Returns and Yields

2005 AFA Landowner Clinic

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Magnolia, Arkansas

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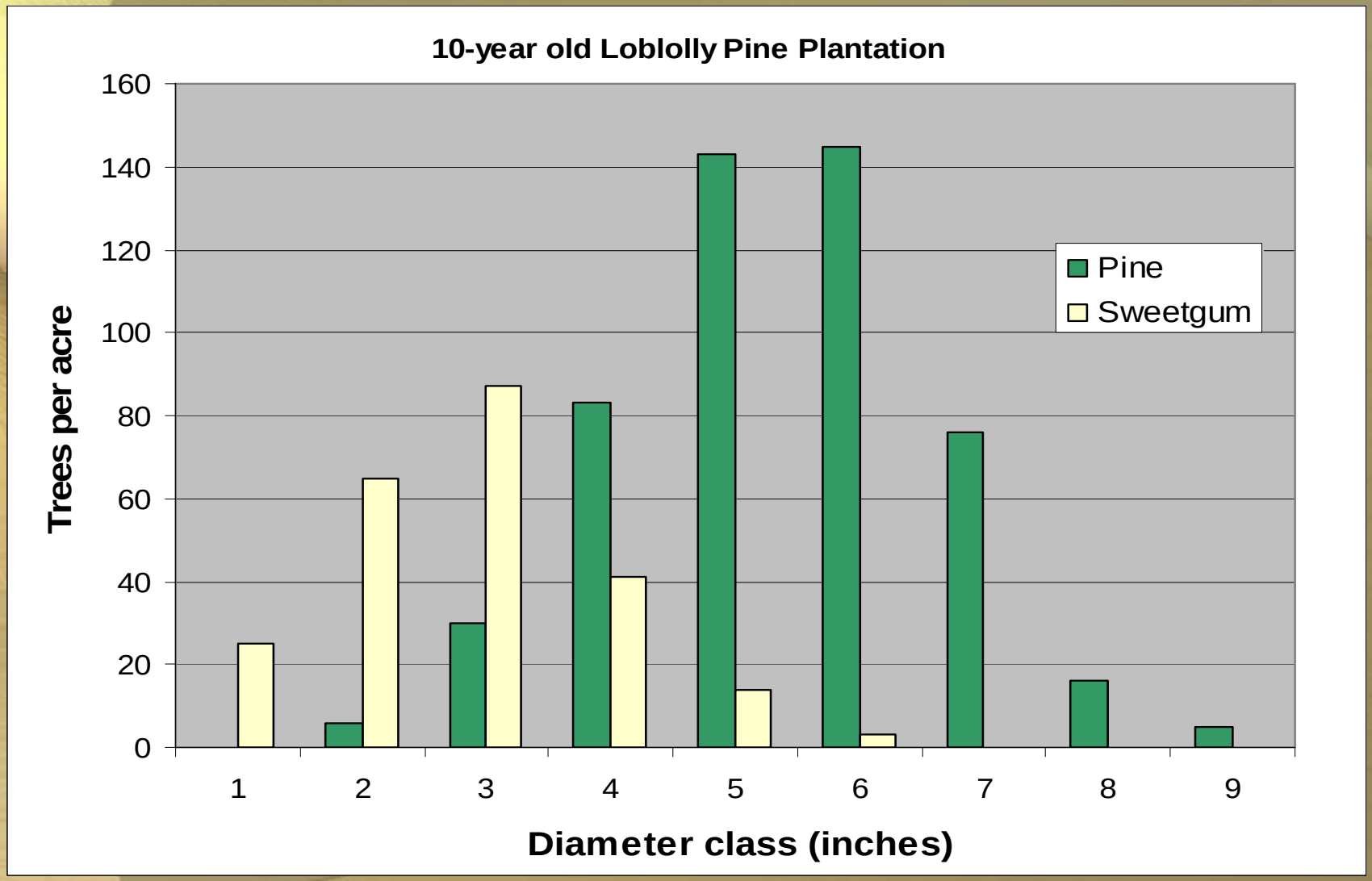
Situation

- 10-year old loblolly pine plantation
- Site index 95 at 50 years
- History:
  - Harvested in 1995
  - Prescribed burning for site preparation in fall of 1995
  - Hand planted on 8x10 spacing in early 1996
- At age 10, pine survival is good, but there is a lot of sweetgum in the stand

Diameter class / species distribution



Mid-rotation release

- Aerial application of herbicides
  - Arsenal ®
    - Imazapyr
    - 16 oz. / acre
  - Escort ®
    - Metsulfuron methyl
    - 1 - 2 oz. / acre
  - After July 15 but before mid-October

How to calculate rate of return

- Need to know effects that can be attributed only to the herbicide application!
- "With and without" method of determining marginal benefits
  - Field studies
    - Require $$ and take a long time
    - Results are good for included sites
  - Computer-based simulations
    - Cheaper, faster
    - Can test under greater number of conditions
    - Quality of results?

Forest Vegetation Simulator (FVS)

- Developed by U.S. Forest Service
- Individual-tree growth model
- Models for specific regions of USA (LS, CS, NE, SN, SE, PNW, RM, AK)
- Advantages
  - Can program many treatments
  - Self-calibrating
  - Based on very large data set
- Disadvantages
  - Complex software
  - No fertilization regimes for SE USA
  - Requires detailed stand data

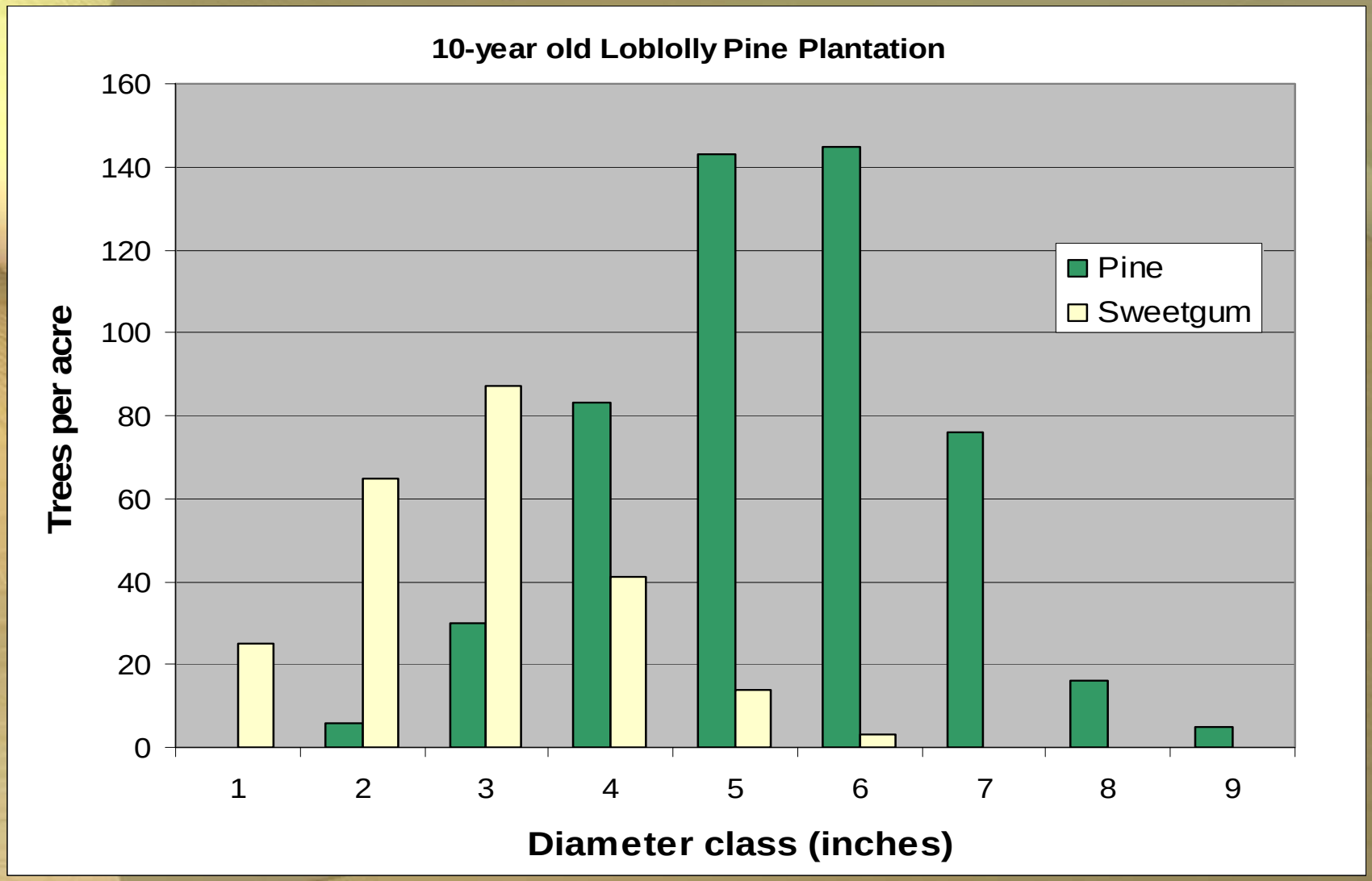
Using FVS to analyze herbicide returns

- Baseline simulation
  - Grow 10-year old stand to age 30
  - Examine yields
- Herbicide treatment
  - Simulate killing 80% of hardwoods
  - Grow stand to age 30
  - Examine yields
- Marginal analysis (value of herbicides)
  - Cost of herbicide treatment ($90)
  - Value of additional volume, if any

