

Simpson

June 11, 1975

Mr. James M. McDonough
PROSE, Inc.
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Los Angeles, California 90045

Dear Jim,

I've been meaning to write to you since the Western Forest Economists' Conference in Wemme, Oregon last month. I enjoyed your presentation, and believe more and more of it is beginning to sink in. You and Joe Thames must have also picked up a greater appreciation of the political-education aspects of our project.

Since we talked at Wemme I've been pretty busy on other things and haven't had the chance to do much more on reviewing your paper. I'm still convinced, however, that the example in your paper taken from my dissertation requires an oldest first harvest priority for a present value maximum. It's not clear to me why EPOC/TIMM wants to harvest so many age classes at the same time, but I recall Lembersky's comment that the model you used was designed to work best when there was some level of control applied to most activities. Is there any possible connection?

It's fairly easy to come up with a counter-example to the EPOC/TIMM solution that has a higher present value. We've done this with your EPOC/TIMM solution by interchanging the age classes of the acres harvested in periods one and two only, without changing the number of acres harvested during either period. This leaves your solution unchanged for the remaining time periods.

The EPOC/TIMM solution harvests in age classes 6-11 in period one and age classes 8-12 in period two. We've duplicated this with a hand calculation which is slightly different than your computer run due to rounding. Our hand calculation of your results shows 7,966,101 units being harvested from 47,277 acres in period one and 8,034,347 units being harvested from 41,919 acres in period two. The present value of the harvests for these two periods is \$393,674,048.

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Our counter-example to show that this is not a maximum defers the harvest of 1,463 acres of age class 6 during period one until period two when it is age class 7. Instead, an additional 1,463 acres of age class 11 are harvested in period one which in your solution were left for harvest in period two. The present value of the harvests from these two periods increases by \$1,038,293 to \$394,712,341 with just this one change. Since we haven't changed the acres harvested during these two periods and have the same inventory after the controls have been performed, we haven't changed the remainder of your solution. Attachments I and II show the details of the calculations we have made.

I'm convinced that for this particular problem present value will always be increased by substituting volume from older age classes for younger age classes at every point in time when this is possible. Attachment III takes the EPOC/TIMM solution in terms of harvest volumes and uses the ECHO model's final report generator to derive a harvest plan that takes these volumes from the oldest available stands. The present value of the EPOC/TIMM harvest levels increases by \$2,672,706 by specifying that the oldest stands be harvested first. Again, this is more evidence that the oldest first logging priority is optimal for this example with only one type of stand.

Finally, I'm not sure if I ever gave you a copy of an ECHO solution to the same example you used in your paper presented at Wemme. This is enclosed as Attachment IV. These ECHO results are slightly higher than the EPOC/TIMM results, but I'm still amazed at the similarity of the two approaches. ECHO starts the cash flows at the beginning rather than the end of each year so we adjusted your EPOC/TIMM results by 1.06 to make them comparable to ECHO. For this particular ECHO run we've also used a ϕ factor of .003 to account for land holding costs. I recognize that the ϕ factor is not constant over time for this non-linear problem, but believe it to be an adequate technique to account for land holding costs. The ϕ factor is described in detail in Gaffney which I sent you earlier. Hence we used 1.063 for $1+i+\phi$ in the difference equation, but discounted all the resulting net cash flows by just 6.0 percent.

I understand you've already made some revisions to your Wemme paper and have submitted it for publication. If you've retained the comparison with ECHO, I think the problems used in both models should be identical. In

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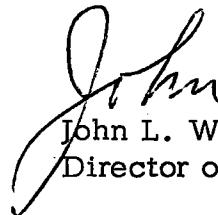
your Wemme paper the major differences between your problem and the one referred to from my dissertation were the one versus ten year time and regeneration periods. The difference in regeneration periods accounts for most of the difference in the two steady state averages.

Other differences that have been eliminated by Attachment IV are the forest inventory when harvesting begins, the per acre harvest volumes available from each age class, and the demand and marginal revenue curves.

After you've had a chance to look at this material, I'll give you a call. If you have an extra copy of your latest paper, I'd also like to see it.

We are moving slower than I expected in getting a project organized and funded at the University of Washington, but are still moving ahead with it. It will be at least a couple of weeks before we know anything definite about the Pacific Northwest Regional Commission. I hear from Jack Keane very frequently, and I'm sure he's keeping you informed.

Sincerely yours,



John L. Walker
Director of Resource Services

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Attachments

cc: John T. Keane, W.T.A.

ATTACHMENT I

An Example Showing the EPOC/TIMM Solution
Improved by Substituting Older for Younger
Age Classes in the Harvest Plan

	<u>EPOC/TIMM</u>		<u>Counter-Example</u>	
	<u>Period One</u>	<u>Period Two</u>	<u>Period One</u>	<u>Period Two</u>
<u>Volume</u>	7,966,101	8,034,347	8,104,925	7,916,526
<u>Price</u>	60.17	59.83	59.48	60.41
<u>Revenue</u>	479,316,274	480,681,041	482,043,454	478,316,510
<u>Costs</u>	137,502,900	134,940,300	137,496,989	134,943,929
<u>Net Rev.</u>	341,813,374	345,740,741	344,546,465	343,372,581
<u>Discount Factor</u>	0.73601	0.41099	0.73601	0.41099
<u>Discounted Net Rev.</u>	251,578,061	142,095,987	253,589,644	141,122,697
<u>Present Value for 20 Years</u>	<u>393,674,048</u>		<u>394,712,341</u>	

ATTACHMENT II

The Substitution of Older for Younger Age
Classes in the EPOC/TIMM Solution

EPOC/TIMM

Age Class	Period One			Period Two		
	Vol./Acre	Acres Cut	Volume	Vol./Acre	Acres Cut	Volume
6	91.68	1463	134,128	116.28	0	0
7	116.28	4078	474,190	138.27	596	82,409
8	138.27	4768	639,271	157.44	571	89,898
9	157.44	4896	770,826	173.61	2256	391,664
10	173.61	4320	749,995	186.57	8352	1,558,233
11	186.57	27752	5,177,691	196.13	30144	5,912,143
		47277	7,966,101		41919	8,034,347

Counter-Example

Age Class	Period One			Period Two		
	Vol./Acre	Acres Cut	Volume	Vol./Acre	Acres Cut	Volume
6	91.68	0	0	116.28	1463	170,118
7	116.28	4078	474,190	138.27	596	82,409
8	138.27	4768	639,271	157.44	571	89,898
9	157.44	4896	770,826	173.61	2256	391,664
10	173.61	4320	749,995	186.57	8352	1,558,233
11	186.57	29215	5,450,643	196.13	28681	5,625,205
		47277	8,104,925		41919	7,917,527

