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

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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

Estimated Wood Use From Minnesota Timber Harvest by Primary Industry Sector 2010
Total Harvest = 2.81 Million Cords

- Pulp & paper 56%
- OSB/Engineered 16%
- Lumber & Specialty 18%
- Wood Energy 10%
BMPs are generally effective when implemented properly.
Issue 1 – operational effectiveness

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

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

1) Calibration training

2) Site level evaluation assessment

3) Spatially referenced database of findings

Watershed/ownership trends in:
• 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

Lower
Forestry
Agriculture
Urban

Higher

Intensive mngt.
Adjacent to water
Erodible soils

Extensive mngt.
Rapid re-vegetation
Level topography

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

Potential for detriment
Disturbance compression in time and space
Operational ineffectiveness
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?

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