

Planning and Management of Forested Agricultural Riparian Buffers

The Case of the Skagit County, Washington
Managed Agricultural Riparian Plantations
(MARP)

September 2006



Why managed buffers?

Riparian forests are the source of large wood (LW)
Ag lands are largely deforested
Afforestation of agricultural riparian margins begins
with designed silvicultural systems.



Purpose of this Study:

Silvicultural Strategies - Models for large wood (LW)

- Species, stocking densities
- Timing of thinning based on stream size

Constraints on this Study:

Empirical research lacking

Inadequate models for
riparian hardwoods

Non-native species not allowed

Dynamic natural systems





Design of Silvicultural Systems for Large Wood (LW)

Produce functional LW on less land ,
in less time.

Design Elements include

- * Species Composition
- * Stand Density
- * Intermediate Operations

Timing of thinning
LW Delivery times

- > Size at 50 years & 100 years
- > Time to meet minimum size



Thinning Concepts

Tree size and stand density relationships

---> Initial Stocking and Tree Growth

Thinning regimes

- * Selection criteria
(species composition, site suitability)
- * Thinning intensity
(residual density, canopy density)
- * Timing is key

Skagit County Functional Requirements -- LW target size by stream size

<u>Stream Size Class</u>	<u>Wood Diameter</u>	<u>Wood length</u>
0-20 feet (0-6 meters)	10 inches (~24 cm)	30 feet (~10 m)
20-40 feet (6-12 meters)	16 inches (~40 cm)	40 feet (~12 m)
40-60 feet (12-18 meters)	20 inches (~50 cm)	60 feet (~18 m)
>60 feet (>18 meters)	30 inches (~75 cm)	80 feet (~24 m)

Range of silvicultural systems for LW Conscription

<u>Silvicultural System</u>	<u>Density (TPA)</u>	<u>Management (years thinned)</u>
A	1600	None
B	1600	25
C	1600	20, 40
D	800	None
E	800	25
F	400	None
G	400	25

Forest Vegetation Simulation (FVS) Model

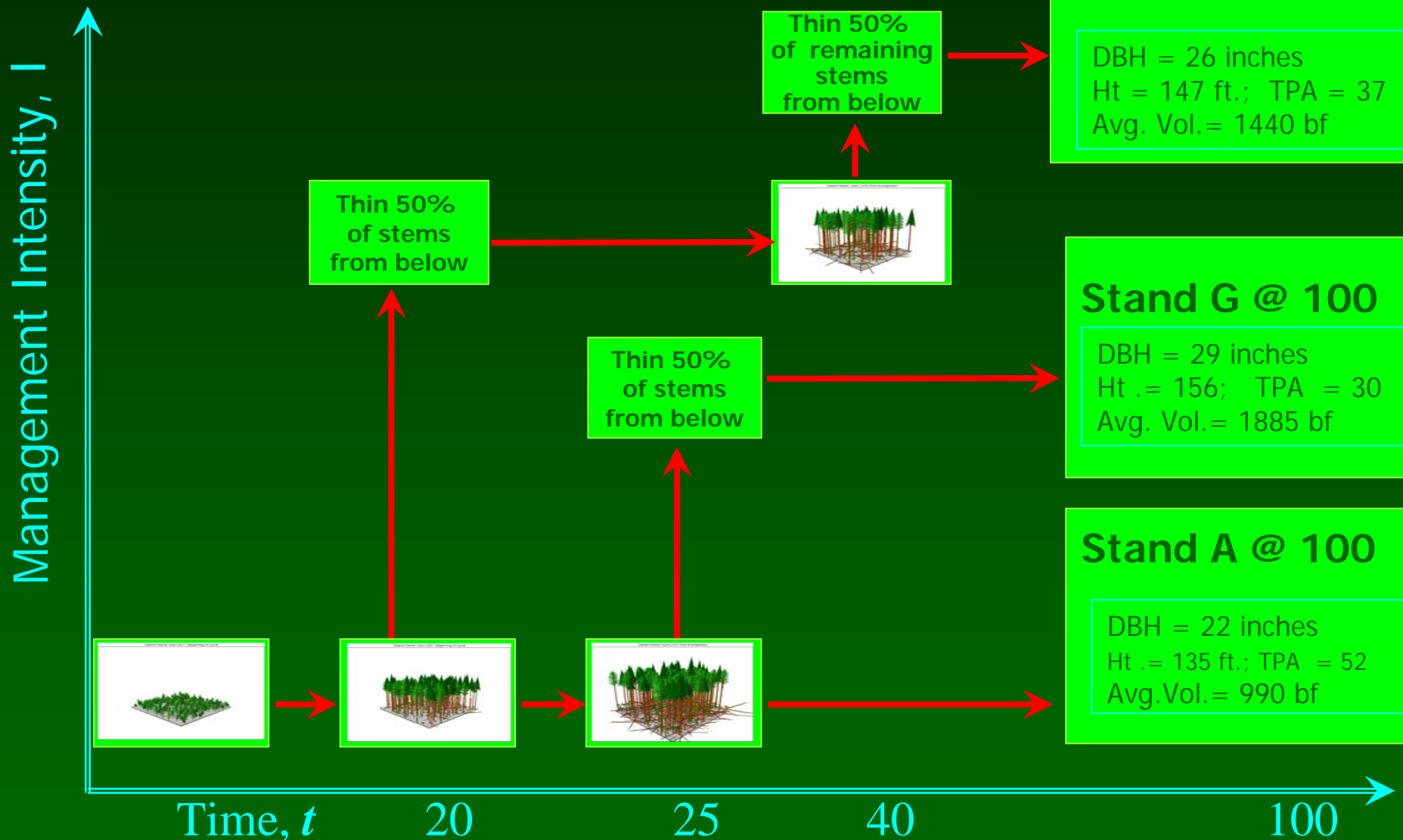
----->Stand Visualization System (SVS)

