FORESTRY CORP

Manning Diversified Forest Products Ltd.
Polygon Update Protocol:
Sampling Results and Block Assignment
August 15, 2005

The following methods were reviewed with Alberta SRD on August 10, 2005.

REVIEW OF SAMPLING DESIGN

Sampling Design:

- ✓ grid survey at ½ intensity of SRD regeneration manual requirements
- ✓ 1.78 m radius plots (10 m^2)
- ✓ tally by species and height class (2 m intervals)
- ✓ note stocking status and whether stocked to conifer, deciduous or both (field "stat)
- ✓ where tallest conifer and tallest deciduous were in the same height class, call which would be the eventual "winner" (field "lead")
- ✓ sample tally card:

LINE	PLOT		DRAIN	SPP		0.3-1.1	1.2-2.0	2.1-4	4.1-6	6.1-8	8.1-10	10.1-12	12.1-14	14.1-16	16.1-18	18.1-20	20+	STAT	D	C
																			LEAD	
3	9	8	M W	S	W		1											S	C	
3	9	7	M W	S	W			2										S	B	X
				A	W				1											
3	9	6	R	A	W						5							S	D	
				P	B					2										
3	9	5	R	A	W						1							S	B		X
				P	B					2										
				S	W						1									

Sampling Populations:

- ✓ 10% aerial
  - o aerial herbicided
  - o 10% subsample required
  - o results to be applied to all aerial herbicide blocks except 2004 blocks

- ✓ 10% aerial 04
  - o aerial herbicided in 2004
  - o 10% sample required

- o in treated areas, assume all deciduous is dead (since treatment response not yet evident)[1]
- o results to be applied to remaining 90% of 2004 aerial herbicide blocks

✓ 10% basal
- o basal herbicide treatment;
- o 10% subsample required
- o results to be applied to all basal herbicide blocks except 2004 blocks

✓ 10% basal 04
- o basal herbicide treated in 2004
- o 10% sample required; in treated areas, assume all deciduous is dead (since treatment response not yet evident)
- o in treated areas, assume all deciduous is dead (since treatment response not yet evident)
- o results to be applied to remaining 90% of 2004 basal herbicide blocks

✓ P6MOF
- o 50% sample
- o results to be applied only to the P6MOF block

✓ L12L19
- o 100% sample
- o does not follow the grid-based survey methods
- o line transects with even spacing and interplot distances with goal of 100 plots
- o results to be applied to L12L19 area only

PLOT LEVEL COMPILATION

For each plot, the total number of stems was tallied by species and 2 m height class. For densities of ten or more, the notation '10+' was used. For analysis, this was converted to a numeric value of 10 (we can consider this a capped density). For processing purposes, each of the height classes was assigned a numerical value from 1 (shortest) to 12 (tallest).

Values for layer 1 were assigned as follows:

```
/* assign layer 1 - for deciduous, also assign if a D/U plot (will need
something trickier for C/U, CD/U, DC/U) */

  layer1='XXX';
  if maxcon=. and maxdec=. then do;
    stock='N';
      layer1='NSR';
```

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[1] For AERIAL 04 and BASAL 04 subpopulations, the areas within each block that were treated were delineated by Manning Diversified staff. Within areas that were treated, all deciduous in survey plots were assumed to be dead.

```
  end;
  else if maxcon>(maxdec+2) and maxdec ne . then layer1='C';
  else if (maxcon ne . and maxdec =.) then layer1='C';
  else if maxdec>(maxcon+2) and maxcon ne . then layer1='D/U';
  else if (maxdec ne . and maxcon =.) then layer1='D';
  else if layer1='XXX' and maxdec ne . and maxcon ne . then layer1='MW';
  else layer1='??'; /* to flag those with improper assignment */

/* break MW into CD or DC (for tracking purposes)-"tallest wins" scenario */

  if layer1='MW' and maxcon>maxdec then layer1='CD';
  else if layer1='MW' and maxdec>maxcon then layer1='DC';
  else if layer1='MW' and maxdec=maxcon and conlead='X' then layer1='CD';
  else if layer1='MW' and maxdec=maxcon and declead='X' then layer1='DC';
  else if layer1='MW' and maxdec=maxcon and conlead ne 'X' and declead ne 'X'
      then layer1='CD'; /* there are only 4 plots with no "leading" call */
```

