Exotic Larch Stand Table Projection

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NESAF Meeting

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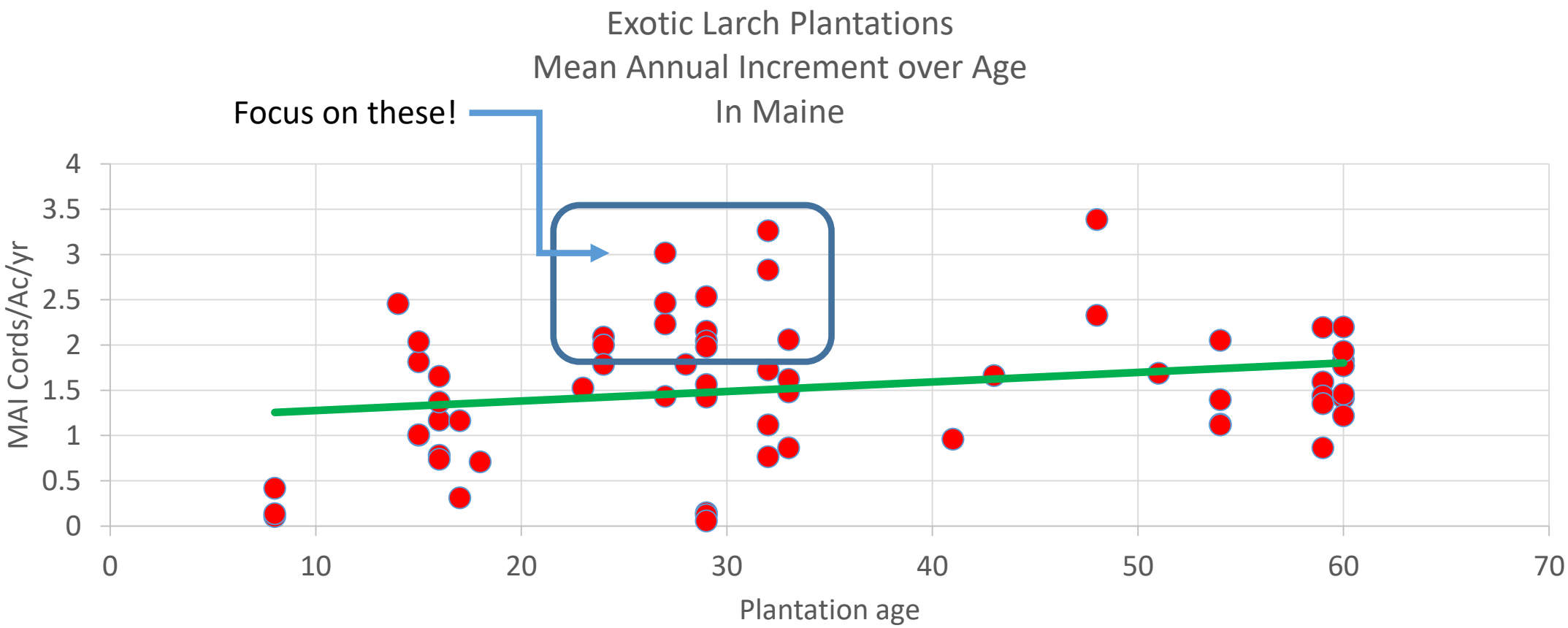
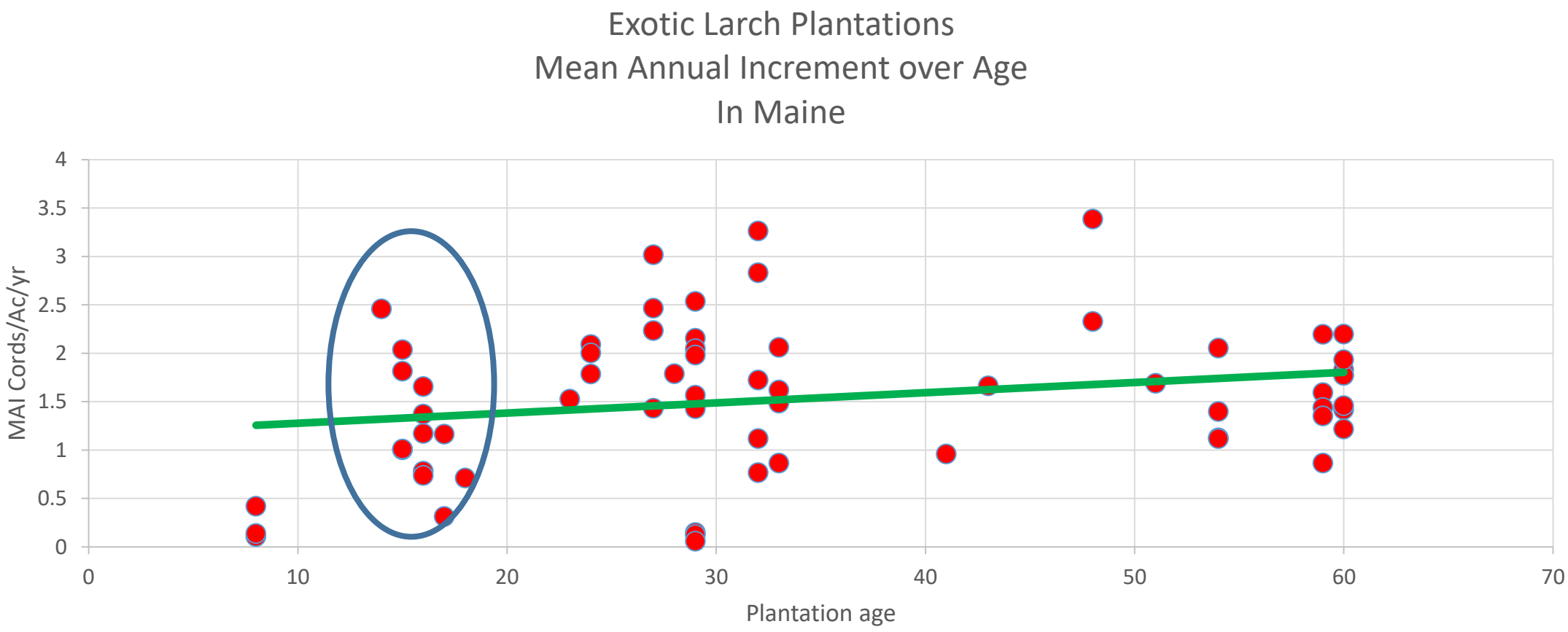
Possible to have volume of 90 cords/Ac at 30 years in un-thinned plantations



