

Water Quality, Ecological Effects and Tile Drainage in South Dakota



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Overview

- **Introduction to agricultural tile drainage**
- **Tile drainage effects on wetlands and water quality**
- **Service Trust Resources in the Dakotas**
- **Evaluation of tile discharges into public wetlands in SD.**

The Problem

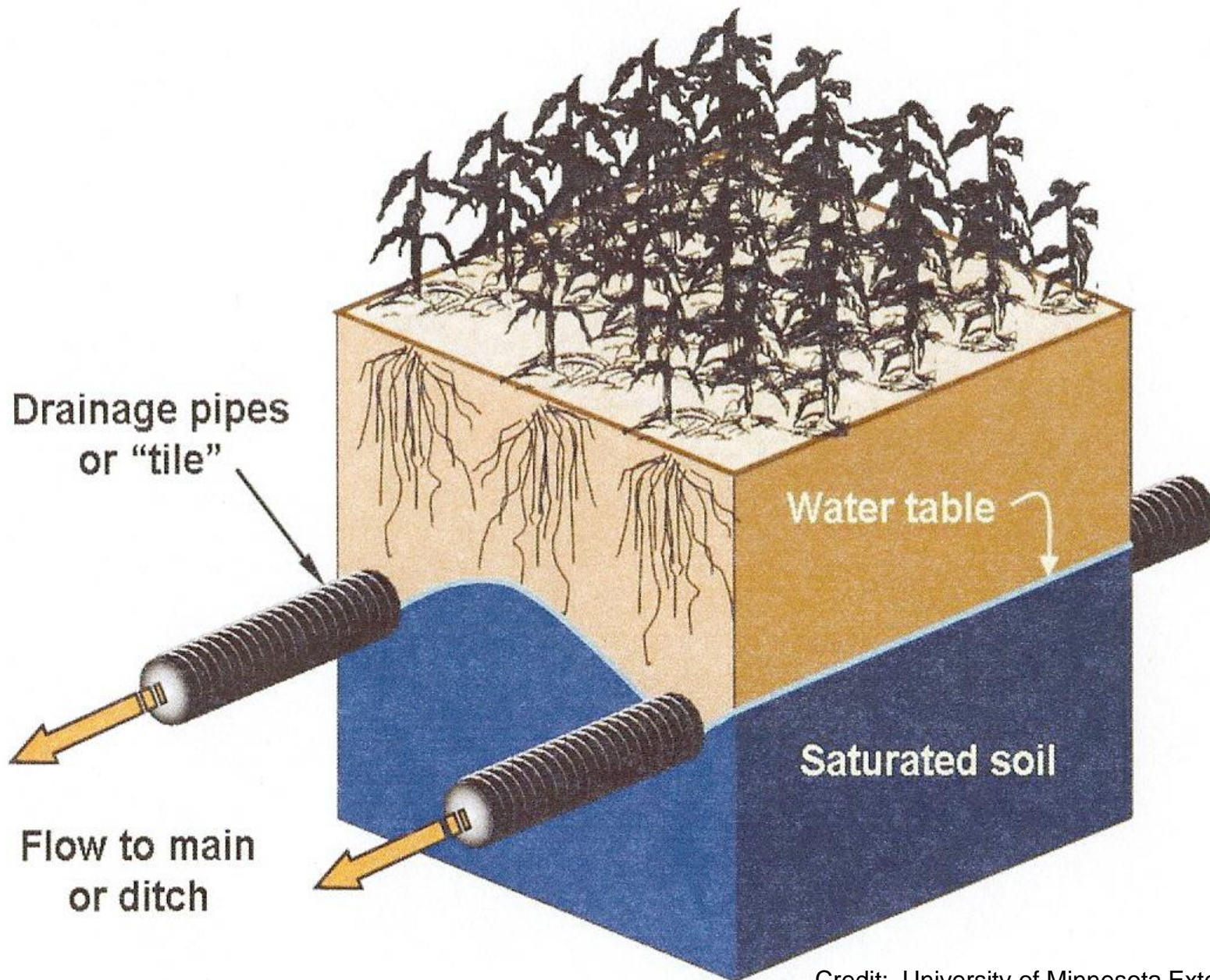
- **The Prairie Pothole Region of the Dakotas Provide key habitat for Service Trust Species**
- **Tile Drainage in this Region is increasing and can result in wetland loss and water quality issues.**
- **Efforts to evaluate and reduce the negative effects of tile are lacking.**

Agricultural Drainage Tile



***Installation with
a Tile Plow***





Credit: University of Minnesota Extension *Agricultural Drainage Issues and Answers* by Lowell Busman and Gary Sands extension.umn.edu

