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## RURAL ECONOMY

A Delphi Study of Growth and Yield in Canada's Forests
Report of a Scientific Survey
W. Phillips, J. Beck, D. Boulter, D. Booth and K. Clark

Project Report 95-03

## Project Report



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# A DELPHI STUDY OF GROWTH AND YIELD IN CANADA'S FORESTS 

## Report of a Scientific Survey

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## EXECUTIVE SUMMARY

Information on growth and yield of Canada's forests tends to be anecdotal, site specific, difficult to compile, and unsuitable for general aggregation across species and to provincial and ecological region-wide levels. Yet aggregated information on growth and yield is necessary for estimating future timber supplies for large regions in order to plan for the future of both the industry and the other various non-timber forest users. Thus, a study was undertaken using the Delphi technique to summarize the opinions of growth and yield experts and practicing foresters across the country. Survey participants were asked to fill in a series of three sequential and carefully-designed questionnaires. Feedback from each previous questionnaire was used as a basis to refine initial responses and establish a final set of growth and yield estimates for various regions across the country.

The regional breakdown followed a combination of Rowe's forest regions and provincial boundaries: Atlantic-Acadian; Atlantic-Boreal; Quebec-Great Lakes/St. Lawrence; Quebec-Boreal; Ontario-Great Lakes/St. Lawrence; Ontario-Boreal; Prairie/Northwest Territories-Boreal; Interior British Columbia/Yukon-Boreal; Interior British ColumbiaSubalpine; Interior British Columbia-Montane; Interior British Columbia-Columbia; Coastal British Columbia-Coast; and Coastal British Columbia-Subalpine. Within each of these 13 regions, responses were broken down further by species groupings: softwood, mixed-wood, and hardwood. Also, the questionnaires were divided into two parts, existing stands and regenerated stands.

Results of the Delphi survey show that existing stands are currently being harvested beyond the age of maximum mean annual increment (MAI) across the country with the exception of the Quebec-Great Lakes/St. Lawrence where harvest is at the age of maximum MAI. Estimated future harvest ages of regenerated stands were at the age of maximum MAI for all regions except the Atlantic-Acadian and Ontario-Great Lakes/St. Lawrence where estimated ages were beyond the age of maximum MAI.

Estimated growth responses connected with unevenaged management, fertilization, cleaning/brushing, juvenile spacing/pre-commercial thinning, and commercial thinning were provided by survey respondents for both existing and regenerated stands. Growth responses from genetic improvement were also provided for regenerated stands. Respondents' estimates of growth from unevenaged management tended to be considerably less than maximum MAI growth rates. Estimates of growth increases as a result of fertilization ranged from 0.1 $\mathrm{m}^{3} / \mathrm{ha} /$ year for regenerated stands in the Atlantic-Acadian region to $2.6 \mathrm{~m}^{3} / \mathrm{ha} /$ year for both existing and regenerated stands in the Coastal British Columbia-Coast region. Duration of increased growth was generally between 5 and 15 years.

Estimated growth increases from cleaning/brushing varied regionally from a low of 0.3 $\mathrm{m}^{3} / \mathrm{ha} /$ year for regenerated stands in Coast British Columbia-Subalpine and Ontario-Boreal regions to a high of $1.8 \mathrm{~m}^{3} / \mathrm{ha} /$ year for regenerated stands in the Atlantic-Boreal region. Duration of the increased growth response generally fell within the 7 to 15 year range. The expected growth response from juvenile spacing/pre-commercial thinning varied between -1.0 $\mathrm{m}^{3} / \mathrm{ha} /$ year for the Interior British Columbia-Subalpine region and $+2.6 \mathrm{~m}^{3} / \mathrm{ha} /$ year for the Atlantic-Acadian region. Predicted change in the number of years to reach a rotation based on harvestable tree size was between 0 and -20 years but the effect on rotation age using maximum MAI was generally between -5 and +5 years. Predicted growth increases from commercial thinning varied from a low of $-1.8 \mathrm{~m}^{3} / \mathrm{ha} /$ year for existing stands in the Coast British Columbia-Coast region to a high of $+1.5 \mathrm{~m}^{3} /$ ha/year for regenerated stands in the

Atlantic-Boreal region. Duration of growth changes are expected to be between 8 and 20 years except in the Coastal British Columbia regions where the range is from 27 to 43 years. Predicted shortening of rotation time based on harvestable tree size is from 1 to 10 years while changed rotation age at maximum MAI varied from -2 years to +17 years.

Estimated increases in MAI growth from genetic improvement of regenerated stands varied from 0.3 to $1.2 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{year}$. In general, for most regions, predicted rotations from genetic improvement were shortened by 5 to 10 years.

The results were based on 42 responses over the 13 regions in the third and final round of the survey. Great care should be taken regarding the use of data for the four Interior British Columbia regions due to minimal responses. Otherwise, the data seem to represent the view of experts in the field. Delphi studies such as this one are useful as a first estimate when there is insufficient hard empirical data.

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## 1. INTRODUCTION

Information on growth and yield of Canada's second growth forests is necessary for estimating future timber supply in order to plan for the future of both the industry and the various other forest users. While second growth is already an important component of harvest in some regions, particularly the Atlantic region, this is not the case for most of Canada. Millions of dollars have been spent over the years on regenerating and tending recently harvested areas. What are and what will be the yields on these new "tended" forests? While the national forest inventory can provide estimates of standing volumes per hectare and mean annual increments for existing stands (CFS 1994), how representative are these of future growth rates? And how does growth change under different management options and as a result of different disturbances?

There are 416 million hectares (ha) of forested lands in Canada that range from the tundra to the prairies, from the northern boreal forests to the rainforests of B.C.'s coast. Despite over one hundred years of harvesting, Canada's forests are still predominantly mature or over-mature; nearly $50 \%$ of the area of nonreserved, stocked forest area is old, representing over $68 \%$ of the volume, or 17 billion $\mathrm{m}^{3}$ are in those marturity classes. This large stock of standing mature forest continues to be the main source of fibre for Canada's forest sector, and as a result, the focus of timber supply analysis to date has not been on growth and yield for second growth forests.

However, a number of factors are changing the face of timber supply analysis in Canada. Allowable annual cuts (AACs), which are the amounts of wood that can be harvested for a given area over time, are determined in each jurisdiction, with the bulk of the forest resource owned and controlled by the provinces. Because of the large expanse of existing mature forests however, these AACs reflect to a large extent the rate at which existing stocks of old timber can be harvested. Growth rates of existing as well as regenerating forests in many regions have historically not factored significantly into the calculation of short term harvest rates.

Over the past twenty years, there has been a recognition that there is a significant margin of the AAC that is not economically recoverable, given expectations of current and future costs, prices, products, technology, etc. The physical supply of timber was recognized to be clearly greater than the economic supply by some unknown margin. In addition, concerns for the environment and non-consumptive land uses (predominantly recreational), have begun to have an increasing impact in the form of withdrawals from the forest land base. The area of accessible, virgin mature timber is decreasing, and there is increasing pressures on the forest land base from other users of the forest. At the same time, previously harvested areas are maturing and the forest products industry is preparing for a transition to second growth. Intensive management of second growth stands is seen by some to be the solution to reductions in industrial forest area as a result of increasing regulations and land withdrawals.

There is a large amount of information on growth and yield across Canada but it tends to be very site specific. It is spread across the country, variable in quality, is not easily compiled, and is difficult to generalize. Anecdotal evidence of high yields has led some researchers and policy-makers to conjecture that there is a huge potential for growth increases from management of second growth stands, or even from unmanaged stands. Is it reasonable to extrapolate site-specific growth and yield information to all of Canada's forests? What in fact is the "average" growth response? This lack of good growth and yield and other forest resource information is indicated by Brand (1991) when he states that "...good data are not
available on the nature and extent of the Canadian forest, its rates of growth, and the rates of harvesting, wildfire, or pest management" (p. 3). There is a "... need for enhancement in the current information base" (p. 3). Brand and Penner (1991) attempted to update information on Canada's growth and yield from second growth forests by carrying out an informal survey of growth rates in managed and natural stands across the country.

This Delphi study is a first attempt to quantify, on an aggregate basis, the expert judgements of growth and yield experts on the growth of Canada's forests both today and in the future. Because the information needed to make inferences about future second growth for large regional aggregates is lacking, a Delphi survey technique involving an expert panel of growth and yield specialists and practising foresters across Canada was used to generate the information. The panel was selected by a peer review and used to solicit member views as to current and future supply responses, i.e., growth and yield, following stand or forest depletion. Participants were asked to fill in a series of three carefully-designed questionnaires. Feedback from each previous questionnaire was used to try and refine and narrow the responses to the next, in order to reach a consensus of expert opinion. This project reports on the Delphi process and analyzes resultant growth and yield information on Canada's forests. Questions were asked on current growth and yield of existing forests and their responses to various management options. In addition, questions were asked on the growth and yield of second growth stands on forest land after logging, again for various intensive management options.

The final product contained in this report is a set of tables of yield data that are based on responses by regional experts across the country. National assessments of the supply of timber from Canada's forests have been carried out periodically over a number of years. This growth and yield information will be a vital component of analytical and economic studies of the forest sector, both within the Canadian Forest Service and outside.

## 2. METHODOLOGY

### 2.1 SURVEY TECHNIQUE

Participants in the survey were considered to be experts on the present and potential future growth and yield of forests. Their collective judgements are important, given the absence of a less than complete state of knowledge. Because the knowledge base is lacking, pooled expert opinion can provide an important foundation for improved forest resource modelling, routine problem solving and decision making. The Delphi technique was developed as a structured means of improving the information base using experts.

First developed by Delbecq et al. (1975) at the Rand Corporation during the late 1950s, the Delphi technique consists of a set of well-designed sequential questionnaires. Responses from the earlier questionnaire rounds are summarized and fed back to respondents in later questionnaires. The first questionnaire usually solicits responses to broad, general questions that focus on issues and relationships -- in this case estimates of growth and yield of Canada's forests. The questionnaires that follow allow for a review of earlier responses and reflect any clarification and refinement of expert opinion provided in the previous round. A minimum of three rounds of questionnaires are usually required (as in this case). The process is halted once a consensus is reached or sufficient information interchange is attained such that further significant opinion shifts are not likely.

The Delphi technique has been widely used in addressing a considerable variety of
problems. First applications in the area of forecasting were followed by business and social planning applications. Prediction of future trends with great uncertainty and diverse opinion, advisability of alternative corporate strategies, establishment of social planning priorities, identification of underlying assumptions or information leading to diverse judgements, and correlation of expert judgements on various topics have all been successfully addressed using the technique. Two other applications of the Delphi technique to Canadian forestry preceded the growth and yield study reported herein. Phillips et al. (1986) used the technique to establish forest economics research priorities in western Canada. Fraser et al. (1985) applied the technique to forecast the potential impact of the long range transport of air pollutants on Canadian forests.

Application of the Delphi technique is particularly appropriate for a survey on growth and yield forest productivity in Canada. Experts are spread across the country, and the fact that the technique does not require face-to-face meetings of respondents is a distinct cost saving advantage. Resulting anonymity is also useful given the limited information available and the need for speculation. Self-consciousness in a face-to-face setting could otherwise interfere with some or all of the creative thought processes. Furthermore, balanced participation by the entire respondent group, and balanced attention to each idea, is facilitated by the technique. In a face-to-face setting, individual reputations, position seniority and personality styles may result in an imbalance of participation and attention to ideas. Individual judgements can be swayed by group social pressure. The application of the technique avoids these potential problems. Finally, survey responses can be quantified thus allowing for aggregation of individual judgements.

There are also a number of potential limiting factors that can arise in using this technique, but were not deemed to be problematic in this case. For example, the time required to design, distribute, revise and process each round of questionnaires can be considerable. In this case, the full growth and yield survey (three rounds) extended over a ten-month period and required a considerable commitment of staff resources to develop and test questionnaires and to analyze the results. The fact that the technique required participant skills in written communication was not an issue given that the respondent group consisted of professional foresters. A high degree of motivation to commit essential time and effort to the process in the part of respondents was, however, essential.

### 2.2 REGIONS AND SPECIES AGGREGATIONS

The growth of Canada's diverse forests is a function of many variables including climate, patterns of disturbance, tree species, silvicultural programs, site productivity, aspect, and geographic location, among other things. While there is a large amount of site and species specific data as well as anecdotal information on growth, there is very little information available at a broad scale for regional and national planning and decision-making purposes. While we recognize that there are significant biological and geographical differences across Canada that will have impacts on expected future yields, from a statistical and logistical point of view the number of experts limited the possible number of categories and regions. Therefore, responses are solicited based on Rowe's forest regions (Rowe, 1972) as a broad proxy for ecological regions. These were subdivided into provincial regions, to reflect the reality that most experts would tend to be more comfortable responding to their immediate region, but not, for example, for all of the boreal forest region of Canada.
Species groups (i.e., softwood, hardwood, mixed-wood) further stratify the results. Aggregate
species groups were required in order to obtain a manageable number of categories and hence questions. Respondents included information on the relevant species in their responses, i.e., the designation of hardwoods includes different species in the boreal region than in the Great Lakes/St. Lawrence region.

The high degree of aggregation of regions, treatments and species was a significant problem for many experts. Some experts dropped out as a result. More detailed information is of course preferable from a regional or provincial point of view, and is required for timber supply analyses. This study, however, allows a national perspective on growth and yield, with comparability among regions, and a manageable number of options and categories, and is a useful benchmark or baseline for future studies.

### 2.3 PROCESS

The selection of the panel was carried out using a peer-nominating technique to identify individual participants. The process began with the selection of well-known and respected individuals in the area of growth and yield. These individuals were contacted and provided with an explanation of the survey project, including criteria for selecting panel members. These same individuals were then asked for nominations of individuals who were felt to be desirable participants in the survey. A list of nominees was then prepared with particular attention paid to multiple nominations (i.e., if a person was nominated by a number of different people, then their status as an expert was probably justified). Consideration was made of appropriate representation of both biological forest regions and geographic regional jurisdictions in Canada. Individuals from this list were then asked to participate and a final list of panel members was developed.

The research team was guided by an advisory panel consisting of seven leading growth and yield experts from across Canada (Appendix A). The advisory panel was instrumental in establishing the panel of experts by identifying the initial list of potential panel members. The advisory panel also pre-tested and critically reviewed initial questionnaire drafts. One of the advisory panel members, Mr. Joe Lowe, arranged to provide base line growth and yield data that served as an initial benchmark in questionnaire \#1 (see Appendix C).

Seventy-seven experts (listed in Appendix B) were nominated through the selection process outlined above. From this list over 50 actively participated in the survey process by responding to one or more of the three rounds of questionnaires. Every effort was made to have at least six panel members for each of the 13 forest regions, identified geographically as follows (see Rowe, 1972):

1. Atlantic Acadian
2. Atlantic Boreal
3. Quebec Great Lakes - St. Lawrence
4. Quebec Boreal
5. Ontario Great Lakes - St. Lawrence
6. Ontario Boreal
7. Prairie/Northwest Territories (NWT) Boreal
8. Yukon/Interior British Columbia Boreal
9. Interior British Columbia Subalpine
10. Interior British Columbia Montane
11. Interior British Columbia
12. Coast British Columbia Coast, and
13. Coast British Columbia Subalpine.

The survey process consisted of several stages beginning with clarification of goals and ending with a final report. The flow chart in Figure 1 describes the intervening stages as well as dates of completion of each stage.

### 2.4 QUESTIONNAIRE DESIGN

## Questionnaire \#1

Questionnaire \#1, used in the first of the three rounds of questionnaires, consisted of two parts, one for existing stands and one for regenerated stands (see Appendix C for sample questionnaires. A separate technical appendix contains the questionnaires for all regions). Existing stands are those stands currently standing (stands alive "today"). Regenerated stands are those stands that would regenerate after harvesting (stands originating after "today").

## Figure 1


*These delayed dates reflect the fact there was a poor response rate for four of the B.C. Regions and efforts on the part of the authors to get further responses for these regions.

The specific questions in each section were accompanied by baseline data from Canada's Forest Inventory (CanFI91) (Lowe et al. 1994) made available by Mr. Joe Lowe of the Petawawa National Forest Institute. For each of the 13 survey regions, baseline estimates were given for the areas (ha) within the region by species grouping as well as mean annual increments (MAI) ( $\mathrm{m}^{3} / \mathrm{ha} /$ year). Species groupings of softwood, mixed-wood and hardwood were used. This same breakdown was used in a series of bar graphs showing volumes per hectare ( $\mathrm{m}^{3} / \mathrm{ha}$ ) by age class ( 20 year classes). The data were based on Canada's forest inventory and represented average values for each of the regions in the survey. These data represented a basis for comparison, and questionnaire respondents were referred to the data in order to answer the various questions for both existing and regenerated stands. The same questions were used for each of the 13 regions; only the baseline data varied by region.

Respondents first considered growth and yield of existing stands. They were asked to assess the baseline inventory estimates of MAI by species group, to determine whether they seemed too high, too low, or about right. They were then asked to provide their estimates for an area-weighted mean age of mature stands for each species grouping. Based on their revised estimates of MAI for mature stands, the respondents were then asked how their estimates of MAIs would change (in percentage terms) if the area weighted mean ages were 20 years older, 20 years younger and 40 years younger.

Respondents were then asked to consider yield responses over time from fertilizer applications. The percent change in yield, as well as the number of years this change would be in effect, were considered. Finally, impacts of thinning on both usable fibre (from harvest as well as thinnings) (increase or decrease in percent) and rotation age (increase or decrease in number of years) were considered.

Basically the same type of questions were then asked for regenerated stands. Respondents were asked what the average age at harvest would likely be, as well as the MAI at harvest in comparison to the baseline data. Questions were again asked regarding fertilizer and thinning impacts. Estimates of changes in useable fibre and rotation ages from juvenile spacing, genetically improved stands, and cleaned/brush controlled stands were also considered. At the conclusion of questionnaire \#1, respondents were invited to provide any comments regarding the questionnaire or concerns that could be dealt with in subsequent rounds.

## Questionnaire \#2

Questionnaire \#2 also consisted of two parts, one for existing stands and one for regenerated stands (see Appendix C). Some of the original baseline data as well as the mean responses from questionnaire \#1 were brought forward into questionnaire \#2 for further refinement and elaboration. There were also some changes in the framing of questions, in direct response to comments provided in round one. The result was improved clarity in questionnaire design. The data provided varied by region but, again, the questions themselves were identical across regions. Once again the softwood, mixed-wood and hardwood breakdown was applied throughout.

For existing stands, respondents were provided with the baseline estimates of MAI from the inventory, as well as the round one mean responses. Mean ages of mature stands from round one responses were also provided. The round one information was reformulated into a table (see question 1a) showing age and mean MAI responses from questionnaire \#1 in 20 year classes. Respondents were asked to provide revised MAI estimates based on the
round one feedback.
Based on feedback from round one, respondents were also asked a series of questions on uneven-aged stands. They were asked to indicate the percent of area in the region managed by uneven-aged management, the growth/ha/year on areas managed by uneven-aged management, the after-cut growing stock level ( $\mathrm{m}^{3} / \mathrm{ha}$ ) left in areas managed by uneven-aged management, and the average cutting cycle (in years) used on areas managed by uneven-aged management.

The second question under existing stands in Questionnaire \#2 dealt with fertilization applications and responses. Round one mean responses on yield increases and periods of effectiveness were presented as a point of departure for revised and expanded responses. In particular, respondents were asked to indicate the range of stand ages within which they would fertilize, the rates of fertilizer they would apply ( $\mathrm{kg} / \mathrm{ha}$ ), the percentages of good, medium and poor sites they would fertilize, the expected growth increase ( $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ ), and the length of time (years) that the increased growth would last.

The third question under existing stands in Questionnaire \#2 dealt with thinning. The responses to thinning from round one were presented and further responses requested. In particular respondents were asked to provide changes in growth ( $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ ), length of time growth changes would last (years), changes in rotation (years) based on harvestable tree size, and changes in rotation based on maximum MAI from cleaning/brushing, juvenile spacing/pre-commercial thinning, and commercial thinning.

For regenerated stands, the same three question sets as for existing stands were repeated, except with the corresponding different responses from questionnaire \#1. In addition, a question on genetic improvement was unique to regenerated stands. Round one responses to genetic improvement were presented and respondents were asked to give revised and expanded responses. In particular they were asked to provide expected changes in MAI ( $\mathrm{m}^{3} / \mathrm{h} / \mathrm{l}$ ) from genetic improvement, expected changes in rotation (years) based on harvestable tree size, and expected changes in rotation (years) based on maximum MAI.

## Questionnaire \#3

The responses called for in round two met the objectives of the study in terms of the nature and extent of growth and yield data solicited. The purpose of the third round was to provide feedback from the previous rounds and to provide an opportunity for respondents to revise their individual responses, if desired, after reviewing the earlier collective responses. As a consequence, the questions in Questionnaire \#3 were identical to those in Questionnaire \#2. The only difference was the provision of mean responses from both rounds one and two. Once again the questions were identical across the 13 regions, but the mean responses varied over the regions.

## 3. SURVEY RESULTS

### 3.1 RESPONDENT CHARACTERISTICS AND RESPONSE RATES

The 77 selected panel members (see Appendix B) were drawn from government (federal and provincial), private and university sectors (Table 1). The majority were employed by governments, reflecting the heavy government involvement in growth and yield research programs. There were also significant numbers employed in the private sector.

Table 1: Nominee Group by Employer Category

| Category |  |
| :--- | :---: |
| Government |  |
| Private Sector |  |
| University | 24 |
| Total | 9 |
| Uniner | 77 |

Nominees were geographically distributed and represented all regions of Canada. Table 2 shows the distribution of individuals by region. The largest number came from British Columbia followed by Ontario. This distribution reflects the need to have expertise in all of the various forest regions within these geographic areas.

Table 2: Nominee Group by Geographical Location

| Geographic Area |  | Number of Nominees |
| :--- | :---: | :---: |
| Newfoundland | 6 |  |
| Maritimes | 6 |  |
| Quebec | 6 |  |
| Ontario | 18 |  |
| Prairie/Northwest Territories | 15 |  |
| British Columbia/Yukon | 26 |  |
| Total | 77 |  |

The response rates were somewhat lower than the 77 individuals initially identified. Reasons for non-response varied but were largely related to pressures from other commitments or the inability to respond given the high level of aggregation asked for in the questionnaires. The number of respondents varied over the three rounds of questionnaires (Table 3). Not all respondents completed all three rounds. Many respondents provided expert response to more than one of the 13 forest regions for each round.

## Table 3: Number of respondents by forest region for each round of Questionnaires

| Forest Region | Round One | Round Two | Round <br> Three |
| :---: | :---: | :---: | :---: |
| Atlantic-Acadian | 6 | 3 | 2 |
| Atlantic-Boreal | 5 | 3 | 3 |
| Quebec-Great Lakes-St. Lawrence | 4 | 7 | 3 |
| Quebec-Boreal | 5 | 5 | 3 |
| Ontario-Great Lakes-St. Lawrence | 8 | 4 | 6 |
| Ontario-Boreal | 7 | 5 | 5 |
| Prairie/NWT-Boreal | 12 | 7 | 8 |
| Yukon/Interior B.C.-Boreal | 2 | 2 | 1 |
| Interior B.C.-Subalpine | 2 | 0 | 1 |
| Interior B.C.-Montane | 3 | 0 | 1 |
| Interior B.C.-Columbia | 5 | 1 | 1 |
| Coastal B.C.-Coast | 7 | 2 | 4 |
| Coastal B.C.-Subalpine | 4 | 2 | 4 |
| Total No. of Responses | 70 | 41 | 42 |
| Total No. of Respondents | 51 | 29 | 29 |

### 3.2 REGIONAL GROWTH ESTIMATES

Table 4 summarizes the responses of participants for existing and regenerated stands for each region for softwood, mixed-wood, and hardwood species groups. These estimates represent an average for the whole region, over all sites and species, for a pulpwood utilization standard. For existing stands, the fourth age (shown as bold) in each species group represents the participants' estimate of the area-weighted mean age of harvest of that species group and the mean annual increment, MAI, of that age. Participants provided MAI values which were then multiplied by age to produce the per hectare volumes in Table 4. For regenerated stands, this fourth age (also bold) represents the expected age of harvest of regenerated stands. This fourth age was considered the base age, and growth estimates for age classes in the two 20 year age classes above and below this age were considered.

