Executive Summary

Report of the New Brunswick Task Force on Forest Diversity and Wood Supply

Background

In response to recommendations of the New Brunswick Select Legislative Committee on Wood Supply, the Minister of Natural Resources established in 2005 the Task Force on Forest Diversity and Wood Supply. He gave it the mandate to develop a set of realistic and practical forest management alternatives that would encompass a broad range of possible ways for managing New Brunswick's public (Crown) forest.

Each alternative was to meet two requirements:

- to generate increasing yields of a wider variety of commercial tree species and products; and
- to do so in a manner that recognizes and maintains the diversity and important ecological features of New Brunswick's Acadian forest.

Further, the probable short- and long-term outcomes of each alternative were to be fully presented using measures relevant to forest diversity, wood-based business opportunity, and socio-economic impact.

The Task Force was to deal specifically with management of the public forest, not matters of tenure, resource allocation, or private ownerships.

This report presents forest management alternatives developed by the Task Force in accordance with its mandate. By design, it contains no recommendations or judgements. Rather, it presents what can realistically be done in the public forest, and with what probable result. It is intended to promote a full awareness of alternatives and consequences, and thereby contribute in the process by which management of New Brunswick's public forest is determined.

New Brunswick Forest Context

The Acadian forest, used here in reference to the entire forest of New Brunswick, is characterized by high species richness, high diversity in forest composition and structure, and great variety in the types of natural disturbance it experiences. Human influence over the past 200 years has negatively affected several elements of this naturally diverse forest, including the abundance of late-successional tree species, complex and multi-aged stand structures, and very old and very large trees. There is risk that future management will further impact these elements resulting in simplification of the forest structure and composition. Avoidance of that risk and maintenance of key ecological aspects of the Acadian forest factored prominently in design of the management alternatives presented here.

New Brunswick's industrial wood consumption, 70% of which is spruce and balsam fir, has risen 50% over the past 30 years. At the same time, wood consumption has diversified, with increased use being made of species other than spruce and fir. Wood utilization has also changed; most harvested volume is first processed for solid wood products with residual material being used for fibre-based products. In recognition of these trends, the management alternatives presented here were designed to produce sustainable and increasing wood supplies of a variety of species in tree sizes suited to manufacturing of solid wood products.

The New Brunswick public forest today is 55% spruce and balsam fir (by volume), 14% other softwood species, and 32% hardwood species. Black spruce and balsam fir are the two most abundant species, each making up 20% of the inventory. As a result of silviculture activities started in the 1970s, 10% of the forest is currently in plantations and 11% in spaced stands of natural regeneration. Twenty percent of the forest is less than 20 years old, and an equal amount is greater than 85 years old.

Under current policy, 30% of the forest area is designated as conservation forest, where conservation objectives prevail, and 70% is classified as general forest, where timber objectives are emphasized.

The existing forest presents an opportunity to generate a diverse and high quality wood supply, and poses a challenge to do so in a way that ensures continual presence of its important ecological characteristics.

Management Design Framework

Using current inventory data, state-of-the-art forest development forecasting procedures, and input from a wide variety of experts in the fields of forestry, ecology, socio-economics, and the forest industry, eight forest management alternatives were designed using a common framework. That framework was based on seven cornerstone issues which represent key decisions in forest management and about which there are highly diverse views among parties with an interest in the New Brunswick forest.

For each cornerstone issue a range of reasonable options was defined. Management alternatives were then defined by choosing options for each of the issues in various combinations. These cornerstone issues and associated range of options are:

- **Wood Supply** – The tree species and tree sizes given production priority greatly influence characteristics of the forest and the wood supply it provides. All wood supply options, except the status quo, maximized volume of log-potential trees (those dimensionally-suitable as sawlogs) and sustained or increased supply over time of all species groups. Options for species priority included spruce/fir/jack pine (henceforth referred to as spruce/fir) as top priority, non-spruce/fir species as top priority, and equal priority across all species.