- maxcon is the maximum height class conifer occurs in
- maxdec is the maximum height class that deciduous occurs in
- conlead and declead are the surveyor's call on which will be the winner, conifer or
  deciduous, if the tallest conifer and tallest deciduous are both in the same height class

Note that plots with conifer in the upper layer and with deciduous more than two height classes
shorter (>4 m) were defined as conifer, rather than mixedwood plots.

C, CD, and DC plots were redefined as C/U, CD/U, or DC/U plots if there was any gap (no trees
present) of 2 height classes or more below layer 1, with conifer present below the gap.

The leading conifer species was assigned to each plot based on the tallest conifer present in each
plot, as follows:

```
if layer1='C' or layer1='CD' or layer1='DC' then do;
 if SW>=FB and SW>=LT and SW>=PL then leadspp='SW';
 if PL>SW and PL>=LT and PL >=FB then leadspp='PL';
 if LT>SW and LT>PL and LT>FB then leadspp='LT';
 if FB>SW and FB>PL and FB>LT then leadspp='SW';
end;
```

- SW, FB, LT, and PL are the tallest height class each species is present in

BLOCK LEVEL COMPILATION

For each plot, values for coniferous overstory, deciduous overstory, and presence of understory
conifer were assigned based on cover type (Table 1). These were summed by block to assign the
number of deciduous plots, number of coniferous plots, and number of plots with understory
conifer.

Table 1. Value assignment by plot cover type.

Cover Type	Coniferous Overstory	Deciduous Overstory	Understory Conifer
C	1		
C/U	1		1
CD	1	1	
CD/U	1	1	1
DC	1	1	
DC/U	1	1	1
D		1	
D/U		1	1

For each block, percent of plots with conifer and percent of plots with deciduous was calculated relative to the total number of conifer and deciduous plots combined. Percentages are not calculated relative to the total number of stocked plots, since some stocked plots may contribute to both conifer and deciduous plot numbers.

$$PctCon = (NumCon/(NumCon + NumDec))*100$$

$$PctDec = (NumDec/(NumCon + NumDec))*100$$

Broad cover group was assigned based on the percent conifer relative to percent deciduous:

Table 2. Broad cover group assignment.

Broad Cover Group	Percent Conifer	Percent Deciduous
C	80-100	0-20
CD	50-79	21-50
DC	21-49	51-79
D	0-20	80-100

Percent of plots with conifer understory was calculated relative to the number of total stocked plots within each block:

$$PctUnderstory = (NumUnderstory / NumStockedPlots)*100$$

For blocks where 30% or more plots have a conifer understory, an understory designation (/U) was appended to the broad cover group. The 30% cutoff was selected because a) using AVI criteria, 30% represents an A density stand and b) A density SW is considered a valid understory for yield stratification.

Leading conifer species was assigned based on frequency: the species present in the most plots within each block was deemed the leading species.

All assigned attributes, including final broad cover group assignment, in presented in Table 3. Yield stratum is assigned using this final assignment, plus leading species and FMU (for some

yield strata). All regenerating stands will be assumed to be fully stocked (since all met the minimum 80% stocking).

Table 3. Number of blocks by sampling stratum, broad cover group assignments, percent understory and final assignment.

Sampling Stratum	BCG Assign.	Lead Conifer	Percent Underst.	Final Assign	Number of Blocks	Total Area
10% AERIAL	C	SW	0	C	1	4
	CD	SW	0	CD	5	51
			3	CD	1	8
10% AERIAL 04	C	SW	0	C	3	34
			9	C	1	7
	CD	SW	0	CD	8	87
			15	CD	1	3
10% BASAL	CD	SW	31	CD/U	1	13
			43	CD/U	1	13
			44	CD/U	1	11
			45	CD/U	1	13
	DC	SW	42	DC/U	1	12
		SW	50	DC/U	1	13
10% BASAL 04	CD	SW	2	CD	1	34
			3	CD	1	18
			10	CD	1	13
L12L19	CD	SW	21	CD	1	669
P6MOF [1,2]	CD	SW	2	CD	1	125
			14	CD	1	193
			17	CD	1	156
			18	CD	2	397
			20	CD	1	251
			21	CD	1	277
			28	CD	1	164
	DC	SW	22	DC	1	35
			33	DC/U	1	122
Grand Total					40	2723