Tile Drain Outfalls



Targeted Tiling



2010 12 2

Pattern Tiling



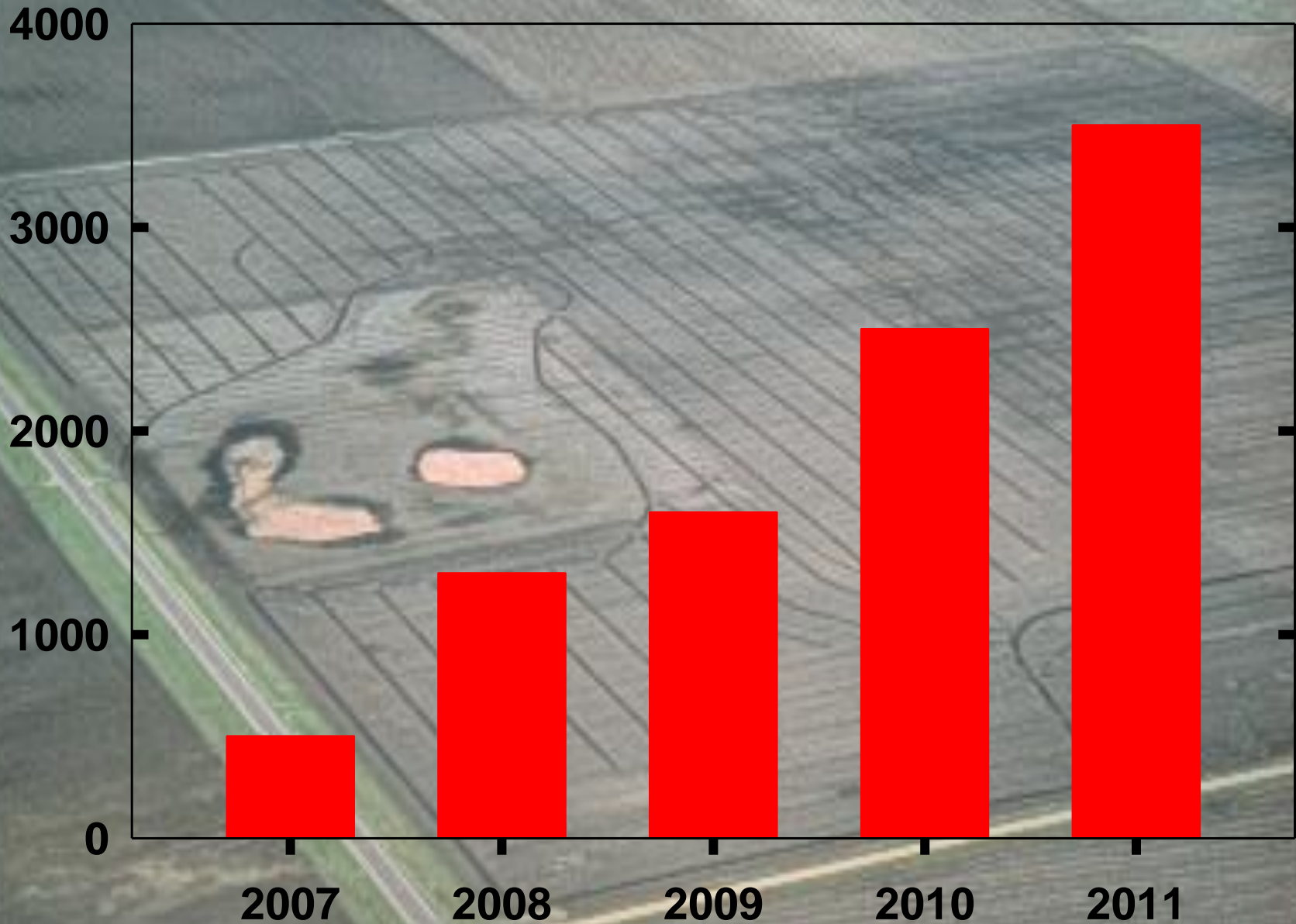
Combination of Techniques



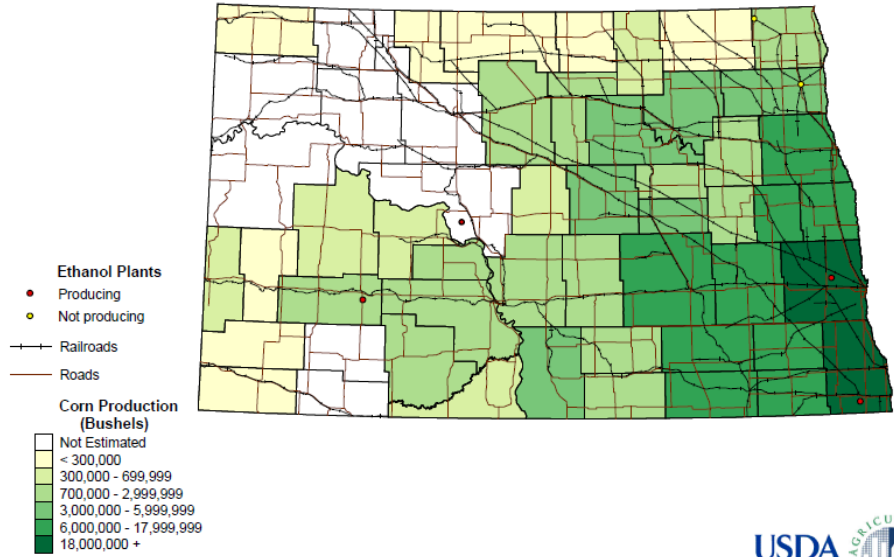
Wetland Classification and Setbacks



Wetland Determination Requests in Eastern South Dakota

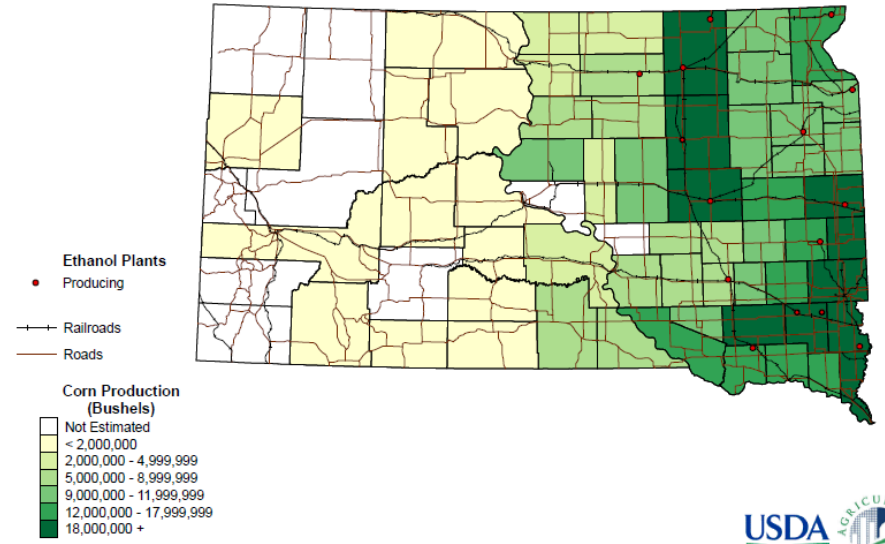


**North Dakota Corn for Grain 2010
Production by County and Location of Ethanol Plants