ATTACHMENT III

ECHO -- ECONOMIC HARVEST OPTIMIZER
 STATIC DEMAND -- NO GENETICS

EPOC/TIMM Solution With Oldest First Logging Priority

PROBLEM SPECIFICATIONS

CARD 1

INITIAL ITERATION STEP IS 99999. INTEREST RATE IS.791 REGENERATION COST IS 30. HARVESTS ARE SPECIFIED
 INITIAL HARVEST LEVEL IS 8000000. TIME HORIZON IS 31YEARS FIXED COSTS ARE 1250000. ANNUALLY
 TOLERABLE DIFFERENCE IN HARVEST LEVELS OF CYCLE (DCYCLE) IS 2.0 FIRST TIME TO CHECK FOR CYCLING IS 31
 TOLERABLE SUM OF ACRES USED AND LEFT (DACRES) IS 10.0 TIME PERIODS BETWEEN CHECKS FOR CYCLING IS 20
 TOLERABLE DIFFERENCE IN INITIAL HARVEST LEVEL (DX0) IS 0.5

ITERATION REPORT REQUESTED
 INTERMEDIATE PARTIAL INVENTORY REPORT REQUESTED
 BEGINNING TIME 0 ENDING TIME 1
 BEGINNING ITERATION 35 ENDING ITERATION 40

DEMAND CURVE IS NOT SHIFTING

CARD 2

AGE	1	2	3	4	5	6	7	8	9
0	0	0	0	0	0	0	0	0	0
0- 9	4000.	0.	0.	0.	0.	0.	0.	0.	0.
10- 19	26600.	0.	0.	0.	0.	0.	0.	0.	0.
20- 29	16100.	0.	0.	0.	0.	0.	0.	0.	0.
30- 39	19000.	0.	0.	0.	0.	0.	0.	0.	0.
40- 49	21500.	0.	0.	0.	0.	0.	0.	0.	0.
50- 59	15700.	0.	0.	0.	0.	0.	0.	0.	0.
60- 69	17700.	0.	0.	0.	0.	0.	0.	0.	0.
70- 79	17800.	0.	0.	0.	0.	0.	0.	0.	0.
80- 89	20300.	0.	0.	0.	0.	0.	0.	0.	0.
90- 99	21600.	0.	0.	0.	0.	0.	0.	0.	0.
100-109	70600.	0.	0.	0.	0.	0.	0.	0.	0.
110-119	0.	0.	0.	0.	0.	0.	0.	0.	0.
120-129	0.	0.	0.	0.	0.	0.	0.	0.	0.
130-139	0.	0.	0.	0.	0.	0.	0.	0.	0.
140-149	0.	0.	0.	0.	0.	0.	0.	0.	0.
150-159	0.	0.	0.	0.	0.	0.	0.	0.	0.

CARD 3

YIELD EQUATION VOL=-63.70 +(3.549)*AGE+(-.7193E-02)*AGE**2+(-.3270E-04)*AGE**3

EST AFTER

0 -32.362 0.913 32.376 61.832 89.084 113.936 136.192 155.655 172.130 185.421 195.330 201.662 204.220 202.809 197.232 187.294

EQUATION FOR UNIT COST COST(VOL) = 44.32 + (-.4591 *VOL) + (0.2716E-02*VOL**2) + (-.5620E-05) *VOL**3

EQUATION FOR AMOUNT OF WOOD ALLOCATED TO MARKETS

AS A FUNCTION OF TOTAL MARGINAL REVENUE (MRT), TIME, AND RATE OF SHIFT OF DEMAND (RATE)
MRT A VOL=0.1000E 08*((1+RATE)**T)+(-.1000E 06*MRT)+(0.0 *MRT**2)+(0.0 *MRT**3)
MRT B VOL=0.0 *((1+RATE)**T)+(0.0 *MRT)+(0.0 *MRT**2)+(0.0 *MRT**3)

EQUATION FOR PRICE AS A FUNCTION OF AMOUNT OF WOOD TO A MARKET, TIME, AND RATE

MARKET A PRICE=100.0 *((1+RATE)**T)+(-.5000E-05*VOL)+(0.0 *VOL**2)+(0.0 *VOL**3)
MARKET B PRICE=0.0 *((1+RATE)**T)+(0.0 *VOL)+(0.0 *VOL**2)+(0.0 *VOL**3)

EQUATION FOR VOLUME TO A MARKET AS A FUNCTION OF PRICE, TIME, AND RATE

MARKET A PRICE=C.2070E 08*((1+RATE)**T)+(-.2000E 06*PRICE)+(0.0 *PRICE**2)+(0.0 *PRICE**3)
MARKET B PRICE=C.0 *((1+RATE)**T)+(C.0 *PRICE)+(0.0 *PRICE**2)+(0.0 *PRICE**3)

TWO-PIECE TOTAL MARGINAL REVENUE (MRT) CURVE AS A FUNCTION OF TOTAL HARVEST VOLUME, TIME, AND RATE

FROM 0 TO ***** MRT=100.0 *((1+RATE)**T)+(-.1000E-04*VOL)+(0.0 *VOL**2)+(0.0 *VOL**3)
ABOVE ***** MRT=0.0 *((1+RATE)**T)+(0.0 *VOL)+(0.0 *VOL**2)+(0.0 *VOL**3)

TWO-PIECE FUNCTION FOR TOTAL HARVEST VOL AS A FUNCTION OF MRT, TIME, AND RATE

FROM 0 TO ***** VOL=0.1000E 08*((1+RATE)**T)+(-.1000E 06*MRT)+(0.0 *MRT**2)+(0.0 *MRT**3)
ABOVE ***** VOL=0.0 *((1+RATE)**T)+(0.0 *MRT)+(0.0 *MRT**2)+(0.0 *MRT**3)

TWO-PIECE FUNCTION FOR PRICE AS A FUNCTION OF TOTAL HARVEST, TIME, AND RATE

FROM 0 TO ***** PRI=100.0 *((1+RATE)**T)+(-.5000E-05*VOL)+(0.0 *VOL**2)+(0.0 *VOL**3)
ABOVE ***** PRI=0.0 *((1+RATE)**T)+(0.0 *PRI)+(0.0 *PRI**2)+(0.0 *PRI**3)