1) only one call required for MoF block - overall, this block is assigned to the CD stratum

2) only one stand was NSR - this was one of the MoF blocks at 75% - overall the MoF block is SR

Based on these results, the majority of stands are mixedwood types. One noticeable difference is between the 10% BASAL and 10% BASAL 04 populations. The 10% BASAL blocks all have a conifer understory whereas the 10% BASAL 04 did not. Generally, the 10% BASAL blocks are older, and have less area treated, and were in different areas, which may explain the slightly different trajectory.

APPLYING COMPILATION RESULTS

Initial sampling was based upon selecting 10% of blocks based on number of blocks in each stratum (not 10% of area). Regardless, the selected blocks ended up being VERY close to 10% of total area (Table 4). For the 10% basal 04, 25% were selected – there were only 4 blocks in this population, so a sample of 1 block yielded this result. No weighting by area was used. The actual sample for the aerial and basal strata was larger because many of the alternates were also sampled. Note that for P6MOF, 50% was the target, and for L12/L19, the entire area was surveyed. This information is summarized in Table 4.

Table 4. Required vs. actual sample.

		Total Population	% Required to Sample	Required to Sample *	Selected to Sample **	% Selected to Sample	Actual Sample ***	% Actual Sample
10% AERIAL	Total Area	435.5	10	43.6	39	9	63	14
	Number of Blocks	45.0	10	4.5	5	11	7	16
10% AERIAL 04	Total Area	1328.2	10	132.8	137	10	131	10
	Number of Blocks	116.0	10	11.6	12	10	13	11
10% BASAL	Total Area	372.0	10	37.2	51	14	75	20
	Number of Blocks	35.0	10	3.5	4	11	6	17
10% BASAL 04	Total Area	114.8	10	11.5	13	11	65	57
	Number of Blocks	4.0	10	0.4	1	25	3	75
P6MOF	Total Area	2624.4	50	1312.2	1276	49	1720	66
	Number of Blocks	16.0	50	8.0	8	50	10	63
L12/L19	Total Area	668.7	100	668.7	669	100	669	100
	Number of Blocks	237.0	100	237.0	237	100	237	100

* based on % of total blocks
** required sample rounded up to the nearest whole number
*** larger than selected sample because alternate blocks were also sampled

The results can be applied to the population either on a "number of stands" basis or on an area basis. For example, 10% aerial: 14% of surveyed stands came to a C broad cover group, but on an area basis, 6% of the total area surveyed came to a C. So when applying to the population, one can either assign 14% of the blocks to C if balancing on a block basis, of assign 6% of the population area if balancing on an area basis.

Table 5. Percent based on total blocks vs. total area.

		Based on % Total Blocks	Based on % Total Area
10% AERIAL	C_SW	14	6
	CD_SW	86	94
10% AERIAL 04	C_SW	31	31
	CD_SW	69	69
10% BASAL	CD_SW	67	67
	DC_SW	33	33
10% BASAL 04	CD_SW	100	100
P6MOF	CD_SW	80	91
	DC_SW	20	9
L12/L19	CD_SW	100	100

As per discussions with Alberta SRD, results will be applied on a "number of blocks" basis – e.g., for the 10% aerial population, roughly 14% will be assigned to the "C" stratum and 86% will be assigned to the "CD" stratum. Effort will be made to maintain some balance with respect to area. Assignment of blocks to strata will be made based on professional knowledge of the blocks in question.

Note that P6MOF will only have one call for the entire area. This would be a CD call since the majority of sampled blocks were CD. Also note that CD and DC stands are represented by the same yield curve (and MX curve) and therefore there are no yield implications in this respect.