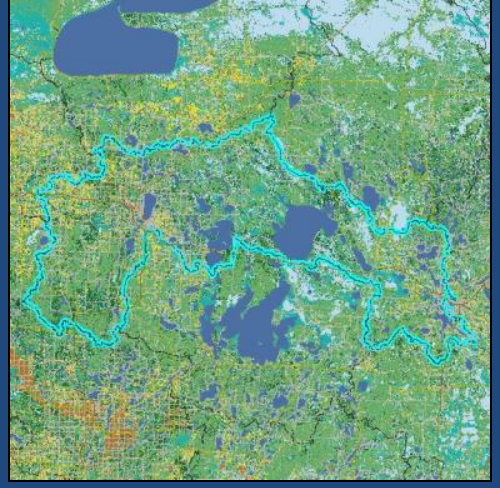


A holistic risk-based approach for BMP effectiveness at the watershed scale

BMP Effectiveness Symposium
May 2014

Rob Slesak, MFRC
Dick Rossman, MN DNR

Minnesota Department of Natural Resources

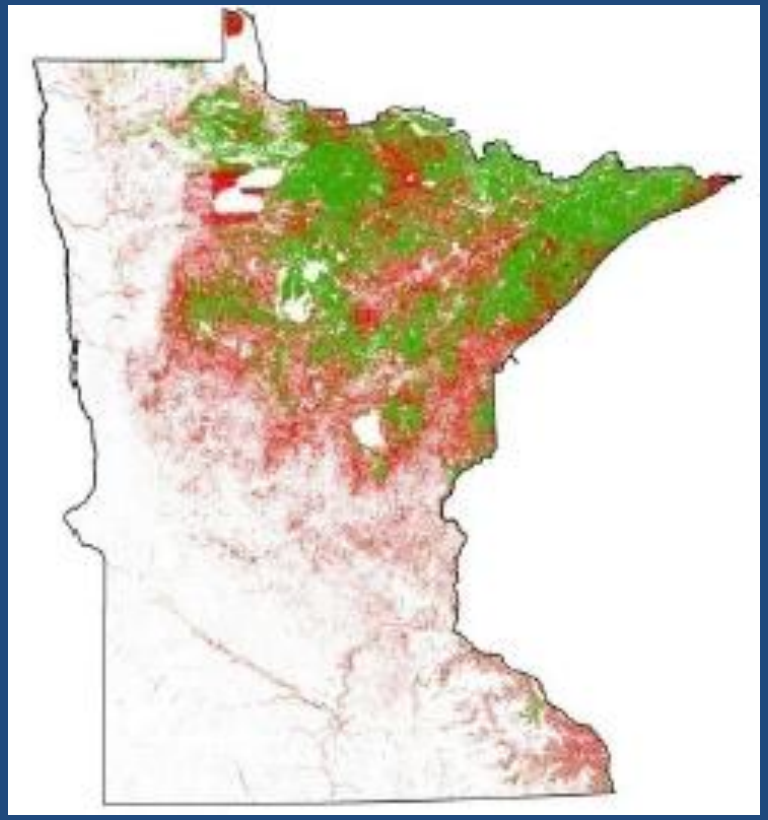
Minnesota Forest Resources Council

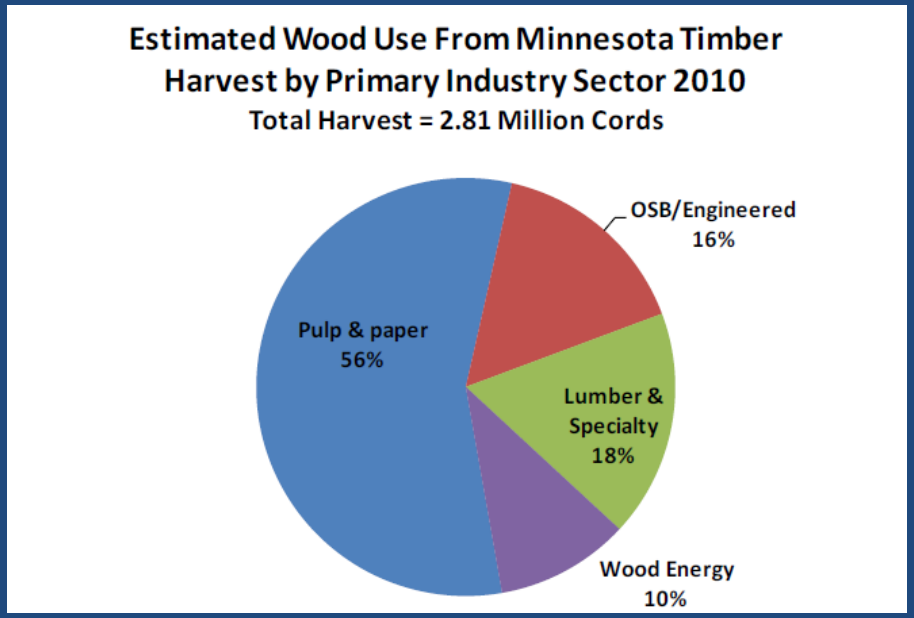
MN forestry at a glance

~16 mil. ac. of timberland

Public 53%

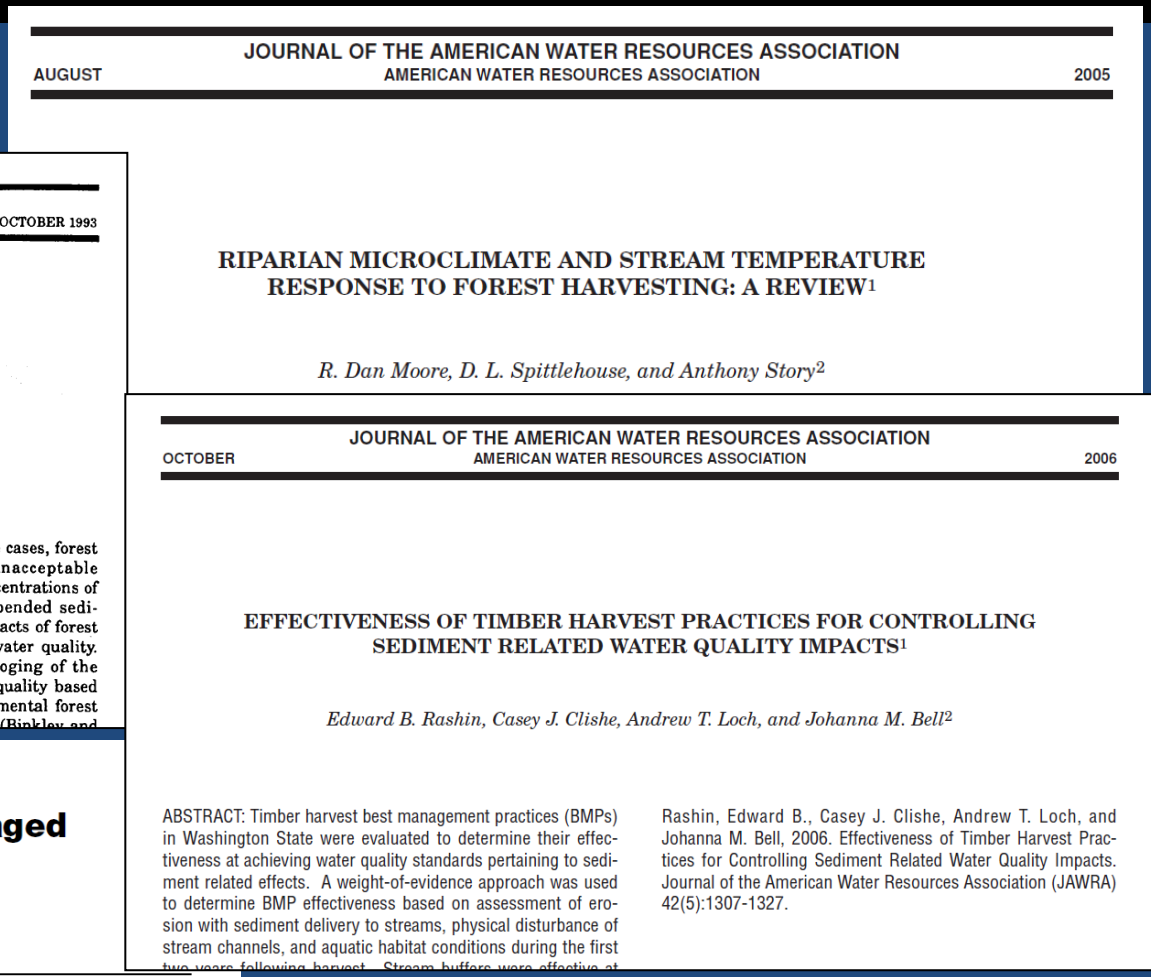
Private 47%





- 60-70% winter harvest
- Predominantly clearcut with residuals
- >8 million acres certified
- Comprehensive, voluntary BMPs

BMPs are generally effective



JOURNAL OF THE AMERICAN WATER RESOURCES ASSOCIATION
AUGUST AMERICAN WATER RESOURCES ASSOCIATION 2005

RIPARIAN MICROCLIMATE AND STREAM TEMPERATURE RESPONSE TO FOREST HARVESTING: A REVIEW[1]

R. Dan Moore, D. L. Spittlehouse, and Anthony Story[2]

JOURNAL OF THE AMERICAN WATER RESOURCES ASSOCIATION
OCTOBER AMERICAN WATER RESOURCES ASSOCIATION 2006

EFFECTIVENESS OF TIMBER HARVEST PRACTICES FOR CONTROLLING SEDIMENT RELATED WATER QUALITY IMPACTS[1]