STATIC DEMAND -- NO GENETICS
HARVEST, NET CASH FLOW AND PRESENT VALUE REPORT

TIME	XT	XA	XB	PA	PB	ACRES REGEN	REGEN COST	FIXED COST	LOGGING COST	NET CASH FLOW	1/(1+i)^t * DISCOUNTED NCF
0	7966074.	7966074.	0.	60.170	0.0	42698.2	1280947.	1250000.	133098192.	343686400.	7.8017268134368.
10	8033968.	8033968.	0.	59.830	0.0	41632.4	1248971.	1250000.	132290512.	345883904.	4.3565150683584.
20	7686145.	7686144.	0.	61.569	0.0	41737.1	1252113.	1250000.	128724416.	342003456.	2.432783157696.
30	7194419.	7194419.	0.	64.028	0.0	43853.4	1315602.	1250000.	124131088.	333946368.	1.358449363136.
40	6255166.	6255166.	0.	68.724	0.0	4792.8	1343784.	1250000.	111986256.	315300608.	0.758523916480.
50	5791832.	5791831.	0.	71.041	0.0	60307.1	1809214.	1250000.	117814112.	290582784.	0.423612308020.
60	2761898.	2761898.	0.	86.191	0.0	34951.3	1048538.	1250000.	61205968.	174564864.	0.23654128296.
70	2652797.	2652796.	0.	86.736	0.0	30471.9	914157.	1250000.	56243840.	171664928.	0.13212267468.
80	3090352.	3090352.	0.	84.548	0.0	33707.9	1011237.	1250000.	64050912.	194971632.	0.07371437891.
90	3729517.	3729517.	0.	81.352	0.0	39924.1	1197222.	1250000.	76674896.	224282288.	0.0412923625.
100	5791832.	5791831.	0.	71.041	0.0	65470.8	1964124.	1250000.	121920480.	286321664.	0.023065416.
110	2761898.	2761898.	0.	86.191	0.0	30125.3	903759.	1250000.	57243344.	178652272.	0.0128229404.
120	2652797.	2652796.	0.	86.736	0.0	24575.1	737254.	1250000.	51384368.	176721296.	0.0072126714.
130	3090352.	3090352.	0.	84.548	0.0	26576.4	797293.	1250000.	58166480.	201070016.	0.004080506.
140	3729517.	3729517.	0.	81.352	0.0	32478.2	974347.	1250000.	70532496.	230648176.	0.002251563.
150	5791832.	5791831.	0.	71.041	0.0	54654.5	1639634.	1250000.	113012096.	295554560.	0.001236899.
160	2761898.	2761898.	0.	86.191	0.0	25558.3	766750.	1250000.	53474928.	182557696.	0.000712727.
170	2652797.	2652796.	0.	86.736	0.0	22813.6	684407.	1250000.	49930832.	178227680.	0.00046933.
180	3090352.	3090352.	0.	84.548	0.0	22350.6	670518.	1250000.	5345568.	204017696.	0.00024435.
190	3729517.	3729517.	0.	81.352	0.0	25341.4	760243.	1250000.	65903328.	235491360.	0.00012858.
200	5791832.	5791831.	0.	71.041	0.0	39593.5	1187804.	1250000.	102476176.	306542336.	0.00012678.
210	2761898.	2761898.	0.	86.191	0.0	19762.5	592874.	1250000.	49347376.	186859120.	0.0000707.
220	2652797.	2652796.	0.	86.736	0.0	18028.5	540855.	1250000.	46878624.	181423440.	0.0000383.
230	3090352.	3090352.	0.	84.548	0.0	19628.7	588861.	1250000.	53862496.	205582432.	0.0000243.
240	3729517.	3729517.	0.	81.352	0.0	33362.0	700893.	1250000.	64804752.	236649328.	0.0000156.
250	5791832.	5791831.	0.	71.041	0.0	15827.1	1000859.	1250000.	98863344.	310342144.	0.0000114.
260	2761898.	2761898.	0.	86.191	0.0	14472.1	474812.	1250000.	4707048.	189254512.	0.000039.
270	2652797.	2652796.	0.	86.736	0.0	14472.1	434163.	1250000.	44551760.	183856992.	0.000021.
280	3090352.	3090352.	0.	84.548	0.0	16564.3	496929.	1250000.	51634000.	207902848.	0.000013.
290	3729517.	3729517.	0.	81.352	0.0	19856.7	595701.	1250000.	62131840.	239427456.	0.00009.
300	5791832.	5791831.	0.	71.041	0.0	30808.4	924252.	1250000.	96438688.	312843264.	0.00006.

TOTAL = 593571534

*Planes cut per double are identical to the EPOCH/TIHM solution. The areas cut differ from EPOCH/TIHM; the
 exact area shown is cut first.

EPOCH/TIHM 100 ac PV = 589 687 858
 *EchP 100 ac. PV = 592 360 564
 (adjusted by 1.06 to match EchP)

TIME = 0 HARVEST LEVEL = 7966074.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
100	70600.00	186.57	13171617.37
MR =	20.33926	UNCOST = 16.70813	MV = 1213.207
MR =	22.53906	UNCOST = 16.35324	
NEXT HARVEST LEVEL = 7746094.00000			

TIME = 1 HARVEST LEVEL = 8033968.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
110	27901.76	196.13	5472288.85
100	21600.00	186.57	4029843.27
MR =	19.66032	UNCOST = 16.70813	MV = 986.365
MR =	21.33245	UNCOST = 16.35324	
NEXT HARVEST LEVEL = 7861756.00000			

TIME = 2 HARVEST LEVEL = 7686145.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
110	7869.37	196.13	1543396.64
100	20300.00	186.57	3787306.41
90	17800.00	173.61	3090183.86
MR =	23.13857	UNCOST = 17.06944	MV = 1886.898
MR =	26.82191	UNCOST = 16.70813	
NEXT HARVEST LEVEL = 7317809.00000			

TIME = 3 HARVEST LEVEL = 7194419.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
100	4232.24	186.57	789595.93
90	17700.00	173.61	3072823.28
80	15700.00	157.44	2471816.42
70	21500.00	138.27	2972742.10
MR =	28.05582	UNCOST = 17.90915	MV = 2512.469
MR =	33.39744	UNCOST = 17.42924	
NEXT HARVEST LEVEL = 6661257.00000			

TIME = 4 HARVEST LEVEL = 6255166.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
80	15278.83	157.44	2405506.75
70	19000.00	138.27	2627074.42
60	16100.00	116.28	1872133.78
MR =	37.44835	UNCOST = 18.82196	MV = 3878.806
MR =	45.96214	UNCOST = 17.90915	
NEXT HARVEST LEVEL = 5403786.00000			

TIME = 5 HARVEST LEVEL = 5791832.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
70	5586.00	138.27	772359.78
60	26600.00	116.28	3072823.28
50	4000.00	91.68	366721.25
40	4298.24	64.66	2760845.28

MR = 42.08170 UNCDST = 24.46886 MV = 2039.482
MR = 42.97166 UNCDST = 20.72609
NEXT HARVEST LEVEL = 5702834.00000

TIME = 6 HARVEST LEVEL = 2761898.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
50	18577.09	91.68	1703153.59
40	41632.39	64.66	2691928.25

MR = 72.38103 UNCDST = 24.46886 MV = 5547.996
MR = 81.24066 UNCDST = 20.72609
NEXT HARVEST LEVEL = 1875634.00000

TIME = 7 HARVEST LEVEL = 2652797.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
50	25258.23	91.68	2315682.56
40	41737.13	64.66	2698700.83

MR = 73.47205 UNCDST = 24.46886 MV = 5674.332
MR = 82.61867 UNCDST = 20.72609
NEXT HARVEST LEVEL = 1738134.00000

TIME = 8 HARVEST LEVEL = 3090352.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
50	36523.44	91.68	3348480.60
60	69.09648 UNCDST = 20.72609 MV = 7941.711		

