

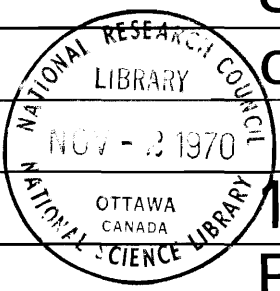
8



Ser
Q21
C232
no.8

70

Science Council
of Canada



1970
Report No.8

Seeing the
Forest and the
Trees

ANALYZED

**Seeing the
Forest and the
Trees**

**A Report on
Forest
Resources
Research**

© Crown Copyrights reserved

Available by mail from the Queen's
Printer, Ottawa, and at the following
Canadian Government bookshops:

Halifax

1735 Barrington Street

Montreal

Aeterna-Vie Building, 1182 St. Catherine
Street West

Ottawa

Daly Building, Corner Mackenzie
and Rideau

Toronto

221 Yonge Street

Winnipeg

Mall Centre Building, 499 Portage Avenue
Vancouver

657 Granville Street

or through your bookseller

Price 75 cents

Catalogue No. SS22-1970/8

Price subject to change without notice

Queen's Printer for Canada

Ottawa, 1970

Design: Gottschalk + Ash Ltd.

October 1970.

The Rt. Hon. Pierre Elliott Trudeau,
P.C., M.P.,
Prime Minister of Canada,
House of Commons,
Ottawa 4, Ontario.

Dear Mr. Prime Minister:

In accordance with sections eleven and thirteen of the Science Council Act, I take pleasure in forwarding to you the views and recommendations of the Council as they concern policies on forest resources research, in the form of a report entitled "Science Council Report No. 8—Seeing the Forest and the Trees."

Yours sincerely,

O.M. Solandt,
Chairman,
Science Council of Canada.

Foreword

The present report relies heavily on results of Special Study No. 14, *Forest Resources Research in Canada*, by Dr. J.H.G. Smith and Mr. J.L.G. Lessard, which describes the current status, assesses the adequacy and makes recommendations concerning desirable future development of forest resources research. Stressing a national viewpoint, broad issues and timeliness of results, the authors of the Special Study analysed current scientific activities in forest resources research. Definition of goals, future needs and means of attaining them were considered thoroughly. The conclusions they reached are acceptable to and endorsed by the Science Council.

In this report, the Science Council is seeking to highlight the results of the study on forest resources research, which will be of particular interest to those concerned with Canada's forests and wildlands, and to make appropriate recommendations for action. The Council is planning to conduct a more comprehensive review of science in the primary industries and in its forthcoming reports will view forest resources research in this broader context, and in particular will consider recommendations with specific fiscal implications.

Table of Contents

Foreword	5
Economic and Social Impact of Canada's Forest Resources	9
Forest Resources Research Now and in the Future	12
Universities	15
Priorities for Action	16
Recommendations	17
Government research	17
University research and education	18
Industrial research	18
Science Council Committee on Forest Resources Research	21
Publications of the Science Council of Canada	22

Economic and Social Impact of Canada's Forest Resources

Canada is a forest nation. Almost one-half of Canada's total area is forested, and about three-fifths of its forest land can produce saleable roundwood. Canada's forest area is exceeded only by that of Brazil and Russia and is one of the least costly to harvest. Forest resources provide cash crops without floor prices, production or transportation subsidies. Moreover, the timber harvest frequently initiates the access needed to stimulate other resource development.

Present estimates show that Canada's forests could sustain at least three times the present annual harvest of wood; thus it appears that there now is no shortage of raw wood in Canada. The economically accessible forest area, however, can be increased by only about 35 per cent (Figure 1). Declining use of wood as fuel and more efficient conversion of logs to wood products recently have allowed slight annual decreases in world production of roundwood despite increasing rates of consumption of wood products. If anticipated rates of world demand for wood materialize, the annual timber harvest presently considered "allowable" in Canada could be achieved within thirty years.

Canada's forests require from fifty to one hundred and fifty years' growth to become economically mature; therefore, it is likely that regional shortages of logs in Canada will become more general and severe before the turn of the century. Soundly based planning and intensification of forest management are required now.

Forest industries presently account for one-fifth of all railway-car loadings in Canada. As regional shortages of wood develop, construction of systems for transporting timber products, now economically inaccessible, will have a significant impact on the economy. Use and manufacture of timber represented about 5 per cent of GNP in 1968. Net earnings that year from export of wood products were

\$2.4 billion and accounted for 18.6 per cent of total merchandise exports. The markets for forest products are constantly changing, however, and are by no means assured in their present form. A high level of scientific competence must be available to assist the industry to accommodate the changing production systems and markets.