as of March 3, 2011**



U.S. Department of Agriculture, National Agricultural Statistics Service

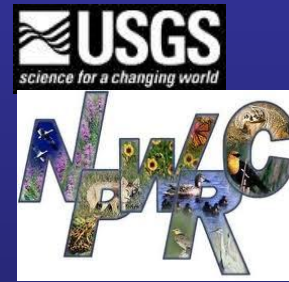
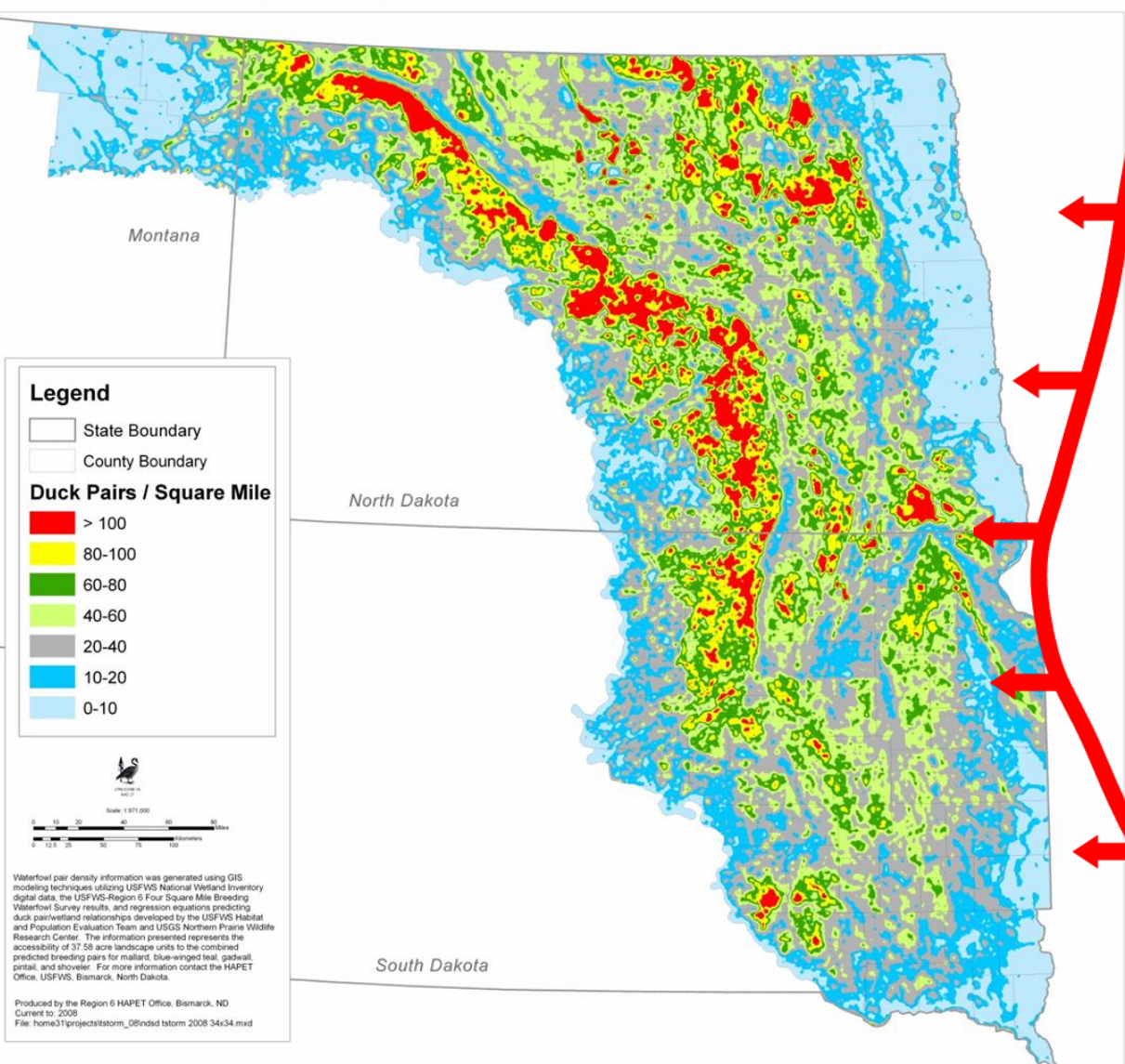
**South Dakota Corn for Grain 2010
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U.S. Department of Agriculture, National Agricultural Statistics Service

