




One Landowner is Thinning While the Adjoining Landowner is not: Which One is Losing Money?

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Financial Considerations Regarding Forest Management - *Coastal Douglas-fir Example*

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- **Discounting**
- **Opportunity Cost**
- **Considerations for Thinning Evaluation**
  - Growth and Yield
  - Product Differentiation
  - Logging Costs
  - Valuing Future Rotations
  - Rotation Ages
- **Example Bringing it all Together**

Discounting (Time Value Of Money)

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The idea that money today is worth more than the same amount of money in the future.

	Discount Rate				
Years from Now	0.02	0.04	0.06	0.08	0.10
0	453	208	97	46	22
5	500	253	130	68	36
10	552	308	174	99	57
15	610	375	233	146	92
20	673	456	312	215	149
25	743	555	417	315	239
30	820	676	558	463	386
35	906	822	747	681	621
40	1000	1000	1000	1000	1000

Opportunity Cost

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The value of the next highest alternative use

(or)

Value of Highest and Best Use

-

Value of Alternative

=

Cost of Choosing the Alternative

"It cost $699. But when you factor in the time wasted sitting in front of it, well, the real cost is enormous."

Considerations for Thinning Evaluation

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Growth and Yield

- Information on how a stand will develop over time for a given silvicultural regime

Product Differentiation

- The volume and prices of products the harvest will provide

Logging Costs

- The cost of extracting the products from the forest

Rotation Ages

- How your decisions change the timings of either the final harvest or other future thinnings

Example: 30 Year Old Stand

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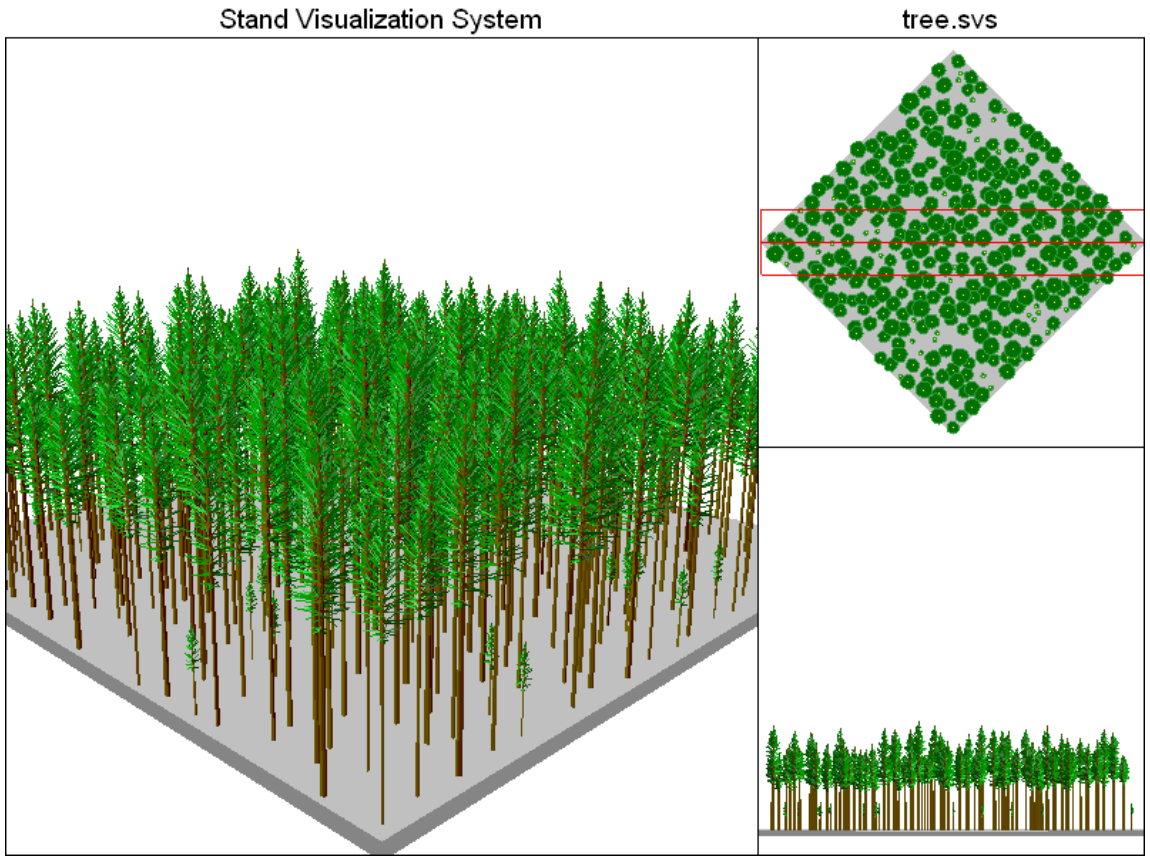
- 377 trees-per-acre all Douglas-fir
- 9.2 inches Quadratic Mean Diameter
- 50-year Site Index 115
- 331 Stand Density Index
- 4964 Cubic Feet per Acre
- 11.38 Thousand Board Feet per Acre



Growth and Yield

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Age	TPA	QMD	SDI	Cubic Feet	MBF	MAI	PAI
30	377	9.2	331	4,964	11	165	
35	363	10.3	381	6,685	20	191	344
40	347	11.3	422	8,369	27	209	337
45	328	12.2	453	9,937	36	221	314
50	303	13.2	471	11,267	42	225	266
55	275	14.1	478	12,324	49	224	211
60	249	15.0	480	13,213	56	220	178
65	228	15.9	480	14,016	62	216	161
70	209	16.8	480	14,760	68	211	149
75	194	17.6	480	15,455	72	206	139
80	181	18.4	480	16,109	77	201	131
85	170	19.1	480	16,726	83	197	123
90	160	19.9	480	17,308	89	192	116
95	151	20.6	480	17,860	91	188	110
100	143	21.2	480	18,385	99	184	105
105	136	21.9	480	18,885	102	180	100
110	130	22.5	480	19,360	108	176	95
115	125	23.2	480	19,814	112	172	91
120	120	23.8	480	20,248	116	169	87
125	115	24.3	480	20,662	123	165	83
130	111	24.9	480	21,056	126	162	79

Product Differentiation

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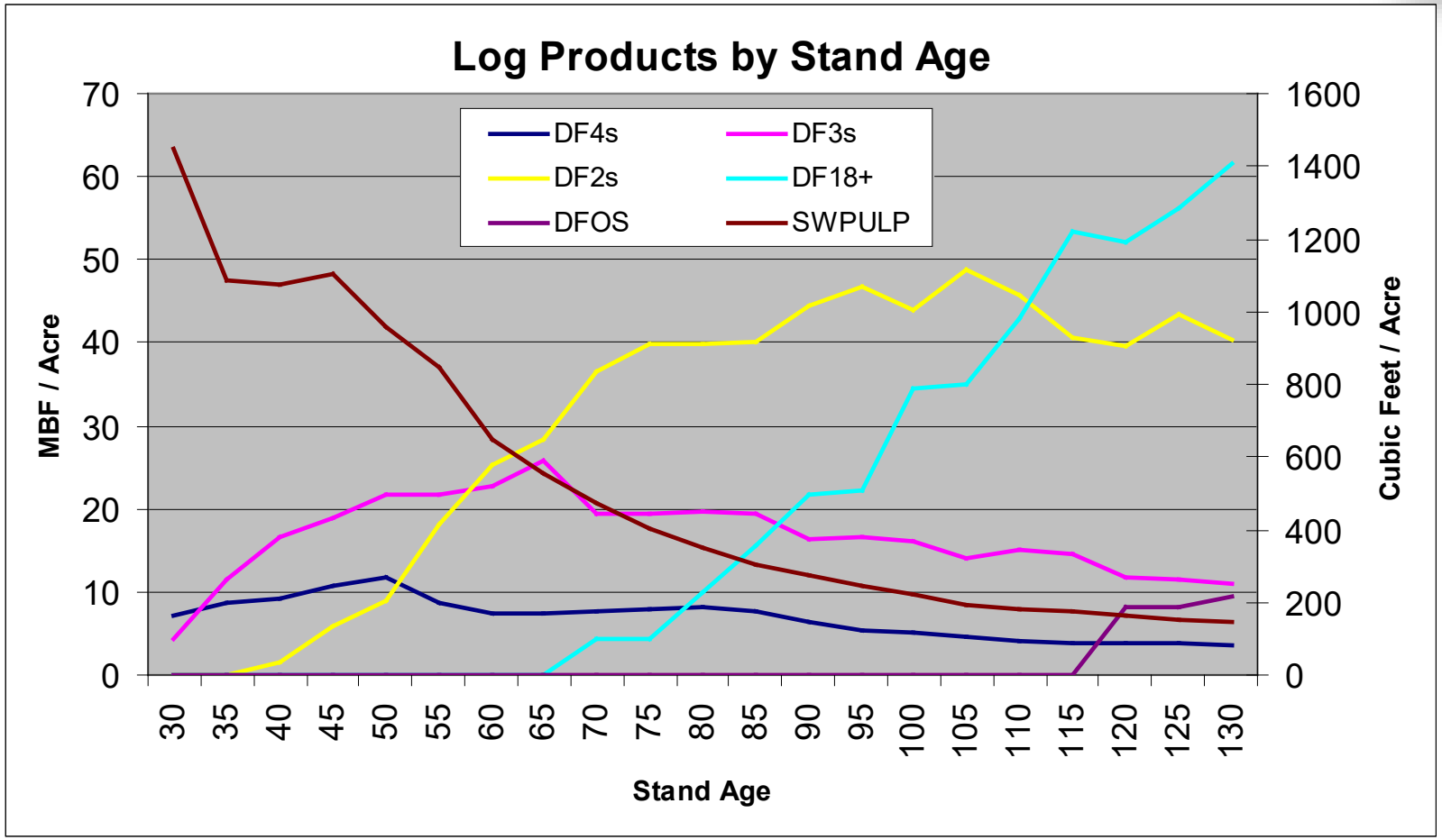