Cash values of Canada's forests vary according to intensity and type of use. The sales value produced by Canadian forest-based industries in 1968 including wood, furniture and fixtures, paper and allied products amounted to \$6 billion. The indirect economic impact of that timber production on particular regions and the nation as a whole is not known. To the need for understanding and refining these values must be added concern for sound information about amounts and values of possible additional uses of the forest resource such as for recreation. The sum value of all uses of forest resources is large. Economic and social values of Canada's forests have much remaining potential for development, in addition to intensified scientific management to sustain and increase the forest yield.

Other major uses of forested lands, including those which do not currently or potentially yield merchantable timber, are for recreational purposes such as fishing, hunting, camping, nature appreciation and other amenities. The contribution of these activities to GNP, or their contribution to value from forested lands in particular, is not adequately known either in Canada or elsewhere. Canadian figures available for certain recreational activities, such as numbers of park visitors and sales of hunting and fishing licences, indicate high demand rates; however, these data do not reflect the actual level of participation and do not indicate the full range of use for forest recreation. Scientists must provide the analytical tools to permit evaluation so that potential future values of all forest amenities, including recreation, may be taken fully into account in planning future use of Canada's forest resources.

Almost every activity of the forest-based industries is a potential or present source of severe environmental problems. The cutting of large areas of timber (or conversely, extensive reforestation) can have major effects on local climate, on wildlife, on water supply; the use of Canada's rivers and lakes for the transportation of logs generates costs as well as benefits; the growing use of fertilizers in forest stands should be examined; the pulp and paper industry is the source of vast quantities of liquid and gaseous wastes which have far too frequently been dumped untreated into the surrounding air or rivers resulting in unacceptable levels of pollution. Many pulp and paper mills in Canada are major offenders while some others have tackled the problem effectively. Logging operations can and should be planned to minimize the damage to the environment.

It is imperative for Canada that the forest-based industries remain healthy and economic but also that they operate in a manner which does not cause irreversible damage to the ecology of their surroundings. The challenge of realizing the combination of these two goals which is in the best interest of Canadians stands waiting. If the forest product companies themselves take the initiative there is much to be gained. If they do not do so very quickly, punitive legislation will result from the growing public concern and the best balance of these two goals will become more difficult to attain. Much of the scientific and engineering knowledge to attain these goals is already available. The research community must be ready immediately to fill in any gaps or generate new understanding as the needs are identified. The urgency of the situation is undeniable. The consequences, both desirable and undesirable, of massive use of pesticides in forest stands have been recognized and work on these problems which involve pollution is progressing.

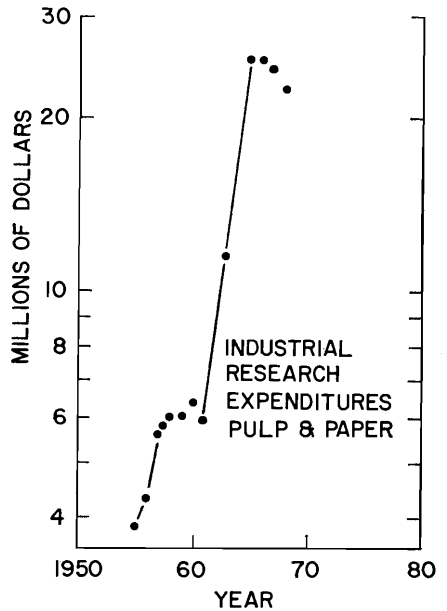
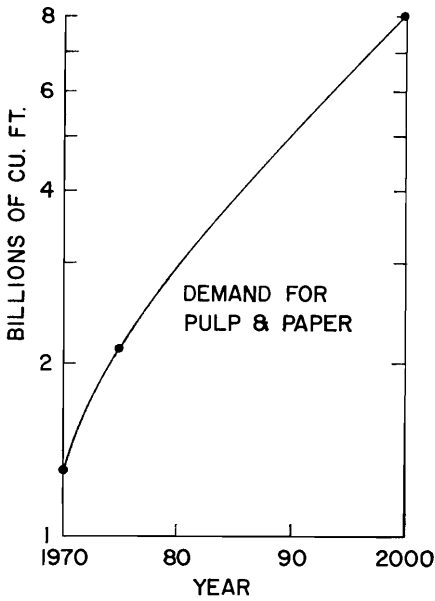
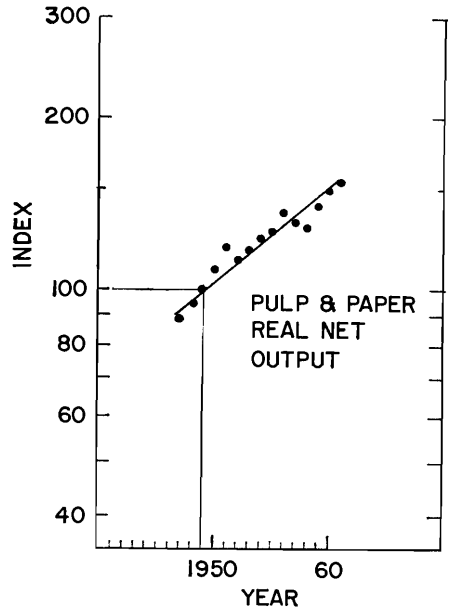
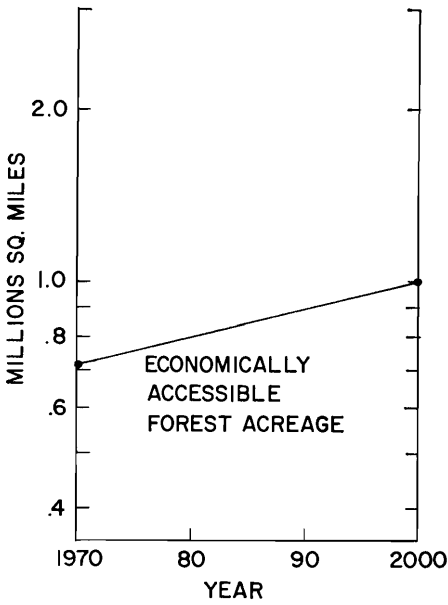
Damage to the forest environment is not limited to the forest product companies. The increasing number of people

