B. Vegetation Composition and Age Class Objectives

The following section takes a look at the Forest Plan Species Composition and age class distributions and compares them to what is accomplished as of early 2011 and planned but not accomplished (2011 +5 column on age class tables).

Forest-wide figures for species compositions and age class distributions are presented. Detailed results of age class and species distributions for each of the Landscape Ecosystems (LEs) are also presented.

Key Points

- To achieve composition objectives requires a significant amount of conversions, a concerted effort and investment by the forest.
- Forest wide the 0-9 age class has decreased significantly across all Landscape Ecosystems since 2004. Conversely, the older age classes (50 + years) have increased more than projected.

Monitoring Question

To what extent is the Forest meeting vegetation composition and age class objectives for each of the Landscape Ecosystems?

Results

A. Forest-wide Vegetation Composition

Table 3.2. Forest-wide Vegetation composition Objectives for *Uplands* in the Minnesota Drift and Lake Plains Section. (Reference: Forest Plan, Table DLP-2, p. 2-57)

Forest Types	2003		2011		10-yr Obj. %	20-yr Obj. %	100-yr Obj. %	% difference from 2009-10-yr obj.
	Acres	%	Acres	%				
Jack pine	14500	6	10,954	2.5	5	6	6	-2.5
red pine	73900	16	71,730	16.5	17	17	19	-.5
white pine	4600	1	5,576	1.3	2	3	6	-.7
spruce-fir	28400	6	22,212	5.1	7	8	9	-1.9
oak	9500	2	7,026	1.6	2	2	2	-.4
Northern hardwoods	59900	13	78,570	18.3	15	16	17	+3.3
aspen	226400	50	208,022	47.7	45	42	32	+2.7
paper birch	38100	8	31,586	7.2	8	7	9	-.8
TOTAL	455,500	100	435,676	100	100	100	100	

This table does not incorporate figures for White Cedar Swamp and Wet Sedge Meadow because they are lowland areas and have had little or no harvest.

Based on numbers from the above table, the following shifts in acres need to occur to meet the 10 year forest-wide objectives.

Table 3.3 Shifts needed in forest types.

Forest Types	Direction of Shift	Acres
jack pine	Increase	10,829
red pine	Increase	2,335
white pine	Increase	3,138
spruce-fir	Increase	8,285
oak	Increase	1,687
paper birch	Increase	3,268
Northern hardwoods	Decrease	13,219
aspen	Decrease	11,968

The following table shows where species shifts need to occur relative to the LEs.

Table 3.4 Need to maintain (m), increase (+), or decrease (-) acres based on comparing 2011 percentages to Decade 1 percentages for each LE (reference tables: Forest Plan pp 2-57 through 2-79).

	Landscape Ecosystem						
	Hardwood LEs		Pine LEs			Lowland LEs	
Forest Type	**BHC**	**MNH**	**DP**	**DMP**	**DMPO**	**TS**	**WCS**
Uplands							
Jack pine	-	m	+	m	+	m	n/a
red pine	m	m	-	m	+	m	m
white pine	+	m	m	+	m	m	n/a
spruce-fir	+	+	m	+	+	+	+
oak	m	m	-	+	m	-	m
Northern hardwoods	-	-	-	-	-	-	+
aspen	-	+	-	-	-	-	-
paper birch	m	+	-	+	-	-	-
ACRES	100,000	64,751	11,918	82,812	157,616	19,611	
Lowlands							
black spruce	+	+	+	+	+	+	m
tamarack	-	m	-	m	-	-	m
lowland hardwoods	-	-	+	-	m	+	+
white cedar	m	m	m	m	m	m	m
ACRES	31,199	6,703	405	7,475	20,243	31,077	12,883

Hardwood LEs: BHC- Boreal Hardwood Conifer MNH – Mesic Northern Hardwood
Pine LEs: DP – Dry Pine DMP – Dry Mesic Pine DMPO – Dry-Mesic Pine/Oak
Lowland LEs: TS – Tamarack Swamp WCS – White Cedar Swamp

Based on information in the above tables to meet the 10 year objectives, the Forest needs to

- **<u>Increase</u>** the amount of jack pine, red pine, white pine, spruce-fir, oak and paper birch on the landscape.
    - Jack pine has decreased since 2003. Jack pine/red pine stands typed as jack pine have shifted to red pine as jack pine has been harvested or died. The Forest needs to almost double the amount of jack pine from the 2011 numbers to achieve 5% of the landscape in jack pine. This would result in an increase in acres from about 11,000 currently to 22,000 primarily in the Dry Pine and Dry-Mesic Pine/Oak LEs. Possibilities include conversion of red pine, aspen, or birch stands to jack pine.

      Jack pine has been difficult to get established due to hazel competition; shoot blights (e.g. *Diplodia*), and rabbits/hares. The Forest has also shifted to seeding jack pine to move away from the plantation look to a more random and diverse spacing and to increase natural function, especially with more "doghair" stands. However, the success of seeding has not yet been determined because it takes to harvest stands under contract, prepare the sites for regeneration, and allow time for germination, establishment and growth.

    - Red pine has slightly increased since 2003. Yet it will take approximately 2200 acres of additional red pine to meet the 17% forest-wide objective. Additionally more acres may be needed if red pine stands are converted to increase the amount of jack pine. Increases need to occur in the Dry-Mesic Pine/Oak LE. It would be possible to convert aspen and birch stands to red pine to move towards this objective.

    - White pine stands are not common. Our focus on increasing the white pine component within stands doesn't make them a white pine forest type. Another 3,050 acres will be needed primarily in the Boreal Hardwood Conifer and Dry Mesic Pine LEs by the end of the decade to achieve the 2% forest–wide objective.

    - Increasing the amount of spruce-fir is an objective in most of our vegetation projects. Another 8300 acres of spruce-fir across all the LEs will be needed to meet the 7% objective by the end of the first decade. Sometimes this can be achieved by releasing existing components in the lower canopy layers of stands. In many instances, seeding of spruce-fir is planned after harvest. Results from these efforts won't be evident for several years yet because of the time it takes to harvest stands under contract, prepare the sites for regeneration, and allow time for regeneration establishment and growth.

    - Virtually no harvest has occurred in the oak forest type. The oak component within stands is often designated for retention but still comprises a minor component of the stand composition. Additional acres of the oak forest type would be most suited in the Dry Mesic Pine LE. Conversions to oak thus far have been minimal.