DF4s	Douglas-fir Logs 5" - 7" Top
DF3s	Douglas-fir Logs 8" - 11" Top
DF2s	Douglas-fir Logs 12" - 17" Top
DF18+	Douglas-fir Logs 18" Plus Top
DFOS	Oversized Douglas-fir Logs 32" Plus Bottom
SWPULP	Non-merch Trees and Tops to 2"

Price Differentiation (Nominal)

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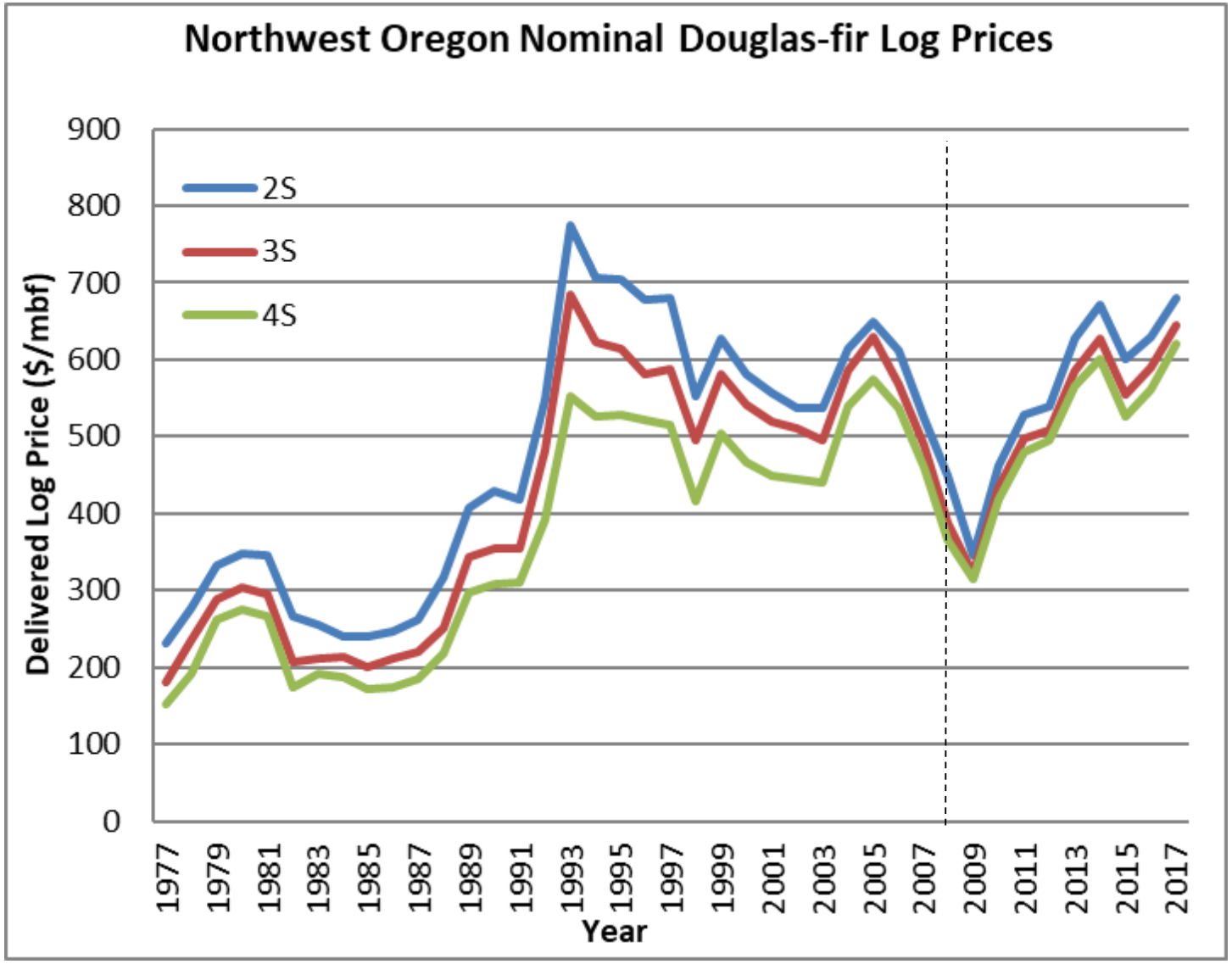

Price Differentiation (PPI)

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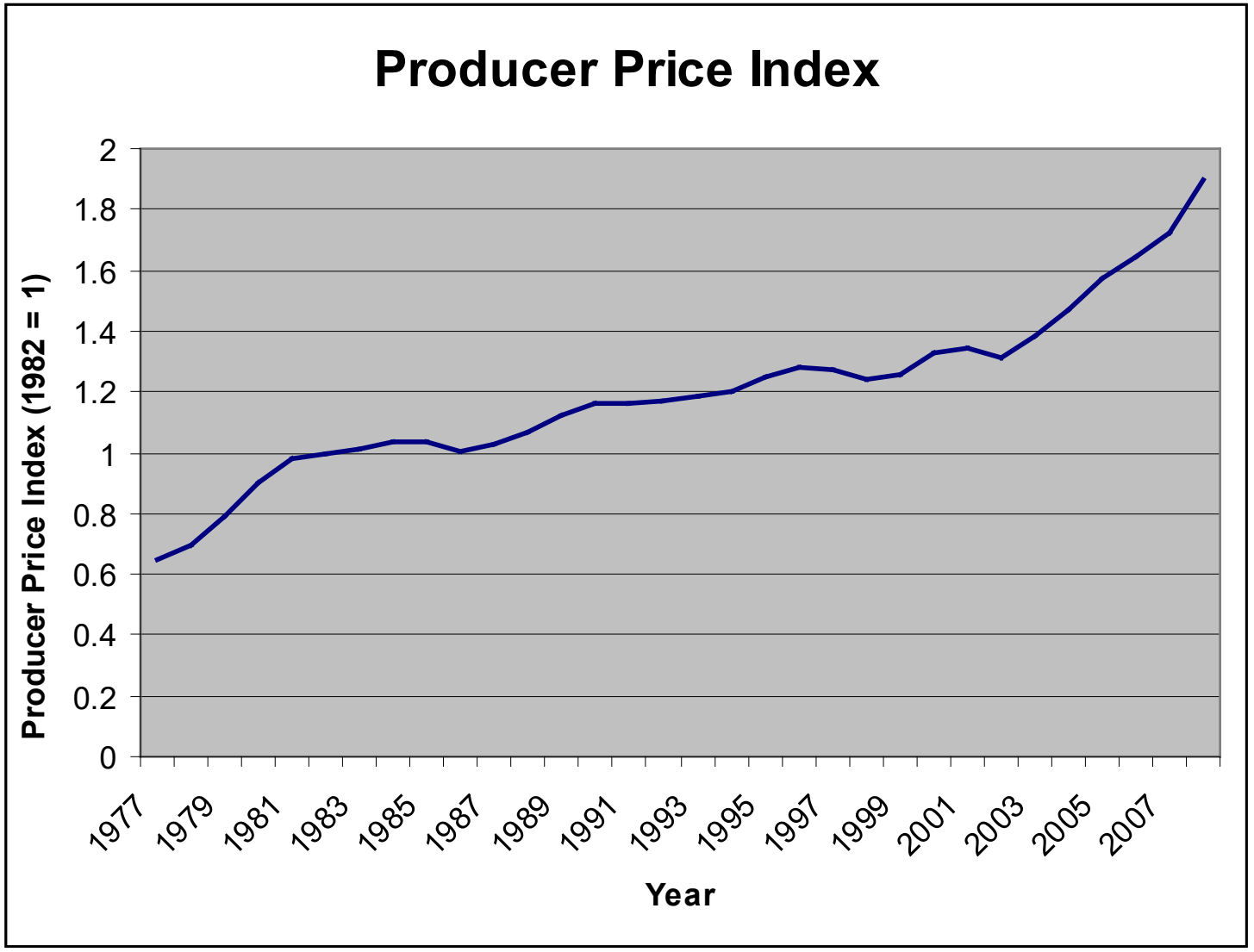

The **Producer Price Index (PPI)** program measures the average change over time in the selling prices received by domestic producers for their output.