MR = 87.11919 UNCDST = 18.82196
NEXT HARVEST LEVEL = 1268082.00000

TIME = 9 HARVEST LEVEL = 3729517.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
50	2815.53	116.28	327394.24
60	43853.41	91.68	4020494.81

MR = 62.70483 UNCDST = 20.72609 MV = 6892.293
MR = 78.09438 UNCDST = 18.82196
NEXT HARVEST LEVEL = 2190563.00000

TIME = 10 HARVEST LEVEL = 5791832.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
60	6744.87	116.28	784304.61
50	44792.83	91.68	4106620.49
40	60307.14	64.66	3899427.50

MR = 42.08170 UNCDST = 24.46886 MV = 2039.482
MR = 42.97166 UNCDST = 20.72609
NEXT HARVEST LEVEL = 5702834.00000

TIME = 11 HARVEST LEVEL = 2761898.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
50	46374.04	91.68	4251586.74
MR = 72.38103 UNCDST = 20.72609 MV = 8480.984			

MR = 91.75684 UNCDST = 18.82196
NEXT HARVEST LEVEL = 824317.00000

TIME = 12 HARVEST LEVEL = 2652797.0000000

STAND AGE ACRES VOL. PER ACRE STAND VOLUME
60 16248.73 116.28 1889428.45
50 34951.25 91.68 320434.8
MR = 73.47205 UNCCOST = 20.72609 MV = 8660.113
MR = 93.29730 UNCCOST = 18.82196
NEXT HARVEST LEVEL = 670270.00000

TIME = 13 HARVEST LEVEL = 3090352.0000000

STAND AGE ACRES VOL. PER ACRE STAND VOLUME
60 26624.83 116.28 3095978.20
MR = 69.09648 UNCCOST = 18.82196 MV = 10469.293
MR = 93.62704 UNCCOST = 17.90915
NEXT HARVEST LEVEL = 637296.00000

TIME = 14 HARVEST LEVEL = 3729517.0000000

STAND AGE ACRES VOL. PER ACRE STAND VOLUME
70 48.38 138.27 6689.96
60 30471.92 116.28 3543323.82
50 33707.91 91.68 3090352.00
MR = 62.70483 UNCCOST = 20.72609 MV = 6892.293
MR = 78.09438 UNCCOST = 18.82196
NEXT HARVEST LEVEL = 2190563.00000

TIME = 15 HARVEST LEVEL = 5791832.0000000

STAND AGE ACRES VOL. PER ACRE STAND VOLUME
60 31749.99 116.28 3691939.35
50 39924.07 91.68 3660251.36
MR = 42.08170 UNCCOST = 20.72609 MV = 3506.279
MR = 48.97530 UNCCOST = 18.82196
NEXT HARVEST LEVEL = 5102471.00000

TIME = 16 HARVEST LEVEL = 2761898.0000000

STAND AGE ACRES VOL. PER ACRE STAND VOLUME
60 17019.56 116.28 1979061.83
50 69470.80 91.68 6002383.58
MR = 72.38103 UNCCOST = 20.72609 MV = 8480.984
MR = 91.75684 UNCCOST = 18.82196
NEXT HARVEST LEVEL = 824317.00000

TIME = 17 HARVEST LEVEL = 2652797.0000000

STAND AGE ACRES VOL. PER ACRE STAND VOLUME
60 56932.04 116.28 6620148.96
MR = 73.47205 UNCCOST = 18.82196 MV = 11380.469
MR = 100.21701 UNCCOST = 17.90915
NEXT HARVEST LEVEL = -21701.00000

TIME = 18 HARVEST LEVEL = 3090352.0000000

STAND AGE ACRES VOL. PER ACRE STAND VOLUME
70 34118.48 138.27 4717462.99
MR = 69.09648 UNCCOST = 17.90915 MV = 12674.758
MR = 97.93428 UNCCOST = 17.42924
NEXT HARVEST LEVEL = 206572.00000

TIME = 19 HARVEST LEVEL = 3729517.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
80	11767.98	157.44	187742.08
70	30125.31	138.27	4165338.71

MR = 62.70483 UNCCOST = 17.90915 MV = 11092.090
 MR = 87.88181 UNCCOST = 17.42924
 NEXT HARVEST LEVEL = 1211820.00000

TIME = 20 HARVEST LEVEL = 5791832.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
80	16551.76	157.44	2605918.38
70	24575.15	138.27	3397933.87

MR = 42.08170 UNCCOST = 17.90915 MV = 5985.488
 MR = 55.44669 UNCCOST = 17.42924
 NEXT HARVEST LEVEL = 4455332.00000

TIME = 21 HARVEST LEVEL = 2761898.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
80	1533.41	157.44	241421.04
70	26576.45	138.27	3674647.81

MR = 72.38103 UNCCOST = 17.90915 MV = 13488.059
 MR = 103.10005 UNCCOST = 17.42924
 NEXT HARVEST LEVEL = -319005.00000

TIME = 22 HARVEST LEVEL = 2652797.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
80	8347.40	157.44	1314219.45
70	32478.23	138.27	4490670.04

MR = 73.47205 UNCCOST = 17.90915 MV = 13758.211
 MR = 104.81595 UNCCOST = 17.42924
 NEXT HARVEST LEVEL = -481594.00000

TIME = 23 HARVEST LEVEL = 3090352.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
80	22797.13	157.44	3589192.39
70	69.09648 UNCCOST = 17.42924 MV = 14567.660		
MR = 100.98170 UNCCOST = 17.06944			

NEXT HARVEST LEVEL = -98170.00000

TIME = 24 HARVEST LEVEL = 3729517.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
90	3168.44	173.61	550059.11
80	54654.50	157.44	8604833.37

MR = 62.70483 UNCCOST = 17.42924 MV = 12765.527
 MR = 90.60110 UNCCOST = 17.06944
 NEXT HARVEST LEVEL = 939890.00000

TIME = 25 HARVEST LEVEL = 5791832.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
90	34459.84	173.61	5982429.06
MR = 42.08170 UNCCOST = 17.06944 MV = 7777.40			
MR = 58.38937 UNCCOST = 16.70813			

NEXT HARVEST LEVEL = 4161663.00000

TIME = 26 HARVEST LEVEL = 2761898.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
100	1097.87	186.57	204826.57
90	2558.32	173.61	4437073.66
MR =	72.38103	UNCOST = 17.06944	MV = 17196.445
MR =	108.88124	UNCOST = 16.70813	
NEXT HARVEST LEVEL = -338124.00000			

TIME = 27 HARVEST LEVEL = 2652797.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
100	10829.14	186.57	2020358.56
90	22813.56	173.61	3960566.71
MR =	73.47205	UNCOST = 17.06944	MV = 17535.645
MR =	110.69936	UNCOST = 16.70813	
NEXT HARVEST LEVEL = -1069935.00000			

