Forest Structure and Succession in Riparian Areas in Western Oregon

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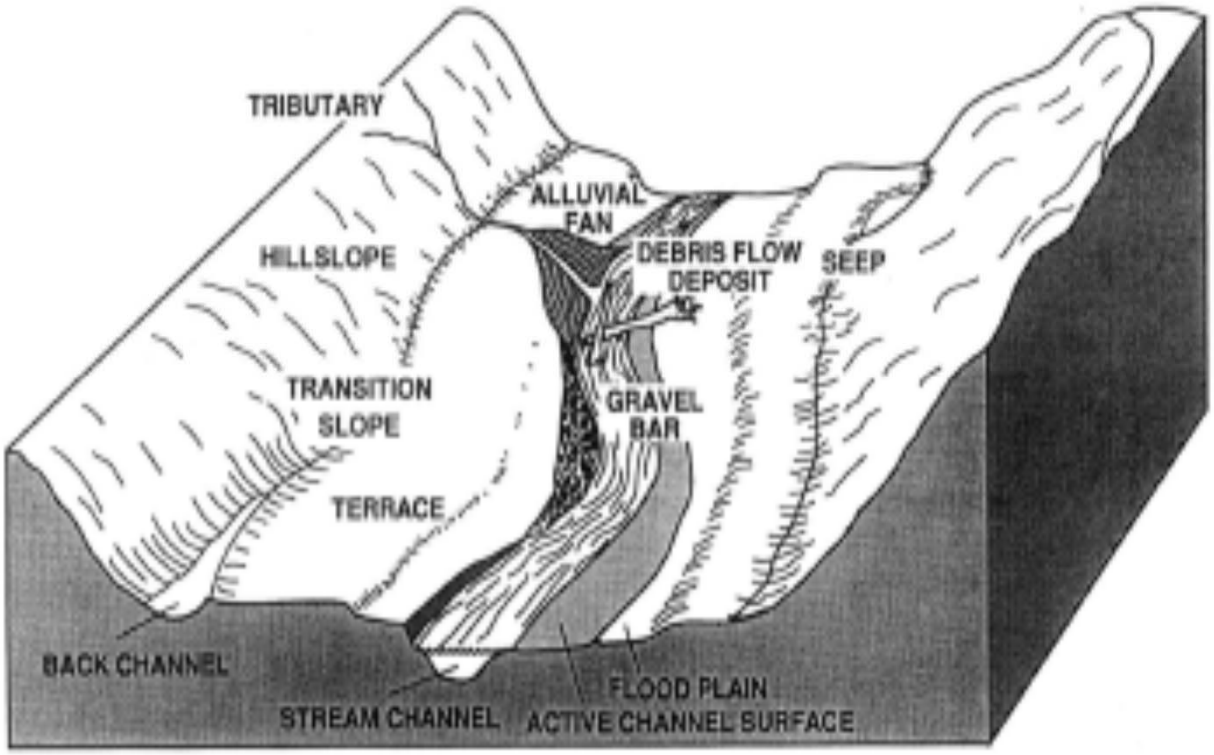
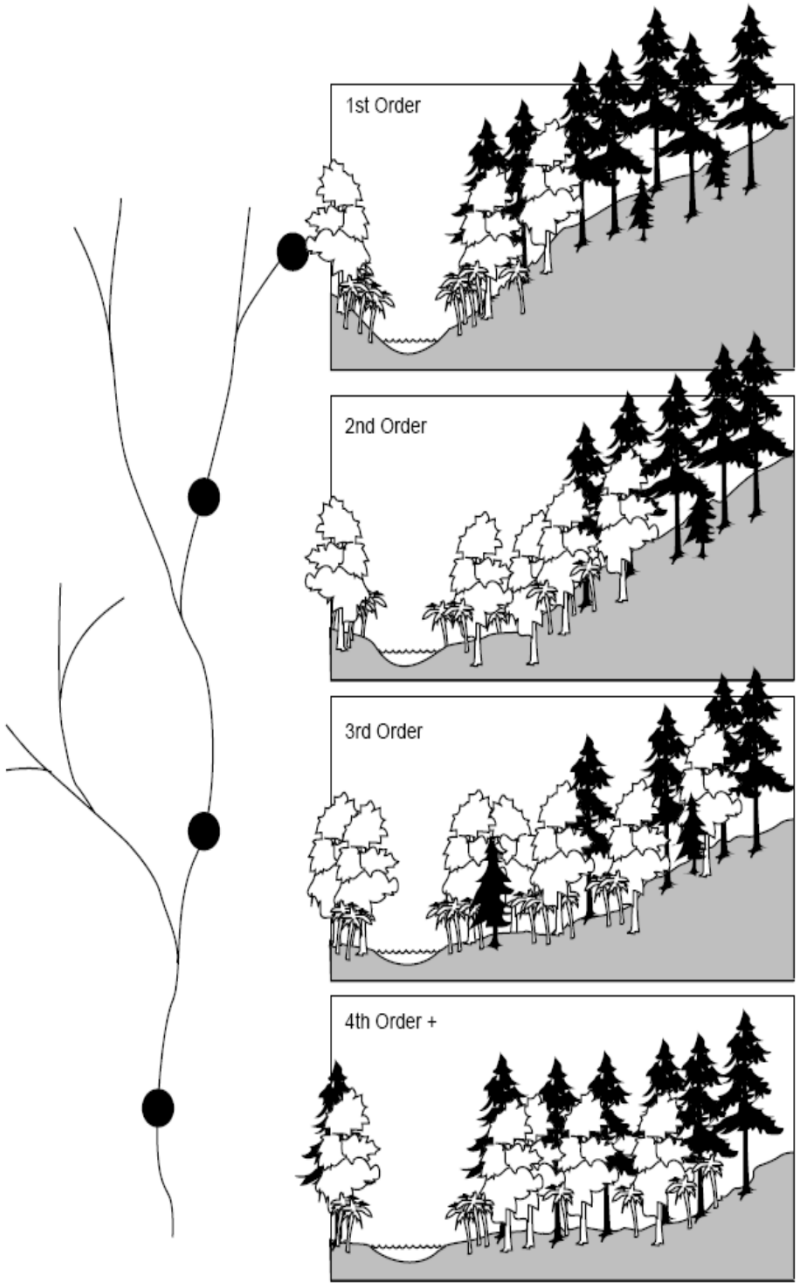
What I will cover

- Structure and composition of naturally regenerated westside riparian forests
- Successional patterns following natural disturbances
- Thinning for ecological goals
- Alternatives to standard buffer widths

Riparian Zones:
Diverse vegetation on a variable and dynamic substrate



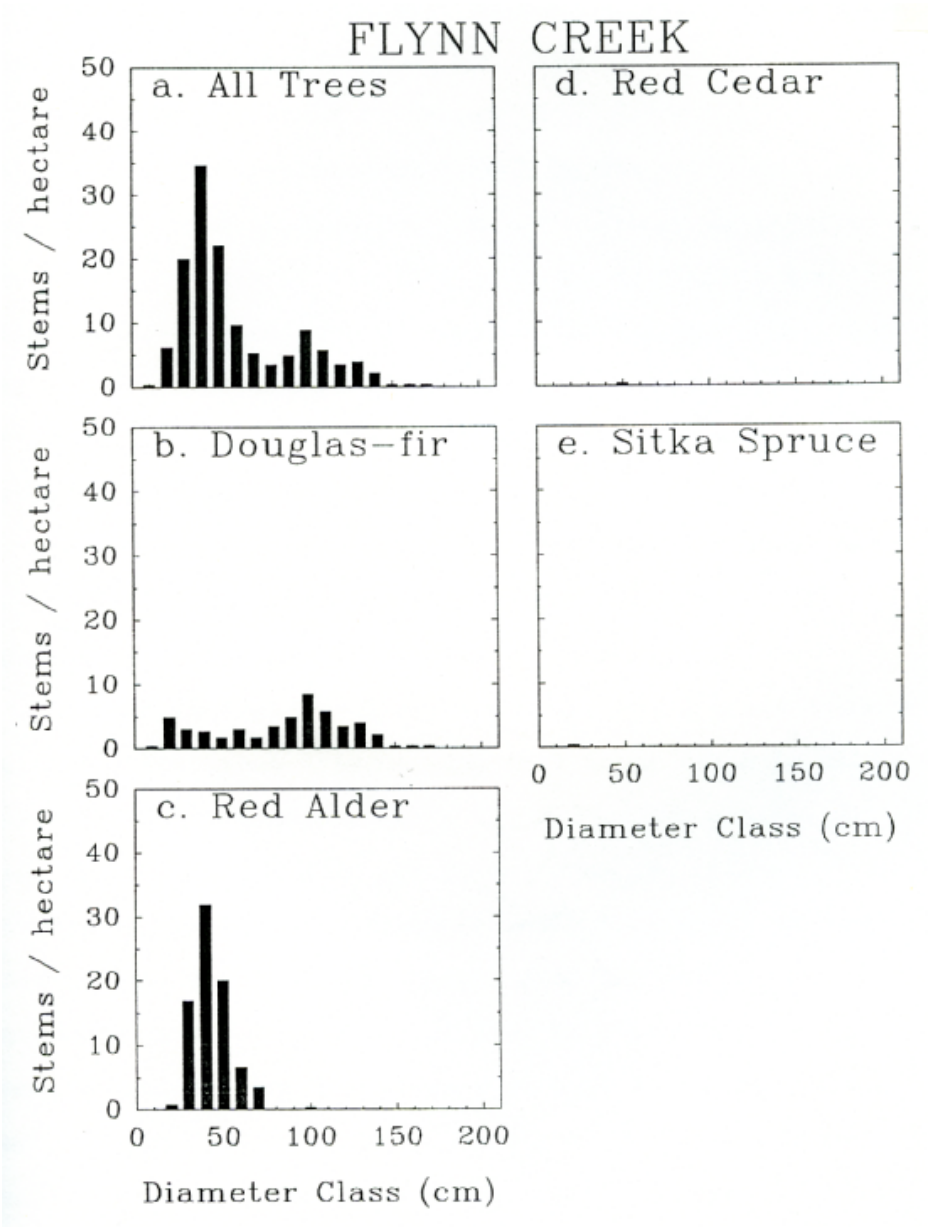


Riparian Vegetation Varies with Stream Size (Order)

