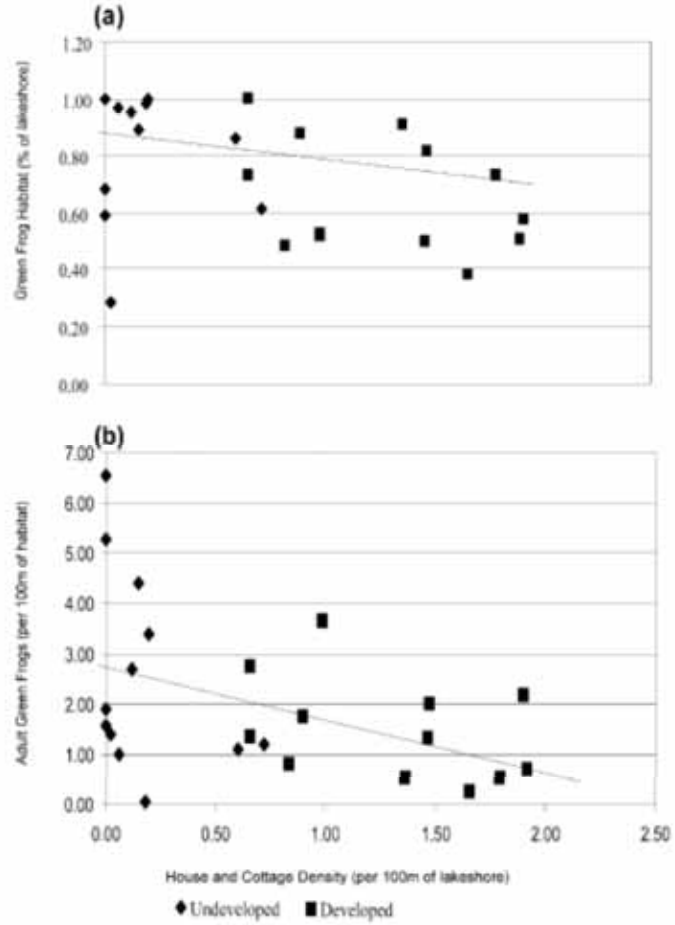
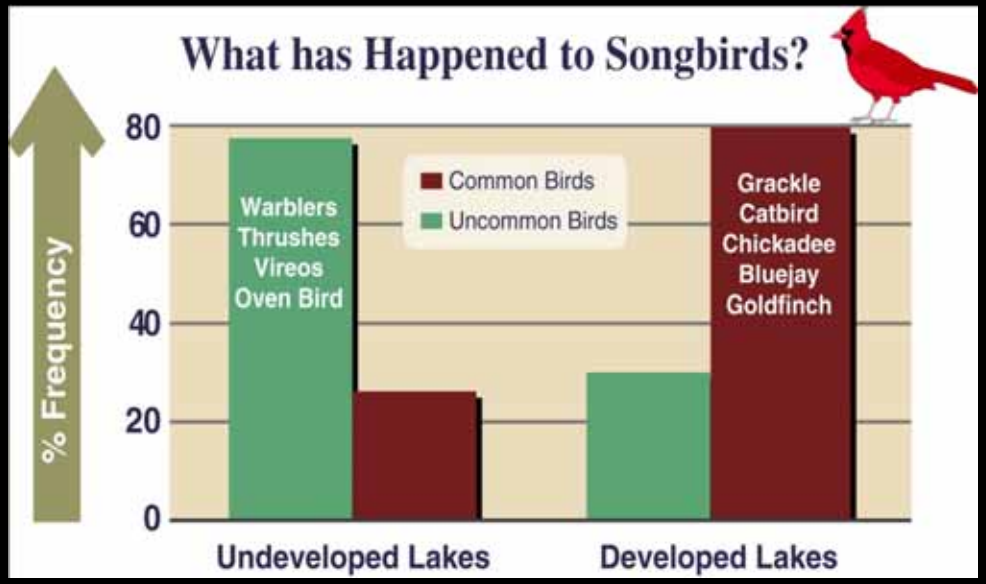


Fig. 3. "Best fit" models from linear regression for decreasing (a) green frog habitat ($y=-0.14x+0.845$; $P<0.05$) and (b) adult abundance ($y=-1.08x+2.838$; $P<0.05$) at developed and undeveloped lakes as shoreline house and cottage density increased.

Shoreland bird trends

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



Several species showed significant associations with developed or undeveloped lakes. The American crow *Corvus brachyrhynchos*, American goldfinch *Carduelis tristis*, American robin *Turdus migratorius*, eastern phoebe *Sayornis phoebe*, great crested flycatcher *Myiarchus crinitis*, Baltimore oriole *Icterus galbula* and red-winged blackbird *Agelaius phoeniceus* were all associated with developed lakes ($P<0.05$; G-test). The black-and-white warbler *Mniotilta varia*, black-throated blue warbler *Dendroica caerulescens*, common loon *Gavia immer*, golden-crowned kinglet *Regulus satrapa*, hermit thrush *Catharus guttatus*, ruffed grouse *Bonasa umbellus* and the warbling vireo *Vireo gilvus* were associated with undeveloped lakes ($P<0.05$; G-test). Several

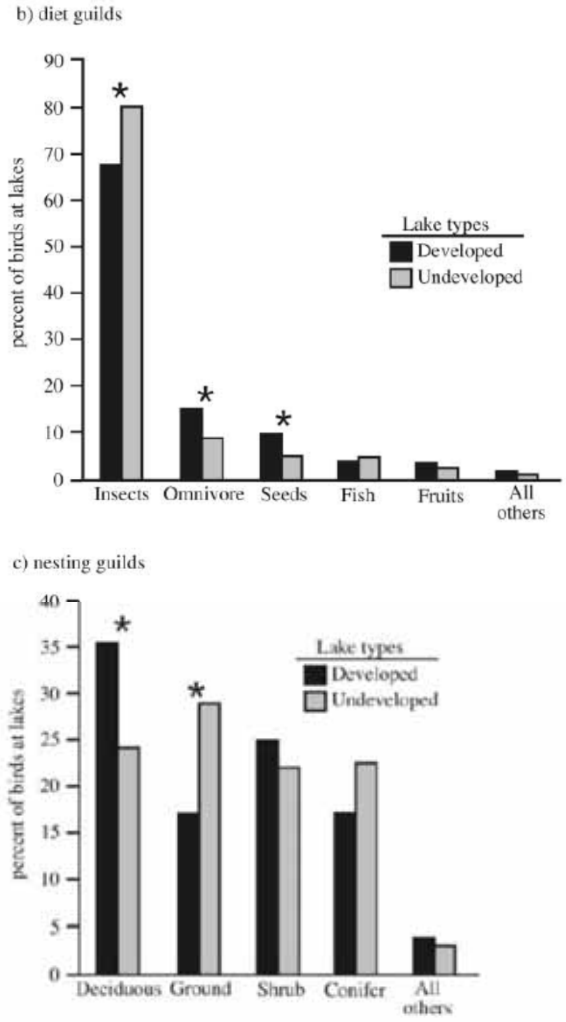
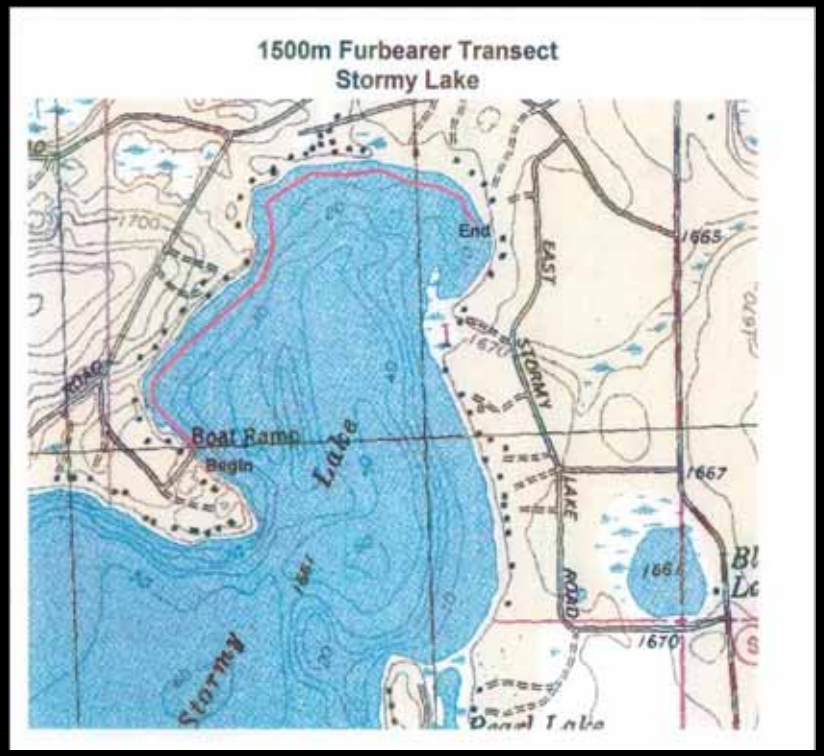


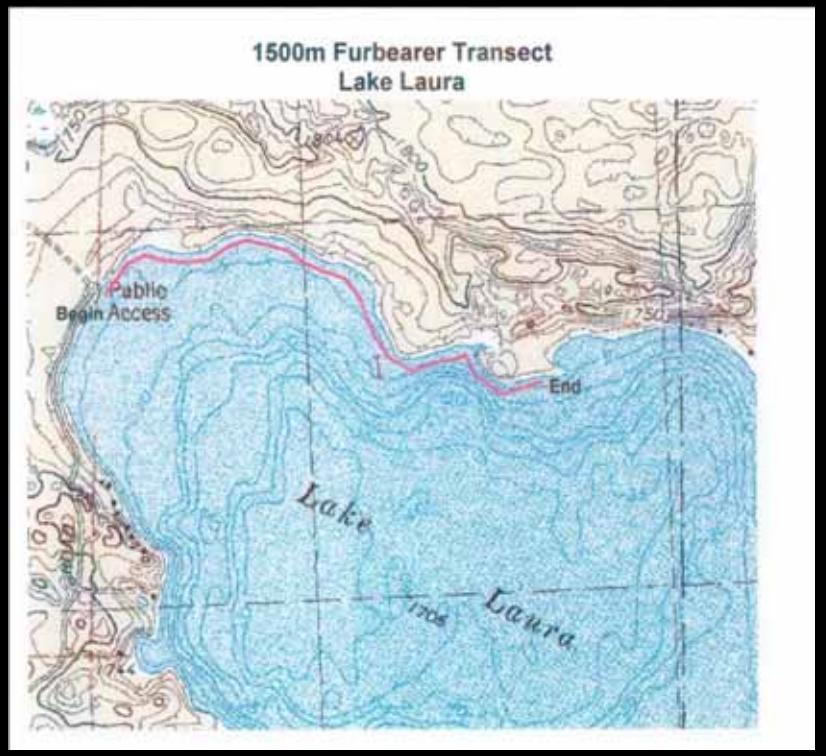
Fig. 2. Compositions of each of the three resource guild classes [(a) foraging guilds, (b) diet guilds, (c) nesting guilds] observed on developed and undeveloped lakes. Values given are the percentages of each guild within the resource guild class across all developed or undeveloped lakes. Light bars are values for undeveloped lakes, dark bars are for developed lakes.

Carnivore Diversity on Lake Riparian Areas in Vilas County, Wisconsin 2009

From: Haskell, D.et al. (In Press) American Midland Naturalist

Snow Track Survey Transects





Remote Camera Methods

High-Development:

- $n = 2$
- Mean house density ~ 16/km
- Cameras $n = 6$
- Sites randomly picked
- Sites at ≥ 1 km apart

Low-Development:

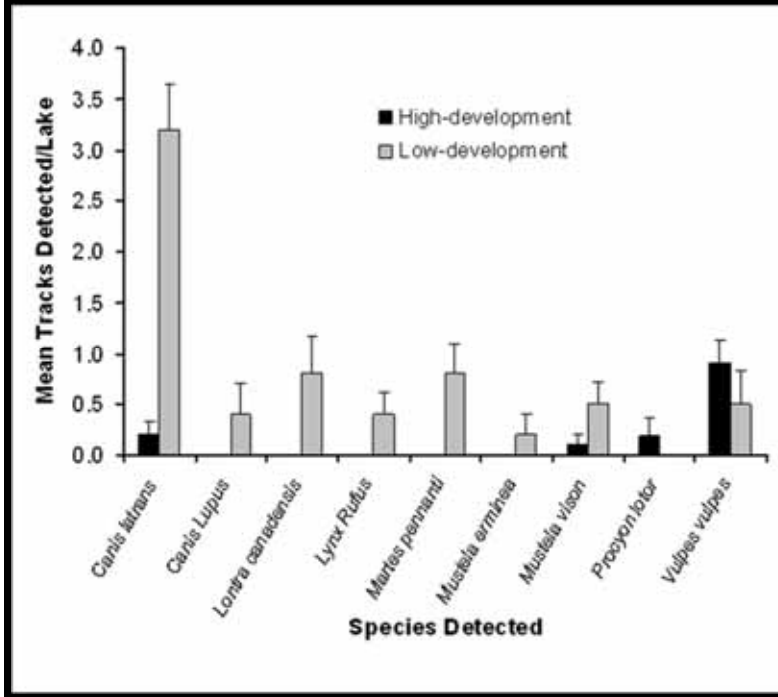
- $n = 2$
- Mean house density ~ 1/km
- Cameras $n = 6$
- Sites randomly picked
- Sites at ≥ 1 km apart

Photos

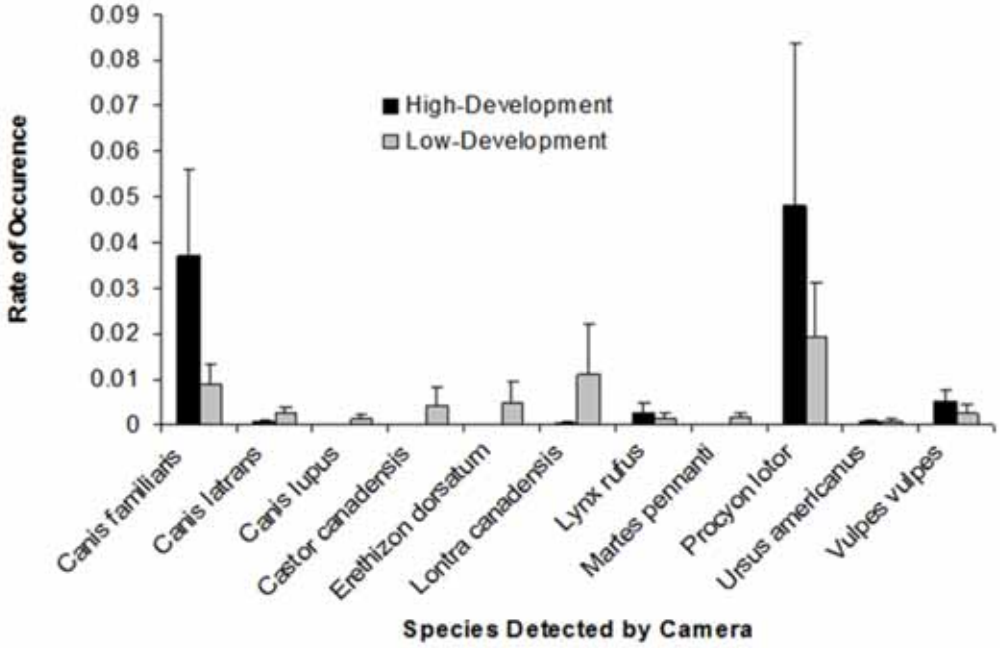

10/07/07 12:58 PM MDNR
9/22/08 7:24 PM MDNR
9/27/08 1:27 AM MDNR
6/18/08 5:01 AM MDNR
7/14/07 2:58 PM MDNR
7/17/07 2:25 AM MDNR

Carnivore Diversity and Abundance Greater on Undeveloped Lakes

Snow Tracks



Camera



Our results suggest that a higher diversity of carnivores (P = 0.006) were present on low-development lakes. Coyotes (Canis latrans) were detected most frequently (n = 34) especially on low-development lakes. Fishers (Martes pennanti), wolves (Canis lupus), bobcats (Lynx rufus), and northern river otters (Lontra canadensis) were exclusively detected on low-development lakes by snow track surveys. Raccoons (Procyon lotor) and red fox (Vulpus vulpus) detection was greater on higher-development lakes than low-development lakes.

White-tailed deer much more abundant on developed lakes
Supplemental feeding by property owners, no hunting

Because feed sites attract deer into tight densities, natural nearby browse is often depleted.

Project Goal – Quantify the benefits of shoreland restoration by comparing habitat and wildlife endpoints at "restored" vs. "unrestored" shorelines on developed lakes. Endpoints are measured before and for 10 years after restorations.

Study Objectives -

1. Pair five developed lakes in Vilas County, Wisconsin with five undeveloped (reference) lakes. Developed lakes are segmented into control shorelines (without restorations) and treatment shorelines (with buffer restorations).

2. Within treatment shorelines, educate and enroll property owners by conducting lake ecology workshops, creating and distributing educational information, and offering "free" restorations.

3. Develop site specific management plans for each enrolled property owner.

4. Restore and conserve native vegetation and reduce erosion within the shoreland riparian buffer (35' minimum) of all participating properties.

5. Quantify the benefits of restoration activities by conducting habitat and plant and animal species surveys at reference, control, and treatment lakes before restoration occurs and in subsequent years.

Five Lake Pairs

Developed Lakes

- Found (2007-8)
- Lost (2010-11)
- Moon (2009-10)
- Little St. Germain (2011-12)
- Crystal (2011)

Reference Lakes

- Escanaba
- White Sand
- Jag
- Star
- Starrett

What is Shoreland Restoration?

Shoreland Restoration is a lake management practice that uses native trees, shrubs, and groundcover, along with natural and biodegradable materials (biologs, delta-lock bags, sediment logs, soil lifts, woody material), to reduce lakeshore erosion and improve aquatic and wildlife habitat quality.