TIME = 28 HARVEST LEVEL = 3090352.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
100	19170.60	186.57	3576598.12
MR =	69.09648	UNCOST = 16.70813	MV = 17503.605
MR =	105.59952	UNCOST = 16.35324	
NEXT HARVEST LEVEL = -559951.00000			

TIME = 29 HARVEST LEVEL = 3729517.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
110	2606.28	196.13	511162.62
100	22350.60	186.57	4169880.22
MR =	62.70483	UNCOST = 16.70813	MV = 15368.074
MR =	94.71101	UNCOST = 16.35324	
NEXT HARVEST LEVEL = 528899.00000			

TIME = 30 HARVEST LEVEL = 5791832.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
110	5100.19	196.13	1000284.49
100	29341.43	186.57	4727870.66
90	39593.50	173.61	6873662.62
MR =	42.08170	UNCOST = 17.06944	MV = 7776.340
MR =	58.38937	UNCOST = 16.70813	
NEXT HARVEST LEVEL = 4161663.00000			

ECHO -- ECONOMIC HARVEST OPTIMIZER
 STATIC DEMAND -- NO GENETICS

ECHO Solution to EPOC/TIMM Example

PROBLEM SPECIFICATIONS

CARD 1

INITIAL ITERATION STEP IS 99999. INTEREST RATE IS 7.1 REGENERATION COST IS 30. HARVESTS ARE CALCULATED
 INITIAL HARVEST LEVEL IS 800000. TIME HORIZON IS 50 YEARS FIXED COSTS ARE 1250000. ANNUALLY
 TOLERABLE DIFFERENCE IN HARVEST LEVELS OF CYCLE (DCYCLE) IS 2.0 FIRST TIME TO CHECK FOR CYCLING IS 31
 TOLERABLE SUM OF ACRES USED AND LEFT (DACRES) IS 8.0 TIME PERIODS BETWEEN CHECKS FOR CYCLING IS 20
 TOLERABLE DIFFERENCE IN INITIAL HARVEST LEVEL (DX0) IS 0.5

ITERATION REPORT REQUESTED
 INTERMEDIATE PARTIAL INVENTORY REPORT REQUESTED
 BEGINNING TIME 0 ENDING TIME 1
 BEGINNING ITERATION 35 ENDING ITERATION 40

DEMAND CURVE IS NOT SHIFTING

CARD 2

INITIAL INVENTORY

AGE	1	2	3	4	5	6	7	8	9
0- 9	4000.	0.	0.	0.	0.	0.	0.	0.	0.
10- 19	26600.	0.	0.	0.	0.	0.	0.	0.	0.
20- 29	16170.	0.	0.	0.	0.	0.	0.	0.	0.
30- 39	19000.	0.	0.	0.	0.	0.	0.	0.	0.
40- 49	21500.	0.	0.	0.	0.	0.	0.	0.	0.
50- 59	15700.	0.	0.	0.	0.	0.	0.	0.	0.
60- 69	17700.	0.	0.	0.	0.	0.	0.	0.	0.
70- 79	17600.	0.	0.	0.	0.	0.	0.	0.	0.
80- 89	20300.	0.	0.	0.	0.	0.	0.	0.	0.
90- 99	21600.	0.	0.	0.	0.	0.	0.	0.	0.
100-109	70600.	0.	0.	0.	0.	0.	0.	0.	0.
110-119	0.	0.	0.	0.	0.	0.	0.	0.	0.
120-129	0.	0.	0.	0.	0.	0.	0.	0.	0.
130-139	0.	0.	0.	0.	0.	0.	0.	0.	0.
140-149	0.	0.	0.	0.	0.	0.	0.	0.	0.
150-159	0.	0.	0.	0.	0.	0.	0.	0.	0.

CARD 3

FIELD EQUATION VOL=-63.70 +(3.549)*AGE+(-.7193E-02)*AGE**2+(-.3270E-04)*AGE**3

EST AFTER

0 -32.362 0.913 32.376 61.832 89.084 113.936 136.192 155.655 172.130 185.421 195.330 201.662 204.220 202.809 197.232 187.294

EQUATION FOR UNIT COST COST(VOL) = 44.32 + (-.4591 *VOL) + (0.216E-02 *VOL**2) + (-.562CE-05) *VOL**3

EQUATION FOR AMOUNT OF WOOD ALLOCATED TO MARKETS AS A FUNCTION OF TOTAL MARGINAL REVENUE (MRT), TIME, AND RATE OF SHIFT OF DEMAND (RATE)
MRKT A VOL=C.1000E-8*((1+RATE)**T+(-.1000E 06*MRT))+(0.0 *MRT**2)+(0.0 *MRT**3)
MRKT B VOL=C.0 *((1+RATE)**T+10.0 *MRT)+(0.0 *MRT**2)+(0.0 *MRT**3)

EQUATION FOR PRICE AS A FUNCTION OF AMOUNT OF WOOD TO A MARKET, TIME, AND RATE
MARKET A PRICE=100.0 *((1+RATE)**T)+(-.500CE-05*VOL)+(0.0 *VOL**2)+(0.0 *VOL**3)
MARKET B PRICE=C.0 *((1+RATE)**T)+(0.0 *VOL)+(0.0 *VOL**2)+(0.0 *VOL**3)

EQUATION FOR VOLUME TO A MARKET AS A FUNCTION OF PRICE, TIME, AND RATE
MARKET A PRICE=C.2000E 08*((1+RATE)**T)+(-.200CE 06*PRICE)+(0.0 *PRICE**2)+(0.0 *PRICE**3)
MARKET B PRICE=C.0 *((1+RATE)**T)+(0.0 *PRICE)+(0.0 *PRICE**2)+(0.0 *PRICE**3)

TWO-PIECE TOTAL MARGINAL REVENUE (MRT) CURVE AS A FUNCTION OF TOTAL HARVEST VOLUME, TIME, AND RATE
FROM 0 TO ***** MRT=100.0 *((1+RATE)**T)+(-.1000E-04*VOL)+(0.0 *VOL**2)+(0.0 *VOL**3)
ABOVE ***** MRT=0.0 *((1+RATE)**T)+(0.0 *VOL)+(0.0 *VOL**2)+(0.0 *VOL**3)

TWO-PIECE FUNCTION FOR TOTAL HARVEST VOL AS A FUNCTION OF MRT, TIME, AND RATE
FROM 0 TO ***** VOL=0.100CE 08*((1+RATE)**T)+(-.1000E 06*MRT)+(0.0 *MRT**2)+(0.0 *MRT**3)
ABOVE ***** VOL=0.0 *((1+RATE)**T)+(0.0 *MRT)+(0.0 *MRT**2)+(0.0 *MRT**3)

TWO-PIECE FUNCTION FOR PRICE AS A FUNCTION OF TOTAL HARVEST, TIME, AND RATE
FROM 0 TO ***** PRI=100.0 *((1+RATE)**T)+(-.5000E-05*VOL)+(0.0 *VOL**2)+(0.0 *VOL**3)
ABOVE ***** PRI=0.0 *((1+RATE)**T)+(0.0 *PRI)+(0.0 *PRI**2)+(0.0 *PRI**3)