- Paper birch has declined since 2003. An additional 3500 acres is needed to meet the 10 year objective. LEs best suited for paper birch Dry Mesic Pine and Mesic Northern Hardwood. Paper birch should decrease in the Dry Pine and Dry Mesic Pine/Oak LEs by about 1600 acres.

- **Decrease** northern hardwoods and aspen on the landscape.
  - Northern hardwoods are increasing and are expected to continue to do so. An increase resulted several years ago from stand re-delineation, recent stand inventory, and management activities. Presently, a decrease of 14, 377 acres is needed across all LEs to meet decadal objectives but this may be a conservative estimate. This number is expected to be higher by the end of the decade because many aspen stands are planned for conversion to northern hardwoods. This aspen conversion works with species on site and is relatively easy and cheap to accomplish.

  - Decreasing the amount of aspen on the landscape is a short and long term goal. Roughly 50% of the upland landscape is in the aspen forest type. To make a shift of 2.7% requires a change on about 11,763 acres which should occur on all LEs except for the Mesic Northern Hardwood LE. The most cost effective conversions are those where other species on site could be managed in the future, such as northern hardwoods as discussed above. Otherwise aspen conversions are costly and require extensive site preparation, planting, and stand tending.

- Harvest treatments that affect species composition for Decade 1 have already been planned and are under timber sale contract. As implementation occurs, acres and percentages will change. Current planning efforts and those that occur during the remainder of Decade 1 will affect the objectives specified for Decade 2.

B. Forest-wide Age Class Objectives

The following table contains the objectives and 2003 acres and percentages in Table DLP-3 (FP, p. 2-58) and compares them to numbers for 2001 and 2001+5. The 2011 numbers reflect what is currently on the ground, whereas the 2011+5 numbers reflect acres in projects planned but not yet harvested.

Table 3.5. Forest-wide Age Class Objectives from Table DLP-3 (FP, p 2-58), 2011, 2011+5 and acres and percentages.

Age Class	2003		2011		Objectives		% difference from 2011 to Decade 1	2011 + 5 yrs	
					Decade 1	Decade 2			
UPLANDS	Acres	%	Acres	%	%	%		Acres	%
0-9	38,000	8	17,085	4	8	8	-4	20,585	5
10-49	191,800	42	197,673	44	49	48	-5	191,740	43
50-99	192,000	42	182,935	41	33	29	8	171,774	38
100-149	31,700	7	45,266	10	9	13	1	57,771	13
150+	2,200	0	4,455	1	1	1	--	5,526	1
TOTAL	455,500	100	447,414	100	100	100		447,397	100
LOWLANDS									
0-9	600	1	630	1	4	4	-3	936	1
10-49	5,200	5	6,340	6	5	7	1	5,293	5
50-99	41,600	43	37,341	37	31	18	6	31,269	31
100-149	46,900	48	50,356	49	55	60	-6	54,026	53
150+	3,300	3	7,260	7	5	10	2	9,722	10
TOTAL	97,700	100	101,927	100	100	100		101,246	100

- The Forest is roughly creating half of the 0-9 age class the Forest Plan projected. Although this is up slightly when looking at the projects planned but not yet accomplished (2011+5), it is still well below the projected 8%.

- The Forest is well over the amount of 50-99 the Forest Plan projected. The gap widens in 5 years (2011+5) due to a decrease in the percentage for Decade 2. Since most of the Forest species reach CMAI in this age class (FP, p. 2-20), there may be opportunities to increase the amount of even-aged harvests which would decrease this age class and increase the amount of 0-9. The Forest is also exceeding objectives for the 100-149 age class but not to the degree that a shift needs to occur.

- More detailed information obtained by looking at tables for each of the LEs, indicates that increases in the 0-9 age and decreases in 80+ age class are needed in the Dry Pine, Dry Mesic Pine, Dry Mesic Pine/Oak, Boreal Handwood Conifer, and Tamarack Swamp to meet objectives. The exception is in the Mesic Northern Hardwoods LE which is close to achieving the 0-9 objectives and where increases in the amount of 80+ are desired.

C. Vegetation Composition and Age Class Objectives by Landscape Ecosystem

Species composition and age class acres and percentages for 2011 are compared to Decade 1 objectives for each LE. The 2003 numbers are taken from tables in the Forest Plan on pages 2-60 through 2-74 and are included to provide a context for the shift and trends since the 2004 FP went into effect. The 2011 acres and percentages reflect what is accomplished and on the ground. For the age class tables, the 2011+5 column captures acres planned for harvest but have yet to be accomplished. It is assumed they will be accomplished in 5 years which places them in Decade 2. For the most part, trends for Decade 2 are not discussed. Although there are some

exceptions, generally if movement is towards meeting Decade 1 objectives, then the Forest is on trajectory for meeting Decade 2 objectives.

Lowlands are not discussed because so little harvest has occurred in them. Shifts tend to be a function of succession, re-typing, and stand inventory rather than active management.

Dry Pine Landscape Ecosystem

Table 3.6 Species composition

Forest Type	FP 2003		2011		Objectives		% difference from 2011 to Decade 1
					Decade 1	Decade 2	
UPLANDS	Acres	%	Acres	%	%	%	
Jack Pine	3300	27	2579	22	35	41	-13
Red Pine	4900	41	4942	41	39	37	+2
White Pine	200	1	221	2	2	2	--
Spruce-fir	200	1	123	1	1	2	--
Oak	400	3	504	4	3	3	+1
Northern Hdwds	100	1	347	3	1	1	+2
Aspen	2700	23	2670	22	16	12	+6
Paper Birch	300	2	533	4	2	2	+2
TOTAL	12,100	100	11,918	100	100	100	
LOWLANDS							
Black Spruce	300	71	222	55	71	71	-16
Tamarack	100	13	63	16	13	13	+3
Lowland Hdwds	100	13	38	9	13	13	-4
White Cedar	<100	3	83	20	3	3	+17
TOTAL	400	100	405	100	100		

Table 3.7 Age class distributions.

Age Class	2003		2011		Objectives		% difference from 2011 to Decade 1	2011 + 5 yrs	
					Decade 1	Decade 2			
UPLANDS & LOWLANDS	Acres	%	Acres	%	%	%		Acres	%
0-9	1800	14	799	6	12	10	-6	663	5
10-39	5000	40	4906	40	45	45	-5	4762	39
40-79	4700	37	3687	30	24	28	+6	3238	26
80-179	1100	8	2927	24	19	17	+5	3657	30
180+	0	0	3	0	0	0	--	3	0
TOTAL	12,500	100	12,323	100	100	100		12,323	100

To meet Decade 1 objectives:

- Increase jack pine acres by approximately 1600 acres which can only be accomplished by conversions of red pine, paper birch and aspen to jack pine. Decrease red pine by about 300 acres; convert these acres to jack pine
- Decrease aspen approximately 800 acres. Converting these acres to jack pine would be ideal if economically and technically feasible to accomplish.

