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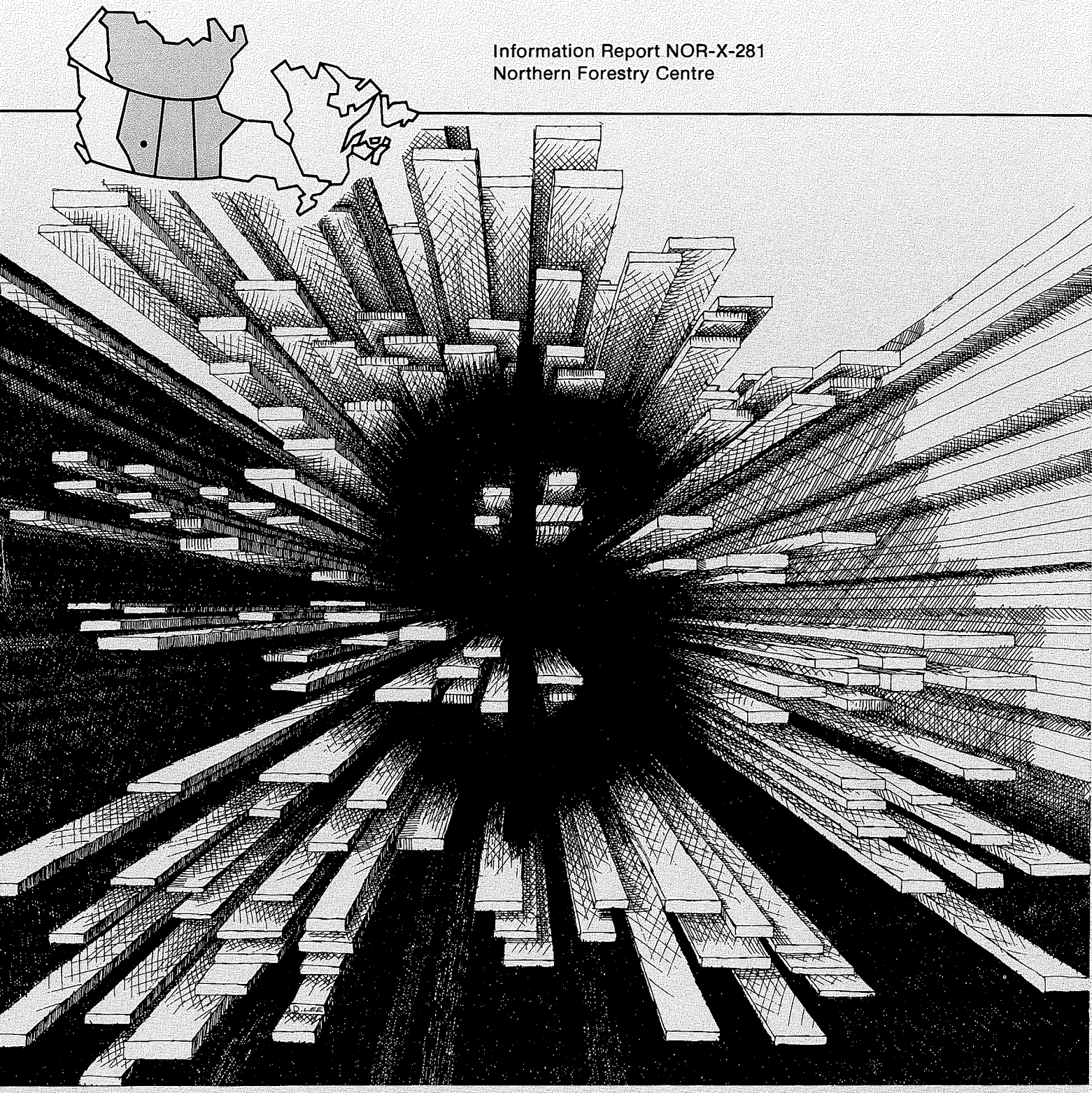
Forest economics research needs for west-central Canada

W.E. Phillips, J.A. Beck, and G.W. Lamble

Information Report NOR-X-281
Northern Forestry Centre



University of Alberta

Rural Economy Bulletin No. 27
Faculty of Agriculture and Forestry

The Northern Forestry Centre (NoFC) of the Canadian Forestry Service is responsible for fulfilling the federal role in forestry research, regional development, and technology transfer in Alberta, Saskatchewan, Manitoba, and the Northwest Territories. The main objectives of the center are research and regional development in support of improved forest management for the economic, social, and environmental benefit of all Canadians. Since 1982 the center has also assumed responsibility for the implementation of federal-provincial forestry agreements and employment stimulation programs in the forestry sector.

One of six regional centers, two national forestry institutes, and a headquarters unit, NoFC is located in Edmonton, Alberta, and has district offices in Prince Albert, Saskatchewan, and Winnipeg, Manitoba. Until joining Agriculture Canada in 1984 under a Minister of State (Forestry and Mines), the Canadian Forestry Service was part of Environment Canada.

FOREST ECONOMICS RESEARCH NEEDS FOR WEST-CENTRAL CANADA

W.E. Phillips,[1] *J.A. Beck,*[1] *and G.W. Lamble*[2]

INFORMATION REPORT NOR-X-281
NORTHERN FORESTRY CENTRE
CANADIAN FORESTRY SERVICE

and

BULLETIN 27
DEPARTMENT OF RURAL ECONOMY
FACULTY OF AGRICULTURE AND FORESTRY
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Catalogue No. Fo46-12/281E
ISBN 0-662-14884-3
ISSN 0704-7673

This publication is available at no charge from:

Northern Forestry Centre
Canadian Forestry Service
5320 - 122 Street
Edmonton, Alberta
T6H 3S5

Phillips, W.E.; Beck, J.A.; Lamble, G.W. 1986. *Forest economics research needs for west-central Canada.* Univ. Alberta, Fac. Agric. For., Dep. Rural Econ., Edmonton, Alberta. Bull. 27, and Can. For. Serv., North. For. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-281.

ABSTRACT

Forest economic research activities and needs were identified and defined for west-central Canada (Alberta, Manitoba, the Northwest Territories, and Saskatchewan) using a modified Delphi Technique and the Nominal Group Technique. Three sequential questionnaires were completed by 88 forest economics researchers and research users; from these, a list of past and current research activities was made, and the gap between existing activities and research needs was defined. Twenty-six research needs were identified and ranked for the entire region and for the prairie provinces and Northwest Territories.

RESUME

Les activités et besoins en matière de recherche sur l'économie forestière ont été déterminés pour le centre-ouest du Canada (Alberta, Manitoba, Territoires du Nord-Ouest et Saskatchewan) à l'aide d'une méthode Delphi modifiée et de la méthode du groupe nominal. Quatre-vingt-huit chercheurs en économie et utilisateurs des recherches ont rempli trois questionnaires séquentiels; à partir des réponses obtenues, une liste des activités de recherche passées et présentes a été établie, et les lacunes par rapport aux besoins ont été déterminées. Vingt-six activités de recherche requises ont ainsi été reconnues et classées par ordre de priorité pour toute la région, ainsi que pour les provinces des Prairies et les Territoires du Nord-Ouest.

PREFACE

This project is the result of an initial idea by Dr. Michael Heit of the Northern Forestry Centre, Canadian Forestry Service, Edmonton, Alberta. The authors took his idea and developed the project, which was one of the initial projects funded under the new Program of Research by Universities in Forestry (PRUF) system of contracts. We would like to acknowledge and thank the 88 mail survey participants for their input and their employers for allowing them time to participate in the study. We would also like to thank the advisory committee consisting of Dr. Michael Heit and Ms. Diana Boylen of the Canadian Forestry Service, Mr. Ed Gillespie of the Alberta Forest Service, and Dr. Richard Dempster, a private consultant, for their help, support, and advice throughout the project.

Many staff members at the University of Alberta have helped with the project. Several deserve particular note and our sincere appreciation and thanks: Mr. Clare Shier for data processing, Mrs. Judy Boucher for data entry and word processing, Mr. Jim Copeland and Ms. Wendy Williamson for assistance in final manuscript preparation, Ms. Sheila Greenberg and Mr. Val Smyth for meeting arrangements and travel assistance, Ms. Bertine LeBlanc for bookkeeping, Mr. Doug Krystofiak for follow-up phoning, Mr. Cam French for research inventory verification, and Ms. Linda Ehrler for travel arrangements. Outside the University of Alberta, Ms. Emily Novotny of the Natural Resources Institute of the University of Manitoba deserves special thanks for her help in making meeting arrangements in Manitoba.

Finally, we would like to thank the area meeting participants for their valuable input into the project. The authors have tried to accurately portray the desires and opinions of all participants in the study and humbly request your forgiveness, in advance, for any errors or omissions that may exist in this report.

FOREWORD

This study was sponsored by the Canadian Forestry Service under a PRUF (Program of Research by Universities in Forestry) contract. This report has been reviewed by the Canadian Forestry Service and approved for distribution. Approval does not necessarily signify that the contents reflect the views and policies of the Canadian Forestry Service. Mention of trade names or commercial products does not constitute recommendation or endorsement for use.

CONTENTS

APPENDIXES

FIGURE

TABLES

PURPOSE AND OBJECTIVES

Forest economics research activity in the prairie provinces and Northwest Territories is thought to be undefined, unfocused, and uncoordinated. This condition does not mean that research is of a low quality or that researchers are unqualified; rather, it means that there is a lack of cohesiveness in the research community. There is a need for organizational development and coordination.

The purpose of this project is to facilitate the meeting of forest economics research participants and users whose tasks are to define forest economics research needs. Objectives of this study are as follows:

1. to identify existing research activities;
2. to define forest economic research needs;
3. to define the gap between the activities and needs;
4. to identify the constraints upon meeting research needs; and
5. to strengthen a sense of community among the participants and users of forest economics research.

The focus of this exercise is forest resource utilization. The interactive aspects such as recreational use of the forest, product development, and surface and subsurface extraction on forest lands are recognized. It also includes the social, economic, and institutional interactivity of forest resource allocation. The spectrum of interest covers the forestry system from forest land resource base to final consumer demand.

METHODOLOGY

Judgmental Decision–making Techniques

The nature of the study purpose was one of judgmental decision making (Thompson and Tuden 1959). Such decisions have also been referred to as heuristic (Simon 1960) and creative (Delbecq et al. 1975) decision making. This type of decision has the following distinguishing characteristic:

> the lack of agreement or incomplete state of knowledge concerning either the nature of the problem or the components which must be included in a successful solution. As a result, heterogeneous group members must pool their judgments to invent or discover a satisfactory course of action (Delbecq et al. 1975, page 5).

Judgmental decisions may be contrasted with programmed or routine decisions where concerned individuals agree upon the desired goal, and technologies exist to achieve this goal. In such situations the decision is usually delegated to a trained technical expert or team of experts to handle on the basis of established formulas or procedures.

This particular study involved judgmental decision making in that it required the pooling of judgments of a variety of individuals about priority needs for forest economics research. Because of a lack of agreement and incomplete knowledge of the issues involved, no one person could make the required decision.

Two special purpose techniques have been developed to facilitate judgmental decisions. They are the Delphi Technique and the Nominal Group Technique (Delbecq et al. 1975). Both of these techniques are designed for systematically soliciting and aggregating the judgments of a number of individuals on a particular topic in order to improve the quality of judgmental decision making. The Delphi Technique was selected as the basic design for this study. A modified Nominal Group Technique was also used in conducting one phase of the study.

The Delphi Technique was developed by Dalkey and his associates at the Rand Corporation in the early 1950s (Delbecq et al. 1975). It uses a set of carefully designed sequential questionnaires, interspersed with summarized information and feedback of opinions derived from earlier responses. The first questionnaire usually asks individuals to respond to a broad question, and subsequent questionnaires ask for review, clarification, and expression of opinion on the previous information. The process stops when consensus has been approached among participants or when sufficient information exchange has been obtained. A minimum of three iterations of questionnaires is usually required. The specific design and implementation can be modified depending on the nature of the problem being investigated and constrained by the amount of human and physical resources available. The Delphi Technique has gained considerable recognition and is used in planning settings to achieve several objectives:

1. to determine or develop a range of possible program alternatives;
2. to explore or expose underlying assumptions or information leading to different judgments;
3. to seek out information that may generate a consensus on the part of the respondent group;
4. to correlate informed judgments on a topic spanning a wide range of disciplines; and
5. to educate the respondent group as to the diverse and interrelated aspects of the topic.

A unique advantage of this technique is that it does not require bringing respondents together in a face–to–face meeting. It lets people remain anonymous. It can be used where people are hostile toward one another or where individual personality styles would be distracting in a face–to–face setting. It is also a convenient way of involving participants who are spread over a large geographical region.

The Delphi Technique does have some requirements that may limit its use. For example, it requires a considerable amount of time to conduct; at least 45 days are required, and a great deal of time on the part of the staff group leading the technique is needed to develop and test questionnaires and analyze the returns. The technique requires participant skill in written communication. Participants also must have a high degree of motivation to commit the needed amount of time and effort to the process.

The Nominal Group Technique was developed by Andre Delbecq and Andrew Van de Ven in 1968 as a synthesis of social–psychological studies of group decision making and citizen participation in program planning (Delbecq et al. 1975). It has been widely applied in health, social service, education, industry, and government organizations. Like the Delphi Technique, it is a special purpose technique for judgmental decision making. Unlike the Delphi Technique, which relies on written communication among participants, the Nominal Group Technique is a group–centered technique that structures a face–to–face group meeting by following a prescribed sequence of problem–solving steps. There are typically six basic steps in the process:

1. silent independent generation of ideas in writing by group members to prepare their contribution to the

meeting;
2. round robin sharing and recording of ideas on a flip chart to map the group's initial thinking, guide further discussion, see the richness of ideas, and stimulate additional ideas;
3. serial discussion of the listed items to clarify their meaning and explain reasons for agreement or disagreement, but not to win arguments or resolve differences of opinion;
4. preliminary mathematical vote in writing to aggregate judgments of members regarding the relative importance of items;
5. discussion of the preliminary vote to examine the voting pattern for inconsistencies, surprises, and clarification, but not to pressure toward artificial consensus; and
6. final vote to accurately aggregate group members' judgments, determine the output of the meeting, and provide a sense of closure and accomplishment.

The Delphi Technique and Nominal Group Technique have a number of common advantages for handling judgmental decisions. They ensure that different and appropriate processes are used for the two major phases of creative problem solving: a) idea generation or fact finding and b) evaluation or synthesis and choosing among strategic elements. The techniques facilitate balanced participation among group members and balanced attention to each idea generated. Mathematical rating procedures increase the accuracy in aggregating individual judgments. Obtaining the voting in writing helps eliminate social pressure on individual judgments. Both techniques result in clear evidence of the task being brought to closure and participant satisfaction about the accomplishment.

These techniques have been used to identify elements of a problem situation; explore components of a solution; establish priorities; review preliminary proposals; involve citizens, clients, or consumers; and utilize multidisciplinary experts. These judgmental decision–making techniques were deemed appropriate for this particular study.

The use of these techniques in the context of the purpose and objectives of this project resulted in a series of sequential steps designed to fulfill the requirements of the project. These steps are outlined in the accompanying project process flow chart (Fig. 1). There were two basic phases to the project. The first phase involved the application of the Delphi Technique with 88 selected participants to determine research activities and needs. Preliminary results of this phase served as input into Phase II and as input into the final report. Phase II involved area meetings of study participants to allow face–to–face contact on research needs for the region and subregions.

Project Advisory Committee

The project was undertaken by the project leaders with the assistance of an advisory committee. In order to facilitate frequent contact among members of the committee, members were selected who reside in the Edmonton vicinity. The advisory committee consisted of the project leaders: Ms. Diana Boylen and Dr. Michael Heit, Canadian Forestry Service; Mr. Edward Gillespie, Alberta Forest Service; and Dr. Richard Dempster, private consultant.

The advisory committee provided valuable guidance and suggestions in selection of study participants, questionnaire design, planning of area meetings, and analysis of findings.

Participant Selection

The study required the identification and participation of a sample of individuals recognized as knowledgeable about forest economics research activities and needs in the region. To guide the selection process the following criteria were used. Participants were to have the following characteristics:
1. a deep interest in the study topic;
2. important knowledge or experience to share;
3. motivation to include the survey questionnaires in their schedule of competing tasks;
4. representation of the various subregions or areas (Alberta, Manitoba, Saskatchewan, and the Northwest Territories); and
5. representation of private industry, public service, and university perspectives.

Using these criteria a referral nomination technique was used to identify individual participants. The process began with the project advisory committee identifying three to five individuals who met the criteria in each of the four subregions. Each of these people was then contacted by telephone, invited to participate in the study, and asked to nominate others who they thought met the qualifications of desirable respondents. People who received multiple nominations through this referral process were also invited to participate in the study and to nominate others. Through this referral process 88 respected individuals were identified by their peers, and they agreed to participate in the study. There were 28 participants from Alberta, 22 from Manitoba, 14 from the Northwest Territories, and 24 from Saskatchewan. Names and affiliations of participants are given in Appendix 1.

Each participant in the study was initially contacted by telephone during September 1983 by one of the project leaders. The contact person described the objectives of the study, the nature of the respondent panel, the nomination process, the obligations of participants, the length of time the process would likely

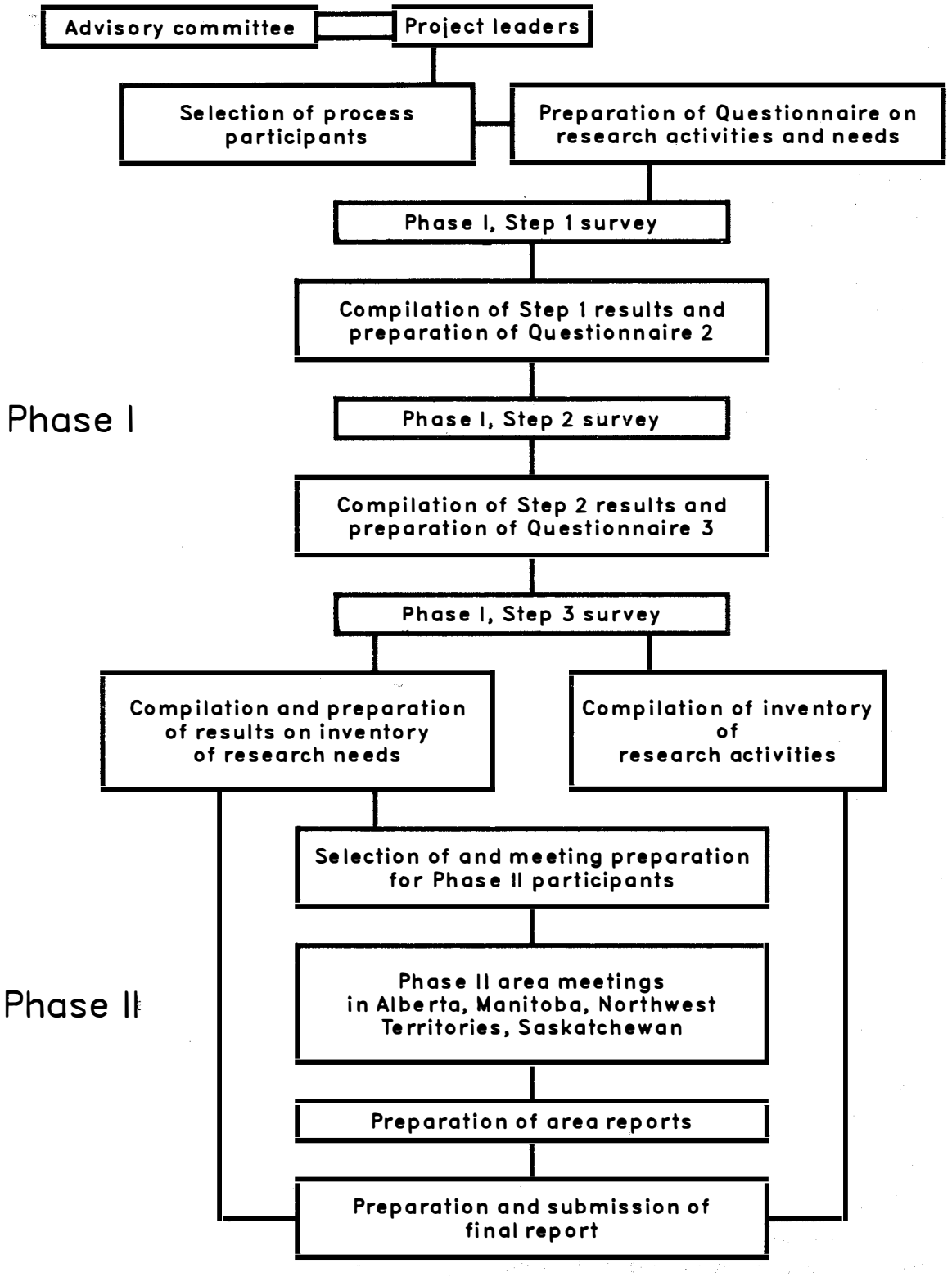

Figure 1. Project process flow chart.

take, and the information that would be shared among participants. During these initial contacts, the contact person attempted to establish within the participants the necessary motivation and interest in the study outcome by convincing them of the importance of the study and the importance of their participation.

First–round Questionnaire

Questionnaire 1 (Appendix 2) was developed and tested with the advisory committee during the last 2 weeks of September 1983 and was sent to respondents under a covering letter on October 1. A summary of the project proposal was enclosed to remind them of the study purpose, processes, and anticipated outputs.

The main item in the questionnaire was a rather broad, open–ended question asking respondents to list the important forest economic research needs, topics, or questions that they felt should be addressed for the west–central region of Canada and to briefly state their reason for each item listed. Another question invited respondents to list any forest economics research projects relevant to the region of which they were aware.

A third question asked respondents to comment or elaborate on four possible criteria and to add other possible criteria. They were then asked to rate the importance they would assign to each criterion in evaluating and rating forest economics research needs.

Finally, a question attempted to have respondents describe their current professional practice or role in terms of geographic area or subregion, type of employment, and professional role. The questionnaires, as were rounds two and three questionnaires, were coded to help maintain continuity with individual respondents between each round.

The covering letter thanked the individual for participating, explained why his or her help was needed, explained how the results would be utilized, and provided instructions and a response date. A self–addressed, postpaid envelope was enclosed for respondent convenience.

Seventy–seven of the 88 people in the sample had returned their first–round questionnaire by the first part of November. These questionnaires were analyzed by the project leaders to produce a summary list of the items identified and comments made. A summary list of 26 major research needs was developed that reflected the initial opinions of respondents and was short enough for all respondents to easily review, criticize, support, or oppose. These research needs became the contents for Questionnaire 2.

The importance ratings of the various possible criteria for evaluating and rating forest economics research needs were analyzed using mean scores and correlation coefficients. The results indicated that while "urgency"—basic information needed to aid in solution to a threat or problem—appeared to be a distinct criterion, the other possible criteria could be combined and labelled as "importance"—expected benefits or contribution in relation to costs. These two criteria became the basis for rating the identified research needs in Questionnaire 2.

A list of the existing forest economics research projects relevant to the region as identified by the respondents was compiled and is reported in Appendix 4.

The responses regarding the type of professional practice of respondents were tabulated by prime geographic area of practice (Appendix 3, Table A), type of employment (Appendix 3, Table B), and professional role (Appendix 3, Table C) and were used for subsequent cross–tabulations of second– and third–round results.

Second–round Questionnaire

Questionnaire 2 (Appendix 2) was developed to have participants comment concerning the items identified in Questionnaire 1 as summarized into 26 groupings by the project leaders. It also asked respondents to rate items on the basis of importance and urgency to establish preliminary priorities among items. This questionnaire and an accompanying covering letter were mailed on November 18, 1983.

The covering letter included items similar to those in Questionnaire 1. It thanked the participants for their responses, expressed continued need for their help, and indicated the purpose of Questionnaire 2 and its place in relation to Questionnaire 3. It also contained a tentative schedule for the area meetings. A self–addressed, postpaid envelope was again enclosed for returning the completed questionnaire.

The return of these questionnaires was interrupted by the Christmas holiday season. By mid–January, 69 questionnaires had been returned. The analysis of this round consisted primarily of a tally of the importance and urgency ratings of the items and a summary of comments made about the items in a form that was both thought provoking and easy to understand. The correlation between the importance and urgency ratings was very high (0.98). It was concluded that just one criterion of item importance would be sufficient for determining the priority of research needs in the final round of questionnaires. The following are the results and benefits of Questionnaire 2:

1. the identification of areas of disagreement;
2. the identification of areas of agreement;
3. the identification of items requiring discussion or clarification; and
4. an early awareness of preliminary priorities.

Third–round Questionnaire

The original purpose of the study was to generate consensus on important forest economics research needs. Toward that end research needs had been identified in Questionnaire 1, and clarifications, supportive statements, and a preliminary indication of priorities were obtained through ratings in Questionnaire 2. The third and final round of questionnaires permitted the participants to review prior responses and to express their individual judgments as to the importance of each item.

The objectives of Questionnaire 3 (Appendix 2) were as follows:

1. provide closure for the study;
2. suggest research areas where diversity of judgments exist as well as allow for the aggregation of judgments; and
3. provide guidelines for future research and planning.

The final questionnaire provided closure to the study and a feeling among participants that their effort was worthwhile by permitting them to vote on items developed and clarified in the previous rounds. This final questionnaire also provided for the aggregation of research priorities by voting, but individual difference in judgment still existed. Any sizeable majority view on the importance of an item may be just as important in future planning as the identification of agreed–upon priorities. The third–round questionnaire permitted the measurement of both diversity and agreement. Finally, the results of the study can provide guidance to researchers and supporting agencies for setting priorities for forest economics research.

The mechanics of the final questionnaire paralleled the earlier rounds. A covering letter and a self–addressed, postpaid envelope was included with the questionnaire, which was mailed January 30, 1984. The questionnaire listed the final items, clustered into 26 groups, to which reactions were being sought. The mean rating scores on each of the two criteria of item importance and urgency were also provided. The respondents were asked to provide a final rating for each item in terms of its overall importance and to make any brief comments on any items to clarify meaning or to suggest implications for future action.

