Possible Partial Cut Stocking Standards Examples with Application to Salvage areas

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Scenario #1

Proposed Overstory Standard :

- **Min. - 16 m^2/ha (ave) – Fd with Preferred Health and Vigor.**
- **Target – 20-24 m^2/ha (ave) Total overstory stocking.**
- **No more than 15% of the area (unmappable) or 1 ha (mappable) with less than 10 m^2/ha of trees having preferred health and vigor.**

Rationale – First entry in an uneven-aged system to improve vigor and add growth. Next entry in 20 years to open stand for regen. (To fit with deer winter range objectives and natural regeneration requirements for Fdi)

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Target – 20-24 m^2/ha (ave) overstory stocking.

Prescriptive guidance, NOT so much a stocking target or standard.

Scenario #1

Partial cut stocking standards

Scenario #1

Proposed Overstory Standard :

- Min. - 16 m^2/ha (ave) - Fd with Preferred Health and Vigor.
- Max - 24 m^2/ha (ave) – Total overstory stocking.
- No more than 15% of the area (unmappable) or 1 ha (mappable) with less than 10 m2/ha of trees having preferred health and vigor.

Rationale – First entry in an uneven-aged system to improve vigor and add growth. Next entry in 20 years to open stand for regen. (To fit with deer winter range objectives and natural regeneration requirements for Fdi)

No more than 15% of the area (unmappable) or 1 ha (mappable) with less than 10 m^2/ha of trees having preferred health and vigor.

(CRITERIA FOR DISTRIBUTION)

Advantages:

- Simple criteria to deal with openings or voids
- If you can draw a boundary around an area 1 ha or larger with < 10 m^2 acceptable trees – it must be managed separately.
- Can easily determine if there is >15% unmappable using a proportion of plots. Here 2 plots in 10, or 4 plots in 20 < 10 m^2/ha would be unacceptable.

Scenario #1 Acceptability Criteria

Partial cut stocking standards

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PREFERRED HEALTH AND VIGOR:

Min Live Crown - 25%

Min dbh – 28 cm

Health/vigor – Normal colour, full crown, no defects.

Form: No conks, sweep, crook or fork.

Some criteria may species specific.

No species preference criteria

Stand has only Fdi

Unacceptable wounding:

- Exposed sapwood > 400 cm^2
- Any exposed sapwood on roots within 1 m of base of the tree.
- Any gouge (splintering into sapwood)
- Broken top

Scenario #2 - Salvage entry in a two layered stand

Implementation Elements:

- **Silvi System** – Unevenaged Selection System or an Irregular Shelterwood (eventually)
- **Next planned entry** – 10-15 yrs to expand existing openings to improve regen growth and create new openings.
- **Regeneration objective for this entry** – PERHAPS – determine post salvage
- **Other considerations** – deer winter range

Scenario #2 Salvage in a 2-layered stand

DFP standards - ALL of these criteria must be met:

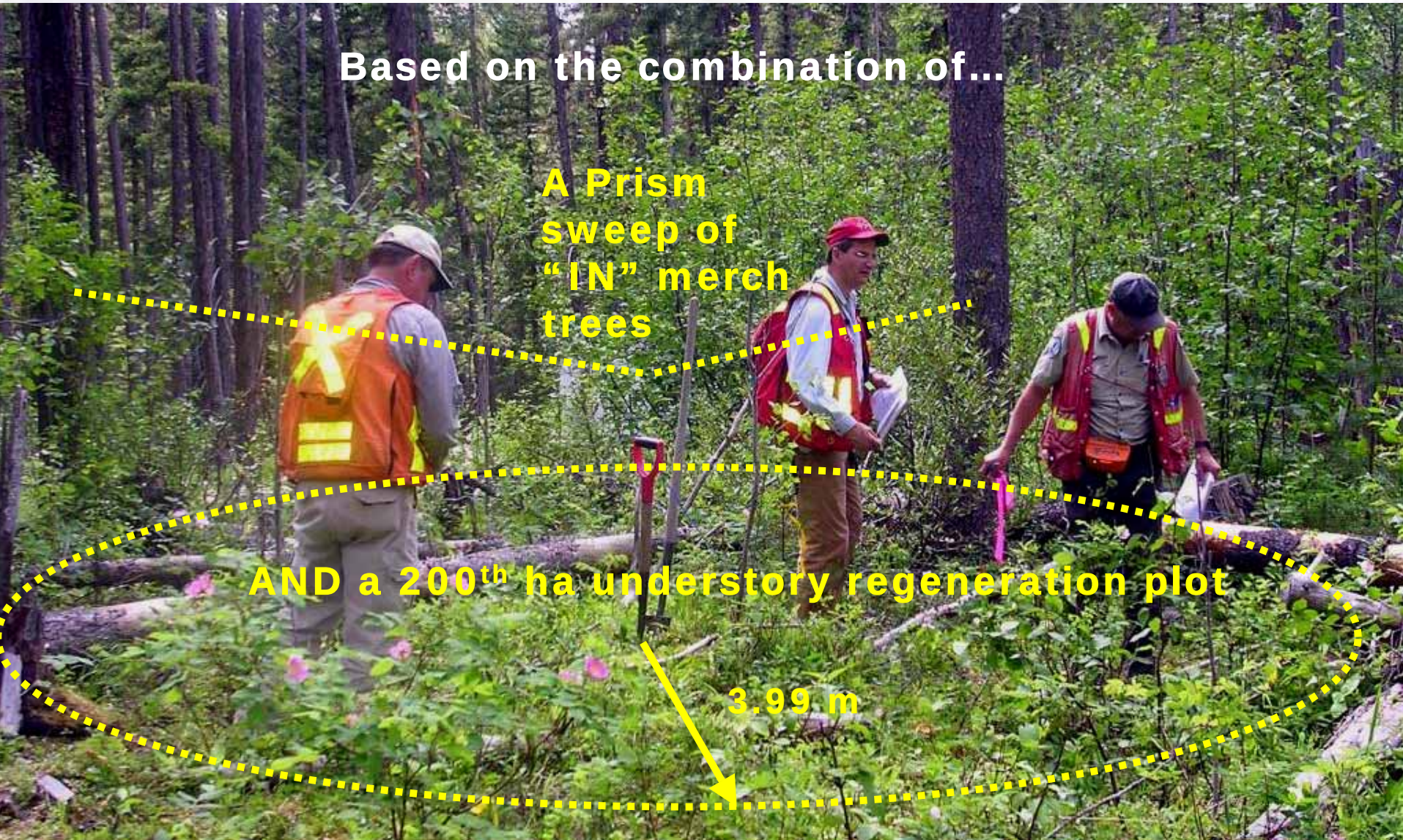
- Min of 20m^2/ha (ave) meeting acceptability criteria.
- Max ave deviation from potential = 0.20 (or 20%)
- Proportion of plots in "stocked" class is > or = 60%
- Proportion of plots in "partial stocked" class is < or = 40%
- Proportion of plots in "open" class is < 20%

Stocking amount

Stocking distribution

Stocking Classes (here based on the Rocking Mtn Standards)	
Open (O) =	Open - High potential for additional volume growth. Approx 41% DFP. Additional stocking is required where timber production is the primary management objective.
Partial stocking (P) =	Partial Stocking Moderate potential for additional volume production through additional stocking. Approximately 21 – 40% DFP. Assess options, additional stocking may be required
Stocked =	Low potential for additional growth through additional stocking. Approximately 20% or less DFP. No further treatments required

Scenario #2 – Using the Deviation from Potential (DFP) method to assess stocking:



Scenario #2

DFP concept

Overstory Basal area (L1) and understory density (L2,3,4) are combined.

