



Forest Dynamics Studies in Sub-Boreal Spruce Forests

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Background

- ☞ Stand dynamics studies started with the Date Creek study
 - began model development based on SORTIE small-scale disturbance model from eastern US
- ☞ Mountain Pine Beetle has focused attention on SBS (several ongoing studies)
- ☞ Formation of BV Research Centre

Part of a Bigger Picture

- ☞ SORTIE related studies across Canada
 - Quebec (Iac Duparquet Research Forest and southern mixed hardwoods: C. Messier, M. Beaudet, B. Harvey, J. Poulin, M. Papaik)
 - Ontario (black spruce and southern mixedwoods: J. Caspersen and students at U of Toronto)
 - Alberta (spruce-aspen: Rasmus Astrup, UBC)
 - Labrador (B. Woods, Metis Nation)
- ☞ Collaboration with other research groups in tropics and New Zealand

Neighbourhood Dynamics Research Approach

- Recruitment of new individuals
- Growth
- Mortality
- Scale from individual tree responses to stand dynamics

Sub-Boreal Spruce Studies

- Juvenile tree growth (up to 5-8 cm DBH)
 - on going studies for several years, new detailed work by Rasmus Astrup, UBC
- Adult tree growth
 - significant progress over past 2 years (BV Centre)
- Mortality
 - several studies, a very difficult topic (new FSP Project, Rasmus Astrup)
- Snags
 - sorting out light transmission and fall rates in MPB

More Sub-Boreal Spruce Studies

➤ Natural regeneration

- new BV Centre Project starting this year in MPB damaged stands
- looking at regeneration since MPB attack

➤ Advance Regeneration

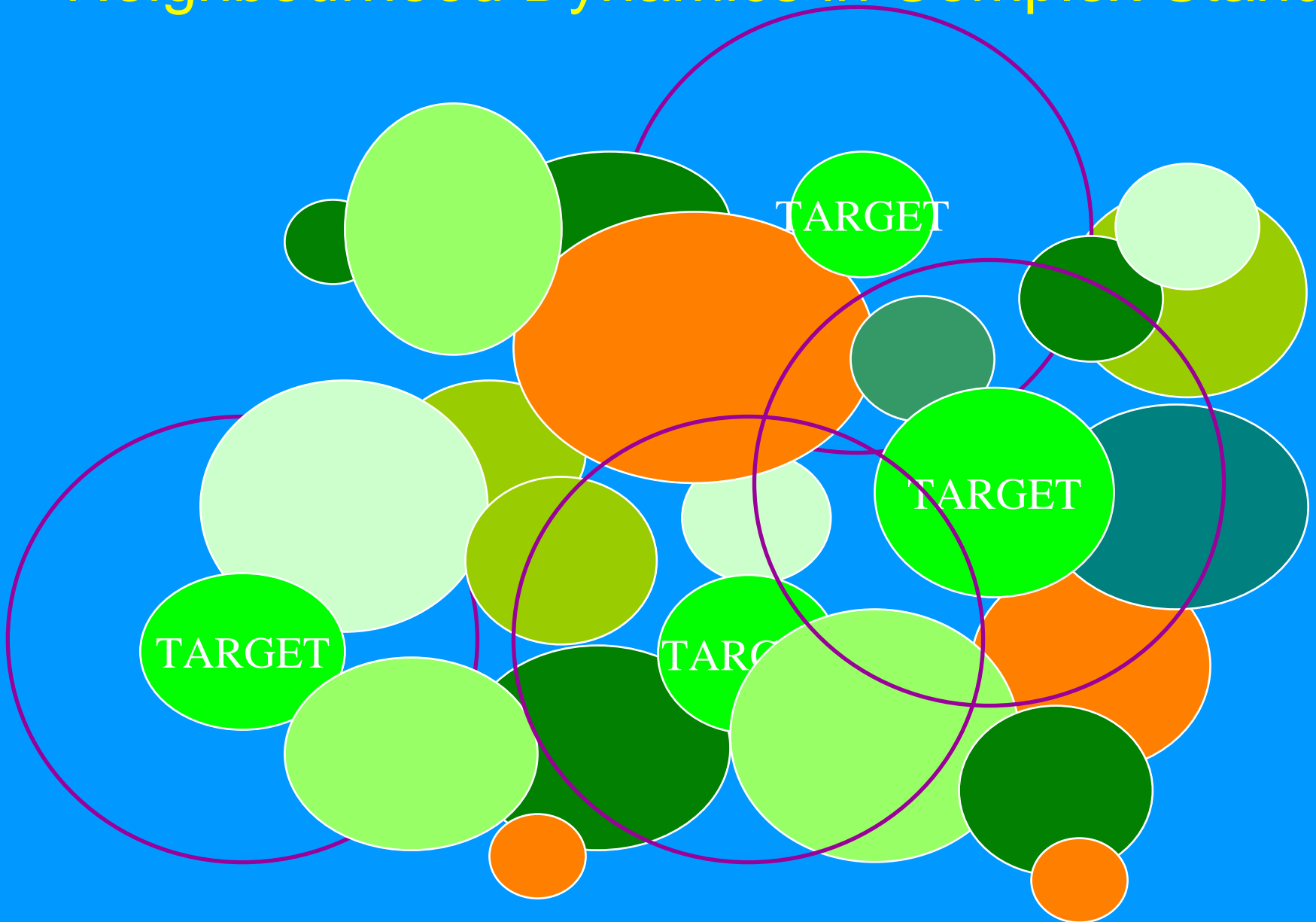
- Phil Burton, CFS, using same methods as natural regeneration in MPB damaged stands