Results

Forest Vegetation Simulator (FVS; Wykoff 1982) for MARP silvicultural systems.

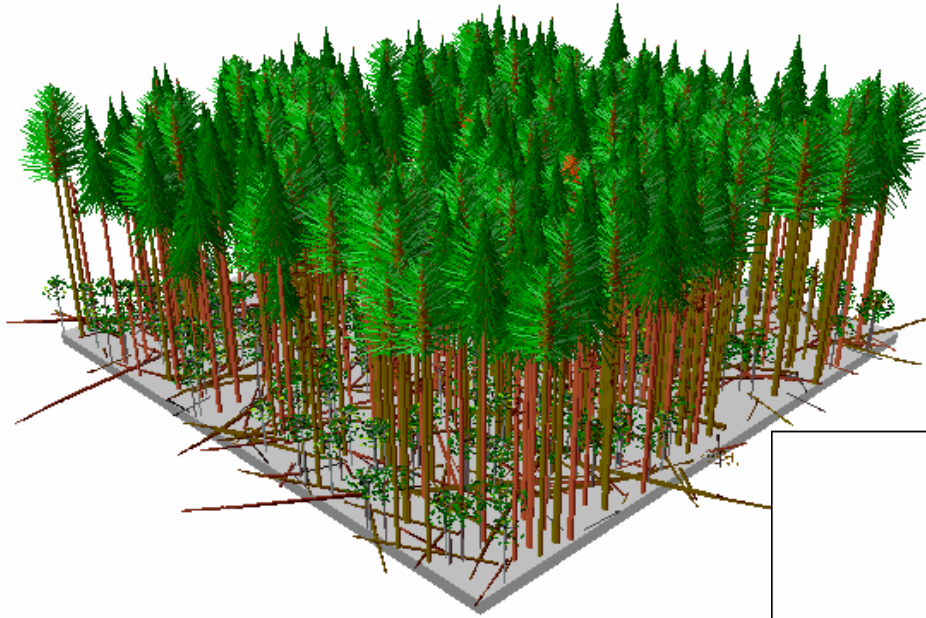
Silvicultural System	Yr 50						Yr 100								
	<i>Douglas-fir</i>				<i>Redcedar</i>				<i>Douglas-fir</i>			<i>Redcedar</i>			
(ID)	<u>dbh</u>	<u>ht</u>	<u>tpa</u>		<u>dbh</u>	<u>ht</u>	<u>tpa</u>		<u>dbh</u>	<u>ht</u>	<u>tpa</u>		<u>dbh</u>	<u>ht</u>	<u>tpa</u>
Stand A	15	90	153		12	95	149		24	137	54		22	135	52
Stand B	15	90	166		13	99	120		24	138	59		25	143	62
Stand C	15	90	157		12	97	143		24	138	55		23	137	50
Stand D	18	95	101		15	105	97		27	141	39		26	148	37
Stand E	18	95	106		15	105	100		27	142	42		26	147	40
Stand F	20	99	64		17	113	61		30	144	28		29	157	27
Stand G	21	99	70		17	113	66		31	146	33		29	156	31