Waterfowl Nesting in the Dakotas

1987 - 2008

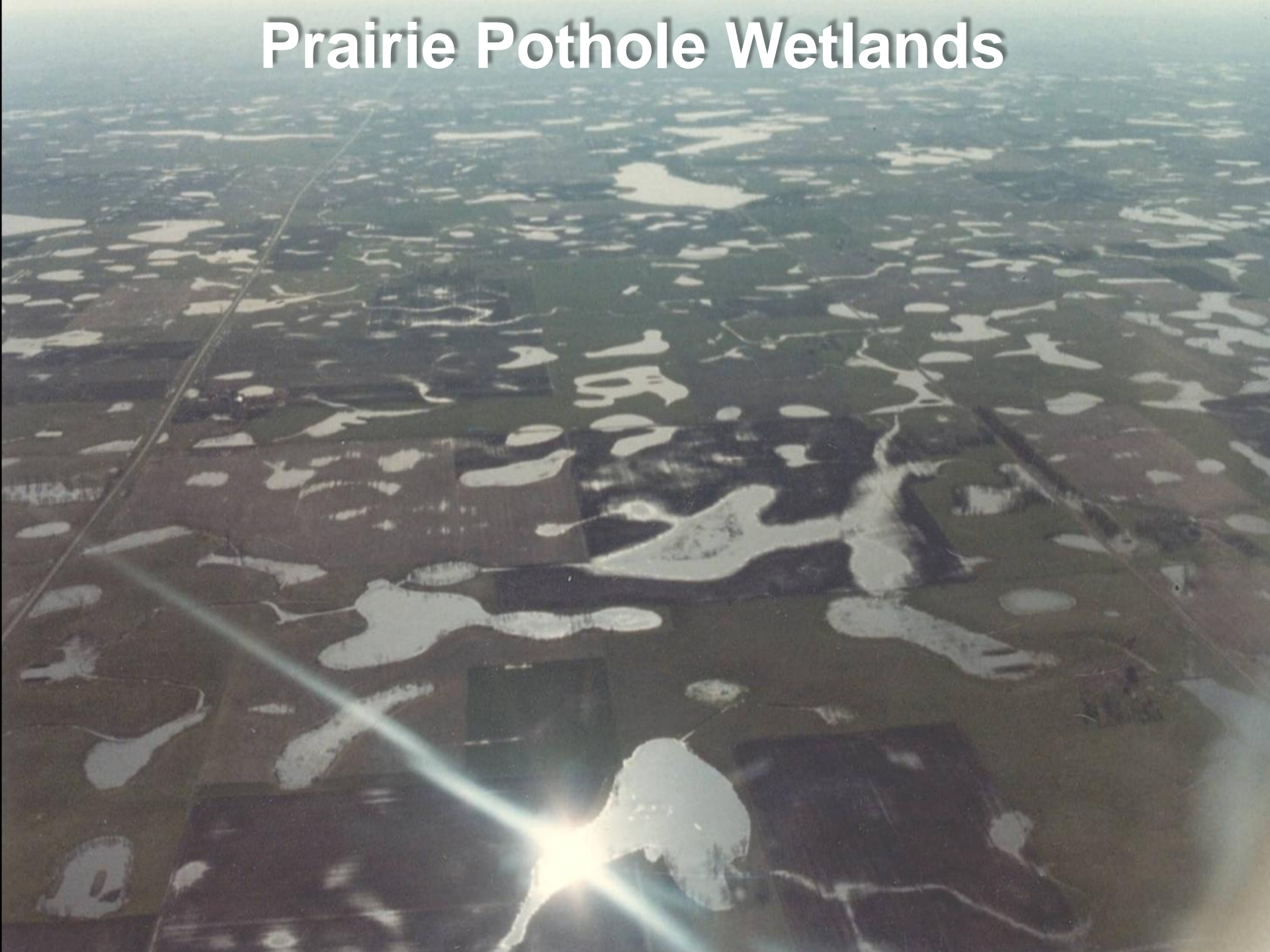


http://www.ppvj.org/thunderstorm_maps.htm

Adverse Effects Related to Tile Drainage

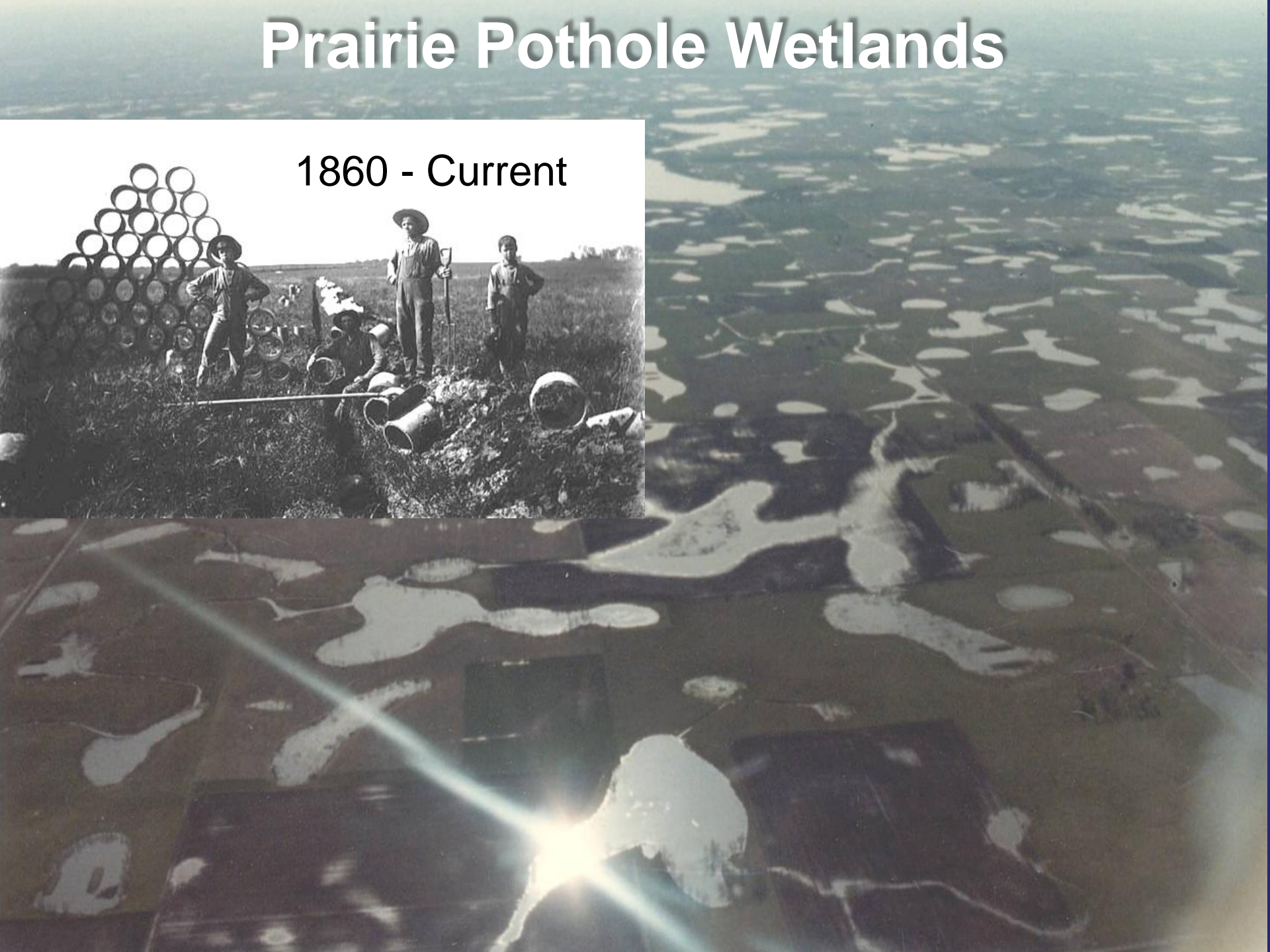
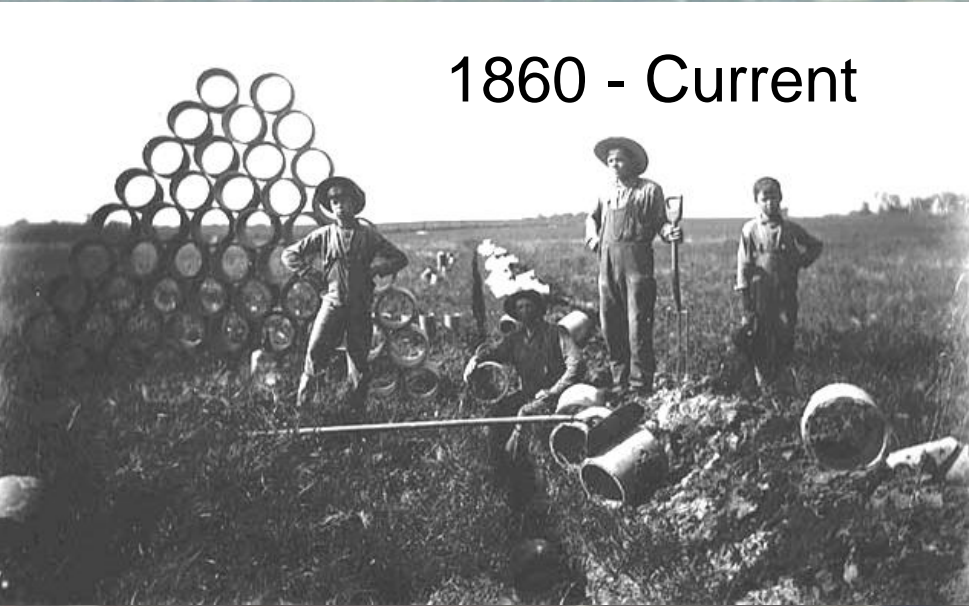
- **Wetland Loss**
- **Altered Wetland Habitat**
- **Water quality Degradation**

