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LAKEHEAD UNIVERSITY

School of Forestry

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INTRODUCTION

Forestry in Canada is now in the grave situation where definite signs of the lack of long-term planning are so evident that Mr. R.M. Fowler, President of the Canadian Pulp & Paper Association, predicted that: "Canada will face a wood shortage by 1975 unless immediate steps are taken to improve forest policies and management techniques". Mr. Fowler went on to say: "The changes in demand will, in a few years, tax forest resources to full capacity and Canada will face a shortage of wood unless we move quickly towards better forestry legislation, improved silviculture and protection, and grow the wood we need".

Long-term planning for the future in forestry education parallels the lack of planning in the forests. Universities of Degree granting status in Forestry have long ago lost the agressiveness required to compete for the finances required to expand Forestry education to the position it merits in our country.

A look at the vast gap between the considerable dollar value of our forests to Canada's economy and the meagre amount that is made available for Research and Development should indicate the gravity of the situation to our country.

Canadian Forestry education should never have been ignored to the point where so called "crash programs" are necessary. To say we have been slow to develop Forestry education is a gross understatement. Our planning for the future has been almost non-existent.

When Mr. Fowler of the Pulp and Paper Association mentions

1975 as a critical point in wood supply, I feel certain that a man in his position knew that we are already too late to grow extra wood in that period of time. Foresters will verify that it requires at least 30 years to grow a commercially sized tree under the best climatic conditions we can find in Canada.

In the field of Forest education, it takes time to develop and consolidate a good program and it takes time for graduates of new schools to prove the worth of the educational program.

"Better late than never" is a sad but hopeful proverb that must be applied to Forestry Education.

The observations and recommendations presented in this report will hopefully create a viable atmosphere for expansion and progress in the School of Forestry at the Lakehead University.

LAKEHEAD UNIVERSITY

(Forest Technology Diploma and Forest Research Technology Certificate Program)

Lakehead University had its origin in the Lakehead Technical Institute, established by the Ontario Department of Education in 1946. Classes in Forestry began in September 1948. At that time, its offerings comprised two-year programs leading to Diplomas in Forest Technology and Mining Technology and first-year courses in Arts and Applied Science; additional programs were developed as the enrollment increased. This development marked the initial step in making post-secondary education available in Northwestern Ontario; at that time, the nearest universities were located 600 miles to the west and 1,000 miles to the east of the Lakehead. In 1957, the Institute became the Lakehead College of Arts, Science and Technology and was established on its present site, a 200-acre campus located between Port Arthur and Fort William and donated by the former city; administrative control of the College was placed in the hands of a Board of Governors.

Second-year Arts courses were added to the College program in 1960-61 and in 1962 the original Lakehead College of Arts, Science and Technology Act was amended to give the College "university powers" to establish faculties and "to confer university degrees in Arts and Science". The first such degrees were awarded in 1965. The Lakehead University Act of 1965 provided the charter for continuation of the College under this new designation. Responsibility for its administrative control continues to be vested in a Board of Governors, while overall internal administration of all academic programs is provided by the University Senate, comprising the President, Librarian,

Registrar, Deans and Directors, Chairman of Teaching Departments, and three elected members representing the academic staffs of the Faculties of Arts and Science.

The combination of university (degree-granting) programs and technology (diploma) instruction is justified on the basis of the relatively sparse population of the region in which the University is located (100,000 at Lakehead, 300,000 in Northwest Ontario) and the need to ensure a student body of sufficient size to warrant first class accommodations and facilities for instruction, as well as a larger faculty and increased opportunities for specialization.

Until 1967-68, the university and technology students shared the same physical facilities, but the completion of a separate building containing classrooms and laboratories specifically for the technology programs has provided much needed space and relieved,at least temporarily, a badly overcrowded situation in the University as a whole.

The academic programs at Lakehead University are organized in three divisions: The Faculty of Arts, offering instruction leading to the Bachelor of Arts (General and Honors) and Master of Arts degrees; the Faculty of Science,with programs for the Bachelor of Science (General and Honors) and Master of Science degrees; the University Schools offering courses at both the degree and diploma levels. The degree programs in the University Schools provide the first year or first two years of study for students contemplating transfer to other universities for the purpose of completing professional education (except for the School of Nursing which offers three- and four-year resident instruction leading to the B.S.N. degree), and the School of Business Administration which offers a four-year B.Comm. degree.

The University Schools Division is composed of five separate schools, of which the School of Forestry is one. Three specific programs are currently offered in Forestry:

(1) Forestry Degree Program, covering the first two years of a professional (B.S.F.) degree course and designed to prepare young men and women for advance standing admission in the Faculties of Forestry at the Universities of Toronto and New Brunswick. This program was initiated in 1965. It is discussed in some detail in the section of this report devoted to Pre-forestry Programs.

(2) Diploma in Forest Technology, a two-year program of academic study and practical training intended to prepare students for work as forest technicians, offered at Lakehead continuously since 1948. This is not necessarily a terminal program, since the opportunity to continue on to a professional degree (B.Sc.F.) is available for those students who demonstrate above average ability in their work at Lakehead and satisfy the admission requirements of the university to which they would transfer.

(3) Certificate in Forest Research Technology, a one-year course of study initiated in 1967-68 for people who wish to enter the field of research and development at the technologist level. Admission is restricted to students who have already received a diploma in Forest Technology from Lakehead University with an overall average of at least 60%.