- **Protected Areas** – The forest in protected areas cannot be harvested and develops through time only as influenced by natural dynamics. It has important ecological, scientific, and social value, but is unavailable as a source of wood. Options for the percent of forest area designated as protected ranged from the current level of 4% to 22%, the latter being deemed by some conservation agencies as the amount needed to provide full ecological representation in the province.

- **Area of Conservation Forest** – Conservation forest has the primary objectives to maintain habitat to support wildlife populations, maintain water quality, and protect riparian and wetland habitats. Some timber harvesting is permitted, but only on a restricted and limited basis that does not compromise the conservation objectives. Options for conservation forest area included maintaining it at the current level of 30% of the forest (which includes 4% of the forest currently in protected areas), increasing it to 37%, and decreasing it to 25% and 20%.

- **Old Forest** – The unique physical conditions and ecological functions of old forest make it ecologically important and socially significant. Management strategies focused on wood supply frequently target old stands for harvest because of their high timber-value, and can preclude growth of stands into old forest condition. Options for the percent forest area in old forest conditions ranged from 25% to 40%.

- **Area in Plantations** – Plantations are highly productive sources of wood supply, but their establishment involves practises and creates conditions deemed by some as ecologically damaging or otherwise undesirable. Plantation area options ranged from reducing plantation area to zero, to increasing it to 37% of the total forest over the next 50 years.

- **Harvest Treatments** – The treatments, or prescriptions, by which stands are harvested shapes forest condition, controls species composition and stand structure, and affects wood supply quantity, quality, and cost. Views vary widely about the acceptability of different harvest treatments. Treatment options were defined by the stand types in which harvesting must be by non-clearcut prescriptions, and by the amount of area left permanently unharvested (termed retention) to provide structural diversity in harvested stands. Retention levels varied from 0% to 20% of stand area.

- **Forest Composition** – Stand types, defined by the mixture of tree species growing in association, are the building blocks of forest landscapes and their relative abundance influences both forest and wood supply diversity. Forest composition options were defined in terms of area of stand types deemed less abundant today than historically (pre-1940). Options ranged from preventing future decline of these types to increasing them to estimated past levels of abundance.

Management Alternatives

Management alternatives can be created by combining options for the seven cornerstone issues in various ways. Of the numerous such combinations, the Task Force defined eight alternatives for full analysis. These eight are not an exhaustive set and alternatives defined by other combinations of options may warrant consideration. They were chosen to cover a broad range of possibilities, and vary both in the relative emphasis given to wood supply and forest diversity objectives, and in the means by which those objectives are realized *(Table ES1)*. All alternatives, except the status quo, ensure a steady or increasing wood supply of log-potential volume for all major tree species. In addition, all alternatives include the current silviculture budget of $24.5 million per year.

Status Quo

This alternative reflects forest management on Crown land as implemented under current government policy and includes both diversity and wood supply objectives.

Alternative A

This alternative has forest conservation as the over-riding objective, which it achieves primarily through:

- increasing protected area from the present 4% to 22%;
- increasing conservation forest area from the present 30% of the total forest to 37%;
- reducing plantation area over time to zero;
- maximizing use of non-clearcut harvesting where silviculturally appropriate and conducting all harvest treatments to maintain key within-stand characteristics as would exist following natural disturbances.

Alternative B

This alternative focuses on changing the forest condition to increase forest diversity in all its dimensions, including wood supply, species composition, stand type abundance, and amount of old forest. It does so primarily by:

- increasing protected area from 4% to 10%;
- maintaining at least 40% of the forest in old forest conditions;
- maximizing use of non-clearcut harvesting where silviculturally appropriate;
- limiting plantations to 13% of the forest area (their abundance in 2012, which is the end of the current planning cycle).

Alternative C

This alternative increases the emphasis on diversity and conservation objectives relative to the status quo and includes measures to partly offset the resulting wood supply impacts. It does so primarily by:

- increasing protected area from 4% to 13%;
- maximizing use of non-clearcut harvesting where silviculturally appropriate;
- allowing plantation area to increase to 19% over the next 50 years;
- reducing conservation forest area from 30% to 25%.