Edward B. Rashin, Casey J. Clishe, Andrew T. Loch, and Johanna M. Bell[2]

ABSTRACT: Timber harvest best management practices (BMPs) in Washington State were evaluated to determine their effectiveness at achieving water quality standards pertaining to sediment related effects. A weight-of-evidence approach was used to determine BMP effectiveness based on assessment of erosion with sediment delivery to streams, physical disturbance of stream channels, and aquatic habitat conditions during the first

Rashin, Edward B., Casey J. Clishe, Andrew T. Loch, and Johanna M. Bell, 2006. Effectiveness of Timber Harvest Practices for Controlling Sediment Related Water Quality Impacts. Journal of the American Water Resources Association (JAWRA) 42(5):1307-1327.

WATER RESOURCES BULLETIN
AMERICAN WATER RESOURCES ASSOCIATION
O. 5 OCTOBER 1993

FOREST PRACTICES AS NONPOINT SOURCES OF POLLUTION IN NORTH AMERICA[1]

Dan Binkley and Thomas C. Brown[2]

T: Forest management activities may substantially alter of water draining forests, and are regulated as nonpoint pollution. Important impacts have been documented, in s, for undesirable changes in stream temperature and ions of dissolved oxygen, nitrate-N, and suspended sedi- present a comprehensive summary of North American t have examined the impacts of forest practices on each arameters of water quality. In most cases, retention of ffer strips along streams prevents unacceptable increas- am temperatures. Current practices do not typically dition of large quantities of fine organic material to nd depletion of streamwater oxygen is not a problem;

regulations (Brown *et al.*, 1993). In some cases, forest practices have resulted in large or unacceptable changes in stream temperature and concentrations of dissolved oxygen, nitrate-N, and suspended sediments. In this paper, we review the impacts of forest practices on these four parameters of water quality. This is a synopsis of a detailed cataloging of the effects of forest management on water quality based on experiments in more than 40 experimental forest areas in the United States and Canada (Binkley and

Sediment delivery in managed forests: a review

J.C. Croke and P.B. Hairsine

Abstract: The opening or removal of forest canopies during harvesting or land clearing results in a predictable sequence of responses, the descriptions of which appear remarkably similar around the world. Such activities are now widely acknowledged to have adverse impacts upon water quality and in-stream ecology. Sediment delivery, therefore, encapsulates the dominant process by which water resources are impacted and the process that can be best managed to limit off-site impacts. This paper is a review of current processes, and perceptions, of sediment delivery in managed forests. We outline the major components

Effective <u>when implemented properly</u>

Issue 1 – operational effectiveness

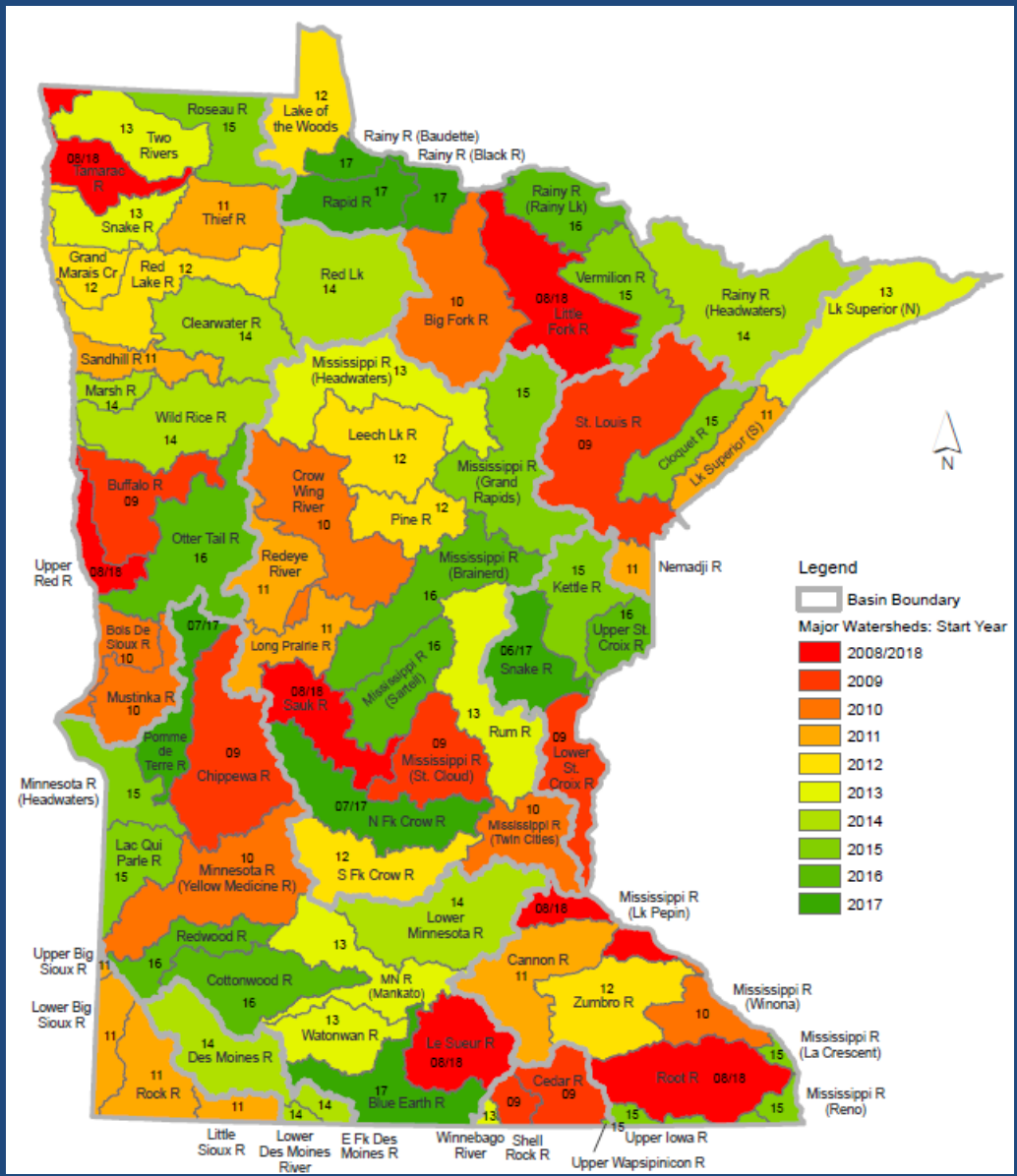
- Implemented at all?
- Implemented properly?
- Implemented properly and effective?