Measures of Success

Shoreland Restoration will be considered a successful management practice if it:

- Reduces surface water and nutrient run-off
- Reduces lake bank erosion
- Increases native plant abundance and diversity
- Improves wildlife habitat quality
- Increases wildlife abundance and diversity

Before / after photos > Kloepfer Property

The Wisconsin Lakes Partnership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Erosion control method > biologs / Enviro-lok® bags

The Wisconsin Lakes Partnership

Before / after photos > Breus Property

The Wisconsin Lakes Partnership

Breus's - Impervious patio receives stormwater
Open soil on 45^0 slope
Obvious sediment movement downslope

Enviro-lok Bags® / sediment logs to create tiered effect; slow water flows; native plantings

Erosion control method > straw mats with plantings

The Wisconsin Lakes Partnership

Erosion control method > soil lifts

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

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- Bare root is grown in an experimental gravel culture medium that is well-watered
- *Aronia melanocarpa*, *Cornus racemosa*, *Sambucus canadensis*, *Symphoricarpos alba*, *Physocarpus virginanum*, *Viburnum lentago*
- Paired with container stock of same species
- Planted in same shoreland area
- Marked/tagged for long-term monitoring

Woody habitat comparison > 10’ X 10’ sites

- The project is examining the use of woody habitat on restored plantings
- Monitoring changes in soil temperature and moisture between sites with no wood on the ground, 25% woody cover, and 50% woody cover
- Perhaps woody habitat can lessen plant mortality

The Wisconsin Lakes Partnership

Coarse Wood Augmentation Reduces Soil Temperature and Fluctuations

From: Haskell, D. et al. (2012) Restoration Ecology 20: 113-121.

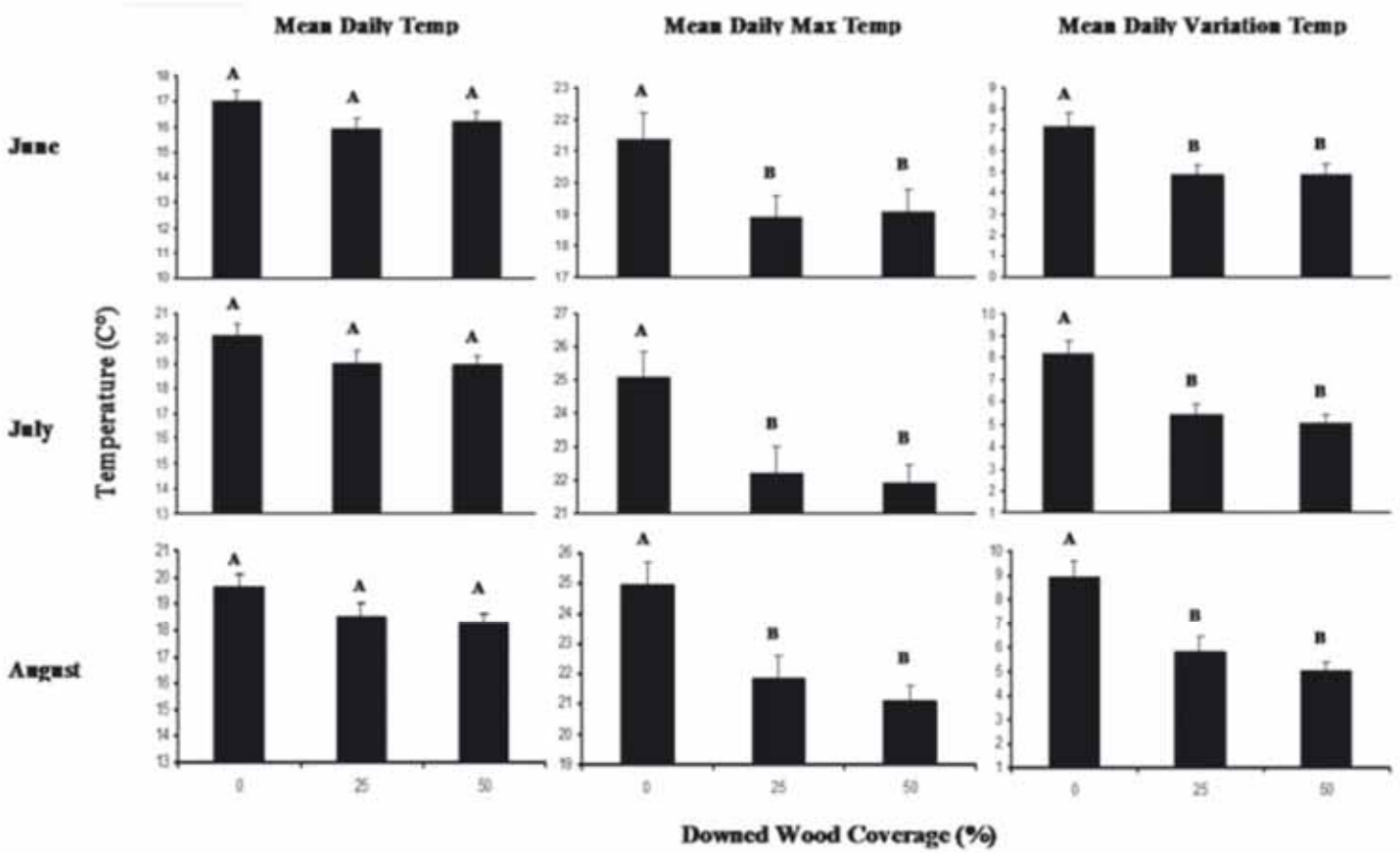


Figure 3. Mean daily, mean maximum soil temperatures, and the mean daily soil temperature variation and one standard error for 3 months in 2008 on downed woody material coverage treatments. Data collected during the summer of 2008 on Found and State House Lakes in Vilas County, Wisconsin. Bar columns with the same letter are not significantly different by Holm–Sidak pair-wise multiple comparison procedures ($p \leq 0.001$).

Coarse Wood Augmentation Reduces Soil Moisture Loss and Increases Canopy Volume of Shrubs

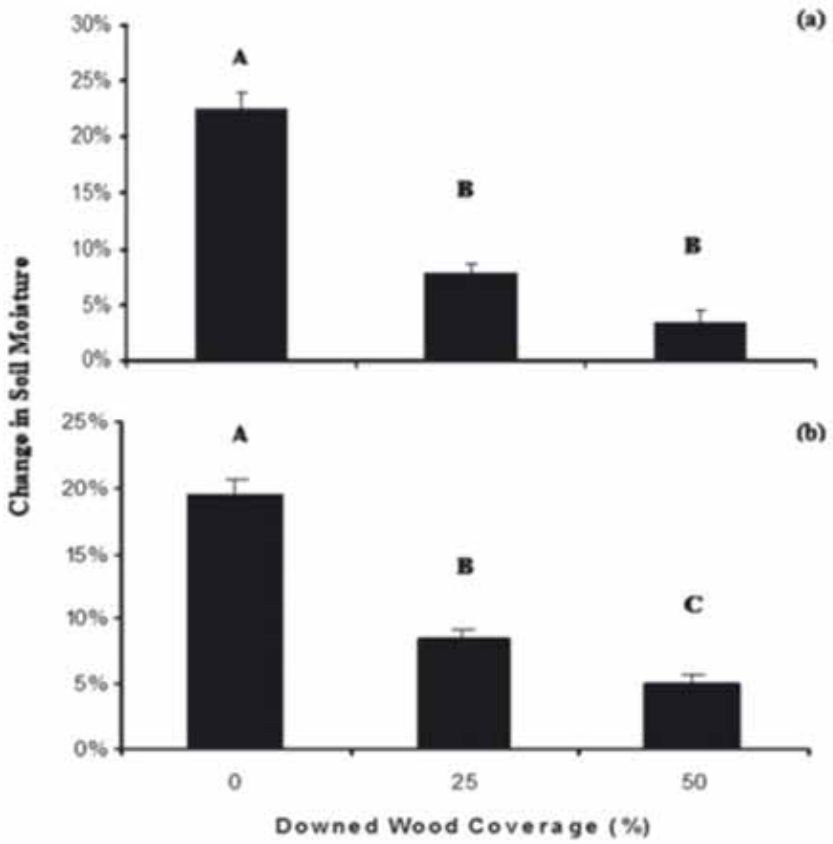


Figure 4. Mean percent change of soil moisture content from 12 to 36 hours after watering from July (a) and August (b) 2008 on three downed woody material coverage treatment. Data were collected from restoration projects on Found and State House Lakes, Vilas County, Wisconsin. Bar columns with the same letter are not significantly different by Holm–Sidak pair-wise multiple comparison procedures ($p < 0.001$).

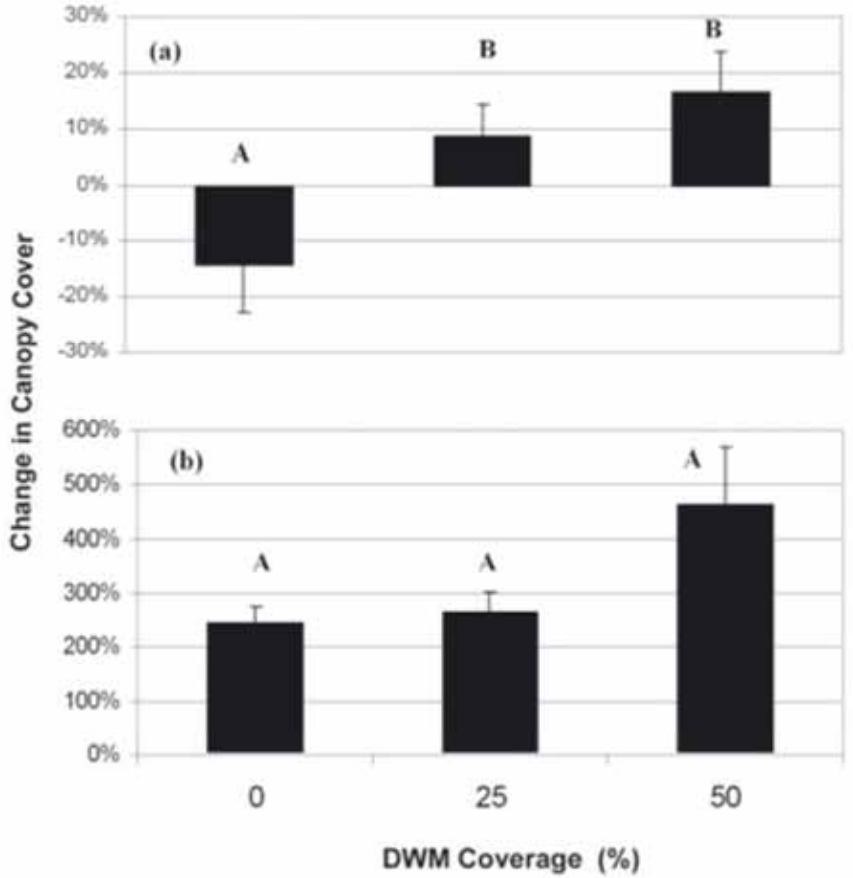
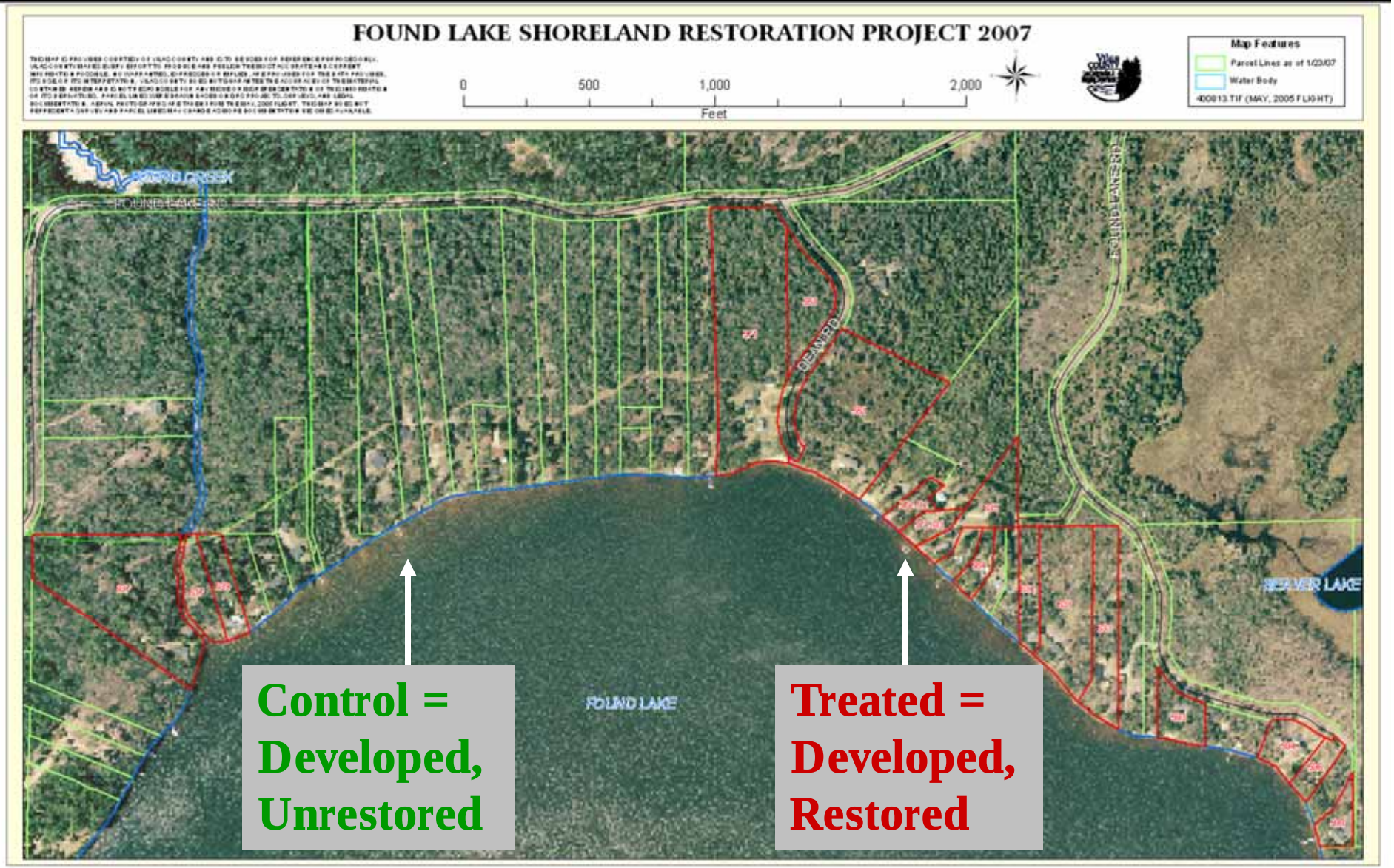


Figure 5. Percent change in canopy volume for snowberry (a) and sweet fern (b) over a 1-year period on three downed woody material coverage treatment. Data collected on Found and State House Lakes Vilas County, Wisconsin from August 2007 to 2008. Bar columns with the same letter are not significantly different by Holm–Sidak pair-wise comparison procedures ($p < 0.001$).

Restoration Completed at Found Lake 2007-2008 in Partnership with Vilas County LWCD, WDNR, WDATCP, MTU



Reference Lake = Escanaba Lake (Undeveloped)

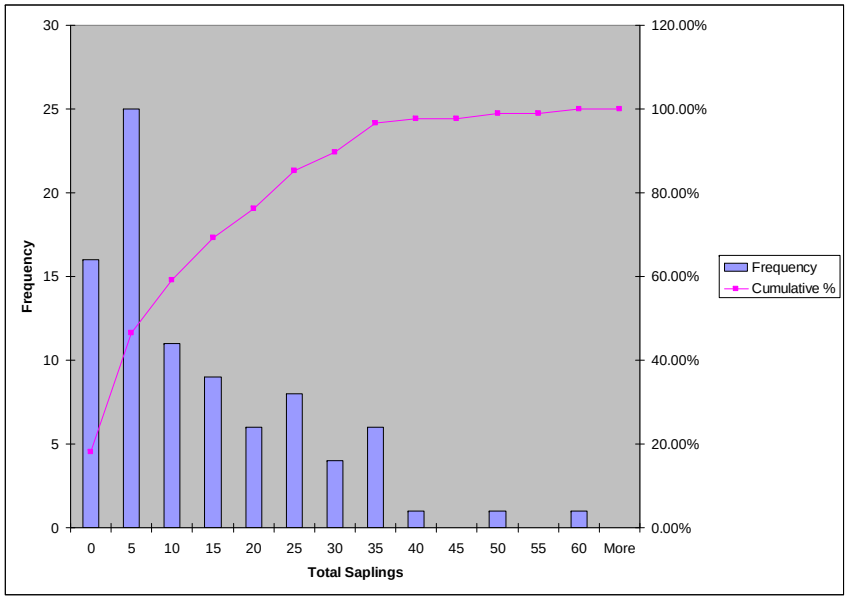
Long-term Vegetation Quadrats ($10m^2$)

Botany Work

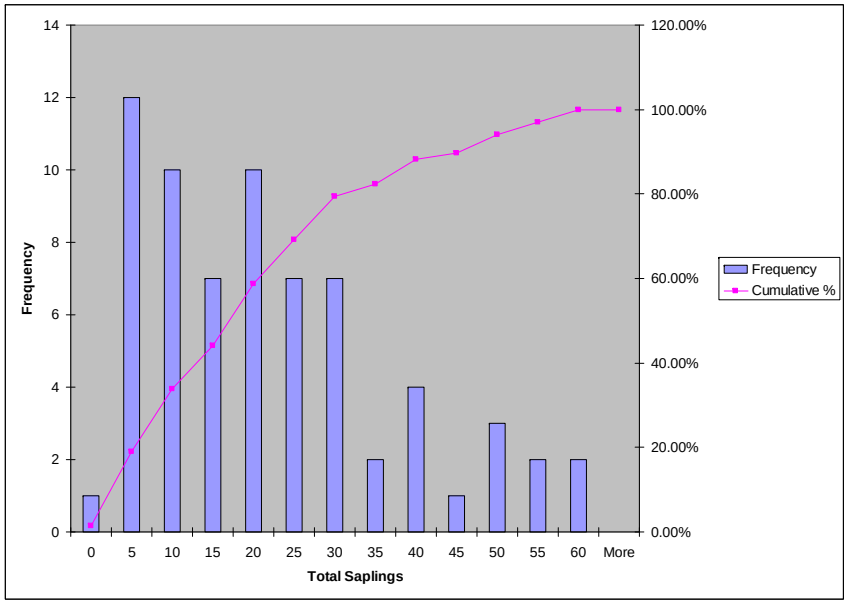
Quantify trees, saplings, shrubs, coarse wood, and groundcover at each quadrant