who use the forests for recreation are themselves a rapidly growing source of pollution and destruction. Forest fires resulting from the careless acts of humans represent an unnecessary and avoidable waste and destruction. Non-returnable bottles, cans, plastic containers and sundry other garbage litter the forest campsite of the neophyte as a monument to his ignorance of his environment. Some of these are the same people who are quick to criticize industry. Perhaps they need a mirror to place their own acts in perspective.

Beauty in the landscape, clean and healthy air to breathe, and pleasant space in which to live and play are being increasingly demanded today by the general public. Trees to enhance man's environment are essential in Canada's cities. Scientific, cultural, and other amenity benefits derived from forests and nature reserves are becoming more important as the natural environment becomes more disturbed and as outdoor education and interpretive programs are developed. Continuing increases in discretionary income and leisure time, combined with man's greater mobility, are leading to rapid expansion in the demands made on both public and private forest recreation facilities. More and better facilities and services are expected by the rapidly growing numbers of domestic and foreign tourists.

Another benefit of the scientific management of forest lands is the regulation of water yield and quality as well as flood control. Economic expansion of Canada's wood-based industries, however, is dependent on the ability to attract additional capital investment, to capture new markets and to hold existing ones. Besides anticipated increases in demand for more and new wood products, withdrawals of land for non-forest uses will accelerate the need to manage and use productive forest land more intensively. Demands for reservoirs and highways and utilities rights-of-way, for conversion of forested land to agricultural cropland and pasture, for intensive recreational developments,

Figure 1—Demand, Productivity, Resource Base and Research Expenditures for Pulp and Paper



Sources: D.V. Love, 1961, Resources for Tomorrow Conference; DBS 14-502, Productivity Trends in Industry; W.E. Haviland, I.B. Chenoweth, and E.T. Owens, 49th Annual Meeting, Woodlands Section, Can. Pulp and Paper Assoc.; DBS 13-532, Industrial Research-Development Expenditures in Canada.

for wilderness reserves and for mining are expected to continue to reduce the productive forest acreage. In addition to encouraging multiple-purpose use of forested land and reducing the effects of withdrawals, more intensive forest management, including large-scale programs of reforestation and artificial regeneration, will be necessary if economic expansion is to be achieved and maintained. A major concern of the forest scientist is to ensure the short-term and continuing need of the forest industries for economic viability, while maintaining or enhancing the forest and related environments over the long term. One of the necessary starting points in Canada's efforts to develop an improved scientific base for management and use of forest resources must be quantification, where possible, of all social and economic benefits from forests.

Roundwood production and manufacturing have a large and easily measurable direct effect on Canada's economy. This and other uses of trees and forests have, in addition, major social and indirect economic effects which are not readily measurable. Improvements in roundwood production and manufacturing, as well as measurement and rationalization of all uses with social and economic effects, are the concern of science applied to Canada's forest resources.

Forest Resources Research Now and in the Future

Forest resources research is concerned with the generation and application of knowledge derived from the natural, social and economic sciences. Development and innovation based on this research can result in increased efficiency in the production of goods and services from forest resources and make possible their most effective use by society. Included is research in support of the growing, protecting and conserving, managing, harvesting, utilizing, manufacturing and marketing of goods and services from forests and associated wildlands, and research on maintaining and enhancing

the long-term quality and productivity of such lands.