Sixty–one questionnaires were returned for analysis during the last week of February. The analysis followed the same procedures as the analysis of Questionnaire 2. Descriptive statistics of mean and standard deviation were calculated for each item. The mean score provided the basis for determining the rating of items. The standard deviation indicated the degree of consensus among respondents regarding the mean score. For example, a very low standard deviation indicated a very high degree of consensus about the mean score, regardless of whether the mean score happened to be high, medium, or low.

Area Meetings

Phase II of the project consisted of holding an area meeting in each of the four subregions. The objectives of these meetings were as follows:

1. to provide further elaboration of the research needs identified in Phase I;
2. to identify major constraints upon conducting such research; and
3. to help strengthen a sense of community among the participants in forest economics research.

The study participants were informed of the schedule of area meetings in the covering letter with Questionnaire 2. They were formally invited to participate in the area meeting within their respective subregion or area by a letter mailed January 23, 1984. An agenda was enclosed, and participants were asked to return a form in a self–addressed postpaid envelope indicating their intentions for participating in the meeting.

The meetings were held in Edmonton, Alberta, on February 14; in Yellowknife, Northwest Territories, on February 16; in Prince Albert, Saskatchewan, on February 21; and in Winnipeg, Manitoba, on February 23. Each meeting lasted approximately 7 hours including a luncheon.

The meetings were conducted in a workshop format (Appendix 5). In the first couple of hours, the Nominal Group Technique was used to select the top six priority research needs from the full listing of needs identified in Phase I. These priority items were then discussed in detail by subgroups in the meetings to identify specific questions that should be addressed within each priority research topic and to identify major constraints upon conducting such research. The reports of the subgroups were discussed by the total group in the meetings. A discussion of the variations occurring between subregions with respect to research priorities concluded each meeting. Flip charts were used extensively to record the conclusions and recommendations of these meetings.

MAIL SURVEY RESULTS

First–round Results

Questionnaire 1 (Appendix 2) was mailed to the 88 participants (Appendix 1) on October 1, 1983. There were 77 subsequent returns. Nearly one–third of the respondents indicated Alberta as their prime geographic area of practice. Saskatchewan was second with 23%, Manitoba 18%, and the Northwest Territories 13% . The remaining 13% of the respondents indicated various combinations of areas as prime geographic areas of practice (Appendix 3, Table A). In terms of areas represented from the sample selection process, the 77 respondents were distributed as follows: Alberta (32%), Manitoba (25%), the Northwest Territories (16%), and Saskatchewan (27%).

Nearly one–half of the respondents are employed by government (39% provincial or territorial and 10% federal), and slightly more than one–third are employed in private industry including crown corporations. Universities employ 12% and other employers 5% (Appendix 3, Table B). The types of employment or professional roles are dominated by foresters (25%), followed by managers (21%), economists (17%), and planners (12%). The remaining proportions of respondents are distributed over several other categories (Appendix 3, Table C).

Ratings of forest economics research needs from subsequent questionnaire returns are broken down by province and territory, professional role, and employer. This breakdown serves to highlight any differences within each area, role, or employer category.

In addition to respondent profiles, each respondent to Questionnaire 1 was asked to (a) identify past and current forest economics research, and (b) identify forest economics research needs. This information serves as a basis in meeting three of the five project objectives:

1. to identify existing research activities;
2. to define forest economics research needs, and
3. to define the gap between the activities and needs.

All existing research identified and verified is contained in Appendix 4. Some items are published, some are not. Some items are confidential, most are not. Only items that may be categorized as forest economics research in a broad sense and that are relevant to the west–central region are included in the list. Consequently, a few items provided by respondents are omitted. As discussed in more detail at the end of this chapter, the items identified represent a broad array of research topics. When compared with research needs, gaps exist between existing research and all research needs identified, although more research has been done to close the gap in some areas than in others. Attention is first directed to research needs.

The research needs identified by respondents to Questionnaire 1 were summarized into 26 groups (Table 1). Summaries of forest economics research needs are also contained in Questionnaires 2 and 3 (Appendix 2) and in Appendix 3, Tables E through L. The order of appearance of the research topics in Table 1 is the same as that which appears in detail in Questionnaire 3 and in the Appendix 3 tables. Every effort was made to present the research needs information by the respondents to Questionnaire 1 as close to original phrasing as possible to minimize interpretative bias on the part of the authors. As a consequence, there is considerable overlap among the 26 research needs and parts thereof.

The set of forest economics research needs identified by first–round respondents is impressive. It proved to be invaluable in the design of questionnaires for rounds two and three and as basic material for the four area meetings held. In anticipation of the subsequent need to have participants rate the research needs in rounds two and three, they were asked to assess four suggested rating criteria used in previous studies of this kind and to suggest additional criteria (Questionnaire 1, Appendix 2). The four suggested criteria were 1) urgency, 2) expected benefits in relation to costs, 3) potential contribution to knowledge, and 4) relevance to goals for forestry. There were 21 other criteria suggested by respondents, but they were largely covered under the suggested four criteria.

A statistical summary of the ratings of each criterion is given in Appendix 3, Table D. The ratings were provided by respondents on a five–point scale with 5 being very high and 1 being very low. The average (arithmetic mean) of individual ratings for each criterion represents a rating score by which to rank the criteria in order of preference. Three of the four criteria scored quite high. Urgency, expected benefits in relation to costs, and relevance to goals for forestry all scored in the order of 4 out of 5 (4.082, 4.055, and 3.919, respectively). The use of a standard difference of means test showed that all three scores were not significantly different from one another at the 95% confidence level (e.g., a score of 4.082 is not significantly higher than 3.919); however, these three scores are all significantly higher than the score of 3.041 for potential contribution to knowledge. As a result, this criterion was dropped from further consideration. There was a fairly high degree of consensus among respondents for the top three criteria as indicated by standard deviations of

Table 1. Summary of forest economics research needs

1. Forest industry impact (regional/economic)
2. Economics of integrated forest land use
3. Economics of forest protection
4. Allowable cut determination/timber supply analysis modelling
5. Supply and demand modelling
6. Economics of poplar utilization
7. Economics of nontimber forest land uses
8. Economics of intensive timber management alternatives
9. Stumpage valuation
10. Forest economics education
11. Evaluation in economic terms of improved research, development, and application of new technology
12. Economic analysis of forestry industry structure
13. Forest land use policy and planning studies
14. Economics of environmental safeguards on forest land
15. Socioeconomic studies and native forest land use issues
16. Economic analyses of agricultural and forestry land use interface
17. Economic studies of timber resource utilization including smallwood
18. Economics of forest renewal
19. Economics of timber accessibility and transportation
20. Economics of wood energy utilization
21. Timber product development
22. Forest products marketing studies
23. Socioeconomic analysis of the effects on trapping by timber harvesting and fire
24. Economics of milling technology
25. Economics of harvesting technologies
26. Economics of urban forestry

approximately 1.05. The degree of consensus was somewhat less for the rejected criterion as indicated by the higher standard deviation of 1.24.

A means had to be found to reduce the three high ranking criteria to two in order to avoid excessive complexity in the design of the second– and third–round questionnaires. A decision was made to combine two criteria, expected benefits in relation to costs and relevance to goals for forestry, into one criterion, importance. The criterion, relevance to goals for forestry, is interpreted as a part of the criterion, expected benefits in relation to costs. The resultant criteria, urgency and importance, were selected for use in the design of Questionnaire 2 along with the identified research needs.

Second–round Results

Questionnaire 2 (Appendix 2) was mailed to the 88 participants on November 18, 1983. There were 69 subsequent returns of which 65 were usable for analysis. Respondents were asked to rate each research need or part of it twice; once using the importance criterion and once using the urgency criterion, and using a five–point scale in both cases with 5 being very high and 1 very low. The results from this second round are considered preliminary and are therefore not discussed in great detail.

The average (mean) importance rating scores are given in Appendix 2, Questionnaire 3. They range from a high of 4.290 for Number 1, forest industry impact (regional/economic), to a low of 1.945 for Number 26, economics of urban forestry. The highest degree of consensus is Number 1, forest industry impact (regional/economic), with the lowest standard deviation of 0.797; the lowest degree of consensus is for Number 13, forest land use policy and planning studies: forest management under public and private ownership (standard deviation of 1.410). Any two rating scores that are within 0.35–0.50 of one another are not generally significantly different from one another. The greater the combined degrees of consensus (standard deviations or standard errors), the smaller the difference can be and still be significant. For example, research need Number 1 (4.290) is not significantly different from research need Number 3, economics of forest protection (4.190), because the scores differ by only 0.10; however, research need Number 1 (4.290) is significantly different from Number 5, supply and demand modelling (3.579), because the scores differ by 0.71.

The average (mean) urgency rating scores are given also in Appendix 2, Questionnaire 3. They follow the importance rating scores very closely but tend to be slightly lower in magnitude. The urgency rating scores (means) range from a high of 4.119 for Number 2, economics of integrated forest land use, to a low of 1.855 for Number 26, economics of urban forestry. The highest degree of consensus is for Number 25c, economics of harvesting technologies: studies of the costs and benefits of various alternative harvesting technologies including feller buncher and grapple skidding (standard deviation of 0.891), although the urgency rating score is only 2.320 out of 5.000. Research need Number 1, forestry industry impact (regional/economic), has the fourth highest degree of consensus (standard deviation of 1.029). The lowest degree of consensus exists for Number 15a, socioeconomic studies and native forest land use issues: design on institutional arrangements for increased nature business and employment opportunities in forest products (standard deviation of 1.448).

An average (mean) importance score and an average urgency score are derived for each research need containing two or more parts by taking the means of these parts of each criterion. The resultant scores along with the importance and urgency for each research need with only one part are given in Appendix 3, Table E. The 26 research needs so presented are also ranked under each criterion. A combined score consisting of the mean of the importance score and urgency score for each of the 26 research needs is also presented. This combined score is calculated for two reasons. First, there is little or no advantage in keeping importance and urgency scores separate because each reveal virtually the same result. The correlation between the two sets of scores is 0.98 out of a perfect positive correlation of 1.00. The rank correlation coefficient also works out to 0.98. The second reason for the combined score is to determine an ordering of research needs for the round–three questionnaire. The ordering is from high combined score to low combined score. For those research needs with two or more parts, the parts are rendered by the same procedure. The research needs in Questionnaire 3 are consequently identical to those in Questionnaire 2 but reordered (Appendix 2). Also, only one overall importance criterion is used in Questionnaire 3.

A brief examination of combined scores and rankings by province and territory indicates some differences among the four areas, Alberta, Manitoba, the Northwest Territories, and Saskatchewan (Appendix 3, Table F). The first three research needs (Table 1), forest industry impact, economics of integrated forest land use, and economics of forest protection ranked among the top four for each area. The fourth research need, allowable cut determination/timber supply analysis, is among the top four for Manitoba and Saskatchewan. Number 5, supply and demand

modelling, is among the top four for Alberta, and Number 6, economics of poplar utilization, is among the top four for the Northwest Territories. Although area rankings tend to follow the overall ranking, there are some notable differences. For example, Number 8, economics of intensive timber management alternatives, ranked 13th for Alberta and 19th for the Northwest Territories, but 5th and 6th for Manitoba and Saskatchewan. More notable still is Number 15, socioeconomic studies and native forest land use issues, which ranked 5th for both Manitoba and the Northwest Territories, but 24th for Alberta and, less notably, 13th for Saskatchewan. There are several other differences, but because those results are but preliminary to round–three results they are not highlighted here.

Third–round Results

Questionnaire 3 (Appendix 2) was mailed to the 88 participants on January 30, 1984. There were 61 subsequent returns of which 60 were usable for analysis. The research needs identified in the first round and rated in the second round were presented in Questionnaire 3 in order of the combined importance and urgency scores from Questionnaire 2. The participants were asked to consider the scores and rank the research need again on the five–point scale but with the knowledge of the collective results from the second round. This time only one ranking for each research need item was requested.

A statistical summary of average rating scores are given in Appendix 3, Table G. The average (mean) scores range from a high of 4.316 for Number 2, economics of integrated forest land use, to a low of 1.607 for Number 26, economics of urban forestry. The highest degree of consensus is for Number 2, economics of integrated forest land use, with a standard deviation of 0.76; the lowest degree of consensus is for Number 20c, economics of wood energy utilization: the relation between energy prices and timber demand, with a standard deviation of 1.322 and a mean score of 2.621.

There are some differences between Round 2 and Round 3 results (Appendix 3, Table H). Table 2 lists the top 12 research needs from Round 3 by including only those topics with scores greater than 3.0. There is little doubt that Number 2, economics of integrated forest land use, is the most important research need. Not only does it exhibit the highest rating score and the highest degree of consensus, but it is significantly higher than Number 1, forest industry impact.[1] The top seven research needs topics are significantly greater than 3.0, whereas the remaining five research needs are not.[2] Among the research needs shown in Table 2, Number 2, economics of integrated forest land use, Number 3, economics of forest protection, Number 5, supply and demand modelling, and Number 7, economics of nontimber forest land uses, exhibited the highest degrees of consensus among respondents to Questionnaire 3. Number 1, forest industry impact, Number 6, economics of poplar utilization, Number 13, forest land use policy and planning studies, and Number 14, economics of environmental safeguards on forest land, exhibited the lowest degrees of consensus.

Beyond the top 12 research needs listed in Table 2, there are some parts of the remaining research needs that merit recognition. These parts with rating scores in excess of 3.1 are given in Table 3. Items 19a, 16a, 17b, and 22a are of particular note in that scores exceed 3.4.

Third–round Results by Province and Territory

The results from Questionnaire 3 (Appendix 2) are given by province and territory in Appendix 3, Tables I and J. The top 12 research needs from Table 2 are ranked by area in Table 4. In order to accommodate the top six for each area (province and territory), Number 15, socioeconomic studies and native forest land use issues, which ranked 16th overall, Number 18, economics of forest renewal, which ranked 19th overall, and Number 23, socioeconomic analysis of the effects on trapping by timber harvesting and fire, which ranked 24th overall, had to be added to the list (Table 4).

The top three research needs overall, Number 2, economics of integrated forest land use, Number 1, forest industry impact, and Number 3, economics of forest protection, also ranked at or near the top for each area. Subsequent research needs tended to show considerable variation in rankings. Alberta and Manitoba rankings showed the greatest consistency with overall rankings. The one notable difference for Alberta is Number 9, stumpage valuation, which ranked 6th overall but 12th for Alberta. Two notable differences exist for Manitoba; Number 12, economic analysis of forest industry structure, ranked 9th overall but 16th for Manitoba, and Number 6, economics of poplar utilization, ranked 11th overall but 17th for that province.

The Northwest Territories showed the greatest divergence from overall rankings. Number 4, allowable cut determination/timber supply analysis modelling, ranked 4th overall but 10th for the NWT; Number 9, stumpage valuation, ranked 6th overall but 12th for the NWT; Number 8, economics of intensive timber

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[1] Difference of means test between scores .316 and 3.947 shows a Z-score of 2.01, which is greater than the critical Z value of 1.96 at the 95% confidence level. Both sample sizes are 57 (Appendix 3, Table L).

[2] Based on a one-tail Z-test with a critical value of 1.65 at the 95% confidence level.

Table 2. The twelve most preferred forest economics research needs in order of importance

	Research need	Rating score[1]	Rank
2.	Economics of integrated forest land use	4.316	1
1.	Forest industry impact (regional/economic)	3.947	2
3.	Economics of forest protection	3.895	3
4.	Allowable cut determination/timber supply analysis modelling	3.570	4
5.	Supply and demand modelling	3.421	5
9.	Stumpage valuation	3.281	6
7.	Economics of nontimber forest land uses	3.277	7
8.	Economics of intensive timber management alternatives	3.219	8
12.	Economic analysis of forest industry structure	3.198	9
13.	Forest land use policy and planning studies	3.123	10
6.	Economics of poplar utilization	3.082	11
14.	Economics of environmental safeguards on forest land	3.021	12

[1] Ratings are on a five–point scale with 5 very high and 1 very low. Figures are taken from Appendix 3, Table H.

Table 3. The most preferred subsets of forest economics research needs

	Research need	Rating score[1]
19.	Economics of timber accessibility and transportation	
	a. Determination of economically accessible stands	3.860
16.	Economic analyses of agricultural and forestry land use interface	
	a. Evaluation of economic and social decision criteria for land allocation at the interface between forestry and agriculture	3.466
	b. Economic evaluation of local economy from a forestry–agricultural land use mix compared to an all–agriculture or all–forestry land use pattern	3.119
	c. Economics of utilizing forest land for agricultural purposes	3.119
17.	Economic studies of timber resource utilization including smallwood Related to:	
	a. Harvesting costs	3.259
	b. Regeneration	3.414
	c. Timber values	3.298
	d. Conversion technology	3.121
22.	Forest products marketing studies	
	a. Analysis of the market potential and demand trends, both domestic and export, for new and existing products of the west–central region	3.414
20.	Economics of wood energy utilization	
	a. Use of wood wastes for energy	3.224
18.	Economics of forest renewal	
	Benefit–cost analysis of specific forest renewal techniques such as:	
	a. Spraying versus no spraying	3.175
	b. Juvenile spacing	3.123

[1] Ratings are on a five–point scale with 5 very high and 1 very low. Figures are taken from Appendix 3, Table G.

Table 4. Ranking of forest economics research needs by province and territory

Research need	Region	Rank[1] Alberta	Manitoba	NWT	Saskatchewan
2. Economics of integrated forest land use	1	1	1	1	2
1. Forest industry impact (regional/economic)	2	2	3	5	1
3. Economics of forest protection	3	4	2	2	3
4. Allowable cut determination/timber supply analysis modelling	4	3	8	10	4
5. Supply and demand modelling	5	5	4	7	11
9. Stumpage valuation	6	12	7	12	5
7. Economics of nontimber forest land use	7	6	6	6	17
8. Economics of intensive timber management alternatives	8	9	5	21	7
12. Economic analysis of forest industry structure	9	7	16	12	8
13. Forest land use policy and planning studies	10	11	11	9	13
6. Economics of poplar utilization	11	8	17	15	12
14. Economics of environmental safeguards on forest land	12	16	10	16	10
15. Socioeconomic studies and native forest land use issues	16	20	12	4	23
18. Economics of forest renewal	19	23	15	25	6
23. Socioeconomic analysis of the effects on trapping by timber harvesting and fire	24	25	25	3	21

[1] From Appendix 3, Tables H and J.

Table 5. Ranking of forest economics research needs by professional role

Research need	Rank[1]		
	Region	Economists	Noneconomists
2. Economics of integrated forest land use	1	1	1
1. Forest industry impact (regional/economic)	2	10	2
3. Economics of forest protection	3	2	3
4. Allowable cut determination/timber supply analysis modelling	4	5	4
5. Supply and demand modelling	5	3	5
9. Stumpage valuation	6	3	7
7. Economics of nontimber forest land use	7	9	6
8. Economics of intensive timber management alternatives	8	8	8
12. Economic analysis of forest industry structure	9	7	10
13. Forest land use policy and planning studies	10	11	11
6. Economics of poplar utilization	11	15	9
14. Economics of environmental safeguards on forest land use	12	18	12
10. Forest economics education	13	6	20

[1] From Appendix 3, Table K.

Table 6. Ranking of forest economics research needs by employee group

Research need	Rank[1]					
	Region	Federal government	Provincial or territorial government	Industry or crown corporation	University	Other
2. Economics of integrated forest land use	1	1	1	2	1	6
1. Forest industry impact	2	3	3	1	11	2
3. Economics of forest protection	3	2	2	3	11	6
4. Allowable cost determination/timber supply analysis modelling	4	6	5	4	2	18
5. Supply and demand modelling	5	13	6	6	3	6
9. Stumpage valuation	6	13	7	17	4	2
7. Economics of nontimber forest land uses	7	17	4	16	6	17
8. Economics of intensive timber management alternatives	8	4	14	5	7	14
12. Economic analysis of forest industry structure	9	17	8	10	14	15
13. Forest land use policy and planning studies	10	10	10	7	9	21
6. Economics of poplar utilization	11	7	18	9	5	23
14. Economics of environmental safeguards on forest land	12	11	16	10	10	19
15. Socioeconomic studies and native forest land use issues	16	17	9	22	16	4
18. Economics of forest research	19	5	24	13	20	10
20. Economics of wood energy utilization	20	20	17	23	17	2

[1] From Appendix 3, Table K.

management alternatives, ranked 8th overall but 21st for the NWT; Number 15, socioeconomic studies and native forest land use issues, ranked 16th overall but 4th for the NWT; and Number 23, socioeconomic analysis of the effects on trapping by timber harvesting and fire, ranked 24th overall but 3rd for the NWT. The research needs priorities for the Northwest Territories are in many instances distinct from the prairie provinces.

Saskatchewan registered three notable ranking differences from the overall rankings. Number 5, supply and demand modelling, ranked 5th overall but 11th for Saskatchewan; Number 7, economics of nontimber forest land uses, ranked 7th overall but only 17th for Saskatchewan; and Number 18, economics of forest renewal, which ranked 19th overall, is an important research need in Saskatchewan, where it ranked 6th.

Examination of area difference serves as a reminder that regional forest economic research needs priorities may need to be tempered by area research needs priorities. Research need 23 ranked 24th overall and on that basis alone would perhaps be dropped from consideration. Dropping it would be a significant oversight because it ranks 3rd for the Northwest Territories and thus merits consideration for that area (Table 4).

Third–round Results by Professional Role and Employer

The results from Questionnaire 3 (Appendix 2) are given by professional role in Appendix 3, Table K. Scores and ranks are divided into two groups: economist and noneconomist. A further breakdown of noneconomists (Appendix 3, Table C) was not carried out because of ambiguity of professional roles. For example, some of the respondents who indicate a professional role as manager are also foresters. Detailed results of this kind may be misleading. Since the role economist was specified on the questionnaire, such ambiguity is unlikely in this case.

The top 13 research needs overall (region) include the top 11 research needs for economists and the top 12 for noneconomists (Table 5). Noneconomist rankings are virtually the same as those for the region as a whole with the exception of Number 10, forest economics education, which ranked 13th overall and 20th for noneconomists. Economists ranked it 6th, possibly reflecting the dominance of academics among that group. Other notable differences between economists and noneconomists (for the region overall) include: Number 1, forest industry impact, which ranked 2nd overall but 10th for economists; and Number 14, economics of environmental safeguards on forest land, which ranked 12th overall but 18th for economists. There are two other notable differences not shown in Table 5. Number 20, economics of wood energy utilization, which ranked 20th overall and 22 among noneconomists, ranked 13th among economists with a rating score of 3.136; and Number 15, socioeconomic studies and native forest land use issues, which ranked 16th among noneconomists, ranked 12th among economists with a rating score of 3.152 (Appendix 3, Table K).

The results from Questionnaire 3 (Appendix 2) are given by employer in Appendix 3, Table L. Scores and ranks are broken down by federal government, provincial and territorial government, industry and crown corporation, university, and other (see also Appendix 3, Table B). Forest economics research needs are ranked by region and the employer groups in Table 6. At least the six research needs for each category are included.

The top five forest economics research needs regionally also tend to be among the top six by employer group with the exception of the following: Number 1, forest industry impact, and Number 3, economics of forest protection, which tied for 11th place among university participants; Number 4, allowable cut determination/timber supply analysis modelling, which ranked 18th in the other grouping; and Number 5, supply and demand modelling, which ranked 13th among federal employees. Beyond the first five research needs, rankings among the various groups differed considerably. University and other employees ranked Number 9, stumpage valuation, quite highly (4 and 2, respectively); federal and university employees ranked Number 7, economics of nontimber forest land uses in their top six (4 and 6, respectively); Number 8, economics of intensive timber management alternatives was rated 4th by federal employees and 5th by industry. University employees ranked Number 6, economics of poplar utilization, 5th. Other employees ranked Number 15, socioeconomic studies and native forest land use issues, and Number 20, economics of wood energy utilization, 4th and 2nd, respectively. Number 18, economics of forest renewal, ranked 5th among federal employees.

The breakdowns by professional role and employee are perhaps less important than area breakdowns discussed in the previous section; nevertheless, they do indicate that divergent research interests exist between economists and noneconomists and among different employee groups.

Activities and Needs Gaps

The inventory of past and current forest economics and related research (Appendix 4) provided by the mail survey respondents in Questionnaire 1 cover one or more aspects of the research needs also identified in the same

questionnaire. For the most part, however, the research on any one topic is sparse and sporatic. There are some 15 research items that pertain to forest industry impact (Number 1, Table 1). There are also 15 research items that pertain to economics of nontimber forest land uses (Number 7) and particularly fish and wildlife benefits and costs (Number 7c, Questionnaire 3, Appendix 2). Most of the studies listed under nontimber forest land uses are not touched upon by any of the research items listed. Another 15 items listed in Appendix 4 pertain to economic analysis of forest industry structure (Number 12); however, they apply to only two of the four parts identified under that research need (parts b and c).

Economics of forest protection (Number 3) and forest land use policy planning studies (Number 13) are the best represented (17 items each) in the inventory list. Comprehensive coverage of all aspects of these research needs is lacking, however. The remaining research needs (Table 1) each have less than 10 research items pertaining to them.

Economics of integrated forest land use (Number 2), allowable cut determination and timber supply analysis modelling (Number 4), economics of intensive timber management alternatives (Number 8), economics of environmental safeguards on forest land (Number 14), economic studies of timber resource utilization including smallwood (Number 17), economics of wood energy utilization (Number 20), and forest products marketing (Number 22) each have from five to nine items pertaining to them from the research inventory list. Less than five items pertain to each of the remaining research needs. In fact, no items pertain to four of the research needs: forest economics education (Number 10); timber product development (Number 21); socioeconomic analysis of the effects on trapping by timber harvesting and fire (Number 23); and economics of urban forestry (Number 26).

The inventory of research items contained herein is not assumed to be complete but does represent the bulk of past and current forest economics research activities in the prairies and the Northwest Territories. When compared to the research needs identified, the inventory list falls short of fulfilling completely any of these needs, although significant beginnings have been made. In some cases the gap between research need and activity is very large because little or no economics research has been carried out in these areas. This fact becomes even more evident when comparing the inventory list with the area meetings results in which additional components of various research needs are identified.