- Increase the 0-9 and 10-39 age classes almost 750 acres each by decreasing the 40-79 and 80-179 age classes by comparable amounts.
- 1600 acres more of the jack pine forest type is needed and can only be achieved through even-aged regeneration harvest which creates 0-9.

Dry-Mesic- Pine Landscape Ecosystem

Table 3.8 Species composition

Forest Type	FP 2003		2011		Objectives		% difference from 2011 to Decade 1.
					Decade 1	Decade 2	
UPLANDS	Acres	%	Acres	%	%	%	%
Jack Pine	1200	1	713	1	1	1	--
Red Pine	13000	15	12168	15	15	16	--
White Pine	800	1	1203	1	4	6	-3
Spruce-fir	4000	5	2997	4	8	9	-4
Oak	5100	6	3235	4	6	6	-2
Northern Hdwds	12300	15	17678	22	15	15	+7
Aspen	38800	46	36967	45	41	37	+4
Paper Birch	9100	11	6849	8	10	10	-2
TOTAL	84,300	100	81,812	100	100	100	
LOWLANDS							
Black Spruce	3600	53	3266	44	53	53	-9
Tamarack	600	9	703	9	9	9	--
Lowland Hdwds	1600	24	2146	29	24	24	+5
White Cedar	900	13	1361	18	13	13	+5
TOTAL	6700	100	7,475	100	100	100	

Table 3.9 Age class distributions.

Age Class	2003		2011		Objectives		% difference from 2011 to Decade 1	2011 + 5 yrs	
					Decade 1	Decade 2			
UPLANDS	Acres	%	Acres	%	%	%		Acres	%
0-9	6800	8	3658	4	9	9	-5	2665	3
10-39	29900	36	25084	31	37	40	-6	23068	28
40-79	29700	35	25364	31	27	22	+4	19993	24
80-179	17800	21	27587	34	27	29	+7	35966	44
180+	<100	0	119	0	0	0	--	141	0
TOTAL	84,300	100	81,812	100	100	100		81833	100
LOWLANDS									
0-9	<100	0	76	1	4	4	-3	8	0
10-39	300	4	250	3	3	5	--	289	4
40-79	1200	18	847	11	7	5	+4	542	7
80-119	3800	57	4273	57	57	45	--	4245	57
120-179	1300	19	1927	26	28	38	-2	2253	30
180+	100	1	102	1	2	2	-1	137	2
TOTAL	6700	100	7475	100	100	100		7475	100

To meet Decade 1 objectives:

- The largest species shifts need to be increases in spruce-fir (3550 acres), white pine (2000 acres), oak (1700 acres), and paper birch (1350 acres).
- Both the northern hardwoods (5400 acres) and aspen (3400 acres) will require significant decreases through conversions to meet decadal objectives.

- Increases are needed in the upland 0-9 age class (3700 acres) which can only be accomplished through even-aged harvest. In 5 more years, there is a greater decline (by 1000 acres) and departure in this age class.
- An increase is desired in the 10-39 age class (5200 acres) and will occur naturally through ingrowth from the 0-9 age class. However, these acres decline by the early part of Decade 2.

Dry-Mesic- Pine/Oak Landscape Ecosystem

Table 3.10 Species composition

Forest Type	FP 2003		2011		Objectives		% difference from 2011 to 10-yr obj
					Decade 1	Decade 2	
UPLANDS	Acres	%	Acres	%	%	%	
Jack Pine	9200	6	6832	4	9	11	-5
Red Pine	48900	30	47734	30	31	33	-1
White Pine	2500	2	2909	2	2	2	--
Spruce-fir	7000	4	5577	4	5	4	-1
Oak	2900	2	2482	2	2	2	--
Northern Hdwds	13300	8	17176	11	10	11	+1
Aspen	65700	40	63067	40	34	30	+6
Paper Birch	13700	8	11839	8	7	7	+1
TOTAL	163,200	100	157,616	100	100	100	
LOWLANDS							
Black Spruce	10100	52	9956	49	52	52	-3
Tamarack	2800	15	3139	16	15	15	+1
Lowland Hdwds	3500	18	3570	18	18	18	--
White Cedar	2900	15	3578	18	15	15	+3
TOTAL	19,200	100	20,243	100	100	100	

Table 3.11 Age class distributions.

Age Class	2003		2011		Objectives		% difference from 2011 to Decade 1.	2011 + 5 yrs	
					Decade 1	Decade 2			
UPLANDS	Acres	%	Acres	%	%	%		Acres	%
0-9	12700	8	5034	3	9	9	-6	7507	5
10-39	58400	36	50983	32	35	34	-3	45214	29
40-79	45600	28	41978	27	24	25	+3	41164	26
80-119	41500	25	50968	32	27	24	+5	53098	34
120-179	4400	3	7797	5	5	8	--	9659	6
180+	700	0	847	1	1	1	--	877	1
TOTAL	163,200	100	157,616	100	100	100		157527	100
LOWLANDS									
0-9	100	1	66	0	2	3	-2	54	0
10-39	800	4	850	4	4	5	--	812	4
40-79	3300	17	2467	12	10	6	+2	1969	10
80-119	11200	58	10871	54	53	38	+1	10042	50
120-179	3600	19	5789	29	30	46	-1	7090	35
180+	100	1	200	1	1	2	--	219	1
TOTAL	19,200	100	20,243	100	100	100		20188	100

To meet Decade 1 objectives:

- Increase upland jack pine by 7352 acres doubling the existing amount. This would be difficult and expensive to accomplish given that surpluses are in the aspen, northern hardwood, and birch forest types.
- Increase upland red pine and spruce-fir by about 1600 acres each.
- Decrease upland aspen by 9500 acres.
- Decrease upland northern hardwoods and paper birch about 1600 acres each.

