The Uniform Buffer Paradigm, Ecosystem Services, and A Call for Spatially Explicit Riparian Management

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Goals of Washington Forest Practices Act as Defined by the Forest and Fish Report (FFR)

1. to provide compliance with the Endangered Species Act for aquatic and riparian-dependent species;
2. to restore and maintain riparian habitat to support a harvestable supply of fish;
3. to meet the requirements of the Clean Water Act for water quality; and
4. to keep the timber industry economically viable in the State of Washington.

Riparian Strategy

Conservation objective:
To restore riparian functions to high levels and to maintain those levels once they are attained.

Approach for western Washington:

- Protection measures are designed to place riparian forests on growth trajectories toward a "desired future condition" (DFC, riparian forest stand at 140 years of age).

- This age is assumed to be representative of a mature forest stand that provides the full range of ecological functions important for the survival and recovery of covered species.

Approach for eastern Washington:

- Protection measures are intended to provide for stand conditions that vary over time.
- Varying stand conditions are designed to mimic natural disturbance regimes within a range that meets resource objectives and maintains general forest health.

Prescription Designs for Protection of Aquatic Resources and for Achieving DFC

WESTERN WASHINGTON

S | F — TYPE 'S' OR 'F' WESTERN WASHINGTON RMZ REQUIREMENTS

TYPES 'S' AND 'F' ARE FISH HABITAT STREAMS

Site Class	Total RMZ Width	Core Zone Width[1]	Inner Zone Width[2] Stream ≤ 10'	Inner Zone Width[2] Stream > 10'	Outer Zone Width[3] Stream ≤ 10'	Outer Zone Width[3] Stream > 10'
I	200'	50'	83'	100'	67'	50'
II	170'	50'	63'	78'	57'	42'
III	140'	50'	43	55'	47'	35'
IV	110'	50'	23	33'	37'	27'
V	90'	50'	10'	18'	30'	22'

No Harvest (Core Zone and Inner Zone)

EASTERN WASHINGTON

S | F — TYPE 'S' OR 'F' EASTERN WASHINGTON RMZ REQUIREMENTS

TYPES 'S' AND 'F' ARE FISH HABITAT STREAMS

Bankfull width less than or equal to 15 feet

Site Class	Total RMZ Width	Core Zone Width[1]	Inner Zone Width[2]	Outer Zone Width[3]
I	130'	30'	45'	55'
II	110'	30'	45'	35'
III	90'	30'	45'	15'
IV	75'	30'	45'	0'
V	75'	30'	45'	0'

No Harvest (Core Zone and Inner Zone)

[1] Measured from outer edge of bankfull width (BFW) or outer edge of Channel Migration Zone (CMZ), whichever is greater.

[2] Measured from outer edge of Core Zone.

[3] Measured from outer edge of Inner Zone.

Bankfull width greater than 15 feet

Site Class	Total RMZ Width	Core Zone Width[1]	Inner Zone Width[2]	Outer Zone Width[3]
I	130'	30'	70'	30'
II	110'	30'	70'	10'
III	100'	30'	70'	0'
IV	100'	30'	70'	0'
V	100'	30'	70'	0'

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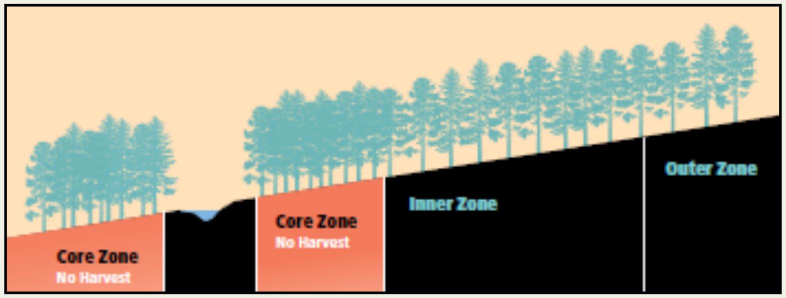


B. DO YOU HAVE ADEQUATE SHADE?

You can harvest inside the inner zone only if there is adequate shade present. See WAC 222-30-040

YES | NO → NO HARVEST

C. DO YOU MEET THE DESIRED FUTURE CONDITION (DFC) REQUIRED?

Desired Future Condition Target Basal Area at 140 years

Site Class I	325 sq. feet per acre
Site Class II	325 sq. feet per acre
Site Class III	325 sq. feet per acre
Site Class IV	325 sq. feet per acre
Site Class V	325 sq. feet per acre

Knowing the age of your trees and its basal area, you can calculate the Desired Future Condition. A computer program will help you determine this. See page 74 to learn how to calculate the basal area.

FOREST PRACTICES MANUAL

See the Board Manual Section 7.