➤ **All these studied link into SORTIE model**

Focus on Complex Stand Management

- ☞ Infinite variety of spatial and temporal configurations of removal (or retention)
 - different tree species
 - tree sizes
- ☞ How to predict stand dynamics?
 - regeneration, growth, mortality

Neighbourhood Dynamics in Complex Stands



SORTIE-ND

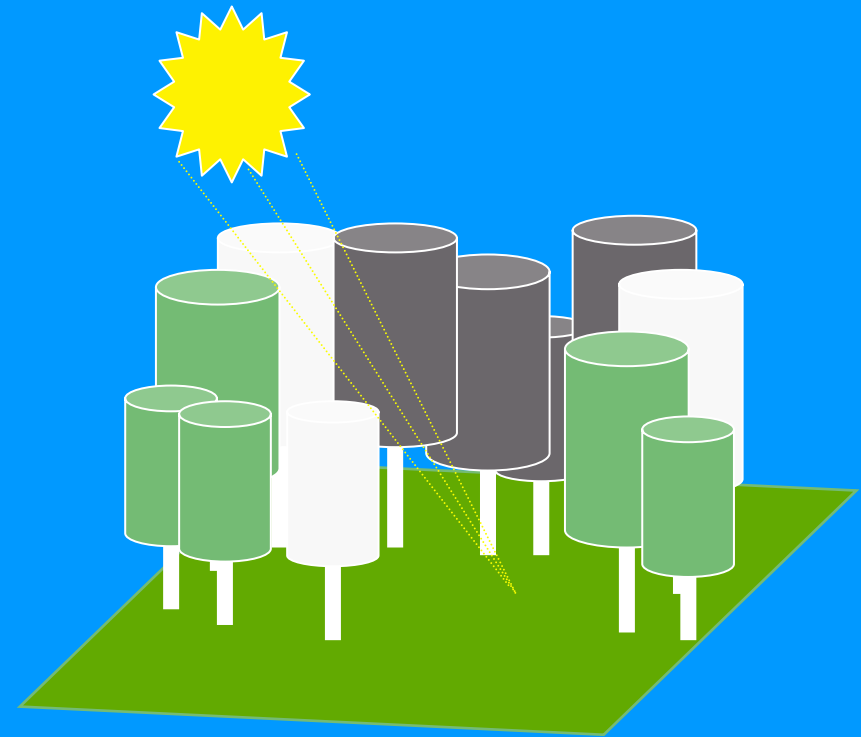
(re-engineered version of original SORTIE)