- Increase the upland 0-9 age class by 9150 acres.
- Increase the upland 10-39 age class by 4200 acres. Given ingrowth from the 0-9 age class of about 5000 acres, the 10-39 age class would not be achievable for Decade 1.
- Decrease the upland 40-79 age class by 4150 acres. This could be achieved by regenerating mature stands within this age class.
- Decrease the upland 80-119 age class by 8400 acres. Even-aged regeneration harvests would contribute substantially to the 0-9 age class.

Boreal Hardwood/Conifer Landscape Ecosystem

Table 3.12 Species composition

Forest Type	FP 2003		2011		Objectives		% difference from 2011 to Decade 1
					Decade 1	Decade 2	
UPLANDS	Acres	%	Acres	%	%	%	
Jack Pine	500	0	513	1	0	0	+1
Red Pine	3700	4	3554	4	4	4	--
White Pine	600	1	664	1	3	4	-2
Spruce-fir	11000	11	8662	9	12	13	-3
Oak	100	0	42	0	0	0	--
Northern Hdwds	11800	11	16247	16	13	13	+3
Aspen	68400	66	64351	64	63	60	+1
Paper Birch	6900	7	5965	6	6	6	--
TOTAL	102,900	100	100,000	100	100	100	
LOWLANDS							
Black Spruce	14800	49	13450	43	49	49	-6
Tamarack	2400	8	2860	9	8	8	+1
Lowland Hdwds	9800	32	10592	34	32	32	+2
White Cedar	3300	11	4296	14	11	11	+3
TOTAL	30,300	100	31,199	100	100	100	

Table 3.13 Age class distributions.

Age Class	2003		2011		Objectives		% difference from 2011 to Decade 1	2011 + 5 yrs	
					Decade 1	Decade 2			
UPLANDS	Acres	%	Acres	%	%	%		Acres	%
0-9	8900	9	3815	4	9	10	-5	6249	6
10-39	48700	47	45050	45	47	45	-2	39601	40
40-79	28800	28	26031	26	25	23	+1	24926	25
80-179	16500	16	25100	25	19	22	+6	29213	29
180+	0	0	3	0	0	0	--	15	0
TOTAL	102,900	100	100,000	100	100	100		100004	
LOWLANDS									
0-9	200	1	202	1	4	4	-3	512	2
10-39	1400	5	1464	5	5	8	--	1460	5
40-79	5100	17	3979	13	9	4	+4	2681	9
80-119	16800	56	16770	54	52	40	+2	16238	52
120-179	6500	22	8476	27	29	42	-2	9976	32
180+	200	1	307	1	1	2	--	331	1
TOTAL	30,300	100	31,119	100	100	100		31199	100

To meet Decade 1 objectives:

- Increase upland white pine by 1350 acres.
- Increase upland spruce-fir by 3350 acres.
- Decrease upland jack pine by 500 acres. However, given the lack of jack pine on other LEs, the Forest may want to retain this until harvest is necessary in these stands.
- Decrease upland northern hardwoods by 3250 acres and aspen by 1350 acres. Convert to white pine or spruce/fir where feasible.

- Increase upland 0-9 age class by 5185 acres. There is a fair amount of 0-9 planned by not yet accomplished. Even so, the 0-9 would be several percentage points below the objective.
- Increase upland 10-39 age class by 1950 acres.
- Decrease the 80-179 age class by 6100 acres. Even-aged harvests in suitable forest types would create 0-9.

Mesic Northern Hardwood Landscape Ecosystem

Table 3.14 Species composition

Forest Type	FP 2003		2011		Objectives		% difference from 2011 to Decade 1
					Decade 1	Decade 2	
UPLANDS	Acres	%	Acres	%	%	%	
Jack Pine	100	0	117	0	0	0	--
Red Pine	2100	3	1809	3	3	3	--
White Pine	500	1	476	1	1	1	--
Spruce-fir	4000	6	2855	4	6	7	-2
Oak	800	1	634	1	1	1	--
Northern Hdwds	20300	31	24178	37	32	37	+5
Aspen	32000	48	29658	46	47	43	-1
Paper Birch	6800	10	5025	8	10	8	-2
TOTAL	66,400	100	64,751	100	100	100	
LOWLANDS							
Black Spruce	3100	52	2824	42	52	52	-10
Tamarack	500	8	555	8	8	8	--
Lowland Hdwds	1900	31	2269	34	31	31	+3
White Cedar	500	9	1054	16	9	9	+5
TOTAL	6000	100	6,703	100	100	100	

Table 3.15 Age class distributions.

Age Class	2003		2011		Objectives		% difference from 2011 to Decade 1	2011 + 5 yrs	
					Decade 1	Decade 2			
UPLANDS	Acres	%	Acres	%	%	%		Acres	%
0-9	5300	8	2373	4	5	6	-1	2390	4
10-39	2200	33	20735	32	35	28	-3	19420	30
40-79	24300	37	18795	29	24	26	+5	14588	23
80-119	12800	19	20263	31	32	33	-1	25270	39
120-189	2000	3	2496	4	5	8	-1	2994	5
190+	100	0	90	0	0	0	--	90	0
TOTAL	66,400	100	64,751	100	100	100		64751	100
LOWLANDS									
0-9	<100	0	17	0	1	2	-1	22	0
10-39	100	2	182	3	1	2	+2	172	3
40-79	1400	23	1125	17	12	6	+5	825	12
80-119	3300	55	3779	56	57	51	-1	3824	57
120-179	1200	20	1561	23	28	39	-5	1821	27
180+	<100	0	39	1	0	1	+1	39	1
TOTAL	6100	100	6703	100	100	100		6703	100

To meet Decade 1 objectives:

- Increase spruce-fir and paper birch by 1000 acres and 1500 acres, respectively.
- Decrease northern hardwoods by 3500 acres.
- Decrease aspen by 750 acres.

- Increase 0-9 age class by 850 acres.
- Increase 10-39 age class by 2550 acres.
- Decrease the 40-79 age class by 3267 acres. This could be achieved by some even-aged harvest to create more 0-9 and by leaving some of the 40-79 to grow into the 80-119 age class.
- Increase the 80-119 age class by 450 acres. However this objective will be exceeded early in Decade 2.
- The 120-179 age class will meet the objective by the end of the decade and on trajectory to meet Decade 2 objectives.