Total Saplings Per Plot Sample

Developed Lakes



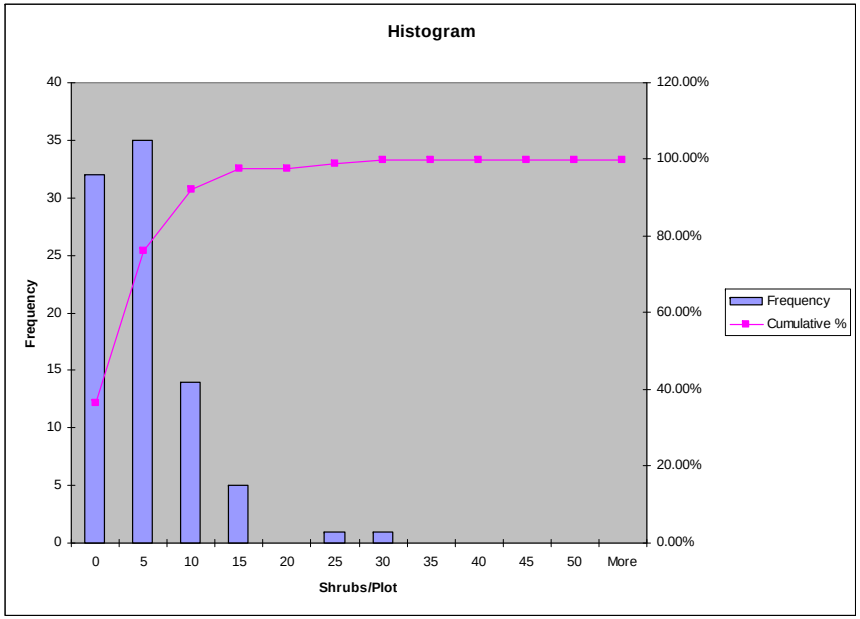
Reference Lakes



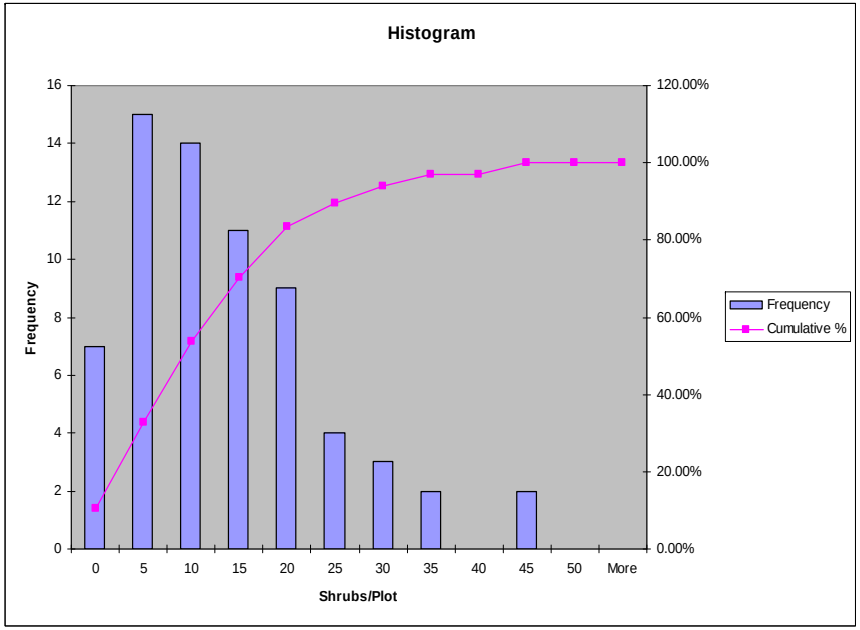
66% of plot samples on reference lakes had >10 shrubs vs.
31% of plot samples on developed lakes

Total Shrubs Per Plot Sample

Developed Lakes



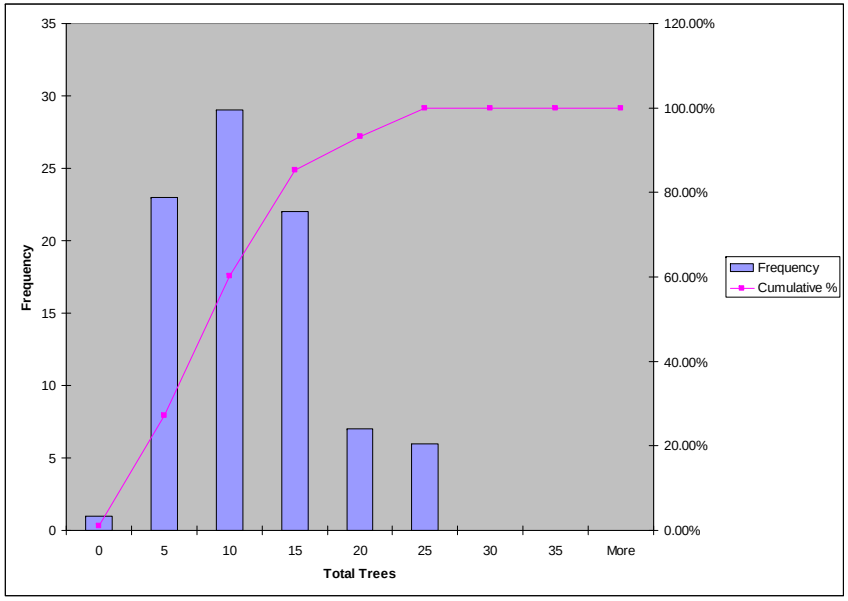
Reference Lakes



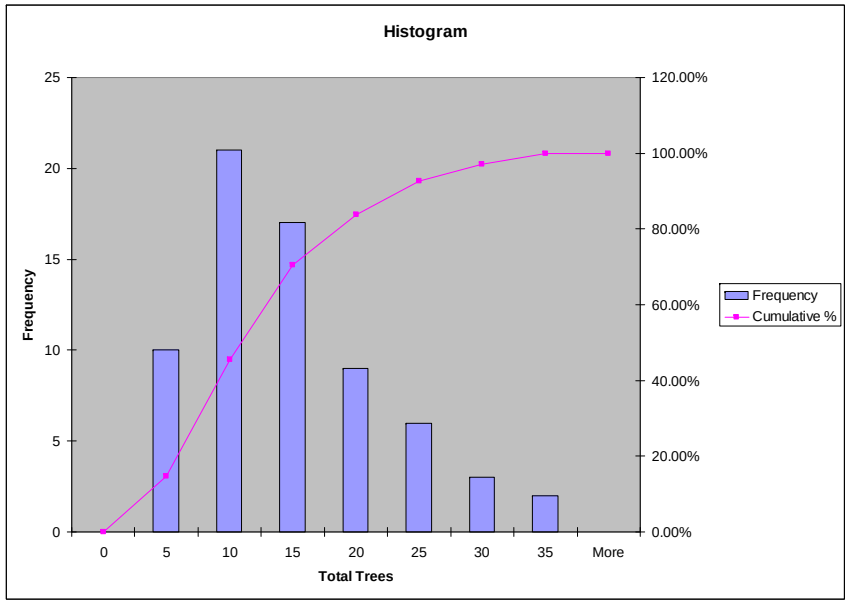
43% of plot samples on reference lakes had >10 shrubs vs.
8% of plot samples on developed lakes

Total Trees Per Plot

Developed Lakes



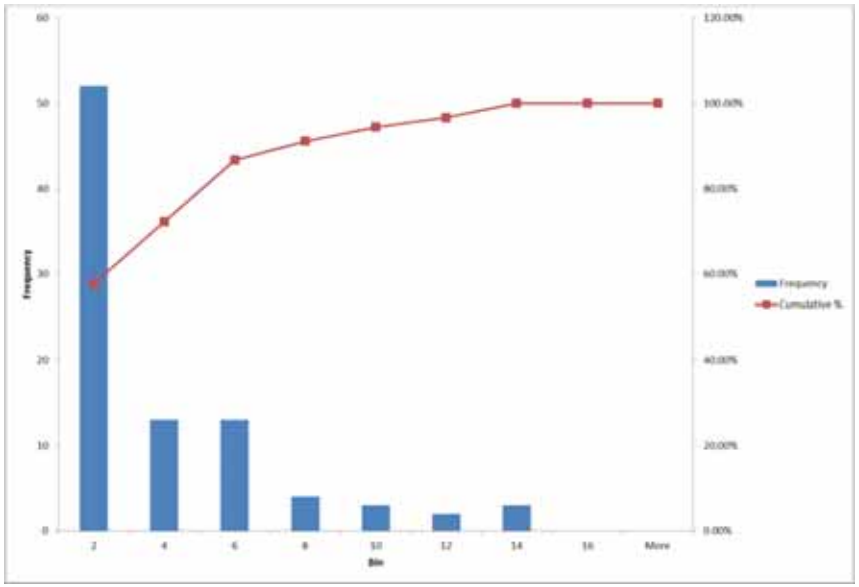
Reference Lakes



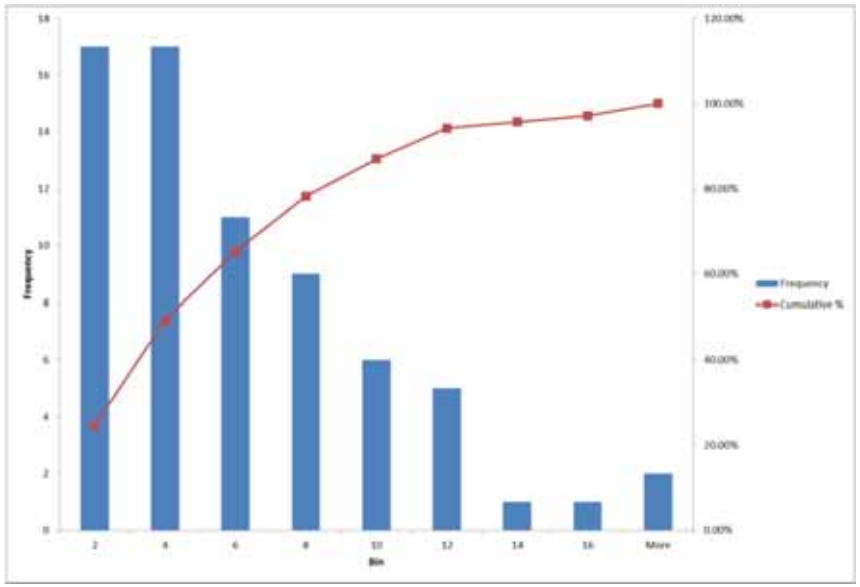
66% of plots on reference lakes had >10 trees vs. 31% of plots on developed lakes

Total Coarse Wood Per Plot

Developed Lakes



Reference Lakes



35% of plots on reference lakes had >6 wood pieces vs. 13% of plot samples on developed lakes

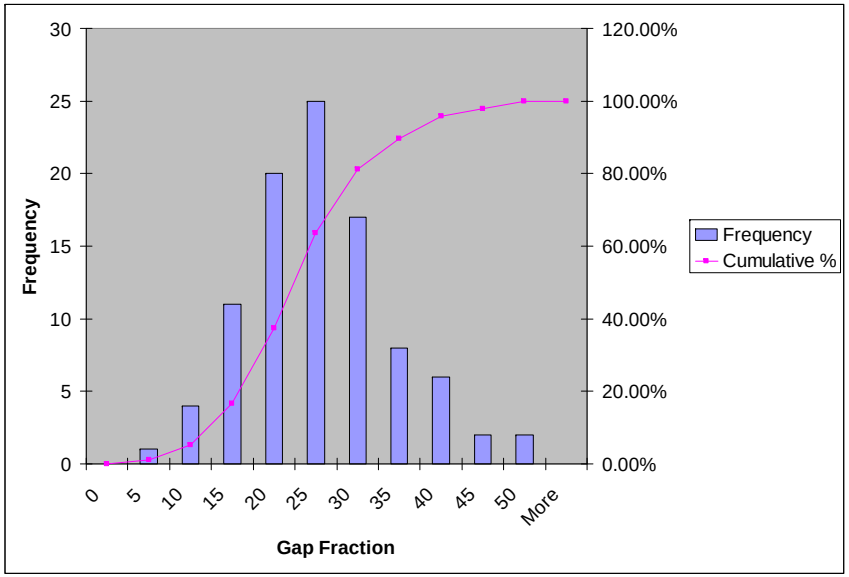
Canopy Photos

High-Development

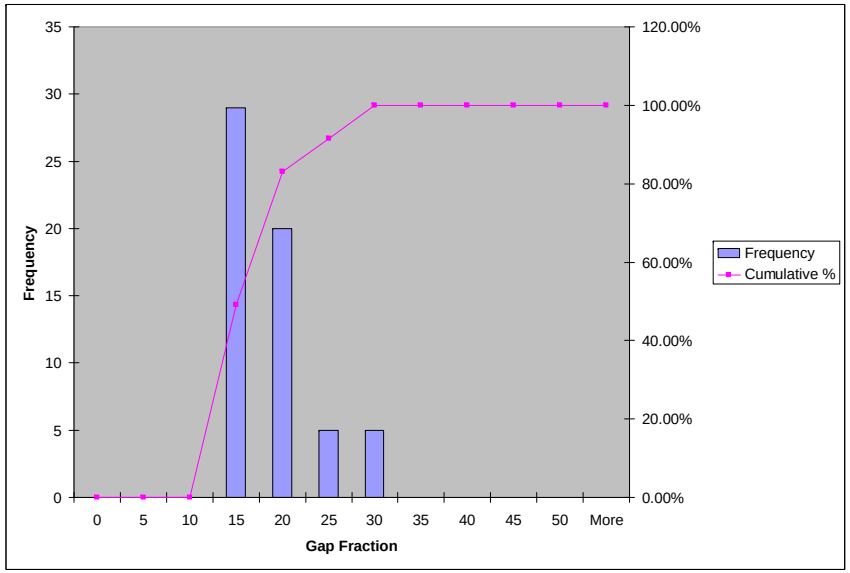
Low-Development

Plot Canopy Gap Fraction

Developed Lakes

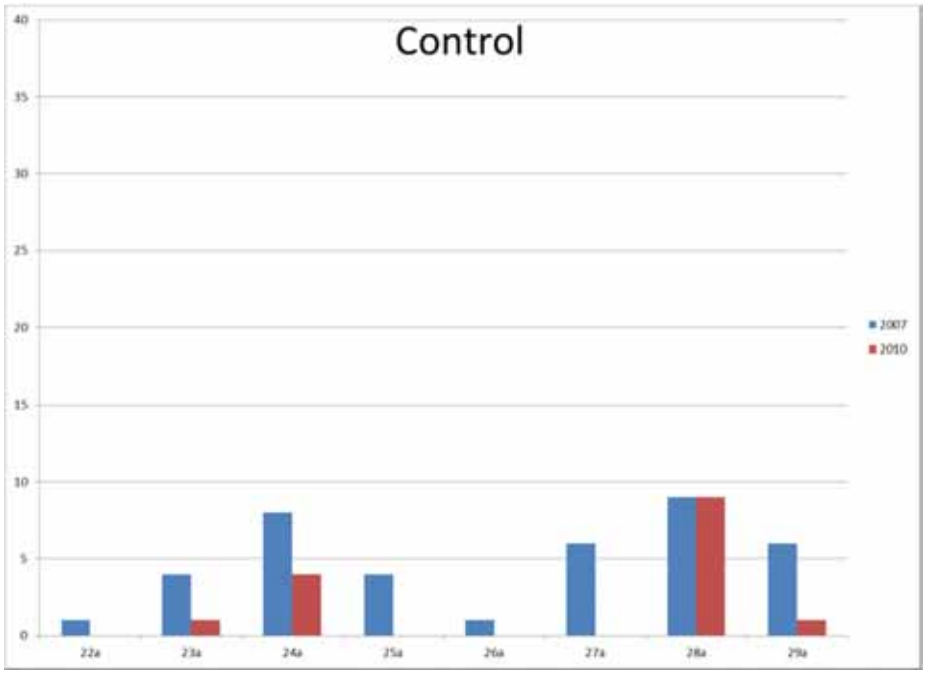


Reference Lakes



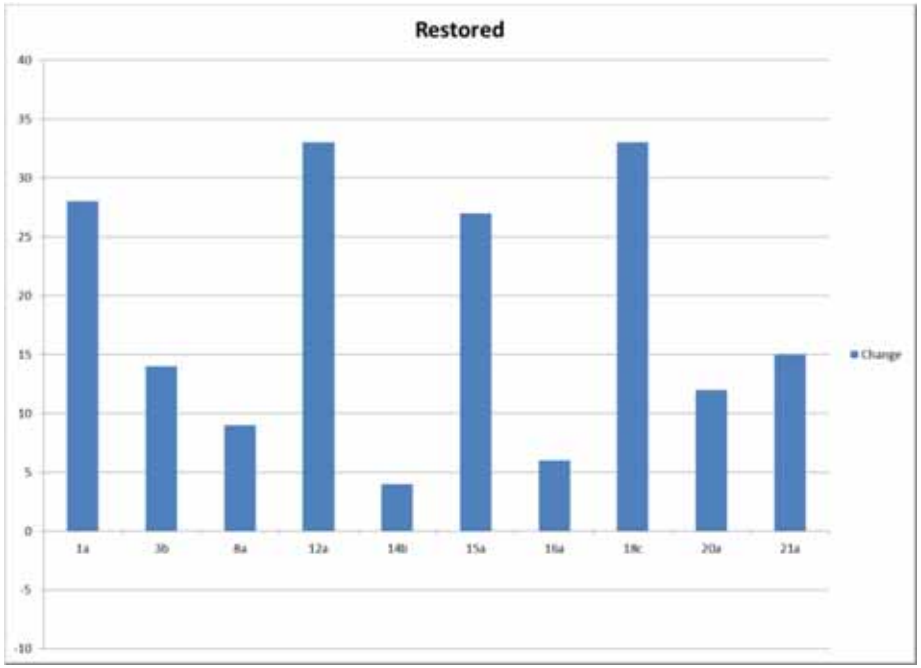
83% of plots on reference lakes had <20% open canopy vs. 37% of plots on developed lakes

