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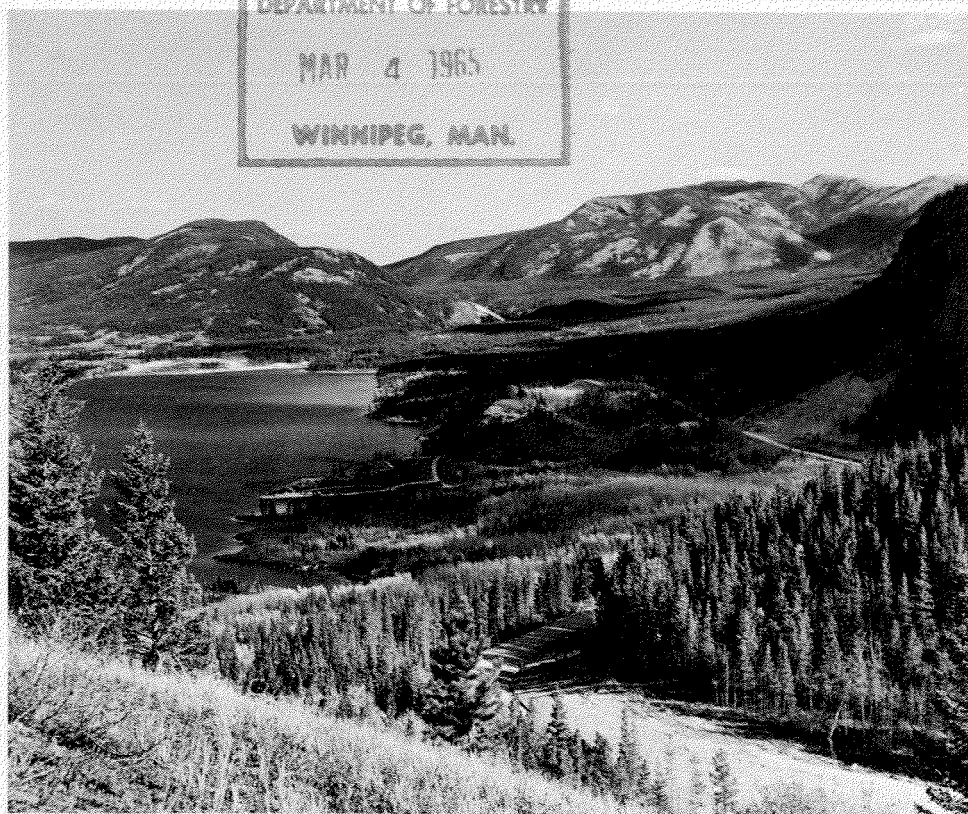


DEPARTMENT OF FORESTRY
CANADA

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ANNUAL REPORT

1963 - 1964

COVER PICTURE

KANANASKIS FOREST EXPERIMENT STATION

View north east into Stoney Creek

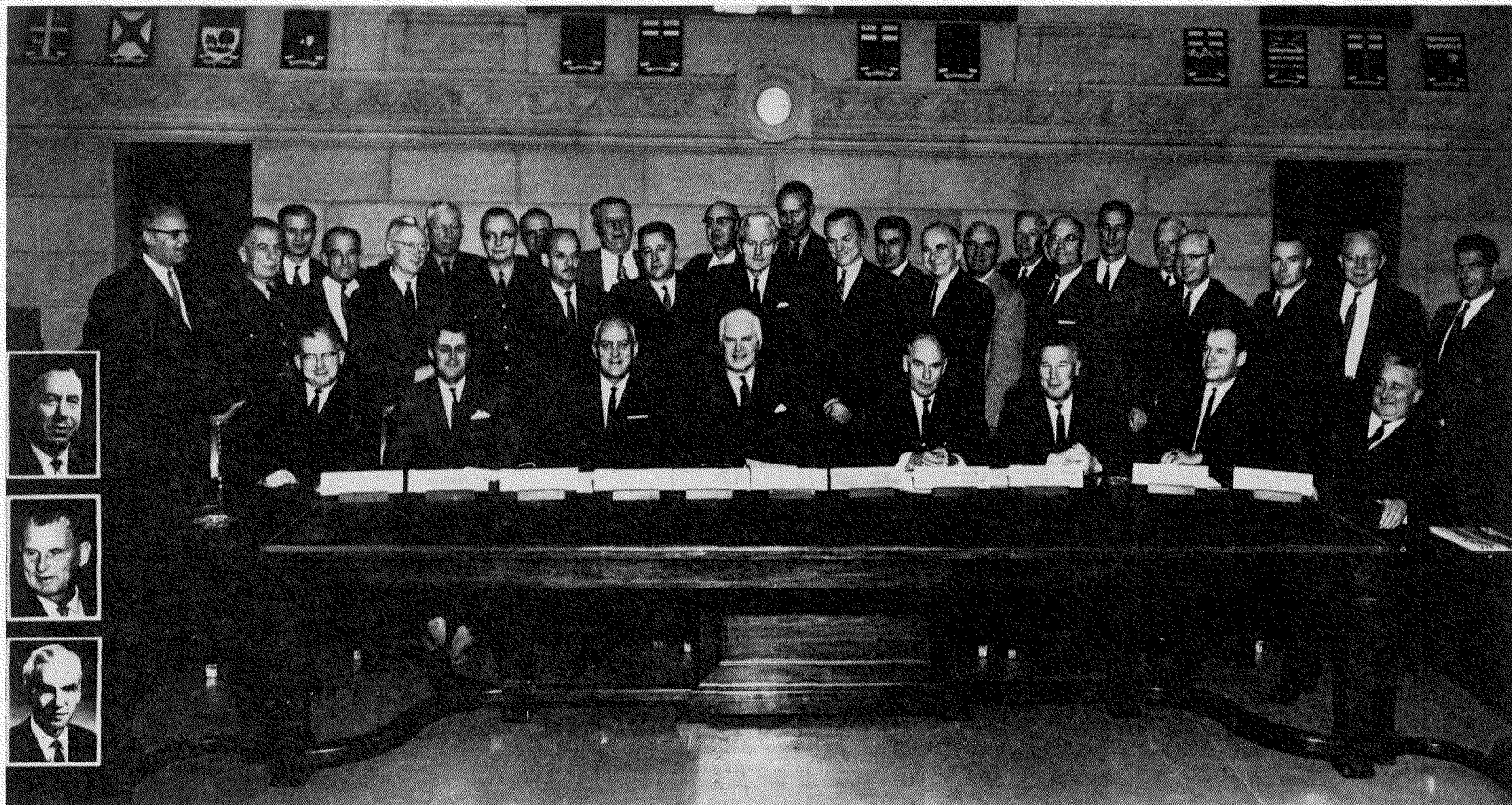


*Department
of Forestry
Canada*

ANNUAL REPORT

FISCAL YEAR 1963-1964

Price: 75 cents



FIRST FEDERAL-PROVINCIAL FOREST MINISTERS' CONFERENCE — OTTAWA, OCTOBER 21-22, 1963

Sitting (left to right)—Hon. Leo F. Rossiter, Prince Edward Island; Hon. C. H. Witney, Manitoba; Hon. Lucien Cliche, Quebec; Hon. John R. Nicholson, Canada; Hon. H. Graham Crocker, New Brunswick; Hon. Ray Gillis Williston, British Columbia; Hon. Eiling Kramer, Saskatchewan; Hon. W. J. Keough, Newfoundland. *Insets (top to bottom)*—Hon. A. Kelso Roberts, Ontario; Hon. E. D. Haliburton, Nova Scotia; Hon. Norman A. Willmore, Alberta. *Standing (left to right)*—Dr. D. R. Redmond, Canada; J. A. Brodie, Ontario; Dr. D. A. Wilson, Canada; Dr. L. Z. Rousseau, Canada; Dr. G. W. I. Creighton, Nova Scotia; F. A. MacDougall, Ontario; R. R. MacBean, Ontario; R. Code, Ontario; A. Gagnon, Quebec; S. W. Schortinghuis, Manitoba; J. P. Giroux, Quebec; A. W. Braine, Manitoba; R. Deschamps, Quebec; W. Foster, Ontario; S. Anderson, Manitoba; R. L. Bishop, New Brunswick; K. B. Brown, New Brunswick; D. A. Wolstenholme, New Brunswick; Dr. M. L. Prebble, Canada; R. G. McKee, British Columbia; W. R. Parks, Saskatchewan; H. W. Beall, Canada; J. W. Churchman, Saskatchewan; Dr. Stuart Peters, Newfoundland; Dr. J. H. Jenkins, Canada; E. Ralph Newfoundland

THE HONOURABLE MAURICE SAUVÉ, P.C., M.P.,
Minister of Forestry.

SIR:

I have the honour to submit the fourth Annual Report of the Department of Forestry covering activities during the fiscal year ended March 31, 1964.

The year under review was marked by several special developments of considerable moment. Outstanding amongst these was the convening of the First Federal-Provincial Forest Ministers' Conference in Ottawa, October 21-22, 1963, under the Chairmanship of the then Minister of Forestry, The Honourable John R. Nicholson. All Provincial Forest Ministers and their senior staffs were in attendance, as were senior observers from various departments of the Government of Canada.

Earlier in the year, the Department acted as official host to a meeting of the North American Forestry Commission, sponsored by the Food and Agriculture Organization of the United Nations, and held in Ottawa June 17-22, 1963, at which I had the great honour to serve as Chairman. Some 50 leading foresters and forestry scientists from the United States, Mexico and Canada attended as well as F.A.O. officials from Rome and Mexico City. Amongst the highlights of the conference were the study tours to various forestry, industrial and research establishments made possible by the Provinces of Ontario and Quebec and the forest industries.

The Canadian delegation to the 12th Biennial Conference of the Food and Agriculture Organization of the United Nations, held in Rome, November 16 to December 6, 1963, was headed by the Minister of Forestry. The Deputy Minister served as Chairman of the technical committee meetings on forestry convened immediately prior to the Conference.

In March, 1963, the time appeared opportune to take the first major step towards the development of a departmental organization appropriately oriented towards our functional responsibilities to the Canadian forest community. Towards the end of the fiscal year under review, the draft report of the re-organization survey team, consisting of two senior officials of this Department and one official from the Organization Division of the Civil Service Commission, was nearing completion.

In order to make it possible for the Pulp and Paper Research Institute of Canada to meet the increasing demands of the industry for more advanced and diversified research essential to the maintenance of its competitive position in World markets, the Government, in November, 1963, undertook to provide \$3,000,000 over a three-year period to enlarge the Institute's research facilities at Pointe Claire, Quebec. The original Pointe Claire research building was constructed by the Federal Government in 1958 and leased to the Institute who pay all operating costs.

In the area of capital works development by the Department, satisfactory progress continued on the new forest research laboratory at Victoria, B.C., and

by the end of the fiscal year, the major structural features had been completed. Steps have also been initiated towards the establishment of a new research laboratory at Edmonton, Alberta, which will make it possible for the Department to consolidate its research activities in this area.

During March, 1964, the responsibilities for the administration of the Agricultural Rehabilitation and Development Act, the Maritime Marshland Rehabilitation Act and western feed grain freight and storage assistance were transferred from the Department of Agriculture to this Department.

The general activities of the Department are described in detail in the body of this Report. Several matters, however, appear worthy of special mention.

In February, 1964, an important event in the field of forest economics took place in Ottawa through the convening of a conference on lumber industry statistics attended by representatives of the Federal Government, including officials of this Department, and members of industry.

The study of Canadian timber resources and requirements, requested by the Food and Agriculture Organization for inclusion in a world summary being prepared for the next World Forestry Congress, continued throughout the year.

Payments to the provincial governments in 1963-64 of \$7,910,000 under the general forestry agreements, plus \$137,000 to New Brunswick for aerial spraying operations against the spruce budworm, and \$91,000 to Nova Scotia for stand-improvement work on Cape Breton Island brought to a total of \$45,900,000 federal contributions to the provinces under all shared-cost forestry agreements since 1951-52.

The Department's forest management responsibility continued on such military areas as Camps Borden, Gagetown and Petawawa. In response to a request from the Department of Justice, a forest survey and management report was started on the area of the Beaver Creek Correctional Camp, near Gravenhurst, Ontario. It is interesting to note that timber production on Federal lands reached a volume of 440,076 cunits during 1962-63, almost 50 per cent greater than in the previous year.

The public information work of the Department is developing satisfactorily. Generally speaking, activities in this area continued to increase rapidly over previous years. As an indication of rising interest in forestry matters throughout Canada, more than 150,000 copies of general and educational publications were distributed during the year in response to requests received plus over 216,000 copies of research and technical material. This high level of publication movement represents an increase of 150 per cent over the previous year.

In the field of forest management research, the production of high-quality wood continued to be the Department's primary objective. There is, however, growing evidence that mechanization of harvesting methods with attendant reductions in costs requires considerable modification of classic forestry procedures and the re-definition of optimum stand conditions. Since wide spacing and large tree diameters are essential to efficient mechanization, a greater proportion of the research effort is being directed towards the determination of the effects of spacing on tree growth for saw-timber and pulpwood production across Canada.

The securing of adequate regeneration is essential to forest management and can account for a large proportion of silvicultural costs. Maximum emphasis is, therefore, being given to research into silvicultural methods of ensuring regeneration at reasonable costs.

During the year, numerous older studies were concluded and the results published. Newer programs consistent with the requirements of modern mechanized forestry were expanded and the search for basic biological facts essential to the development of applied silvicultural methods was pressed forward.

Impetus to the Department's forest land research program has been added by ARDA's present requirements for land inventory and capability ratings. In co-operation with provincial forest authorities and other federal departments, pilot scale surveys of forest land are being made at a number of points. Forest soil research and watershed research, the latter on the East Slope of the Rocky Mountains in co-operation with provincial and other federal departments, are continuing satisfactorily.

In the vital area of forest fire control research, a project has been undertaken in the Maritime Provinces to develop means for providing and applying fire-danger forecasts at least three times daily. Further study of prescribed burning is going forward as is a study of the physical characteristics of lightning as a fire cause.

A Forest Fire Danger Manual was published including instructions for the establishing and operating of a forest fire weather station and information on the use of the danger rating system in general. A French edition of this manual is in preparation.