Current research effort costing \$57 million (Table 1) is predominantly in such categories as forest products, silviculture, forest protection from insects and diseases, and forest biology and ecology (Table 2). The federal government contributed 34 per cent of the scientist man-years and 38 per cent of the funds (Table 1). The scientific effort of forest industries, which employed 47 per cent of research professionals and scientists in 1968, was devoted primarily to improved utilization of wood and fibre, with but limited effort on woodlands and marketing research. Forest products research occupied almost one-half of all forest resources research scientists, of which only 13 per cent were employed by the federal government. Provincial governments contributed 10 per cent of the research workers, all in woodlands research; universities another 9 per cent, of which 70 per cent were in woodlands and 30 per cent in forest products research.

Research performance related to productivity of the entire forest industry has not been studied, but the available data for pulp and paper mills indicate the need for research, development and innovation. If demand for wood and real productivity rates of pulp and paper mills continue as predicted, a shortfall in production appears inevitable (Figure 1) because the productive forest resource is limited. Increases in productivity through increased efficiency and more effective use of land and wood require research, development and innovation. Most research to date has been on the use of timber, with little research being done on the effective use of land. Even more disturbing has been the recent decline in real expenditures on research and development by the wood industries. More emphasis, particularly in the woodlands segment of the forest industries, is needed, not less.

The subjects in need of most urgent attention include forest land recreation, environmental quality, fire control and

Table 1—Scientific Effort Related to Forest Resources Research in 1968

	Research Professionals and Scientist Man-Years ^a						Expenditures	
	Wood-lands	%	Forest Products	%	Total	%	(\$'000)	%
Federal Govt.	306	52	68	13	374	34	22 024	38
Provincial Govt.	105	18	0	0	105	10	3 292	6
Industry	102	18	408	81	510	47	29 400	51
University: ^b								
faculties of forestry	24	4	6	1	30	3	925	1.7
other	47	8	23	5	70	6	1 800	3.3
Total	584	100	505	100	1 089	100	57 441	100.0

^aFull time equivalents.^bGrants only, exclusive of salaries and other administrative costs.**Table 2—Distribution of Scientific Effort in 1968, Suggested Priorities for Expansion of Research, 1969-78**

Topic	Project Leader Man-Years 1968, Total	1969-78 ^a Priority Suggested for Expansion
Forest Land Recreation	1	High
Environmental Quality and Urban Forestry	1	High
Forest Fire Protection	14	High
Forest Engineering	25	High
Forest Economics	18	High
Forest Products Marketing	5	High
Forest Products Utilization	570	High
Forest Genetics	11	High
Forest Surveys	10	Medium
Silviculture	98	Medium
Timber Management	63	Medium
Wildlife Habitat Management	1	Medium
Range Management	1	Medium
Forest Hydrology	7	Low
Forest Insects	94	Low
Forest Diseases	53	Low
Forest Soils	17	Low
Forest Biology and Ecology	98	Low
Total	1 089	

^aBased on probable ratios of benefits to costs, maturity of existing scientific programs, nature and extent of operational roles and the probable lag in application.

use, products utilization, engineering, economics and products marketing and forest genetics (Table 2). Other priorities, in order of importance, are expansion of research in surveys, silviculture, timber management and forest-related research in wildlife and range management.

Forest resources research and management programs will contribute to and be influenced by other resource and social development programs that Canada may start, such as research to improve housing, transport or use of the water resource. Northern development will rely heavily on local forest resources; the commercial forest margin will be advanced northward as new rail and water transport systems emerge. Development of Canada's forest resources tends to stimulate new urban centres but may and frequently does have undesirable effects on air and water quality. Therefore, forest and other resource management and development programs in Canada must be integrated effectively. Research toward integrated resource management has been initiated in Alberta and Ontario, but the projects have been mainly oriented to water supply and flood control and have been conducted mainly by natural scientists and engineers. The scientific contributions toward first approximations of integrated resource management require inputs from the social sciences such as economics, sociology, law and political science.

Some of the major problems to be solved are not scientific. Present responsibility for forest resources research and management is divided among industries, governments, both federal and provincial, and universities. Moreover, there is a lack of clear definition of goals among them. The needs are urgent to secure accord as to jurisdiction, to work toward integrated resources management, and to find the funds required to implement improved forest management practices.