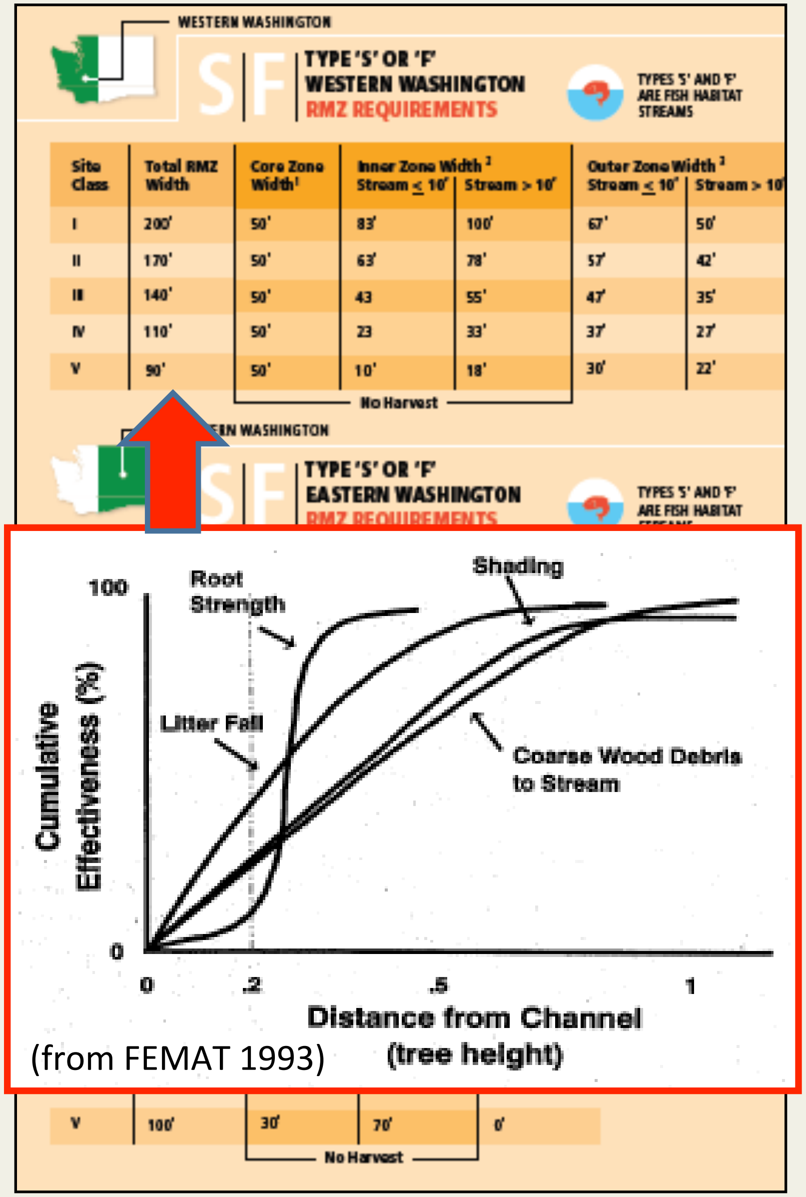
YES | NO → NO HARVEST

Inner Zone | Option 1
Thinning from Below Canopy
This option is explained in the following two pages.

Inner Zone | Option 2
Leave Trees Closest to Water
This option is explained in pages 70 and 71.

Outer Zone
You must leave 20 riparian leave trees per acre after harvest. Leave trees in the outer zone may be dispersed or clumped. See WAC 222-30-021 for species and size.

Prescription Designs for Protection of Aquatic Resources and for Achieving DFC



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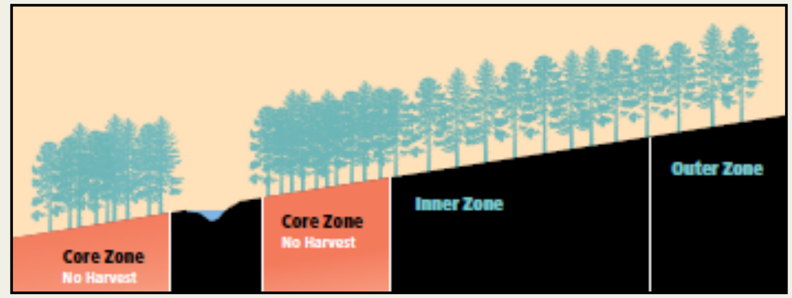
No Harvest

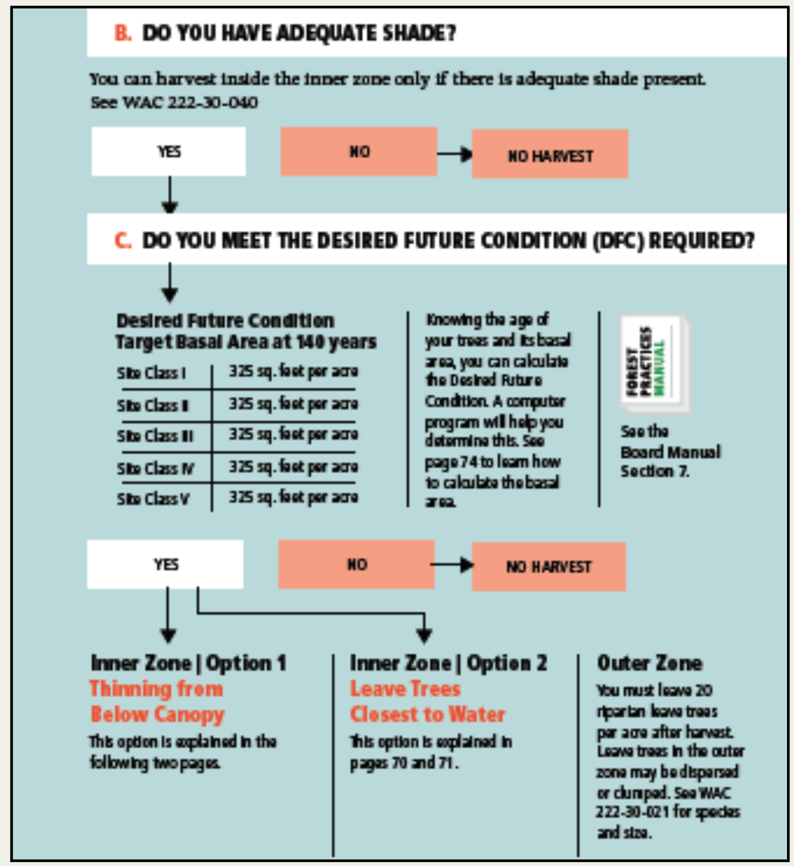
TYPE 'S' OR 'F' EASTERN WASHINGTON RMZ REQUIREMENTS

V	100'	30'	70'	0'

No Harvest

(from FEMAT 1993)