Redcedar, LW

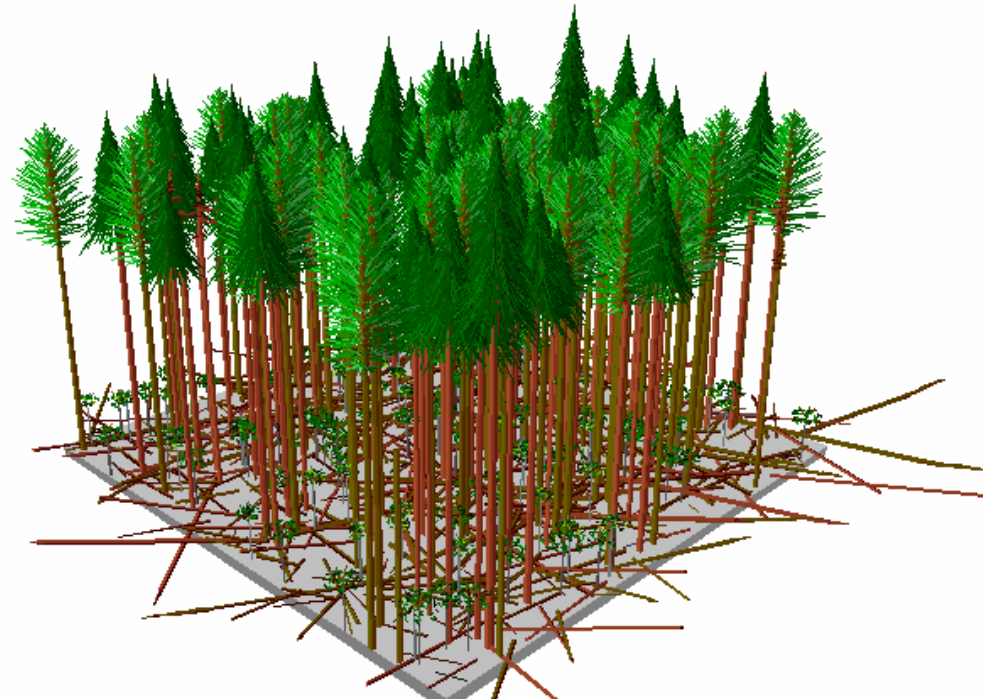


$$\text{Target, } LW_i = \sum_{i=A}^G f^G(I, t)$$

Results of Stand Visualization System

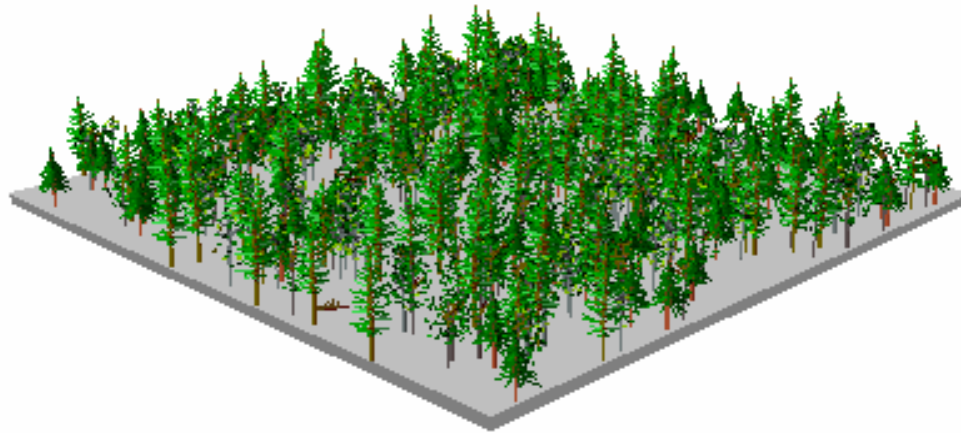


Stand A at Age 50