From BLS http://www.bls.gov/pPI/

Price Differentiation (Real)

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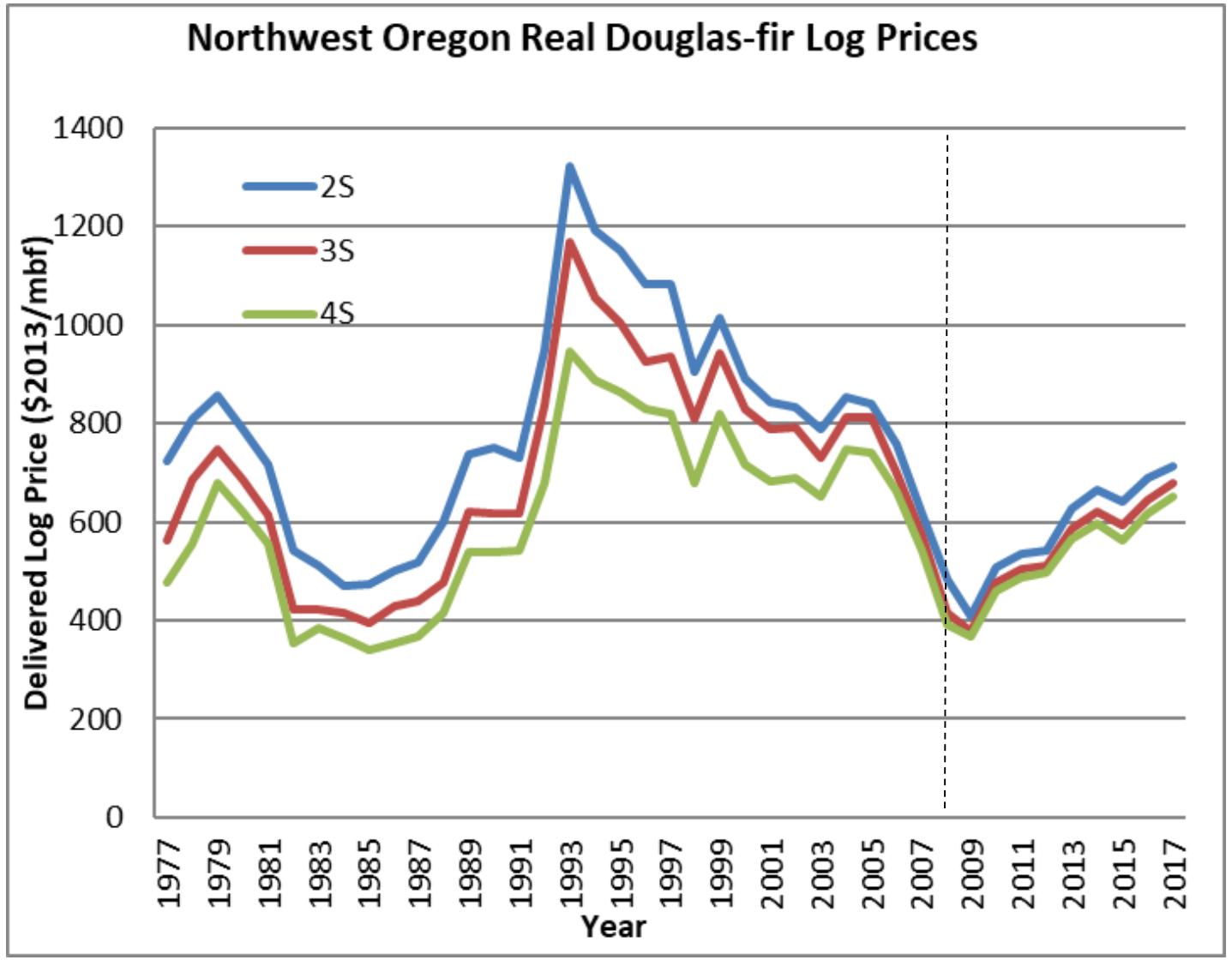

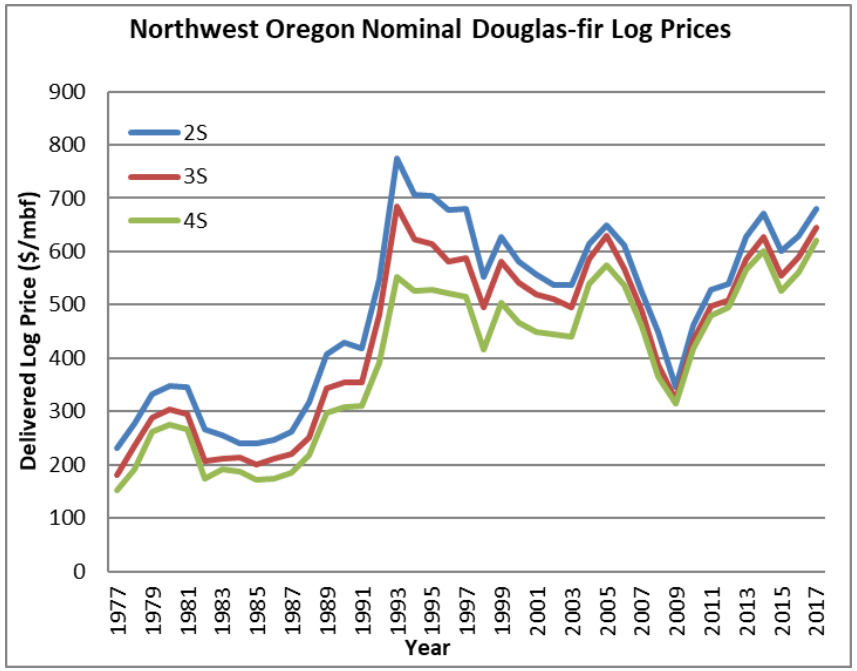

Price Differentiation

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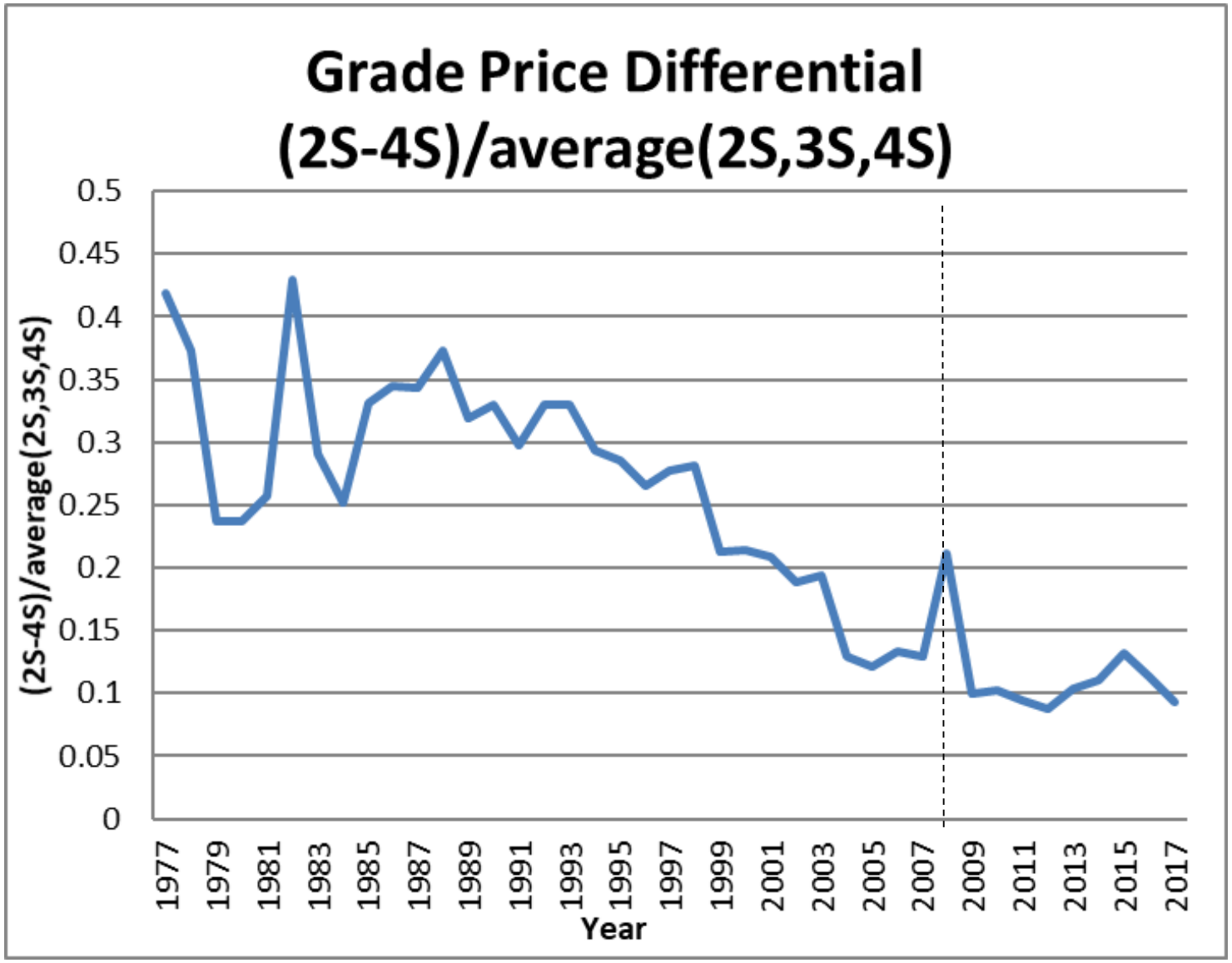