Two Case Studies

- Flynn Creek--Deciduous Stand
- Trout Creek--Mixed Conifer Harwood Stand

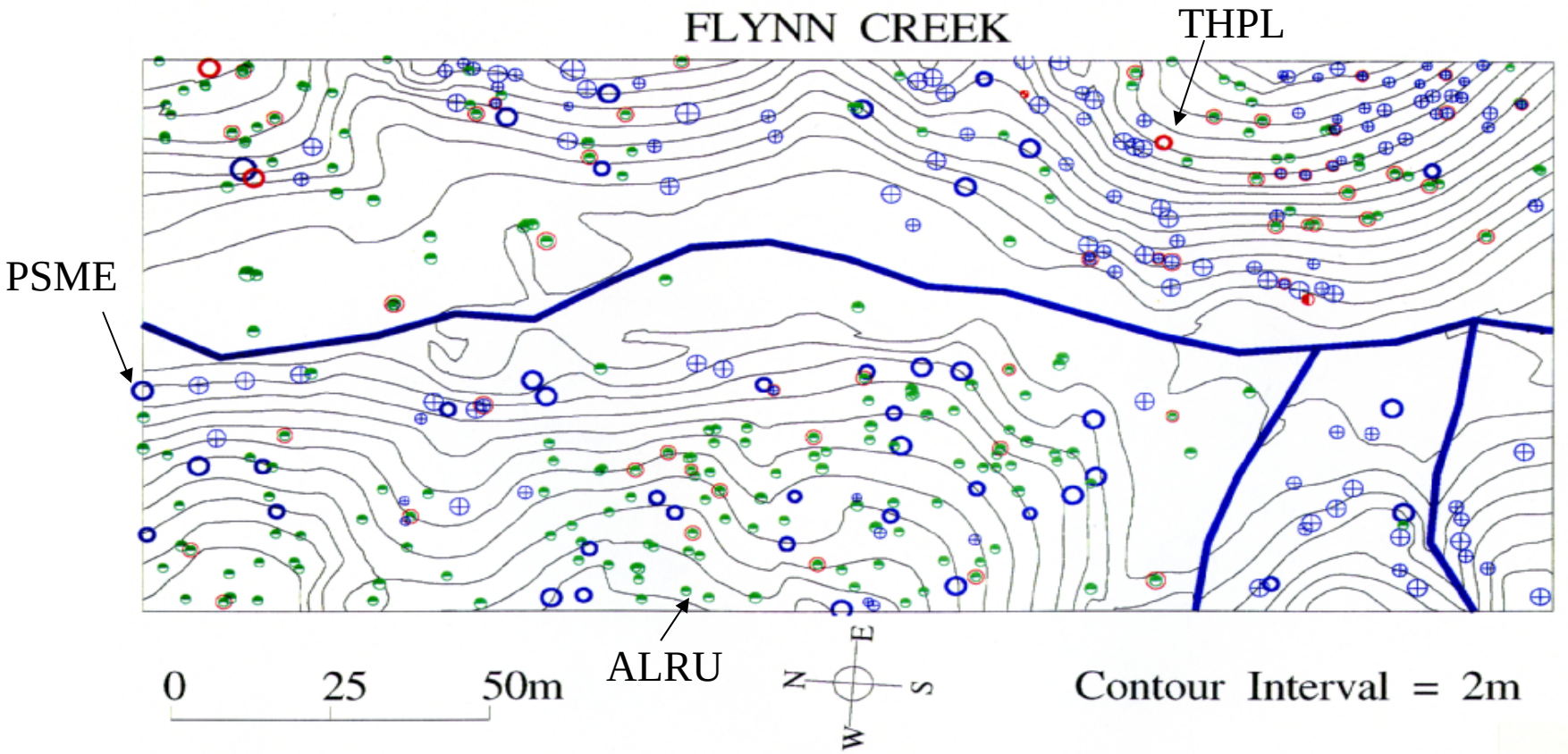
Mature Hardwood-Conifer Riparian Stand

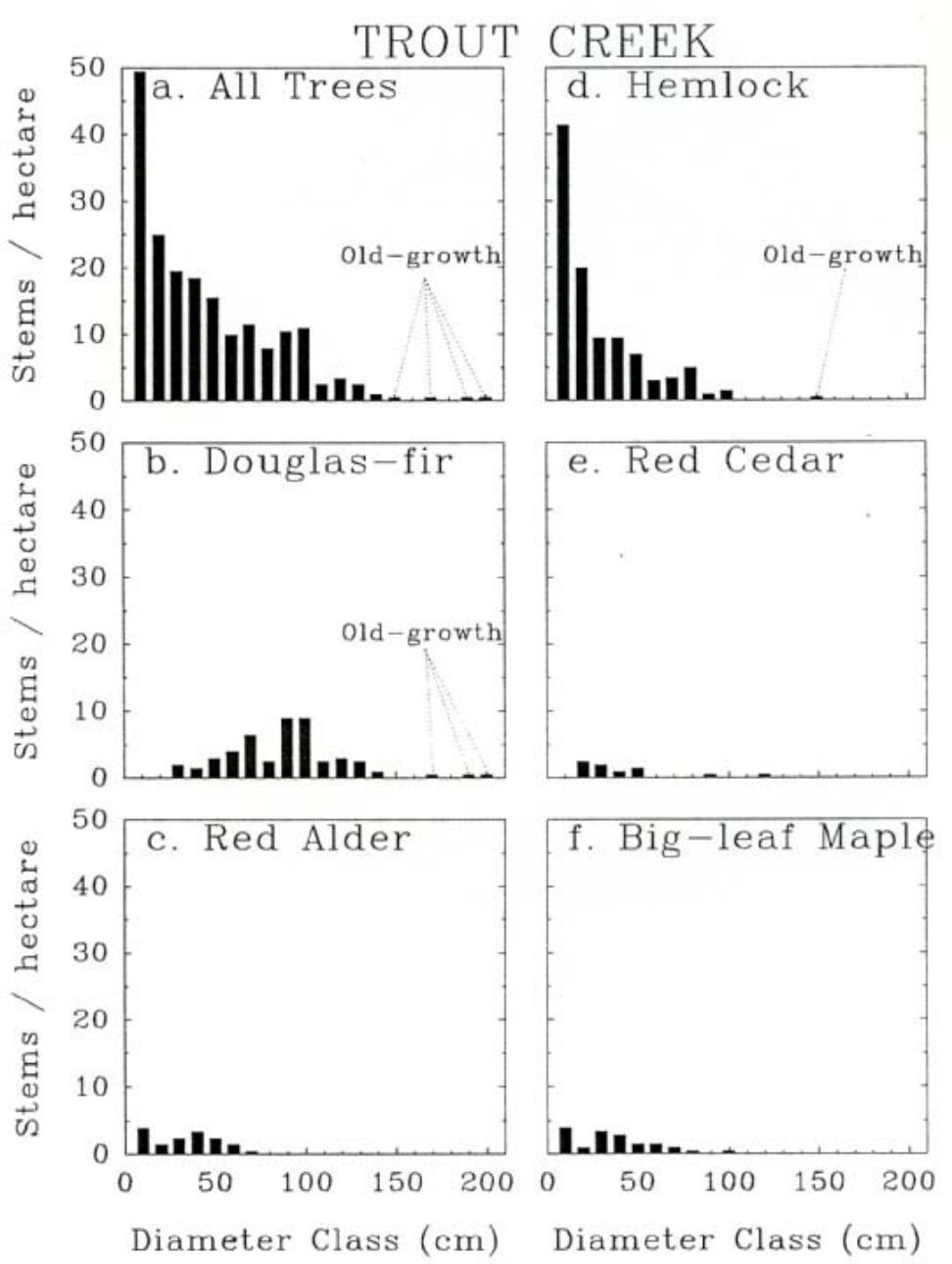


Range of size of trees
Reflects disturbance history

Fires in 1850, 1868, Mid 1880s

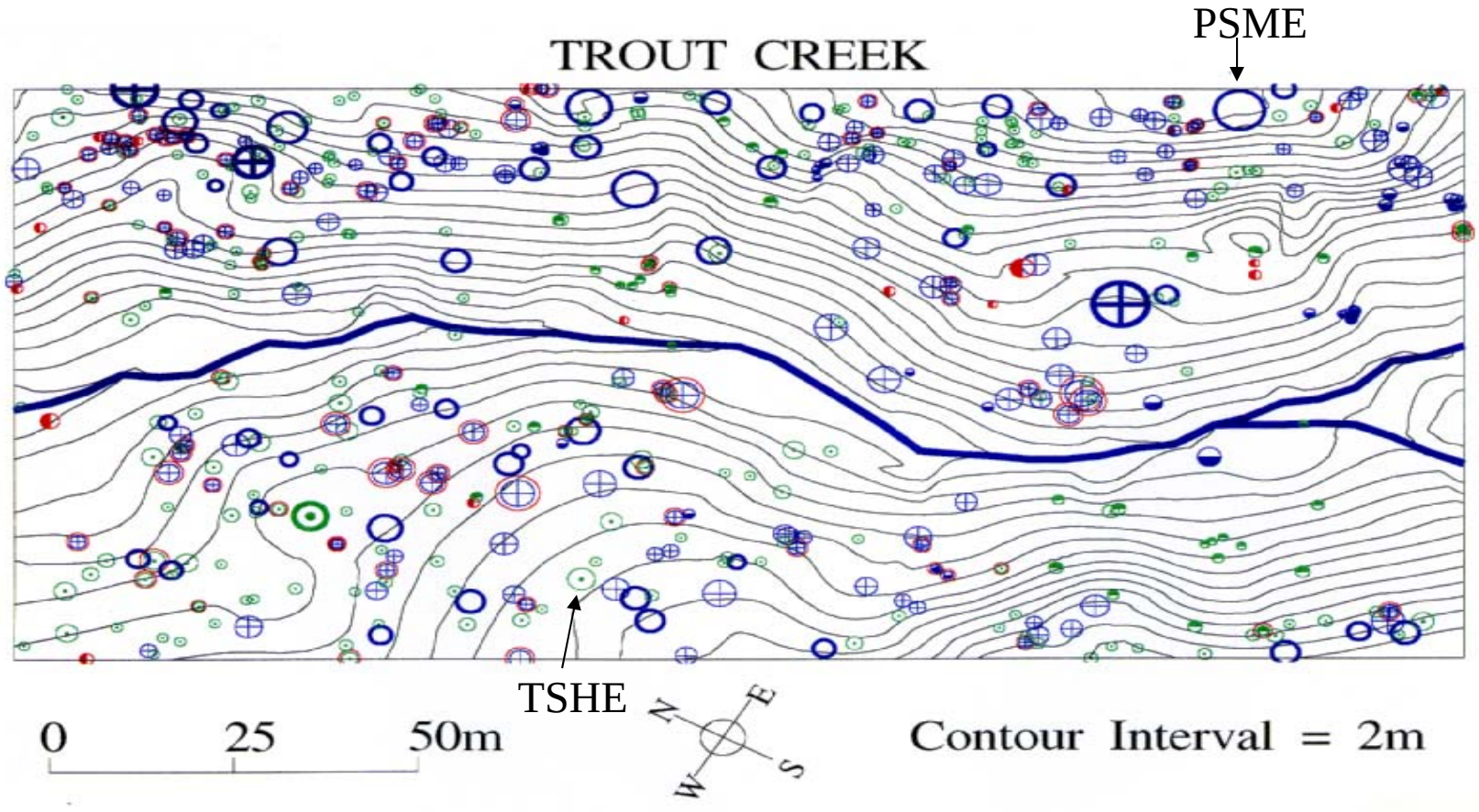
Spatial pattern a mature conifer hardwood riparian stand



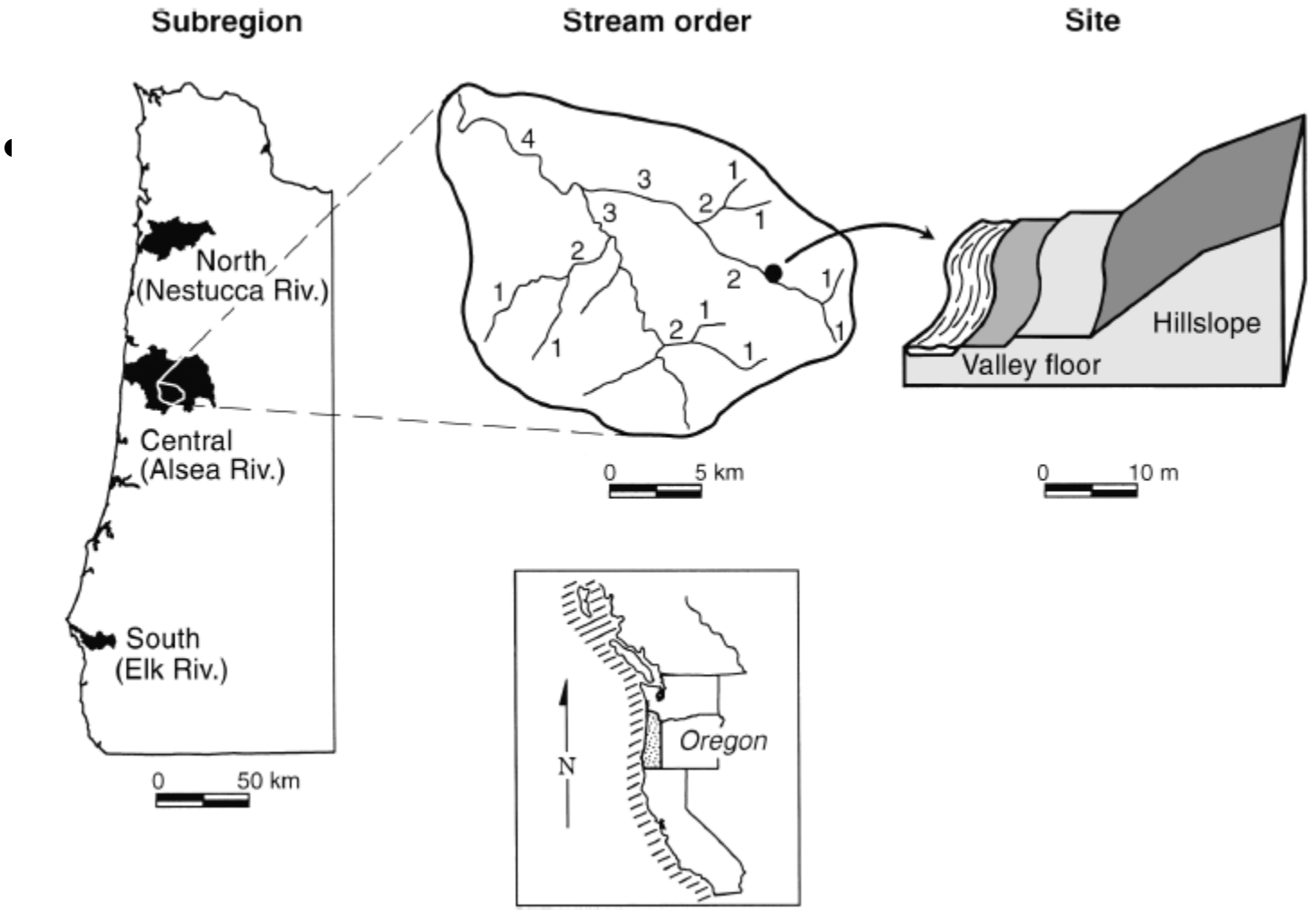


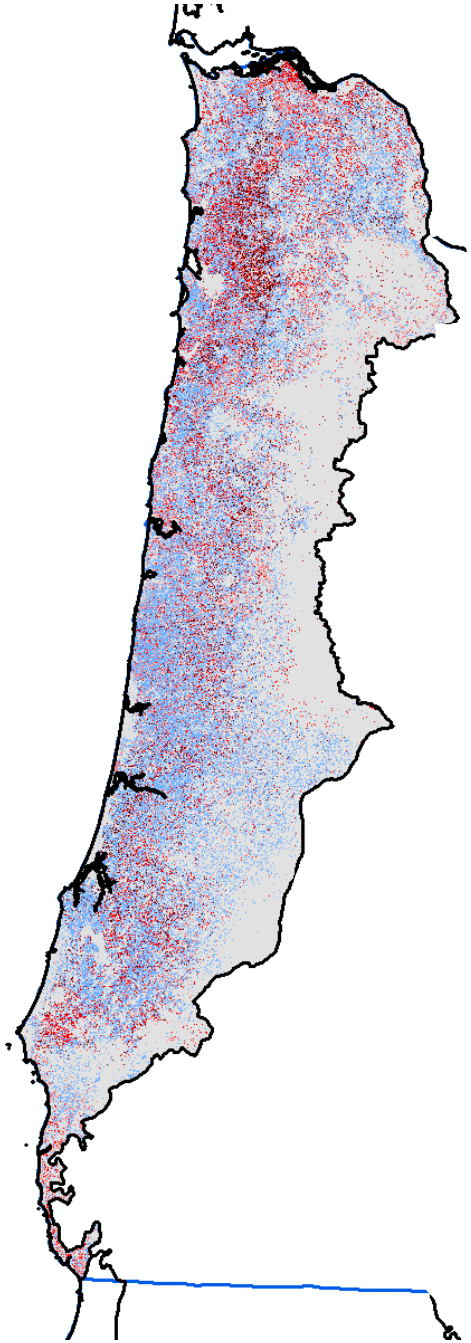
Old-growth remnants in a Mature Stand

Spatial Pattern in a Mature/old Growth Riparian Stand

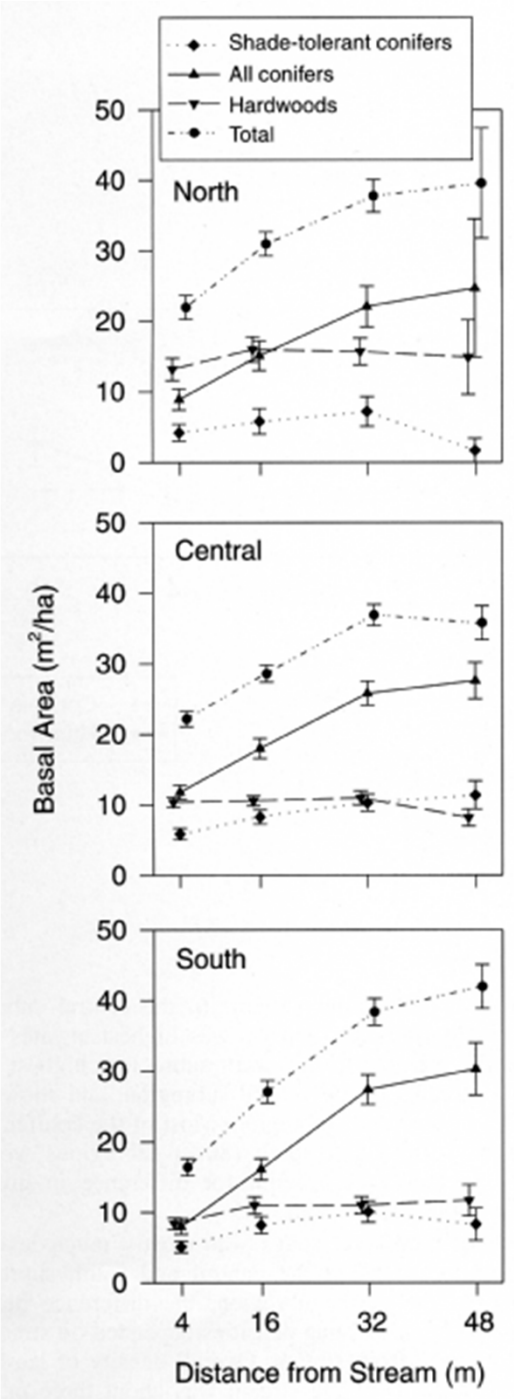


Regional Analysis of Mature and Old Growth Riparian Forests



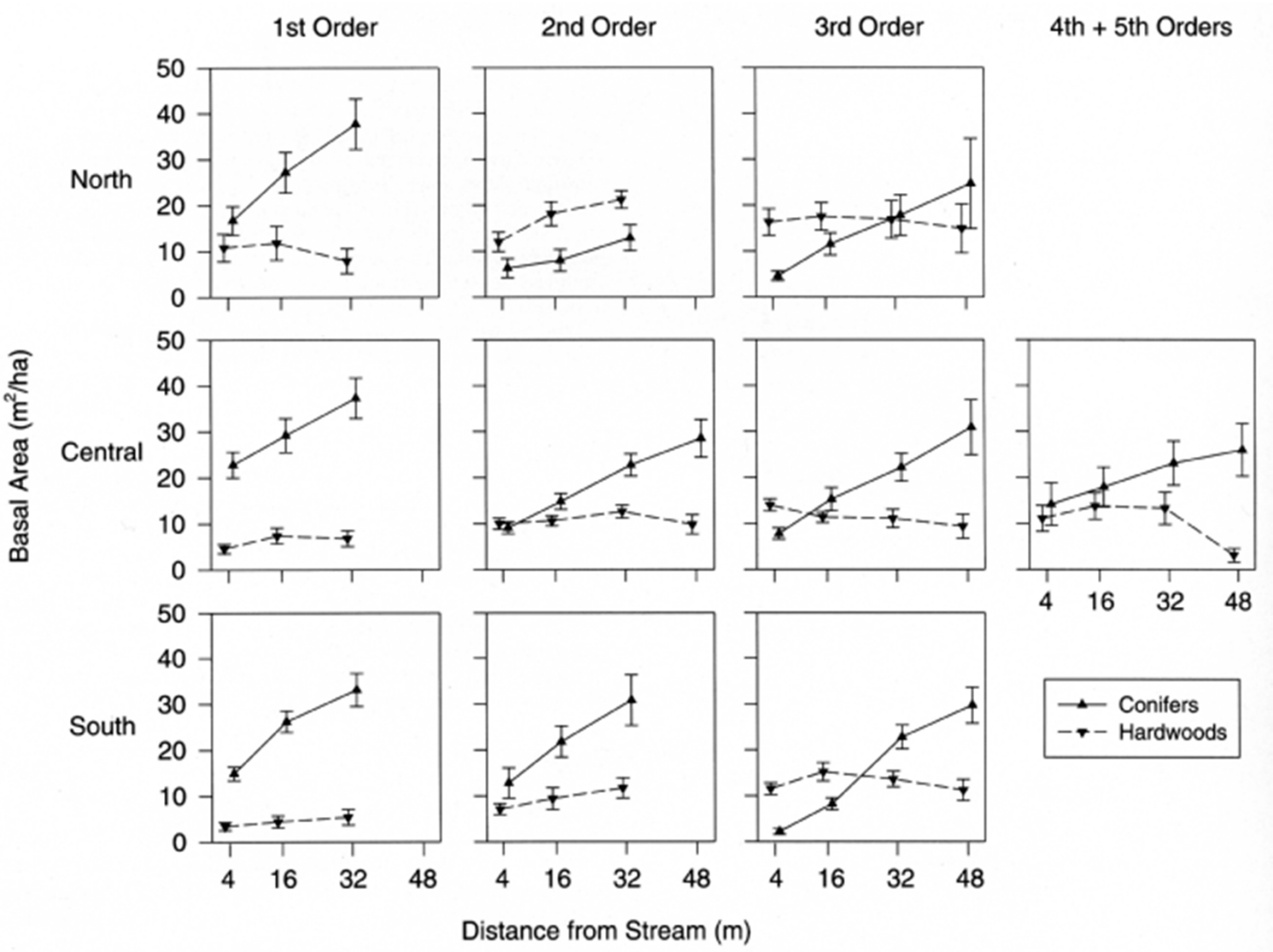


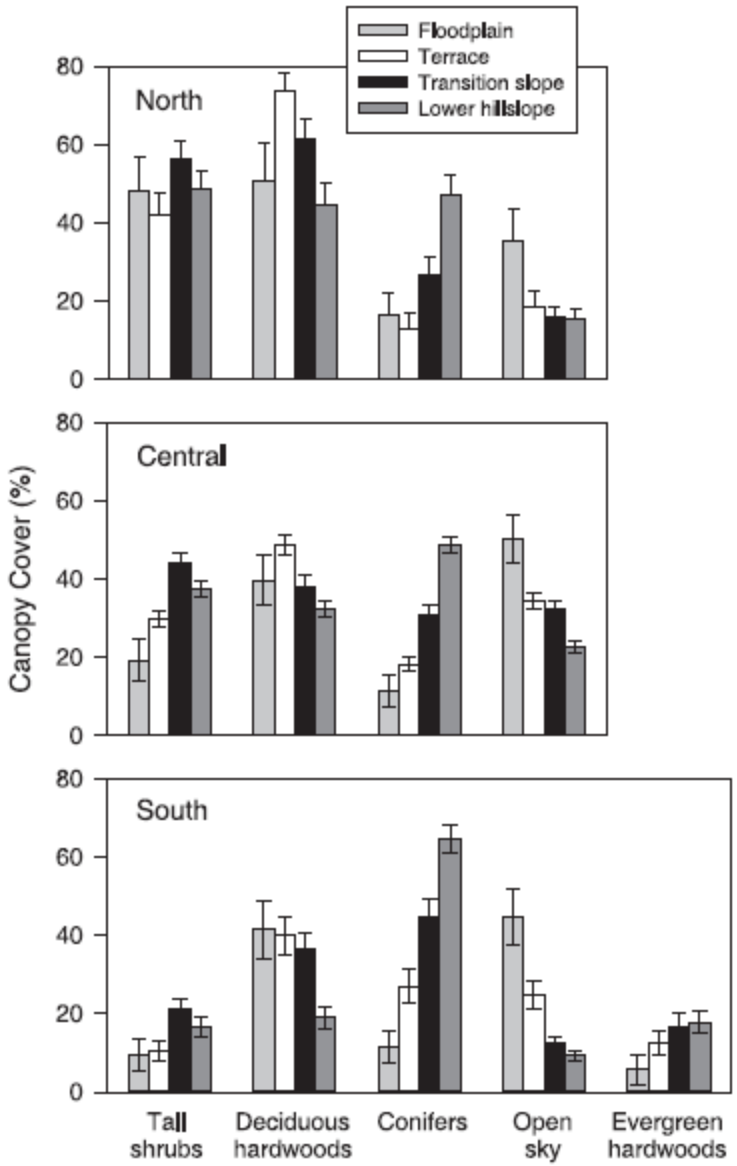
Distribution of Alder Basal Area Oregon Coast Range