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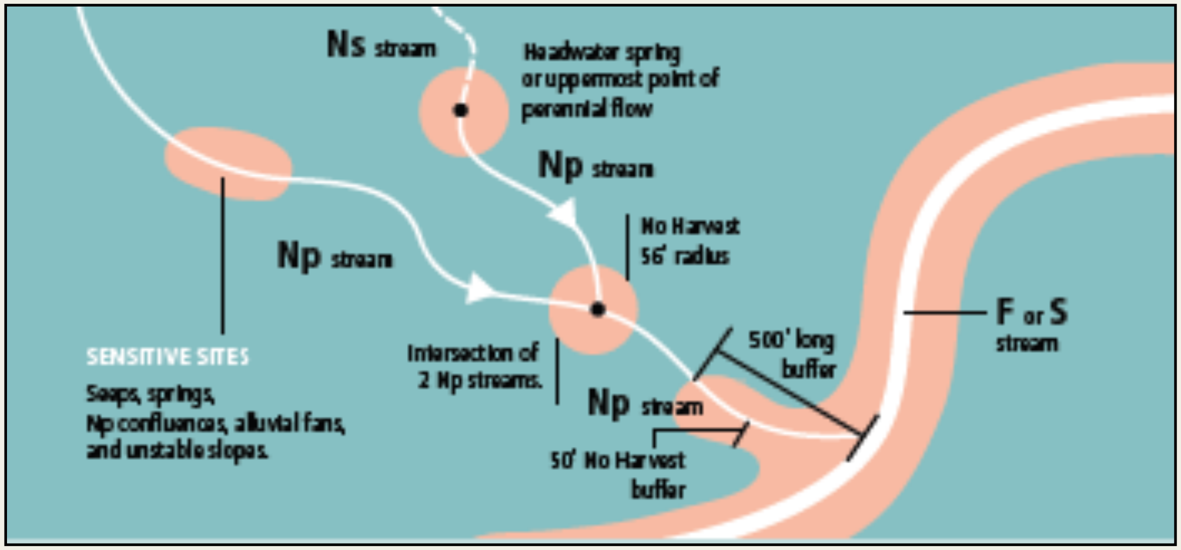
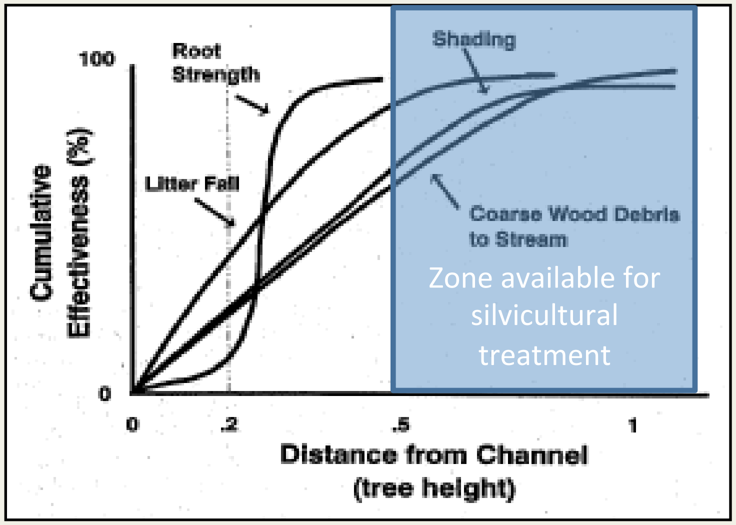
Prescriptions for Headwaters Address Water Quality, Riparian Dependent Amphibians, and Downstream Export-Water Quality



What do we Know About Riparian Forests and Riparian Functions Under the Current RMZ Prescriptions

Harvest Treatments can only be Applied to the Outer Portion of the RMZ, So Effectiveness to Influence Riparian Functions is Limited

Riparian Function Source Distance Curves (FEMAT 1993)



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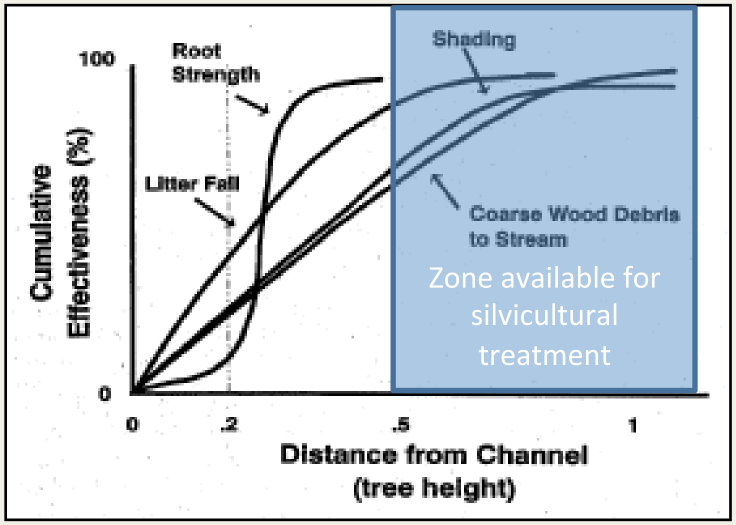
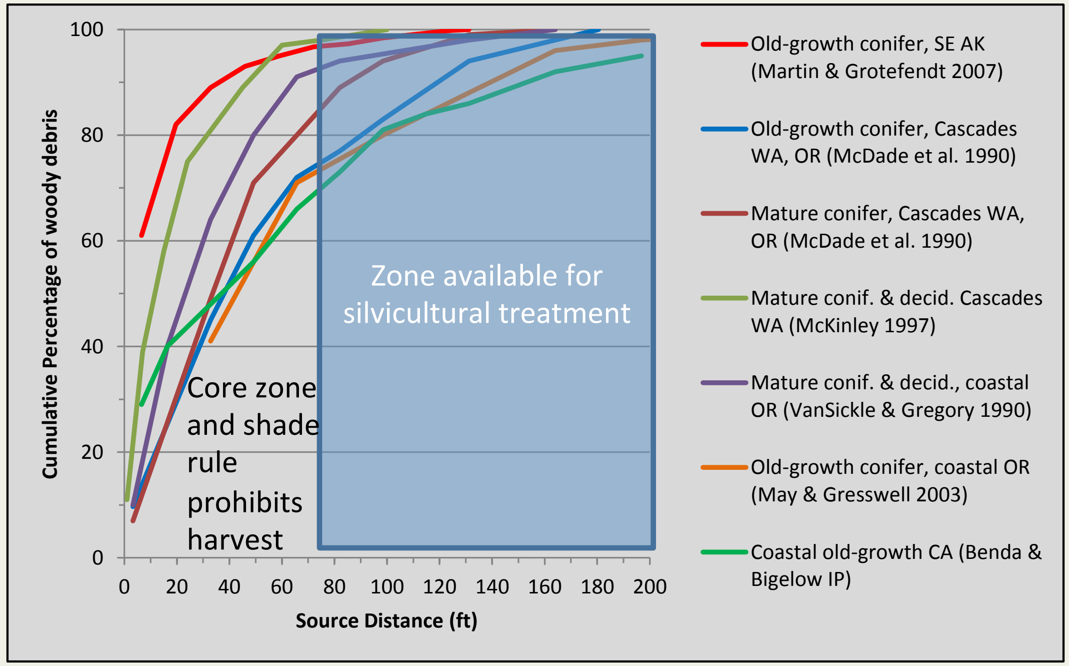
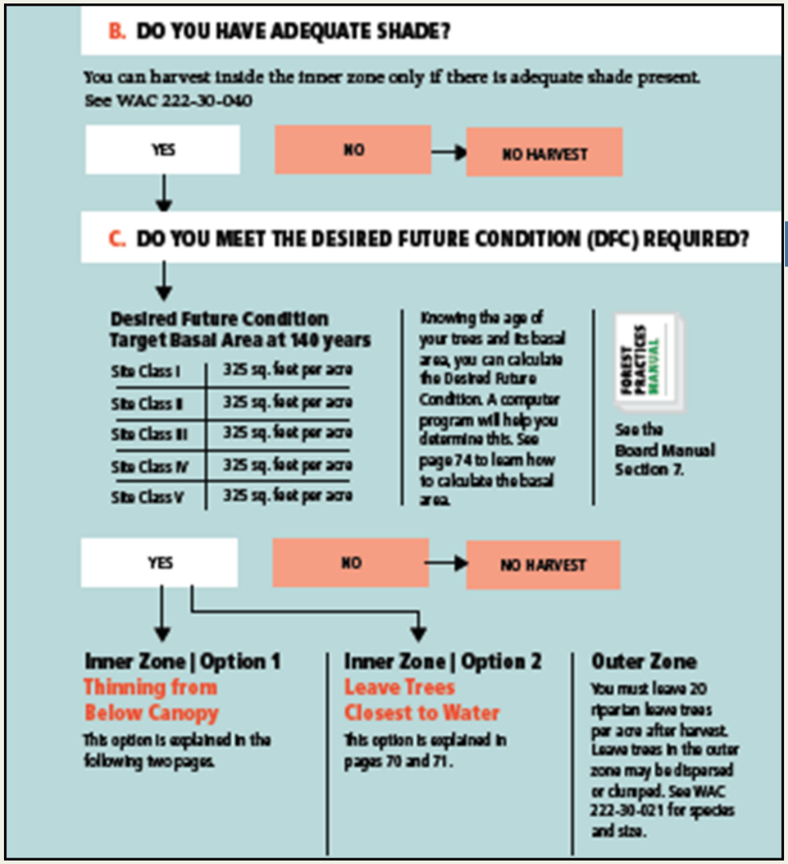


