

The Ecology of Shoreland Zoning: How the law protects Maine's Lakes



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Protecting Maine's Air, Land and Water

Overview

- Background – the statute and buffer basics
- How lakeshore development alters ecological functions of lakes
- Maine's Shoreland Zoning Act: connection to lake ecology
- Current littoral research in Maine's lakes



The Statute

Title 38: WATERS AND NAVIGATION

Chapter 3: PROTECTION AND IMPROVEMENT OF WATERS

Subchapter 1: ENVIRONMENTAL PROTECTION BOARD

Article 4-A: WATER CLASSIFICATION PROGRAM

§465-A. Standards for classification of lakes and ponds

A. Class GPA waters must be of such quality that they are suitable for the designated uses of drinking water after disinfection, recreation in and on the water, fishing, agriculture, industrial process and cooling water supply, hydroelectric power generation, navigation and as habitat for fish and other aquatic life. The habitat must be characterized as natural.

<http://www.mainelegislature.org/legis/statutes/38/title38sec465-A.html>



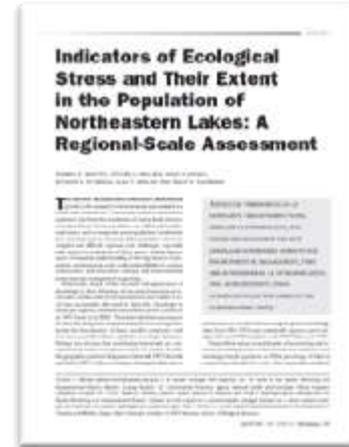
Why Bother?

1990s: New England Lakes Study (EMAP)

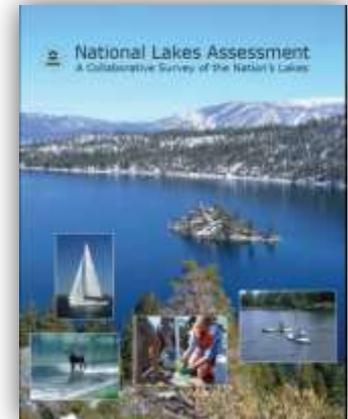
→ Over 45% of lakes in New England are stressed by shoreline disturbance.

2007: National Lakes Assessment (NLA)

→ Lakeshore Disturbance and shallow water Habitat most widespread problems in Northeast US Lakes



Whittier, Paulsen, Larsen, Petersen, Herlihy and Kaufmann. 2002.

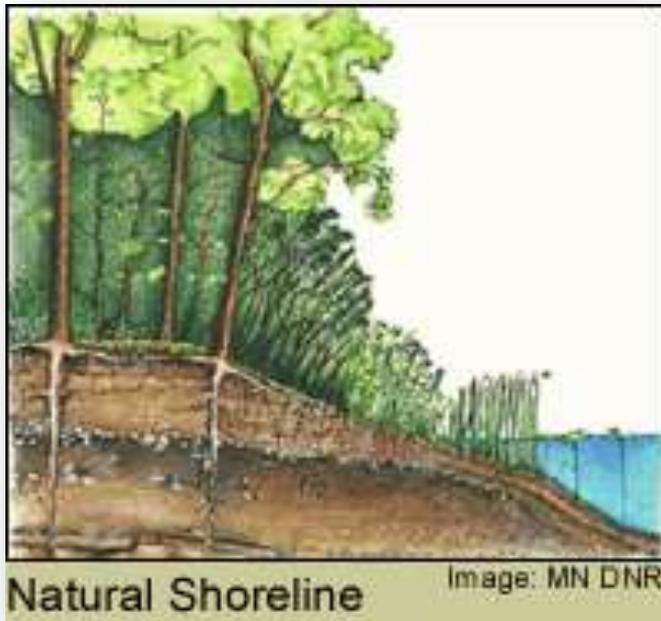


U.S. EPA, 2009



Buffer Basics

Naturally vegetated lakeshores protect water quality



Multiple layers of
vegetation slow speed of
rain and runoff, hold soil



Buffer Basics

- Loss of Shoreland Vegetation:
 - Destabilizes Shorelines
 - Increases Nutrient Loading
 - Simplifies shoreland and Littoral Habitat