Range of conditions:
- Topography
- Equipment mix
- Season of harvest
- Weather

Issue 2 – relevant scales

Assessments have been conducted statewide historically

Watershed scale most relevant for water management and related planning efforts



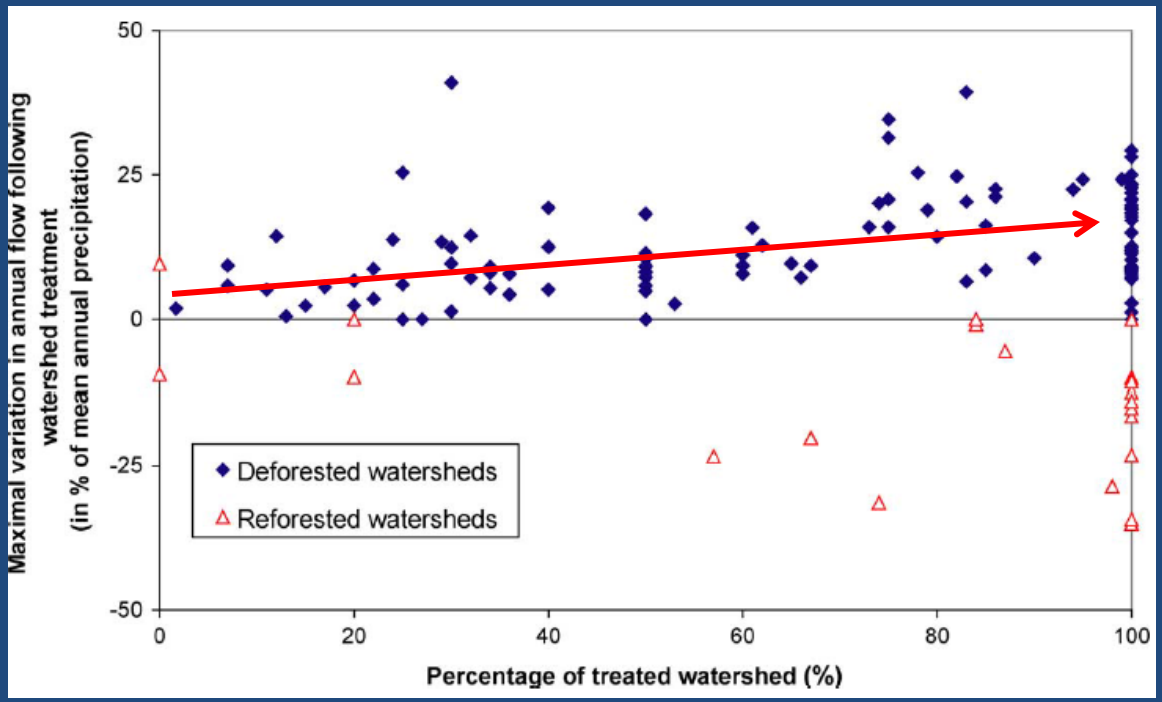
Issue 3 – disturbance patterns

Landuse / landcover and disturbance patterns important at watershed scale

Forest harvest can alter watershed hydrology

-Alter timing and magnitude of peakflow

-In-stream sediment production