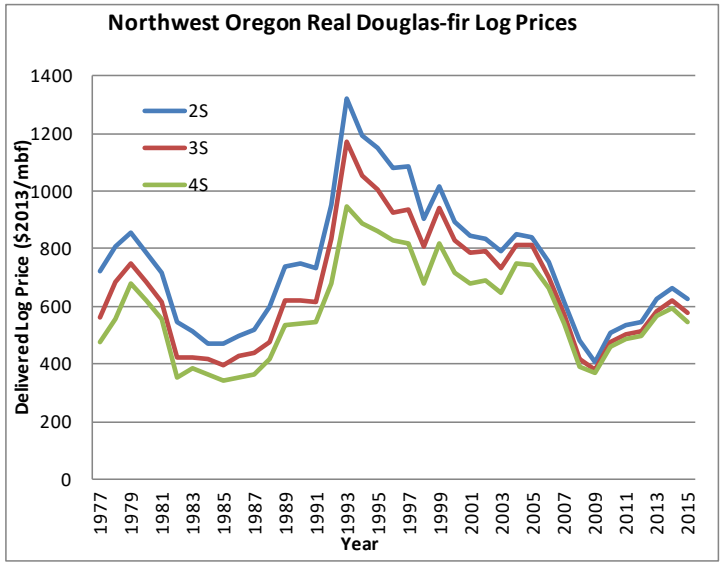

Logging Costs

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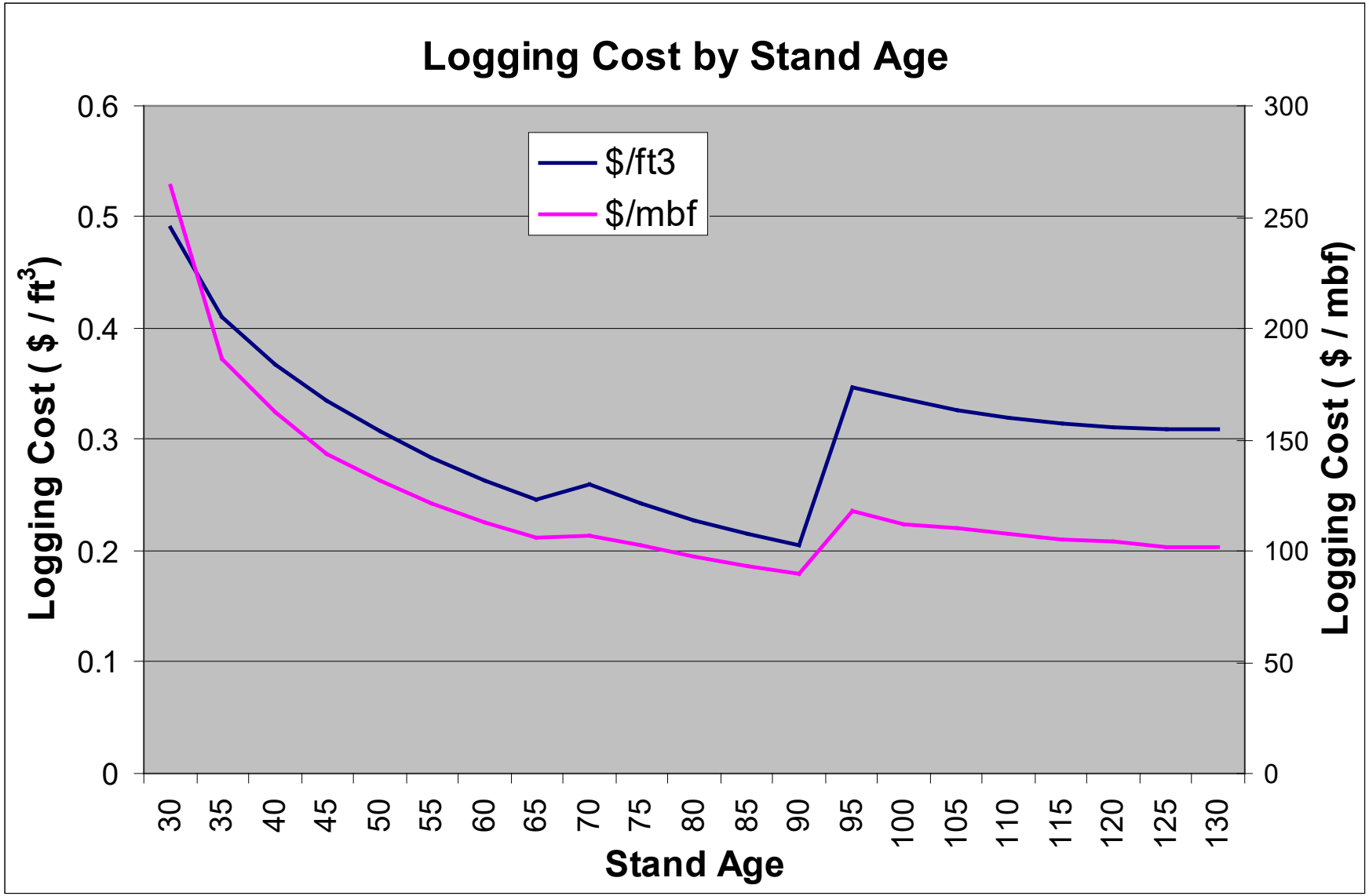

Future Rotations

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$$SEV = \max \frac{\sum_{age=0}^{Rotation} \left(Logprice * LogQuantity_{age} - Costs_{age} \right) \left(1 + DiscountRate\right)^{Rotation-age}}{\left(1 + DiscountRate\right)^{Rotation} - 1}$$

For our stand, the Soil Expectation Value (bare land value) is $863/acre

Stand Age	TPA	QMD (inches)	Volume ft^3/acre	Volume (mbf / acre) 4S	3S	2S	Pulp ft^3/acre	Logging Cost $/$ft^3$	Revenue $ / acre	Cost $ / acre	Net Rev. $ / acre	SEV $ / acre
5	436	0.01	0	0.0	0.0	0.0	0	1.00	0	0	0	-1,583
10	436	2.6	81	0.0	0.0	0.0	31	1.00	9	50	-41	-958
15	436	5	612	0.0	0.0	0.0	509	1.00	150	612	-462	-1,017
20	436	7.1	1,849	0.0	0.0	0.0	1,585	1.00	468	1,849	-1,381	-1,207
25	422	8.9	3,869	0.0	0.0	0.0	3,385	1.00	999	3,869	-2,870	-1,393
30	398	10.3	6,236	20.2	0.0	0.0	601	0.41	8,653	3,574	5,078	586
35	366	11.5	8,467	11.1	18.2	0.0	552	0.36	13,284	4,488	8,796	856
40	324	12.7	10,266	7.3	30.0	0.0	492	0.32	17,150	5,138	12,013	851
45	**288**	**13.7**	**11,684**	**14.3**	**34.9**	**0.0**	**442**	**0.29**	**22,381**	**5,862**	**16,519**	**863**
50	261	14.6	12,900	15.2	38.1	0.0	405	0.27	24,204	6,146	18,058	614
55	238	15.5	14,004	5.5	40.2	12.7	372	0.25	27,865	6,462	21,403	488
60	218	16.3	15,009	4.7	31.4	28.9	342	0.27	32,050	7,271	24,778	362
65	202	17.1	15,914	4.6	23.8	44.9	316	0.25	36,954	7,641	29,314	270
70	189	17.9	16,717	7.1	25.6	42.9	295	0.24	37,830	7,728	30,102	111
75	178	18.6	17,445	8.9	19.9	55.8	276	0.22	42,719	8,116	34,603	38

Other Assumptions: $400/acre establishment cost in year 0, 6% discount rate, and $50/mbf transportation (road and hauling) cost.