Tamarack Swamp Landscape Ecosystem

Table 3.16 Species composition

Forest Type	FP 2003		2011		Objectives		% difference from 2011 to Decade 1
					Decade 1	Decade 2	
UPLANDS	Acres	%	Acres	%	%	%	
Jack pine	200	1	200	1	1	1	--
red pine	1300	7	1523	8	8	9	--
white pine	<100	0	103	1	1	1	--
spruce-fir	1900	11	2028	10	16	21	-6
oak	200	1	129	1	0	0	+1
Northern Hdwds	2000	11	2944	15	11	11	+4
aspen	10800	61	11309	58	56	49	+2
paper birch	1400	8	1375	7	6	5	+1
TOTAL	17,800	100	19,611	100	100	100	
LOWLANDS							
tamarack	8400	27	8954	29	27	27	+2
Black spruce	14400	47	12216	39	47	47	-12
white cedar	4800	15	6196	20	15	15	+5
lowland hdwds	3200	11	3710	12	11	11	+1
TOTAL	30800	100	31077	100	100	100	

Table 3.17 Age class distributions.

Age Class	2003		2011		Objectives		% difference from 2011 to Decade 1	2011 + 5 yrs	
					Decade 1	Decade 2			
UPLANDS	Acres	%	Acres	%	%	%		Acres	%
0-9	1200	7	374	2	7	8	-5	482	2
10-39	6500	36	6761	34	42	41	-8	6264	32
40-79	6400	36	5725	29	23	25	+6	4882	25
80-119	3400	19	5662	29	23	19	+6	6426	33
120-189	400	2	1086	6	4	6	+2	1547	8
190+	<100	0	3	0	0	0	--	10	0
TOTAL	17,800	100	19,611	100	100	100		19612	100
LOWLANDS									
0-9	300	1	253	1	4	4	-3	333	1
10-39	1300	4	1153	4	4	6	--	1161	4
40-79	5600	18	4740	15	11	8	+4	3647	12
80-119	17300	56	15884	51	47	35	+4	15078	49
120-179	6100	20	8861	29	34	46	-5	10644	34
180+	200	1	164	1	1	1	--	193	1
TOTAL	30,800	100	31,077	100	100	100		31077	100

To meet Decade 1 objectives:

- Increase spruce-fir by 1100 acres.
- Decrease northern hardwoods by 800 acres, aspen by 350 acres, and paper birch by 2000 acres. This would provide opportunities to increase the amount of spruce-fir.

- Increase 0-9 age class by 1000 acres.
- Increase 10-39 age class by 1450 acres.
- Decrease the 40-79 age class by 4550 acres.
- Decrease the 80-119 age class by 1150 acres.
- Decrease the 120-179 age class by 300 acres.

White Cedar Swamp Landscape Ecosystem

Table 3.18 Species composition

Forest Type	FP 2003		2011		Objectives		% difference from 2011 to Decade 1
					Decade 1	Decade 2	
UPLANDS and LOWLANDS	Acres	%	Acres	%	%	%	
Jack pine			23	0			n/a
red pine	0	0	31	0	0	0	--
spruce-fir	500	3	384	3	6	8	-3
oak	0	0	16	0	0	0	--
No. hardwoods	200	1	552	1	2	2	-1
aspen	8100	62	7,975	62	57	52	+5
paper birch	0	0	214	2	0	0	+2
black spruce	1100	8	968	8	8	8	--
tamarack	100	1	109	1	1	1	--
lowland hdwds	2300	18	1,749	14	18	18	-4
white cedar	800	6	862	7	9	11	-2
TOTAL	13,900	100	12,883	100	100	100	

Table 3.19 Age class distributions.

Age Class	2003		2011		Objectives		% difference from 2011 to Decade 1	2011 + 5 yrs	
					Decade 1	Decade 2			
	Acres	%	Acres	%	%	%		Acres	%
0-9	1400	11	829	6	6	6	--	493	4
10-49	4400	34	4960	39	46	49	-7	5537	43
50-79	2900	22	2348	18	11	6	+7	1671	13
80-109	2500	19	2396	19	16	12	+3	2399	19
110-139	1300	10	1829	14	15	18	-1	2014	16
140+	600	4	521	4	6	9	-2	767	6
TOTAL	13,100	100	12,883	100	100	100		12883	100

To meet Decade 1 objectives:

- Increase upland spruce-fir by 400 acres.
- Increase upland northern hardwoods by 300 acres.
- Increase lowland northern hardwoods by 550 acres.
- Decrease upland aspen by 600 acres.
- Decrease upland paper birch by 200 acres

- Increase upland 10-49 age class by 950 acres.
- Decrease the 50-79 age class by 950 acres.
- Decrease the 80-109 age class by 350 acres.
- Increase the 110-139 age class by 100 acres.
- Increase the 140+ age class by 250 acres.

This is the only LE in which the 0-9 age class is being met. Continue even-aged harvests to maintain the amount of 0-9.

Recommendations

- The Forest needs to assess whether or not the species composition and age class objectives are achievable given other resource values, social and political concerns. Refer to discussions in the timber section for some of the reasons why these objectives have not been achievable.

Species composition, age class, and MIH tables for each of the Landscape Ecosystems have been compiled and can be found in the Appendix.

D. Forest Type Summaries

The following information was based on data from MIH tables and species composition tables for each of the LEs. The full report which includes tables and results is part of the project file and is available upon request.

Also incorporated into this section are comments from on project planning efforts or discussions.

a. Jack Pine

There are about 3500 fewer acres of jack pine today than in 2003 at the time of Forest Plan Revision. Possible explanations include:

- A shift to red pine in regenerated jack pine stands especially earlier in the Decade 1. This was in part a carryover from the 1986 Forest Plan implementation.
- Forest type changes are due to old jack pine dying and falling out of stands, jack pine harvested in mixed stands of jack/red pine earlier in the decade, and recent stand exams or stand re-delineation that caused shifts from jack pine to red pine.

Stand re-delineation, re-typing, and better stand exam data may have also resulted in classification to another forest type, frequently red pine.

A 75% reduction in 0-9 since 2003 (5100 to 1357 in 2011) can be attributed to:

- ingrowth into 10-39 age class.
- Regeneration harvests in mature and older stands were deferred to meet the Forest Plan standard of 5300 acres of mature and older jack pine in the first decade.

In the 0-9 age class, more seeding of jack pine is being done to increase random spacing, natural function, and reduce the plantation look. Seeding increases the time for regeneration establishment and at this point the success is undetermined.