AREA MEETING RESULTS

Three kinds of results arose from the participants in each of the area meetings held in Alberta, Manitoba, the Northwest Territories, and Saskatchewan (Appendix 1). First, the forest economics research needs identified in the mail survey were discussed and rated. Second, the top six research needs selected at each meeting were elaborated upon. Third, constraints that may inhibit fulfilling each of these research needs were identified at these meetings. In obtaining these results, two objectives of this project were met, namely, community building and constraints identification.

The top six research needs selected are summarized by rank in Tables 7 and 8 for each area. Table 7 also lists the overall mail survey ranking results under region. Except for the Northwest Territories area meeting participants, each area group chose to combine two or three research needs into a single one. Each of the Alberta, Manitoba, and Saskatchewan groups combined research needs Number 7, economics of nontimber forest land uses, and Number 16, economic analysis of agricultural and forestry land use interface, with Number 2, economics of integrated forest land use (2, 7, and 16). The Alberta group ranked it 1st, the Manitoba group ranked it 3rd, and the Saskatchewan group, 2nd (Tables 7 and 8).

The Manitoba and Saskatchewan groups each combined Number 8, economics of intensive timber management alternatives, and Number 18, economics of forest renewal, into a single research need (8 and 18). The Manitoba group ranked it 1st and the Saskatchewan group, 3rd. The group from Manitoba also combined Number 15, socioeconomic studies and native forest land use issues, and Number 23, socioeconomic analysis of the effects on trapping by timber harvesting and fire, into a single need (15 and 23) and ranked it 6th. The Saskatchewan group combined Number 4, allowable cut determination/timber supply analysis modelling, and Number 19, economics of timber accessibility and transportation, into a single research need (4 and 19) and ranked it 4th. In total, the Alberta group came up with one combination and the Manitoba and Saskatchewan groups each came up with three (Tables 7 and 8).

The 2, 7, and 16 combination for Alberta that ranked 1st was followed by Number 4, allowable cut determination/timber supply analysis modelling, which ranked 2nd, and Number 12, economic analysis of forest industry structure, which ranked 3rd. Number 5, supply and demand modelling, and Number 13, forest land use policy and planning studies, tied for 4th place. Number 1, forest industry impact, and Number 8, economics of intensive timber management alternatives, tied for 6th place. Each of these research needs are discussed in the next section.

As indicated above in Tables 7 and 8, the Manitoba group ranked the 8 and 18 combination 1st, the 2, 7, and 16 combination 3rd, and the 15 and 13 combination 6th. Number 3, economics of forest protection, ranked 2nd; Number 1, forest industry impact, ranked 4th; and Number 4, allowable cut determination/timber supply analysis modelling, ranked 5th. Each of these research needs are later discussed in detail from a Manitoba group perspective.

The Northwest Territories group ranked Number 2, economics of integrated forest land use, the top research need. Number 15, socioeconomic studies and native forest land use issues, ranked 2nd; Number 3, economics of forest protection, ranked 3rd; Number 7, economics of nontimber forest land uses, 4th; and Number 5, supply and demand modelling, 5th. Number 20, economics of wood energy utilization, ranked 6th. Details of each research need are given below.

The Saskatchewan group made three combinations, 2, 7, and 16, 8 and 18, and 4 and 19 ranked 2nd, 3rd, and 4th, respectively. Number 1, forest industry impact, is 1st. Number 3, economics of forest protection, and Number 14, economics of environmental safeguards on forest land, are 5th and 6th. Each one is discussed in detail below.

Alberta Research Needs Content

Forest economics research need combination 2, 7, and 16 is the most important one from the Alberta group perspective. The economics of integrated forest land use includes both timber and nontimber uses. The need for economic analyses of agricultural and forestry land use interface is of particular interest in Alberta. The group indicated that the descriptions for items 2, 7, and 16 derived from the mail survey (Appendix 2, Questionnaire 3), are adequate. Item 16b, economic evaluation of local economy from a forestry–agricultural land use mix compared to an all–agriculture or all–forestry land use pattern was emphasized by the group. In terms of farms versus forestry, the group raised the concept of highest and best use of land and questioned whether or not land was being put to such use. Other particular questions were raised. What are the affects of watershed protection, farming, and other nontimber uses on the security of timber supply? The uncertainty of future timber supply frustrates development plans. Forestry companies need a stable land use policy. There is a need to know the interactive effects (production functions) among different land uses.

Table 7. Area meeting ratings of forest economics research needs

Research need	Rank				
	Region[1]	Alberta[2]	Manitoba	NWT	Saskatchewan
2. Economics of integrated forest land use[3]	1	1	3	1	2
1. Forest industry impact (regional/economic)	2	6	4		1
3. Economics of forest protection	3		2	3	5
4. Allowable cut determination/timber supply analysis modelling[4]	4	2	5		4
5. Supply and demand modelling	5	4			
7. Economics of nontimber forest land uses[3]	7	1	3	4	2
8. Economics of intensive timber management alternatives[5]	8	6	1		3
12. Economic analysis of forest industry structure	9	3			
13. Forest land use policy and planning studies	10	4			
14. Economics of environmental safeguards on forest land	12				6
19. Economics of timber accessibility and transportation[4]	14				4
15. Socioeconomic studies and native forest land use issues[6]	16		6	2	
16. Economic analysis of agricultural and forestry land use interface[3]	18	1	3		
18. Economics of forest renewal[5]	19		1		3
20. Economics of wood energy utilization	20			6	
23. Socioeconomic analysis of the effects on trapping by timber harvesting and fire[6]	24		6	5	

[1] Derived from mail survey results (Appendix 3, Tables G and H).
[2] Research need numbers 5 and 13 were tied for 4th place, and research need numbers 1 and 8 tied for 6th place for Alberta.
[3] Research need numbers 2, 7, and 16 are combined into one item for Alberta, Manitoba, and Saskatchewan.
[4] Research need numbers 4 and 19 are combined into one item for Saskatchewan.
[5] Research need numbers 8 and 18 are combined into one item for Manitoba and Saskatchewan.
[6] Research need numbers 15 and 23 are combined into one item for Manitoba.

Table 8. Area meeting ratings of the top six forest economics research needs[1]

Alberta		Manitoba		Northwest Territories		Saskatchewan	
Research need number	Rank	Research need number	Rank	Research need number	Rank	Research need number	Rank
2, 7, 16	1	8, 18	1	2	1	1	1
4	2	3	2	15	2	2, 7, 16	2
12	3	2, 7, 16	3	3	3	8, 18	3
5	4	1	4	7	4	4, 19	4
13	4	4	5	23	5	3	5
1	6	15, 23	6	20	6	14	6
8	6						

[1] Research numbers correspond to research needs listed in Table 7. The Alberta area meeting resulted in seven items rather than six because of the tie for 6th place between numbers 1 and 8.

Part of the problem is the lack of methodology to assess multiple use alternatives. Even if the methodology is in place, is there an adequate policy process in place to integrate research results into that process?

The group reviewed their second research need priority, allowable cut determination and timber supply analysis modelling. The research needs components of it as provided by the mail survey (Appendix 2, Questionnaire 3) is considered adequate.

The third–ranked research need, economic analysis of forestry industry structure, is adequately described from the mail survey results. The group felt that the measurement of flows of inputs and outputs between different entities in the industry, such as sawmill by–products serving as inputs to pulp mills, is important to know. There is also a need to know more about an optimum input mix, that is, production functions in which output is a function of the inputs land, labor, capital, and management. A number of questions need to be answered. What is the best mix of processing plants in the area or region? Is there an optimum mix now? Is the current mix there by accident or by design? What happens to processing plants linked to a pulp mill if that pulp mill closes? Were forestry's problems given proper consideration in the recent "Crow debate"? Is there a need for running forestry through a national input–output model?

Supply and demand modelling, which tied for 4th place in importance, was considered by the group. It is adequately defined as it now exists in the mail survey results (Appendix 2, Questionnaire 3). Forest land use policy and planning studies, which was also ranked 4th by the group, is also considered to be adequately described. A couple of points did arise. Forest sustained yield and even–flow timber harvesting studies must emphasize both renewable and nonrenewable components of the fiber resource. Second, an examination of federal and provincial institutions is called for.

Forest industry impact (regional/economic), which tied for 6th place, was considered by the group. The question was raised as to how it differed from forest industry structure. Discussion centered around flows of inputs and outputs within the region. The question as to how forestry fits into the region arose. What are the multiplier effects? There is a need to know the impact of forestry on the regional economy expressed in dollar terms. Finally, the other sixth–ranked forest economic research need, economics of intensive timber management alternatives, was considered by the group. The survey results description is adequate except for the need to add drainage to the list of options (Appendix 2, Questionnaire 3). Much of the remaining discussion centered on the need for the development of biological production functions to facilitate economic analysis of the various intensive management options.

Manitoba Research Needs Content

The economics of intensive timber management alternatives including the economics of forest renewal (Appendix B, Questionnaire 3, research needs 8 and 18) is the most important research need among the Manitoba group. They elaborated upon the mail survey results description. Any evaluation of treatment (timber management) alternatives should determine which ones are the most beneficial in dollar terms. Regarding stand tending, the question arose as to what is trying to be accomplished. Where is extra volume of wood fiber going to come from over time? The assessment of intensive management alternatives relates to advanced roading and must be considered. One of the benefits from intensive management comes in the form of freeing part of the land base for other uses. A final point raised in the group was the need to know the relative value of intensive stands for other uses such as recreation.

In addressing the second most important research need, economics of forest protection, the group emphasized the need to find ways to estimate both fiber and nonfiber potential losses (values at risk) as well as good estimates of fiber and nonfiber losses from insects, diseases, and fire. There is also a need for response data (biological production functions) to potential action in order to facilitate economic measures of that response data. A suggestion was made that a historical comparison of results from protection expenditures in the different areas of the region be undertaken and that an economic analysis of presuppression and prevention spending in response to, or based on, weather data also be undertaken. A final point raised called for a social, economic, and institutional analysis of centralized versus localized protection activities.

The third–ranked forest economics research need selected by the Manitoba group is the economics of integrated forest land use including both timber and nontimber uses and economic analysis of agricultural and forestry land use interface (Appendix 2, Questionnaire 3, research needs 2, 7, and 16). They suggested that this combination of research needs be given a new title, economics of forest land use. Four points were raised in the group. First, research should include a study of the alienation of the timber land base for all other purposes including agriculture, hydro, parks, reserves, land claims, and highways. Second, a study of the economics of various environmental safeguards such as buffers (Appendix 2, Questionnaire 3, research need 14) should also be included. The third point emphasized the importance of land for forestry. Economic studies are needed to show the land base

needs of forestry. A feeling was expressed that forestry is a residential group that gets leftover land. A final point emphasized the need for an integrated land use approach that looked at many uses jointly.

Forest industry impact, regional and economic, is the fourth–ranked research need discussed by the Manitoba group. There were several points raised in connecton with this research need that elaborate upon the mail survey results description (Appendix 2, Questionnaire 3, research need 1). The first point raised emphasized the need for public relations and research regarding forest industry impact. A second point emphasized regional dependencies on forestry; there is regional disparity and worry about single–resource based communities. A suggestion was made to review past and present fund allocations to temper future public decisions. An impact study has a timing aspect that must be considered. There is a need to implement results once research is completed. The research itself must be rigorous regarding the derivation of multipliers and their application. Social costs must be identified, results must be presented in a palatable form, and creditability of the researchers and research results must be maintained. Discussion concluded on transportation utilization and industry linkages.

The fifth–ranked research need, allowable cut determinaton and timber supply analysis modelling, was found to be adequately described in the mail survey results (Appendix 2, Questionnaire 3, research need 4). Determination of the allowable cut effort, more intensive management of areas close to mills than of areas more distant from the mills, use of genetically improved stock, and increased protection levels were all emphasized. In connection with increased protection levels, it was expressed that there is a need to determine volumes and rotations for second growth stands and growth of existing stands.

The final and sixth–ranked research need, socieconomic studies and native forest land use issues, also includes socioeconomic analysis of the effects on trapping by timber harvesting and fire (Appendix 2, Questionnaire 3, research needs 15 and 23). The group suggested that the effects on trapping by timber harvesting and fire (Number 23) become part of the value of forests to traditional native lifestyles (Number 15c). The question was raised whether or not research could be done in this area; if so, it would have to be multidisciplinary in scope. There needs to be an identification of various management program options to allow for desirable allocations. Among the land use options, trapping is very important since it is often one of the few options in remote communities. Research should also include an analysis of funding allocations among various programs such as noncommercial thinning by natives. A trade–off exists between capital and labor that needs to be examined in an economic context. An alternative research focus was suggested where, for example, there is an industry focus versus a regional community focus in meeting local demands for such things as housing, wood, and energy.

Northwest Territories Research Needs Content

The group from the Northwest Territories selected the economics of integrated forest land use as the most important forest economics research need but instead labelled it the social and economic analyses of integrated forest land use. The description derived from the mail survey results (Appendix 2, Questionnaire 3, research need 2) is incomplete. Trapping and lifestyle must be added to timber harvesting, grazing, wildlife and fisheries, watershed, outdoor recreation, and tourism considerations. Also, the integration of forest harvesting into parks (Number 13c) and environmental safeguards for fish and wildlife as well as timber (Number 14a, b, and c) are to be added. The term "benefit–cost analysis" is open to various interpretations and must be defined in the broad sense of identifying, measuring, and organizing benefits and costs into a framework for decision making (and not in the narrow sense of looking only at benefit–cost ratios or rates of return on investment). Research on this topic must have an applied component and involve public participation from the grass roots up.

The second–ranked research need, socioeconomic studies and native land use issues (Number 15), will require provision for overcoming language difficulties in carrying out research and will need to involve a northern company to facilitate this effort. In discussions of institutional arrangements for increased native business and employment opportunities in forest products (Number 15a), the Leard forested area of the Northwest Territories was identified as an area of considerable potential. The value of forests to traditional native lifestyles (Number 15c) must be determined. Very knowledgeable and understanding researchers will need to be involved in addressing this particular research need.

Economics of forest protection (Number 3) ranks 3rd. The description from the mail survey results were deemed adequate. The discussion centered on fire protecton with regard to needs to determine optimum uses of different aircraft combinations and to assess air versus ground fire control and suppression. The question of what and who are to be protected was also raised. Budget allocation questions also need answers. How much should be spent? How should the funds be spent?

The fourth–ranked research need, economics of nontimber forest land uses (Number 7) was discussed

with the focus primarily on outdoor recreation. There is a need to take inventory in addressing the supply side of recreation. Recreation demand must also be determined. The impact of recreation on forest land needs to be assessed in conjunction with carrying capacities, which also must be determined. Outdoor recreation benefits and costs must be defined in a social sense that goes beyond dollar measures. The need to define native land use rights in a growing park system was also identified for research consideration.

Socioeconomic analysis of the effects on trapping by timber harvesting and fire (Number 23), which ranked 5th, is to be expanded to include hunting; the research need is therefore defined as socioeconomic analysis of the effects on hunting and trapping by timber harvesting and fire. Discussion centered around the need for a data base relevant to wildlife management aspects, which could be time–consuming to establish.

The final research need discussed by the Northwest Territories group was economics of wood energy utilization (Number 20), which ranked 6th. The main concern raised here was the lack of data and the need for fact–finding studies in the cost of providing energy.

Saskatchewan Research Needs Content

The Saskatchewan area meeting group selected forest industry impact, regional and economic (Appendix 2, Questionnaire 3, research need 1) as their first research need priority. Such research should determine the contribution of sawmills and pulp mills a) to gross national product and balance of payments, b) to government revenues, and c), to overall employment. An historical comparison of the forest industry impact with other industries such as agriculture and mining and including the role of subsidies and subsidy adjustments is called for by the group. Two other components were also identified; determination of the manner and extent to which the forest industry stimulates other industries such as secondary industry and recreation (the latter through increased accessibility); and means of improving community stability from the forest industry as it relates to employment.

Economics of integrated forest land use including both timber and nontimber uses and economic analysis of agricultural and forestry land use interface (2, 7, and 16) was ranked 2nd by the Saskatchewan group. Discussions centered around the need to determine the benefits and the costs of wildlife, timber, grazing, fisheries, tourism, recreation, watershed, and agriculture to the people of Saskatchewan. In so doing there is a need to estimate interactive relationships among the different land uses (multi–product production functions). There are needs to address native land claims and northern municipal councils in facilitating or constraining various alternative land use patterns.

Third–ranked economics of intensive timber management alternatives including economics of forest removal (8 and 18) were revised by the group. They felt that advanced roading, included in management alternatives, and all but spraying versus no spraying and juvenile spacing, included in forest removal, should be eliminated from the research need combination (i.e., eliminate 8k and 18c–18g from the mail survey descriptions). These items are viewed as company or operator responsibilities and thus do not require publicly funded research. The balance of the group discussion centered around the need to estimate costs and benefits associated with management alternatives.

Allowable cut determination, timber supply analysis modelling, and economics of timber accessability and transportation are combined (4 and 19) for the fourth–ranked research need by the area meeting group. Components of this research need to include a) embellishment of stand data with economic data and their attachment to specific locations in the land base, b) proximity analysis (e.g., road requirements for one small stand versus several small stands), c) operability (i.e., determining the percentage of volume that may not be operable), and d) cost of getting inventory to processing plants under summer versus winter hauling and work force availability.

The fifth research need is economics of forest protection; it should include economic analysis of development of accessibility for protection, which fits into roading and determination of values–at–risk in which fuel mapping is involved. A comparison of incremental protection costs versus incremental reforestation and an economic analysis of predicting fire weather index to determine the probability of large fires are to be included. How to best divide funds among prevention, protection, detection, and initial attack is the central question to be answered. Final points are a) the need to incorporate values–at–risk into stand economics, b) measurement of fire risk probability over time, and c) recognizing that as forest management intensifies, values–at–risk go up, which may justify increased protection expenditures.

The group examined their sixth–ranked choice, economics of environmental safeguards on forest land (Number 14) and suggested alterations to the mail survey description. Limits on use of pesticides (Number 14a) was adequate as presented. Not only cut block size limitation (Number 14b), but all utilization standards should be researched. Buffer strips (Number 14c) should include streams and lakes, roads (road construction policies), skyline reserves, and shaded fire breaks. Alternatives to buffers that achieve the same goals should also be investigated. Finally, logging

elevation limits (Number 14d) should be replaced with protected lands including delicate and sensitive sites, ecological reserves, and recreation and wilderness reserves.

Constraints

The Alberta group raised a number of items that could constrain research with regard to the research needs discussed. The inability of clients or researchers to ask the "right" questions was an issue raised. There is also a lack of adequate data, particularly for integrated forest land use, allowable cut determination and timber supply analysis modelling, supply and demand modelling, and intensive timber management alternatives (research needs 1, 4, 5, and 8, Table 7). Regarding allowable cut determination and timber supply analysis modelling (Number 4), economics is not often a major consideration, and utilization standards are continually changing. This research need and intensive timber management alternatives (Number 8) suffer from a lack of single and multi–product biological production functions necessary to carry on economic analyses. One must also contend with uncertainty about future returns regarding Number 8. Both Number 4 and Number 13, forest land use policy and planning studies, are subject to political constraints. Number 13 is contrained by a lack of a defined decision–making process.

The group identified several constraints for supply and demand modelling (Number 5, Table 7): lack of expertise; lack of funding; and conflicting objectives. Two constraints affecting economic analysis of forest industry structure (Number 12, Table 7), are a lack of data because Statistics Canada does not give enough attention to forestry given its size in relation to agriculture, and a lack of lobby.

The Manitoba group cited lack of funding and expertise on all items discussed by them (numbers 1–4, 7, 8, 15, 16, 18, and 23, Table 7). Political constraints applied to most items as well. For example, jurisdictional overlap constrains forest industry impact (Number 1) and intensive timber management alternatives including forest renewal (numbers 8 and 18); lack of awareness of the problem constrains allowable cut determination and timber supply analysis modelling and integrated forest land use including timber and nontimber uses and the agriculture–forestry interface (numbers 4, 27, and 16); and a lack of commitment constrains socioeconomic studies and native forest land use issues including effects on trapping by timber harvest and fire (numbers 15 and 23). Economics of integrated forest land use (Number 2) is constrained by a lack of statutory requirement for benefit–cost analysis.

Lack of data base is considered a serious constraint by the Manitoba group for integrated forest land use (numbers 2, 7, and 16), forest protection (Number 3), allowable cut determination and timber supply analysis modelling (Number 4), and intensive timber management alternatives (numbers 8 and 18). There is also a lack of known functional relationships (production functions) to facilitate economics of forest protection and timber supply analysis modelling (numbers 3 and 4). Lack of definition of objectives was seen as a constraint for native forest land use issues and intensive timber management alternatives (numbers 15 and 23, and numbers 8 and 18). There is also a cross–cultural problem regarding native land use issues. Economics of forest protection (Number 3) is constrained by nonquantifiable benefits. A final constraint identified by the Manitoba group was the emphasis on traditional approaches to economic analysis (return on investment) that applies to stand analysis instead of forest analysis.

The Northwest Territories group rated several constraints in carrying out research on the economics of integrated forest land use (Number 2, Table 7). These include: a lack of research personnel in the Northwest Territories; the requirement that research must be community based and involve public participation and that local people must be involved in research activities; the need to reflect local values in assessing alternative land use patterns; and the requirement that research must have a readily applied component. Several constraints were also cited for research on economics of forest protection (Number 3). These are a lack of funds, the large geographic area involved, determining number and location of fires, and the presence of hard positions in communities on issues related to this topic. Constraints on economic research related to nontimber forest land uses (Number 7) relate primarily to recreation. There is difficulty in justifying research work of this kind because of the large area and low volume of activities even though such land uses are very important to the Northwest Territories. There is a lack of research funds.

Socioeconomic studies and native forest land use issues research (Number 15, Table 8) face serious constraints in the Northwest Territories. Native feelings for the land must be considered; language difficulties arise; local involvement is essential; and there are jurisdictional constraints. Constraints regarding economics research on wood energy utilization include lack of data and the need for fact–finding studies on costs of providing energy to facilitate economic assessments. Finally, constraints on socioeconomic analysis of the effects on hunting and trapping by timber harvesting and fire (Number 23) include presence of nonquantifiable benefits and costs. There is

also a timing constraint because wildlife assessments will take much longer than forest or recreation components. The generation of data needs for wildlife require a considerably long time horizon.

The Saskatchewan group identified several constraints that applied to all research needs considered (numbers 1–4, 7, 8, 14, 18, and 19, Table 8). These constraints are: problems with timing of information; lack of funding; lack of data, particularly multi–product production functions and data confidentiality; lack of immediately available expertise and lack of funding and training programs to eventually meet the shortage; and lack of public and political acceptance of forest economics research needs. The presence of nonquantifiable benefits constrains research on integrated forest land use (numbers 2, 7, and 16), timber management alternatives (numbers 8 and 18) and environmental safeguards (Number 14). Also, regarding timber management alternatives, there is a land tenure constraint and a problem in applying generalized results to local timber management situations.

There was a concern expressed in the Saskatchewan group that public decisions may override economic solutions to forest industry impact and environmental safeguard studies (numbers 1 and 14). A lack of definition may constrain allowable cut determination and timber supply analysis modelling including timber accessibility and transportation (numbers 4 and 19). There is a technical problem in defining economics of a timber stand. Also, with reference to accessibility and transportation, there is a lack of analytical techniques and models.

SUMMARY

This study identified and defined forest economic research needs in the west–central region of Canada (Alberta, Manitoba, the Northwest Territories, and Saskatchewan). The following five objectives were met:

1. identification of existing research activities;
2. definition of forest economics research needs;
3. definition of the gap between the activities and needs;
4. identification of the constraints upon meeting research needs; and
5. strengthening a sense of community among the participants and users of forest economics research.

The first three objectives were met through the use of a modified Delphi technique involving the use of three sequential questionnaires mailed to a sample of 88 leading forest economics researchers and research users. The participants were selected using a peer nominating process. The last two objectives were met through four area meetings within the region using a workshop format.

A comprehensive list of past and current forest economics research activities was assembled. Most items pertained to forest industry impact, forest protection, nontimber forest land uses, forest industry structure, and forest land use policy and planning studies. Twenty–six major research needs were identified and rated in terms of urgency and importance. They included 1) economics of integrated forest land use, 2) regional and economic forest industry impact, 3) economics of forest protection, 4) allowable cut determination and timber supply analysis modelling, 5) supply and demand modelling, 6) stumpage valuation, 7) economics of nontimber forest land uses, 8) economics of intensive timber management alternatives, 9) forest industry structure analysis, 10) forest land use policy and planning studies, 11) economics of poplar utilization, and 12) economics of environmental safeguards on forest land. These items are in order of priority for the region as a whole.

A breakdown by region showed some variation. Alberta's research needs were 1) economics of integrated forest land use, 2) forest industry impact, 3) allowable cut determination and timber supply analysis modelling, 4) economics of forest protection, 5) supply and demand modelling, and 6) economics of nontimber forest land uses. Manitoba mail survey respondents came up with 1) economics of integrated forest land use, 2) economics of forest protection, 3) forest industry impact, 4) supply and demand modelling, 5) economics of intensive timber management alternatives, and 6) economics of nontimber forest land uses. The Northwest Territories respondents deviated most from the overall region priorities with 1) economics of integrated forest land use, 2) economics of forest protection, 3) socioeconomic analysis of the effects on trapping by timber harvesting and fire, 4) socioeconomic studies and native forest land use issues, 5) forest industry impact, and 6) economics of nontimber forest land uses. Saskatchewan participants responded with 1) forest industry impact, 2) economics of integrated forest land use, 3) economics of forest protection, 4) allowable cut determination and timber supply analysis modelling, 5) stumpage valuation, and 6) economics of forest renewal.

The research activities provided by the mail survey participants, although not assumed to be complete, do represent the bulk of past and current forest economics research activities in the region. When compared to the research needs identified, activities fall short of fulfilling completely any of these needs, although significant beginnings have been made in some areas. For the most part, the gaps between the research needs and activities are very large. There is also a lack of cohesiveness in the existing research thrust. Results from this study could be used to initiate efforts to improve it.