Prairie Pothole Wetlands



Prairie Pothole Wetlands

1860 - Current



Prairie Pothole Wetlands

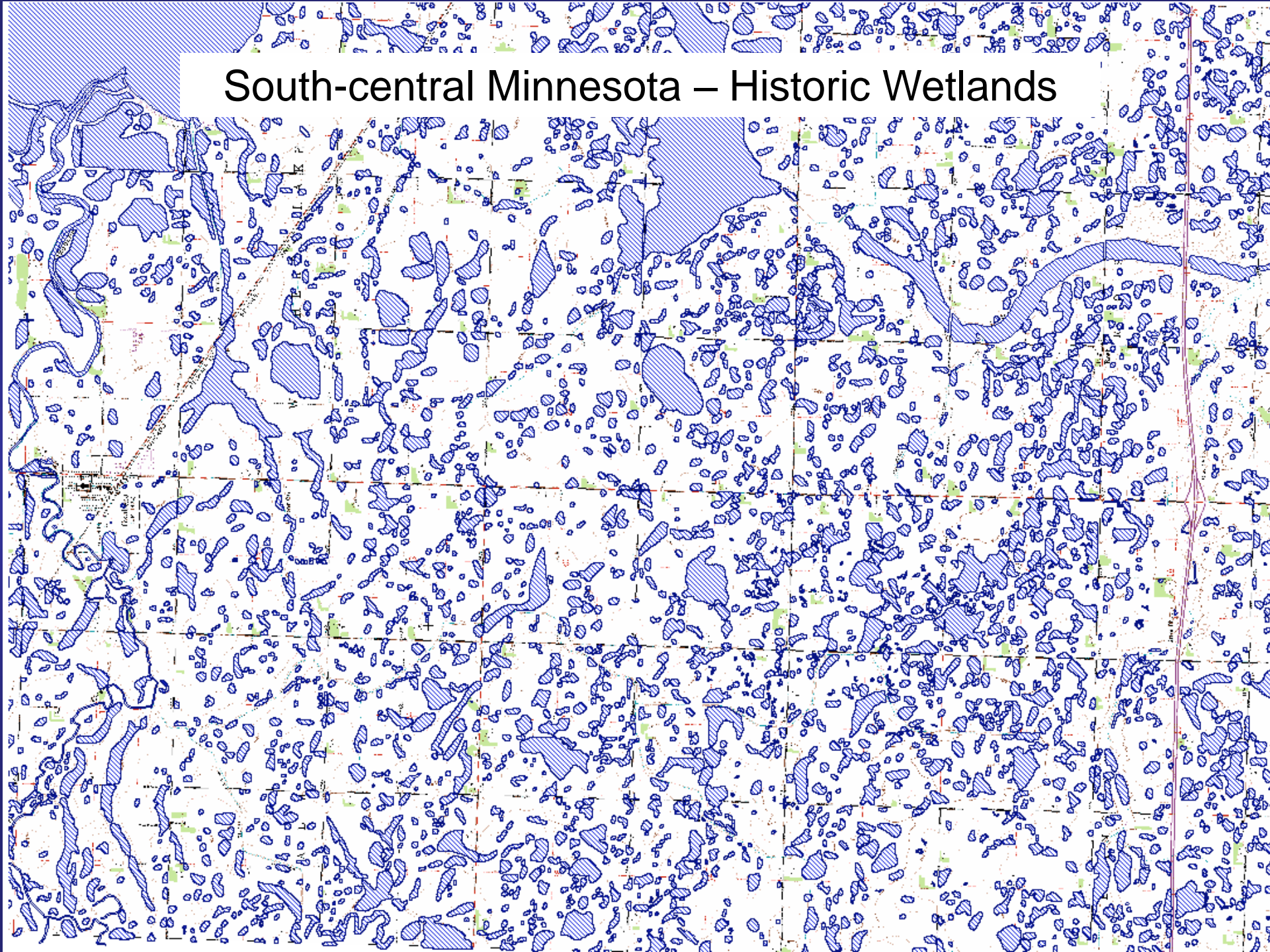
1860 - Current



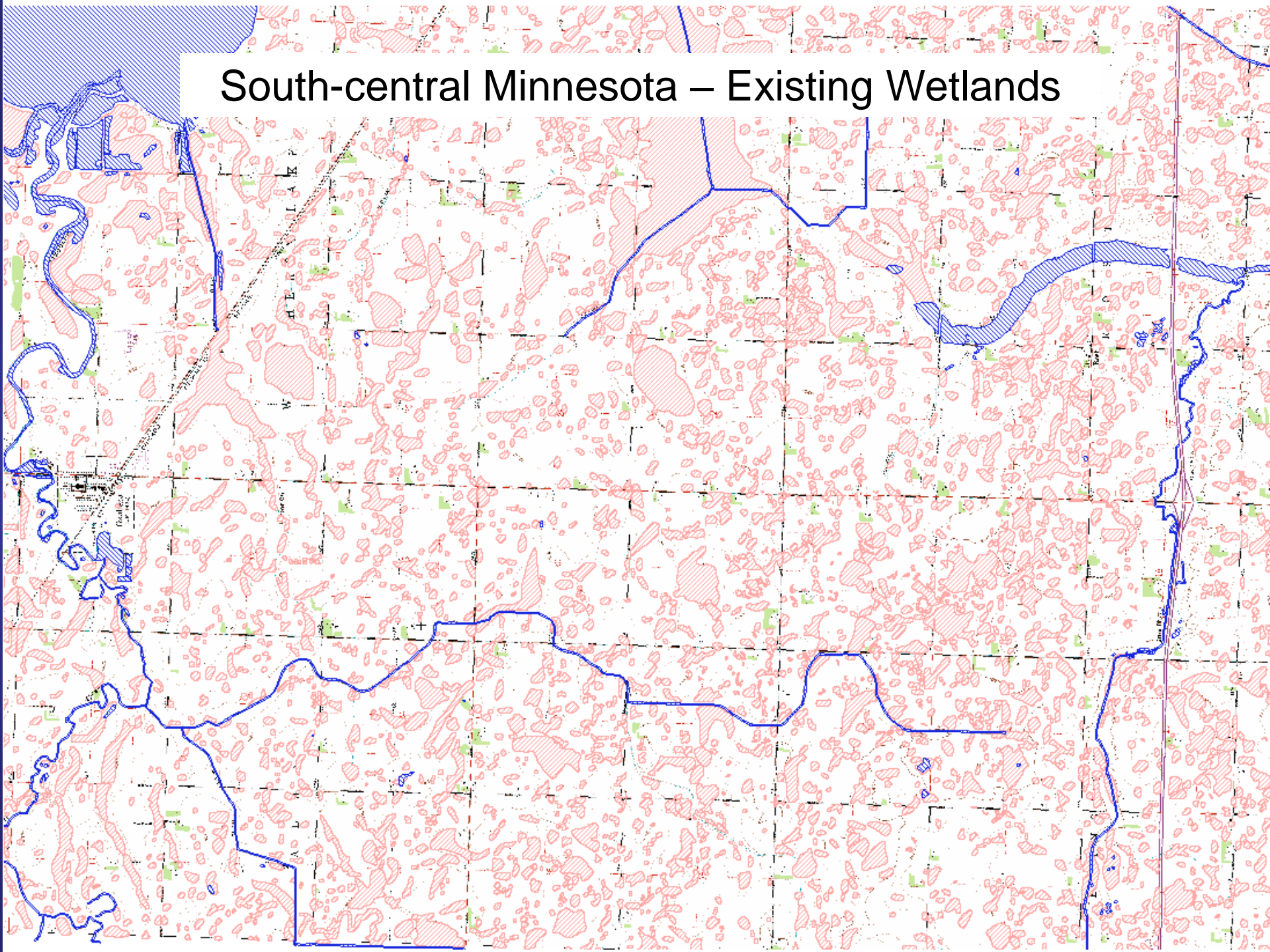
Percent of Wetlands lost

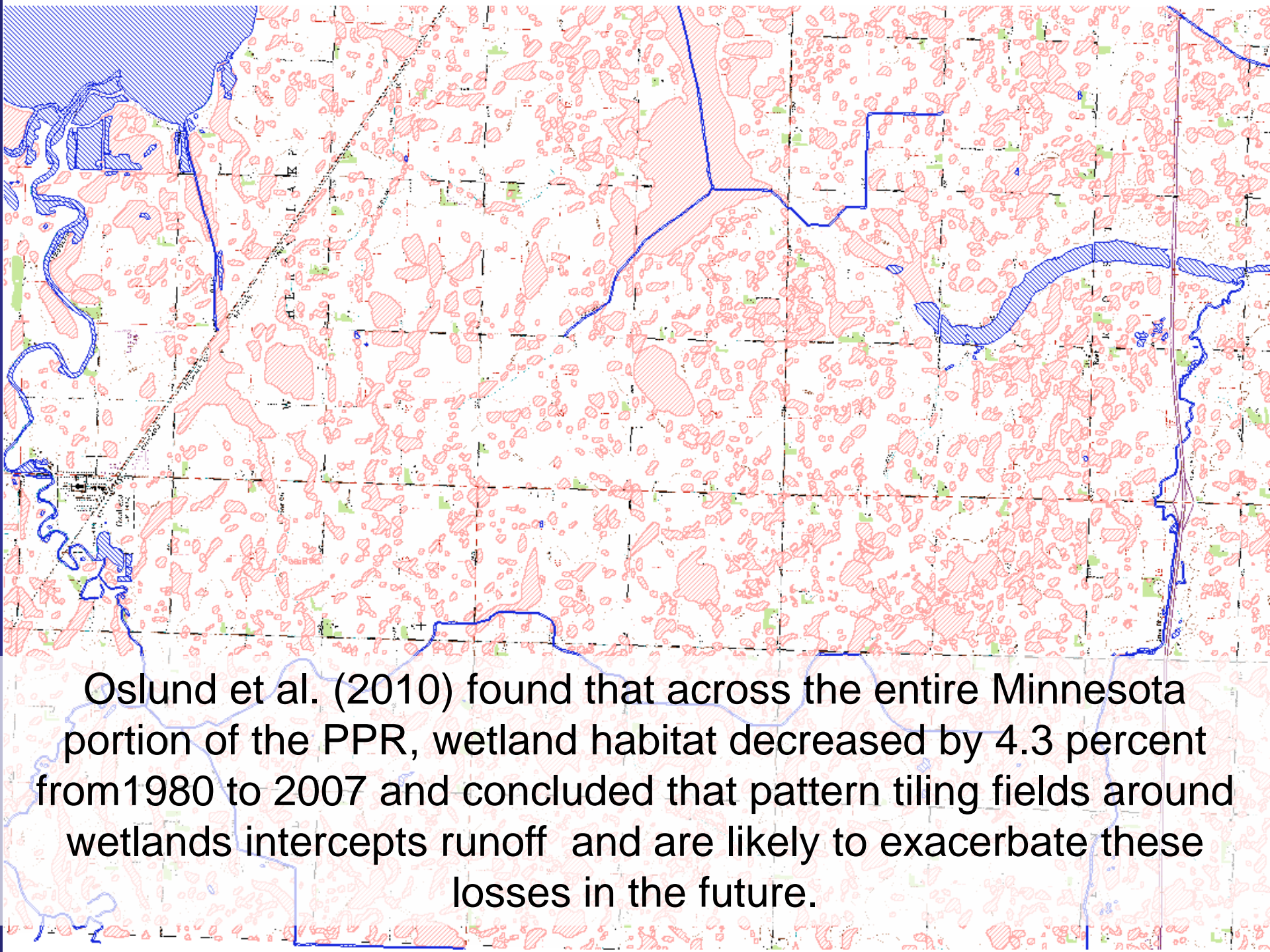
- Montana 20%
- S. Dakota 35%
- N. Dakota 49%
- Minnesota 82%
- Iowa 99%

South-central Minnesota – Historic Wetlands



South-central Minnesota – Existing Wetlands





Oslund et al. (2010) found that across the entire Minnesota portion of the PPR, wetland habitat decreased by 4.3 percent from 1980 to 2007 and concluded that pattern tiling fields around wetlands intercepts runoff and are likely to exacerbate these losses in the future.

Temporary Wetlands at Risk



Alteration of Wetland Habitat



Temporary/Seasonal



*Semi-permanent /
Permanent*

Alteration of Wetland Vegetation



*Emergent aquatic
vegetation*



Undesirable vegetation

Tile Drains and Water Quality



Good: Can decrease phosphorus, some pesticides, and sediments compared to surface drained fields