Rotation Age Lengtheners

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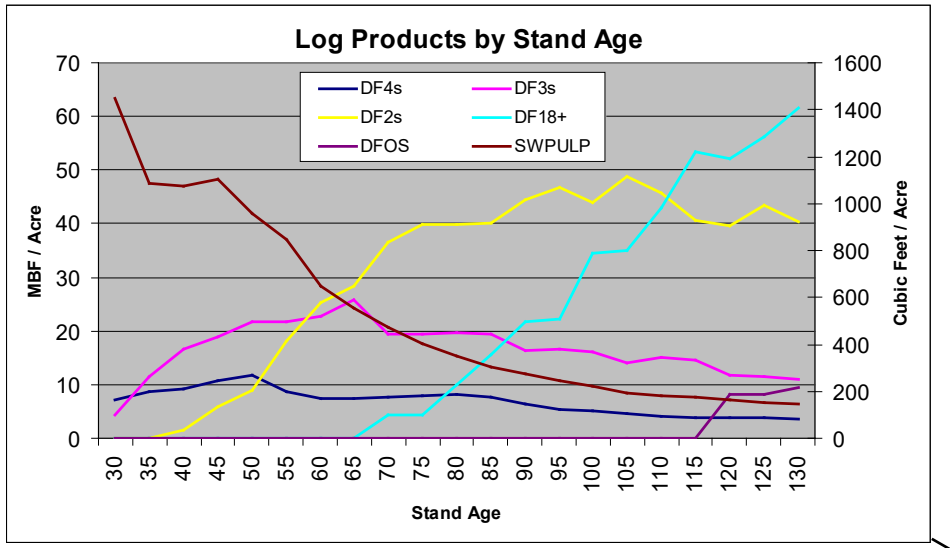

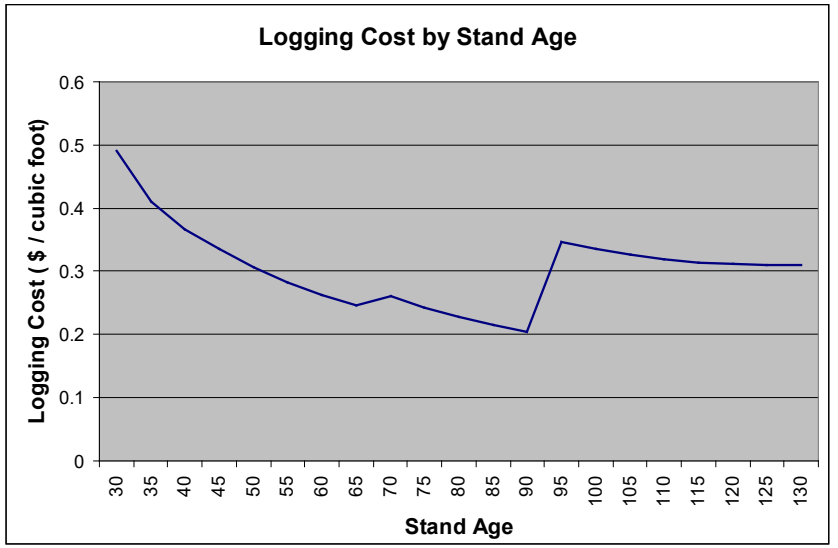

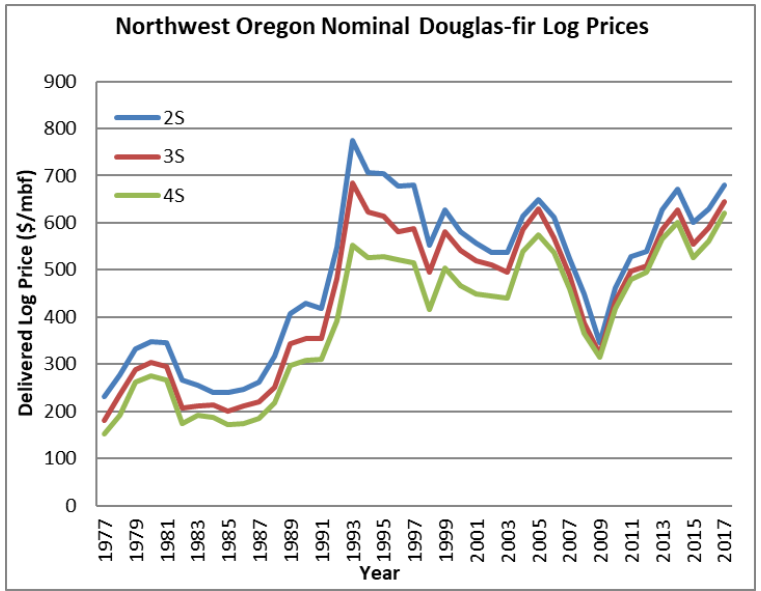

The longer we wait to harvest… The more volume, concentrated in higher value products, that can be removed at a lower per-unit cost.

Rotation ↑

Future Rotations

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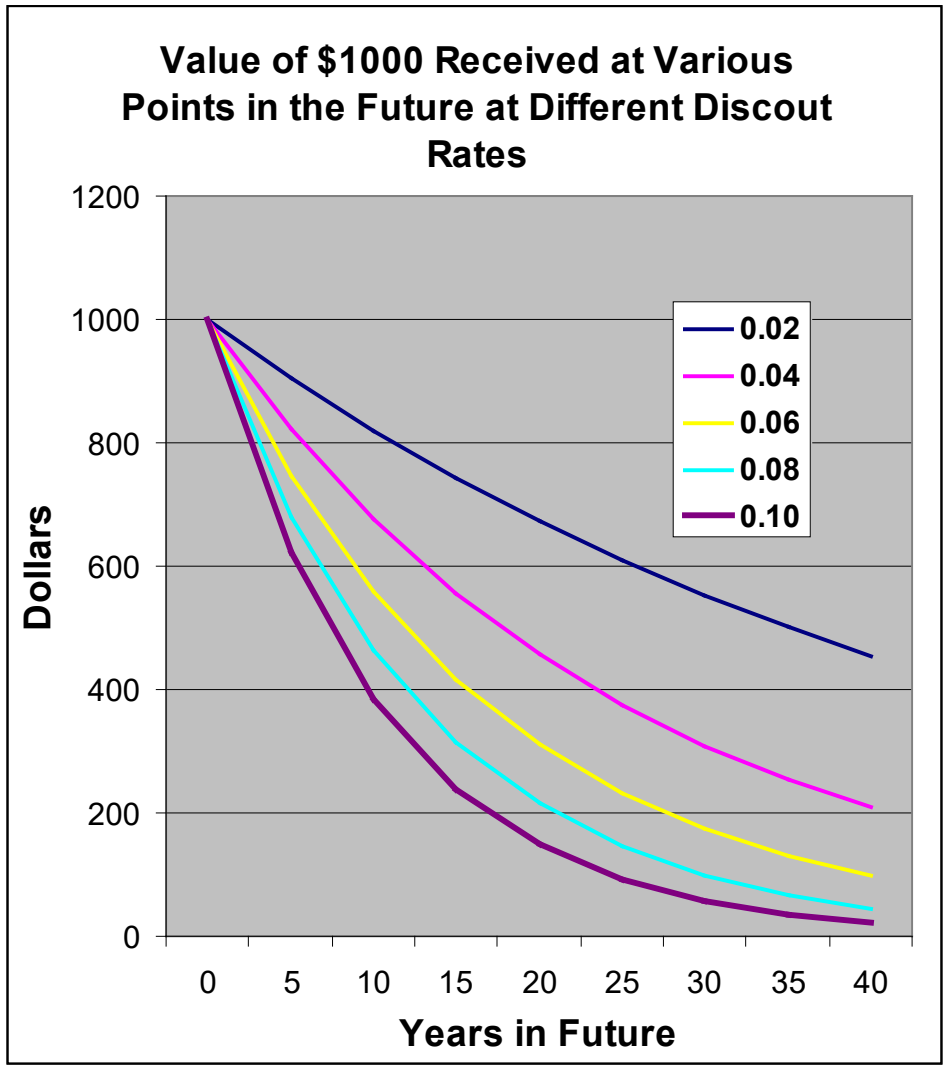

Consideration of Future Rotations rather than a single rotation value. (SEV)

The sooner the harvest…

We have our money in hand and can use it for other things.

Rotation

Example Bringing it all Together

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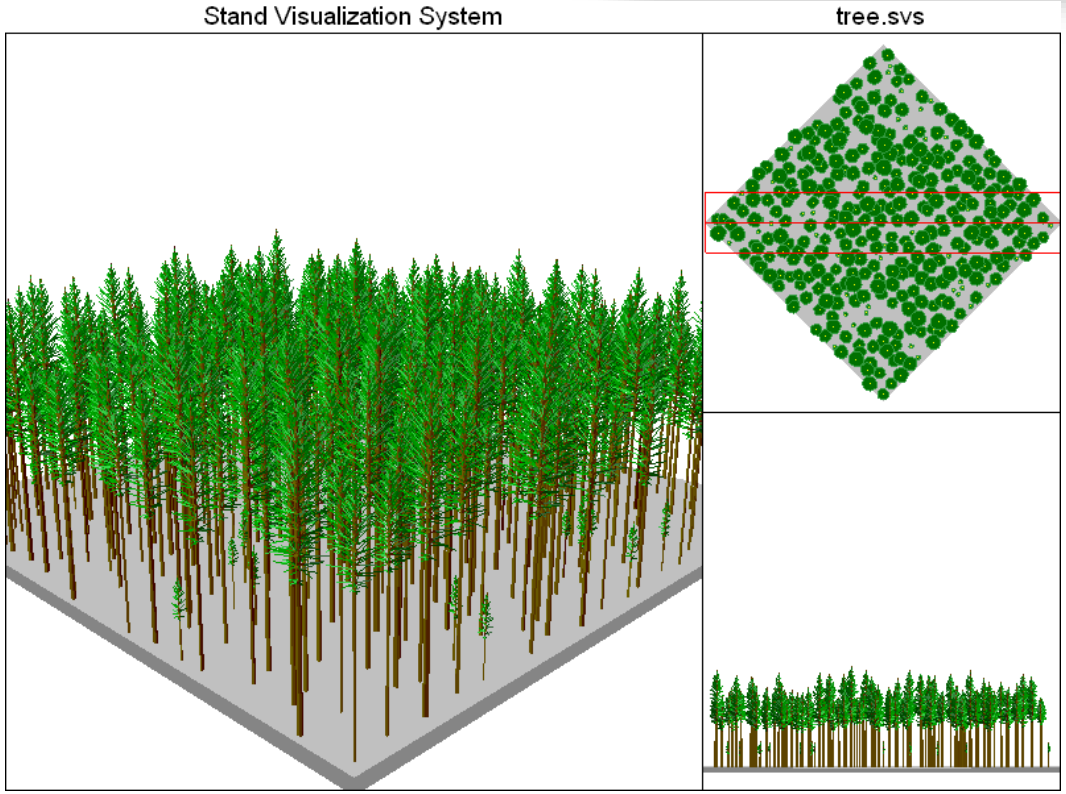
Using the same 30 year old stand, log prices, harvest costs and 6% discount rate we will evaluate:

- No Thinning
- Thin 35% of Volume Now
- Thin 35% of Volume in 5 Years



Now we are looking at a Land and Timber value Equation

$$LTV = \max \frac{\sum_{age=0}^{Rotation} \left(Logprice * LogQuantity_{age} - Costs_{age}\right)\left(1 + DiscountRate\right)^{Rotation-age} + SEV}{\left(1 + DiscountRate\right)^{Rotation-current\_age}}$$

Growth and Yield – Stand Characteristics

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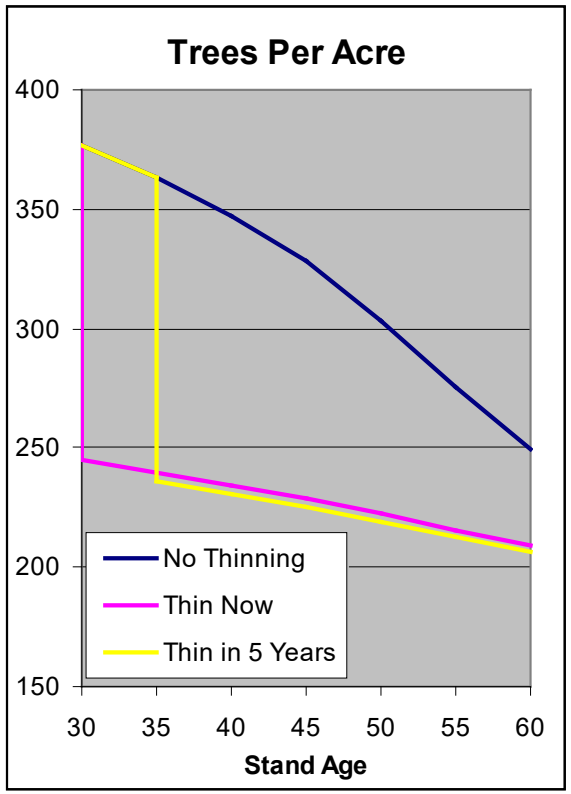
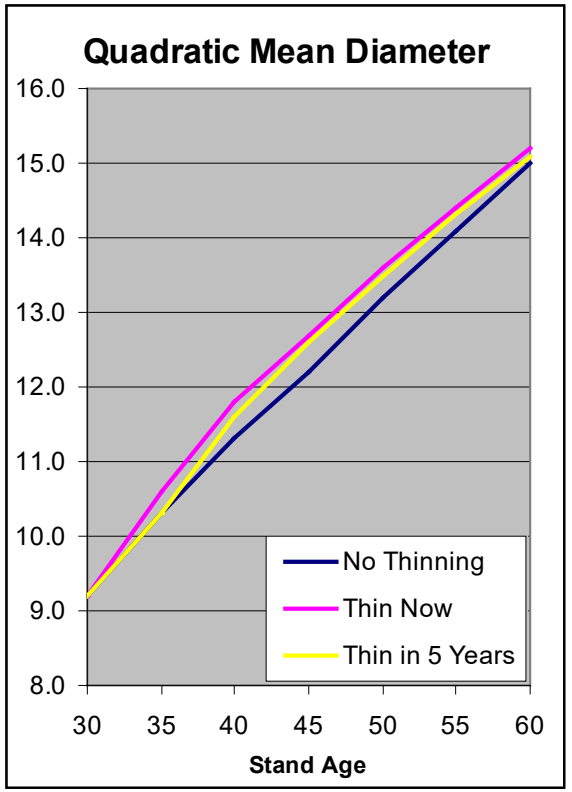
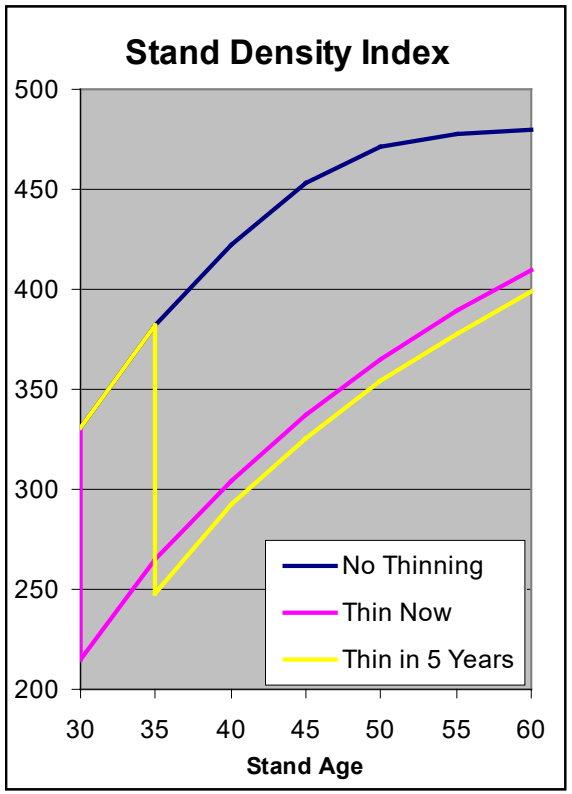
	No Thinning			Thin Now			Thin in 5 Years		
Stand Age	**TPA**	**QMD**	**SDI**	**TPA**	**QMD**	**SDI**	**TPA**	**QMD**	**SDI**
30	377	9.2	331	245	9.2	215	377	9.2	331
35	363	10.3	381	240	10.6	265	236	10.3	248
40	347	11.3	422	234	11.8	304	231	11.6	292
45	328	12.2	453	229	12.7	337	225	12.6	326
50	303	13.2	471	222	13.6	365	219	13.5	354
55	275	14.1	478	216	14.4	389	213	14.3	378
60	249	15.0	480	209	15.2	410	206	15.1	399