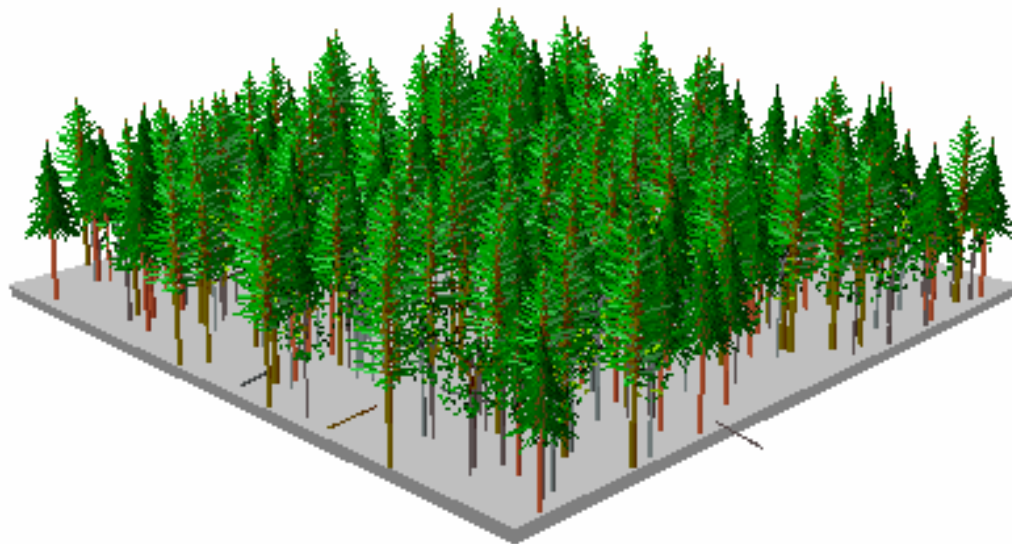


Stand A at Age 100

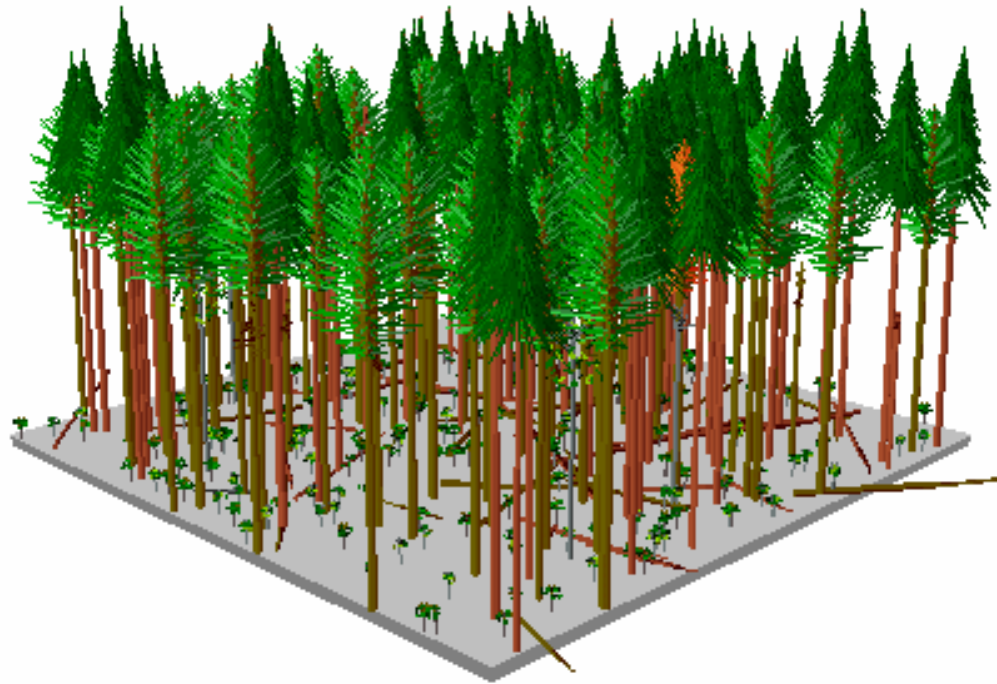
Stand A at Age 15



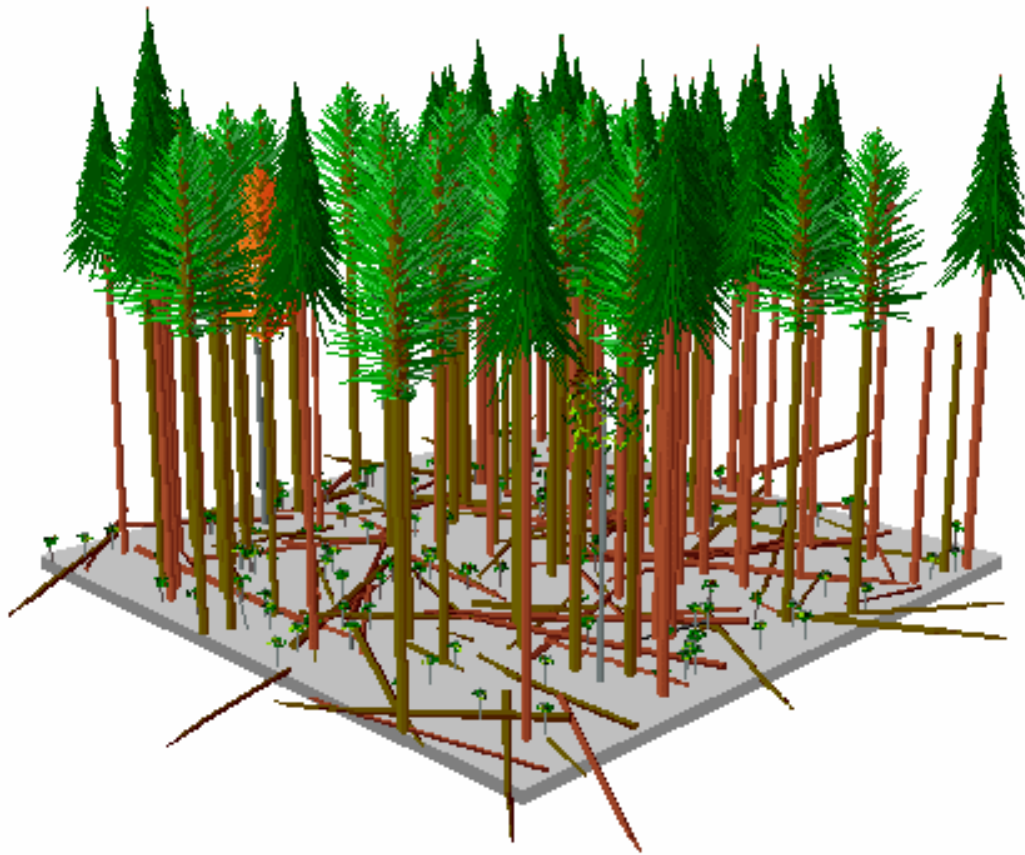
Stand A at Age 40



