Value Engineering for Stream Protection and Restoration: Challenges in the Maine Woods

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- Problem statement
- Background and Justification
  - Evidence-based BMPs?
- Existing research on costs
- Implementation and enforcement
- Value Engineering Opportunities: Evidence
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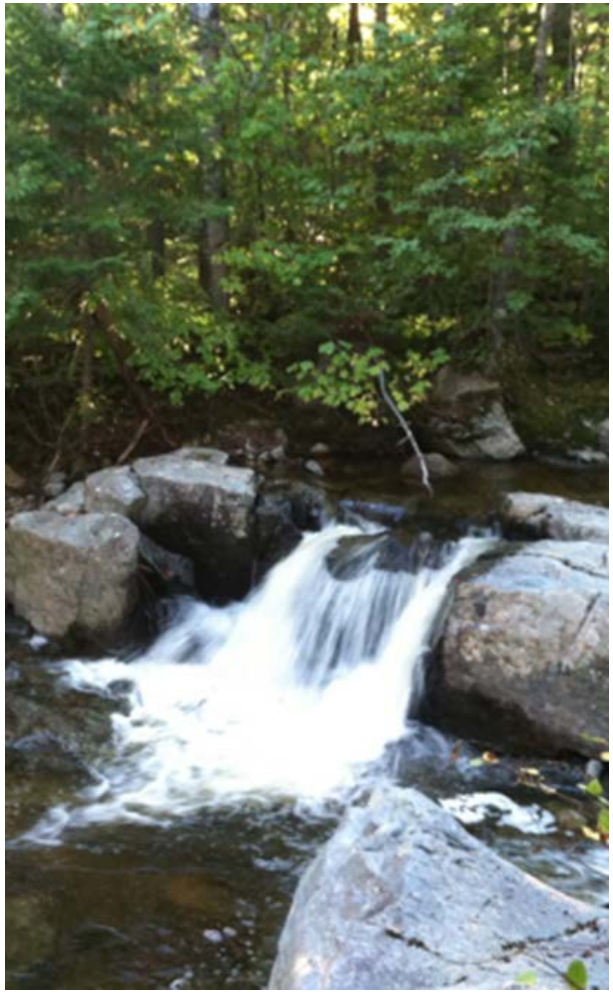
- Private owners do not own the water that flows through their lands
- This is a trust resource
- Downstream riparians have a right to clean water
- Owners do not have the right to put sediment or slush into the streams



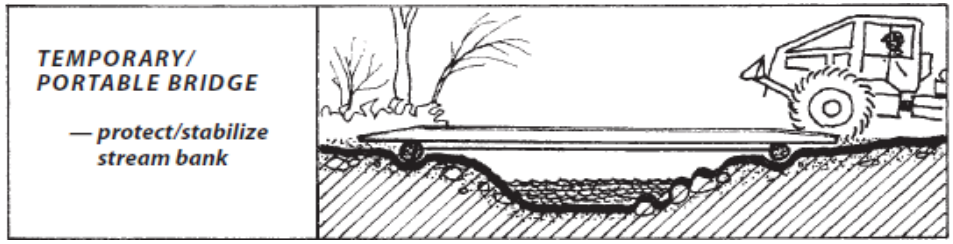
Maine's Forest Economy

- 17.6 MM acres of forest land
- 100,000 + forest owners
- 32,000 miles of permanent & perennial streams
- 5,400 logging jobs/year
- 400,000 acres harvested each year
- 12.8 MM Tons harvested/year

Source: MFPC (2016)

Policy side

- Forestry identified as a contributor of nonpoint source pollution by:
  - Federal Water Pollution Control Act (1972)
  - Clean Water Act Amendments (1977 & 1987)
- BMPs introduced as suggested guidelines/techniques to help protect water quality and habitat integrity
- Extensive research confirmed its effectiveness, often 70% or more (Schuler & Briggs, 2000; Edwards & Williard, 2010; MFS, 2015)