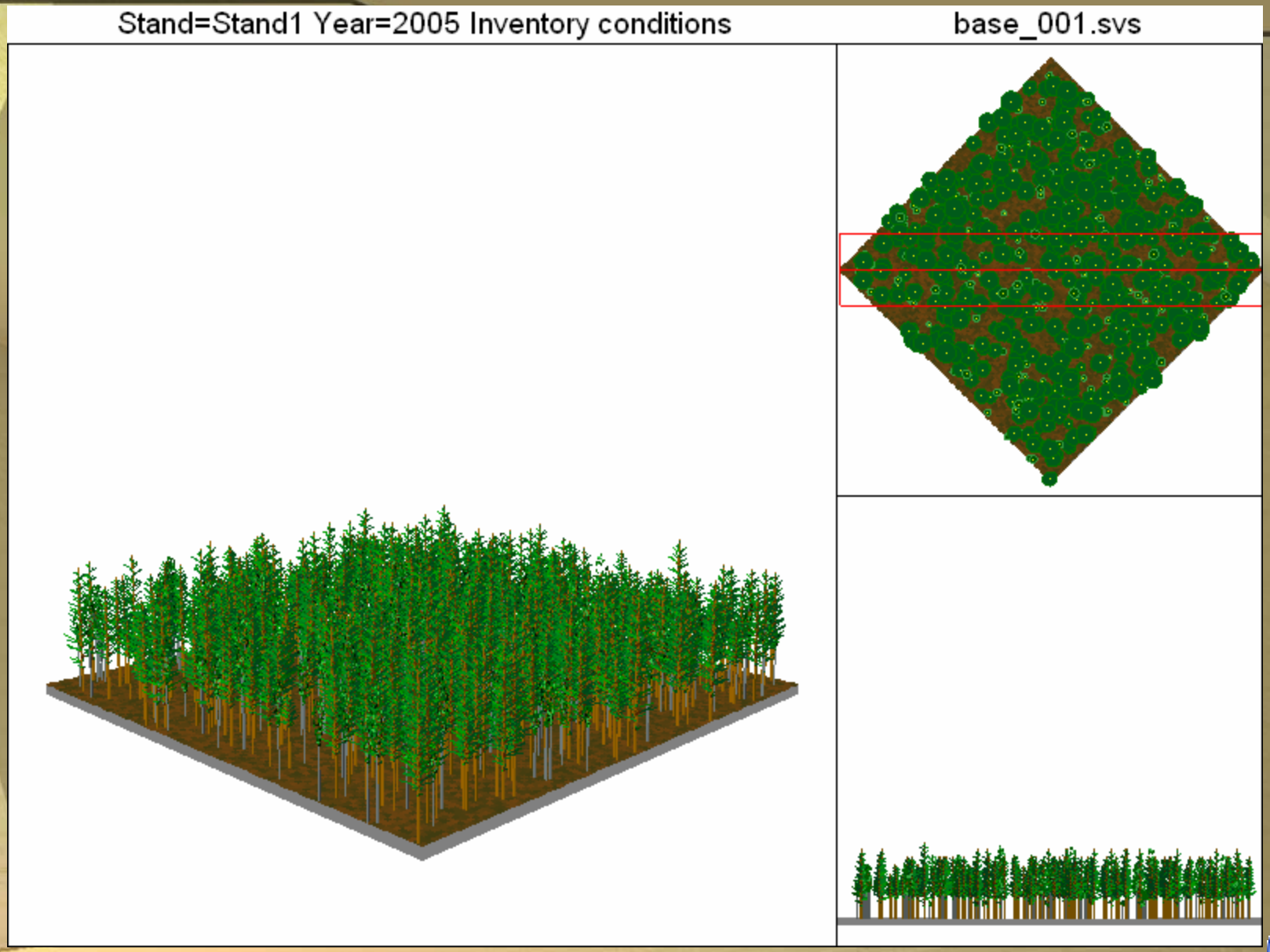
Baseline simulation

- 510 pine stems per acre
- 235 sweetgum stems per acre

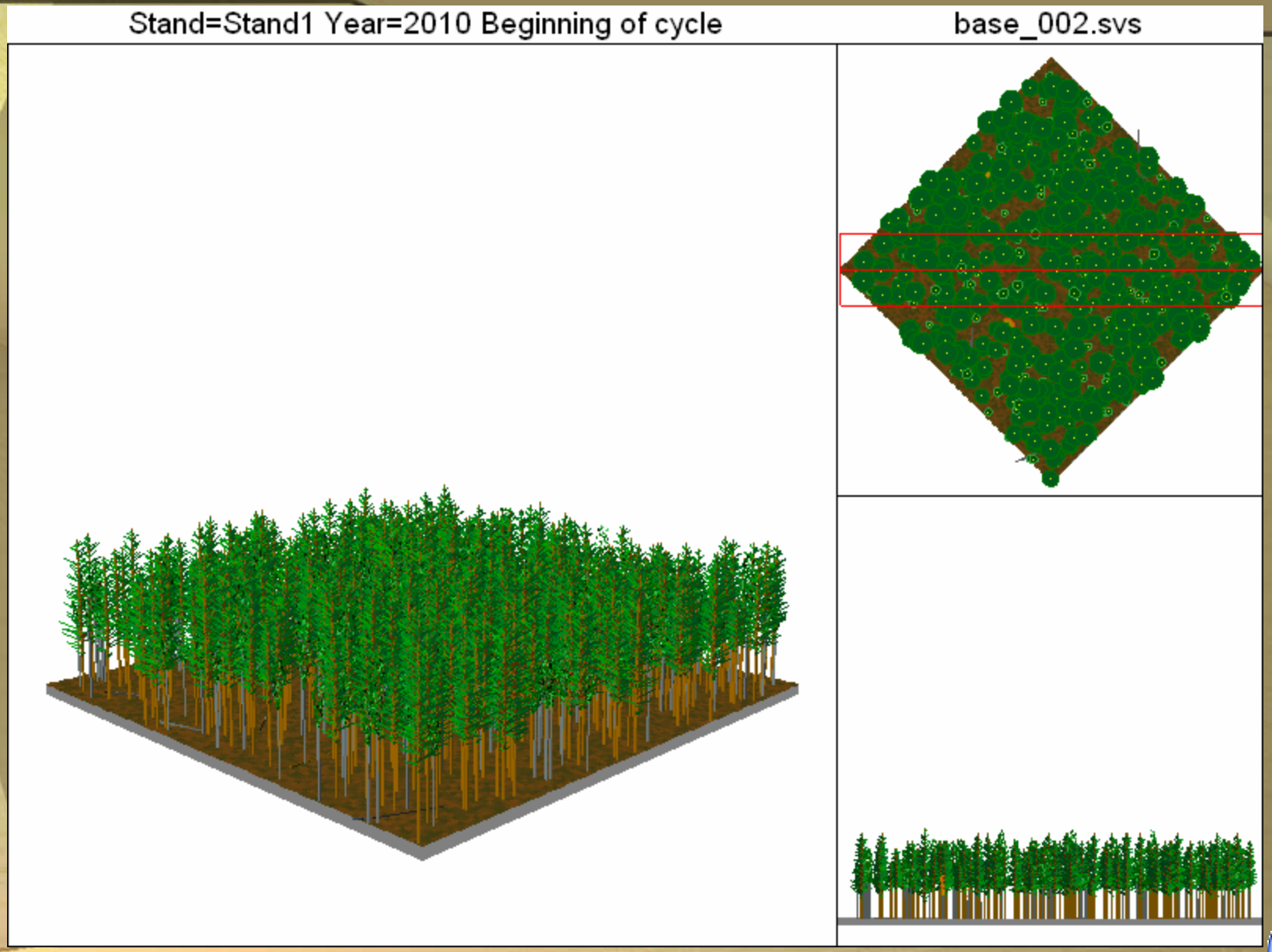
Diameter class / species distribution



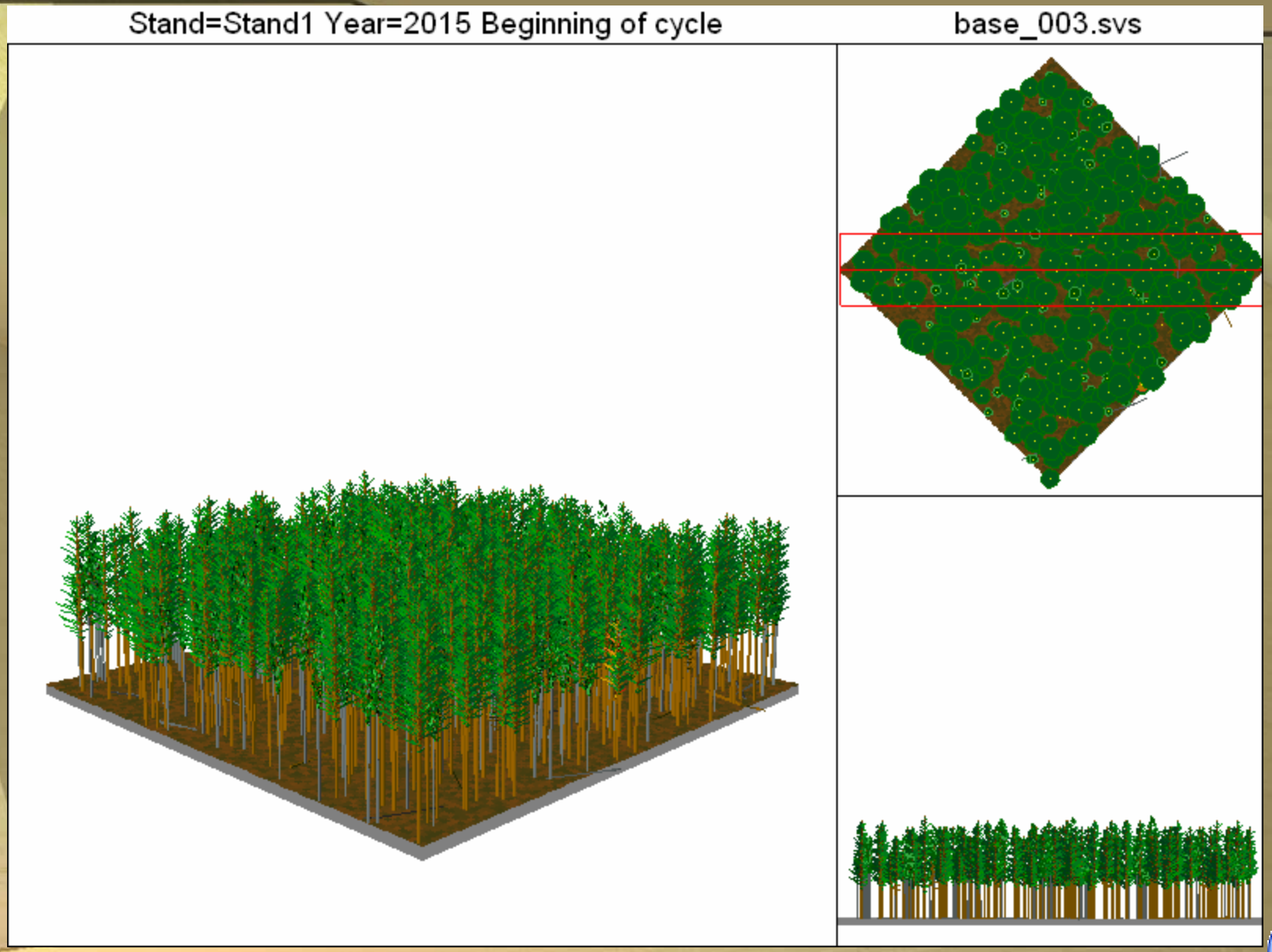