☞ Spatially-explicit

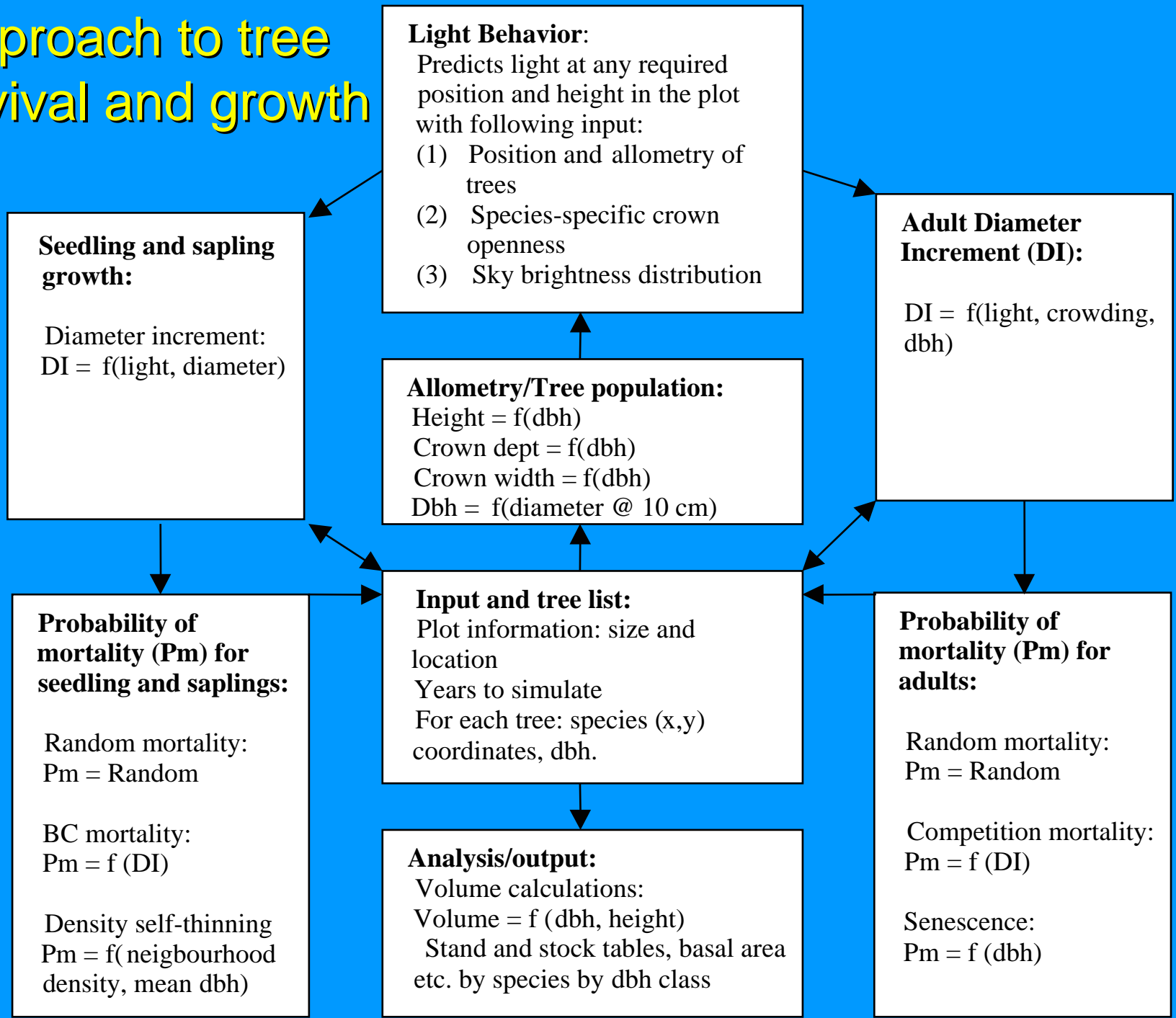
- position of each tree defined

☞ Permits simulation of

- complex mixed-species stands
- partial cuts
- all forms and types of openings (gaps, patch cuts)



Approach to tree survival and growth



SORTIE Model: Sub-boreal spruce zone

Open output files: ... Lecture\Output\Silvics2_3sp_undersnags.out Display choices for this file: Whole plot: Table Draw

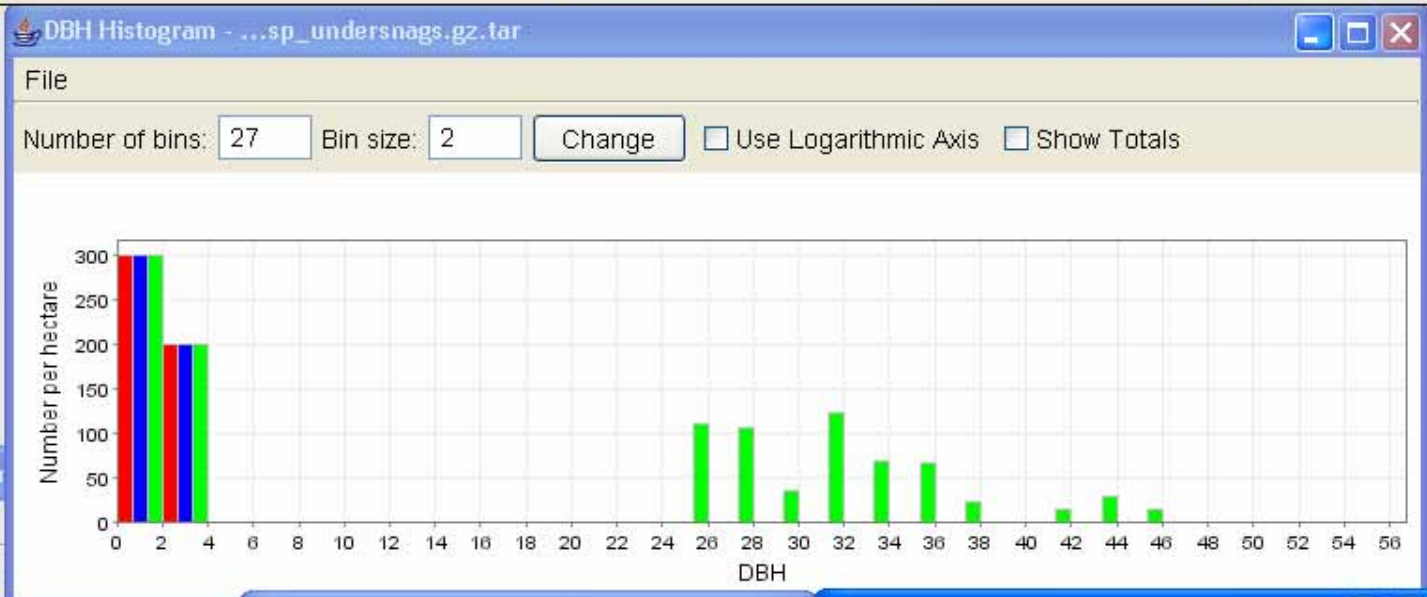
Silvics2_3sp_un...