A 12-man advisory committee is planned, as a means of providing liaison between the School of Forestry and the forestry profession, the forest industries, and the public agencies concerned with forest administration and research. Its membership is intended to include representatives of these groups, as well as a recent graduate of the School and an undergraduate. Direct contact is maintained with the Deans of the Faculties of Forestry at the Universities of Toronto and New Brunswick.

Staff

The Staff of the School of Forestry is headed by a chairman, who holds the rank of associate professor in the University. He reports directly to the Director of University Schools. Assisting him in the instruction are four full-time lecturers and a sessional lecturer, the latter a specialist in forest fire control who is an employee of the Ontario Department of Lands and Forests. All but the indicated specialist have professional forestry degrees, and three of them also hold advanced degrees. It is anticipated that two more full-time instructors will be added to the staff by 1974-75, at which time it is expected that a full four-year degree course will be offered at Lakehead University.

Full-time staff members are employed on a 12-month basis, but are relatively free from mid-May to September. However, they are expected to engage in summer activities which relate to their professional interests. All initial appointments are probationary, and a minimum of four years is required for tenure.

Instruction in non-forestry subjects is provided by members of the Faculties of Arts and Science and the School of Engineering.

Student Body

The Basic requirement for admission to the two-year Forest Technology program is attainment of an Ontario Secondary School Graduation Diploma after four years (Grade XII) of successful study in the five-year program, with a minimum average of 60 percent in Grade XI and XII Mathematics, Physics, Chemistry, English and History. A student who has obtained the Secondary School Graduation Diploma with high standing in a terminal four-year program may be considered for admission on an individual basis. Applicants from other Provinces must submit evidence of equivalent standing. In addition, students 21 years of age or older who have been away from formal education for more than two years and who do not meet the minimum education requirements, may apply for admission as special adult students. They are evaluated on an individual basis, with due regard for qualifying experience; they may be admitted on a trial basis and may be required to take extra courses to qualify for the Diploma in Forest Technology.

Promising students enrolled in the Diploma program may transfer to the Degree program at Lakehead University. However, if they intend to transfer to the University of Toronto to study for the professional (B.Sc.F.) degree, they will have to take a "make-up" year in which they must attain the standard of the Grade XIII program. This does not apply to transfers to the first year of the forestry course at the University of New Brunswick or to other universities requiring only a Grade XII certificate for admission.

Admission to the program leading to the Certificate in Forest Research Technology is based solely on satisfactory completion of the course of study leading to the Diploma in Forest Technology at Lakehead. It is, in effect, a third year specialized extension of that educational experience.

Enrollment in the Forest Technology program has shown a steady growth, especially since 1961, and further increase is projected for the next several years. The average annual enrollments are indicated in the following tabulation:

Period*	Approximate Average Annual Enrollments First Year	Second Year	Totals
1948-49 to 1952-53	10	6	15**
1953-54 to 1957-58	10	5	15
1958-59 to 1962-63	19	7	26
1963-64 to 1967-68	46	21	67
1968-69 to 1970-71 (projected)	75	45	120

*By five-year periods, except for the projected three-year interval of 1968-69 to 1970-71.

**Total enrollment influenced by fact that only first-year students were in residence in 1948-49.

With reference to the indicated anticipated enrollment for the period of 1968-69 to 1970-71, it is now expected that the figures will need to be revised downward somewhat, as a consequence of the establishment of the two-year Forest Technical program at Sir Sandford Fleming and Cambrian Colleges and the prospect of additional offerings at other units in the new community college system. In addition, the University is prepared to limit admission to high school graduates with a 60 per-cent or better average.

Current Expansion

The School of Forestry is presently engaged in the development of a proposed third year course in Logging Technology (September, 1969).

The objective of the course is to provide the students with up-to-date knowledge and skills in the field of wood harvesting, so that the employer in the woods industry will have a source of trained personnel that should prove valuable in the organization and work that is involved in modern mechanical harvesting.

Cooperation by employers in the training of this type of personnel is considered to be of great importance and it is expected that about 50% of the proposed course will be in the form of on-the-j0b training.

The financial outlay in training equipment would be considered much too great for the School to propose the course without the assistance of industry.

No significant demands are expected to be made on the School Budget in the Logging Technology course. With full cooperation from industry, lecturers and discussion leaders could be drawn from the professional ranks in industry without remuneration from the School of Forestry.

A brief report on the course development to date follows.

MECHANICAL HARVESTING TECHNOLOGY

Progress Report #1

A. Bartholomew

September 19, 1968.

During the past summer, meetings were held with the woodlands personnel of the following companies to discuss the University's proposal to institute a program in Mechanical Harvesting Technology:

a) The Ontario Paper Company Limited
b) American Can Company of Canada Limited
c) Domtar Limited (Nipigon Woodlands Division)
d) The Ontario Minnesota Pulp & Paper Company Limited
4) Kimberly Clark Pulp & Paper Company Limited
f) Dryden Paper Company

To date, the woodlands personnel of the following companies have been unavailable for a meeting:

a) The Great Lakes Paper Company
b) Abitibi Paper Company

In summary, it may be said that there is complete agreement within the industry with respect to the need for well trained logging technologists on modern mechanical harvesting operations. Each of the companies interviewed expressed a willingness to cooperate in a program of alternating periods of practical and academic training, but none could make definite commitments until we have a concrete proposal and schedule. Companies have agreed to a meeting of their representatives and the University some time this winter to discuss our final proposal.