Baseline simulation – age 10



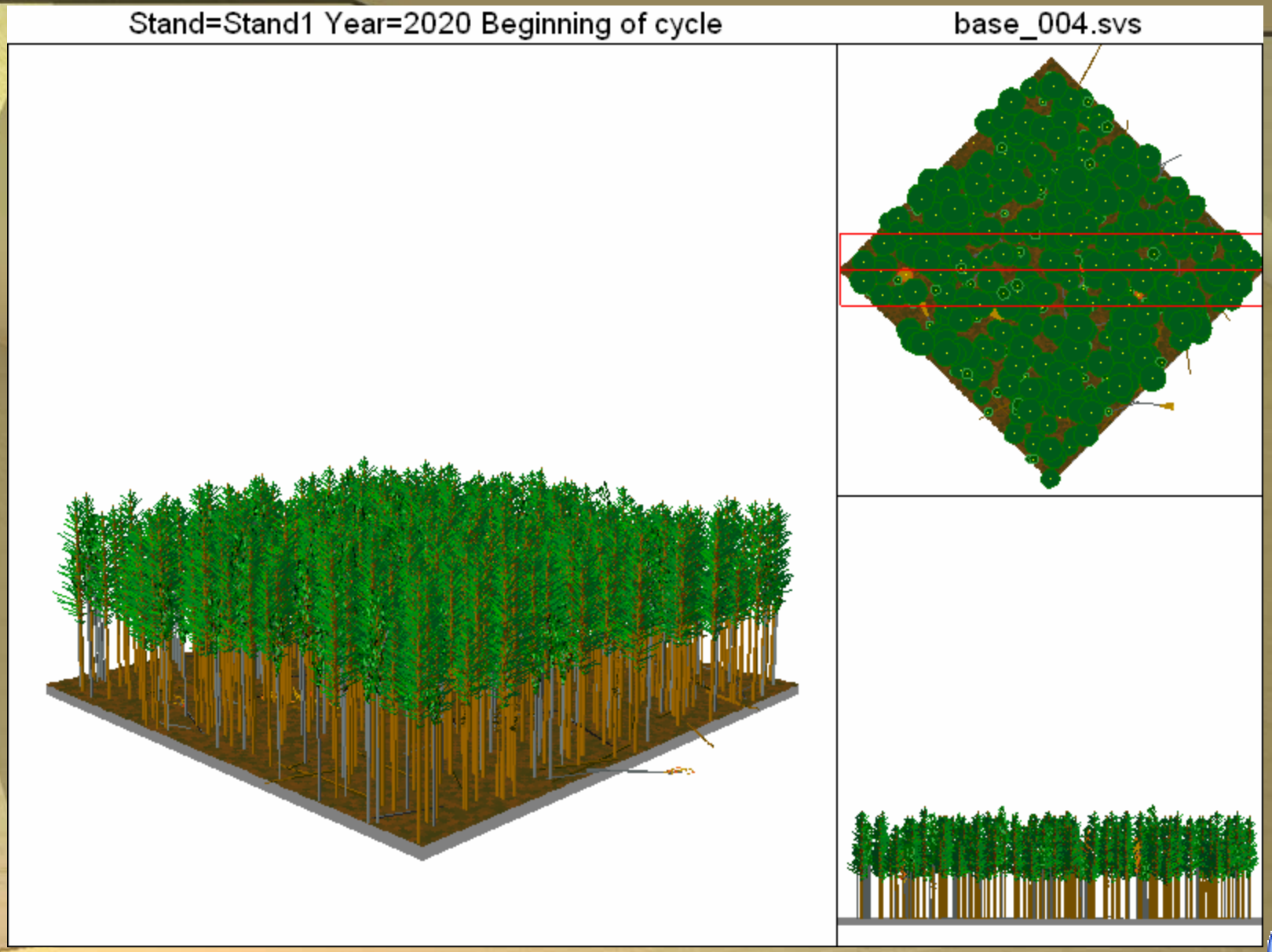
Baseline simulation – age 15



Baseline simulation – age 20

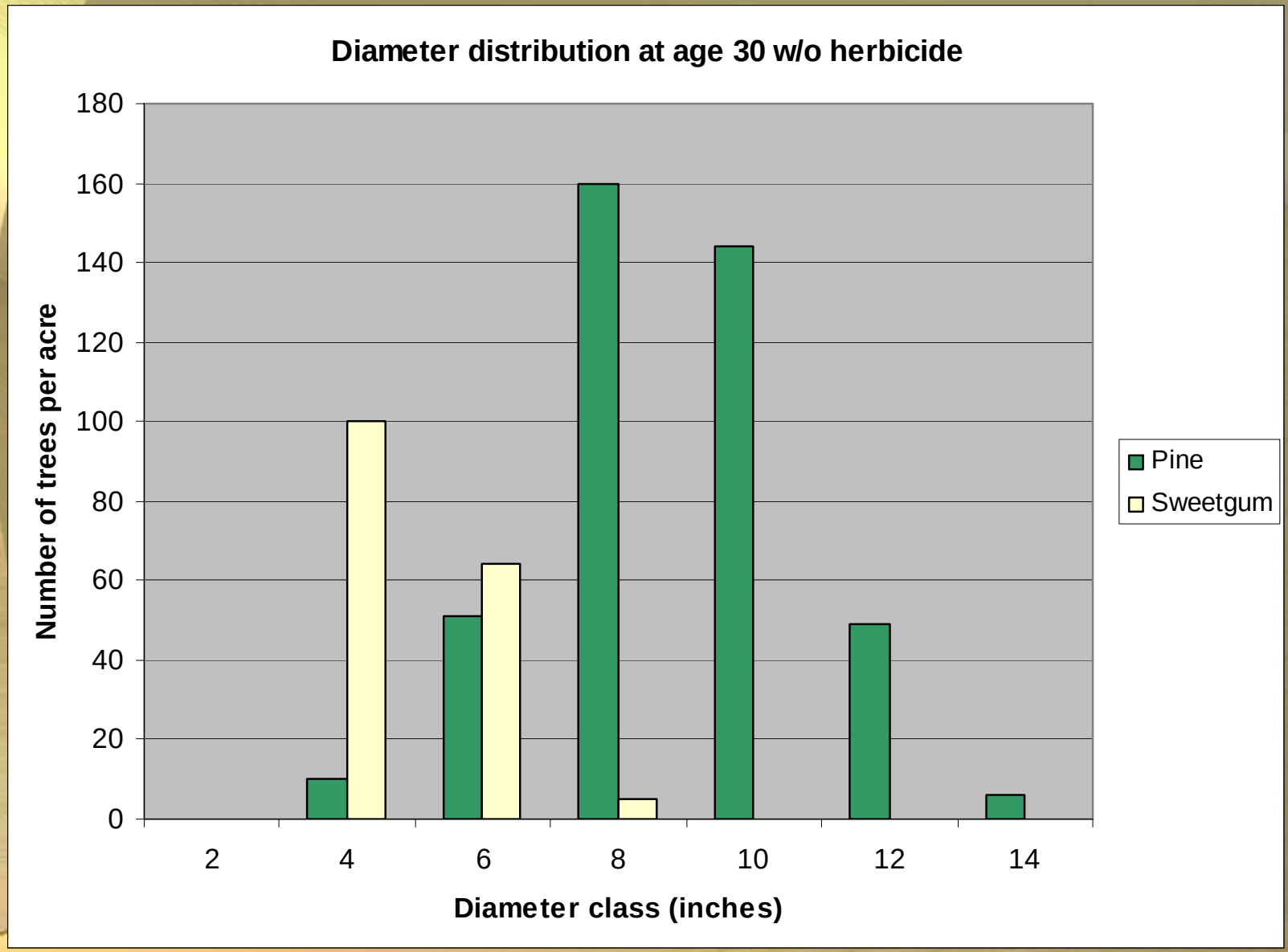


Baseline simulation – age 25



Baseline simulation – age 30