National forest insect and disease ground and aerial surveys during the year indicated that the very serious balsam woolly aphid problem in Newfoundland has not changed appreciably since 1962 so far as the main infestation boundaries are concerned. Some 20 per cent of the total forested area is infested and considerable mortality is resulting.

Spruce budworm populations have increased in central New Brunswick but declined in Quebec and northern Ontario. Severe infestations of larch sawfly occurred in Newfoundland, eastern Quebec, northern Manitoba, Saskatchewan, and Alberta and in parts of central British Columbia.

The 1962 outbreak of spruce bark beetle in central British Columbia is now considered the most serious ever recorded in that Province.

With increased understanding of the biology and behaviour of pests and of the complex interrelationships of mortality forces, biological control techniques may become more refined. Active projects are being directed against five major pests of foreign origin in the Atlantic Provinces, southern Ontario, and Manitoba. One of the most striking results so far has been the rapid build-up of a parasite of the winter moth in Nova Scotia.

In the Department's forest products research activities, developments in the machine-grading of lumber received special attention at both the Ottawa and Vancouver laboratories. A closely related area of research includes a technique devised for studying the vibrational properties of wood cross-arms with a view to developing non-destructive strength tests.

As a move towards clarification of strength-property standards for certain Canadian species exported for housing, successful discussions were concluded with the United States Forest Service and the United States Federal Housing Authority designating those areas of British Columbia in which the spruce is exclusively White Spruce.

The Vancouver laboratory completed during the year the initial phase of a study of the density of British Columbia-Alberta commercial species. The information finally resulting from these studies will be of great assistance in predicting strength properties of wood in relation to area of origin.

Research continued in the improvement of the fire-resistance properties of wood through the application of fire retardants. For shingles alone, over 125 different chemical formulations were tested.

Through the Industrial Liaison Service, the Department continued its program to assist industry and government through the presentation of special courses on improved sawmilling techniques, lumber seasoning, and log-quality evaluation.

The forest products research program for the year under review included 183 projects for the Ottawa Laboratory and 71 projects for the Vancouver Laboratory representing a continually increasing workload at both facilities.

In general, the Department ended the year still suffering somewhat from the austerity program originally initiated in mid-1962. Nonetheless, in several specific areas there was the distinct feeling that at last we were beginning to move towards the development of a department appropriate to playing its proper rôle in serving the research needs of the Canadian forest community.

Respectfully submitted,

L.-Z. ROUSSEAU,

Deputy Minister.

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DEPARTMENT OF FORESTRY ESTABLISHMENT DIRECTORY

Effective August 1964

DEPUTY MINISTER DR. L.-Z. ROUSSEAU
Executive Assistant R. F. HURLEY

Economics Division

DIRECTOR DR. D. A. WILSON

Administration Branch

DIRECTOR H. W. BEALL
Administrative Services R. R. J. Mulligan
Forest Management Section R. G. Ray
Information and Technical Services D. R. Monk
Personnel Services R. H. Dowdell
Provincial Agreements Section D. A. S. Dyer
Liaison Officers
Atlantic Provinces — Fredericton,
New Brunswick E. N. Doyle
Quebec — Sillery R. J. Mathieu
Ontario — Ottawa R. A. Haig
Manitoba-Saskatchewan —
Winnipeg, Manitoba Vacant
Alberta-British Columbia —
Victoria, British Columbia H. J. Johnson

Forest Research Branch

DIRECTOR DR. D. R. REDMOND
Associate Director (Forest Management
Research) A. Bickerstaff
Associate Director (Forest Fire
Research) J. C. Macleod
Petawawa Forest Experiment Station
(Chalk River, Ont.) Dr. I. C. M. Place

District Forest Officers

Newfoundland — St. John's	D. E. Nickerson
Maritimes — Fredericton, New Brunswick	H. D. Heaney
Quebec — Sillery	Dr. A. Linteau
Ontario — Richmond Hill	G. H. D. Bedell
Manitoba-Saskatchewan — Winnipeg, Manitoba	C. C. Thomson
Alberta—Calgary	J. L. McLenahan
British Columbia — Victoria	V. H. Phelps

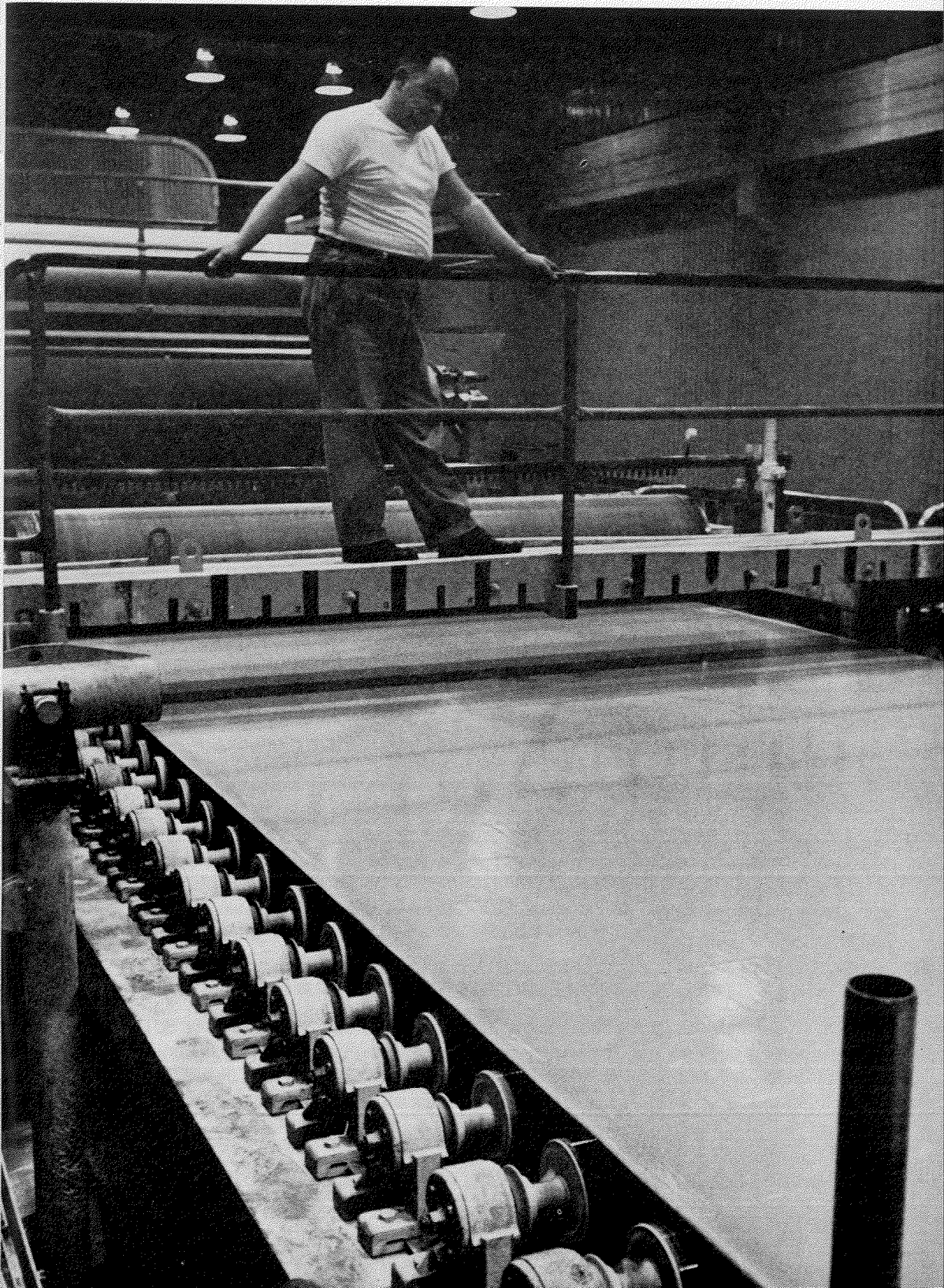
Forest Entomology and Pathology Branch

DIRECTOR	DR. M. L. PREBBLE
Associate Director (Entomology)	Dr. B. M. McGugan
Associate Director (Pathology)	Dr. V. J. Nordin
Assistant Director (Administration)	D. E. Gray
Co-ordinator, Forest Insect and Disease Survey	R. M. Prentice
Associate Co-ordinator	Dr. A. G. Davidson
Acting Head, Statistical Research Service	Dr. D. M. Brown
Officers-in-Charge of Laboratories	
Newfoundland — Corner Brook	Dr. W. J. Carroll
Maritime Provinces — Fredericton..	Dr. R. M. Belyea
Sub-Laboratory, Debert	F. G. Cuming
Quebec — Sillery	Dr. L. Daviault
Ontario (Entomology) — Sault Ste. Marie	W. A. Reeks
Ontario (Pathology) — Maple (Toronto)	Dr. L. T. White
Manitoba-Saskatchewan	
Winnipeg (Entomology)	Dr. F. E. Webb
Saskatoon (Pathology)	Dr. W. B. G. Denyer (acting)
Alberta-Calgary	Dr. G. P. Thomas
British Columbia — Victoria	R. R. Lejeune
Sub-Laboratory, Vernon	Dr. D. A. Ross
Section Heads	
Chemical Control Section—Ottawa	Dr. J. J. Fettes
Insect Pathology Research Institute — Sault Ste. Marie ..	Dr. J. M. Cameron
Cytology and Genetics Section — Sault Ste. Marie	Dr. S. G. Smith
Bioclimatology Section — Victoria..	Dr. W. G. Wellington

Forest Products Research Branch

DIRECTOR	DR. J. H. JENKINS
Assistant to the Director	J. A. Doyle
Laboratory Superintendents	
Ottawa Laboratory	Dr. H. Schwartz
Vancouver Laboratory	Dr. J. A. F. Gardner
Industrial Liaison Service	
Atlantic Provinces	Vacant
Quebec	L. G. Lessard
Ontario	J. D. Irwin
Manitoba-Saskatchewan	W. Thornber
Alberta	

ECONOMICS DIVISION



A fine paper making machine at Annacis Island.
(N.F.B. photograph)

ECONOMICS DIVISION

INTRODUCTION

The functions of the Economics Division are to advise the Department regarding the economic implications of present and proposed policies; to keep the economic position of Canada's forest industries under review; to keep in touch with forestry and forest products developments in other countries; and to conduct economic studies relating to forestry in Canada. Co-operation with international organizations concerned with forestry and in which Canada maintains membership includes the preparation of quarterly and annual statistical reports to the Food and Agriculture Organization of the United Nations and to the Organization for Economic Co-operation and Development. A National Forest Inventory is compiled annually from data supplied by the provincial governments and is published by the Dominion Bureau of Statistics in a series entitled "Canadian Forestry Statistics". This information is also used in Canada's submission to F.A.O. for the compilation of the World Forest Inventory every five years.

The Division continued to provide a departmental representative on the Interdepartmental Food and Agriculture Organization Committee and a member of the Division attended the 12th Session of the F.A.O. Conference in Rome.

ADVISORY COMMITTEE ON FORESTRY STATISTICS

The staff of the Division also continued to serve on the Interdepartmental Advisory Committee on Forestry Statistics. An important event in this field during the year was a conference of Federal Government and industry representatives on lumber industry statistics, held in Ottawa in February 1964.

CANADIAN TIMBER RESOURCES AND REQUIREMENTS

The main project being carried out in the Division during the year was a study of Canadian timber resources and requirements. The study consists of preparing projections of Canadian consumption of forest products, prospective supply of forest products and the potential exportable surplus from Canada. The study was requested by the Food and Agriculture Organization to provide information from Canada to be included in a world summary of forest resources and requirements being prepared for the next World Forestry Congress.

SAMPLING OF PRIMARY FOREST PRODUCTION ON PRIVATE LANDS

The sampling of forest production on private lands was continued by the Dominion Bureau of Statistics and the provinces concerned, but with less participation by Division staff than in previous years. Advice and assistance was provided in the sampling program in Nova Scotia.

ECONOMICS OF PLANTATIONS

Work on several specific projects was continued and the Division continued to provide information and advice to government and outside users.

Summary economic data of forestry and the forest industries of Canada are given in Tables 1 to 4 of the Appendix.

ADMINISTRATION BRANCH



*The Department's new Forest Research Laboratory
in Victoria, B.C., nears completion.*

ADMINISTRATION BRANCH

INTRODUCTION

The Administration Branch consists of five divisions: Provincial Agreements, Forest Management, Information and Technical Services, Personnel Services, and Administrative Services. The last two function in a supporting rôle to the Department as a whole. The first two are essentially operating divisions, being concerned respectively with the administration of shared-cost agreements with the provinces, and with forest surveys and other management functions on federally-administered lands.

The Information and Technical Services Division combines both servicing and operating activities. In the former rôle it provides library, editorial, drafting and art and graphic services required to implement various Departmental programs. It also conducts its own public information programs in forestry, and interprets the scientific work of the Department to the lay public and the forest community generally. The Chief of the division is directly responsible to the Deputy Minister on matters of information policy.

Payments to the provincial governments in 1963-64 of \$7,910,000 under the general forestry agreements, \$137,000 to New Brunswick for aerial spraying operations against the spruce budworm, and \$91,000 to Nova Scotia for stand-improvement work in the area of Cape Breton Island affected by the closure of coal mines, brought to a total of \$45.9 million the federal contributions to the provinces under all shared-cost forestry agreements since 1951-52. A renewal of the general agreements, with some changes designed to provide greater flexibility in the application of funds, was offered to the provinces for the fiscal year 1964-65.

With regard to forest management, reports were prepared on forest conditions in a number of Indian Reserves; work was continued on forest maps for the Northern Territories and Riding Mountain National Park; forest management activities were carried out on behalf of the Department of National Defence at various military training areas; and assistance was provided to the Department of Justice at the Beaver Creek Correctional Camp. The volume of wood reported as being cut on federal lands in 1962-63 was 440,000 units, or half as much again as in the previous fiscal year. Co-operation was continued with the External Aid Office with respect to forest surveys in other countries under technical assistance programs.