Images: VT ANR



Shoreline Development & Lake Ecology



Shoreline Development & Wildlife



- Deer browse supply and winter habitat quality is lower

Armstrong et al., 1983



- Mink activity decreases

Racey and Euler, 1983

Shoreline Development & Wildlife



- Turtles lose basking sites, shelter, and corridors to inland nest sites

Engel and Pederson, 1998



- Green frog populations decline due to habitat loss

Woodford and Meyer, 2003

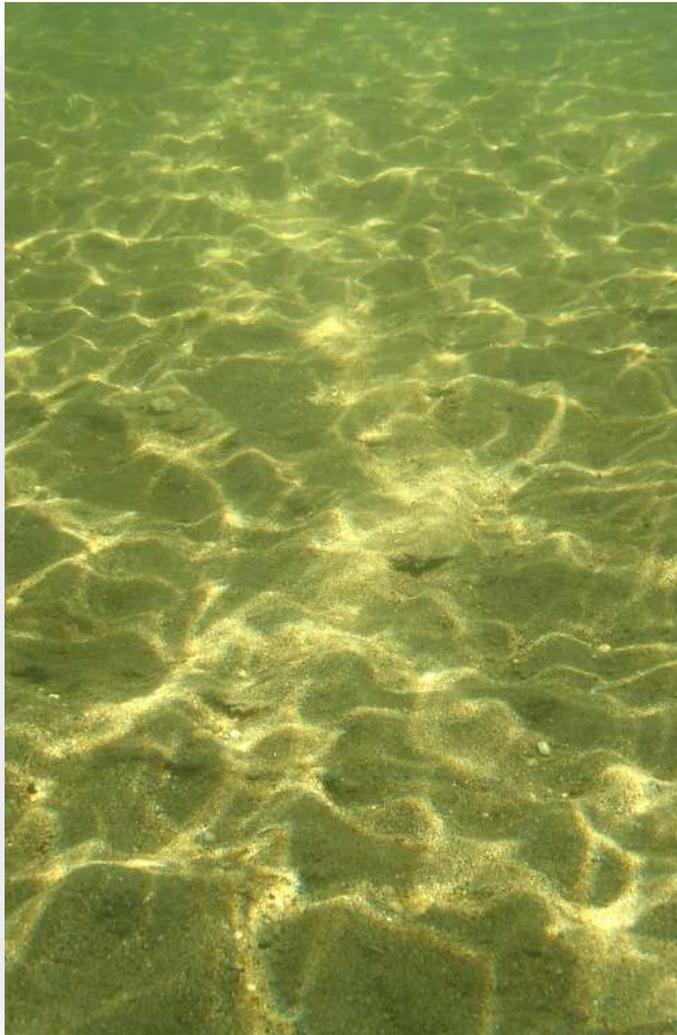


- Dragonfly and damselfly numbers decrease

Butler and deMaynadier, 2007



Shoreline Development & Fish



- Large and small woody habitat provide protection and shade for fish
- Gravel used for nest building in some species
- Nursery grounds for eggs and larval fish
- Developed shores lack shoreline cover, recruitment of woody habitat
- Sedimentation covers gravel, homogenizes substrate and suffocates interstitial spaces

Images: VT ANR



Shoreline Development & Fish



- Shifts in age structure of communities; species richness and abundance of larvae and juveniles declines

Bryan and Scarnecchia, 1992; Brazner, 1997; Engel and Pederson 1998; Tiallon and Fox, 2004;

- Decline in number of nests and probability of nest success

Wagner et al., 2006; Reed and Pereira, 2011

- Sensitive native species decline and tolerant species endure

Brazner, 1997

Images: VT ANR



Littoral Habitat and Aquatic Macroinvertebrates

- Developed Shores:
 - Decreased Shading
 - *warmer water*
 - Decreased Woody habitat and leaf litter
 - *Less cover & less food*
 - Decreased Aufwuchs (Biofilm)
 - *Less food*
 - Increased Sand & Embeddedness
 - *Covers holes and gaps important for refuge*
 - *Smothers eggs that need oxygen*



The Ecology of the Maine Shoreland Zoning Act



Maine's Shoreland Zoning Act: Ecological Functions

- 5 key criteria:
 1. 100' structure setback from high water line
 2. Retain 24 'points' of trees in 25' x 50' buffer segments
 3. No cut vegetation under 3' tall
 4. If path present, $\leq 6'$ wide and meandering
 5. No canopy openings $>250\text{ft}^2$