DFP values:

- Indicate the proportion of potential growing space not effectively occupied.
- Were generated from Provincial growth and yield model.

DFP Better indicates growing space occupancy than multi-layered standards.

Table 1. DFP by understory tree density and overstory basal area.

2nd Approximation – Deviation From Potential (DFP)									
OS basal area (m2/ha)	Well-spaced trees in plot*								
	0	1	2	3	4	5	6	7	8
0	1.00	0.76	0.52	0.34	0.22	0.13	0.07	0.03	0.00
1	0.98	0.74	0.51	0.34	0.21	0.13	0.07	0.03	0.00
2	0.96	0.73	0.50	0.33	0.21	0.13	0.07	0.03	0.00
3	0.93	0.71	0.49	0.32	0.20	0.12	0.07	0.03	0.00
4	0.90	0.68	0.47	0.31	0.20	0.12	0.06	0.03	0.00
5	0.86	0.65	0.45	0.30	0.19	0.11	0.06	0.02	0.00
6	0.82	0.62	0.43	0.28	0.18	0.11	0.06	0.02	0.00
7	0.77	0.58	0.40	0.27	0.17	0.10	0.05	0.02	0.00
8	0.72	0.55	0.38	0.25	0.16	0.09	0.05	0.02	0.00
9	0.67	0.51	0.35	0.23	0.15	0.09	0.05	0.02	0.00
10	0.62	0.47	0.32	0.21	0.14	0.08	0.04	0.02	0.00
11	0.57	0.43	0.30	0.20	0.12	0.07	0.04	0.02	0.00
12	0.52	0.39	0.27	0.18	0.11	0.07	0.04	0.01	0.00
13	0.47	0.35	0.24	0.16	0.10	0.06	0.03	0.01	0.00
14	0.42	0.32	0.22	0.15	0.09	0.05	0.03	0.01	0.00
15	0.38	0.28	0.20	0.13	0.08	0.05	0.03	0.01	0.00
16	0.33	0.25	0.17	0.11	0.07	0.04	0.02	0.01	0.00
17	0.29	0.22	0.15	0.10	0.06	0.04	0.02	0.01	0.00
18	0.26	0.19	0.13	0.09	0.06	0.03	0.02	0.01	0.00
19	0.22	0.17	0.12	0.08	0.05	0.03	0.02	0.01	0.00
20	0.19	0.14	0.10	0.07	0.04	0.02	0.01	0.01	0.00
21	0.16	0.12	0.08	0.06	0.04	0.02	0.01	0.00	0.00
22	0.13	0.10	0.07	0.05	0.03	0.02	0.01	0.00	0.00
23	0.11	0.08	0.06	0.04	0.02	0.01	0.01	0.00	0.00
24	0.09	0.07	0.05	0.03	0.02	0.01	0.01	0.00	0.00
25	0.07	0.05	0.04	0.02	0.02	0.01	0.00	0.00	0.00
26	0.05	0.04	0.03	0.02	0.01	0.01	0.00	0.00	0.00
27	0.04	0.03	0.02	0.01	0.01	0.00	0.00	0.00	0.00
28	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00
29	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

* total number of well-spaced trees in a 0.005 hectare plot.

DFP web link: http://www.for.gov.bc.ca/hfp/silviculture/MPBI/index.htm

Scenario #2

DFP concept

- **Stocking classes can be custom designed based on objectives.**

Table 1. Deviation from potential (DFP) volume by unc

OS Basal Area (m2/ha)	Well-spaced trees in plot								
	0	1	2	3	4	5	6	7	8
0	1.00	0.74	0.52	0.34	0.22	0.13	0.07	0.03	0.00
1	0.98	0.74	0.51	0.34	0.21	0.13	0.07	0.03	0.00
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21	0.16	0.12	0.08	0.06	0.04	0.02	0.01	0.00	0.00
22	0.13	0.10	0.07	0.05	0.03	0.02	0.01	0.00	0.00
23	0.11	0.08	0.06	0.04	0.02	0.01	0.01	0.00	0.00
24	0.09	0.07	0.05	0.03	0.02	0.01	0.01	0.00	0.00
25	0.07	0.05	0.04	0.02	0.02	0.01	0.00	0.00	0.00
26	0.05	0.04	0.03	0.02	0.01	0.01	0.00	0.00	0.00
27	0.04	0.03	0.02	0.01	0.01	0.00	0.00	0.00	0.00
28	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00
29	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Open

