

Shoreland zoning history

- The **Wisconsin Constitution**, adopted in 1848, says navigable waters are “common highways and forever free”
 - This led to “**The waters of WI belong to the people of WI**” which is the basis of the Public Trust Doctrine
 - State of WI has obligation to protect the **public’s rights** in all navigable waters including boating, fishing, swimming & hunting
 - Shoreland zoning, adopted in 1966, protects **public rights** through its purposes
 - Preventing and controlling water pollution is needed for boating and swimming
 - Protecting spawning grounds is needed for good fishing
 - Maintaining shore cover is needed for fishing & hunting
- s. 281.31 Wisconsin Statutes



Shoreland zoning standards protect property values

Less clear water = Lower waterfront property values



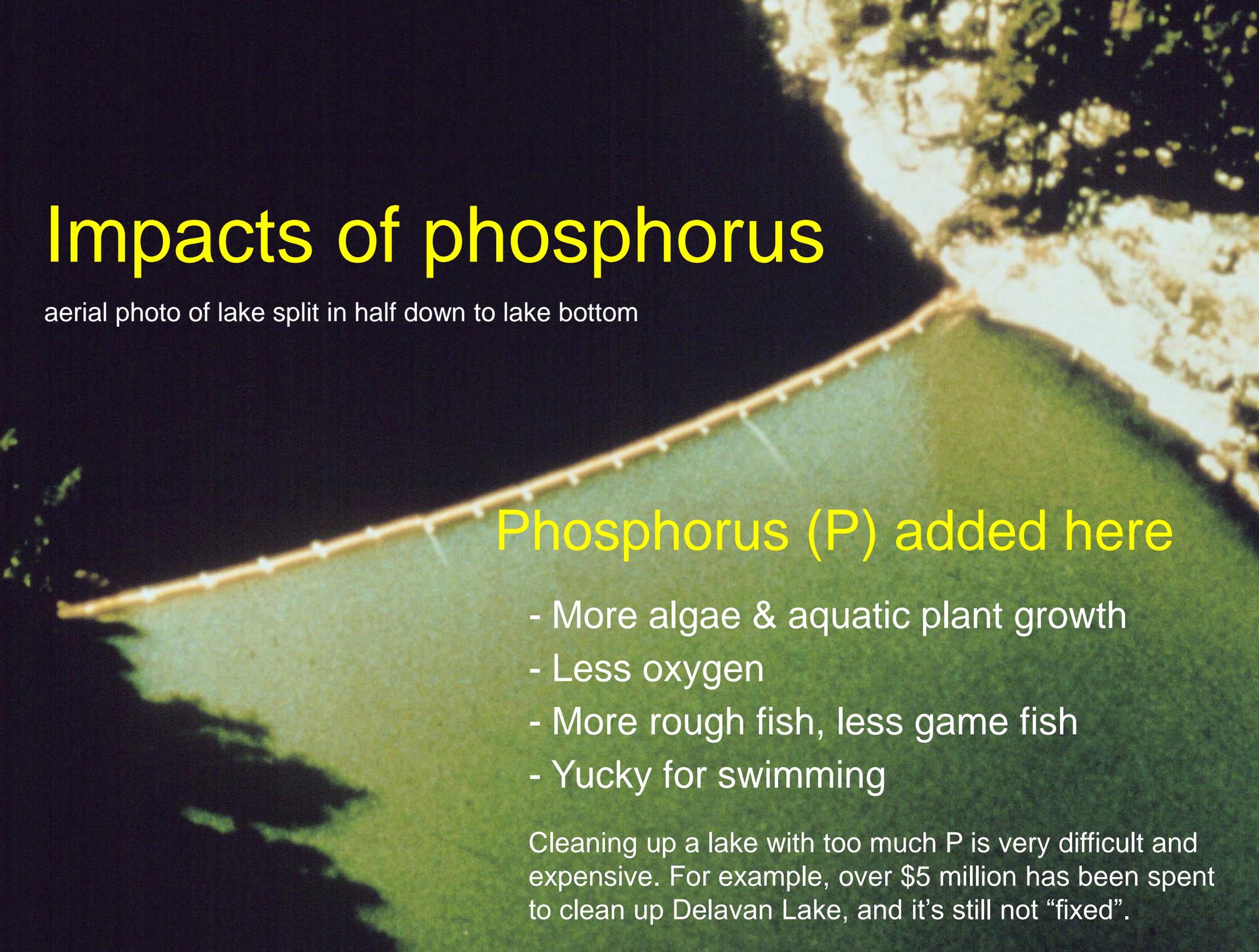
- A study of over 1200 waterfront properties in Minnesota found when water clarity went down by 3 feet, waterfront property values around these lakes went down by tens of thousands to millions of dollars