- Subalpine Fir
- Hybrid Spruce
- Lodgepole Pine
- Trembling Aspen

Showing timestep: 0 of 20

Rate: 1 timestep(s)

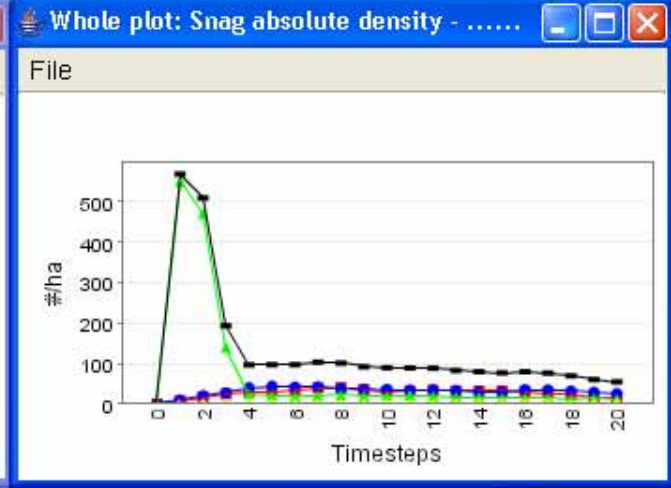
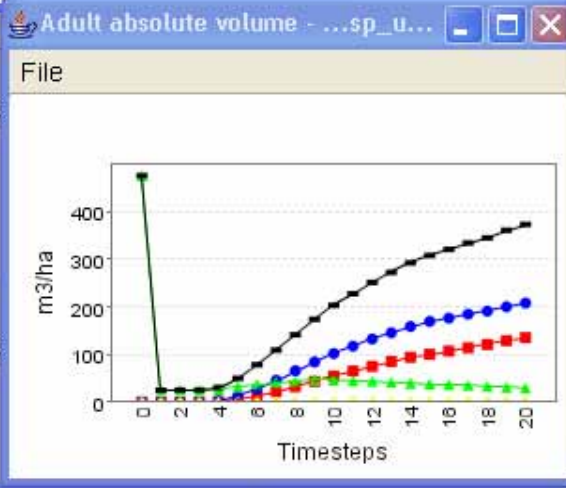
Go to timestep: 0 Go



Density is in #/ha, basal area in sq. m/ha

Adults			
Species	Abs Den	Rel Den	Abs BA
Subalpine Fir	100.75		0.098
Hybrid Spruce	104.75		0.101
Lodgepole Pine	687.5		45.799
Trembling Aspen	0		0
Total	893		45.998

Snags			
Species	Abs Den	Rel Den	Abs BA
Subalpine Fir	0		0
Hybrid Spruce	0		0
Lodgepole Pine	0		0
Trembling Aspen	0		0



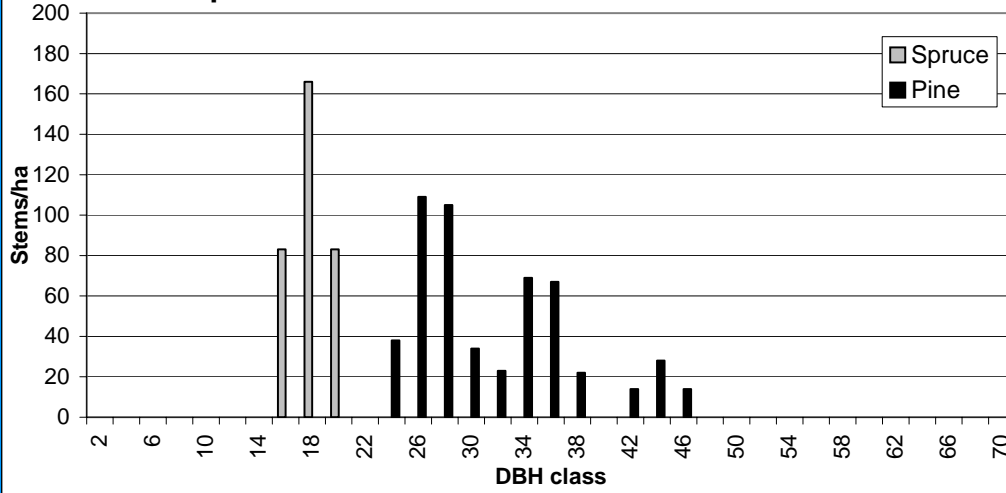
MPB Silvicultural Strategies

- Full salvage and plant
 - Salvage with protection of residual trees
 - No salvage & underplant
 - No salvage
- ➡ Need predictions of Future yield