Large Wood Source Distance Curves



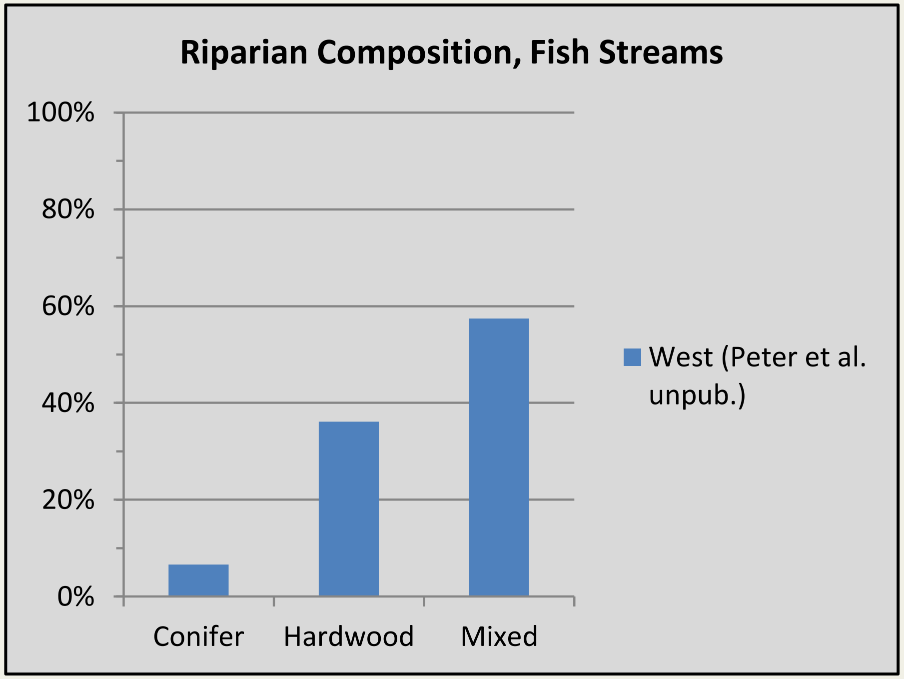
- Less than 30% of future wood supply could be influence by RMZ harvest treatments designed to promote large conifers!

DFC Tree Retention and BA Requirements Prohibits RMZ Harvest Options in Most Streams



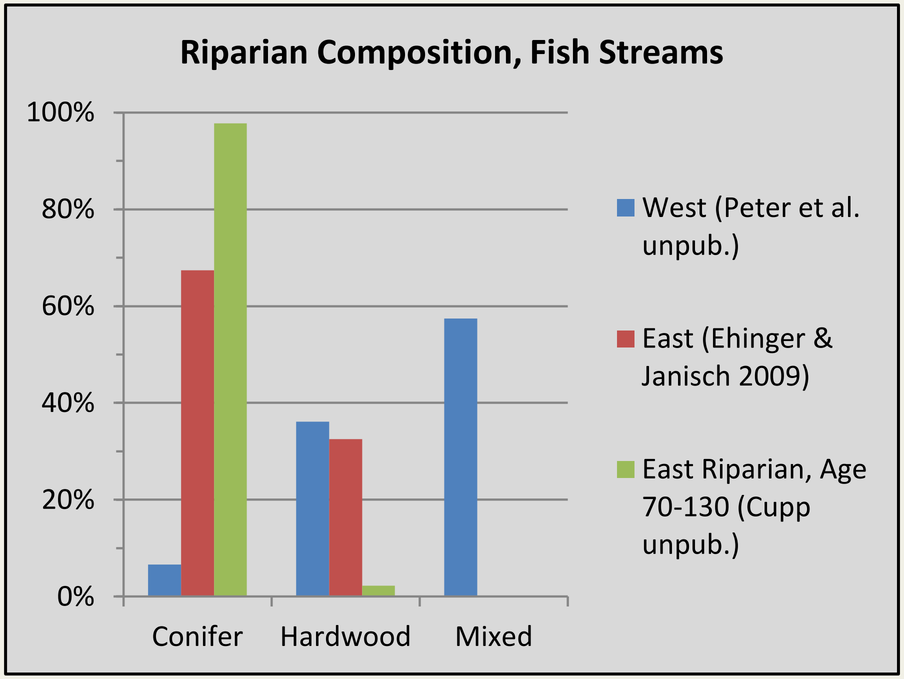
- Westside: 80-85% of sites do not meet DFC (WFPA analysis based on McConnell 2010)
- Eastside: 52-60% of sites do not qualify (MB&G 2008, CMER Study

Riparian Composition Under Current Conditions (Based on 50 Random Sites)



- Westside dominated by hardwood and conifer/hardwood mix
- What is the desired composition and how/ when will it be achieved?