A problem that is managerial rather than scientific is the communications gap between scientists and managers. One of the difficulties faced by forest land man-

agers, whether company or provincial government foresters, in assessing the appropriateness and the need for Canadian research in forestry, is that 52 per cent of the scientists engaged in woodlands research work for another employer, the federal government (Table 1). Thus forest resources development, the responsibility of forest-based industries and provincial governments, has been dependent to a great extent on federal government scientists for recognition of problems amenable to research, direction of research and interpretation of the results. In many other fields, industrial managers are qualified to advise on, assess and interpret research done in government laboratories; hence implementation is more rapid and less unsure.

An outcome of the relative lack of forest scientists in industry qualified to interpret and apply the results of forest science research has been a deep concern among practical forest land managers about relevance of government and university research programs and applicability of their results. Forest research is problem oriented and should create improvements in land management practices and the products thereof. Research is also a "hedge" against an uncertain future; therefore all enterprises should provide for and encourage research, including long-range exploratory work that probes the frontiers of knowledge. However, the work more remote from application should be done only by the most competent scientists who have a clear concept of the objectives of the organization they work for.

The Canadian Forestry Service made commendable efforts in 1965 to expand the research effort by making grants-in-aid of research to university professors and by entering agreements with provinces. When the cost-sharing agreements between federal and provincial agencies were abandoned in March 1967, the concern for development of the best possible research program caused federal scientists to look inward to an extent that now works to the detriment of the balanced

development of research capabilities in both universities and government.

The federal government has a virtual monopoly on research related to forest land management. This is especially true in the fields of forest entomology and pathology. In these aspects of forest protection, and in forest biology generally, there has been a justifiable reluctance on the part of students to embark on graduate work in a field in which the federal government is virtually the sole employer.

When the Canadian Forestry Service began to remedy the long-standing deficiencies in support for research in forest resources in 1965, National Research Council committees, either consciously or unconsciously, discounted the need for support of university research in those areas. The financial support of forestry research in university faculties was too little and too late.

The already low level of support of extramural research by the Canadian Forestry Service was decreased by 24 per cent in 1969-70. This contrasts remarkably with an aggregate increase in federal research funds for universities of nearly \$9 million or about 8 per cent among the main granting agencies. The expansion of research in the Forestry Branch that was started as a "crash" program in 1965, but collided with austerity in 1968, had the advantage over that in faculties of forestry in that it at least got off the ground.

Universities

The Science Council has a grave concern for the future of forestry in Canadian universities and in the supply of top Canadian talent to work in this important resource area both in research and management. The demand for graduates in classical forestry will increase steadily, but even more important, the need for graduates with resource development and environmental quality orientation will accelerate as operational programs in multiple-purpose resource use are undertaken.

Notwithstanding a few excellent teachers, scientists and engineers working in these areas, and notwithstanding some research that has commanded international attention through its high quality, in general the four faculties of forestry at Canadian universities are in trouble. Taken as a group, the accommodation for forestry faculties is inadequate. They are understaffed and have been under-funded for so long that the projects they choose for research are in some cases minor matters and the products of poverty. As a consequence, forestry faculties do not attract their fair share of the really bright students entering university. On the other hand, forestry activities at the federal level have been, by comparison, well funded. They have developed strength, and because of the disparate levels of funding between the federal laboratories and the universities, have developed a near monopoly in many of the areas of common interest. This whole system is circular because, as the university faculties get relatively weaker, the federal organization may claim quite justifiably the inadequacy of university research, and therefore the *a priori* justification for doing more in-house research at the federal level. They may also complain about the quality and quantity of the graduates from Canadian universities and therefore may seek increasing numbers of their staff from outside Canada. This has a further negative impact on the universities. If the universities happen to recruit someone who is very good, the federal laboratories could hire him away on the basis of their superior equipment and funding. As the monopoly position increases, the federal agencies become inward looking and their co-operation with universities becomes less.

The Science Council suggests that this circular process has reached a critical state in forestry. The Council suggests, moreover, that the only way this circle can be broken and the trends reversed is by deliberate and substantial federal support of the university forestry faculties. This increased support should come from

the department responsible for federal forestry activities and not from the National Research Council. The National Research Council should continue to perform its vital balance-wheel role, but inasmuch as it has not had the leverage to prevent this spiral decline, it will not have the power to reverse it. The leverage must come from the federal department responsible for forestry in committing mission-oriented money, and in the present budgetary climate this means curtailing their present in-house activities to provide the funds for university grants. We are aware that they have made \$40 000 grants to each of the four deans of faculty for the last several years but it is the Council's view that this is completely inadequate. Some twenty-odd years ago the federal government, in order to create viable academic institutes of oceanography at the University of British Columbia and Dalhousie, earmarked \$90 000 a year for each, and they were institutes, not entire faculties. Also, the purchasing power of the dollar has decreased considerably in the meantime.

