Western Red Alder and Douglas-fir Discounted Cash Flow Calculations

For:

Washington Hardwood Commission

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Discounted Cash Flow, Alder and Douglas-fir

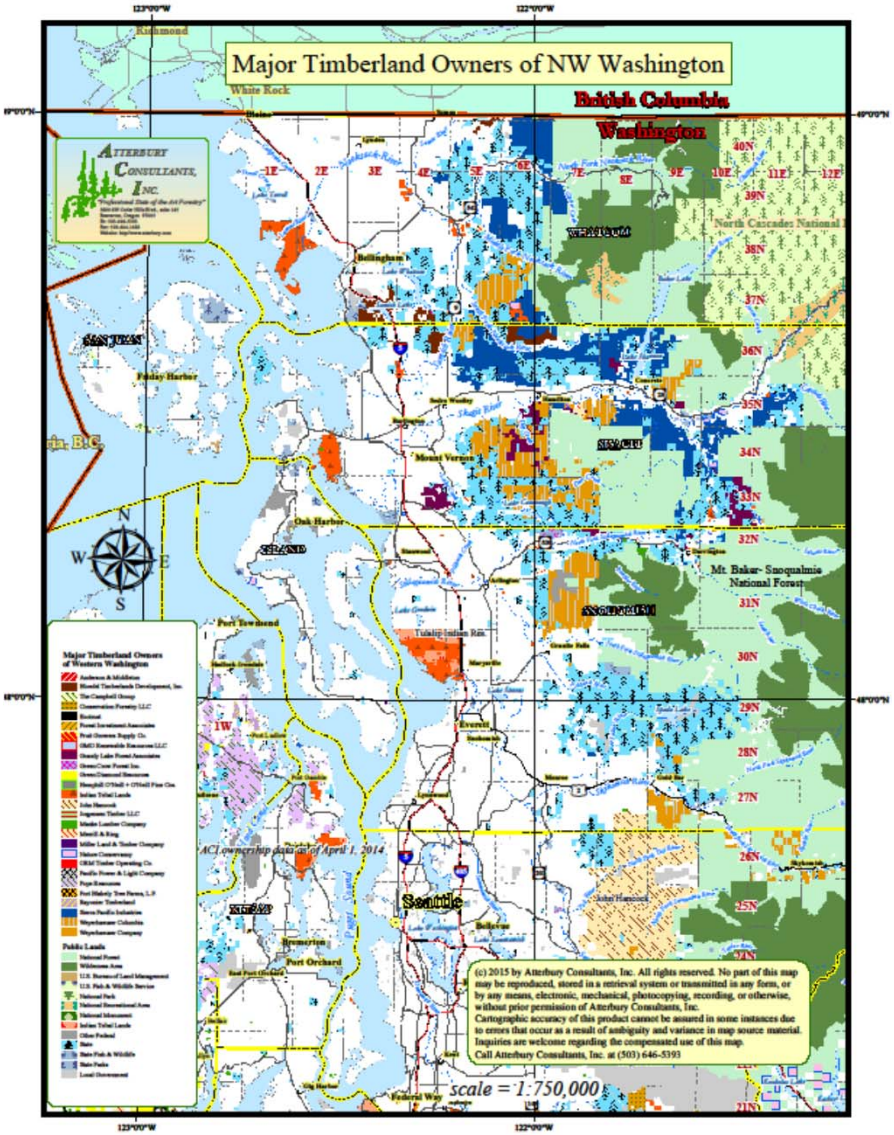
- Introduction
- Ownership and Inventory
- Discounted Cash Flows
- Summary

Introduction

- This presentation is to describe a process, not the answer. As more data is available, better analysis can be done.
- Discounted Cash Flow analysis is a way to help make decisions about choosing which species to grow and how to manage them.
- Management options are financial decisions. Planting stock, spacing, thinning, and pruning will change the yield and value of the final crop.