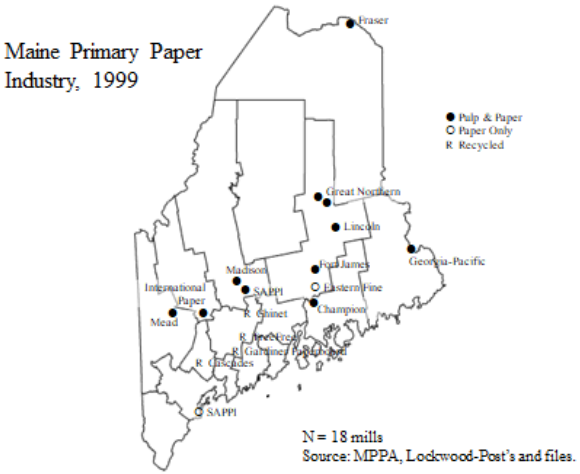


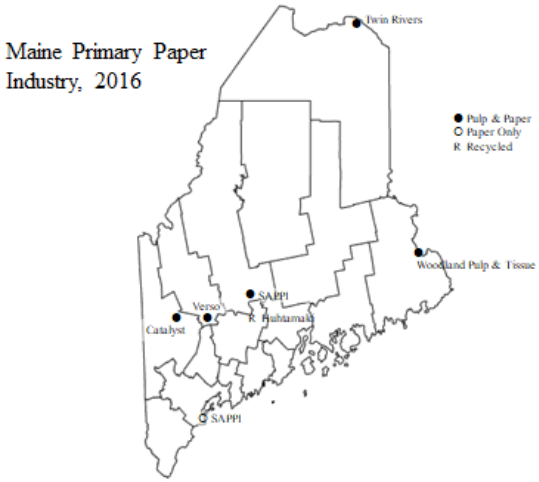
Challenges

- Roads, culverts and bridges are old and stressed by changes in climate
- Some are washing out or overdue for replacement
- Short time horizon of some owners
- Many owners have camp lots on leases; roads are usually poor

Challenges

- Simultaneously, markets are off and landowner returns are weak
- Deteriorating roads – truck speeds declining; damage to vehicles; lost bridges; longer hauls
  - All add to higher delivered wood costs
- Yet expectations for improved water quality continue (required by law)





Why Implement BMPs?

- The 1972 Clean Water Act requires all forested states to have a forest water quality protection program based on acceptable BMPs.
- In many states, BMPs are the basis for a voluntary program that relies on logger and forest landowner education, while some states make them mandatory or include them as part of a broader state forest practices law.