But what if we thinned at an early age?



You say commercial thinning can't be done at less than age 20?

One hybrid larch plantation in western Maine was harvested at age 13. A note from the forester indicated that 45 tons of pulp and biomass per acre were removed from 28 acres.

Forester said, "I measured approximately 30 trees that averaged 7.1 inches, varying from 4 inches to 10.5 inches"

10” Breast Height “Cookie”, 13 years old from mediocre stand in Lily Bay. **Photo by Carl Haag**

13 year old “Hybrid larch” Plantation in Upper Androscoggin Valley. Dan Simonds is pictured.

Need to know four things for exotic larch projection

1. An existing stand
2. Mortality by diameter class
3. Growth by diameter class
4. Volume

Have 6 studies measured by Scott/SD Warren/Plum Creek/Weyerhaeuser starting in 1985 and re-measured at various intervals with 3743 tree records

1. Existing stand

Selected young plantation from Upper Androscoggin River Valley

Plantation age: 15 years

Larch tpa: 394 BA/ac: 120 ft^2

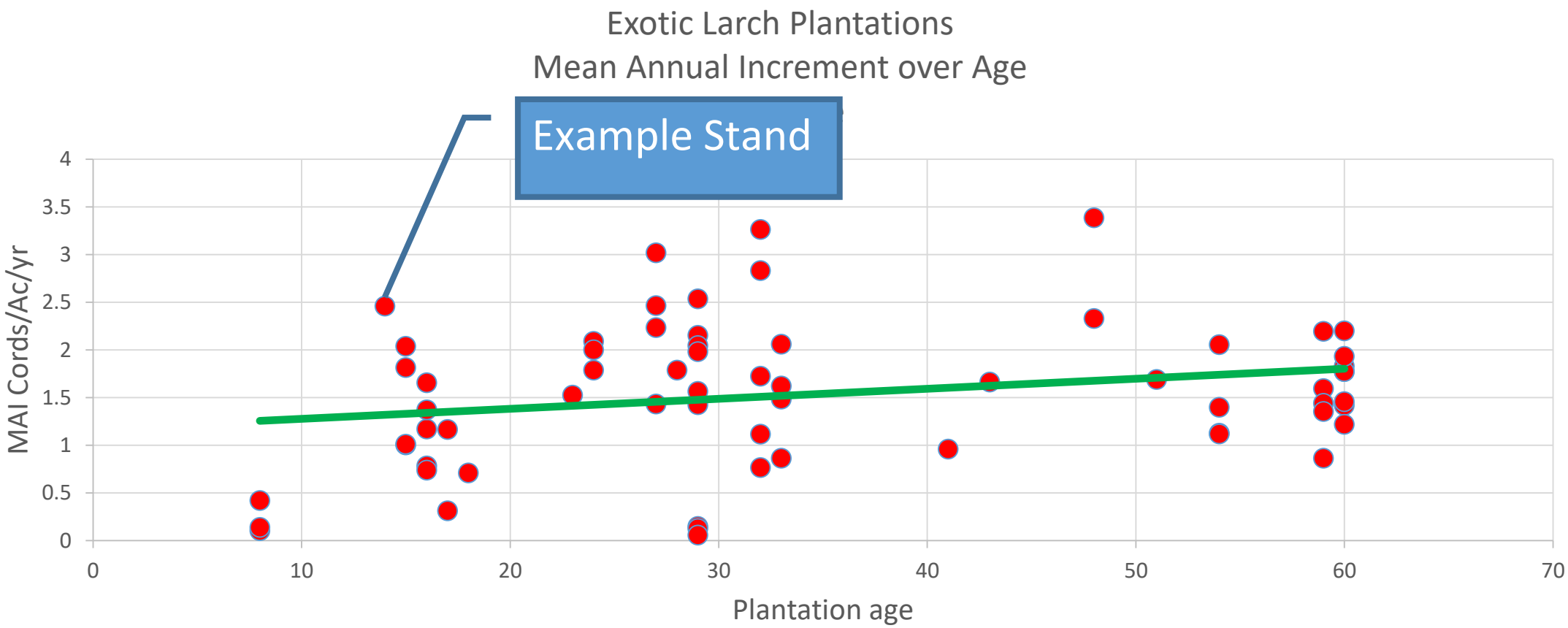
Larch volume/ac: 2780 ft^3 per acre (32.7 cords/ac or 66.7 tons/ac)

Average height: 49.3 ft (3.3 ft/yr)

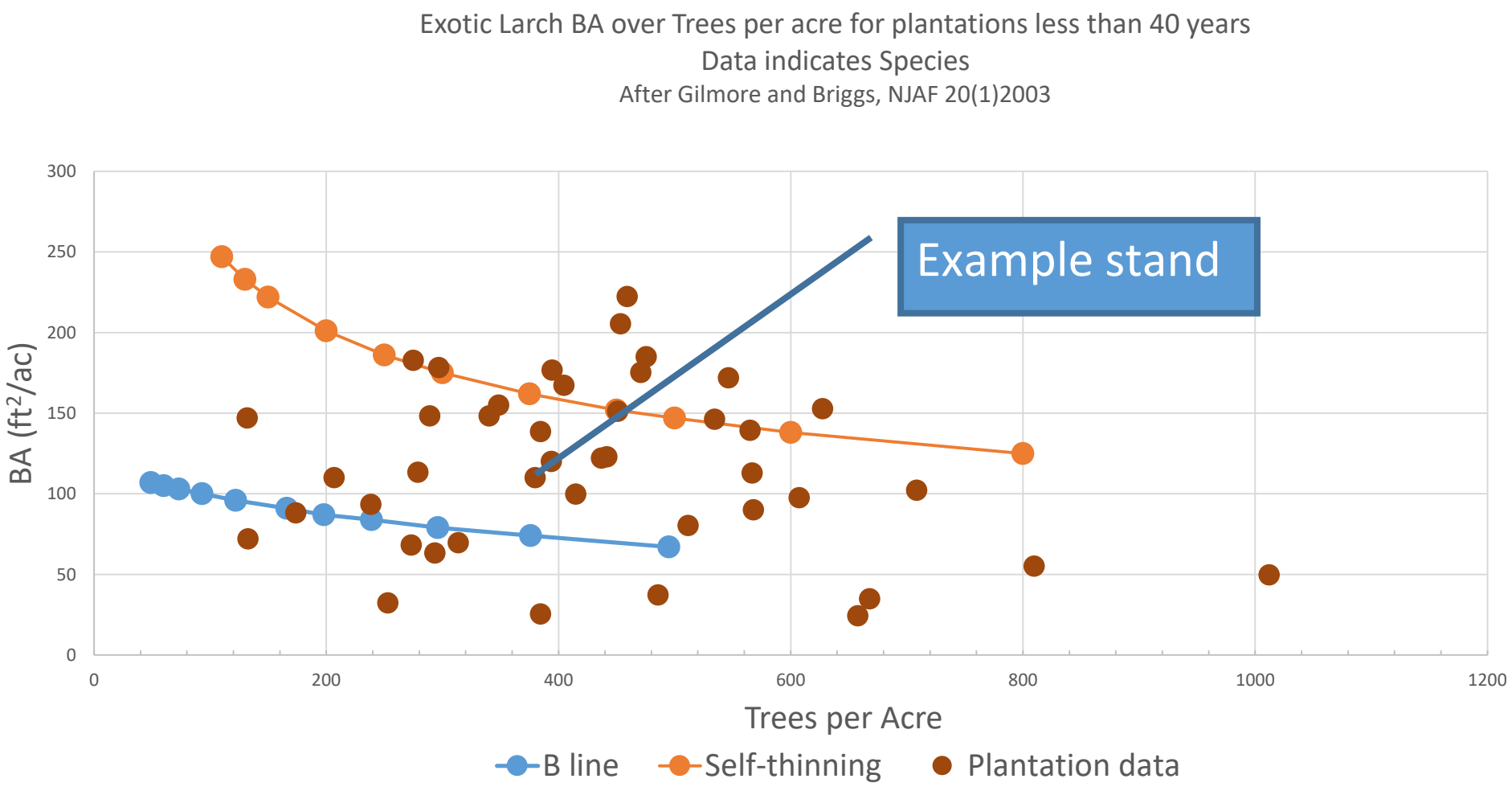
QMD: 7.6”