Introduction

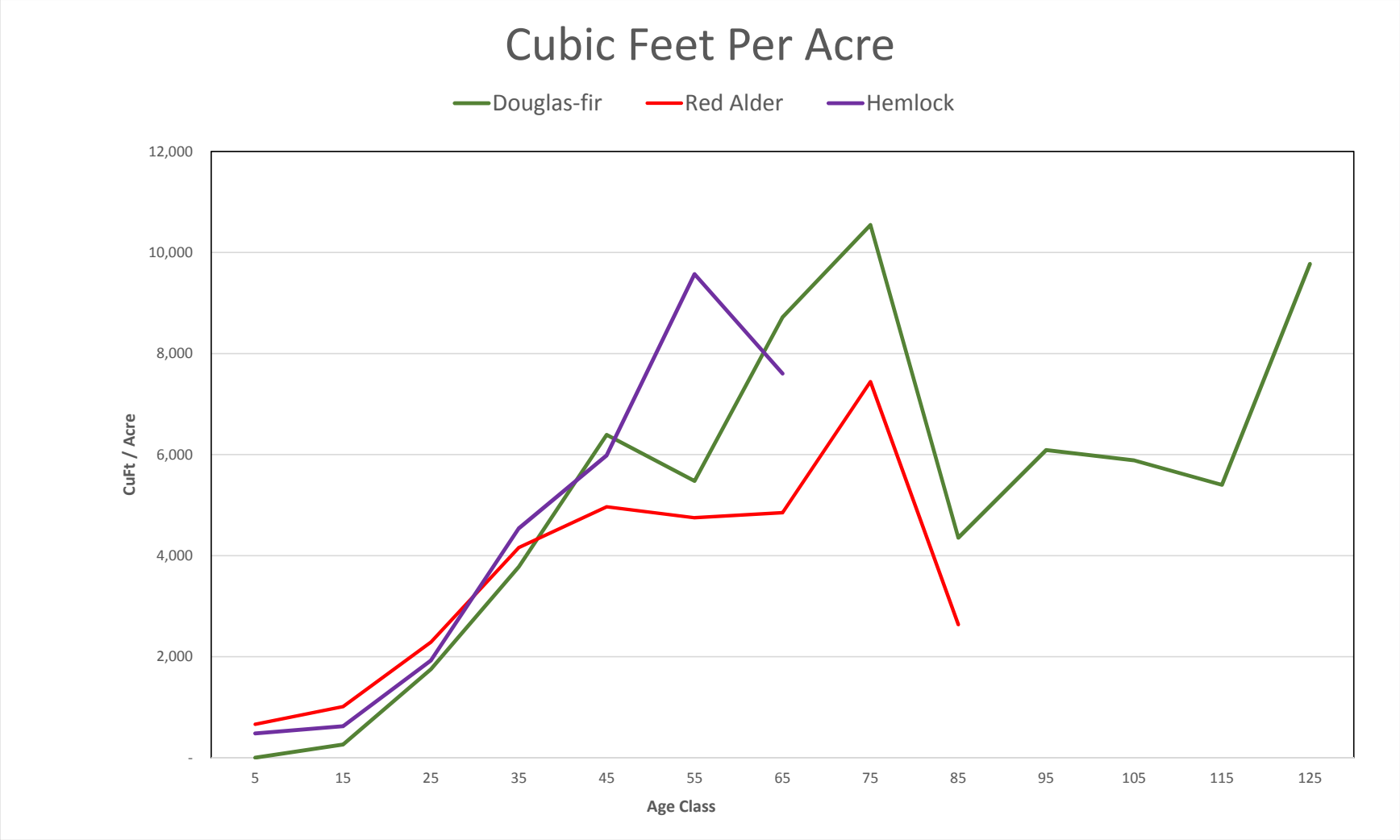
- Many years (in the 1970s?) ago I gave a talk at an Alder conference in Ocean Shores Washington, comparing yields of Red Alder and Douglas-fir. All we had was old yield tables and forest inventory data. Then everyone planted Douglas-fir.
- Today, many permanent plots are established measuring the growth and yield of Alder under various management regimes.
- Data for the red alder in this paper was taken from part of a paper I was given written by B. Herman.
- The Douglas-fir data is from an actual plantation in which we established permanent plots at age 15. We know the history of this plantation. Yields would have been higher if the big leaf maple was killed.