Andreassian 2004

Approach overview

1) Conduct field monitoring at the watershed scale

- localized operational effectiveness and factors influencing it

2) Quantify forest disturbance patterns by watershed

- time and space, disturbance type

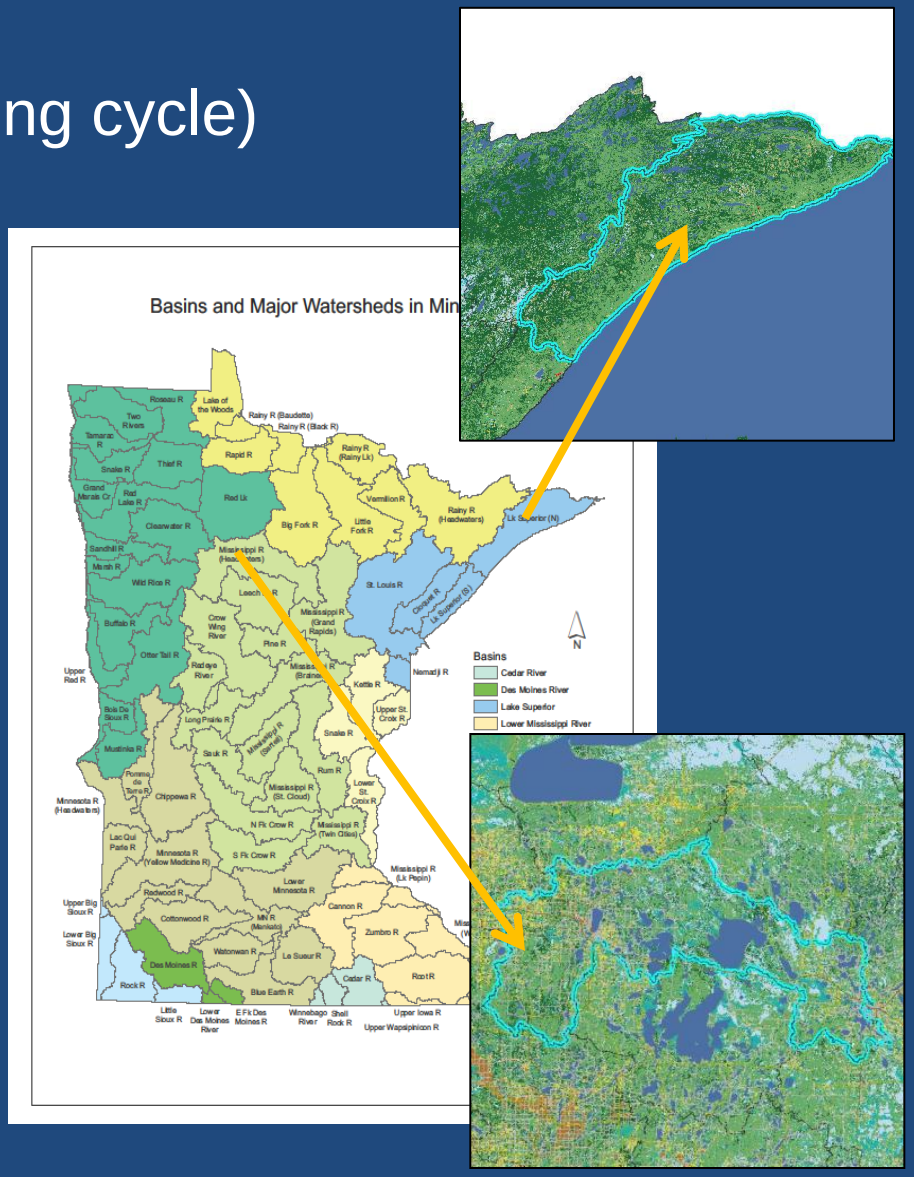
3) Combine info from 1 and 2 to develop a *relative assessment* of risk to water quality by watershed

- risk metrics, conceptual frameworks, modeling

4) Target education and outreach based on info from 3.