The list below presents those subject areas which must be covered in the new program. In actual fact, two or more of these subject areas may be more conveniently taught as a single course than as separate courses. This program will create a need for some increase in the Forestry staff and it will be necessary to rely

heavily on very specialized service courses. In many cases it will be inadequate to simply use existing service courses. Industry was quite explicit on this point. They do not want half-trained foresters; they want highly specialized technologists and are unwilling to cooperate in a program that produces anything less.

Planning and Control of Logging Operations Road Location and Construction Transport of Forest Products Senior Report Seminar	Bartholomew
Statistical Analysis Principles of Time and Motion Study	School of Forestry
Introduction to Computer Science Woodlands Accounting Production Management Human Relations Trade Unionism	School of Business
Introductory Economics	Economics Department
Report Writing	English Department
Equipment Engineering	Engineering Department

Statistical Analysis and Time and Motion Study are shown as being given by the Forestry Department. As we move to degree status, it will be imperative that we have a mensurationist-statistician on the Forestry staff. He should, therefore, be hired now and could begin work by teaching first year mensuration, statistics to Degree II students, and the two courses given above. Since my work load will be greatly increased, the Photogrammetry course would have to be taught by someone else. The addition of a photogrammetrist to the staff would also make us better equipped for degree work, and this man could handle part of the Road Location course.

If the Mechanical Harvesting program is to begin next fall, we must have firm commitments on service courses and on budget increases for additional staff.

Expansion Possibilities

1) Third-year Technology programs in each or any of the following fields:

a) Natural Resource Management - The trend toward the consolidation and research in the field of natural resources will require the help of expanding numbers of Technologists with a broad background in Biology, Zoology, Soils, Water, Management Forests, Plants, etc.

b) Forest Products Research - The recent Seminars on Forest Products and Utilization held in the Lakehead by the Northwestern Ontario Development Council pointed up the lack of diversification in the forest products manufacturing industry in Northwestern Ontario. There is definitely a need for trained Technologists in the area of products research in both industry and Government.

c) Fish and Wildlife Management - The trend toward the scientific and professional approach in the management of wildlife resources has gained a great impetus in recent years. The Federal and Provincial Governments will very likely be the parties most involved and there is no doubt about the future need for trained Technologists in the field.

d) Forest Soils Research - Canada has just begun to scratch the surface in forest soils. There is a definite need to have the forest soils and sites classified before much progress can be made in the scientific management of our forest resources.

The Federal and Provincial Governments are now beginning to expand the work on soils under the ARDA program, and there is a demand that now exists for Technologists trained in soils and classification procedures.

2) Establish an Honors B.Sc. in Forest Biology

In cooperation with the Biology Department an Honors B.Sc. program could be worked out and, while such a program would be of considerable value in the field of Forestry, it would not really constitute an expansion in the School of Forestry, as the credit would naturally fall on the Biology Department.

3) Offer a five-year program leading to a B.Sc. in Forestry with an opportunity to specialize in the fifth and final year. Entrance could be from Grade XII and the course could be of our own design. The drawback would be the number of fully qualified instructors that would be required in the final years and until Ontario is generally accepting Grade XII students into University programs we would run into opposition from the O.P.F.A., Toronto and the C.I.F. in Ontario.

4) Offer a full Four-year Program of Our Own Design

From the point of tailoring a program to the area needs, it is likely that we could design something worthwhile for Northwestern Ontario. Objections would be that not all students would be from Ontario and we might have too much emphasis on some subjects to the detriment of the general education of the foresters.

5) Offer the third and fourth years of the University of Toronto, or at least along the same lines as the general course offered in Toronto.

I would consider adding the third year in September 1970 and the fourth year in 1971 as our major objective in the School of Forestry. I believe that if we get the Technical course in Logging established, continue on with the Research Technology and get the third year of the degree course by 1970, we will be expanding at a reasonable rate both academically and economically.

There is certainly a distinct advantage to the Technology program in instituting a full degree program as the two or more full time instructional staff that we will have to employ would be able to take part in future expansion of the Technology programs.

The enrollment in the degree course over the period that we have had it established indicates that we can expect sufficient students to justify the operation. I would also think that the fact that we will be offering the complete course would have the tendency to attract better students from the high schools than the rejected ones from Toronto.

Enrollment School of Forestry in the Degree Program	1966-67	1967-68	1968-69
1st Year	9	17	32*
2nd Year	0	4	11*

*Cannot be verified as absolute in the Registrar's office as yet.

The Proposed Expansion

The proposed expansion is to offer the third and fourth years of a general course in Forestry along the lines of the Toronto (General) curriculum.

The general course in Toronto has received recognition in the Provinces and in the United States, and should be a course that would provide an agreeable beginning. The objective is to begin with an already recognized curriculum and revamp when considered necessary.

Core Requirements for a Professional Course

Minimum Requirements

Dendrology

Forest Ecology

Silviculture

Forest Protection

Forest Mensuration

Forest Economics

Forest Policy

Forest Administration

Forest Management

Other professional subjects that depend on the type of programme as options offered by the College or University.

Logging - Principles & Practices

Wood Technology

Wood-using Industries

Management of Resources dependent on or related to Forests.

Forest Valuation

Advanced work in any Core subject

Non-Professional Subjects

English - communication - written and oral, report writing, public speaking

Botany - general, systematic, physiology, ecology, genetics

Zoology - general

Chemistry - general and elementary organic

Physics - general

Mathematics - trigonometry, algebra, statistics, analytical, geometry, calculus

Geology - physical and some historical and physiographic

Soils - general

Surveying - Boundary survey - mappery and cartographic drafting

Economics - organization - specific conditions as applied to Forestry

Political Science - organization and functioning of governments.