Alternative D

This alternative includes objectives to increase forest diversity, while introducing measures to mitigate the negative wood supply consequences of those objectives. Its key features include:

- increasing protected area from 4% to 13%;
- conducting non-clearcut harvesting in stands where late-successional species currently dominate;
- reducing conservation forest area from 30% to 25%;
- allowing plantation area to increase to 37% over the next 50 years.

Alternative E

This alternative reflects the recommendations of the report by the New Brunswick Task Force on Self-Sufficiency. It has the primary objective of increasing current and future wood supply. It achieves this by:

- increasing protected area from 4% to 10%, all of which is drawn from the current conservation forest so that no reduction in general forest results;
- reducing the conservation forest area from 30% to 20%;
- allowing plantation area to increase to 37% over the next 50 years;
- maintaining the current proportions of harvesting by clearcut and non-clearcut prescriptions.

Alternative F

This alternative relies on extensive application of low-intensity harvesting across the forest so that most hectares contribute to both wood supply and diversity objectives. It is in contrast to a zoning strategy (where the forest is divided into zones, each with specialized objectives). Its key elements include:

- maximizing use of non-clearcut harvesting where silviculturally appropriate and conducting all harvest treatments to maintain key within-stand characteristics as would exist following natural disturbances;
- retaining 10% to 20% of each harvested stand in a permanently unharvested state (including areas to be planted);
- with the exception of protected areas, riparian buffers, and deer wintering areas, making all conservation forest eligible for low intensity harvest prescriptions;
- allowing plantation area to increase to 25% of the forest.

Alternative G

This alternative uses specialized zones; one to provide diversity values; one to provide wood supply values; and one to provide both. It combines the benefits of single-objective management in the first two zones with those of multiple-objective management in the third. It includes:

- increasing protected area from 4% to 16%;
- maintaining conservation forest at 30%;
- allocating 25% of the forest to intensive management of plantations established on sites of above average productivity;
- managing the balance of the forest with low-intensity prescriptions, which include non-clearcut harvesting in all eligible types, and permanent within-stand retention of 10% to 20% in all harvested areas.

Table ES1 – Summary of alternative forest management strategies defined by selected options for each of seven cornerstone issues.

Alternative	Wood Supply Priority	Protected Area (%)[1]	Conservation Area (%)[1,3]	Minimum Old Forest Area (%)[1]	Maximum Plantation Area (%)[1]	Harvest Treatments[2]	Forest Composition
SQ	spruce/fir	4	30	25[5]	25	non-clearcutting where late-successional species individually >50% (current policy)	maintain vegetation communities[4]
A	equal	22	37	40	0	emulate natural disturbance	restore under-represented types
B	equal	10	30	40	13	restore late-successional species by non-clearcutting where their combined content >20%	increase under-represented types to above 1940 levels
C	spruce/fir	13	25	25	19	restore late-successional species by non-clearcutting where their combined content >20%	restore under-represented types
D	spruce/fir	13	25	25[5]	37	maintain late-successional species by non-clearcutting where their combined content >50%	maintain under-represented types
E	spruce/fir	10	20	25[5]	37	non-clearcutting where late-successional species individually >50% (current policy)	maintain vegetation communities[4]
F	equal	10	20	25[5]	25[6]	emulate natural disturbance	maintain vegetation communities[4]
G	spruce/fir	16	30	25[5]	25	emulate natural disturbance	maintain under-represented types

1 Expressed as percent of the total Crown forest area of 2.99 million ha.
2 Species classified as "late-successional" in this report include cedar, hemlock, red spruce, white pine, sugar maple, and yellow birch. Percentages based on stand volume.
3 Includes protected area.
4 Vegetation communities, which are groups of stand types defined by species composition, are the basis for objectives used in current management strategies.
5 These alternatives are based on the status quo and thus have no explicit old forest targets as old forest is defined in this report. As a result of other objectives old forest is maintained at or above 25% of the forest.
6 Gross plantation area is set at 25%, but under this alternative 10% of all harvest areas is left as permanent retention; thus actual area planted equals 22.5% of total forest.