What shoreland practices make water less clear?

- Soil erosion
- Rooftops and pavement close to the water cause runoff that carries pollutants to waterway
- No shoreline buffer to filter runoff

Impacts of phosphorus



aerial photo of lake split in half down to lake bottom

Phosphorus (P) added here

- More algae & aquatic plant growth
- Less oxygen
- More rough fish, less game fish
- Yucky for swimming

Cleaning up a lake with too much P is very difficult and expensive. For example, over \$5 million has been spent to clean up Delavan Lake, and it's still not "fixed".



How do shoreland zoning standards keep phosphorus and other pollutants out of lakes & streams?

1. **Curb pollutants at their source:** Limits on filling and grading reduce the amount of soil erosion

Many soils in WI have high levels of phosphorus (P). For 80% of lakes in WI, if you add more P, you get more algae & aquatic plant growth. One pound of P in a lake can cause up to 500 pounds of algae growth.

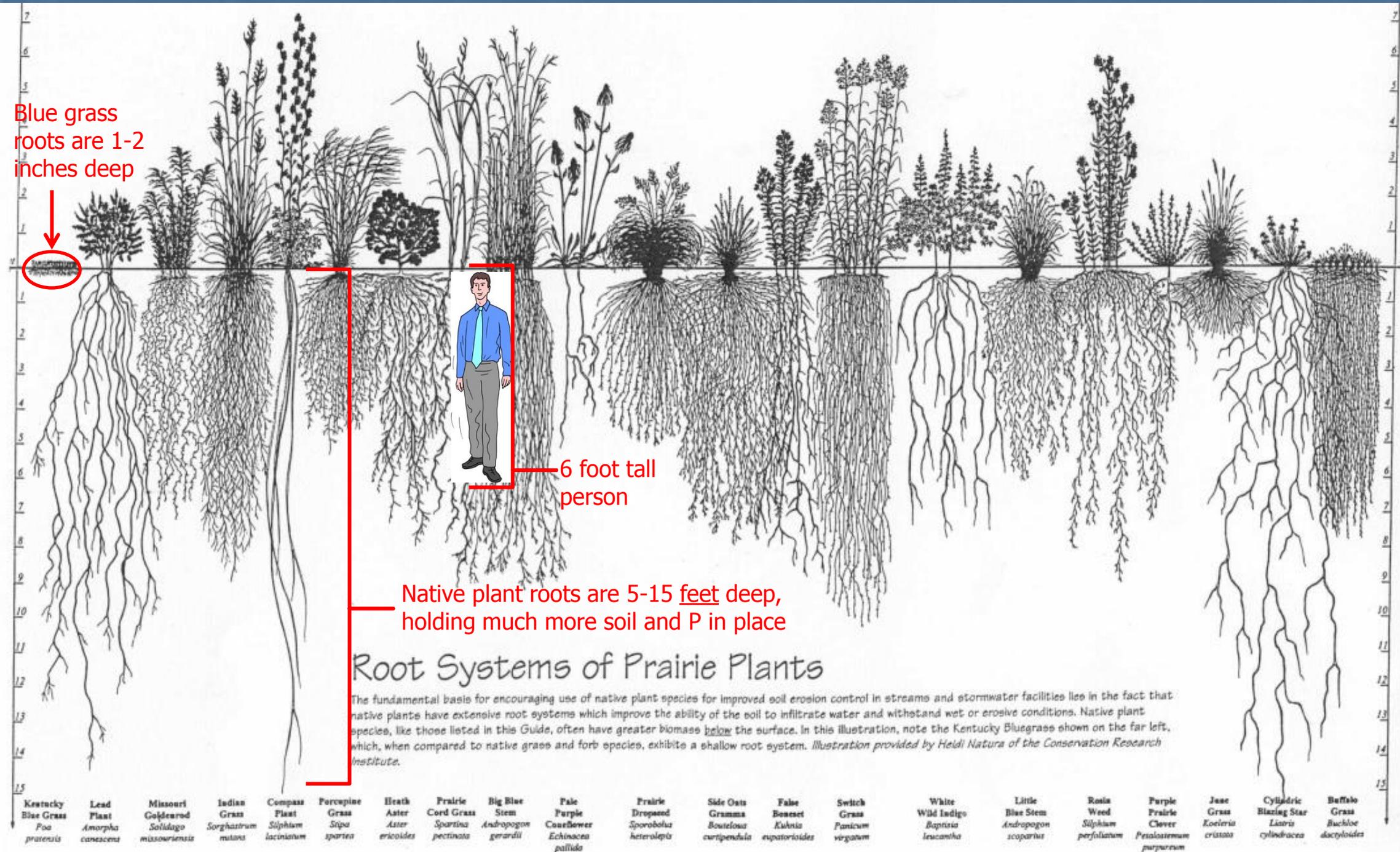
2. **Cut runoff:** Limits on impervious surfaces reduce the amount of runoff going to the waterway