Nothing short of a very substantial and sustained effort, to provide financial support for a minimum of ten years to the forestry faculties through the federal department responsible for forestry, will raise the four university forestry faculties to the position of strength which the Council considers essential if the solutions to Canadian problems are to emerge.

If the forestry faculties are to attract their share of bright students they must be encouraged to undertake substantial, relevant, research programs. Such a change in direction and elevation of the general level of competence in forestry faculties will not be easy and will not be attainable overnight. It will require a complete dedication to the goals of quality and relevance by the existing faculties and a re-examination of their programs and emphasis. With a clear declaration of intent to reach such goals by the department responsible for federal forestry research and by the university faculties, we believe these goals can be achieved.

We believe that this is a vital step if we are to successfully manage and develop our forest resources.

Priorities for Action

The problems in forest resources management which only Canada can solve for herself are forest recreational use, forest products marketing, economics, forest protection from fire and maintenance of environmental quality. Canada has an apparent but short-lived super-abundance of forests (Figure 1), which soon must be used more intensively and for a diversity of purposes. Some land presently available or used for roundwood production will be converted to other uses and some presently arable land will revert to forest. Therefore, relevant projections and policies based on forest resources research are needed now. Besides avoiding undesirable duplications and ensuring potential economic and social returns, research policies should be focussed on redistribution and expansion of effort to emphasize solutions to uniquely Canadian problems.

A competitive advantage as well as partial solutions to anticipated shortages of raw wood could be gained by Canadian leadership in research relating to forest harvesting and forest products utilization.

In protection of forests from insects and disease, in mensuration and basic forest biology, the Canadian research effort should elucidate new knowledge from around the world and responsible executives should ensure that the applicable results are implemented. Results of research must be implemented promptly and fully. In all fields of forest resources research there is a continuing need for adaptation of what is already known to the special conditions of labour, species, soils and climate that are uniquely Canadian.

An integrated, co-ordinated, multiple-purpose approach to management of land and water is needed and could be implemented once solutions are found for legal, political, economic and social restraints. General neglect of resource management

has occurred in Canada. The “piece-meal” approach of operational programs has contributed specifically to neglect of development and innovation in land management practices. A Major Program for Integrated Resource Management is one in which forestry would have much to contribute. A holistic approach to development of integrated resource management practices is needed, but the problems are many and complex. A pilot approach to integrated resource management on at least one representative area of forested land in each of Canada’s five major regions would yield useful principles and lead to the development of essential guidelines. Each pilot project would require inputs from economists, social and political scientists and lawyers, as well as the natural scientists and engineers.

Broadly viewed, the present rate of expenditure on science related to forest resources seems to be at an appropriate level. The investment is readily justified, but the total evaluation is, perforce, subjective because of the difficulties of assessing recreational and other amenity benefits to Canadians. If the increasing use of wildlands for public recreation is a reliable indicator, significant increases in expenditures in the next decade will be justified.

The optimal levels of future expenditures depend on much more rigorous economic analyses of forest-based industries and of recreational and social values of forests. By 1988 the appropriate expenditure might well be at least triple that of 1968, but that is only conjecture. For the next five years it would be useful to raise expenditures to start new activities recommended, while older patterns of activity are being examined, phasing out those that are least relevant and building those of promise.

Recommendations

Government Research

1. The federal government, by direct support and incentives, should encourage faster growth rates of forest resources research performance in universities and industries, thus decreasing its own propor-

tion of the total. Research growth rates could also be stimulated through increased use of federal contracts for both research services and development of products. Funds, incentives and contracts as in the PAIT and IRDIA programs are available from federal departments other than Fisheries and Forestry, which is the main federal performer of forest resources research but which has limited flexibility during austerity for shifting the relative balance of federal funding and performance of forest resources research.

2. The Minister of Fisheries and Forestry should establish a National Co-ordinating Committee on Forest Resources Research. The terms of reference for the Committee should include requirements to:

a) provide continuing advice to the Minister on use and application of science in forest resources management and development in Canada;

b) assist in co-ordination of forest resources research by providing advice to the Minister on national needs and priorities for research, in federal, provincial, industrial and university groups and through him to other federal departments and granting agencies by the Intercouncil Co-ordinating Committee and the Advisory Panel on Science and Technology as recommended in Science Council Report No 5, *University Research and the Federal Government*;

c) review and make recommendations on applications to the Canada Department of Fisheries and Forestry for grants-in-aid of forest resources research, and

d) encourage and help co-ordinate the development of strong university programs in forest resources research.