Management Outcomes

Using state-of-the-art forecasting models, forest development was forecast for each alternative over a 100-year time horizon. The resulting outcomes were characterized by a set of indicators relating to forest diversity, wood-based business opportunity, and socio-economic impacts. These indicators were selected with input from numerous professionals, practitioners, and others knowledgeable in these three subject areas. The analyses performed here did not include spatial lay-out, operational net-down, and other detailed procedures employed in developing management plans for implementation on Crown licenses. As a result, the absolute wood supply levels can not be compared to those in Licensees' management plans or to timber allocations derived from them. The analyses should, however, accurately reveal relative differences in outcomes between alternatives and provide a sound basis for evaluating their relative merits *(Table ES2)*.

Wood Supply – Spruce/fir

Only alternative **E** produces a sustainable wood supply of log-potential spruce/fir above that of the status quo in the short-term (next 25 years). It does so primarily by reducing area in conservation forest, which makes more area available for harvest.

The other six alternatives **(A, B, C, D, F, G)** produce less in the short-term than the status quo, because they increase one or more of the following as a means of achieving forest diversity values:

- retention of unharvested patches in harvested stands;
- amount of protected area;
- use of non-clearcut treatments;
- amount of old forest condition.

The greater the levels of these factors, the lower the spruce/fir supply; thus, of these six alterntatives, **A** and **B** produce the lowest log-potential supply (at 62% of the status quo), and **F** and **D** the most (at 99% and 94% of the status quo, respectively).

The short-term wood supply is constrained by a minimum inventory level forecast to occur within the next 20 years. After that point, the spruce/fir wood supply increases. That increase is greatest, and wood supply doubles in the long-term, under alternatives **D** and **E**. The long-term spruce/fir supply is a direct function of the yield and area of plantations, and these two alternatives have the highest plantation area (37% of the total forest). Future spruce/fir wood supply is the lowest under alternative **A**, because it allows no planting.

Wood Supply - Other Species

The status quo results in the highest short-term supply of cedar, white pine, intolerant hardwood, and poplar, but the log-potential wood supply of each declines in the future because the status quo contains no sustainability objectives for wood supply of these particular species.

All other alternatives produce sustainable, non-declining wood supply of all major species groups, including spruce/fir, white pine, cedar, tolerant hardwood (sugar maple and yellow birch), intolerant hardwood (red maple and white birch), and poplar. This reduces the immediate supply of each to ensure long-term sustainability and has a negative effect on short-term spruce/fir wood supply of approximately 4%, as it restricts harvesting in some mixed stands that would otherwise be harvested to capture their spruce/fir content.

Excluding the status quo, the supply of cedar and white pine is highest in both the short-term and long-terms under alternatives **E** and **F**, because they reduce conservation forest area. Long-term supply of pine is favoured with planting, because pine is part of the standard planting mix; thus, the future pine supply increases most under alternatives with high planting levels. Because of its relatively slow growth and limited silviculture options, cedar shows only modest increases in supply (6-14%) over the long-term under all alternatives.

The supply of tolerant hardwood is sustainable under the status quo because of the long-standing tolerant hardwood policy for Crown licenses. It is highest in the short-term under alternative **E** because of the reduced area of conservation forest. In general, the long-term log-potential supply varies relatively little across alternatives because all include the tolerant hardwood policy of the status quo; however, the long-term supply under alternative **B** is highest because it includes objectives to increase the future abundance of stand types in which tolerant hardwood is a main component.

Intolerant hardwood and poplar log-potential supplies are highest under alternatives **E** and **F**, and lowest under **A** and **B**, primarily because of the land allocation to conservation forest under those alternatives. Under the status quo, which has no objectives to sustain wood supply of intolerant hardwood and poplar, the log-potential supply of these species drops by approximately 50% in the long-term. Under the other seven alternatives, supplies of poplar and intolerant hardwood are sustained, but do not increase. Increasing the wood supply of these species, and therefore their content in the forest, was seen as

Table ES2 – Summary of selected outcomes under eight forest management alternatives for New Brunswick Crown forest.