Partially Stocked

Stocked

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DFP stocking classes – Allow for multiple stocking criteria

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- Proportion of plots in “stocked” class is > or = 60%
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DFP - Data Inputs…

STRATUM B1 **BLK 115**

Plot #	Total BA at sample point (m2/ha)	BA /ha of Acc. Trees	Total Regen stems	Well Spaced Acceptable Stems: Fd	Sx	Pl	Total WSA	Stocking Class	DFP
1	32	28	0	1			1	S	0.02
2	8	0	1	2			2	O	0.52
3	24	16	5	0	1		1	S	0.25
4	32	24	2	0			0	S	0.09
5	24	20	1	0			0	S	0.19
6	28	20	1	1	1	1	3	S	0.07
7	12	4	3	0			0	O	0.90
8	16	12	5	2	2		4	P	0.11
9	8	4	5	0	1		1	P	0.68
10	28	12	1	0	1		1	P	0.39
11	16	12	2	0	2		2	P	0.27
12	24	16	0	0			0	P	0.33
13	28	20	2	1			1	S	0.14
14	12	12	4		4		4	S	0.11
15	28	24	4	1			1	S	0.07
16	16	16	3	1	1		2	S	0.17
17	20	4	3	0	2		2	O	0.47
18							0		0.00
19							0		0.00
20							0		0.00
Average	**21**	**14**	**494**	**106**	**176**	**12**	**294**		**0.28**
	63			**36%**	**60%**	**4%**			# of plo
Total plots =	17						% O =	18%	
							% P =	29%	
							% S =	53%	% of plots wi

DFP - Data Outputs...Stocking Summary

Current Stocking Status =	**NSR**					**but should log or cut some L1 stems to facilitate regen**	
Average DFP =	**0.28**						
Stocking Class Breakdown =	**18%**	OPEN,	**29%**	PARTIALLY STOCKED,	**53%**	STOCKED	
Average Basal Area of Acceptable trees (L1) =	**14**	m2/ha					
% plots with < 10 m2/ha of acceptable L1 trees =	**24%**						
Average well-spaced Acceptable regen (L2-4) =	**294**	stems/ha					
Average # of plantable spots/ha =	**871**	spots/ha					
% plots with overstory voids > 100 m2 =	**53%**						
Average size of overstory void =	**208**	m2					
Brush Hazard =	**6%**	LOW	**94%**	MODERATE	**0%**	HIGH	**0%** VERY HIGH
Frost Hazard =	**6%**	LOW	**94%**	MODERATE	**0%**	HIGH	

DFP - Data Inputs... If you want a stand table

PRISM SWEEP SUMMARY SHEET

BAF	**4**
# PLOTS	**17**

Regen. Plot Radius = 3.99

S.T.F. For B.A.F.=1

DBH Class	DBH Range	SPH Factor		Fd			Sx			At			Pl	DEAD		Sx	Dead
			G	F	P	G	F	P	G	F	P			D			D
0	0.0-2.4	n/a															
5	2.5-7.4	n/a															
		n/a															
20	**12.5-24.5**	**31.8**	**4**		**1**	**2**					**1**			2			1
30	**27.5-32.4**	**14.1**	**10**			**3**	**1**			**1**				10			
40	**37.5-42.4**	**8**	**17**			**15**	**1**		**5**	**2**				3			
50	**47.5-52.4**	**5.1**	**4**			**2**				**1**							
60	**57.5-62.4**	**3.5**	**1**			**1**											
70	**67.5-72.4**	**2.6**				**1**											
80	**77.5-82.4**	**2**															
90	**87.5-92.4**	**1.6**															
100	97.5-102.4	**1.3**															