Owner	Acres	Per-cent	Gov %
National Forest	1 ,827,276	32%	
Other Public Private	1,162,489 2,176,199	20% 38%	52%
Unknown	547,708	10%	
Totals	**5,713,672**	**100%**	

Private Lands - King, Snohomish, Skagit, and Whatcom Counties

	Douglas-fir			Red Alder			Western Hemlock		
Age Class	Acres	Cu Ft	Cu Ft / Acre	Acres	Cu Ft	Cu Ft / Acre	Acres	Cu Ft	Cu Ft / Acre
Missing	254	2,081,957	8,197	282	2,351,556	8,339	0	0	
Nonstk	0	0		0	0		0	0	
5	31,183	0	-	28,837	19,103,224	662	25,005	12,057,914	482
15	62,034	16,191,076	261	24,174	24,455,612	1,012	19,037	11,885,410	624
25	**42,002**	**73,590,507**	**1,752**	**34,913**	**79,868,383**	**2,288**	**26,962**	**51,962,156**	**1,927**
35	32,528	122,954,303	3,780	68,975	286,903,868	4,160	46,684	211,984,910	4,541
45	38,217	244,214,645	6,390	71,275	354,054,391	4,967	62,787	375,786,228	5,985
55	29,202	159,981,903	5,478	46,205	219,461,527	4,750	33,566	321,270,120	9,571
65	35,747	311,690,472	8,719	23,147	112,235,895	4,849	7,714	58,646,000	7,603
75	3,826	40,345,074	10,545	9,159	68,173,705	7,443	0	0	
85	5,322	23,177,674	4,355	7,461	19,656,075	2,635	0	0	
95	19,022	115,857,046	6,091	0	0		0	0	
105	4,472	26,322,410	5,886	11,113	78,154,611	7,033	0	0	
115	6,903	37,288,471	5,402	0	0		0	0	
125	4,089	39,967,772	9,774	0	0		0	0	
Totals	314,801	1,213,663,310	3,855	325,541	1,264,418,847	3,884	221,755	1,043,592,738	4,706


Cubic Feet Per Acre
Douglas-fir
Red Alder
Hemlock
12,000
10,000
8,000
6,000
4,000
2,000
-
CuFt / Acre
5
15
25
35
45
55
65
75
85
95
105
115
125
Age Class

Comparing Discounted Cash Flow Values of Red Alder and Douglas-fir

$/Acre = ((Revenue - Costs) * Yield) / (1+DR)^Rotation years

Discount Rate = 5.50%

Alder

Highgrade	5%	$727
Sawlogs	75%	$677
Pulp	20%	$200
	100%	**$584**

Douglas-fir

Poles	5%	$800
Sawlogs	90%	$480
Pulp	5%	$225
	100%	**$483**

Rotation Years	Rev	Costs	Mbf Yield	Present Value
27	$584	$400	17.500	$759

Rotation Years	Rev	Costs	Mbf Yield	Present Value
27	$483	$300	12.600	$544

Log prices are from RISI Log Lines May 2015 NW Washington.

Natural Stands In NW Washington

Discount Rate 5.50%

	Red Alder							Douglas-fir						
Age Class	Acres	Cunits	*CCF / Acre*	Rev /CCF	Costs / CCF	Stumpage	NPV / Acre	Acres	Cunits	*CCF / Acre*	Rev / CCF	Costs / CCF	Stumpage	NPV / Acre
5	28,837	191,032	*6.62*					31,183	0	-				
15	24,174	244,556	*10.12*	$247	$81	$1,679	$752	62,034	161,911	*2.61*	$230	$81	$390	$175
25	34,913	798,684	*22.88*	$247	$81	$3,808	$998	42,002	735,905	*17.52*	$230	$81	$2,615	$686
35	68,975	2,869,039	*41.60*	$230	$81	$6,198	$951	32,528	1,229,543	*37.80*	$230	$81	$5,642	$866
45	71,275	3,540,544	*49.67*	$247	$81	$8,268	$743	38,217	2,442,146	*63.90*	$230	$81	$9,539	$857
55	46,205	2,194,615	*47.50*	$247	$81	$7,905	$416	29,202	1,599,819	*54.78*	$230	$81	$8,187	$431
65	23,147	1,122,359	*48.49*	$247	$81	$8,070	$249	35,747	3,116,905	*87.19*	$230	$81	$13,015	$401
75	9,159	681,737	*74.43*	$247	$81	$12,389	$223	3,826	403,451	*105.45*	$230	$81	$15,740	$284
85	7,461	196,561	*26.35*	$247	$81	$4,385	$46	5,322	231,777	*43.55*	$230	$81	$6,501	$69
95	0	0		$247	$81	$0	$0	19,022	1,158,570	*60.91*	$230	$81	$9,092	$56
105	11,113	781,546	*70.33*	$247	$81	$11,705	$42	4,472	263,224	*58.86*	$230	$81	$8,786	$32
115	0	0		$247	$81	$0	$0	6,903	372,885	*54.02*	$230	$81	$8,063	$17
125	0	0		$247	$81	$0	$0	4,089	399,678	*97.74*	$230	$81	$14,590	$18
Totals	**325,259**	**12,620,673**	***38.80***					**314,547**	**12,115,814**	***38.52***				

Converting Cunits to Mbf for Log Prices

Cunits, CCF is 100 cubic feet.