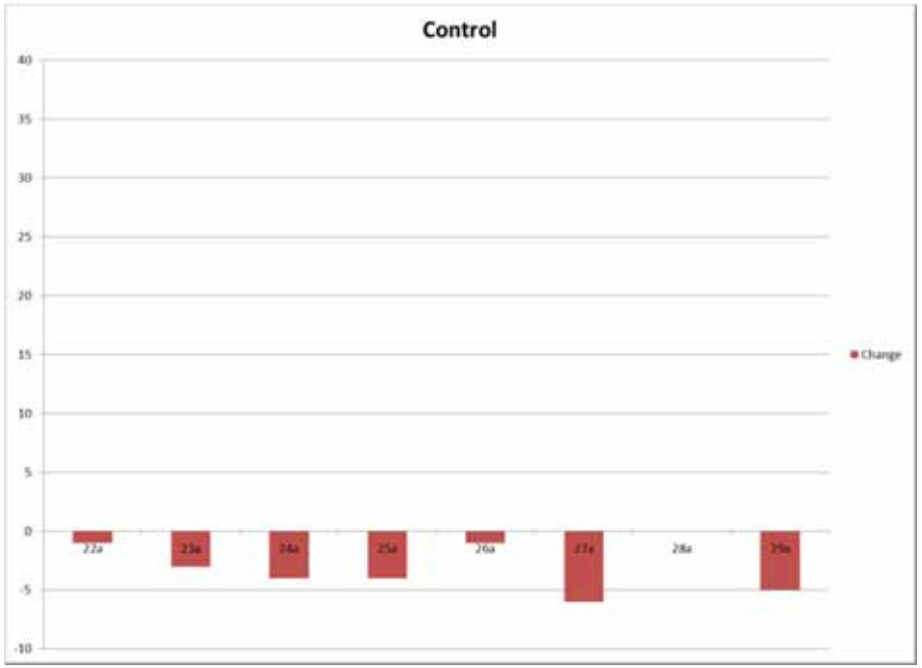
Found Lake 2007-2010 Shrubs



Shrubs increased on all restoration plots between years

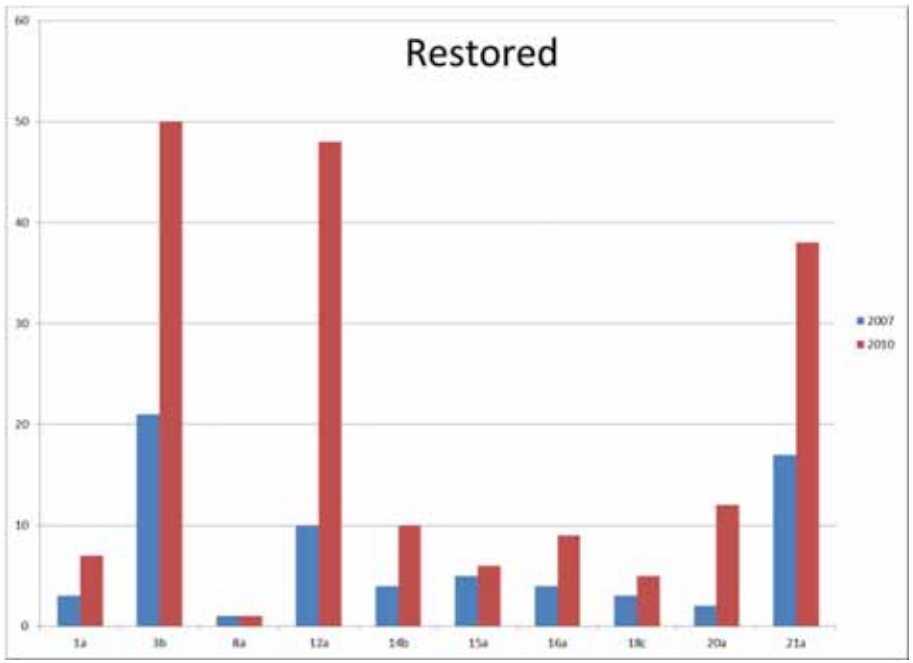
Found Lake 2007-2010
Change in Shrubs

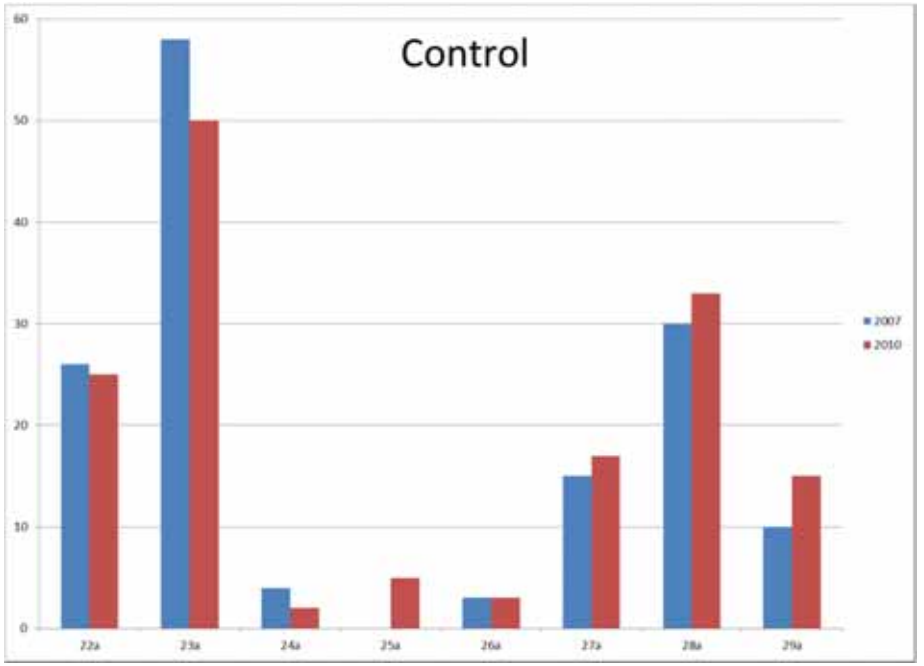




The difference between treatment is dramatic, all control plots lost shrubs between years, all treated plots gained

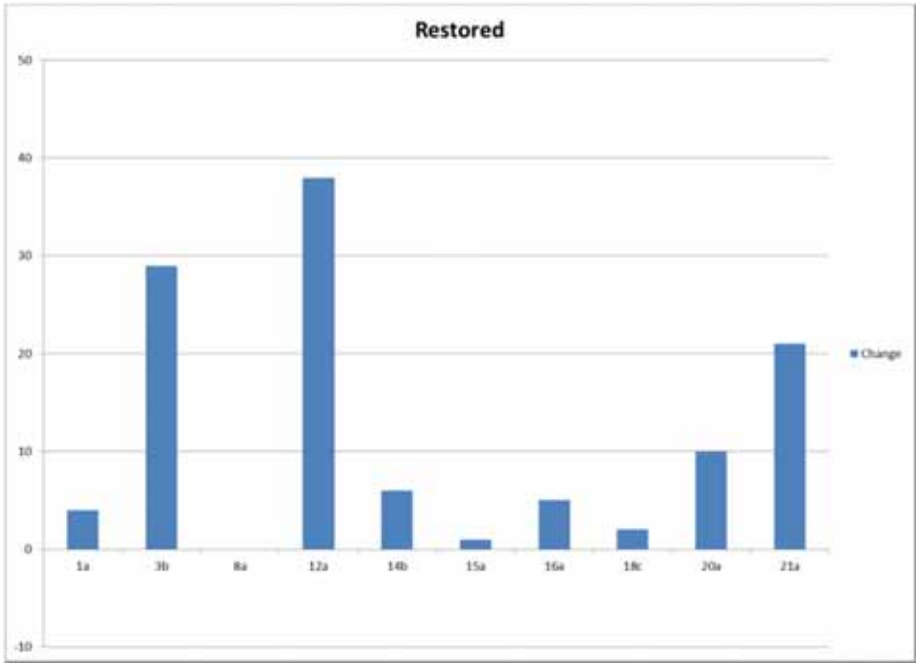
Found Lake 2007-2010 Saplings

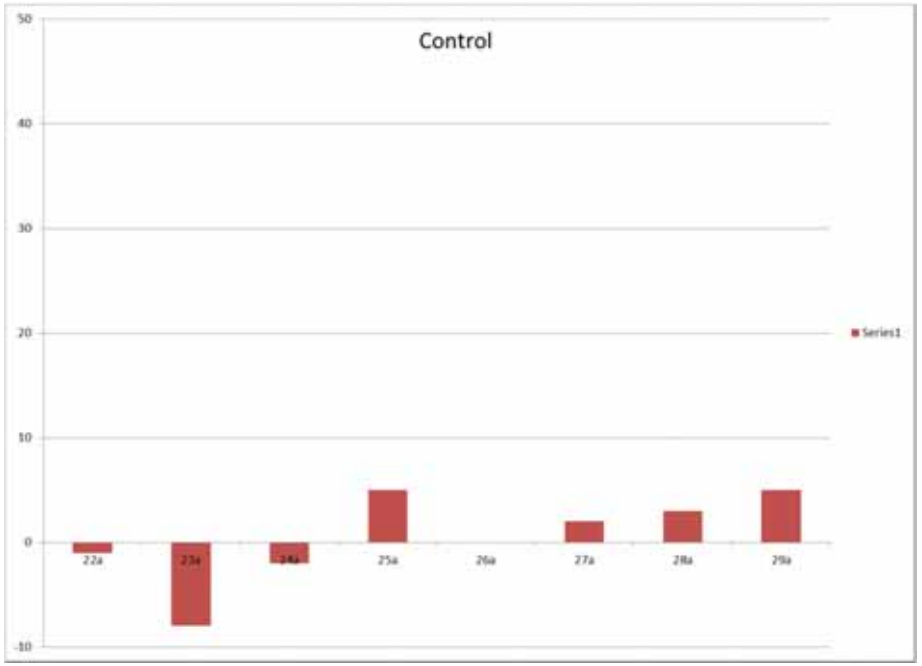




Saplings followed a similar pattern, increasing at most treated plots

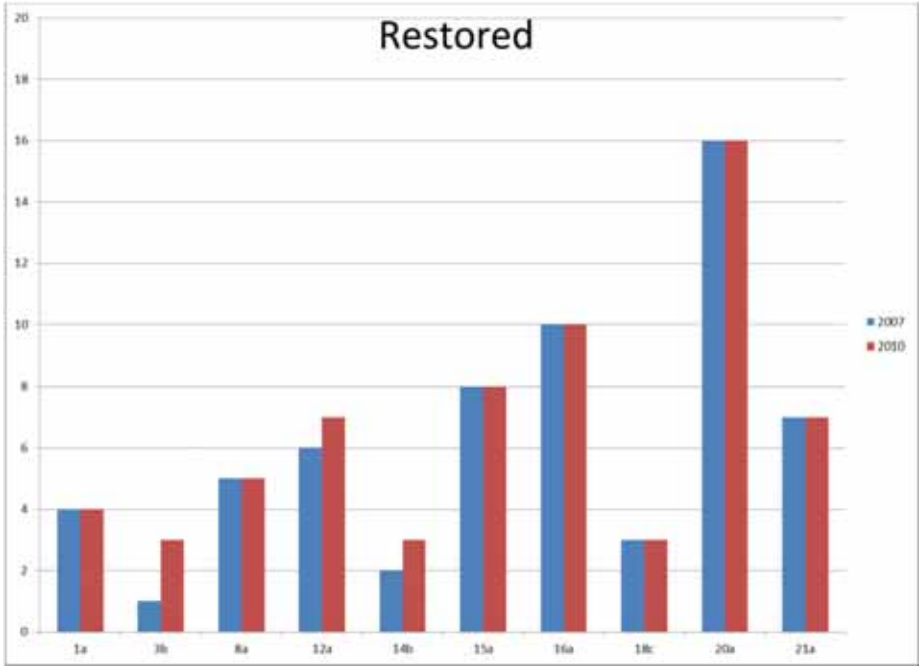
Found Lake 2007-2010 Change in Saplings

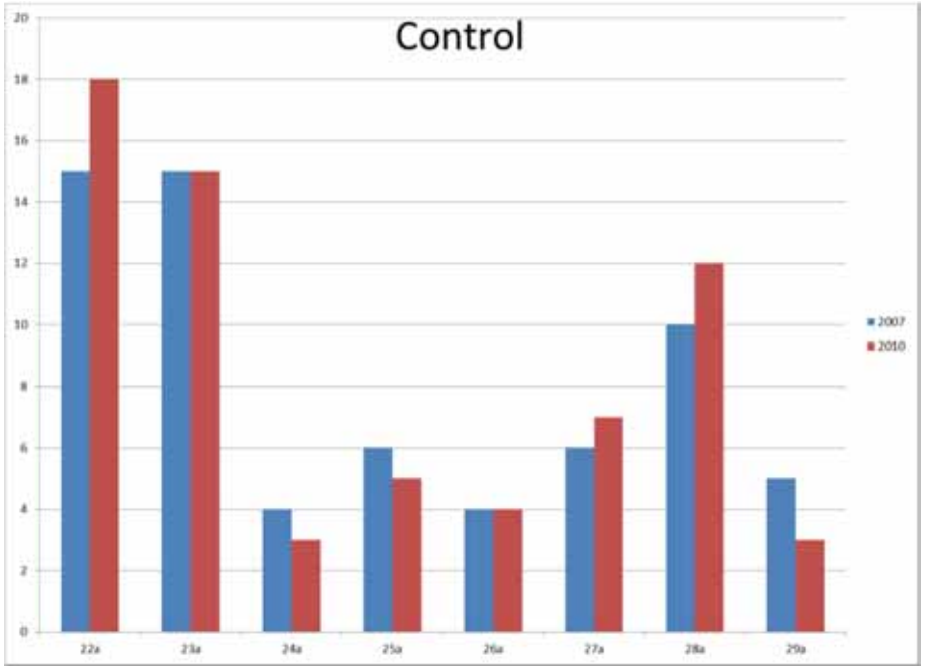




Sapling numbers increased at all restoration plots, but at only four control plots.