	Indicator and Units	Alternative[1] SQ	A	B	C	D	E	F	G
WOOD SUPPLY	**Spruce/fir Log-Potential**[2] (million m³/yr)	2.7 4.2	1.7 2.2	1.7 2.3	2.3 3.5	2.5 5.1	**2.8 5.3**	2.6 4.4	2.5 4.8
	Spruce/fir Total[2] (million m³/yr)	4.0 6.1	2.5 3.1	2.7 3.4	3.6 5.1	3.8 7.0	**4.2 7.3**	3.9 6.1	3.7 6.8
	Other Softwood Log-Potential[2] (thousand m³/yr)								
	Cedar	**89** 39	43 49	35 39	62 69	60 66	72 76	75 **83**	62 68
	White Pine	**133** 128	67 136	51 112	95 141	118 189	130 200	131 **212**	113 173
	Other Softwood Total[2] (thousand m³/yr)								
	Cedar	**146** 58	70 70	55 55	99 99	96 96	113 113	119 **119**	98 98
	White Pine	**229** 349	125 300	101 266	174 372	196 469	212 478	207 **546**	187 455
	Hardwood Log-Potential[2] (thousand m³/yr)								
	Sugar Maple and Yellow Birch	210 239	129 217	171 **320**	183 261	202 270	**246** 278	212 270	202 233
	White Birch and Red Maple	**234** 110	113 127	128 170	158 158	158 158	179 **179**	171 171	159 159
	Poplar	**194** 75	90 90	86 107	111 111	113 113	132 **132**	117 117	105 105
	Hardwood Total[2] (thousand m³/yr)								
	Sugar Maple and Yellow Birch	417 **662**	259 490	326 661	348 526	373 535	**451** 542	392 570	377 496
	White Birch and Red Maple	**848** 603	453 499	503 585	615 627	608 608	677 **677**	650 669	608 616
	Poplar	**386 384**	198 218	193 237	240 303	242 270	279 306	245 317	229 282
	Wood Cost ($/m³ for years 1-25 in constant dollars)	43.3	44.5	44.9	44.6	45.1	43.7	**45.7**	44.8
	Land Allocation (% of total forest area)[4]								
	General forest	68	62	68	75	75	79	**82**	72
	Protected natural area (PNA)	4	**22**	10	13	13	10	10	16
	Conservation forest outside PNA	**28**	16	22	12	12	11	8	12
	Forest Condition (% total forest area in 2062)								
	Even-aged Planted[5]	22	5	13	19	**37**	**37**	23	23
	Spaced	21	**29**	25	23	9	8	22	22
	No silviculture treatment	**27**	25	20	21	23	**27**	21	22
	Uneven-aged (created by harvest)	7	12	16	16	10	9	**19**	10
	Unmanipulated	23	**29**	26	21	21	19	15	23
	Old Forest (% of total forest area in 2062)	34	49	**51**	34	33	31	37	34
	Forest Composition[3] (% of total forest area in 2092)								
	Fir and Spruce/fir	**54**	53	41	47	49	52	51	52
	Tolerant (pure and mixed)	21	26	**37**	30	25	23	26	24
	Pine (combined)	4	4	**6**	5	**6**	**6**	4	4
	Intolerant Mixed wood	**21**	17	16	18	20	19	19	20
	Area clearcut (% of total area harvested over years 1-25)	**81**	49	52	50	66	72	45	63
	Natural Disturbance-based Harvest (% of total area harvested over years 1-25)	23	**100**	58	63	40	34	**100**	73
	Employment[6] (jobs/yr)	**7600**	3900	4000	6000	6500	7200	6700	6300
	Value of Shipments[6] (billion $/yr)	**1.44**	0.72	0.72	1.07	1.14	1.30	1.19	1.11
	Contribution to GDP[6] (billion $/yr)	**0.80**	0.40	0.40	0.59	0.64	0.72	0.66	0.62
	Royalties[6] (million $/yr)	**61**	31	30	48	53	60	55	51

1 Highest values for each indicator are in bold; lowest values are underlined.
2 Left value in cell is average for years 1-25; right value is average for years 26-100. Higher precision in values is used for calculating percentages stated in text.
3 Stand types are described in more detail in main text.
4 Land allocation to conservation forest varies slightly from the options defined for some alternatives because of inoperable forest and non-spatial inventory compilation.
5 Plantation area changes through time in accordance with limits for each alternative; limits are not met until after year 50 for some alternatives.
6 Average for years 1-10 (in constant dollars).

conflicting with diversity objectives for the Acadian forest, so no objectives to increase them were employed.