Conifer Basal Area Across Coast Range Increases with Distance from Streams

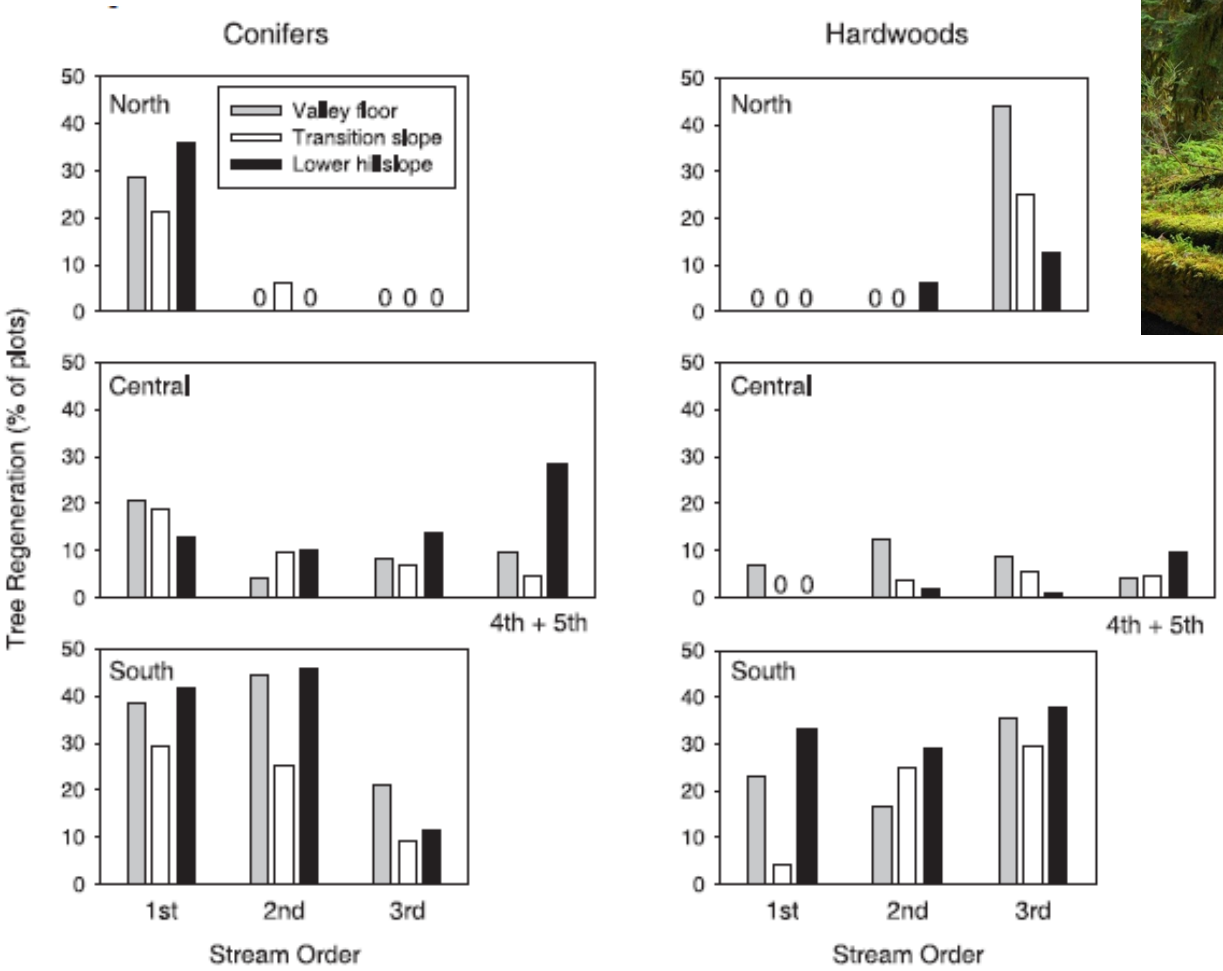
Conifer basal area is highest in low-order drainages



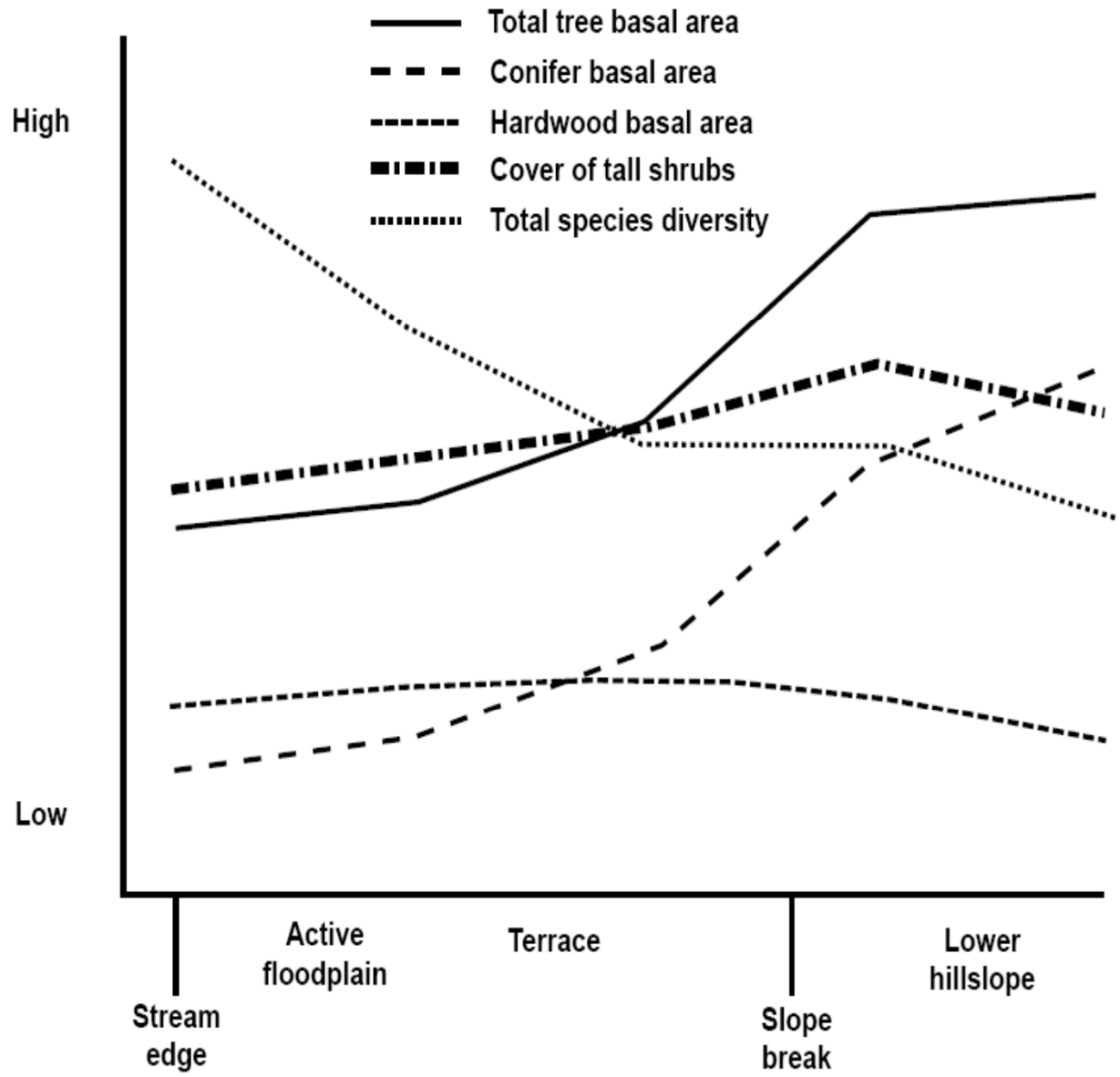


Canopy Cover Varies By Geomorphology and Region

Tree Regeneration Varies with Stream Order



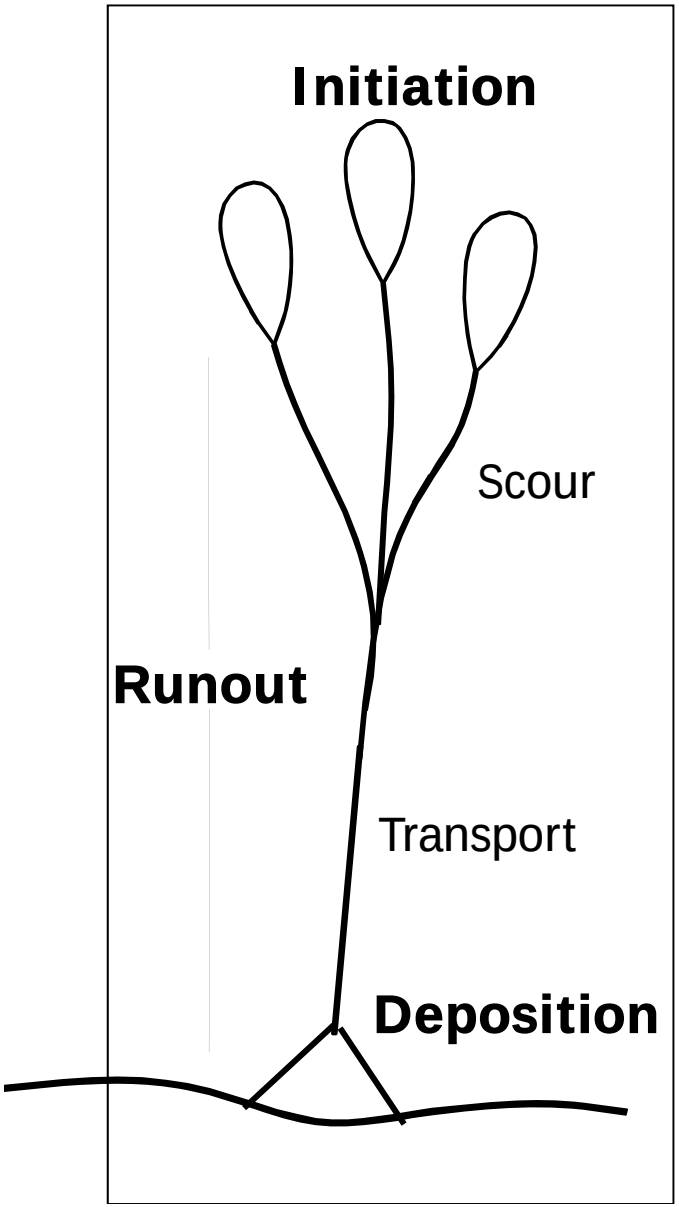
Generalized Trends in Forest Structure with Distance from Stream



Natural Disturbances that Initiate Succession

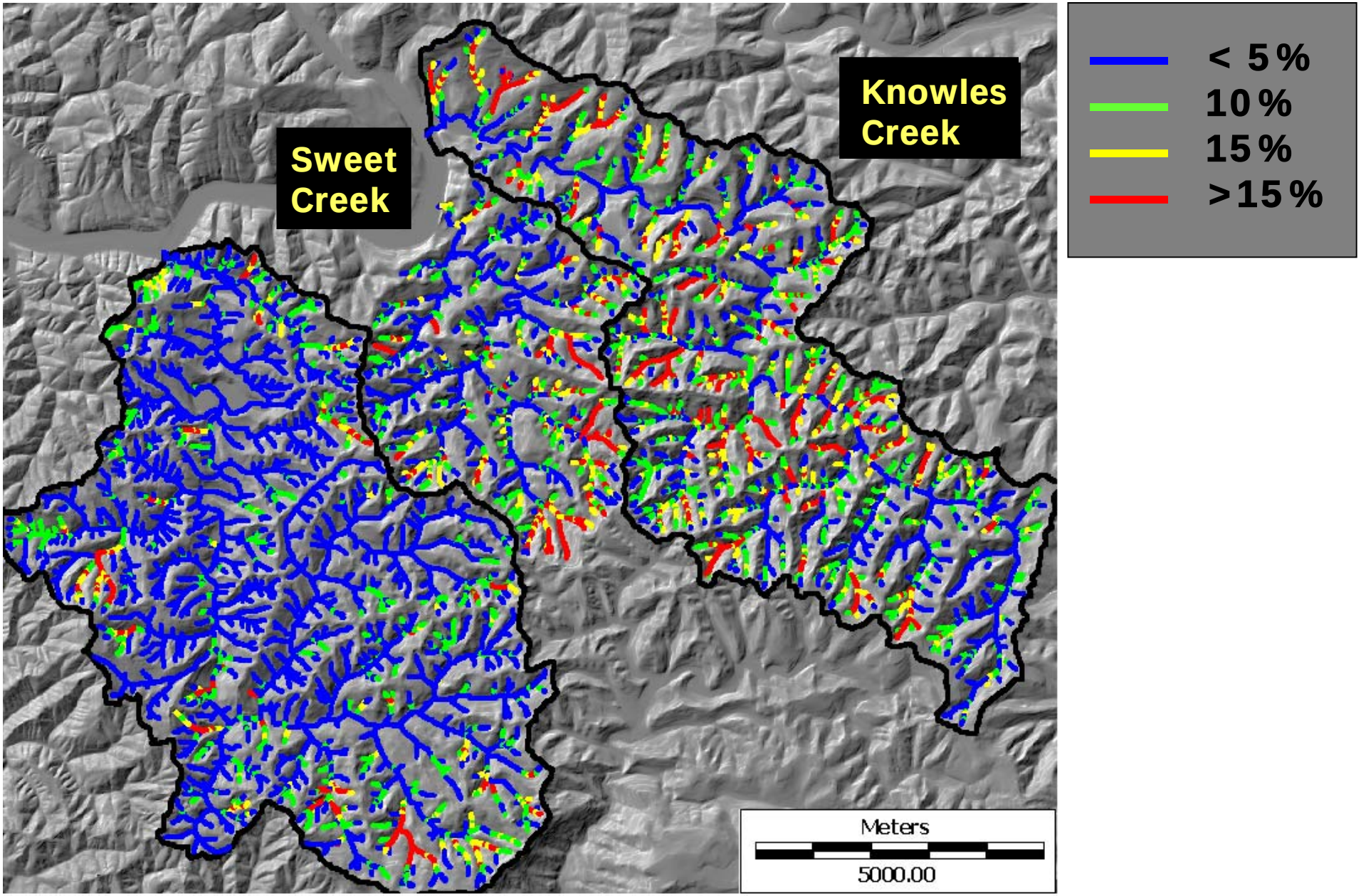
- Fire
- Landslides
- Debris Flows
- Flooding
- Windthrow
- Stream bank erosion
- Herbivory
- Pathogens