The area meeting workshops permitted face–to–face contact among participants who were asked to elaborate upon, rate, and identify constraints on many of the research needs identified in the mail survey. The ranking of research needs differed from mail survey rankings by area, in part, because area meeting proceedings allowed for combinations of two or more research needs into a single one and allowed for alterations of descriptions.

The top research needs identified by the participants of the Alberta area meeting were 1) economics of integrated forest land use including both timber and nontimber land uses and agricultural and forestry land use interface, 2) allowable cut determination and timber supply analysis modelling, 3) economic analysis of forest industry structure, 4, tie) supply and demand modelling, 4, tie) forest land use policy and planning studies, 6, tie) forestry industry impact, and 6, tie) economics of intensive timber management alternatives. The Manitoba group selected 1) economics of intensive timber management alternatives including forest renewal, 2) economics of forest protection, 3) economics of forest land use, 4) forest industry impact, 5) allowable cut determination and timber supply analysis modelling, and 6) socioeconomic studies and native forest land use issues including socioeconomic analysis of the effects on trapping by timber harvesting and fire. The Northwest Territories group selected 1) social and economic analysis of integrated forest land use, 2) socioeconomic studies and native land use issues, 3) economics of forest protection, 4) economics of

nontimber forest land uses, 5) socioeconomic analysis of the effects on hunting and trapping by timber harvesting and fire, and 6) economics of wood energy utilization. The Saskatchewan group selected 1) forest industry impact, 2) economics of integrated forest land use including both timber and nontimber land uses and agricultural and forestry land use interface, 3) economics of intensive timber management alternatives including forest renewal, 4) allowable cut determination, timber supply analysis modelling, and economics of timber accessibility and transportation, 5) economics of forest protection, and 6) economics of environmental safeguards on forest land.

Constraints upon meeting the various research needs include lack of research expertise, lack of funding, conflicting objectives, nonquantifiable benefits and costs, lack of data, and lack of problem definition and defined decision–making processes. There are also political constraints, which include jurisdictional overlap, lack of awareness, and lack of public commitment or acceptance. Cross–cultural problems, language difficulties, communication gaps, and hard positions in communities can also make it difficult to meet forest economics research needs.

A broad spectrum of forest economics needs has been identified and defined. Past and current research, although important, has only begun to close the gaps between research activities and needs. There is no cohesive forest economics research thrust in the region. The results of the study provide considerable direction in establishing such a thrust. The authors hope that this study will be taken seriously to this end, and that its usefulness not be limited to the Canadian Forestry Service, which funded it, but extended to the forestry community at large.

This study has facilitated increased dialogue among different forest economics research interests. Efforts must be made to continue this process. It is hoped that a means of ensuring continued dialogue, research inventory updating, and research needs modifications can be found. Such efforts are essential to increase and maintain momentum in meeting forest economic research needs in west–central Canada.

REFERENCES

Delbecq, A.L.; Van de Ven, A.H.; Gustafson, D.H. 1975. Group techniques for program planning. Scott, Foresman and Company, Glenview, Illinois.

Simon, H.A. 1960. The new science of management decisions. Harper Brothers, New York, New York.

Thompson, J.; Tuden, A. 1959. Strategies, structures, and processes of organizational decisions. Pages 195–216 *in* J. Thompson, P. Hammond, R. Hawkes, B. Junker, and A. Tuden, eds. Comparative studies in administration. University of Pittsburg Press, Pittsburg, Pennsylvania.

APPENDIX 1

PARTICIPANTS

A. Mail Survey Participants

B. Area Meetings Participants

A. MAIL SURVEY PARTICIPANTS

Mr. Al Anderson, Anderson Mills

Mr. Brodie Anderson, Saskatchewan Department of Parks and Renewable Resources

Mr. Norm Anderson, Weldwood of Canada Ltd.

Mr. Richard Anderson, Alberta Economic Development

Mr. Robert Andrews, Alberta Fish and Wildlife Division

Mr. Peter Ashton, Inter Group Consulting Economists Ltd.

Mr. Walt Bailey, Saskatchewan Department of Parks and Renewable Resources

Mr. Tom Ballantyne, Consultant

Mr. Terry Barr, Procter & Gamble Cellulose Ltd.

Mr. Brock Bartlett, Abitibi Price Inc.

Mr. Bob Beard, B.C. Forest Products Ltd.

Mr. Steve Beaufoy, Procter & Gamble Cellulose Ltd.

Dr. James Beck, University of Alberta

Mr. Bob Bell, Renewable Resources, Government of the NWT

Mr. Jamie Benson, Saskatchewan Department of Parks and Renewable Resources

Mr. Vic Be Grand, Saskatchewan Department of Parks and Renewable Resources

Mr. Roy Bickell, Canadian Forest Products

Mr. Hugh Bigsby, Alberta Forest Service

Dr. Alfred Birch, Alberta Agriculture

Mr. Gene Bossemaier, Manitoba Department of Natural Resources

Ms. Diana Boylen, Canadian Forestry Service

Mr. Norman Brandson, Manitoba Department of Environment

Mr. Art Briggs, Manitoba Department of Natural Resources

Mr. Norm Brocard, Simpson Timber Co.

Mr. Tim Cascadden, Saskatchewan Planning Bureau

Mr. James Clark, St. Regis (Alberta) Ltd.

Mr. Les Davis, Zeidler Forest Industries Ltd.

Dr. W.R. Dempster, Consultant

Mr. John Didula, MacMillan Bloedel Industries Ltd.

Mr. John Donnihe, Renewable Resources, Government of the NWT

Mr. Derrik Doyle, Manitoba Department of Natural Resources

Mr. Henry Epp, Saskatchewan Environment

Dr. Robert Fenton, University of Winnipeg

Mr. Mac Forbes, Alberta Public Lands Division

Mr. Phil Frewer, Zeidler Forest Industries Ltd.

Mr. Klem Froning, Canadian Forestry Service

Mr. Ed Gillespie, Alberta Forest Service

Mr. Jack Gilmour, Department of Indian and Northern Development

Mr. Laurie Gravelines, Manitoba Department of Natural Resources

Dr. John Gray, University of Manitoba

Mr. Bruce Hansen, Abitibi Price Inc.

Mr. Les Harding, International Woodworkers of America

Dr. Jack Heidt, University of Alberta

Dr. M.J. Heit, Canadian Forestry Service

Mr. Art Hoole, Manitoba Parks Branch

Mr. Richard C. Hudson, Manecon Partnership

Mr. David James, Saskatchewan Ministry for State and Economic Development

Mr. William Jonas, Manitoba Forestry Resources Ltd.

Mr. David Kiil, Canadian Forestry Service

Mr. Cal Kirby, Saskatchewan Department of Parks and Renewable Resources

Mr. Jack Lameraux, Economic Development, Government of the NWT

Mr. Murray Little, Saskatchewan Department of Parks and Renewable Resources

Mr. Don Loyd, Saskatchewan Forest Products Ltd.

Ms. Kathleen MacDonald, Alberta Agriculture

Mr. Fred McDougall, Alberta Department of Energy and Natural Resources

Mr. John McQueen, Department of Indian and Northern Development

Mr. Mac Millar, Miller Western Industries Ltd.

Mr. Barry Mjolsness, Spray Lakes Sawmills Ltd.

Mr. David Morgan, Alberta Forest Service

Dr. Peter Murphy, University of Alberta

Mr. Duncan Newman, NEWFOR

Mr. William Ondro, Canadian Forestry Service

Mr. Gene Patterson, Patterson Enterprises Ltd.

Mr. Abe G. Penner, Southeast Forest Products Ltd.

Dr. Mike Percy, University of Alberta

Mr. Jim Perkins, Prince Albert Pulp Company Ltd.

Mr. Barrie Phillips, University of Alberta

Dr. William Phillips, University of Alberta

Mr. Steve Price, Canadian Forestry Service

Mr. David Rannard, Manitoba Department of Natural Resources

Mr. John Reid, Saskatchewan Crown Management Board

Mr. Tony Richmond, Saskatchewan Department of Parks and Renewable Resources

Mr. Alan Rittman, Alberta Energy Company

Mr. Gordon Robb, Spruce Products Ltd.

Mr. Gordon Robinson, Saskatchewan Crown Management Board

Mr. Barry Rogers, Alberta Forest Service

Mr. Arden Rytz, Alberta Forest Products Association

Mr. Jim Schaefer, NWT Hunters and Trappers Federation

Mr. T. Sheldon Schwartz, Saskatchewan Treasury Board

Mr. Steve Smith, Prince Albert Pulp Company Ltd.

Mr. Dale F. Stewart, Manitoba Department of Natural Resources

Dr. Guy Swinnerton, University of Alberta

Mr. Ernest Tirshman, Roblin Forest Products Ltd.

Mr. Allan Vaughan, Economic Development, Government of the NWT

Mr. John Walker, Simpson Timber Co.

Mr. Don Weisbeck, Economic Development, Government of the NWT

Mr. Tim Williamson, Canadian Forestry Service

Mr. David Witty, Hildermann, Witty and Associates

B. AREA MEETINGS PARTICIPANTS

ALBERTA:

Mr. Richard Anderson, Alberta Economic Development

Dr. James Beck, University of Alberta

Mr. Hugh Bigsby, Alberta Forest Service

Dr. Alfred Birch, Alberta Agriculture

Ms. Diana Boylen (observer), Canadian Forestry Service

Ms. Susan Calp, Alberta Forest Service

Dr. Richard Dempster, Consultant

Mr. Phil Frewer, Zeidler Forest Industries Ltd.

Dr. Mike Heit, Canadian Forestry Service

Mr. David Kiil, Canadian Forestry Service

Ms. Kathleen MacDonald, Alberta Agriculture

Dr. Glen Manning (observer), Canadian Forestry Service

Mr. Dean Marshall, Spray Lakes Sawmills Ltd.

Dr. William Phillips, University of Alberta

Mr. Alan Rittman, Alberta Energy Company

Mr. Jack Smyth (observer), Canadian Forestry Service

Mr. Joe Soos, Alberta Forest Service

Dr. Guy Swinnerton, University of Alberta

Mr. Tim Williamson, Canadian Forestry Service

MANITOBA:

Mr. Dave Baird, Manitoba Forestry Resources Ltd.

Mr. Dave Boulter, Canadian Forestry Service

Mr. Bob Buck, Manitoba Department of Natural Resources

Mr. Klem Froning, Canadian Forestry Service

Dr. Mike Heit, Canadian Forestry Service

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Mr. Bruno Seppala, Manitoba Department of Natural Resources

Mr. Bill Snell, Abitibi Price Inc.

Mr. Tim Williamson, Canadian Forestry Service

Mr. Dave Witty, Hildermann, Witty and Associates

Mr. Dave Wotten, Manitoba Department of the Environment

NORTHWEST TERRITORIES:

Ms. Diana Boylen, Canadian Forestry Service

Mr. Jack Gilmour, Department of Indian and Northern Development

Mr. Paul Gray, Renewable Resources, Government of the NWT

Mr. James Schaefer, Northwest Territories Hunters and Trappers Federation

Mr. Keith Thompson, Tourism and Parks, Government of the NWT

Mr. Tim Williamson, Canadian Forestry Service

SASKATCHEWAN:

Mr. Tom Ballantyne, Consultant

Mr. A.C. Baumgartner, Saskatchewan Department of Parks and Renewable Resources

Mr. Jamie Benson, Saskatchewan Department of Parks

and Renewable Resources

Mr. Allan Campbell, Saskatchewan Department of Parks and Renewable Resources

Mr. Jim Farrell, Canadian Forestry Service

Mr. Paul Klotz, Saskatchewan Forest Products Ltd.

Mr. Don Loyd, Saskatchewan Forest Products Ltd.

Mr. Duncan Newman, NEWFOR

Mr. Roman Orynik, Prince Albert Pulp Company Ltd.

Mr. Madan Pandila, Saskatchewan Department of Parks and Renewable Resources

Mr. Jim Perkins, Prince Albert Pulp Company Ltd.

APPENDIX 2

QUESTIONNAIRES

Questionnaire 1

Questionnaire 2

Questionnaire 3

Forest Economics Research Needs for the West-Central Region of Canada

Code: ____

QUESTIONNAIRE #1

Scope of Forestry Economics Research
For the purposes of this study consider forest economics research to include the study of forest resource utilization including interactive aspects such as recreational use of the forest, product development, surface and sub-surface extraction on forest lands. It also includes the social, economic and institutional dimensions of forest resource allocation. The spectrum of interest sought covers the forestry system from forest land resource base to final consumer demand.

1. Please check or write in the appropriate responses to the following questions regarding your current professional practice or role.

   a. Prime geographic area of practice within the West-Central Region (check one or more)

      ____ Alberta

      ____ Manitoba

      ____ Northwest Territories

      ____ Saskatchewan

   b. Employer:

      ____ Federal Government

      ____ Provincial/Territorial Government

      ____ Private Industry/Crown Corporation

      ____ University/College

      ____ Other (specify) _____

   c. Professional role:

      ____ Economist

      ____ Other (specify) _____

2. We would like to compile a complete listing of existing forest economics research relevant to the region.

   List any forest economics research projects of which you are aware that are relevant to the West-Central Region of Canada.

   Where the project is on-going, provide as complete information as you can regarding the project title or brief description, name of principal investigator, name of sponsoring agency, and expected completion date. If the project is completed or has been reported, provide appropriate reference information regarding author, title, source/publisher, and date of report.

   Please list the items below.

(If additional space required, please attach sheet.)

3. The central purpose of this survey is to determine the forest economics research that needs to be done for the region.

   In the left-hand column, list the important forest economics research needs, topics, or questions that you feel should be addressed for the West-Central Region of Canada. Briefly state your reason for each entry in the right-hand column.

   Your list may be short or long, but each item should be stated concisely.

Research Need	**Reason**

4. The next questionnaire will provide an opportunity to evaluate and rate the forest economics research needs identified from this round. We would like your opinion on the important criteria that should be used in making such an evaluation and rating.

   Four possible criteria are listed below. Use the space provided to comment or elaborate on these criteria and/or add other possible criteria. Then using the 5-point scale to the right, indicate the level of importance you would assign to each criteria (1 = Very Low, to 5 = Very High).

	Criteria	Importance Rating Very Low				Very High
(a)	Urgency--basic information needed to aid in solution to threat or problem	1	2	3	4	5
(b)	Expected benefits in relation to costs	1	2	3	4	5
(c)	Potential for contribution to knowledge	1	2	3	4	5
(d)	Relevance to provincial, regional, or national goals for forestry	1	2	3	4	5
(e)	Other (specify)_____	1	2	3	4	5

THANK YOU FOR YOUR CONTRIBUTION. PLEASE RETURN THIS QUESTIONNAIRE IN THE ENVELOPE PROVIDED BEFORE OCTOBER 21, 1983 TO:

The University of Alberta
Faculty of Extension
Corbett Hall
Edmonton, Alberta
T6G 9Z9

Forest Economics Research Needs for the West-Central Region of Canada

Code: ____

QUESTIONNAIRE #2

Instructions for Responding to Delphi Questionnaire #2

We have listed the proposed forest economics research needs as compiled from the responses to the first Delphi questionnaire. Please do four things in this list.

1. Review all the items on the list.

2. Comment, in a brief statement, on any items you wish. You may argue in favour or against any item, or request clarification. Brevity and clarity will facilitate analysis.

3. Rate each of the items in terms of its

   a. importance (expected benefits or contribution in relation to costs), and

   b. urgency (basic information needed to aid in solution to threat or problem)

   by circling the appropriate number code on the respective scales to the right of each item (1 = very low, 5 = very high). Note: This rating is preliminary. The final rating will be made in the next questionnaire.

4. Return your completed questionnaire in the enclosed self-addressed, post-paid envelope by **December 12,** 1983.

RESEARCH NEEDS	IMPORTANCE RATING (Very Low 1 2 3 4 5 Very High)	URGENCY RATING (Very Low 1 2 3 4 5 Very High)	COMMENTS
1. Economics of Intensive Timber Management Alternatives Studies of the biological response, economic costs and benefits and effects on society of various intensive management options including:			
a. Using genetically improved stock	1 2 3 4 5	1 2 3 4 5	
b. Thinning	1 2 3 4 5	1 2 3 4 5	
c. Fertilization	1 2 3 4 5	1 2 3 4 5	
d. Juvenile spacing	1 2 3 4 5	1 2 3 4 5	
e. Mixed wood stand conversion	1 2 3 4 5	1 2 3 4 5	
f. Determination of priority stands for treatment	1 2 3 4 5	1 2 3 4 5	
g. Use of herbicides for site preparation and release	1 2 3 4 5	1 2 3 4 5	
h. Determination of the allowable cut effect	1 2 3 4 5	1 2 3 4 5	
i. Thinning or conversion of fire origin suppressed pine stands	1 2 3 4 5	1 2 3 4 5	
j. Increased protection levels	1 2 3 4 5	1 2 3 4 5	
k. Advanced roading	1 2 3 4 5	1 2 3 4 5	
l. More intensive management of areas close to mills than of areas more distant from the mill	1 2 3 4 5	1 2 3 4 5	
2. Forest Industry Impact (Regional/Economic) Economic impact of the forest industry including value-added and multiplier effects on community, regional and provincial jurisdictions	1 2 3 4 5	1 2 3 4 5	

RESEARCH NEEDS	IMPORTANCE RATING (Very Low 1 2 3 4 5 Very High)	URGENCY RATING (Very Low 1 2 3 4 5 Very High)	COMMENTS
3. Economics of Forest Renewal Benefit-cost analysis of specific forest renewal techniques such as:			
a. Container versus bare root planting	1 2 3 4 5	1 2 3 4 5	
b. Planting versus seeding	1 2 3 4 5	1 2 3 4 5	
c. Machine versus hand planting	1 2 3 4 5	1 2 3 4 5	
d. Contract versus own nurseries	1 2 3 4 5	1 2 3 4 5	
e. Contract versus own planting	1 2 3 4 5	1 2 3 4 5	
f. Spraying versus no spraying	1 2 3 4 5	1 2 3 4 5	
g. Juvenile spacing	1 2 3 4 5	1 2 3 4 5	
4. Allowable Cut Determination/Timber Supply Analysis Modelling Research needs include:			
a. The use of economic factors in the analysis	1 2 3 4 5	1 2 3 4 5	
b. Biometric growth modelling for inputs	1 2 3 4 5	1 2 3 4 5	
c. The use of criteria that recognize the economics of harvesting and processing of small wood	1 2 3 4 5	1 2 3 4 5	
d. Computer modelling and other analytical techniques for forest utilization planning	1 2 3 4 5	1 2 3 4 5	
e. Development of methodology and criteria to assist in optimum resource allocation determination for forest protection, management and processing	1 2 3 4 5	1 2 3 4 5	
5. Stumpage Valuation Economic significance of alternative stumpage/royality pricing systems	1 2 3 4 5	1 2 3 4 5	

RESEARCH NEEDS	IMPORTANCE RATING (Very Low 1 2 3 4 5 Very High)	URGENCY RATING (Very Low 1 2 3 4 5 Very High)	COMMENTS
6. Economics of Harvesting Technologies Studies of the costs and benefits of various alternative harvesting technologies including:			
a. Whole tree utilization	1 2 3 4 5	1 2 3 4 5	
b. Feller brancher and grapple skidding	1 2 3 4 5	1 2 3 4 5	
c. Hand felling and cable skidding	1 2 3 4 5	1 2 3 4 5	
d. Delimbing and delimbers	1 2 3 4 5	1 2 3 4 5	
e. New technologies including derrigibles, ballons, felling head, wide tires, etc.	1 2 3 4 5	1 2 3 4 5	
7. Economics of Timber Accessibility and Transportation Analysis of the economics of transportation of forest products to include:			
a. Determination of economically accessible stands	1 2 3 4 5	1 2 3 4 5	
b. Winter versus summer hauling to mill	1 2 3 4 5	1 2 3 4 5	
c. Determination of optimium road size	1 2 3 4 5	1 2 3 4 5	
d. Government versus company built roads	1 2 3 4 5	1 2 3 4 5	
e. Transport of finished products to market both domestic and export	1 2 3 4 5	1 2 3 4 5	
8. Economics of Poplar Utilization Studies on the economics of poplar utilization must include:			
a. Market feasibility studies	1 2 3 4 5	1 2 3 4 5	
b. Product development studies	1 2 3 4 5	1 2 3 4 5	
c. Determination of the economically available potential poplar supply	1 2 3 4 5	1 2 3 4 5	

RESEARCH NEEDS	IMPORTANCE RATING (Very Low 1 2 3 4 5 Very High)	URGENCY RATING (Very Low 1 2 3 4 5 Very High)	COMMENTS
9. Economics of Forest Protection Benefit-cost analysis of alternative methods to determine optimum levels of expenditure for forest protection (prevention, detection and control) against loses from fire, insects and disease	1 2 3 4 5	1 2 3 4 5	
10. Economics of Environmental Safeguards on Forest Land Analysis of the costs and benefits, both dollar and non-dollar values, of various environmental safeguards such as:			
a. Buffer strips	1 2 3 4 5	1 2 3 4 5	
b. Logging elevation limits	1 2 3 4 5	1 2 3 4 5	
c. Cutblock size limitations	1 2 3 4 5	1 2 3 4 5	
d. Limits on use of pesticides	1 2 3 4 5	1 2 3 4 5	
11. Economics of Urban Forestry	1 2 3 4 5	1 2 3 4 5	
12. Economic Studies of Timber Resource Utilization Including Smallwood These studies are to be related to:			
a. Regeneration	1 2 3 4 5	1 2 3 4 5	
b. Use of trash species	1 2 3 4 5	1 2 3 4 5	
c. Conversion technology	1 2 3 4 5	1 2 3 4 5	
d. Merchantability standards	1 2 3 4 5	1 2 3 4 5	
e. Timber values	1 2 3 4 5	1 2 3 4 5	
f. Harvesting costs	1 2 3 4 5	1 2 3 4 5	
g. Determination of potential building log stands	1 2 3 4 5	1 2 3 4 5	

RESEARCH NEEDS	IMPORTANCE RATING (Very Low 1 2 3 4 5 Very High)	URGENCY RATING (Very Low 1 2 3 4 5 Very High)	COMMENTS
13. Economics of Milling Technology Studies regarding:			
a. Debarking	1 2 3 4 5	1 2 3 4 5	
b. Chipping	1 2 3 4 5	1 2 3 4 5	
c. Screening	1 2 3 4 5	1 2 3 4 5	
d. Whole tree utilization	1 2 3 4 5	1 2 3 4 5	
e. Use of fire killed wood and Jack pine for pulp	1 2 3 4 5	1 2 3 4 5	
14. Economics of Wood Energy Utilization Analysis of energy and forestry relationships including:			
a. The relation between energy prices and timber demand	1 2 3 4 5	1 2 3 4 5	
b. Use of biomass for energy	1 2 3 4 5	1 2 3 4 5	
c. Use of peat for energy	1 2 3 4 5	1 2 3 4 5	
d. Use of wood wastes for energy	1 2 3 4 5	1 2 3 4 5	
15. Supply and Demand Modelling The modelling is to facilitate both short-term and long-term projections. Supply is to focus on regional, national and international forest resource availability, cost, and use. Demand is to focus on regional, national and international demands and to include price projections and studies of substitutes for forest products at various projected prices	1 2 3 4 5	1 2 3 4 5	

RESEARCH NEEDS	IMPORTANCE RATING (Very Low 1 2 3 4 5 Very High)	URGENCY RATING (Very Low 1 2 3 4 5 Very High)	COMMENTS
16. Forest Products Marketing Studies These studies are to include:			
a. Analysis of the market potential and demand trends, both domestic and export, for new and existing products of the west central region	1 2 3 4 5	1 2 3 4 5	
b. Examination of alternative pricing methods for chips	1 2 3 4 5	1 2 3 4 5	
c. Development of an econometric model of the spruce-pine-fir lumber market	1 2 3 4 5	1 2 3 4 5	
d. Analysis of alternative grading standards	1 2 3 4 5	1 2 3 4 5	
17. Economic Analysis of Forestry Industry Structure Studies are to include:			
a.Demand, supply, marketing and value-added analysis of producing secondary products from logs and pulp within the region	1 2 3 4 5	1 2 3 4 5	
b. Analysis of the economies of scale, technological change and input substitution, including capital versus labor, for various forestry operations including the sawmilling industry	1 2 3 4 5	1 2 3 4 5	
c. Evaluation of alternative wood acquisition programs such as own roundwood production and purchased chips and wood	1 2 3 4 5	1 2 3 4 5	
d. Analysis of the long-term viability of the forest industry including the costs and benefits of industry rationalization and the maintenance of a data base information system in each jurisdiction of the region	1 2 3 4 5	1 2 3 4 5	

RESEARCH NEEDS	IMPORTANCE RATING (Very Low 1 2 3 4 5 Very High)	URGENCY RATING (Very Low 1 2 3 4 5 Very High)	COMMENTS
18. Timber Product Development Studies including:			
a. Pulp products	1 2 3 4 5	1 2 3 4 5	
b. Solid wood products	1 2 3 4 5	1 2 3 4 5	
19. Economics of Integrated Forest Land Use Includes the application of benefit-cost analysis devoted to the relative economic importance of various forest land use patterns. Uses include commercial and non-commercial, consumptive and non-consumptive and environmental protection uses. Specifically, timber harvesting, grazing, wildlife and fisheries, watershed, outdoor recreation and tourism must be considered. The evaluation and interaction of such uses is made in order to assist planners and policy makers in deciding on various land use options and patterns	1 2 3 4 5	1 2 3 4 5	
20. Socioeconomic Studies and Native Forest Land Use Issues Studies include:			
a. Design of institutional arrangements for increased native business and employment opportunities in forest products	1 2 3 4 5	1 2 3 4 5	
b. Remote native community enhancement	1 2 3 4 5	1 2 3 4 5	
c. Value of forests to traditional native lifestyles	1 2 3 4 5	1 2 3 4 5	
21. Forest Economics Education Review and analysis of curricula/course contents and methods to enhance understanding of forest economics	1 2 3 4 5	1 2 3 4 5	