3. **Capture and cleanse:** Shoreline buffers and rain gardens catch pollutant-carrying runoff

References

- Many soils in WI have high levels of phosphorus.
 - Average soil test phosphorus and potassium levels decline in Wisconsin. 2011. John Peters. ipcm.wisc.edu/blog/2011/01/average-soil-test-phosphorus-and-potassium-levels-decline-in-wisconsin/ Average soil test P for all Wisconsin farm soils in the 2005-2009 period was 53 ppm.
 - Optimum soils test levels for Wisconsin. 1999. K.A. Kelling et al. University of Wisconsin Extension. Page 6. learningstore.uwex.edu/Assets/pdfs/A3030.pdf High phosphorus levels for corn are 16-42 ppm.
- For 80% of lakes in WI, if you add more P, you get more algae & aquatic plant growth.
 - Understanding Lake Data. 2004. Byron Shaw. University of Wisconsin Extension. Page 6. learningstore.uwex.edu/Assets/pdfs/G3582.pdf
- One pound of P in a lake can cause up to 500 pounds of algae growth.
 - Lakescaping for Wildlife and Water Quality. Carrol L. Henderson et al. Minnesota Department of Natural Resources. Page 27.

Shoreline buffers



Blue grass cannot hold as much soil in place as native plants because blue grass has much shorter roots. Blue grass can lead to loss of shoreline, erosion, and sediment covering fish spawning beds.

What happens when a shoreline is clear cut?