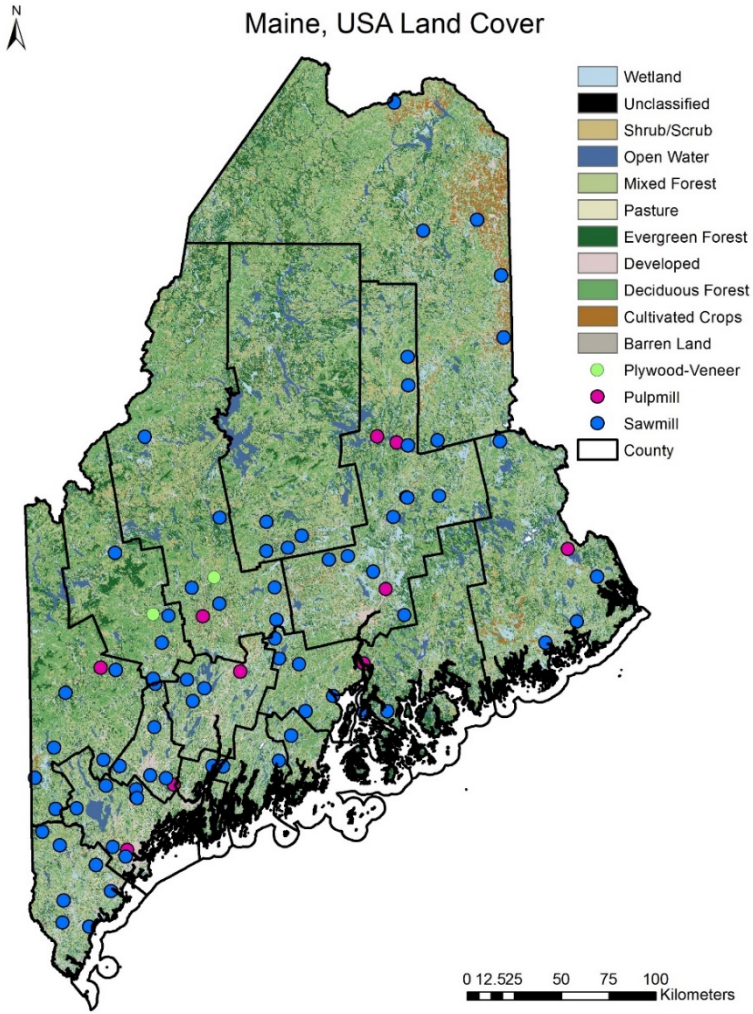
Maine Forestry BMPs

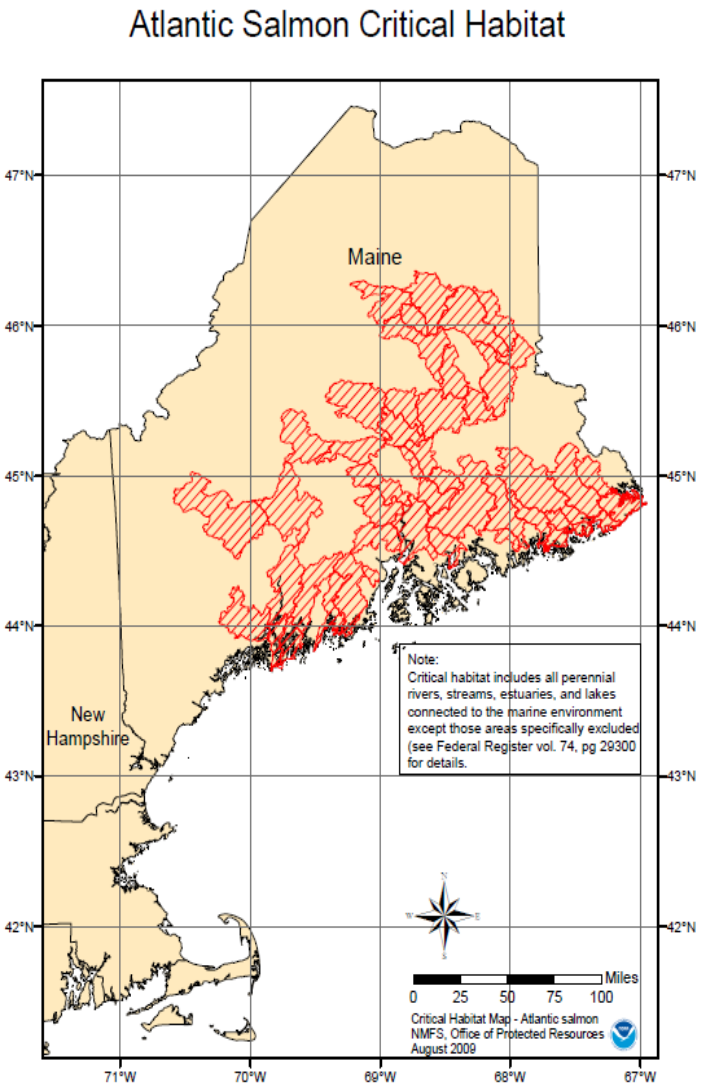
- Maine Forest Service promotes voluntary implementation of BMPs, stating:
  - It is often more effective, cheaper, and easier to prevent pollution than to fix problems after they occur.
  - When you understand the principles behind BMP techniques, you will be able to anticipate and prevent problems before they end up costing you time and money.