RESEARCH NEEDS	IMPORTANCE RATING (Very Low 1 2 3 4 5 Very High)	URGENCY RATING (Very Low 1 2 3 4 5 Very High)	COMMENTS
22. Economic Analyses of Agricultural and Forestry Land Use Interface Such analyses include:			
a. Evaluation of the status and prospects for forestry on private farm land	1 2 3 4 5	1 2 3 4 5	
b. Analysis of the impact of transforming mixed wood areas to grazing through range improvement programs	1 2 3 4 5	1 2 3 4 5	
c. The costs and benefits to the forest industry from domestic grazing on reforested cut-over areas	1 2 3 4 5	1 2 3 4 5	
d. Evaluation of economic and social decision criteria for land allocation at the interface between forestry and agriculture	1 2 3 4 5	1 2 3 4 5	
e. Economic evaluation of local economy from a forestry-agricultural land use mix compared to an all-agriculture or all-forestry land use pattern	1 2 3 4 5	1 2 3 4 5	
f. Comparison of productivity and technological change in terms of land using or land saving effects for agriculture and forestry	1 2 3 4 5	1 2 3 4 5	
g. Economics of small woodlot operators	1 2 3 4 5	1 2 3 4 5	
h. Economics of utilizing forest land for agricultural purposes	1 2 3 4 5	1 2 3 4 5	
23. Socioeconomic Analysis of the Effects on Trapping by Timber Harvesting and Fire	1 2 3 4 5	1 2 3 4 5	

RESEARCH NEEDS	IMPORTANCE RATING (Very Low 1 2 3 4 5 Very High)	URGENCY RATING (Very Low 1 2 3 4 5 Very High)	COMMENTS
24. Forest Land Use Policy and Planning Studies Studies to include:			
a. The economics of forestry incentives and regulation	1 2 3 4 5	1 2 3 4 5	
b. Sustained yield - is it an economically viable policy objective	1 2 3 4 5	1 2 3 4 5	
c. Post-project evaluation	1 2 3 4 5	1 2 3 4 5	
d. Forest management under public and private resource ownership	1 2 3 4 5	1 2 3 4 5	
e. Inventory of timber including value of satelite imaginary versus manual cruising in forested land use planning	1 2 3 4 5	1 2 3 4 5	
f. Federal incentive and cost sharing programs	1 2 3 4 5	1 2 3 4 5	
g. Socioeconomic and environmental impact assessments effects or company operations	1 2 3 4 5	1 2 3 4 5	
h. Integration of forest harvesting into parks	1 2 3 4 5	1 2 3 4 5	
i. Public perceptions of integrated resource use on public lands	1 2 3 4 5	1 2 3 4 5	
j. Impact of allowable cut requirements on wood processing operations	1 2 3 4 5	1 2 3 4 5	
k. Policy evaluation regarding effective use of softwood and hardwood	1 2 3 4 5	1 2 3 4 5	
l. Evaluation of institutional arrangements for forest industry regulation including industry stablization	1 2 3 4 5	1 2 3 4 5	
m. Use of physical, economic, social and political criteria in decision making	1 2 3 4 5	1 2 3 4 5	

RESEARCH NEEDS	IMPORTANCE RATING (Very Low 1 2 3 4 5 Very High)	URGENCY RATING (Very Low 1 2 3 4 5 Very High)	COMMENTS
25. Economics of Non-Timber Forest Land Uses Studies include:			
a. Tourism potential	1 2 3 4 5	1 2 3 4 5	
b. Feasibility of commercial recreation developments	1 2 3 4 5	1 2 3 4 5	
c. Wilderness parks	1 2 3 4 5	1 2 3 4 5	
d. Outdoor recreation benefits and costs	1 2 3 4 5	1 2 3 4 5	
e. Fish and wildlife benefits and costs	1 2 3 4 5	1 2 3 4 5	
f. Watershed protection benefits	1 2 3 4 5	1 2 3 4 5	
g. Losses to timber production due to nontimber uses	1 2 3 4 5	1 2 3 4 5	
26. Evaluation in Economic Terms of Improved Research, Development and Application of New Technology Such evaluation to include:			
a. New genetic adaptations	1 2 3 4 5	1 2 3 4 5	
b. New production practices	1 2 3 4 5	1 2 3 4 5	
c. New distribution practices	1 2 3 4 5	1 2 3 4 5	

THANK YOU FOR YOUR CONTRIBUTION. PLEASE RETURN THIS QUESTIONNAIRE IN THE ENVELOPE PROVIDED BEFORE **DECEMBER 12,** 1983 TO:

The University of Alberta
Faculty of Extension
Corbell Hall
Edmonton, Alberta
T6G 9Z9

Forest Economics Research Needs for the West-Central Region of Canada

Code: ____

QUESTIONNAIRE #3

Instructions for Responding to Delphi Questionnaire #3

BACKGROUND

The enclosed questionnaire contains:

1. a listing of proposed forestry economics research needs as identified by study respondents in Round 1; and

2. a preliminary rating of these research needs according to importance and urgency as determined by respondents in Round 2.

The preliminary ratings are reported as mean scores on the 5-point scale.

TASK

Your task is to:

1. review all the items on the list;

2. comment, in a brief statement, on any items you wish to clarify its meaning and/or suggest implications for future action;

3. provide a final rating for each item in terms of its overall importance (consider expected benefits or contribution in relation to costs as well as urgency) by circling the appropriate number code on he respective scales to the right of each item (1 = very low; 5 = very high).

4. return your completed questionnaire in the enclosed self-addressed, post-paid envelope by February 10, 1984.

	RESEARCH NEEDS	SCORE Importance	SCORE Urgency	RATING Very Low				Very High	COMMENTS
1.	**Forest Industry Impact (Regional/Economic)** Economic impact of the forest industry including value-added and multiplier effects on community, regional and provincial jurisdictions	4.290	4.081	1	2	3	4	5	
2.	**Economics of Integrated Forest Land Use** Includes the application of benefit-cost analysis devoted to the relative economic importance of various forest land use patterns. Uses include commercial and non-commercial, consumptive and non-consumptive and environmental protection uses. Specifically, timber harvesting, grazing, wildlife and fisheries, watershed, outdoor recreation and tourism must be considered. The evaluation and interaction of such uses is made in order to assist planners and policy makers in deciding on various land use options and patterns	4.237	4.119	1	2	3	4	5	
3.	**Economics of Forest Protection** Benefit-cost analysis of alternative methods to determine optimum levels of expenditure for forest protection (prevention, detection and control) against loses from fire, insects and disease	4.190	3.968	1	2	3	4	5	
4.	**Allowable Cut Determination/Timber Supply Analysis Modelling** Research needs include:								
	a. The use of economic factors in the analysis	4.048	3.774	1	2	3	4	5	
	b. Development of methodology and criteria to assist in optimum resource allocation determination for forest protection, management and processing	3.983	3.797	1	2	3	4	5	
	c. The use of criteria that recognize the economics of harvesting and processing of small wood	3.836	3.820	1	2	3	4	5	
	d. Computer modelling and other analytical techniques for forest utilization planning	3.750	3.467	1	2	3	4	5	
	e. Biometric growth modelling for inputs	3.404	3.316	1	2	3	4	5	

	RESEARCH NEEDS	SCORE Importance	SCORE Urgency	RATING Very Low				Very High	COMMENTS
5.	**Supply and Demand Modelling** The modelling is to facilitate both short-term and long-term projections. Supply is to focus on regional, national and international forest resource availability, cost, and use. Demand is to focus on regional, national and international demands and to include price projections and studies of substitutes for forest products at various projected prices	3.579	3.386	1	2	3	4	5	
6.	**Economics of Poplar Utilization** Studies on the economics of poplar utilization must include:								
	a. Market feasibility studies	3.661	3.232	1	2	3	4	5	
	b. Product development studies	3.589	3.196	1	2	3	4	5	
	c. Determination of the economically available potential poplar supply	3.182	2.964	1	2	3	4	5	
7.	**Economics of Non-Timber Forest Land Uses** Studies include:								
	a. Losses to timber production due to nontimber uses	3.810	3.667	1	2	3	4	5	
	b. Watershed protection benefits	3.661	3.484	1	2	3	4	5	
	c. Fish and wildlife benefits and costs	3.603	3.413	1	2	3	4	5	
	d. Outdoor recreation benefits and costs	3.333	3.222	1	2	3	4	5	
	e. Tourism potential	3.213	2.950	1	2	3	4	5	
	f. Wilderness parks	3.016	2.887	1	2	3	4	5	
	g. Feasibility of commercial recreation developments	2.902	2.750	1	2	3	4	5	

RESEARCH NEEDS	SCORE Importance	SCORE Urgency	RATING Very Low				Very High	COMMENTS
8. Economics of Intensive Timber Management Alternatives Studies of the biological response, economic costs and benefits and effects on society of various intensive management options including:								
a. Determination of the allowable cut effect	3.909	3.732	1	2	3	4	5	
b. More intensive management of areas close to mills than on areas more distant from the mill	3.911	3.655	1	2	3	4	5	
c. Determination of priority stands for treatment	3.768	3.630	1	2	3	4	5	
d. Using genetically improved stock	3.879	3.386	1	2	3	4	5	
e. Increased protection levels	3.582	3.304	1	2	3	4	5	
f. Juvenile spacing	3.421	3.232	1	2	3	4	5	
g. Thinning or conversion of fire origin suppressed pine stands	3.232	3.232	1	2	3	4	5	
h. Use of herbicides for site preparation and release	3.263	3.125	1	2	3	4	5	
i. Thinning	3.263	3.053	1	2	3	4	5	
j. Mixed wood stand conversion	3.035	2.862	1	2	3	4	5	
k. Advanced roading	2.679	2.554	1	2	3	4	5	
l. Fertilization	2.464	2.214	1	2	3	4	5	
9. Stumpage Valuation Economic significance of alternative stumpage/royality pricing systems	3.371	3.081	1	2	3	4	5	

	RESEARCH NEEDS	SCORE Importance	SCORE Urgency	RATING Very Low				Very High	COMMENTS
10.	**Forest Economics Education** Review and analysis of curricula/course contents and methods to enhance understanding of forest economics	3.351	3.088	1	2	3	4	5	
11.	**Evaluation in Economic Terms of Improved Research, Development and Application of New Technology** Such evaluation to include:								
	a. New production practices	3.379	3.138	1	2	3	4	5	
	b. New genetic adaptations	3.281	3.140	1	2	3	4	5	
	c. New distribution practices	3.105	2.947	1	2	3	4	5	
12.	**Economic Analysis of Forestry Industry Structure** Studies are to include:								
	a. Analysis of the long-term viability of the forest industry including the costs and benefits of industry rationalization and the maintenance of a data base information system in each jurisdiction of the region	3.593	3.271	1	2	3	4	5	
	b.Demand, supply, marketing and value-added analysis of producing secondary products from logs and pulp within the region	3.333	3.088	1	2	3	4	5	
	c. Analysis of the economies of scale, technological change and input substitution, including capital versus labor, for various forestry operations including the sawmilling industry	3.293	3.086	1	2	3	4	5	
	d. Evaluation of alternative wood acquisition programs such as own roundwood production and purchased chips and wood	2.707	2.569	1	2	3	4	5	

RESEARCH NEEDS	SCORE Importance	SCORE Urgency	RATING Very Low				Very High	COMMENTS
13. Forest Land Use Policy and Planning Studies Studies to include:								
a. Sustained yield - is it an economically viable policy objective	3.638	3.448	1	2	3	4	5	
b. The economics of forestry incentives and regulation	3.456	3.286	1	2	3	4	5	
c. Integration of forest harvesting into parks	3.411	3.250	1	2	3	4	5	
d. Inventory of timber including value of satelite imaginary versus manual cruising in forested land use planning	3.421	3.105	1	2	3	4	5	
e. Public perceptions of integrated resource use on public lands	3.246	3.140	1	2	3	4	5	
f. Use of physical, economic, social and political criteria in decision making	3.231	2.962	1	2	3	4	5	
g. Socioeconomic and environmental impact assessments effects or company operations	3.125	3.000	1	2	3	4	5	
h. Federal incentive and cost sharing programs	3.111	2.963	1	2	3	4	5	
i. Post-project evaluation	3.180	2.860	1	2	3	4	5	
j. Impact of allowable cut requirements on wood processing operations	3.063	2.958	1	2	3	4	5	
k. Evaluation of institutional arrangements for forest industry regulation including industry stablization	2.854	2.729	1	2	3	4	5	
l. Forest management under public and private resource ownership	2.891	2.655	1	2	3	4	5	
m. Policy evaluation regarding effective use of softwood and hardwood	2.827	2.673	1	2	3	4	5	

RESEARCH NEEDS	SCORE Importance	SCORE Urgency	RATING Very Low				Very High	COMMENTS
14. Economics of Environmental Safeguards on Forest Land Analysis of the costs and benefits, both dollar and non-dollar values, of various environmental safeguards such as:								
a. Limits on use of pesticides	3.390	3.271	1	2	3	4	5	
b. Cutblock size limitations	3.459	3.098	1	2	3	4	5	
c. Buffer strips	3.302	3.172	1	2	3	4	5	
d. Logging elevation limits	2.483	2.328	1	2	3	4	5	
15. Socioeconomic Studies and Native Forest Land Use Issues Studies include:								
a. Design of institutional arrangements for increased native business and employment opportunities in forest products	3.193	3.211	1	2	3	4	5	
b. Remote native community enhancement	3.000	3.018	1	2	3	4	5	
c. Value of forests to traditional native lifestyles	3.017	2.879	1	2	3	4	5	

RESEARCH NEEDS	SCORE Importance	SCORE Urgency	RATING Very Low				Very High	COMMENTS
16. Economic Analyses of Agricultural and Forestry Land Use Interface Such analyses include:								
a. Evaluation of economic and social decision criteria for land allocation at the interface between forestry and agriculture	3.500	3.450	1	2	3	4	5	
b. Economic evaluation of local economy from a forestry-agricultural land use mix compared to an all-agriculture or all-forestry land use pattern	3.237	3.133	1	2	3	4	5	
c. Economics of utilizing forest land for agricultural purposes	3.283	3.083	1	2	3	4	5	
d. The costs and benefits to the forest industry from domestic grazing on reforested cut-over areas	3.086	2.828	1	2	3	4	5	
e. Analysis of the impact of transforming mixed wood areas to grazing through range improvement programs	2.915	2.746	1	2	3	4	5	
f. Comparison of productivity and technological change in terms of land using or land saving effects for agriculture and forestry	2.827	2.712	1	2	3	4	5	
g. Evaluation of the status and prospects for forestry on private farm land	2.800	2.633	1	2	3	4	5	
h. Economics of small woodlot operators	2.746	2.517	1	2	3	4	5	

RESEARCH NEEDS	SCORE Importance	SCORE Urgency	RATING Very Low				Very High	COMMENTS
17. Economic Studies of Timber Resource Utilization Including Smallwood These studies are to be related to:								
a. Harvesting costs	3.517	3.293	1	2	3	4	5	
b. Regeneration	3.396	3.151	1	2	3	4	5	
c. Timber values	3.368	3.123	1	2	3	4	5	
d. Conversion technology	3.073	2.945	1	2	3	4	5	
e. Merchantability standards	2.965	2.842	1	2	3	4	5	
f. Use of trash species	2.685	2.444	1	2	3	4	5	
g. Determination of potential building log stands	2.291	2.145	1	2	3	4	5	
18. Economics of Forest Renewal Benefit-cost analysis of specific forest renewal techniques such as:								
a. Spraying versus no spraying	3.418	3.259	1	2	3	4	5	
b. Juvenile spacing	3.393	3.218	1	2	3	4	5	
c. Container versus bare root planting	3.123	2.947	1	2	3	4	5	
d. Planting versus seeding	3.089	2.875	1	2	3	4	5	
e. Machine versus hand planting	2.818	2.673	1	2	3	4	5	
f. Contract versus own planting	2.527	2.618	1	2	3	4	5	
g. Contract versus own nurseries	2.527	2.527	1	2	3	4	5	

RESEARCH NEEDS	SCORE Importance	SCORE Urgency	RATING Very Low				Very High	COMMENTS
19. Economics of Timber Accessibility and Transportation Analysis of the economics of transportation of forest products to include:								
a. Determination of economically accessible stands	3.719	3.439	1	2	3	4	5	
b. Transport of finished products to market both domestic and export	3.115	2.843	1	2	3	4	5	
c. Government versus company built roads	2.710	2.482	1	2	3	4	5	
d. Winter versus summer hauling to mill	2.655	2.436	1	2	3	4	5	
e. Determination of optimium road size	2.500	2.396	1	2	3	4	5	
20. Economics of Wood Energy Utilization Analysis of energy and forestry relationships including:								
a. Use of wood wastes for energy	3.475	3.237	1	2	3	4	5	
b. Use of biomass for energy	2.907	2.815	1	2	3	4	5	
c. The relation between energy prices and timber demand	2.719	2.439	1	2	3	4	5	
d. Use of peat for energy	2.446	2.250	1	2	3	4	5	
21. Timber Product Development Studies including:								
a. Solid wood products	3.170	2.736	1	2	3	4	5	
b. Pulp products	2.780	2.420	1	2	3	4	5	
22. Forest Products Marketing Studies These studies are to include:								
a. Analysis of the market potential and demand trends, both domestic and export, for new and existing products of the west central region	3.593	3.271	1	2	3	4	5	
b. Examination of alternative pricing methods for chips	2.724	2.638	1	2	3	4	5	
c. Development of an econometric model of the spruce-pine-fir lumber market	2.857	2.679	1	2	3	4	5	
d. Analysis of alternative grading standards	2.263	2.158	1	2	3	4	5	

	RESEARCH NEEDS	SCORE Importance	SCORE Urgency	RATING Very Low	2	3	4	Very High	COMMENTS
23.	**Socioeconomic Analysis of the Effects on Trapping by Timber Harvesting and Fire**	2.783	2.600	1	2	3	4	5	
24.	**Economics of Milling Technology** Studies regarding:								
	a. Use of fire killed wood and Jack pine for pulp	3.179	2.911	1	2	3	4	5	
	b. Whole tree utilization	3.111	2.796	1	2	3	4	5	
	c. Debarking	2.519	2.222	1	2	3	4	5	
	d. Chipping	2.426	2.222	1	2	3	4	5	
	e. Screening	2.358	2.113	1	2	3	4	5	
25.	**Economics of Harvesting Technologies** Studies of the costs and benefits of various alternative harvesting technologies including:								
	a. Whole tree utilization	3.130	2.868	1	2	3	4	5	
	b. New technologies including derrigibles, ballons, felling head, wide tires, etc.	2.593	2.389	1	2	3	4	5	
	c. Feller buncher and grapple skidding	2.500	2.320	1	2	3	4	5	
	d. Delimbing and delimbers	2.460	2.340	1	2	3	4	5	
	e. Hand felling and cable skidding	2.157	2.000	1	2	3	4	5	
26.	**Economics of Urban Forestry**	1.945	1.855	1	2	3	4	5	

THANK YOU FOR YOUR CONTRIBUTION. PLEASE RETURN THIS QUESTIONNAIRE IN THE ENVELOPE PROVIDED BEFORE **FEBRUARY 10**, 1984 TO:

The University of Alberta
Faculty of Extension
Corbell Hall
Edmonton, Alberta
T6G 9Z9

APPENDIX 3

QUESTIONNAIRE RESULTS

Table A. Distribution of respondents by prime geographic area of practice

Area of practice	Respondents	
	Number	Percent
Alberta	25	32.5
Manitoba	14	18.2
Northwest Territories	10	13.0
Saskatchewan	18	23.4
Alberta-Northwest Territories	1	1.3
Alberta-Saskatchewan	1	1.3
Manitoba-Saskatchewan	1	1.3
Alberta-Manitoba-Saskatchewan	2	2.6
Alberta-Northwest Territories-Saskatchewan	1	1.3
Alberta-Manitoba-Northwest Territories-Saskatchewan	4	5.2
Total[1]	77	100.0

[1] Of the 88 participants (Appendix 1), 77 completed and returned Questionnaire 1 (Appendix 2).

Table B. Distribution of respondents by employer

Employer	Respondents	
	Number	Percent
Federal government	8	10.4
Provincial or territorial government	30	39.0
Private industry or crown corporation	26	33.8
University	9	11.7
Other	4	5.2
Total[1]	77	100.0

[1] Of the 88 participants (Appendix 1), 77 completed and returned Questionnaire 1 (Appendix 2).

Table C. Distribution of respondents by professional role

Professional role	Respondents	
	Number	Percent
Economist	13	16.9
Forester	19	24.7
Manager	16	20.8
Forest management	3	3.9
Planner	9	11.7
Sawmill operator	3	3.9
Assistant Deputy Minister	2	2.6
Vice-president	2	2.6
Agrologist	1	1.3
Wildlife biologist	2	2.6
Researcher	2	2.6
Analyst	3	3.9
Administrator	1	1.3
Unspecified	1	1.3
Total	77	100.0

Table D. Rating of proposed criteria for forest economics research needs by respondents

Criterion	Rating scores[1]						
	Arithmetic mean	Standard error	Median	Mode	Standard deviation	Range	No. of respondents
Urgency	4.082	0.125	4.0	5.0	1.064	4	73
Expected benefits in relation to costs	4.055	0.118	4.0	5.0	1.012	4	73
Potential contribution to knowledge	3.041	0.145	3.0	3.0	1.243	4	74
Relevance to goals for forestry	3.919	0.112	4.0	4.0	0.962	4	74
Other	4.286	0.230	5.0	5.0	1.056	4	21

[1] Of the 77 respondents for Questionnaire 1, 74 provided ratings on a five-point scale with 5 being very high and 1 being very low.

Table E. Combined importance-urgency rating of forest economics research needs from Questionnaire 2 for Questionnaire 3

Research needs	Combined score[1]	Importance		Urgency	
		Score	Rank	Score	Rank
1. Forest industry impact (regional/economic)	4.186	4.290	1	4.081	2
2. Economics of integrated forest land use	4.177	4.237	2	4.119	1
3. Economics of forest protection	4.079	4.190	3	3.968	3
4. Allowable cut determination/timber supply analysis modelling	3.720	3.804	4	3.635	4
5. Supply and demand modelling	3.483	3.579	5	3.386	5
6. Economics of poplar utilization	3.304	3.477	6	3.131	8
7. Economics of nontimber forest land uses	3.280	3.363	9	3.196	6
8. Economics of intensive timber management alternatives	3.266	3.367	8	3.165	7
9. Stumpage valuation	3.226	3.371	7	3.081	10
10. Forest economics education	3.220	3.351	10	3.088	9
11. Evaluation in economic terms of improved research, development, and application of new technology	3.165	3.255	11	3.075	11
12. Economic analysis of forestry industry structure	3.118	3.232	12	3.004	13
13. Forest land use policy and planning studies	3.096	3.189	13	3.002	14
14. Economics of environmental safeguards on forest land	3.063	3.159	14	2.967	15
15. Socioeconomic studies and native forest land use issues	3.053	3.070	15	3.036	12
16. Economic analyses of agricultural and forestry land use interface	2.969	3.049	16	2.888	16
17. Economic studies of timber resource utilization including smallwood	2.946	3.042	17	2.849	18
18. Economics of forest renewal	2.930	2.985	18	2.874	17
19. Economics of timber accessibility and transportation	2.830	2.941	20	2.719	19

Table E continued

Research needs	Combined score[1]	Importance		Urgency	
		Score	Rank	Score	Rank
20. Economics of wood energy utilization	2.786	2.887	21	2.685	21
21. Timber product development	2.777	2.975	19	2.578	23
22. Forest products marketing studies	2.773	2.859	22	2.687	20
23. Socioeconomic analysis of the effects on trapping by timber harvesting and fire	2.692	2.783	23	2.600	22
24. Economics of milling technology	2.586	2.719	24	2.453	24
25. Economics of harvesting technologies	2.476	2.568	25	2.383	25
26. Economics of urban forestry	1.900	1.945	26	1.855	26

[1] Average of scores for importance and urgency rating criteria. Ratings are on a five-point scale with 5 being very high and 1 being very low.

Table F. Combined importance-urgency rating of forest economics research needs from Questionnaire 2 by province and territory[1]

Research needs	Alberta		Manitoba		NWT		Saskatchewan		Region
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score
1. Forest industry impact (regional/economic)	4.214	2	3.969	3	4.572	1	4.195	1	4.186
2. Economics of integrated forest land use	4.375	1	4.500	1	4.500	2	3.559	4	4.177
3. Economics of forest protection	3.572	5	4.441	2	4.429	3	4.195	2	4.079
4. Allowable cut determination/timber supply analysis modelling	4.069	3	3.424	4	3.779	6	3.564	3	3.720
5. Supply and demand modelling	3.762	4	3.167	11	3.700	7	3.344	7	3.483
6. Economics of poplar utilization	3.342	9	3.300	7	3.267	13	3.271	8	3.304
7. Economics of nontimber forest land uses	3.481	6	3.262	8	3.580	10	3.156	10	3.280
8. Economics of intensive timber management alternatives	3.210	13	3.327	6	2.842	19	3.554	5	3.266
9. Stumpage valuation	3.238	12	2.751	17	3.688	8	3.441	6	3.226
10. Forest economics education	3.250	11	3.250	9	3.200	14	3.157	9	3.220
11. Evaluation in economic terms of improved research, development, and application of new technology	3.158	16	3.219	10	3.111	16	3.141	12	3.165
12. Economic analysis of forestry industry structure	3.333	10	3.009	15	3.155	15	2.900	15	3.118
13. Forest land use policy and planning studies	3.147	17	3.101	13	3.486	12	2.862	16	3.096
14. Economics of environmental safeguards on forest land	3.351	8	3.146	12	2.948	18	2.622	20	3.063
15. Socioeconomic studies and native forest land use issues	2.542	24	3.413	5	4.139	5	2.913	13	3.053
16. Economic analyses of agricultural and forestry land use interface	3.400	7	2.877	16	2.815	20	2.499	22	2.969
17. Economic studies of timber resource utilization including smallwood	3.029	14	2.650	19	3.080	17	2.848	17	2.946
18. Economics of forest renewal	2.757	23	3.048	14	2.667	23	3.149	11	2.930

Table F continued

Research needs	Alberta		Manitoba		NWT		Saskatchewan		Region
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score
19. Economics of timber accessibility and transportation	2.884	21	2.500	22	3.663	9	2.782	18	2.830
20. Economics of wood energy utilization	2.885	20	2.647	20	3.565	11	2.448	23	2.786
21. Timber product development	2.917	18	2.679	18	2.809	21	2.675	19	2.777
22. Forest products marketing studies	3.194	15	2.399	24	2.729	22	2.621	21	2.773
23. Socioeconomic analysis of the effects on trapping by timber harvesting and fire	2.381	25	2.067	26	4.250	4	2.907	14	2.692
24. Economics of milling technology	2.846	22	2.548	21	2.060	25	2.435	24	2.586
25. Economics of harvesting technologies	2.890	19	2.442	23	2.625	24	1.991	25	2.476
26. Economics of urban forestry	1.868	26	2.313	25	1.584	26	1.608	26	1.900

[1] The 65 usable responses from Questionnaire 2 are distributed as Alberta 22, Manitoba 17, NWT 8, and Saskatchewan 18.