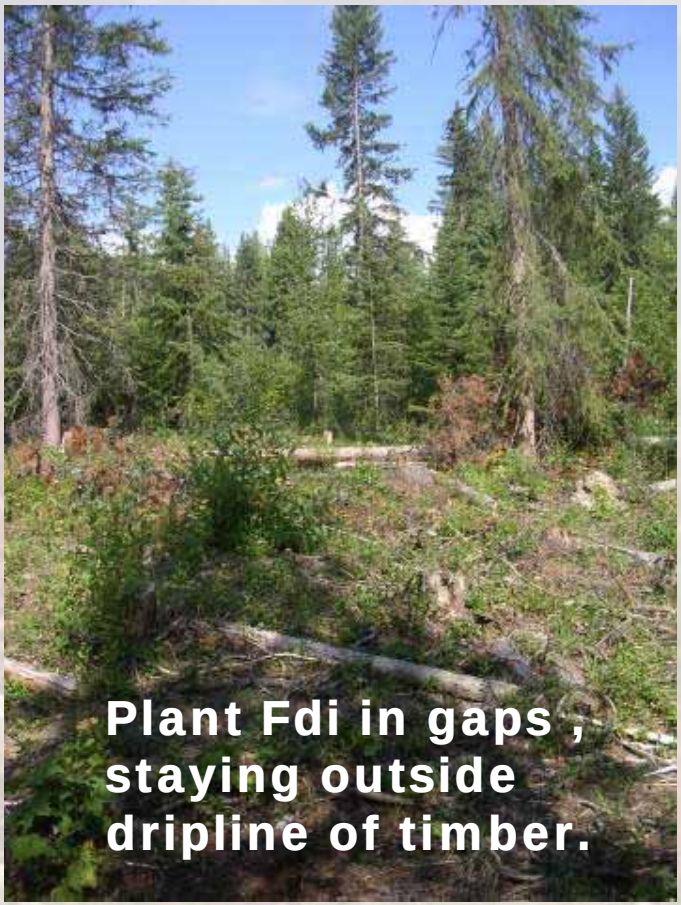
DFP - Data Inputs...Stand Table

May help build prescription

STAND TABLE **STRATUM B1**

Diameter Class		Species % (by basal area in the corresponding diameter class)								STEM / HA TOTAL	STEM / HA % G&F	STEM / HA % Dead	Basal area m2/ha Total	Basal area m2/ha % G&F	Basal area m2/ha % Dead
L2, L3, L4		Fd 36%	Sx 60%	Pl 4%		**DEAD**		**DEAD**		**494**	**294** WSA		na	na	na
12.5 to 24.9		Fd 45%	Sx 18%	At 9%		Pl 18%		Sx 9%		**82**	55%	27%	**2.6**	55%	27%
25 to 34.9		Fd 40%	Sx 16%	At 4%		Pl 40%		0 0%		**83**	60%	40%	**5.9**	60%	40%
35 to 44.9 cm		Fd 40%	Sx 37%	At 16%		Pl 7%		0 0%		**81**	93%	7%	**10.2**	93%	7%
45 to 54.9 cm		Fd 57%	Sx 29%	At 14%		0 0%		0 0%		**8**	100%	0%	**1.6**	100%	0%
55 cm plus		Fd 33%	Sx 67%			0 0%		0 0%		**2**	100%	0%	**0.7**	100%	0%
TOTAL		**Fd 42**	**Sx 29**	**At 11**		**Pl 17**		**Sx 1**		**257**	**70%**	**24%**	**21.0**	**80%**	**18%**

DFP - Only helps measure stocking – Prescriptions still require common sense



Plant Fdi in gaps , staying outside dripline of timber.