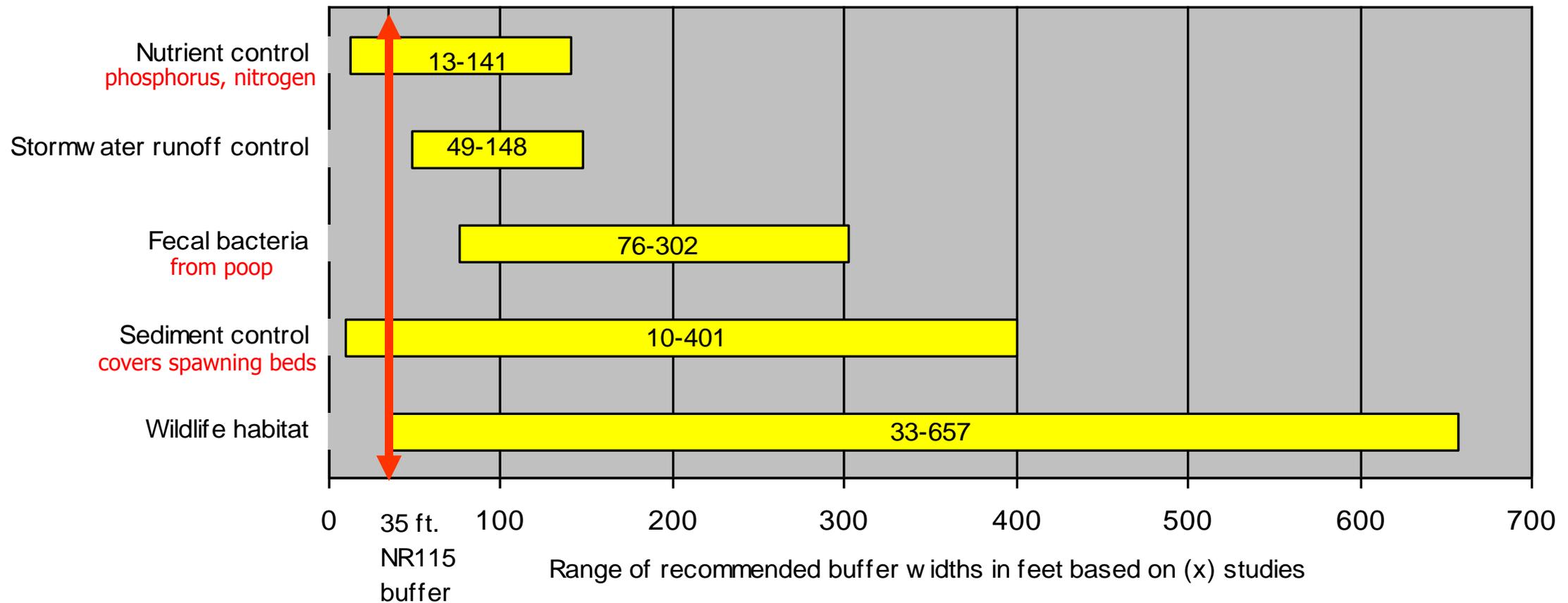


Developed site in Vermont

- Shoreline bank is destabilized, resulting in loss of land
- Soil erosion covers spawning beds, reduces fish habitat, and feeds algae growth
- Loss of shade, so warmer water temperatures, especially in streams
- Loss of habitat for birds, frogs and other wildlife
- Loss of natural scenic beauty

What can buffers do if they're big enough?

Recommended Shoreline Buffer Widths A Research Summary



Review of 52 U.S. studies by Aquatic Resource Consultants, Seattle WA

A 35 foot deep shoreline buffer does not keep bacteria from poop out of the water. In many situations, it doesn't keep P and sediment out of the water, and isn't enough for wildlife.

References

- Bar graph for shoreline buffers
 - A Literature Review of Recommended Buffer Widths to Maintain Various Functions of Stream Riparian Areas. 1992. Johnson, Alan W. (Aquatic Resource Consultants, Seattle, WA) and Diane M. Ryba. Prepared for King County Surface Water Management Division. 29 pages.

- What happens if a shoreline is clear cut? No shoreline buffer.
 - Determining if Maine's Mandatory Shoreland Zoning Act Standards are Effective at Protecting Aquatic Habitat, March 14, 2013 by the Vermont Department of Environmental Conservation.
anr.state.vt.us/dec/waterq/lakes/docs/lp_mainezoning.pdf
 - Study is summarized in Does shoreland zoning work? at uwsp.edu/cnr-ap/clue/Documents/Water/MaineVermontSLzoningresults.pdf

Buffers affect birds

- Shoreline buffers provide habitat for
 - Eagles, loons, great blue herons, wood ducks and more