Larch MAI: 185 ft^3/ac/yr (13m^3/ha/yr)

1. Example stand

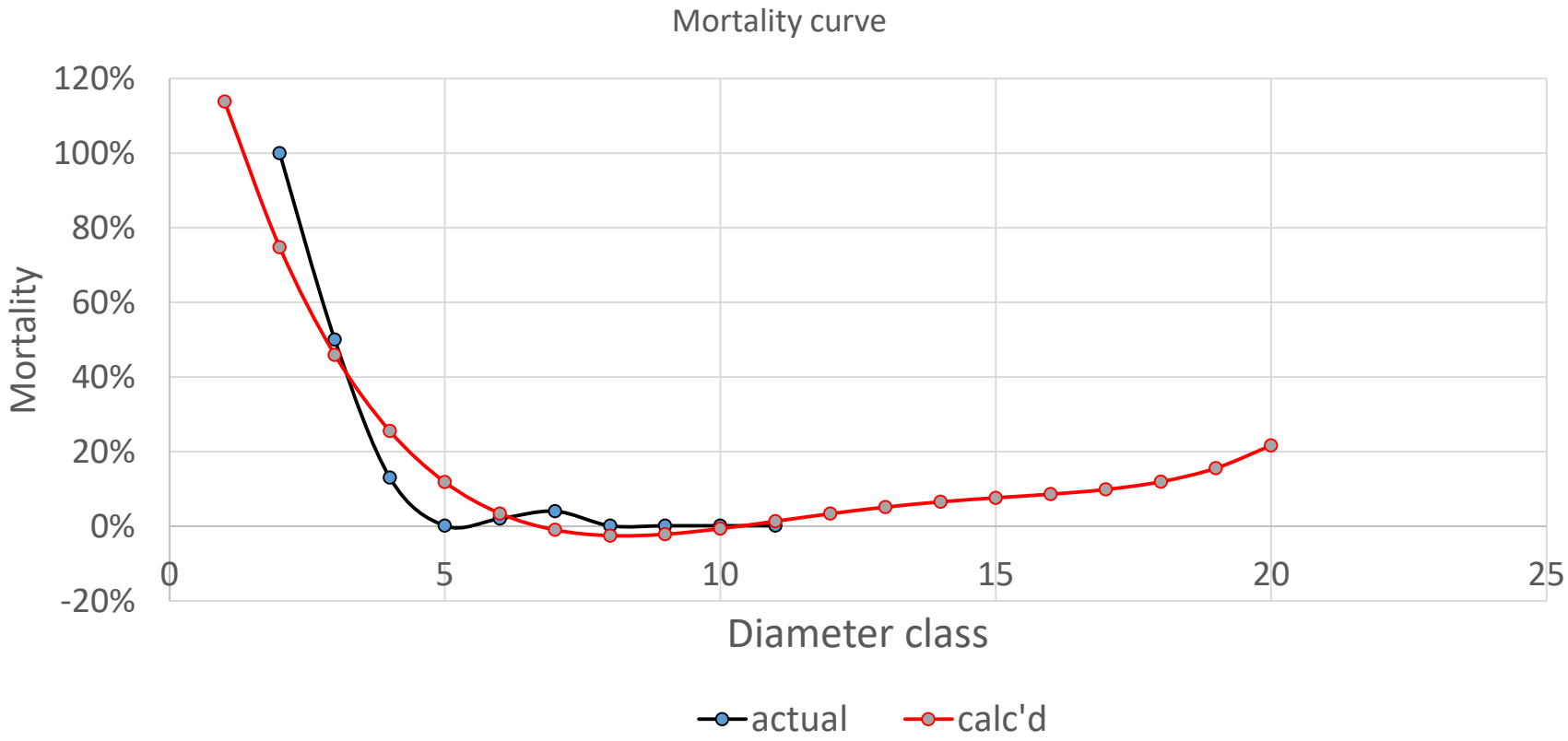


1. Example stand



2. Mortality

One of Weyerhaeuser studies in a block design was measured at age 16 and again at age 27. Mortality rates were calculated for interior trees only. Sample size was 998 trees.



3. Growth by diameter class

- Sample size of 4,469 trees
- Some trees were measured at 5 year intervals, others at 4, 6 and 11 year intervals
- Non-five year intervals were prorated to 5 years

3. Growth by diameter class

DBH class	5 year Dia growth
1	2.977
2	3.164
3	2.371
4	1.752
5	1.673
6	1.591
7	1.312
8	1.243
9	1.435
10	1.523

75% trees in diameter class 4” move two diameter classes, 25% moves 1 diameter class

DBH class	Dia growth
11	1.909
12	2.146
13	2.560
14	3.060