Table G. Rating of forest economics research needs by respondents to Questionnaire 3

	Research needs	Rating scores' Mean	Standard error	Median	Mode	Standard deviation	Range	No. of respondents
1.	Forest industry impact (regional/economic) Economic impact of the forest industry including value-added and multiplier effects on community, regional and provincial jurisdictions	3.947	0.153	4.0	4.0	1.156	4	57
2.	Economics of integrated forest land use Includes the application of benefit-cost analysis devoted to the relative economic importance of various forest land use patterns. Uses include commercial and noncommercial, consumptive and nonconsumptive and environmental protection uses. Specifically, timber harvesting, grazing, wildlife and fisheries, watershed, outdoor recreation and tourism must be considered. The evaluation and interaction of such uses is made in order to assist planners and policy makers in deciding on various land use options and patterns	4.316	0.101	4.0	5.0	0.760	2	57
3.	Economics of forest protection Benefit-cost analysis of alternative methods to determine optimum levels of expenditure for forest protection (prevention, detection and control) against losses from fire, insects and disease	3.895	0.134	4.0	5.0	1.012	4	57
4.	Allowable cut determination/timber supply analysis modelling Research needs include:							
	a. The use of economic factors in the analysis	3.895	0.136	4.0	4.0	1.030	4	57
	b. Development of methodology and criteria to assist in optimum resource allocation determination for forest protection, management and processing	3.737	0.143	4.0	3.0	1.078	4	57
	c. The use of criteria that recognize the economics of harvesting and processing of smallwood	3.643	0.145	4.0	4.0	1.086	4	56
	d. Computer modelling and other analytical techniques for forest utilization planning	3.482	0.130	3.5	3.0	0.972	4	56
	e. Biometric growth modelling for inputs	3.091	0.140	3.0	3.0	1.041	4	55

Table G continued

	Research needs	Rating scores' Mean	Standard error	Median	Mode	Standard deviation	Range	No. of respondents
5.	Supply and demand modelling The modelling is to facilitate both short-term and long-term projections. Supply is to focus on regional, national and international forest resource availability, cost, and use. Demand is to focus on regional, national and international demands and to include price projections and studies of substitutes for forest products at various projected prices	3.421	0.135	3.0	3.0	1.017	4	57
6.	Economics of poplar utilization Studies on the economics of poplar utilization must include:							
	a. Market feasibility studies	3.193	0.153	3.0	3.0	1.156	4	57
	b. Product development studies	3.207	0.165	3.0	4.0	1.253	4	58
	c. Determination of the economically available potential poplar supply	2.845	0.157	3.0	2.0	1.197	4	58
7.	Economics of nontimber forest land uses Studies include:							
	a. Losses to timber production due to nontimber uses	3.690	0.113	4.0	4.0	0.863	4	58
	b. Watershed protection benefits	3.356	0.143	3.0	3.0	1.095	4	59
	c. Fish and wildlife benefits and costs	3.542	0.124	4.0	4.0	0.953	3	59
	d. Outdoor recreation benefits and costs	3.508	0.129	4.0	3.0	0.989	4	59
	e. Tourism potential	3.138	0.131	3.0	3.0	0.999	3	58
	f. Wilderness parks	2.966	0.155	3.0	3.0	1.184	4	58
	g. Feasibility of commercial recreation developments	2.741	0.140	3.0	2.0	1.069	4	58

Table G continued

	Research needs	Rating scores[1] Mean	Standard error	Median	Mode	Standard deviation	Range	No. of respondents
8.	Economics of intensive timber management alternatives Studies of the biological response, economic costs and benefits and effects on society of various intensive management options including:							
	a. Determination of the allowable cut effect	3.741	0.147	4.0	4.0	1.117	4	58
	b. More intensive management of areas close to mills than of areas more distant from the mill	3.983	0.124	4.0	4.0	0.946	4	58
	c. Determination of priority stands for treatment	3.737	0.136	4.0	4.0	1.027	4	57
	d. Using genetically improved stock	3.466	0.142	3.5	3.0	1.080	4	58
	e. Increased protection levels	3.474	0.144	4.0	4.0	1.087	4	57
	f. Juvenile spacing	3.155	0.141	3.0	3.0	1.073	4	58
	g. Thinning or conversion of fire origin suppressed pine stands	3.086	0.126	3.0	3.0	0.960	4	58
	h. Use of herbicides for site preparation and release	2.964	0.172	3.0	2.0	1.276	4	55
	i. Thinning	3.052	0.152	3.0	3.0	1.161	4	58
	j. Mixed wood stand conversion	3.000	0.157	3.0	3.0	1.199	4	58
	k. Advanced roading	2.655	0.147	2.0	2.0	1.117	4	58
	l. Fertilization	2.310	0.131	2.0	2.0	0.995	4	58
9.	Stumpage valuation Economic significance of alternative stumpage/royalty pricing systems	3.281	0.145	3.0	3.0	1.098	4	57

Table G continued

	Research needs	Rating scores' Mean	Standard Error	Median	Mode	Standard deviation	Range	No. of respondents
10.	Forest economics education Review and analysis of curricula/course contents and methods to enhance understanding of forest economics	2.983	0.151	3.0	3.0	1.147	4	58
11.	Evaluation in economic terms of improved research, development, and application of new technology Such evaluation to include:							
	a. New production practices	3.089	0.118	3.0	3.0	0.880	4	56
	b. New genetic adaptations	2.857	0.118	3.0	3.0	0.883	4	56
	c. New distribution practices	2.661	0.128	3.0	3.0	0.959	4	56
12.	Economic analysis of forestry industry structure Studies are to include:							
	a. Analysis of the long-term viability of the forest industry including the costs and benefits of industry rationalization and the maintenance of a data base information system in each jurisdiction of the region	3.638	0.145	4.0	4.0	1.103	4	58
	b. Demand, supply, marketing and value-added analysis of producing secondary products from logs and pulp within the region	3.259	0.149	3.0	3.0	1.133	4	58
	c. Analysis of the economies of scale, technological change and input substitution, including capital versus labor, for various forestry operations including the sawmilling industry	3.086	0.146	3.0	3.0	1.113	4	58
	d. Evaluation of alternative wood acquisition programs such as own roundwood production and purchased chips and wood	2.810	0.153	3.0	2.0	1.162	4	58

Table G continued

	Research needs	Rating scores' Mean	Standard error	Median	Mode	Standard deviation	Range	No. of respondents
13.	Forest land use policy and planning studies Studies to include:							
	a. Sustained yield - is it an economically viable policy objective	3.643	0.152	4.0	4.0	1.135	4	56
	b. The economics of forestry incentives and regulation	3.607	0.124	4.0	3.0	0.928	4	56
	c. Integration of forest harvesting into parks	3.304	0.153	3.0	3.0	1.143	4	56
	d. Inventory of timber including value of satellite imagery versus manual cruising in forested land use planning	3.214	0.163	3.0	3.0	1.217	4	56
	e. Public perceptions of integrated resource use on public lands	3.298	0.142	3.0	3.0	1.068	4	57
	f. Use of physical, economic, social and political criteria in decision making	3.268	0.166	3.0	3.0	1.243	4	56
	g. Socioeconomic and environmental impact assessments effects on company operations	3.071	0.153	3.0	3.0	1.142	4	56
	h. Federal incentive and cost-sharing programs	3.018	0.158	3.0	3.0	1.183	4	56
	i. Post-project evaluation	2.982	0.166	3.0	2.0	1.243	4	56
	j. Impact of allowable cut requirements on wood processing operations	3.018	0.143	3.0	3.0	1.070	4	56
	k. Evaluation of institutional arrangements for forest industry regulation including industry stabilization	2.782	0.139	3.0	2.0	1.031	4	55
	l. Forest management under public and private resource ownership	2.714	0.168	2.5	2.0	1.261	4	56
	m. Policy evaluation regarding effective use of softwood and hardwood	2.679	0.161	2.5	2.0	1.208	4	56

Table G continued

	Research needs	Rating scores[1] Mean	Standard error	Median	Mode	Standard deviation	Range	No. of respondents
14.	Economics of environmental safeguards on forest land Analysis of the costs and benefits, both dollar and nondollar values, of various environmental safeguards such as:							
	a. Limits on use of pesticides	3.153	0.165	3.0	3.0	1.271	4	59
	b. Cut block size limitations	3.203	0.156	3.0	3.0	1.200	4	59
	c. Buffer strips	3.169	0.159	3.0	3.0	1.220	4	59
	d. Logging elevation limits	2.559	0.176	2.0	1.0	1.355	4	59
15.	Socioeconomic studies and native forest land use issues Studies include:							
	a. Design of institutional arrangements for increased native business and employment opportunities in forest products	2.932	0.139	3.0	3.0	1.065	4	59
	b. Remote native community enhancement	2.914	0.150	3.0	2.0	1.144	4	58
	c. Value of forests to traditional native lifestyles	2.850	0.150	3.0	2.0	1.162	4	60

Table G continued

	Research needs	Rating scores[1] Mean	Standard error	Median	Mode	Standard deviation	Range	No. of respondents
16.	Economic analyses of agricultural and forestry land use interface Such analyses include:							
	a. Evaluation of economic and social decision criteria for land allocation at the interface between forestry and agriculture	3.466	0.158	4.0	4.0	1.203	4	58
	b. Economic evaluation of local economy from a forestry-agricultural land use mix compared to an all-agriculture or all-forestry land use pattern	3.119	0.157	3.0	4.0	1.205	4	59
	c. Economics of utilizing forest land for agricultural purposes	3.119	0.162	3.0	3.0	1.247	4	59
	d. The costs and benefits to the forest industry from domestic grazing on reforested cutover areas	2.741	0.147	3.0	3.0	1.117	4	58
	e. Analysis of the impact of transforming mixedwood areas to grazing through range improvement programs	2.559	0.148	2.0	2.0	1.134	4	59
	f. Comparison of productivity and technological change in terms of land-using or land-saving effects for agriculture and forestry	2.596	0.158	3.0	3.0	1.193	4	57
	g. Evaluation of the status and prospects for forestry on private farm land	2.525	0.150	2.0	2.0	1.150	4	59
	h. Economics of small woodlot operators	2.621	0.163	2.0	2.0	1.240	4	58

Table G continued

	Research needs	Rating scores' Mean	Standard error	Median	Mode	Standard deviation	Range	No. of respondents
17.	Economic studies of timber resource utilization including smallwood These studies are to be related to:							
	a. Harvesting costs	3.259	0.157	3.0	4.0	1.193	4	58
	b. Regeneration	3.414	0.143	3.0	3.0	1.093	4	58
	c. Timber values	3.298	0.139	3.0	3.0	1.052	4	57
	d. Conversion technology	3.121	0.144	3.0	4.0	1.093	4	58
	e. Merchantability standards	2.879	0.133	3.0	2.0	1.010	4	58
	f. Use of trash species	2.466	0.140	2.0	2.0	1.063	4	58
	g. Determination of potential building log stands	1.948	0.136	2.0	1.0	1.033	4	58
18.	Economics of forest renewal Benefit-cost analysis of specific forest renewal techniques such as:							
	a. Spraying versus no spraying	3.175	0.172	3.0	3.0	1.297	4	57
	b. Juvenile spacing	3.123	0.160	3.0	3.0	1.211	4	57
	c. Container versus bare-root planting	2.877	0.162	3.0	4.0	1.226	4	57
	d. Planting versus seeding	3.018	0.158	3.0	3.0	1.183	4	56
	e. Machine versus head planting	2.684	0.153	3.0	2.0	1.152	4	57
	f. Contract versus own planting	2.333	0.151	2.0	2.0	1.139	4	57
	g. Contract versus own nurseries	2.456	0.156	2.0	3.0	1.181	4	57

Table G continued

	Research needs	Rating scores[1] Mean	Standard error	Median	Mode	Standard deviation	Range	No. of respondents
19.	Economics of timber accessibility and transportation Analysis of the economics of transportation of forest products to include:							
	a. Determination of economically accessible stands	3.860	0.136	4.0	4.0	1.025	4	57
	b. Transport of finished products to market both domestic and export	3.053	0.157	3.0	3.0	1.187	4	57
	c. Government versus company built roads	2.621	0.155	2.0	2.0	1.182	4	58
	d. Winter versus summer hauling to mill	2.500	0.137	2.0	2.0	1.047	4	58
	e. Determination of optimium road size	2.638	0.153	2.0	2.0	1.165	4	58
20.	Economics of wood energy utilization Analysis of energy and forestry relationships including:							
	a. Use of wood wastes for energy	3.224	0.152	3.0	3.0	1.155	4	58
	b. Use of biomass for energy	3.000	0.159	3.0	3.0	1.214	4	58
	c. The relation between energy prices and timber demand	2.621	0.174	2.0	2.0	1.322	4	58
	d. Use of peat for energy	2.310	0.173	2.0	2.0	1.314	4	58
21.	Timber product development Studies including:							
	a. Solid wood products	2.897	0.147	3.0	3.0	1.119	4	58
	b. Pulp products	2.621	0.159	2.0	2.0	1.211	4	58

Table G continued

	Research needs	Rating scores' Mean	Standard error	Median	Mode	Standard deviation	Range	No. of respondents
22.	Forest products marketing studies These studies are to include:							
	a. Analysis of the market potential and demand trends, both domestic and export, for new and existing products of the west-central region	3.414	0.150	3.0	3.0	1.140	4	58
	b. Examination of alternative pricing methods for chips	2.793	0.170	2.0	2.0	1.295	4	58
	c. Development of an econometric model of the spruce-pine-fir lumber market	2.561	0.144	2.0	2.0	1.086	4	57
	d. Analysis of alternative grading standards	2.228	0.146	2.0	2.0	1.102	4	57
23.	Socioeconomic analysis of the effects on trapping by timber harvesting and fire	2.542	0.166	2.0	2.0	1.277	4	59
24.	Economics of milling technology Studies regarding:							
	a. Use of fire-killed wood and jack pine for pulp	2.982	0.153	3.0	3.0	1.157	4	57
	b. Whole tree utilization	3.088	0.149	3.0	3.0	1.123	4	57
	c. Debarking	2.482	0.151	2.0	2.0	1.128	4	56
	d. Chipping	2.393	0.148	2.0	2.0	1.107	4	56
	e. Screening	2.232	0.140	2.0	2.0	1.044	4	56
25.	Economics of harvesting technologies Studies of the costs and benefits of various alternative harvesting technologies including:							
	a. Whole tree utilization	3.086	0.154	3.0	3.0	1.174	4	58
	b. New technologies including dirigibles, balloons, felling heads, wide tires, etc.	2.339	0.140	2.0	2.0	1.049	4	56
	c. Feller buncher and grapple skidding	2.298	0.103	2.0	2.0	0.778	3	57
	d. Delimbing and delimbers	2.404	0.120	2.0	2.0	0.904	4	57
	e. Hand felling and cable skidding	2.123	0.118	2.0	2.0	0.888	3	57

Table G continued

	Research needs	Rating scores[1]						
		Mean	Standard error	Median	Mode	Standard deviation	Range	No. of respondents
26.	Economics of urban forestry	1.607	0.127	1.0	1.0	0.947	4	56

[1] Of the 88 participants, 61 returned Questionnaire 3 (Appendix 2). Sixty responses were useable. Ratings were on a five-point scale with 5 being very high and 1 being very low.

Table H. Rating scores of forest economics research needs from questionnaires 2 and 3

	Research needs	Questionnaire 2[1]		Questionnaire 3[2]	
		Score	Rank	Score	Rank
1.	Forest industry impact (regional/economic)	4.186	1	3.947	2
2.	Economics of integrated forest land use	4.177	2	4.316	1
3.	Economics of forest protection	4.079	3	3.895	3
4.	Allowable cut determination/timber supply analysis modelling	3.720	4	3.570	4
5.	Supply and demand modelling	3.483	5	3.421	5
6.	Economics of poplar utilization	3.304	6	3.082	11
7.	Economics of nontimber forest land uses	3.280	7	3.277	7
8.	Economics of intensive timber management alternatives	3.266	8	3.219	8
9.	Stumpage valuation	3.226	9	3.281	6
10.	Forest economics education	3.220	10	2.983	13
11.	Evaluation in economic terms of improved research, development, and application of new technology	3.165	11	2.869	17
12.	Economic analysis of forestry industry structure	3.118	12	3.198	9
13.	Forest land use policy and planning studies	3.096	13	3.123	10
14.	Economics of environmental safeguards on forest land	3.063	14	3.021	12
15.	Socioeconomic studies and native forest land use issues	3.053	15	2.899	16
16.	Economic analyses of agricultural and forestry land use interface	2.969	16	2.843	18
17.	Economic studies of timber resource utilization including smallwood	2.946	17	2.912	15
18.	Economics of forest renewal	2.930	18	2.809	19
19.	Economics of timber accessibility and transportation	2.830	19	2.934	14

Table H continued

	Research needs	Questionnaire 2[1] Score	Questionnaire 2[1] Rank	Questionnaire 3[2] Score	Questionnaire 3[2] Rank
20.	Economics of wood energy utilization	2.786	20	2.789	20
21.	Timber product development	2.777	21	2.759	21
22.	Forest products marketing studies	2.773	22	2.749	22
23.	Socioeconomic analysis of the effects on trapping by timber harvesting and fire	2.692	23	2.542	24
24.	Economics of milling technology	2.586	24	2.635	23
25.	Economics of harvesting technologies	2.476	25	2.449	25
26.	Economics of urban forestry	1.900	26	1.607	26

[1] Average of scores for importance and urgency rating criteria. Ratings are on a five-point scale with 5 being very high and 1 being very low. There were 65 usable responses to Questionnaire 2.

[2] Ratings are on a five-point scale with 5 being very high and 1 being very low. There were 60 usable responses to Questionnaire 3.

Table I. Rating of forest economics research needs from Questionnaire 3 by province and territory[1]

	Research needs	Alberta		Manitoba		NWT		Saskatchewan		Region	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1.	Forest industry impact (regional/economic) Economic impact of the forest industry including value-added and multiplier effects on community, regional and provincial jurisdictions	4.048	1.284	3.533	1.407	3.857	0.900	4.286	0.611	3.947	1.156
2.	Economics of integrated forest land use Includes the application of benefit-cost analysis devoted to the relative economic importance of various forest land use patterns. Uses include commercial and noncommercial, consumptive and nonconsumptive and environmental protection uses. Specifically, timber harvesting, grazing, wildlife and fisheries, watershed, outdoor recreation and tourism must be considered. The evaluation and interaction of such uses is made in order to assist planners and policy makers in deciding on various land use options and patterns	4.318	0.716	4.357	0.745	4.714	0.488	4.071	0.917	4.316	0.760
3.	Economics of forest protection Benefit-cost analysis of alternative methods to determine optimum levels of expenditure for forest protection (prevention, detection and control) against losses from fire, insects and disease	3.571	1.076	4.133	0.990	4.143	1.069	4.000	0.877	3.895	1.012
4.	Allowable cut determination/timber supply analysis modelling Research needs include:										
	a. The use of economic factors in the analysis	4.095	0.889	3.733	1.033	3.571	1.397	3.929	1.072	3.895	1.030
	b. Development of methodology and criteria to assist in optimum resource allocation determination for forest protection, management and processing	3.857	1.062	3.400	1.183	3.857	1.345	3.857	0.864	3.737	1.078
	c. The use of criteria that recognize the economics of harvesting and processing of smallwood	3.810	1.030	3.000	1.109	3.286	1.254	4.214	0.699	3.643	1.086
	d. Computer modelling and other analytical techniques for forest utilization planning	3.619	0.865	3.214	0.975	2.857	1.345	3.857	0.770	3.482	0.972
	e. Biometric growth modelling for inputs	3.429	1.028	2.615	1.044	2.571	0.976	3.286	0.914	3.091	1.041

Table I continued

	Research needs	Alberta Mean	Alberta SD	Manitoba Mean	Manitoba SD	NWT Mean	NWT SD	Saskatchewan Mean	Saskatchewan SD	Region Mean	Region SD
5.	Supply and demand modelling The modelling is to facilitate both short-term and long-term projections. Supply is to focus on regional, national and international forest resource availability, cost, and use. Demand is to focus on regional, national and international demands and to include price projections and studies of substitutes for forest products at various projected prices	3.545	1.011	3.467	1.125	3.429	1.272	3.154	0.801	3.421	1.017
6.	Economics of poplar utilization Studies on the economics of poplar utilization must include:										
	a. Market feasibility studies	3.409	1.182	3.000	1.069	3.143	1.345	3.077	1.188	3.193	1.156
	b. Product development studies	3.455	1.224	2.933	1.223	2.857	1.464	3.286	1.267	3.207	1.253
	c. Determination of the economically available potential poplar supply	3.000	1.345	2.533	1.125	2.857	1.069	2.929	1.141	2.845	1.197
7.	Economics of nontimber forest land uses Studies include:										
	a. Losses to timber production due to nontimber uses	3.955	0.722	3.667	0.488	3.571	1.397	3.357	1.008	3.690	0.863
	b. Watershed protection benefits	3.565	0.788	3.267	1.033	3.143	1.464	3.214	1.424	3.356	1.095
	c. Fish and wildlife benefits and costs	3.739	0.915	3.533	0.743	3.857	0.900	3.071	1.141	3.542	0.953
	d. Outdoor recreation benefits and costs	3.522	0.898	3.400	0.828	3.714	1.254	3.500	1.225	3.508	0.989
	e. Tourism potential	2.955	0.899	3.067	0.961	3.857	1.069	3.143	1.099	3.138	0.999
	f. Wilderness parks	3.000	0.816	3.200	1.146	3.571	1.397	2.357	1.447	2.966	1.184
	g. Feasibility of commercial recreation developments	2.773	1.020	2.400	1.056	3.714	1.380	2.571	0.756	2.741	1.069

Table I continued

Research needs	Alberta		Manitoba		NWT		Saskatchewan		Region	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
8. Economics of intensive timber management alternatives Studies of the biological response, economic costs and benefits and effects on society of various intensive management options including:										
a. Determination of the allowable cut effect	4.045	0.722	3.333	1.345	3.571	1.512	3.786	1.122	3.741	1.117
b. More intensive management of areas close to mills than of areas more distant from the mill	3.955	0.899	4.067	1.033	3.429	1.272	4.214	0.699	3.983	0.946
c. Determination of priority stands for treatment	3.818	0.795	3.714	1.267	3.286	1.380	3.857	0.949	3.737	1.027
d. Using genetically improved stock	3.500	0.964	3.733	0.884	2.286	1.113	3.714	1.139	3.466	1.080
e. Increased protection levels	3.000	0.949	3.867	1.125	3.429	1.272	3.786	0.975	3.474	1.087
f. Juvenile spacing	3.273	0.883	3.067	1.280	2.143	1.215	3.571	0.756	3.155	1.073
g. Thinning or conversion of fire origin suppressed pine stands	2.955	0.785	3.133	1.060	2.714	1.254	3.429	0.938	3.086	0.960
h. Use of herbicides for site preparation and release	2.864	0.990	3.286	1.383	1.800	1.304	3.214	1.424	2.964	1.276
i. Thinning	2.955	1.046	3.067	1.223	2.286	1.380	3.571	1.016	3.052	1.161
j. Mixed wood stand conversion	3.182	1.053	3.067	1.335	2.000	1.155	3.143	1.167	3.000	1.199
k. Advanced roading	2.500	1.012	2.933	1.387	2.571	1.397	2.643	0.842	2.655	1.117
l. Fertilization	2.409	0.959	2.467	1.187	1.571	0.787	2.357	0.842	2.310	0.995
9. Stumpage valuation Economic significance of alternative stumpage/royalty pricing systems	3.143	1.062	3.200	1.146	3.143	1.345	3.643	1.008	3.281	1.098

Table I continued

	Research needs	Alberta Mean	Alberta SD	Manitoba Mean	Manitoba SD	NWT Mean	NWT SD	Saskatchewan Mean	Saskatchewan SD	Region Mean	Region SD
10.	Forest economics education Review and analysis of curricula/course contents and methods to enhance understanding of forest economics	2.909	1.065	3.133	1.302	2.714	1.380	3.071	1.072	2.983	1.147
11.	Evaluation in economic terms of improved research, development, and application of new technology Such evaluation to include:										
	a. New production practices	3.136	0.834	3.000	0.816	3.000	1.000	3.143	1.027	3.089	0.880
	b. New genetic adaptations	2.909	0.921	2.846	0.801	2.571	1.134	2.929	0.829	2.857	0.883
	c. New distribution practices	2.591	0.796	2.692	0.855	2.714	0.951	2.714	1.326	2.661	0.959
12.	Economic analysis of forestry industry structure Studies are to include:										
	a. Analysis of the long-term viability of the forest industry including the costs and benefits of industry rationalization and the maintenance of a data base information system in each jurisdiction of the region	3.682	1.129	3.267	1.033	4.000	1.414	3.786	0.975	3.638	1.103
	b. Demand, supply, marketing and value-added analysis of producing secondary products from logs and pulp within the region	3.455	1.184	2.933	0.799	3.143	1.345	3.357	1.277	3.259	1.133
	c. Analysis of the economies of scale, technological change and input substitution, including capital versus labor, for various forestry operations including the sawmilling industry	3.091	1.151	2.800	0.775	3.286	1.254	3.286	1.326	3.086	1.113
	d. Evaluation of alternative wood acquisition programs such as own roundwood production and purchased chips and wood	3.136	1.283	2.333	0.724	2.143	1.215	3.143	1.099	2.810	1.162