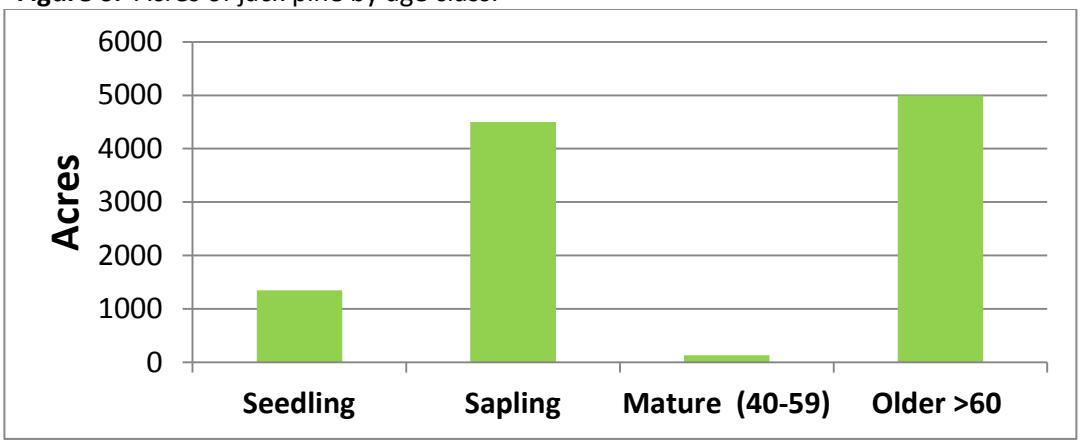
Regeneration of jack pine and conversion to jack pine opportunities should be in the Dry Pine and Dry-Mesic Pine/Oak LEs which have the largest acres of jack pine, are best suited for jack pine, and show the greatest need for shifts to more jack pine. Blackduck has more of the jack pine type than the other districts.

Although jack pine stands were infested with jack pine budworm during a recent epidemic from 2004-2006, there was very little resulting mortality. In 2004, 2005, 2006, there were 3,789 acres of jack pine affected on the forest (FY 2006 M&E rpt, p.49); 31% of the forest's jack pine acres. Most of these acres were considered to be lightly or moderately infected. Observations since then do not indicate much mortality in jack pine as a result of budworm.

Historically the jack pine forest types were sustained by large scale, stand replacement fires. Consequently, jack pine is suited to larger, temporary openings. Large scale fire has been removed from the landscape. Although prescribed fire has been planned for some stands, burning windows and funding limits the accomplishment of burn objectives. Mechanical site preparation is used to prepare most sites for seeding or planting.

The existing age class distribution for jack pine poses some challenges and may not be balanced for decades.

Figure 6. Acres of jack pine by age class.



Mature and Older jack pine analysis:
Direction in the Forest Plan requires retention of mature and older jack pine. S-WL-10 states "Maintain at least 5,300 acres … during the first 10 years of plan implementation." (p. 2-32) The Forest Plan defines mature jack pine as 40 years old or older.

An analysis conducted in 2007 showed that there were 5630 acres of mature or older jack pine on the landscape. These acres included and accounted for treatments in jack pine stands in projects with decisions through 2007. The analysis concluded that there were 330 acres above the Forest Plan standard.

Subsequent to the 2007 analysis, projects planned in 2008 and 2009 were sensitive to retaining mature and older jack pine. The best of the jack pine stands were deferred from harvest; the poorest (those most likely to die in the next few years) were considered for harvest. 60 acres were identified and included in vegetation projects. The assumption is treatments proposed in the 2008 and 2009 projects would be harvested before the end of the Decade 1.

Projects planned in 2010 identified 136 acres of regeneration harvest in jack pine stands that would likely be harvested sometime in Decade 2.

Given that the 2007 analysis showed that there was a surplus of 330 acres beyond the 5300 acres required, and that projects in 2008 and 2009 planned for 60 acres of regeneration harvests, then there should be a surplus of 270 acres at the end of Decade 1. Currently there remains 5113 acres of mature and older jack pine; 187 acres short of meeting the 5300 acre standard. *This is more likely a result of jack pine dying in some of the retention stands rather than over harvesting in the jack pine stands.*

Recommendations

- For future project areas, evaluate the need to regenerate mature and older jack pine stands. For harvest activities that occur in Decade 2, the requirement for maintaining 5300 acres (S-WL-10) would no longer apply. The Forest Plan projects that there would be about 3000 acres of mature or older jack pine at the end of Decade 2 (FEIS, Figure WLD 8b, p. 3.3.1-60). Since there are currently 5113 the mature class, to achieve this would require the retention of over half of the older jack pine.

  Once jack pine falls out of these stands, there is usually not enough remaining merchantable volume to support a harvest. In reality some stands become hazel brushfields. The challenge then becomes one of finding the funds to regenerate these sites.

  According to the Forest Plan, there should be approximately 6500 acres of 0-9 jack pine at the end of Decade 2 (FEIS, Figure WLD 8b, p. 3.3.1-60). The likelihood of achieving this is low.

- Temporary openings larger than 40 acres are well suited to jack pine areas due to historical, large stand replacement burns. A strategy to create larger temporary openings should be developed that considers existing openings greater than 40 acres, and opportunities to harvest in younger, middle-aged stands as well as older stands to create larger openings. The best opportunities occur on the Blackduck District in the Lydick project area.

- The Forest needs to almost double the amount of jack pine in the DP and DMPO LEs to meet Decade 1 objectives. To increase the amount of jack pine on the landscape requires conversions of other forest types. Opportunities to convert to jack pine should occur in the Dry Pine and Dry-Mesic Pine/Oak LEs which have the largest acres of jack

pine, are best suited for jack pine, and show the greatest need for shifts to more jack pine.

Red pine may be the easiest and most economical to convert to jack pine, but in the DMPO, the larger of the two LEs, there should be more red pine as well. It would be possible to convert some of the surplus red pine stands in the DP LE to jack pine (refer to red/white pine discussion). Young red pine plantations have been considered for harvest and conversion to jack pine, but there is hesitancy to convert these stands because of past investments to site prep, plant and tend them and because of their good growth. Conversions of aspen to jack pine are costly.

- As a result of climate change, projections on species shifts show jack pine migrating to the north and east. The future suitability of jack pine to this area is questionable which raises the question as to how much time and money should be invested to increase jack pine on our landscape.

b. Red/White Pine

Overall objective is to increase the amount of red and white pine by about 6500 acres to meet Decade 1 objectives. From 2003 to 2011, there has been a 100 acre increase.