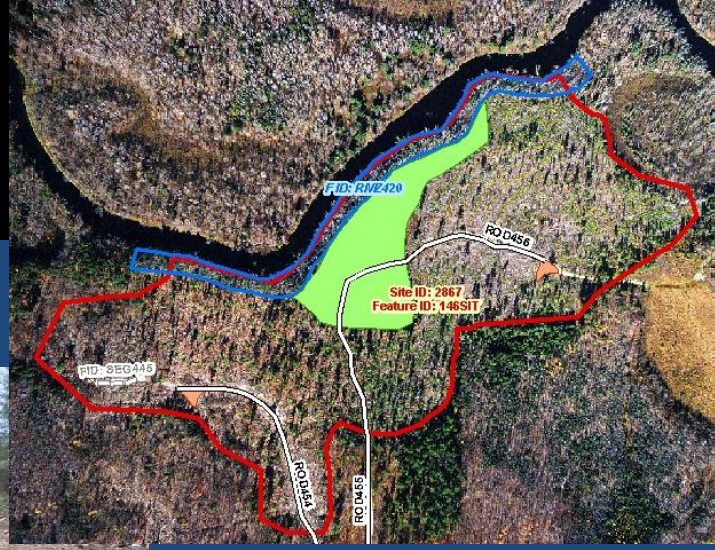
Site scale - field data

- 4 watersheds annually (recurring cycle)
- 30-40 harvest sites per watershed
- Random site selection biased towards water
- All ownerships representative of watershed



Site scale - field data

2) Site level evaluation assessment



3) Spatially referenced database of findings

1) Calibration training

<u>Watershed/ownership trends in:</u>

- Overall implementation
- Effectiveness
- Risk factors for failure

Larger-scale – remote sensing

Landsat Time Series Stacks

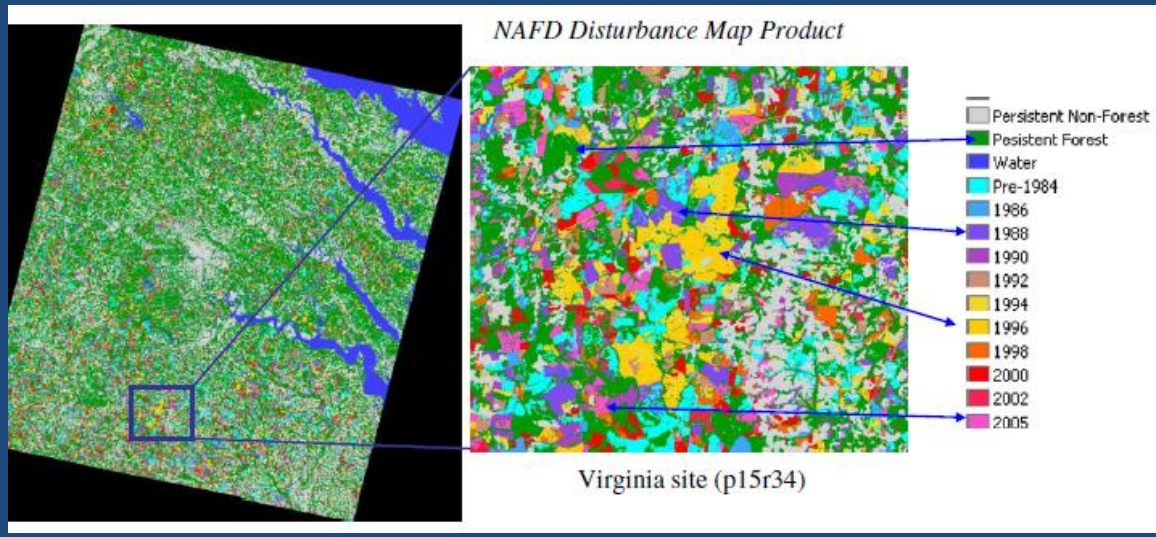
All forested watersheds in MN

Biennial time step

Detection of forest change

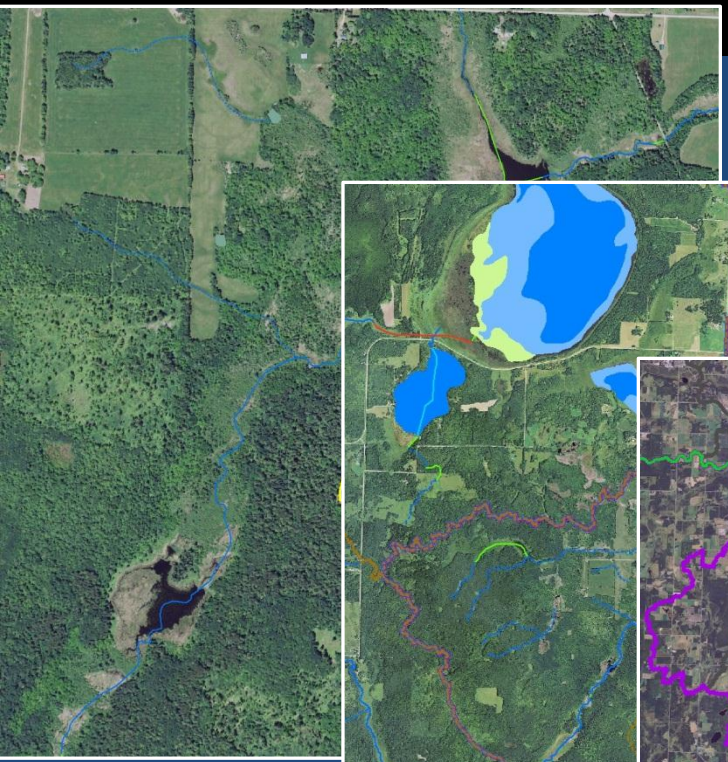
Disturbance patterns classified over time