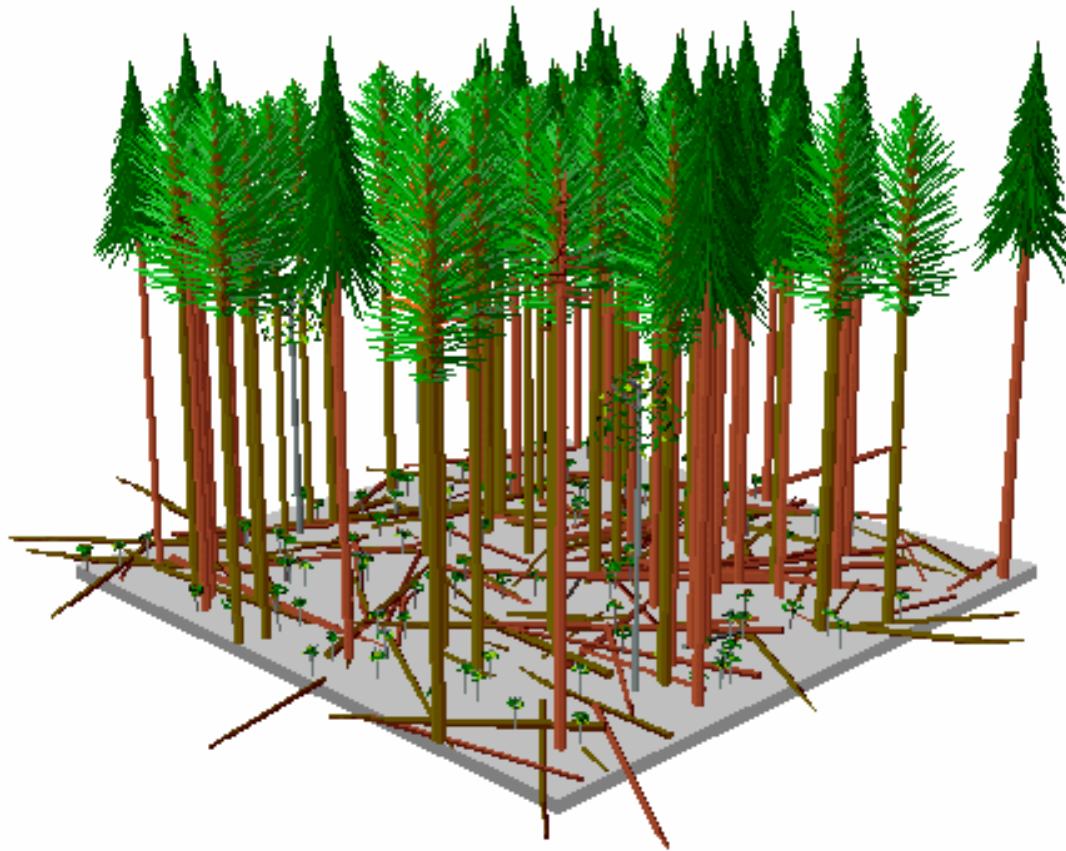
Stand A at Age 50



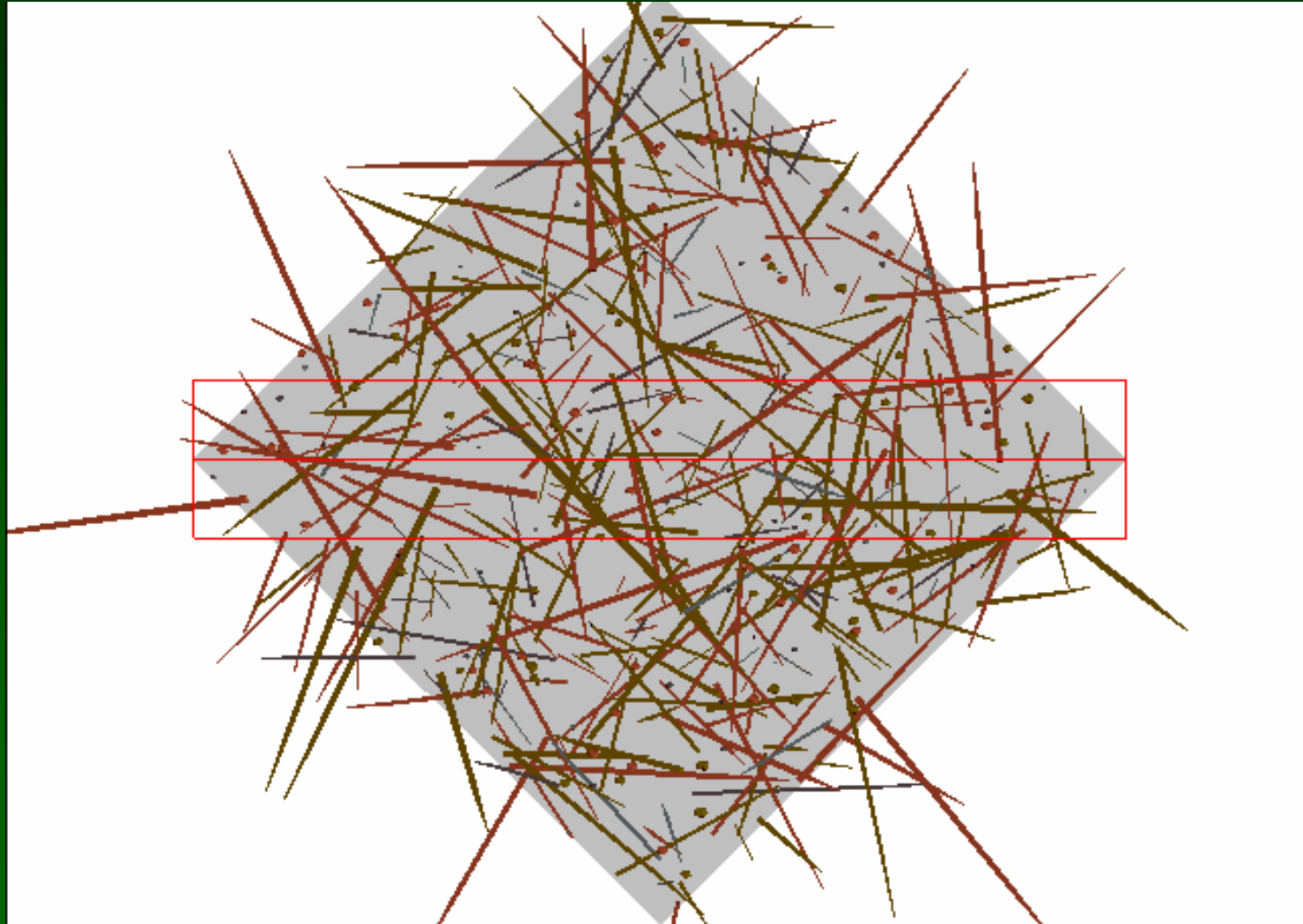
Stand A at Age 80



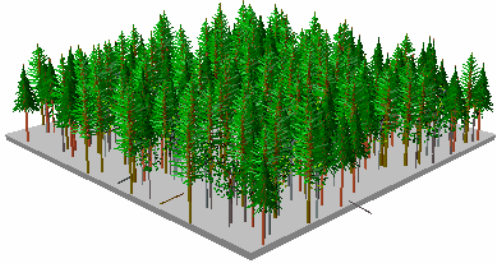
Stand A at Age 100



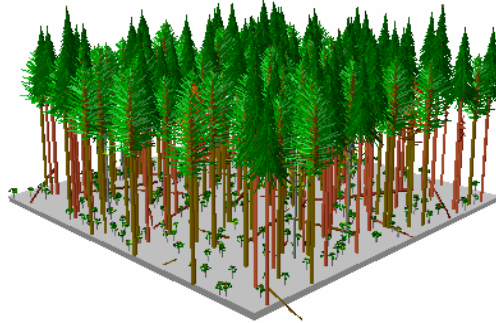