For existing stands, participants' responses confirm that, in most of the country, stands are currently being harvested above the age of maximum MAI. The major regional exception to this is the Quebec-Great Lakes/St. Lawrence region where current harvest is estimated to be right at the age of maximum MAI.

For regenerated stands, participants estimated future harvest ages at or slightly older than the age of maximum MAI for all regions except the Atlantic-Acadian and Ontario-Great Lakes/St. Lawrence regions, where estimated harvest ages were beyond the age of maximum MAI.

Table 4: Regional Growth \& Yield Estimates

## Atlantic-Acadian

## Existing Stands

| Softwood |  |  | Mixed-wood |  |  | Hardwood |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Age | MAI | $\mathrm{Vol} / \mathrm{ha}$ | Age | MAI | Vol/ha | Age | MAI | $\mathrm{Vol} / \mathrm{ha}$ |
| Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ |
| 16 | 2.0 | 32 | 18 | 2.2 | 40 | 23 | 2.3 | 53 |
| 36 | 2.2 | 79 | 38 | 2.3 | 87 | 43 | 2.4 | 103 |
| 56 | 2.2 | 123 | 58 | 2.3 | 133 | 63 | 2.3 | 145 |
| 76 | 1.7 | 129 | 78 | 1.8 | 140 | 83 | 1.9 | 158 |
| 96 | 1.1 | 106 | 98 | 1.4 | 137 | 103 | 1.5 | 155 |
| 116 | 0.3 | 35 | 118 | 1.0 | 118 | 123 | 1.2 | 148 |

## Regenerated Stands

| Softwood |  |  | Mixedwood |  |  | Hardwood |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Age | MAI | Vol/ha | Age | MAI | Vol/ha | Age | MAI | Vol/ha |
| Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3 / h a}$ |
| 0 | 1.0 | 0 | 0 | 1.0 | 0 | 0 | 1.0 | 0 |
| 8 | 2.3 | 18 | 15 | 2.8 | 42 | 18 | 2.8 | 50 |
| 28 | 3.7 | 104 | 35 | 2.8 | 98 | 38 | 2.8 | 106 |
| 48 | 3.0 | 144 | 55 | 2.2 | 121 | 58 | 2.3 | 133 |
| 68 | 2.9 | 197 | 75 | 2.0 | 150 | 78 | 2.0 | 156 |
| 88 | 2.3 | 202 | 95 | 1.8 | 171 | 98 | 1.9 | 186 |

## Existing Stands

| Softwood |  |  | Mixedwood |  |  | Hardwood |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Age | MAI | $\mathrm{Vol} / \mathrm{ha}$ | Age | MAI | Vol/ha | Age | MAI | Vol/ha |
| Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ |
| 31 | 1.1 | 34 | 34 | 1.8 | 61 | 15 | 1.3 | 20 |
| 51 | 2.0 | 102 | 54 | 2.3 | 124 | 35 | 1.9 | 67 |
| 71 | 1.9 | 135 | 74 | 2.0 | 148 | 55 | 1.8 | 99 |
| 91 | 1.6 | 146 | 94 | 1.7 | 160 | 75 | 1.6 | 120 |
| 111 | 1.1 | 122 | 114 | 1.1 | 125 | 95 | 1.3 | 124 |
| 131 | 1.0 | 131 | 134 | 0.6 | 80 | 115 | 1.2 | 138 |

Regenerated Stands

| Softwood |  |  | Mixedwood |  |  | Hardwood |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Age | MAI | $\mathrm{Vol} / \mathrm{ha}$ | Age | MAI | Vol/ha | Age | MAI | $\mathrm{Vol} / \mathrm{ha}$ |
| Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ |
| 0 | 0.0 | 0 | 0 | 0.0 | 0 | 0 | 0.0 | 0 |
| 19 | 0.3 | 6 | 18 | 1.0 | 18 | 12 | 1.3 | 16 |
| 39 | 1.9 | 74 | 38 | 2.0 | 76 | 32 | 2.3 | 74 |
| 59 | 2.3 | 136 | 58 | 2.5 | 145 | 52 | 2.8 | 146 |
| 79 | 2.0 | 158 | 78 | 2.3 | 179 | 72 | 2.5 | 180 |
| 99 | 1.7 | 168 | 98 | 1.5 | 147 | 92 | 1.8 | 166 |

Table 4: Regional Growth \& Yield Estimates (Continued)
Coastal B.C. - Coast
Existing Stands

|  | Softwood <br> Age <br> MAI | Mol/ha <br> $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | Age <br> $\mathrm{m}^{3} / \mathrm{ha}$ | Mears <br> MAI | M $3 / \mathrm{ha} / \mathrm{y}$ | Vol/ha <br> $\mathrm{m}^{3} / \mathrm{ha}$ | Age <br> Years | Hardwood <br> $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Years | Vol/ha <br> $\mathrm{m}^{3} / \mathrm{ha}$ |  |  |  |  |  |  |  |
| 198 | 3.3 | 653 | 125 | 4.7 | 588 | 22 | 4.0 | 88 |
| 218 | 2.9 | 632 | 145 | 4.3 | 624 | 42 | 5.7 | 239 |
| 238 | 2.8 | 666 | 165 | 3.9 | 644 | 62 | 5.2 | 322 |
| $\mathbf{2 5 8}$ | 2.7 | 697 | $\mathbf{1 8 5}$ | 3.6 | 666 | $\mathbf{8 2}$ | 4.7 | 385 |
| 278 | 2.5 | 695 | 205 | 3.2 | 656 | 102 | 3.4 | 347 |
| 298 | 2.0 | 596 | 225 | 2.9 | 653 | 122 | 2.0 | 244 |

## Regenerated Stands

| Softwood |  |  | Mixedwood |  |  | Hardwood |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Age | MAI | Vol/ha | Age | MAI | Vol/ha | Age | MAI | Vol/ha |
| Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ |
| 27 | 4.7 | 127 | 29 | 3.6 | 104 | 1 | 0.0 | 0 |
| 47 | 6.2 | 291 | 49 | 4.8 | 235 | 21 | 5.2 | 109 |
| 67 | 7.5 | 503 | 69 | 5.5 | 380 | 41 | 7.1 | 291 |
| 87 | 7.5 | 653 | 89 | 5.8 | 516 | 61 | 6.7 | 409 |
| 107 | 7.0 | 749 | 109 | 5.7 | 621 | 81 | 5.6 | 454 |
| 127 | 6.4 | 813 | 129 | 5.2 | 671 | 101 | 4.3 | 434 |

## Coastal B.C. - Subalpine

## Existing Stands

|  | Softwood <br> Age <br> MAI | Vol/ha <br> $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | Age <br> $\mathrm{m}^{3} / \mathrm{ha}$ | Mixedwood <br> MAI | Mol/ha <br> $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | Age <br> $\mathrm{m}^{3} / \mathrm{ha}$ | Hardwood <br> YAI | Vol/ha <br> $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{m}^{3} / \mathrm{ha}$ |  |  |  |  |  |  |  |  |

## Regenerated Stands

| Softwood |  |  | Mixedwood |  |  | Hardwood |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Age | MAI | Vol/ha | Age | MAI | $\mathrm{Vol} / \mathrm{ha}$ | Age | MAI | Vol/ha |
| Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ |
| 55 | 3.1 | 171 | 37 | 2.4 | 89 | 5 | 0.8 | 4 |
| 75 | 4.0 | 300 | 57 | 3.0 | 171 | 25 | 2.0 | 50 |
| 95 | 5.0 | 475 | 77 | 3.6 | 277 | 45 | 2.9 | 131 |
| 115 | 4.8 | 552 | 97 | 3.8 | 369 | 65 | 3.6 | 234 |
| 135 | 4.4 | 594 | 117 | 3.7 | 433 | 85 | 3.3 | 281 |
| 155 | 4.0 | 620 | 137 | 3.5 | 480 | 105 | 2.7 | 284 |

Table 4: Regional Growth \& Yield Estimates (Continued)
Interior B.C. - Columbia
Existing Stands

| Softwood |  |  | Mixedwood |  |  | Hardwood |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Age | MAI | $\mathrm{Vol} / \mathrm{ha}$ | Age | MAI | Vol/ha | Age | MAI | Vol/ha |
| Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ |
| 103 | 3.0 | 309 | 83 | 2.3 | 191 | 47 | 1.5 | 71 |
| 123 | 2.9 | 357 | 103 | 2.5 | 258 | 67 | 1.8 | 121 |
| 143 | 2.8 | 400 | 123 | 2.4 | 295 | 87 | 2.0 | 174 |
| 163 | 2.6 | 424 | 143 | 2.3 | 329 | 107 | 1.8 | 193 |
| 183 | 2.4 | 439 | 163 | 2.1 | 342 | 127 | 1.5 | 191 |
| 203 | 2.2 | 447 | 183 | 1.9 | 348 | 147 | 1.0 | 147 |

## Regenerated Stands

| Softwood |  |  | Mixedwoiod |  |  | Hardwood |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Age | MAI | $\mathrm{Vol} / \mathrm{ha}$ | Age | MAI | Vol/ha | Age | MAI | Vol/ha |
| Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ |
| 34 | 1.2 | 41 | 33 | 1.0 | 33 | 17 | 1.0 | 17 |
| 54 | 2.2 | 119 | 53 | 1.8 | 95 | 37 | 1.6 | 59 |
| 74 | 2.8 | 207 | 73 | 2.3 | 168 | 57 | 2.0 | 114 |
| 94 | 3.2 | 301 | 93 | 2.6 | 242 | 77 | 2.3 | 177 |
| 114 | 3.1 | 353 | 113 | 2.5 | 283 | 97 | 2.2 | 213 |
| 134 | 3.0 | 402 | 133 | 2.4 | 319 | 117 | 2.0 | 234 |

## Interior B.C. - Montane

## Existing Stands

| Softwood |  |  | Mixedwood |  |  | Hardwood |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Age | MAI | Vol/ha | Age | MAI | Vol/ha | Age | MAI | Vol/ha |
| Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ |
| 100 | 2.0 | 200 | 105 | 2.0 | 210 | 95 | 2.0 | 190 |
| 120 | 2.3 | 276 | 125 | 2.3 | 288 | 115 | 2.2 | 253 |
| 140 | 2.2 | 308 | 145 | 2.2 | 319 | 135 | 2.1 | 284 |
| 160 | 2.1 | 336 | 165 | 2.1 | 347 | 155 | 1.9 | 295 |
| 180 | 2.0 | 360 | 185 | 2.0 | 370 | 175 | 1.7 | 298 |
| 200 | 1.8 | 360 | 205 | 1.8 | 369 | 195 | 1.4 | 273 |

## Regenerated Stands

|  | Softwood <br> Age <br> MAI | Mol/ha <br> $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | Age <br> $\mathrm{m}^{3} / \mathrm{ha}$ | Mixedwood <br> MAI | Mol/ha <br> $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | Age <br> $\mathrm{m}^{3} / \mathrm{ha}$ | Yardwood <br> YAI | Vol/ha <br> $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{m}^{3} / \mathrm{ha}$ |  |  |  |  |  |  |  |  |

Table 4: Regional Growth \& Yield Estimates (Continued)
Interior B.C. - Subalpine
Existing Stands

| Softwood |  |  | Mixedwood |  |  | Hardwood |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Age | MAI | $\mathrm{Vol} / \mathrm{ha}$ | Age | MAI | $\mathrm{Vol} / \mathrm{ha}$ | Age | MAI | Vol/ha |
| Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ |
| 130 | 3.0 | 390 | 140 | 2.5 | 350 | 90 | 2.0 | 180 |
| 150 | 2.9 | 435 | 160 | 2.4 | 384 | 110 | 1.9 | 209 |
| 170 | 2.8 | 476 | 180 | 2.2 | 396 | 130 | 1.7 | 221 |
| 190 | 2.6 | 494 | 200 | 2.0 | 400 | 150 | 1.5 | 225 |
| 210 | 2.4 | 504 | 220 | 1.8 | 396 | 170 | 1.3 | 221 |
| 230 | 2.0 | 460 | 240 | 1.6 | 384 | 190 | 1.0 | 190 |

Regenerated Stands

| Softwood |  |  | Mixedwood |  |  | Hardwood |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Age | MAI | Vol/ha | Age | MAI | Vol/ha | Age | MAI | Vol/ha |
| Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ |
| 60 | 2.5 | 150 | 40 | 1.8 | 72 | 20 | 1.0 | 20 |
| 80 | 2.9 | 232 | 60 | 2.4 | 144 | 40 | 1.8 | 72 |
| 100 | 3.1 | 310 | 80 | 2.8 | 224 | 60 | 2.2 | 132 |
| 120 | 3.0 | 360 | 100 | 3.0 | 300 | 80 | 2.5 | 200 |
| 140 | 2.9 | 406 | 120 | 2.9 | 348 | 100 | 2.3 | 230 |
| 160 | 2.7 | 432 | 140 | 2.7 | 378 | 120 | 2.0 | 240 |

NWT and Prairies - Boreal
Existing Stands

| Softwood |  |  | Mixedwood |  |  | Hardwood |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Age | MAI | Vol/ha | Age | MAI | Vol/ha | Age | MAI | Vol/ha |
| Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ |
| 49 | 1.4 | 69 | 40 | 1.7 | 68 | 26 | 1.9 | 49 |
| 69 | 1.6 | 110 | 60 | 1.9 | 114 | 46 | 2.3 | 106 |
| 89 | 1.7 | 151 | 80 | 1.9 | 152 | 66 | 2.4 | 158 |
| 109 | 1.6 | 174 | 100 | 1.9 | 190 | 86 | 2.3 | 198 |
| 129 | 1.4 | 181 | 120 | 1.7 | 204 | 106 | 2.1 | 223 |
| 149 | 1.3 | 194 | 140 | 1.5 | 210 | 126 | 1.6 | 202 |

## Regenerated Stands

| Softwood |  |  | Mixedwood |  |  | Hardwood |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Age | MAI | Vol/ha | Age | MAI | Vol/ha | Age | MAI | Vol/ha |
| Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ |
| 30 | 1.3 | 39 | 33 | 1.7 | 56 | 8 | 1.8 | 14 |
| 50 | 1.7 | 85 | 53 | 2.0 | 106 | 28 | 2.2 | 62 |
| 70 | 1.9 | 133 | 73 | 2.8 | 204 | 48 | 2.4 | 115 |
| 90 | 1.8 | 162 | 93 | 2.7 | 251 | 68 | 2.4 | 163 |
| 110 | 1.7 | 187 | 113 | 2.6 | 294 | 88 | 2.2 | 194 |
| 130 | 1.5 | 195 | 133 | 1.8 | 239 | 108 | 2.0 | 216 |

Table 4: Regional Growth \& Yield Estimates (Continued)
Ontario - Boreal
Existing Stands

| Softwood |  |  | Mixedwood |  |  | Hardwood |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Age | MAI | Vol/ha | Age | MAI | $\mathrm{Vol} / \mathrm{ha}$ | Age | MAI | Vol/ha |
| Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ |
| 40 | 1.7 | 68 | 33 | 2.0 | 66 | 23 | 2.1 | 48 |
| 60 | 2.0 | 120 | 53 | 2.3 | 122 | 43 | 2.8 | 120 |
| 80 | 2.1 | 168 | 73 | 2.4 | 175 | 63 | 2.8 | 176 |
| 100 | 2.0 | 200 | 93 | 2.1 | 195 | 83 | 2.5 | 208 |
| 120 | 1.7 | 204 | 113 | 1.8 | 203 | 103 | 2.0 | 206 |
| 140 | 1.4 | 196 | 133 | 1.5 | 200 | 123 | 1.6 | 197 |

Regenerated Stands

| Softwood |  |  | Mixedwood |  |  | Hardwood |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Age | MAI | Vol/ha | Age | MAI | Vol/ha | Age | MAI | Vol/ha |
| Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ |
| 19 | 1.1 | 21 | 15 | 1.0 | 15 | 1 | 0.6 | , |
| 39 | 1.7 | 66 | 35 | 1.8 | 63 | 21 | 2.0 | 42 |
| 59 | 2.0 | 118 | 55 | 2.4 | 132 | 41 | 2.5 | 103 |
| 79 | 2.1 | 166 | 75 | 2.5 | 188 | 61 | 2.9 | 177 |
| 99 | 1.8 | 178 | 95 | 2.1 | 200 | 81 | 2.6 | 211 |
| 119 | 1.6 | 190 | 115 | 1.7 | 196 | 101 | 2.1 | 212 |

## Ontario - Great Lakes/St. Lawrence

Existing Stands

|  | Softwood |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Age | MAI | Vol/ha | Age | Mixedwood <br> MAI | Vol/ha | Age | Mardwood <br> MAI | Vol/ha |
| Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ |
| 53 | 2.1 | 111 | 42 | 2.1 | 88 | 50 | 2.0 | 100 |
| 73 | 2.3 | 168 | 62 | 2.4 | 149 | 70 | 2.3 | 161 |
| 93 | 2.3 | 214 | 82 | 2.5 | 205 | 90 | 2.3 | 207 |
| $\mathbf{1 1 3}$ | 2.2 | 249 | $\mathbf{1 0 2}$ | 2.1 | 214 | $\mathbf{1 1 0}$ | 2.0 | 220 |
| 133 | 1.9 | 253 | 122 | 2.0 | 244 | 130 | 1.8 | 234 |
| 153 | 1.6 | 245 | 142 | 1.7 | 241 | 150 | 1.6 | 240 |

## Regenerated Stands

| Softwood |  |  | Mixedwood |  |  | Hardwood |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Age | MAI | Vol/ha | Age | MAI | Vol/ha | Age | MAI | Vol/ha |
| Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ |
| 27 | 2.7 | 73 | 21 | 2.2 | 46 | 21 | 1.9 | 40 |
| 47 | 3.1 | 146 | 41 | 2.7 | 111 | 41 | 2.4 | 98 |
| 67 | 2.9 | 194 | 61 | 2.9 | 177 | 61 | 2.8 | 171 |
| 87 | 2.8 | 244 | 81 | 2.8 | 227 | 81 | 2.8 | 227 |
| 107 | 2.3 | 246 | 101 | 2.5 | 253 | 101 | 2.2 | 222 |
| 127 | 1.9 | 241 | 121 | 2.2 | 266 | 121 | 1.9 | 230 |

Table 4: Regional Growth \& Yield Estimates (Continued)
Quebec - Boreal

## Existing Stands

| Softwood |  |  | Mixedwood |  |  | Hardwood |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Age | MAI | Vol/ha | Age | MAI | $\mathrm{Vol} / \mathrm{ha}$ | Age | MAI | Vol/ha |
| Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ |
| 44 | 0.7 | 31 | 32 | 0.9 | 29 | 18 | 0.9 | 16 |
| 64 | 1.2 | 77 | 52 | 1.5 | 78 | 38 | 1.6 | 61 |
| 84 | 1.2 | 101 | 72 | 1.6 | 115 | 58 | 2.0 | 116 |
| 104 | 1.0 | 104 | 92 | 1.4 | 129 | 78 | 1.8 | 140 |
| 124 | 0.7 | 87 | 112 | 1.0 | 112 | 98 | 1.5 | 147 |
| 144 | 0.5 | 72 | 132 | 0.6 | 79 | 118 | 0.9 | 106 |

Regenerated Stands

| Softwood |  |  | Mixedwood |  |  | Hardwood |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Age | MAI | Vol/ha | Age | MAI | Vol/ha | Age | MAI | Vol/ha |
| Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ |
| 16 | 0.4 | 6 | 6 | 0.3 | 2 | 0 | 0.5 | 0 |
| 36 | 0.9 | 32 | 26 | 1.0 | 26 | 16 | 1.0 | 16 |
| 56 | 1.3 | 73 | 46 | 1.8 | 83 | 36 | 1.9 | 68 |
| 76 | 1.4 | 106 | 66 | 1.8 | 119 | 56 | 2.1 | 118 |
| 96 | 1.1 | 106 | 86 | 1.4 | 120 | 76 | 1.9 | 144 |
| 116 | 0.9 | 104 | 106 | 0.7 | 74 | 96 | 1.7 | 163 |

Quebec - Great Lakes/St. Lawrence
Existing Stands

| Softwood |  |  | Mixedwood |  |  | Hardwood |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Age | MAI | $\mathrm{Vol} / \mathrm{ha}$ | Age | MAI | $\mathrm{Vol} / \mathrm{ha}$ | Age | MAI | Vol/ha |
| Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ |
| 0 | 0.0 | 0 | 10 | 0.6 | 6 | 25 | 1.2 | 30 |
| 20 | 1.3 | 26 | 30 | 1.5 | 45 | 45 | 1.7 | 77 |
| 40 | 1.5 | 60 | 50 | 1.9 | 95 | 65 | 2.0 | 130 |
| 60 | 1.6 | 96 | 70 | 2.0 | 140 | 85 | 2.2 | 187 |
| 80 | 1.4 | 112 | 90 | 1.9 | 171 | 105 | 2.0 | 210 |
| 100 | 1.0 | 100 | 110 | 1.7 | 187 | 125 | 1.9 | 238 |

## Regenerated Stands

|  | Softwood <br> Age | MAI <br> $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | Vol/ha <br> $\mathrm{m}^{3} / \mathrm{ha}$ | Mge <br> Years | Mixedwood <br> $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | Vol/ha <br> $\mathrm{m}^{3} / \mathrm{ha}$ | Age <br> Years | Mardwood <br> $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | 0.7 | 0 | 10 | 0.7 | 7 | 50 | 1.6 | Vol/ha $\mathrm{m}^{3} / \mathrm{ha}$ |
| 18 | 0.7 | 13 | 30 | 1.4 | 42 | 70 | 2.0 | 139 |
| 38 | 1.5 | 57 | 50 | 1.9 | 95 | 90 | 2.0 | 180 |
| $\mathbf{5 8}$ | 1.8 | 104 | $\mathbf{7 0}$ | 2.0 | 140 | $\mathbf{1 1 0}$ | 2.1 | 231 |
| 78 | 1.7 | 133 | 90 | 1.8 | 162 | 130 | 1.9 | 247 |
| 98 | 1.3 | 127 | 110 | 1.6 | 176 | 150 | 0.9 | 135 |

## Table 4: Regional Growth \& Yield Estimates (Continued)

Yukon and Interior B.C. - Boreal
Existing Stands

| Softwood |  |  | Mixedwood |  |  | Hardwood |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Age | MAI | $\mathrm{Vol} / \mathrm{ha}$ | Age | MAI | Vol/ha | Age | MAI | Vol/ha |
| Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ |
| 85 | 1.9 | 162 | 80 | 2.2 | 176 | 55 | 1.9 | 105 |
| 105 | 2.0 | 210 | 100 | 2.3 | 230 | 75 | 2.0 | 150 |
| 125 | 1.9 | 238 | 120 | 2.1 | 252 | 95 | 1.9 | 181 |
| 145 | 1.8 | 261 | 140 | 2.0 | 280 | 115 | 1.8 | 207 |
| 165 | 1.7 | 281 | 160 | 1.9 | 304 | 135 | 1.6 | 216 |
| 185 | 1.6 | 296 | 180 | 1.8 | 324 | 155 | 1.2 | 186 |

Regenerated Stands

| Softwood |  |  | Mixedwood |  |  | Hardwood |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Age | MAI | $\mathrm{Vol} / \mathrm{ha}$ | Age | MAI | Vol/ha | Age | MAI | Vol/ha |
| Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ | Years | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | $\mathrm{m}^{3} / \mathrm{ha}$ |
| 55 | 1.8 | 99 | 45 | 2.0 | 90 | 15 | 1.9 | 29 |
| 75 | 1.9 | 143 | 65 | 2.1 | 137 | 35 | 2.2 | 77 |
| 95 | 2.0 | 190 | 85 | 2.2 | 187 | 55 | 2.3 | 127 |
| 115 | 2.0 | 230 | 105 | 2.2 | 231 | 75 | 2.4 | 180 |
| 135 | 1.9 | 257 | 125 | 2.1 | 263 | 95 | 2.3 | 219 |
| 155 | 1.8 | 279 | 145 | 1.9 | 276 | 115 | 2.1 | 242 |

### 3.3 RESPONSES TO SILVICULTURAL TREATMENTS

As well as developing estimates for existing and regenerated stand growth rates, the survey attempted to obtain estimates of the growth responses to various silvicultural management options. Estimates were obtained for each species group (softwood, hardwood and mixed-wood) for growth-related data for unevenaged management, and responses to fertilization, cleaning/brushing, juvenile spacing/pre-commercial thinning, and commercial thinning for existing stands. For regenerated stands, response information was gathered for all of the above silvicultural techniques as well as genetic improvement. These estimates are summarized by region in Tables 5-17 and are shown in detail in the technical appendix to this report.