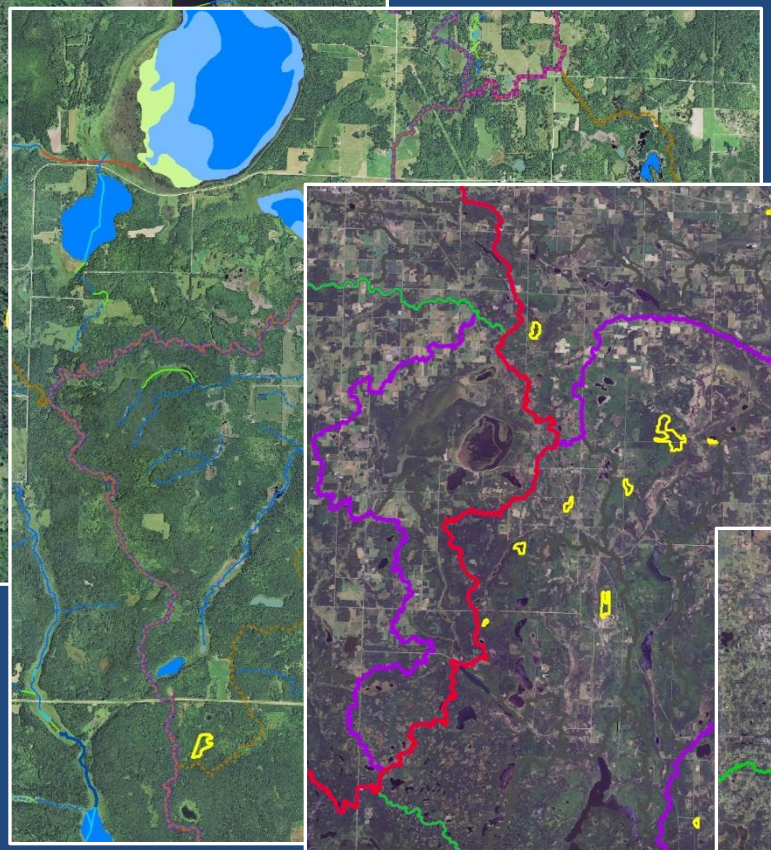
- Persistent forest
- Persistent water
- Disturbed X years ago