Major Stand Types

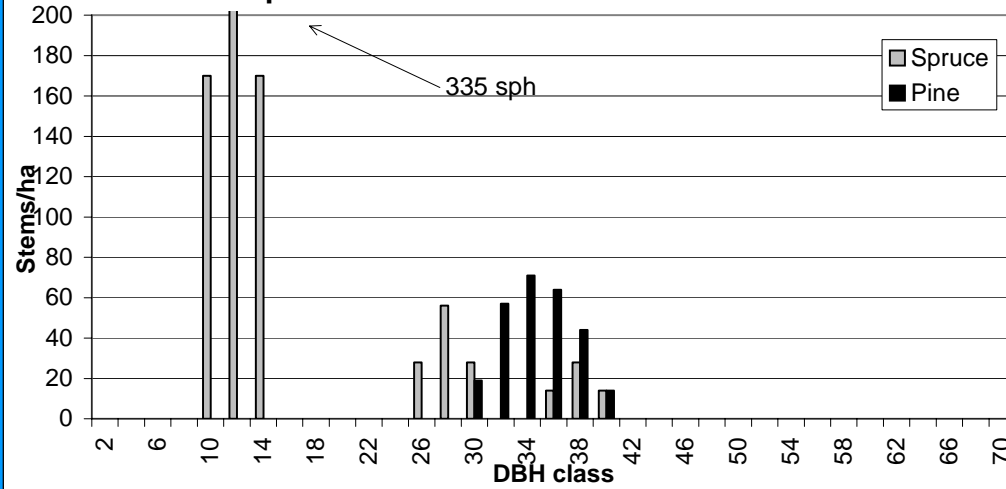
- Pine Dominant
 - Pine Minor Spruce
 - Mixed Pine – Spruce
 - Spruce Minor Pine
- ☞ Modelled several silvicultural scenarios to explore the implications on different stand types.