Growth and Yield - Volume

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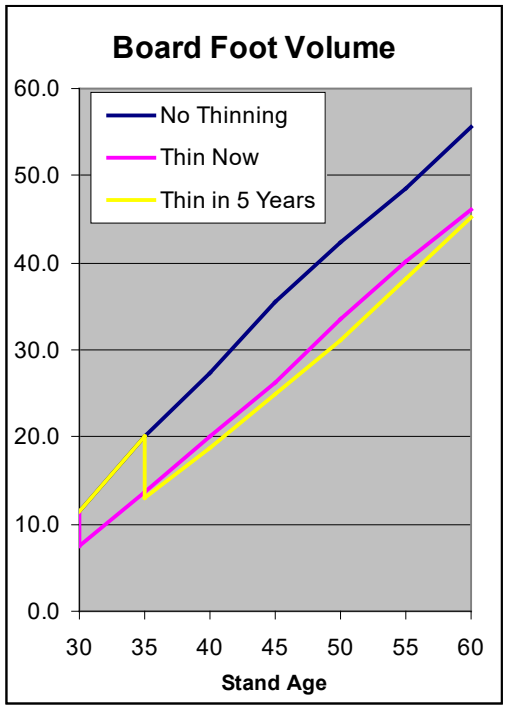
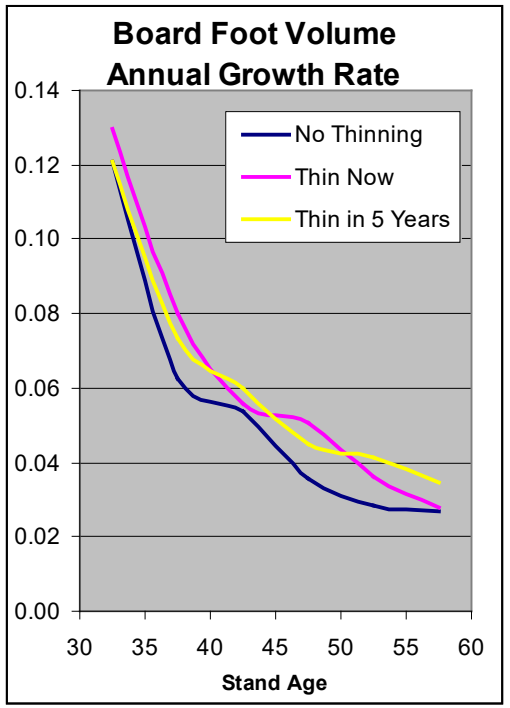
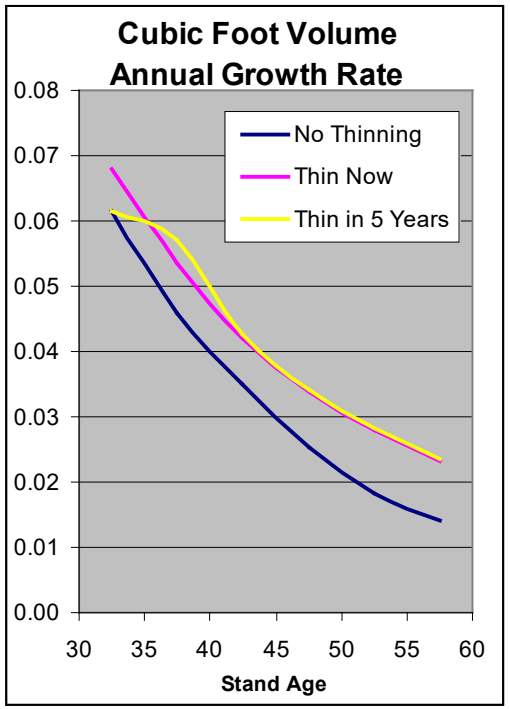
	No Thinning			Thin Now			Thin in 5 Years		
Stand Age	ft^3/acre	mbf/acre	ft^3 Pulp	ft^3/acre	mbf/acre	ft^3 Pulp	ft^3/acre	mbf/acre	ft^3 Pulp
30	4,964	11.4	1,448	4,840	7.4	941	4,964	11.4	1,448
35	6,685	20.2	1,083	4,482	13.6	748	6,518	13.1	704
40	8,369	27.3	1,073	5,820	20.0	727	5,592	18.7	688
45	9,937	35.5	1,102	7,148	26.2	726	6,893	24.9	686
50	11,267	42.3	957	8,442	33.6	514	8,155	31.1	731
55	12,324	48.6	845	9,684	40.2	518	9,368	38.1	497
60	13,213	55.5	651	10,859	46.1	512	10,521	45.1	492







Growth and Yield – Product Differentiation

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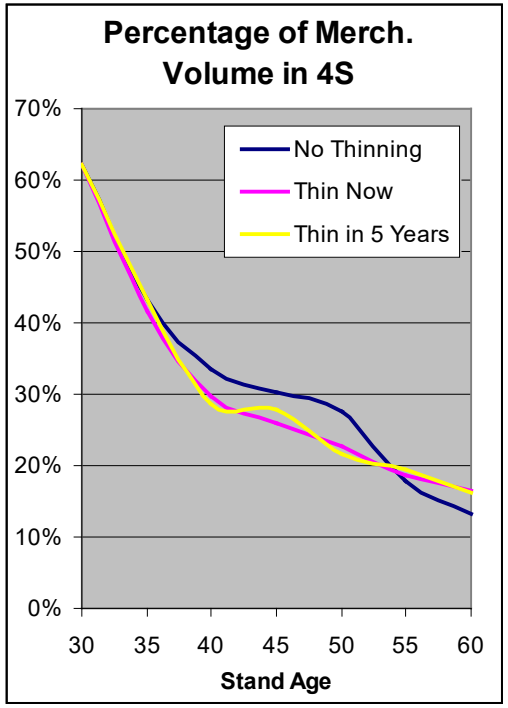
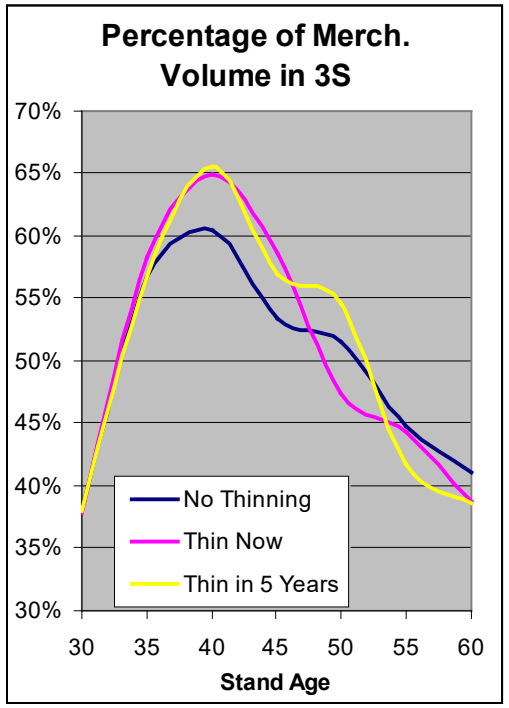
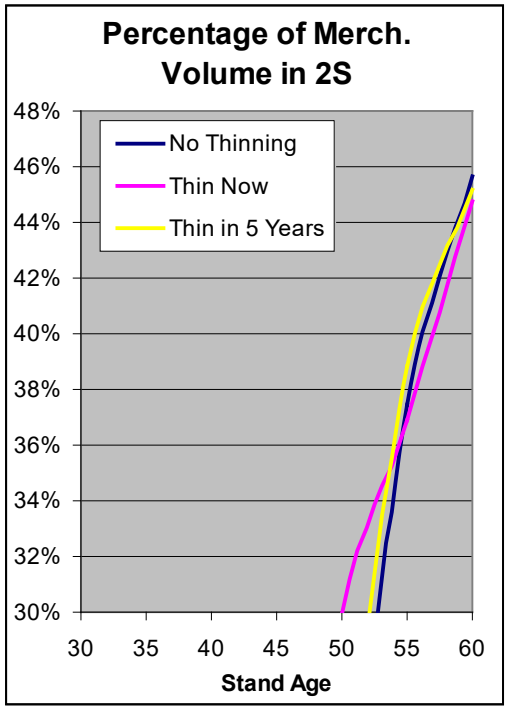
	No Thinning			Thin Now			Thin in 5 Years		
Stand Age	**4S**	**3S**	**2S**	**4S**	**3S**	**2S**	**4S**	**3S**	**2S**
30	7.1	4.3	0.0	4.6	2.8	0.0	7.1	4.3	0.0
35	8.7	11.5	0.0	5.7	7.9	0.0	5.7	7.4	0.0
40	9.2	16.5	1.7	5.9	13.0	1.1	5.4	12.2	1.1
45	10.8	19.0	5.8	6.8	15.4	4.0	7.0	14.2	3.8
50	11.6	21.8	8.8	7.6	15.9	10.1	6.8	17.0	7.4
55	8.6	21.8	18.2	7.5	17.8	14.8	7.4	15.9	14.8
60	7.4	22.8	25.3	7.6	17.9	20.6	7.3	17.4	20.4







Price Differentiation

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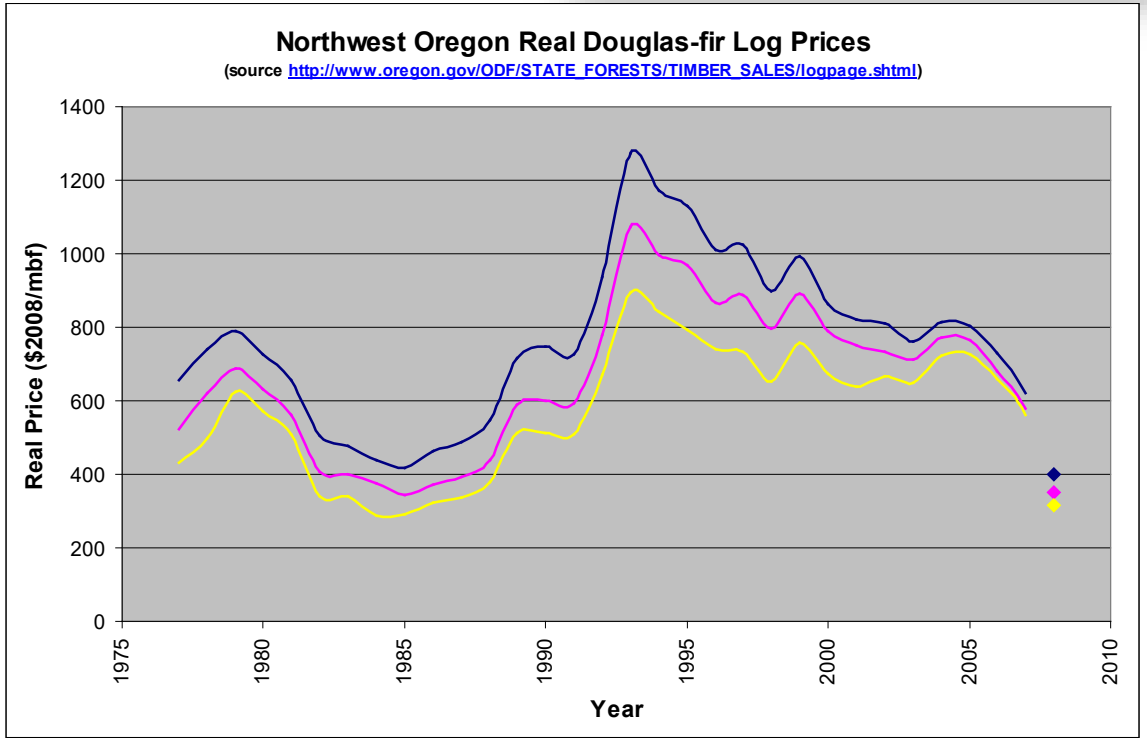
Here we look at current prices (Dots), past prices (Lines) and expectations of future prices to get the values we will use for the LTV equation.