It is important to note that although the eight management alternatives vary significantly in terms of the harvest and silviculture treatments employed, the resulting impacts on wood supply from the treated stands will not materialize for at least 25 years. The greatest determinants of immediate wood supply of all species are decisions that govern availability of stands for harvest today, most notably the amount of non-clearcut harvesting and the amount of area allocated to the general and conservation forest.

Wood Cost

Wood costs increase 6% across alternatives from a low of $\$43.3/m^3$ under the status quo to a high of $\$45.7/m^3$ under alternative **F**. Since clearcutting is the lowest cost harvest prescription, wood costs generally increase with the amount of harvesting conducted by non-clearcut methods.

Land Allocation

The allocation of land to general forest and conservation forest zones is a key determinant of outcomes because of the differing objectives and treatment possibilities defined for each zone.

The protected area and conservation area options defined for each alternative directly determined the allocation of area to forest zones. The conservation forest was set highest under alternative **A** (37% of the total forest), and set lowest under **F** and **E** (18% and 21%, respectively). Consequently, the area of general forest was set highest under alternatives **F** and **E** (82% and 79%, respectively) and set lowest under **A** (62%).

The amount of forest allocated to protected area (a subset of the conservation forest) was also set highest under alternative **A** (22%), which has the objective of providing full representation of forest conditions in a protected area network. Protected area was set lowest under the status quo, at 4% of the total forest area. Protected area under all other alternatives was set at levels between these two extremes.

Forest Condition

The forecast future forest conditions are a combined result of land allocation, harvest treatment, and old forest options of each management alternative and vary significantly between alternatives.

Future forest conditions (described at year 50 of the 100 year forecasts) under alternatives **D** and **E** are similar and most strongly reflect the imprint of management for timber objectives. The forest area under each is approximately 37% plantations and 8% spacings. Stands managed by uneven-aged harvesting make up approximately 10% of the forest, and stands unmanipulated by any management activities make up 20%. These two alternatives result in the lowest area in old forest condition, just over 30% of the total forest area.

The status quo forest condition is similar to that resulting under alternatives **D** and **E**, except it contains less area in plantations (22%), more in spacings (21%), and slightly more in unmanipulated condition (23%).

The forest conditions resulting under alternatives **A** and **B** show the least impacts of active management. At year 50 the forest is forecasted to contain 29% and 26% unmanipulated forest, respectively, which is the most of any alternatives. They also contain the least area in plantations, 5% and 13%, respectively, and the most area in old forest condition, approximately 50% under both alternatives.

Alternative **C** results in the most even distribution of forest conditions, with plantations, spacings, untreated even-aged, uneven-aged stands, and unmanipulated stands each making up approximately one-fifth of the forest area.

The extensive application of low intensity management under alternative **F** creates a much different forest condition. It contains the least area of unmanipulated forest at forecast year 50 (15%) and the most in stands undergoing uneven-aged management (19%).

The forest condition under alternative **G** clearly reveals the impact of its zoning structure. It is unique amongst alternatives, in that its two dominant forest conditions

represent the two extremes of management intensity; plantations and unmanipulated forest each make up approximately 23% of the forest area.

Forest Composition

The forest composition, defined by the abundance of tree species growing in various mixtures, is heavily influenced by harvest and silviculture prescriptions, but their effect on the overall forest composition emerges only gradually over time, as more and more hectares are affected by those prescriptions.

Generally, increased use of non-clearcut treatments favours regeneration and development of shade tolerant tree species, those being ones adapted to grow in the low light conditions that exist under a canopy. Thus, alternatives with greatest use of non-clearcut treatments, like **B** and **C**, result in the highest area of stand types dominated by tolerant species (37% and 30% at year 50, respectively); those with least use of such treatments, like **E** and the status quo, result in the lowest abundance of such types.