## Unevenaged Management

Participants were asked to estimate what proportion of the region was currently managed by unevenaged management as well as what portion of the area would be managed by unevenaged management in the future. Results tend overall to indicate that more area will be managed by unevenaged management in the future compared to the present levels, although there are many exceptions.

The Great Lakes/St. Lawrence region (both Quebec and Ontario) had the largest proportion of area managed by unevenaged management. Growth estimates for unevenaged management, in general and for most regions, tended to be lower, usually significantly lower, than the maximum MAI growth rates estimated for each species group. The reserve growing stock levels, with the exception of British Columbia, tended to be in the 80 to $120 \mathrm{~m}^{3} / \mathrm{ha}$ range, while the estimated cutting cycle was close to 20 years in almost all cases.

The survey results for this section tended to have less closure between survey rounds across all regions, and tended to have large standard deviations in comparison to mean values.

## Fertilization

Estimates of fertilization rates were in the 150 to $275 \mathrm{~kg} / \mathrm{ha}$ range, with a tendency to concentrate fertilization on Good and Medium site classes for both existing and regenerated stands. Age of application appears to vary considerably across regions as well as for existing and regenerated stands. For existing stands, results indicate that fertilization would occur near harvest age for the Quebec - Great Lakes/St. Lawrence, the Atlantic - Boreal and the Ontario - Boreal regions. On the other hand, fertilization in all Coastal and Interior British Columbia regions would occur only on young existing stands. In the remaining regions, fertilization tended to occur at mid-rotation age.

For regenerated stands, fertilization was expected to occur near harvest age for both Atlantic regions and the Quebec - Boreal region. Fertilization of regenerated stands was expected at an early stage for all British Columbia regions except the Coast British Columbia - Coast region which would be fertilized at an early to mid-rotation age time. Fertilization of the remaining regions was estimated to occur at mid-rotation age.

Estimates of growth increases from fertilization, and the duration of the increased growth, did not differ significantly between existing stands and regenerated stands in any specific region. Increased growth ranged from $0.1 \mathrm{~m}^{3} / \mathrm{ha} /$ year for regenerated stands in the Atlantic - Acadian region to $2.6 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{year}$ for Coast British Columbia - Coastal region, for

## Table 5: Estimated Results of Silvicultural Options

Atlantic - Acadian

## Existing Stands

| Unevenaged Management | Softwood |  | Mixedwood |  | Hardwood |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |
| Current Area Management | 4.0 | \% | 9.0 | \% | 23.0 | \% |
| Growth per Hectare per Year | 1.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 1.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 1.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ |
| After Cut Growing Stock | 79 | $\mathrm{m}^{3} / \mathrm{ha}$ | 77 | $\mathrm{m}^{3} / \mathrm{ha}$ | 77 | $\mathrm{m}^{3} / \mathrm{ha}$ |
| Cutting Cycle Length | 18 | years | 18 | years | 18 | years |
| Fertilization |  |  |  |  |  |  |
| Minimum Stand | 32 | years | 34 | years | 34 | years |
| Maximum Stand | 45 | years | 50 | years | 53 | years |
| Rate of Application | 200 | kg/ha | 200 | kg/ha | 200 | kg/ha |
| Increase in Growth | 0.2 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 0.2 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 0.2 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ |
| Duration of Increased Growth | 5 | years | 5 | years | 5 | years |
| Cleaning/Brushing |  |  |  |  |  |  |
| Change in Growth | 0.4 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 0.4 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 0.4 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ |
| Duration of Growth Response | 13 | years | 13 | years | 13 | years |
| Change in Tree Size Rotation | -5 | years | -5 | years | -5 | years |
| Change in MAI Rotation | -2 | years | -2 | years | -2 | years |
| Juv.Spacing/Pre-com. Thinning |  |  |  |  |  |  |
| Change in Growth | 2.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 2.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 2.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ |
| Duration of Growth Response | 23 | years | 23 | years | 23 | years |
| Change in Tree Size Rotation | 0 | years | 2 | years | 2 | years |
| Change in MAI Rotation | 10 | years | 10 | years | 10 | years |
| Commercial Thinning |  |  |  |  |  |  |
| Change in Growth | 0.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 0.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 0.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ |
| Duration of Growth Response | 20 | years | 20 | years | 20 | years |
| Change in Tree Size Rotation | -5 | years | -5 | years | -5 | years |
| Change in MAI Rotation | 10 | years | 10 | years | 10 | years |

# Table 5: Estimated Results of Silvicultural Options (Continued) Atlantic-Acadian 

## Regenerated Stands

|  | Softwood |  | Mixedwood |  | Hardwood |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Unevenaged Management |  |  |  |  |  |  |
| Current Area Management | 4.0 | \% | 6.0 | \% | 20.0 | \% |
| Growth per Hectare per Year | 4.9 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 1.9 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 1.9 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ |
| After Cut Growing Stock | 78 | $\mathrm{m}^{3} / \mathrm{ha}$ | 78 | $\mathrm{m}^{3} / \mathrm{ha}$ | 78 | $\mathrm{m}^{3} / \mathrm{ha}$ |
| Cutting Cycle Length | 18 | years | 18 | years | 18 | years |
| Fertilization |  |  |  |  |  |  |
| Minimum Stand | 25 | years | 25 | years | 25 | years |
| Maximum Stand | 40 | years | 40 | years | 50 | years |
| Rate of Application | 200 | kg/ha | 200 | kg/ha | 200 | kg/ha |
| Increase in Growth | 0.1 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 0.1 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 0.1 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ |
| Duration of Increased Growth | 5 | years | 5 | years | 5 | years |
| Cleaning/Brushing |  |  |  |  |  |  |
| Change in Growth | 0.4 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 0.4 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 0.4 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ |
| Duration of Growth Response | 13 | years | 13 | years | 13 | years |
| Change in Tree Size Rotation | 0 | years | 0 | years | 0 | years |
| Change in MAI Rotation | 0 | years | 0 | years | 0 | years |
| Juv.Spacing/Pre-com. Thinning |  |  |  |  |  |  |
| Change in Growth | 2.1 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 2.4 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 2.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ |
| Duration of Growth Response | 23 | years | 23 | years | 23 | years |
| Change in Tree Size Rotation | -13 | years | -13 | years | -11 | years |
| Change in MAI Rotation | 10 | years | 12 | years | 15 | years |
| Commercial Thinning |  |  |  |  |  |  |
| Change in Growth | 0.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 0.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 0.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ |
| Duration of Growth Response | 10 | years | 10 | years | 10 | years |
| Change in Tree Size Rotation | -5 | years | -5 | years | -5 | years |
| Change in MAI Rotation | 10 | years | 10 | years | 10 | years |
| Genetic Improvement |  |  |  |  |  |  |
| Change in MAI | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 0.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 0.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ |
| Change in Tree Size Rotation | 0 | years | -2 | years | -2 | years |
| Change in MAI Rotation | 0 | years | NA | years | NA | years |

## Table 6: Estimated Results of Silvicultural Options

## Atlantic - Boreal

Existing Stands

|  | Softwood |  | Mixedwood |  | Hardwood |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Unevenaged Management |  |  |  |  |  |  |
| Current Area Management | 2.0 | \% | 2.5 | \% | 2.5 | \% |
| Growth per Hectare per Year | 1.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 1.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 1.9 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ |
| After Cut Growing Stock | 75 | $\mathrm{m}^{3} / \mathrm{ha}$ | 100 | $\mathrm{m}^{3} / \mathrm{ha}$ | 125 | $\mathrm{m}^{3} / \mathrm{ha}$ |
| Cutting Cycle Length | 20 | years | 15 | years | 10 | years |
| Fertilization |  |  |  |  |  |  |
| Minimum Stand | 50 | years | 45 | years | NA | years |
| Maximum Stand | 70 | years | 55 | years | NA | years |
| Rate of Application | 200 | $\mathrm{kg} / \mathrm{ha}$ | 150 | kg/ha | NA | kg/ha |
| Increase in Growth | 1.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | NA | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ |
| Duration of Increased Growth | 10 | years | 5 | years | NA | years |
| Cleaning/Brushing |  |  |  |  |  |  |
| Change in Growth | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 1.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 1.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ |
| Duration of Growth Response | 15 | years | 15 | years | 5 | years |
| Change in Tree Size Rotation | -10 | years | -5 | years | -5 | years |
| Change in MAI Rotation | -5 | years | -3 | years | -5 | years |
| Juv.Spacing/Pre-com. Thinning |  |  |  |  |  |  |
| Change in Growth | 1.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 2.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 2.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ |
| Duration of Growth Response | 23 | years | 15 | years | 10 | years |
| Change in Tree Size Rotation | -18 | years | -15 | years | -10 | years |
| Change in MAI Rotation | -10 | years | -5 | years | 5 | years |
| Commercial Thinning |  |  |  |  |  |  |
| Change in Growth | 0.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 1.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ |
| Duration of Growth Response | 20 | years | 10 | years | 10 | years |
| Change in Tree Size Rotation | -3 | years | -2 | years | NA | years |
| Change in MAI Rotation | 3 | years | 2 | years | NA | years |

## Table 6: Estimated Results of Silvicultural Options (Continued)

## Atlantic - Boreal

## Regenerated Stands

| Unevenaged Management | Softwood |  | Mixedwood |  | Hardwood |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |
| Current Area Management | 3.0 | \% | 5.0 | \% | 5.0 | \% |
| Growth per Hectare per Year | 1.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | NA | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | NA | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ |
| After Cut Growing Stock | 85 | $\mathrm{m}^{3} / \mathrm{ha}$ | 110 | $\mathrm{m}^{3} / \mathrm{ha}$ | 135 | $\mathrm{m}^{3} / \mathrm{ha}$ |
| Cutting Cycle Length | 20 | years | 15 | years | 10 | years |
| Fertilization |  |  |  |  |  |  |
| Minimum Stand | 30 | years | 35 | years | NA | years |
| Maximum Stand | 50 | years | 45 | years | NA | years |
| Rate of Application | 150 | kg/ha | 100 | kg/ha | NA | kg/ha |
| Increase in Growth | 1.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 1.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | NA | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ |
| Duration of Increased Growth | 10 | years | 5 | years | NA | years |
| Cleaning/Brushing |  |  |  |  |  |  |
| Change in Growth | 1.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 1.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 1.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ |
| Duration of Growth Response | 20 | years | 10 | years | 10 | years |
| Change in Tree Size Rotation | -15 | years | -10 | years | -10 | years |
| Change in MAI Rotation | -10 | years | -5 | years | -5 | years |
| Juv.Spacing/Pre-com. Thinning |  |  |  |  |  |  |
| Change in Growth | 1.4 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 1.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 1.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ |
| Duration of Growth Response | 30 | years | 20 | years | 15 | years |
| Change in Tree Size Rotation | -20 | years | -20 | years | -15 | years |
| Change in MAI Rotation | -13 | years | -10 | years | -10 | years |
| Commercial Thinning |  |  |  |  |  |  |
| Change in Growth | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 1.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 1.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ |
| Duration of Growth Response | 20 | years | 10 | years | 10 | years |
| Change in Tree Size Rotation | -3 | years | -2 | years | NA | years |
| Change in MAI Rotation | 3 | years | 2 | years | NA | years |
| Genetic Improvement |  |  |  |  |  |  |
| Change in MAI | 0.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 0.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ |
| Change in Tree Size Rotation | -10 | years | -5 | years | -5 | years |
| Change in MAI Rotation | -5 | years | -3 | years | -3 | years |

## Table 7: Estimated Results of Silvicultural Options

Coastal B.C. - Coast

## Existing Stands

| Unevenaged Management | Softwood |  | Mixedwood |  | Hardwood |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |
| Current Area Management | 4.0 | $\%$ | 2.0 | \% | 0.0 | \% |
| Growth per Hectare per Year | 4.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 3.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 1.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ |
| After Cut Growing Stock | 338 | $\mathrm{m}^{3} / \mathrm{ha}$ | 267 | $\mathrm{m}^{3} / \mathrm{ha}$ | 175 | $\mathrm{m}^{3} / \mathrm{ha}$ |
| Cutting Cycle Length | 20 | years | 18 | years | 10 | years |
| Fertilization |  |  |  |  |  |  |
| Minimum Stand | 28 | years | 33 | years | 0 | years |
| Maximum Stand | 45 | years | 52 | years | 12 | years |
| Rate of Application | 233 | kg/ha | 225 | kg/ha | 75 | kg/ha |
| Increase in Growth | 2.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 1.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ |
| Duration of Increased Growth | 29 | years | 10 | years | 7 | years |
| Cleaning/Brushing |  |  |  |  |  |  |
| Change in Growth | 1.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 1.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ |
| Duration of Growth Response | 40 | years | 40 | years | 22 | years |
| Change in Tree Size Rotation | -12 | years | -13 | years | -3 | years |
| Change in MAI Rotation | 4 | years | 7 | years | 0 | years |
| Juv.Spacing/Pre-com. Thinning |  |  |  |  |  |  |
| Change in Growth | -0.2 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | -0.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | -0.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ |
| Duration of Growth Response | 30 | years | 7 | years | 6 | years |
| Change in Tree Size Rotation | -12 | years | -13 | years | -5 | years |
| Change in MAI Rotation | -9 | years | 7 | years | 0 | years |
| Commercial Thinning |  |  |  |  |  |  |
| Change in Growth | -1.1 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | -1.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ | -1.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{y}$ |
| Duration of Growth Response | 40 | years | 37 | years | 35 | years |
| Change in Tree Size Rotation | -2 | years | -2 | years | -2 | years |
| Change in MAI Rotation | 11 | years | 13 | years | 2 | years |

# Table 7: Estimated Results of Silvicultural Options (Continued) 

Coastal B.C. - Coast

## Regenerated Stands

|  | Softwood |  | Mixedwood |  | Hardwood |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Unevenaged Management |  |  |  |  |  |  |
| Current Area Management | 5.0 | \% | 5.0 | \% | 0.0 | \% |
| Growth per Hectare per Year | 5.4 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 4.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| After Cut Growing Stock | 300 | $\mathrm{m}^{3} / \mathrm{ha}$ | 267 | $\mathrm{m}^{3} / \mathrm{ha}$ | 175 | $\mathrm{m}^{3} / \mathrm{ha}$ |
| Cutting Cycle Length | 20 | years | 20 | years | 10 | years |
| Fertilization |  |  |  |  |  |  |
| Minimum Stand | 24 | years | 28 | years | 0 | years |
| Maximum Stand | 45 | years | 48 | years | 16 | years |
| Rate of Application | 233 | $\mathrm{kg} / \mathrm{ha}$ | 125 | $\mathrm{kg} / \mathrm{ha}$ | 75 | kg/ha |
| Increase in Growth | 2.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Increased Growth | 28 | years | 12 | years | 7 | years |
| Cleaning/Brushing |  |  |  |  |  |  |
| Change in Growth | 1.4 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 39 | years | 39 | years | 23 | years |
| Change in Tree Size Rotation | -12 | years | -13 | years | -3 | years |
| Change in MAI Rotation | 4 | years | 8 | years | -2 | years |
| Juv.Spacing/Pre-com. Thinning |  |  |  |  |  |  |
| Change in Growth | -0.4 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -0.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -0.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 30 | years | 7 | years | 6 | years |
| Change in Tree Size Rotation | -13 | years | -13 | years | -5 | years |
| Change in MAI Rotation | 9 | years | 8 | years | 1 | years |
| Commercial Thinning |  |  |  |  |  |  |
| Change in Growth | -1.1 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -1.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | $-1.3$ | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 43 | years | 38 | years | 35 | years |
| Change in Tree Size Rotation | -3 | years | -4 | years | -3 | years |
| Change in MAI Rotation | 10 | years | 11 | years | 0 | years |
| Genetic Improvement |  |  |  |  |  |  |
| Change in MAI | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.1 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.2 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Change in Tree Size Rotation | -6 | years | -5 | years | -7 | years |
| Change in MAI Rotation | -4 | years | -4 | years | -7 | years |

## Table 8: Estimated Results of Silvicultural Options

## Coastal B.C. - Subalpine

## Existing Stands

|  | Softwood |  | Mixedwood |  | Hardwood |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Unevenaged Management |  |  |  |  |  |  |
| Current Area Management | 3.0 | \% | 3.0 | \% | 0.0 | \% |
| Growth per Hectare per Year | 2.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 2.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| After Cut Growing Stock | 118 | $\mathrm{m}^{3} / \mathrm{ha}$ | 107 | $\mathrm{m}^{3} / \mathrm{ha}$ | 0 | $\mathrm{m}^{3} / \mathrm{ha}$ |
| Cutting Cycle Length | 26 | years | 27 | years | 0 | years |
| Fertilization |  |  |  |  |  |  |
| Minimum Stand | 25 | years | 35 | years | 0 | years |
| Maximum Stand | 40 | years | 53 | years | 25 | years |
| Rate of Application | 135 | kg/ha | 250 | kg/ha | 0 | kg/ha |
| Increase in Growth | 1.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Increased Growth | 35 | years | 13 | years | 13 | years |
| Cleaning/Brushing |  |  |  |  |  |  |
| Change in Growth | 0.4 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.4 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.4 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 35 | years | 48 | years | 30 | years |
| Change in Tree Size Rotation | -10 | years | -12 | years | -5 | years |
| Change in MAI Rotation | 7 | years | 12 | years | -3 | years |
| Juv.Spacing/Pre-com. Thinning |  |  |  |  |  |  |
| Change in Growth | -0.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -0.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -0.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 32 | years | 10 | years | 7 | years |
| Change in Tree Size Rotation | -12 | years | -15 | years | -7 | years |
| Change in MAI Rotation | 5 | years | 3 | years | 0 | years |
| Commercial Thinning |  |  |  |  |  |  |
| Change in Growth | -1.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -1.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -1.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 33 | years | 40 | years | 27 | years |
| Change in Tree Size Rotation | -4 | years | -3 | years | -3 | years |
| Change in MAI Rotation | 15 | years | 17 | years | 7 | years |

## Table 8: Estimated Results of Silvicultural Options (Continued)

## Coastal B.C. - Subalpine

## Regenerated Stands

|  | Softwood |  | Mixedwood |  | Hardwood |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Unevenaged Management |  |  |  |  |  |  |
| Current Area Management | 6.0 | \% | 7.0 | \% | 0.0 | \% |
| Growth per Hectare per Year | 2.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 2.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| After Cut Growing Stock | 163 | $\mathrm{m}^{3} / \mathrm{ha}$ | 167 | $\mathrm{m}^{3} / \mathrm{ha}$ | 0 | $\mathrm{m}^{3} / \mathrm{ha}$ |
| Cutting Cycle Length | 24 | years | 23 | years | 0 | years |
| Fertilization |  |  |  |  |  |  |
| Minimum Stand | 25 | years | 35 | years | 0 | years |
| Maximum Stand | 40 | years | 53 | years | 25 | years |
| Rate of Application | 135 | kg/ha | 250 | $\mathrm{kg} / \mathrm{ha}$ | 0 | kg/ha |
| Increase in Growth | 1.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Increased Growth | 20 | years | 13 | years | 13 | years |
| Cleaning/Brushing |  |  |  |  |  |  |
| Change in Growth | 0.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 30 | years | 37 | years | 23 | years |
| Change in Tree Size Rotation | -9 | years | -10 | years | -2 | years |
| Change in MAI Rotation | 5 | years | 7 | years | -2 | years |
| Juv.Spacing/Pre-com. Thinning |  |  |  |  |  |  |
| Change in Growth | -0.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -0.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | $-0.3$ | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 31 | years | 8 | years | 7 | years |
| Change in Tree Size Rotation | -9 | years | -13 | years | -5 | years |
| Change in MAI Rotation | 5 | years | 7 | years | 0 | years |
| Commercial Thinning |  |  |  |  |  |  |
| Change in Growth | -1.4 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -1.2 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | $-1.2$ | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 33 | years | 38 | years | 27 | years |
| Change in Tree Size Rotation | -4 | years | -3 | years | -3 | years |
| Change in MAI Rotation | 16 | years | 17 | years | 7 | years |
| Genetic Improvement |  |  |  |  |  |  |
| Change in MAI | 0.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Change in Tree Size Rotation | -7 | years | -6 | years | -6 | years |
| Change in MAI Rotation | -5 | years | -6 | years | -6 | years |

## Table 9: Estimated Results of Silvicultural Options

Interior B.C. - Columbia

Existing Stands

| Unevenaged Management | Softwood |  | Mixedwood |  | Hardwood |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |
| Current Area Management | 20.0 | \% | 20.0 | \% | NA | \% |
| Growth per Hectare per Year | 2.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 2.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | NA | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| After Cut Growing Stock | 150 | $\mathrm{m}^{3} / \mathrm{ha}$ | 150 | $\mathrm{m}^{3} / \mathrm{ha}$ | NA | $\mathrm{m}^{3} / \mathrm{ha}$ |
| Cutting Cycle Length | 30 | years | 30 | years | NA | years |
| Fertilization |  |  |  |  |  |  |
| Minimum Stand | 0 | years | 0 | years | 0 | years |
| Maximum Stand | 30 | years | 30 | years | 20 | years |
| Rate of Application | NA | kg/ha | NA | kg/ha | NA | kg/ha |
| Increase in Growth | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Increased Growth | 15 | years | 15 | years | 10 | years |
| Cleaning/Brushing |  |  |  |  |  |  |
| Change in Growth | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 15 | years | 15 | years | 10 | years |
| Change in Tree Size Rotation | -5 | years | -5 | years | -5 | years |
| Change in MAI Rotation | -5 | years | -5 | years | -5 | years |
| Juv.Spacing/Pre-com. Thinning |  |  |  |  |  |  |
| Change in Growth | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 15 | years | 15 | years | 10 | years |
| Change in Tree Size Rotation | -10 | years | -10 | years | -5 | years |
| Change in MAI Rotation | 0 | years | 0 | years | 0 | years |
| Commercial Thinning |  |  |  |  |  |  |
| Change in Growth | -1.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -1.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -1.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 20 | years | 20 | years | 15 | years |
| Change in Tree Size Rotation | -3 | years | -3 | years | -5 | years |
| Change in MAI Rotation | 10 | years | 10 | years | 10 | years |