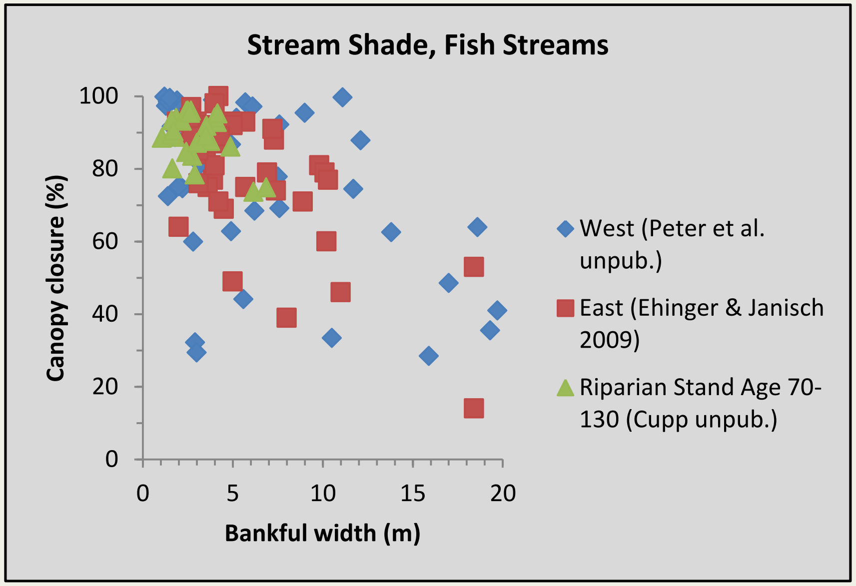
Riparian Composition Under Current Conditions



- Westside dominated by hardwood and conifer/hardwood mix
- What is the desired composition and how/ when will it be achieved?

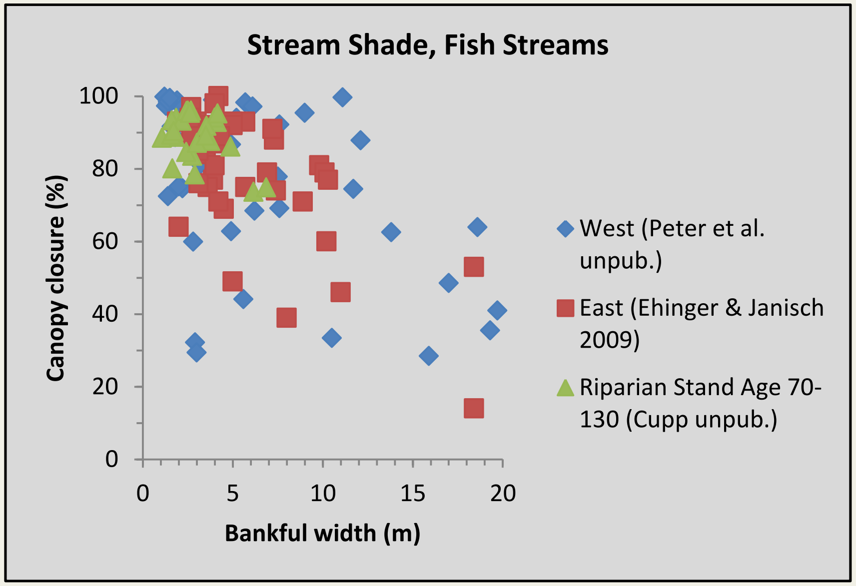
- Eastside dominated by conifer
- Fire protection has resulted in high fuel loading; fire and insect/disease hazard in many areas

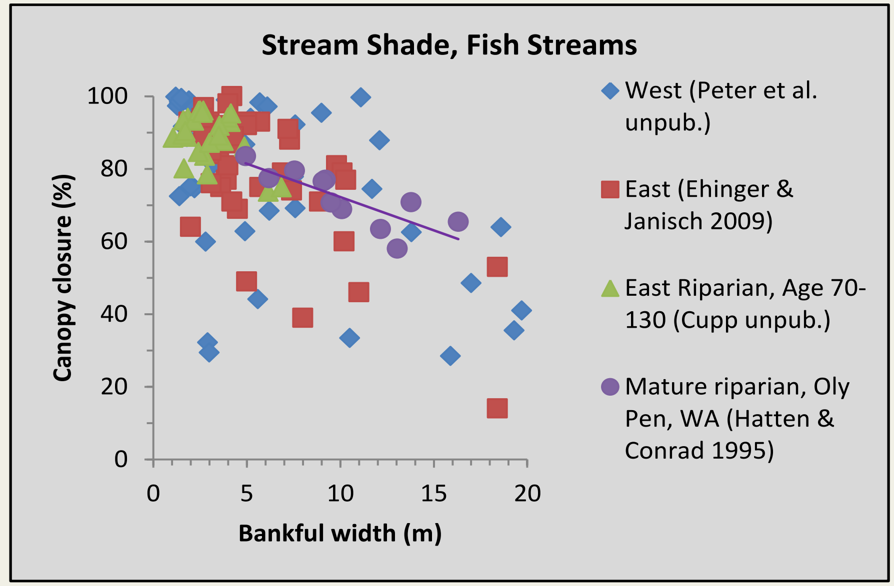
Stream Shade Under Current Riparian Conditions



- Shade is variable, as expected, given wide range of harvest ages
- Shade is high (>80%) at most sites with no recent harvest

Stream Shade Under Current Riparian Conditions

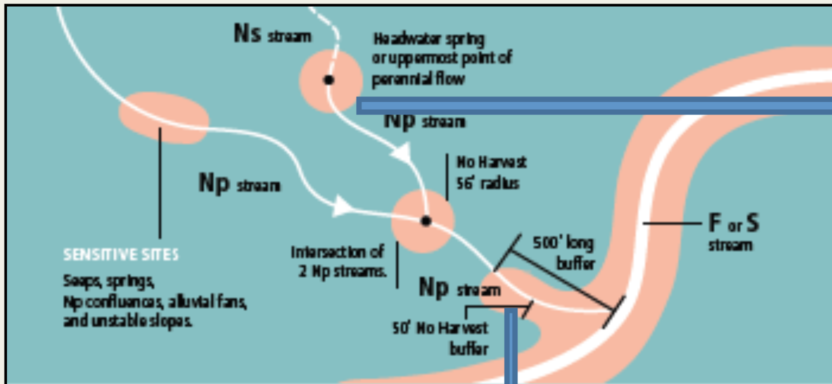




- Shade is variable, as expected, given wide range of harvest ages
- Shade is high (>80%) at most sites with no recent harvest

- Shade probably exceeds levels for mature riparian stands
- Light can limit overall aquatic productivity
- Are we creating too much shade?