Baseline simulation - age 30 diameters…



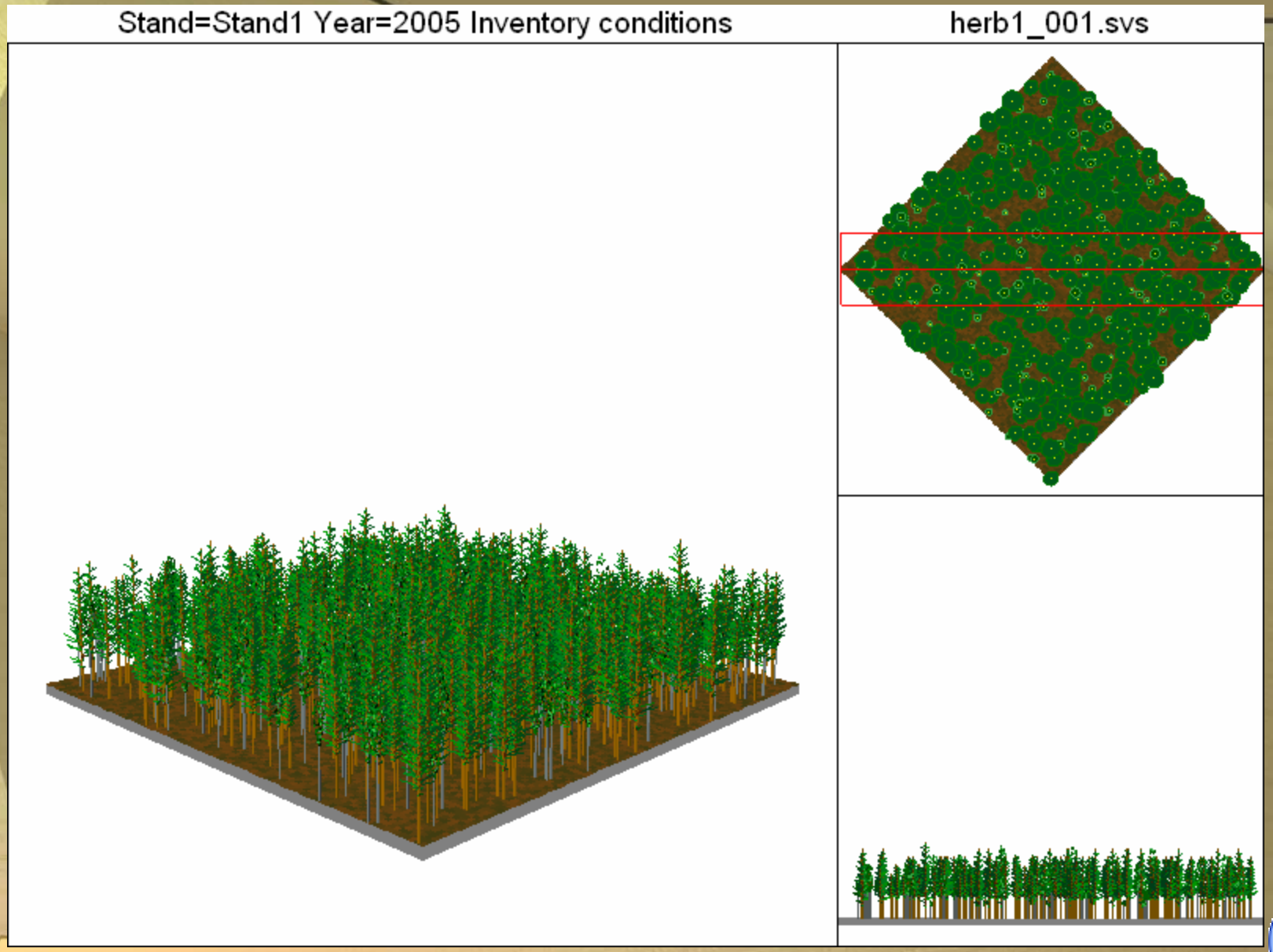
Yields and returns from baseline

- Assume $150 / ac spent in stand establishment
- NPV at 6% is $638 / acre (timber only)
- Rate of return is 12.02%