Public Administration

Restricted and Free electives in the social sciences.

Note: The University of Toronto course in Forestry certainly covers the minimum requirements as set out by the Society of American Foresters in the U.S.A. We, at the Lakehead, could decide to place more emphasis on Logging or Utilization after we feel we are soundly established.

Staff Requirements

A minimum of six (6) full time professors in the core subjects, plus the utilization of professors in Mathematics, English, Botany, Zoology, etc.

Should the course be established by September, 1970, then two new staff members would be required in the core subjects. By September 1971, two more added to Faculty. Further additions would be dependent on options offered, the basic number of six are required for a general Forestry course.

Laboratory assistants would be necessary as work loads increased but would be drawn from senior students when they became available.

Required Space

Equivalent of four extra 20-30 student classrooms by 1971.

Required Equipment

No other specialized equipment would be required, but only addition to equipment already in use.

Budget Requirement

Salaries & extra equipment 1970-71	-	$30,000
Salaries & extra equipment 1971-72	-	20,000

Library Facilities

We have sufficient material now to carry out an under graduate program.

Should the proposed expansion in the Degree program actually take place by 1970-71, then the only other expansion that may be possible by 1975 would be in the establishment of other options in the third year technology programs.

I personally feel that a trained technologist in Wildlife Management or in the Management of Natural Resources will have the greatest opportunity in the coming years.

Third year programs as mentioned have the distinct advantage of utilizing a great deal of instruction offered by the Biology Department, and should prove to be a most economical way to finance a course.

Do We Need Another Degree Granting School of Forestry?

F.A.O. panel on Forestry education summarizes the world need as follows.

Present number of Foresters 75,000. Forested land in world forests, eleven thousand million acres. Acres per forester - approximately 150,000.

If world forests were managed at the level now attained in the U.S.A.(which is far below the level practised in Europe) then the world would require some 300,000 foresters, or four times the number now employed. If we were to strive for such a goal for the year 1980, then beyond natural replacement we would need some 11,250 foresters annually.

The existing schools in the world are equipped to graduate some 8,000 annually, of which about 3,000 are needed for replacement; this leaves an annual deficit of some 6,250 foresters.

Some areas of the world are equipped to graduate sufficient for the needs of the immediate future and perhaps a brief look at the distribution of forestry schools in the major forested countries would help.

Education Facilities in Forestry on a World Basis

How does Canada compare?

Universities, Colleges and Schools with Forestry Programs

Country	Universities & Colleges	Technical Courses	Elementary Courses
U.S.A.	40	8	-
Japan	25	-	-
U.S.S.R.	23	26	19
Australia	8	-	-
U.K.	4	12	-
Canada	4	13	-
Brazil	1	-	-

Countries in Order of Size of Forested Area

Coniferous	Hardwoods
1. U.S.S.R.	1. Brazil (Tropical)
2. Canada	2. South Africa (Tropical)
3. U.S.A.	3. U.S.A. (Temperate)

N.B. Coniferous Forests provide the bulk of commercial wood.

Schools in Order of Forested Area

Country	Professional Schools	Technical Schools
U.S.S.R.	23	26
Canada	4	13
U.S.A.	40	8

Canada, although second in the world in size of coniferous forested area, comes an extremely poor third in the facilities for forest education.

The comparison between educational facilities in Canada and the U.S.A. is quite evident in the number of forestry graduates produced yearly.

Bachelor Degrees Granted in Forestry

Year	U.S.A.	Canada
1958	1,358	150
1959	1,521	139
1960	1,466	115
1961	1,544	120

Undergraduate Enrollment in Forestry in 1961

U.S.A.	8,612
Canada	756

Distribution of Forestry Enrollment in Canada for the year 1961.

Toronto	103
U.N.B.	253
U.B.C.	186
Laval	214

A recent study on graduates of the professional and technical schools in Canada shows that while we are steadily improving the supply of technologists, we are hardly holding our own in the professional field.

"Production of Professional Foresters and Forest Technicians in Canada" - H.W. Blenis, June 1967

Introduction

"Data on graduates and on enrollment and graduates was secured from all professional and technical forestry schools respectively by means of a questionnaire.

"Appreciation is expressed to all school executives for their prompt and complete compliance with the request for information.

"The four professional forestry schools in Canada graduated an aggregate of 110 graduates in 1967. This year's graduating classes brought the number of professional foresters produced by Canadian schools to a total of 3,524. Numbers of 1967 graduates and total graduates by school are shown in Table 1.

Table 1 - Graduates of Professional Schools

School	Graduated 1967	Total Graduates June 1967
Toronto	21	962
New Brunswick	29	1,002
Laval	27	663
British Columbia	33	897
Totals	110	3,524

"In contrast to the four professional schools the 11 technical forestry schools in Canada have graduated or expect to graduate 508 forest technicians in 1967. By the end of 1967 the aggregate production of forest technicians will amount to approximately 6,992 or in round numbers 7,000. Data for Canadian technical forestry schools is given in Table 2.