Log Price Assumptions

1. Grade price differential will remain at current levels
2. Future real log prices will be higher than current levels but below the recent past (we will use 133% as a multiplier
3. There will be no real price appreciation in future (flat real prices

Real Log Prices for our Analysis

2 Saw	$532 / mbf
3 Saw	$466 / mbf
4 Saw	$419 / mbf
Pulp	$10 / ton stumpage

Logging Costs

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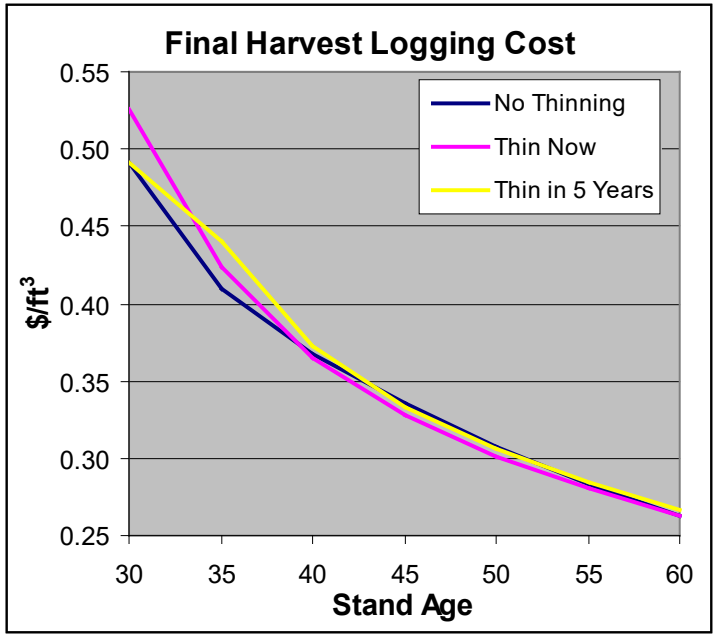
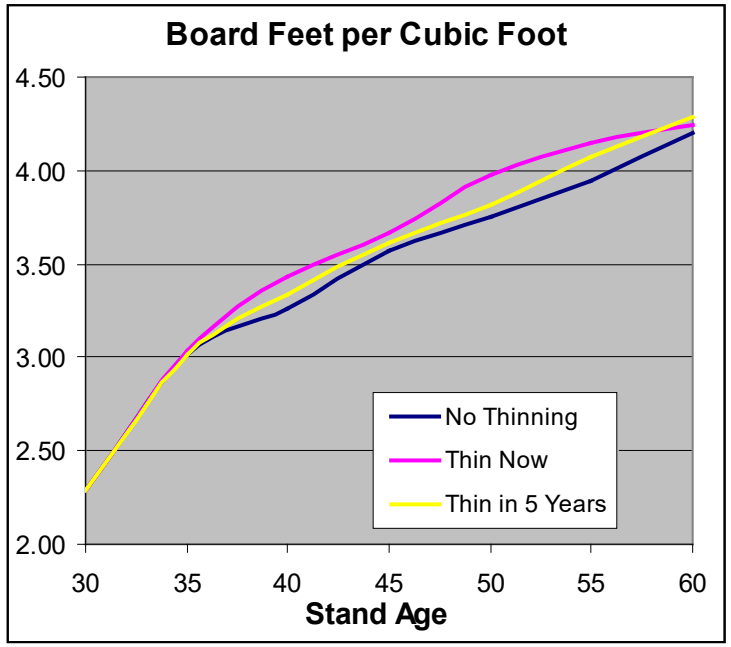
	No Thinning		Thin Now		Thin in 5 Years	
Stand Age	**Clearcut $/ft^3**	**Thinning $/ft^3**	**Clearcut $/ft^3**	**Thinning $/ft^3**	**Clearcut $/ft^3**	**Thinning $/ft^3**
30	0.49		0.53	0.58	0.49	
35	0.41		0.42		0.44	0.49
40	0.37		0.37		0.37	
45	0.34		0.33		0.33	
50	0.31		0.30		0.31	
55	0.28		0.28		0.28	
60	0.26		0.26		0.27	





Adapted from: FIGHT, R.D., C.B. LEDOUX, AND T.L. ORTMAN. 1984. Logging costs for management planning for young-growth coast Douglas-fir. USDA For. Serv. Gen. Tech. Rep. PNW-176. 10 p.

Revenues and Costs

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Revenue and Cost from Thinning Operations

	No Thinning			Thin Now			Thin in 5 Years		
Stand Age	Revenue	Cost	Net Rev.	Revenue	Cost	Net Rev.	Revenue	Cost	Net Rev.
30				1,887	1,185	702			
35							3,252	1,463	1,789

Revenue and Cost from Final Harvest

	No Thinning			Thin Now			Thin in 5 Years		
Stand Age	Revenue	Cost	Net Rev.	Revenue	Cost	Net Rev.	Revenue	Cost	Net Rev.
30	5,396	3,006	2,390	3,504	2,024	1,480	5,396	3,006	2,390
35	9,294	3,748	5,546	6,283	2,575	3,708	6,038	2,519	3,519
40	12,713	4,437	8,276	9,306	3,123	6,183	8,710	3,013	5,697
45	16,734	5,104	11,630	12,375	3,656	8,719	11,738	3,542	8,195
50	19,996	5,571	14,425	16,101	4,221	11,881	14,868	4,050	10,818
55	23,677	5,917	17,760	19,478	4,719	14,759	18,531	4,567	13,964
60	27,378	6,251	21,127	22,633	5,161	17,471	22,172	5,056	17,117

Land and Timber Value

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$$LTV = \max \frac{\sum_{age=0}^{Rotation} \left(Logprice * LogQuantity_{age} - Costs_{age}\right)\left(1 + DiscountRate\right)^{Rotation-age} + SEV}{\left(1 + DiscountRate\right)^{Rotation-current\_age}}$$

	No Thinning		Thin Now		Thin in 5 Years	
Stand Age	**LTV**	**Optimal**	**LTV**	**Optimal**	**LTV**	**Optimal**
30	3,252		3,045		3,252	
35	4,789		4,118		4,611	
40	5,103		4,637		5,000	
45	5,213	**X**	4,700	**X**	5,116	**X**
50	4,767		4,676		4,979	
55	4,339		4,342		4,791	
60	3,829		3,894		4,467	

Opportunity Cost

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In our particular case the No Thinning option yields the highest and best value for this stand.

If you choose to thin the stand now the opportunity cost would be **$513/acre**

If you choose to thin the stand in five years the opportunity cost would be **$97/acre**

Effect of Discount Rate

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8% Discount Rate

Stand Age	No Thinning LTV	No Thinning Optimal	Thin Now LTV	Thin Now Optimal	Thin in 5 Years LTV	Thin in 5 Years Optimal
30	2,599		2,391		2,599	
35	3,917		3,368		3,755	
40	3,930	X	3,663	X	3,953	X
45	3,732		3,517		3,867	
50	3,140		3,296		3,583	
55	2,624		2,888		3,287	
60	2,120		2,459		2,939	

8% Discount Rate

6% Discount Rate

Stand Age	No Thinning LTV	No Thinning Optimal	Thin Now LTV	Thin Now Optimal	Thin in 5 Years LTV	Thin in 5 Years Optimal
30	3,252		3,045		3,252	
35	4,789		4,118		4,611	
40	5,103		4,637		5,000	
45	5,213	X	4,700	X	5,116	X
50	4,767		4,676		4,979	
55	4,339		4,342		4,791	
60	3,829		3,894		4,467	

6% Discount Rate

4% Discount Rate

Stand Age	No Thinning LTV	No Thinning Optimal	Thin Now LTV	Thin Now Optimal	Thin in 5 Years LTV	Thin in 5 Years Optimal
30	5,319		5,112		5,319	
35	6,966		6,158		6,771	
40	7,570		6,859		7,298	
45	8,084	X	7,170		7,647	
50	7,920		7,462	X	7,744	
55	7,761		7,337		7,807	X
60	7,417		6,992		7,651	

4% Discount Rate

Conclusion

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One Landowner is Thinning While the Adjoining Landowner is not: Which One is Losing Money?

- Can we tell?
- Or better yet what would we need to know?

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