A high or increasing content of intolerant species is generally viewed as inconsistent with the natural character of the Acadian forest, and except under the status quo, the abundance of stands dominated by intolerant species is kept at or below 20% of the total forest area.

Wildlife Habitats

The four alternatives with 30% or more area designated as conservation forest maintain habitat at levels deemed necessary by provincial biologists to maintain viable populations of native vertebrate species and desired populations of selected species (e.g. deer).

Reducing the conservation forest area, with no change in management of the general forest, will reduce abundance of some habitat types, which in turn, may reduce populations of species which require those types. Any impacts on populations will likely relate directly to the reduction in conservation forest area; thus, potential negative wildlife population effects of reduced conservation forest will be least under alternatives **C** and **D**, which set conservation forest area at 25%, and most under alternative **E**, which sets conservation forest area at 20%. Which species are most affected will depend upon what specific areas are reclassified from conservation to general forest status and exactly how the general forest is managed.

Reducing the conservation forest area under alternative **F** may have no negative impacts on population levels, because the low intensity harvesting extensively applied across the forest was designed to maintain habitat-suitable conditions in partially harvested areas. Confirmation that negative impacts are unlikely under this alternative will require closer investigation by wildlife habitat experts within the Department of Natural Resources.

Old Forest

Old forest conditions, which make up roughly 45% of the forest today, drop over the next 50 years as a result of harvesting under six of the alternatives. Old forest at year 50 drops to the lowest levels under alternatives **E** (31%) and **D** (33%) and falls between 34% and 37% of the total forest under the status quo and alternatives **C**, **F**, and **G**. Alternatives **A** and **B** result in a future increase in old forest area, which, respectively, reaches 49% and 51% of the forest area at forecast year 50.

Harvest Treatments

The amount and types of forest harvested by clearcutting has both ecological and social significance. The area clearcut as a percent of total area harvested in the first 25 years ranges across alternatives from a high of 81% under the status quo, to a low of 45% under alternative **F**. As clearcutting is required to prepare sites for conventional planting, alternatives with high plantation areas generally include more clearcut harvesting (e.g. **D** and **E**). Clearcutting tends to hinder regeneration and growth of shade tolerant and late-successional tree species, thus alternatives with high objectives for those species result in less clearcut harvesting (e.g. **A**, **B**, **C**).

A predominate view in forest ecology is that diversity can best be maintained in the forest if harvesting is conducted in accordance with the natural disturbances stands are prone to experience. This means harvesting so that post-harvest stand conditions retain some of the key elements stands possess following natural disturbances.

Such "natural disturbance-based" harvest prescriptions were defined for all stand types and the higher the percent area harvested according to those prescriptions, the higher the likelihood natural forest diversity will be maintained. Under two alternatives, **A** and **F**, 100% of the harvest area was by these disturbance-based prescriptions. The percent was lowest under the status quo (23%) and alternative **E** (34%) and intermediate under **B** (58%), **C** (63%), and **G** (73%).

Socio-Economic Impact Related to Wood Supply

Economic consequences of management alternatives are highly important, but given changes in the forest industry and forest products markets, forecasting those consequences is exceedingly difficult. To provide some basis for comparing alternatives, short-term (10 years) forecasts were made of four socio-economic indicators related to wood products manufacturing: direct employment, value of shipments, contribution to gross domestic product, and royalties paid to government.

These were based on current trends in employment and prices, assume full utilization of available wood supply, and consider wood processing only to the point of pulp, lumber, and veneer production. Down stream, value added manufacturing (e.g. paper and engineered wood products), the opportunities for which are shaped by available wood supply, is largely in the realm of industrial strategy, and was not addressed in this examination of forest management alternatives. All economic and employment indicators are based on production only from Crown land. They therefore represent only a portion of the total levels, which would include production from all private lands.

No economic indicators were assessed beyond the short-term (10 years). Instead, the characteristics of the forecast wood supply (quantity, quality, and species make-up) should provide a basis for making inferences about longer term wood supply-related socio-economic impacts and opportunities resulting from the management alternatives.

All four economic indicators vary 2-fold across the range of alternatives, and the ranking of alternatives remains essentially the same across alternatives.