Table I continued

Research needs	Alberta		Manitoba		NWT		Saskatchewan		Region	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
13. Forest land use policy and planning studies Studies to include:										
a. Sustained yield - is it an economically viable policy objective	3.750	0.910	3.333	1.234	3.571	1.512	3.857	1.167	3.643	1.135
b. The economics of forestry incentives and regulation	3.850	0.813	3.267	0.887	3.571	1.272	3.643	0.929	3.607	0.928
c. Integration of forest harvesting into parks	2.950	0.945	3.733	1.033	3.857	1.215	3.071	1.328	3.304	1.143
d. Inventory of timber including value of satellite imagery versus manual cruising in forested land use planning	3.048	1.244	3.143	1.027	3.286	1.890	3.500	1.019	3.214	1.217
e. Public perceptions of integrated resource use on public lands	3.429	0.926	3.133	1.125	3.429	1.272	3.214	1.188	3.298	1.068
f. Use of physical, economic, social and political criteria in decision making	3.650	1.226	2.800	0.862	3.571	1.397	3.071	1.439	3.268	1.243
g. Socioeconomic and environmental impact assessments effects on company operations	3.000	1.124	3.133	0.834	3.571	1.512	2.857	1.292	3.071	1.142
h. Federal incentive and cost-sharing programs	3.000	1.414	3.400	1.121	2.857	0.900	2.714	0.994	3.018	1.183
i. Post-project evaluation	2.800	1.240	3.533	1.125	2.571	0.976	2.857	1.406	2.982	1.243
j. Impact of allowable cut requirements on wood processing operations	3.250	1.020	2.667	0.900	3.000	1.291	3.071	1.207	3.018	1.070
k. Evaluation of institutional arrangements for forest industry regulation including industry stabilization	2.842	1.015	2.467	1.060	3.286	1.254	2.786	0.893	2.782	1.031
l. Forest management under public and private resource ownership	2.650	1.268	2.667	1.175	3.143	1.574	2.643	1.277	2.714	1.261
m. Policy evaluation regarding effective use of softwood and hardwood	2.900	1.119	2.333	1.175	2.714	1.254	2.714	1.383	2.679	1.208

Table I continued

	Research needs	Alberta Mean	Alberta SD	Manitoba Mean	Manitoba SD	NWT Mean	NWT SD	Saskatchewan Mean	Saskatchewan SD	Region Mean	Region SD
14.	Economics of environmental safeguards on forest land Analysis of the costs and benefits, both dollar and nondollar values, of various environmental safeguards such as:										
	a. Limits on use of pesticides	3.087	1.125	3.333	1.397	2.714	1.496	3.286	1.326	3.153	1.271
	b. Cut block size limitations	3.043	1.107	3.200	1.265	3.286	1.704	3.429	1.089	3.203	1.200
	c. Buffer strips	2.870	1.100	3.333	1.175	3.000	1.732	3.571	1.158	3.169	1.220
	d. Logging elevation limits	2.609	1.076	2.467	1.356	2.714	1.890	2.500	1.605	2.559	1.355
15.	Socioeconomic studies and native forest land use issues Studies include:										
	a. Design of institutional arrangements for increased native business and employment opportunities in forest products	2.591	0.796	3.000	1.000	3.500	1.414	3.071	1.207	2.932	1.065
	b. Remote native community enhancement	2.591	0.854	3.200	1.082	4.143	0.900	2.500	1.286	2.914	1.144
	c. Value of forests to traditional native lifestyles	2.522	0.846	2.933	1.100	4.125	0.991	2.571	1.342	2.850	1.162

Table I continued

Research needs	Alberta		Manitoba		NWT		Saskatchewan		Region	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
16. Economic analyses of agricultural and forestry land use interface Such analyses include:										
a. Evaluation of economic and social decision criteria for land allocation at the interface between forestry and agriculture	4.000	0.873	3.067	1.280	3.000	1.633	3.286	1.139	3.466	1.203
b. Economic evaluation of local economy from a forestry-agricultural land use mix compared to an all-agriculture or all-forestry land use pattern	3.565	1.037	2.933	1.163	3.000	1.633	2.643	1.151	3.119	1.205
c. Economics of utilizing forest land for agricultural purposes	3.696	0.926	2.800	1.207	2.571	1.618	2.786	1.311	3.119	1.247
d. The costs and benefits to the forest industry from domestic grazing on reforested cutover areas	3.318	0.945	2.400	0.828	2.429	1.618	2.357	1.082	2.741	1.117
e. Analysis of the impact of transforming mixedwood areas to grazing through range improvement programs	3.174	0.887	1.933	0.704	2.143	1.464	2.429	1.284	2.559	1.134
f. Comparison of productivity and technological change in terms of land-using or land-saving effects for agriculture and forestry	2.818	1.181	2.571	1.284	2.286	1.254	2.429	1.158	2.596	1.193
g. Evaluation of the status and prospects for forestry on private farm land	2.609	0.988	2.600	1.183	2.000	1.414	2.571	1.284	2.525	1.150
h. Economics of small woodlot operators	2.364	1.093	2.667	1.047	3.143	1.345	2.714	1.590	2.621	1.240

Table I continued

Research needs	Alberta		Manitoba		NWT		Saskatchewan		Region	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
17. Economic studies of timber resource utilization including smallwood These studies are to be related to:										
a. Harvesting costs	3.545	1.057	2.933	0.961	3.571	1.272	3.000	1.519	3.259	1.193
b. Regeneration	3.364	0.790	3.333	1.175	3.000	1.414	3.786	1.251	3.414	1.093
c. Timber values	3.500	0.802	3.000	1.069	3.286	1.496	3.308	1.182	3.298	1.052
d. Conversion technology	3.273	0.985	2.667	1.047	3.143	1.345	3.357	1.151	3.121	1.093
e. Merchantability standards	3.000	0.926	2.533	0.990	3.000	1.414	3.000	0.961	2.879	1.010
f. Use of trash species	2.364	1.049	2.467	0.990	2.714	1.380	2.500	1.092	2.466	1.063
g. Determination of potential building log stands	1.818	0.853	1.867	0.743	2.429	1.272	2.000	1.414	1.948	1.033
18. Economics of forest renewal Benefit-cost analysis of specific forest renewal techniques such as:										
a. Spraying versus no spraying	2.864	1.167	3.714	1.069	2.143	1.345	3.643	1.336	3.175	1.297
b. Juvenile spacing	3.091	0.971	3.071	1.269	2.286	1.380	3.643	1.277	3.123	1.211
c. Container versus bare-root planting	2.409	1.008	2.929	1.207	2.143	1.345	3.929	0.829	2.877	1.226
d. Planting versus seeding	2.545	1.057	3.286	1.204	2.500	1.378	3.714	0.914	3.018	1.183
e. Machine versus head planting	2.409	1.054	2.429	1.016	2.000	1.155	3.714	0.825	2.684	1.152
f. Contract versus own planting	2.000	0.926	2.286	1.069	2.000	1.000	3.071	1.328	2.333	1.139
g. Contract versus own nurseries	2.091	0.811	2.143	1.167	1.857	0.900	3.643	1.082	2.456	1.181

Table I continued

	Research needs	Alberta		Manitoba		NWT		Saskatchewan		Region	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
19.	Economics of timber accessibility and transportation Analysis of the economics of transportation of forest products to include:										
	a. Determination of economically accessible stands	3.727	0.935	3.857	0.949	3.714	1.380	4.143	1.099	3.860	1.025
	b. Transport of finished products to market both domestic and export	2.955	0.899	2.786	1.188	3.429	1.397	3.286	1.490	3.053	1.187
	c. Government versus company built roads	2.455	1.101	2.467	0.834	3.000	1.291	2.857	1.562	2.621	1.182
	d. Winter versus summer hauling to mill	2.364	0.848	2.600	0.986	2.571	1.272	2.571	1.342	2.500	1.047
	e. Determination of optimium road size	2.318	0.945	2.333	0.724	3.000	1.528	3.286	1.437	2.638	1.165
20.	Economics of wood energy utilization Analysis of energy and forestry relationships including:										
	a. Use of wood wastes for energy	2.818	1.140	3.467	0.915	3.857	1.464	3.286	1.139	3.224	1.155
	b. Use of biomass for energy	2.636	1.217	3.133	1.060	3.714	1.496	3.071	1.141	3.000	1.214
	c. The relation between energy prices and timber demand	2.409	1.098	2.667	1.345	3.429	1.512	2.500	1.506	2.621	1.322
	d. Use of peat for energy	2.091	0.971	2.533	1.598	2.571	1.718	2.286	1.326	2.310	1.314
21.	Timber product development Studies including:										
	a. Solid wood products	2.955	1.046	2.467	1.060	2.857	0.900	3.286	1.326	2.897	1.119
	b. Pulp products	2.727	1.077	2.400	1.183	2.286	1.113	2.857	1.512	2.621	1.211

Table I continued

	Research needs	Alberta Mean	Alberta SD	Manitoba Mean	Manitoba SD	NWT Mean	NWT SD	Saskatchewan Mean	Saskatchewan SD	Region Mean	Region SD
22.	Forest products marketing studies These studies are to include:										
	a. Analysis of the market potential and demand trends, both domestic and export, for new and existing products of the west-central region	3.591	0.959	3.000	1.134	3.286	1.254	3.643	1.336	3.414	1.140
	b. Examination of alternative pricing methods for chips	3.409	1.297	2.400	1.056	2.286	1.113	2.500	1.345	2.793	1.295
	c. Development of an econometric model of the spruce-pine-fir lumber market	2.682	1.041	2.214	0.802	2.429	0.976	2.786	1.424	2.561	1.086
	d. Analysis of alternative grading standards	2.227	1.110	2.000	1.038	2.286	1.380	2.429	1.089	2.228	1.102
23.	Socioeconomic analysis of the effects on trapping by timber harvesting and fire	2.130	0.920	2.071	0.829	4.125	1.458	2.786	1.369	2.542	1.277
24.	Economics of milling technology Studies regarding:										
	a. Use of fire-killed wood and jack pine for pulp	2.682	1.041	2.933	1.033	2.429	1.397	3.846	0.987	2.982	1.157
	b. Whole tree utilization	3.045	1.133	2.600	0.986	3.000	1.291	3.769	0.927	3.088	1.123
	c. Debarking	2.409	1.098	2.071	0.829	2.714	1.254	2.923	1.320	2.482	1.128
	d. Chipping	2.318	1.129	2.286	0.994	2.571	1.397	2.538	1.127	2.393	1.107
	e. Screening	2.273	1.032	2.000	0.784	2.429	1.397	2.308	1.182	2.232	1.044
25.	Economics of harvesting technologies Studies of the costs and benefits of various alternative harvesting technologies including:										
	a. Whole tree utilization	3.000	1.195	2.600	0.986	3.000	1.155	3.786	1.122	3.086	1.174
	b. New technologies including dirigibles, balloons, felling heads, wide tires, etc.	2.190	0.873	2.400	1.242	2.429	1.272	2.462	1.050	2.339	1.049
	c. Feller buncher and grapple skidding	2.227	0.752	2.133	0.834	2.429	0.976	2.538	0.660	2.298	0.778
	d. Delimbing and delimbers	2.273	0.767	2.267	1.100	2.286	0.756	2.846	0.899	2.404	0.904
	e. Hand felling and cable skidding	2.000	0.756	2.067	0.799	3.000	1.291	1.923	0.760	2.123	0.888

Table I continued

	Research needs	Alberta		Manitoba		NWT		Saskatchewan		Region	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
26.	Economics of urban forestry	1.409	0.666	2.000	1.134	2.000	1.414	1.250	0.622	1.607	0.947

[1]The 60 usable responses to Questionnaire 3 are distributed as Alberta 23, Manitoba 15, NWT 8, and Saskatchewan 14.

Table J. Rating scores of forest economics research needs from Questionnaire 3 by province and territory[1]

Research needs	Alberta		Manitoba		NWT		Saskatchewan		Region
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score
1. Forest industry impact (regional/economic)	4.048	2	3.533	3	3.857	5	4.286	1	3.947
2. Economics of integrated forest land use	4.318	1	4.357	1	4.714	1	4.071	2	4.316
3. Economics of forest protection	3.571	4	4.133	2	4.143	2	4.000	3	3.895
4. Allowable cut determination/timber supply analysis modelling	3.762	3	3.192	8	3.228	10	3.829	4	3.570
5. Supply and demand modelling	3.545	5	3.467	4	3.429	7	3.154	11	3.421
6. Economics of poplar utilization	3.288	8	2.822	17	2.952	15	3.097	12	3.082
7. Economics of nontimber forest land uses	3.358	6	3.219	6	3.632	6	3.030	17	3.277
8. Economics of intensive timber management alternatives	3.205	9	3.311	5	2.591	21	3.440	7	3.219
9. Stumpage valuation	3.143	12	3.200	7	3.143	12	3.643	5	3.281
10. Forest economics education	2.909	15	3.133	9	2.714	18	3.071	16	2.983
11. Evaluation in economic terms of improved research, development, and application of new technology	2.879	17	2.846	14	2.762	17	2.929	19	2.869
12. Economic analysis of forestry industry structure	3.341	7	2.833	16	3.143	12	3.393	8	3.198
13. Forest land use policy and planning studies	3.163	11	3.047	11	3.264	9	3.077	13.5	3.123
14. Economics of environmental safeguards on forest land	2.902	16	3.083	10	2.929	16	3.197	10	3.021
15. Socioeconomic studies and native forest land use issues	2.568	20	3.044	12	3.923	4	2.714	23	2.899
16. Economic analyses of agricultural and forestry land use interface	3.193	10	2.621	20	2.572	23	2.652	25	2.843
17. Economic studies of timber resource utilization including smallwood	2.981	13	2.686	19	3.020	14	2.993	18	2.912
18. Economics of forest renewal	2.487	23	2.837	15	2.133	25	3.622	6	2.809

Table J continued

Research needs	Alberta		Manitoba		NWT		Saskatchewan		Region
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score
19. Economics of timber accessibility and transportation	2.764	19	2.809	18	3.143	12	3.229	9	2.934
20. Economics of wood energy utilization	2.489	22	2.950	13	3.393	8	2.786	21.5	2.789
21. Timber product development	2.841	18	2.434	21	2.572	23	3.072	15	2.759
22. Forest products marketing studies	2.977	14	2.404	22	2.572	23	2.840	20	2.749
23. Socioeconomic analysis of the effects on trapping by timber harvesting and fire	2.130	25	2.071	25	4.125	3	2.786	21.5	2.542
24. Economics of milling technology	2.545	21	2.378	23	2.629	19.5	3.077	13.5	2.635
25. Economics of harvesting technologies	2.338	24	2.293	24	2.629	19.5	2.711	24	2.449
26. Economics of urban forestry	1.409	26	2.000	26	2.000	26	1.250	26	1.607

[1]The 60 usable responses to Questionnaire 3 are distributed as Alberta 23, Manitoba 15, NWT 8, and Saskatchewan 14.

Table K. Rating scores of forest economics research needs from Questionnaire 3 by professional role[1]

Research needs	Economist		Noneconomist		Region	
	Score	Rank	Score	Rank	Score	Rank
1. Forest industry impact (regional/economic)	3.273	10	4.089	2	3.947	2
2. Economics of integrated forest land use	4.700	1	4.239	1	4.316	1
3. Economics of forest protection	4.091	2	3.844	3	3.895	3
4. Allowable cut determination/timber supply analysis modelling	3.727	5	3.517	4	3.570	4
5. Supply and demand modelling	4.000	3.5	3.289	5	3.421	5
6. Economics of poplar utilization	2.818	15	3.168	9	3.082	11
7. Economics of nontimber forest land uses	3.325	9	3.272	6	3.277	7
8. Economics of intensive timber management alternatives	3.370	8	3.172	8	3.219	8
9. Stumpage valuation	4.000	3.5	3.174	7	3.281	6
10. Forest economics education	3.545	6	2.826	20	2.983	13
11. Evaluation in economic terms of improved research, development, and application of new technology	2.800	16	2.866	16	2.869	17
12. Economic analysis of forestry industry structure	3.409	7	3.130	10	3.198	9
13. Forest land use policy and planning studies	3.252	11	3.088	11	3.123	10
14. Economics of environmental safeguards on forest land	2.727	18.5	3.085	12	3.021	12
15. Socioeconomic studies and native forest land use issues	3.152	12	2.837	19	2.899	16
16. Economic analyses of agricultural and forestry land use interface	2.773	17	2.849	18	2.843	18
17. Economic studies of timber resource utilization including smallwood	2.714	20	2.964	13	2.912	15
18. Economics of forest renewal	2.428	21	2.912	15	2.809	19
19. Economics of timber accessibility and transportation	2.873	14	2.952	14	2.934	14

Table K continued

Research needs	Economist		Noneconomist		Region	
	Score	Rank	Score	Rank	Score	Rank
20. Economics of wood energy utilization	3.136	13	2.728	22	2.789	20
21. Timber product development	2.410	22	2.859	17	2.759	21
22. Forest products marketing studies	2.727	18.5	2.744	21	2.749	22
23. Socioeconomic analysis of the effects on trapping by timber harvesting and fire	2.182	25	2.660	24	2.542	24
24. Economics of milling technology	2.291	24	2.717	23	2.635	23
25. Economics of harvesting technologies	2.327	23	2.490	25	2.449	25
26. Economics of urban forestry	1.727	26	1.591	26	1.607	26

[1] Includes 11 economists and 48 noneconomists out of the total of 60 respondents used to determine regional scores.

Table L. Rating scores of forest economics research needs from Questionnaire 3 by employer[1]

Research needs	Federal government		Provincial or territorial government		Private industry or crown corporation		University		Other	
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
1. Forest industry impact (regional/economic)	4.250	3	3.783	3	4.263	1	3.143	11.5	4.500	2
2. Economics of integrated forest land use	4.750	1	4.333	1	4.053	2	5.000	1	4.000	7
3. Economics of forest protection	4.500	2	4.000	2	3.842	3	3.143	11.5	4.000	7
4. Allowable cut determination/timber supply analysis modelling	3.800	6	3.496	5	3.495	4	3.800	2	3.400	18
5. Supply and demand modelling	3.250	13.5	3.478	6	3.211	6	3.750	3	4.000	7
6. Economics of poplar utilization	3.750	7	2.812	18	3.089	9	3.500	5	2.833	23.5
7. Economics of nontimber forest land uses	3.000	17.5	3.528	4	2.910	16	3.464	6	3.429	17
8. Economics of intensive timber management alternatives	3.958	4	2.947	14	3.254	5	3.451	7	3.542	14
9. Stumpage valuation	3.250	13.5	3.455	7	2.842	17	3.625	4	4.500	2
10. Forest economics education	3.000	17.5	2.652	22	3.105	8	3.375	8	3.000	22
11. Evaluation in economic terms of improved research, development, and application of new technology	3.333	12	2.797	19	2.930	14	2.762	15	2.833	23.5
12. Economic analysis of forestry industry structure	3.000	17.5	3.315	8	3.066	10.5	3.094	14	3.500	15.5
13. Forest land use policy and planning studies	3.481	10	3.074	10	3.154	7	3.209	9	3.084	21

Table L continued

Research needs	Federal government		Provincial or territorial government		Private industry or crown corporation		University		Other	
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
14. Economics of environmental safeguards on forest land	3.375	11	2.854	16	3.066	10.5	3.188	10	3.375	19
15. Socioeconomic studies and native forest land use issues	3.000	17.5	3.130	9	2.614	22	2.708	16	4.055	4
16. Economic analyses of agricultural and forestry land use interface	3.094	15	2.766	20	2.757	20	3.141	13	3.625	12.5
17. Economic studies of timber resource utilization including smallwood	3.500	9	2.983	12.5	2.955	12	2.339	21	2.714	25
18. Economics of forest renewal	3.893	5	2.557	24	2.932	13	2.393	20	3.929	10
19. Economics of timber accessibility and transportation	3.600	8	2.983	12.5	2.832	18	2.450	19	3.900	11
20. Economics of wood energy utilization	2.938	20.5	2.837	17	2.592	23	2.688	17	4.500	2
21. Timber product development	2.625	24	2.892	15	2.763	19	2.250	22.5	4.000	7
22. Forest products marketing studies	2.938	20.5	2.739	21	2.711	21	2.656	18	3.625	12.5
23. Socioeconomic analysis of the effects on trapping by timber harvesting and fire	2.250	25	3.043	11	2.053	25	2.000	24	4.000	7
24. Economics of milling technology	2.650	23	2.627	23	2.916	15	1.750	26	3.500	15.5
25. Economics of harvesting technologies	2.700	22	2.543	25	2.466	24	1.875	25	3.200	20
26. Economics of urban forestry	1.750	26	1.522	26	1.444	26	2.250	22.5	2.000	26

[1] The 58 responses used were distributed as federal government 4, provincial or territorial government 24, private industry or crown corporation 19, university 8, and other 3.

APPENDIX 4

FOREST ECONOMICS RESEARCH PROJECTS

FOREST ECONOMICS RESEARCH PROJECTS

Adamowicz, Wiktor L., 1983. "Economic Analysis of Hunting of Selected Big Game Species in the Eastern Slopes of Alberta." Unpublished M.Sc. Thesis, Department of Rural Economy, University of Alberta, Edmonton, Alberta.

Adams, D.M. and Haynes, R.E., 1980. *The 1980 Softwood Timber Assessment Market Model. Structure, Projections and Policy Simulations.* Forest Science Monograph #22, Society of America Foresters.

Alberta Economic Development. "Alberta Forest Industry Raw Material Transportation Study." A study in progress under the direction of the Forest Industries Section, Process Industry Development Branch. Alberta Environment. Completion expected in 1984.

Alberta Economic Development. "Alberta Forest Products Transportation Study." A study in progress under the direction of the Forest Industries Section, Process Industry Development Branch. Alberta Environment. Completion expected in 1984.

Alberta Research Council, 1981. "Conceptual Design, Equipment Requirements and Capital Cost of Panelboard Development Facilities." For Forest Products Working Group. Open File Report, Edmonton, Alberta.

Alberta Research Council (ongoing project). "Developing Stress Tables for Spruce Plywood." Machine stress rating of spruce plywood. Western Plywood Manufacturers Association, Edmonton, Alberta. Unpublished.

Baker, W.M. "A System Planning Study of Rivers in the NWT." Prepared for Parks Canada, Department of Indian and Northern Affairs, and Government of NWT, Economic Development and Tourism, Yellowknife, NWT Projected completion date: April, 1984.

Beck, J.A. "Determination of Economic Timber Supply in Saskatchewan." A research project, Department of Forest Science, University of Alberta. Anticipated completion, September 1985.

Bella, I.E. and De Franceschi, J.P., 1980. "Biomass Productivity of Young Aspen Stands in Western Canada." Environment Canada, Canadian Forestry Service, Northern Forest Research Centre, Edmonton, Alberta. Information Report NOR-X-219.

Berndt, Ernst R., Cox, Alan J., and Pearse, Peter H., 1979. "Estimation of Logging Costs and Timber Supply Curves from Forest Inventory Data." *The Forestry Chronicle,* Vol. 55 (August): pp. 144-147.

Bigsby, Hugh, 1983. "Estimating Production Technology and Technological Change Bias in the Canadian Sawmilling Industry." Non-thesis M.A. paper, Department of Economics, University of Alberta, Edmonton, Alberta.

Bigsby, H.R., 1983. "Land Values for Forestry in Northern Alberta." Prepared for the Alberta Forest Service, Alberta Energy and Natural Resources.

Bowell Consultants Ltd., Vancouver, B.C., 1982. "Alberta Chip Pricing Study." Prepared for Alberta Departments of Economic Development and Energy and Natural Resources, Edmonton, Alberta. Confidential.

Boylen, D., Ondro, W. and Williamson, T. "An Assessment of the Forest-Based Economy of the Prairie Provinces." Research project NOR-3-123 in progress. Northern Forest Research Centre, Canadian Forestry Service, Edmonton, Alberta.

Bradley, D.P. and Biltonen, F.E., 1972. "Economic Operability - Factors Affecting Harvest and Transport Costs in Aspen." Symposium Proceedings. USDA., North Central Forest Experiment Station. Gen. Tech. Report NC-1.

Buck, Robert J. "Annual Helitac Program Report" (ongoing). Manitoba Department of Natural Resources.

Canadian Forestry Service, 1982. "Selected Economic Indicators for the Forest Industry." Environment Canada, Economics Branch, Ottawa, Ontario (Quarterly Indicators): September 1983.

Canadian Forestry Service, 1982. *Alberta's Forests.* Forestry Report 25, Environment Canada, Northern Forest Research Centre, Edmonton, Alberta.

Canadian Forestry Service, 1982. *Saskatchewan's Forests.* Forestry Report 26, Environment Canada, Northern Forest Research Centre, Edmonton, Alberta.

Canadian Forestry Service, 1982. *Manitoba's Forests* Foresty Report 27, Environment Canada, Northern Forest Research Centre, Edmonton, Alberta.

Canadian Institute of Forestry, 1982. *The Importance of Potential and Timber Resource in Alberta.* Rocky Mountain Section, Resource Monitoring Committee, Environment Canada.

Carroll, M.R., 1978. "Economic Incentives for Reforestation in Alberta." Paper prepared for Environment Council of Alberta, April 25, 1978.

Carroll, M.R., 1983. "Economic Returns in the Sawmill Industry in Alberta." Unpublished report prepared for Environment Canada, Canadian Forestry Service, Northern Forest Research Centre, Edmonton, Alberta.

Clark, J., et al., 1983. "Alberta Forest Products Association, Status of WCB. Cost Distribution in Class 3:01 (Logging) in Alberta." Alberta Forest Products, Edmonton, Alberta.

Clark, W. "Values at Risk - Post-Fire Economic Impact." Petawawa Nat. For. Inst. Note: Current ongoing study - no publications directly associated with it.