To get Mbf, Long log scribner, a plot was constructed in SuperACE to yield 38 Cunits per Acre and get the volume in board feet, in this case long log scribner.

SuperACE calculates both cubic and board feet for each log in each tree.

A Timber Analysis Report yields the volume and value of the timber.

This was done for red alder and Douglas-fir.

Timber Value Analysis

Project: **ALDER** **Date** **6/4/2015**

Twp	Rge	Sec:	Tract:	Type	Acres:
01N	**01W**	**01**	**YIELD**	**0002**	1.00

Revenues Species	Name	Av. Log Dia	Len	Logs	Tons	Cunits	MBF	$/Log	$/Acre	$/Ton	$/CCF	$/MBF	Total Dollars
R ALDER	3-SAWMIL	6.7	29	150	56	19	7	33.93	$5,089	$91	$273	$727	$5,089
R ALDER	4-SAWMIL	5.9	26	180	43	14	7	24.82	$4,468	$105	$315	$677	$4,468
R ALDER	PULP	5.0	22	110	15	5	2	10.93	$1,202	$79	$237	$501	$1,202
Revenue Tots & Ave.		6.0	26	*440*	*114*	*38*	*16*	*24.45*	*$10,760*	*$95*	*$284*	*$672*	*$10,760*
Per Acre				*440*	*114*	*37.89*	*16.000*						

Costs Costs by Line Item	$/Log	$/Acre	$/Ton	$/CCF	$/MBF	Total Dollars
1 FALL, BUCK	0.76	$336	2.96	8.87	21.00	336
2 YARD	2.55	$1,120	9.85	29.56	70.00	1,120
3 LOAD	0.44	$192	1.69	5.07	12.00	192
4 HAUL	0.96	$424	3.73	11.19	26.50	424
5 ROAD MAINT	0.18	$80	0.70	2.11	5.00	80
6 HARVEST TAX	0.80	$352	3.10	9.29	22.00	352
7 REFOREST	0.44	$195	1.72	5.15	12.19	195
8 ADIM	0.73	$320	2.81	8.44	20.00	320
Cost Totals and Averages	6.86	$3,019	26.56	79.67	188.69	3,019
Pre-Tax Profit or Loss	**17.59**	**$7,741**	**68.09**	**204.27**	**483.79**	**7,741**

Timber Value Analysis

Douglas -fir Stand, Planted, Site Index 140

Revenues Species	Name	Av. Log Dia	Len	Total Logs	Tons	Cunits	MBF	$/Log	$/Acre	$/Ton	$/CCF	$/MBF	Dollars
DOUG FIR	4-SAWMIL	5.1	22	10,195	1,384	532	246	12.40	2666.51	91.28	237.34	514.00	126,366
DOUG FIR	DOMESTIC	6.5	33	5,582	2,010	773	298	31.01	3652.11	86.09	223.83	580.00	173,074
Spp. Tot. and Ave.		**5.6**	**26**	***15,776***	***3,395***	***1,306***	***544***	***18.98***	***6318.62***	***88.21***	***229.34***	***550.19***	***299,439***
BL MAPLE	PULP	5.0	19	734	100	33	13	3.50	54.18	25.81	77.42	200.00	2,568
R ALDER	PULP	5.2	28	357	65	22	11	15.03	113.09	82.39	247.18	501.00	5,360
COTWOOD	CAMPRUN	5.4	19	280	21	10	6	9.00	53.22	119.47	250.89	450.00	2,522
WR CEDAR	SAWLOGS	5.0	12	133	7	3	1	10.66	29.82	195.64	440.20	1,066.00	1,413
Revenue Tots & Ave.		**5.5**	**26**	***17,280***	***3,588***	***1,374***	***575***	***18.02***	***6568.94***	***86.77***	***226.60***	***541.66***	***311,302***
Per Acre				*365*	*76*	*28.99*	*12.127*						