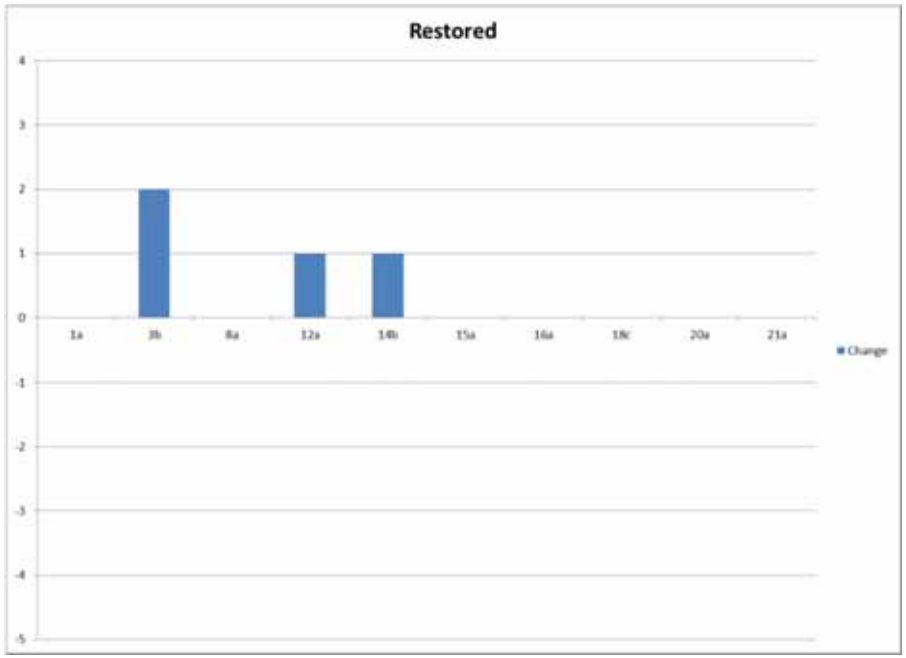
Found Lake 2007-2010 Trees

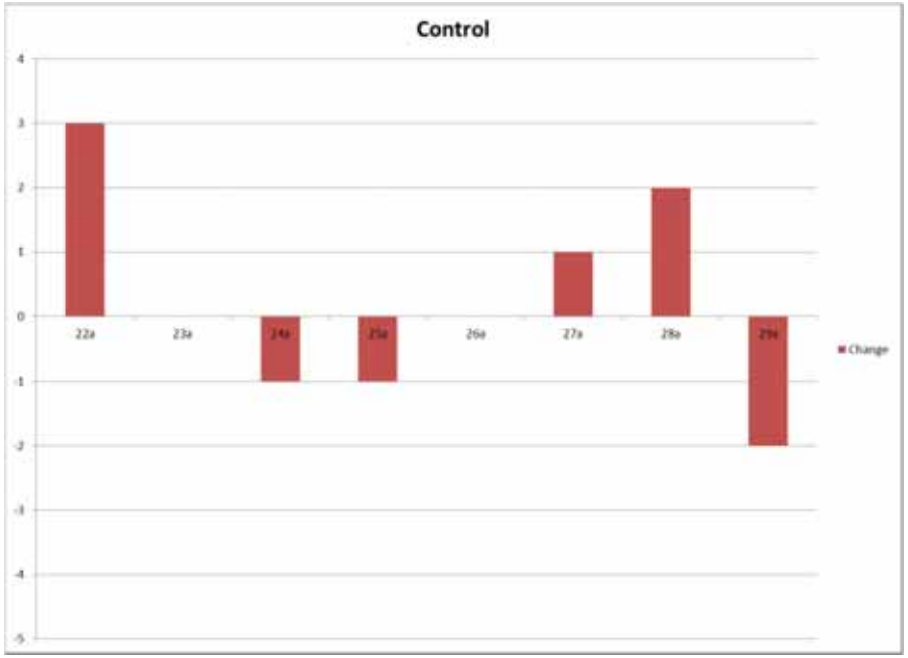




Tree numbers remained relatively constant between years

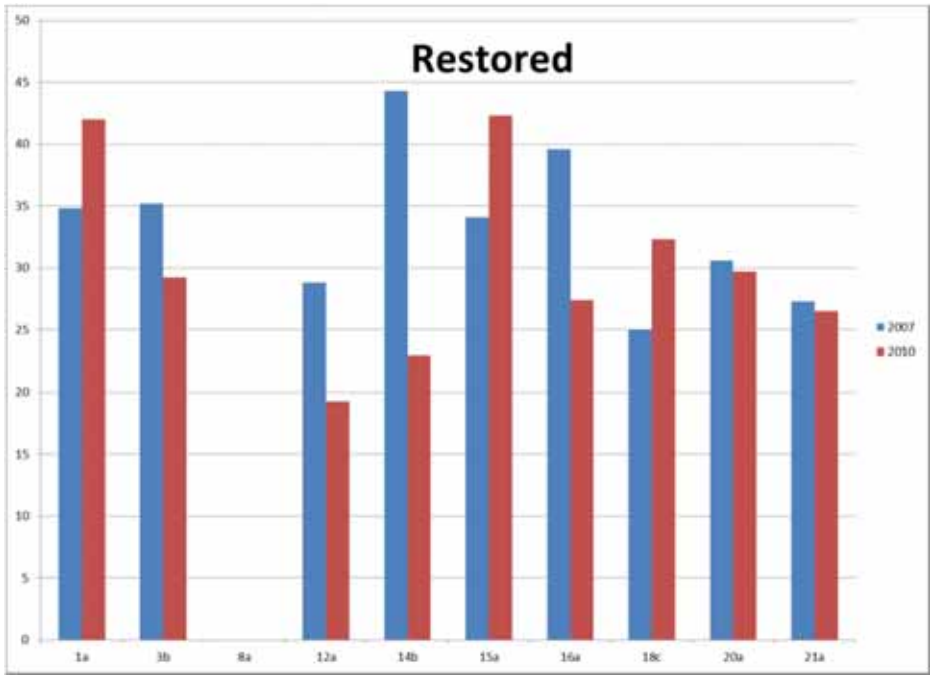
Found Lake 2007-2010
Change in Trees

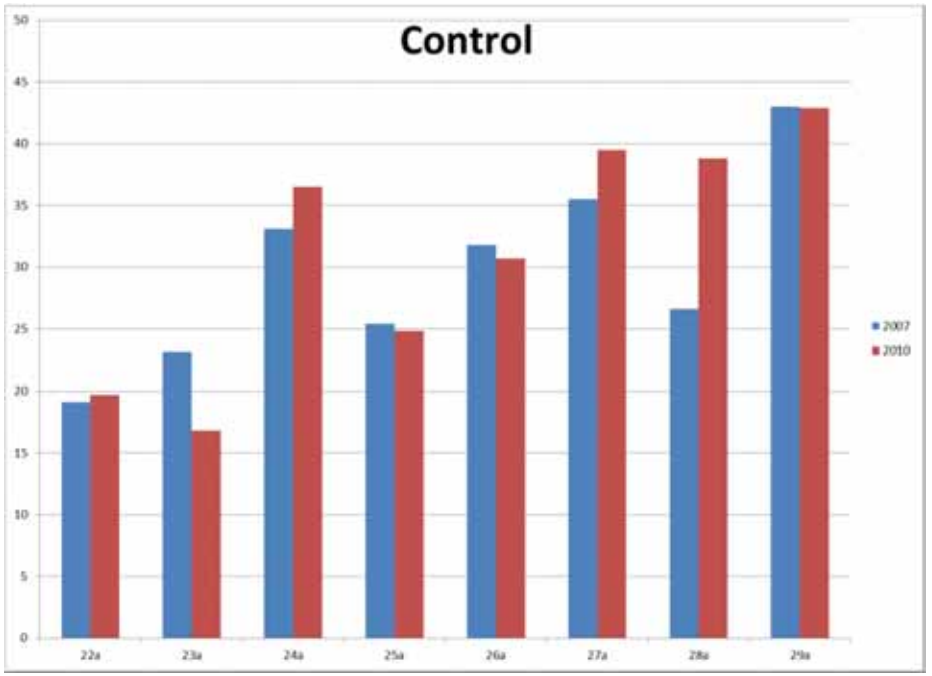




Only a few large trees were planted on the treated plots due to much higher costs

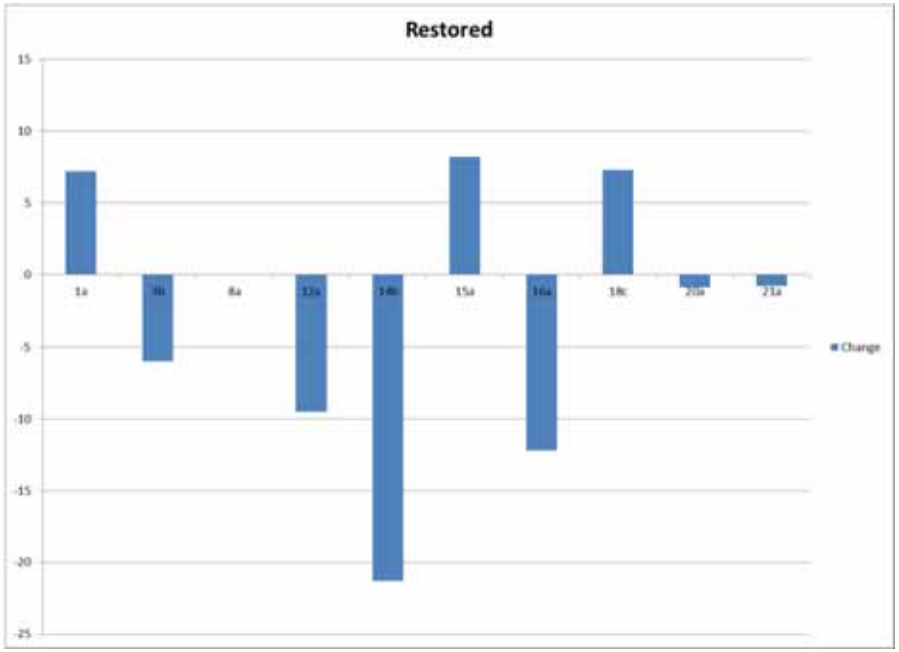
Found Lake 2007-2010 Canopy Openness

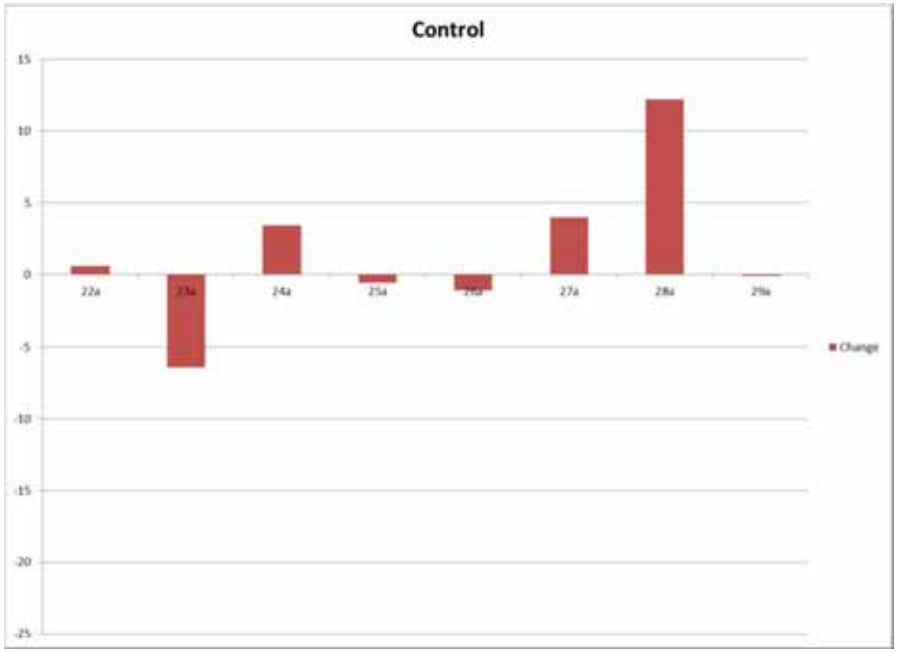




Canopy openness did decline at half of the treated plots

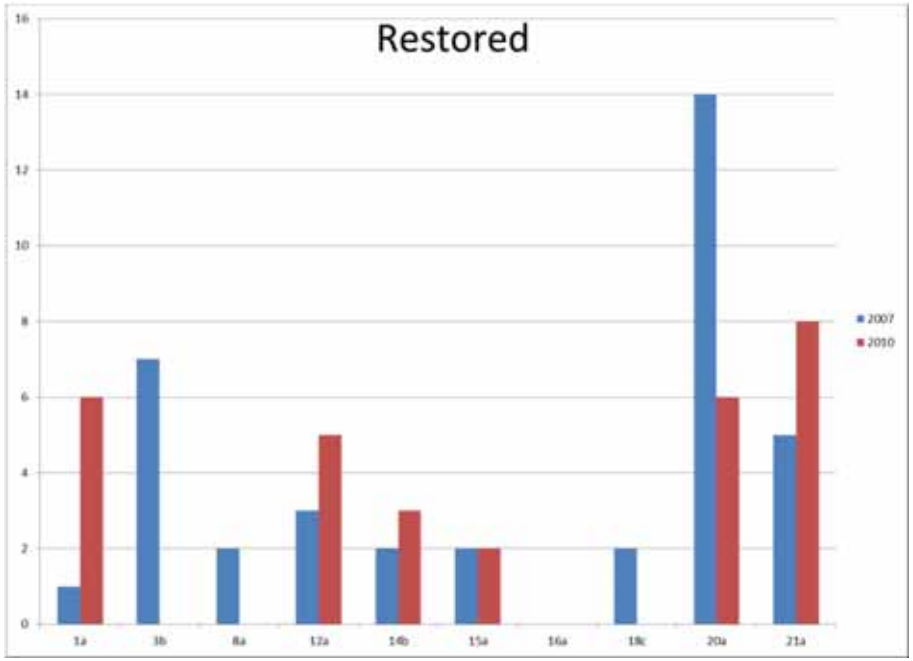
Found Lake 2007-2010
Change in Canopy Openness

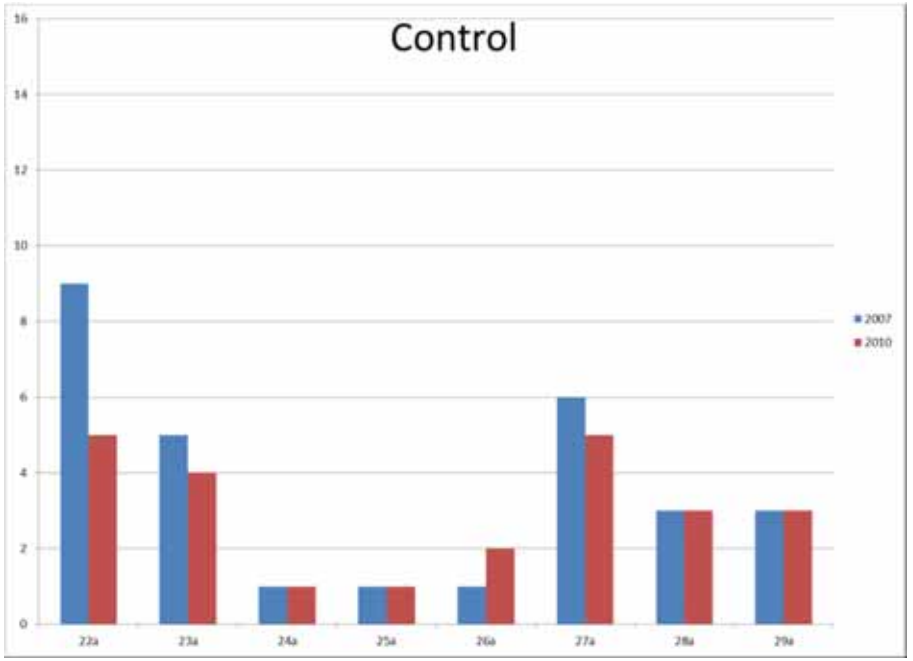




We anticipate this trend towards a less open canopy will continue as the restoration projects mature

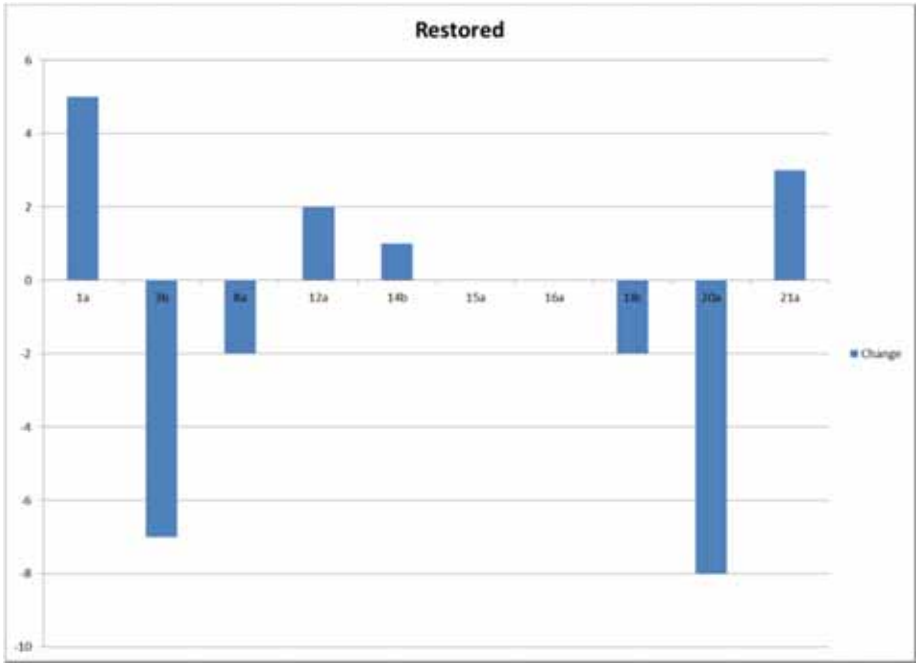
Found Lake 2007-2010
Coarse Wood

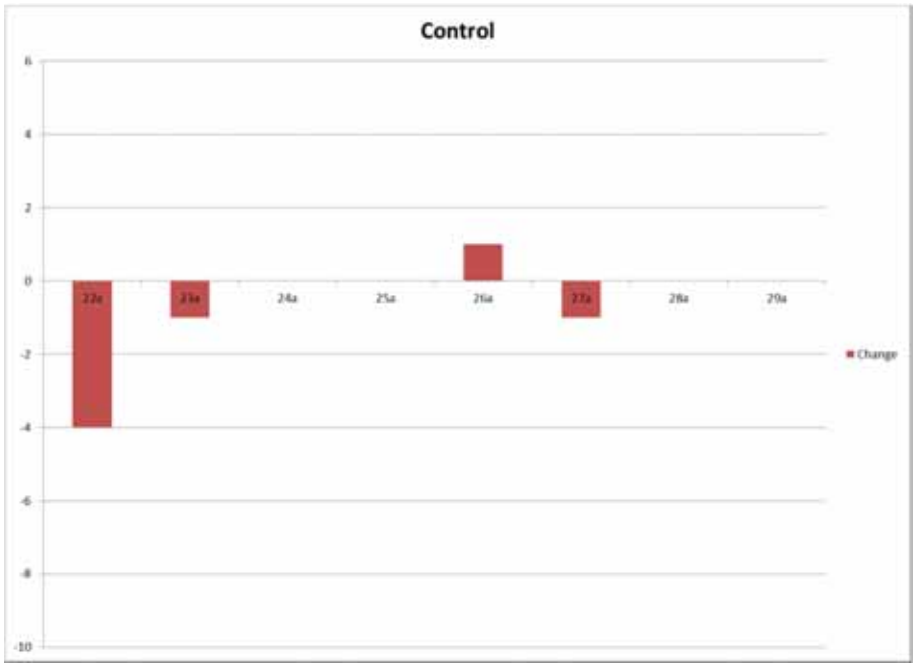




Coarse wood showed mixed results on the treated plots, but remained relatively unchanged on the control plots.