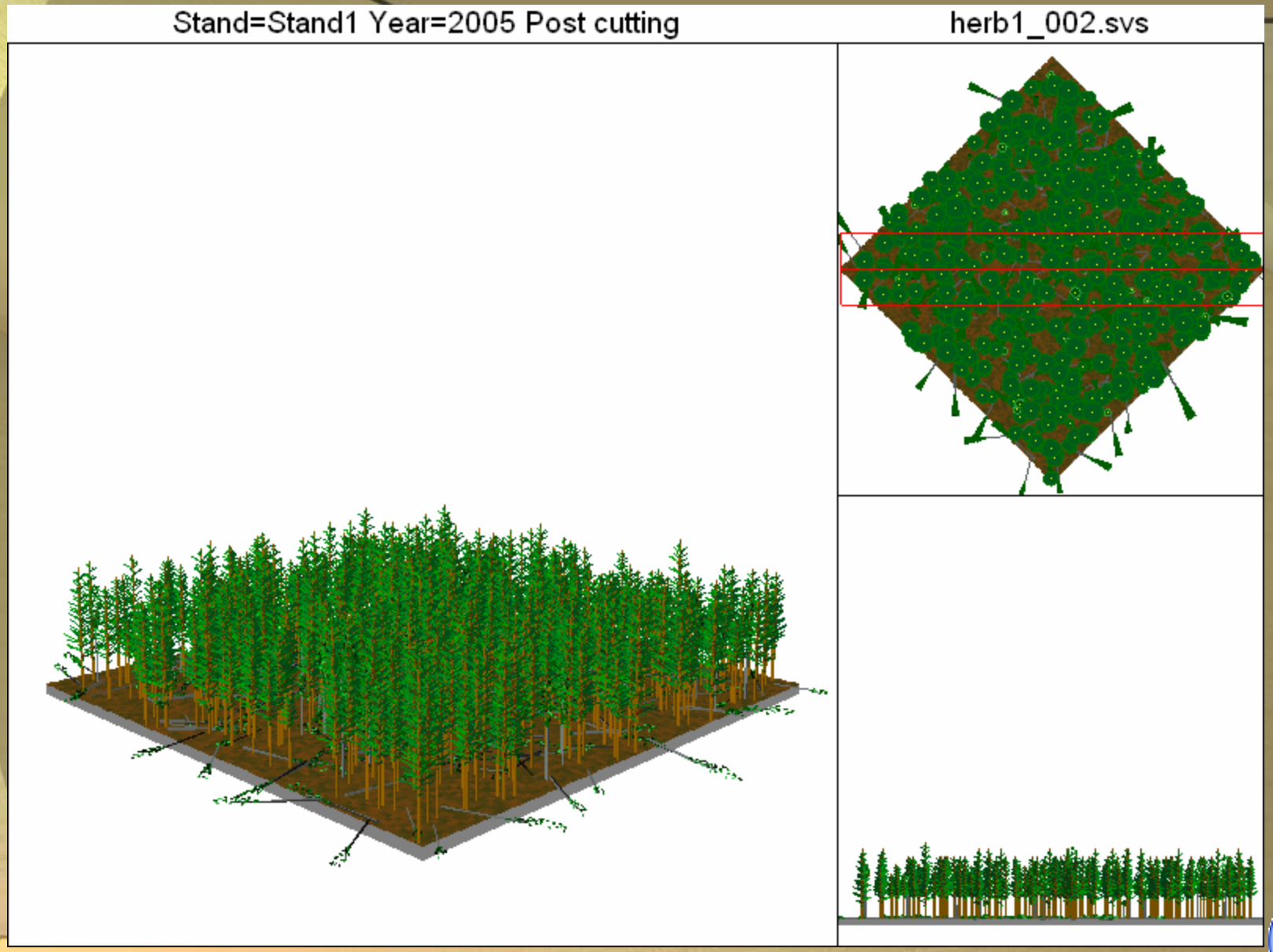
		Volume (tons / ac)		Price ($/ton)		Cash Flow		
Year	Activity	Pulpwood	Sawtimber	Pulpwood	Sawtimber		6.00%	12.02%
0	Establish stand					(150)	(150)	(150)
30	Clearfell hardwood	10.1	0	$7.75	$20	78	14	3
30	Clearfell pine	63.7	84	$6.50	$48	4,446	774	148
						NPV =	638	0

Now let's simulate herbicide application…

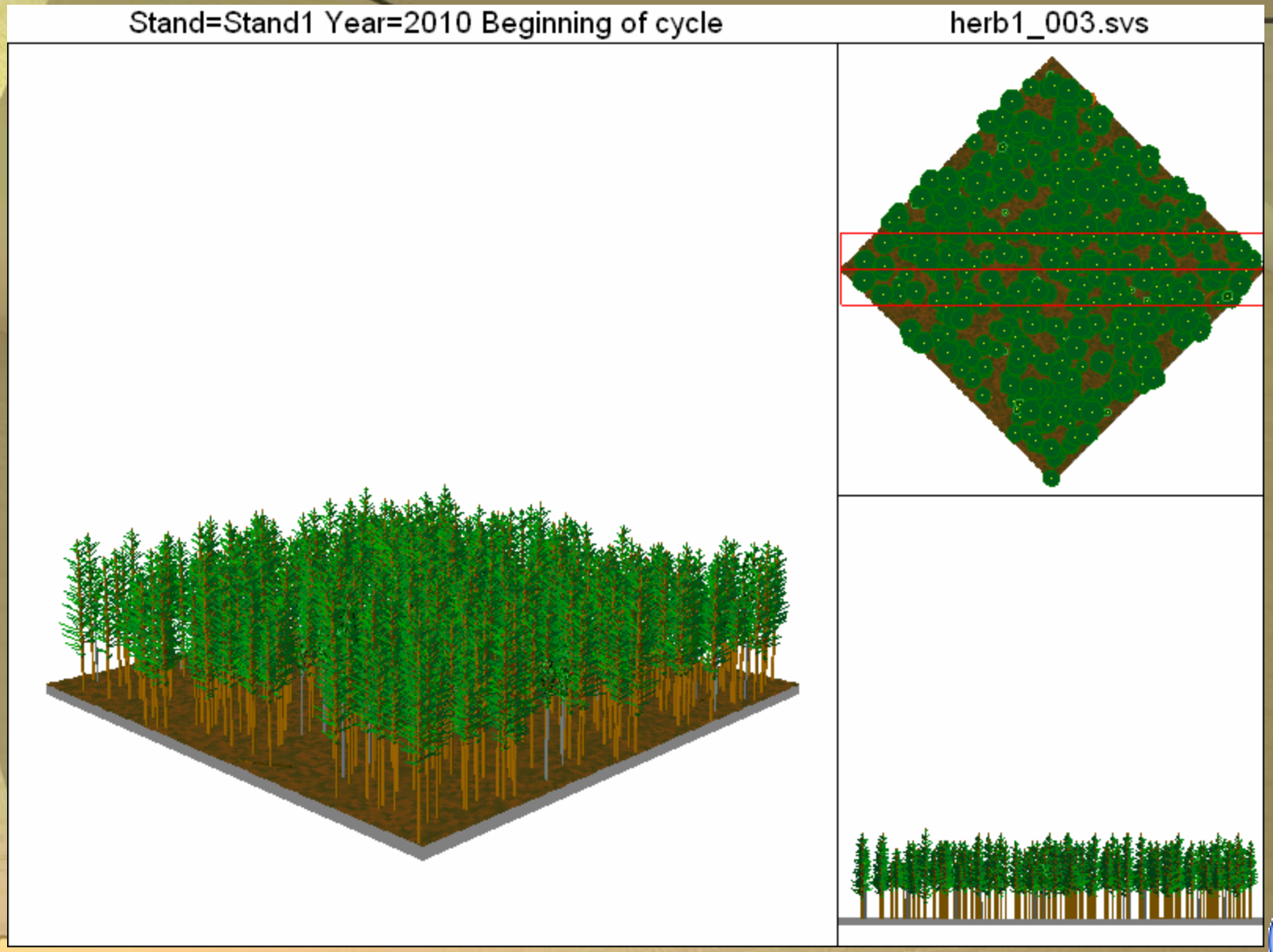
Herbicide simulation – initial conditions



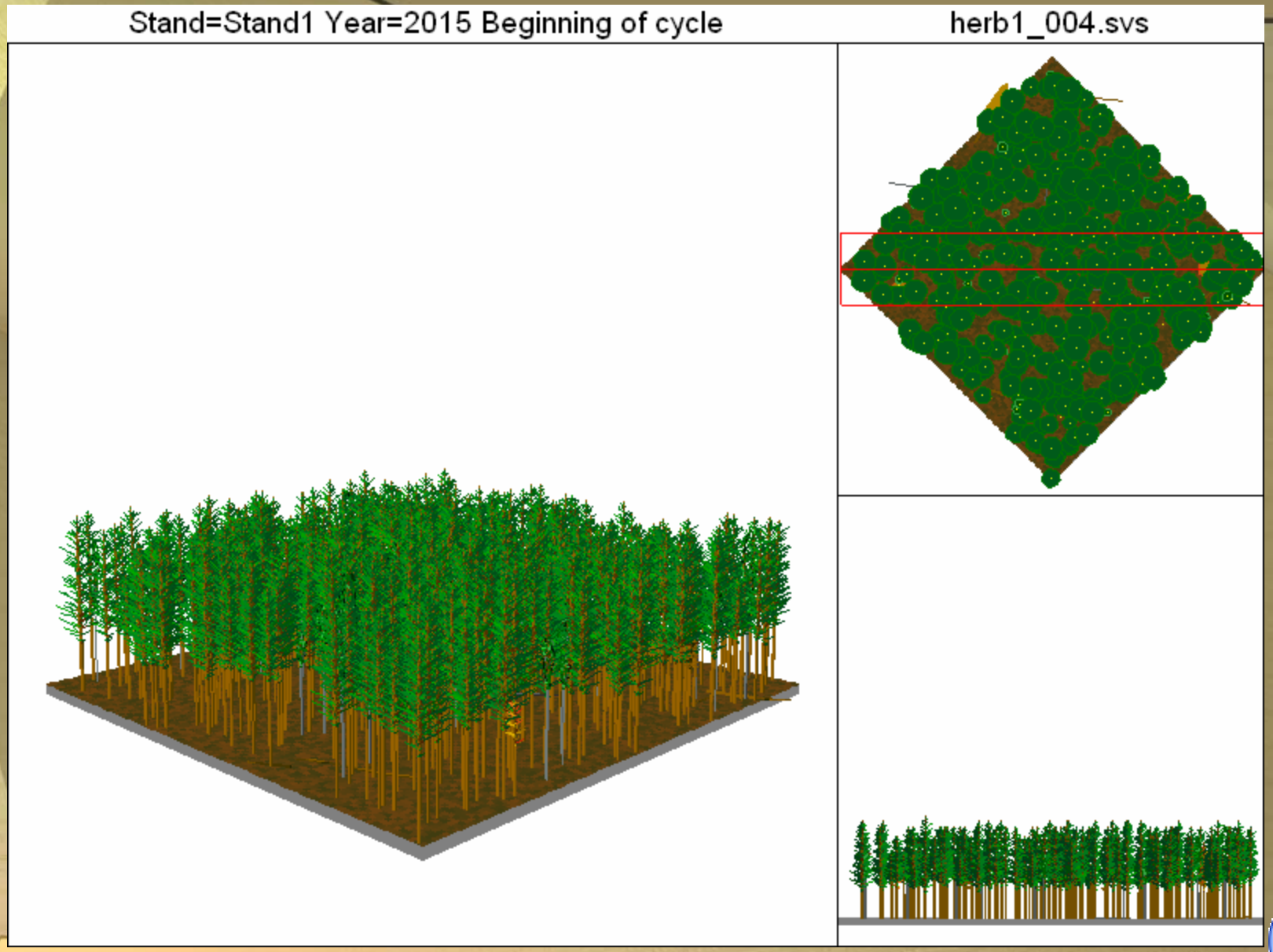
Herbicide simulation – age 10 after herbicide



