Hardwood Conversion

As part of the

Riparian Forest Restoration Strategy

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Conversion Definition

General

- **Silvicultural treatments in riparian stands dominated by red alder with the goal of regenerating conifer trees and maintaining them until they are on trajectory to form the dominant stand component.**

RFRS

Conifer BA< 50% and < 25 “viable” conifers per acre

Presentation Objectives

Be able to list

- **conversion sideboards.**
- **benefits and disadvantages of conversion.**
- **3 riparian functions most impacted by conversion.**
- **characteristics of sites suitable and unsuitable for conversion.**
- **challenges of conversion.**

Conversion Objective

- "Create a conifer dominated stand that will develop into an older forest condition" (RFRS).
- Riparian forests should contain a Mixture of conifer and hardwood species to provide the diverse kinds of vegetative cover, leaf litter, and large wood input to streams that sustain complex aquatic and terrestrial food chains.

Management Sideboards

- **RFRS**
- Patch cuts < 2.5 ac in size
- Uncut patches of 150’
- Retain all conifers
- Retain some big-leaf maple (1-3)
- Site-specific evaluation (shade)
- Minimum of 25-foot no touch inner zone

Management Sideboards

- Forest Practice Rules - No exemption from Conversion and Shade WAC

Shade:

- Shade requirement for Type S and F Waters (Type1-3).
- Applies to 75-foot zone from BW or CMZ.
- Methods in Board Manual Section 1.

Conversion:

If I could explain them in < 5min and if….

- Work with your FP Forester
- Alternate Plans

Conversion - Riparian Functions

Why convert?

Improve physical fish habitat and in stream ecosystem processes.

Red alder stands may be succeeded by brush-dominated stands (Hibbs and Giordano 1996).

- **Improve shade**
- **Deliver LWD to streams: long-lasting, > 50 cm in diameter**
- **Improve stream bank stability**

Conversion benefits won’t be realized for decades

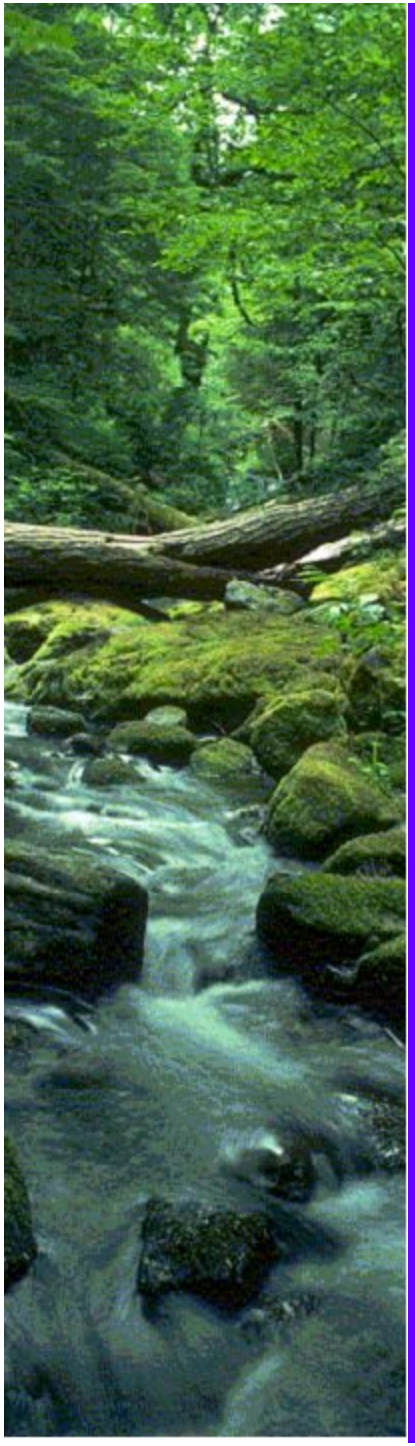
Conversion - Riparian Functions

Why not to convert?

Hardwoods play critical role for aquatic food web.

- **Increased sunlight, N input (groundwater) – increased algae production – increased amount of "grazers"**
- **Increased nutrient input (leaf litter 3x N-content of conifer*) – increased amount of "shredders"**
- **Higher levels of terrestrial insects associated with red alder (**4 times more than conifer)**

*Volk et al. **Deal et al.



Conversion Evaluation

- Benefits long-term
- Long-term consequences unknown
- Red alder has always played large role in ecosystem (seed records)
- Tradeoffs between physical habitat characteristics and aquatic productivity
- Risk of delivery

Conversion Impacts

- Potential immediate impacts of hardwood conversion on riparian forest functions:
  - Reduction in shade (increased radiation)
  - Reduction in relative humidity
  - Reduction in LWD delivery