PROVINCIAL AGREEMENTS

The Provincial Agreements Section administers the federal-provincial forestry agreements which provide federal financial assistance to the provinces in five fields of forestry work. This assistance program was initiated in 1951 in the fields of forest inventory and reforestation; in 1957 forest fire protection was included and, in 1958, the construction of forest access roads. In 1962, new agreements were entered into with the provinces covering the same four fields

of work and also including stand-improvement operations. Under this agreement, which covered a two-year period terminating March 31, 1964, a total of \$7,910,000 of federal funds was provided annually and this sum was allocated among the provinces *pro rata* to their productive forest areas. A new agreement, incorporating minor revisions of the previous one, has recently been offered to all provinces. This will extend federal assistance to March 31, 1965.

FOREST INVENTORIES*

Under the terms of the present agreements, assistance is available to the provinces for reconnaissance, provincial, maintenance, and management inventories. The Federal Government pays half the cost of the approved inventory work being done in the seven participating provinces.

At the present time most provinces are involved in management surveys designed to provide information for relatively small areas in sufficient detail for the preparation of sustained-yield management plans. In addition, each province is maintaining its over-all provincial inventory by incorporating the detailed management data into the provincial summaries and also adjusting these summaries from growth and depletion records. In the fiscal year 1963-64, seven provinces made claims for forest inventory projects, and the total federal contribution was \$910,000.

REFORESTATION**

All provincial reforestation work carried out on Crown lands or public authority lands under the control of the Province for reforestation purposes, is sharable. The Federal Government reimburses the provinces to the extent of \$15.00 per thousand trees planted, \$4.00 per acre seeded with ground preparation, and \$2.00 per acre seeded without ground preparation. In addition, the Federal Government pays one-quarter of the cost of establishing and operating new nurseries. In the case of Prince Edward Island, 50 per cent of the cost of reforesting lands unsuitable for agriculture is contributed.

In 1963-64 payments were made to seven provinces for the planting of 41.7 million trees on 75,200 acres. Two provinces claimed assistance for seeding operations on 10,600 acres, and contributions were made to the costs of new nurseries in three provinces. Since 1951, the Federal Government has shared in the planting of nearly 220 million trees and the seeding of approximately 33,300 acres. Construction costs of 16 new nurseries have been shared under the agreements.

FOREST FIRE PREVENTION AND CONTROL*

In 1963-64 all provinces participated under the forest fire prevention and control section of the agreements. The Federal Government shares in provincial capital expenditures for the improvement of prevention, detection, and suppression facilities and also shares in the hiring of aircraft required for such purposes. It is interesting to note that since the implementation of fire prevention and control

* See Appendix, Table 5.

** See Appendix, Tables 5 and 6.

assistance in 1957 there has been a continued trend towards increased use of aircraft by the provinces. Several provinces have purchased aircraft and helicopters under the agreements to be used for patrol, transportation, and water-dropping purposes. Other provinces have adopted the policy of chartering aircraft during the fire season. Out of a total of \$2,219,400 paid to the provinces in 1963-1964, more than one-third was claimed for aircraft charter.

FOREST ACCESS PROJECTS*

Under the provisions of the agreement the provinces could not claim more than 60 per cent of their allotments for other than forest access projects. In effect, a province could claim its entire allotment for access projects but must claim a minimum of 40 per cent for this form of work if it wished to claim its entire share of the federal funds. The requirements for improved access vary between regions; some provinces have not met the minimum requirement while others have far exceeded it.

In 1963-64, all provinces carried out forest access projects, and a total of \$3,572,000 was contributed by the Federal Government, representing nearly 50 per cent of provincial expenditures. Since 1958, when forest access projects first became sharable, federal contributions have totalled more than \$15.9 million. Work accomplished includes the clearing of 3,308 miles, the grading of 2,598 miles and the gravelling of 1,432 miles of road. In addition, 20 airstrips have been constructed. All these projects provide more rapid access for fire suppression; some also open hitherto inaccessible areas for extraction purposes or for reforestation and stand-improvement operations.

STAND-IMPROVEMENT OPERATIONS*

Seven provinces, two for the first time, claimed under the stand-improvement section of the agreements. This form of work is 50 per cent sharable and the total federal contribution amounted to \$542,000. Sharable projects include cleaning, thinning, pruning, and release operations designed to promote increased growth of a stand or improve individual tree quality.

In 1963-64, the Federal Government continued to share, under a special agreement, in a program of stand improvement in Nova Scotia designed to provide employment for miners in Cape Breton Island affected by the closure of several coal mines. Under this special agreement, the Federal Government contributed \$91,000 in 1963-64, and employment was provided for approximately 80 men.

AERIAL SPRAYING OPERATIONS—NEW BRUNSWICK**

To prevent widespread mortality in forest stands, a spraying operation against the spruce budworm was again carried out in 1963. This program was initially planned to cover about 400,000 acres, however, when the operation was underway, an additional area of 229,000 acres was found to contain a dangerously high insect population. This area was added to the spray program.

* See Appendix, Table 5.

** See Appendix, Table 7.

All spraying operations were conducted by a provincial Crown corporation—Forest Protection Limited. The Federal Government contributed one-third of the cost and the remainder was shared equally between the province and industry. The federal contribution in 1963-64 amounted to \$137,000.

Post-spray surveys in 1963 indicated that areas totalling 2,000,000 acres have residual populations sufficient to cause severe defoliation in 1964. It is proposed to continue spraying operation on this area in 1964.

FOREST MANAGEMENT

FOREST INVENTORY IN THE TERRITORIES

There were no forest surveys in the Territories during the fiscal year 1963-64.

Work was continued on the 1:250,000 scale forest cover mapping of the Yukon Territory and an officer was seconded to the Department of Northern Affairs and National Resources for two months to replace the Superintendent of Forestry, Whitehorse, Yukon Territory who had been seriously injured in an accident.

Preliminary forest cover maps were prepared for approximately 1,200 square miles of the alluvial flats of the Peel and Arctic Red Rivers and of the southern portion of the Mackenzie River Delta. This is to be cruised by a small field party during the summer of 1964.

FOREST INVENTORY—NATIONAL PARKS

The revision of the 40 township maps of the Riding Mountain National Park was completed and 7 new maps were prepared of parts of the Park to show the extent of the 1961 fires.

A close check was made of the actual cut returns and the estimated timber volumes from logging of 6,055 acres of the Peace River Delta, Wood Buffalo National Park. The estimates proved to be 6% low after the company-reported cull of 20% had been subtracted from the original figures.

FOREST INVENTORY—INDIAN RESERVES

Reports were prepared for the Shubenacadie Indian Reserve #13 in Nova Scotia, the Osnaburg Indian Reserves #63A and 63B, Mountbatten Indian Reserve #76A in Ontario and areas adjoining the Wabasca Indian Reserve #166 in Alberta. Reports are underway on 18 other Indian reserves.

Preliminary forest cover maps were prepared for 9 additional reserves in Alberta and Saskatchewan totalling 289 square miles in area. Field sampling of the forested portions of these reserves is to be done during the summer of 1964.

FOREST MANAGEMENT—MILITARY AREAS

Camp Borden

Cutting in Camp Borden has been considerably heavier than normal during the past two years. The threat of the Dutch elm disease has resulted in heavy cutting of this species and a selective cut, largely of overmature pine and poplar,

was made on 480 acres. In addition, 46 acres of 30-year old pine plantation was thinned and 22 acres of deformed Scots pine plantation was clear cut. These operations produced 500,000 board feet of lumber, 840 cords of pulpwood, 1,430 short cords (16" bolts) of boltwood and 313 poles. Stumpage dues of \$9,000 were collected. Almost all cutting is done on a selective basis and all brush is burnt, lopped or scattered.

Camp Gagetown

The 430 square miles of Camp Gagetown, New Brunswick were forest cover mapped at a scale of 1 inch to 20 chains and a small party measured 760 field plots as the basis for a timber estimate. 7 of the 17 preliminary forest cover maps have been revised. New road construction on the Camp area amounted to 27.3 miles and 19.2 miles of older roads were improved for truck hauling. There were 7 grass fires but alert work prevented these spreading into the forested sections.

The total timber cut on the camp amounted to 12,260 cunits. This included 1,374,000 board feet of saw timber, 8,687 cords of pulpwood, 2,207 cords of fuelwood and 2,502 poles. In addition, 3 grazing and 5 hay permits were issued. Total sales amounted to \$52,342.

Camp Petawawa

In order to increase the target area for artillery practice, the clear cutting of 6,313 acres was proposed. The detailed forest survey of the proposed blocks indicated 33,000,000 foot board measure of softwoods, of which 30,400,000 were white and red pine, and 12,300,000 board feet of hardwood species. The smaller timber, or trees less than 10 inches in diameter totalled 29,840 cords of softwoods and 25,000 cords of hardwoods. This smaller timber could be sold either as poles or pulpwood. Timber disposal was carried out by the Forest Research Branch.

Bathurst Rifle Range

253 cords of poplar pulpwood and 172 cords of spruce were cut.

McGivney Ordnance Depot

Salvage operations following severe hurricane damage were delayed by unusually heavy snowstorms. Only 70 cords of wood had been recovered by 31 March but the operations are continuing.

FOREST MANAGEMENT—DEPARTMENT OF JUSTICE

In 1961 a low security prison camp near Gravenhurst, Ontario, the Beaver Creek Correctional Camp, was opened by the Federal Department of Justice. A large part of the camp's 324 acres is forested and the Department of Forestry was requested to prepare a program that would not only improve the forest but provide instructive employment for the inmates. Accordingly a forest survey was made and a forest management report is underway. Periodic visits were made to the camp to assist in its implementation.

TIMBER PRODUCTION ON FEDERAL LANDS

The volume of wood cut on federal lands during the fiscal year 1962-63 was 440,076 cunits or almost 50% greater than during 1961-62. Indian reserves provided 75% of this amount. 39% of the total was saw and veneer timber, mostly from British Columbia and Alberta. 14%, or 69,609 cords was pulpwood, largely from Ontario, 34% was fuelwood and 13% roundwood.

OVERSEAS SURVEYS

At the request of the External Aid Office, the Chief of the Forest Management Section visited the Malay Peninsula in order to ascertain the forest resource potential of that area.

The Kenya forest survey program is progressing favourably. The Department of Forestry acts in a consultant rôle and the actual work is being done by a private agency. 1,600 square miles of forest air-photo interpretation has been field checked and compilation is complete for 500 square miles. The field crew has been working as a completely African unit since January, 1964, though its work is checked by a supervisor. It is expected that the African staff will be able to handle all phases of reconnaissance forest surveys, including the air-photo interpretation and cruise line selection by the end of June 1964.

INFORMATION AND TECHNICAL SERVICES DIVISION

The activities of the Information and Technical Services Division were generally expanded during the year. The easing of staff hiring restrictions permitted recruitment to be undertaken to fill several of the positions that were planned when the Division was established in 1961-62, but which remained unstaffed. An Art and Graphics Section was formed late in the year with the appointment of a Section Head. Steps were taken also to recruit other staff for this unit. The Division consists of five sections: Public Information, Editorial, Library, Mapping and Drafting, and Art and Graphics.

PUBLIC INFORMATION

Press, radio and television liaison included the issuing of 40 formal press releases on such subjects as the Federal-Provincial Forest Ministers' Conference, the meetings of the North American Forestry Commission held in Ottawa, federal-provincial forestry agreements, forest spraying, forest fire statistics, research on forest fires and silviculture, the industrial liaison service and other phases of Departmental activity. Wide coverage was afforded this material in the mass communication media and the forestry trade press.

Assistance was given newspaper and news agency writers preparing material on forestry, and arrangements were made for senior members of the Department to appear on various local or network television programs. A one-minute television clip on forest fire prevention was distributed across Canada to television stations and theatre outlets. The film was shown on nearly 2,000 occasions on CBC and

private television. Production of another forest fire prevention clip for television distribution in 1964 was completed during the year.

More than 150,000 copies of general and educational publications on forestry were distributed in response to requests received, and through co-operation with provincial departments of forest and education, and forestry associations in all the provinces. Distribution of research and technical publications exceeded 100,000 copies. The movement of publications showed a 150 per cent increase over 1962-63.

A departmental film library was organized, and showings with a total attendance of more than 8,000 were held during the year under the sponsorship of the Department's field establishments, provincial departments, forestry and forest ranger schools, and other organizations.

Re-organization of the Departmental Photo Library was nearly completed during the year. The active library now consists of some 4,000 black and white photographs, and 2,000 colour transparencies. A new index card system was introduced for easy reference in locating photographs.

A bilingual exhibit, "CANADA—A FOREST NATION" was produced and put on display at the Central Canada Exhibition in Ottawa, the Annual Meeting of the Canadian Institute of Forestry in Halifax, and the Canadian National Sportsmen's Show in Toronto.

As in previous years, 15,000 forest fire prevention posters were produced from the prize-winning design in the school contest sponsored by the Canadian Forestry Association, and distributed to post offices across Canada in co-operation with the Post Office Department.

Co-operation was extended to the Canadian Wood Development Council in connection with the promotion of National Forest Products Week, and to the Canadian Forestry Association regarding National Forest Conservation Week. Liaison and co-operation were maintained with a number of federal departments and agencies in the development of material and public information programs with forestry implications.

Some 4,600 mail requests for publications and information on forestry were received and answered during the year, an increase of almost 1,000 over the previous year.

DEPARTMENTAL LIBRARY

The Departmental Library facilities consist of a central unit in Ottawa of about 60,000 volumes, and 12 other units serving field establishments across Canada.

A Library Committee was formed during the year. An increased exchange of publications between adjacent departmental establishments has been developed, and a central union catalogue of all Departmental library holdings is nearing completion.

MAPPING AND DRAFTING

During the year work was completed on the Forest Vegetation Map of Labrador and a reprinted edition of the Forest Classification map of Canada, both of which were lithographed in colour. Work commenced on a new series of forest inventory maps of the Yukon and Northwest Territories to be produced

by colour lithography on a scale of 1:250,000 (4 miles to the inch). Work continued on forest inventory maps of the Upper Liard, Slave and Mackenzie River areas, Riding Mountain National Park and military camps and Indian reserves throughout Canada, as well as External Aid maps for Dominica and Malaysia.

Large numbers of organization, personnel, functional and statistical charts were produced as well as departmental forms, area grids, publication covers and illustrations. Displays, crests and special items were designed and produced for the North American Forestry Commission (FAO) Conference held in Ottawa. The reproduction unit of the Section handled some 500 photo-reproduction orders during the year.