15	3.647
16	3.647
17	3.647
18	3.647
19	3.647
20	3.647

6% trees in diameter class 14” moves 4 diameter classes, 94% move three diameter classes

4. Volume

Used Kozak volume equations after Li et al. 2012. Parameters for hybrid larch provided by Jereme Frank.

Merchantable volume: above a 6” stump to a 3.5” top diameter

Assumed 2.5 feet of height growth per year. This was the median height growth from Gilmore; and height increased with age.

Sawlog volume: Minimum length was 12 feet plus 6” trim to a 9” top diameter

Hand calculated sawlog volumes using the ¼” International log scale. Sawlog volumes converted to cubic feet at 12 BF per cubic foot.

Pulp volumes shown are merchantable volumes less sawlog volumes.

Results:

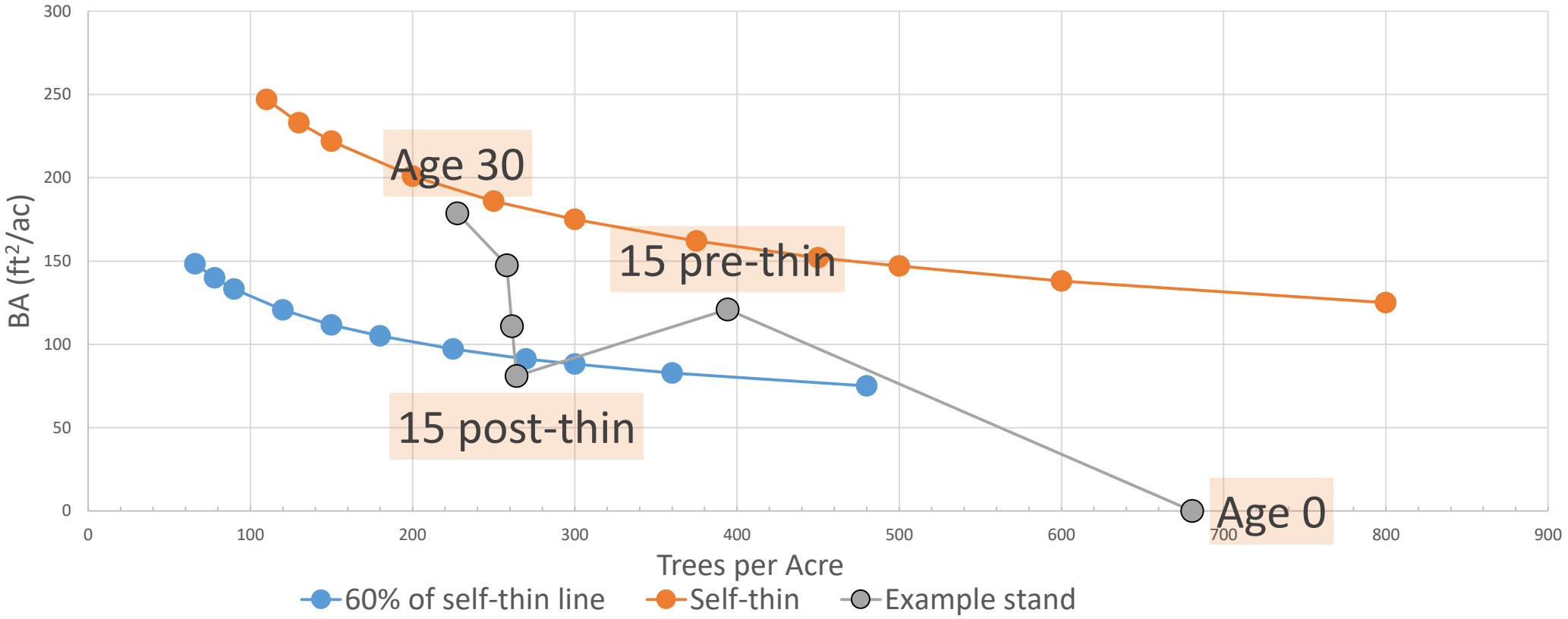
Two Scenarios:

1. Thin at age 15 and let grow for 15 years

2. Let grow until reach self-thin line, then thin and let grow

- each thinning was third row thinning removing 33% of the trees.
- let grow for 15 years after thinning

Scenario 1: Thin at age 15; let grow for 15 years



Scenario 1: Thin at age 15; let grow for 15 years

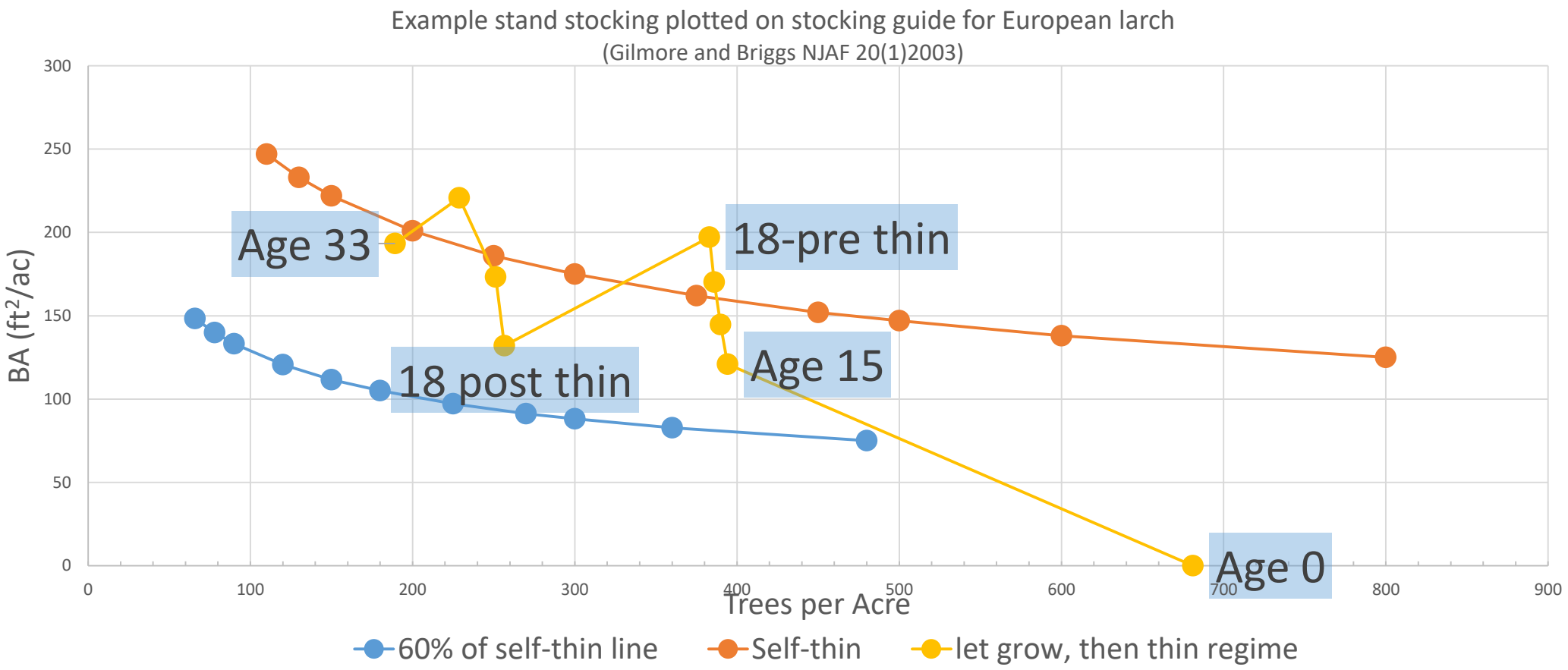
Summary		
Age	MBF	Pulp (ft^3)
Age 0	0	0
15 pre-thin	0	2109
15 post-thin	0	1413
Age 20	0	2589
Age 25	4	4047
Age 30	13	4910