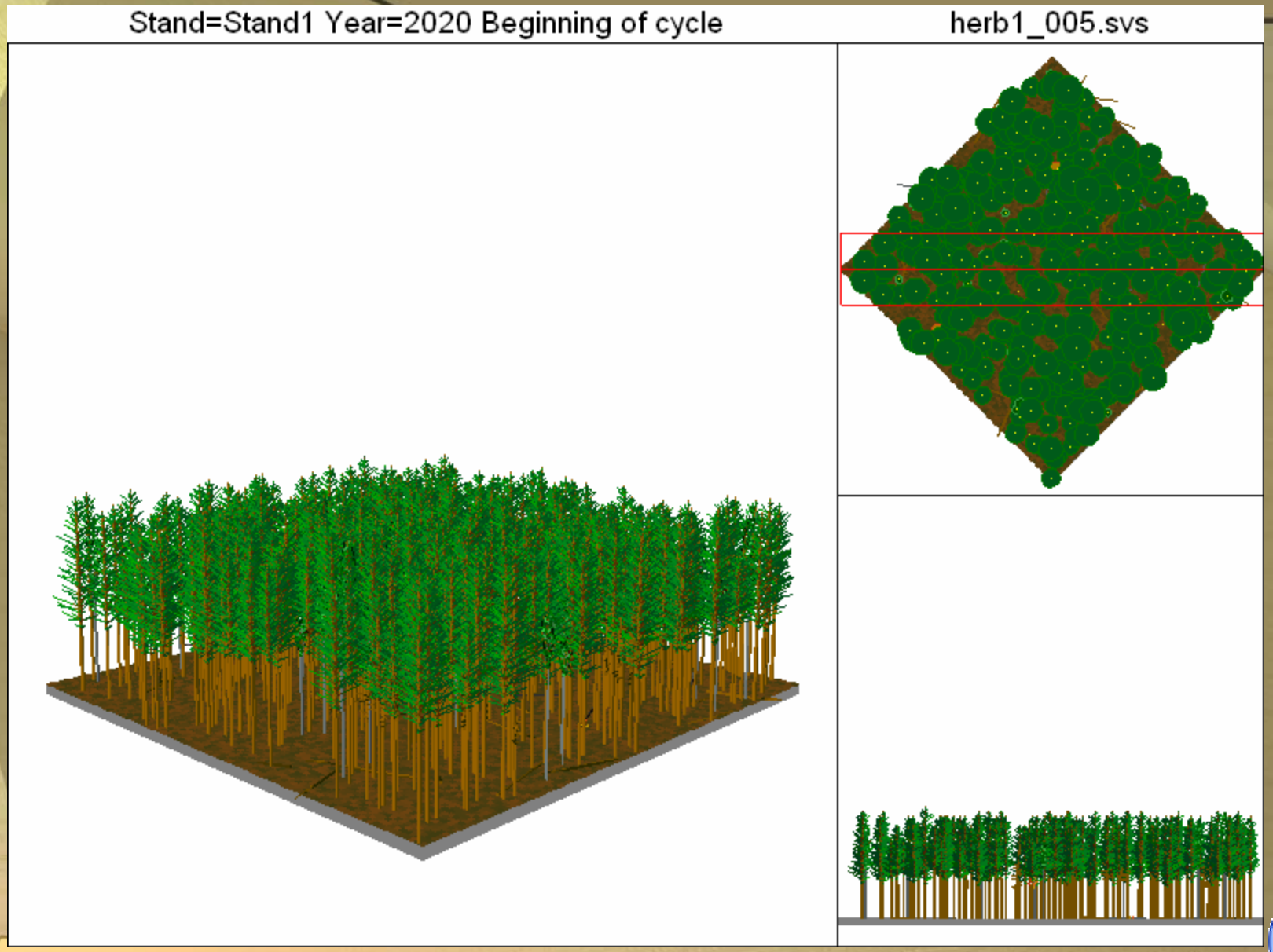
Herbicide simulation – age 15



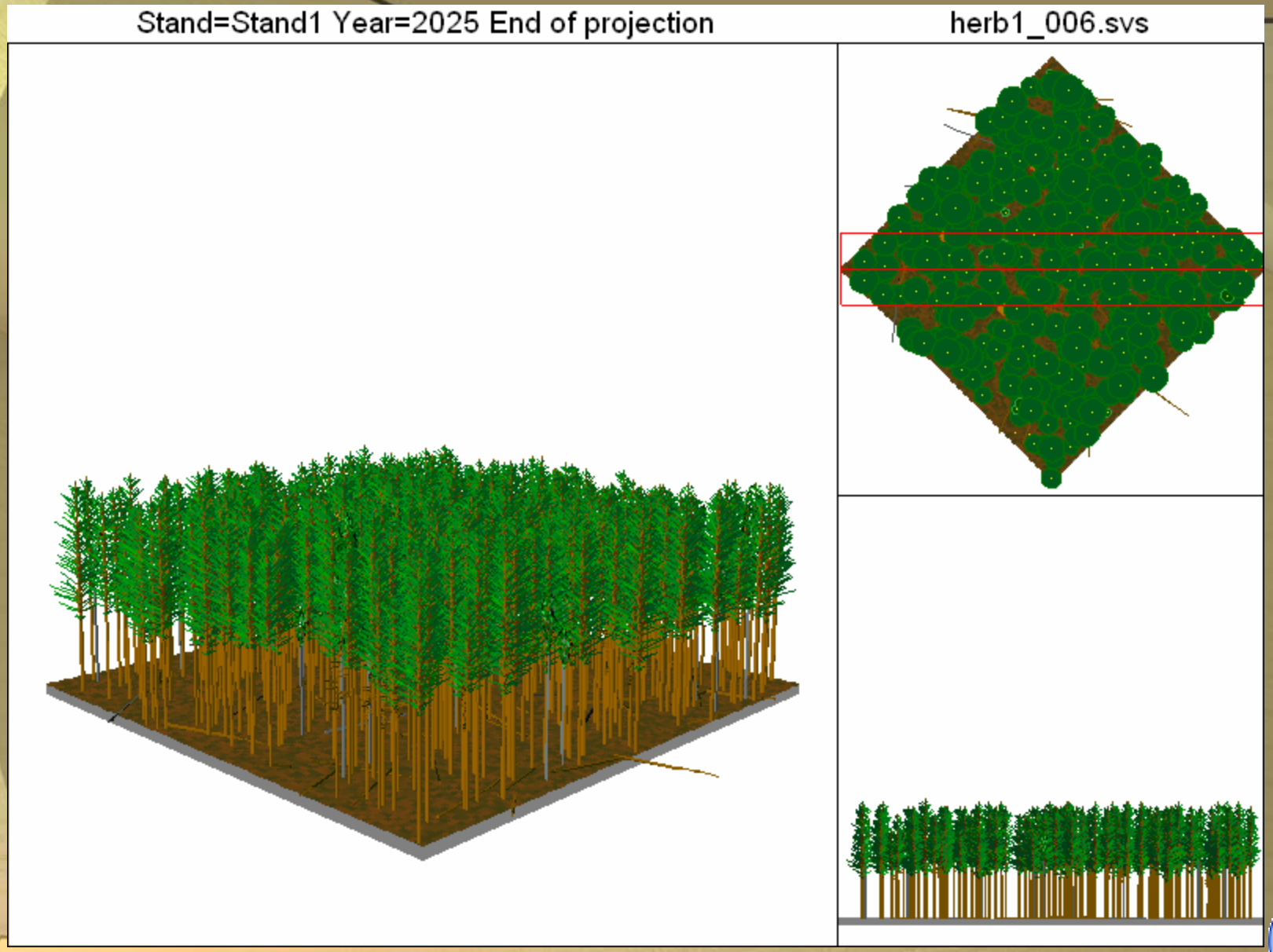
Herbicide simulation – age 20



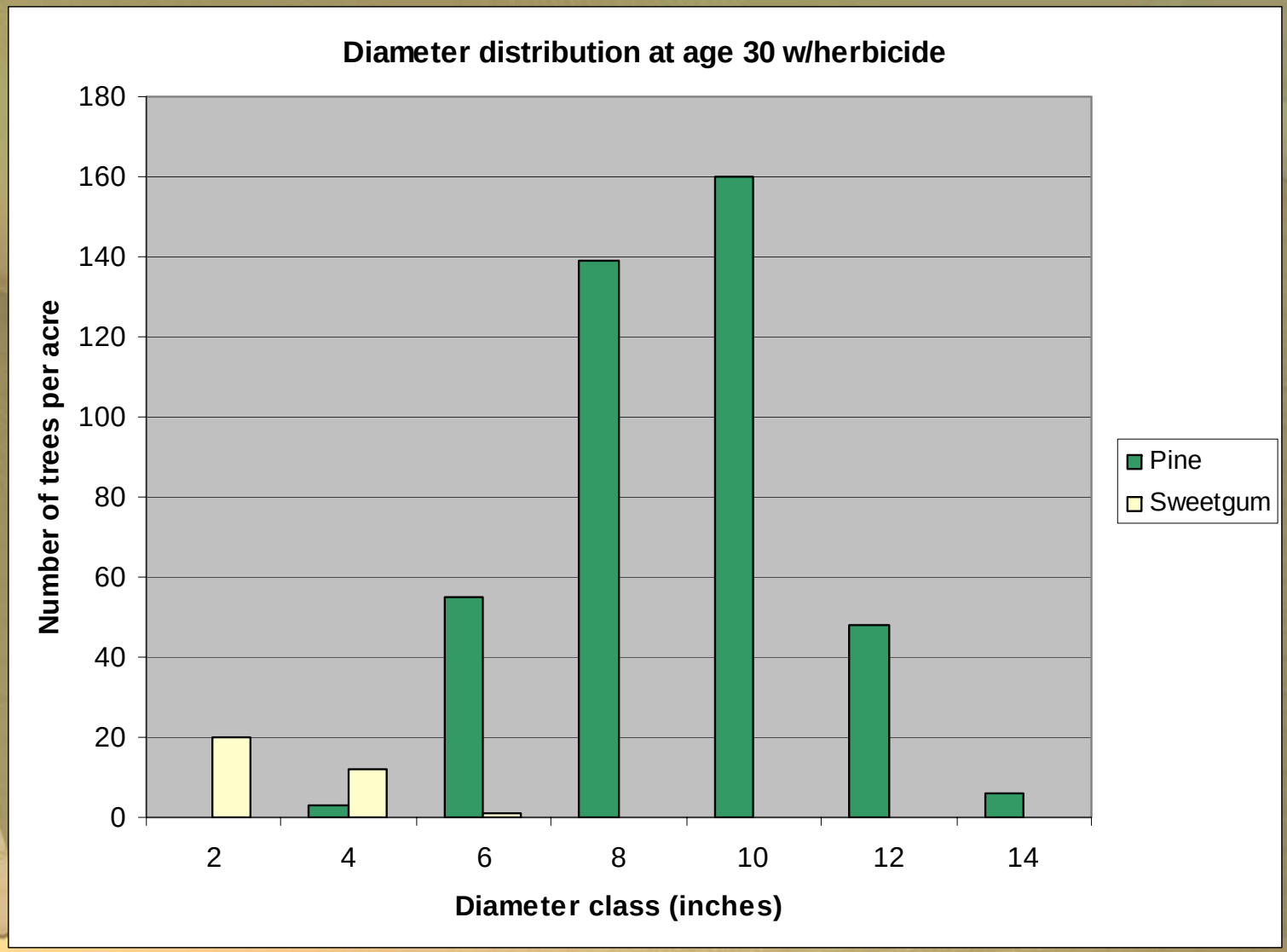
Herbicide simulation – age 25



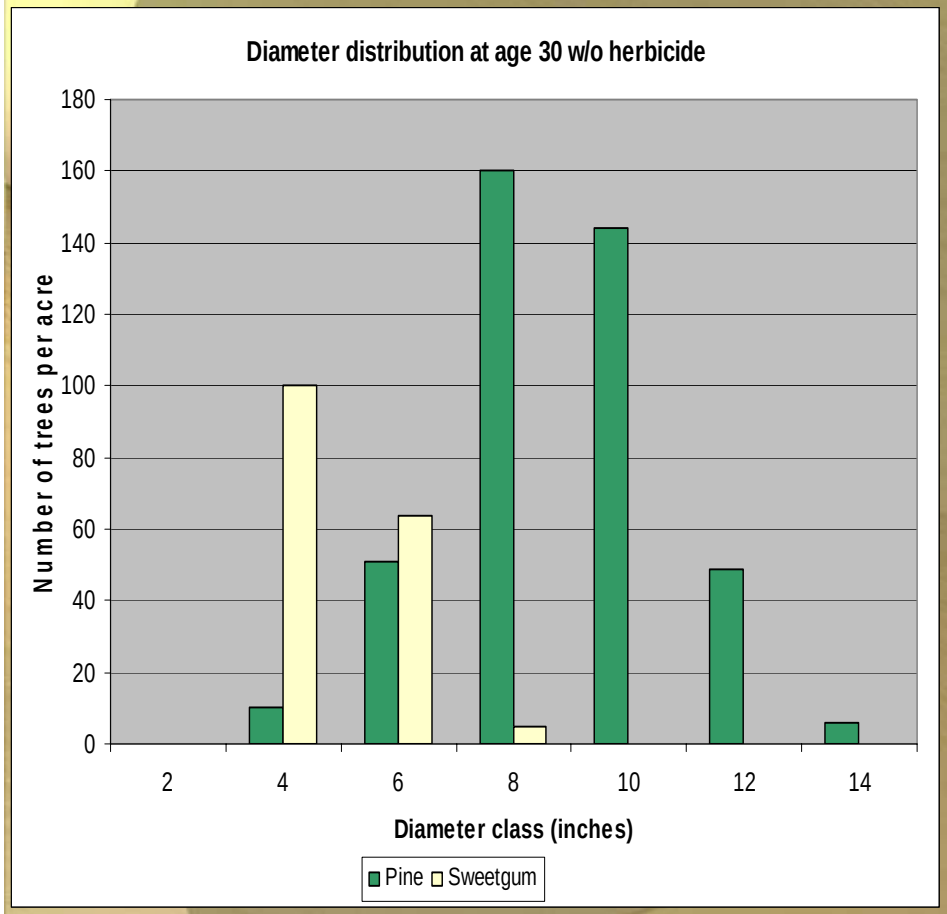
Herbicide simulation – age 30

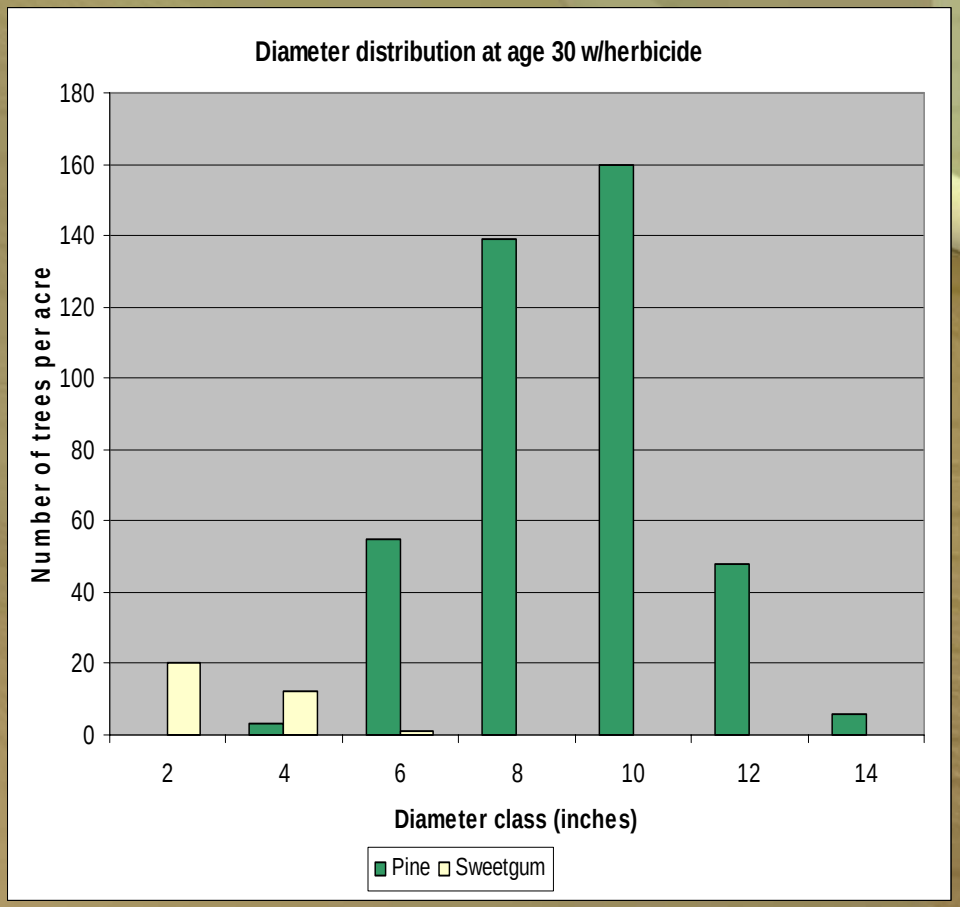


Herbicide simulation – age 30 diameters…

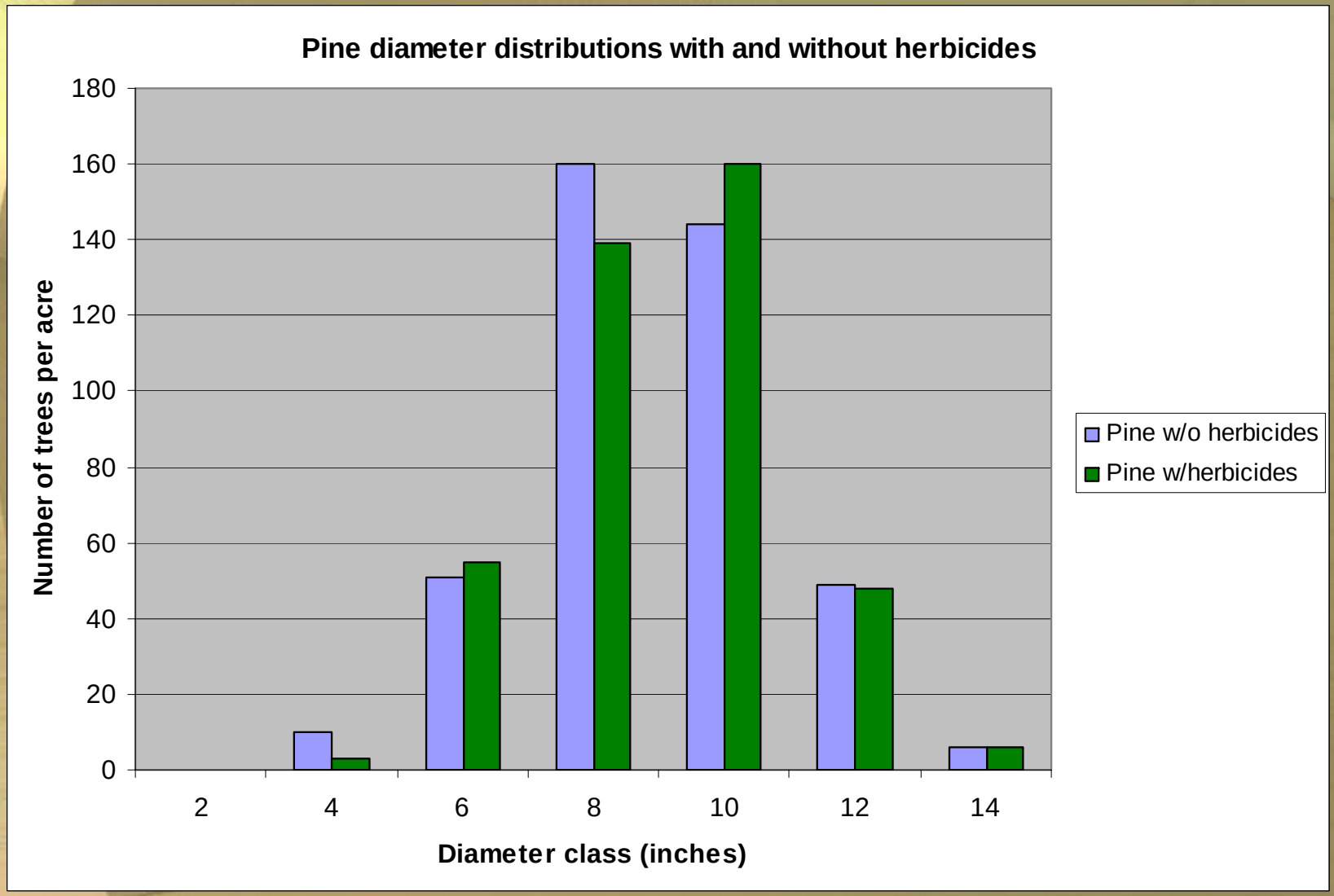


Comparing 30-year diameter distributions





Herbicides cause shift in pine diameters…



Yields and returns with herbicides

- Assume $150 / ac spent in stand establishment
- NPV at 6% is $787 / acre (timber only)
- Rate of return is 12.21%

		Volume (tons / ac)		Price ($/ton)		Cash Flow		
Year	Activity	Pulpwood	Sawtimber	Pulpwood	Sawtimber		6.00%	12.21%
0	Establish stand					(150)	(150)	(150)
10	Herbicide					(90)	(50)	(28)
30	Clearfell hardwood	2.1	0	$7.75	$20	16	3	1
30	Clearfell pine	49.8	111	$6.50	$48	5,652	984	178
						NPV =	787	0

But what is rate of return on herbicide?