Pine minor Spruce Stand



	Density	Basal Area
Spruce	332	7.6
Pine	523	39.8
Total	855	47.4

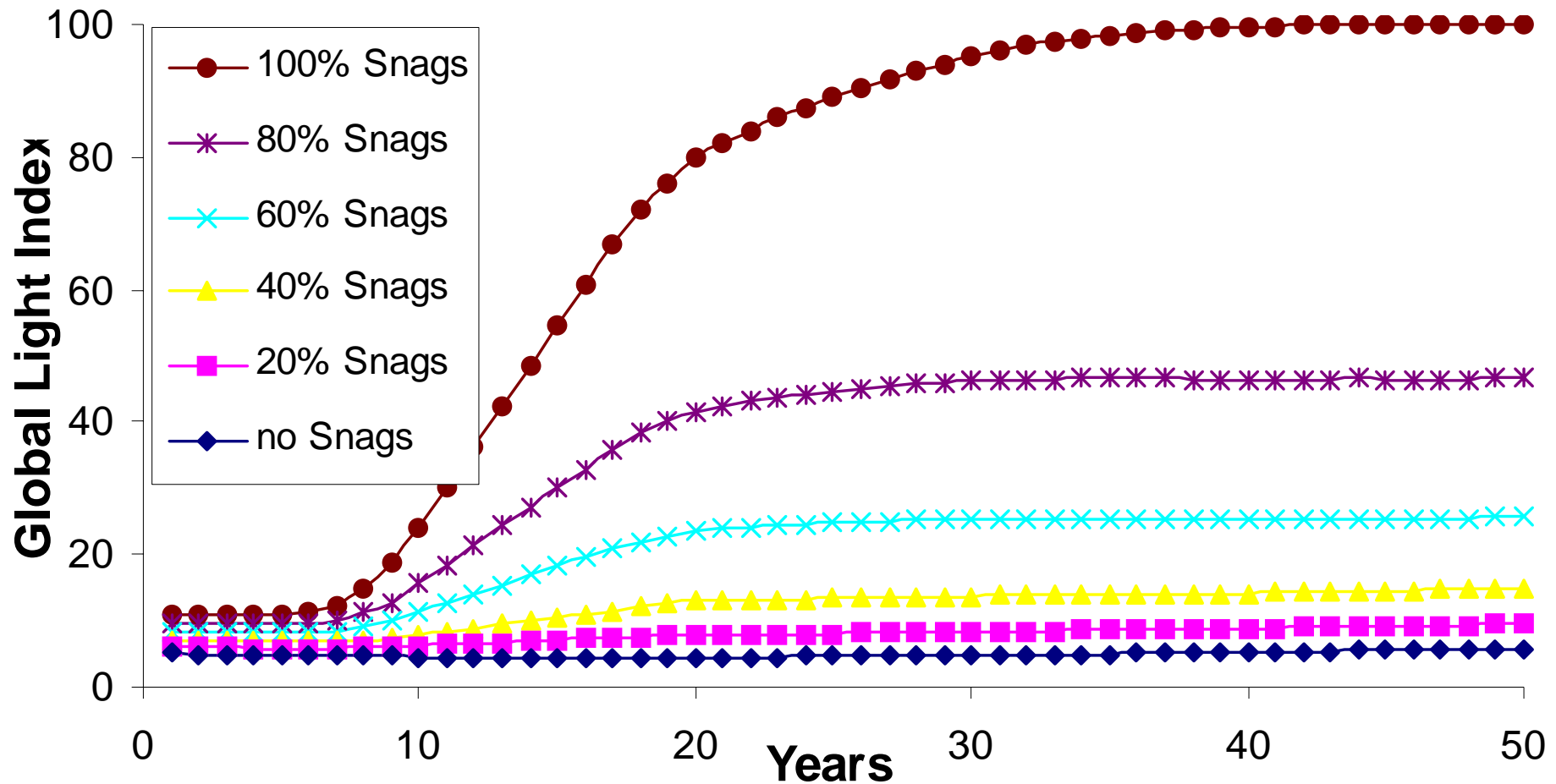
Mixed Pine and Spruce Stand



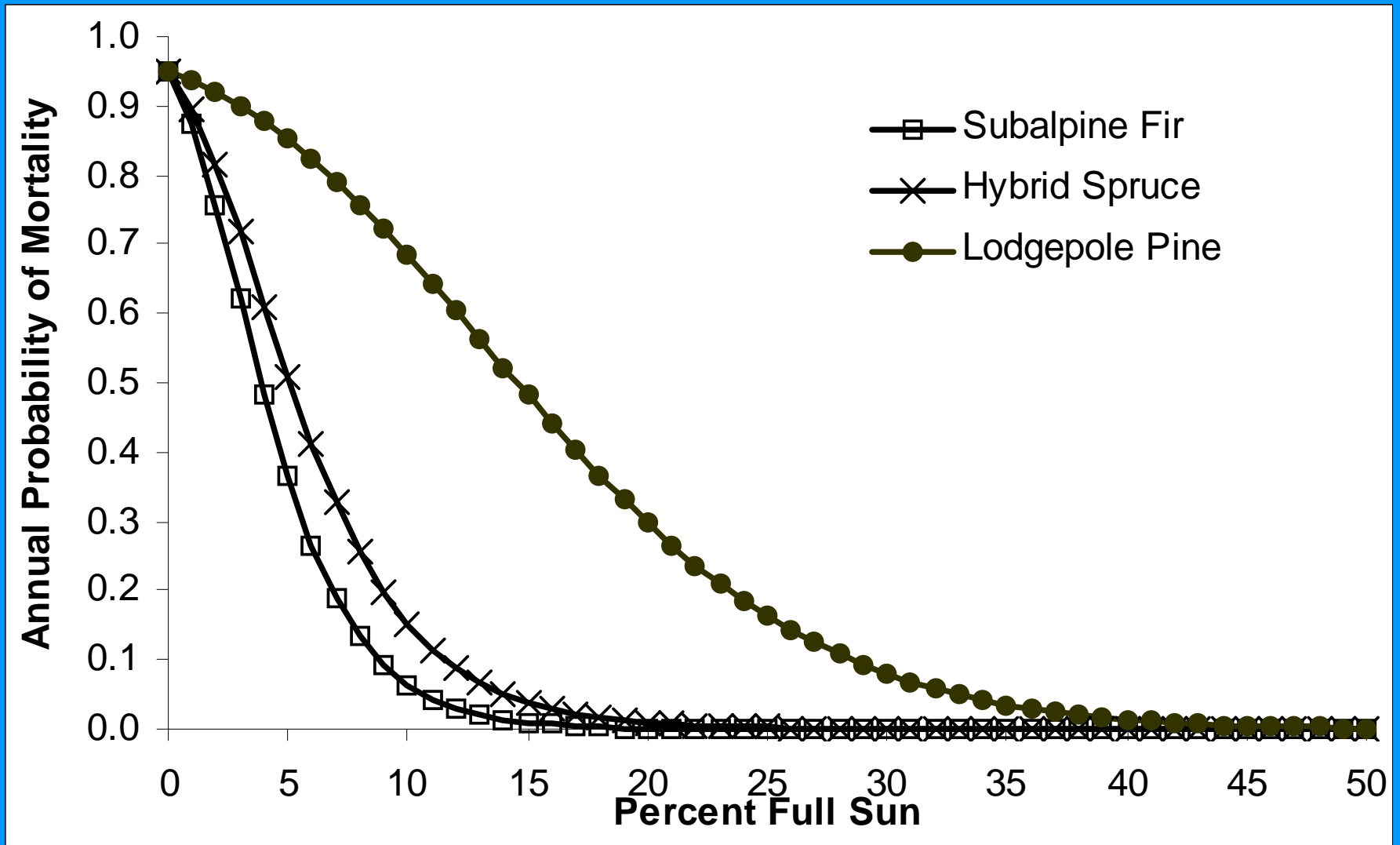
	Density	Basal Area
Spruce	848	19.1
Pine	269	24.2
Total	1117	43.3