Fully Recovered at in 5 years after thinning

Sawlogs at age 20, 'though < 1 MBF/ac

Significant sawlog volumes at age 30

Scenario 2: Let grow for 3 years; then thin



Scenario 2: Let grow for 3 years; then thin

Summary		
Age	MBF	Pulp (ft^3)
Age 0	0	0
Age 15	0	2109
18-pre thin	0	4072
18 post thin	0	2728
Age 23	8	3894
Age 28	24	5222
Age 33	29	13938

Nearly double volume in 3 years

Sawlog volume at age 23

Conclusions:

- Exotic larch have the potential of growing 3 cords/ac/yr (17 m^3/ac/yr)
- Thinning at early age offers significant volume as well.

Scenario 1 (inc. thinning volume)		
Age	Tons/ac	m^3/ha/yr
15 pre-thin	50.6	9.8
15 post-thin	50.6	9.8
Age 20	62.6	9.1
Age 25	104.8	12.2
Age 30	153.2	14.9

Conclusions:

Scenario 2 (inc. thinning volume)		
Age	Tons/ac	m^3/ha/yr
Age 15	50.6	9.8
18-pre thin	98.3	15.9
18 post thin	98.3	15.9
Age 23	110.4	14.0
Age 28	172.4	17.9
Age 33	243.8	21.5

Conclusions:

- Larch plantations can be thinned as early as age 15, and respond quickly
- Larch plantations can be thinned once they reach the self-thinning level and can also respond quickly
- Sawlogs can be seen as early as age 20 after planting

Thinned European larch plantation, Sebois Plantation TWP. October 2016. **Photo by Max McCormack**

Larch plantations, Howland, ME, Near I-95. October 2016. Photo by Max McCormack

14 year old European larch Plantation in Upper Androscoggin Valley. Dan Simonds is pictured.

14 year old European larch Plantation in Upper Androscoggin Valley. Dan Simonds is holding a white spruce and red pine that were planted simultaneously with the larch.

Certification issue:

- Neither standard prohibits planting exotics
- FSC: Principle 10.4: "Exotic species, which shall be used when their performance is greater than that of native species, shall be carefully monitored to detect unusual mortality, disease or insect outbreaks or adverse ecological impacts."

- SFI: Indicator 2.1.3 "*Plantings* of *exotic tree species* should *minimize* risk to *native* ecosystems."

Questions?

References:

- Anonymous, (no date). Tree Growth and Stand Table Projection. Louisiana Tech Study Guide 3.
- Gilmore and Briggs. 2003. A Stocking Guide for European Larch in Eastern North America. NJAF 20(1) p 34-38.
- Li et al. 2012. Regional Stem Taper Equations for Eleven Conifer Species in the Acadia Region of North America: Development and Assessment. NJAF (29) 1 2012 p5-14.

Appendix: Stand table projection: a quick review -

- Used an individual tree stand table projection from Louisiana Tech Study Guide #3
  - there are many others
- Limited to short projection times

Stand table projection: a quick review - Current stand

					DBH growth/DBH class size	# trees moving up			
DBH	Present # trees	Mortality	Survival	DBH Growth	Growth Index ratio	Stay	1 class	2 classes	Future trees
6	522	40	313	2.2	1.1	0	282	31	0
8	352	35	229	2.3	1.15	0	194	34	282
10	179	25	134	2.4	1.2	0	107	27	226
12	88	20	70	2.2	1.1	0	63	7	142
14	40	15	34	2.4	1.2	0	27	7	90
16	11	10	10	2.6	1.3	0	7	3	34
18	10	10	9	2.1	1.05	0	9	0	14
20	8	20	6	1.8	0.9	6	0	0	18
22									
Total	1210	175	805						805