Table 2 - Technical School Enrollments and Graduates

School	Currently Enrolled	Graduates to December 1966	Expected to Graduate 1967	Projected Total Graduates to End of 1967
Newfoundland	21	0	8	8
Maritime	69	925	65	990
Chicoutimi	30[1]	0	0	0
Duchesnay	180	3,150[2]	175	3,325
Ontario	113	1,507	110	1,617
Lakehead	45	106	16	122
Saskatchewan	52	43	26	69
Alberta[3]	82	312	42	354
B.C.I.T.[4]	58	46	42	88
B.C.F.S.[5]	13	395	24	419
Selkirk	28[6]	0	0	0
Totals	702	6,484	508	6,992

[1] Initial year of three-year program.

[2] Including technical specialist course graduates.

[3] In-service personnel included in data.

[4] Two programs: Forestry and Forest Products.

[5] Data for basic and advanced courses combined.

[6] Initial year of two-year program.

"The preceding tables indicate that nearly five forest technicians were produced for every new professional forester who graduated in Canada in 1967. By the end of 1967 there will be approximately two trained forest technicians per professional forester in Canada.

"The ratio of forest technicians to professional foresters has increased markedly during the sixties. In 1960 the ratio was about 1:1 (Blenis) essentially unchanged from 1952 (Blenis 1953). By 1964 it had increased to 3:2 (Blenis 1965) and in 1967 approached 2:1. The 1967 production ratio of approximately 5:1 and the appearance of three new schools suggest that the ratio will continue to increase throughout the decade."

References

1. Blenis, H.W. 1953. The Role of Forest Ranger Schools in Canada and the United States. For. Chron. 29.

2. _____ 1960. Forestry Education in Specialized Schools. Forestry Education in Canada. Canadian Institute of Forestry.

3. _____ 1965. The Maritime Forest Ranger School and its Place in Canadian Forestry Education. Paper presented at the Annual Meeting, New England Section, Society of American Forestry.

H.W. Blenis, June 1967.

It is now 43 years since a new degree granting course in Forestry has been established and while achievement in time may not be a measure of need, it is often a measure of progress. It requires a few years to establish a good course in Degree Forestry and our University should be prepared to help supply the demand that must surely arise in the near future.

Other more obvious reasons support the establishment of a degree here at the Lakehead.

Opportunity to become a leader in the field of Forestry Education in Ontario.

Close to the forests that supply the bulk of commercial wood.

Can attract students from Manitoba and Saskatchewan where forest conditions are similar.

Providing a five-year course is established with minimum entrance at Grade XII standards, an opportunity will be provided to compete for Ontario students that now attend U.N.B.

Definite need in the area for a centre of research in Forestry. Independent investigation can prove to be valuable to woodlot owners, companies and municipal organizations.

Graduates should receive ready acceptance in Government or industry because of the reputation built up by our graduates in Technology and records attained at U.N.B. by Technology graduates that carried on to a degree.

Cost of establishment of the Forestry course would be much less than comparable Applied Science courses.

We have an excellent start on the necessary library facilities.

Many practical aspects of the Forest industry are easily available in the immediate area, from logging to manufacture.

Industry should prove favourable toward the proximity of a professional school.

Greater interest would be created in Forestry in the area high schools if a student could carry through to a degree.

Support from Foresters in the area would come in the form of Guest Lecturers, Supply of Information and cooperation in research.

Should be able to offer a better curriculum. We will be able to take advantage of experience and studies carried out.

Course would be attractive to students from other countries where forest management is in the pioneer stage.

Establishment of the course could enable us to approach the Dominion Forest Service for laboratory facilities in the area.

The demand for Foresters will increase. We should plan for future opportunities and be ready to supply quantity and quality. We will require about ten years to become firmly established.

The rapid expansion in the field of the Technologist will most certainly be reflected in the professional field.

The older Forestry Schools do not have or seem not to have the ability for expansion.

Forestry and Forest Products*

"In 1967 the four institutes offering diplomas in forestry and forest products technology - British Columbia Institute of Technology, Northern Alberta Institute of Technology, Lakehead University, and the College of Trades and Technology at St. John's produced 95 graduates. An increase over this number of approximately 50 per cent is anticipated in 1968.

"However, as in previous years, the supply of graduates in forestry and forest products technology will not meet the expected requirements, which will again ensure very favourable employment opportunities for these graduates. Indeed the Canadian Institute of Forestry estimates at least two positions will be open to each qualified graduate. As a result of this strong demand salaries for these positions will remain very competitive. The average starting salary for 1967 graduates was in the range of $415 - $420 per month, although starting salaries in the Lakehead region have been reported as high as $450.

"The entrance requirement to all of the institutes granting the diploma in forestry technology is a high school graduation diploma or its equivalent. The basic curriculum requires a strong background in mathematics, science, and English. These courses vary in content from such technical skills as drafting, surveying, and cruising methods, to such academic subjects as silviculture, entomology, pathology, botany, zoology, and dendrology. All of the institutes provide for some compulsory period of field operations and strongly advise students to obtain related summer experience.

"The course duration in forestry and forest products technology is two years and is intended to be terminal. However, Lakehead University notes that its outstanding diploma graduates can obtain an advanced standing in a degree course in forestry.

"The British Columbia Institute of Technology also offers a two-year option of forest products technology, which is designed to provide industry with graduates qualified in manufacturing and plant operations, quality control, and sales. This course, in addition to providing the student with the basic skills, emphasizes such specialized areas as the wood option which stresses the most economical methods in collecting raw timber and converting it into such commercial products as lumber, particle board and plywood. Another area of concentration in this course is the pulp and paper option which is concerned mainly with the theory and practice of mechanical, semi-mechanical, and chemical pulping and the conversion of pulp into such useful products as newsprint, paper, and textiles.