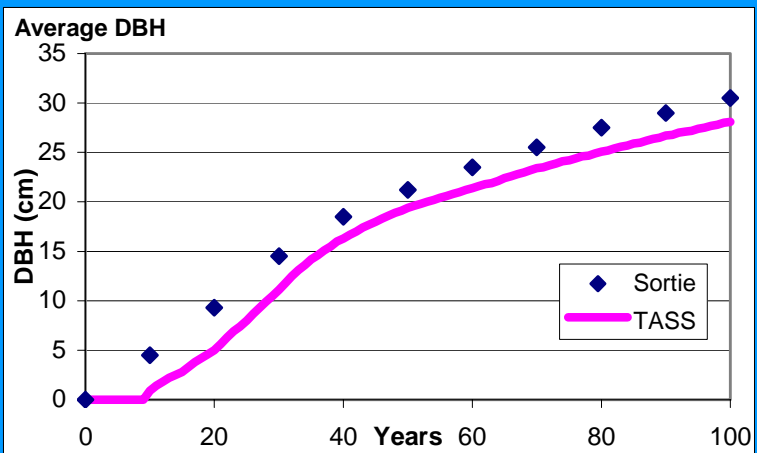
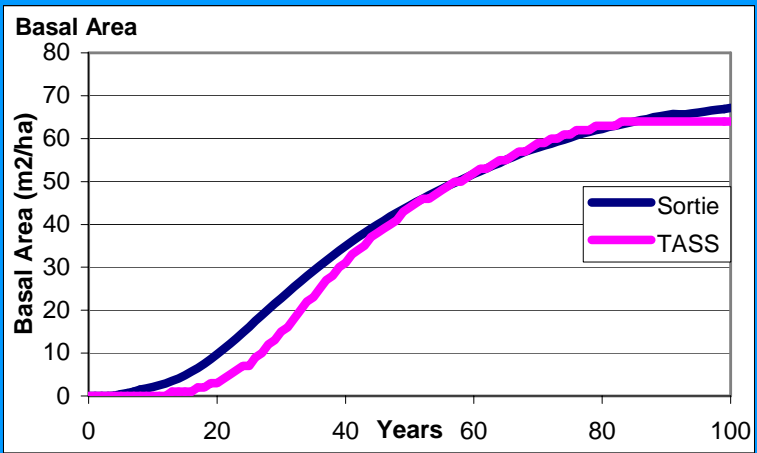
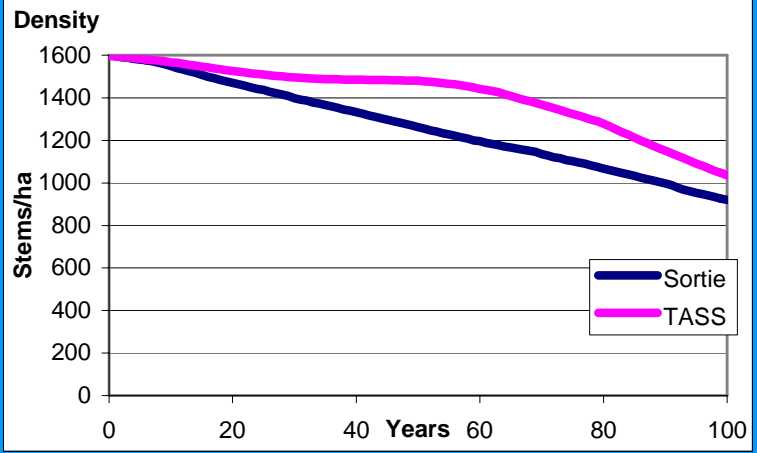
Effect of snags on light transmission