Debris Flows:
Initiation, Runout, and Deposition

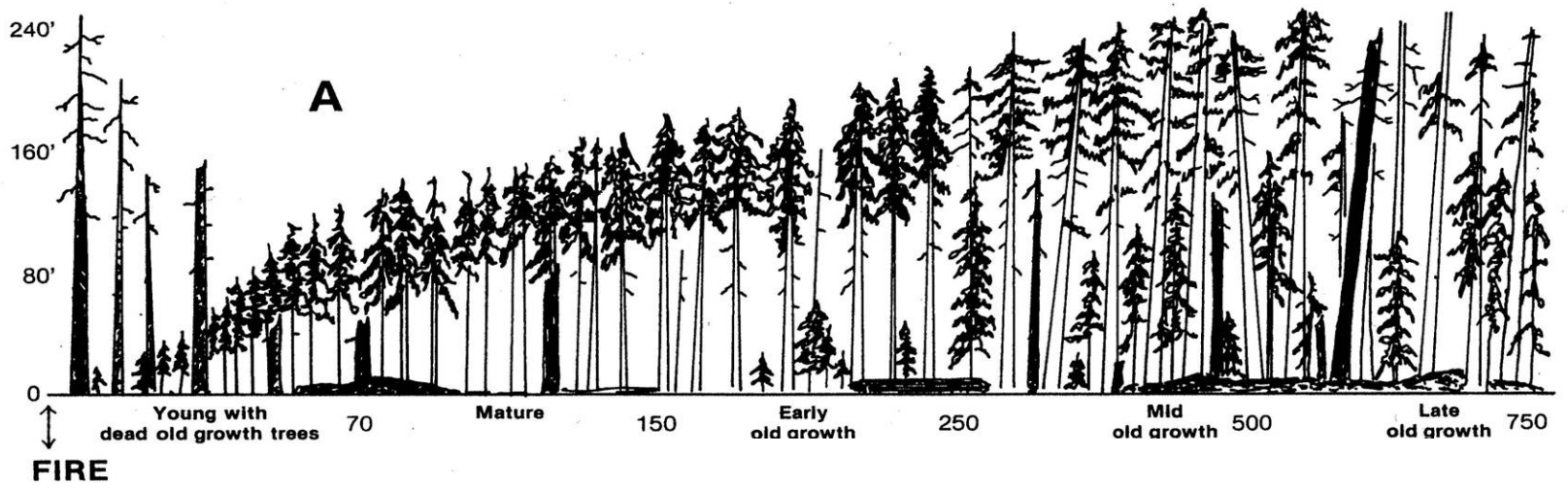


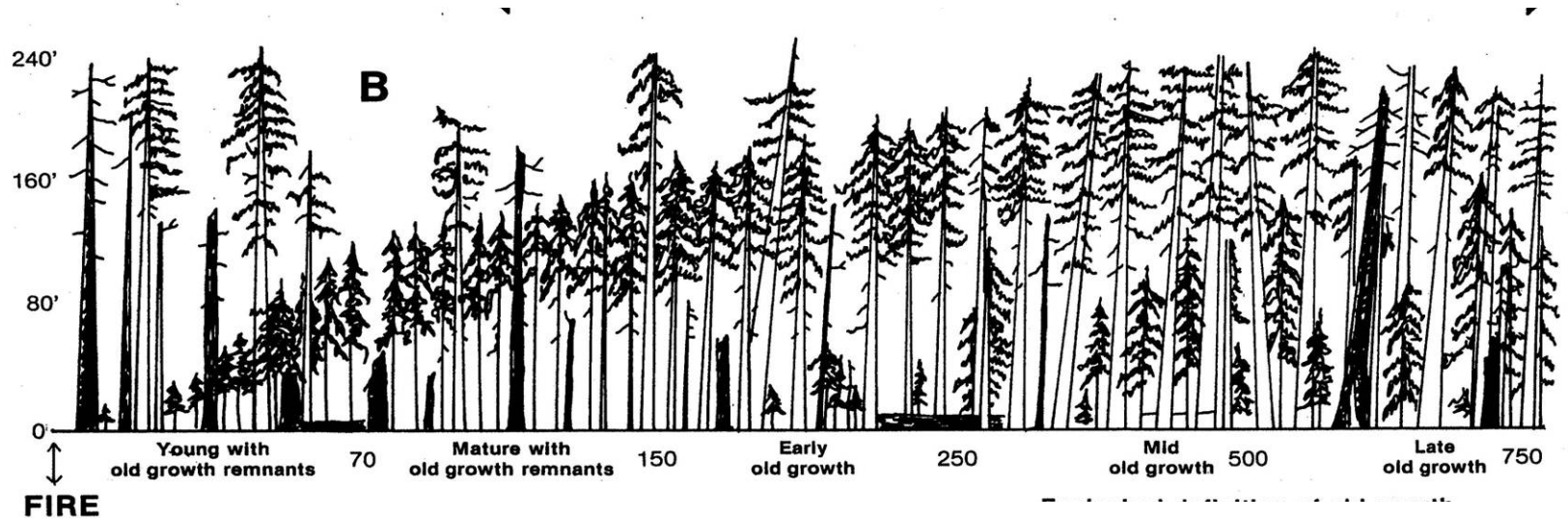
0 0.5km

Within and Among Basin Heterogeneity in Debris Flow Probability

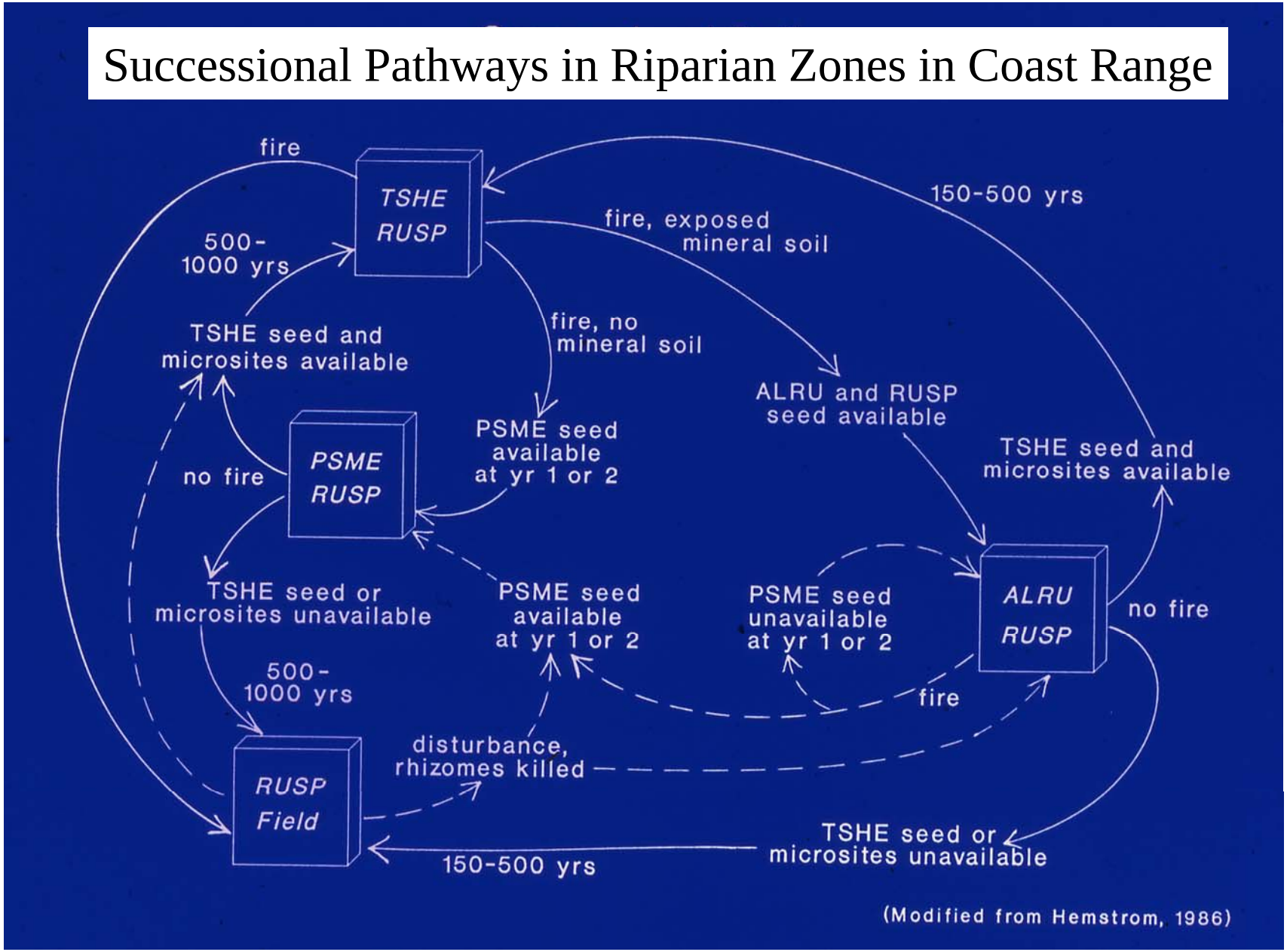


Upland Successional Trends Following Wildfire



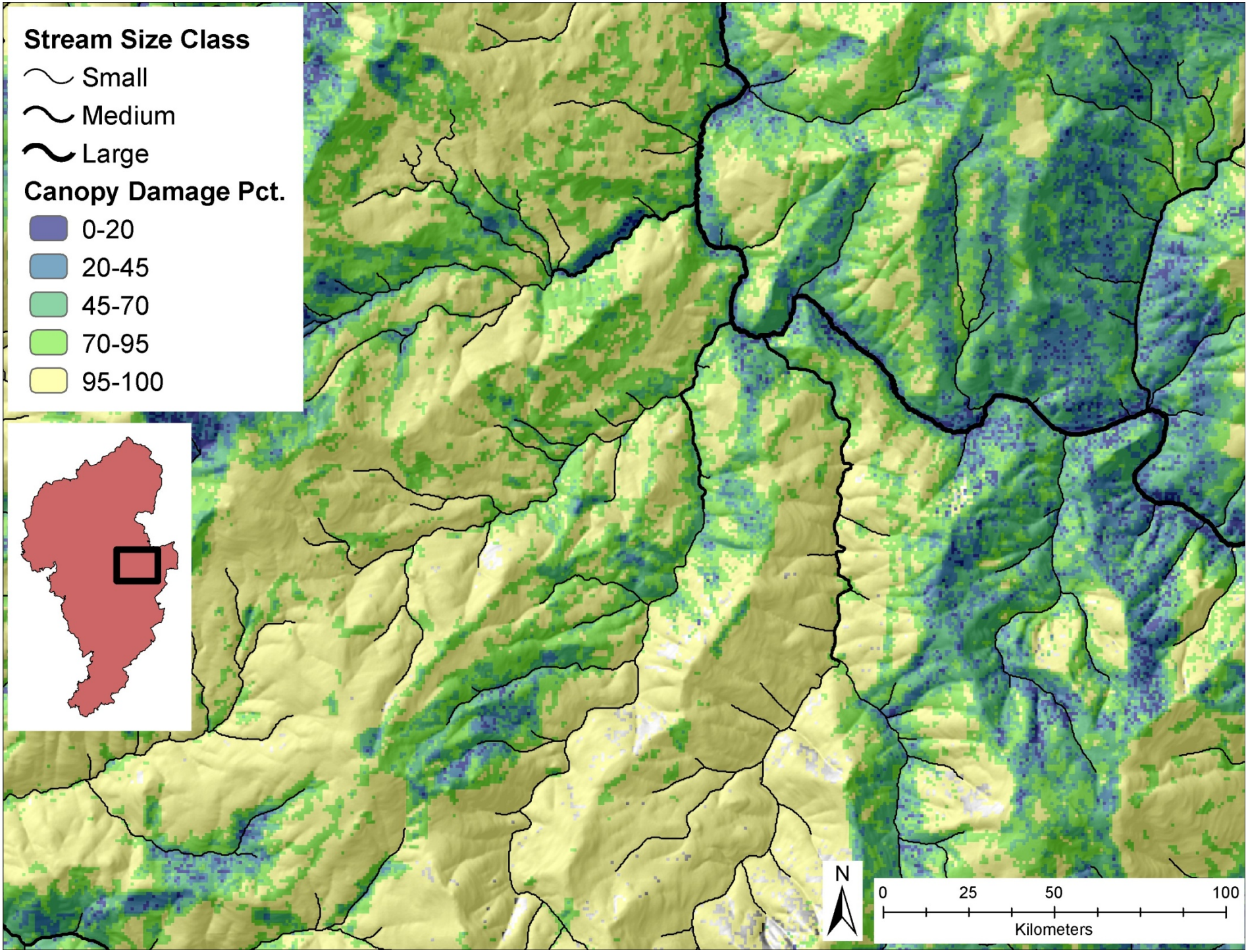


Successional Pathways in Riparian Zones in Coast Range

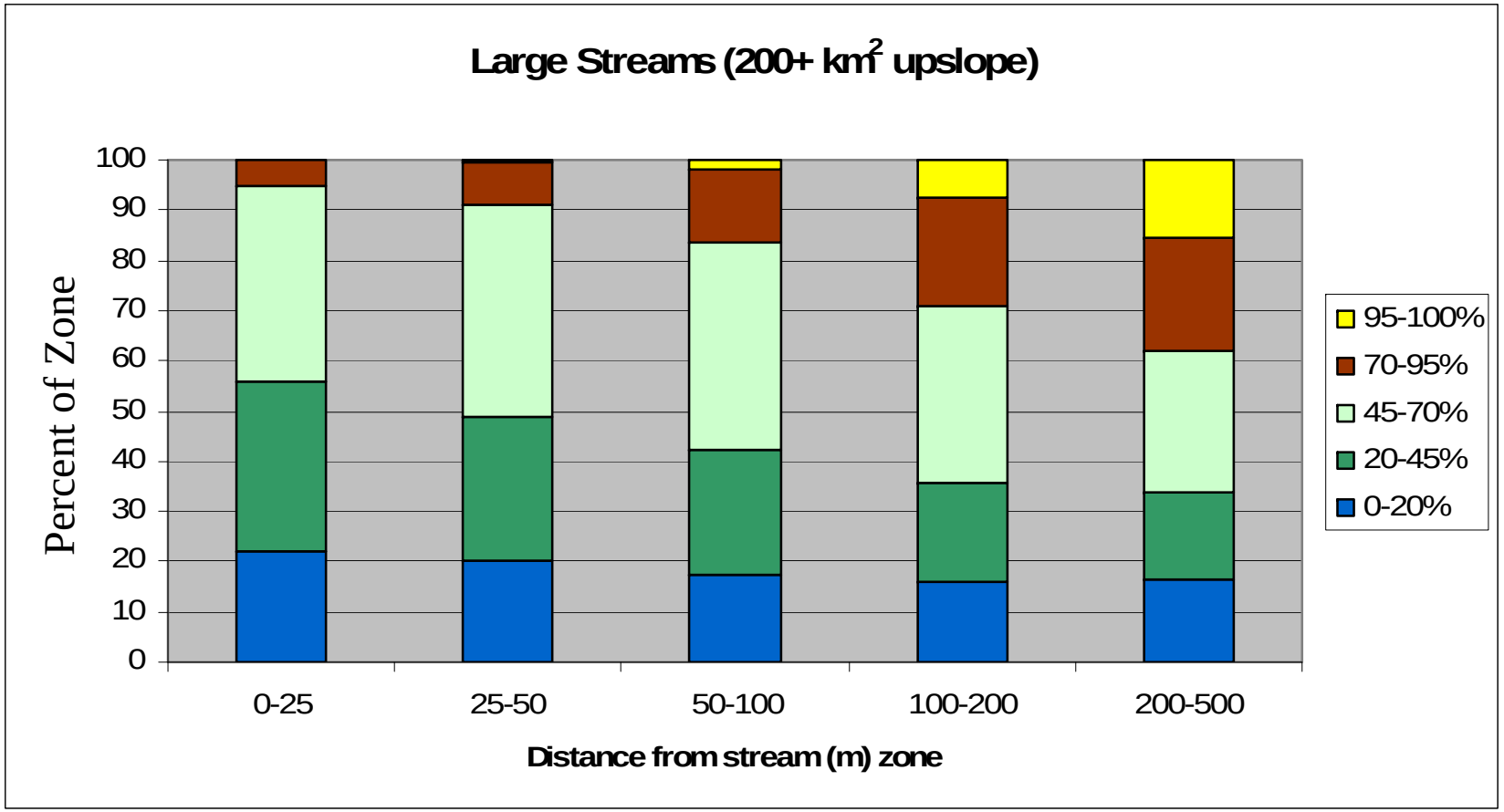


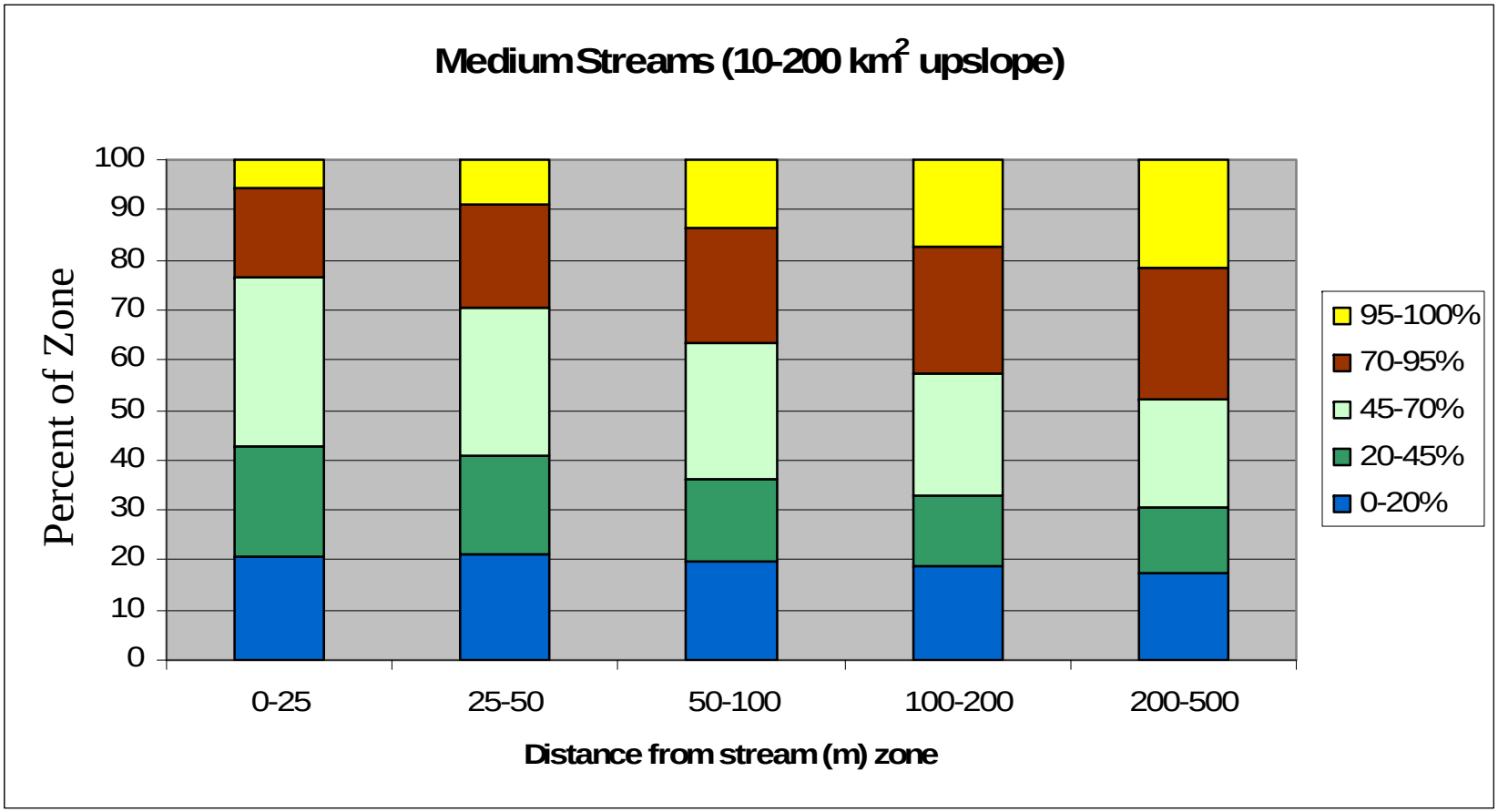
Wildfire and Riparian Vegetation

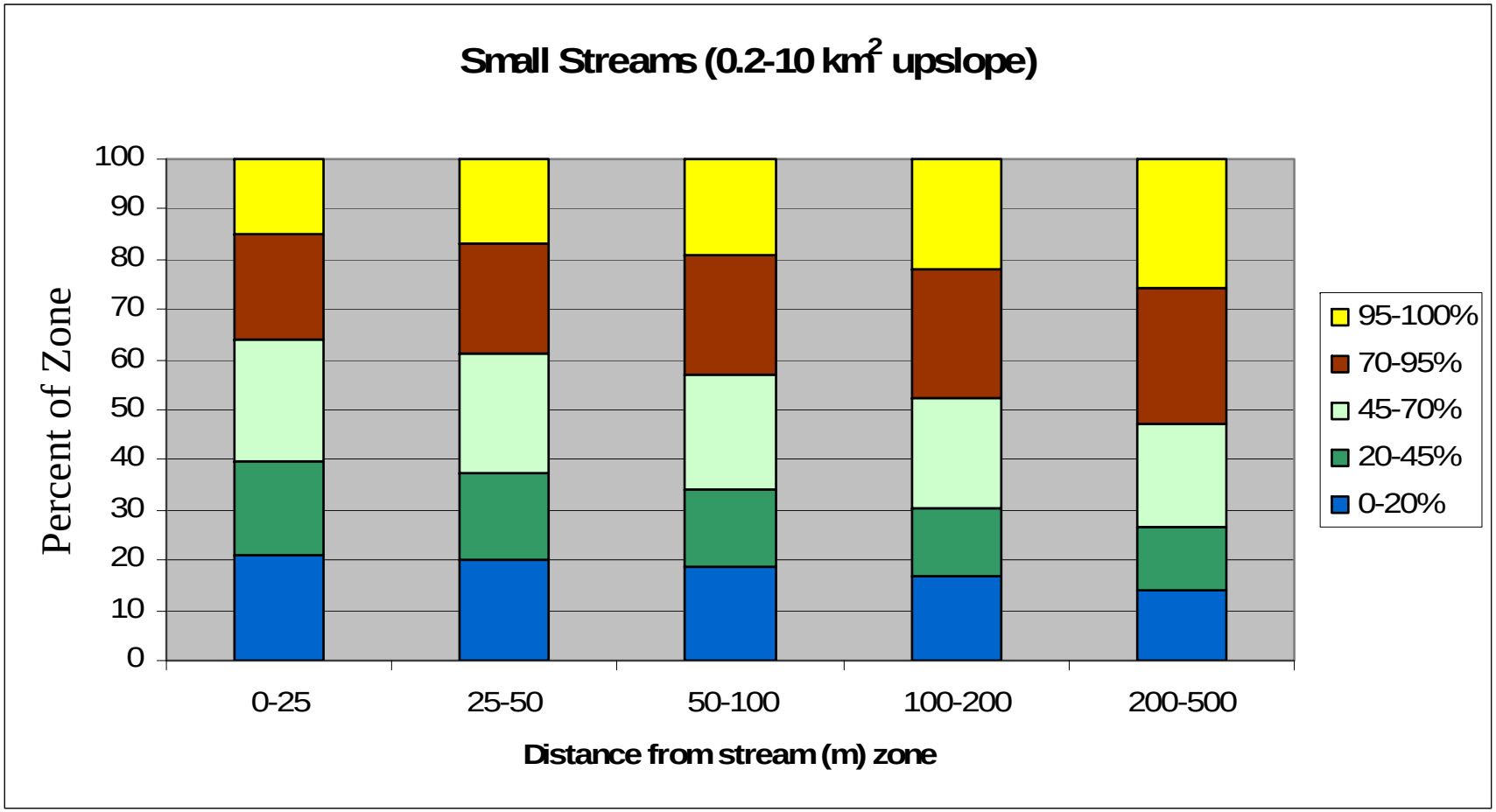
The 2002 Biscuit Fire


Stream Size Class
Small
Medium
Large
Canopy Damage Pct.
0-20
20-45
45-70
70-95
95-100
N
0
25
50
100
Kilometers