The status quo alternative produces the highest levels of employment (7600 jobs, 1128 of which are seasonal silviculture jobs), shipment value ($1.44 billion/yr), GDP contribution ($0.80 billion/yr), and royalties ($61 million/yr) over the next 10 years (in constant dollars). This results because of the relatively high spruce/fir wood supply, and because of a short-term (and unsustainable) harvest of other species made possible by the absence of a sustainability objective for those species.

Alternative **E** is next highest for all four economic indicators because of the reduced area of conservation forest and resulting higher harvest. The economic indicator values drop as increasing emphasis is placed on forest diversity and conservation objectives. For this reason the economic indicators fall to the lowest levels under alternatives **A** and **B**.

Important Considerations

Interpolation of Other Alternatives

Eight management alternatives are presented in detail in this report, however, numerous others can be defined by combining the options for the seven cornerstone issues in various ways. Should any of these other possibilities be of interest, their probable consequences can be inferred from the cause-effect relationships presented in Part 4 of this report.

Catastrophic Loss

None of the analyses include accounting for catastrophic loss, as might be caused by wildfire, insect outbreaks, or windstorm. The assumption was made that New Brunswick will continue its relatively effective forest protection programs, and in the event major losses do occur, they will be addressed by salvage harvesting and revision of management plans as is current practise.

Climate Change

Climate change has the potential to significantly impact the forest. Given the complexity and uncertainty surrounding climate change and its impacts, it was only indirectly

addressed in the management alternatives, by controlling the abundance of tree species deemed by the scientific community as best adapted to the expected changes in climate. Changes in tree growth rates, fire and pest incidence, and regeneration patterns are expected to occur, although gradually over time. Under any management alternative, the forestry community must be alert to such changes and ready to revise management strategies as understanding of climate change impacts improves.

Unquantified Impacts

Given the Task Force mandate, socio-economic impacts addressed here relate only to wood products manufacturing. But the forest provides other economic benefits which should be considered when evaluating alternatives, such as those relating to eco-tourism, consumptive and non-consumptive recreation, and non-timber forest products. Further, there are important social implications of management that cannot readily be addressed by objective measures. Such matters include aesthetics, spirituality, and perception of risk.

To a limited extent, impacts on these socio-economic dimensions can be inferred from the forest conditions forecast under each alternative. However, more complete and explicit consideration of them should be made when evaluating the desirability of various alternatives.

The effect on ecological services provided by the forest is another important consideration in evaluating alternatives. Inferences about some such services, for example, maintenance of diversity, provision of habitat, and protection of water, can be readily made from the provided descriptions of management outcomes. Others, like water and air purification, water regime regulation, and nutrient cycling, are not directly addressed, but the variation in impacts between alternatives is tempered by the fact that all alternatives retain the same forested land area and all involve ongoing maintenance and regeneration of forest cover.

Management Flexibility

Consideration of the future necessitates use of forecasts, despite the presence of many unavoidable uncertainties and unknowns relating to economic conditions, environmental conditions, forest products markets, and social values and preferences. Adaptation to changes in these factors is partly accommodated in forest management by regular and frequent replanning in which strategy adjustments are made in response to unfolding reality.

The ability to adapt to change is partly governed by the degree of flexibility afforded by the forest condition. There is no one forest condition that all parties would agree provides maximum flexibility. Regardless, the inevitability of unpredictable change makes thoughtful consideration of management flexibility a necessary part of responsible decision-making about forest management.

Trade-offs

Finally, few would disagree that the overarching forest management objective in New Brunswick is to act now to create a forest that will be economically valuable, ecologically healthy, and socially desirable in the future, while deriving economic, environmental and social benefit from the forest today. But there is no one right way to accomplish this.

As revealed in this report, not all benefits can be simultaneously maximized; measures to enhance some benefits will negatively affect others. The resulting trade-offs cannot be avoided but they should be explicitly recognized, and consciously factored into management decisions. The decision-making challenge is to thoroughly evaluate possibilities and implement a management strategy that provides the best balance of benefits through time. The Task Force hopes this report assists the Province in that important and formidable task.