		Volume (tons / ac)		Price ($/ton)		Cash Flow		
Year	Activity	Pulpwood	Sawtimber	Pulpwood	Sawtimber		6.00%	12.21%
0	Establish stand					(150)	(150)	(150)
10	Herbicide					(90)	(50)	(28)
30	Clearfell hardwood	2.1	0	$7.75	$20	16	3	1
30	Clearfell pine	49.8	111	$6.50	$48	5,652	984	178
						NPV =	787	0

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		Volume (tons / ac)		Price ($/ton)		Cash Flow		
Year	Activity	Pulpwood	Sawtimber	Pulpwood	Sawtimber		6.00%	12.02%
0	Establish stand					(150)	(150)	(150)
30	Clearfell hardwood	10.1	0	$7.75	$20	78	14	3
30	Clearfell pine	63.7	84	$6.50	$48	4,446	774	148
						NPV =	638	0

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		Marginal volume (tons/ac)		Price ($/ton)				
Year		Pulpwood	Sawtimber	Pulpwood	Sawtimber		6.00%	13.50%
10	Herbicide					(90)	(50)	(25)
30	Clearfell hardwood	-8	0	$7.75	$20	(62)	(11)	(1)
30	Clearfell pine	-13.9	27	$6.50	$48	1,206	210	27
						NPV =	149	0

NPV of herbicide is $149 / acre and ROR is 13.5%