STATIC DEMAND -- NO GENETICS
HARVEST, NET CASH FLOW AND PRESENT VALUE REPORT

TIME	XT	XA	XB	PA	PB	ACRES REGEN	REGEN COST	FIXED COST	LOGGING COST	NET CASH FLOW	1/(1+i)^t	DISCOUNTED NCF
0	8019336.	8019636.	0.	59.902	0.0	42985.3	1289559.	1250000.	133993120.	343857664.	7.8017268268000.	7.8017268268000.
10	7822223.	7822222.	0.	60.689	0.0	40512.1	1215364.	1250000.	128772624.	345048064.	4.3565150319456.	4.3565150319456.
20	7476282.	7476282.	0.	62.619	0.0	40420.2	1212606.	1250000.	125025120.	340666112.	2.432782872368.	2.432782872368.
30	6929073.	6925073.	0.	65.355	0.0	41183.3	1235497.	1250000.	118897184.	331463936.	1.358445025936.	1.358445025936.
40	6186228.	6186228.	0.	69.063	0.0	42493.8	1274814.	1250000.	109631776.	315118592.	0.758523902688.	0.758523902688.
50	5216573.	5216573.	0.	73.917	0.0	43305.9	1299177.	1250000.	97281072.	285763584.	0.423612103897.	0.423612103897.
60	4770304.	4770304.	0.	76.148	0.0	55812.7	1674382.	1250000.	101974192.	258352464.	0.236561104996.	0.236561104996.
70	4311363.	4311863.	0.	78.441	0.0	55116.7	1653500.	1250000.	96006880.	239314976.	0.132131606668.	0.132131606668.
80	3716240.	3716239.	0.	81.419	0.0	52046.6	1561397.	1250000.	86475600.	213284272.	0.07371572945.	0.07371572945.
90	2942386.	2942386.	0.	85.288	0.0	44618.3	1338548.	1250000.	71267952.	177093904.	0.0412725297.	0.0412725297.
100	2860353.	2860352.	0.	85.698	0.0	45006.4	1350191.	1250000.	70395888.	172131008.	0.0230395827.	0.0230395827.
110	3498853.	3498853.	0.	82.506	0.0	54112.0	1623359.	1250000.	85612928.	200189800.	0.0128257058.	0.0128257058.
120	3563817.	3563816.	0.	82.181	0.0	55116.7	1653500.	1250000.	87202480.	202771536.	0.0072145393.	0.0072145393.
130	3365305.	3365305.	0.	83.173	0.0	52046.4	1561392.	1250000.	82345008.	194747344.	0.00024233.	0.00024233.
140	2884994.	2884993.	0.	85.575	0.0	44618.0	1338541.	1250000.	70592304.	173702496.	0.00012108.	0.00012108.
150	2910090.	2910088.	0.	85.450	0.0	45006.1	1350181.	1250000.	71206288.	174859232.	0.00011185.	0.00011185.
160	3498852.	3498852.	0.	82.506	0.0	54111.6	1623346.	1250000.	85612560.	200189168.	0.0000758.	0.0000758.
170	3563817.	3563817.	0.	82.181	0.0	55116.1	1653484.	1250000.	87202064.	202771952.	0.0000429.	0.0000429.
180	3365305.	3365304.	0.	83.173	0.0	52045.8	1561375.	1250000.	82344544.	194747808.	0.0000230.	0.0000230.
190	2384994.	2884993.	0.	85.575	0.0	44617.3	1338519.	1250000.	70591712.	173703104.	0.0000114.	0.0000114.
200	2910089.	2910088.	0.	85.450	0.0	45005.1	1350153.	1250000.	71205504.	174860048.	0.0000064.	0.0000064.
210	3498852.	3498852.	0.	82.506	0.0	54110.3	1623308.	1250000.	85611504.	200190224.	0.0000041.	0.0000041.
220	3563817.	3563817.	0.	82.181	0.0	55114.5	1653434.	1250000.	87200704.	202773312.	0.0000023.	0.0000023.
230	3365304.	3365304.	0.	83.173	0.0	52043.7	1561310.	1250000.	82342752.	194749856.	0.0000012.	0.0000012.
240	2384995.	2884993.	0.	85.575	0.0	44614.5	1338434.	1250000.	70589376.	173705520.	0.0000006.	0.0000006.
250	2910089.	2910088.	0.	85.450	0.0	45001.4	1350041.	1250000.	71202448.	174863216.	0.0000003.	0.0000003.