Costs Costs by Line Item	Total $/Log	$/Acre	$/Ton	$/CCF	$/MBF	Dollars
1 FALL, BUCK	0.70	254.68	3.36	8.79	21.00	12,069
2 YARD	2.33	848.92	11.21	29.28	70.00	40,230
3 LOAD	0.40	145.53	1.92	5.02	12.00	6,897
4 HAUL	0.88	321.38	4.25	11.09	26.50	15,230
5 ROAD MAINT	0.17	60.64	0.80	2.09	5.00	2,874
6 HARVEST TAX	0.73	266.80	3.52	9.20	22.00	12,644
7 REFOREST	0.53	195.00	2.58	6.73	16.08	9,241
8 ADIM	0.67	242.55	3.20	8.37	20.00	11,494

Stand Projection Model- Discounted Cash Flow

Project:	Testing	**Owner:**	Private	**Species**	**Red Alder**
Discount Rate	**5.50%**	**Species**	**RA**	**Log Prices**	**$/Mbf**
Real Price Increase	**0.00%**	**Site**	**120**	#2 Saw	**$650**
		Acres	**1.00**	#3 Saw	**$550**
		Annual Costs	**$ 20.0**	Pulp	**$200**

			Inventory Data						Costs			Log Grades				Rev	EBITDA	
Age	**Year**	**Activity**	**Trees / Acre**	**Ht feet**	**BA / Ac**	**QM DBH**	**Mbf / Acre**	**Total Mbf**	**Cost $ / Acre**	**Annual Costs $ / Acre**	**Cost $ / Mbf**	**#2 Saw**	**#3 Saw**	**Pulp**	**Total Grade %**	**Rev-enue $ / Mbf**	**Total Annual Cash Flow**	**Discounted Value**
0	**2015**	**Plow,Plant**	**250**	-	-				$400	$20				100%	100%		-$420	-$420
1	2016	**Spray**	**250**	5.0	8.0	2.4			$70	$20				100%	100%		-$90	-$85
2	2017	**Spray**	**250**	10.0	16.0	3.4			$70	$20				100%	100%		-$90	-$81
3	2018		**250**	15.0	24.0	4.2				$20				100%	100%		-$20	-$17
4	2019		**250**	20.0	32.0	4.8				$20				100%	100%		-$20	-$16
5	2020		**250**	25.0	40.0	5.4				$20				100%	100%		-$20	-$15
6	2021		**250**	30.0	48.0	5.9				$20				100%	100%		-$20	-$15
7	2022		**250**	34.0	56.0	6.4				$20				100%	100%		-$20	-$14
8	2023		**250**	37.0	64.0	6.9				$20				100%	100%		-$20	-$13
9	2024		**250**	40.0	72.0	7.3				$20				100%	100%		-$20	-$12
10	2025	**Thin**	150	43.0	80.0	9.9	2.000	2.0	$0	$20	$180			100%	100%	$ 200	$20	$12
11	2026	**Pruning**	150	46.0	82.5	10.0			$150	$20				100%	100%		-$170	-$94
12	2027		150	49.0	84.9	10.2				$20				100%	100%		-$20	-$11
13	2028		150	52.0	87.2	10.3				$20				100%	100%		-$20	-$10
14	2029		150	55.0	89.5	10.5				$20				100%	100%		-$20	-$9
15	2030		150	57.5	91.8	10.6				$20			25%	75%	100%		-$20	-$9
16	2031		150	60.0	94.0	10.7				$20			50%	50%	100%		-$20	-$8
17	2032		150	62.5	96.3	10.8				$20			50%	50%	100%		-$20	-$8
18	2033		150	65.0	98.5	11.0				$20			50%	50%	100%		-$20	-$8
19	2034		150	67.0	100.7	11.1				$20			75%	25%	100%		-$20	-$7
20	2035	**Thin**	100	69.0	102.9	13.7	2.500	2.5		$20	$150	0%	75%	25%	100%	$ 463	$761	$261
21	2036		100	66.0	103.9	13.8				$20		0%	75%	25%	100%		-$20	-$6
22	2037		100	68.0	104.9	13.9				$20		0%	75%	25%	100%		-$20	-$6
23	2038		100	70.0	105.9	13.9				$20		0%	75%	25%	100%		-$20	-$6
24	2039		100	67.0	106.9	14.0				$20		0%	75%	25%	100%		-$20	-$6
25	2040		100	69.0	107.9	14.1				$20		0%	75%	25%	100%		-$20	-$5
26	2041		100	71.0	108.9	14.1				$20		0%	75%	25%	100%		-$20	-$5
27	2042	Clearcut	100	68.0	109.9	14.2	17.000	17		$20	$150	10%	75%	15%	100%	$ 508	$6,058	$1,427
																	Total Value	**$812.6**
																	Per Acre	$812.62