EDITORIAL

The Editorial Section handled 140 manuscripts of scientific and lay nature. These manuscripts were edited and translations of summaries or abstracts obtained (complete translations where required). Illustrations for the manuscripts were obtained and co-ordinated, and various stages of production through the Department of Public Printing and Stationery or trade and scientific journals were supervised and co-ordinated. General improvement of publication layout and cover design was effected.

The breakdown of the work handled by the Section is: Articles for publication in journals, 75; articles for publication by the Department, 65; reprints of existing publications, 7.

Table 10 in the Appendix indicates the volume and diversity of publication activity during 1963-64.

ART AND GRAPHICS

The Art and Graphics Section, established late in the fiscal year with the appointment of a Section Head, soon began to serve in the areas of art production for publications and publicity use; poster, display and exhibit design and technical information in the graphic arts. At the same time, the process of organizing the new section, such as staff recruiting, equipment purchase and darkroom planning, was initiated. The Section is designed to serve the demands for scientific art and photography, and to become a central source for information on art production and scientific photography and for the co-ordination of these activities at laboratories and field establishments.

PERSONNEL SERVICES

Personnel Services is responsible for advising and assisting in the formulation and administration of personnel policies, regulations, and procedures in consultation with Departmental officers, to ensure the adequacy of recruitment, promotion and reclassification programs and to administer staff pay, leave, attendance, and employee benefits.

During the fiscal year 71 appointments were made, 18 of which were professional appointments. Of the 79 separations, 20 were in the professional classes. There were 164 promotions made, 82 of which were professionals.

The Department's establishment consisted of 1,108 full-time positions and 411 seasonal positions for a total of 1,519 positions. The continued austerity requirements imposed in June 1962 restricted the total full-time strength to 91.5% or 1,013 employees at the close of the fiscal year.

ADMINISTRATIVE SERVICES

The Administrative Services division is responsible for the development, co-ordination and direction of the financial, purchasing and property management activities and procedures as well as the general administration services required throughout the Department. Its main rôle is the provision of the services to the research and operating personnel both at headquarters and in field establishments, and the development of administrative policies and procedures on a consistent departmental basis.

During the year improved policies and procedures were introduced for departmental equipment and stores. Instructions were also promulgated to facilitate Departmental pre-audit of travelling expenses. Administrative improvements were also effected for signing authorities and related matters.

Under a Chief of Administrative Services the division is organized on a functional basis in four sections:

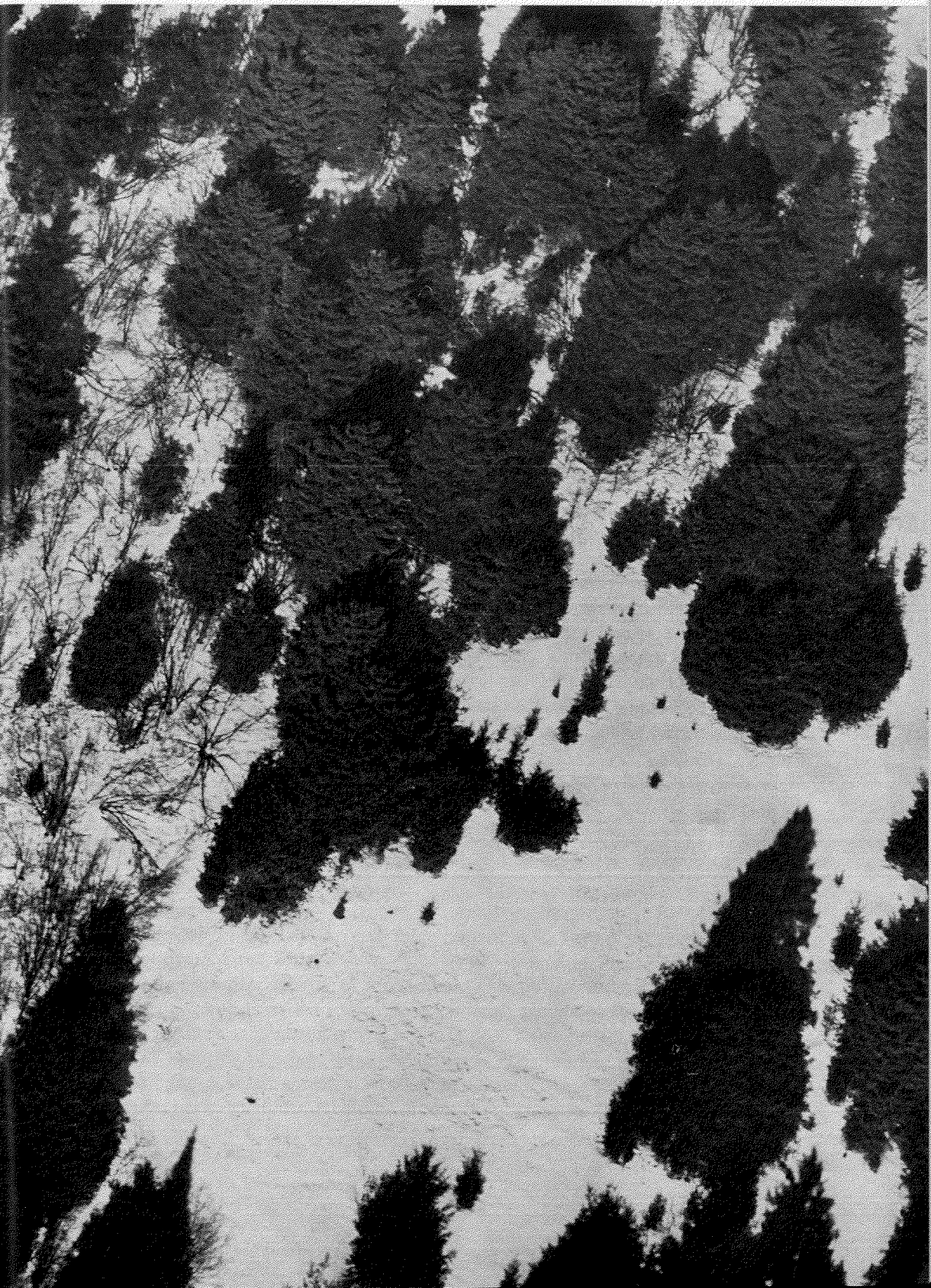
1. *Financial Services*: responsible for the administration and co-ordination of the Department's financial operations covering such areas as development and implementation of financial policies, estimates, budgetary control and revenues, management accounting and financial reports, and administration of regulations having financial content. The section provides day-to-day liaison with the staff of the Treasury Board and Chief Treasury Office.

2. *Property Management*: responsible for policy procedures and assistance in all aspects of the efficient utilization of existing Departmental accommodation and facilities at Headquarters and in the field, and for co-ordination of Departmental planning and follow-up for the construction and acquisition of new facilities. The section provides liaison with the Department of Public Works, especially for major construction and renovation projects, and carries the responsibility for normal maintenance.

3. *Purchasing*: responsible for policies, procedures and assistance in all purchasing and procurement activities at Headquarters and in field establishments. During the year the unit was assigned responsibility for equipment and stores matters and for assisting field officers in the management of their equipment and stores.

4. *General Administration*: responsible for the normal administration and general "housekeeping" associated with departmental activities, including the Central Registry, mail, messenger and other communication services, stenographic services, administrative co-ordination of Parliamentary Returns, travel arrangements, motor vehicles operation, etc. Towards the end of the period under report recruitment of a Chief of Records enabled a thorough review of Departmental records management and practices to be commenced.

FOREST RESEARCH BRANCH



Large scale oblique air photos hold potential for refining forest inventory methods.

FOREST RESEARCH BRANCH

INTRODUCTION

The research conducted by this Branch contributes to the development of Canadian forestry in two ways: firstly, by providing basic information on the characteristic occurrence, growth, development and behaviour of tree species throughout the wide range of forest types and environmental conditions in the various forest regions of Canada; and secondly, by developing and testing new or improved methods for use in forest management and forest fire control. Results are made available through publications, instructions, training, technical assistance, demonstration of new or improved methods and practices. Many of the studies are conducted in co-operation with other Federal departments, provincial forest authorities, other research agencies, universities and industrial companies.

The research program of the Branch is conducted through seven district offices located at Victoria, British Columbia; Calgary, Alberta; Winnipeg, Manitoba; Richmond Hill, Ontario; Quebec, Quebec; Fredericton, New Brunswick; and St. John's, Newfoundland. Most of the staff of the Branch are located at these district offices and at the Petawawa Forest Experiment Station, Chalk River, Ontario. In addition, a group of Research Officers at Ottawa deals with the specialized aspects of research in forest fire and in forest inventories.

During the past year there was no change in the Forest Research Branch establishment that includes, on a full-time basis, 110 research officers assisted by 72 technicians and a supporting administrative, clerical, labour and maintenance staff of 102. In addition, there was a seasonal staff of 191 composed of students, technicians and labourers, to assist in various aspects of the field program and maintenance.

This Report deals only with some of the more important highlights of the research program for 1963-64. Details of the program may be found in the Annual Report of the Forest Research Branch for the year ending March 31, 1964.

SILVICULTURE AND MANAGEMENT

Research in silviculture and management is designed to provide the basic information required for the most efficient production of high quality wood while maintaining the productivity of forest land. This objective requires the recognition of silvicultural costs as a significant factor in all phases of forestry and stimulates interest in those techniques which promise cost reductions.

The securing of adequate regeneration is essential to forest management and accounts for a large proportion of silvicultural costs. Maximum emphasis has therefore been given to methods of ensuring regeneration at reasonable cost.

Seedbed preparation, both mechanically and through controlled burning, shows promise of giving economical regeneration when appropriately combined with natural or artificial seeding. Seedbed preparation is usually a general requirement for regeneration success, and modifications in treatment are needed for differences in site condition. The study of environmental characteristics and required treatment methods involving the development of seed supply, scarification, prescribed burning, and brush control, are the focal points of the Department's silvicultural program.

The costs of treatments required to secure regeneration from seed on some sites are excessive, and more economical results can be achieved through planting or seeding. Attention has therefore been devoted to quality of planting stock, methods of seeding and planting, and subsequent plantation treatment to efficiently regenerate these problem areas. "Bullet" planting of young seedlings in containers offers an intermediate cost treatment of great potential value. The method lends itself to mechanization at all levels of seedling production and outplanting and also promises to extend the normally short planting season, thus offering management an opportunity for integrating the regeneration program with other phases of silvicultural activity. To develop the full potential of this planting method, research workers of the Department are investigating various aspects of rearing and planting small seedlings grown from seed in containers.

While the production of high quality wood continues to be the primary objective, there is growing evidence that mechanization of harvesting methods with attendant reductions in costs requires considerable modification of classic forestry procedures and the re-definition of optimum stand conditions. Since wide spacing and large tree diameters are essential to efficient mechanization, a greater proportion of the research effort is being directed toward the determination of the effects of spacing on tree growth.

During the year numerous older studies were concluded and the results published. Newer programs consistent with the requirements of modern mechanized forestry were expanded and the search for basic biological facts essential to the development of applied silvicultural methods was continued. A total of 33 research officers were engaged either full or part time on 160 active silvicultural projects, which resulted in 86 mimeographed reports and 32 publications.

FOREST MENSURATION AND INVENTORY

Forest mensuration involving the measurement of tree and stand volume, the factors influencing tree and stand growth, and the determination of growing stock levels is an essential part of forest management research. During the year increased attention was given to the determination of tree volume functions and sampling methods for the calculation of stand volume. Computer analysis of various functions describing the growth of individual trees was conducted in an effort to evaluate the external factors influencing tree growth. These studies were carried out on western white spruce, trembling aspen, lodgepole pine and balsam fir. The effect of stand density on dry matter production of balsam fir was investigated by stand dissection techniques. Prediction equations for the component

elements of dry matter including foliage, twigs, branches, bark and stem were developed. Studies on the effect of spacing on tree growth were initiated for lodgepole pine and white spruce.

Research on the use of large-scale 70 mm. format photography was continued. Panchromatic prints enlarged 4 times to a scale of about 25 feet to the inch were used to test the accuracy with which the height, crown size and stem diameter of individual trees could be measured on the photographs. The accuracy of measurements on plots established on the photographs was also checked in the field. Analyses of how accurately the photo measurements predict tree and stand volume continued. Projects on the determination of photographic scale dealt with a refinement of the radial line plot method and the relative merits of various types and sizes of photo sample plots.

The results of two studies on point sampling were published; one was an attempt to find the best basal area factor, the other was an appraisal of the value of point samples in the maintenance of a forest inventory. Further tests were made on the "Moosehorn", an instrument designed to measure per cent crown closure of forest stands. An instrument called a transect area-meter was developed and found to be faster and yield more accurate results than the "dot grid" method of planimetry forest type maps.

Improved data-processing facilities have led to the increased use of mathematical analysis, particularly in the fields of tree volume equations and stand growth determinations. Such techniques have greatly expanded the number of causative factors which can be included in growth analysis. A total of 16 research officers were engaged either full or part time on 43 active projects on mensurational problems. Twenty-two mimeographed reports were prepared and seven publications were issued.

TREE BIOLOGY

A program of fundamental research on the biology of tree species supports studies of the practical problems of forest regeneration and growth. Much of the work concerns three critical segments of the life cycle of the tree—flowering and seed production, dissemination and germination of the seed, establishment and early growth of the seedling.

Projects on the physiology and biochemistry of cone production in Douglas fir and spruce were continued in an attempt to find the key mechanism that switches bud primordia toward production of flowers or toward vegetative shoots. Among the aspects of tree metabolism investigated were carbohydrate and amino acid reserves, growth hormones, and respiration rates. Observations of actual cone and seed crops of spruces and pines in various parts of the country have helped to clarify the cycles of production, and germination tests have shown the importance at this stage of specific temperature regimes and of fungicidal treatments. Long-term studies were initiated on a 5-acre experimental area to trace the biological effects of nitrogen fertilizer on Douglas fir.

Problems of growth and survival of young trees were clarified through a wide range of studies that related physiological processes, anatomy and morphogenesis to the effective environmental factors light, heat, moisture and nutrients. For

example, a short "light break" at midnight increased fir growth, experimental control of soil moisture identified the relative needs of planted seedlings, and the nitrogen content of spruce foliage was correlated with growth rate. Ecological research now embraces many hardwood species, including poplar, maple and birch, as well as the common conifers, and studies of rooting as a key to early survival have been expanded.