Term appointments to the Committee should be made by the Governor-in-Council on the advice of the Minister. Membership in the Committee should not be more than twenty, and should reflect the views of the forest-based industries, federal and provincial public services and the universities. The Committee should reflect the wide range of interests, not just those of foresters in the classical sense, and it must be and appear to be independ-

ent. A senior representative of the Canadian Forestry Service should be appointed Convenor of the Committee and the Department should provide a non-voting secretary and secretariat. The Chairman of the Committee should be elected by its members for a term once renewable. Because an important role of the National Co-ordinating Committee would be the provision of advice on the disbursement of funds to universities and industries, the Council recommends that those funds be clearly identified in the budget and that responsibility for advising the Minister on their disbursement rest solely with the Committee. The Committee should draft a detailed national policy for forest resources research. The Committee should seek to ensure implementation of its policy by maintaining liaison with other federal agencies which have related missions, with advisory groups to industry, and with provincial governments, including the Canadian Council of Resource Ministers.

3. The Science Council believes that research agencies should be permitted to develop increased capabilities for forward planning. The present system of five-year planning required by the Federal Treasury Board results in a waste of manpower at all levels unless scientific agencies of government are permitted to plan with reasonable assurance that they will be allowed to implement the plan or its alternatives.

4. The Canadian Forestry Service should develop increased capabilities for measurements of cost-effectiveness as well as for retrieval and analysis of published and unpublished scientific and technical information, wherever performed, in order to enhance its role of initiating, co-ordinating and financing of research.

5. Forest resources research activities should be strengthened in provincial governments, in close association with their operating programs, both to contribute more directly to the solution of operating problems and to facilitate the use of knowledge more quickly as it becomes available through research conducted by others. To this end, provincial

governments should be encouraged to bring into cohesive units staff and activities associated with forest resources, research and development.

University Research and Education

1. The four university forestry faculties should receive substantial and sustained financial support, involving both capital and operating grants, through the federal Department of Fisheries and Forestry, in order to raise them to the position of strength which the Science Council considers essential if the solutions to Canadian forest resource problems are to be achieved.

2. Forestry faculties in universities should strive to qualify for major development grants offered by the National Research Council, as outlined in Science Council Report No. 5, *University Research and the Federal Government*. The four faculties of forestry in Canada must orient themselves to qualify for these major grants by proposing broad, continuing and interdisciplinary programs of investigation relevant to management and use of Canadian forests.

3. Individual project grants for support of forest resources research should be continued, where they exist, and coverage should be extended, as recommended in Science Council Report No. 5, to include those persons whose projects presently fall in between the coverage of existing granting councils and their various committees.

4. Forest research laboratories and institutes should be developed in close association with those major Canadian universities with faculties of forestry or with special capabilities in renewable resources research.

Industrial Research

1. Forest industries should place more emphasis on woodlands research with a view to effective use of land as well as increasing productivity from forested land. As a matter of self-interest, industry should support research to define costs and benefits from investments in reforestation and other timber and land management

practices. Corporations use their resources including timber at rates calculated to maximize the present worth of future net benefits, and commonly recognize that the ideas of continued production and an ethic of good husbandry are socially attractive. However, even where sustained yield and reforestation are legally required, the optimum investments remain undefined and little is known about the best approaches to ensure co-ordination of other resource uses with timber production.

2. Industries should conduct more research on reduction of costs for harvesting of fibre and transport to conversion sites in order to improve their competitive position. Research in wood products other than pulp and paper is neglected in relation to that in the domestic pulp and paper industry. Pulp and paper research in Canada is comparable to that in the United States but should be well ahead because of the relatively greater importance of the pulp and paper industry to the Canadian economy.

3. Additional industrial research is required into tenure systems, stumpage charges, co-operative agreements and application of technology which will stimulate integration of pulp and paper with other wood products production. Critical economic elements and sensitive social issues are involved. Effective solution of the problems could provide a competitive advantage for Canada's forest-based industries.

4. Thorough studies of potential demand for particular technical properties, such as clear wood, are needed and should be reflected in stand-management and tree-improvement programs.

5. Increased emphasis should be placed also on new methods for use of wood, new forest products, and improved packaging systems involving wood products.

6. High priority should be given to the rectification of the unacceptably high air and water pollution which now exists in many forest and forest product operations, particularly pulp and paper plants. Education programs to teach the public

fire safety and good camping practices must be intensified and anti-litter legislation which now exists in many areas should be enforced.

Science Council Committee on Forest Resources Research

Chairman

Dean J. W. Ker
Faculty of Forestry
University of New Brunswick
Fredericton, New Brunswick

Members

Mr. Lloyd Brooks
Assistant Deputy Minister
Manitoba Department of Mines and
Natural Resources
Winnipeg, Manitoba

Dean J.A.F. Gardner
Faculty of Forestry
University of British Columbia
Vancouver, British Columbia

Mr. A.J. Herridge
Chief, Timber Branch
Ontario Department of Lands and Forests
Toronto, Ontario

Dr. P.E. Lachance
President
Council of Pulp and Paper Producers of
Quebec
Quebec, P.Q.