Microclimatic Influences

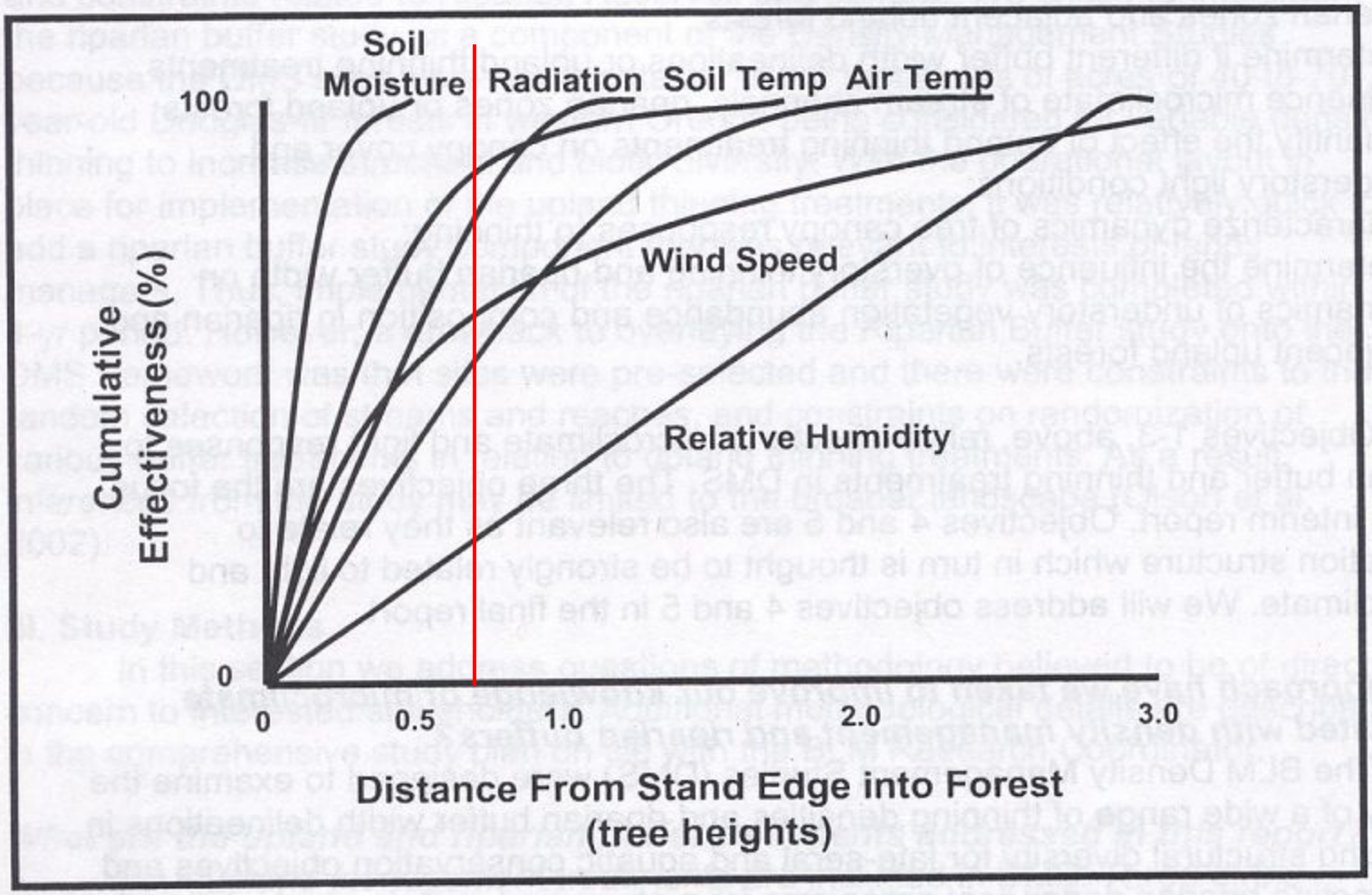


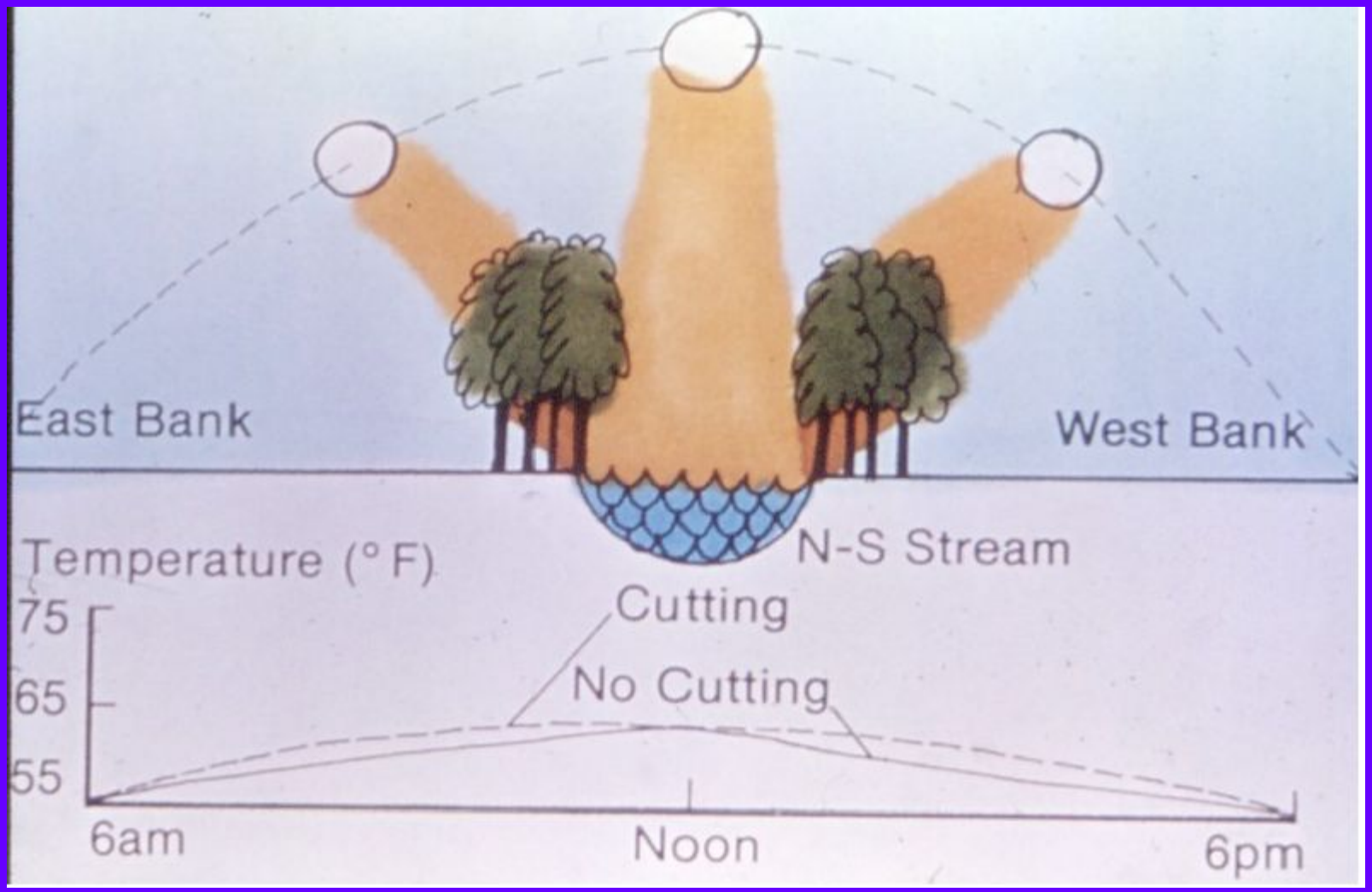
Figure 1. Cumulative effectiveness of an old-growth stand in mitigating microclimatic changes associated with clearcutting. Adapted from FEMAT (1993).

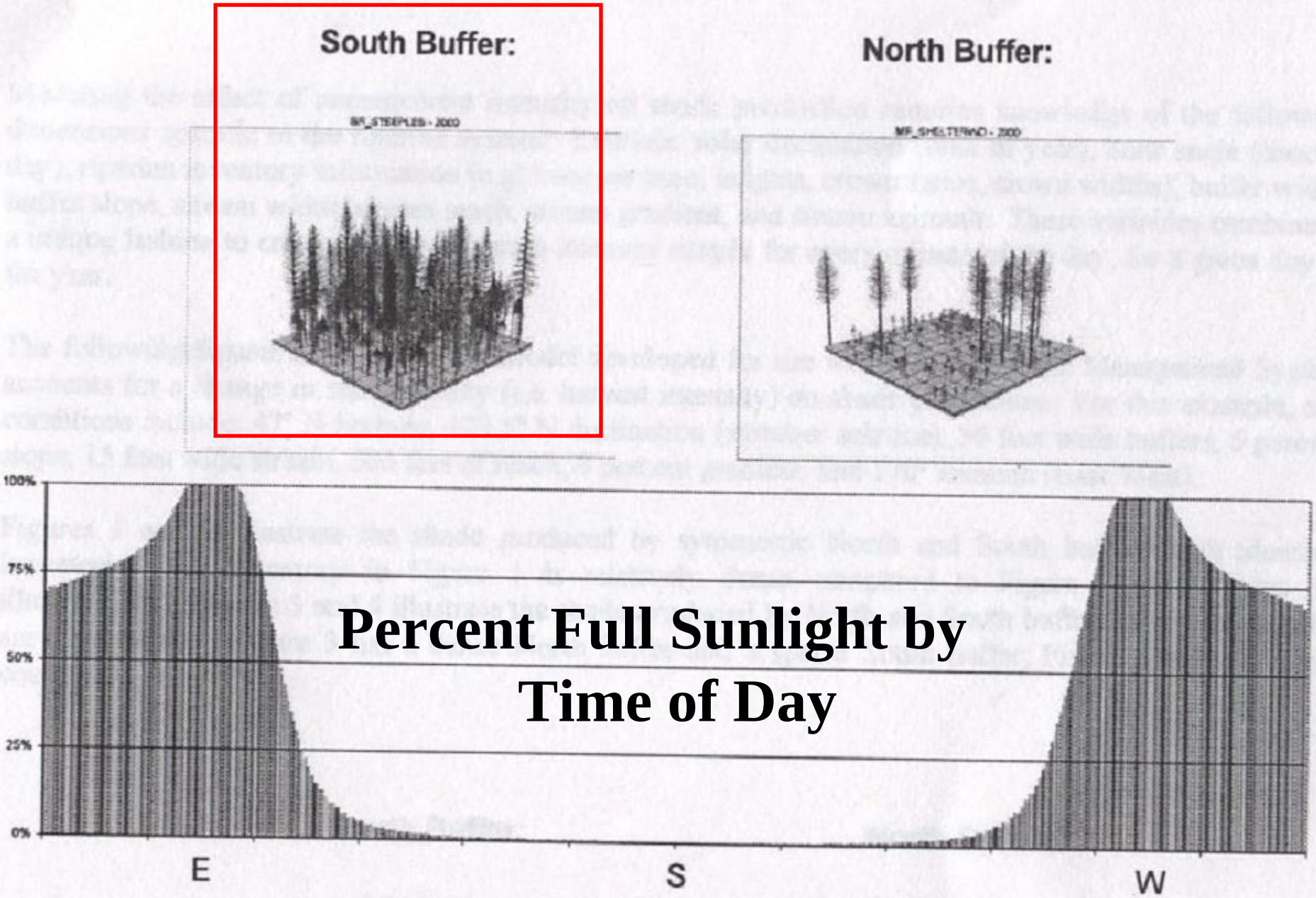
Stream Temperature and Shade

- ST not influenced by direct solar radiation alone (groundwater influx, channel morphology).
- Diffuse radiation has no impact.
- Solar radiation is almost the only factor that can be controlled (buffer width, height and density).