Then and now

Multiple Water Values

- Shifting from recreation to multiple values
- Last bastion of native brook trout
- Opportunity to restore Atlantic salmon?
- Recognition of ecological/fishery role of diadromous spp.


Maine, USA Land Cover
N
Wetland
Unclassified
Shrub/Scrub
Open Water
Mixed Forest
Pasture
Evergreen Forest
Developed
Deciduous Forest
Cultivated Crops
Barren Land
Plywood-Veneer
Pulpmill
Sawmill
County
0 12.525 50 75 100
Kilometers


Atlantic Salmon Critical Habitat
Maine
New Hampshire
Note:
Critical habitat includes all perennial rivers, streams, estuaries, and lakes connected to the marine environment except those areas specifically excluded (see Federal Register vol. 74, pg 29300 for details.
Miles
0 25 50 75 100
Critical Habitat Map - Atlantic salmon
NMFS, Office of Protected Resources
August 2009
47°N
46°N
45°N
44°N
43°N
42°N
71°W
70°W
69°W
68°W
67°W

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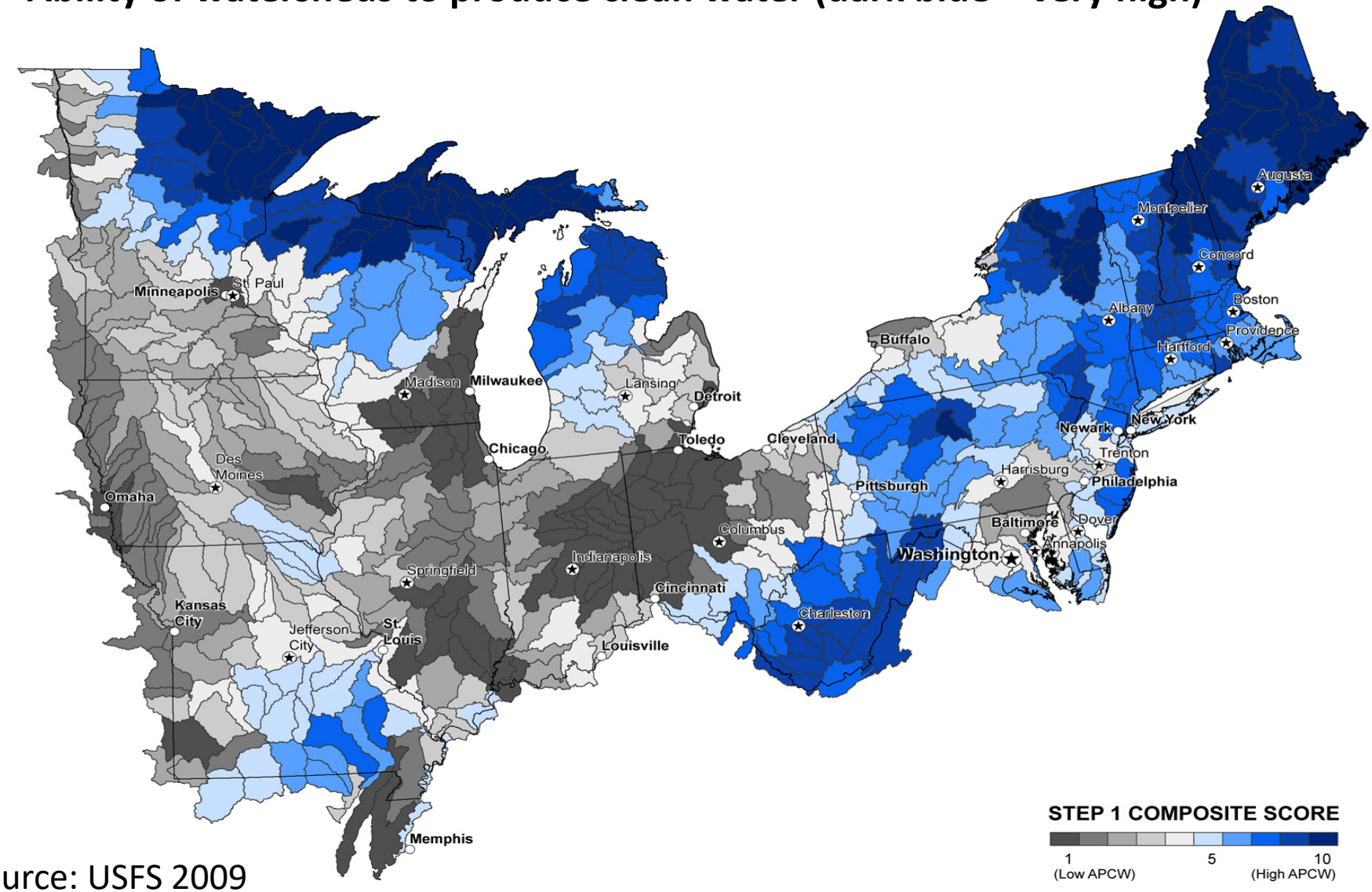
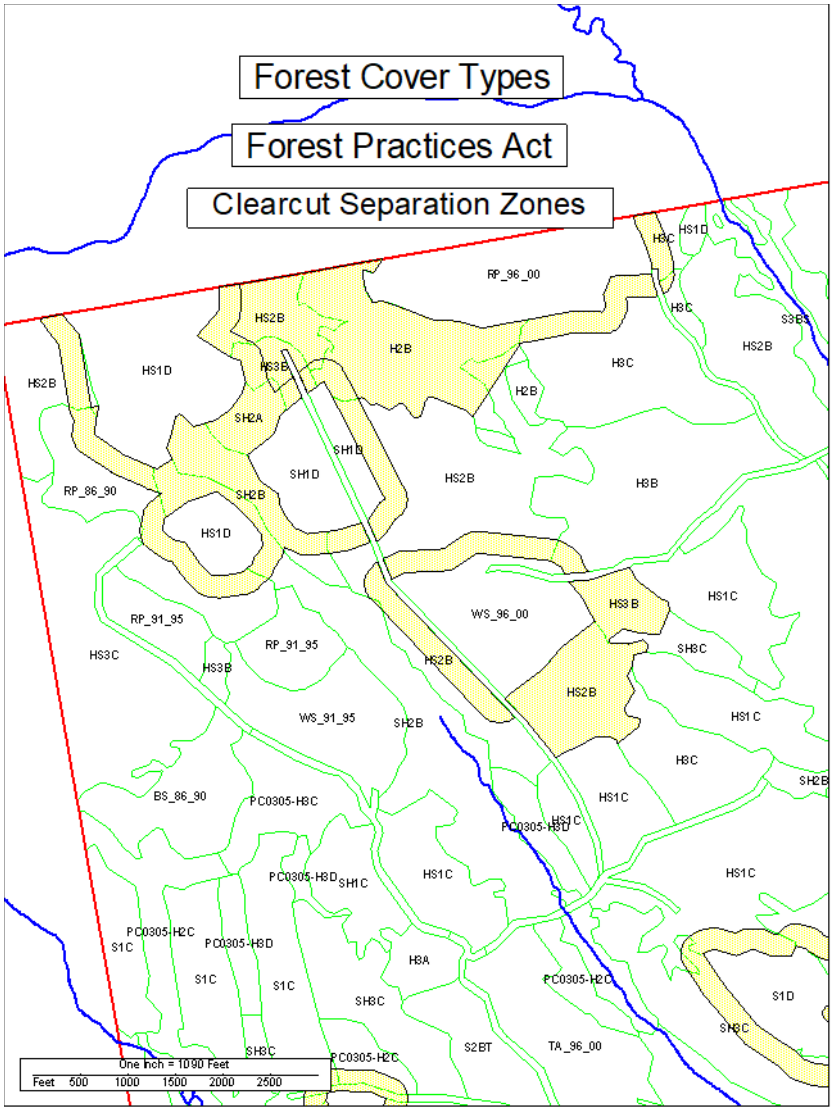
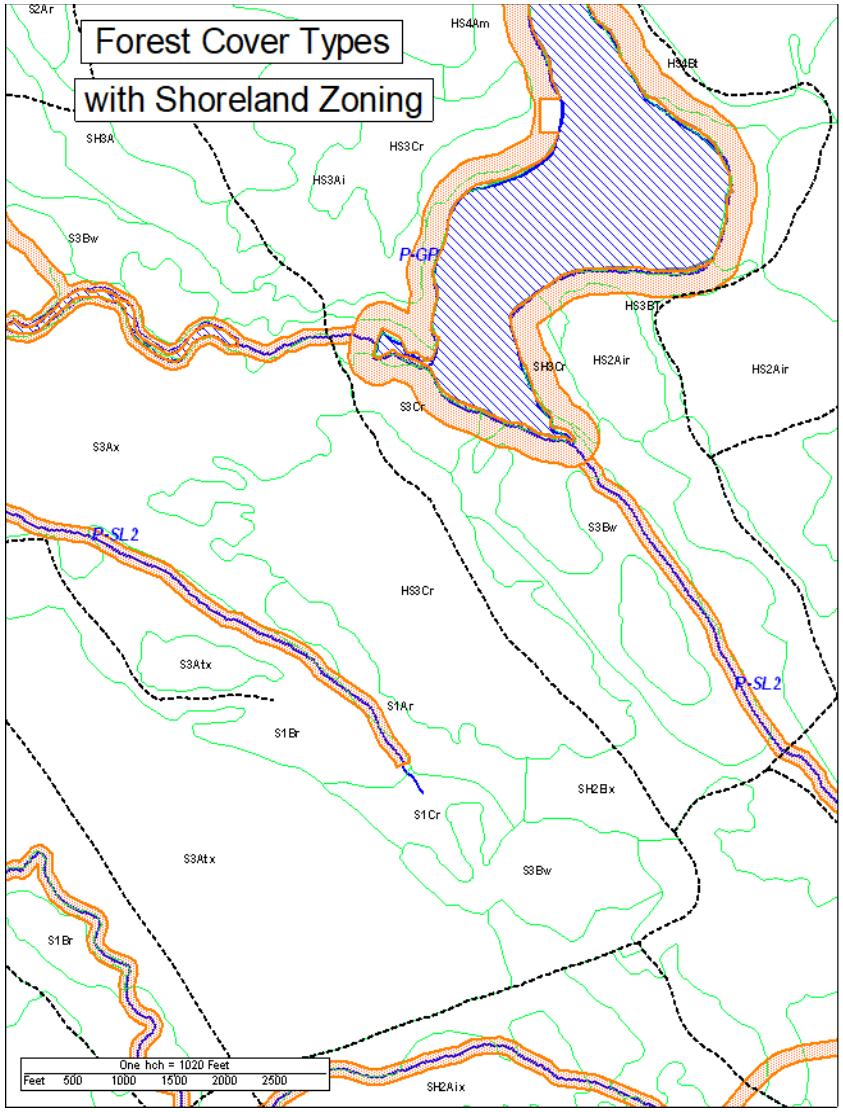
Ability of watersheds to produce clean water (dark blue = very high)