A reduction in 0-9 from 3800 acres in 2003 to 1444 acres can be attributed to:

- ingrowth into the sapling age class
- fewer regeneration harvests, especially clearcuts

There has been a slight increase (approximately 1500 ac) in mature from 2003 to 2010. Besides some ingrowth, there were some type changes from jack pine to red pine due to harvesting of jack pine in mixed stands and old jack pine dying in other stands.

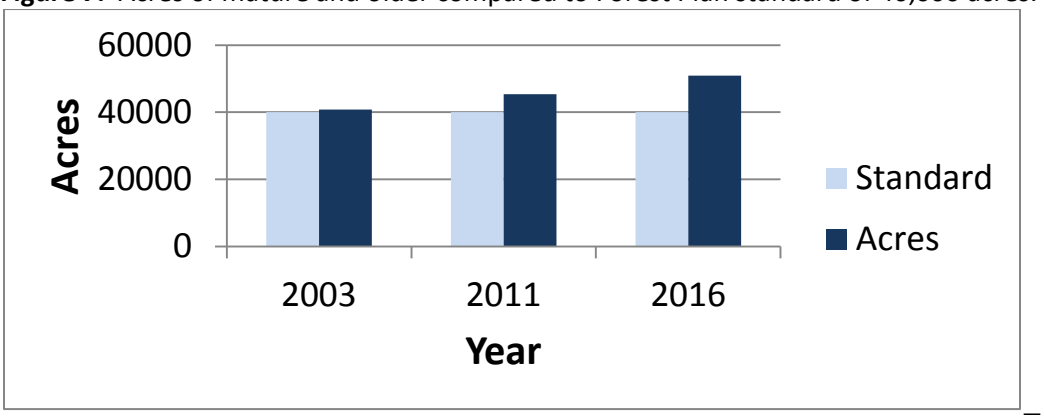
The amount of older almost doubled since 2003 (increase from 4400 to 7495 acre) and may be due to:

- Better stand inventory, stand re-delineation and re-typing;
- Forest Plan direction to:
  - "Maintain at least 40,000 acres in mature and older red and white pine forest types during the implementation period of the forest plan (S-WL-9 (FP, p. 2-32))
    - As of 2011, the Forest has 45,381 acres of mature and older, an increase of 4,581 acres since 2003.
    - As of 2016, this increases to 50,965 acres.
    - According to the FEIS, there should be approximately 60,000 acres of mature and older at the end of Decade 2 (FEIS, Figure WLD 8b, p. 3.3.1-59).
  - "Maintain or increase the acres and numbers of patches of mature or older upland forest in patches 300 acres or larger…." (O-VG-19 (FP, p. 2-23));
  - "In mature or older red and white pine…maintain characteristics of mature or older native vegetation communities…" (O-VG-17 (FP, p. 2-23));

- "Increase acres of old forest, old-growth forest, …" (O-VG-15, (FP, p. 2-23))
- to maintain or increase acres of mature and older red/white pine MIH objectives in 4 of the 5 upland LE's (see MIH report)

- Retention of stands due to their spiritual value for tribal members

Figure 7. Acres of mature and older compared to Forest Plan standard of 40,000 acres.



Harvest and regeneration of young red pine plantations with the intent to convert them, has been limited because of past investments to establish and tend stands and because of their good growth.

Thinning in red pine stands has exceeded the amount projected by the Forest Plan. This is explained in more detail in the timber section. There are 65,000 acres in DP, DMP, &DMP/O LEs. Of this, approximately 30,000 acres are sapling (10-49) and 36,000 acres are mature (50-119). Thinning is occurring in both sapling and mature stands.

Recommendations

- To increase amount of red and white pine forest type (up to 6500 acres) by end of Decade 1.
  - The largest increases for white pine need to occur in BHC, DMP LEs, in that order.
  - The largest increases for red pine need to occur in the DMPO LE.
    There are ample opportunities to convert aspen, or birch to red or white pine.
    There is a need to increase the amount of red pine while at the same time consider converting red pine to jack pine in the DMP LE (see jack pine discussion above).

- The amount of red/white pine in the DP LE needs to be slightly decreased.

- Increase the amount of 0-9 red and white pine through conversions to red/white pine and possibly some even-aged regeneration harvests of the red/white pine forest type. The best LEs for red and white pine are the DP, DMP, and DMPO. All of these LEs are below Decade 1 objectives for 0-9. According to the FEIS, there should be approximately 3800 acres of 0-9 at the end of Decade 2 (FEIS, Figure WLD 8b, p. 3.3.1-59). Although most of this may be achieved through conversions, some level of even-aged regeneration was anticipated in that the FEIS indicates that clearcutting and

shelterwood harvests are appropriate in the red and white pine forest types (FEIS, Vol II., B-15).

- Patch size may be decreased by regenerating stands to meet 0-9 objectives as long as Forest Plan standards are met. Forest Plan direction to maintain or increase mature and older stands appears to be in conflict with Forest Plan expectations that some of these stands would be even-aged regenerated. According to the Forest Spatial Pattern analysis (see MIH report), currently there are 100,215 acres in patches > 300 acres. By 2016 this number is expected to increase to 110,504 acres.
    - The Forest Plan requires "Maintain a minimum of 85,000 acres of mature or older forest in patches 300 acres or greater" (S-VG-2) (FP, p. 2-23 and 24).
    - The FEIS effects analysis states "Management direction to meet LE based vegetation objectives for forest composition and age…would cause a decrease in the large mature upland forest patches in the first decade. The full amount of this decrease would be stemmed by the spatial management guideline to maintain at least 85,000 acres in this indicator. (FEIS, 3.2-61).

- Two-aged regenerated stands of red (and jack) regeneration under a red pine overstory are difficult to achieve and may not be realistic because of shoot blights in the overstory that cause seedling mortality. This was recognized in the Forest Plan (FEIS, p. 3.2-80) and confirmed by recent research results from the Red Pine Overstory Study on the Forest. An alternative approach is to establish white pine under red pine.

c. Upland Spruce-fir

Significant increases in spruce/-ir (12,000 acres) are needed to meet Decade 1 objectives in all LEs except for DP. Since 2003, there has been about a 300 acre increase. The largest increases in the spruce-fir forest type are needed in the BHC, DMP, and DMPO, in that order. The probability of meeting this objective by the end of Decade 1 is low.

There are opportunities to convert aspen and birch stands to spruce-fir. Past EAs have planned for conversions of aspen and red pine stands to spruce-fir. This is usually accomplished by even-aged regeneration harvests and planting-seeding. The success will be determined in the future as stands are certified. Increases in spruce-fir due to conversions are not showing up yet because of the years needed for conversions to take place.