Maine's Shoreland Zoning Act

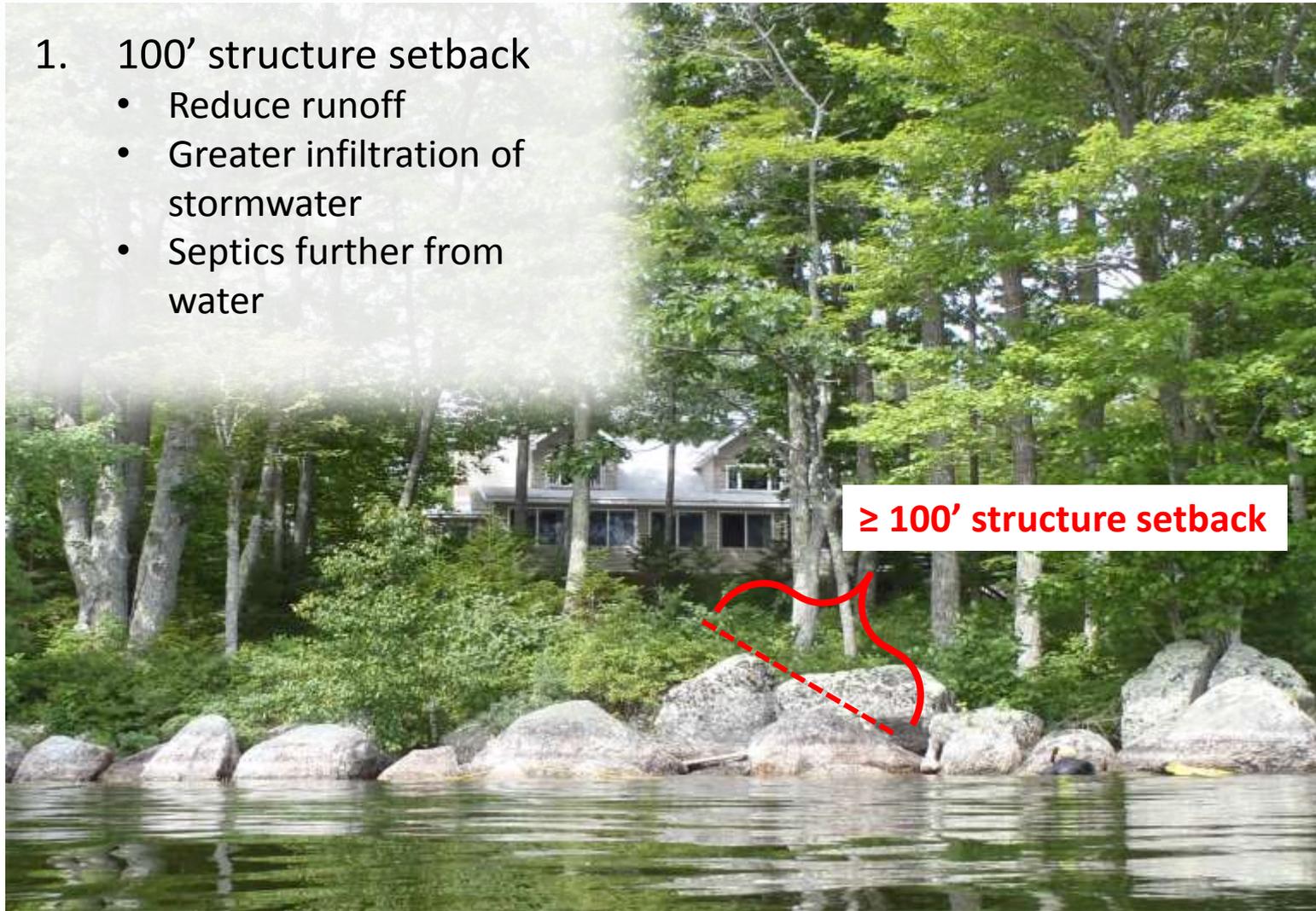


photo: VT ANR



Maine's Shoreland Zoning Act

1. 100' structure setback
 - Reduce runoff
 - Greater infiltration of stormwater
 - Septics further from water



≥ 100' structure setback

photo: VT ANR



Maine's Shoreland Zoning Act

2. Retain 24 "points" of trees in 25' x 50' buffer area
- Root system slows erosion
 - Reduce energy of rain
 - Increase woody habitat