TOTAL = 595030,272

ENR 100 yr. PV = 594,065,751

(adjusted) 100 yr. EPPEN PV = 589,687,859

Difference = 0.7%

Difference = 0.70%

150 yr PV = 594,980,840

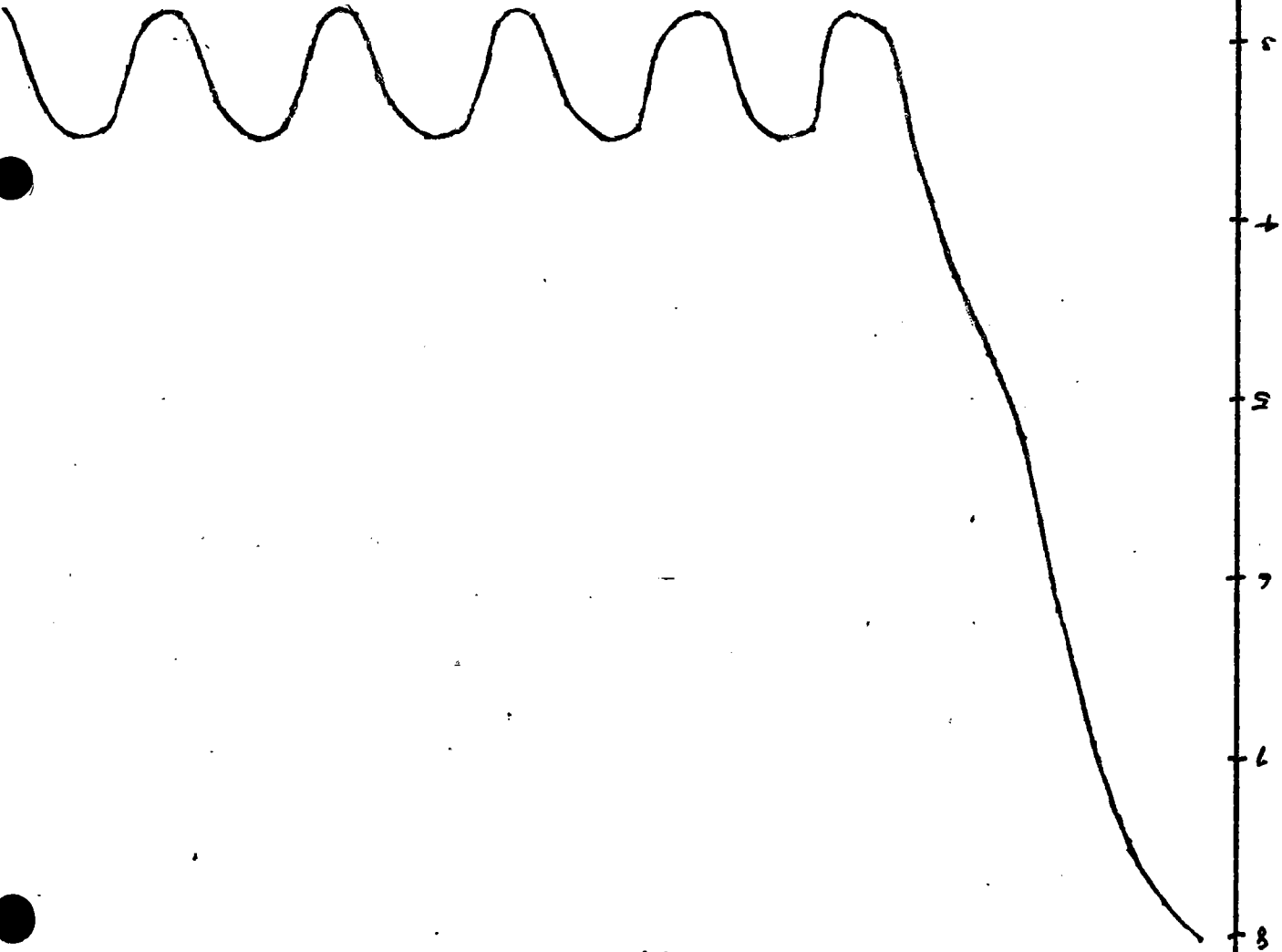
150 yr PV = 590,848,380

Difference = 0.70%

TIME (YEARS)



VOLUME OF TIMBER HARVESTED
6% STATIC DEMAND
10 YR. INCREMENTS



MILLIONS OF CUBIC FEET

ECHO

Note: all values are computed for (AGE-5), to agree with EPOCA run.

TIME = 0 HARVEST LEVEL = 8019636.1485462

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
95-100	70600.00	186.57	13171617.37
MR =	19.80365	UNCOST = 16.70813	MV = 1034.252
MR =	21.62662	UNCOST = 16.35324	
NEXT HARVEST LEVEL = 7837339.00000			

TIME = 1 HARVEST LEVEL = 7822223.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
95-110	27614.67	196.13	5415982.04
95-100	21600.00	186.57	4029843.27
MR =	21.77779	UNCOST = 16.70813	MV = 1693.836
MR =	24.98965	UNCOST = 16.35324	
NEXT HARVEST LEVEL = 7501335.00000			

TIME = 2 HARVEST LEVEL = 7476282.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
110	8702.52	196.13	1706799.88
100	20300.00	186.57	3787306.41
90	17800.00	173.61	3090183.86
MR =	25.23718	UNCOST = 17.06944	MV = 2539.361
MR =	30.31912	UNCOST = 16.70813	
NEXT HARVEST LEVEL = 6968088.00000			

TIME = 3 HARVEST LEVEL = 6929073.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
100	6382.32	186.57	1190729.31
90	17700.00	173.61	3072823.28
80	15700.00	157.44	2471916.42
70	21500.00	138.27	2972742.10
MR =	30.70927	UNCOST = 17.90915	MV = 3169.505
MR =	37.56068	UNCOST = 17.42924	
NEXT HARVEST LEVEL = 6243532.00000			

TIME = 4 HARVEST LEVEL = 6186228.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
80	20099.06	157.44	3164406.66
70	19300.00	138.27	2627074.42
60	16100.00	116.28	1872133.78
MR =	38.13773	UNCOST = 18.82196	MV = 4022.364
MR =	47.00040	UNCOST = 17.90915	
NEXT HARVEST LEVEL = 5299961.00000			

TIME = 5 HARVEST LEVEL = 5216573.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
70	12705.25	138.27	1756717.80
60	26600.00	116.28	3093090.59
50	4000.00	91.68	367111.25
40	42985.33	64.66	2777008.60
MR =	47.83427	UNCOST = 24.46886	MV = 2705.603

MR = 50.23735 UNCDST = 20.72609
NEXT HARVEST LEVEL = 4976265.00000

TIME = 6 HARVEST LEVEL = 4770304.1934009

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
50	42984.66	91.68	3940846.99
40	40512.15	64.66	2619493.87

MR = 52.29697 UNCDST = 24.46886 MV = 3222.361
MR = 55.87389 UNCDST = 20.72609
NEXT HARVEST LEVEL = 4412612.00000

TIME = 7 HARVEST LEVEL = 4311863.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
50	27684.06	91.68	2538083.33
40	40420.20	64.66	2613548.92

MR = 56.98138 UNCDST = 24.46886 MV = 3753.214
MR = 61.66414 UNCDST = 20.72609
NEXT HARVEST LEVEL = 3833587.00000

TIME = 8 HARVEST LEVEL = 3716240.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
50	12987.57	91.68	1190704.30
40	41183.26	64.66	2662887.86

MR = 62.83762 UNCDST = 24.46886 MV = 4442.918
MR = 69.18706 UNCDST = 20.72609
NEXT HARVEST LEVEL = 3081295.00000

TIME = 9 HARVEST LEVEL = 2942386.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
50	2124.24	91.68	194750.89
40	42493.81	64.66	2747627.14
30	43305.92	35.42	1533687.49

MR = 70.57614 UNCDST = 31.21533 MV = 2496.387
MR = 63.77707 UNCDST = 24.46886
NEXT HARVEST LEVEL = 3692293.00000

TIME = 10 HARVEST LEVEL = 2860353.1070688

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
40	43305.70	64.66	2800123.32
30	55812.74	35.42	1976619.04

MR = 71.39648 UNCDST = 31.21533 MV = 2548.416
MR = 63.98173 UNCDST = 24.46886
NEXT HARVEST LEVEL = 3611828.00000

TIME = 11 HARVEST LEVEL = 3498853.0000000

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
40	54112.07	64.66	3498857.61
MR = 65.01147 UNCDST = 24.46886 MV = 4654.637			
MR = 71.93268 UNCDST = 20.72609			

NEXT HARVEST LEVEL = 2806733.00000

TIME = 12 HARVEST LEVEL = 3563816.6473019

STAND AGE ACRES VOL. PER ACRE STAND VOLUME
 50 0.07 91.68 6.54
 40 55116.70 64.66 356304.33
 MR = 64.36185 UNCONST = 24.46886 MV = 4619.414
 MR = 71.11218 UNCONST = 20.72609
 NEXT HARVEST LEVEL = 2888782.00000