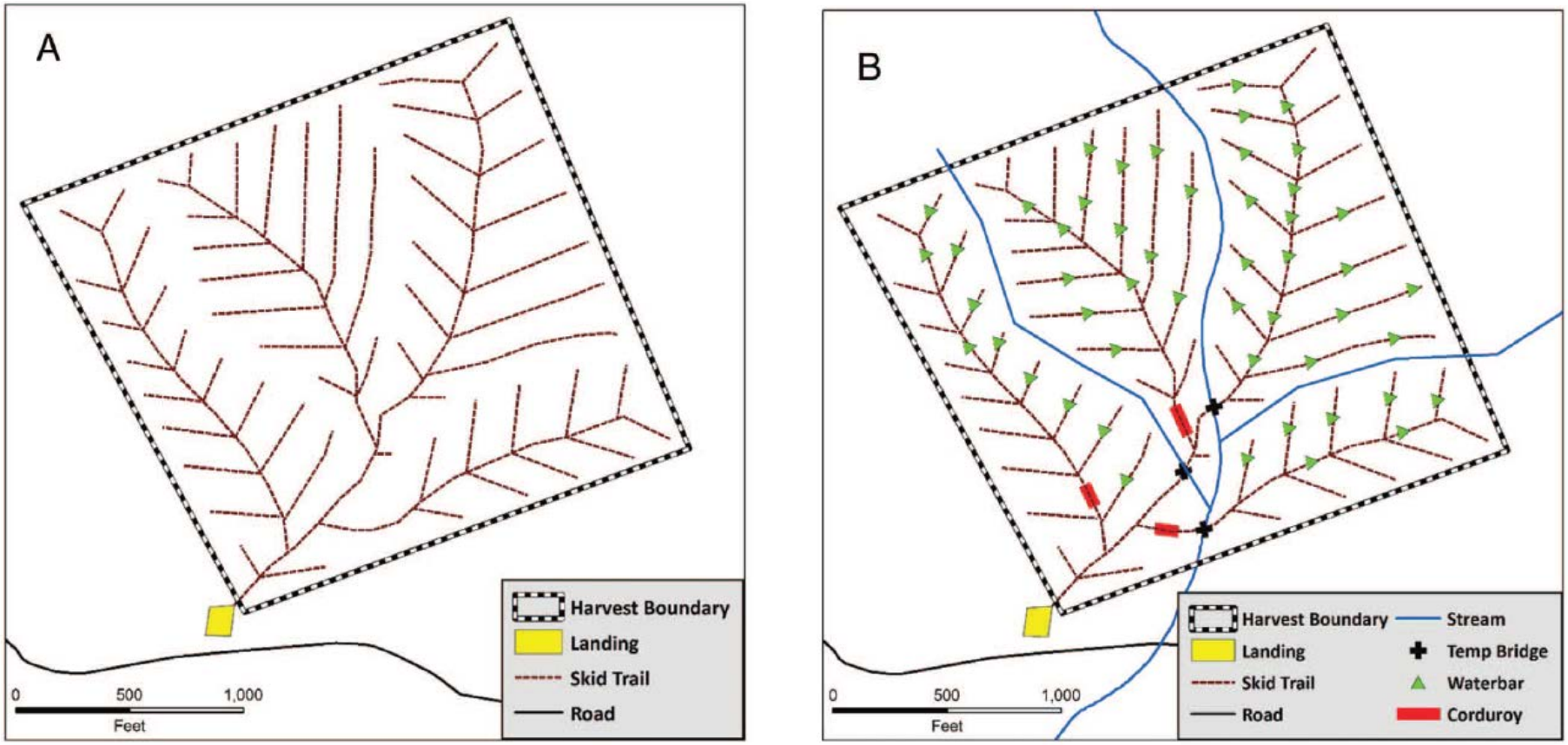


Source: USFS 2009


Forest Cover Types
Forest Practices Act
Clearcut Separation Zones
RP_96_00
HS2B
H2B
HS1D
HS3B
SH2A
SH1D
RP_86_90
SH2B
HS1D
H3C
HS1D
S3B
HS2B
H3B
HS1C
WS_96_00
HS3B
SH3C
RP_91_95
HS3C
HS2B
WS_91_95
SH2B
HS1C
H3C
SH2B
BS_86_90
PC0305-H3C
HS1C
PC0305-H3D
PC0305-H3D
SH1C
HS1C
PC0305-H2C
S1C
PC0305-H3D
H3A
S1C
S1C
SH3C
PC0305-H2C
S1D
SH3C
S2BT
TA_96_00
PC0305-H2C
One inch = 1090 Feet
Feet 500 1000 1500 2000 2500