## Table 9: Estimated Results of Silvicultural Options (Continued)

## Interior B.C. - Columbia

## Regenerated Stands

| Unevenaged Management | Softwood |  | Mixedwood |  | Hardwood |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |
| Current Area Management | 30.0 | \% | 30.0 | \% | 0.0 | \% |
| Growth per Hectare per Year | 2.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 2.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | NA | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| After Cut Growing Stock | 150 | $\mathrm{m}^{3} / \mathrm{ha}$ | 150 | $\mathrm{m}^{3} / \mathrm{ha}$ | NA | $\mathrm{m}^{3} / \mathrm{ha}$ |
| Cutting Cycle Length | 30 | years | 30 | years | NA | years |
| Fertilization |  |  |  |  |  |  |
| Minimum Stand | 0 | years | 0 | years | 0 | years |
| Maximum Stand | 20 | years | 20 | years | 15 | years |
| Rate of Application | NA | kg/ha | NA | kg/ha | NA | kg/ha |
| Increase in Growth | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Increased Growth | 15 | years | 15 | years | 10 | years |
| Cleaning/Brushing |  |  |  |  |  |  |
| Change in Growth | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 15 | years | 15 | years | 10 | years |
| Change in Tree Size Rotation | -5 | years | -5 | years | -5 | years |
| Change in MAI Rotation | -5 | years | -5 | years | -5 | years |
| Juv.Spacing/Pre-com. Thinning |  |  |  |  |  |  |
| Change in Growth | -1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 15 | years | 15 | years | 10 | years |
| Change in Tree Size Rotation | -10 | years | -10 | years | -5 | years |
| Change in MAI Rotation | 0 | years | 0 | years | 0 | years |
| Commercial Thinning |  |  |  |  |  |  |
| Change in Growth | -1.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -1.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -1.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 20 | years | 20 | years | 15 | years |
| Change in Tree Size Rotation | -5 | years | -5 | years | -5 | years |
| Change in MAI Rotation | 10 | years | 10 | years | 10 | years |
| Genetic Improvement |  |  |  |  |  |  |
| Change in MAI | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Change in Tree Size Rotation | -5 | years | -5 | years | -10 | years |
| Change in MAI Rotation | -5 | years | -5 | years | -10 | years |

## Table 10: Estimated Results of Silvicultural Options

## Interior B.C. - Montane

## Existing Stands

|  | Softwood |  | Mixedwood |  | Hardwood |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Unevenaged Management |  |  |  |  |  |  |
| Current Area Management | 10.0 | \% | 0.0 | \% | 0.0 | \% |
| Growth per Hectare per Year | 1.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | NA | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | NA | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| After Cut Growing Stock | 105 | $\mathrm{m}^{3} / \mathrm{ha}$ | NA | $\mathrm{m}^{3} / \mathrm{ha}$ | NA | $\mathrm{m}^{3} / \mathrm{ha}$ |
| Cutting Cycle Length | 30 | years | NA | years | NA | years |
| Fertilization |  |  |  |  |  |  |
| Minimum Stand | 0 | years | 0 | years | 0 | years |
| Maximum Stand | 30 | years | 30 | years | 20 | years |
| Rate of Application | NA | kg/ha | NA | kg/ha | NA | kg/ha |
| Increase in Growth | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | NA | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Increased Growth | 15 | years | 15 | years | NA | years |
| Cleaning/Brushing |  |  |  |  |  |  |
| Change in Growth | -0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 15 | years | 15 | years | 10 | years |
| Change in Tree Size Rotation | -5 | years | -5 | years | -5 | years |
| Change in MAI Rotation | -10 | years | -10 | years | -10 | years |
| Juv.Spacing/Pre-com. Thinning |  |  |  |  |  |  |
| Change in Growth | -0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 20 | years | 20 | years | 10 | years |
| Change in Tree Size Rotation | -10 | years | -10 | years | -5 | years |
| Change in MAI Rotation | 0 | years | 0 | years | 0 | years |
| Commercial Thinning |  |  |  |  |  |  |
| Change in Growth | $-1.0$ | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 20 | years | 20 | years | 20 | years |
| Change in Tree Size Rotation | -5 | years | -5 | years | -5 | years |
| Change in MAI Rotation | 10 | years | 10 | years | 5 | years |

## Table 10: Estimated Results of Silvicultural Options (Continued)

## Interior B.C. - Montane

## Regenerated Stands

|  | Softwood |  | Mixedwood |  | Hardwood |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Unevenaged Management |  |  |  |  |  |  |
| Current Area Management | 20.0 | \% | 20.0 | \% | NA | \% |
| Growth per Hectare per Year | 2.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 2.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | NA | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| After Cut Growing Stock | 150 | $\mathrm{m}^{3} / \mathrm{ha}$ | 150 | $\mathrm{m}^{3} / \mathrm{ha}$ | NA | $\mathrm{m}^{3} / \mathrm{ha}$ |
| Cutting Cycle Length | 25 | years | 25 | years | NA | years |
| Fertilization |  |  |  |  |  |  |
| Minimum Stand | 0 | years | 0 | years | 0 | years |
| Maximum Stand | 30 | years | 30 | years | 20 | years |
| Rate of Application | NA | $\mathrm{kg} / \mathrm{ha}$ | NA | kg/ha | NA | kg/ha |
| Increase in Growth | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | NA | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Increased Growth | 15 | years | 15 | years | NA | years |
| Cleaning/Brushing |  |  |  |  |  |  |
| Change in Growth | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 15 | years | 15 | years | 10 | years |
| Change in Tree Size Rotation | -5 | years | -5 | years | -5 | years |
| Change in MAI Rotation | -10 | years | -10 | years | -10 | years |
| Juv.Spacing/Pre-com. Thinning |  |  |  |  |  |  |
| Change in Growth | -0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 20 | years | 20 | years | 10 | years |
| Change in Tree Size Rotation | -10 | years | -10 | years | -5 | years |
| Change in MAI Rotation | 0 | years | 0 | years | 0 | years |
| Commercial Thinning |  |  |  |  |  |  |
| Change in Growth | -1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | $-1.0$ | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 20 | years | 20 | years | 20 | years |
| Change in Tree Size Rotation | -5 | years | -5 | years | -5 | years |
| Change in MAI Rotation | 10 | years | 10 | years | 5 | years |
| Genetic Improvement |  |  |  |  |  |  |
| Change in MAI | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Change in Tree Size Rotation | -10 | years | -10 | years | -15 | years |
| Change in MAI Rotation | $-10$ | years | -10 | years | -20 | years |

## Table 11: Estimated Results of Silvicultural Options

## Interior B.C. - Subalpine

## Existing Stands

|  | Softwood |  | Mixedwood |  | Hardwood |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Unevenaged Management |  |  |  |  |  |  |
| Current Area Management | 10.0 | \% | 10.0 | \% | 0.0 | \% |
| Growth per Hectare per Year | 2.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 2.2 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | NA | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| After Cut Growing Stock | 150 | $\mathrm{m}^{3} / \mathrm{ha}$ | 150 | $\mathrm{m}^{3} / \mathrm{ha}$ | NA | $\mathrm{m}^{3} / \mathrm{ha}$ |
| Cutting Cycle Length | 30 | years | 30 | years | NA | years |
| Fertilization |  |  |  |  |  |  |
| Minimum Stand | 0 | years | 0 | years | 0 | years |
| Maximum Stand | 30 | years | 30 | years | 29 | years |
| Rate of Application | NA | kg/ha | NA | kg/ha | NA | $\mathrm{kg} / \mathrm{ha}$ |
| Increase in Growth | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | NA | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Increased Growth | 10 | years | 10 | years | NA | years |
| Cleaning/Brushing |  |  |  |  |  |  |
| Change in Growth | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 15 | years | 15 | years | 10 | years |
| Change in Tree Size Rotation | -10 | years | -10 | years | -5 | years |
| Change in MAI Rotation | $-10$ | years | -10 | years | -5 | years |
| Juv.Spacing/Pre-com. Thinning |  |  |  |  |  |  |
| Change in Growth | -1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | $-1.0$ | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -0.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 15 | years | 15 | years | 10 | years |
| Change in Tree Size Rotation | -10 | years | -10 | years | -10 | years |
| Change in MAI Rotation | 0 | years | 0 | years | 0 | years |
| Commercial Thinning |  |  |  |  |  |  |
| Change in Growth | $-1.5$ | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -1.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | $-1.0$ | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 15 | years | 15 | years | 10 | years |
| Change in Tree Size Rotation | -5 | years | -5 | years | -5 | years |
| Change in MAI Rotation | 10 | years | 10 | years | 5 | years |

## Table 11: Estimated Results of Silvicultural Options (Continued)

## Interior B.C. - Subalpine

## Regenerated Stands

|  | Softwood |  | Mixedwood |  | Hardwood |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Unevenaged Management |  |  |  |  |  |  |
| Current Area Management | 20.0 | \% | 10.0 | \% | NA | \% |
| Growth per Hectare per Year | 2.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 2.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | NA | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| After Cut Growing Stock | 150 | $\mathrm{m}^{3} / \mathrm{ha}$ | 150 | $\mathrm{m}^{3} / \mathrm{ha}$ | NA | $\mathrm{m}^{3} / \mathrm{ha}$ |
| Cutting Cycle Length | 30 | years | 30 | years | NA | years |
| Fertilization |  |  |  |  |  |  |
| Minimum Stand | 0 | years | 0 | years | 0 | years |
| Maximum Stand | 30 | years | 30 | years | 10 | years |
| Rate of Application | NA | kg/ha | NA | $\mathrm{kg} / \mathrm{ha}$ | NA | kg/ha |
| Increase in Growth | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | NA | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Increased Growth | 15 | years | 15 | years | NA | years |
| Cleaning/Brushing |  |  |  |  |  |  |
| Change in Growth | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 15 | years | 15 | years | 10 | years |
| Change in Tree Size Rotation | -10 | years | -10 | years | -5 | years |
| Change in MAI Rotation | -10 | years | -10 | years | -5 | years |
| Juv.Spacing/Pre-com. Thinning |  |  |  |  |  |  |
| Change in Growth | $-1.0$ | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | $-1.0$ | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -0.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 15 | years | 15 | years | 10 | years |
| Change in Tree Size Rotation | -10 | years | -10 | years | -10 | years |
| Change in MAI Rotation | 0 | years | 0 | years | 0 | years |
| Commercial Thinning |  |  |  |  |  |  |
| Change in Growth | -1.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -1.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 15 | years | 15 | years | 10 | years |
| Change in Tree Size Rotation | -5 | years | -5 | years | -5 | years |
| Change in MAI Rotation | 10 | years | 10 | years | 5 | years |
| Genetic Improvement |  |  |  |  |  |  |
| Change in MAI | 0.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Change in Tree Size Rotation | -5 | years | -5 | years | -5 | years |
| Change in MAI Rotation | -5 | years | -5 | years | -10 | years |

## Table 12: Estimated Results of Silvicultural Options <br> NWT and Prairies - Boreal

## Existing Stands

|  | Softwood |  | Mixedwood |  | Hardwood |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Unevenaged Management |  |  |  |  |  |  |
| Current Area Management | 1.0 | \% | 4.0 | \% | 0.0 | \% |
| Growth per Hectare per Year | 1.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| After Cut Growing Stock | 68 | $\mathrm{m}^{3} / \mathrm{ha}$ | 90 | $\mathrm{m}^{3} / \mathrm{ha}$ | 27 | $\mathrm{m}^{3} / \mathrm{ha}$ |
| Cutting Cycle Length | 35 | years | 43 | years | 17 | years |
| Fertilization |  |  |  |  |  |  |
| Minimum Stand | 37 | years | 41 | years | 25 | years |
| Maximum Stand | 72 | years | 75 | years | 57 | years |
| Rate of Application | 74 | kg/ha | 56 | kg/ha | 36 | kg/ha |
| Increase in Growth | 1.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.9 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 2.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Increased Growth | 8 | years | 8 | years | 8 | years |
| Cleaning/Brushing |  |  |  |  |  |  |
| Change in Growth | 0.4 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 9 | years | 9 | years | 8 | years |
| Change in Tree Size Rotation | -9 | years | -8 | years | -8 | years |
| Change in MAI Rotation | -6 | years | -3 | years | -3 | years |
| Juv.Spacing/Pre-com. Thinning |  |  |  |  |  |  |
| Change in Growth | 0.2 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.2 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.2 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 9 | years | 9 | years | 8 | years |
| Change in Tree Size Rotation | -8 | years | -5 | years | -4 | years |
| Change in MAI Rotation | -1 | years | 0 | years | 0 | years |
| Commercial Thinning |  |  |  |  |  |  |
| Change in Growth | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 12 | years | 11 | years | 10 | years |
| Change in Tree Size Rotation | -10 | years | -8 | years | -5 | years |
| Change in MAI Rotation | 1 | years | 0 | years | -1 | years |

# Table 12: Estimated Results of Silvicultural Options(Continued) NWT and Prairies - Boreal 

## Regenerated Stands

|  | Softwood |  | Mixedwood |  | Hardwood |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Unevenaged Management |  |  |  |  |  |  |
| Current Area Management | 2.0 | \% | 12.0 | \% | 2.0 | \% |
| Growth per Hectare per Year | 1.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| After Cut Growing Stock | 40 | $\mathrm{m}^{3} / \mathrm{ha}$ | 86 | $\mathrm{m}^{3} / \mathrm{ha}$ | 36 | $\mathrm{m}^{3} / \mathrm{ha}$ |
| Cutting Cycle Length | 34 | years | 29 | years | 20 | years |
| Fertilization |  |  |  |  |  |  |
| Minimum Stand | 41 | years | 42 | years | 28 | years |
| Maximum Stand | 76 | years | 78 | years | 59 | years |
| Rate of Application | 74 | kg/ha | 81 | kg/ha | 36 | kg/ha |
| Increase in Growth | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.2 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Increased Growth | 9 | years | 10 | years | 8 | years |
| Cleaning/Brushing |  |  |  |  |  |  |
| Change in Growth | 0.4 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 8 | years | 8 | years | 7 | years |
| Change in Tree Size Rotation | -7 | years | -7 | years | -6 | years |
| Change in MAI Rotation | -5 | years | -5 | years | -5 | years |
| Juv.Spacing/Pre-com. Thinning |  |  |  |  |  |  |
| Change in Growth | 0.2 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 10 | years | 9 | years | 8 | years |
| Change in Tree Size Rotation | -8 | years | -8 | years | -7 | years |
| Change in MAI Rotation | -1 | years | -1 | years | -1 | years |
| Commercial Thinning |  |  |  |  |  |  |
| Change in Growth | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 12 | years | 11 | years | 11 | years |
| Change in Tree Size Rotation | -8 | years | -7 | years | -5 | years |
| Change in MAI Rotation | 0 | years | -1 | years | -1 | years |
| Genetic Improvement |  |  |  |  |  |  |
| Change in MAI | 0.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.9 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.2 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Change in Tree Size Rotation | -11 | years | -11 | years | -13 | years |
| Change in MAI Rotation | -2 | years | -2 | years | -3 | years |

## Table 13: Estimated Results of Silvicultural Options

## Ontario - Boreal

## Existing Stands

| Unevenaged Management | Softwood |  | Mixedwood |  | Hardwood |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |
| Current Area Management | NA | \% | 9.0 | \% | 10.0 | \% |
| Growth per Hectare per Year | 1.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 2.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 2.4 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| After Cut Growing Stock | 43 | $\mathrm{m}^{3} / \mathrm{ha}$ | 52 | $\mathrm{m}^{3} / \mathrm{ha}$ | 57 | $\mathrm{m}^{3} / \mathrm{ha}$ |
| Cutting Cycle Length | 32 | years | 29 | years | 22 | years |
| Fertilization |  |  |  |  |  |  |
| Minimum Stand | 14 | years | 8 | years | 7 | years |
| Maximum Stand | 35 | years | 33 | years | 30 | years |
| Rate of Application | 183 | kg/ha | 175 | kg/ha | 175 | kg/ha |
| Increase in Growth | 0.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Increased Growth | 9 | years | 9 | years | 8 | years |
| Cleaning/Brushing |  |  |  |  |  |  |
| Change in Growth | 0.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 11 | years | 6 | years | 7 | years |
| Change in Tree Size Rotation | -2 | years | 1 | years | 1 | years |
| Change in MAI Rotation | -1 | years | -2 | years | 2 | years |
| Juv.Spacing/Pre-com. Thinning |  |  |  |  |  |  |
| Change in Growth | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 12 | years | 9 | years | 12 | years |
| Change in Tree Size Rotation | -7 | years | -1 | years | -1 | years |
| Change in MAI Rotation | -2 | years | -3 | years | -3 | years |
| Commercial Thinning |  |  |  |  |  |  |
| Change in Growth | 0.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 10 | years | 8 | years | 9 | years |
| Change in Tree Size Rotation | -1 | years | -3 | years | -3 | years |
| Change in MAI Rotation | -2 | years | -2 | years | -2 | years |

## Table 13: Estimated Results of Silvicultural Options (Continued)

## Ontario - Boreal

Regenerated Stands

| Unevenaged Management | Regenerated Stands |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Softwood |  | Mixedwood |  | Hardwood |  |
|  |  |  |  |  |  |  |
| Current Area Management | 5.0 | \% | 9.0 | \% | 10.0 | \% |
| Growth per Hectare per Year | 1.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 2.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 2.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| After Cut Growing Stock | 55 | $\mathrm{m}^{3} / \mathrm{ha}$ | 55 | $\mathrm{m}^{3} / \mathrm{ha}$ | 55 | $\mathrm{m}^{3} / \mathrm{ha}$ |
| Cutting Cycle Length | 22 | years | 20 | years | 20 | years |
| Fertilization |  |  |  |  |  |  |
| Minimum Stand | 5 | years | 8 | years | 5 | years |
| Maximum Stand | 30 | years | 30 | years | 30 | years |
| Rate of Application | 200 | kg/ha | 150 | kg/ha | 150 | kg/ha |
| Increase in Growth | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Increased Growth | 10 | years | 8 | years | 15 | years |
| Cleaning/Brushing |  |  |  |  |  |  |
| Change in Growth | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 8 | years | 7 | years | 10 | years |
| Change in Tree Size Rotation | -4 | years | -1 | years | -4 | years |
| Change in MAI Rotation | -2 | years | -1 | years | -4 | years |
| Juv.Spacing/Pre-com. Thinning |  |  |  |  |  |  |
| Change in Growth | 0.2 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.2 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.2 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 10 | years |  | years | 9 | years |
| Change in Tree Size Rotation | -4 | years | -2 | years | -3 | years |
| Change in MAI Rotation | -3 | years | -1 | years | -3 | years |
| Commercial Thinning |  |  |  |  |  |  |
| Change in Growth | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | NA | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 10 | years | 11 | years | 11 | years |
| Change in Tree Size Rotation | -2 | years | -2 | years | -2 | years |
| Change in MAI Rotation | -2 | years | -2 | years | -2 | years |
| Genetic Improvement |  |  |  |  |  |  |
| Change in MAI | 0.4 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Change in Tree Size Rotation | 1 | years | -1 | years | -1 | years |
| Change in MAI Rotation | 1 | years | -1 | years | -1 | years |

## Table 14: Estimated Results of Silvicultural Options <br> Ontario - Great Lakes/St. Lawrence

## Existing Stands

| Unevenaged Management | Softwood |  | Mixedwood |  | Hardwood |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |
| Current Area Management | 15.0 | \% | 25.0 | \% | 50.0 | \% |
| Growth per Hectare per Year | 2.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 2.2 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 2.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| After Cut Growing Stock | 50 | $\mathrm{m}^{3} / \mathrm{ha}$ | 50 | $\mathrm{m}^{3} / \mathrm{ha}$ | 63 | $\mathrm{m}^{3} / \mathrm{ha}$ |
| Cutting Cycle Length | 17 | years | 19 | years | 22 | years |
| Fertilization |  |  |  |  |  |  |
| Minimum Stand | 11 | years | 11 | years | 6 | years |
| Maximum Stand | 33 | years | 31 | years | 33 | years |
| Rate of Application | 200 | kg/ha | 208 | kg/ha | 235 | kg/ha |
| Increase in Growth | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.9 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Increased Growth | 5 | years | 5 | years | 5 | years |
| Cleaning/Brushing |  |  |  |  |  |  |
| Change in Growth | 0.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 11 | years | 6 | years | 5 | years |
| Change in Tree Size Rotation | -3 | years | -1 | years | -1 | years |
| Change in MAI Rotation | -1 | years | 0 | years | 0 | years |
| Juv.Spacing/Pre-com. Thinning |  |  |  |  |  |  |
| Change in Growth | 0.9 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.9 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.9 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 10 | years | 8 | years | 7 | years |
| Change in Tree Size Rotation | -5 | years | -4 | years | -4 | years |
| Change in MAI Rotation | 0 | years | -1 | years | 0 | years |
| Commercial Thinning |  |  |  |  |  |  |
| Change in Growth | 0.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 9 | years | 10 | years | 11 | years |
| Change in Tree Size Rotation | -2 | years | -2 | years | -3 | years |
| Change in MAI Rotation | 1 | years | 1 | years | 1 | years |

Table 14: Estimated Results of Silvicultural Options (Continued) Ontario - Great Lakes/St. Lawrence

Regenerated Stands

|  | Softwood |  | Mixedwood |  | Hardwood |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Unevenaged Management |  |  |  |  |  |  |
| Current Area Management | 23.0 | \% | 33.0 | \% | 51.0 | \% |
| Growth per Hectare per Year | 2.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 2.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 2.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| After Cut Growing Stock | 66 | $\mathrm{m}^{3} / \mathrm{ha}$ | 84 | $\mathrm{m}^{3} / \mathrm{ha}$ | 82 | $\mathrm{m}^{3} / \mathrm{ha}$ |
| Cutting Cycle Length | 22 | years | 22 | years | 19 | years |
| Fertilization |  |  |  |  |  |  |
| Minimum Stand | 15 | years | 13 | years | 15 | years |
| Maximum Stand | 24 | years | 24 | years | 32 | years |
| Rate of Application | 200 | $\mathrm{kg} / \mathrm{ha}$ | 239 | $\mathrm{kg} / \mathrm{ha}$ | 175 | kg/ha |
| Increase in Growth | 0.9 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.4 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Increased Growth | 6 | years | 7 | years | 6 | years |
| Cleaning/Brushing |  |  |  |  |  |  |
| Change in Growth | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 8 | years | 7 | years | 8 | years |
| Change in Tree Size Rotation | -3 | years | -2 | years | -3 | years |
| Change in MAI Rotation | -3 | years | -1 | years | -2 | years |
| Juv.Spacing/Pre-com. Thinning |  |  |  |  |  |  |
| Change in Growth | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 12 | years | 9 | years | 10 | years |
| Change in Tree Size Rotation | -3 | years | -3 | years | -3 | years |
| Change in MAI Rotation | 0 | years | 1 | years | 0 | years |
| Commercial Thinning |  |  |  |  |  |  |
| Change in Growth | 0.4 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.4 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.4 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 9 | years | 8 | years | 8 | years |
| Change in Tree Size Rotation | -3 | years | -1 | years | -2 | years |
| Change in MAI Rotation | 1 | years | 1 | years | 1 | years |
| Genetic Improvement |  |  |  |  |  |  |
| Change in MAI | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Change in Tree Size Rotation | -3 | years | -3 | years | -3 | years |
| Change in MAI Rotation | -3 | years | -3 | years | -3 | years |