Diameter	Points
Under 2"	0
2" to < 4"	1
4" to < 8"	2
8" to < 12"	4
12" or greater	8

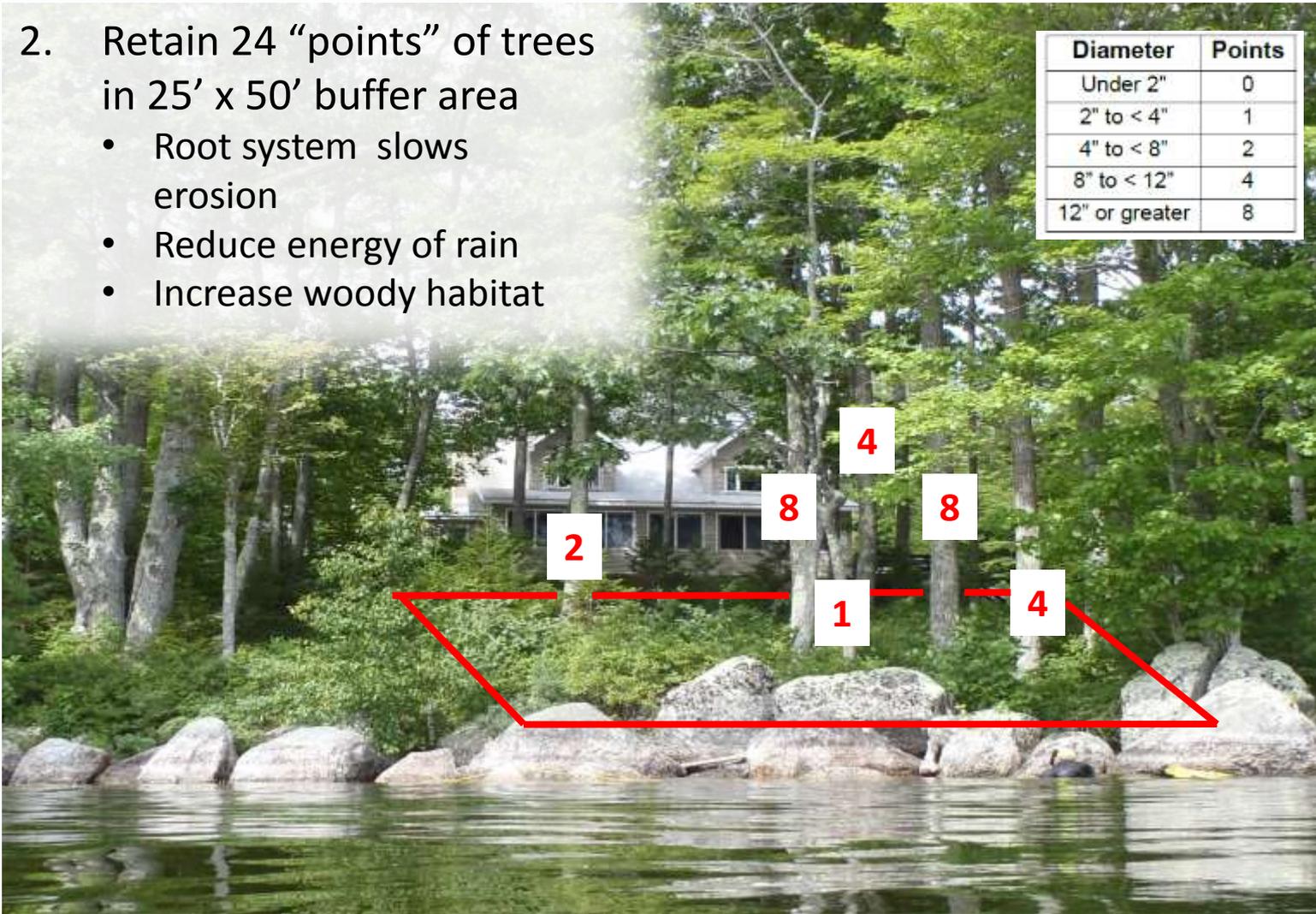


photo: VT ANR

Maine's Shoreland Zoning Act

3. No cut vegetation under three feet tall
 - Slows erosion, reduces rain energy
 - No lawn
 - Duff layer

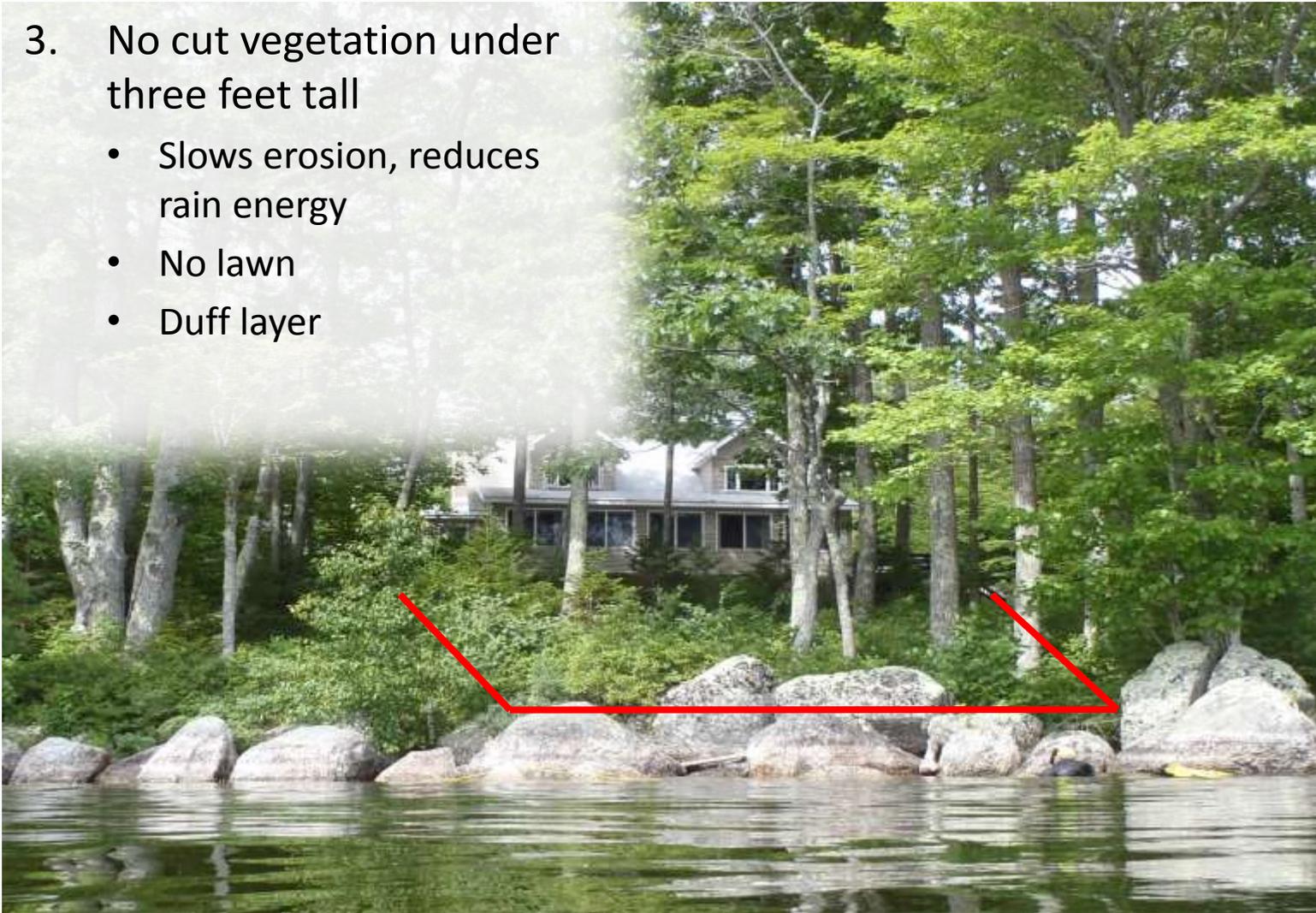


photo: VT ANR



Maine's Shoreland Zoning Act

4. If path, maximum six feet wide and meandering
 - No direct runoff path to lake
 - Slows and sheds runoff into vegetation



photo: VT ANR



Maine's Shoreland Zoning Act



5. No canopy openings greater than 250 ft²
- Reduces rain energy
 - Increases shading

photo: VT ANR



What happens without Shoreland Zoning?