Increase in direct solar radiation most responsible for high stream temperatures.

Effects of Cutting along N-S Stream





Percent Full Sunlight by Time of Day

Figure 4. Percent of East-West Stream Reach Receiving Full Sunlight by Solar Azimuth (Time of Day)

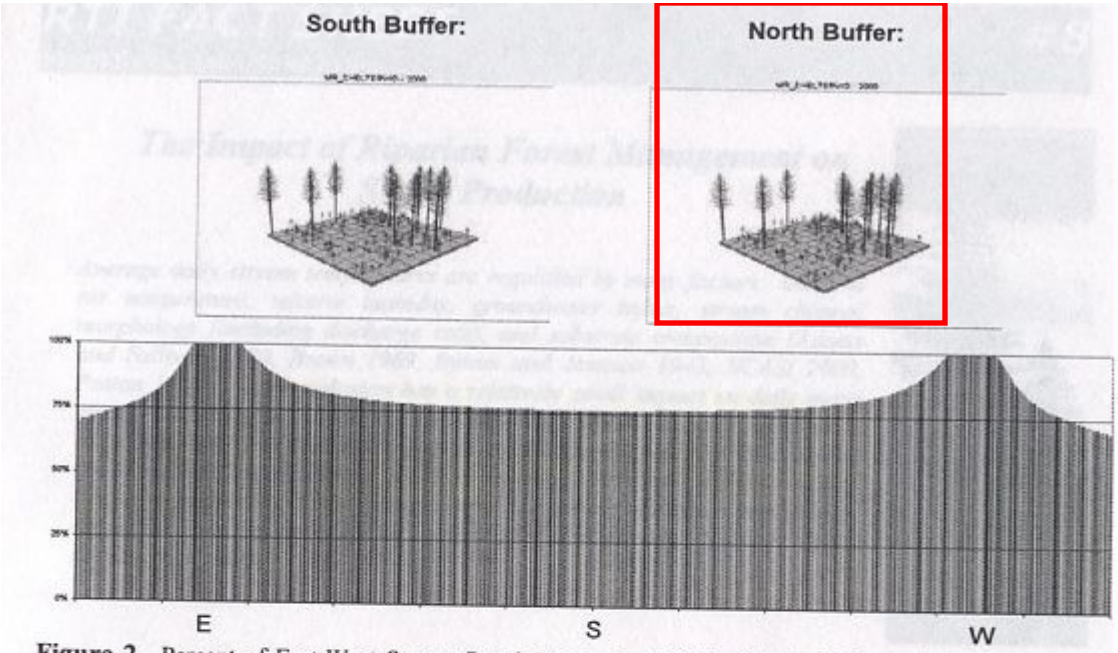


Figure 2. Percent of East-West Stream Reach Receiving Full Sunlight by Solar Azimuth (Time of Day)

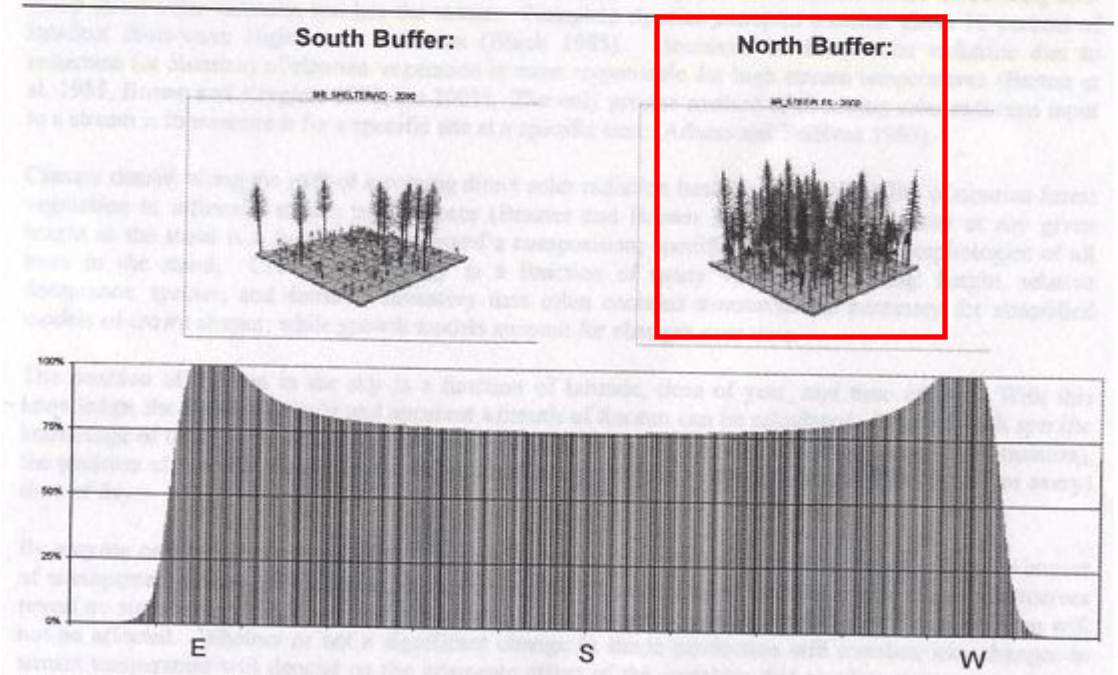


Figure 3. Percent of East-West Stream Reach Receiving Full Sunlight by Solar Azimuth (Time of Day)