Table 15: Estimated Results of Silvicultural Options
Quebec - Boreal

## Existing Stands

| Unevenaged Management | Softwood |  | Mixedwood |  | Hardwood |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |
| Current Area Management | 5.0 | \% | 7.0 | \% | 0.0 | \% |
| Growth per Hectare per Year | 1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| After Cut Growing Stock | 40 | $\mathrm{m}^{3} / \mathrm{ha}$ | 95 | $\mathrm{m}^{3} / \mathrm{ha}$ | 120 | $\mathrm{m}^{3} / \mathrm{ha}$ |
| Cutting Cycle Length | 30 | years | 28 | years | 30 | years |
| Fertilization |  |  |  |  |  |  |
| Minimum Stand | 58 | years | 50 | years | 38 | years |
| Maximum Stand | 70 | years | 63 | years | 52 | years |
| Rate of Application | 254 | kg/ha | 177 | kg/ha | 25 | kg/ha |
| Increase in Growth | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Increased Growth | 10 | years | 10 | years | 10 | years |
| Cleaning/Brushing |  |  |  |  |  |  |
| Change in Growth | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 18 | years | 18 | years | 14 | years |
| Change in Tree Size Rotation | -8 | years | -8 | years | -7 | years |
| Change in MAI Rotation | 0 | years | 0 | years | 0 | years |
| Juv.Spacing/Pre-com. Thinning |  |  |  |  |  |  |
| Change in Growth | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 23 | years | 23 | years | 18 | years |
| Change in Tree Size Rotation | -10 | years | -10 | years | -8 | years |
| Change in MAI Rotation | -3 | years | -3 | years | -3 | years |
| Commercial Thinning |  |  |  |  |  |  |
| Change in Growth | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 14 | years | 13 | years | 13 | years |
| Change in Tree Size Rotation | -7 | years | -7 | years | -6 | years |
| Change in MAI Rotation | 2 | years | 2 | years | 2 | years |

## Table 15: Estimated Results of Silvicultural Options (Continued) Quebec - Boreal

Regenerated Stands

|  | Softwood |  | Mixedwood |  | Hardwood |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Unevenaged Management |  |  |  |  |  |  |
| Current Area Management | 10.0 | \% | 17.0 | \% | 0.0 | \% |
| Growth per Hectare per Year | 1.1 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.4 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | NA | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| After Cut Growing Stock | 40 | $\mathrm{m}^{3} / \mathrm{ha}$ | 60 | $\mathrm{m}^{3} / \mathrm{ha}$ | NA | $\mathrm{m}^{3} / \mathrm{ha}$ |
| Cutting Cycle Length | 15 | years | 10 | years | NA | years |
| Fertilization |  |  |  |  |  |  |
| Minimum Stand | 50 | years | 40 | years | 35 | years |
| Maximum Stand | 62 | years | 52 | years | 47 | years |
| Rate of Application | 254 | kg/ha | 267 | kg/ha | 242 | kg/ha |
| Increase in Growth | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.4 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Increased Growth | 10 | years | 10 | years | 10 | years |
| Cleaning/Brushing |  |  |  |  |  |  |
| Change in Growth | 0.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 18 | years | 18 | years | 14 | years |
| Change in Tree Size Rotation | -6 | years | -6 | years | -4 | years |
| Change in MAI Rotation | 0 | years | 0 | years | 0 | years |
| Juv.Spacing/Pre-com. Thinning |  |  |  |  |  |  |
| Change in Growth | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 23 | years | 22 | years | 18 | years |
| Change in Tree Size Rotation | -9 | years | -9 | years | -8 | years |
| Change in MAI Rotation | 0 | years | 0 | years | 0 | years |
| Commercial Thinning |  |  |  |  |  |  |
| Change in Growth | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 16 | years | 15 | years | 14 | years |
| Change in Tree Size Rotation | -7 | years | -7 | years | -6 | years |
| Change in MAI Rotation | 2 | years | 2 | years | 2 | years |
| Genetic Improvement |  |  |  |  |  |  |
| Change in MAI | 0.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Change in Tree Size Rotation | -8 | years | -8 | years | -8 | years |
| Change in MAI Rotation | -8 | years | -8 | years | -8 | years |

## Table 16: Estimated Results of Silvicultural Options

Quebec - Great Lakes/St. Lawrence

## Existing Stands

|  | Softwood |  | Mixedwood |  | Hardwood |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Unevenaged Management |  |  |  |  |  |  |
| Current Area Management | 17.0 | \% | 48.0 | \% | 60.0 | $\%$ |
| Growth per Hectare per Year | 1.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 2.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 2.1 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| After Cut Growing Stock | 88 | $\mathrm{m}^{3} / \mathrm{ha}$ | 98 | $\mathrm{m}^{3} / \mathrm{ha}$ | 105 | $\mathrm{m}^{3} / \mathrm{ha}$ |
| Cutting Cycle Length | 23 | years | 20 | years | 20 | years |
| Fertilization |  |  |  |  |  |  |
| Minimum Stand | 43 | years | 40 | years | 50 | years |
| Maximum Stand | 55 | years | 53 | years | 67 | years |
| Rate of Application | 229 | $\mathrm{kg} / \mathrm{ha}$ | 254 | kg/ha | 294 | $\mathrm{kg} / \mathrm{ha}$ |
| Increase in Growth | 0.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Increased Growth | 10 | years | 10 | years | 10 | years |
| Cleaning/Brushing |  |  |  |  |  |  |
| Change in Growth | 0.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 13 | years | 14 | years | 13 | years |
| Change in Tree Size Rotation | -7 | years | -7 | years | -7 | years |
| Change in MAI Rotation | -1 | years | -1 | years | -1 | years |
| Juv.Spacing/Pre-com. Thinning |  |  |  |  |  |  |
| Change in Growth | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 13 | years | 15 | years | 15 | years |
| Change in Tree Size Rotation | -8 | years | -7 | years | -7 | years |
| Change in MAI Rotation | -2 | years | -2 | years | -2 | years |
| Commercial Thinning |  |  |  |  |  |  |
| Change in Growth | 0.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 15 | years | 14 | years | 14 | years |
| Change in Tree Size Rotation | -6 | years | -6 | years | -5 | years |
| Change in MAI Rotation | 3 | years | 2 | years | 2 | years |

Table 16: Estimated Results of Silvicultural Options (Continued) Quebec - Great Lakes/St. Lawrence

| Unevenaged Management | Regenerated Stands |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Softwood |  | Mixedwood |  | Hardwood |  |
|  |  |  |  |  |  |  |
| Current Area Management | 17.0 | \% | 45.0 | \% | 57.0 | \% |
| Growth per Hectare per Year | 1.1 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 2.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 1.2 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| After Cut Growing Stock | 88 | $\mathrm{m}^{3} / \mathrm{ha}$ | 98 | $\mathrm{m}^{3} / \mathrm{ha}$ | 105 | $\mathrm{m}^{3} / \mathrm{ha}$ |
| Cutting Cycle Length | 23 | years | 20 | years | 20 | years |
| Fertilization |  |  |  |  |  |  |
| Minimum Stand | 37 | years | 42 | years | 58 | years |
| Maximum Stand | 48 | years | 53 | years | 65 | years |
| Rate of Application | 229 | kg/ha | 254 | kg/ha | 2079 | kg/ha |
| Increase in Growth | 0.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Increased Growth | 10 | years | 10 | years | 10 | years |
| Cleaning/Brushing |  |  |  |  |  |  |
| Change in Growth | 0.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 13 | years | 14 | years | 13 | years |
| Change in Tree Size Rotation | -7 | years | -7 | years | -7 | years |
| Change in MAI Rotation | -1 | years | -1 | years | -1 | years |
| Juv.Spacing/Pre-com. Thinning |  |  |  |  |  |  |
| Change in Growth | 0.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 13 | years | 15 | years | 15 | years |
| Change in Tree Size Rotation | -8 | years | -7 | years | -7 | years |
| Change in MAI Rotation | -2 | years | -2 | years | -2 | years |
| Commercial Thinning |  |  |  |  |  |  |
| Change in Growth | 0.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 15 | years | 14 | years | 14 | years |
| Change in Tree Size Rotation | -8 | years | -8 | years | -7 | years |
| Change in MAI Rotation | 2 | years | 2 | years | 2 | years |
| Genetic Improvement |  |  |  |  |  |  |
| Change in MAI | 0.8 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Change in Tree Size Rotation | -8 | years | -8 | years | -8 | years |
| Change in MAI Rotation | -9 | years | -8 | years | -8 | years |

## Table 17: Estimated Results of Silvicultural Options

Yukon and Interior B.C. - Boreal

Existing Stands

|  | Softwood |  | Mixedwood |  | Hardwood |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Unevenaged Management |  |  |  |  |  |  |
| Current Area Management | 5.0 | \% | NA | $\%$ | NA | \% |
| Growth per Hectare per Year | 1.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | NA | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | NA | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| After Cut Growing Stock | 100 | $\mathrm{m}^{3} / \mathrm{ha}$ | NA | $\mathrm{m}^{3} / \mathrm{ha}$ | NA | $\mathrm{m}^{3} / \mathrm{ha}$ |
| Cutting Cycle Length | 30 | years | NA | years | NA | years |
| Fertilization |  |  |  |  |  |  |
| Minimum Stand | 5 | years | 0 | years | 0 | years |
| Maximum Stand | 30 | years | 30 | years | 30 | years |
| Rate of Application | NA | $\mathrm{kg} / \mathrm{ha}$ | NA | kg/ha | NA | kg/ha |
| Increase in Growth | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Increased Growth | 15 | years | 13 | years | 10 | years |
| Cleaning/Brushing |  |  |  |  |  |  |
| Change in Growth | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 15 | years | 13 | years | 10 | years |
| Change in Tree Size Rotation | -5 | years | -5 | years | -5 | years |
| Change in MAI Rotation | -5 | years | -5 | years | -5 | years |
| Juv.Spacing/Pre-com. Thinning |  |  |  |  |  |  |
| Change in Growth | -0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 15 | years | 13 | years | 10 | years |
| Change in Tree Size Rotation | -10 | years | -10 | years | -10 | years |
| Change in MAI Rotation | 0 | years | 0 | years | 0 | years |
| Commercial Thinning |  |  |  |  |  |  |
| Change in Growth | -1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 20 | years | 17 | years | 15 | years |
| Change in Tree Size Rotation | -5 | years | -5 | years | -5 | years |
| Change in MAI Rotation | 0 | years | 0 | years | 0 | years |

## Table 17: Estimated Results of Silvicultural Options (Continued)

Yukon and Interior B.C. - Boreal

## Regenerated Stands

|  | Softwood |  | Mixedwood |  | Hardwood |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Unevenaged Management |  |  |  |  |  |  |
| Current Area Management | 5.0 | \% | 0.0 | \% | 0.0 | \% |
| Growth per Hectare per Year | 1.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | NA | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | NA | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| After Cut Growing Stock | 150 | $\mathrm{m}^{3} / \mathrm{ha}$ | NA | $\mathrm{m}^{3} / \mathrm{ha}$ | NA | $\mathrm{m}^{3} / \mathrm{ha}$ |
| Cutting Cycle Length | 30 | years | NA | years | NA | years |
| Fertilization |  |  |  |  |  |  |
| Minimum Stand | 5 | years | 0 | years | 0 | years |
| Maximum Stand | 30 | years | 30 | years | 30 | years |
| Rate of Application | NA | kg/ha | NA | kg/ha | NA | kg/ha |
| Increase in Growth | 0.7 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.6 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Increased Growth | 15 | years | 13 | years | 10 | years |
| Cleaning/Brushing |  |  |  |  |  |  |
| Change in Growth | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 15 | years | 13 | years | 10 | years |
| Change in Tree Size Rotation | -5 | years | -5 | years | -5 | years |
| Change in MAI Rotation | -5 | years | -5 | years | -5 | years |
| Juv.Spacing/Pre-com. Thinning |  |  |  |  |  |  |
| Change in Growth | -0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -0.5 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 15 | years | 13 | years | 10 | years |
| Change in Tree Size Rotation | -10 | years | -10 | years | -10 | years |
| Change in MAI Rotation | 0 | years | 0 | years | 0 | years |
| Commercial Thinning |  |  |  |  |  |  |
| Change in Growth | -1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | -1.0 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Duration of Growth Response | 20 | years | 17 | years | 15 | years |
| Change in Tree Size Rotation | -5 | years | -5 | years | -5 | years |
| Change in MAI Rotation | 0 | years | 0 | years | 0 | years |
| Genetic Improvement |  |  |  |  |  |  |
| Change in MAI | 0.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ | 0.3 | $\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$ |
| Change in Tree Size Rotation | -5 | years | -5 | years | -5 | years |
| Change in MAI Rotation | -5 | years | -5 | years | -10 | years |

both regenerated and existing stands. The duration of increased growth was generally in the 5 to 15 year period with some longer periods estimated for the coastal British Columbia regions.

## Thinning

Estimated results regarding thinning vary by type of thinning. Respondents commented on the difficulty in answering the extremely simplified questions on thinning for existing stands and on juvenile spacing and thinning for regenerated stands in the round one survey. Thus, the survey for Questionnaires \# 2 and \#3 extended this section to include more species groups and more classes of thinning (cleaning/brushing, juvenile spacing/precommercial thinning, and commercial thinning).

For cleaning/brushing, participants predicted little difference in response between existing stands and regenerated stands within a given region. However, responses between regions vary considerably. The change in growth varies from a low of $0.3 \mathrm{~m}^{3} / \mathrm{ha} /$ year for regenerated stands in both the Coast British Columbia - Subalpine and the Ontario - Boreal regions to a high of $1.8 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{year}$ for regenerated stands in the Atlantic - Boreal region. Most estimates of expected growth increase fell within the range of 0.5 to $1.0 \mathrm{~m}^{3} / \mathrm{ha} /$ year. The estimated duration of the increased growth response due to cleaning/brushing ranges from 5 years for existing stands in the Atlantic - Acadian and the Ontario - Great Lakes/St. Lawrence regions to a high of 40 years in existing stands in the Coast British Columbia Coast region. Most estimates for duration of the growth response fell within the range of 7 to 15 years. These changes in growth were estimated to modify rotation ages in general by shortening them, although there were some exceptions where extended rotations were predicted.

For juvenile spacing/pre-commercial thinning, participant responses again did not differ significantly between existing stands and regenerated stands within a given region. Differences between regions did exist. Expected growth responses varied from -1.0 $\mathrm{m}^{3} / \mathrm{ha} /$ year for the Interior British Columbia - Subalpine region to $+2.6 \mathrm{~m}^{3} / \mathrm{ha} /$ year for the Atlantic - Acadian region. Predicted growth response was negative for about half of the regions and positive for the other half. Predicted changes in time to reach a rotation based on harvestable tree size range from 0 to -20 years indicating, in general, the expectation of bigger trees sooner. However, the effect on rotation age determined by maximum MAI is mixed, with a range from -13 to +15 years. Most predictions are in the -5 to +5 range.

For commercial thinning, results show more differences between existing stands and regenerated stands than either of the two classes of thinning discussed above, but in general, they are not significantly different within a region. Predicted growth increases range from a low of $-1.8 \mathrm{~m}^{3} / \mathrm{ha} /$ year for existing stands in the Coast British Columbia - Coast region to a high of $+1.5 \mathrm{~m}^{3} /$ ha/year for regenerated stands in the Atlantic - Boreal region. These growth changes are predicted to last from 8 to 20 years in all regions except the Coastal British Columbia regions, where the responses are predicted to last from 27 to 43 years. Length of time to reach a harvestable tree size estimate is reduced by 1 to 10 years. Estimates of the change in rotation age at maximum MAI range from -2 years to +17 years.

## Genetic Improvement of Regenerated Stands

Participants estimated increases in MAI from genetic improvement of regenerated stands from 0.3 to $1.2 \mathrm{~m}^{3} / \mathrm{ha} /$ year, with the largest being predicted for hardwoods in both the Coast British Columbia - Coast and NWT/Prairies - Boreal regions. The effects of genetic improvement on harvestable tree size rotation age and age of maximum MAI rotation age varied from reducing rotation ages as much as 20 years in the Interior British Columbia Montane region to lengthening the rotation by one year in the Ontario - Boreal region. However, most regions predicted shortened rotations in the 5 to 10 year range.

### 3.4 DEGREE OF CLOSURE OF RESULTS

The mean estimates over the three rounds were expected to vary as respondents reconsidered their answers in light of previous aggregated results. The technical appendix, as a companion document, reports the results of all three rounds. The major issue is not shifts in means as answers are refined, but rather whether the variations around the means have declined by the third round.
Any Delphi survey technique application attempts to achieve a degree of consensus on values over the sequential questionnaire rounds. This attempt to reach closure on specific values is often measured by the change in variances or standard deviations of replies to each question between survey rounds. A decline in standard deviations represents some closure or agreement or consensus as to the values involved.

In this study the standard deviation of the responses to each question for each region for surveys two and three were calculated and analyzed. Due to the low level of responses for B.C. Coast-Coast, B.C. Coast-Subalpine, Interior B.C.-Columbia, Interior B.C.-Montane, Interior B.C., Subalpine, and Yukon/Interior B.C.-Boreal, it is impossible to measure any closure by comparing the two survey rounds. Standard deviations either were not calculable or not reliable due to the low number of responses to questions in either the second survey or third survey or both. In general, round three results showed less variation than round two. However, the degree of closure varied somewhat and, as indicated above, could not be assessed in the British Columbia regions. Each of the remaining regions other than those in British Columbia are discussed below.

## Atlantic-Acadian

While the number of respondents declined from survey two to survey three, the standard deviations for the vast majority of answers in round three were smaller than the standard deviations of answers in round two. In cases where this decline was not true, the increases in standard deviations were small in comparison to round two standard deviations and to the mean values involved. The estimates of the changes in rotation ages based on harvestable tree size resulting from juvenile spacing of existing stands were an exception to this general statement. In this case, the standard deviations of the round three means were significantly larger than the round two standard deviations and were up to several times the size of the means. With this exception, overall closure or consensus on mean values seems reasonable.

## Atlantic Boreal

Most of the questions in both round two and round three were answered by only one respondent. In cases where more than one respondent replied in both rounds, the round three standard deviations were smaller, indicating some degree of closure.

## NWT/Prairies-Boreal

The number of answers per question in round three was nearly double that of round two despite the fact that the number of respondents was only marginally larger (seven versus eight - see Table 3). The standard deviations for estimated mean responses in round three for a vast majority of cases were substantially lower than those of round two. In cases where this was not true, the increases in standard deviations were very small and the round three standard deviations remained small in relation to mean estimates. Overall closure was attained.

## Ontario-Boreal

The number of respondents for round two and round three were identical. However, there was a reduction in replies to questions in round three compared to round two. In spite of a reduced number of answers in round three, the standard deviations followed the pattern of that discussed above for the NWT/Prairies Boreal. As in the previous case, closure was evident.

## Ontario-Great Lakes/St. Lawrence

The response rate was higher in round three than in round two and the standard deviations for estimated means for round three followed the same pattern as for those of the NWT/Prairie-Boreal region, which demonstrated reasonable consensus on final results.

## Quebec-Boreal

There was a drop in response rate in round three compared to round two, but, as above, the round three standard deviations indicated a reasonable degree of closure when compared to round two standard deviations.

## Quebec-Great Lakes/St. Lawrence

Respondents to round three dropped by over half (from seven to three - see Table 3). However, in spite of fewer round three respondents, standard deviations to estimated values were smaller for round three compared to round two for the majority of cases. Similar to most of the other non-B.C. regions, these estimates for this region show reasonable closure.

### 3.5 OVERALL PARTICIPATION

During the design and planning of this study, the authors were concerned about two major issues. First, would a panel of participants agree to participate in the study given the degree of aggregation required for each region? And second, if a panel was formed, would they follow through with the survey and reach closure on estimates? We were pleased to find a representative panel of 77 persons who represented a good cross section of survey regions. However, as the survey progressed, some of the panel members who had agreed to participate wrote to us indicating they could not participate because of concerns over the degree of aggregated responses required. As well, some, after viewing the results of round one or
round two, discontinued participation because they saw what they felt were inconsistencies in the average results and thus did not feel the study was going to close on a theoretically valid result. Of particular note is the low response rate to the second and third round surveys from the British Columbia regions (Table 3).

Since the study was designed based on a small number of participants (justified due to the availability of knowledgeable people, timing and budget limitations), any loss of participation has a serious impact on the significance of resulting estimates. Therefore, great care should be taken in using data in this report, particularly from the six B.C. regions. For the other seven regions with higher response rates, the responses did come to varying degrees of closure and therefore better represented "the view of the experts in the field".

However, users of the results must remember that Delphi studies are used when there is no source of "hard data". This study shows the summary results of experts' estimates of growth and yield, provided by those of the 77 participants listed in Appendix B who chose to participate.

### 3.6 AREAS FOR FURTHER RESEARCH

The information collated here provides useful input into studies of the forest resource. However, the economic dimension was not addressed to any extent. This type of Delphi study could be useful in identifying the extent of the economically accessible forest land base. One member of the advisory panel recommended that the current study be oriented in that direction. The idea would be to solicit responses to volume ( $\mathrm{m}^{3} / \mathrm{ha}$ ) and value ( $\$ / \mathrm{m}^{3}$ ) curves over time for existing levels of silviculture expenditures, no silviculture, and twice the current level of silviculture expenditures. In addition, harvesting cost curves ( $\$ / \mathrm{m}^{3}$ ) for the lowest cost, average cost, and high costs proportions of the physical land base could be solicited. Other information on the land base could also be requested. For example, the proportions of the land base (in terms of area, by age class) that are physically accessible versus currently economically accessible, the probability of catastrophic destruction, and the proportion of the land base likely to be set aside for other uses in the near future, would be useful information. This type of information is not available for Canada as a whole on any comparable basis, and makes assessment of supply options and opportunities difficult. Questions related to investments in silviculture and assessing tradeoffs in silviculture expenditures, versus protection of current standing stocks, or extending the operability margin, are all important to the picture of Canada's future timber supply. Providing a national perspective on growth and yield, however, is one step in this direction.

## 4. CONCLUSIONS

This study provides a view of the growth and yield of Canada's forests by region and aggregate species groups. The results are based on the convergence of expert opinion, and provide a reasonable indication, for most regions, of average yields and responses to treatments.

There are many caveats and problems with this sort of analysis that are, in part, a function of the degree of aggregation. There are many factors that influence growth that are not captured in the aggregate questions of the survey. In addition, to what extent do today's forests reflect their future potential? For example, there have been significant changes in forest policies in the provinces over the years, some of which directly impact the growth of
forests. These include policies on planting, site preparation, and species selection after harvest. Do current second growth forests reflect the actual potential of the forest? For example, if species were planted on the wrong site, or if harvesting practices were to change significantly, then what is on the ground now would not be a good indication of future potential. Questions such as the impact on growth from ecosystem management practices and partial cuttings are also difficult to assess.