TIME = 13 HARVEST LEVEL = 3365305.3073639

STAND AGE ACRES VOL. PER ACRE STAND VOLUME
 50 0.10 91.68 8.83
 40 52046.59 64.66 365304.96
 MR = 66.34695 UNCONST = 24.46886 MV = 4619.414
 MR = 73.61946 UNCONST = 20.72609
 NEXT HARVEST LEVEL = 2638054.00000

TIME = 14 HARVEST LEVEL = 2884994.4399441

STAND AGE ACRES VOL. PER ACRE STAND VOLUME
 50 0.13 91.68 12.02
 40 44618.27 64.66 2884993.86
 MR = 71.15007 UNCONST = 24.46886 MV = 5405.457
 MR = 79.68593 UNCONST = 20.72609
 NEXT HARVEST LEVEL = 2031408.00000

TIME = 15 HARVEST LEVEL = 2910089.5973340

STAND AGE ACRES VOL. PER ACRE STAND VOLUME
 50 0.18 91.68 16.21
 40 45006.37 64.66 2910088.16
 MR = 70.89912 UNCONST = 24.46886 MV = 5376.398
 MR = 79.76897 UNCONST = 20.72609
 NEXT HARVEST LEVEL = 2063103.00000

TIME = 16 HARVEST LEVEL = 3498852.7717683

STAND AGE ACRES VOL. PER ACRE STAND VOLUME
 50 0.23 91.68 20.96
 40 54112.00 64.66 3498853.00
 MR = 65.1149 UNCONST = 24.46886 MV = 4694.641
 MR = 71.93272 UNCONST = 20.72609
 NEXT HARVEST LEVEL = 2806728.00000

TIME = 17 HARVEST LEVEL = 3563817.1669371

STAND AGE ACRES VOL. PER ACRE STAND VOLUME
 50 0.33 91.68 30.04
 40 55116.67 64.66 3563814.72
 MR = 64.36183 UNCONST = 24.46886 MV = 4619.414
 MR = 71.11218 UNCONST = 20.72609
 NEXT HARVEST LEVEL = 2888782.00000

TIME = 18 HARVEST LEVEL = 3365304.5968040

STAND AGE ACRES VOL. PER ACRE STAND VOLUME
 50 0.43 91.68 39.12
 40 52046.56 64.66 3365302.71
 MR = 66.34697 UNCONST = 24.46886 MV = 4819.414
 MR = 73.61946 UNCONST = 20.72609
 NEXT HARVEST LEVEL = 2638054.00000

TIME = 19 HARVEST LEVEL = 2884994.4890816

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
50	0.58	91.68	52.79
40	44618.23	64.66	2884990.50
MR =	71.15007	UNCOST = 24.46886	MV = 5405.457
K =	79.68593	UNCOST = 20.72609	
NEXT HARVEST LEVEL = 2031408.00000			

TIME = 20 HARVEST LEVEL = 2910089.1764901

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
50	0.76	91.68	69.76
40	45006.32	64.66	2910084.82
MR =	70.89912	UNCOST = 24.46886	MV = 5376.398
MR =	79.36897	UNCOST = 20.72609	
NEXT HARVEST LEVEL = 2063103.00000			

TIME = 21 HARVEST LEVEL = 3498852.4267106

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
50	1.01	91.68	92.73
40	54111.90	64.66	3498846.60
MR =	65.01149	UNCOST = 24.46886	MV = 4694.641
MR =	71.93272	UNCOST = 20.72609	
NEXT HARVEST LEVEL = 2806728.00000			

TIME = 22 HARVEST LEVEL = 3563817.2647319

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
50	1.34	91.68	123.22
40	55116.57	64.66	3563808.31
MR =	64.36183	UNCOST = 24.46886	MV = 4619.414
MR =	71.11218	UNCOST = 20.72609	
NEXT HARVEST LEVEL = 2988782.00000			

TIME = 23 HARVEST LEVEL = 3365304.3694768

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
50	1.77	91.68	162.02
40	52046.41	64.66	3365293.07
MR =	66.34697	UNCOST = 24.46886	MV = 4849.281
MR =	73.61946	UNCOST = 20.72609	
NEXT HARVEST LEVEL = 2638054.00000			

TIME = 24 HARVEST LEVEL = 2884994.6251510

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
50	2.33	91.68	213.69
40	44618.04	64.66	2984978.93
MR =	71.15007	UNCOST = 24.46886	MV = 5405.457
MR =	79.68593	UNCOST = 20.72609	
NEXT HARVEST LEVEL = 2031408.00000			

TIME = 25 HARVEST LEVEL = 2910089.1764901

STAND AGE	ACRES	VOL. PER ACRE	STAND VOLUME
50	3.06	91.68	280.74

2910068.62

5376.38

64.66

24.46886 MV =

20.72609

2062103.00000

MR = 70.89912 UNCDST = 24.46886 MV = 64.66
MR = 79.36897 UNCDST = 20.72609
NEXT HARVEST LEVEL = 2062103.00000

TIME = 26 HARVEST LEVEL = 3498851.194361

STAND AGE ACRES VOL. PER ACRE STAND VOLUME
50 4.02 91.68 368.91
40 54111.57 64.66 3498825.10
MR = 65.71151 UNCDST = 24.46886 MV = 4674.641
MR = 71.93272 UNCDST = 20.72609
NEXT HARVEST LEVEL = 2806728.00000

TIME = 27 HARVEST LEVEL = 3563817.283513

STAND AGE ACRES VOL. PER ACRE STAND VOLUME
50 5.30 91.68 486.07
40 55116.15 64.66 3563780.95
MR = 64.36183 UNCDST = 24.46886 MV = 4619.414
MR = 71.11218 UNCDST = 20.72609
NEXT HARVEST LEVEL = 2888782.00000

TIME = 28 HARVEST LEVEL = 3365304.1949198

STAND AGE ACRES VOL. PER ACRE STAND VOLUME
50 6.96 91.68 637.68
40 52045.84 64.66 3365256.62
MR = 66.34697 UNCDST = 24.46886 MV = 4849.281
MR = 73.61946 UNCDST = 20.72609
NEXT HARVEST LEVEL = 2633034.00000

TIME = 29 HARVEST LEVEL = 2884994.5797945

STAND AGE ACRES VOL. PER ACRE STAND VOLUME
50 9.13 91.68 836.71
40 44617.31 64.66 2884931.64
MR = 71.15007 UNCDST = 24.46886 MV = 5405.457
MR = 79.68593 UNCDST = 20.72609
NEXT HARVEST LEVEL = 2031408.00000

TIME = 30 HARVEST LEVEL = 2910089.1764901

STAND AGE ACRES VOL. PER ACRE STAND VOLUME
50 11.97 91.68 1097.13
40 45005.11 64.66 2910006.43
MR = 70.89912 UNCDST = 24.46886 MV = 5376.398
MR = 79.36897 UNCDST = 20.72609
NEXT HARVEST LEVEL = 2062103.00000

EJ RE9RJECO

09.38.27, DURATION 00.06.09 RUN DAY = 05/05/75

will check time on 369/50