Tree improvement work is concentrated in Ontario (at the Petawawa Forest Experiment Station) and in the Maritime Provinces (at Acadia Forest Experiment Station) but with co-operators in all the Districts. The program is chiefly directed to the study, selection and breeding of good quality spruce and two-needled pines for important forest producing areas in eastern Canada. Extensive provenance plantations of jack pine, red pine, native spruces and Norway spruce provide materials for the development of tree breeding techniques and hybridization trials. Some results in this year were: the selection of weevil-resistant Norway spruce, the further testing of a rapid growing red spruce-black spruce hybrid, and the examination from the genetic viewpoint of various native and exotic true firs. Taxonomic studies in western Canada identified some members of two hybrid swarms, one embracing the British Columbia spruces and the other the Alberta poplars.

FORESTS AND FOREST LAND

The basic resource from which forests spring is the land; forest management necessitates an inventory of the land resource and study of its potentialities for production. At present the requirements of the ARDA program for land inventory and capability ratings add impetus to the forest land research program. In co-operation with provincial forestry organizations and other Federal departments, pilot-scale surveys of forest land are being made in a number of the provinces. The preparation of landtype maps has been continued as a basis for land-use planning and management.

Land form, soil and vegetation relationships were investigated in assessing plantation sites of southwestern Nova Scotia. In Quebec a pilot-scale study of 200 square miles of forest land neared completion; reliance has been placed on the interpretation from aerial photographs of the landtypes and plant communities. In Manitoba a site classification developed in the south east was extended to the Interlake region. Co-operative work continued with the British Columbia Forest Service and the Department of Agriculture in Interior British Columbia, developing suitable methods for inventory and for the rating of use-capability, trafficability, and windthrow hazard of forest land.

Research in the important field of forest soils has been stimulated by public interest in the reforestation of abandoned farmland and in plantation management. Studies of the long-term effects of trees on soils continued, as have examinations of the effects of fertilization regimes on conifer seedlings in nurseries. Special studies have been made of the uptake of available nutrients by entire stands of trees. The acidity of soils (pH), an indicator of soil quality, received attention in two separate studies.

Watershed research on the east slopes of the Rocky Mountains, embracing the headwaters of the Saskatchewan River, is carried on co-operatively between the Forest Research Branch and other Federal and provincial government agencies. The program is designed to safeguard the water resources of the Prairie Provinces. Research in the Marmot Creek Experimental Basin in the Kananaskis River valley was furthered with the preparation of a map of the forest and alpine vegetation sites. Additional work included studies of rainfall interception, streamflow, soil moisture storage, soil temperature, snow accumulation and melt, and soil erosion. Plans are underway to institute gauged basin studies in aspen and lodgepole pine forest areas in other experimental basins. Co-ordination of the joint program is proceeding smoothly and requests have been received from several provinces for an extension to them of similar work.

FOREST FIRE PREVENTION AND CONTROL

Adequate protection of forests against fire is essential not only to conserve the resource, but also to encourage good forest management by providing security against destruction of improvements and other investments made in the forests by governments and industries.

In the Maritime Provinces, a project has been undertaken to develop means for providing and applying fire danger forecasts, at least three times daily, for specific forest regions. In addition, local television and radio stations and the press will be provided with up-to-the-minute fire weather information that will apply specifically to the localities they cover.

A Forest Fire Danger Manual was published. This bulletin includes instructions for the establishment and operation of forest fire weather stations, directions for using the Forest Fire Danger and Hazard Tables issued by the Department, and information on the uses of the danger rating system in general.

Several prescribed burns were conducted or attended by fire research officers in Newfoundland, Ontario, Alberta and British Columbia. These investigations served the two-fold purpose of determining how prescribed fires should be conducted and how the intensity or severity of a fire should be measured. Present indications are that the simplest way to describe a forest fire is in terms of B.T.U.'s per second per foot of fire front; a study is being made to determine simple parameters for measuring, or objectively estimating, this heat production.

A study of the physical characteristics of lightning as a cause of forest fires was continued and the associated field work, a questionnaire survey made through co-operation of fire control organizations, was completed.

Additional investigations concerning the flammability of Christmas trees were completed and a very popular booklet on the subject was distributed just prior to the Christmas season.

In the latest issue of the annual report "Forest Fire Losses in Canada", for the year 1962, the authors included an analysis of the rising costs of forest fire control in Canada and an analysis of man-caused fires.

FOREST ENTOMOLOGY
AND PATHOLOGY BRANCH



*Larvae of pine sawfly killed by a virus sprayed
from an aircraft on a pine plantation in eastern
Canada.*

FOREST ENTOMOLOGY AND PATHOLOGY BRANCH

INTRODUCTION

The Forest Entomology and Pathology Branch conducts forest insect and disease research and surveys throughout Canada. The Branch also provides technical advisory services to provincial forestry departments, industrial firms and associations, private owners and other agencies concerned with control of insects and diseases affecting forests, woodlots and shade trees. Details of the Branch program may be found in the Annual Report of the Forest Entomology and Pathology Branch, for the year ending March 31, 1964.

The closely inter-related activities of the Branch are performed by specially trained staff at regional laboratories located at Corner Brook, Newfoundland; Debert, Nova Scotia; Fredericton, New Brunswick; Quebec, Quebec; Maple (Toronto) and Sault Ste. Marie, Ontario; Winnipeg, Manitoba; Saskatoon, Saskatchewan; Calgary, Alberta; and Vernon and Victoria, British Columbia. In addition to the work of the regional laboratories, investigations in cytology and genetics, bioclimatology, and chemical control of wide general interest and applicability, are carried out by three subject-matter sections located at Sault Ste. Marie, Victoria and Ottawa, respectively. Fundamental studies in insect pathology are carried out by the Insect Pathology Research Institute, at Sault Ste. Marie, which also co-operates with regional laboratories in problems relating to the use of insect pathogens as biological control agents. The Statistical Research Service collaborates with all three research branches of the Department in the application of mathematics, statistics and electronic computer techniques to the solution of complex research problems. The program of the Branch is directed and co-ordinated on a national scale by Branch Headquarters in Ottawa.

The establishment of the Branch in the fiscal year 1963-64 comprised 186 professional employees, 294 other year-round employees, and 166 seasonals, for a total of 646. Headquarters functions were performed by seven professional and eight other year-round employees. Under the research fellowship program sponsored by the National Research Council, two postdoctorate fellows were associated with the Forest Entomology and Pathology Branch in the fiscal year 1963-64. One Fellow was engaged in population dynamics research at the Fredericton laboratory, the other in studies of tree rusts at the Victoria laboratory.

The work programs undertaken by the Branch are based on careful reviews of forest insect and disease problems in the different regions of Canada, continuing appraisals of the need for additional information to be obtained through surveys and research, and periodic consultations with provincial forestry departments, industry, and other Federal departments and agencies.

Because of the affinities between entomological and pathological problems in Forestry and in Agriculture, members of the Forest Entomology and Pathology Branch maintained close contacts with their counterparts in the Department of Agriculture, especially in relation to taxonomic services provided by institutes of the Research Branch of the latter department, and in relation to biological control of insect pests through the introduction of parasites and predators. In the field of chemical control, the Branch continued its collaboration with the Fisheries Department, the Fisheries Research Board and the Canadian Wildlife Service, through the Interdepartmental Committee on Forest Spraying Operations, which reviews forest insect infestations requiring direct control action, promotes research projects aimed at discovery of control measures less hazardous to fish and wildlife, and recommends the adoption of results of such research in large-scale control operations. Increased co-operation on forest insect and disease problems on a continental scale is one of the objectives of the newly established North American Forestry Commission, operating under the aegis of the Food and Agriculture Organization. A Working Group on Forest Insects and Diseases was set up in 1961 with membership drawn from Canada, the United States and Mexico, to arrange for greater exchange of information and for co-operative effort, wherever possible, in research, control, and quarantine procedures. Two senior officers of the Forest Entomology and Pathology Branch participated in the activities of the Working Group, which met in Mexico City in November of 1963. In the realm of wider international co-operation on forest insect and disease problems, members of Branch Headquarters participated in the work of two study groups set up by the International Union of Forest Research Organizations aimed at reducing hazard from insects and tree diseases involved in the movement of tree species among different continents.

FOREST INSECT AND DISEASE SURVEY

The Forest Insect and Disease Survey processed approximately 27,000 insect and 8,000 disease collections at regional survey centres across Canada in 1963. To complement the biological data derived from the collections, ground and aerial surveys were carried out to define outbreak areas and to assess the degree of hazard in cases where control measures might be warranted.

Ground and aerial surveys of the balsam woolly aphid in Newfoundland revealed that there were no appreciable changes in the main infestation boundaries in 1963. However the outbreak, which covers about 20 per cent of the forested area, is causing considerable mortality and is recognized as the most serious problem of the region.

An upsurge of spruce budworm populations, attributed to unusually high survival of overwintering larvae, was recorded in central New Brunswick. In contrast, budworm numbers in Quebec and northwestern Ontario again declined and have now reached the lowest levels recorded in the past decade. Infestations continued in northern Manitoba and Saskatchewan, in the Northwest Territories, and in British Columbia.

Moderate to severe defoliation of trembling aspen and other deciduous hosts by the forest tent caterpillar continued over an area of 140,000 square miles

extending from northwestern Ontario to British Columbia. Populations were substantially reduced in many areas because of unseasonal spring weather and the increasing effectiveness of parasites and disease. A further reduction is forecast for 1964 although severe defoliation may again occur in some regions.

Severe infestations of the larch sawfly occurred in Newfoundland, eastern Quebec, northern Manitoba, Saskatchewan, and Alberta, and in parts of central British Columbia.

The outbreak of the spruce bark beetle that developed in central British Columbia in 1962 is now considered the most serious ever recorded in that province. A substantial increase in damage by the Douglas-fir beetle and the mountain pine beetle was noted in 1963.

The Dutch elm disease again attracted considerable attention over an extensive area in eastern Canada and continues to cause serious losses in previously infected areas. Significant changes in the known limits of the disease were recorded in New Brunswick with minor extensions in Ontario and Quebec.

Poria root rot, which for some years has been recognized as one of the most serious disease problems of Douglas-fir in coastal British Columbia, was found to be widespread and damaging in the transition zone of the Interior.

Extremes of weather again caused serious damage to forest trees in many regions of Canada. Mortality attributed to the 1961 drought continued in trembling aspen and balsam fir stands in Manitoba and Saskatchewan.

RESEARCH PROGRAM

Programs of basic research on forest insect and disease problems are essential to establish adequate foundations for effective preventive or control measures. A very substantial part of these programs is conducted at the regional laboratories, where a combination of research, experimentation, and surveys is prerequisite to sound consultative and advisory services on control programs undertaken by the provinces and industry. As noted earlier, research in cytology and genetics, insect pathology, bioclimatology, chemical control, and mathematical statistics and electronic computing, is conducted by subject-matter sections. Physiological studies are carried out to provide a fuller understanding of the physical and biotic requirements of pest species, and their interrelationships with their host trees. Studies of the population dynamics of certain pest species are being continued to discover the causes of population fluctuations from generation to generation. Investigations of the importance of native and introduced parasites and predators, climatic influences, characteristics of the forest stand, and of insecticides, as factors affecting regulation of pest populations, are particularly revealing when they are incorporated as integral segments in more comprehensive studies of the population dynamics of the pest species.

The results of these programs of research are made available in Departmental reports and publications, and in notes and papers published in technical and trade journals. They are also reviewed in conferences for the exchange of new information, and serve as the basis for workshop discussions on control programs. A few of the highlights are brought out in the following paragraphs on important insect and disease problems.

SPRUCE BUDWORM

Results of long-term studies of the population dynamics of the budworm during epidemics have been published, and investigations are being continued during the endemic phase. Concurrently, surveys, population estimations, and hazard appraisals are being conducted by staff of the Fredericton laboratory as support services for the continuing program for the chemical control of budworm infestations in central New Brunswick. In 1963, about 668,000 acres of infested forest were sprayed from the air, including 22,100 acres sprayed with Phosphamidon and the remainder with DDT. There was a resurgence of populations in areas not sprayed in 1963, and also in areas added to the spray plan late in the 1963 program. The consequence is that a larger area of forest in hazardous condition will require treatment in 1964.

DECAYS AND ROOT ROTTS

Decays and root rots are the most important cause of disease loss in Canada accounting for an estimated annual loss in excess of 800 million cubic feet.

Earlier extensive Branch surveys of decay incidence in important timber species have largely been taken over by provincial forestry personnel, with advice and guidance being supplied by the Forest Entomology and Pathology Branch. Thus, research officers of the Branch are freed to concentrate on basic studies of decay development and ecological relationships. For example, investigations have shown that balsam fir, recently killed by defoliating insects, decays rapidly because the fungus causing much of the decay is introduced into the sapwood by wood-wasps when the trees are weakened or dying. Studies have also shown that decay in black spruce may be insignificant on many sites but at least two of these require special attention in forest management because of the serious incidence of root-rotting fungi. In some timber species and localities, direct losses from trunk decays are less important than tree mortality or windthrow resulting from root and butt rots. Research on root rots is being undertaken in Ontario, Saskatchewan, and British Columbia, as a guide to forest management practices.

BALSAM WOOLLY APHID

The balsam woolly aphid, an insect of European origin, now occurs in a limited area of southwestern British Columbia and extensively in the Atlantic Provinces as a major forest pest. It is a primary threat to the long-term production of balsam fir pulpwood in Newfoundland where nearly 20 per cent of the softwood stands are infested. While there have been no major changes in the areas severely infested, several new spot infestations were observed in 1963 in eastern Newfoundland indicating a wider distribution. Advanced aerial photographic methods will be tested in 1964 as a rapid means of detecting early evidence of new infestations. In the Maritime Provinces, the general abundance of the aphid continues to increase slowly from the extremely low level caused by the severe winter of 1961-62.

Biological control efforts were intensified in 1963 with a special search for potential predators in Japan. Releases of several species continued and one species is now sufficiently well established in western Newfoundland to provide material for release in the central part of the Province. The predators now established unfortunately do not yet provide a significant degree of control. The tests of systemic insecticides in 1963 produced no ready means of direct control. Additional insecticides and new techniques will be tested in 1964. Meanwhile basic biological studies of the aphid and of tree and stand deterioration following aphid attack are being intensified.