Not Good: Increased nitrates (10 – 40 mg/L, USEPA) some pesticides, and sediments.

Tile Drains and Water Quality



Compared to land in natural forest or perennial grassland, conversion and drainage of land for agriculture usually increases peak runoff rates, sediment, and pollutant loads to surface-water resources.”

(Blann et al. 2009)

Nitrate Toxicity

Blue baby syndrome



Blue-green algae



Malformations (Johnson et al 2007)



Eutrophication

Nitrate Standards and Benchmarks

- Nitrate background 0.24 mg/L, > 5 mg/L eutrophication (USGS 2010)
- SD acute 88 mg/L and chronic 50 mg/L
- 2 mg/L NO₃-N benchmark for aquatic life (Camargo et al. 2005)
- SWDA standard is 10 mg/L NO₃-N
- Increase in thyroid cancer risk in women exposed to nitrate ≥ 5 mg/L for more than 5 years (Ward et al 2010)

Service Trust Resources

- **Migratory Birds (MBTA, 1918)**
- **Federally Listed Species (ESA, 1973)**
- **Federal Lands and Easements (RIA, 1997)**

Waterfowl and the PPR



Federally Listed Species



Whooping crane



Piping Plover

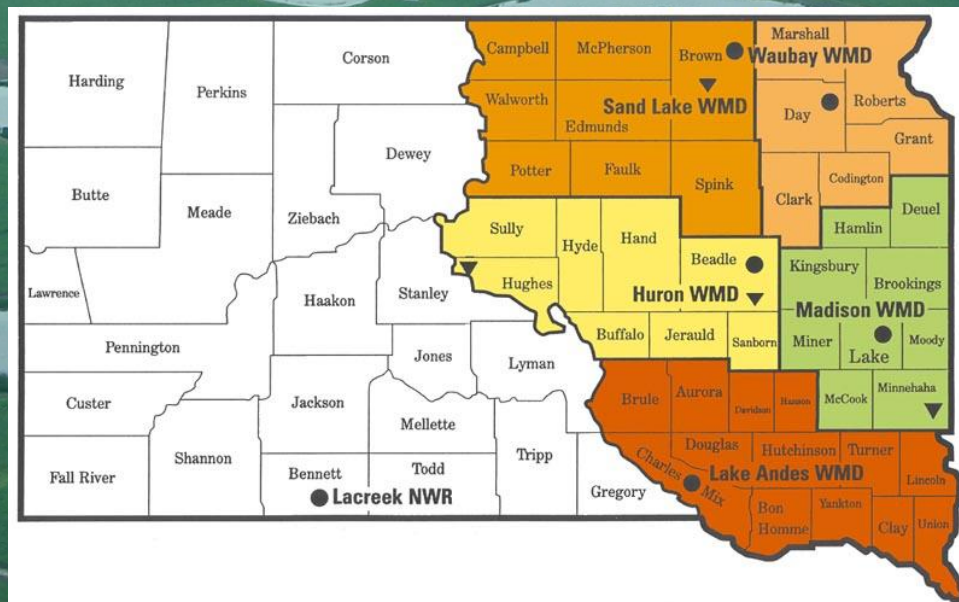


Topeka shiner
(South Dakota)