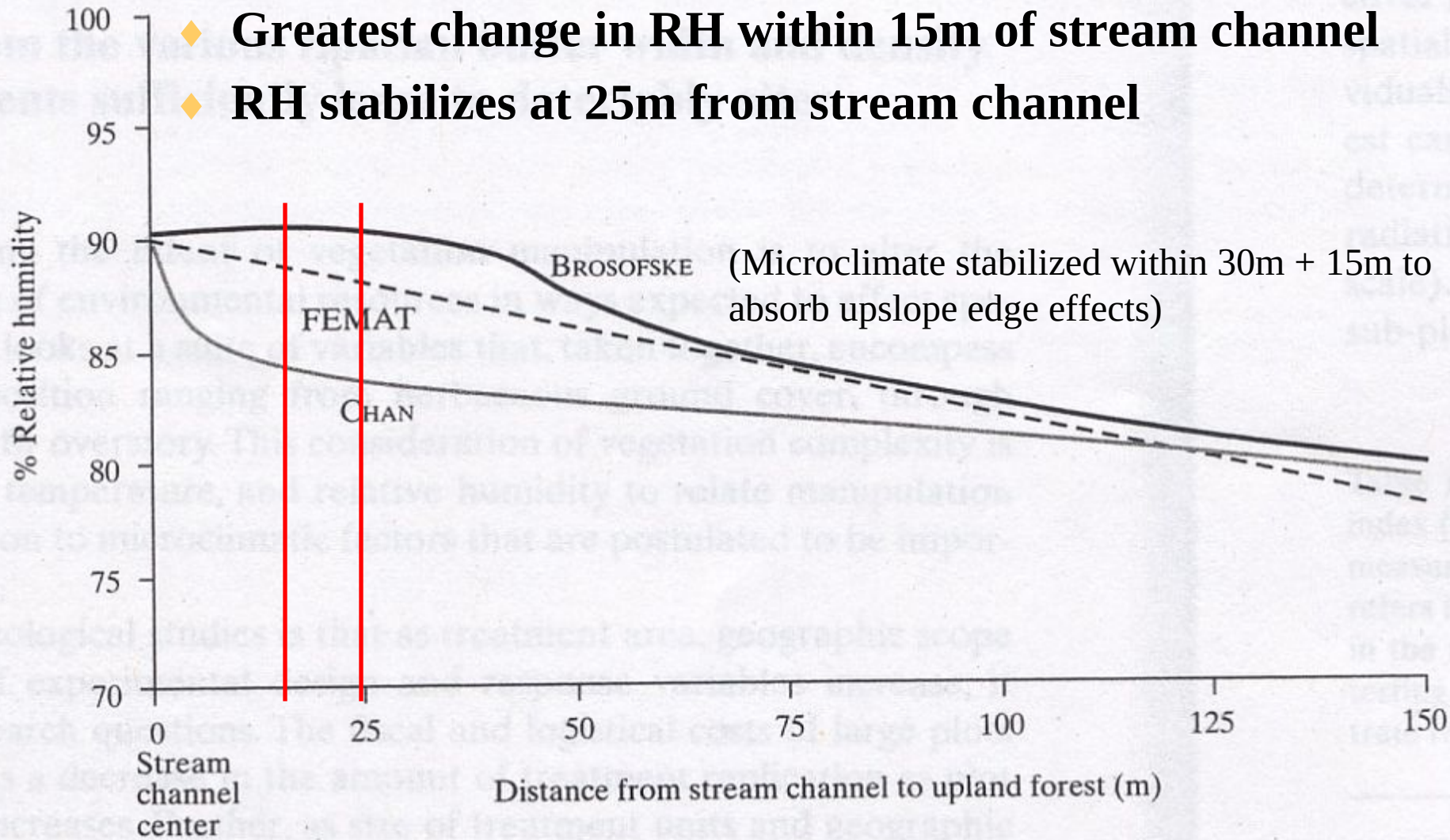
Uniform prescriptions achieve variety of results.

Consider stream orientation, channel width, topographic shading and vegetation structure (height, density).

Understory vegetation can contribute
significantly to stream shading

Relative Humidity

- **Greatest change in RH within 15m of stream channel**
- **RH stabilizes at 25m from stream channel**



(Microclimate stabilized within 30m + 15m to absorb upslope edge effects)

LWD Delivery

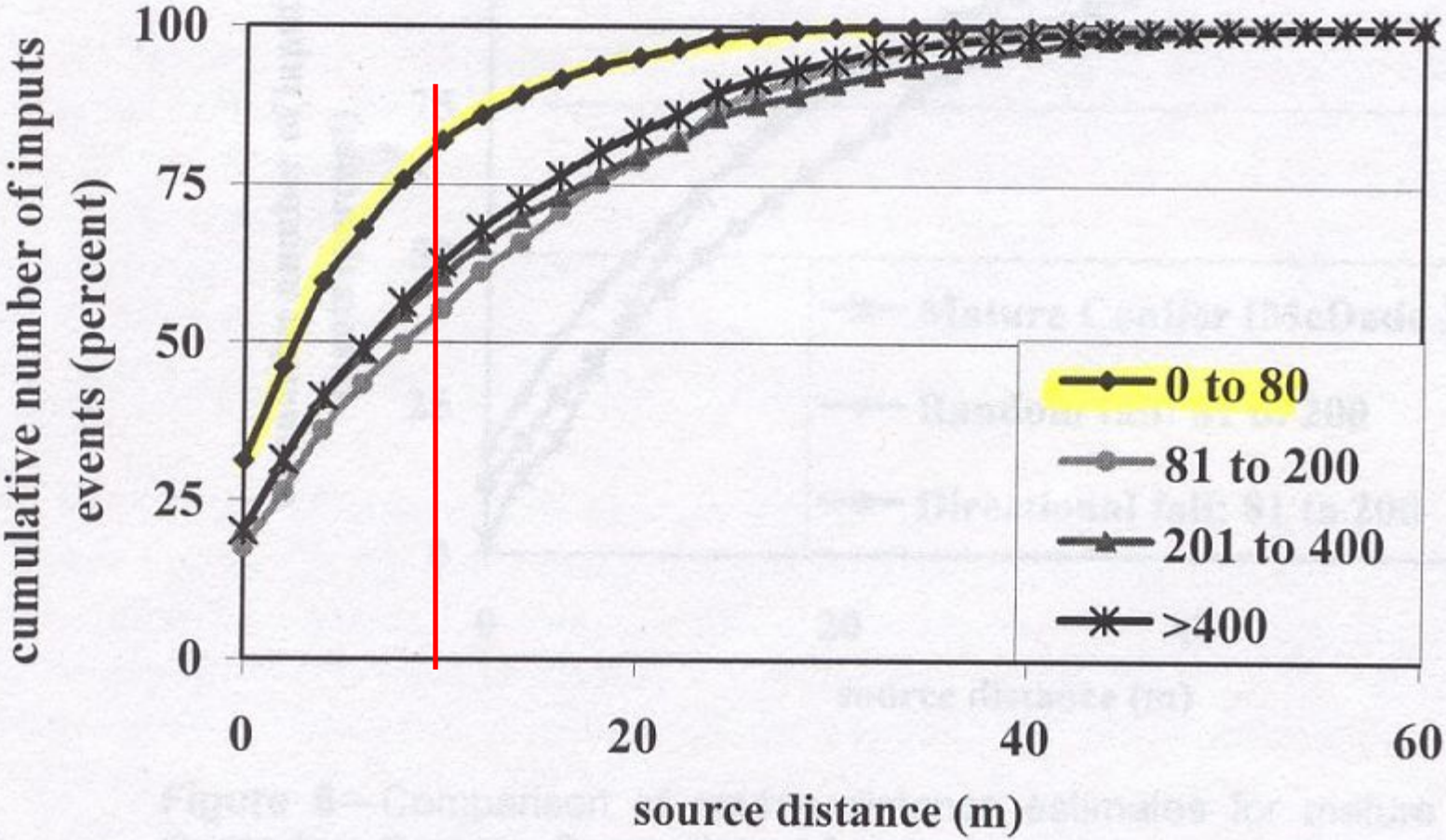
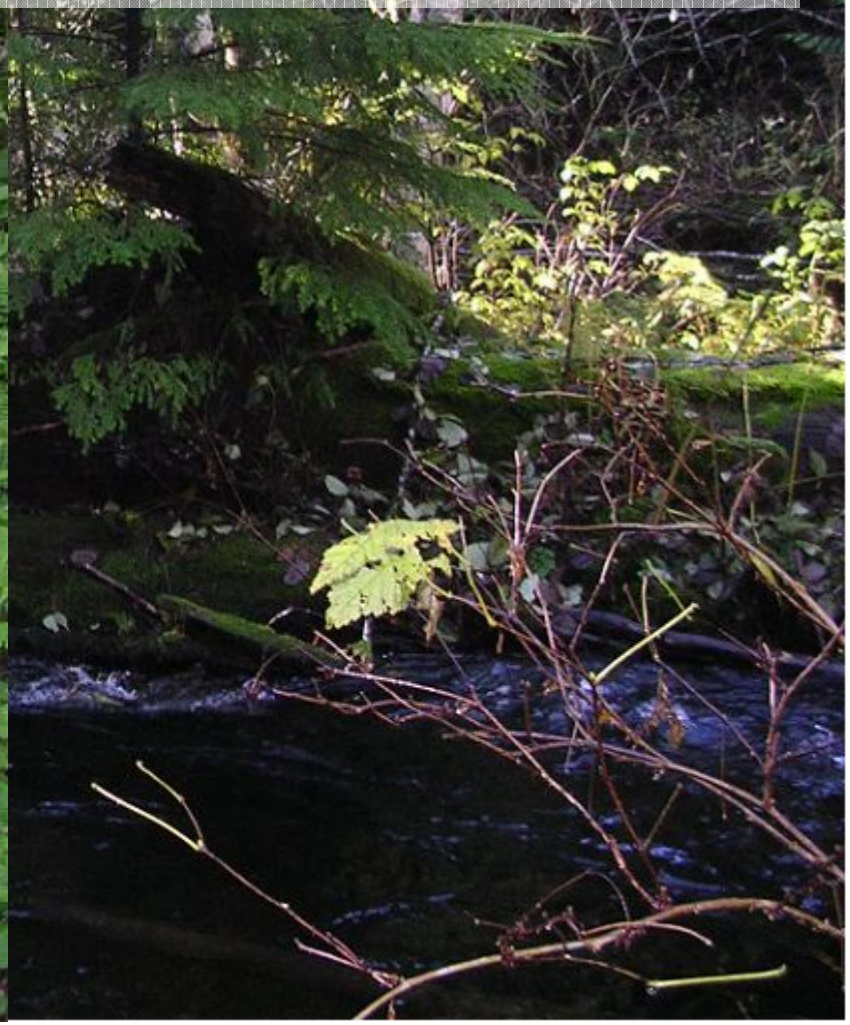