Canopy Damage and Distance from Stream

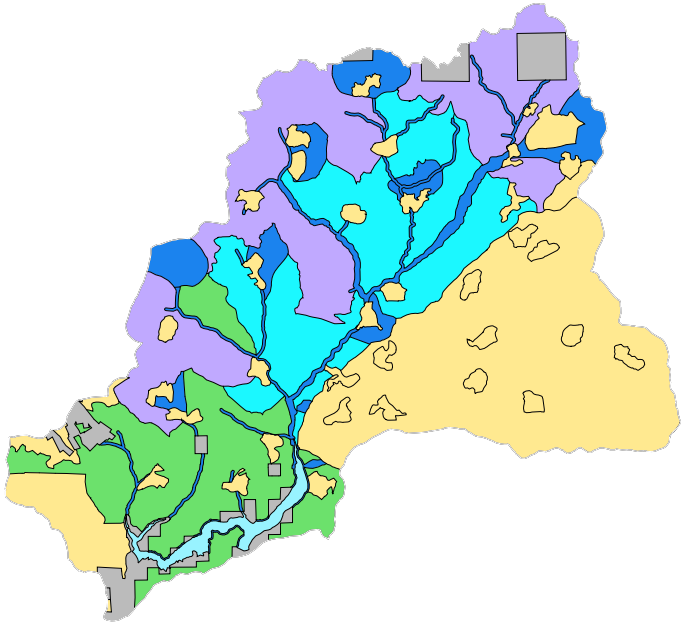



Medium Streams (10-200 km2 upslope)
Percent of Zone
100
90
80
70
60
50
40
30
20
10
0
0-25
25-50
50-100
100-200
200-500
Distance from stream (m) zone
95-100%
70-95%
45-70%
20-45%
0-20%


Small Streams (0.2-10 km2 upslope)
Percent of Zone
100
90
80
70
60
50
40
30
20
10
0
0-25
25-50
50-100
100-200
200-500
Distance from stream (m) zone
95-100%
70-95%
45-70%
20-45%
0-20%

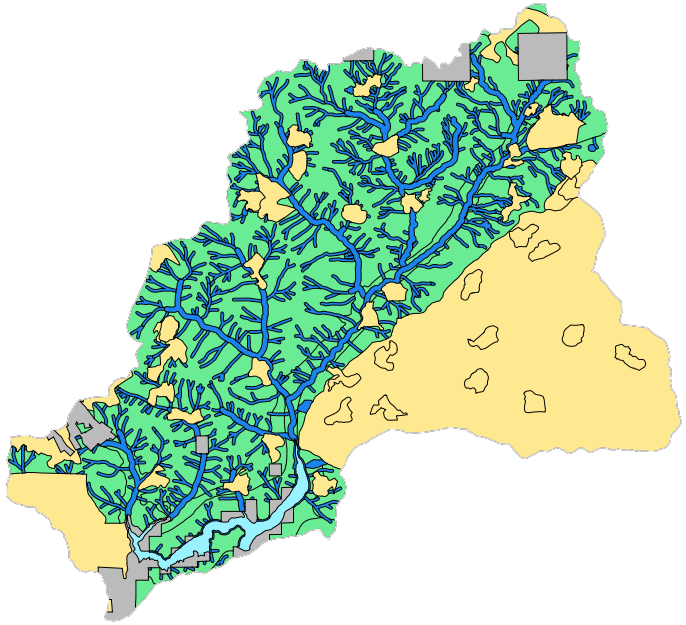
A Natural Disturbance Regime Based Approach to Riparian Functions

Blue River Alternative



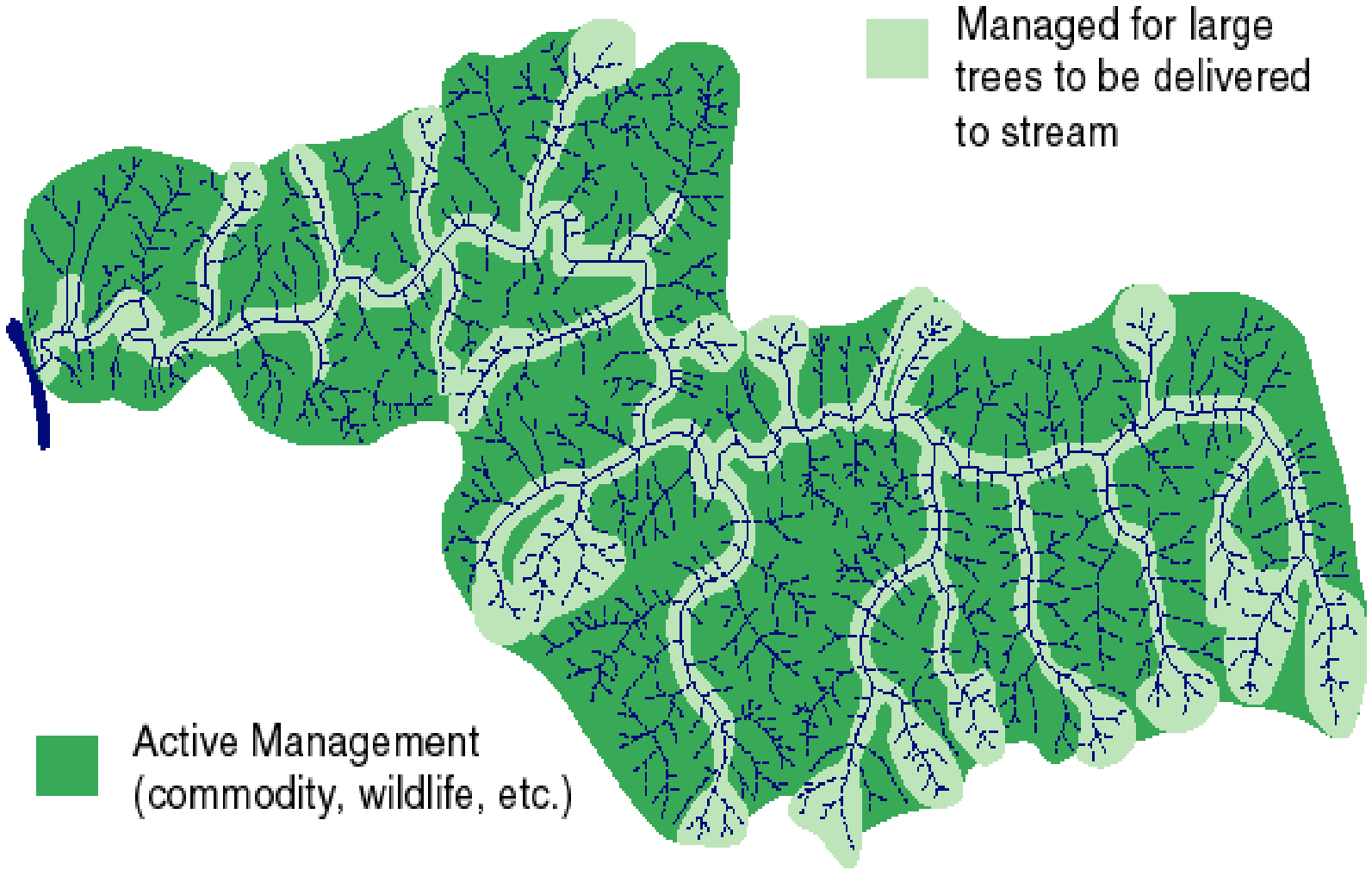
- Special Area Reserves
- Aquatic Reserves
- Landscape Area 1
- Landscape Area 2
- Landscape Area 3