Large Wood (LW) / Dead Wood Component



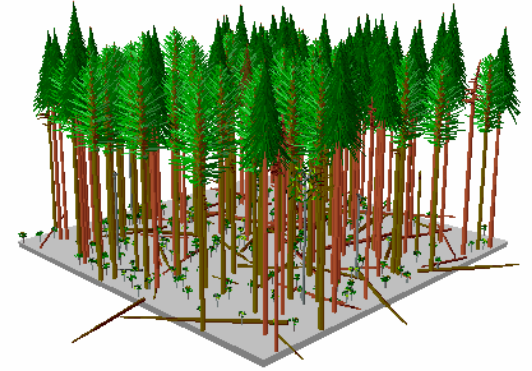
Age 25



Age 45

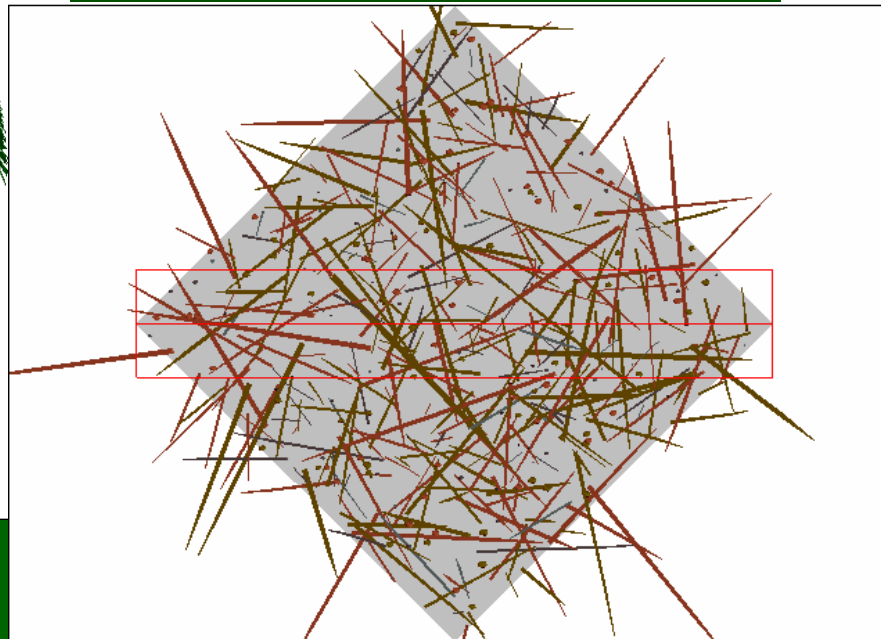
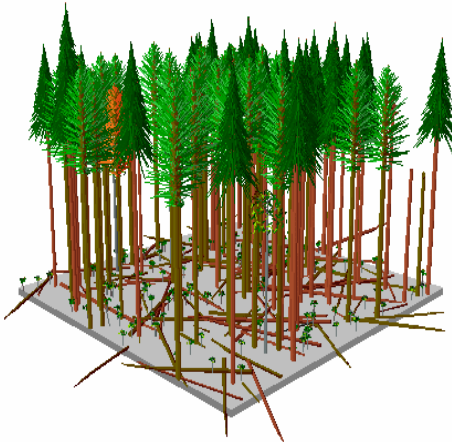