Found Lake 2007-2010
Change in Coarse Wood

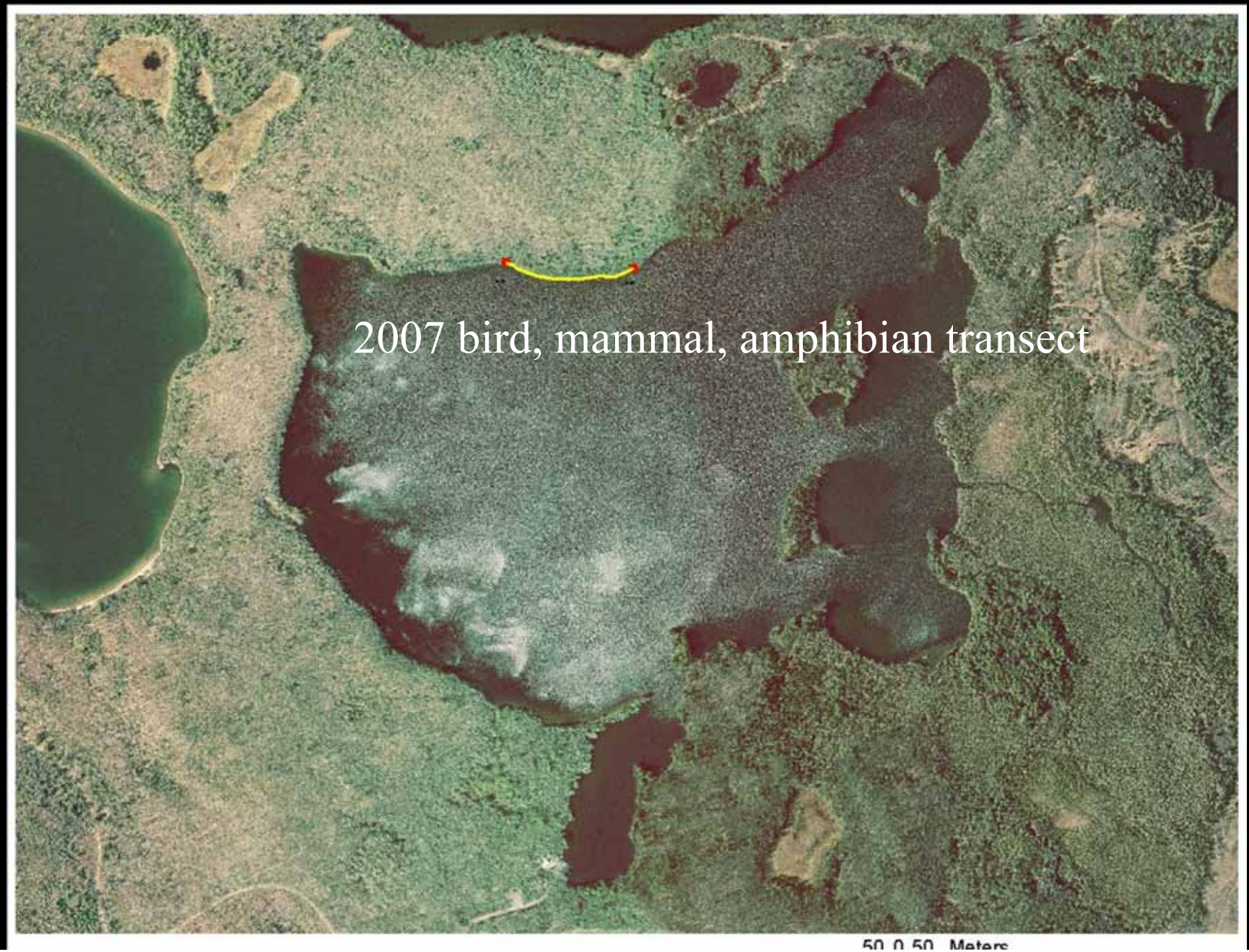




Because coarse wood has been shown to reduce soil temperature fluctuations, increase soil moisture, and improve shrub growth in some species, we will work with landowners to attempt to increase Coarse wood density on our restoration plots

2007-10 Bird, Amphibian, Small Mammal Transects

Paired Reference (Undeveloped) Lake – Escanaba Lake NHAL




Avian Surveys
Photo by: D. Haskell

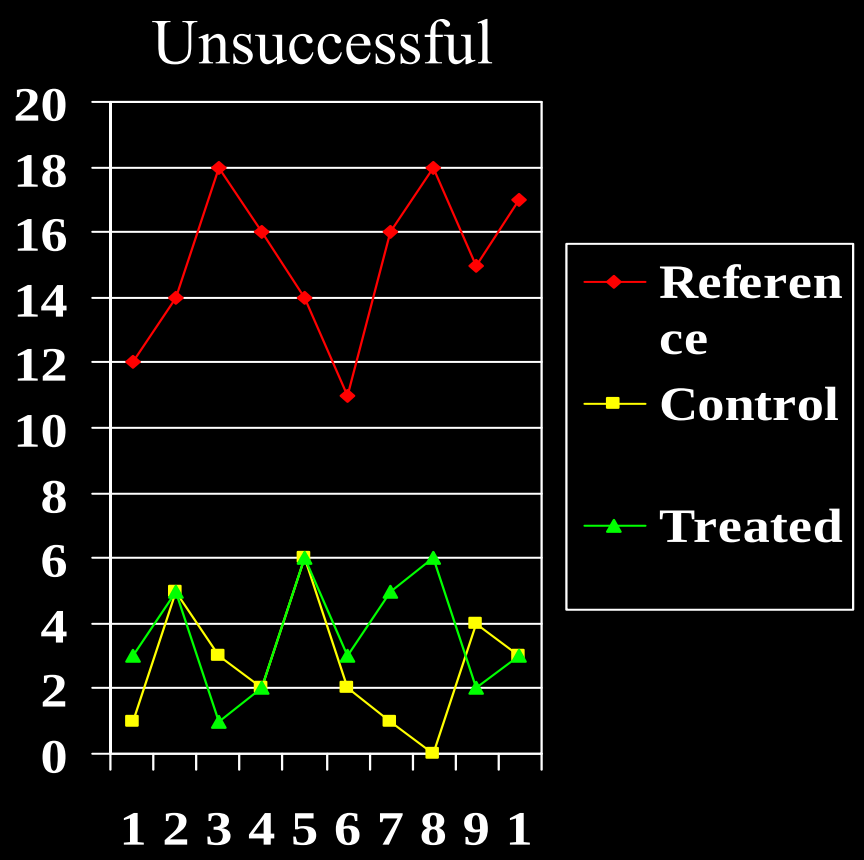
Avian Surveys

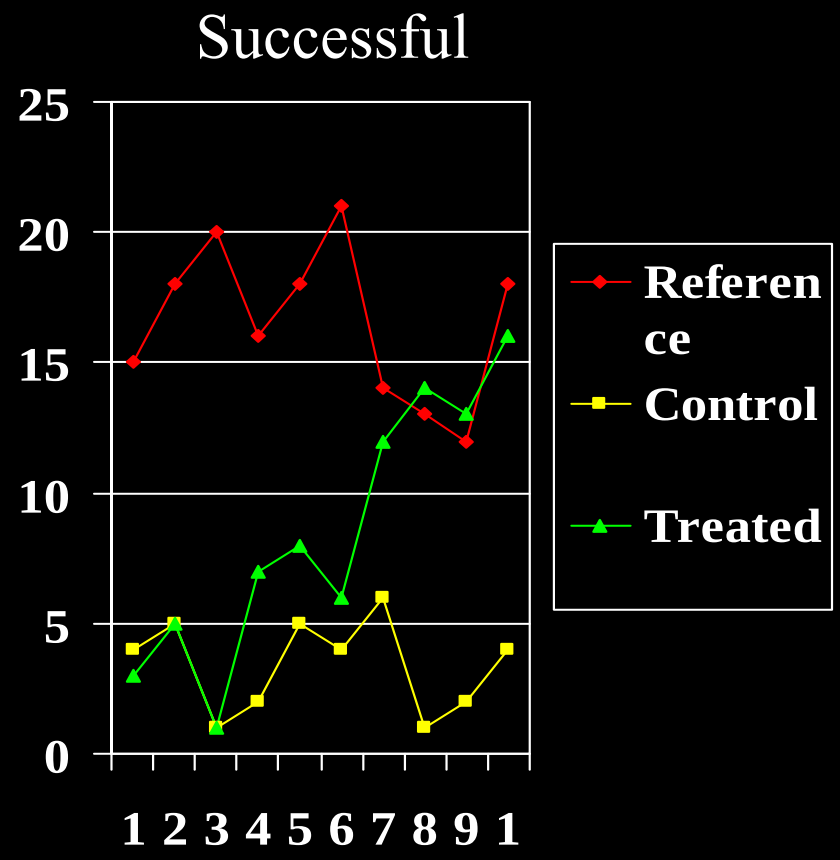
- Tallied all species seen or heard
- 23 indicator species
  - Ground & shrub nesting
  - Canopy nesting
  - Cavity nesting

Shoreland Restoration
Avian Indicator Species

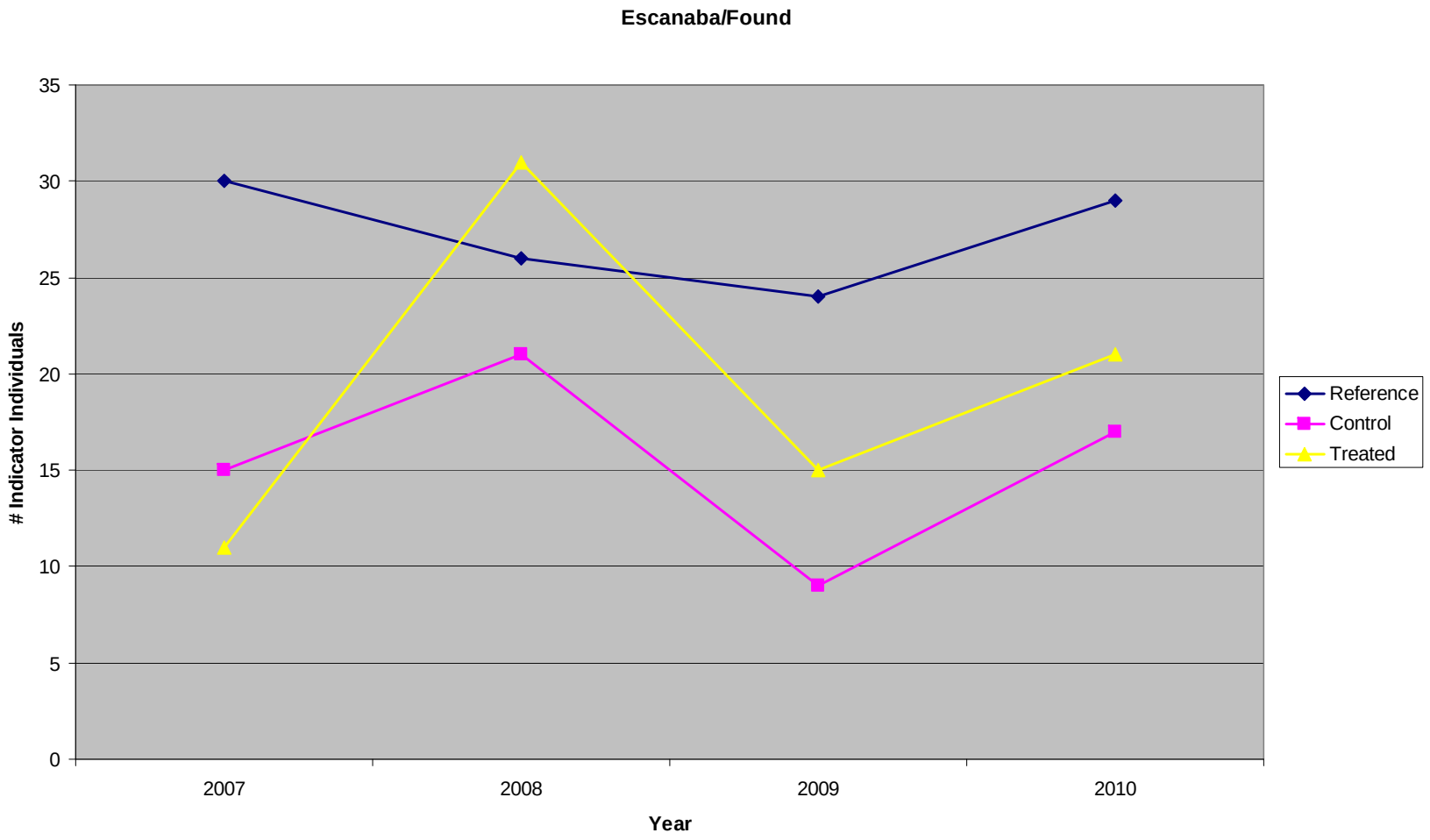
- AMRE American Redstart
- AMRO American Robin
- BAWW Bl. & Wh. Warbler
- BLBW Blackburian Warbler
- BTBW Bl-thr. Bl. Warbler
- BTNW Bl-thr. Gr. Warbler
- CSWA Ch.-sided Warbler
- EAPW E. Wood-pewee
- GCFL Gr-crest Flycatcher
- HETH Hermit Thrush
- MYWA Myrtle Warbler
- NOPA Northern Parula
- PIWA Pine Warbler
- NAWA Nashville Warbler
- OVEN Ovenbird
- REVI Red-eyed Vireo
- RBNU Red-br Nuthatch
- RBGR Rose-br. Grosbeak
- SOSP Song Sparrow
- TRES Tree Swallow
- VEER Veery
- WTSP Wh.-thr. Sparrow

Quantifying Success – Hypothetical Example





Results 2007-2010 of Indicator Species



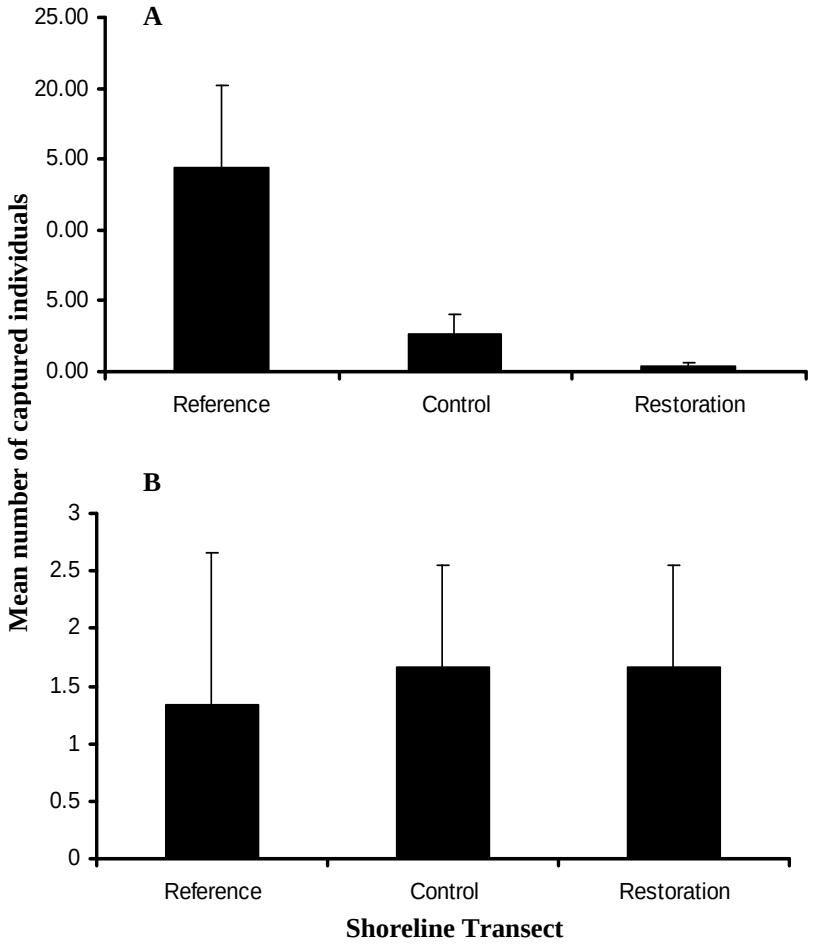
Small Mammal Trapping

Photo by D. Haskell

Peromyscus Spp.

- Deer mice abundance was negatively correlated with human development in central Ontario, Canada (Racey & Euler 1982)
- Historically, white-footed mouse are found in the southern three quarters of the state with a preference for deciduous forests (Jackson 1961)
- Currently, it may be moving slowly northward with the habitat alterations, climate change, and/or forest management practices

Results *Peromyscus Spp.*



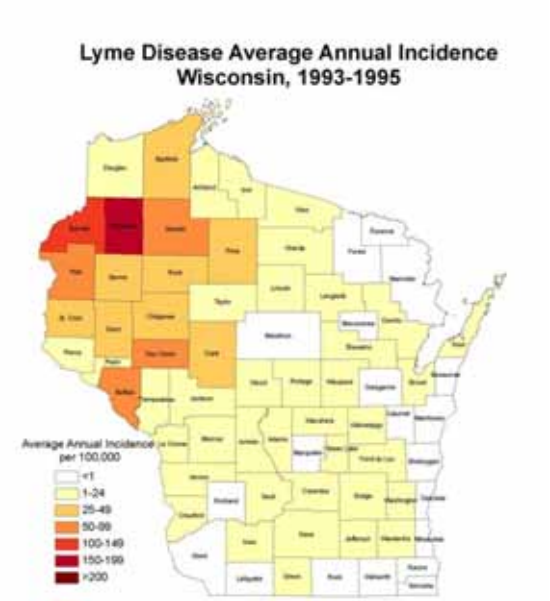
Deer Mouse
(*Peromyscus maniculatus)*

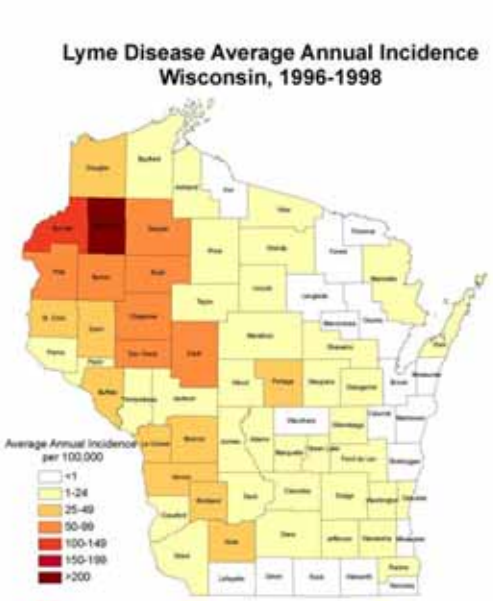
White-footed Mouse
(*Peromyscus leucopus)*

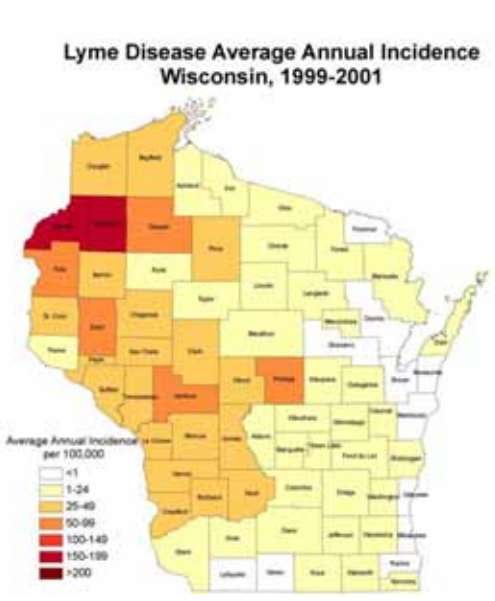
Means and standard errors of deer mouse (*Peromyscus maniculatus)* (A) and white-footed mice (*Peromyscus leucopus*) (B) captured on three matched lakes in Vilas County, Wisconsin in 2008.