DUTCH ELM DISEASE

Prompt removal of dead and dying elms and spraying with insecticides to control the beetle vectors will markedly reduce the incidence of the Dutch elm disease. Work is in progress to obtain information on the effectiveness of sanitation programs and of spraying, alone or in combination. Basic studies on the physiology of the causal fungus, the browning reaction that interferes with translocation in infested trees, and chemotherapy are being continued to find effective direct control measures. Chemo-therapeutants under test in Ontario have yielded encouraging results under greenhouse conditions. Treatments under field conditions are planned. Results have also been encouraging on the development of resistant elms grown from irradiated seeds and experimentation in this area is continuing. European elm hybrids, resistant to the disease, are being propagated and tested for winter hardiness and resistance to native diseases.

SPRUCE BARK BEETLE

An outbreak of spruce bark beetles has developed during the past few years in the mature and overmature spruce forests of the Prince George and Prince Rupert forest districts of northern British Columbia. The severity of the outbreak was not fully realized until 1963 when the trees attacked in 1962 changed colour and could be more easily surveyed. Over 600,000 acres of forest were involved and more than one-third of the trees were attacked or killed over a quarter of this area. It is estimated that 400 million cu. ft. of spruce timber have been lost during the current outbreak. Intensive surveys are being maintained and detailed biological studies have been initiated. The flight of beetles was much reduced in 1963 and is expected to continue near this lower level in 1964. Further attacks will be largely restricted to areas where losses have been most severe.

BLISTER RUST AND NEEDLE CAST

For several years, studies have been in progress to determine the effectiveness of systemic antibiotics in the control of certain forest diseases. Two compounds, Phytoactin and cycloheximide thiosemicarbazone, appear to be the most promising of the materials used on Rhabdocline-infected Douglas-fir. Little phytotoxicity and good control of needle cast resulted from their application both as basal stem and foliar sprays. In contrast, the results of tests with Actidione and Phytoactin, involving many formulations, concentrations, and methods of application against

blister rust in eastern white pine have been disappointing. Recent trials have been devoted to retesting, with more replications, those few treatments that appeared to give some measure of control.

Studies have been initiated to determine the factors in white pine influencing resistance to white pine blister rust and to utilize this knowledge in selecting resistant trees. Results to date indicate that the location of phenols and the osmotic pressure in the host at the time of infection may be important in determining resistance.

PLANTATION PROBLEMS

The increased emphasis on reforestation programs has been accompanied by a number of serious insect and disease problems. Some of the problems are caused by native species that flourish best under plantation conditions, while other pest species have been introduced from other continents. The latter include the European pine sawfly and the European pine shoot moth which occur in southwestern Ontario on Scots and red pine. It has been confirmed that the European pine shoot moth has become established in the interior of British Columbia from plantings of exotic pines in that area. Its presence creates a serious threat to native ponderosa pine. Comprehensive studies of the biology and factors influencing population regulation are underway for both these species. Three native weevils, the pine root collar weevil, pales weevil, and the northern pine weevil, are of concern to plantation owners in southern Ontario and southeastern Manitoba. Research studies are presently directed towards control through chemicals and improved cultural and management practices. Another species, the plantation weevil, has since 1961 been recognized as the cause of heavy losses of young transplants in the coastal area of British Columbia. Surveys to detect high hazard areas are in progress, paralleling studies on the biology of the weevil and chemical control through the use of seedling dips prior to planting. Tree-planting projects in southern Manitoba have been hampered because of white grubs attacking transplants. Studies on the species involved and their complex life cycles are in progress along with testing of various cultural and chemical control methods.

Fomes annosus root rot was discovered in plantations in southwestern Ontario in 1955 and since that time has continued to spread in this area. Although its distribution is relatively restricted, it is regarded as a potentially dangerous pathogen on the basis of its destructiveness in Europe and the United States. Intensive surveys are being made to follow its spread, and studies are in progress to provide the necessary background for the development of biological and chemical control measures. Root rot caused by *Armillaria mellea* occurs in a number of Douglas-fir plantations in British Columbia and plot studies have demonstrated that disease incidence has more than doubled in one area in a three-year period. This root-rot fungus is important in coniferous plantations in Ontario. A severe outbreak of a foliage disease, termed "red skirt", caused severe defoliation and mortality of Monterey and Bishop pines in plantations on Vancouver Island. Heavy mortality from combined drought and stem canker continued in many shelterbelts in southern Alberta.

BIOLOGICAL CONTROL

A traditional method of biological control especially suited to foreign pests that have become established in forests or plantations is the introduction of their natural parasites and predators. Much attention has been given to this approach in Canada with a significant degree of success over the years. With increased understanding of the biology and behaviour of pests and of the complex inter-relationships of mortality factors, this method of control may become more refined. Active projects are being directed against five major pests of foreign origin—the balsam woolly aphid and winter moth in the Atlantic Provinces, the European pine sawfly and the European pine shoot moth in southern Ontario, and the larch sawfly in Manitoba. Closer liaison among overseas officers of the Commonwealth Institute of Biological Control, officers of the Department of Agriculture responsible for importation and distribution of parasites and predators, and officers of the Department of Forestry concerned with the forest pest problems in Canada, has contributed to a number of promising developments in recent years. One of the most striking is the rapid spread and build-up of a parasite of the winter moth in Nova Scotia. This, in combination with a naturally occurring disease, may prevent further serious outbreaks. However, the winter moth continues to spread into New Brunswick. Careful field trials with European pine sawfly parasites that had previously failed to become established have shown indications of success. The establishment of one parasite was confirmed during 1963 and recoveries from over a half mile from the release site are most encouraging. Similar intensive efforts have led to the positive establishment of at least one additional larch sawfly parasite during the past year. The rôle of these new biotic agents in the control of the pest species will be followed closely.

FOREST PRODUCTS
RESEARCH BRANCH



*Inspection of a new design corrugated fibre board
butter box undergoing a rough-handling test in the
Ottawa Laboratory 14-foot Hazard machine.*

FOREST PRODUCTS RESEARCH BRANCH

INTRODUCTION

This report presents various activities of the Forest Products Research Branch and highlights the many fields of research in which the Laboratories were active during the year. Studies of the Branch as in past years were directed toward the more efficient utilization of wood, and to aiding in the continued advancement of Canada's forest industries.

A broad program of basic and applied research included the mechanical, physical, chemical and anatomical properties of Canadian woods, the development of new and better uses for wood products, and improved manufacturing techniques. The results of this research received wide dissemination and were made available through various media to the thousands of plants comprising the timber manufacturing and wood-using industries of Canada.

The establishment of the Forest Products Research Branch, with Headquarters staff in Ottawa, comprises an Industrial Liaison Service, a Technical Information Service, and research laboratories located in Ottawa and Vancouver. During 1963-64, the Branch employed 70 professional personnel, 57 technicians and tradesmen, and 26 clerical staff in continuing positions. An additional 30 research workers were hired on a seasonal basis.

A study of the work for the year under review shows considerable progress and accomplishment. In general, emphasis continued to be placed on areas of research which would contribute to the more efficient use of Canadian woods and thereby be of assistance to the forest products industries. Details of the Branch program may be found in the Annual Report of the Forest Products Research Branch for the year ending March 31, 1964.

RESEARCH HIGHLIGHTS

Developments in the machine grading of lumber received special attention at both laboratories. The Vancouver Laboratory, with the active co-operation and assistance of the lumber industry, commenced research and testing of mechanical stress rating systems as applied to Canadian species and manufacturing conditions. Evaluation of the merits of this new grading method is well in hand. A commercial grading machine is on order for the Ottawa Laboratory. Another closely connected area of research includes a technique devised for studying the vibrational properties of wood cross-arms, with a view to developing non-destructive strength tests. This has been adapted for tests of structural timber, and is being evaluated as a means for stress grading such material.

During the year the Vancouver Laboratory completed the initial phase of a study of the density of commercial species growing in British Columbia and Alberta. A knowledge of the distribution and variability of density throughout a species range, because it is an important criterion of wood quality, is of great assistance in predicting strength properties of wood from any producing area. Extensive sampling conducted in the interior of British Columbia and Western Alberta, with the primary emphasis on spruce, was completed and an analysis of results is being completed rapidly. Preparations are now being made by the Ottawa Laboratory to carry out a similar density study in the Maritime Provinces.

A successful wood utilization conference was conducted by the FPRB from January 20 to 31, 1964, in which representatives of the United States Forest Service and of the Federal Department of Forestry discussed problems related to tree and log quality evaluation techniques. The conference was devoted to quality evaluation relative to stand management and end use; analysis and programming techniques; and program co-ordination between the two countries. The U.S. representatives emphasized closer co-operation in developing common evaluation techniques. In dealing with the proper selection of logs relative to various product uses, principal species cited were: spruce; Douglas fir; white, red and jack pine; yellow birch; maple; poplar; and hemlock.

In co-operation with the Forest Research Branch of this Department and the Ontario Department of Lands and Forests, the Ottawa Laboratory is evaluating properties and potential uses of plantation-grown red pine. A veneer cutting study on logs, from 50-year-old trees which had been pruned at an early age, indicated the advantages of pruning. These logs appeared to be well suited for the manufacture of veneer and plywood. Other test material is being studied in relation to the use of red pine as poles. Attempts are also being made to overcome difficulties in drying red pine material containing juvenile core.

The Post-doctoral Fellowship Program of the National Research Council of Canada was extended for the first time to the FPRB. Dr. K. Myrakami, Lecturer at Shinshu University, Japan, commenced research on red cedar polyphenols at the Vancouver Laboratory in October 1963.

Research concerned with the improvement of the fire-resistance properties of wood continued during the year. Studies carried out on the treatment of veneers with fire retardants resulted in the development of a diffusion treating technique. The results indicate that the technique has potential value as a low-cost process for the manufacture of fire-retardant treated plywood. Further experimental work will depend on the flame-spread results obtained in the Laboratory 8-foot fire tunnel on experimental plywood panels produced from treated veneers.

Studies on fire-retardant treatments for shingles included tests of over 125 formulations. Several showed sufficient effectiveness to warrant further testing and the project work is continuing.

INDUSTRIAL LIAISON

The Industrial Liaison Service Officers, located at strategic points across the country, continued their rôle of disseminating information and research findings through visits to industrial plants, government and association officials; attending

meetings and conferences; presenting lectures and talks, participating in FPRB courses on the application of research findings; and dealing with technical enquiries. The Officers in the various regions participated actively on industrial committees and were frequently represented on technical panels and group discussions. They continued to direct the attention of FPRB research personnel to prevailing problems and research needs of industry.

During the year the Branch continued its program to assist industry and government by presenting industrial courses on improved techniques in sawmilling, lumber seasoning, as well as demonstrations in the techniques of log quality evaluation. Some 56 key personnel from industry attended lumber seasoning courses conducted at the Ottawa and Vancouver Laboratories. Three one-day sawmill symposiums were presented in Newfoundland. A series of lectures and field sessions on lumber grading, log quality evaluation, sawmilling and lumber seasoning were presented to over 100 students at the Ontario Department of Lands and Forests Ranger School at Dorset, Ontario. A two-day hardwood log quality evaluation demonstration was also presented at the Maritime Forest Ranger School at Fredericton, N.B.

TECHNICAL ASSISTANCE

During the year, 3,788 requests for technical information were answered, 2,436 by the Ottawa Laboratory and 1,352 by the Vancouver Laboratory. Distribution of Branch publications totalled 115,947 and 14,983 wood specimens were sold. Forty-two articles were published in various technical journals and trade papers and 16 technical publications were edited and published by the Branch. Some 75 talks and lectures were delivered by the staff to industrial and public groups.

Effective liaison was maintained in fields of research and technical development. Staff members presented technical papers at numerous conferences and meetings sponsored by associations, research societies, and technical institutes in Canada and the United States.

In addition, the Branch was represented at a number of important conferences in Europe. Dr. J. H. Jenkins, Branch Director, attended the International Standards Organization Technical Committee on Lumber in Moscow, U.S.S.R., November 25-30. Mr. J. A. Doyle, Assistant to the Director, was a member of a 7-man Study Mission which visited European furniture industry during June and July to study the latest trends and technological developments in England, Denmark, Sweden, West Germany and Italy. Mr. R. W. Peterson, Head of the Plywood and Physics Section at the Ottawa Laboratory, participated in the F.A.O. Consultation on Plywood and Other Wood-Based Panel Products, in Rome, July 1963.

FPRB personnel have continued active in the important fields of national and international committee work and have contributed much technical and scientific data pertaining to Canadian woods. These representations include the Executive, Associate and Technical Committees of the National Building Code; the Advisory Committee on Building Research; the Executive and Board of

Directors of the Canadian Standards Association, and Sectional Committee on Timber and Specification Committees of this Association on such items as engineered design in timber, laminated construction, lumber standards, yard lumber, plywood, shingles, millwork, poles and piling, preservative treatments, protective packaging and containers, ladders, decorative plastic laminates; the Canadian Government Specification Board Committees on paints, test methods, construction and maintenance, and cushioning materials. Staff members were also active on technical committees of various trade and research organizations.

In the international field, technical committees served include those of the International Union of Forest Research Organizations, the International Standards Organization, the Food and Agriculture Organization of the United Nations, the American Wood Preservers' Association, and the American Society for Testing Materials.

Such participation ensures that technical advice and information resulting from forest products research is made available to specification-writing committees, and that important gaps in scientific knowledge are pointed out where urgent research is required.

Research News, the bi-monthly newsletter containing brief reports and descriptions of current research work conducted at the Ottawa and Vancouver Laboratories and other items of interest to industry, increased in circulation to 4,000 copies per issue. This publication, introduced in 1958, now has wide circulation in all segments of the wood-using and wood-manufacturing industries of Canada.

The program to provide additional research information to the trade press was continued. In addition to article length releases, a substantial number of short items of diversified subject material was released to the trade papers during the year.

RESEARCH PROGRAM

The research program for the year includes some 183 projects for the Ottawa Laboratory and 71 projects for the Vancouver Laboratory. Details of the various projects are described in the Annual Report and Program of Work of the Forest Products Research Branch.