"In Quebec, the institute of technology at Chicoutimi offers a three-year course in forestry technology and the Institut de papeterie at Trois-Rivieres gives a course in pulp and paper technology of the same duration.

"The Saskatchewan Technical Institute at Saskatoon offers a related but more general course of renewable resources technology which is designed to provide students with the necessary skills and related knowledge required to equip them for employment as conservation officers, fish forestry, and wildlife technicians, or park wardens. This course of study is the only one of its kind in Canada, stressing fisheries, wildlife, parks, and outdoor recreation along with other academic and technical subjects.

"The demand for well-trained graduates in this discipline comes from a variety of sources. The College of Trades and Technology at St. John's reports an urgent need for people in such areas as pulp and paper operations, research, quality control, product sales, sealing production, and reforestation programs. Other institutes point out that with new principles and techniques being applied in industry and with the increasing importance of the lumber industry to the national economy, the demand for highly competent men in this field should continue for some time.

"New graduates in forestry technology have a wide variety of employment opportunities available both in industry and government. Well-trained technologists are required in the protection of forests from fires, insect infestation, and disease attacks as well as in the supervision of regeneration surveys, planting, seeding, and nursing operations. These skills can be applied in such positions as conservation officers, forestry technicians with entomological and pathological surveys, forest rangers, field supervisors in reforestation programs, and in research. Graduates will also find numerous positions available with paper mills and organizations manufacturing products for the building industry where the skills acquired in forest products technology will be most useful. Finally the graduate may choose a position in the field or in logging where he will prepare and lay out setting plans and cutting boundaries; mark timber and survey and construct roads; or in the field of cruising and stand management where he will cruise timber stands for inventory and logging development."

*Department of Manpower & Immigration - Technical Institute Graduates.

Employment

In a questionnaire circulated to the incoming students this year (September 1968), considering the second year only, at least 85% indicated that they intended to continue forestry education after graduation.

Future Employment Prospects

"If world forests were to be managed on a level of that now practised in the U.S.A. the difference between possible need and possible supply would be some 6,250 Foresters annually". (Source: F.A.O. Study on Forestry Education).

"The need for the services of the professional Forester is likely to increase commensurately with demands for the products of Forest Operations, expansions of the Federal Department of Forestry and emphasis of the trend toward more intensive management of forest land in the relatively accessible areas of the country". (Source: Supply & Demand of University Graduates, N.E.S.

Work areas for forestry graduates are expanding. In recent years Wildlife Management, Land Management, Watershed Management and Range Management have been added to curriculums.

Appendix A

STUDY OF FORESTRY EDUCATION IN CANADA

Dr. George A. Garratt, Dean Emeritus, Yale University School of Forestry, was commissioned by the Canadian Institute of Forestry to carry out a study on Forestry Education in Canada. Unfortunately, the study is not yet complete and only an interim report can be presented here.

TECHNICAL TRAINING PROGRAMS AND UNDERGRADUATE PROFESSIONAL FORESTRY EDUCATION IN CANADA[1]

By GEORGE A. GARRATT[2]

Oxf. 954.3

— What is happening to industrial and government forest management in Canada?

— How do current trends relate to the education and training of technicians and foresters?

— How will the increasing number of forest technicians effect the occupational status and educational level of the professional forester?

Dr. Garratt, the Director of the Canadian Forestry Education Study, outlines his views based on discussions and interviews held across Canada in 1966 and 1967.

Introduction

Professional education in forestry had its inception in Canada in 1907, with the creation of a Faculty of Forestry in the University of Toronto. Three other undergraduate programs were established during the following 13 years: at the University of New Brunswick in 1908; the Quebec Forest School, now the Faculty of Forestry and Geodesy at Laval University, in 1910; and at the University of British Columbia in 1920. The ensuing 47-year period is notable for the fact that no additional baccalaureate programs have been initiated, although at least two universities are currently giving thought to such a move. However, definite interest is being evinced in the broad area of natural resource management and administration, and related programs have been established recently in a number of non-forestry faculties in other than the four named universities.

The modern trend toward the formal training of technicians has found a fertile field in forestry, with a current count of 13 such programs now in existence in seven of the Canadian provinces, and more under consideration in connection with the planned extension of the community college system in several of these provinces. Pioneer among the institutions involved is L'Ecole Forestiere in Quebec, founded in 1925. The decade of the 40's saw the establishment of three additional one-year ranger schools: Ontario Forest Technical School in 1943; B.C. Forest Service Training School, an in-service institution, in 1946; and The Maritime Forest Ranger School, also in 1946. In addition, the first of the two-year technical (or technological) institute type programs, that in forest technology at Lakehead Technical Institute (now Lakehead University) was organized in 1948. It is worthy of note that all of these older institutions are still in operation, as are all the more recent ones.

The most substantial expansion in forest technician training occurred over

[1] An extension of the paper prepared for presentation at the meeting of the Division of Education, Joint CIF-SAF Meeting, Ottawa, Canada, on October 19, 1967.