Forest Cover Types
with Shoreland Zoning
S2Ar
HS4Am
HS4Bt
SH3A
HS3Cr
HS3Ai
S3Bw
P-GP
HS3Br
SH3Cr
HS2Air
HS2Air
S3Cr
S3Ax
S3Bw
P-SL2
HS3Cr
S3Atx
S1Ar
P-SL2
S1Br
SH2Bx
S1Cr
S3Atx
S3Bw
S1Br
SH2Aix
One inch = 1020 Feet
Feet 500 1000 1500 2000 2500

Costing out BMPs



Source: Kelly et al (JoF, 2017)

Costing out BMPs

- BMP costs ranged from $0 to $62/ac, based on results from eight case studies and a survey of 112 loggers.
- The case studies showed a reduction in harvest productivity due to BMPs from 0 to 9%
- Estimates similar to other (limited) studies:
  - US South: $26/ac
  - Virginia: $12-75/ac
  - Minnesota: 1-9% increase in logging cost

Source: Kelly et al (JoF, 2017)

Costing out BMPs (2017 dollars)

BMP	Cost	Unit
Pre-harvest planning	$4.76	$/ac
Bridges	$1105-$2325	$/bridge
Water bars	$22	$/water-bar
Culvert	$300-$565	$/culvert
SMZ	$113	$/SMZ
Seeding and mulching	$402	$/landing

Source: Shaffer et al (FPS, 1998)

Effectiveness research

- Cristan et. al. (2016) conduct a very extensive review of the literature by region, with 20 studies focusing on the Northern United States and their major conclusion is the water quality is protected when BMPs are properly applied
- Wilkerson et al. (2004) found that streams without buffers had the highest increase in weekly maximum temperatures (this goes back to buffers services, including shade)

Effectiveness research

- Edwards & Williard (2010) found that BMPs reduce sediments from 53 to 94% and nutrients such as nitrogen by 60-80% and phosphorus by 85-86%

- Schuler & Briggs (2000) found strong relationship between BMP application and prevention of sediment movement

- Anderson & Lockaby (2011) argue there is a research gap in some of these topics and suggest approaches to bridge it

Implementation data (Maine-specific)

- 85% of sites: BMPs applied appropriately on crossing and approaches, or were avoided if possible
- BMPs were not applied on 4% of stream crossings and approaches
- 92% of tests: found no sediment entered a waterbody
- 98% of sites: no evidence of chemical spills
- 96% of sites: no haul road or landing in the waterbody buffer/filter strip
- Wetlands were either avoided or effective BMPs were used to cross

How Maine Compares (implementation %)

	AL	FL	ME	MI	MO	NC	OH	SC	VT	VA	WI	Mean
Timber harvest	98	99	**90**	*	99	*	85	94	*	*	97	94.6
Forest roads	93	99	**89**	91	97	84	83	98	94	85	70	89.4
Skid trails	*	100	**89**	87	99	82	73	*	84	90	88	88
Log landings	*	100	**97**	99	100	*	81	*	70	94	*	91.6
Stream crossings	96	98	**81**	86	94	72	78	81	68	92	*	84.6
SMZs *	97	98	**93**	94	97	91	81	92	86	92	89	91.8

*Stream Management Zone

General Conclusions

- BMPs appear to be highly effective (70%+) if correctly implemented
- Recent studies found high implementation rates (85%+)
- Limited studies on regional/state BMP costs
  - Data we found does indicate that it is more ‘costly’ than doing nothing though
- More extreme weather + deteriorating markets and infrastructure → more cost and effort required in future?

Paths forward

- Perform local study to quantify local costs
- Assess equipment and methods carefully
- Onsite field work , time studies, current data
- Examine silviculture methods for connections to costs
- Improve roadbuilding techniques
- Bridges & culverts
  - Designs & technologies
  - Durability & its tradeoffs

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Questions?