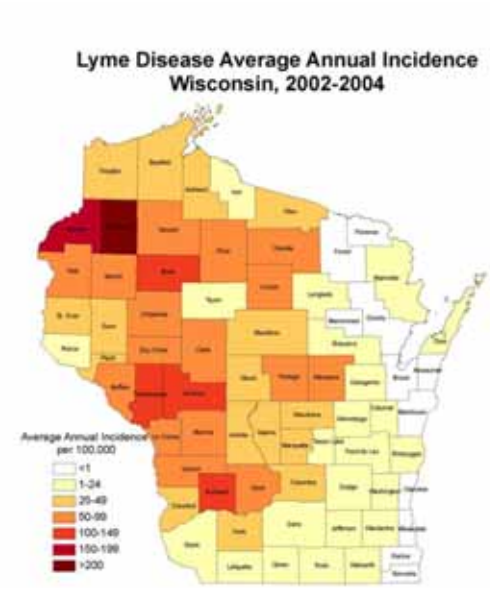
Ticks and Lyme Disease

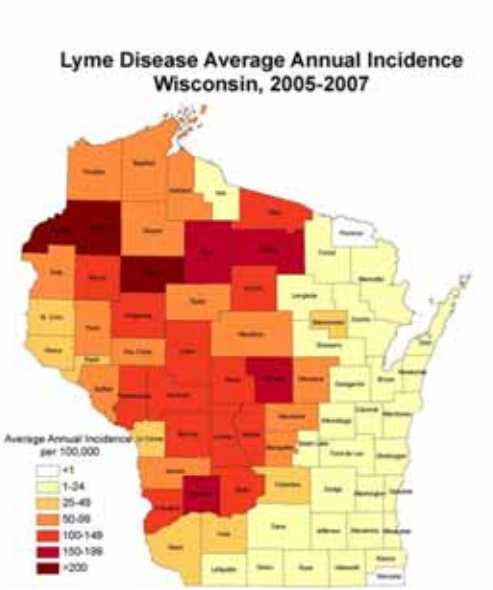
Cases have spread over a larger area

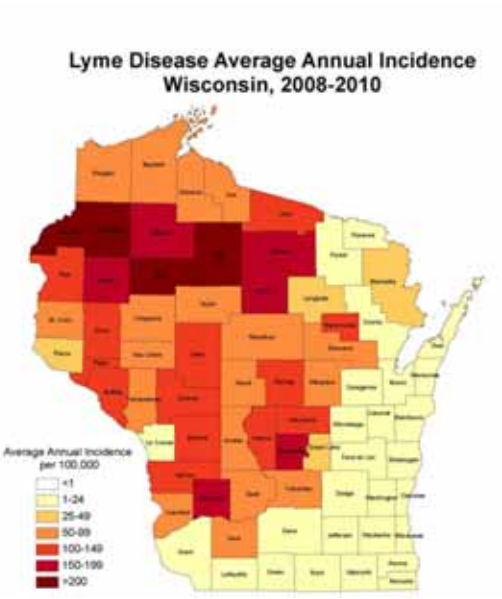








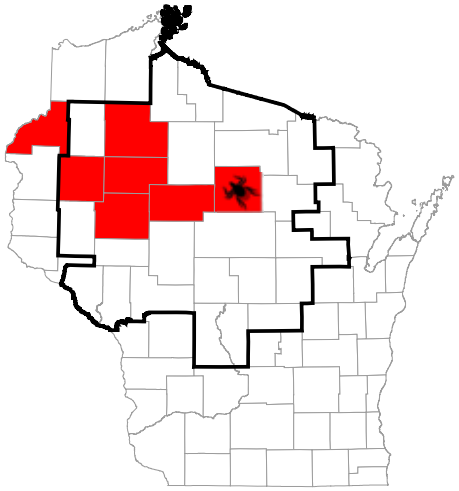




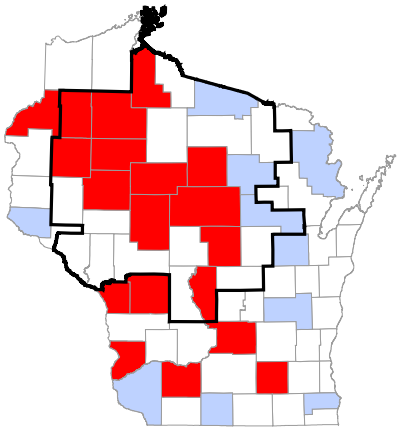
WDPH data: http://www.dhs.wisconsin.gov/communicable/TickBorne/LymeDisease/Data%20and%20Statistics.htm

The tick has spread across the state

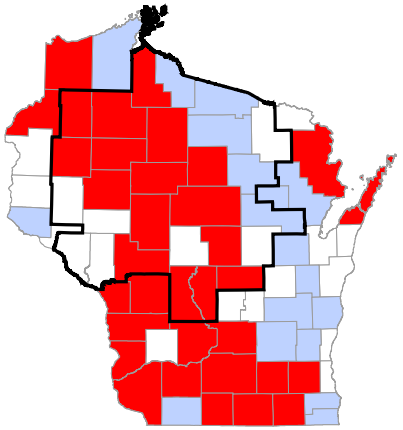
1st tick survey - 1968



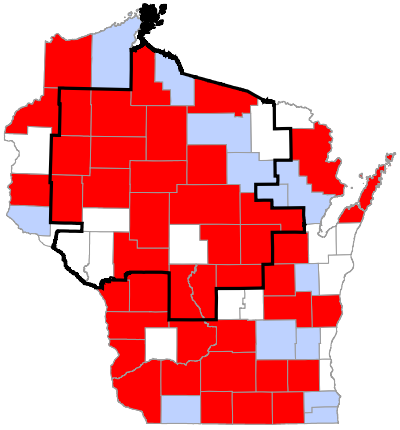
1979-1982



1996-1998



2008



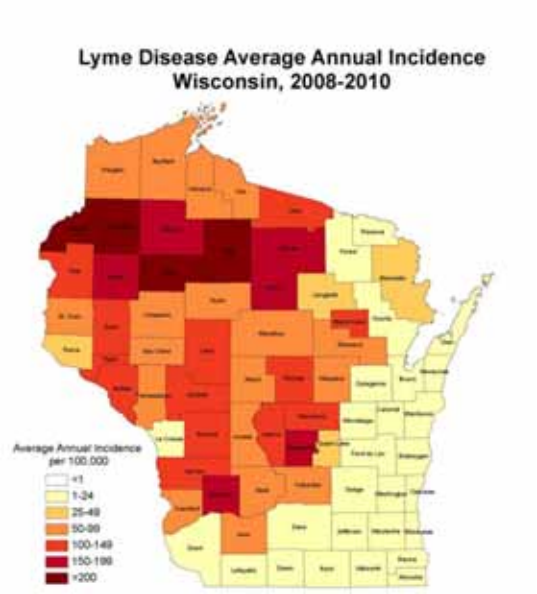
Marshfield Clinic Service Area

I. scapularis-positive County

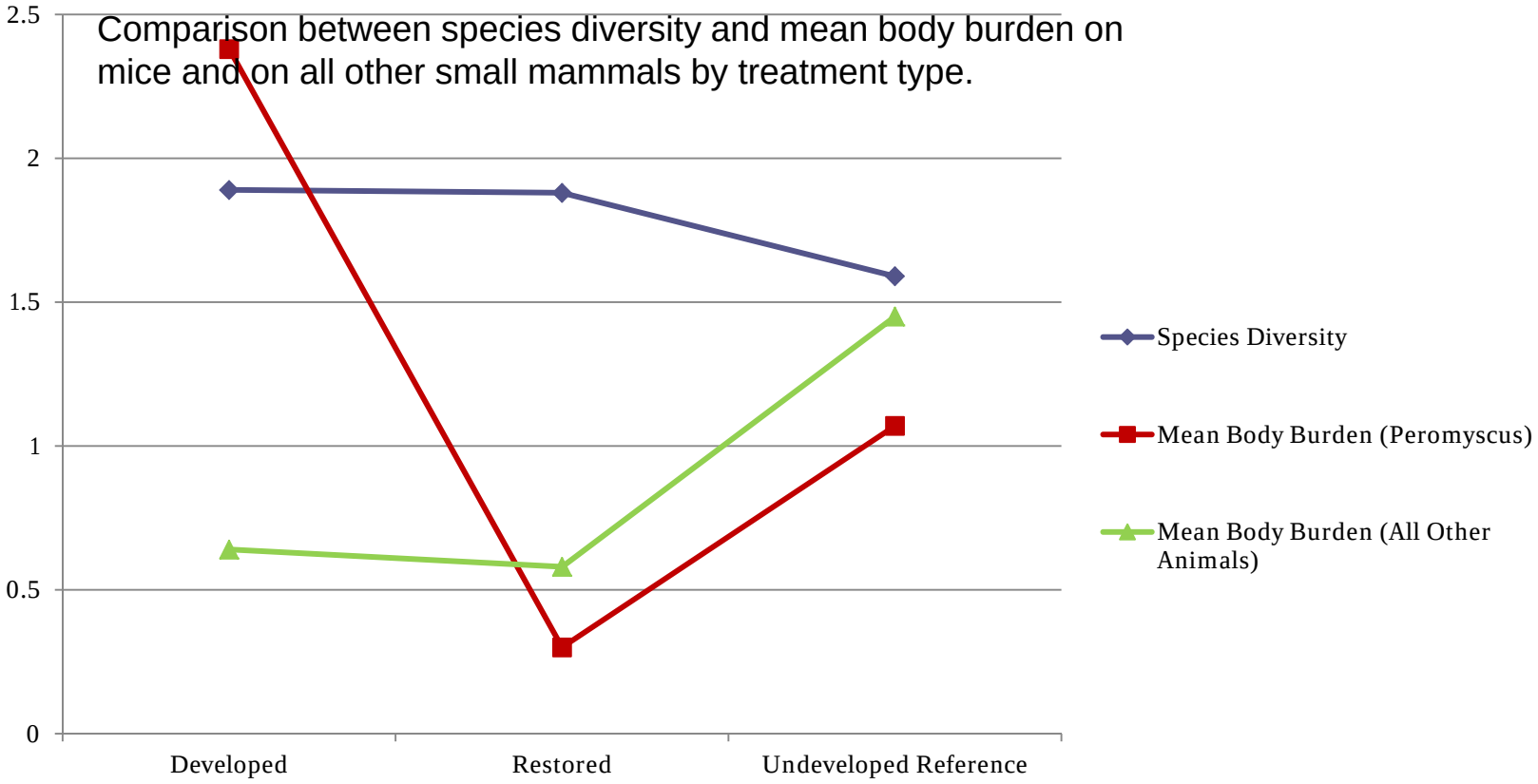
I. scapularis-negative County

No reports

Jackson & DeFoliart (1970)
Davis et al. (1984)
Callister et al. (1988)
French et al. (1995)
Riehle & Paskewitz (1996)
Walker et al. (1996)
Caporale et al. (2005)
Guerra et al. (2002)
Diuk-Wasser et al. (2006)
WDPH (unpublished)



Results
Species Diversity and Mean Tick Body Burden



Results

Tick Abundance on Small Mammals

Table 1: The odds of finding a tick on a small mammal

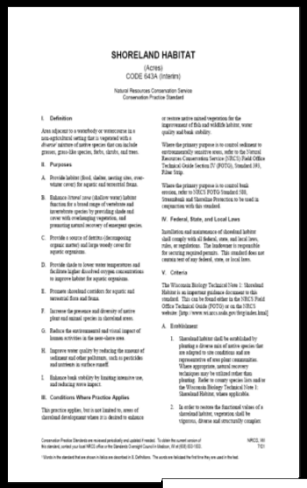
	Odds Ratio	95% CI	*P*
Developed vs. Undeveloped Reference	**3.20**	1.03 - 9.84	0.043*
Restored vs. Undeveloped Reference	**0.85**	0.26 - 2.77	0.784
Restored vs. Developed	**0.27**	0.14 - 0.50	<0.0001*

Table 2: The relative tick abundance on small mammals

	Relative Tick Abundance	95% CI	*P*
Developed vs. Undeveloped Reference	**3.07**	1.51 - 6.26	0.002*
Restored vs. Undeveloped Reference	**1.31**	0.63 - 2.74	0.47

*Statistically significant

Lessons learned > partnership building



SHORELAND HABITAT

(Acres)

CODE 643A (Interim)

Natural Resources Conservation Service
Conservation Practice Standard

I. Definition

Area adjacent to a waterbody or watercourse in a non-agricultural setting that is vegetated with a diverse mixture of native species that can include grasses, grass-like species, forbs, shrubs, and trees.

II. Purposes

A. Provide habitat (food, shelter, nesting sites, over-winter cover) for aquatic and terrestrial fauna.

B. Enhance littoral zone (shallow water) habitat function for a broad range of vertebrate and invertebrate species by providing shade and cover with overhanging vegetation, and promoting natural recovery of emergent species.

C. Provide a source of detritus (decomposing organic matter) and large woody cover for aquatic organisms.

D. Provide shade to lower water temperatures and facilitate higher dissolved oxygen concentrations to improve habitat for aquatic organisms.

E. Promote shoreland corridors for aquatic and terrestrial flora and fauna.

F. Increase the presence and diversity of native plant and animal species in shoreland areas.

G. Reduce the environmental and visual impact of human activities in the near-shore area.

H. Improve water quality by reducing the amount of sediment and other pollutants, such as pesticides and nutrients in surface runoff.

I. Enhance bank stability by limiting intrusive use, and reducing wave impact.

III. Conditions Where Practice Applies

This practice applies, but is not limited to, areas of shoreland development where it is desired to enhance or restore native mixed vegetation for the improvement of fish and wildlife habitat, water quality and bank stability.

Where the primary purpose is to control sediment to environmentally sensitive areas, refer to the Natural Resources Conservation Service (NRCS) Field Office Technical Guide Section IV (FOTG), Standard 391, Filter Strip.

Where the primary purpose is to control bank erosion, refer to NRCS FOTG Standard 580, Streambank and Shoreline Protection to be used in conjunction with this standard.

IV. Federal, State, and Local Laws

Installation and maintenance of shoreland habitat shall comply with all federal, state, and local laws, rules, or regulations. The landowner is responsible for securing required permits. This standard does not contain text of any federal, state, or local laws.

V. Criteria

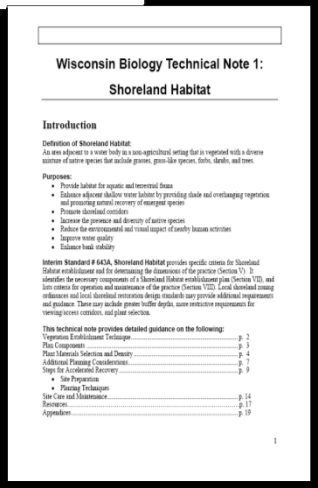
The Wisconsin Biology Technical Note 1: Shoreland Habitat is an important guidance document to this standard. This can be found either in the NRCS Field Office Technical Guide (FOTG) or on the NRCS website [http://www.wi.nrcs.usda.gov/forguides.html]

A. Establishment

1. Shoreland habitat shall be established by planting a diverse mix of native species that are adapted to site conditions and are representative of area plant communities. Where appropriate, natural recovery techniques may be utilized rather than planting. Refer to county species lists and/or the Wisconsin Biology Technical Note 1: Shoreland Habitat, where applicable.

2. In order to restore the functional values of a shoreland habitat, vegetation shall be vigorous, diverse and structurally complex

NRCS, WI
7/21



Wisconsin Biology Technical Note 1:

Shoreland Habitat

Introduction

Definition of Shoreland Habitat:
An area adjacent to a water body in a non-agricultural setting that is vegetated with a diverse mixture of native species that include grasses, grass-like species, forbs, shrubs, and trees.

Purposes:

- Provide habitat for aquatic and terrestrial fauna
- Enhance adjacent shallow water habitat by providing shade and overhanging vegetation and promoting natural recovery of emergent species
- Promote shoreland corridors
- Increase the presence and diversity of native species
- Reduce the environmental and visual impact of nearby human activities
- Improve water quality
- Enhance bank stability

Interim Standard # 643A, Shoreland Habitat provides specific criteria for Shoreland Habitat establishment and for determining the dimensions of the practice (Section V). It identifies the necessary components of a Shoreland Habitat establishment plan (Section VII), and lists criteria for operation and maintenance of the practice (Section VIII). Local shoreland zoning ordinances and local shoreland restoration design standards may provide additional requirements and guidance. These may include greater buffer depths, more restrictive requirements for viewing/access corridors, and plant selection.

This technical note provides detailed guidance on the following:

1

- Partners had to come together around a common purpose—a research project that helps us better understand if shoreland restorations improve water quality and wildlife habitat
- Each agency/partner had to think about other partners points of view, including landowners, relating to items like lakeshore access, erosion control techniques, permitting work, plant choices, planting density, contracts, media coverage, etc.
- A holistic partnership involving a myriad of agencies, people, and talents is crucial to this project's success

The Wisconsin Lakes Partnership

Lessons learned > landowners

• Ecological literacy varies – need to educate

•Restorations require maintenance by landowners and some loss of access. Many landowners seasonal.

•Expectations not always met – restoration does not equal landscaping. Deer resistant plant species often "boring".

•Deer feeding must end at all properties – will cause complete project failure. Deal-breaker for some.