Light Levels under a Pine dominant canopy with varying intensities of MPB attack



Effect of light levels on seedling survival



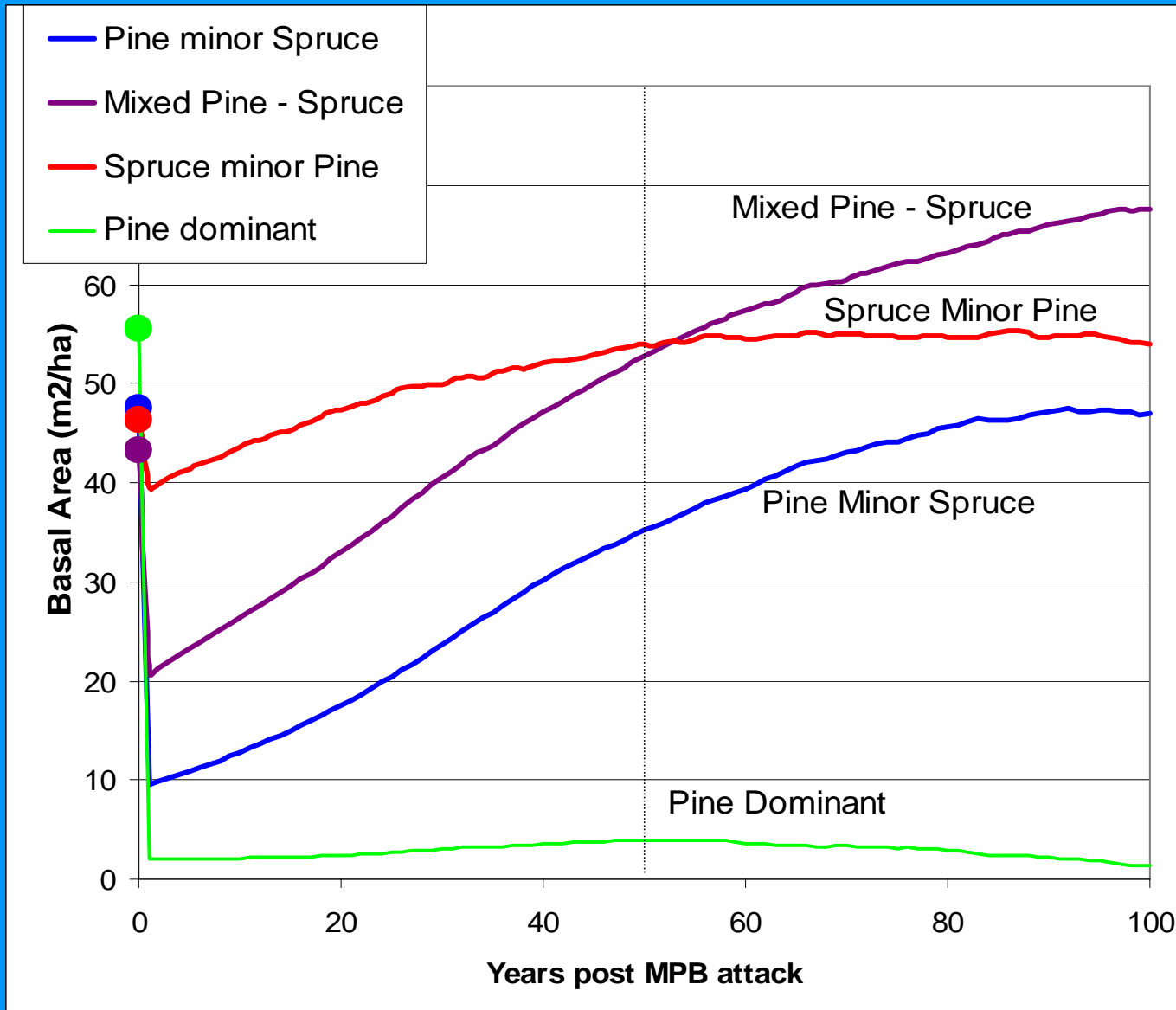


Comparison of spruce density, basal area and average DBH in TASS and SORTIE-ND

Basal area (m²/ha) of the four major stands pre-attack, 50 and 100 years post-attack with no management intervention.

Stand Type	Basal Area						
	Pre-MPB	50 years post-MPB			100 years post-MPB		
		Spruce	Pine	Total	Spruce	Pine	Total
<i>Pine Minor Spruce</i>	47.4	33.4	1.9	35.2	45.9	1.1	47.0
<i>Mixed Pine - Spruce</i>	43.3	51.9	0.9	52.7	67.1	0.5	67.6
<i>Spruce Minor Pine</i>	46.6	53.7	0.2	53.9	53.9	0.1	54.0
<i>Pine Dominant</i>	55.5	0.0	3.9	3.9	0.0	1.3	1.3

Stand Development without Salvage



Effect of Timing when Underplanting Spruce

Planting Delay (years)	Planting Survival at 20 years (stems/ha)	Basal Area at 100 Years: (m²/ha)
2	237	47.0
4	452	50.5
6	758	57.2
8	1134	60.4
10	1297	60.8