Nonetheless, there are some useful results and conclusions that can be gained from this study. One of them is that the experts do not see, with a few exceptions, huge volume increases or major changes in rotation ages with second growth stands, on aggregate large regions.

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Name<br>Jamie Benson<br>David Brand<br>Joe Lowe<br>Dave Maclean<br>Steve Northway<br>Stephen Sterns-Smith<br>Chhun Huon Ung

Affiliation<br>Saskatchewan Dept. of Environment \& Resource Management Canadian Forest Service, Ottawa<br>Canadian Forest Service, Chalk River<br>Canadian Forest Service, Fredericton<br>MacMillan Bloedel Ltd., Nanaimo<br>British Columbia Ministry of Forests<br>Service canadien des forêts, Ste-Foy

## APPENDIX B: List of Panel Members

| Name | Affiliation |
| :--- | :--- |
| Peter Afflect | Timberline Forest Inventory Consultants |
| Dave Archibald | Ontario Manitoba Ministry of Natural Resources |
| Denes Bajzak | Memorial University |
| Jim Ball | Canadian Forest Service |
| John Barker | Western Forest Products |
| Jim Beck | University of Alberta |
| Gerry Becker | Manitoba Ministry of Natural Resources, Forestry Branch |
| Imre Bella | Canadian Forest Service |
| Jamie Benson | Saskatchewan Dept. of Environment and Resource Management |
| Georges Blais | Ministère des Ressources Naturelles |
| Mike Bonnor | Canadian Forest Service |
| David Brand | Canadian Forest Service |
| Rob Brockley | British Columbia Ministry of Forests |
| Ken Brown | Lakehead University |
| Blake Brundson | J.D. Irving Ltd. |
| Darwin Burgess | Canadian Forest Service |
| Ian Cameron | British Columbia Ministry of Forests |
| Doug Campbell | Department of Renewable Resources, GNWT |
| Will Carmean | Lakehead University |
| Reid Carter | Timber West Forests |
| Randy Chan | Tolko Industries Ltd. |
| Dave Chapeskie | Indian and Northern Affairs Canada |
| Carl Corbett | Ontario Ministry of Agriculture and Food |
| Brian Donovan | Algonquin Forest Authority |
| Ren Doucet | Mirimachi Pulp and Paper Inc. |
| Darrell Errico | Ministère des Ressources Naturelles |
| Dennis Farquharson | British Columbia Ministry of Forests |
| Craig Frame | Tolko Industries Ltd. |
| Bill Glen | New Brunswick Department of Natural Resources and Energy |
| Dave Handley | Newfoundland Department of Forest Resources and Lands |
| Darrell Harris | Peter Henry |

## APPENDIX B (cont'd)

## List of Panel Members

| Norm Iles | Ontario Ministry of Natural Resources |
| :---: | :---: |
| Kim Iles | Kim Iles and Associates Ltd. |
| Werner Kurz | Essa Ltd. |
| Jean-Pierre Létourneau | Ministère des Ressources Naturelles |
| Bob Lamont | Manitoba Ministry of Natural Resources, Forestry Branch |
| Janet Lane | Weyerhaeuser Canada Ltd. |
| Paul LeBlanc | Weyerhaeuser Canada Ltd. |
| Val LeMay | University of British Columbia |
| David Lindenas | Saskatchewan Dept. of Environment and Resource Management |
| Jack Louie | British Columbia Ministry of Forests |
| Joe Lowe | Canadian Forest Service |
| Bob MacDonald | British Columbia Ministry of Forests |
| Dave MacLean | Canadian Forest Service |
| Peter Marshall | University of British Columbia |
| Mike Martel | TAEM Ltd. |
| Pat Martin | British Columbia Ministry of Forests |
| Bill Meades | Canadian Forest Service |
| Ken Mitchell | British Columbia Ministry of Forests |
| Dave Morgan | Alberta Environmental Protection |
| Don Munro | University of British Columbia |
| Corrine Nelson | Ontario Manitoba Ministry of Natural Resources |
| Peter Newton | Canadian Forest Service |
| Brian Nicks | E.B. Eddy Forest Products Ltd. |
| Steve Northway | MacMillan Bloedel Limited |
| John Osborn | Ontario Manitoba Ministry of Natural Resources |
| Bijan Payandeh | Canadian Forest Service |
| Margaret Penner | Canadian Forest Service |
| Fred Pinto | Ontario Manitoba Ministry of Natural Resources |
| Don Reimer | D.R. Systems Inc. |
| Jean-Claude Ruel | Université Laval |
| Vic Smith | Trenton |

## APPENDIX B (cont'd)

## List of Panel Members

Mac Squires
Stephen Sterns-Smith
Neil Stevens
Jim Taylor
John Thompson
Jim Thrower
Steve Titus
Kevin Topolniski
Chhun-Huor Ung
Serge Vézina
George Van Dusen
Jon Vivian
Murray Woods

Abitibi-Price Inc.
British Columbia Ministry of Forests
The Forestry Corp
Newfoundland Department of Forest Resources and Lands
Saskatchewan Dept. of Environment and Resource Management
J.F. Thrower

University of Alberta
Fraser Inc.
Canadian Forest Service
Ministère des Ressources Naturelles
Corner Brook Pulp and Paper Ltd.
British Columbia Ministry of Forests
Ontario Manitoba Ministry of Natural Resources

APPENDIX C: Questionnaires and results for Ontario boreal region

| BASELINE ESTIMATES | Softwood | Mixedwood | Hardwood |
| :---: | :---: | :---: | :---: |
|  | AREA (ha) Excluding Protected Areas | $7,251,261$ | $6,650,682$ |
| MAI of Mature Stands $\left(\mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}\right)$ | $1.44(1.2 \mathrm{c}, 0.24 \mathrm{~b})^{*}$ | $2.17(0.99 \mathrm{c}, 1.19 \mathrm{~b})^{*}$ | $1,880,704$ |
| ${ }^{*} \mathrm{c}=$ conifer and $\mathrm{b}=$ broadleaf component of MAI |  |  |  |

VOLUME/
HECTARE
( $\mathrm{m}^{3} / \mathrm{ha}$ )



CONIFER
20 YEAR AGE CLASSES
BROADLEAF

## EXISTING STANDS

1. Are you sufficiently knowledgeable about this region to provide growth and yield estimates?

YES $\qquad$ NO $\qquad$
If "NO" please go on to the information/question set for the next region - Thank you.

If "YES" please proceed in answering the questions below.
2. Please comment on the MAI estimates outlined above in terms of whether they are too high, too low or about right. In the scales below please circle the appropriate percentage value indicating your MAI estimates in relation to the baseline estimates.

Circle your estimate of MAI of mature stands compared to baseline estimates.

| Softwood MAI (\%) | $<505060708090$ MAI 110120130140150160170180190200>200 |
| :--- | :--- |
| Mixedwoods MAI (\%) | $<505060708090$ MAI 110120130140150160170180190 200>200 |
| Hardwood MAI (\%) | $<505060708090$ MAI 110120130140150160170180190200>200 |

2b. Considering the current age distribution of the species making up each of the three species categories, please indicate your estimates for the area-weighted mean age of mature stands (including over-mature) for each category.

|  | Softwood | Mixedwoods | Hardwood |
| :--- | :--- | :--- | :--- |
| Mean age |  | years |  |

3. Given your revised estimate for the MAI of mature stands made in Question 2(a), how would the MAI change if the area weighted mean age was:

|  | Softwood |  | Mixedwoods |  |
| :--- | :--- | :--- | :--- | :--- |
| 20 years older | $\%$ | $\%$ | $\%$ | Hardwood |
| 20 years younger | $\ldots$ | $\%$ | $\%$ | $\%$ |
| 40 years younger | $\ldots$ | $\%$ | $\%$ | $\%$ |

Use $(+)$ or positive percentages for increases in MAI and (-) or negative percentages for decreases in MAI.
4. If existing stands were fertilized what increase $(+)$ or decrease $(-)$ in yield would you expect and for what period would the change apply?

|  | Softwood | Mixedwoods | Hardwood |  |
| :--- | :--- | :--- | :--- | :--- |
| \% Change |  | $\%$ | $\%$ | $\%$ |
| Period of Effect | $\ldots$ | years | $\ldots$ | years |

5a. If existing stands were thinned would you expect a net change in useable fibre (thinning plus final harvest) from the stands?

YES $\qquad$ NO $\qquad$
5b. If yes, what percentage change do you expect? $\qquad$

5 c . Would thinning reduce the rotation age or time till final harvest?
YES $\qquad$ NO $\qquad$

5d. If yes, how many years would the reduction be? $\qquad$ years

## REGENERATED STANDS

6. With current silviculture practice for this region what would you expect the mean age of regenerated stands at harvest to be?

|  | Softwood | Mixedwoods | Hardwood |
| :--- | :--- | :--- | :--- |
| Mean Age at Harvest |  | years | years |

7. Again, with current silviculture practice for this region, what would you expect the MAI of regenerated stands to be at the ages you listed above compared to the MAI of existing mature stands?

Circle your estimate of MAI for regenerated stands compared to baseline estimates

| Softwood MAI (\%) | $<505060708090 \mathrm{MAI} 110120130140150160170180190200210220230240250>250$ |
| :--- | :--- |
| Mixedwoods MAI <br> $(\%)$ | $<505060708090 \mathrm{MAI} 110120130140150160170180190200210220230240250>250$ |
| Hardwood MAI (\%) | $<505060708090 \mathrm{MAI} 110120130140150160170180190200210220230240250>250$ |

8. Given your revised estimate for MAI of the area weighted mean age of regenerated stands, how would the MAI change if the area weighted mean age was:

|  | Softwood |  | Mixedwoods |
| :--- | :--- | :--- | :--- |
| 20 years older |  | $\%$ | $\%$ |
| 20 years younger | - | $\%$ | $\%$ |
| 40 years younger | - | $\%$ | $\%$ |

Use $(+)$ or positive percentages for increases in MAI and $(-)$ or negative percentages for decreases in MAI.
9. If regenerated stands were fertilized what increase $(+)$ or decrease $(-)$ in yield would you expect and for what period would the change apply?
\% Change
Period of Effect

| Softwood |
| :---: |
| $\quad$ years |



10a. If regenerated stands were thinned would you expect a net change in useable fibre (thinning plus final harvest) from the stands?

10b. If yes, what percentage change do you expect?
10 c . Would thinning reduce the rotation age or time till final harvest?

10d. If yes, how many years would the reduction be?
11a. If regenerated stands were juvenile spaced would you expect a net change in useable fibre from the stands?

11b. If yes, what percentage change do you expect?

11c. Would juvenile spacing reduce the rotation age or time till final harvest?
11d. If yes, how many years would the reduction be?
___ years

12a. If regenerated stands were genetically improved would you expect a net change in useable fibre from the stands?

12b. If yes, what percentage change do you expect?
12c. Would genetic improvement reduce the rotation age or time till final harvest?

12d. If yes, how many years would the reduction be?
YES $\qquad$ NO $\qquad$

13a. If regenerated stands were cleaned/brush controlled would you expect a net change in useable fibre from the stands?

YES $\qquad$ NO $\qquad$
13b. If yes, what percentage change do you expect?
$+/$ $\qquad$ $\%$

13c. Would cleaning/brush control reduce the rotation age or time till final harvest? $\qquad$ NO $\qquad$
13d. If yes, how many years would the reduction be? $\qquad$
This space is provided for any comments regarding any part of this survey. If you have concerns you would like to have examined in future rounds of this project, please note these here as well.

## ADMINISTRATIVE / BIOLOGICAL REGION

## Ontario - Boreal

## EXISTING STANDS

1. From Questionnaire \#1, collective (mean) responses from survey participants indicated the following about growth (MAI) of existing stands. Included are average estimates of MAI from the baseline we provided in Questionnaire \#1 and average estimates of area-weighted mean age of mature stands.

|  | MAI: Provided | MAI: Your Est. | AGE: Your Est. |
| :--- | :--- | :--- | :--- |
| Softwood | 1.44 | 1.67 | 100.0 |
| Mixedwood | 2.17 | 2.02 | 93.3 |
| Hardwood | 2.90 | 2.56 | 82.5 |

Additionally you expressed concern over "uneven age management" and that existing stands may be 2nd, 3rd or 4th generation "regenerated stands". For the survey, the growth and yield data for "existing stands" is meant to apply to stands growing today. "Regenerated stands" are those we create after "today".

1a. Please complete the table below with your revised estimates of MAI (Age in years and MAI in $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$ ). Note: NA means not available from round one.

|  | Softwood |  |  | Mixedwood |  |  | Hardwood |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Age | MAI | New MAI | Age | MAI | New MAI | Age | MAI | New MAI |
| 40 | NA |  | 33 | NA |  | 23 | NA |  |
| 60 | 1.93 |  | 53 | 2.20 |  | 43 | 2.83 |  |
| 80 | 1.84 |  | 73 | 2.20 |  | 63 | 2.81 |  |
| *100 | 1.67 |  | *93 | 2.02 |  | *83 | 2.56 |  |
| 120 | 1.50 |  | 113 | 1.91 |  | 103 | 2.26 |  |
| 140 | NA |  | 133 | NA |  | 123 | NA |  |

lb. What proportion of the area in the region is managed by uneven-aged management?
$\qquad$ \% Mixedwood $\qquad$ $\%$

Hardwood $\qquad$ \%

1c. What growth per ha/year do you expect on areas managed by uneven-aged management?
Softwood $\qquad$ m3/ha/yr

Mixedwood $\qquad$ m3/ha/yr

Hardwood $\qquad$ $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$

1d. What after-cut growing stock level do you expect to be left on areas managed by uneven-aged management?
Softwood $\qquad$ m 3 ha Mixedwood $\qquad$ m3/ha

Hardwood $\qquad$ m3/ha
le. What would be the average cutting cycle used on areas managed by uneven-aged management?
Softwood $\qquad$ years

Mixedwood $\qquad$ years

Hardwood $\qquad$ years
2. From Questionnaire \#1 your collective (mean) responses to fertilization of existing stands indicated fertilization would result in yield increases and may have a period of effect as follows:
Softwood
7.4\%
Softwood 8.1 years
$\begin{array}{ll}\text { Mixedwood } & 4.5 \% \\ \text { Mixedwood } & 5.2 \text { years }\end{array}$
Hardwood
$3.5 \%$
Hardwood 5.2 years

However your comments indicated concern over fertilizing "all stands', "all sites", "age of stands fertilized" and "amount of fertilizer". Please answer the following questions to account for these concerns:

2a. At what stand age range would you fertilize? Answer should be range between a low figure and a high figure expressed in years of age.
Softwood $\qquad$ \& $\qquad$ years old

Mixedwood $\qquad$ \& $\qquad$ years old Hardwood $\qquad$ \& $\qquad$ years old

2 b . At what rate of fertilizer ( $\mathrm{kg} / \mathrm{ha}$ ) would you apply? Softwood $\qquad$ $\mathrm{kg} / \mathrm{ha}$

Mixedwood $\qquad$ kg/ha

Hardwood $\qquad$ $\mathrm{kg} / \mathrm{ha}$

2c. If sites are distinguished as Good, Medium and Poor what proportion of sites would you fertilize? Good $\qquad$ \% Medium $\qquad$ \%

Poor $\qquad$ \%

2d. What increase in growth ( $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$ ) would you expect?
$\qquad$
Softwood
Mixedwood $\qquad$ Hardwood $\qquad$
2e. How long would the increased growth indicated above last (years)? Softwood $\qquad$ Mixedwood $\qquad$ Hardwood $\qquad$
3. From Questionnaire \#1 your collective (mean) responses to thinning of existing stands were as follows: $100 \%$ of respondents felt there would be a net change in yield due to thinning, and the mean of the change was a $(+) 15.0 \% .86 \%$ of respondents felt the rotation age would be reduced by a mean of 13.3 years.

Significant comments were made regarding "what to thin", "would never thin in mature stands", "I assume thinning of immature stands only", and "is rotation set by achieving a certain tree size or maximum mean annual increment". To help clarify Thinning responses please answer the following:

3a. For existing immature stands what do you expect from cleaning /brushing (assume no utilization) regarding:
3aa. Change in growth?
Softwood +/__ m3/ha/yr
Mixedwood +/- $\qquad$ m3/ha/yr

Hardwood +/- $\qquad$ m3/ha/yr
3 ab . How long would this change in growth last? Softwood years

Mixedwood $\qquad$ years $\qquad$
3ac. Change in rotation based on harvestable tree size? Softwood +/- $\qquad$ years Mixedwood +/- $\qquad$ years

Hardwood +/- $\qquad$ years
3ad. Change in rotation based on maximum MAI? Softwood +/- $\qquad$ years

Mixedwood +/- $\qquad$ years

Hardwood +/- $\qquad$ years

3b. For existing immature stands what do you expect from juvenile spacing/ pre-commercial thinning (assume no utilization) regarding:

3ba. Change in growth? Softwood $+/$ _ $\quad \mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$

Mixedwood +/- $\qquad$ $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$

Hardwood +/- $\qquad$ m3/ha/yr
3bb. How long would this change in growth last? Softwood years

Mixedwood $\qquad$ years Hardwood $\qquad$ years
3bc. Change in rotation based on harvestable tree size? Softwood $+/$ - $\qquad$ years

Mixedwood +/- $\qquad$ years


3bc. Change
3bd. Change in rotation based on maximum MAI? Softwood $+/-$ $\qquad$ years
Mixedwood +/- $\qquad$ years
Hardwood +/- $\qquad$ years year

Hardwood +/- $\qquad$ years

3c. For existing immature stands what do you expect from commercial thinning (include thinning plus final harvest) regarding:

3ca. Change in growth?
Softwood +1 $\qquad$ m3/ha/yr $\qquad$ m3/ha/yr Hardwood +/- $\qquad$ $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$
3 cb . How long would this change in growth last? Softwood $\qquad$ years

Mixedwood $\qquad$ years

Hardwood $\qquad$ years
3 cc . Change in rotation based on harvestable tree size?
Softwood $+/-$ $\qquad$ years Mixedwood $+/-$ $\qquad$ years

Hardwood +/- $\qquad$ years
3 cd . Change in rotation based on maximum MAI? Softwood $+/-$ $\qquad$ years

Mixedwood +/- $\qquad$ years

Hardwood +/- $\qquad$ years

## REGENERATED STANDS

4. From Questionnaire \#1, collective (mean) responses from survey participants indicated the following about growth (MAI) of regenerated stands. Included are average estimates of MAI from the baseline we provided in Questionnaire \#1 and average estimates of area-weighted mean age of mature stands. "Regenerated stands" are those we create after "today".

|  | MAI: Provided | MAI: Your Est. | AGE: Your Est. |
| :--- | :--- | :--- | :--- |
| Softwood | 1.44 | 1.82 | 78.6 |
| Mixedwood | 2.17 | 2.34 | 75.0 |
| Hardwood | 2.90 | 2.84 | 60.8 |

4a. Please complete the table below with your revised estimates of MAI (Age in years and MAI in $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$ ).

|  | Softwood |  | Mixedwood |  |  | Hardwood |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Age | MAI | New MAI | Age | MAI | New MAI | Age | MAI | New MAI |
| 19 | NA |  | 15 | NA |  | 1 | NA |  |
| 39 | 1.51 |  | 35 | 1.67 |  | 21 | 2.13 |  |
| 59 | 1.99 |  | 55 | 2.11 |  | 41 | 2.59 |  |
| *79 | 1.82 |  | *75 | 2.34 |  | *61 | 2.84 |  |
| 99 | 1.71 |  | 95 | 2.17 |  | 81 | 2.50 |  |
| 119 | NA |  | 115 | NA |  | 101 | NA |  |
|  |  |  | ated | imates | unded) from | s repo | d abo |  |

4 b . What proportion of the area in the region is managed by uneven-aged management?
Softwood $\qquad$ $\%$

Mixedwood $\qquad$ \%

Hardwood $\qquad$ \%

4 c . What growth per ha/year do you expect on areas managed by uneven-aged management?
Softwood $\qquad$ m3/ha/yr

Mixedwood $\qquad$ m3/ha/yr

Hardwood $\qquad$ m3/ha/yr

4 d . What after-cut growing stock level do you expect to be left on areas managed by uneven-aged management?
Softwood $\qquad$ m3/ha

Mixedwood $\qquad$ m3/ha

Hardwood $\qquad$ m3/ha

4e. What would be the average cutting cycle used on areas managed by uneven-aged management?
Softwood $\qquad$ years

Mixedwood $\qquad$ years

Hardwood $\qquad$ years
5. From Questionnaire \#1 your collective (mean) responses to fertilization of regenerated stands indicated fertilization would result in yield increases and may have a period of effect as follows:
Softwood $8.7 \%$
Mixedwood $6.5 \%$
Hardwood $5.5 \%$
Softwood 6.8 years
Mixedwood 5.2 years
Hardwood 5.2 years

However your comments indicated concern over fertilizing "all stands', "all sites", "age of stands fertilized" and "amount of fertilizer". To help clarify these concerns please answer the following questions:

5a. At what stand age range would you fertilize? Answer should be range between a low figure and a high figure expressed in years of age.
Softwood $\qquad$ \& $\qquad$ years old

Mixedwood $\qquad$ \& years oldHardwood $\qquad$ \& $\qquad$ years old

5 b . At what rate of fertilizer ( $\mathrm{kg} / \mathrm{ha}$ ) would you apply?
Softwood $\qquad$ $\mathrm{kg} / \mathrm{ha} \quad$ Mixedwood $\qquad$ $\mathrm{kg} / \mathrm{ha}$

Hardwood $\qquad$ $\mathrm{kg} / \mathrm{ha}$

5c. If sites are distinguished as Good, Medium and Poor what proportion of sites would you fertilize?
Good $\qquad$ $\% \quad$ Medium $\qquad$ \%

Poor $\qquad$ \%

5 d . What increase in growth ( $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$ ) would you expect?
Softwood $\qquad$ Mixedwood $\qquad$ Hardwood $\qquad$
5e. How long would the increased growth indicated above last (years)?
$\qquad$
$\qquad$ Hardwood $\qquad$
6. Significant comments were made regarding "what to thin", "would never thin in mature stands", "I assume thinning of immature stands only", and "is rotation set by achieving a certain tree size or maximum mean annual increment". To help clarify Thinning responses please answer the following:

6a. From Questionnaire \#1 your collective (mean) responses to cleaning/ brush control of regenerated stands were as follows: $86 \%$ of respondents felt there would be a net change in yield, and the mean of the change was a ( + ) $20.8 \% .86 \%$ of respondents felt the rotation age would be reduced by a mean of 16 years. For regenerated immature stands what do you expect from cleaning /brushing (assume no utilization) regarding:

6aa. Change in growth?
Softwood $+/$ - $\qquad$ $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$
6 ab . How long would this change in growth last?
Softwood $\qquad$ years
Mixedwood +/-__ m3/ha/yr

Hardwood +/- $\qquad$ m3/ha/yr

6 ac . Change in rotation based on harvestable tree size?
Softwood $+/-\quad$ years
6ad. Change in rotation based on maximum MAI?
Softwood +/- $\qquad$ years

Mixedwood +/- $\qquad$ years years

Hardwood $\qquad$ years

Mixedwood +/- $\qquad$ years
Hardwood +/- $\qquad$ years

6b. From Questionnaire \#1 your collective (mean) responses to juvenile spacing of regenerated stands were as follows: $71 \%$ of respondents felt there would be a net change in yield, and the mean of the change was a $(+) 5.0 \%$. $71 \%$ of respondents felt the rotation age would be reduced by a mean of 10 years. For regenerated immature stands what do you expect from juvenile spacing/ pre-commercial thinning (assume no utilization) regarding:

6ba. Change in growth?
Softwood $+/-$ $\qquad$ m3/ha/yr
6bb. How long would this change in growth last?
Softwood $\qquad$ years

$$
\text { Mixedwood }+/-
$$ m3/ha/yr

 m3/ha/yr

6bc. Change in rotation based on harvestable tree size?
Softwood $+/-$ $\qquad$ years

Mixedwood +/- $\qquad$ years
_ years
Hardwood $\qquad$ years
$\qquad$ years
Hardwood +/- $\qquad$ years

6bd. Change in rotation based on maximum MAI?
Softwood +/- $\qquad$ years

Mixedwood +/-
Hardwood +/- $\qquad$ years

6 c . From Questionnaire \#1 your collective (mean) responses to thinning of regenerated stands were as follows: $100 \%$ of respondents felt there would be a net change in yield, and the mean of the change was a $(+) 16.7 \% .100 \%$ of respondents felt the rotation age would be reduced by a mean of 13.3 years. For regenerated immature stands what do you expect from commercial thinning (include thinning plus final harvest) regarding:

6ca. Change in growth?
Softwood $+/-$ $\qquad$ $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$
6 cb . How long would this change in growth last?
Softwood years
6 cc . Change in rotation based on harvestable tree size?
$\qquad$ m3/ha/yr
Hardwood $+/-$ m3/ha/yr Softwood $+/$ - $\qquad$ years

Mixedwood +/- $\qquad$ years
6 cd . Change in rotation based on maximum MAI?
Softwood +/- $\qquad$ years

Mixedwood +/- $\qquad$ years years

Hardwood $\qquad$ years

Hardwood +/- $\qquad$ years

Hardwood +/- $\qquad$ years
7. From Questionnaire \#1 your collective (mean) responses to genetic improvement of regenerated stands were as follows: $100 \%$ of respondents felt there would be a net change in yield, and the mean of the change was a $(+) 6.8 \%$. $100 \%$ of respondents felt the rotation age would be reduced by a mean of 7.5 years. Comments indicated uncertainty about unproved genetic improvement yields and concerns over rotation being time to certain size tree or Maximum MAI. Please answer the following:

7a. What change in MAI do you expect for genetic improvement? Softwood $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$ Mixedwood $\qquad$ m3/ha/yr

Hardwood $\qquad$ m3/ha/yr

7b. What change in rotation based on harvestable tree size would you expect? Softwood +/- $\qquad$ years

Mixedwood +/- $\qquad$ years

Hardwood +/- $\qquad$ years

7c. What change in rotation based on Maximum MAI would you expect?
Softwood +/- $\qquad$ years

Mixedwood +/- $\qquad$ years $\qquad$ years

## Ontario - Boreal

## EXISTING STANDS

1. Growth (MAI) of existing stands for softwood, mixedwood and hardwood.

1a. From Questionnaires \#1 and \#2, aggregate (mean) responses from survey participants about growth of existing stands are provided below. In most cases, Questionnaire \#2 results led to a mean MAI maximization which was inconsistent with Questionnaire \#1 age estimate of maximum MAI. Please examine each case below and provide final revised estimates of MAI for each species/age class. The age classes were set in 20 year increments from Questionnaire \#1 results that gave estimates of the ages of maximum MAI's which are denoted by an asterisk. Remember, the MAI should be maximum at the 20 year age class where you expect maximum biological growth for pulpwood utilization for the region.

|  | Softwood |  |  |  |  | Mixedwood |  |  |  |  | Hardwood |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Age | Que\# I <br> MAI | Que\#2 <br> MAI | Final <br> MAI |  | Age | Que\#1 <br> MAI | Que\#2 <br> MAI | Final <br> MAI |  | Age | Que\#1 <br> MAI | Que\#2 <br> MAI | Final <br> MAI |
| 40 | NA | 1.6 |  |  | 33 | NA | 1.9 |  |  | 23 | NA | 1.8 |  |
| 60 | 1.9 | 1.9 |  |  | 53 | 2.2 | 2.5 |  |  | 43 | 2.8 | 2.7 |  |
| 80 | 1.8 | 2.0 |  |  | 73 | 2.2 | 2.5 |  |  | 63 | 2.8 | 2.9 |  |
| $100^{*}$ | 1.7 | 1.8 |  |  | $93^{*}$ | 2.0 | 2.2 |  |  | $83^{*}$ | 2.6 | 2.4 |  |
| 120 | 1.5 | 1.6 |  |  | 113 | 1.9 | 1.8 |  |  | 103 | 2.3 | 2.0 |  |
| 140 | NA | 1.3 |  |  | 133 | NA | 1.5 |  |  | 123 | NA | 1.6 |  |

The aggregated results below are taken from round 2 survey results. Please review the figures and provide any revised figures that you deem more representative of the region. If your revised figure agrees with the survey figure, please enter your estimate even if it is the same as the survey one.
lb. What proportion of the area is managed by uneven-aged management?

## Softwood:

Survey result: $6 \%$
Your est. $\qquad$ \%

Mixedwood:
Survey result: $13 \%$
Your est. $\qquad$ $\%$

## Hardwood:

Survey result: $19 \%$
Your est. $\qquad$ $\%$

1c. What is the growth per ha/year on areas managed by uneven-aged management?

## Softwood:

Survey result: $1.8 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$ Your est. $\qquad$ $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$

Mixedwood:
Survey result: $2.2 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$ Your est. $\qquad$ $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$

## Hardwood:

Survey result: $2.3 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$
Your est. $\qquad$ $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$

1d. What after-cut growing stock level is left on areas managed by uneven-aged management?

## Softwood:

Mixedwood:
Hardwood:
Survey result: $54 \mathrm{~m} 3 / \mathrm{ha}$
Your est. $\qquad$ m3/ha

Survey result: $50 \mathrm{~m} 3 / \mathrm{ha}$ Your est. $\qquad$ m3/ha
2. From Questionnaire ${ }^{*} 2$ the results regarding fertilization of existing stands have been aggregated and are given below. Please

Mixedwood:
Survey result: 24 years Your est. $\qquad$ years
years
$\qquad$

## Softwood:

Survey result: 24 years Your est.
 Yur
2. From Questionnaire $\# 2$ the results regarding fertilization of existing stands have been aggregated and are given below. Please review these figures and provide any revised figures that you deem more representative of the region. Base your figures on one-time application (comments from the previous round suggested that number of applications be clarified). Please enter your estimates even if in one or more cases they are identical to those of the survey results.

2a. At what stand age range would you fertilize? Answer should range between $X$ and $Y$ years of age.
Softwood:
Hardwood:

Survey result: 13 \& 41 yrs old
Your est. $\qquad$ \& $\qquad$ yrs old

Survey result: $12 \& 36$ yrs old
Your est. __ \& $\qquad$ yrs old

2 b . At what rate of fertilizer ( $\mathrm{kg} / \mathrm{ha}$ ) would you apply?

## Softwood:

Survey result: $175 \mathrm{~kg} / \mathrm{ha}$ Your est. $\qquad$ $\mathrm{kg} / \mathrm{ha}$
Survey result: $175 \mathrm{~kg} / \mathrm{ha}$ Your est. $\qquad$ kg/ha

## Hardwood:

Survey result: $175 \mathrm{~kg} / \mathrm{ha}$
Your est. $\qquad$ $\mathrm{kg} / \mathrm{ha}$

2c. If sites are distinguished as Good, Medium and Poor what proportion of sites would you fertilize?

| Good: | Medium: | Poor: |
| :--- | :--- | :--- |
| Survey result: $31 \%$ | Survey result: $25 \%$ | Survey result: $11 \%$ |
| Your est. | Your est. | \% $\%$ |

2 d . What increase in growth ( $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$ ) would you expect?
Softwood:
Survey result: $0.9 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$ Your est. $\qquad$ $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$

Mixedwood:
Survey result: $0.6 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$
Your est. $\qquad$ $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$

## Hardwood:

Survey result: $0.8 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$
Your est. $\qquad$ $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$

2 e . How long would the increased growth indicated above last (years)?
Softwood: Mixedwood: Hardwood:
Survey result: 10 years Survey result: 10 years
Your est. $\qquad$ years
Your est. ___ years

Survey result: 11 years
Your est. $\qquad$ years
3. Comments from Questionnaire \#1 regarding thinning indicated this topic had to be split into several categories and that thinning would occur only on immature stands. Several comments on round 2 again emphasize immature stands only. Each question below applies only to immature stands. The mean of your responses to round 2 are given below. Please review these results and provide revised estimates. If your estimate agrees with the mean figure from round 2 , please enter this as your estimate.

3a. For existing immature stands what do you expect from cleaning/brushing (assume no utilization) regarding:
3aa. Change in growth?

Softwood:
Survey result: $0.7 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$
Your est. +/- $\qquad$ $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$

Mixedwood:
Survey result: $0.4 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$
Your est. +/- $\qquad$ $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$

## Hardwood:

Survey result: $0.8 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$
Your est. +/- $\qquad$ $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$

3ab. How long would this change in growth last?

## Softwood:

Survey result: 11 years
Your est. $\qquad$ years

Mixedwood:
Survey result: 6 years
Your est. $\qquad$ years

## Hardwood:

Survey result: 9 years
Your est. $\qquad$ years

3 ac . Change in rotation based on harvestable tree size?

Softwood:
Survey result: -3 years
Your est. +/- $\qquad$ years

## Mixedwood:

Survey result: +2 years
Your est. +/- $\qquad$ years

## Hardwood:

Survey result: +8 years
Your est. +/- $\qquad$ years

3ad. Change in rotation based on maximum MAI?

Softwood:
Survey result: 00 years
Your est. +/- $\qquad$ years

Mixedwood:
Survey result: +3 years
Your est. +/- $\qquad$ years

## Hardwood:

Survey result: +10 years
Your est. +/- $\qquad$ years

3b. For existing immature stands what do you expect from juvenile spacing/pre-commercial thinning (assume no utilization) regarding:

3ba. Change in growth?

## Softwood:

Survey result: $0.9 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$ Your est. +/- $\qquad$ m3/ha/yr

## Mixedwood:

Survey result: $1.0 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$ Your est. +/- $\qquad$ m3/ha/yr

## Hardwood:

Survey result: $1.1 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$ Your est. +/- $\qquad$ $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$

3bb. How long would this change in growth last?

| $\quad$ Softwood: | Mixedwood: |
| :--- | :--- |
| Survey result: 11 years | Survey result: 11 years |
| Your est. $\quad$ years | Your est. |

Hardwood:
Survey result: 14 years
Your est. $\qquad$ years

3bc. Change in rotation based on harvestable tree size?

## Softwood:

Survey result: -3 years Your est. +/- $\qquad$ years

## Mixedwood:

Survey result: +1 years
Your est. +/- $\qquad$ years

Hardwood:
Survey result: + 1 years Your est. +/- $\qquad$ years

## Hardwood:

Survey result: +1 years
Your est. +/- $\qquad$ years

3c. For existing immature stands what do you expect from commercial thinning (include thinning plus final harvest) regarding:
3ca. Change in growth?

Softwood:
Survey result: $0.8 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$
Your est. +/- $\qquad$ $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$

Mixedwood:
Survey result: $1.2 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$ Your est. +/- $\qquad$ $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$

## Hardwood:

Survey result: $1.2 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$ Your est. +/- $\qquad$ $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$

3 cb . How long would this change in growth last?

## Softwood:

Survey result: 11 years
Your est. $\qquad$ years

Mixedwood:
Survey result: 13 years
Your est. $\qquad$ years

## Hardwood:

Survey result: 12 years Your est. $\qquad$ years

3 cc . Change in rotation based on harvestable tree size?

## Softwood:

Survey result: +2 years
Your est. +/- $\qquad$ years

Mixedwood:
Survey result: +3 years Your est. +/- $\qquad$ years

## Hardwood:

Survey result: +3 years
Your est. +/- $\qquad$ years

## Hardwood:

Survey result: +2 years
Your est. +/- $\qquad$ years

## REGENERATED STANDS

4. Growth (MAI) of regenerated stands for softwood, mixedwood and hardwood.

4a. From Questionnaires \#1 and \#2, aggregate (mean) responses from survey participants about growth of regenerated stands are provided below. In most cases, Questionnaire \#2 results led to a mean MAI maximization which was inconsistent with Questionnaire \#1 age estimate of maximum MAI. Please examine each case below and provide final revised estimates of MAI for each species/age class. The age classes were set in 20 year increments from Questionnaire \#1 results that gave estimates of the ages of maximum MAI's which are denoted by an asterisk. Remember, the MAI should be maximum at the 20 year age class where you expect maximum biological growth for pulpwood utilization for the region.

|  | Softwood |  |  |  | Miedwood |  |  |  | Hardwood |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Age | Que\# 1 <br> MAI | Que\#2 <br> MAI | Final MAI | Age | Que\# 1 <br> MAI | $\begin{aligned} & \text { Que\#2 } \\ & \text { MAI } \end{aligned}$ | Final MAI | Age | Que\# 1 <br> MAI | Que\#2 <br> MAI | Final MAI |
| 19 | NA | 1.2 |  | 15 | NA | 1.2 |  | 1 | NA | 1.1 |  |
| 39 | 1.5 | 1.7 |  | 35 | 1.7 | 2.1 |  | 21 | 2.1 | 2.2 |  |
| 59 | 2.0 | 1.9 |  | 55 | 2.1 | 2.4 |  | 41 | 2.6 | 2.5 |  |
| 79* | 1.8 | 2.0 |  | 75 $*$ | 2.3 | 2.5 |  | 61* | 2.8 | 2.7 |  |
| 99 | 1.7 | 1.8 |  | 95 | 2.1 | 2.1 |  | 81 | 2.5 | 2.3 |  |


| 119 | NA | 1.6 |  |  | 11 <br> 5 | NA | 1.7 |  |  | 101 | NA | 1.6 |  |
| :--- | :--- | :--- | :--- | :--- | ---: | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |

The aggregated results below are taken from round 2 survey results. Please review the figures and provide any revised figures that you deem more representative of the region. If your revised figure agrees with the survey figure, please enter your estimate even if it is the same as the survey one.

4 b . What proportion of the area will be managed by uneven-aged management?
$\begin{array}{ll}\text { Softwood: } & \text { Survey result: } 9 \% \\ & \text { Your est. } \\ & \end{array}$
$\begin{array}{ll}\text { Mixedwood: } & \text { Survey result: } 18 \% \\ & \text { Your est. } \\ & \%\end{array}$
Hardwood: Survey result 21 \%
Your est. _ \%

4c. What growth per ha/year do you expect on areas that will be managed by uneven-aged management?
Softwood: Survey result: $1.9 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$ Your est. __m3/ha/yr
Mixedwood: Survey result: $2.1 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$
Your est. $\qquad$ $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$
Hardwood
Survey result $2.2 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$ Your est. $\qquad$ $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$

4d. What after-cut growing stock level do you expect to be left on areas that will be managed by uneven-aged management?.
Softwood:
Mixedwood:
Hardwood:
Survey result: $47 \mathrm{~m} 3 / \mathrm{ha} \quad$ Survey result: $47 \mathrm{~m} 3 / \mathrm{ha}$
Survey result $46 \mathrm{~m} 3 / \mathrm{ha}$
Your est. $\qquad$ $\mathrm{m} 3 / \mathrm{ha}$
Your est. $\qquad$ m3/ha
Your est. $\qquad$ m3/ha

4 e . What would be the average cutting cycle used on areas that will be managed by uneven-aged management?
Softwood:
Mixedwood:
Hardwood:
Survey result: 24 years Survey result: 21 years
Survey result 21 years
Your est. $\qquad$ years

Your est. $\qquad$ years

Your est. $\qquad$ years
5. From Questionnaire \#2 the results regarding fertilization of regenerated stands have been aggregated and are given below. Please review these figures and provide any revised figures that you deem more representative of the region. Base your figures on one-time application (comments from the previous round suggested that number of applications be clarified). Please enter your estimates even if in one or more cases they are identical to those of the survey results.

5a. At what stand age range would you fertilize? Answer should range between $X$ and $Y$ years of age.

## Softwood:

Survey result: $13 \& 44$ yrs old
Your est. $\qquad$ \& $\qquad$ yrs old

## Hardwood:

Survey result: $12 \& 38$ yrs old
Your est. $\qquad$ \& $\qquad$ yrs old
5 b. At what rate of fertilizer ( $\mathrm{kg} / \mathrm{ha}$ ) would you apply?

## Softwood: <br> Mixedwood:

Survey result: $150 \mathrm{~kg} / \mathrm{ha}$
Your est. $\qquad$ $\mathrm{kg} / \mathrm{ha}$ Survey result: $150 \mathrm{~kg} / \mathrm{ha}$ Your est. $\qquad$ $\mathrm{kg} / \mathrm{ha}$

## Hardwood:

5c. If sites are distinguished as Good, Medium and Poor what proportion of sites would you fertilize?

| Good: | Medium: |
| :--- | :--- |
| Survey result: $28 \%$ | Survey result: $24 \%$ |
| Your est. $\quad$ \% | Your est. |

Survey result: $16 \%$
Your est. $\qquad$ $\%$

5 d . What increase in growth ( $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$ ) would you expect?

## Softwood:

Survey result: $0.5 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$
Your est. $\qquad$ $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr} \quad$ Your est.

Your est.

Mixedwood: Survey result: $0.6 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$
$\qquad$ $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$

Hardwood:
Survey result: $0.5 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$ Your est. $\qquad$ $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$

5e. How long would the increased growth indicated above last (years)?

## Softwood:

Survey result: 10 years
Your est. $\qquad$ years

Mixedwood:
Survey result: 10 years Your est. $\qquad$ years

## Hardwood:

Survey result: 13 years
Your est. $\qquad$ years
6. Comments from Questionnaire \#1 regarding thinning indicated this topic had to be split into several categories and that thinning would occur only on immature stands. Several comments on round 2 again emphasize immature stands only. Each question below applies only to immature stands. The mean of your responses to round 2 are given below. Please review these results and provide revised estimates. If your estimate agrees with the mean figure from round 2 , please enter this as your estimate.

6a. For regenerated immature stands what do you expect from cleaning/brushing (assume no utilization) regarding:

6aa. Change in growth?
Softwood:
Survey result: $0.6 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$ Your est. +/- $\qquad$ $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$

6 ab . How long would this change in growth last?

Softwood:
Survey result: 10 years Your est. $\qquad$ years

Mixedwood:
Survey result: $0.5 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$ Your est. +/- $\qquad$ $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$

Hardwood:
Survey result: $0.8 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$ Your est. +/- $\qquad$ $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$

Mixedwood:
Survey result: 7 years
Your est. $\qquad$ years

## Hardwood:

Survey result: 10 years
Your est. $\qquad$ years

6 ac . Change in rotation based on harvestable tree size?

## Softwood:

Survey result: +1 years
Your est. +/- $\qquad$ years

Mixedwood:
Survey result: +2 years
Your est. +/- $\qquad$ years

## Hardwood:

Survey result: +8 years
Your est. +/- $\qquad$ years

6ad. Change in rotation based on maximum MAI?

## Softwood:

Survey result: +1 years
Your est. +/- $\qquad$ years

## Mixedwood:

Survey result: +2 years
Your est. +/- $\qquad$ years

## Hardwood:

Survey result: +8 years
Your est. +/- $\qquad$ years

6b. For regenerated immature stands what do you expect from juvenile spacing/pre-commercial thinning (assume no utilization) regarding:

6ba. Change in growth?

## Softwood:

Survey result: $0.7 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$
Your est. +/- $\qquad$ m3/ha/yr

## Mixedwood:

Survey result: $0.8 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$ Your est. +/- $\qquad$ m3/ha/yr

## Hardwood:

Survey result: $0.8 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$
Your est. +/- $\qquad$ $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$

Survey result: 14 years Your est. $\qquad$ years

## Hardwood:

Survey result: 00 years
Your est. +/- $\qquad$ years

6bd. Change in rotation based on maximum MAI?

## Softwood:

Survey result: +1 years
Your est. +/- $\qquad$ years

Mixedwood:
Survey result: 13 years Your est. $\qquad$ years

Mixedwood:
Survey result: 00 years
Your est. +/- $\qquad$ years

Mixedwood:
Survey result: +1 years
Your est. +/- $\qquad$ years

## Hardwood:

Survey result: +1 years
Your est. +/- $\qquad$ years

6 c . For regenerated immature stands what do you expect from commercial thinning (include thinning plus final harvest) regarding:
6ca. Change in growth?

Softwood:
Survey result: $0.7 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$
Your est. +/- $\qquad$ $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$

Mixedwood:
Survey result: $0.8 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$
Your est. +/- $\qquad$ m3/ha/yr

## Hardwood:

Survey result: $0.8 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$
Your est. +/- $\qquad$ $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$

6cb. How long would this change in growth last?

## Softwood:

Survey result: 13 years
Your est. $\qquad$ years

Mixedwood:
Survey result: 14 years
Your est. $\qquad$ years

## Hardwood:

Survey result: 13 years
Your est. $\qquad$ years

6 cc . Change in rotation based on harvestable tree size?

Softwood:
Survey result: 00 years
Your est. +/- $\qquad$ years

Mixedwood:
Survey result: + 1 years
Your est. +/- $\qquad$ years

## Hardwood:

Survey result: +3 years
Your est. $+/$ ___ years

6 cd . Change in rotation based on maximum MAI?
Softwood:
Survey result: + 1 years
Your est. +/- $\qquad$ years
7. From Questionnaire $\$ 2$, the results regarding genetic improvement of regenerated stands have been aggregated and are given below. Please review these figures and provide any revised figures that you deem more representative of the region. Please enter your estimates even if, in one or more cases, they are identical to those of the survey results.

7a. What change in MAI do you expect from greater improvement?

## Softwood:

Survey result: $0.7 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$ Your est. $\qquad$ $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$

## Mixedwood:

Survey result: $0.7 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$
Your est. $\qquad$ $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$

## Hardwood:

Survey result: $0.8 \mathrm{~m} 3 / \mathrm{ha} / \mathrm{yr}$ Your est. $\qquad$ $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$

Hardwood:
Survey result: +4 years
Your est. +/- $\qquad$ years

## Hardwood:

Survey result: +3 years
Your est. +/- $\qquad$ years

6b. For regenerated immature stands expectations from juvenile spacing/pre-commercial thinning (assuming no utilization) regarding the following are:

6ba. Change in growth?