•Contracts are a key tool for working with landowners on the ten-year study

• Landowners vital to making this partnership work over the ten-year period of the study – ongoing contact

• Finding willing landowners to participate in the lakeshore restoration process is a continuing issue (even though it is free)

The Wisconsin Lakes Partnership

Lessons learned > plantings and watering

- Know your soil! Plant list depends on it. Testing at UW Soils Lab.
- Use deer resistant plant species - more conifers and hazel in the restoration plans
- Start thinking about climate change for plant species.
- Watering/irrigation essential - 1” weekly for first 2 years.
- Site conditions variable and can be difficult — harsh exposure, ‘*sugar*’ sand soil, steep slopes (up to 45°)
- Need a consistent policy on a “sacrifice area” for winter dock and shore station storage

The Wisconsin Lakes Partnership

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

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

Land owners must agree to end deer feeding

The Wisconsin Lakes Partnership

The Wisconsin Lakes Partnership

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?

- Creating a reliable and consistent funding source for the 10-year duration of the project between multiple agencies continues to be a hurdle to overcome

- Biocontrol and other erosion control techniques can be costly and logistically challenging

Lessons learned > lot sizes

Developed lakes with little shoreland habitat alteration and lot widths >200' have less impact on wildlife and plant communities

The Wisconsin Lakes Partnership

Lessons learned > working with nurseries & contractors

- Building local expertise with nurseries and contractors for effective shoreland buffer designs and installations will be a continued priority

The Wisconsin Lakes Partnership

Additional Lesson Learned - Shore Restore is a hard sell, and the public is not "buying"!

- Majority of public not convinced restoration needed – sensitive to having "done something wrong"
- Property rights – suspect intention of DNR
- Primary concern erosion, not habitat
- Trusted lake leader best recruiter – one vocal squeaky wheel and many bail out
- Restrictive covenant a deal breaker for some – worry about resale or future subdivision potential
- Do not **BLOCK THE VIEW!**
- **DEER DAMAGE A BIG PROBLEM!** Don't like the fence – but essential to success. Feeding has to end for restoration to succeed.
- Neighborhood and family feuds surface

The Wisconsin Lakes Partnership


Moon Lake 2008
Before
Restoration

Moon Lake 2009
After Restoration


MOON BEACH
RESTORING OUR SHORE
"Conservation is a state of harmony between man and land"
Aldo Leopold on the Conservation Ethic
During Spring and Summer of 2009, the 1,300 linear feet of shoreline that stretch out to Vesper Point underwent an "Extreme Makeover" of sorts. Shoreland restoration is a lake management practice that uses native trees, shrubs and groundcover to reduce lakeshore erosion and improve aquatic and wildlife habitat quality.
As you walk the improved lakeshore path,take time to observe the flourishing native plants, trees and specialized erosion control materials. With time and monitoring, we should see a marked improvement in water quality, nesting birdlife, and breeding populations of native fish and amphibians on the shores of Moon Beach Camp.
This restoration is a cooperative effort with Wisconsin DNR, Vilas Co. Land and Water Conserervation Dept., Alma Moon Lake Protection and Rehabilitation District as part of a multi-lake restoration and research project.

Crystal Lake

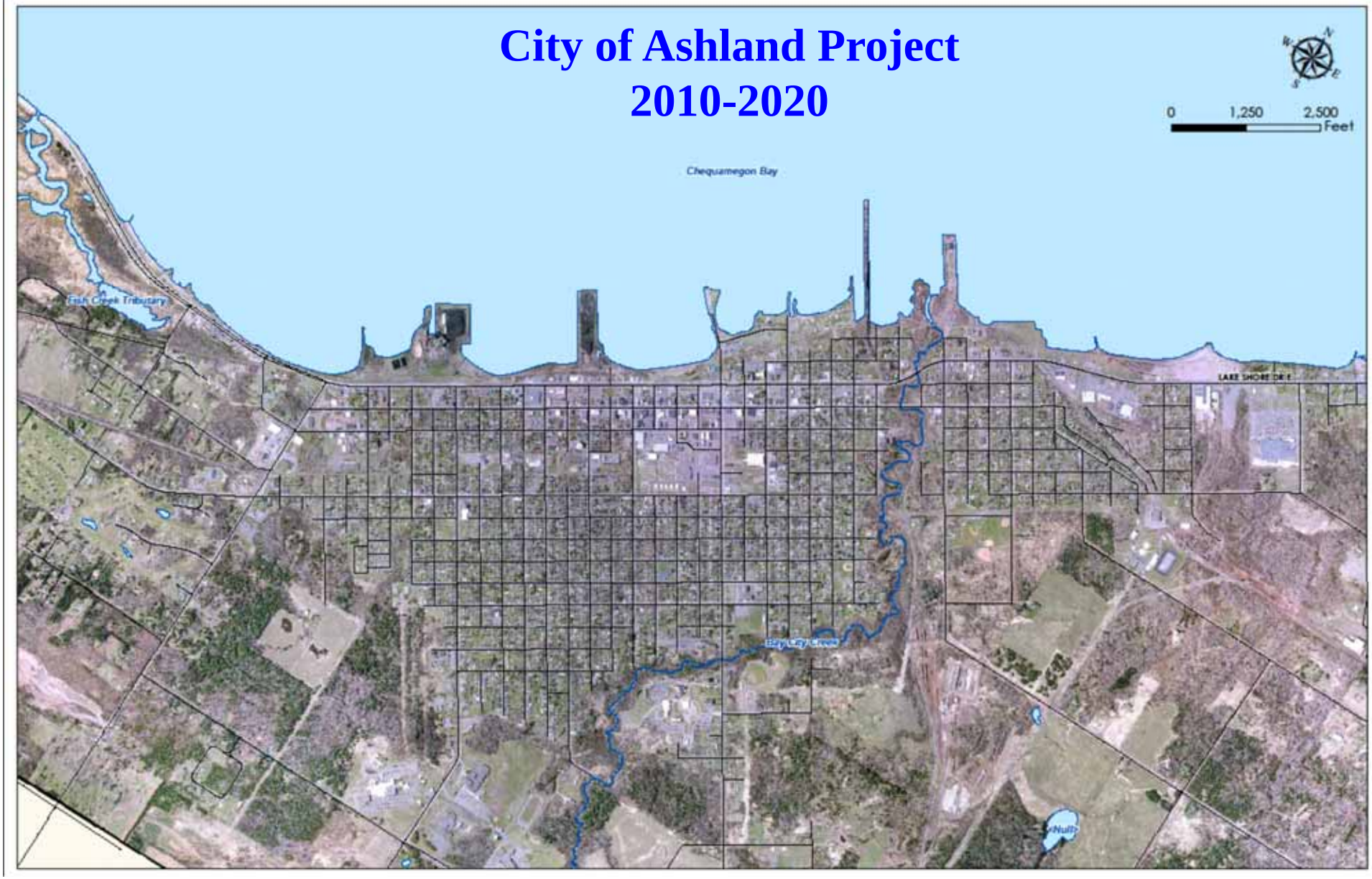
Crystal Lake

Photo by D. Haskell

Additional Partners

- Lost Lake property owners, Vilas County, 2010-2011 (county cost-share)
- Little St. Germain property owners, Vilas County, 2010 – 2012 (Wisconsin Lake Management Grant)
- City of Ashland Waterfront (numerous partners)

Quantifying the Ecological Benefits of Shoreland Restoration in Wisconsin



Funding – USEPA Great Lakes Research Initiative Grant

Partners: WDNR Science Services, IGISES, City of Ashland, Ashland County,Sigurd Olson Environmental Institute/Northland College, Northwest Cooperative Weed Management Unit, UW Extension,

ASHLAND, LAKE SUPERIOR AND THE APOSTLE ISLANDS.

Possible GLRI Funded Restoration Sites

0 1,500 3,000 Feet

Ashland WISCONSIN

Bayview Park Site

Hotel Chequamegon Site

Invasive Species Control

Buckthorn and Japanese honeysuckle infests work sites

— WEDNESDAY, OCTOBER 13, 2010 —

The Daily Press

Read people. Read news.

Council starts union negotiations

Will apply for EPA grants

WEEDING OUT INVADERS

EPA funds benefit Ashland shore

Washburn schools left with lunch tab

INSIDE

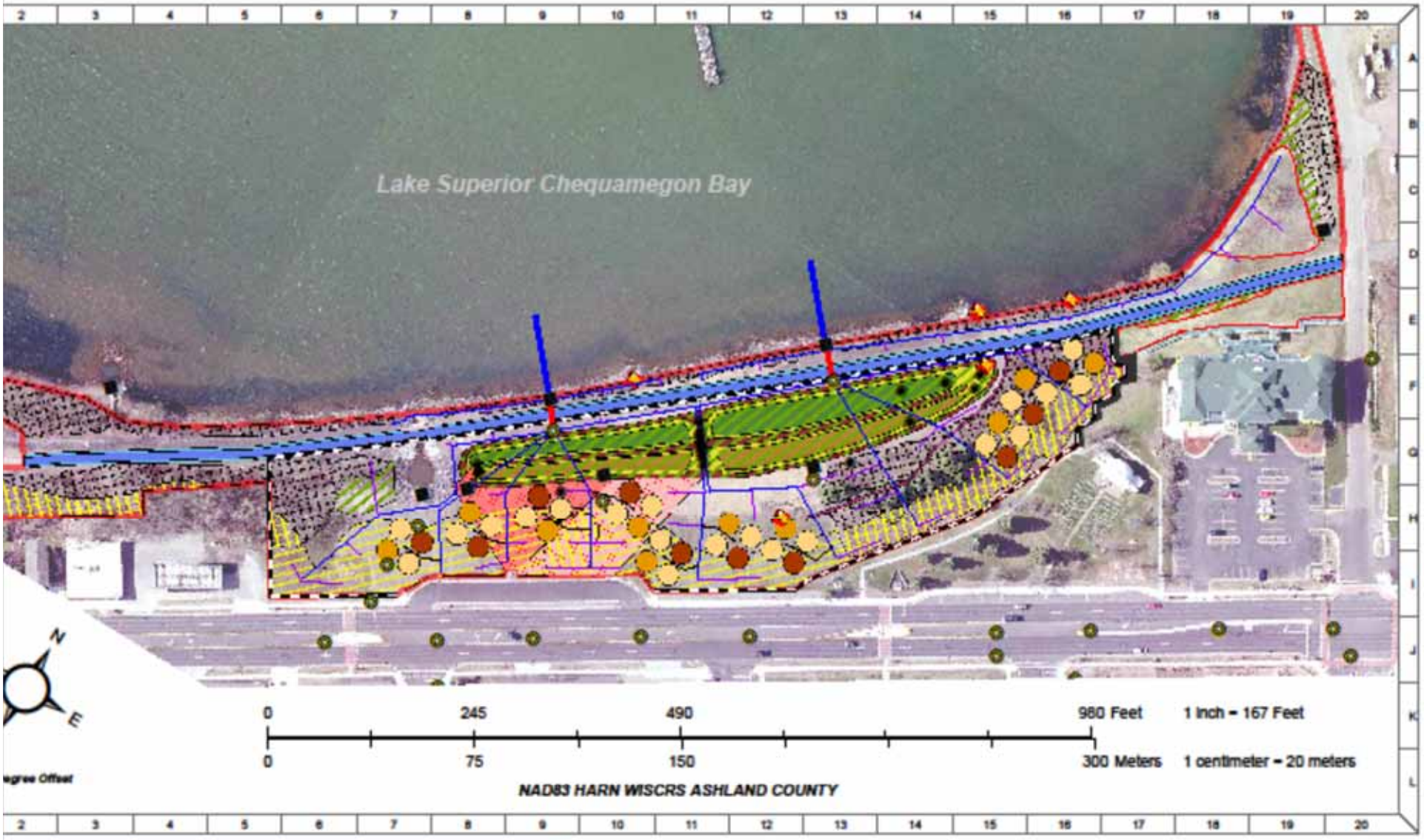
SPORTS

AHS wins big

LOCAL

Kacvinsky honored

OBITUARIES



Enclosed Restoration:
Buffer Upland (Open): 0.69 ha
Buffer Upland (Wooded): 0.32 ha
Buffer Lowland: 0.24 ha
Hi-Density Plot Treatment: 0.05 ha
Low-Density Plot Treatment: 0.05 ha
Control Plot Treatment: 0.1 ha

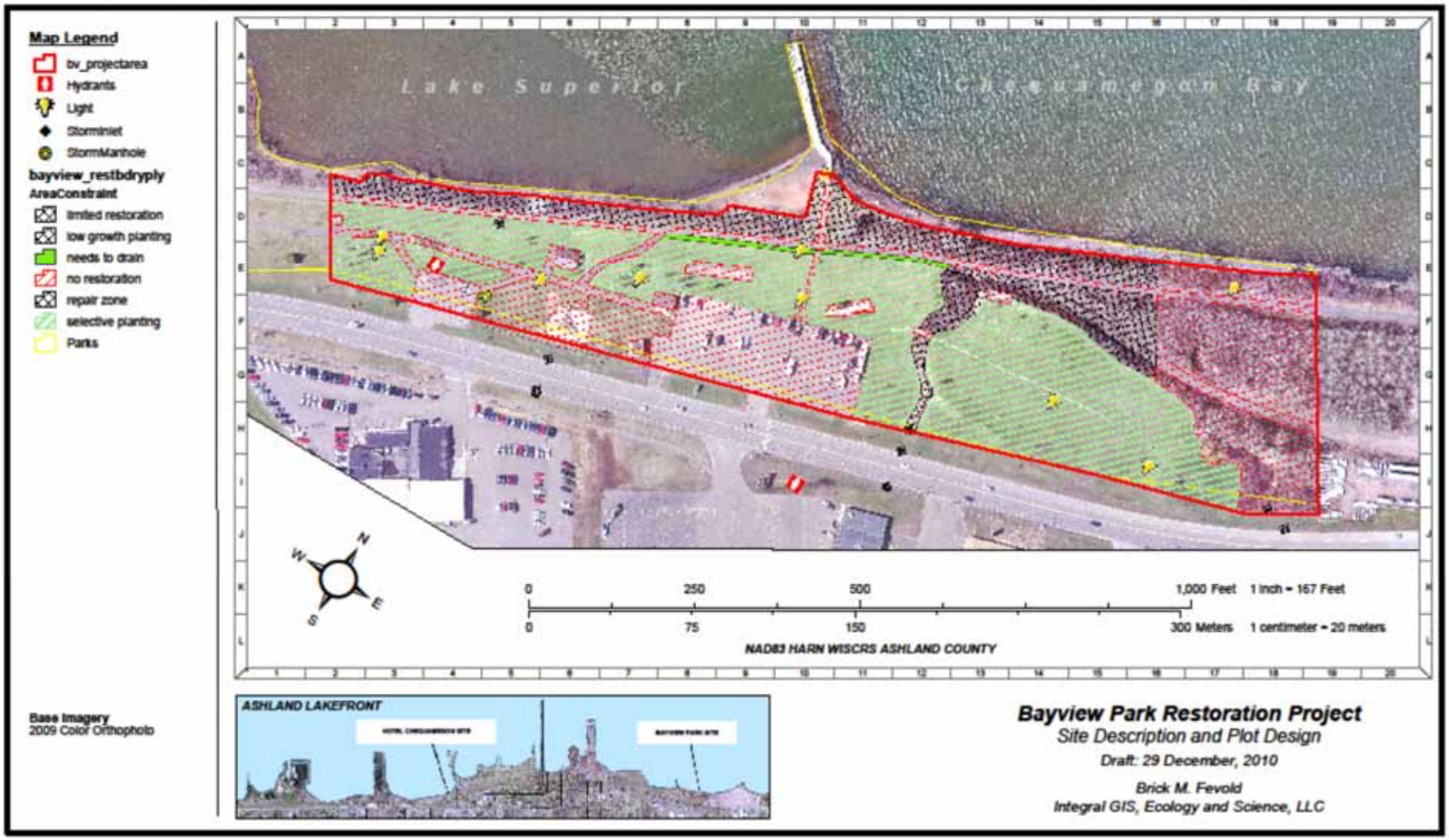
Hotel Chequamegon Restoration Project

Site Description and Plot Design

Draft: 24 January, 2011

IGISES - Integral GIS, Ecology and Science, LLC

Restoration Plan – Bayview Park Site



Restoration of Aquatic Macrophytes

5 years later!

Implementation & Funding Mechanisms - Found Lake

- Wisconsin County Conservation Cost-Share Program
- Reimburses landowner 70% of project costs
- Provides engineering (DATCP) and restoration expertise (VCLWCD)
- Wisconsin DNR Science Services
- Plans and implements restoration projects
- Conducts wildlife surveys
- Provides 30% of project costs, reimbursable to property owners

Implementation & Funding Mechanisms - Moon Lake

- Wisconsin Lake Protection Grant
- Sponsored by Moon/Alma Lake Rehabilitation District – submit proposal, submit invoices for reimbursement, document 25% match requirement
- WDNR reimburses 75% of project costs to Lake District

- Wisconsin DNR Science Services
- Plans and implements restoration projects
- Conducts wildlife surveys

- Moon Beach Camp
- Provides up to 25% of project costs to achieve required match for Lake Protection Grant

Measuring the value of wildlife habitat restoration on northern Wisconsin lakes—the Wisconsin Lakeshore Restoration Project

Mike Meyer[1], Dan Haskell[2], Patrick Goggin / Robert Korth[3], Stacy Dehne[4], Carolyn Scholl[5], and Brent Hanson[6]

[1] Wildlife Research Scientist - Wisconsin Department of Natural Resources > Bureau of Integrated Science Services

[2] Michigan Technical University - School of Forestry and Environmental Science

[3] Lake Specialists - Wisconsin Lakes Partnership, UW-Extension Lakes > University of Wisconsin – Stevens Point, College of Natural Resources

[4] Conservation Engineer - Department of Agriculture, Trade, and Consumer Protection (DATCP)

[5] County Conservationist – Vilas County Land and Water Conservation Department

[6] Nurseryman/contractor - Hanson's Garden Village nursery