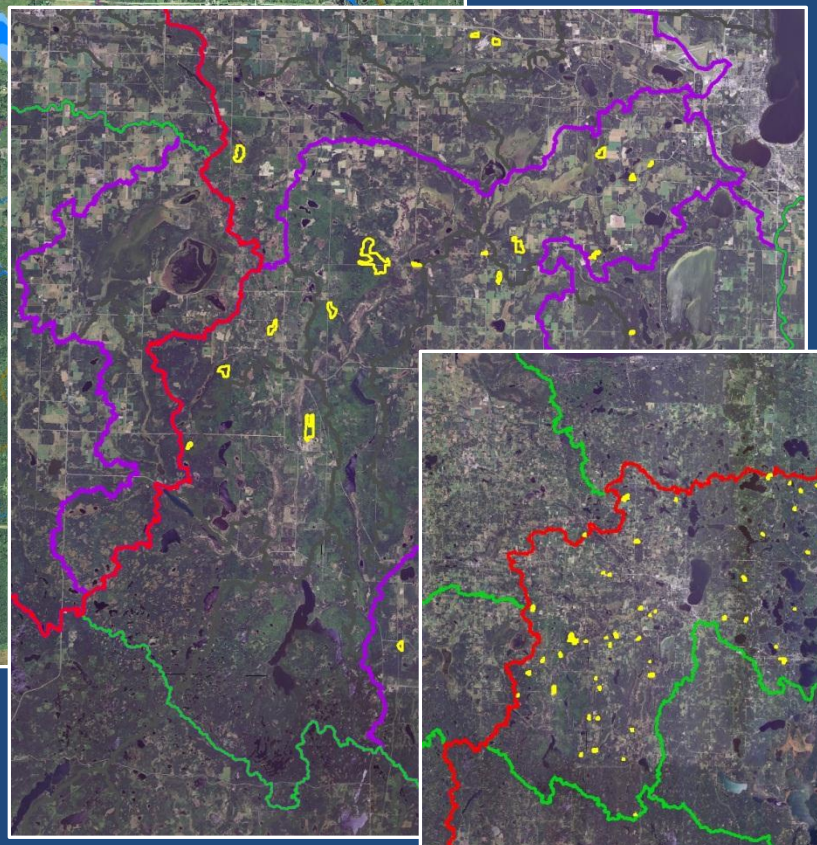


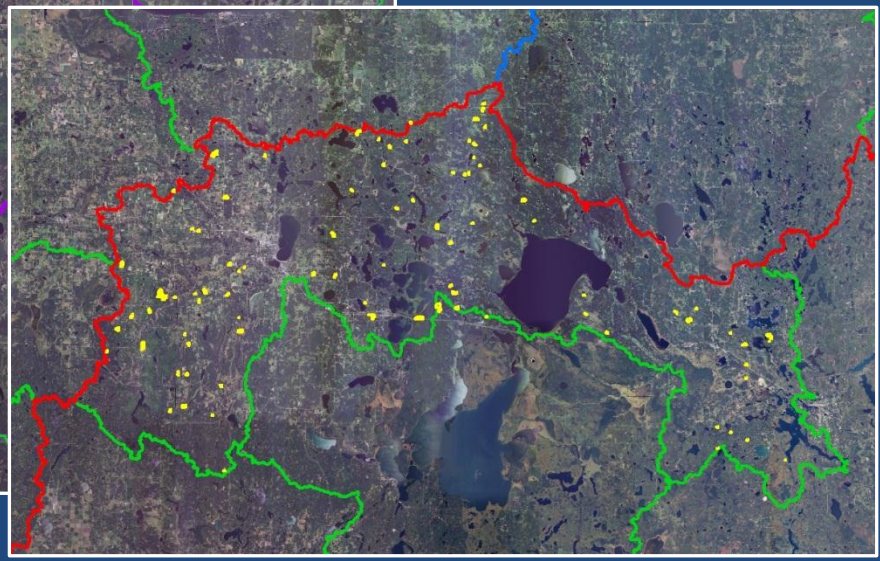
Thomas et al. 2011

Larger-scale – remote sensing data









Disturbance type

Proximity to water

Describe with landscape pattern metrics

Assessing risk at watershed scale

Operational effectiveness scores
- Crossing density, erosion control, etc.

Disturbance metrics:
- Amount of recent disturbance
- Distribution in time and space
- Proximity to water

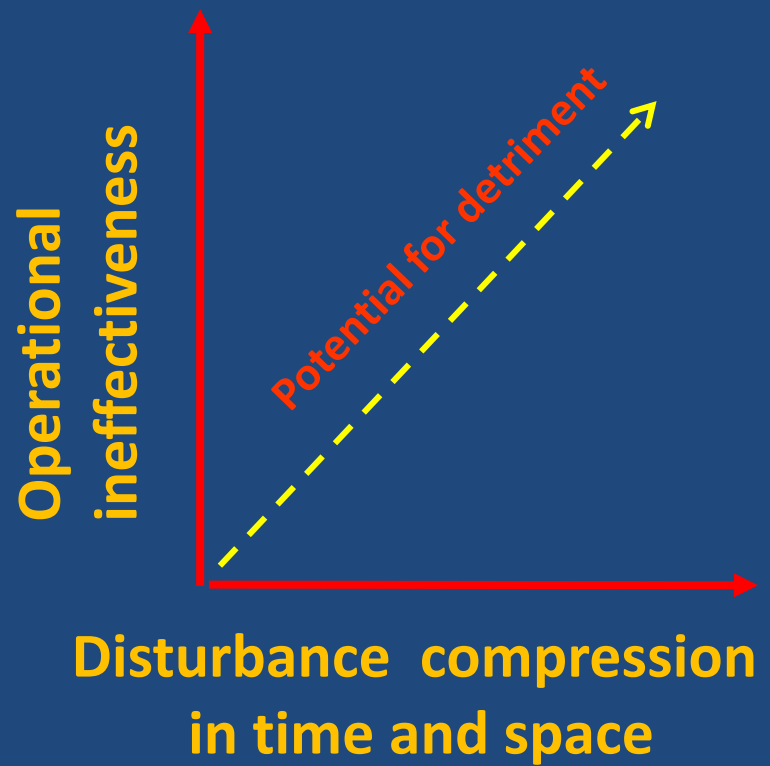
Watershed characteristics
- Landuse / landcover
- Road density and connectivity
- Many others

Assessing Relative Risk

Probability of water quality degradation

Extensive mngt.
Rapid re-vegetation
Level topography

Intensive mngt.
Adjacent to water
Erodible soils



Relative risk is a function of:
Operational effectiveness of practices
Disturbance patterns
Watershed characteristics

Outcomes

Key Objective: Maintain supply of high-quality water from forests

ID factors influencing operational effectiveness

ID “highest” risk watersheds

Targeted outreach/planning

Engaged stakeholders and partners

Questions?

<u>Acknowledgments</u>

Molly Martin

Anna Hess

Dennis Kepler

Amber Ellering

Dave Zumeta

Forrest Boe

Meg Hanisch