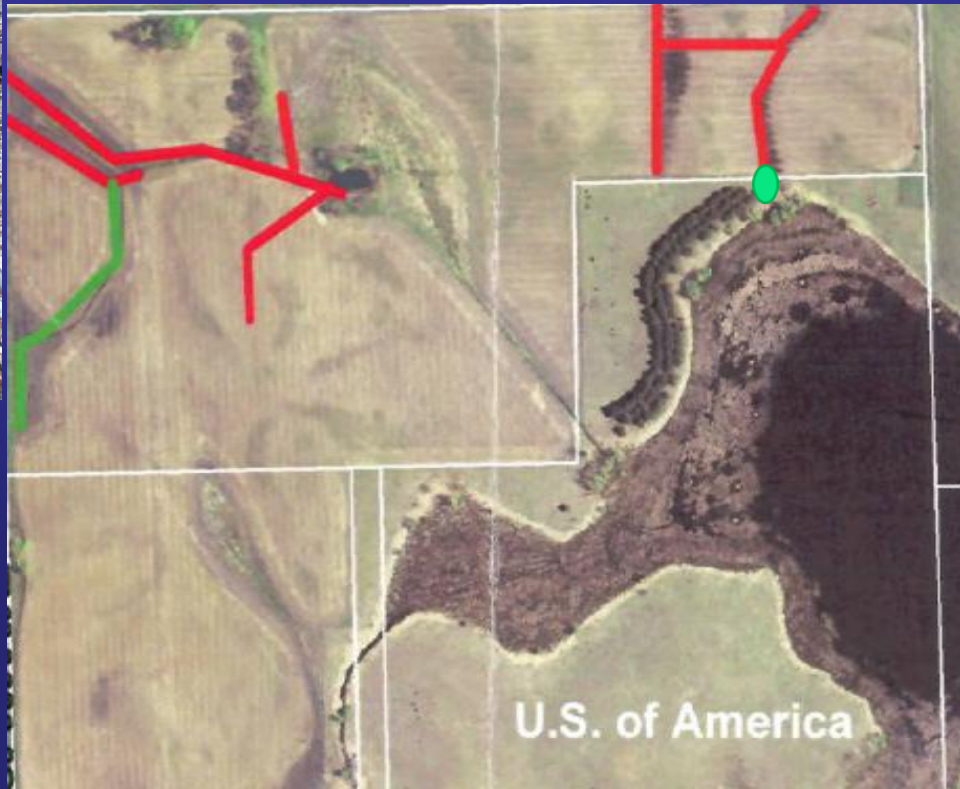
Service Trust Lands



Service Trust Lands



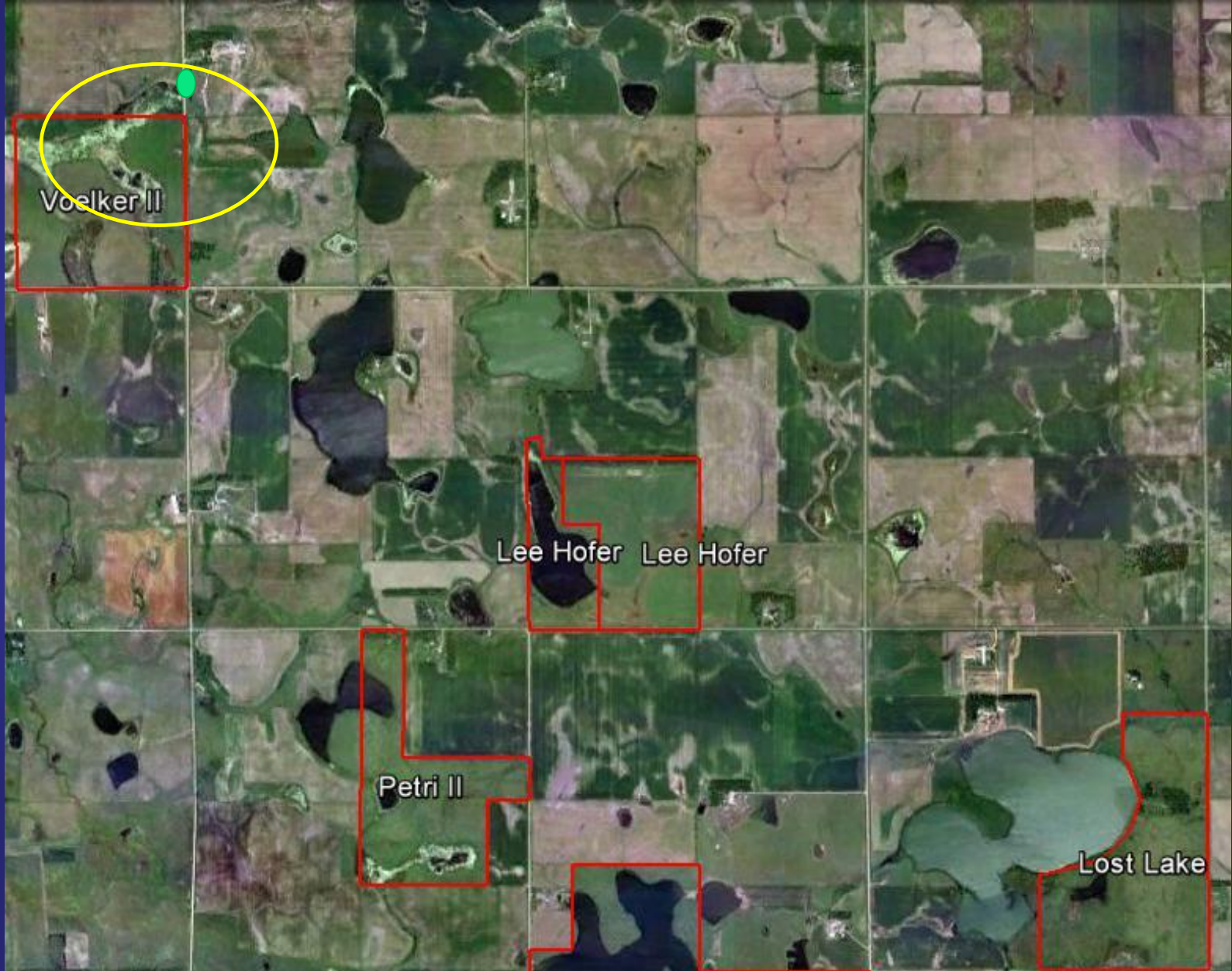
Tile Outlets and Service WPAs



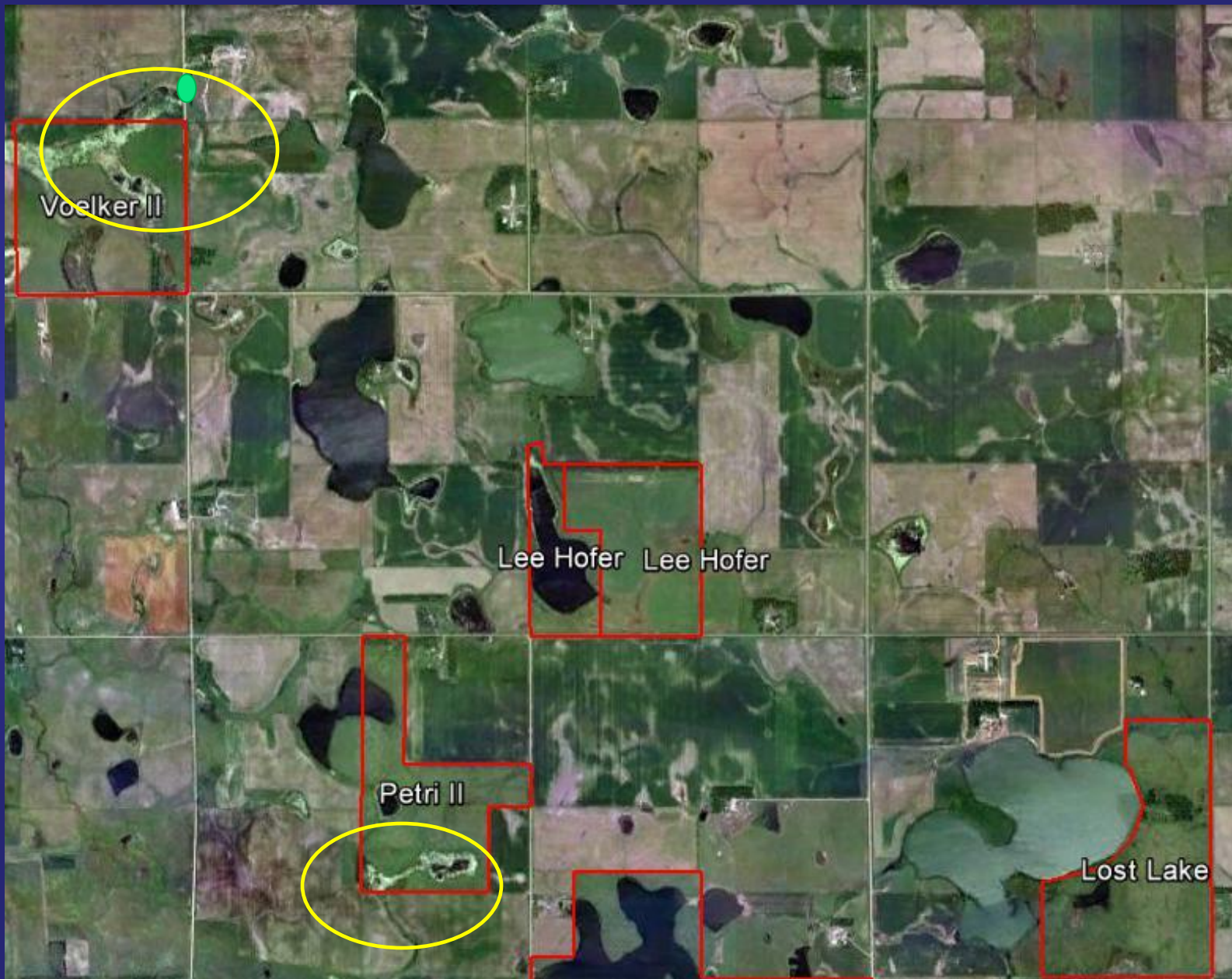
Potential Study Sites



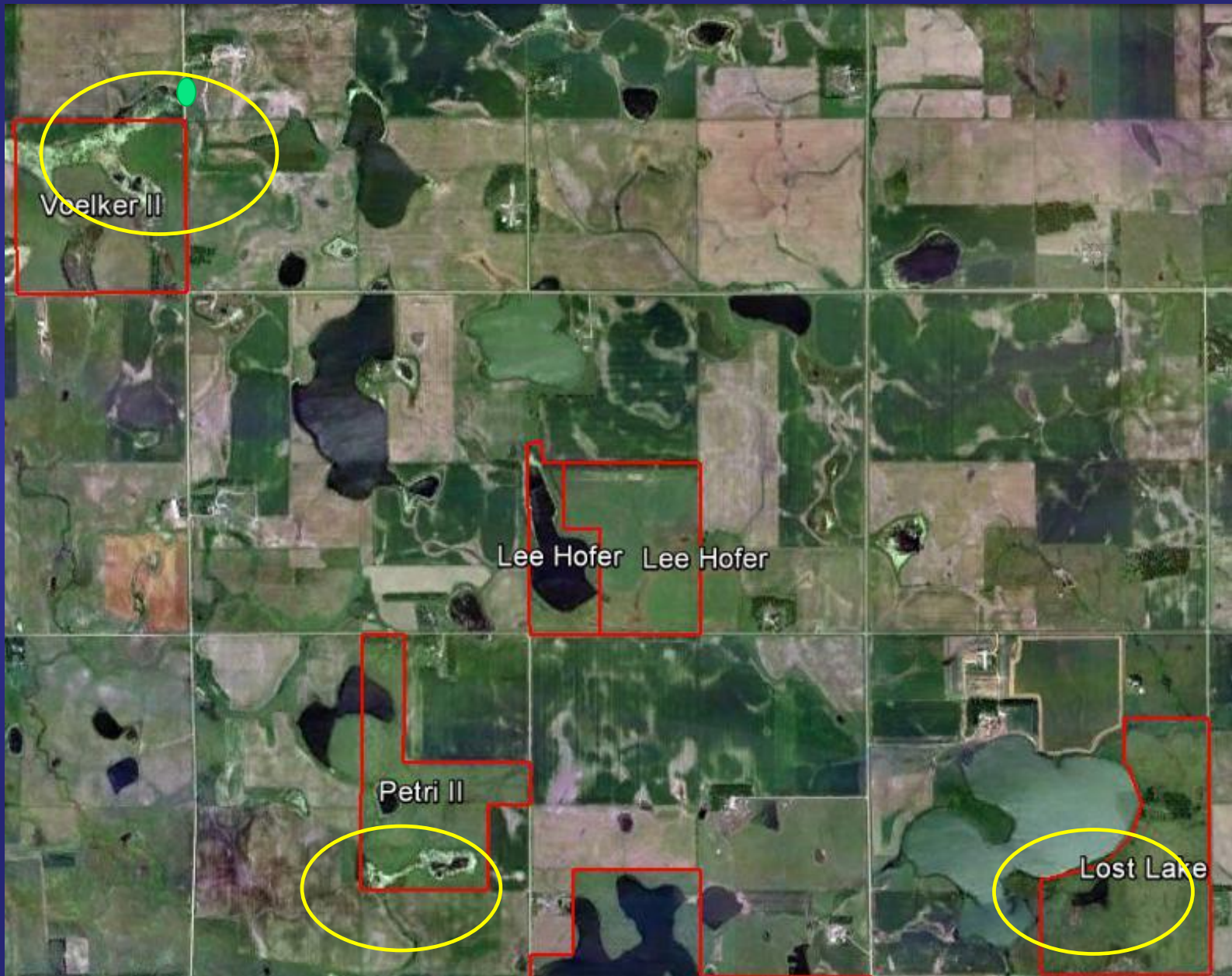
Potential Study Sites



Potential Study Sites



Potential Study Sites



Conclusions

- **Tile drainage demand has recently increased in the Dakotas.**
- **Expected to result in wetland loss and water quality issues.**
- **Ecological effects that result from tile discharges may be harmful to wetland habitat and imperiled species.**
- **The Service is evaluating tile discharges into public wetlands in SD.**

Questions?