Northwest Forest Plan

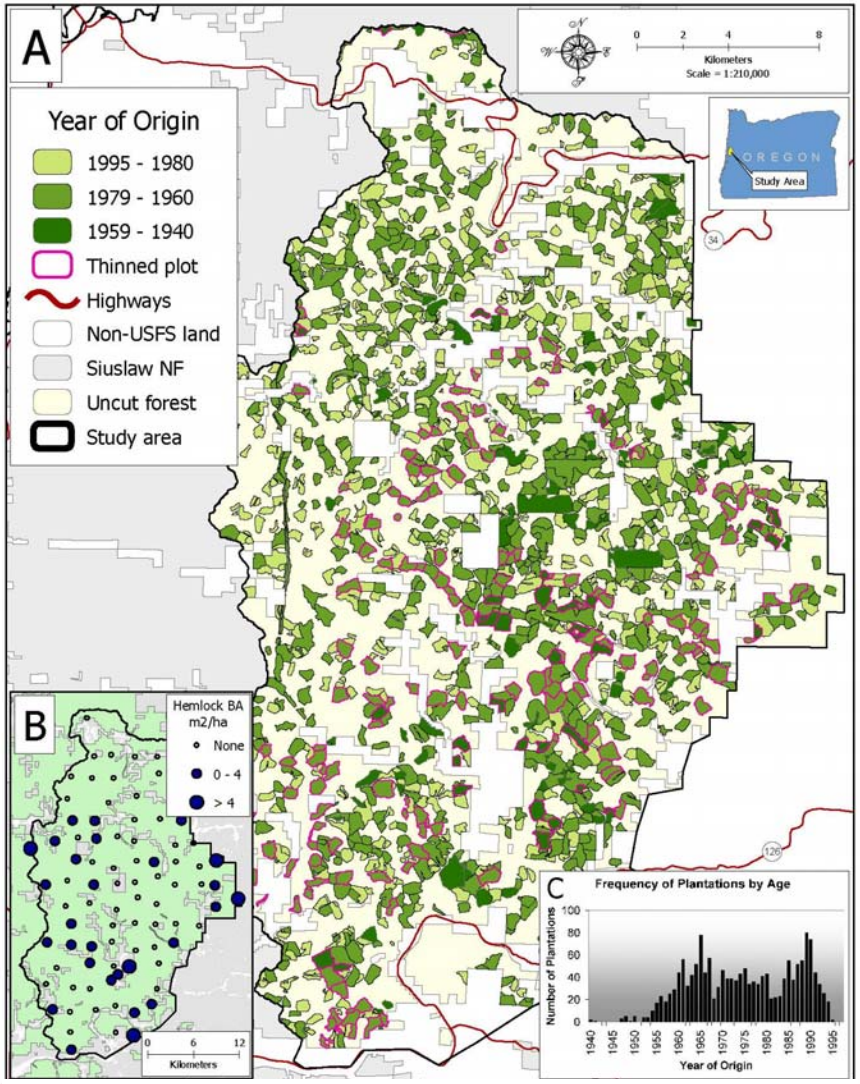


- Special Area Reserves
- Riparian Reserves
- Matrix

Potential Riparian Management Design for Large Wood Delivery

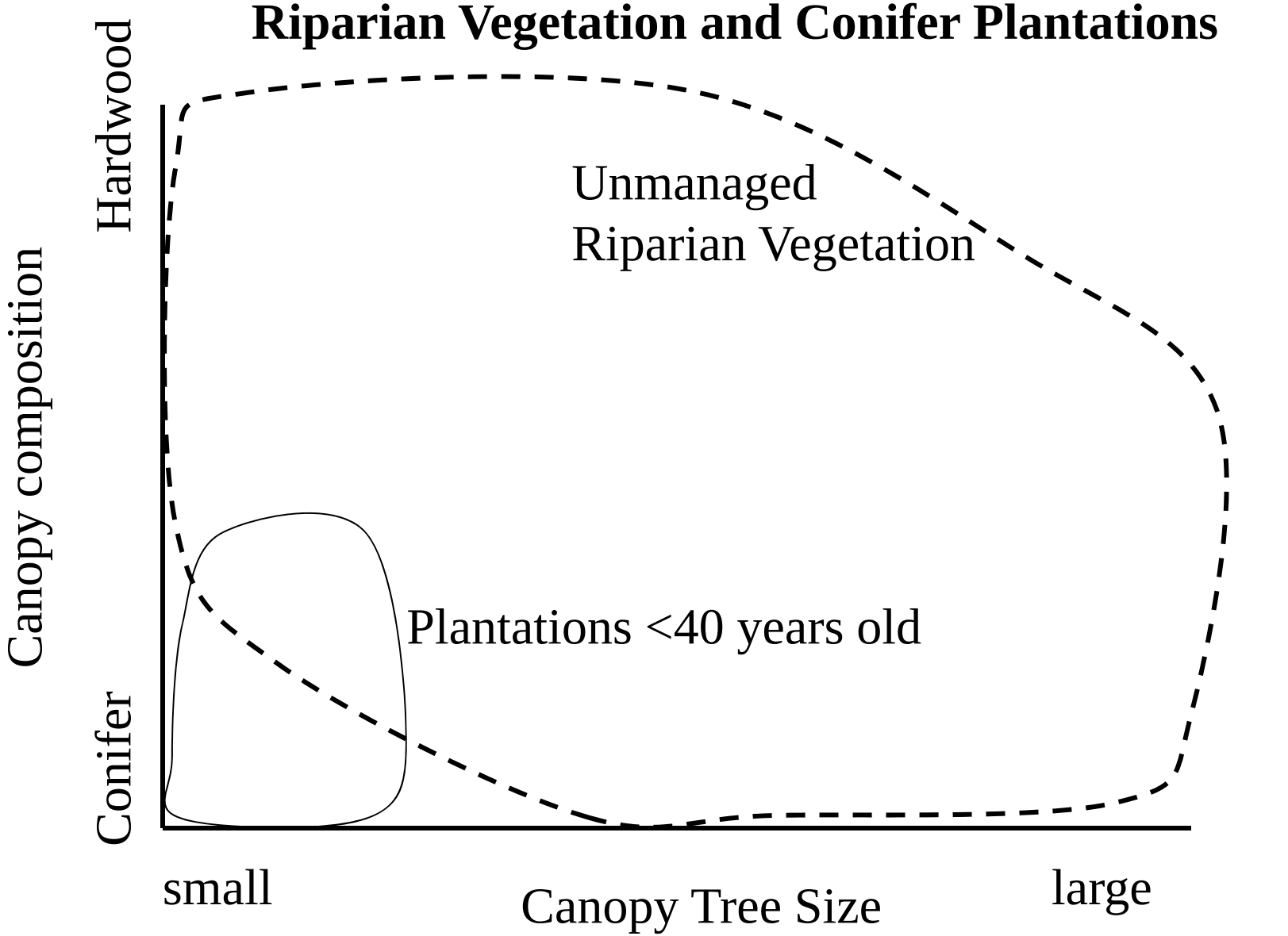


Plantations in Riparian Zones

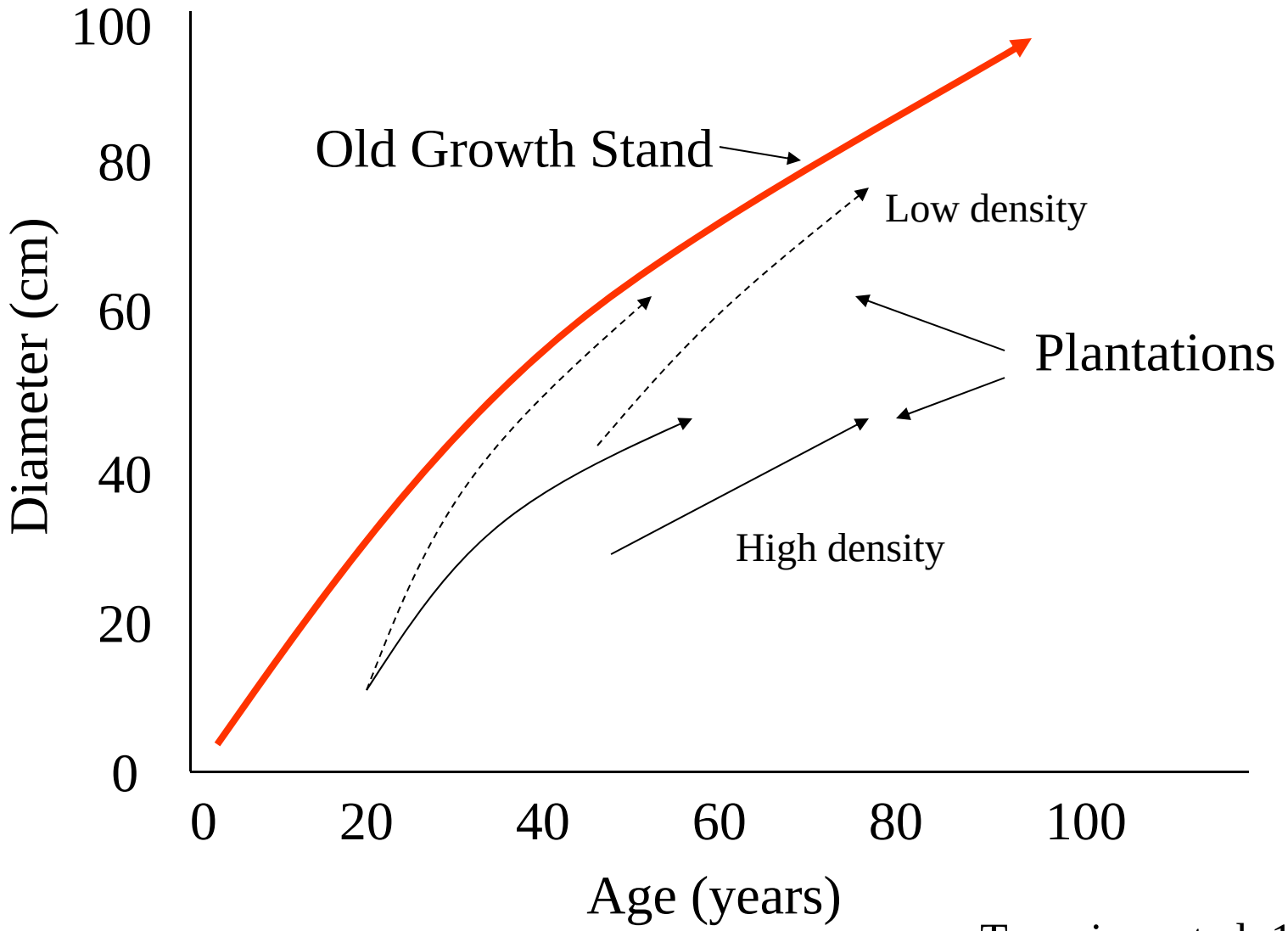


Distribution of Plantations In a Late Successional Reserve in Coastal Oregon

Hypothetical Range of Variation in Unmanaged Riparian Vegetation and Conifer Plantations

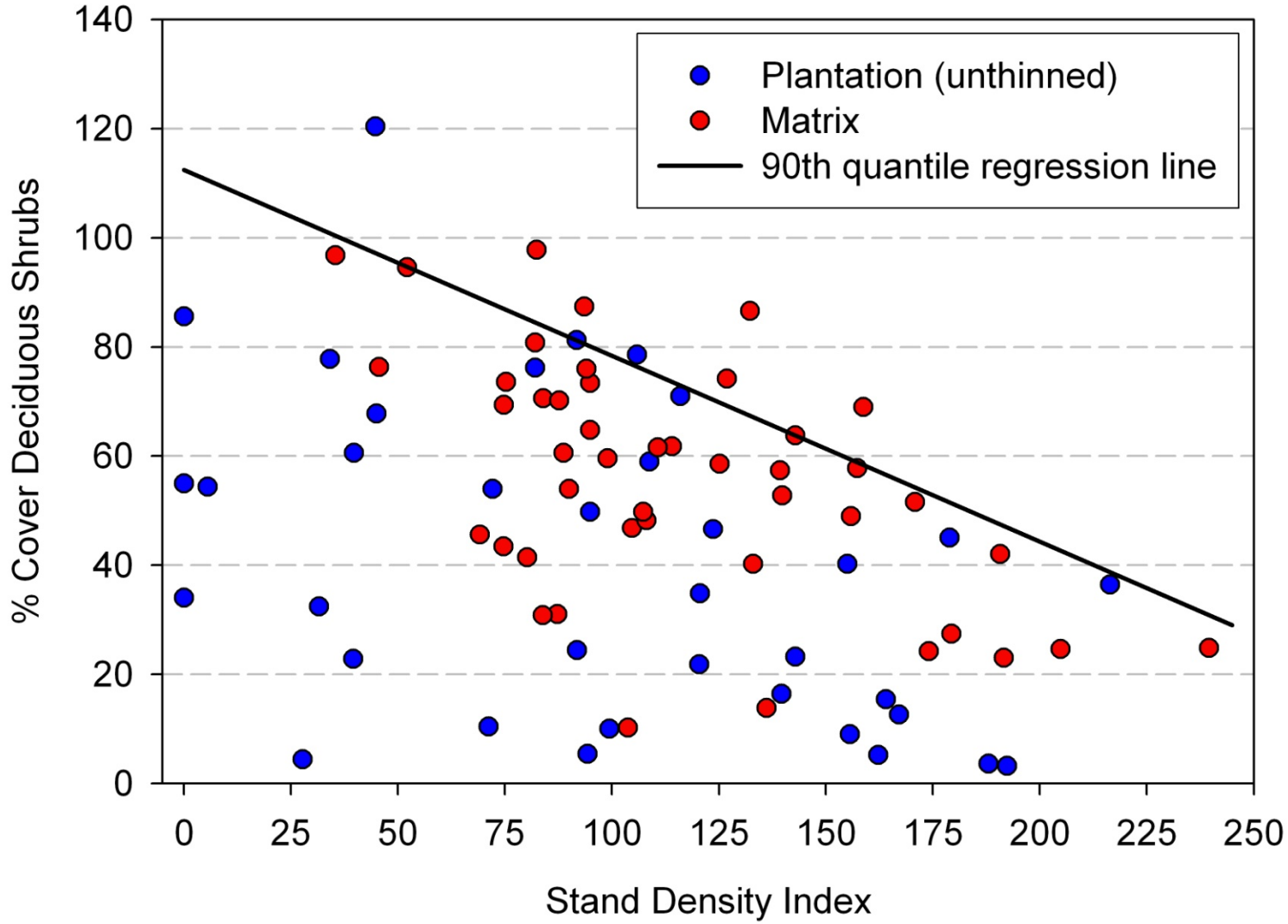


Average stand diameter vs age in old growth and in plantations of different densities



Tappeiner et al. 1997

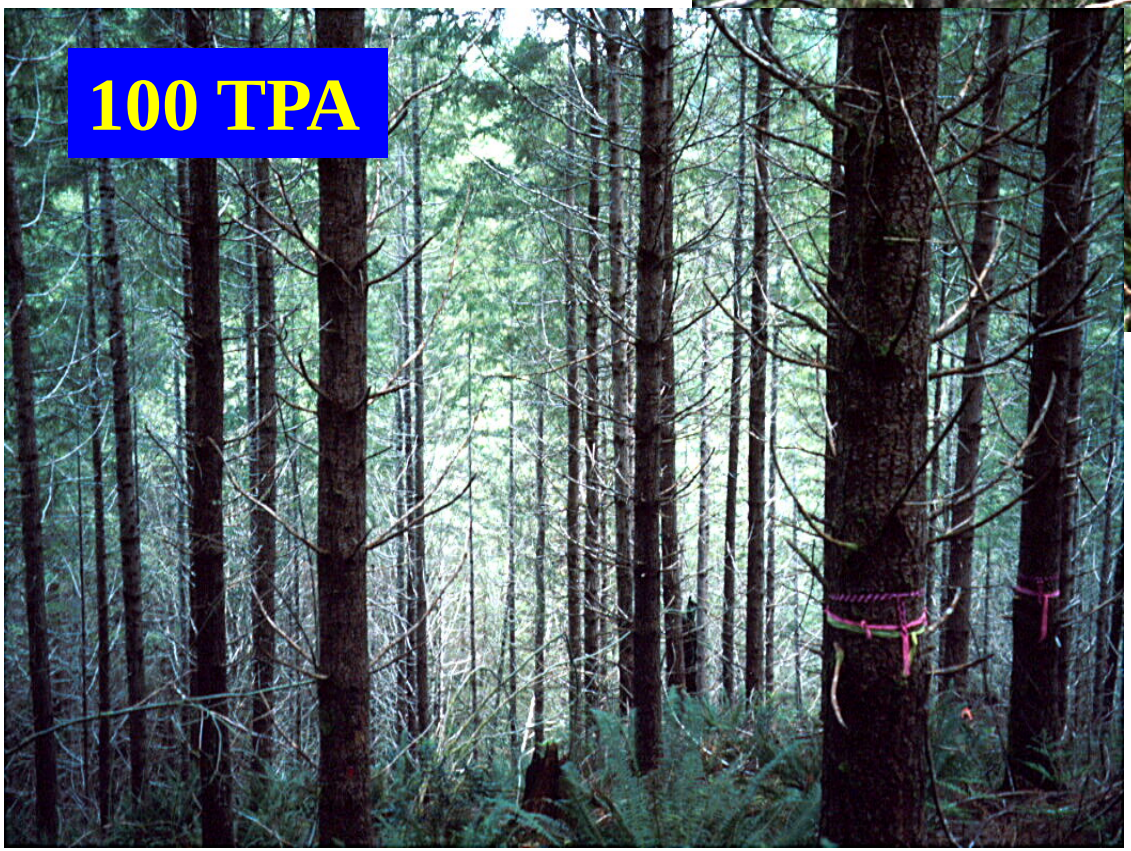
High Stand Densities Limit Deciduous Shrub Cover



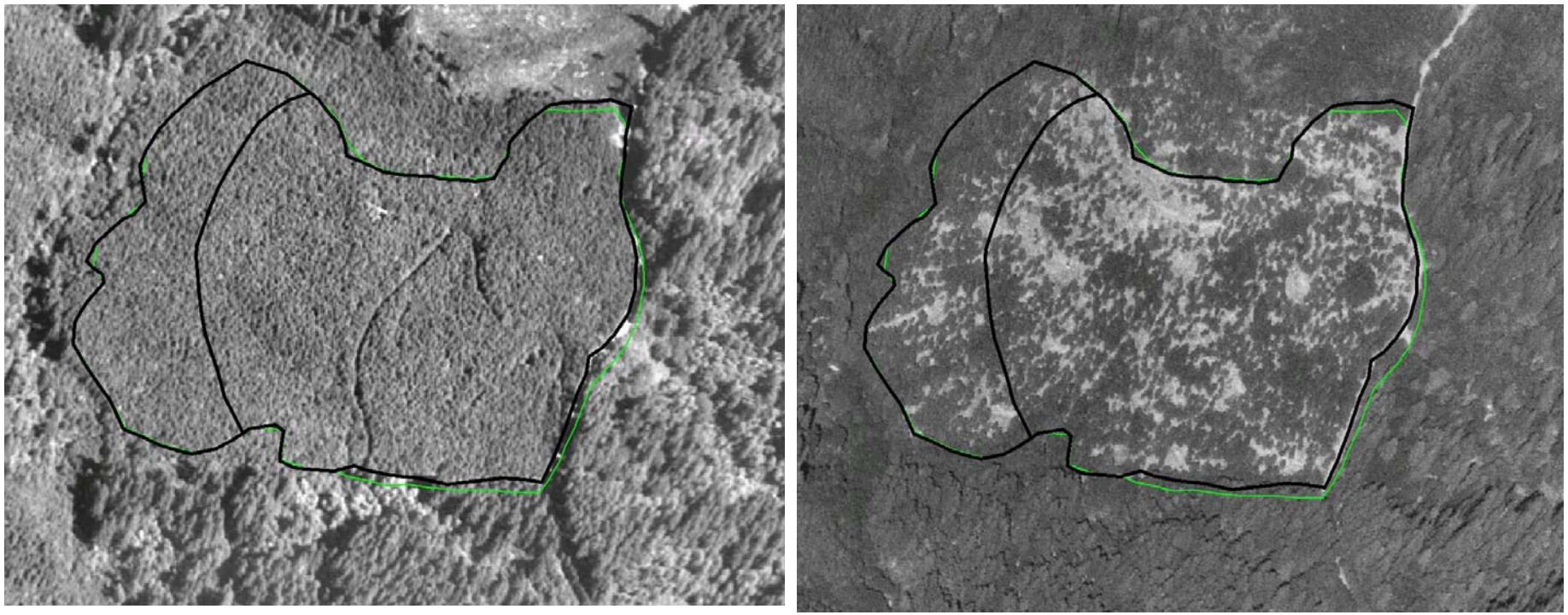
Why Thin in Riparian Areas?