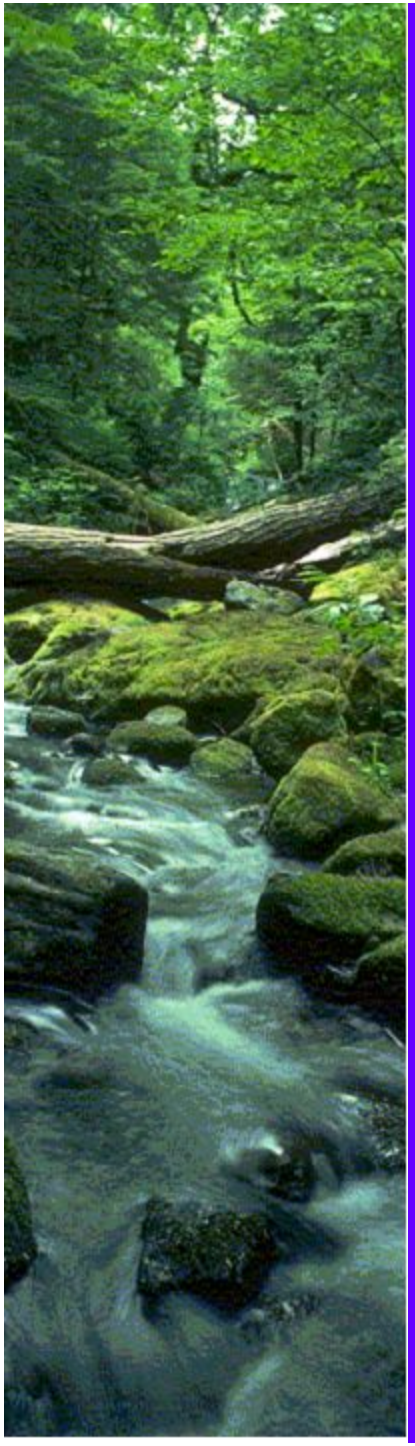
Figure 4—Cumulative number of input events from random fall as a function of the riparian forest age class. The four forest age classes represent young conifer, mature conifer, old-growth dominated by Douglas-fir, and old-growth dominated by western hemlock.

LWD typically remains in channel 70-100 years. Some for centuries/millennia. (Scherer 2004)

Decomposition rate: 1-3% per year



Approx. 100-year-
old alder stand
disintegrates



Conversion Impacts

- Stream shading > site specific analysis.
- Microclimate > buffers in excess of 50 feet.
- LWD delivery > age and max. height of red alder stands limit input from distance.

Site Selection

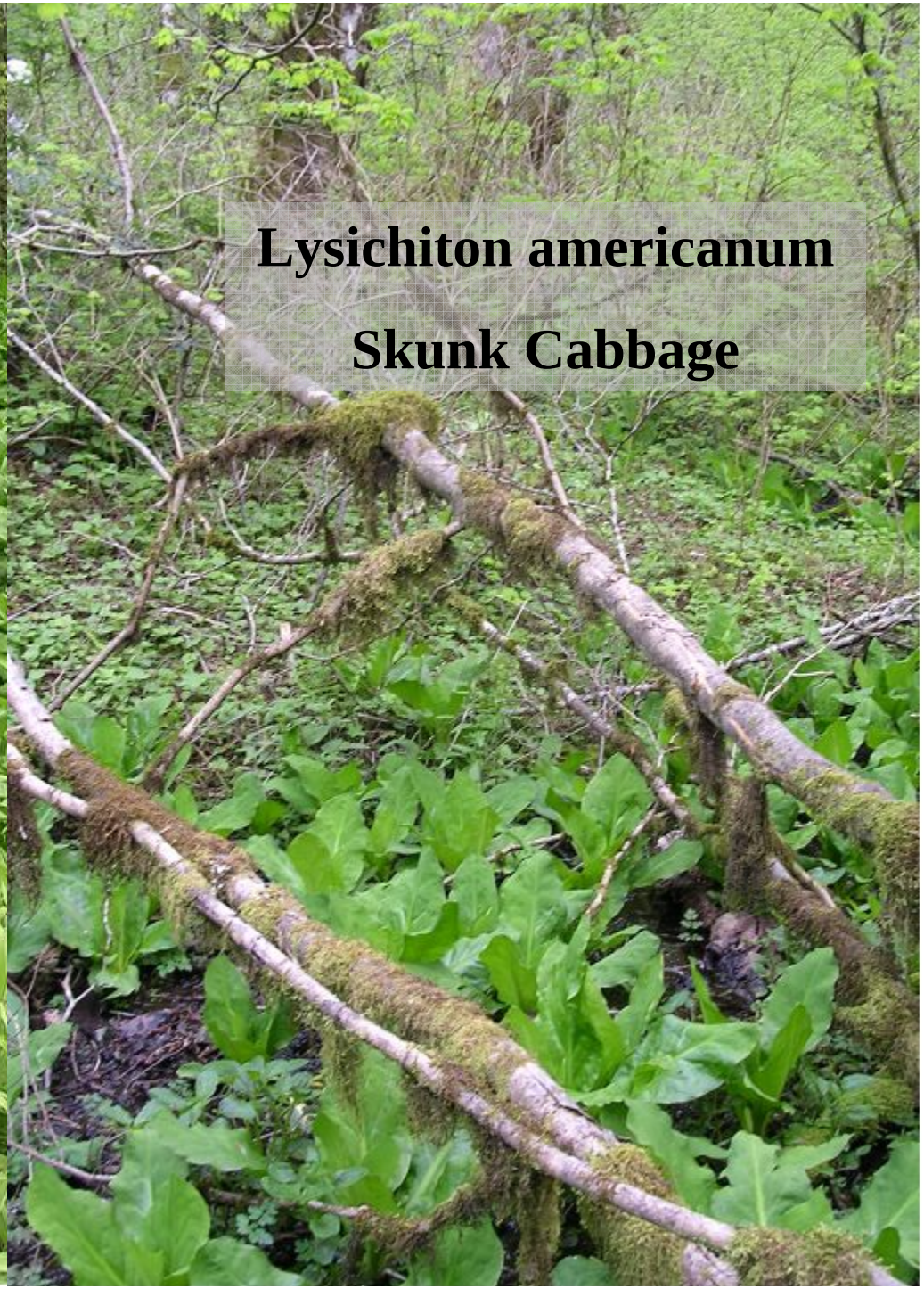
Landscape perspective

- Abundance of alder dominated RMZs in the watershed?