Headwater Buffers are Vulnerable to High Mortality from Windthrow



Factors that increase vulnerability:

- Topographic exposure
- Long fetch due to surrounding clearcut
- Trees with high height to diameter ratio

Buffer mortality causes change in frequency and magnitude of wood loading in small headwater streams

Consequences of high wood loads on water quality and habitat are just becoming known

Un-Intended Consequences of RMZ Rules

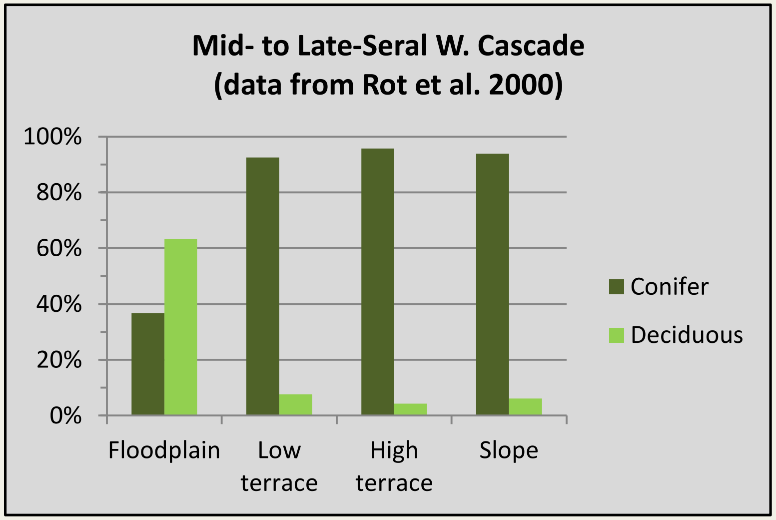
- The RMZs along most fish streams and many eastside non-fish streams are effectively “riparian reserves” with no-active management
- Passive management has increased vulnerability of eastside stands to fire and insect damage
- Westside non-fish buffers have increased vulnerability to windthrow that probably has altered the frequency, magnitude, and distribution of such disturbance events in headwater streams
- The current management strategy, as implemented, has altered riparian forest structure and trajectory such that it may drive riparian forests toward static and uniform conditions over large areas

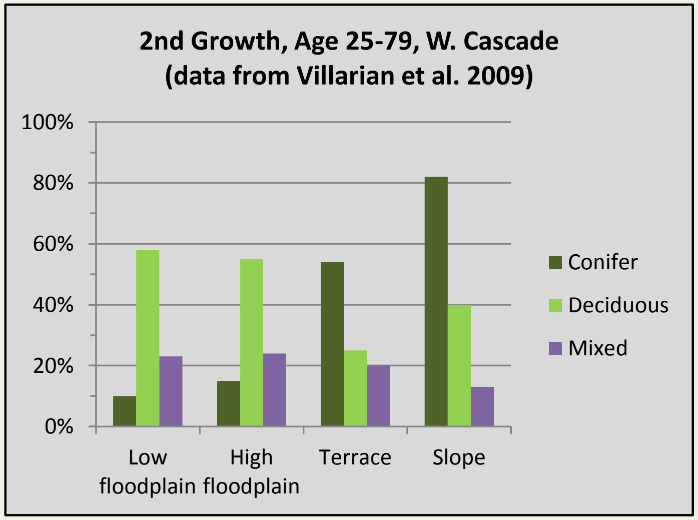
What Needs to Change for Successful Riparian Management?

1. A shift in thinking from a “protection” mindset (e.g., buffering the stream) to an “ecosystem processes” mindset (e.g., results based approach)

2. Recognition that riparian and aquatic environments are spatially and temporally variable, and knowledge of that variability can lead to more effective management strategies to provide ecological functions and be more cost effective in forestry and watershed management

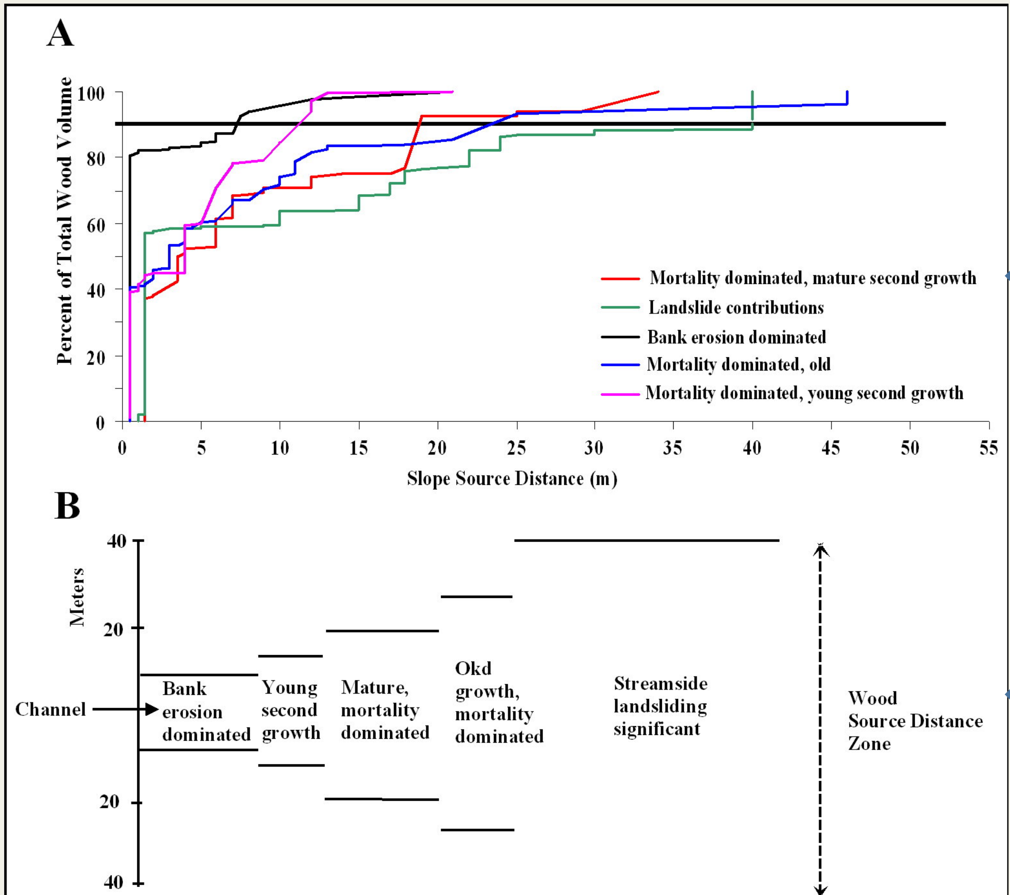
Landform Strongly Influences Riparian Forest Composition





- Distribution of landforms influences spatial and temporal patterns of riparian forests, and future successional trajectories
- Site potential concept is not a suitable analog for managing riparian forest structure