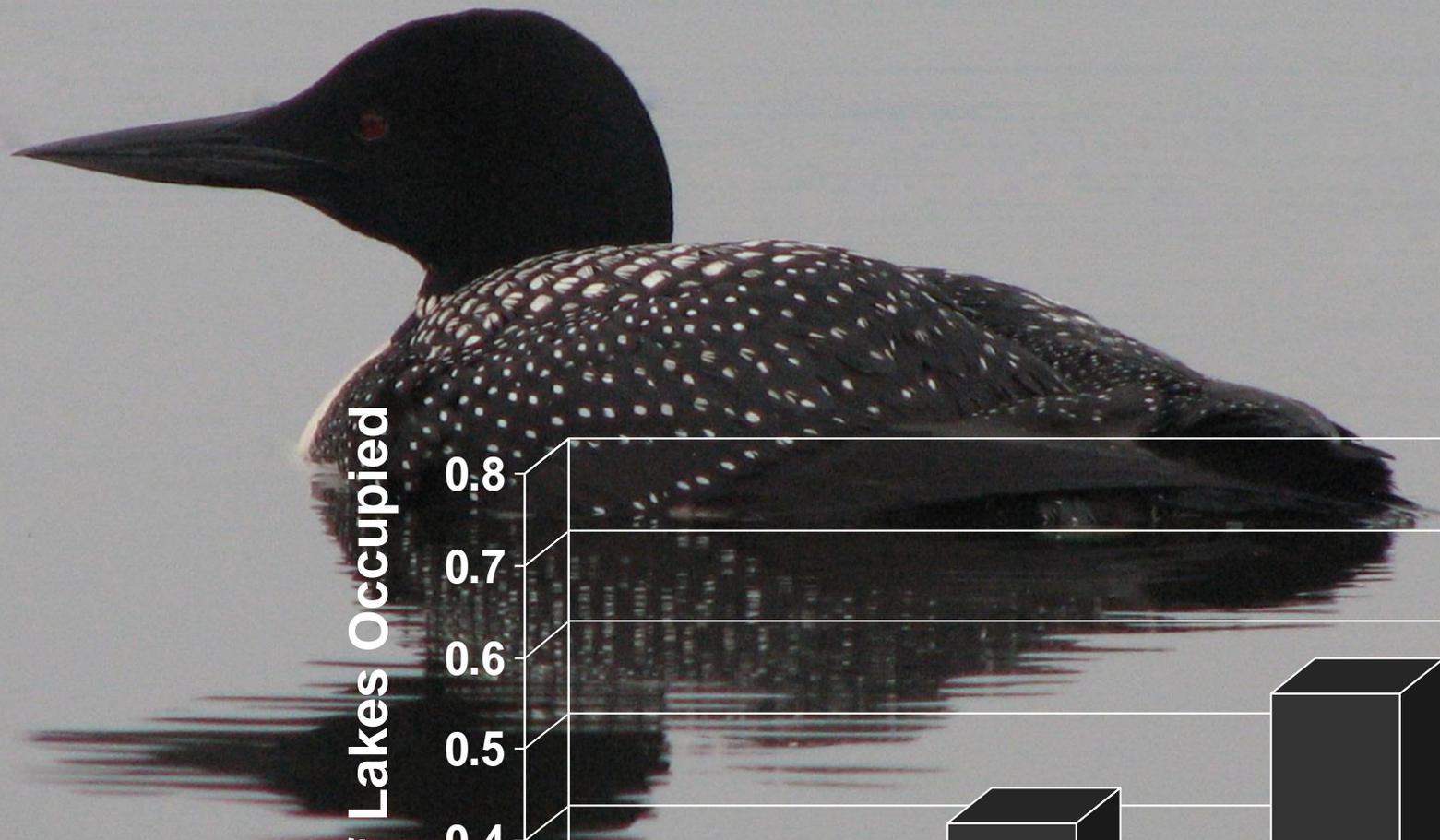
- Lawns provide habitat for
 - Canada geese



Geese avoid buffers because they can conceal predators such as coyotes, foxes and raccoons