Substantial reductions in acres occurred in 0-9 age class from 3400 acres in 2003 to 738 acres in 2011. The MIH decade 1 objectives for 0-9 spruce-fir for 5 LE's are to decrease acres; the other 2 LE's are to maintain. According to the FEIS, there should fewer than 1000 acres of 0-9 at the end of Decade 2 (FEIS, Figure WLD 6a, p. 3.3.1-58).

The older/old growth age class more than doubled since 2003 from 1400 acres to about 3000 acres, whereas the mature age class has decreased from 10,600 to 7,200 acres. The MIH decade 1 objectives for mature and older spruce-fir for all the upland LE's are to maintain or increase.

The Forest is meeting those objectives in the older/old growth in 4 of the 5 upland LE's but are not meeting objectives (in fact, are declining acres) for mature in 4 of the 5 LE's.

According to the Forest Plan, clearcutting, partial cuts and uneven-aged management are the primary treatments for the spruce-fir forest type.

Recommendations

- The Forest needs to look for opportunities for conversions to spruce/fir. The aspen, aspen/fir, and birch type commonly have a spruce-fir component and were modeled to succeed to the spruce-fir forest type.
- Minimize the amount of 0-9 created in this forest type.

d. Aspen-birch

There have been substantial shifts in age classes since 2003.

- Seedlings have decreased by 27,000 acres (from 38,600 in 2003 to 11,657 in 2011), due to ingrowth and fewer regeneration harvests in aspen stands. Forest Plan objectives for 0-9 aspen-birch are currently being met in all LE's (refer to MIH report).
- Clearcutting aspen is no longer the primary harvest treatment but one of several that include partial cuts and uneven-aged harvests (BEIS-8 for treatment types 13-16).
- In an effort to decrease the amount of aspen on the landscape, conversions of aspen to other forest types is an objective. It is difficult to measure the changes in the short term (a decade) because of the time it takes for harvests to be implemented and regeneration to be established.
- Mature decreased 34,000 acres (from 75,500 acres to 41,534) in part due to even-aged harvests that re-set stands to the 0-9 age class, ingrowth into the older age class, and possibly due to recent stand inventory data that resulted in a change in forest type.
- Older increased by 23,000 acres. This may be due to deferring stands and leaving them to succeed to another forest type. The Forest has not actively tracked the acres of aspen for conversion.
- Decreases in aspen need to occur primarily in DMPO (10,000 ac), DP (2100 ac.), and DMP (2,000 ac). Objectives for the MNH LE show an increase for Decade 1 followed by a significant decrease for Decade 2 that is below the current levels.
- Review of EAs show plans to convert aspen to northern hardwoods, pine, and spruce. Approximately 2400 acres have been identified for active conversion. For more detail, refer to the section on conversions.

These results are for aspen and birch. It should be noted that birch off-sets the trends in aspen to a limited degree.

Recommendations

- Develop a tracking system for active and passive conversions.
- Identify the best sites for active conversions. (For more detail, refer to the section on conversions.)
- Identify sites best suited for aspen and that should be managed for aspen.

e. Northern Hardwoods (and oak)

Recent stand inventory and stand re-typing has contributed to a shift in hardwoods from 60,000 acres in 2003 to 79,113 acres in 2011. This number is expected to increase because aspen stands are often planned for conversion to northern hardwoods when hardwood species are on site and can provide adequate stocking in the future.

The amount of 0-9 has slightly increased. Harvest treatments for northern hardwoods are primarily individual tree or group selection prescriptions which do not change age class if the basal area remains greater than 50 sq. ft. The FEIS (BEIS-8) identifies partial cut, multi-age, and shelterwood 60 treatments as appropriate for northern hardwood stands. Many poor quality hardwood stands are not conducive to uneven-aged management. Tree species in these stands regenerate better under a shelterwood harvest which opens the canopy up more. The stand may be regenerated to hardwoods or to aspen unless measures are taken to inhibit or reduce aspen regeneration.

Mitigation measures to protect resource values within many hardwood stands makes the economics of harvesting marginal.

The amount of mature/old has significantly increased (from 50,400 to 70,297) and the amount of older/OG has doubled (from 4600 to 8707). This is consistent with the mature/older northern hardwood MIH objectives for 4 of the 5 upland LEs to maintain or increase acres. Only 1 LE (DMP) has an objective to decrease in the mature northern hardwood MIH.

Northern hardwoods stands comprise many of the larger patches on the landscape. The objective to, "Maintain or increase the acres and numbers of patches of mature or older upland forest in patches 300 acres or larger…." (O-VG-19 (FP, p. 2-23)) may contribute to the increase.

According to the second table, the greatest departures occur in DMP (5400 ac.) and BHC (3200 ac.) LEs. DMPO and MNH are at decade 2 levels. Generally northern hardwood sites are not suited to conifers. However, there may be opportunities for some conversions to primarily white pine. Consequently, decreasing the amount of hardwoods may not be a viable objective. Reducing the amount of aspen on the landscape may be a higher priority than reducing hardwoods.

Recommendations

- Objectives for Decade 1 and 2 indicate decreases in northern hardwood in all LEs except WCS are desirable. This objective is not achievable given site conditions. Analysis should identify more realistic numbers and correction of the Forest Plan.
- Opportunities occur to convert non-sugar maple forest types to white pine.

f. Lowland black spruce-tamarack (lowland conifer)

There has been a decline in overall acres by about 2200 acres possibly due to better stand inventory resulting in shifts to other forest types and flooding caused by beaver activity.

The amount of seedling has decreased by almost half from 2000 acres to 1064. The Forest Plan identifies appropriate harvest treatments as clearcutting and partial cut 35 and 40.

Mature/old has decreased by about 6500 acres. Older/OG has increased by 5500.

Very little harvesting has occurred primarily due to past concerns about adequately regenerating sites and low volumes. Scattered sites are known to be high biological diversity stands (DNR designation) and in some instances have TES plants.

Based on land suitability classification (LSC) of 500, stands should be available to harvest. There are some 100 year old stands of black spruce/balsam fir that average 6 inches in diameter. LSC does not always accurately reflect the commercial capability of stands.

Recommendations

- IDTs could consider treatments in lowland sites to meet Forest Plan expectations.
- Review LSC and update or make corrections; or identify some other indicator to use for site productivity during project planning efforts.
- Consider regenerating sites where impoundments are being removed.