- Develop as a group selection system with logical future entries.
- Log first to expand openings and thin southern edges.
- Then plant Fdi.

Scenario #3 Intermediate Cut (CT)

Implementation Elements:

- Silvi System – Intermediate cut with focus on salvage*
- Next planned entry – 20 yrs
- Regeneration objective – NO
- Other considerations
  - Growth of overstory should be enhanced
  - Leave trees should be healthy and able to release

* Commercial thin with Pli and a few Fdi removed – intent is to have a regeneration entry in 20-30 years – may be clearcut at that time.

Scenario #3 Intermediate Cut (CT)

STOCKING STANDARDS:

Basal area per hectare - Min- 20 m^2/ha ave. merch.

Distribution Criteria - DFP stocking Class Distribution (to limit gaps): -

- No contiguous area > 1 ha with an average DFP in the "open" stocking class (>0.40).
- No more than 25% of DFP plots in "open" and/or "partially stocked" stocking classes.

Species Target: - > 50% Douglas-fir (with Cw and Hw)

Must Meet Acceptability criteria

- size, live crown, form, wounding

Scenario #3 Use of basal area as a min stocking standard:

Use of Basal area rather than density – why go there?

- Allows bigger trees to have a larger contribution to stocking than smaller trees
- Easy to assess – prism sweep with a #4 or #5 prism.

Use of basal area as a min stocking standard:

15, 20, 25 or 30 m^2/ha – what makes the most sense as a minimum?

- The Rocky Mountain & Quesnel Districts use 20 m^2/ha as their minimum in their 2005 standards.
- Slightly less than 20% reduction in growth potential – based on TASS data.
- Basically you have to decide what growth potential you are willing to give up

  Consider:

  - How long till the next harvest?
  - How practical is it to underplant?

Table 1. Deviation f

OS Basal Area (m2/ha)	Well-space				
	0	1	2	3	
0	1.00	0.76	0.52	0.34	0
1	0.98	0.74	0.51	0.34	0
2	0.96	0.73	0.50	0.33	0
3	0.93	0.71	0.49	0.32	0
4	0.90	0.68	0.47	0.31	0
5	0.86	0.65	0.45	0.30	0
6	0.82	0.62	0.43	0.28	0
7	0.77	0.58	0.40	0.27	0
8	0.72	0.55	0.38	0.25	0
9	0.67	0.51	0.35	0.23	0
10	0.62	0.47	0.32	0.21	0
11	0.57	0.43	0.30	0.20	0
12	0.52	0.39	0.27	0.18	0
13	0.47	0.35	0.24	0.16	0
14	0.42	0.32	0.22	0.15	0
15	0.38	0.28	0.20	0.13	0
16	0.33	0.25	0.17	0.11	0
17	0.29	0.22	0.15	0.10	0
18	0.26	0.19	0.13	0.09	0
19	0.22	0.17	0.12	0.08	0
20	0.19	0.14	0.10	0.07	0
21	0.16	0.12	0.08	0.06	0
22	0.13	0.10	0.07	0.05	0
23	0.11	0.08	0.06	0.04	0
24	0.09	0.07	0.05	0.03	0
25	0.07	0.05	0.04	0.02	0
26	0.05	0.04	0.03	0.02	0
27	0.04	0.03	0.02	0.01	0
28	0.02	0.02	0.01	0.01	0
29	0.01	0.01	0.01	0.00	0
30	0.00	0.00	0.00	0.00	0

Use of basal area as a min stocking standard:

The practicality of underplanting a 20 m^2/ha overstory:

- At any point in the stand there would be at least 4 trees of 40 cm dbh within 9 m.
- If the average dbh was 30 cm there would be 4 of these within 7 m of any point.
- If stand height was 25 m^2 plus, how well would a planted understory tree grow?
- ALSO – what is the point of planting if you intended to log in the short term (20 years or so)?