- Bigger live and dead trees both sooner and in the long run
- Accelerate understory vegetation development
  - Deciduous shrubs
  - Shade tolerant regeneration
- Increase greater spatial heterogeneity at stand level

Variable Densities



Diversification of young plantations using variable density Thinning



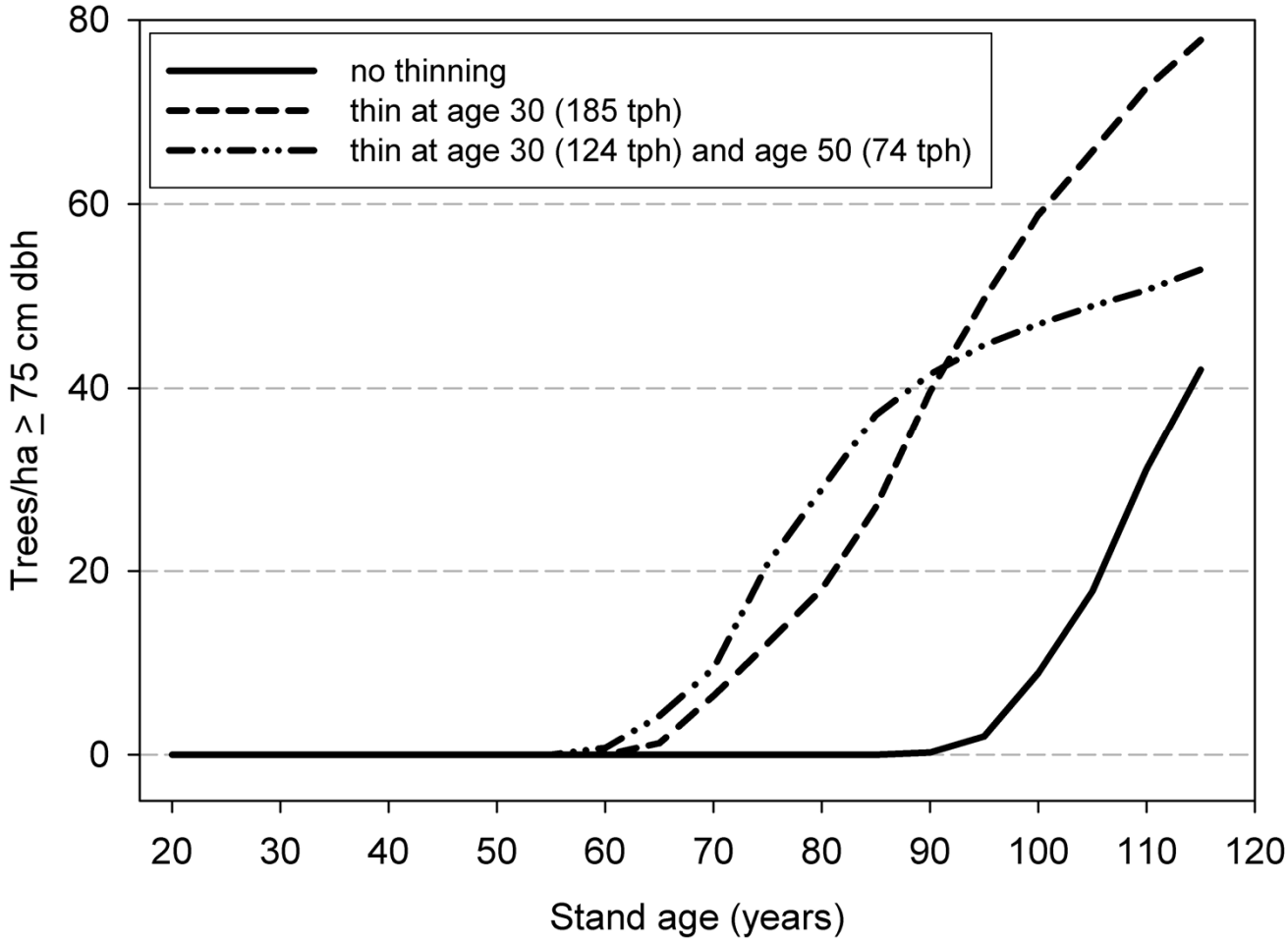
Some guidelines

- Increase spatial heterogeneity
- Prioritize densest stands first (not all stands may need thinning)
- Don’t thin uniformly
- Use combination of heavy thin, moderate thin, light thin, no thin within same stand
- Work with existing heterogeneity (e.g. hardwoods, shrubs)
- Don’t use same approach on all stands

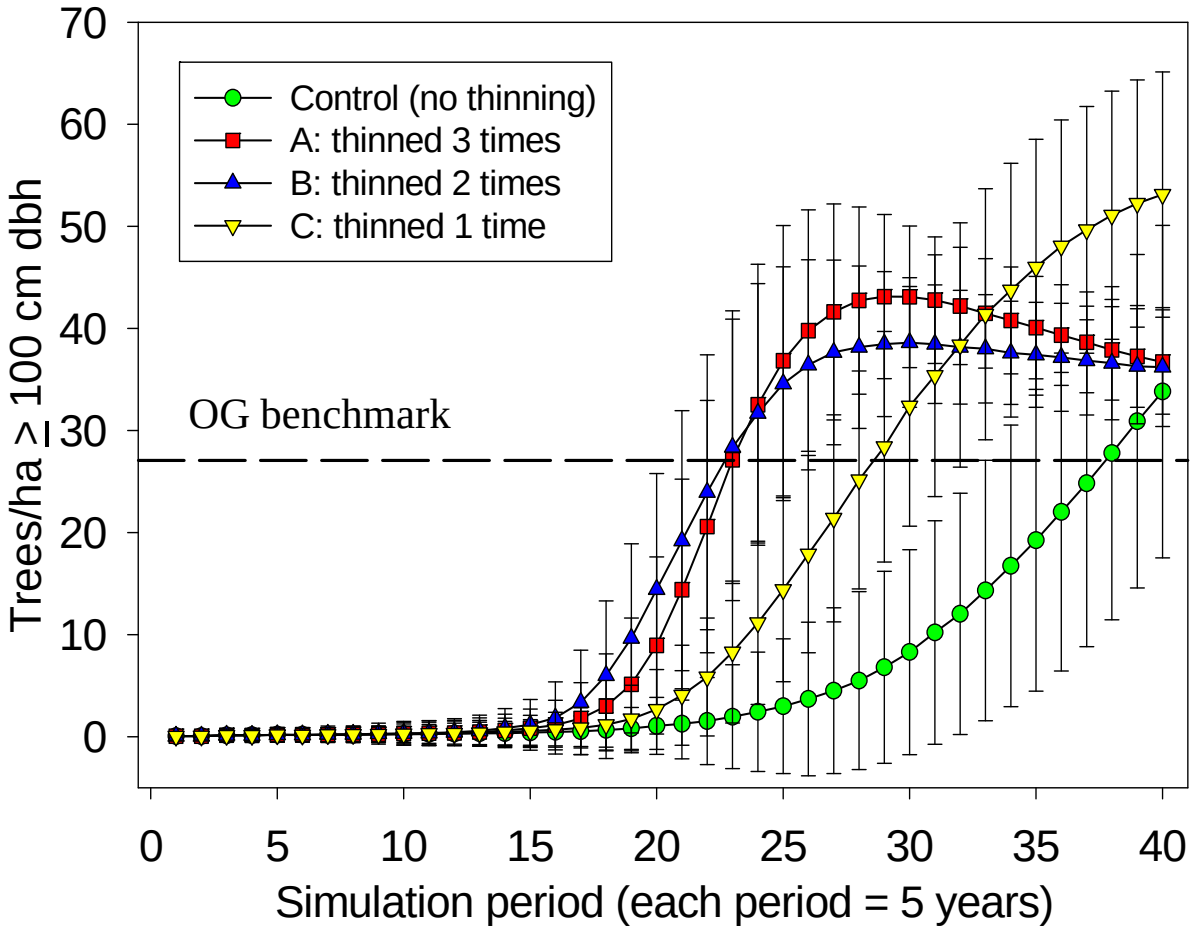
Thinning Simulation I
Silvicultural treatments on Siuslaw N.F.

Rx code	Age range of plots at time 0	Time step of thinning entries (1 step = 5 years)	Target thinning densities (trees/ha)	Snags created (snags/ha)
Control (no thin)	10-30 years	---	---	---
A	10-30 years	2	247	0
		6	124	15
		10	74	7
B	10-30 years	2	124	15
		6	74	7
C	10-30 years	2	185	15

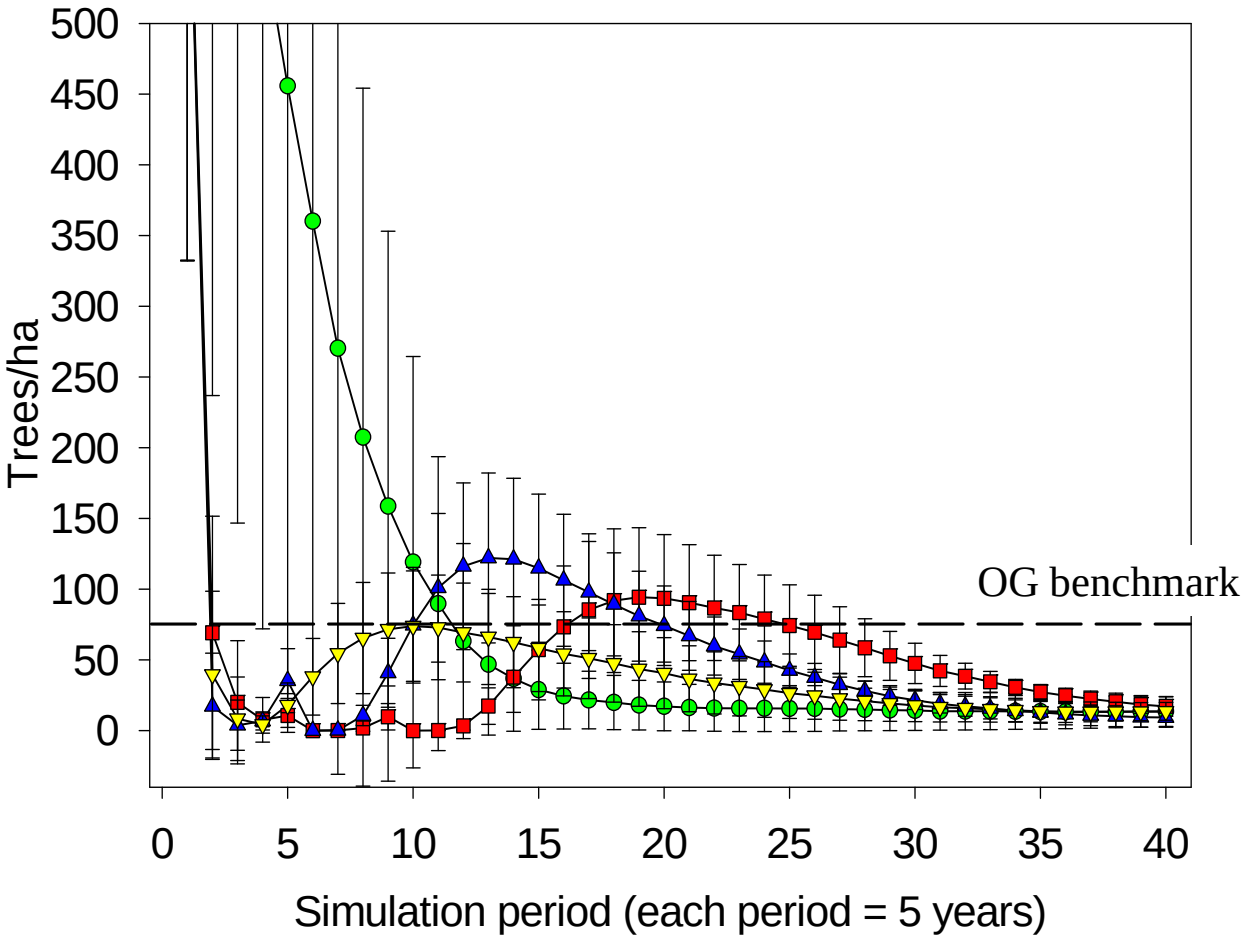
Simulated Effects of Thinning and No Thinning on Density of Large Conifers