Stand perspective

- Evidence of historic presence of conifers (stumps)
- Indications that conifers could succeed (i.e. soils, vegetation, advance conifer regeneration)

Veratrum viride
Indian Hellebore


Lysichiton americanum
Skunk Cabbage

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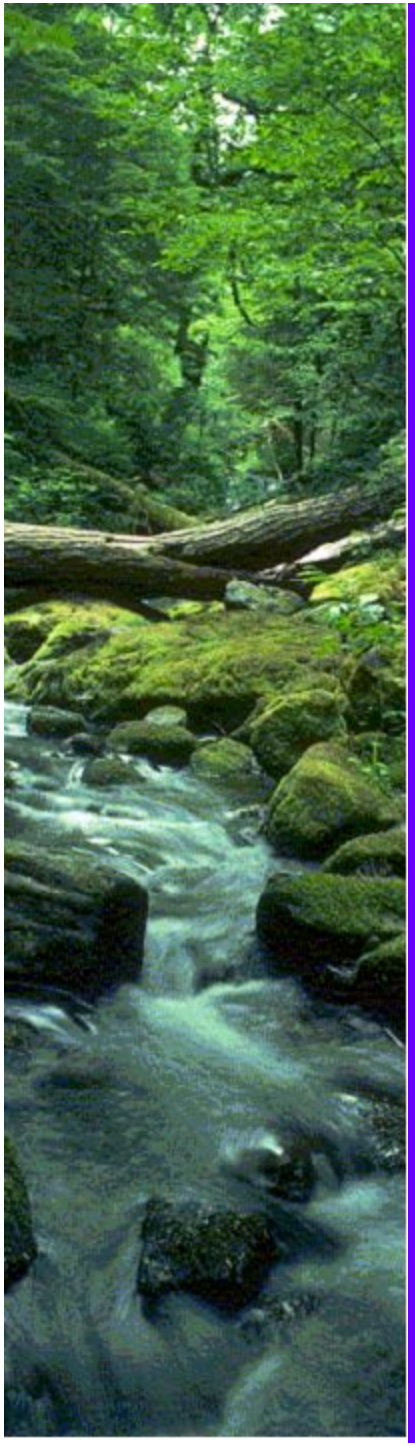
Species Selection

- Site adapted conifers (at least 2)
- Preferably decay resistant
- Candidates: WRC, SS, DF, GF, (WH)
- Avoid DF in areas inundated during winter

Stock Type Selection/ Reforestation

- Larger = better (competition, animal damage); No 2+0!
- Wildlings for small areas?
- Cluster planting (5-10 trees @ 6-8’ spacing)?
- Evaluate need for Browse/Beaver protection (WRC/DF)
- Mechanical/chemical site prep



Natural Regeneration

- **Keys to improve natural regeneration (Center for Streamside Studies):**
- **Proximity of mature, shade-tolerant conifers.**
- **DWD and mineral soil substrates.**
- **Low amount of understory vegetation.**

Attitude for Conversions

"It is a waste of time and resources to attempt restoration of conifers in areas where other resource values will preclude an aggressive approach to establishing conifer dominance. Since conifer restoration can be applied in patches, such conflicts should be easy to avoid."

(Emmingham et al. 2000)

Overstory Competition

- Create gaps (at least 0.5 ac in size)

or

- Thin hardwoods (at least 30’ spacing)