The Spatially Distributed Nature of Bank Erosion, Forest Mortality and Streamside Landsliding Controls Amount and Patterns of Wood Recruitment to Streams



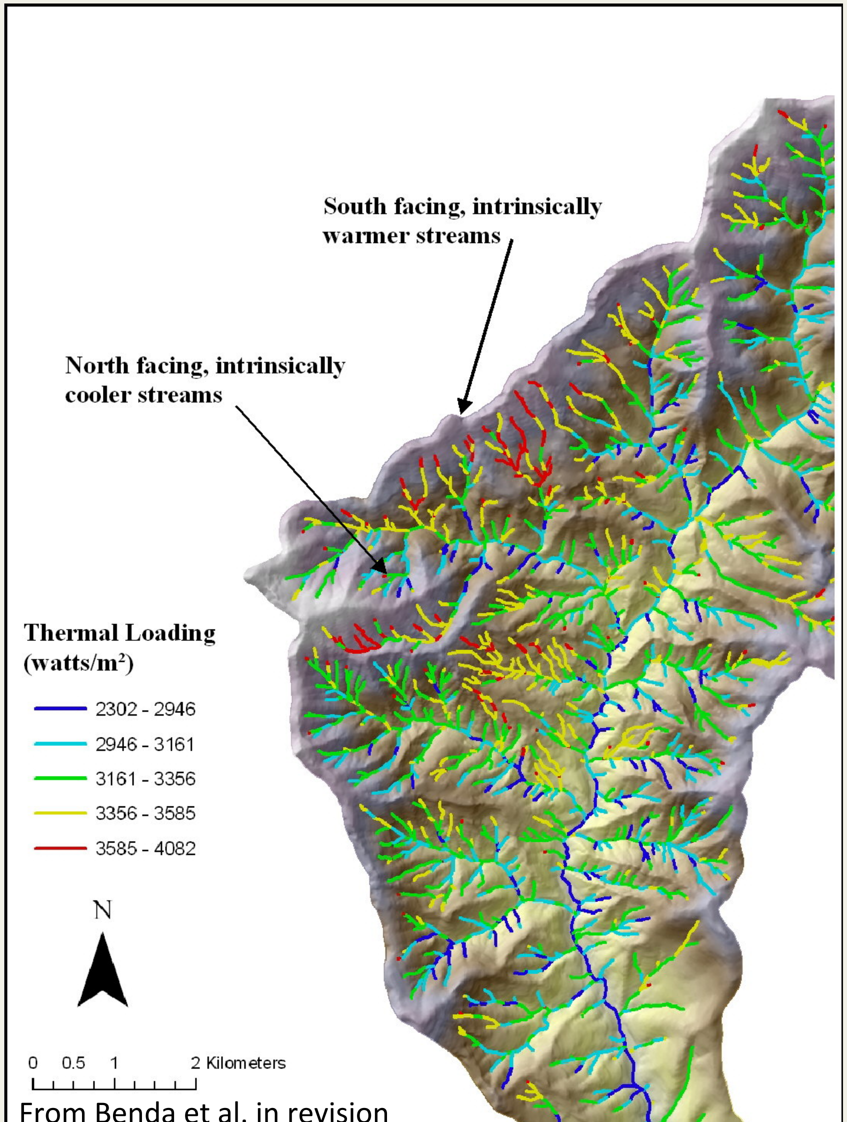
From Benda and Bigelow (2009)

The source distance for large wood is strongly influenced by the dominant recruiting process

RMZ width needed to provide approximately 90% of wood recruitment potential

- A variable width buffer tailored to landform and stand potential could maintain wood supply

Thermal Loading Potential is Highly Variable



From Benda et al. in revision

Intrinsic variability in thermal loading to streams is due to differences in:

- stream orientation
- channel width
- topographic shading
- watershed's latitude

- The spatial differences in thermal loading could be used to focus riparian shade on heat sensitive reaches

A Call for the Development of Riparian Management Strategies More Consistent with Science

Sound Watershed Consulting
Creating Functional Water Environments

Scientific Literature Review of Forest Management Effects on Riparian Functions for Anadromous Salmonids

for

The California State Board of Forestry and Fire Protection

Prepared by:

Mike Liquori
Dr. Doug Martin
Dr. Lee Benda
Dr. Robert Coats
Dr. David Ganz

September 2008

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http://www.fire.ca.gov/CDFBOFDB/pdfs/FINALBOOK_1.pdf

USDA

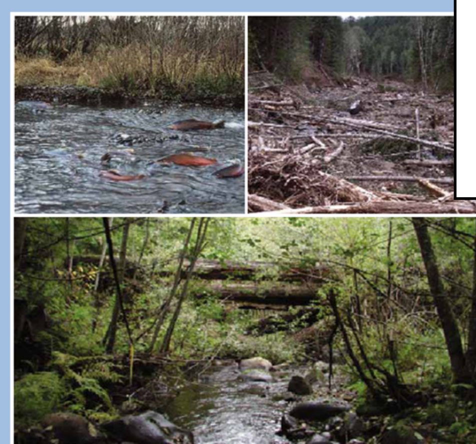
United States Department of Agriculture

Forest Service Pacific Northwest Research Station

General Technical Report PNW-GTR-830

December 2010

Riparian Adaptive Management Symposium: A Conversation between Scientists and Managemer



http://www.fs.fed.us/pnw/pubs/pnw_gtr830.pdf

BRIDGES

Introduction and a theoretical basis for using disturbance by forest management activities to sustain aquatic ecosystems

David P. Kreutzweiser[1,4], Paul K. Sibley[2,5], John S. Richardson[3,6], AND Andrew M. Gordon[2,7]