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the four-year period beginning in 1963, during which time no less than eight programs were initiated, largely as a consequence of the financial incentive provided by the 1961 Federal Technical and Vocational Training Act. First to be established was the two-year renewable resources technology course at the Saskatchewan Institute of Applied Arts and Sciences, which includes forestry as a significant part of its curriculum. This was followed in 1964 by the dual two-year forestry technology and forest products technology programs at the British Columbia Institute of Technology, and the forest technology course of like duration provided by the Northern Alberta Institute of Technology in cooperation with the Forest Technology School at Hinton. The school at Hinton also conducts an in-service program essentially for the Alberta Forest Service, involving a 3-month basic ranger course, begun in 1951, and a subsequent 6-month advanced forestry course, started in 1965; graduates of the latter program are classified as forest technicians by the Alberta Forest Service. The year 1965 also brought the establishment of the two-year forestry technology program at the Newfoundland and Labrador College of Trades and Technology. The three most recent courses are the two-year forestry technology offering at Selkirk College in British Columbia and the three-year forest technician course at the College of General and Professional Studies at Chicoutimi (Quebec), both organized in 1966, and the one-year program at the Sir Sandford Fleming College of Applied Arts and Technology, at Lindsay, Ont., offered for the first time this fall.

It is significant that, in all but one of the technician-training programs, the instruction is in direct administrative charge of a professional forester. Furthermore, the majority (in several cases all) of the members of the teaching staff in at least 8 out of the 13 institutions hold baccalaureate degrees in forestry, and a number of them have advanced degrees.

Evolution of Land Management Policies and Practices

Of paramount importance to both professional education and technician training are the changes that have taken place in forestry and related land management policies and practices in the more immediate past and those that may be anticipated in the years ahead. The significant developments in these areas of resource management will largely determine the nature of the services the professional forester and the forest technician will be called upon to render and the economic, social, and political climate in which they will operate. Brief consideration is given in the following paragraphs to a number of the more important factors involved.

1. Expansion of the forest industries

The importance of the forest industries to the Canadian economy is clearly demonstrated by statistics pertaining to the value of their products (some $3.7 billion in sales value per year) and to the number of jobs provided and wages and salaries paid (both amounting to 13 per cent of the total for all manufacturing in Canada in 1963)[3]. These industries have a particularly vital role in

[3]Mahood, Ian, and F. Leslie C. Reed: Lumber and Plywood--Canada's place in world markets for Lumber and Plywood in 1975 and 2000. Presented at the National Forestry Conference, Montebello, Quebec, February 21-24, 1966.

the world trade of this nation, with 30 per cent of the value of Canadian exports being attributed to forest products.

Especially significant for the future is the development of the pulp and paper industry, which, despite having more than doubled its capacity during the past 20 years, is now engaged in the greatest expansion in its history. In British Columbia alone, pulp capacity is expected to increase more than two-fold between 1965 and 1975, and substantial developments are also taking place in most of the other provinces.

The roundwood requirements of the Canadian pulp and paper industry have been predicted to increase by almost 60 per cent, and those of the lumber and plywood group by 40 per cent between 1965 and 1975; projections to the year 2000 place the increase in roundwood needs in these two major industry classes at 5½ and 2¾ times the 1965 figure, respectively.[4] A projection of somewhat earlier vintage, using 1960 as the base year, is in reasonable agreement as to the increase in demand by 1975.

2. Character of land ownership

One of the significant features of the Canadian situation relates to the extensive public ownership of forest lands. For the country as a whole, 93 per cent of the timbered area is in Crown forests, with all but a very limited amount of federally owned land under the direct control of the provincial governments. Much of the remaining 7 per cent of private land, owned by individuals and corporations, lies in the Maritime Provinces.

Rights to operate on Crown land are assigned under lease or license of various kinds, with tenures ranging from 1 to as many as 99 years, but generally appreciably below this maximum figure. Recently the provincial governments have been providing notable incentive to the expansion of the forest industries, particularly pulp and paper, through special types of leases. These afford more extended tenures than in the past, to insure adequate wood supplies to companies having a considerable investment in plant and equipment, and may also offer other potential operating advantages.

3. Available timber supply

The area of productive forest land in Canada is placed at 611 million acres (30 per cent classified as "accessible-occupied", 45 per cent as "accessible-unoccupied", and 25 per cent as "potentially accessible"), while 482 million acres are indicated as non-productive forest. The estimated productive capacity of the former area under an *extensive* system of management is estimated at about four times the present intensity of utilization[5]. This presumes, of course, the full economic accessibility of the 70 per cent of presently unoccupied productive land, a condition which will be determined largely by the operating costs involved, in

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[4] Haviland, W. E., I. B. Chenowith, and E. T. Owens: Fiber—demand for Canada's wood fiber in 1975 and 2000. Presented at the National Forestry Conference, Montebello, Quebec, February 21-24, 1966. *Also* Mahood and Reed, loc. cit.

[5] Love, D. V.: Potentialities of the forest resource base. Resources for Tomorrow, 2:641-657. July 1961.

relation to the demand and prices to be paid for the resultant products involved on the domestic and world markets.

The early development of the forest industries in Canada was naturally centered in large measure in the more favorable operating locations, as regards the most desirable species and timber stands and advantageous transportation from woods to mill. But, with continued operation, the cutting has tended to move farther and farther out on the company limits, often involving long hauling distances, more difficult terrain, smaller timber, and inferior species. The extent to which such trends toward higher production costs may be offset by increased mechanization of harvesting methods will be a determining factor in fixing the outer limits of profitable expansion of the operation.

In the case of the increasingly dominant pulp and paper industry, some cushion in timber supply may be afforded by such factors as control of accessible Crown limits and ownership of private lands in excess of present and immediately foreseeable needs, potential increase in allowable cuts on allotted limits, the use of species (especially hardwoods) not now being utilized, and reduction in both woods and mill waste. With the sawmill and plywood industries, on the other hand, there are increasing indications of more or less localized shortages in the sizes, kinds, and quality of timber needed.