Stand Projection Model- Discounted Cash Flow

Project:	Testing	**Owner:**	Private	**Species**	Douglas-fir
Discount Rate	5.50%	**Species**	DF	**Log Prices**	**$/Mbf**
Real Price Increase	0.50%	**Site**	140	#2 Saw	$580
		Acres	1.00	#3 Saw	$514
		Annual Costs	$ 20.0	Pulp	$225

			Inventory Data						Costs			Log Grades				Rev	EBITDA	
Age	**Year**	**Activity**	**Trees / Acre**	**Ht feet**	**BA / Ac**	**QM DBH**	**Mbf / Acre**	**Total Mbf**	**Cost $ / Acre**	**Annual Costs $ / Acre**	**Log Cost $ / Mbf**	**#2 Saw**	**#3 Saw**	**Pulp**	**Total Grade %**	**Revenue $ / Mbf**	**Total Annual Cash Flow**	**Discounted Value**
0	2015	Plant	400	-	-				$200	$20				100%	100%		-$220	-$220
1	2016	Spray	399	2.0	2.7	1.1			$70	$20				100%	100%		-$90	-$85
2	2017		398	4.5	5.4	1.6			$0	$20				100%	100%		-$20	-$18
3	2018		398	7.0	8.1	1.9				$20				100%	100%		-$20	-$17
4	2019		397	9.5	10.8	2.2				$20				100%	100%		-$20	-$16
5	2020		396	12.0	13.5	2.5				$20				100%	100%		-$20	-$15
6	2021		395	14.5	16.2	2.7				$20				100%	100%		-$20	-$15
7	2022		394	17.0	18.9	3.0				$20				100%	100%		-$20	-$14
8	2023		394	19.5	21.6	3.2				$20				100%	100%		-$20	-$13
9	2024		393	22.0	24.3	3.4				$20				100%	100%		-$20	-$12
10	2025		392	24.5	27.0	3.6				$20				100%	100%		-$20	-$12
11	2026		391	27.0	29.7	3.7				$20				100%	100%		-$20	-$11
12	2027		390	29.5	32.4	3.9				$20				100%	100%		-$20	-$11
13	2028		390	32.0	35.1	4.1				$20				100%	100%		-$20	-$10
14	2029		389	34.5	37.8	4.2				$20				100%	100%		-$20	-$9
15	2030		388	37.0	40.5	4.4				$20			25%	75%	100%		-$20	-$9
16	2031		385	39.5	49.9	4.9				$20			50%	50%	100%		-$20	-$8
17	2032		381	42.0	59.3	5.3				$20			50%	50%	100%		-$20	-$8
18	2033		378	44.5	68.7	5.8				$20			50%	50%	100%		-$20	-$8
19	2034		374	47.0	78.1	6.2				$20			75%	25%	100%		-$20	-$7
20	2035		371	49.5	87.5	6.6				$20		0%	75%	25%	100%		-$20	-$7
21	2036		368	52.0	96.9	7.0				$20		0%	75%	25%	100%		-$20	-$6
22	2037		364	54.5	106.3	7.3				$20		0%	75%	25%	100%		-$20	-$6
23	2038		361	57.0	115.7	7.7				$20		0%	75%	25%	100%		-$20	-$6
24	2039		357	59.5	125.1	8.0	1.927			$20		0%	75%	25%	100%		-$20	-$6
25	2040		337	62.0	129.1	8.4				$20		0%	75%	25%	100%		-$20	-$5
26	2041		316	64.5	133.1	8.8				$20		0%	75%	25%	100%		-$20	-$5
27	2042	Clearcut	295	67.0	137.1	9.2	12.127	12		$20	$140	10%	85%	5%	100%	$ 579	$5,305	$1,250
																	Total Value	**$690.3**
																	Per Acre	$690.31

Summary

Managed alder produces higher volumes and values than Douglas-fir at young ages, (up to 30 years or so).

Yields for Douglas-fir exceed those of alder at about age 30 and beyond.

Discounted Cash Flow calculations can be used to plan the management of red alder to make sure the investments in management can be profitable. There are risks.

Red Alder can be used to enhance the soils by adding nitrogen.

- Treat root rot areas.
- Inter-planting alder in a fir plantation.
- Alternating crops.