Age 65

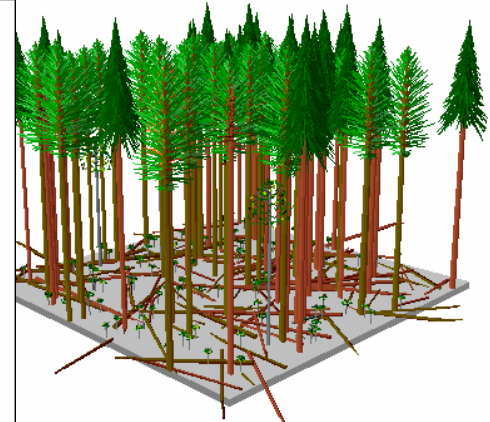


Stand A - Age 25 to 100

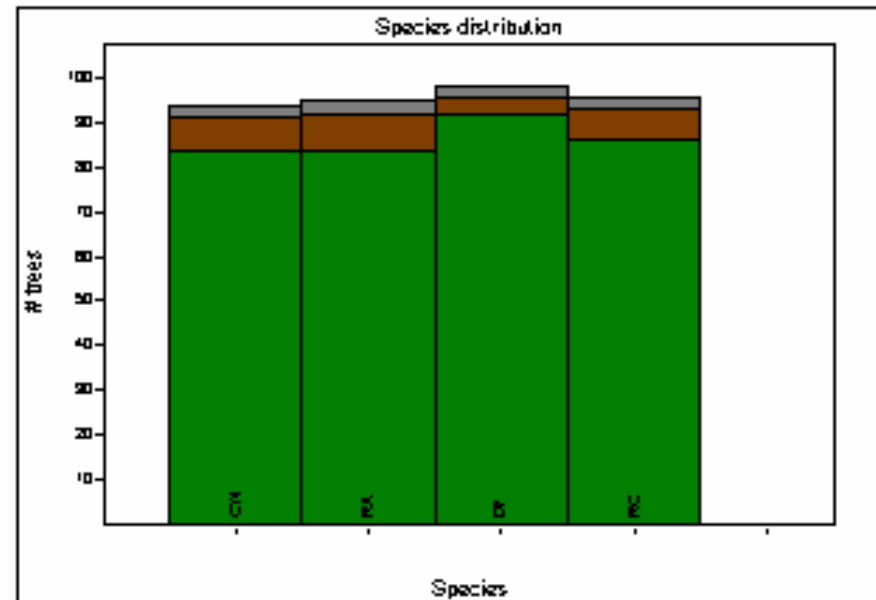
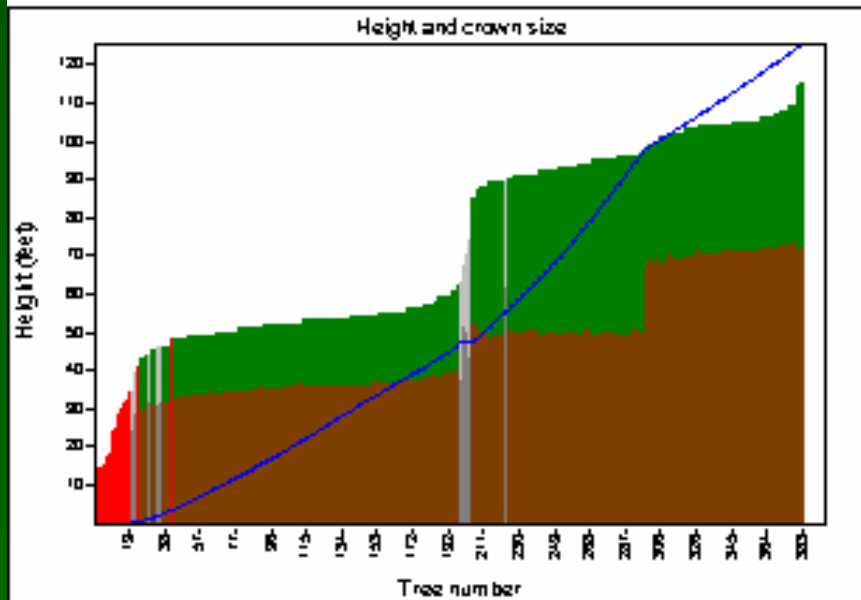
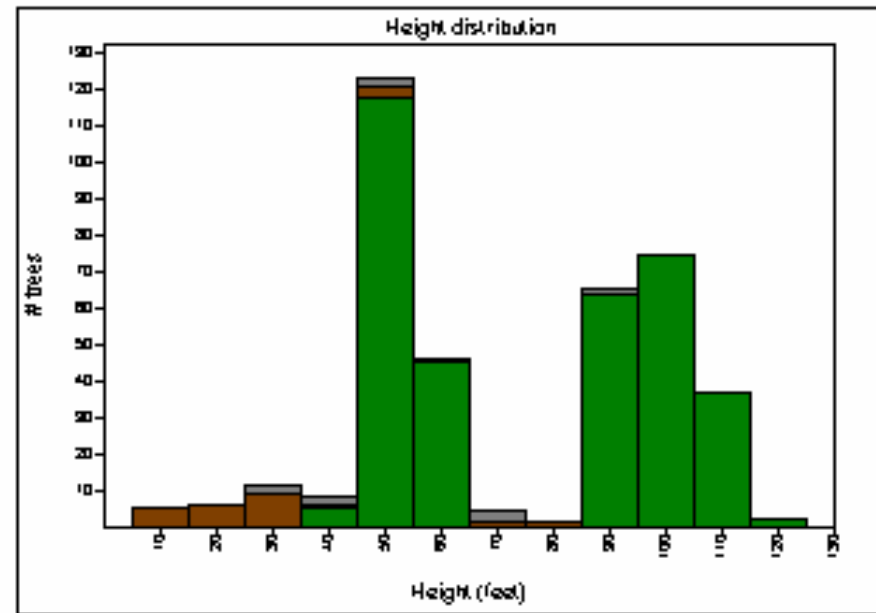
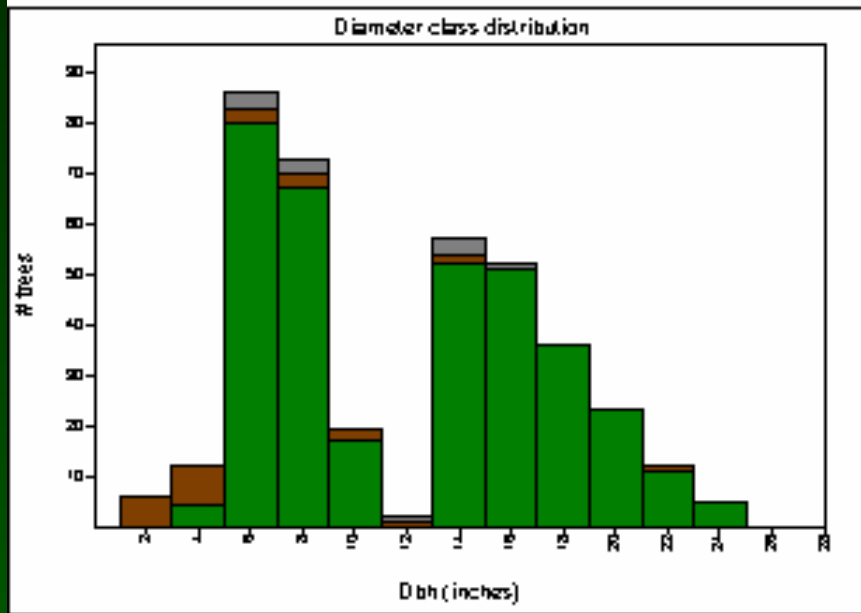
Age 85