Mr. M.F. Matte
Director of Forestry
Domtar Woodlands Limited
Montreal, Quebec

Dr. D.R. Redmond,
Director of Forestry Relations
Department of Fisheries and Forestry
Ottawa, Ontario

Dean L.H. Shebeski*
Faculty of Agriculture and Home
Economics
University of Manitoba
Winnipeg, Manitoba

Mr. R.G. Steele
Director of Forestry
Alberta Department of Lands and Forests
Edmonton, Alberta

The Committee is grateful to its Secretary, Mr. J. Mullin, and to its Project Officers, Dr. A.H. Macpherson (up to April 1969) and Dr. W.J.D. Stephen (from April 1969) and to the Study Group comprising Dr. J.H.G. Smith, Faculty of Forestry, University of British Columbia, Vancouver, and Mr. J.L.G. Lessard, Department of Fisheries and Forestry, Quebec City.

*Member of the Science Council of Canada.

Publications of the Science Council of Canada

Annual Reports

First Annual Report, 1966-67 (SS1-1967).

Second Annual Report, 1967-68 (SS1-1968).

Third Annual Report, 1968-69 (SS1-1969).

Annual Report, 1969-70 (SS1-1970).

Reports

Report No. 1, A Space Program for Canada (SS22-1967/1, \$0.75).

Report No. 2, The Proposal for an Intense Neutron Generator: Initial Assessment and Recommendations (SS22-1967/2, \$0.25).

Report No. 3, A Major Program of Water Resources Research in Canada (SS22-1968/3, \$0.75).

Report No. 4, Towards a National Science Policy for Canada (SS22-1968/4, \$0.75).

Report No. 5, University Research and the Federal Government (SS22-1969/5, \$0.75).

Report No. 6, A Policy for Scientific and Technical Information Dissemination (SS22-1969/6, \$0.75).

Report No. 7, Earth Sciences Serving the Nation—Recommendations (SS22-1970/7, \$0.75).

Special Studies

The first five of the series were published under the auspices of the Science Secretariat.

Special Study No. 1, Upper Atmosphere and Space Programs in Canada, by J.H. Chapman, P.A. Forsyth, P.A. Lapp, G.N. Patterson (SS21-1-1, \$2.50).

Special Study No. 2, Physics in Canada: Survey and Outlook, by a Study Group of the Association of Physicists headed by D.C. Rose (SS21-1/2, \$2.50).

Special Study No. 3, Psychology in Canada, by M.H. Appley and Jean Rickwood (SS21-1/3, \$2.50).

Special Study No. 4, The Proposal for an Intense Neutron Generator: Scientific

and Economic Evaluation, by a Committee of the Science Council of Canada (SS21-1/4, \$2.00).

Special Study No. 5, Water Resources Research in Canada, by J.P. Bruce and D.E.L. Maasland (SS21-1/5, \$2.50).

Special Study No. 6, Background Studies in Science Policy: Projections of R&D Manpower and Expenditures, by R.W. Jackson, D.W. Henderson, and B. Leung (SS21-1/6, \$1.25).

Special Study No. 7, The Role of the Federal Government in Support of Research in Canadian Universities, by John B. Macdonald, L.P. Dugal, J.S. Dupré, J.B. Marshall, J.G. Parr, E. Sirluck, E. Vogt (SS21-1/7, \$3.00).

Special Study No. 8, Scientific and Technical Information in Canada, by J.P.I. Tyas *et al.*

Part I (SS21-1/8, \$1.00).

Part II, Chapter 1, Government Departments and Agencies (SS21-1/8-2-1, \$1.75).

Part II, Chapter 2, Industry (SS21-1/8-2-2, \$1.25).

Part II, Chapter 3, Universities (SS21-1/8-2-3, \$1.75).

Part II, Chapter 4, International Organizations and Foreign Countries (SS21-1/8-2-4, \$1.00).

Part II, Chapter 5, Techniques and Sources (SS21-1/8-2-5, \$1.25).

Part II, Chapter 6, Libraries (SS21-1/8-2-6, \$1.00).

Part II, Chapter 7, Economics (SS21-1/8-2-7, \$1.00).

Special Study No. 9, Chemistry and Chemical Engineering: A Survey of Research and Development in Canada, by a Study Group of The Chemical Institute of Canada (SS21-1/9, \$2.50).

Special Study No. 10, Agricultural Science in Canada, by B.N. Smallman, D.A. Chant, D.M. Connor, J.C. Gilson, A.E. Hannah, D.N. Huntley, E. Mercier, M. Shaw (SS21-1/10, \$2.00)