Softwood: Ques \#2 result: $0.3 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr} \quad$ Mixedwood: Ques \#2 result: $0.4 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$ Ques \#3 result: $0.2 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$
$\begin{aligned} \text { Mixedwood: } & \text { Ques \#2 result: } 0.4 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr} \\ & \text { Ques \#3 result: } 0.3 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}\end{aligned}$

6bb. Length of time this change in growth lasted.
Softwood: Ques \#2 result: 9 years
Mixedwood: Ques \#2 result: 9 years
Ques \#3 result: 9 years
Hardwood: Ques \#2 result: $0.4 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$ Ques \#3 result: $0.3 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$

Ques \#3 result: 10 years
Hardwood: Ques \#2 result: 11 years
Ques \#3 result: 8 years
6bc. Change in rotation based on harvestable tree size.
Softwood: Ques \#2 result: -8 years
Ques \#3 result: -8 years
Mixedwood: Ques \#2 result: -7 years
Ques \#3 result: -8 years
Hardwood: Ques \#2 result: -5 years
Ques \#3 result: -7 years

6bd. Change in rotation based on maximum MAI.
Softwood: Ques \#2 result: 2 years Mixedwood: Ques \#2 result: 2 years
Ques \#3 result: -1 years
Ques \#3 result: -1 years
Hardwood: Ques \#2 result: 2 years Ques \#3 result: -1 years

6c. For regenerated immature stands, expectations from commercial thinning (including thinning plus final harvest) regarding the following are:

6 ca . Change in growth.
Softwood: Ques \#2 result: $1.1 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$ Ques \#3 result: $1.0 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$

Mixedwood: Ques \#2 result: $1.1 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$ Ques \#3 result: $1.0 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$

Hardwood: Ques \#2 result: $1.1 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$ Ques \#3 result: $1.0 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$

6 cb . Length of time this change in growth last.
$\begin{array}{rr}\text { Softwood: Ques \#2 result: } 12 \text { years } & \text { Mixedwood: Ques \#2 result: } 11 \text { years } \\ \text { Ques \#3 result: } 12 \text { years } & \text { Ques \#3 result: } 11 \text { years }\end{array}$
Hardwood: Ques \#2 result: 12 years
Ques \#3 result: 11 years
6 cc . Change in rotation based on harvestable tree size.
Softwood: Ques \#2 result: -7 years Mixedwood: Ques \#2 result: -4 years
Ques \#3 result: -7 years
Ques \#3 result: -8 years
Ques \#3 result: -7 years
Hardwood: Ques \#2 result: -2 years
Ques \#3 result: -5 years
6 cd . Change in rotation based on maximum MAI.
Softwood: Ques \#2 result: 2 years
Mixedwood: Ques \#2 result: 2 years
Ques \#3 result: -1 years
Hardwood: Ques \#2 result: 0 years
Ques \#3 result: - 1 years
7. From Questionnaires \#2, and \#3 the results regarding genetic improvement of regenerated stands have been aggregated and are given below.

7a. Change in MAI expected from greater improvement.

Softwood: Ques \#2 result: $0.9 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$
Ques \#3 result: $0.8 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$
Mixedwood:
Ques \#2 result: $1.0 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$ Ques \#3 result: $0.9 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$

Hardwood: Ques \#2 result: $1.1 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$ Ques \#3 result: $1.2 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$

7b. Change in rotation expected based on harvestable tree size.
Softwood: Ques \#2 result: -12 years
Mixedwood: Ques \#2 result: -12 years
Ques \#3 result: - 11 years
Hardwood: Ques \#2 result: -10 years
Ques \#3 result: -13 years
7c. Change in rotation expected based on Maximum MAI.
Softwood: Ques \#2 result: -2 years
Ques \#3 result: -2 years
Mixedwood: Ques \#2 result: - 1 years
Ques \#3 result: -2 years
Hardwood: Ques \#2 result: -3 years
Ques \#3 result: -3 years

RESULTS FOR ALL 3 QUESTIONNAIRES

## EXISTING STANDS

1. Growth (MAI) of existing stands for softwood, mixedwood and hardwood.

1a. From Questionnaires \#1, \#2 and \#3, aggregate (mean) responses from survey participants about growth of existing stands are provided below. In most cases, Questionnaire \#2 and \#3 results led to mean MAI maximization which was inconsistent with Questionnaire \#1 age estimate of maximum MAI. The age classes were set in 20 year increments from Questionnaire \#1 results that gave estimates of the ages of maximum MAI's which are denoted by an asterisk. The MAI estimates are maximum at the 20 year age class where maximum biological growth is expected for pulpwood utilization for the region.

| Softwood |  |  |  | Mixedwood |  |  |  |  | Hardwood |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Age | Que\#1 <br> MAI | Que\#2 <br> MAI | Que\#3 <br> MAI |  | Age | Que\#1 <br> MAI | Que\#2 <br> MAI | Que\#3 <br> MAI | Age | Que\#1 <br> MAI | Que\#2 <br> MAI | Que\#3 <br> MAI |
| 40 | NA | 1.6 | 1.7 |  | 33 | NA | 1.9 | 2.0 | 23 | NA | 1.8 | 2.1 |
| 60 | 1.9 | 1.9 | 2.0 |  | 53 | 2.2 | 2.5 | 2.3 |  | 43 | 2.8 | 2.7 |
| 80 | 1.8 | 2.0 | 2.1 |  | 73 | 2.2 | 2.5 | 2.4 |  | 63 | 2.8 | 2.9 |
| $100^{*}$ | 1.7 | 1.8 | 2.0 |  | $93^{*}$ | 2.0 | 2.2 | 2.1 |  | $83^{*}$ | 2.6 | 2.4 |
| 120 | 1.5 | 1.6 | 1.7 |  | 113 | 1.9 | 1.8 | 1.8 |  | 103 | 2.3 | 2.0 |
| 140 | NA | 1.3 | 1.4 |  | 133 | NA | 1.5 | 1.5 |  | 123 | NA | 1.6 |

The aggregated results below are from rounds 2 and 3 survey results.
1b. What proportion of the area is managed by uneven-aged management.

Softwood: Ques \#2 result: $6 \%$
Ques \#3 result: NA\%

Mixedwood: Ques \#2 result: 13\%
Ques \#3 result: 9\%

Hardwood: Ques \#2 result: 19\%
Ques \#3 result: 10\%

1c. Growth per ha/year on areas managed by uneven-aged management.
Softwood: Ques \#2 result: $1.8 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr} \quad$ Mixedwood: Ques \#2 result: $2.2 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$
Hardwood: Ques \#2 result: $2.3 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$ Ques \#3 result: $2.4 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$

Id. After-cut growing stock level left on areas managed by uneven-aged management.
Softwood: Ques \#2 result: $54 \mathrm{~m}^{3} / \mathrm{ha}$
Mixedwood: Ques \#2 result: $50 \mathrm{~m}^{3} / \mathrm{ha}$ Ques \#3 result: $43 \mathrm{~m}^{3} / \mathrm{ha}$

Ques \#3 result: $52 \mathrm{~m}^{3} / \mathrm{ha}$
Hardwood: Ques \#2 result: $57 \mathrm{~m}^{3} / \mathrm{ha}$ Ques \#3 result: $57 \mathrm{~m}^{3} / \mathrm{ha}$

1e. Average cutting cycle used on areas managed by uneven-aged management?
Softwood: Ques \#2 result: 24 years
Mixedwood: Ques \#2 result: 24 years
Ques \#3 result: 29 years
Hardwood: Ques \#2 result: 21 years Ques \#3 result: 22 years
2. From Questionnaires \#2 and \#3 the results regarding fertilization of existing stands have been aggregated and are given below. Figures are based on one-time applications

2a. Stand age range when fertilization could take place.

Softwood: Ques \#2 result: 13 \& 41 yrs old Ques \#3 result: 14 \& 35 yrs old

Mixedwood: Ques \#2 result: 14 \& 41 yrs old Ques \#3 result: $8 \& 33$ yrs old

Hardwood: Ques \#2 result: 12 \& 36 yrs old Ques \#3 result: $7 \& 30$ yrs old

Hardwood: Ques \#2 result: $175 \mathrm{~kg} / \mathrm{ha}$ Ques \#3 result: $175 \mathrm{~kg} / \mathrm{ha}$

2c. For sites distinguished as Good, Medium and Poor, the proportion of sites that would be fertilized.
Good: Ques \#2 result: 31\%
Medium: Ques \#2 result: 25\%
Poor: Ques \#2 result: 11\%
Ques \#3 result: 14\%
Ques \#3 result: 20\%
Ques \#3 result: 6\%

2d. Expected increase in growth ( $\mathrm{m} 3 / \mathrm{ha} / \mathrm{yr}$ ).

Softwood: Ques \#2 result: $0.9 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr} \quad$ Mixedwood: Ques \#2 result: $0.6 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$ Ques \#3 result: $0.6 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$

Ques \#3 result: $0.5 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$

Hardwood: Ques \#2 result: $0.8 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$ Ques \#3 result: $0.7 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$

2e. Length of time the increased growth would last (years).
Softwood: Ques \#2 result: 10 years Mixedwood: Ques \#2 result: 10 years Ques \#3 result: 9 years

Ques \#3 result: 9 years
Hardwood: Ques \#2 result: 11 years Ques \#3 result: 8 years
3. Comments from Questionnaire \#1 regarding thinning indicated this topic had to be split into several categories and that thinning would occur only on immature stands. Several comments on round 2 again emphasize immature stands only. The results below apply only to immature stands. The mean of responses to round 2 and 3 are given below.

3a. For existing immature stands, expectations from cleaning/brushing (assuming no utilization) regarding the following are:
3aa. Change in growth.
Softwood: Ques \#2 result: $0.7 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$ Ques \#3 result: $0.6 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$
Mixedwood: Ques \#2 result: $0.4 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$
Ques \#3 result: $0.5 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$
Hardwood: Ques \#2 result: $0.8 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$ Ques \#3 result: $0.7 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$

3ab. Length of time this change in growth would last.
Softwood: Ques \#2 result: 11 years
Ques \#3 result: 11 years
$\begin{aligned} & \text { Mixedwood: } \text { Ques \#2 result: } 6 \text { years } \\ & \text { Ques \#3 result: } 6 \text { years }\end{aligned}$
Hardwood: Ques \#2 result: 9 years
Ques \#3 result: 7 years
3ac. Change in rotation based on harvestable tree size.
Softwood: Ques \#2 result: -3 years
Ques \#3 result: -2 years
Mixedwood: Ques \#2 result: 2 years
Ques \#3 result: 1 years
Hardwood: Ques \#2 result: 8 years
Ques \#3 result: 1 years
3ad. Change in rotation based on maximum MAI.
Softwood: Ques \#2 result: 0 years Mixedwood: Ques \#2 result: 3 years
Ques \#3 result: -1 years
Ques \#3 result: -2 years
Hardwood: Ques \#2 result: 10 years Ques \#3 result: 2 years

3b. For existing immature stands expectations from juvenile spacing/pre-commercial thinning (assuming no utilization) regarding the following are:

3ba. Change in growth.
Softwood: Ques \#2 result: $0.9 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr} \quad$ Mixedwood: Ques \#2 result: $1.0 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$
Ques \#3 result: $0.7 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$

Ques \#3 result: $0.7 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$

Hardwood: Ques \#2 result: $1.1 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$ Ques \#3 result: $0.7 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$

3bb. Length of time this change in growth lasted.

Softwood: Ques \#2 result: 11 years
Ques \#3 result: 12 years
Mixedwood: Ques \#2 result: 11 years
Ques \#3 result: 9 years
Hardwood: Ques \#2 result: 14 years
Ques \#3 result: 12 years
3bc. Change in rotation based on harvestable tree size.
Softwood: Ques \#2 result: -3 years
Ques \#3 result: -7 years
Mixedwood: Ques \#2 result: 1 years
Ques \#3 result: -1 years
3bd. Change in rotation based on maximum MAI.
Softwood: Ques \#2 result: -1 years
Ques \#3 result: -2 years

Mixedwood: Ques \#2 result: 1 years
Ques \#3 result: -3 years

Hardwood: Ques \#2 result: I years Ques \#3 result: -1 years

Hardwood: Ques \#2 result: 1 years Ques \#3 result: -3 years

3c. For existing immature stands expectations from commercial thinning (including thinning plus final harvest) regarding the following are:

3 ca . Change in growth.

Softwood: Ques \#2 result: $0.8 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$ Ques \#3 result: $0.6 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$

Mixedwood: Ques \#2 result: $1.2 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$
Ques \#3 result: $0.6 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$

Hardwood: Ques \#2 result: $1.2 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$ Ques \#3 result: $0.7 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$

3cb. Length of time this change in growth lasted.

Softwood: Ques \#2 result: 11 years
Ques \#3 result: 10 years

Mixedwood: Ques \#2 result: 13 years Ques \#3 result: 8 years

Mixedwood: Ques \#2 result: 3 years Ques \#3 result: -3 years

3 cd . Change in rotation based on maximum MAI.
Softwood: Ques \#2 result: 3 years
Ques \#3 result: -2 years

Mixedwood: Ques \#2 result: 2 years
Ques \#3 result: -2 years

Hardwood: Ques \#2 result: 12 years
Ques \#3 result: 9 years

Hardwood: Ques \#2 result: 3 years
Ques \#3 result: -3 years

Hardwood: Ques \#2 result: 2 years Ques \#3 result: -2 years

## REGENERATED STANDS

4. Growth (MAI) of regenerated stands for softwood, mixedwood and hardwood.

4a. From Questionnaires \#1, \#2 and \#3, aggregate (mean) responses from survey participants about growth of regenerated stands are provided below. In most cases, Questionnaire \#2 and \#3 results led to a mean MAI maximizations which were inconsistent with Questionnaire \#1 age estimate of maximum MAI. The age classes were set in 20 year increments from Questionnaire \#1 results that gave estimates of the ages of maximum MAI's which are denoted by an asterisk. The MAI should estimates are maximum at the 20 year age class where maximum biological growth is expected for pulpwood utilization for the region.

| Softwood |  |  |  | Mixedwood |  |  |  |  | Hardwood |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Age | Que\#1 <br> MAI | Que\#2 <br> MAI | Que\#3 <br> MAI |  | Age | Que\#1 <br> MAI | Que\#2 <br> MAI | Que\#3 <br> MAI |  | Age | Que\#1 <br> MAI | Que\#2 <br> MAI | Que\#3 <br> MAI |
| 19 | NA | 1.2 | 1.1 |  | 15 | NA | 1.2 | 1.0 |  | 1 | NA | 1.1 | 0.6 |
| 39 | 1.5 | 1.7 | 1.7 |  | 35 | 1.7 | 2.1 | 1.8 |  | 21 | 2.1 | 2.2 | 2.0 |
| 59 | 2.0 | 1.9 | 2.0 |  | 55 | 2.1 | 2.4 | 2.4 |  | 41 | 2.6 | 2.5 | 2.5 |
| $79^{*}$ | 1.8 | 2.0 | 2.1 |  | $75^{*}$ | 2.3 | 2.5 | 2.5 |  | $61^{*}$ | 2.8 | 2.7 | 2.9 |
| 99 | 1.7 | 1.8 | 1.8 |  | 95 | 2.1 | 2.1 | 2.1 |  | 81 | 2.5 | 2.3 | 2.6 |
| 119 | NA | 1.6 | 1.6 |  | 115 | NA | 1.7 | 1.7 |  | 101 | NA | 1.6 | 2.1 |

The aggregated results below are taken from rounds 2 and 3 survey results.

4b. Proportion of the area that will be managed by uneven-aged management.

Softwood: Ques \#2 result: 9\% Ques \#3 result: 5\%

Mixedwood: Ques \#2 result: 18\%
Ques \#3 result: 9\%

Hardwood: Ques \#2 result: $21 \%$
Ques \#3 result: 10\%

4c. Growth per ha/year expected on areas that will be managed by uneven-aged management.

Softwood: Ques \#2 result: $1.9 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr} \quad$ Mixedwood: Ques \#2 result: $2.1 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$
Ques \#3 result: $1.8 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$

Ques \#3 result: $2.3 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$

Hardwood: Ques \#2 result: $2.2 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$ Ques \#3 result: $2.5 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$

4d. After-cut growing stock level expected to be left on areas that will be managed by uneven-aged management.
Softwood: Ques \#2 result: $47 \mathrm{~m}^{3} / \mathrm{ha}$
Mixedwood: Ques \#2 result: $47 \mathrm{~m}^{3} / \mathrm{ha}$
Hardwood: Ques \#2 result: $46 \mathrm{~m}^{3} / \mathrm{ha}$
Ques \#3 result: $55 \mathrm{~m}^{3} / \mathrm{ha}$
Ques \#3 result: $55 \mathrm{~m}^{3} / \mathrm{ha}$
Ques \#3 result: $55 \mathrm{~m}^{3} / \mathrm{ha}$

4e. Average cutting cycle used on areas that will be managed by uneven-aged management.

Softwood: Ques \#2 result: 24 years Mixedwood: Ques \#2 result: 21 years
Ques \#3 result: 22 years

Ques \#3 result: 20 years

Hardwood: Ques \#2 result: 21 years
Ques \#3 result: 20 years
5. From Questionnaires \#2 and \#3 the results regarding fertilization of regenerated stands have been aggregated and are given below. Figures are based on one-time applications.

5a. Stand age range when fertilization would take place.

Softwood: Ques \#2 result: $13 \& 44$ yrs old Ques \#3 result: $5 \& 30$ yrs old

Mixedwood: Ques \#2 result: 14 \& 45 yrs old
Ques \#3 result: 8 \& 30 yrs old

Hardwood: Ques \#2 result: 12 \& 38 yrs old
Ques \#3 result: $5 \& 30$ yrs old

5b. Rate of fertilizer ( $\mathrm{kg} / \mathrm{ha}$ ).
Softwood: Ques \#2 result: $150 \mathrm{~kg} / \mathrm{ha}$
Ques \#3 result: $200 \mathrm{~kg} / \mathrm{ha}$

Mixedwood: Ques \#2 result: $150 \mathrm{~kg} / \mathrm{ha}$
Ques \#3 result: $150 \mathrm{~kg} / \mathrm{ha}$

Hardwood: Ques \#2 result: $150 \mathrm{~kg} / \mathrm{ha}$
Ques \#3 result: $150 \mathrm{~kg} / \mathrm{ha}$

5c. For sites distinguished as Good, Medium and Poor, that proportion of sites that would be fertilized.
Good: Ques \#2 result: $28 \%$
Ques \#3 result: $13 \%$
Medium: Ques \#2 result: $24 \%$
Ques \#3 result: 20\%
Poor: Ques \#2 result: 16\%
Ques \#3 result: 0\%
5d. Expected increase in growth (m3/ha/yr).
Softwood: Ques \#2 result: $0.5 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr} \quad$ Mixedwood: Ques \#2 result: $0.6 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$ Ques \#3 result: $0.5 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$

Ques \#3 result: $0.5 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$
Hardwood: Ques \#2 result: $0.5 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$
Ques \#3 result: $0.5 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$

5e. Length of time the increased growth indicated above last (years).
Softwood: Ques \#2 result: 10 years
Mixedwood: Ques \#2 result: 10 years
Ques \#3 result: 8 years
Hardwood: Ques \#2 result: 13 years
Ques \#3 result: 15 years
6. Comments from Questionnaire \#1 regarding thinning indicated this topic had to be split into several categories and that thinning would occur only on immature stands. Several comments on round 2 again emphasize immature stands only. The results below apply only to immature stands. The mean of responses to round 2 and 3 are given below.

6a. For regenerated immature stands, expectations from cleaning/brushing (assuming no utilization) regarding the following are:
6aa. Change in growth.

Softwood: Ques \#2 result: $0.6 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr} \quad$ Mixedwood: Ques $\# 2$ result: $0.5 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$ Ques \#3 result: $0.5 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$

Ques \#3 result: $0.3 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$

Hardwood: Ques \#2 result: $0.8 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$
Ques \#3 result: $0.3 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$

6ab. Length of time this change in growth lasted.
Softwood: Ques \#2 result: 10 years Mixedwood: Ques \#2 result: 7 years
Ques \#3 result: 8 years
Ques \#3 result: 7 years
Hardwood: Ques \#2 result: 10 years
Ques \#3 result: 10 years
6ac. Change in rotation based on harvestable tree size.

| Softwood: Ques \#2 result: 1 years | Mixedwood: Ques \#2 result: 2 years |
| :---: | :---: |
| Ques \#3 result: -4 years | Ques \#3 result: -1 years |

6ad. Change in rotation based on maximum MAI.
Softwood: Ques \#2 result: 1 years
Ques \#3 result: -2 years
Mixedwood: Ques \#2 result: 2 years
Ques \#3 result: - 1 years

Hardwood: Ques \#2 result: 8 years
Ques \#3 result: -4 years

Hardwood: Ques \#2 result: 8 years
Ques \#3 result: -4 years

6b. For regenerated immature stands expectations from juvenile spacing/pre-commercial thinning (assuming no utilization) regarding the following are:

6ba. Change in growth?

Softwood: Ques \#2 result: $0.7 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$ Ques \#3 result: $0.2 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$

Mixedwood: Ques \#2 result: $0.8 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$
Ques \#3 result: $0.2 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$

Hardwood: Ques \#2 result: $0.8 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$ Ques \#3 result: $0.2 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$

6bb. Length of time this change in growth lasted.
Softwood: Ques \#2 result: 14 years
Mixedwood: Ques \#2 result: 13 years
Ques \#3 result: 7 years
Hardwood: Ques \#2 result: 14 years Ques \#3 result: 9 years

6bc. Change in rotation based on harvestable tree size.
Softwood: Ques \#2 result: -2 years
Mixedwood: Ques \#2 result: 0 years
Ques \#3 result: -2 years
Hardwood: Ques \#2 result: 0 years
Ques \#3 result: -3 years
6bd. Change in rotation based on maximum MAI.
Softwood: Ques \#2 result: 1 years
Mixedwood: Ques \#2 result: 1 years
Ques \#3 result: -1 years
Hardwood: Ques \#2 result: 1 years
Ques \#3 result: -3 years
6c. For regenerated immature stands, expectations from commercial thinning (including thinning plus final harvest) regarding the following are:

6ca. Change in growth.

Softwood: Ques \#2 result: $0.7 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr} \quad$ Mixedwood: Ques \#2 result: $0.8 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$
Ques \#3 result: $0.7 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$

Hardwood: Ques \#2 result: $0.8 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$ Ques \#3 result: $\mathrm{NA} \mathrm{m}^{3} / \mathrm{ha} / \mathrm{yr}$

6 cb . Length of time this change in growth last.
Softwood: Ques \#2 result: 13 years
Ques \#3 result: 10 years
Mixedwood: Ques \#2 result: 14 years
Ques \#3 result: 11 years
Hardwood: Ques \#2 result: 13 years
Ques \#3 result: 11 years
6 cc . Change in rotation based on harvestable tree size.

Softwood: Ques \#2 result: 0 years
Ques \#3 result: -2 years
Mixedwood: Ques \#2 result: 1 years
Ques \#3 result: -2 years

Hardwood: Ques \#2 result: 3 years
Ques \#3 result: -2 years

6 cd . Change in rotation based on maximum MAI.
Softwood: Ques \#2 result: 1 years Mixedwood: Ques \#2 result: -1 years
Ques \#3 result: -2 years
Ques \#3 result: -2 years
Hardwood: Ques \#2 result: 1 years Ques \#3 result: -2 years
7. From Questionnaires \#2, and \#3 the results regarding genetic improvement of regenerated stands have been aggregated and are given below.

7a. Change in MAI expected from greater improvement.

Softwood: Ques \#2 result: $0.7 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr} \quad$ Mixedwood: Ques \#2 result: $0.7 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$
Ques \#3 result: $0.4 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$

Ques \#3 result: $0.5 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$

Hardwood: Ques \#2 result: $0.8 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$
Ques \#3 result: $0.5 \mathrm{~m}^{3} / \mathrm{ha} / \mathrm{yr}$

7b. Change in rotation expected based on harvestable tree size.

Softwood: Ques \#2 result: 6 years
Ques \#3 result: 1 years
Mixedwood: Ques \#2 result: 5 years
Ques \#3 result: -1 years

Hardwood: Ques \#2 result: 4 years Ques \#3 result: - 1 years

7c. Change in rotation expected based on Maximum MAI.
Softwood: Ques \#2 result: 5 years
Ques \#3 result: 1 years
Mixedwood: Ques \#2 result: 4 years
Ques \#3 result: -1 years

Hardwood: Ques \#2 result: 3 years Ques \#3 result: -1 years