Stand table projection: a quick review - Mortality and Survival

					DBH growth/DBH class size		# trees moving up			
DBH	Present # trees	Mortality	Survival	DBH Growth	Growth Index ratio		Stay	1 class	2 classes	Future trees
6	522	40	313	2.2	1.1		0	282	31	0
8	352	35	229	2.3	1.15		0	194	34	282
10	179	25	134	2.4	1.2		0	107	27	226
12	88	20	70	2.2	1.1		0	63	7	142
14	40	15	34	2.4	1.2		0	27	7	90
16	11	10	10	2.6	1.3		0	7	3	34
18	10	10	9	2.1	1.05		0	9	0	14
20	8	20	6	1.8	0.9		6	0	0	18
22										
Total	1210	175	805							805

Stand table projection: a quick review – Dia growth

					DBH growth/DBH class size		# trees moving up			
DBH	Present # trees	Mortality	Survival	DBH Growth	Growth Index ratio		Stay	1 class	2 classes	Future trees
6	522	40	313	2.2	1.1		0	282	31	0
8	352	35	229	2.3	1.15		0	194	34	282
10	179	25	134	2.4	1.2		0	107	27	226
12	88	20	70	2.2	1.1		0	63	7	142
14	40	15	34	2.4	1.2		0	27	7	90
16	11	10	10	2.6	1.3		0	7	3	34
18	10	10	9	2.1	1.05		0	9	0	14
20	8	20	6	1.8	0.9		6	0	0	18
22										
Total	1210	175	805							805

Stand table projection: a quick review: interpretation

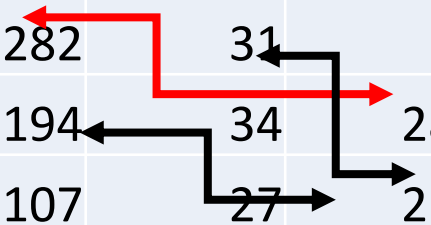
DBH	Present # trees	Mortality	Survival	DBH Growth	DBH grow class size Growth I ratio	Stay	s moving up 1 class	2 classes	Future trees
6	522	40	313	2.2	1.1	0	282	31	0
8	352	35	229	2.3	1.15	0	194	34	282
10	179	25	134	2.4	1.2	0	107	27	226
12	88	20	70	2.2	1.1	0	63	7	142
14	40	15	34	2.4	1.2	0	27	7	90
16	11	10	10	2.6	1.3	0	7	3	34
18	10	10	9	2.1	1.05	0	9	0	14
20				.8	0.9	6	0	0	18
22									
Total									805

10% moves 2 classes; 90% moves 1 class

90% stays in same class; 10% moves 1 class

Stand table projection: a quick review: Future trees

					DBH growth/DBH class size	# trees moving up			
DBH	Present # trees	Mortality	Survival	DBH Growth	Growth Index ratio	Stay	1 class	2 classes	Future trees
6	522	40	313	2.2	1.1	0	282	31	0
8	352	35	229	2.3	1.15	0	194	34	282
10	179	25	134	2.4	1.2	0	107	27	226
12	88	20	70	2.2	1.1	0	63	7	142
14	40	15	34	2.4	1.2	0	27	7	90
16	11	10	10	2.6	1.3	0	7	3	34
18	10	10	9	2.1	1.05	0	9	0	14
20	8	20	6	1.8	0.9	6	0	0	18
22									
Total	1210	175	805						805



Stand table projection: A quick review: Stock table

# trees moving up					Basal Area				Stock table	
Stay	1 class	2 classes	Future trees		BA/tree	present	future	volume/tree	present	future
0	282	31	0		0.19635					
0	194	34	282		0.349066	123	98			
0	107	27	226		0.545415	98	123	42	5628	9484
0	63	7	142		0.785398	69	111	86	6020	12171
0	27	7	90		1.069014	43	96	136	4624	12213
0	7	3	34		1.396263	15	48	201	2010	6874
0	9	0	14		1.767146	18	24	280	2520	3864
6	0	0	18		2.181662	17	38	369	2214	6476
								481	0	0
			805			383	539		23016	51081

Stand table projection A quick review: Stock table

# trees moving up					Stock table		
Stay	1 class	2 classes	Future trees		volume/tree	present	future
0	282	31	0				
0	194	34	282				
0	107	27	226		42	5628	94834
0	63	7	142		86	6020	12171
0	27	7	90		136	4624	12213
0	7	3	34		201	2010	6874
0	9	0	14		280	2520	3864
6	0	0	18		369	2214	6476
					481	0	0
			805			23016	51081