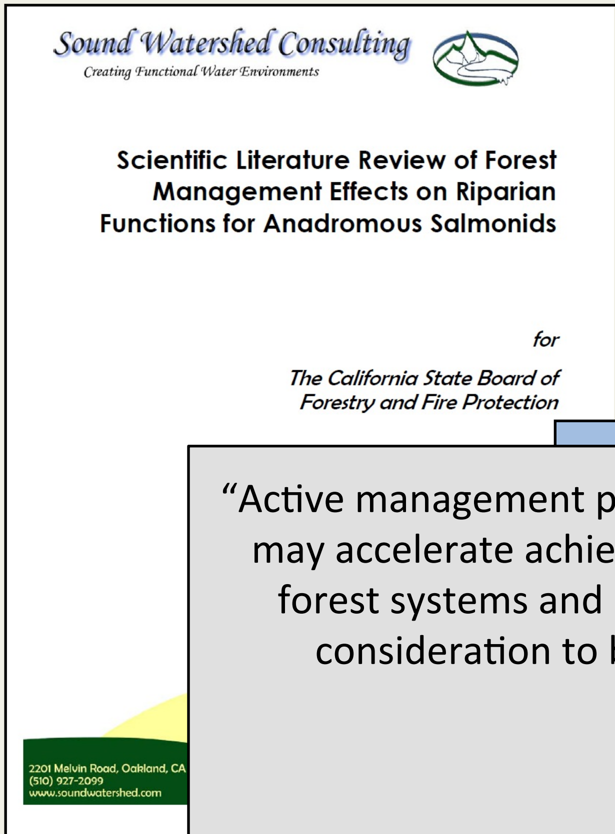
[1] *Canadian Forest Service, Natural Resources Canada, Sault Ste Marie, Ontario, Canada P6A 2E5*
[2] *School of Environmental Sciences, University of Guelph, Guelph, Ontario, Canada N1G 2W1*
[3] *Department of Forest Sciences, University of British Columbia, Vancouver, British Columbia, Canada V6T 1Z4*

Abstract. Emulation of natural disturbance (END) is an emerging paradigm for modern, ecosystem-based forest management in North America. On the premise that periodic disturbance is an integral part of natural, determinative processes on forest landscapes, managing forests by emulating natural disturbance is thought to produce landscape patterns that resemble those arising from natural disturbances and that are known to maintain critical processes and habitat for conserving biodiversity. Applying END principles to forest watersheds has implications for the protection of aquatic ecosystems because END can include intentional logging disturbance near water to emulate natural riparian disturbance. Literature shows that logging in watersheds, and especially in riparian areas, can lead to negative abiotic and biotic effects in aquatic ecosystems. However, an integration of the current understanding of land–water linkages in forest watersheds with general disturbance ecology would suggest that periodic watershed and riparian disturbances may be natural renewal processes that are required for long-term sustainability of aquatic ecosystems. Previous syntheses of END in forestry failed to consider the implications for aquatic ecosystems, and most forest-management guidelines default to the protection of water resources by systematic riparian (shoreline) buffers. This paper introduces the concepts of END and provides a theoretical basis for using intentional riparian forest disturbance to sustain aquatic habitat complexity and ecosystem integrity.

Key words: natural disturbance emulation, forest watershed, logging impacts, aquatic ecosystem sustainability.

Freshwater Science 31(1), 2012

A Call for the Development of Riparian Management Strategies More Consistent with Science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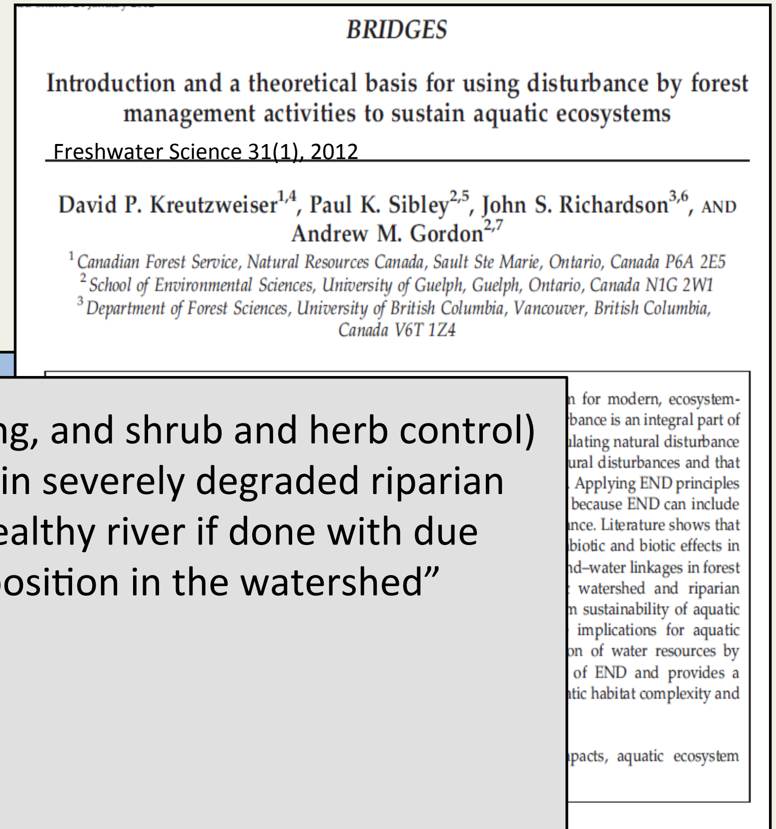
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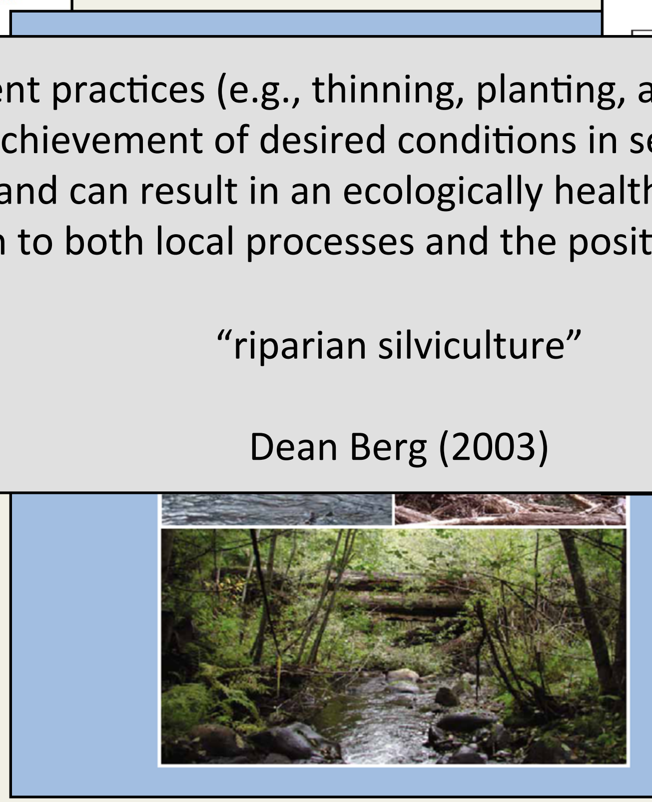

"Active management practices (e.g., thinning, planting, and shrub and herb control) may accelerate achievement of desired conditions in severely degraded riparian forest systems and can result in an ecologically healthy river if done with due consideration to both local processes and the position in the watershed"

"riparian silviculture"

Dean Berg (2003)