- Vermont: No statewide shoreland zoning law (until 2014)
- VT DEC Surveyed Littoral Habitat (2008-2011)
 - Woody habitat & Leaf pack
 - Substrate Condition
 - Aquatic Plants & Biofilm cover
 - Shoreline: tree cover, height, shading
 - Odonate exuviae
 - Macroinvertebrates



photo: VT ANR



VT: Littoral Habitat Study

**Vermont Unbuffered
Developed Sites**



VS

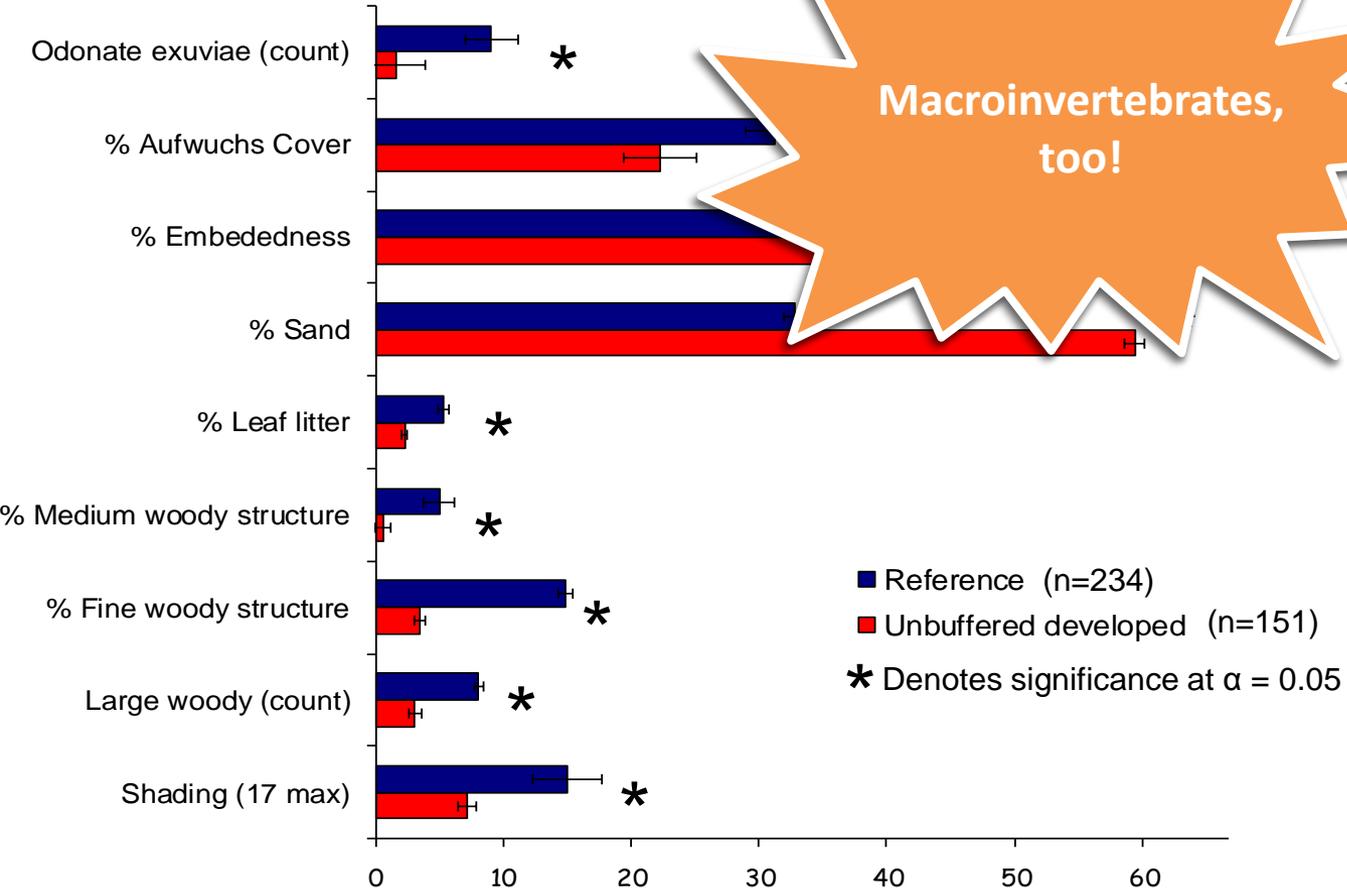
Vermont Reference Sites



photos: VT ANR



Removal of Lakeshore Vegetation → Simplification of Littoral Habitat



Designing Buffers

- **Does Maine's SZA protect littoral habitat?**
- Looked for sites meeting Maine's 40 year old Shoreland Protection Act in Vermont
 - Using 5 key criteria for buffer evaluation
- Of 48 buffered developed Vermont sites found, only 1 met Maine's law