The following research reports are in addition to those presented under the title Research Highlights.

ENGINEERED DESIGN

Improved methods of designing laminated beams are being investigated as presently accepted methods of assigning working stresses do not permit accurate prediction of their ultimate strength. The Ottawa Laboratory is evaluating a group of about 40 beams, of various sizes and spans, manufactured commercially by a unique technique. The Vancouver Laboratory has completed long-term loading studies on 40 Douglas fir laminated beams. Analyses of the test results are continuing.

Small clear specimens of Douglas fir, which are being used in a long-term strength study of wood, have now been under continuous loading in flexure for

nearly a year. The first batch of specimens will soon be unloaded and tested to failure in a testing machine using standard methods. It is planned to test additional batches of specimens after five and ten years and to extend the study to other specimens and to other stress levels.

Performance data were supplied to Central Mortgage and Housing Corporation on 21 different qualities or thicknesses of particle board, insulating fibreboard, and hard-pressed fibreboard for use in determining the acceptability of these materials for various uses in house construction.

Design tables for glulam post and beam construction have been calculated and made available to the Canadian Institute of Timber Construction for use in a special publication to facilitate the use and acceptance of these timbers under the National Housing Act. These tables will subsequently form a part of a larger and more comprehensive set of design tables to be published by the FPRB. Due to the proposal of the lumber industry to adopt different standard sizes for lumber, and suggestions received for a revised format of presentation, publication of the tables will be delayed pending possible technical revisions. Meanwhile, work is continuing on a condensed version of the tables for incorporation in the Housing Standards—Canada.

The laboratories were engaged in investigations of joints and fastenings for timbers. Studies were continued on the lateral instability of glulam beams and of the effect of such variables as beam length, type, and degree of support. Investigations were conducted on the development of economical joints for plywood when used in structural components such as stress-skin panels and box beams. Over 350 tension tests were made on $\frac{1}{4}$ -, $\frac{1}{2}$ -, and $\frac{3}{4}$ -inch Solid One Side Grade, Douglas fir plywood specimens, both unjointed controls and material containing end and edge joints of various configurations. A report comparing several joint patterns and outlining test results was prepared.

NON-DESTRUCTIVE STRENGTH TESTING

In order to check the efficiency of various systems of grading wood for strength, 109 jack pine joists and 111 white spruce joists of 12-foot length and nominally 2 by 6 inches in cross-section were visually graded into three commercial grades with the co-operation of the Canadian Lumbermen's Association. The FPRB technique developed for generating vibrations in wood beams was used to measure the dynamic modulus of elasticity in bending of each joist. The next phase of the study will include machine stress grading of the material with two different types of commercial grading machines followed by conventional destructive tests to determine actual strengths on edge.

The Vancouver Laboratory, working in co-operation with western lumber interests, is conducting an exhaustive study on the merits of mechanical stress grading. Comparisons of actual strengths and machine-rated strengths will be made from samples of 2 by 6-inch stress-rated lumber of various species. A survey of machine stress-rating systems in the United States was undertaken through correspondence with those in the forest industry who have pioneered in such work.

X-RAY INSPECTION OF WOOD

An investigation was carried out on the use of electronic X-ray fluoroscopy for detecting rot in wood, through the co-operation of a manufacturer of this equipment. Decayed areas in samples of dry wood were clearly visible in the fluoroscopic images. Internal rot pockets about $\frac{1}{2}$ -inch in diameter were detected in green softwood lumber 2 inches and 3 inches thick. In general, the results indicated that electronic X-ray fluoroscopy shows considerable promise as a rapid, non-destructive means of inspecting wood for internal rot and buried metal objects.

PACKAGING

A new corrugated fibreboard butter box—which received the Canada Department of Agriculture approval following studies of its performance at the Ottawa Laboratory—has now demonstrated its adequacy following one full season of use. In many instances these boxes have been stacked 16 or more high without apparent ill effect and no complaints regarding box failures have been received.

The Laboratory has continued to co-operate extensively with the Canada Department of Agriculture in the development of more efficient wood-based containers for packing eggs and fresh and frozen poultry. The importance of achieving maximum efficiency in this highly competitive industry can be illustrated by the fact that, last year, nearly 500,000,000 pounds of poultry were packed in nearly 12,000,000 containers.

Research was undertaken for the Department of National Defence on various military packaging for the movement of supplies. Assistance was given to the Department of Transport on the packaging of various items for northern shipment.

Exploratory studies were made on new materials for containers. Basic designs for pallets were investigated and performance tests were conducted.

VENEER CUTTING

In research on the rotary cutting of veneer, methods and techniques for sampling and measuring veneer thickness, roughness, and lathe check severity were defined. Equipment was designed and built to obtain a record of the quality of currently manufactured veneer, and also to study the effects of such factors as knife usage time and sapwood-heartwood differences. Confidential reports were prepared for co-operating companies. This research indicates a potentially large annual saving in wood and labour through moderate improvements in the overall manufacturing operation.

GLUES AND GLUING

A study was undertaken to develop an accelerated test for determining the durability of glue bonds in exterior grade glulam. The standard test now used requires 12 days to carry out. Following tests of 52 laminates of both Douglas fir and white oak the results indicated that a proposed 3-day test should prove satisfactory for Douglas fir laminates. Further research would be required to establish the suitability of the 3-day test for use with oak laminates.

The effect of curing temperature on casein glue bonds was studied and results showed that the rate of cure varied with the curing temperature in the range from 70° to 20°F with the rate of cure decreasing as the temperature decreased. An investigation was undertaken to obtain some information on the properties and characteristics of bonds made with a recently developed thermo-setting resin adhesive of the vinyl emulsion type. Studies were continued on the long-term durability of glue bonds in plywood type construction.

Employing a cleavage test, an attempt has been made to evaluate bond quality in edge-glued lumber panels by comparing the strength of each glued joint with the strength of the two pieces of wood which it joins. A variety of special testing of commercial products was conducted for Central Mortgage and Housing Corporation.

The occurrence of radio frequency (RF) burns in glue lines is a problem sometimes encountered when using dielectric heating for edge-gluing lumber. Because these burns can seriously reduce the strength and durability of the joints in which they occur, an investigation was carried out to determine the cause of RF burns. Findings indicate that research aimed at developing a urea glue with a low dielectric loss factor in the cured state might lead to producing a product which could be more conductive than those presently available and yet have a very low tendency to burn. Such a glue would greatly improve the efficiency of edge-gluing and assembly gluing operations employing dielectric heating.

PANEL SURFACE REGULARITY

In response to a request made by the furniture industry, an inexpensive device was developed for measuring unevenness in contour of sanded surfaces. It consists of a dial gauge mounted on a slider which can be moved along a stiff beam. The beam is supported by three legs which can be adjusted to inspect panels of different sizes. This device has been sent to a large furniture plant for tests to determine its suitability under industrial conditions.

EFFECT OF INTERMOLECULAR FORCES

Studies to obtain information on the molecular structure of wood and on the molecular forces acting between wood and other associated substances such as water, adhesives, preservatives, and coatings have been continued. Polarization measurements on yellow birch have been expanded to cover a frequency range from 50 kc to 50 mc over a temperature range from 20° to 100°C. The results indicate the desirability of further expanding these measurements to zero frequency. The design, procurement, and fabrication of equipment for nuclear magnetic resonance and electron paramagnetic resonance measurements have been completed and such measurements are being initiated.

RED PINE RESINS

Red pine often presents problems caused by resin exudation in service. Following a study of the chemical nature of the pine resins, effective and practical means were sought to reduce (or eliminate) exudation. Solvent seasoning effec-

tively removes the resins and thereby eliminates the exudation problem. However, further study of the economics of the process is required. High-temperature kiln-drying was found effective in eliminating most of the exudation problem. Boron trifluoride treatments of red pine lumber modify the resins chemically and might be effective if applied prior to painting. Ammonia and amine treatments prior to painting are promising, but require further research.

FIRE-RETARDANT TREATMENTS

An investigation was undertaken to determine the flame-spread behaviour of hardwood plywood with birch or poplar cores treated to levels above and below the usual commercial retentions of ammonium phosphate-ammonium sulphate type fire retardants. The face veneers were treated in some cases and untreated in others for investigation into the effect of the use of thin untreated face veneer on the flame-spread properties of core-treated plywood. Flame-spread testing is now in progress.

Studies of the surface flammability properties of eight Canadian species have been completed in the FPRB 8-foot fire tunnel. Matched samples of these eight species were also tested by the Underwriters' Laboratories of Canada in their 25-foot tunnel furnace for comparative purposes. A detailed comparison of the results is being prepared.

Tests of over 125 formulations, most of which were received from chemical and paint manufacturers, showed several to have sufficient fire-retardant effectiveness to warrant further testing. Five paint formulations in this category were subjected to 1,000 hours in the Atlas twin-arc weatherometer, but showed excessive degradation, and were considered unsuitable. Several organic phosphate formulations were set aside, at least temporarily, because the high solvent cost made their use economically questionable. One promising water-borne formulation was shown to have insufficient resistance to leaching, and was discarded. Another water-borne formulation is now being tested, and appears to have good fire-retardant properties as well as good resistance to leaching. However, certain difficulties of application exist, and these are presently being investigated.

PAINTS AND COATINGS

A number of manufacturers are now marketing pre-finished wood siding of various types including overlaid material. Because of the interest in high-performance house siding, samples of these materials have been obtained for accelerated weathering and long-term outdoor exposure tests. Information on the types of coating systems and species of wood employed for such siding is being gathered.

Because of continued interest in the performance of pigmented preservative stains, for house siding and other exterior applications, the Ottawa Laboratory has prepared a number of panels for exterior exposure tests. Various linseed oil and alkyd-based formulations have been included as well as samples of sidings coloured by the presence of chromium-containing preservatives such as chromated zinc chloride.

SAPSTAIN AND MOULD PREVENTIVES

Service tests of the relative effectiveness of newly-formulated sapstain and mould preventives were carried out at eight mills in the British Columbia interior and at one location on the coast. Wood species treated included white spruce, lodgepole pine, Douglas fir and western hemlock, totalling over 11,000 foot board measure. Development of sapstains and moulds were greatly inhibited by the treatments, with the exception of a brown superficial mould (*Cephaloscybus fragrans* = *Ascochybe grovesii*) which was particularly evident upon lumber of all species treated with sodium pentachlorophenate. Results of the investigation are being summarized for publication.

HEMLOCK BROWN STAIN

A number of chemicals found to reduce hemlock brown stain in lumber have been field tested with disappointing results. It is difficult to maintain a sufficient concentration of the control chemical on the lumber to counteract the formation of this tannin-like chemical stain over the lengthy seasoning period, especially when the lumber is exposed to rain. The finding that hemlock brown stain formation is a harmless chemical oxidation of one of the sapwood extractives, and is in no way related to sapstain or decay, has aided in mitigating this problem. However, because of its effect on the appearance of lumber, a search for a satisfactory control treatment is continuing.

SERVICE-LIFE RECORD OF TIMBERS

A revised report on the service life of commercial installations of timbers has been prepared and will be published. This report will cover poles in use in telephone and transmission lines, fence-posts, bridge and wharf components, and will contain information on type of treatment, species used, type of structure, life of test and condition of test specimens.

WOOD PRESERVATIVES

Several new formulations of the copper-chrome-arsenate type have been placed in test at the Petawawa test plot during 1963. A number of tests of fire-retarding salt formulations with wood-preserving value were inaugurated. The salts under test are of the type that has been found to be effective in reducing the spread of flame over wood and are not primarily intended for use as wood preservatives. However, situations may arise in use in which their decay-preventing properties may be valuable, and therefore information on these formulations is desirable.

Laboratory testing of the effectiveness of various western Canadian coal tar products for the preservation of wooden cross-ties has been carried out. Studies of grease and emulsion types of preservatives for application in "bandages" to the ground-line region of poles indicate, that over a two-year period, the total amount of preservative released for subsequent movement into the poles has been satisfactory to give deep and effective treatment.

DETERIORATION OF WOOD CHIPS DURING OUTSIDE STORAGE

Studies have begun on the deterioration of softwood chips during outside storage in eastern Canada to determine the types of organisms responsible for discolorations and decay in the material. Preliminary investigations have shown that almost all chips are infected with bacteria from the beginning of storage and that *Trichoderma viride* is increasingly the dominant fungus with length of storage. Most of the discoloration in the chips occurs in the outer layers of the piles and is caused mainly by *Phialophora* and *Ceratocystis* species. Further studies are underway to determine how the fungi affect the quality of the chips.

PULPING POTENTIAL OF WOOD FROM THE N.W.T.

A study on the basic properties of wood of white spruce, jack pine, and balsam poplar from the Mackenzie District, Northwest Territories, was carried out at the request of the Northern Administration Branch, Department of Northern Affairs and Natural Resources, for the purpose of evaluating the pulping potential of material from that region. The results of tests indicated the suitability of the wood for the manufacture of pulp.

LOGGING AND MANUFACTURING

Logging studies were continued in eastern Canada into logging, hauling, and other work elements, in relation to production by different types of equipment and methods. One article entitled "Relative Skidding Production of Track and Wheel Skidders" was published and three interim reports are being prepared on other components of the study.

With much interest being shown in tree-length logging in eastern Canada, a jack pine lumber recovery study, by volume and grade, was carried out on a modern sawmill operation being supplied with tree-length logs. The pulp chip recovery was also measured in order to obtain a complete picture of the effect of utilizing small tops and cutting to a reduced stump height. A report on this study will be published.

Factors affecting productivity in the felling and skidding of lodgepole pine were compared on five logging operations. Volume and lumber grade recovery from lodgepole pine logs, averaging 7 to 8 inches top diameter, were studied at one board mill and three stud mills in the interior of British Columbia. A paper discussing many of the factors involved in sawing lodgepole pine is being prepared and reports on the effect of sweep and taper on lumber production were completed.

Practical methods of evaluating log and tree quality, based on the external visible characteristics, have been developed for Douglas fir in the interior of British Columbia. These systems will be field tested in 1964.

Investigations on quality evaluation of sawlogs from eastern species continued. Field data on current bucking practices in the preparation of hardwood factory sawlogs show that, on four out of five operations studied, 42 to 50 per cent of the logs produced had an overlength of 7 to 11 inches as compared to the maximum recommended overlength of 4 inches.