or

- Combine thinning with gaps

Light Conditions – Stand Density

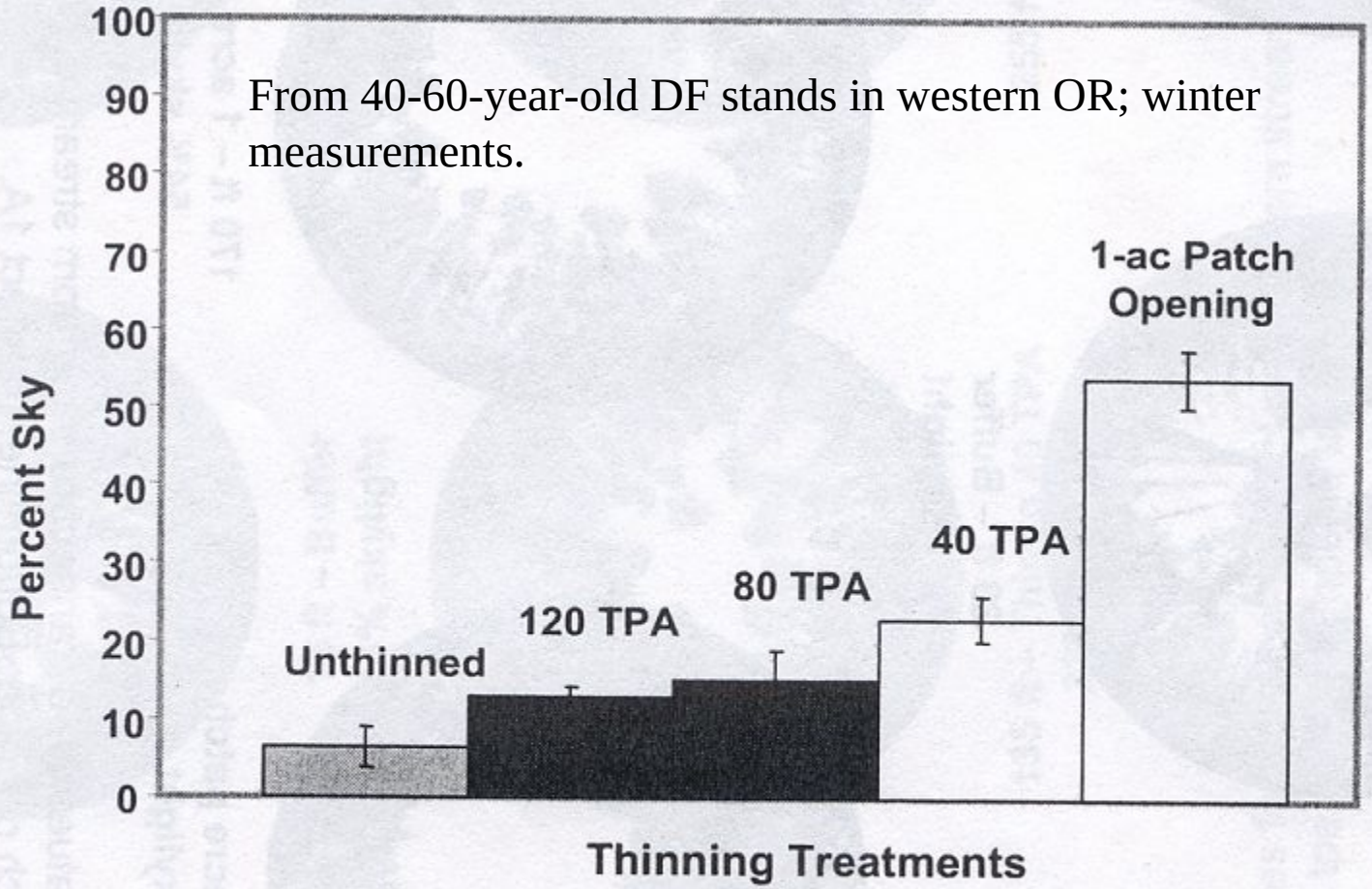
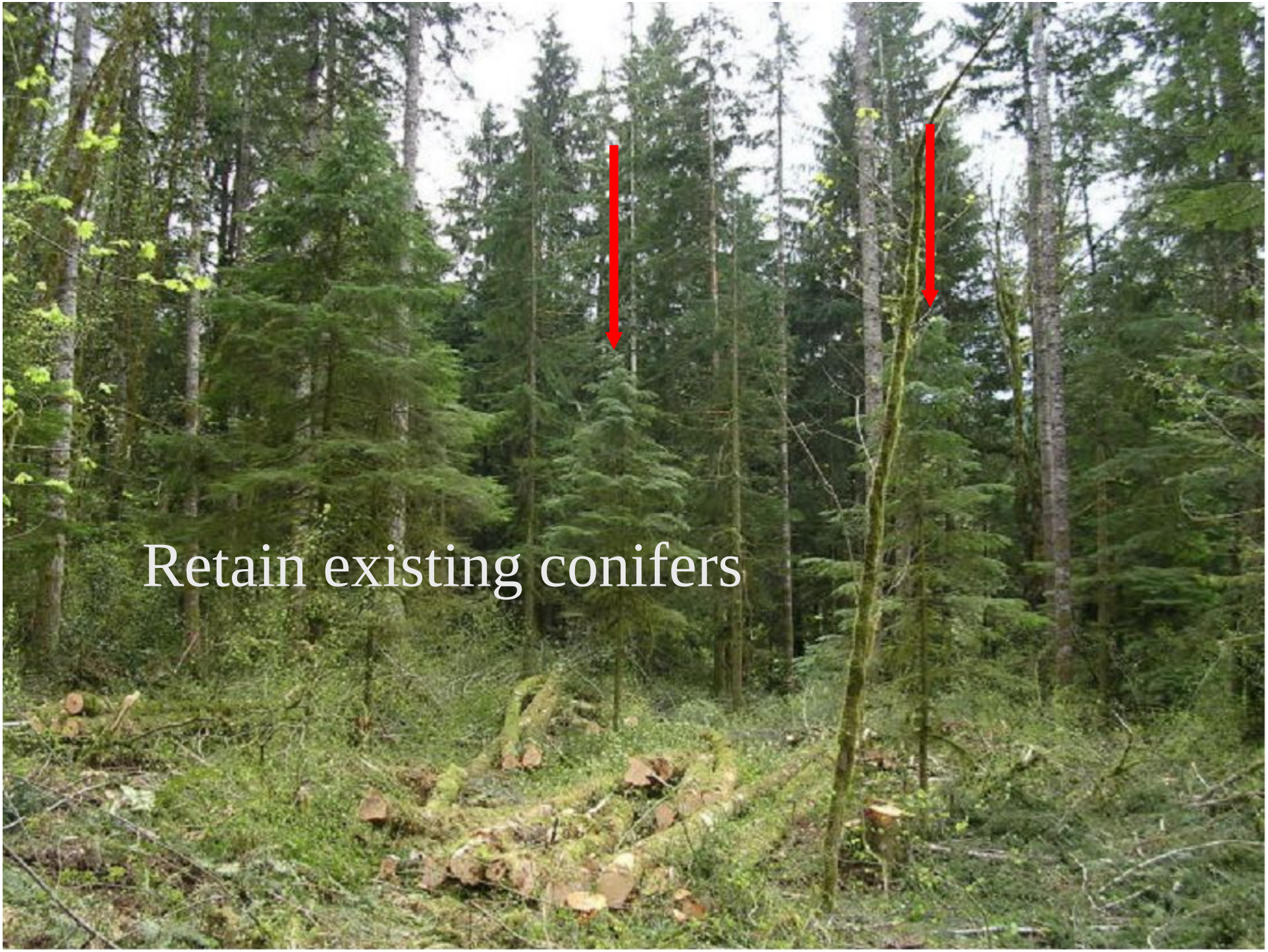
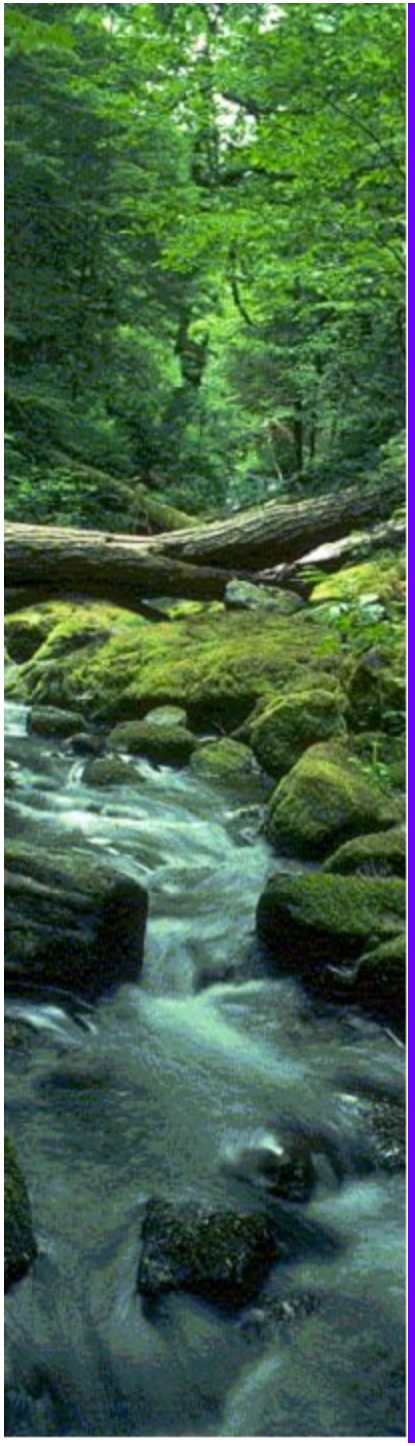


Figure 5. Average percent skylight for DMS silviculture prescriptions across all DMS sites, winter 2003. Values are means ± 95% confidence interval. Bars having different shading indicate mean values that differ significantly.

Larger gaps = better seedling growth


Retain existing conifers



Understory Competition

- Hardwood riparian sites VERY competitive
- Competitive relationships similar in upslope and riparian forests.
- Site prep best time to control competing vegetation
- If manual release: cut in June/July; cut at least 6-10’ circle
- Look out: Rubus spec., red alder, cottonwood (?)

Over the range of pure conifer to pure hardwood overstories, understory cover increased by about 50% (Hibbs and Bower 2001)