VT & ME 2011 Joint Study: Sampled Sites in Maine Meeting State Shoreland Protection Act Standards

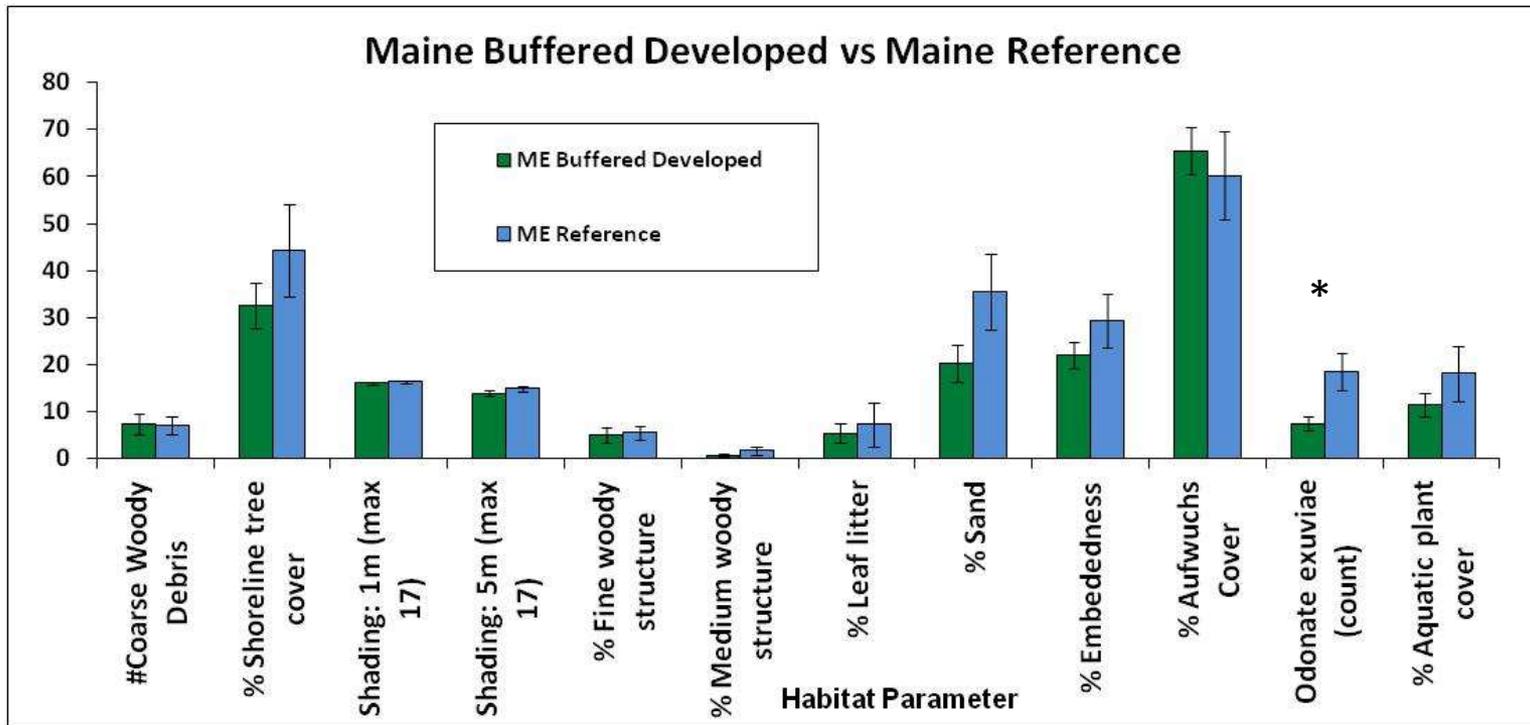
Garrison Beck, ME
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photos: VT ANR

Maine Lakes

- 36 buffered-developed sites (5 lakes)
 - All met Maine's SZA standards
- 13 Reference (undeveloped) sites



* = significant difference at $\alpha = 0.05$



Maine SZA Buffers Are Effective!