If herbicide is 100% effective…

Stand volumes and values at age 30…

		Volume		Price		Cash Flow		
Year	Activity	Pulpwood	Sawtimber	Pulpwood	Sawtimber		6.00%	12.48%
0	Establish stand					(150)	(150)	(150)
10	Herbicide					(90)	(50)	(28)
30	Clearfell hardwood	0	0	$7.75	$20	0	0	0
30	Clearfell pine	49.6	119.5	$6.50	$48	6,058	1,055	178
						NPV =	855	0

Marginal analysis of herbicide costs and returns…

		Marginal volume (tons/ac)		Price ($/ton)				
Year		Pulpwood	Sawtimber	Pulpwood	Sawtimber		6.00%	15.20%
10	Herbicide					(90)	(50)	(22)
30	Clearfell hardwood	-10.1	0	$7.75	$20	(78)	(14)	(1)
30	Clearfell pine	-14.1	35.5	$6.50	$48	1,612	281	23
						NPV =	217	0

Rate of return on herbicide is 15.2%

Conclusions

- Only a simple example
- Herbicide control provides
  - Better survival (plant fewer stems / acre)
  - Better height / diameter growth
  - Shorter rotations, more volume
- All additional silvicultural treatments need to be analyzed using “with and without method”

Questions and discussion....