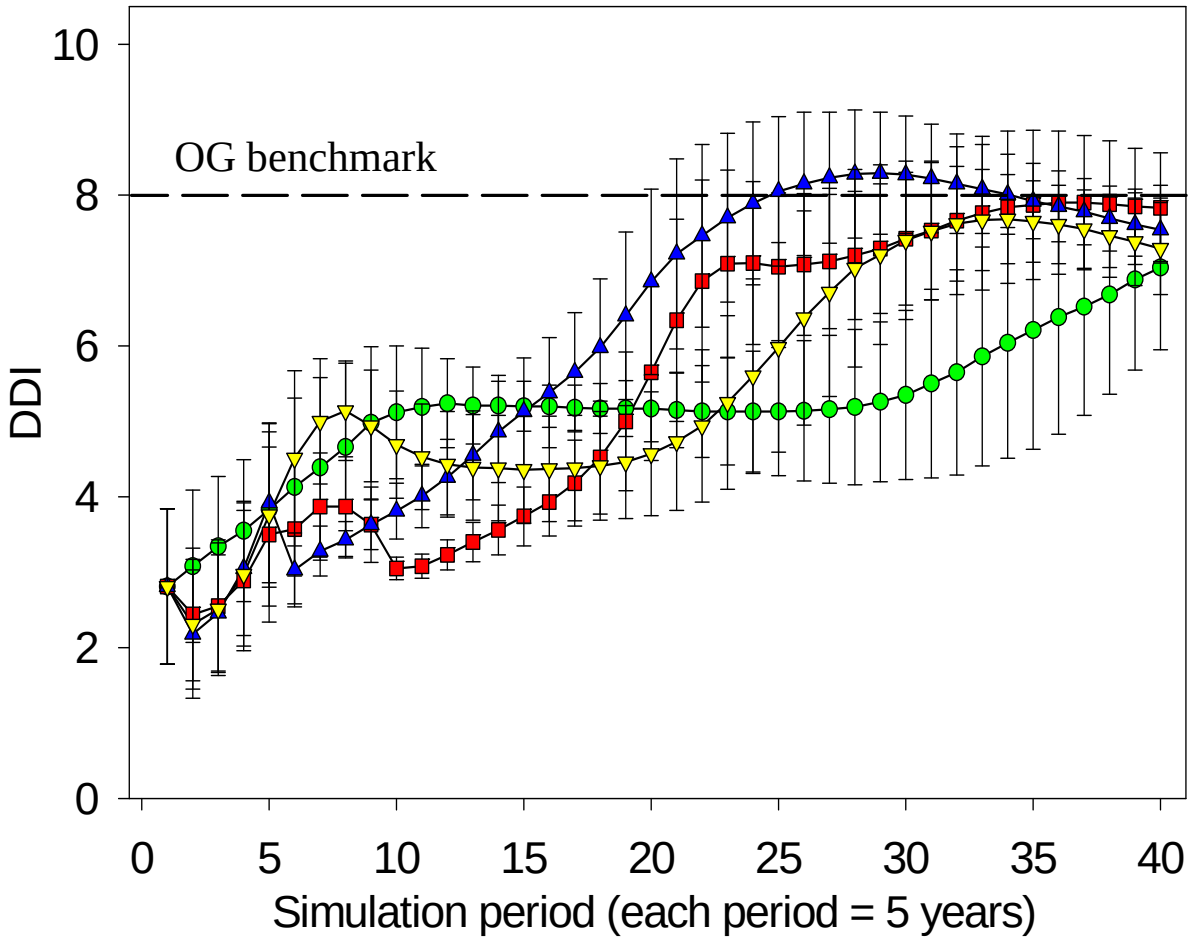
Trees/ha ≥ 100 cm dbh



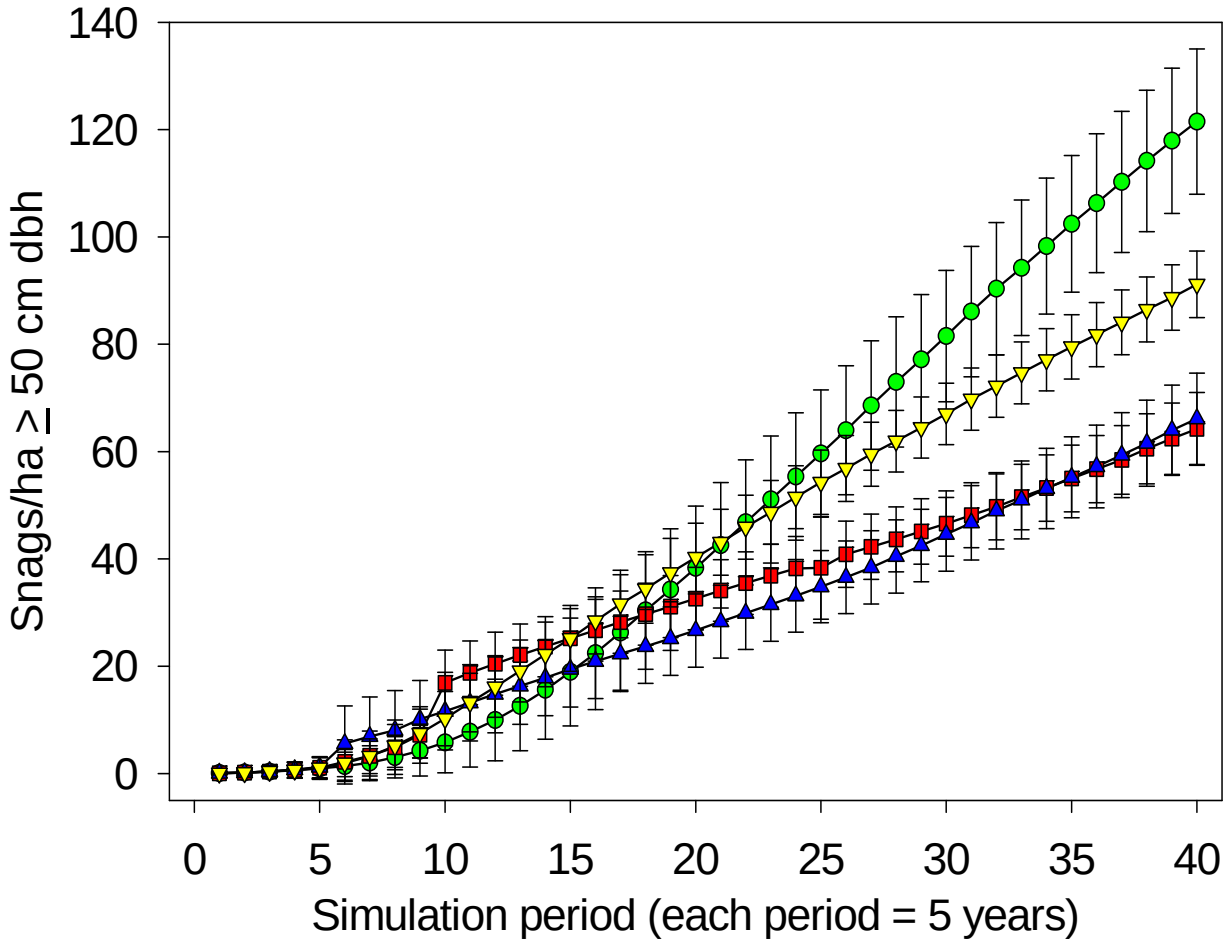
Trees/ha 25-50 cm dbh



Diameter Diversity Index



Cumulative snags/ha ≥ 50 cm dbh



Thinning Simulation II

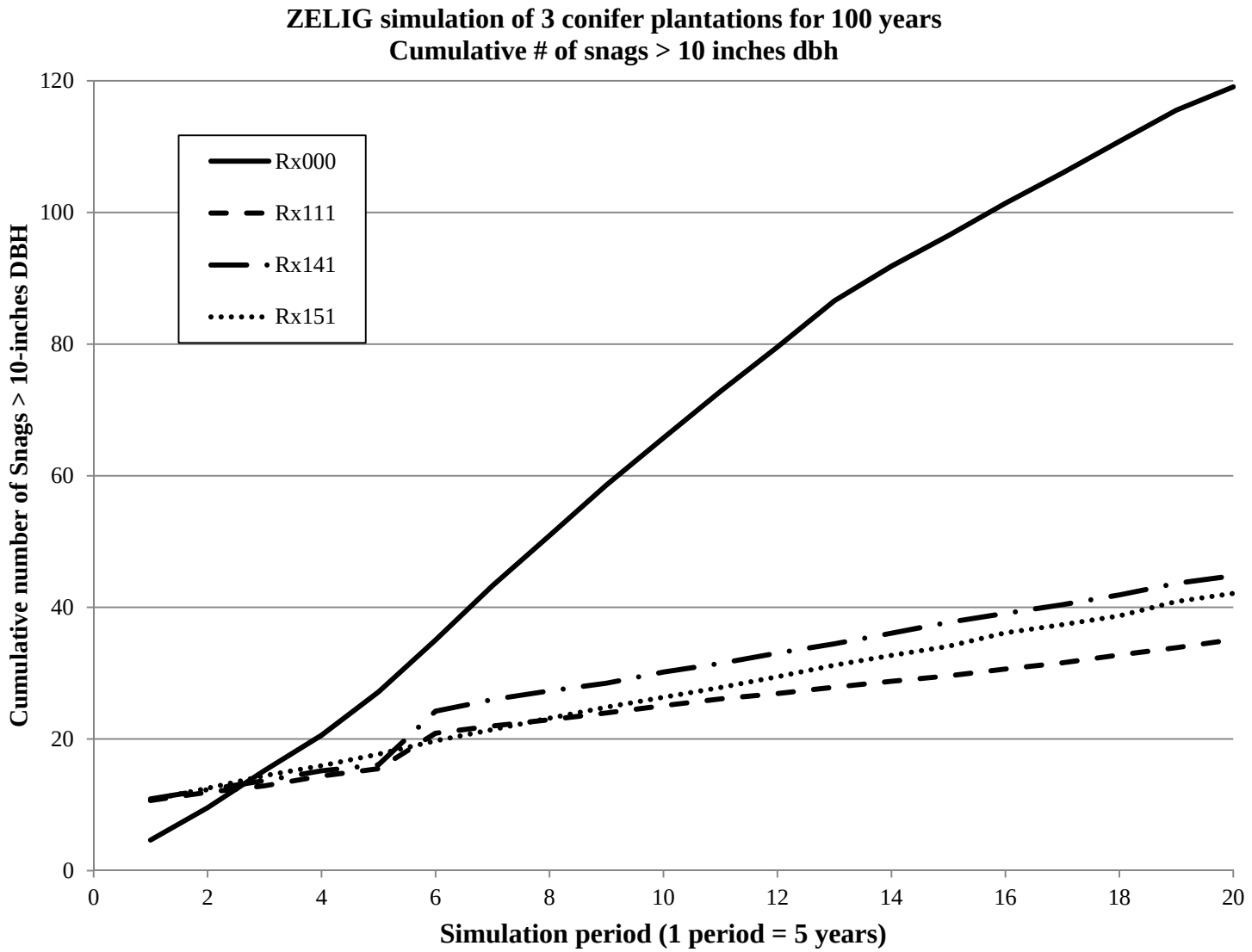
- **Rx 000**: grow only (no thinning)

- **Rx 111**
  - Entry 1 (Period 1)
    - Thin from below to 75 tpa
    - Create 6 snags/ac
  - Entry 2 (Period 6)
    - Thin from below to 40 tpa
    - Create 6 snags/ac

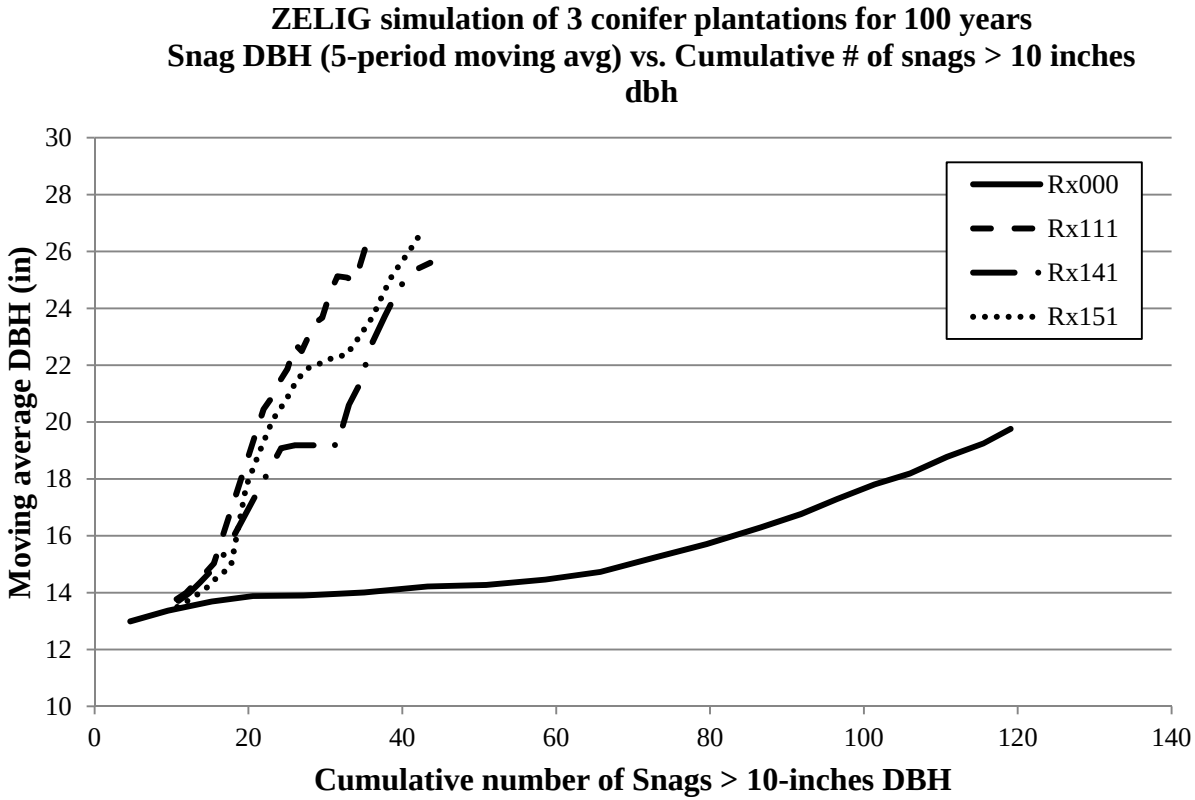
- **Rx 141**
  - Entry 1 (Period 1)
    - Thin from below to 50 tpa
    - Create 6 snags/ac
    - Underplant 75 Tshe/ac + 75 Thpl/ac
  - Entry 2 (Period 6)
    - Thin overstory (trees > 14 in dbh) from below to 30 tpa
    - Create 6 snags/ac
    - Thin understory (trees $\leq$ 14 in dbh) by 50%

- **Rx 151**
  - Entry 1 (Period 1)
    - Thin from below to 75 tpa
    - Create 6 snags/ac

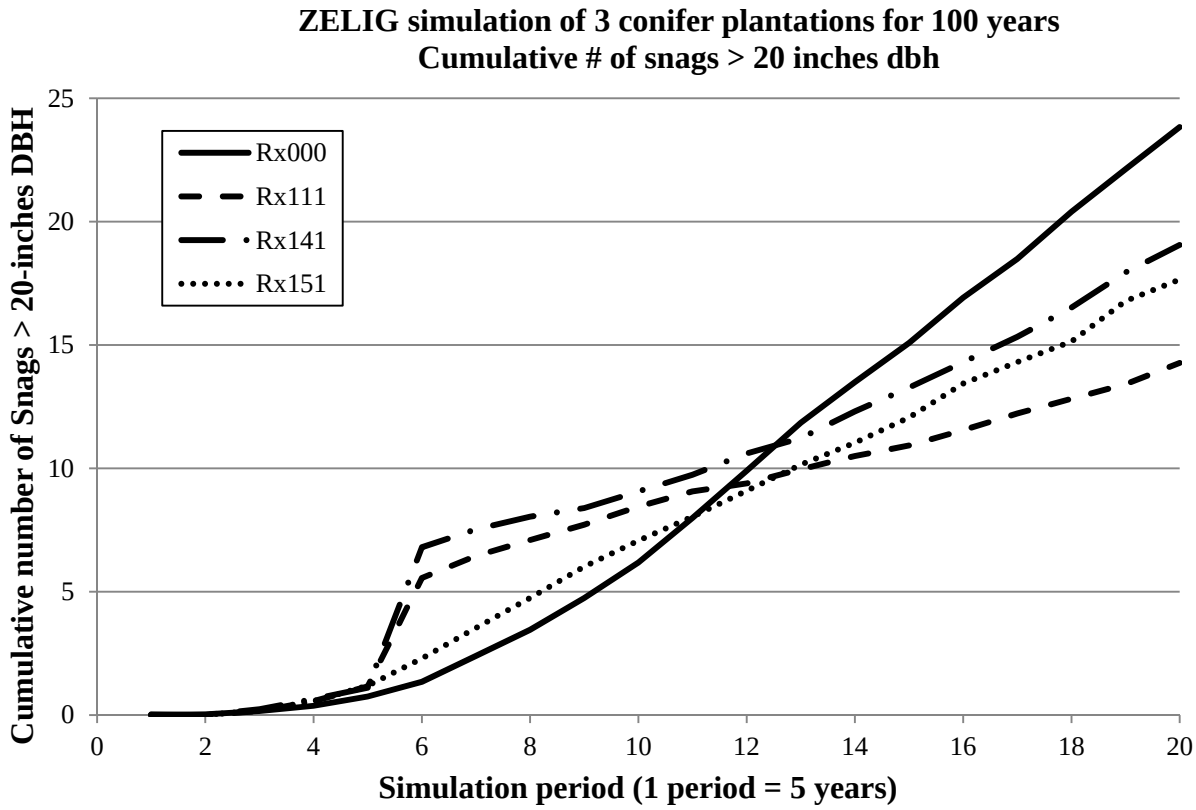
Effects of thinning on number of cumulative number of 10 inch snags



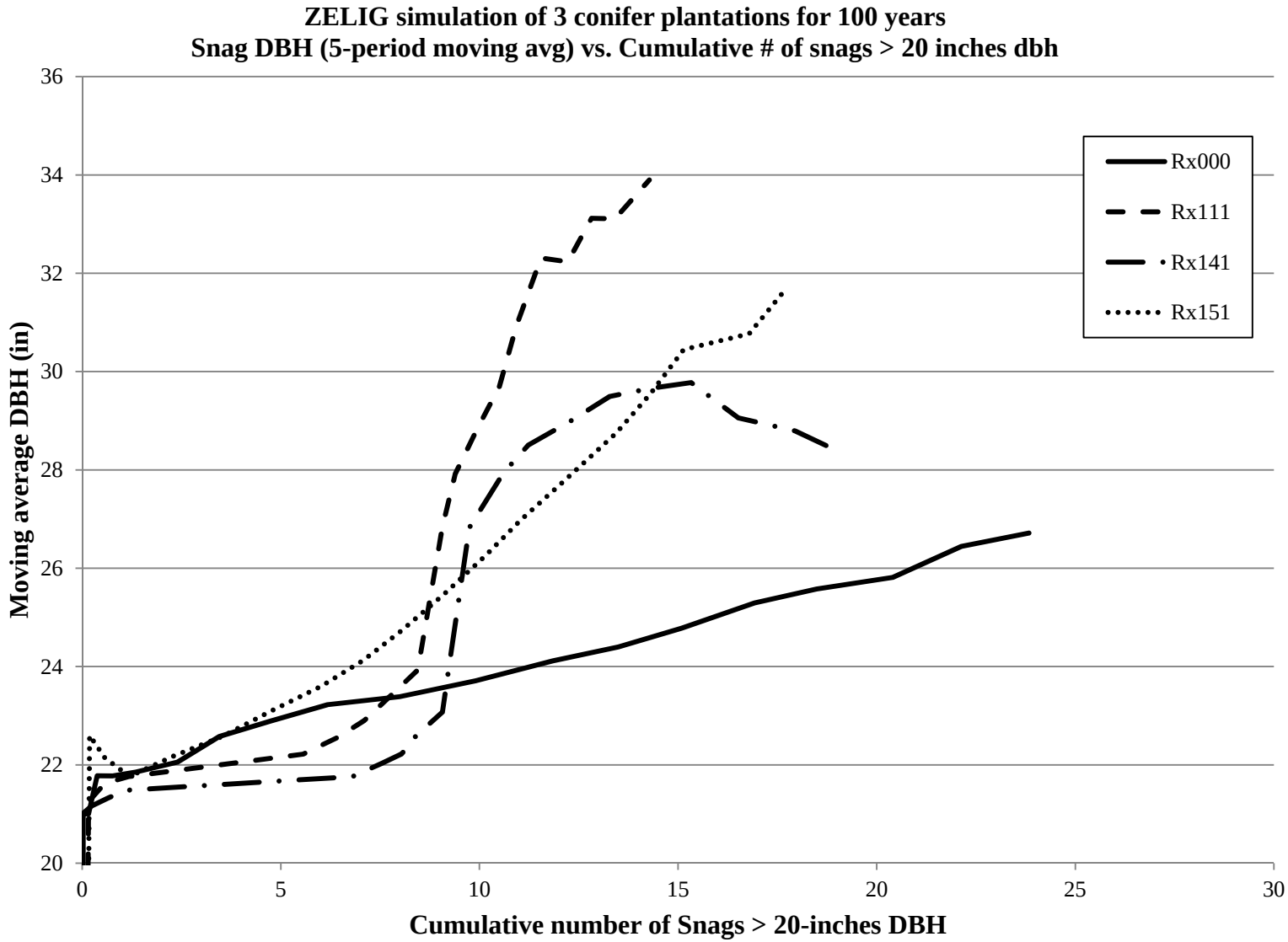
Tradeoffs between Size and Number of Snags for Different Thinning Prescriptions



Effects of thinning on number of cumulative number of 20 inch snags



Tradeoffs between Size and Number of Snags for Different Thinning Prescriptions



What do we know about Riparian Vegetation relative to uplands

- Structured by geomorphic template
- Interactions with stream
- Higher spatial heterogeneity
- Greater proportion of deciduous cover
- Shrub dominated areas often occur

What do we know about Riparian Vegetation relative to uplands

- Edge dominated
- More natural disturbances
- Multiple pathways of succession
- Structure and succession vary with stream size and distance from stream

Plantations differ from unmanaged riparian vegetation

- More uniform
- More conifers
- Smaller trees
- Less shrubs and hardwoods
- Less potential for big tree development

Thinning in plantations

- Can accelerate big trees and shrub layer
- Will reduce number of dead boles
- Use variable density approach
- Not all stands suitable for thinning
- Prioritize based on stand and landscape level considerations

Alternatives to Standard Riparian Buffer Prescriptions

- Based on fire regimes—variable width and shape
- Based on wood delivery potential
  - Not all streams have same potential
  - Vary width