Age 100



SVS graphic display of FVS data for mixed species MARP stands



Scenarios Meeting Target Conditions

Width Class	Target Diameter	At Age 50		At Age 100	
		DF	RC	DF	RC
Feet (m)	Inches (cm)				
10 – 16 <i>(3 – 5)</i>	12.8 - 14.5 <i>(23.5 – 36.8)</i>	A,B,C,D, E,F,G	D,E,F,G	ALL	ALL
20 – 33 <i>(6 – 10)</i>	15.3 - 18.7 <i>(38.7 – 47.5)</i>	E,F,G	---	ALL	ALL
36 – 50 <i>(11 – 15)</i>	19.5 - 22.9 <i>(49.5 – 58.2)</i>	F,G	---	ALL	ALL
52 – 66 <i>(16 – 20)</i>	23.7 - 27.1 <i>(60.2 – 68.8)</i>	---	---	D,E,F,G	D,E,F,G

Year tree size equals or is greater than target DBH by stream size, silvicultural system, and species.

Douglas-fir

<i>Silv. Sys.</i>		Stream Width (m)			
Density	ID	< 5	< 10	< 15	< 20
1600	A		2042		
	B	2032		2062	2077
800	C		2047		2062
	D			2047	
	E	2027	2037	2052	2067
400	F			2047	
	G	2027	2037	2042	2057

Redcedar

<i>Silv. Sys.</i>		Stream Width (m)			
Density	ID	< 5	< 10	< 15	< 20
1600	A	2047	2062	2077	2087
	B	2042	2057	2067	2082
	C	2047	2062	2077	2092
800	D			2067	2082
	E	2042	2057	2072	2087
400	F			2062	
	G	2037	2047	2062	2077

Conclusions

Initial stand density has the single largest impact on targets.

Target LW size at Specific ages (50 & 100 years)

Time to achieve earliest target threshold

These silvicultural systems offer landowners several options:

- In-stream LW meets or exceeds proposed standards
if active management is employed.
- If financial incentives are required,
then surplus LW yield is sold.
- If growth targets are insufficient,
then delivery can be deferred.

Next Steps

- More empirical research
- Best Available Science debate resolution
- Regulatory reform
- Economic incentives

Acknowledgements

Agriculture For Skagit County (ASC)

Riparian Forest Stand Coop - R-PSP

Former Skagit County Commissioners

Erin Hansen, Skagit Co. Public Works

Sara Hemphill, Sustainable Ecosystems Institute

Kathryn Young-Berg, Wild@Heart