Further analysis of white pine log data has resulted in changing the order of importance of defects. Log position and straightness appear to be much less reliable indicators of quality than formerly thought.

Studies on the machining properties of 16 of the major Canadian commercial tree species have been completed. The species have been evaluated and classified by decreasing order of machinability for each of the following operations: turning, shaping, planing, boring and mortising. A report on these findings is being prepared for publication.

An experimental apparatus was built for shearing tests on logs up to 6 inches in diameter. A program of cutting was analyzed by computer, and equations have been developed to show the relation of cutting force, cutting energy, and splitting damage, to knife geometry and log properties when cutting white spruce. Thickness of the shear blade and log diameter were the most important variables in the range studied.

Arrangements were completed for the construction of a new sawmill at the Petawawa Forest Experiment Station. This mill will facilitate the study of various milling operations under controlled conditions, studies in production aspects of lumber seasoning, and evaluation of silvicultural practices. A log bandsaw was installed in the Ottawa Laboratory research sawmill. At the same time, the light mechanical log carriage previously used was replaced by an air/hydraulic carriage to obtain greater accuracy during log break-down.

Investigations continued on methods of preventing chemical brown stain (kiln burn) in white pine lumber. It was found that dip treatment by aqueous solutions of sodium azide or of sodium fluoride was effective in preventing brown stain, even if lumber were subsequently close piled for periods up to three weeks.

Drying stresses and collapse in wood were studied at both laboratories during the year. The Vancouver Laboratory completed experimental work on several hundred sapwood and heartwood samples of Douglas fir using polyethylene glycol solutions in cell wall stabilization. It was found that about a 35 per cent solution stabilized the sapwood and heartwood completely. The Ottawa Laboratory completed two series of investigations, using green specimens of red oak and yellow birch in which water was replaced with ethyl or n-propyl alcohol-water mixtures. Shrinkage rapidly decreased as the concentration of alcohol was increased beyond the 50 per cent level, reaching a minimum when pure alcohol was used for replacement. Of particular interest was the fact that collapse was prevented when specimens were oven-dried from the fully water-replaced condition.

APPENDIX

Table 1.—National Forest Inventory—1963

Forest Land

(thousands of acres)

Softwood	345,299
Mixedwoods	144,384
Hardwoods	73,511
Unclassified	56,291
Total Productive Forest Land	619,485
Non-productive Forest Land	475,419
Total Forest Land	1,094,904
Total Land Area of Canada	2,278,552

Volume of Merchantable Timber

(millions of cubic feet)

Softwoods	611,277
Hardwoods	140,606
Total	751,883

Tenure of Productive Forest Lands

(thousands of acres)

Provincial Crown	505,384
Federal Crown	56,749
Privately-owned	57,352
Total	619,485

SOURCE: Economics Division, Department of Forestry.

Table 2.—Annual Forest Depletion

	Usable Wood Millions of Cubic Feet		Percentage Utilization	
	1952-61 Average	1962*	1952-61 Average	1962
Production of Timber Products:				
Logs and bolts	1,576	1,860	49.1	54.3
Pulpwood	1,284	1,275	40.0	37.2
Fuelwood	287	232	8.9	6.8
Other Products	63	57	2.0	1.7
Totals	3,210	3,424	100.0	100.0
Wastage:				
By forest fires	535	126		
Grand Totals**	3,745	3,550		

*Preliminary estimates.

**Does not include wastage caused by agencies other than fire such as insects, diseases and natural mortality, for which no reliable estimates are available.

SOURCES: Dominion Bureau of Statistics

Forest Research Branch, Department of Forestry

Table 3.—Principal Statistics of the Forest Industries—1961

Industry	Number of Employees	Salaries and Wages (\$'000)	Net Value of Production* (\$'000)	Gross Value of Production (\$'000)
Logging	94,681**	422,374	708,459	846,035
Pulp and paper mills	65,799	355,171	842,420	1,639,672
Sawmills	42,530	150,868	226,046	552,218
Wood-using industries	69,470	238,678	384,796	835,228
Paper-using industries	29,063	115,966	228,896	575,437
Totals	301,543	1,283,057	2,390,617	

*Net value of production is gross or sale value, less cost of materials, fuel, purchased electricity, and process supplies consumed.

**Man-year basis.

SOURCE: Dominion Bureau of Statistics.

Table 4.—Production and Trade of Major Forest Products—1963

Product	Production*	Exports	Imports
Roundwood (millions of cubic feet)	n.a.	122	57
Lumber (millions of board feet)	9,621	6,250	235
Plywood (millions of square feet)	2,225	329	94
Wood pulp (thousands of tons)	12,215	3,339	74
Newsprint (thousands of tons)	6,630	6,212	nil
Paperboard (thousands of tons)	1,197	169	84
Wrapping paper (thousands of tons)	332	31	4
Fine papers (thousands of tons)	347	30	26

*Preliminary estimates.

SOURCES: Dominion Bureau of Statistics
Canadian Pulp and Paper Association
Newsprint Association of Canada.

Table 5.—Payments to Provinces for Forest Inventory, Reforestation, Forest Fire Prevention and Control, Access Projects and Stand Improvements

Province	Forest Inventory		Reforestation		Forest Fire Prevention & Control		Forest Access		Stand Improvements	
	Fiscal Year 1963-64	Total to Date	Fiscal Year 1963-64	Total to Date	Fiscal Year 1963-64	Total to Date	Fiscal Year 1963-64	Total to Date	Fiscal Year 1963-64	Total to Date
Newfoundland.....	—	—	\$3,339	\$3,339	\$146,937	\$598,148	\$113,838	\$180,847	—	—
Prince Edward Island..	—	—	22,775	215,024	4,160	26,364	1,637	2,616	\$11,428	\$23,731
Nova Scotia.....	\$23,819	\$395,336	6,418	26,096	43,774	313,777	64,941	327,656	11,146	18,653
New Brunswick.....	42,200	284,807	—	—	61,500	412,286	91,228	413,611	29,586	39,876
Quebec.....	—	—	—	—	572,507	1,407,985	1,009,815	3,363,074	334,202	557,748
Ontario.....	199,993	2,908,239	500,000	2,296,428	162,417	1,739,487	567,344	3,192,681	127,601	127,601
Manitoba.....	32,783	460,490	43,888	167,350	146,968	627,400	292,156	1,381,271	3,482	4,641
Saskatchewan.....	43,051	497,214	17,980	65,982	121,214	638,086	185,189	1,057,887	25,000	25,000
Alberta.....	83,062	1,046,738	31,171	62,728	444,160	1,523,727	455,863	1,774,557	—	202
British Columbia.....	485,396	5,494,491	40,140	217,051	515,782	2,035,946	790,111	4,244,403	—	—
Totals.....	\$ 910,304	\$11,087,315	\$ 665,711	\$3,053,998	\$2,219,419	\$9,323,206	\$3,572,122	\$15,938,603	\$ 542,445	\$ 797,452

Table 6.—Reforestation Under the Forestry Agreements

Province	Number of Trees Planted		Area Planted (acres)		Area Seeded (acres)	
	Fiscal Year 1963-64	Total to Date	Fiscal Year 1963-64	Total to Date	Fiscal Year 1963-64	Total to Date
Prince Edward Island	98,000	778,000	83	652	—	—
Nova Scotia	428,000	1,791,000	607	2,446	—	—
Ontario	34,660,000	182,368,000	63,320	228,003	4,125	12,838
Manitoba	2,926,000	12,788,000	3,242	13,618	—	1,651
Saskatchewan	678,000	3,242,000	670	2,901	—	2,187
Alberta	243,000	561,000	608	1,169	6,470	16,592
British Columbia	2,676,000	18,098,000	6,699	26,894	—	—
Totals	41,709,000	219,626,000	75,229	275,683	10,595	33,268

Table 7.—Aerial Spraying—New Brunswick and British Columbia

Province	Gross Area Sprayed (acres)		Federal Payments	
	Fiscal Year 1963-64	Total to Date	Fiscal Year 1963-64	Total to Date
New Brunswick	822,800	22,260,350	\$136,816	\$5,050,951
British Columbia	—	156,000	—	83,927
Totals	822,800	22,416,350	\$136,816	\$5,134,878

Table 8.—Annual Timber Production by Federal Agency—in Cunits

Year	Yukon and Northwest Territories	National Parks	Department of National Defence	Forest Experiment Stations	Indian Reserves	All Species Total
1960-61	23,824	46,659	7,294	7,544	268,849	354,170
1961-62	18,144	45,482	13,536	2,366	214,460	293,988
1962-63	41,057	39,604	13,123	14,215	332,077	440,076

Table 9.—Annual Timber Production by Product—in Cunits

Year	Logs	Pulpwood	Fuelwood	Poles, Piling	Mining Timber	Bolts	Other Round- wood	All Species Total
1960-61	137,307	84,330	103,227	12,066	5,310	742	11,188	354,170
1961-62	128,707	55,759	88,756	3,817	567	1,135	15,247	293,988
1962-63	168,816	62,162	151,491	23,489	10,429	707	22,982	440,076

Table 10.—Publications Produced 1963-64

Types of Publications	Forest Economics Division	Adminis- tration Branch	Forest Research Branch	Forest Entomol- ogy and Pathology Branch	Forest Products Research Branch	Total
Bulletins						
English	—	2	—	3	—	5
French	—	2	—	—	—	2
Department of Forestry						
English	—	—	27	2	12	41
French	—	—	2	1	1	4
Articles and Papers in Sci- entific Journals, Pro- ceedings, etc.						
English	—	—	29	81	30	140
French	—	—	—	1	7	8
Chapters in Scientific Books and Monographs						
English	—	—	—	40	—	40
French	—	—	—	—	—	—
Periodicals and Annual Re- ports						
English	1	2	3	6*	10†	22
French	1	2	3	6*	1	13
Miscellaneous						
English	—	2	5	1	2	10
French	—	—	4	—	—	4

*47 articles in six issues during the year.
†6 issues of Research News includes 56 short articles.

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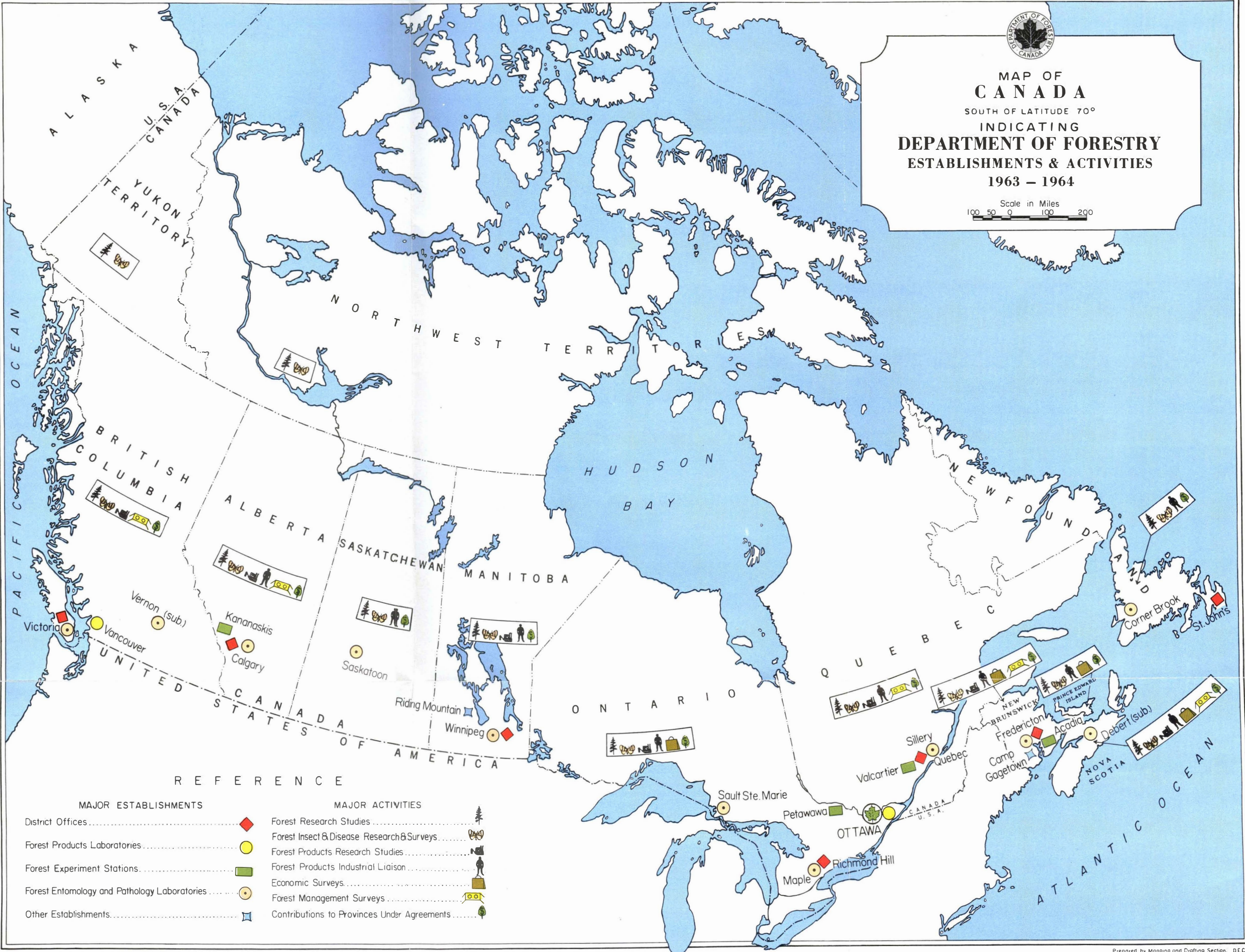
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1964

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MAP OF CANADA
 SOUTH OF LATITUDE 70°
 INDICATING
 DEPARTMENT OF FORESTRY
 ESTABLISHMENTS & ACTIVITIES
 1963 - 1964

Scale in Miles
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MAJOR ACTIVITIES

- | | | | |
|---|---|--|--|
| District Offices..... | ◆ | Forest Research Studies..... | |
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| Other Establishments..... | □ | Economic Surveys..... | |
| | ◆ | Forest Management Surveys..... | |
| | □ | Contributions to Provinces Under Agreements..... | |