Clark, W.R. "Appraisal of Values-at-Risk and Economic Impact." Petawawa National Forestry Institute, Canadian Forestry Service, Project PI-4. Completion expected in 1985.

Data Resources Incorporated, Bi-annual Report. "The Forsim Review." Lexington, Massachusetts (A summary of statistics and prices related to forestry).

Deloitte, Haskins & Sells Associates in Association with B.C. Research, June 1982. *Northwest Territories Travel Surveys, 1981-82.* Summary Report. Visitor Exit Survey; Resident Travel Survey; Park User Survey. A report prepared for Tourism and Parks, Department of Economic Development and Tourism, Government of the Northwest Territories, Yellowknife, NWT.

DePape, D., Phillips, W. E. and Brook, L. R., 1975. *Erosion Control on Public Lands in Northwest Alberta: An Institutional and Legislative Analysis.* Information Bulletin 4, Environment Conservation Authority, Edmonton, Alberta.

DePape, D., Phillips, W.E. and Cooke, A., 1975. *A Socioeconomic Evaluation of Inuit Livelihood and Natural Resource Utilization in the Tundra of the Northwest Territories.* Renewable Resources Project, Vol. 4, Inuit Tapirisat of Canada, Ottawa, Ontario.

DePape, D. and Phillips, W.E., 1977. *The Environmental Effects of Timber Production in Alberta: An*

Institutional and Legislative Analysis. Information Bulletin 3, Environment Conservation Authority (August), Edmonton, Alberta.

DePape, D. and Phillips, W.E., 1976. *The Role of Economics in Shorelands Evaluation.* Alberta Environment, Edmonton, Alberta.

Dutrow, G.F., 1979. "Improved Trees: Economic Promises and Pitfalls," In *Proceedings of the Thirteenth Lake States Forest Tree Improvement Conference.* University of Minnesota; USDA For. Serv., North Cent. For. Exp. Stn., Gen. Tech. Report NC-50.

Environmental Council of Alberta, 1979. *The Environmental Effects of Forestry Operations in Alberta: Report and Recommendations.* Environment Council of Alberta, Edmonton, Alberta.

Feric Report #SR-19A, 1980. "Butt-Damage of Non-Shear Felling Heads." Ottawa, Ontario.

Fortunato Pacios-Rivera, 1983. "Montreal Lake Indian Reserve Forest Management Plan." International Forest Search, Prince Albert, Saskatchewan.

Geldart, Howard George, 1978. "Marketing of Wood Chips from Alberta Sawmills." Unpublished M.Sc. Thesis, Department of Rural Economy, University of Alberta, Edmonton, Alberta.

Goudie, James W. (Moscow, Idaho), 1984 (January). "Interim Stocking Guidelines for Plantations of Lodgepole Prices." File Report. Prepared on contract for B.C. Ministry of Forests, British Columbia.

Gravelines, L., 1983. "Fire Prevention on Northern Indian Reserves." Unpublished Report, Manitoba Department of Natural Resources, Winnipeg, Manitoba.

Gravelines, L. (no date). "Forest Damage/Loss Valuation to Develop a Means for Valuing Forest Lands Reallocated to Non-Compatible Uses or Damage Due to Disease, Fire, etc." (Forestry Priorities), Manitoba Department of Natural Resources, Winnipeg, Manitoba.

Gravelines, L., 1983. "Regional Analysis of the Ten O'Clock Rule." Unpublished Report, Manitoba Department of Natural Resources, Winnipeg, Manitoba.

Gray, John A., 1970. "Pricing and Sale of Crown Timber in Manitoba: Theoretical Framework, Analysis of Present Policies and Modifications." Province of Manitoba, Report to the Department of Mines and Natural Resources, Winnipeg, Manitoba.

Gray, John A., 1971. "Pricing and Sale of Crown Timber: A Case Study of the Province of Manitoba." Unpublished Ph.D Thesis, University of Michigan, Ann Arbor, Michigan.

Gray, John A., 1973. "Report on the Utilization of Forest Resources by the Saskatchewan Forest Industry." Province of Saskatchewan, Report to the Executive Council, Regina, Saskatchewan.

Gray, John A. (to be completed mid-1985). Survey reviewing, comparing and evaluating natural resource charges (including Forest charge stumpage and royalties) in the four western Canadian provinces (Manitoba, Saskatchewan, Alberta, British Columbia). Social Sciences and Humanities Research Council, Sponsoring Agency.

Guss, Leonard and Associates Ltd., 1983. "Market Opportunity for Medium Density Fiberboard or High Quality Industrial Particleboard Produced in Alberta." Tacoma, Washington. Confidential.

Hardy Associates Ltd. (Calgary, Alberta), 1980. "Revegetation and Impact Assessment - Studies in the MacKenzie River Region." Norman Wells, Northwest Territories.

Hardy Associates Ltd. (Calgary, Alberta), 1982. "IPL Monitoring Program in Association with the Use of Wood Chips for Slope Stabilization, Normal Wells Pipeline." Norman Wells, NWT.

Heaps, Terry, 1984. "The Sensitivity of the Present Value of Stumpage Under Alternate Criteria for Harvesting." Simon Fraser University, Vancouver, B.C. Prepared for Economic Council of Canada, Ottawa, Ontario.

Hildahl, V. and Campbell, A.E., 1975. *Forest Tent Caterpillar in the Prairie Provinces.* Information Report NOR-X-135, Environment Canada, Canadian Forestry Service, Northern Forest Research Centre, Edmonton, Alberta.

Hiratsuka, U. (anticipated publication date, 1984). "Decay of Aspen and Balsam Poplar in Alberta: Literature Review and Problem Analyses." Information Report NOR-X., Environment Canada, Canadian Forestry Service, Northern Forestry Research Centre, Edmonton, Alberta.

Intergroup Consulting Economists Ltd. (Winnipeg, Manitoba), 1981. "Availability and Cost of Forest Biomass in Canada." Prepared for Department of Energy, Mines and Resources, Conservation and Renewable Energy Branch, and the Canadian Forestry Service's ENFOR (Energy from the Forest) Program, ENFOR Project P-224(1), Ottawa, Canada.

Intergroup Consulting Economists Ltd. (Winnipeg, Manitoba), 1976. "Northern Saskatchewan Small Scale Forestry Utilization and Development Study." For Department of Northern Saskatchewan.

Intergroup Consulting Economists Ltd. (Winnipeg, Manitoba), 1982. "Commercial Feasibility of Producing and Marketing Wood Chips as an Energy Source." (Unpublished). Prepared for Bear River Timber Company, Powerview, Manitoba.

Intergroup Consulting Economists Ltd., Winnipeg, Manitoba (ongoing study). "Investigation of Potential Use of Forest Biomass as Feedstock for Methanol Fuel Production." No reports publicly available. Prepared for Canadian Methanol Canadien.

Kirjasniemi, M., 1983. "Competitiveness of the Albertan vs. the U.S. Southeastern Forest Industry." Jaakko Poyry, Helsinki, Finland. Prepared for the Alberta Departments of Economic Development and Energy and Natural Resources, Edmonton, Alberta.

Kourtz, P., 1975 (estimated completion date, 2000). "Computerized Fire Management Systems." Petawawa National Forestry Institute, Canadian Forestry Service, Environment Canada, Project PI-6.

Kristoff, Terry (in progress). "Pilot Study to Determine the Potential Uses of TREES and RAM to Examine Timber Supply Problems in Saskatchewan." Department of Forest Science, University of Alberta, Edmonton, Alberta.

Lagimodiere, Ron, 1978. "An Evaluation of Benefits and Costs of the Continued Operation of Slave River Sawmill Ltd., 1978." Department of Regional Economic Expansion, Saskatoon, Saskatchewan.

Little, Arthur D., Incorporated, 1983. "Market Factors Affecting a Proposed Alberta Market Pulpmill." Confidential. Toronto, Ontario.

MacDonald, Alexander Paul, 1983. "The Utilization of Wood Chips in Alberta." Unpublished M.Sc. Thesis, Department of Rural Economy, University of Alberta, Edmonton, Alberta.

MacDonald, Kathleen, 1983. "Potential for Agricultural Expansion Relative to Forestry in Northern Alberta." Alberta Agriculture, Resource Economics Branch, Economic Services Division, Edmonton, Alberta.

Manecon Limited (Edmonton), 1980. "Assessment of the Economic Impact of Forest Fires on the Renewable Resource Industry and Communities in the Northwest Territories." Prepared for NWT Forest Fire Review Panel, Edmonton, Alberta.

Manecon Limited (Edmonton), 1982. "A Feasibility Study for a Central Wood Boiler Facility for Fort Smith, NWT" Prepared for Energy Conservation Division, Department of Government Services, Government of NWT, Yellowknife, NWT.

Manecon Limited (Edmonton), 1983. "Opportunities for Energy Conservation. Fort Smith Water Supply System." Prepared for the town of Fort Smith, NWT.

Manitoba Department of Natural Resources, 1982. *Manitoba's Forest Management Plan, 1971-2000.* Volumes 1 and 2, Forestry Branch, Winnipeg, Manitoba.

Manitoba Department of Natural Resources, 1982. "Nopiming Interim Management Guidelines." Parks Branch, Winnipeg, Manitoba.

Manitoba Department of Natural Resources, 1983. "Whiteshell Master Plan." Parks Branch, Winnipeg, Manitoba.

Manitoba Department of Natural Resources, March 1984 (expected completion). *Herbicide and Pesticide Procedures.* (Principal investigator, Mark Mattson.) Parks Branch, Winnipeg, Manitoba.

Manitoba Department of Natural Resources, March 1984 (expected completion). "Work Permit Procedures in Provincial Parks." (Principal investigator, Mark Mattson.) Parks Branch, Winnipeg, Manitoba.

Mason, G.E. (no date). Annual Report. Fire Management Section, Winnipeg, Manitoba.

McCann, David, Treeline Planning Service Ltd., 1983. "Building Inventory and Energy Use Survey." Prepared for Remote Community Development Planning, Canada Department of Energy, Mines and Resources. Yellowknife, NWT.

Miller, R.J., 1971. "Alberta's Hunting and Fishing Resources: An Economic Evaluation." Alberta Agriculture, Edmonton, Alberta.

Milne, Grant Robert, 1980. "The Economic Impact of the Forest Industry in North Central Alberta." Unpublished M.Sc. Thesis, Department of Rural Economy, University of Alberta, Edmonton, Alberta.

Moncrieff, Patrick, 1972. "Alternative Land Uses in Southwestern Alberta: A Study in Natural Resource Economics." Unpublished M.Sc. Thesis, Department of Rural Economy, University of Alberta, Edmonton, Alberta.

Moore, W.C., 1982. "Operational Mapping of all Burned Forest Land in the NWT with Satellite Imagery." Feasibility study for Canadian Forestry Service, Forestry Statistics and Systems Branch, Petawawa, Ontario.

Murphy, Peter J., Hughes, Stanley R. and Mactavish, John S., 1980. "Forest Fire Management in the Northwest Territories." Northern Affairs Program. Prepared for Minister of Indian Affairs and Northern Development, Ottawa, Ontario.

Murphy, P.J. (anticipated completion 1985). "Cost Effectiveness of Fire Management Expenditures" (title may change). Ph.D research proposal, University of British Columbia, Vancouver, British Columbia.

Newnham, R.M. (F.L.C. Reed and Associates Ltd.), 1978. "Forest Management in Canada: Summary." Information Report FMR-X-104. Environment Canada, Canadian Forestry Service, Forest Management Institute, Ottawa, Ontario.

Nystrom, Lee and Kobishi Consulting Ltd., 1983. "Pre-feasibility Study of a BCTMP Mill in Alberta." Vancouver, British Columbia. Confidential.

Nixon, D., 1982. "The Importance and Potential of the Timber Resource in Alberta." Rocky Mountain Section, Canadian Institute of Forestry (Resource Monitoring Committee), Edmonton, Alberta.

ORQUOTE>Brien, Ron and Kyrwan, Syd., 1982. "Feasibility of Lumber Dry Kiln Operation, 1982." Business Development Section, Commercial Division, Department of Economic Development and Tourism, Yellowknife, NWT.

Ondro, W.J., 1981. "Costs of Harvesting Aspen Stands for Energy Production." ENFOR Project P-163; DSS Contract 4255.KL015-0-0058; Contractor: The Coban Institute, Edmonton, Alberta. Environment Canada, Canadian Forestry Service, Northern Forest Research Centre, Edmonton, Alberta.

Ondro, W.J., Bohning, R.A., Stewart, H.M. and Stevenson, G.R., 1981. *A Directory of Primary Wood-Using Industries in Saskatchewan, 1980.* Information Report NOR-X-232. Environment Canada, Canadian Forestry Service, Northern Forest Reserch Centre, Edmonton, Alberta.

Ondro, W.J., Karaim, B.W., Bohning, R.A. and Stevenson, G.R., 1980. *A Directory of Primary Wood-Using Industries in Alberta, 1979.* Information Report NOR-X-220. Environment Canada, Canadian Forestry Service, Northern Forest Research Centre, Edmonton, Alberta.

Ondro, W.J., Bohning, R.A., Stewart, H.M. and Stevenson, G.R., 1980. *A Directory of Primary Wood-Using Industries in Manitoba, 1980.* Information Report NOR-X-230. Environment Canada, Canadian Forestry Service, Northern Forest Research Centre, Edmonton, Alberta.

Ondro, W.J. and Williamson, T.B., 1982. *The Forest Industry in the Economy of Alberta, 1978-79. Information Report NOR-X-246.* Environment Canada, Canadian Forestry Service, Northern Forest Research Centre, Edmonton, Alberta.

Patterson, Eugene, 1982. "Northwest Territories Forest Industry Development Committee - A Report." Prepared for the Department of Economic Development, Government of the NWT, Yellowknife, NWT.

Pattison, William S. and Phillips, William E., 1971. "Economic Evaluation of Big Game Hunting: An Alberta Case Study." *Canadian Journal of Agricultural Economics.* Vol. 19, 2 (October): pp. 72-85.

Pearse, Peter H., Nilsson, Sten, and Williams, Douglas H., 1983. "An Analytical System for Investigating Economic and Policy Issues in Canada's Forest Sector." The Forest Sector Analysis Project. Faculty of Forestry, University of British Columbia, Vancouver, British Columbia.

Percy, M.B., May 1984 (projected completion date). "The Forestry Industry of B.C.: the Efficiency of Regulation." Prepared for Economic Council of Canada, Ottawa, Ontario.

Phillips, Barratt and Kaiser Engineering Ltd. (Vancouver, British Columbia), 1983. "Sawmill Modernization Study." Prepared for Alberta Economic Development, Edmonton, Alberta.

Phillips, William E., et al. (I.M.P.A.C.T. Environomics Ltd.), 1981. "The Role of Socioeconomic Evaluation in Timber Development Proposals in Alberta." A two volume report: "Final Report," 142 pp.; "Executive Summary," 17 pp. For Alberta Forest Service, Edmonton, Alberta.

Phillips, W.E. and Banskota, K., 1984. "Economic Consequences of Forest Land Losses to Non-Timber Uses in Alberta with Particular Reference to Agriculture." A research project in progress and funded by the Alberta Forest Development Research Trust Fund. Department of Rural Economy, University of Alberta, Edmonton, Alberta.

Phillips, W.E. and Carroll, M.R., 1978. "A Socio-economic Valuation of Wildlife in Alberta,"*Ecology of Even Aged Plantations.* D. Ford (ed.), Edinburgh: International Union of Forestry Research Organizations (Division I), Sept.: pp. 555-565.

Phillips, W.E., DePape, D. and Ewanyk, L., 1978. *A Socioeconomic Evaluation of the Recreational Use of Fish and Wildlife Resources in Alberta, With Particular Reference to the AOSERP Study Area.* AOSERP Report 43, Edmonton, Alberta Oil Sands Environmental Research Program.

Phillips, W.E., DePape, D. and Ewanyk, L., 1977. "Socioeconomic Evaluation of the Recreational Use of Fish and Wildlife Resources in Alberta with Particular Reference to the Athabasca Oil Sands Area." A four volume report: Vol. 1, "Summary and Conclusions,"; Vol. 2, "Recreational Fishing,"; Vol. 3, "Recreational Hunting,"; Vol. 4, "Non Consumptive Use of Fish and Wildlife," Department of Rural Economy, University of Alberta, for the Alberta Oil Sands Environmental Research Program, February.

Phillips, W.E. and Hetland, G.L., 1971. "Socio-economic Value of Biological Resources: The Case of the Peace-Athabasca Delta in Alberta," *Proceedings of the Peace-Athabasca Delta Symposium,* Edmonton: University of Alberta, pp. 241-248.

Phillips, W.E. and McElhaney, E.R. (I.M.P.A.C.T. Environomics Ltd.), 1977. "A Socioeconomic Evaluation of Nonresident Sport Hunting Activity in Alberta." For Alberta Fish and Wildlife Division, Edmonton, Alberta.

Phillips, W.E., 1983. "Economics of Recreational Resources: Fish and Wildlife Valuation," *Symposium on Fish and Wildlife Resources and Economic Development,* Edmonton: Alberta Society of Professional Biologists: pp. 77-95.

Phillips, W.E., 1976. "Wildlife Economic Values," *Transactions 1975.* Thirty-ninth Federal Provincial Wildlife Conference, Ottawa: Wildlife Service, Environment Canada: pp. 42-29.

Powell, J.M. (Compiler), 1980. "Socioeconomic Impacts of Climate," *Proceedings of the Workshop and Annual Meeting of the Alberta Climatological Association, March 1979.* Information Report NOR-X-217. Environment Canada, Canadian Forestry Service, Northern Forest Research Centre, Edmonton, Alberta.

Precht, Paul, 1978. "Estimated Employment Impact on Residents of the Athabasca-Lac La Biche area from a Pulp Mill Development Near Athabasca." Economic Planning and Financial Analysis, Alberta Energy and Natural Resources, Edmonton, Alberta.

Proceedings of the American Society of Agricultural Engineers Symposium on Engineering Systems for Forest Regeneration, March 1981. Section VI (various articles on Forest Economics). Raleigh, North Carolina.

Reed, F.L.C. and Associates Ltd., 1973. "The British Columbia Forest Industry: Its Direct and Indirect Impact on the Economy." Prepared for the Department of Lands, Forests and Water Resources, Vancouver, British Columbia.

Reed, F.L.C. and Associates Ltd., 1978. *Forest Management in Canada.* Volume I: "A Study to Improve the Basis for Policy Formulation, Planning and Practice in Intensive Forest Management." Information Report FMR-X-102. Environment Canada, Canadian Forestry Service. Prepared for Forest

Management Institute, Ottawa, Ontario.

Reed, F.L.C. and Associates Ltd., 1978. *Forest Management in Canada.* Volume II: "Case Studies." Information Report FMR-X-103. Prepared for Forest Management Institute, Ottawa, Ontario.

Reed, F.L.C., 1979. "Realizing the Economic Potential of Canada's Forest Resource." *The Forestry Chronicle.* (December), Vancouver, British Columbia.

Reed, F.L.C. and Associates Ltd., 1979. "Regional Employment Generation by the Forest Sector." Prepared for the Canadian Pulp and Paper Association for the Canadian Forest Congress, Toronto, Ontario.

Reed, F.L.C. and Associates Ltd., 1980. "Recent Reductions in the Canadian Timber Base." Prepared for the Canadian Pulp and Paper Association for the Canadian Forest Congress, Toronto, Ontario.

Resources Management Consultants (NWT) Ltd., 1982. *Campbell Hills/Lake Park Feasibility Study.* Presented to Department of Economic Development and Tourism, Government of the Northwest Territories, May 1982, in cooperation with W.M. Baker, Tourism, Parks and Recreation Consultant and Lambur Scott Architects Ltd., Yellowknife, NWT.

Resources Management Consultants Ltd., 1984 (projected completion date). "Feasibility Study for Hidden Lake Park." Prepared for the Department of Economic Development and Tourism, Government of the Northwest Territories, Yellowknife, NWT.

Robins, J.K. and Susut, J.P., 1974. *Red Belt in Alberta.* Information Report NOR-X-99. Environment Canada, Canadian Forestry Service, Northern Forest Research Centre, Edmonton, Alberta.

Runyon, K.L., Stewart, J.V., Massie, M.R.C. and Narker, R.M., 1972. *Analysis of the Economic Impact of Sawmills and Pulp and Paper Mills in Nova Scotia.* Information Report M-X-33. Department of the Environment, Canadian Forestry Service, Maritimes Forest research Centre, Fredericton, New Brunswick.

Saskatchewan Department of Parks and Renewable Resources, September 1983. "Forest Management Strategy for Saskatchewan, 1984-2003." Confidential Report, Forestry Division, Regina, Saskatchewan.

Saskatchewan Power Corporation, 1979. "Environmental and Social Impact Study on Utilization of Wood for Small-Scale Electric Power Generation." ENFOR Project C-8(1), Canadian Forestry Service, Environment Canada, Hull, Quebec.

Saskatchewan Power Corporation, 1979. "Evaluation of Wood Gasifier at Hudson Bay, Saskatchewan." ENFOR Project C-8(1), Canadian Forestry Service, Environment Canada, Hull, Quebec.

Schultz, C.D. and Company Limited, 1976. "Environmental Effects of Timber Harvesting on Saskatchewan Forests." Prepared for Saskatchewan Department of Environment, Vancouver, B.C. (6 volumes).

Springate, N. Associates, 1973. "Saskatchewan Wood Utilization Study." (Two-phase study.) Prepared for the Government of Saskatchewan, Regina, Saskatchewan.

Sundog Productions Ltd., February 1982. "Policies and Guidelines for Interpretation Services Northwest Territories." Prepared for Office of Tourism and Parks, Department of Economic Development and Tourism, Government of the Northwest Territories, Yellowknife, NWT.

Teskey, A.G. and Smyth, J.H., 1975. "Employment, Income, Products, and Costs in Manitoba's Primary

Wood-Using Industry, 1972." Information Report NOR-X-138. Environment Canada, Canadian Forestry Service, Northern Forest Research Centre, Edmonton, Alberta.

Teskey, A.G. and Smyth, J.H., 1975. "Saskatchewan's Forest Industry and its Economic Importance, 1972." Information Report NOR-X-140. Environment Canada, Canadian Forestry Service, Northern Forest Research Centre, Edmonton, Alberta.

Teskey, A.G. and Smyth, J.H., 1975. "The Economic Importance of Sawmilling and Other Primary Wood-Using Industries in Alberta, 1972." Information Report NOR-X-145. Environment Canada, Canadian Forestry Service, Northern Forest Research Centre, Edmonton, Alberta.

White, William Alexander, April 1982. "An Economic Analysis of the Saskatchewan Wood Utilization Policy." Unpublished M.A. Thesis, Department of Economics, University of Regina, Regina, Saskatchewan.

Williamson, Timothy Bruce, 1983. "A Cross-Sectional Analysis of Production in the Alberta Sawmill Industry." Unpublished M.Sc. Thesis, Department of Rural Economy, University of Alberta, Edmonton, Alberta.

Williamson, Timothy B. and Phillips, William E., 1983. "An Economic Examination of Alberta Sawmill Production." *Agriculture and Forestry Bulletin,* Vol. 6, 3, University of Alberta (September): pp. 39-42.

Woods, Gordon (Management Consultants), May 1981. "A Linear Programming Analysis of the Optimum Wood Supply for the Meadow Lake Sawmill," for Crown Investments Corporation, Toronto, Ontario. Confidential.

Woods, Gordon, 1983. "The Development of New Agricultural Land in Northwestern Alberta." Prepared for the Northern Alberta Development Council, Peace River, Alberta.

APPENDIX 5

AREA MEETINGS WORKSHOP AGENDA

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Time	Activity	Responsibility
9:00-9:30 (30 min.)	Coffee	
9:30-9:40 (10 min.)	Welcome by Project Team and Introduction of Participants	Jim Beck
9:40-9:50 (10 min.)	Opening remarks by CFS Representative	Michael Heit
9:50-10:00 (10 min.)	Review Study Design and Workshop Agenda	Wayne Lamble
10:00-10:05 (5 min.)	Presentation of Listing of Research Topics Generated by the Mail Questionnaires to Guide Further Discussion	Bill Phillips
10:05-10:30 (25 min.)	Serial Discussion of Research Topics to Clarify the Meaning of Each Item	Bill Phillips
10:30-10:40 (10 min.)	Silent Independent Selection of 6 Top Priority Topics from Entire List to Aggregate Judgments of Members (Formation of Sub-Groups and Appointment of Recorders/Reporters)	Wayne Lamble
10:40-10:45 (5 min.)	Round-Robin Sharing and Noting of Priority Topics on the List (Developing a Short List)	Wayne Lamble
10:45-11:15 (30 min.)	Serial Discussion of Short List Topics to Explain Reasons for Priority	Wayne Lamble
11:15-11:30 (15 min.)	Preliminary Voting on Topic Importance a) each group member selects 6 priority topic cards, rank-orders them, and assigns a rating to each (highest rating gets highest score) b) collect rating cards and shuffle them to retain anonymity c) tally the vote and record results on flip chart	Wayne Lamble
11:30-11:45 (15 min.)	Reporting to and Discussion by Total Group of Preliminary Vote for Inconsistencies, Surprises, etc.	Jim Beck
11:45-12:00 (15 min.)	Selection of Top 6 Priority Research Topics (may require another vote if it appears voting may change as a result of discussion)	Jim Beck
12:00-1:00	Lunch	

1:00-3:15 (135 min.)	Identification of Specific Questions to be Addressed within each Priority Research Topic and Major Constraints in Conducting such Research	Wayne Lamble
1:00-1:15 (15 min.)	Orientation, Formation of 3 Groups, Appoint Recorders/Reports	
1:15-1:45 (30 min.)	Session 1 on first 3 topics	
1:45-2:15 (30 min.)	Session 2 on next 3 topics	
2:15-3:15 (60 min.)	Reporting and Discussion of Group Recommendations (10 min. for each topic)	
3:15-3:45	Discussion and Confirmation of Regional Variation in Research Topic Priorities	Bill Phillips
3:45-4:00	Concluding Remarks	Jim Beck
4:00-5:00	Social Hour	