- Maine's Mandatory Shoreland Protection Act Standards Work to Protect Aquatic Habitat

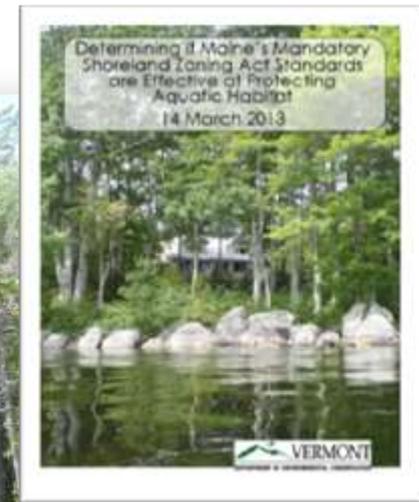


photo: VT ANR



Maine Buffers Are Variable!



photos: ME DEP

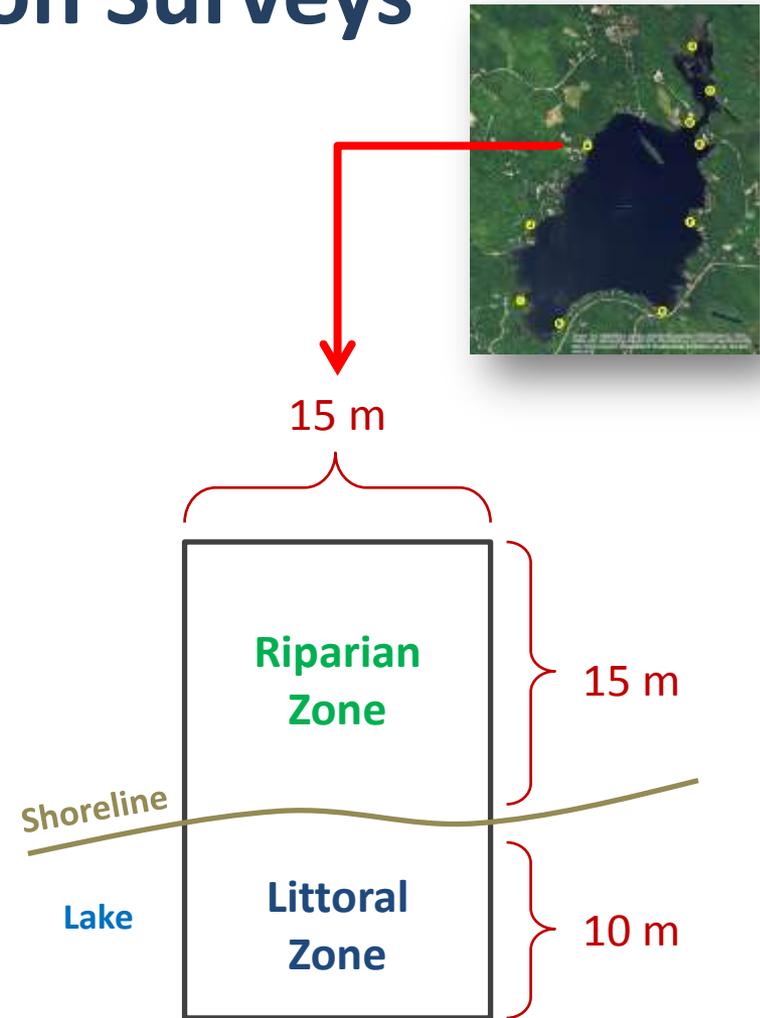


Current Littoral Habitat Work in Maine



Shoreline Condition Surveys

- Riparian Condition
 - Canopy to Ground
- Littoral Zone
 - Habitat cover & types
- Human Influence
 - Buildings, lawns, docks, etc.
- Macrophyte coverage
 - Functional groups, species
- Littoral Substrate Composition



Shoreline Condition: Bioassessment

- **Macroinvertebrates**
 - Rocky Cobble: 3 x 0.25m² quadrat
 - Macrophyte/Soft Substrate: 1-m D-net Sweep
 - Sand: 10 x 6.5 cm cores
- Will develop new metrics/index to compare to natural (reference) condition



photo: ME DEP



Shoreline Condition: Bioassessment

- **Macrophytes** – Quantitative assessment
 - Three 1 m² quadrats
 - 3, 6, 9 meters from shore, mid-plot
 - Percent cover of each species
- Developing new metrics/index to compare to natural (reference) condition



photo: ME DEP





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