Goose video at youtube.com/watch?v=9Oef1C_kPNI

Wisconsin Loons More Likely Found on Lakes with Clearer Water



Proportion of Lakes Occupied

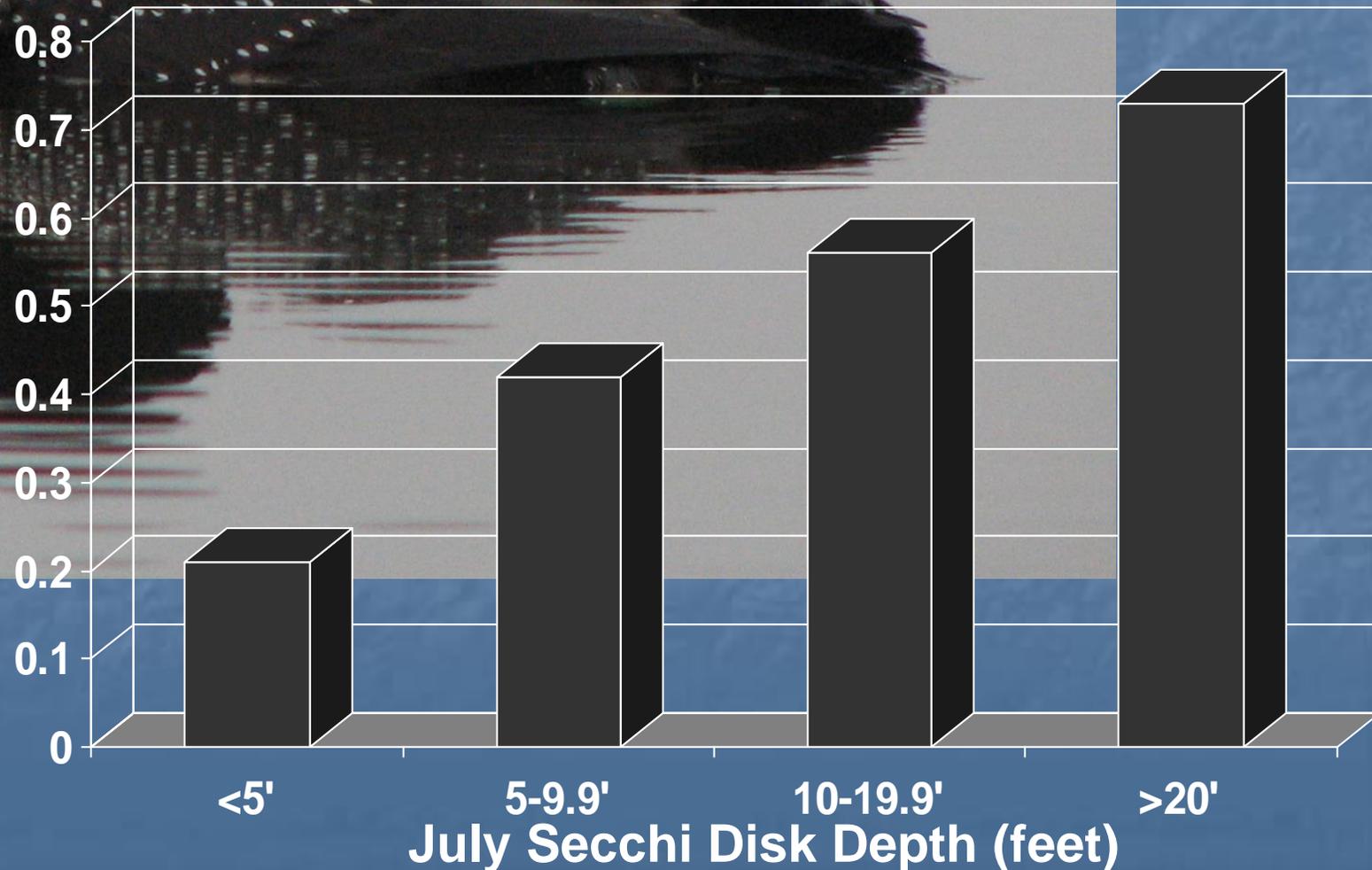
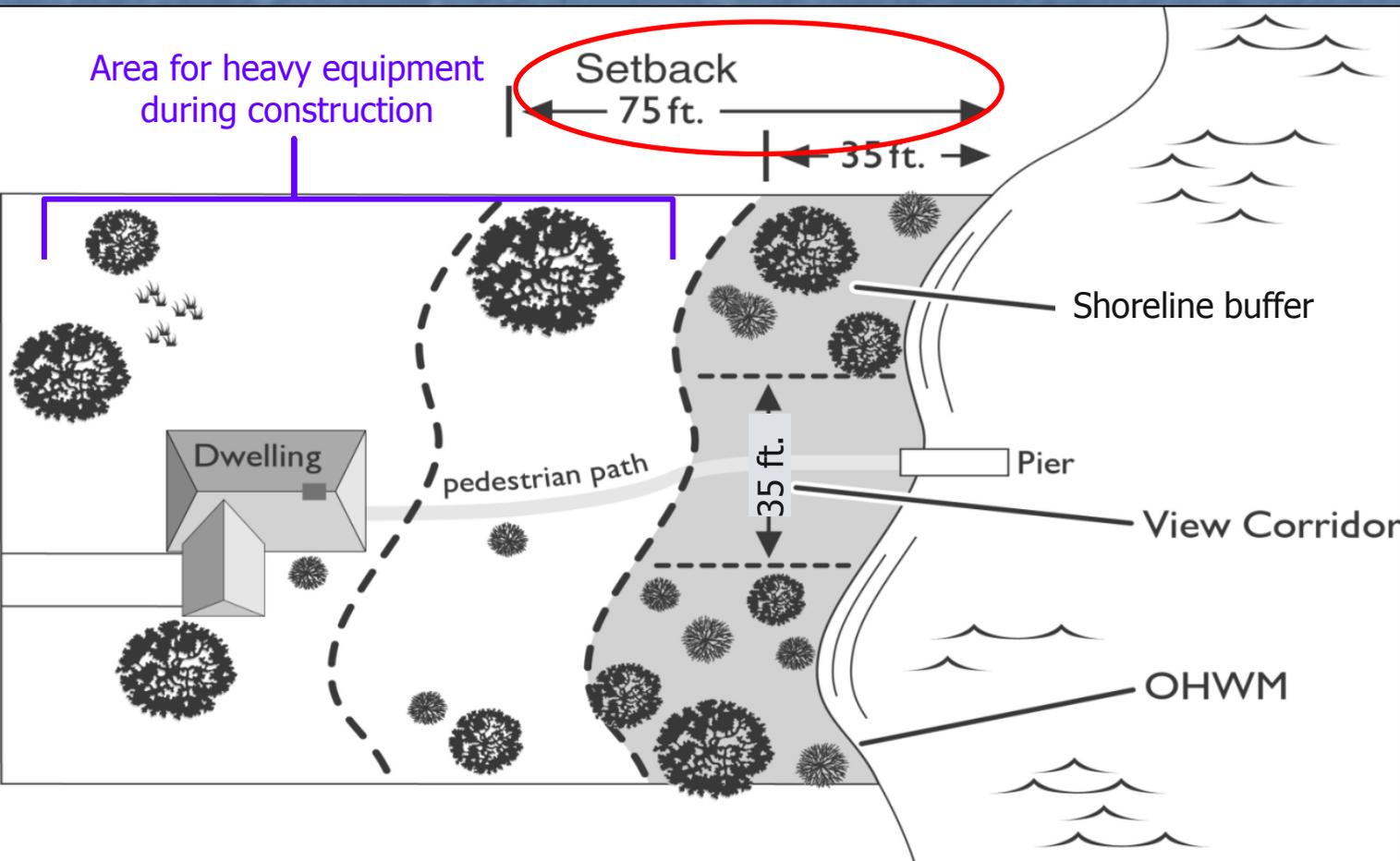


Photo credit
Doug Killian

References

- WI Loon study based on water clarity
 - Meyer, Michael W. 2006. Final Report: Evaluating the impact of multiple stressors on common loon population demographics-an integrated laboratory and field approach. Wisconsin Department of Natural Resources. EPA Grant Number R82-9085

Why shoreline setbacks?