Understory Competition

Emmingham et al. 2000

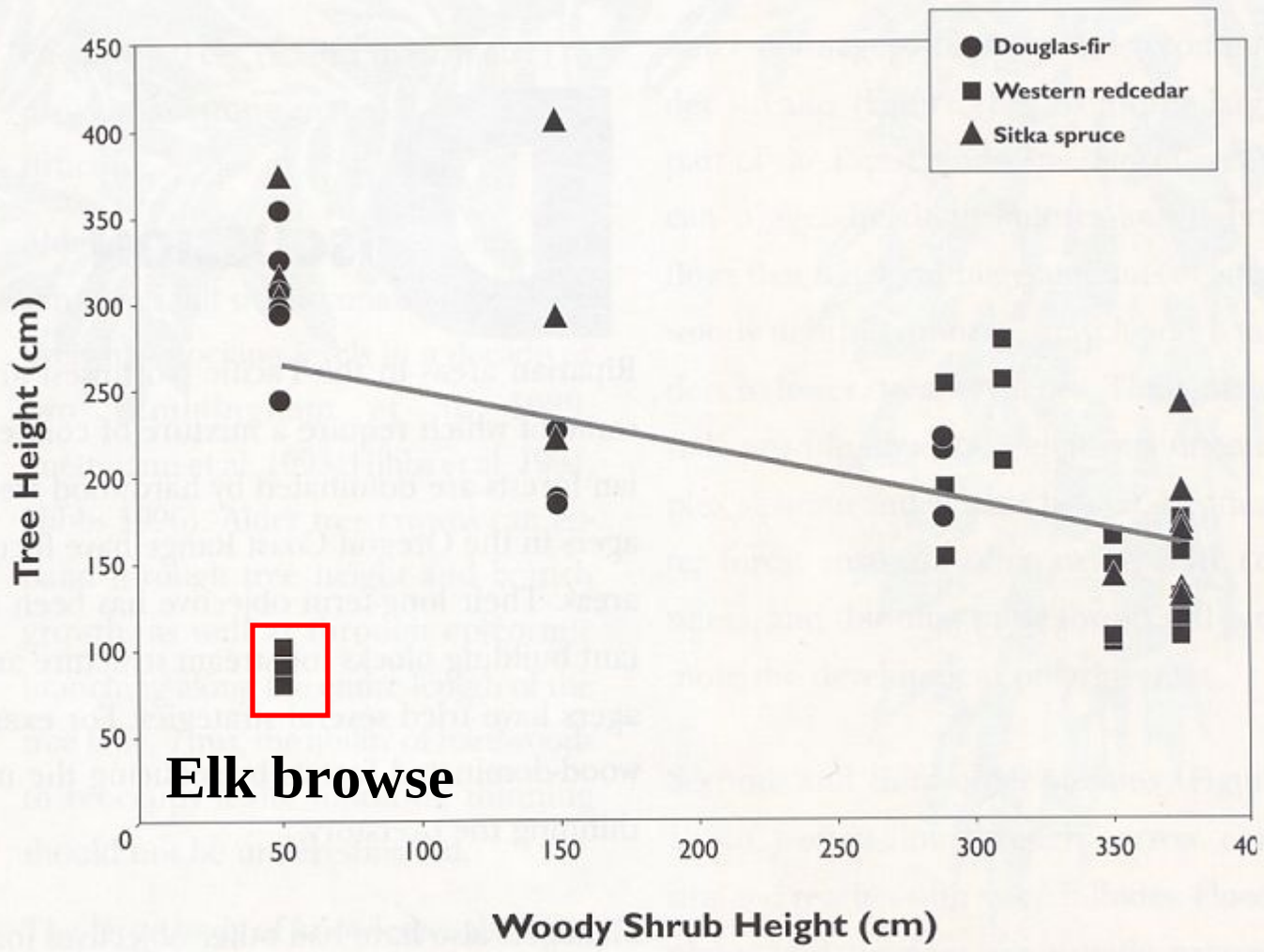
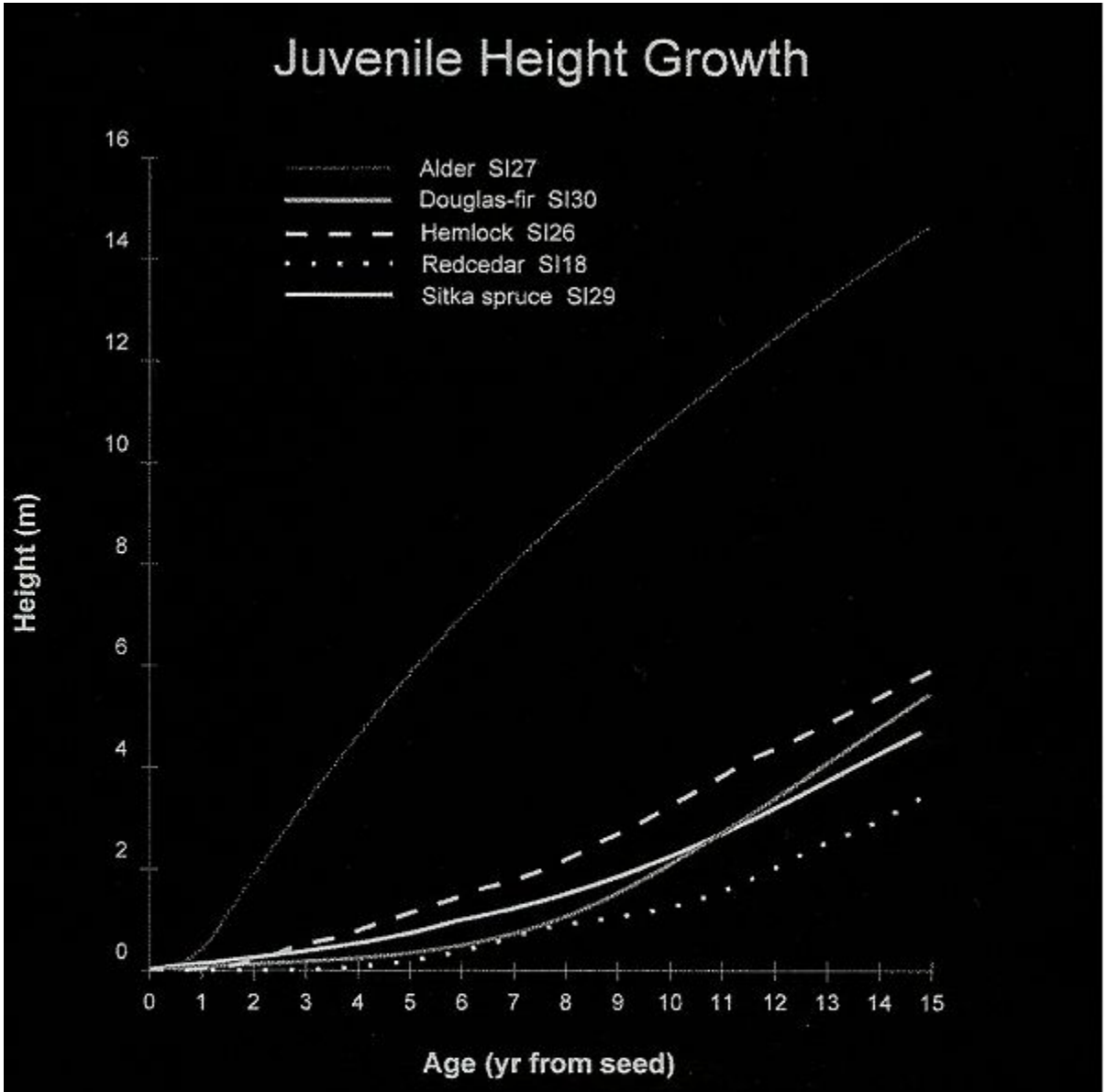


Figure 16. Height of trees 5 years after planting in relation to understory shrub height. The exceptions are western redcedars (in the lower left portion of the figure) that were repeatedly browsed by elk.



10. Comparison of juvenile height-growth rates of red alder and associated coniferous species, from seed to age 15. Height curves and site index values (SI_{50}, Thrower and Nussbaum 1991) are based on median values for conifers on Site productivity class II (Green and Klinka 1994).

Animal Damage

- Best method – large seedlings and vegetation management to escape the damage
- Physical barriers: fences, tubes, netting
- Repellents: short-term

$1.60 – $3.30

$0.45 / Stake

$0.14 – $0.30

$0.10 / Stake

Other Common Problems

- Lack of follow-up maintenance.
- Changes in personnel.
- Poor project tracking.
- Poor record keeping and monitoring.

Conclusion

- Very site –specific assessment (site, shade, competition, animals).
- RFRS – Provide objectives and sideboards
- FP Rules – Shade/Conversion WACs
- Aggressive approach
- Focus on releasing conifers where available
- "Lengthy and costly restoration effort" (Emmingham et al. 2000).

Review

Be able to list

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- **benefits and disadvantages of conversion.**
- **3 riparian functions most impacted by conversion.**
- **characteristics of sites suitable and unsuitable for conversion.**
- **challenges of conversion.**