- To keep the home/structure on stable ground
- To keep the shoreline buffer intact during and after home construction
- To reduce pollutant-carrying runoff entering lake or stream
- To maintain habitat for birds and other wildlife, and natural scenic beauty

Impervious surfaces are hard surfaces like roofs, driveways, parking areas and patios

More Impervious Surface = Less Fish

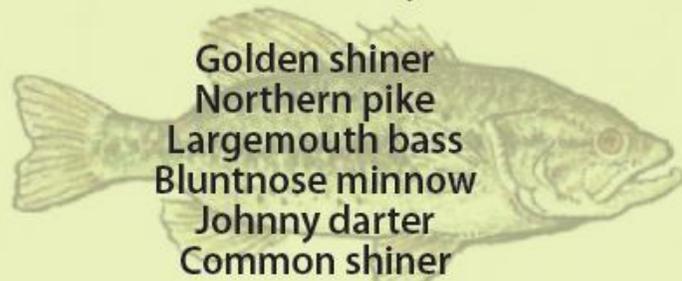
Fish found in streams when impervious surface in the watershed was:

Less than 8%

8 - 12%

Greater than 12%

More Impervious Surfaces in Watershed 



2008 study of 164 WI lakes found the same trend

Fewer species of fish 

References

- A study of 47 streams in southeastern Wisconsin found that when impervious surfaces covered 8-12% of a watershed – the land that drains to the stream – the number of fish species was reduced.¹⁰ In watersheds with impervious surface coverage even slightly above 12%, researchers found that the overall number of fish species plummeted. The same study also indicated that impervious surfaces immediately adjacent to the water, especially within the first 150 feet, had a significant impact on streams.
 - Wang, Lizhu, John Lyons, P. Kanehl, Paul Kanehl, Roger Bannerman and Edward Emmons. 2000. Watershed urbanization and changes in fish communities in southeastern Wisconsin streams. *Journal of the American Water Resources Association*. 36(5):1173-1187.
 - Wang, Lizhu, John Lyons, and Paul Kanehl. 2001. Impacts of urbanization on stream habitat across multiple spatial scales. *Environmental Management*. 28(2):255-266.
- Researchers found that both the number of fish species and the number of small-bodied intolerant fishes was lower when there were higher levels of impervious surfaces within 330 ft of the water or within the entire watershed of the lake, when adjusted for lake type and location in the watershed. Intolerant fish are species that are sensitive to diminished water quality, sedimentation, and other forms of habitat degradation.
 - Garrison, Paul et al. Implementation and interpretation of lakes assessment data for the Upper Midwest. Final report to the U.S. EPA. Grant No. X7-83254601. November 2008. pp.47-48.
- For additional references on this topic see [Impervious Surfaces: How They Impact Fish, Wildlife and Waterfront Property Values](http://uwsp.edu/cnr-ap/clue/Documents/Water/ImperviousSurfaces2013.pdf) at uwsp.edu/cnr-ap/clue/Documents/Water/ImperviousSurfaces2013.pdf

More Impervious Surface = Less Fish

- **More sediments** and algae growth make it difficult for some predator species that hunt by sight to find their food
- **More sediments** cover spawning beds of fish such as walleye and smallmouth bass, depriving eggs of oxygen
- **More runoff** leads to warmer waters that eliminate fish like northern pike & trout



Why 35' height standard on shoreline buildings?

- Limit intensity of development to something that won't degrade the lake or river
 - Boats/personal watercraft
 - Parking
- Maintain buffer & natural scenic beauty



Lake of the Ozarks, Missouri