Reports at the 1966 National Forestry Conference at Montebello, Quebec, suggest that, on a country-wide, total-resource basis, the timber supply should be sufficient to meet the prospective demands of the forest industries at least through 1975. But sometime in the next 15 to 20 years the pinch of shortages will be felt, unless the forest assets can be increased by improved access and protection, notably stepped-up planting of burned and understocked areas, and early adoption of intensive forest management practices.

One of the intangibles relating to the matter of timber supply is the extent to which future demands for other forest uses, and especially recreation, will lead to encroachment on the economically accessible Crown lands. The prospect that government agencies, acting under public pressure, may be moved to set aside substantial tracts of productive timberland for federal and provincial parks, wilderness areas, and other single-purpose uses may be more than an idle threat in the years ahead.

4. Mechanization

In the far western section of Canada, the size of the virgin timber and the rugged topography of most productive forest areas made early mechanization of harvesting operations a physical necessity. Foresters there have long been concerned with the problems involved in planning and supervising operations requiring the use of costly, heavy, mobile equipment.

In contrast, logging east of the Rocky Mountains has developed chiefly under the stimulus of economic rather than physical considerations. The growing scarcity and increased cost of labor have resulted in a rapidly accelerating trend towards mechanization of woods operations. Much of the resultant harvesting has come to involve clear cutting, with increasing attention to tree-length and even full-tree logging (with limbing at the roadside). Innovations are constantly being introduced, and research in this area continues at an intensive pace.

The growing dependence upon mechanization throughout Canada obviously imposes on both supervisory and operating personnel concerned with harvesting a need for understanding the engineering principles and associated economic factors involved. It opens up a potential area of competition between forestry- and engineering-trained professionals and technicians. The indicated greater reluctance of the engineering groups to work "in the bush" at less lucrative jobs than are available in more urban situations has no far tipped the scale in favor of the forestry-minded people.

5. Provincial regulations and forest practice

In all the provinces possessed of Crown lands, the governmental agencies have been closely involved in furthering exploitation of the forested areas under their control and encouraging industrial expansion. Only recently has their attention become directed to a realistic degree to the practice of even an extensive form of forestry. Even now, the intensification of forest management is being delayed by the character of land tenure and the overabundance of mature and overmature timber still within economic reach of many operators. Currently, Canadian forestry may be said to be in the early stages of transition from exploitation to a pattern of limited management designed primarily to ensure future yields of timber for industrial use.

In general, there has been an understandable reluctance on the part of a large segment of the forest industries to make any substantial financial investments on provincially owned areas which they operate under limited tenure and with no rights of equity in the future productivity of the land. However, a relatively small but increasing number of companies are coming to adopt more intensive forestry programs, especially where longer tenure is assured and the government is providing realistic incentives, such as increasing the allowable cut or reducing stumpage charges.

Obviously, the real responsibility for bringing about intensified forestry practice on Crown lands lies with the provincial governments themselves, in their authority to establish and enforce on their leases and licences regulations regarding working plans, regeneration, and other measures. Current requirements range over quite wide limits—from little or nothing in some of the provinces in which present laws are still geared essentially to exploitation and even depletion of the forest resource, to specific regulations relating to site preparation and regeneration in others. But even the latter are barely scratching the surface of substantial forest practice. Real progress will come when both forest industries and provincial governments become realistically concerned about short-range timber supplies. It will have its roots primarily in the transition from an old-growth to a second-growth forest economy.

An increasing amount of experimental work and limited commercial application are being carried out in connection with scarification and other methods of site preparation, seed selection and establishment of seed orchards, planting techniques, bog drainage, modified cutting methods, stand improvement, and other procedures aimed at shortening rotations and improving the quality of the future timber stand. But in the main, these are the things practising foresters talk about at their meetings rather than see applied

on the ground on any substantial scale. Much of the necessary know-how is available; the need is for its effective application under diverse local conditions.

6. Company Organization

The forest industries are today operating essentially on an extraction basis, and the organizational structure of many companies is geared precisely to the objective of harvesting the required timber at the lowest possible cost, with only limited regard for the next generation of trees. In most instances, the woodlands division has been organized into two separate departments, one concerned entirely with operations (logging), the other devoted to such matters as cruising, growth studies, inventory, and other activities considered appropriate for the forestry department. Rather frequently, the forestry department assumes a significant function as the recruiting agency for the other branch of woodlands; following a probationary training period, the more outstanding men are commonly induced to move into operations by virtue of better salaries and improved opportunity for advancement. In the latter area, the concern of the young forester becomes centered rather exclusively on matters strictly related to harvesting and wood procurement, usually with little regard for the application of much of the knowledge he acquired in the university.

While the indicated procedure of recruiting personnel for operations from the forestry department may have the advantage of bringing more of a forestry orientation into the harvesting side of the total woodlands operations, the segregation of the two departments is coming to be generally recognized as disadvantageous in promoting the more intensive forestry practice that will be needed in the years ahead.

In other instances, and especially with the younger companies, there appears to be less tendency to separate forestry and operations. As the importance of forest practice begins to increase with industry's growing concern for its timber supply, even the older companies are moved to consider the merits of an effective integration of the two general types of activity. In such cases, the harvesting function seems destined to assume more of a parallel than a dominant role in relation to actual forest practice, especially as pressures develop to keep the company limits productive.

7. Public pressure for non-timber services

The pressure for increased public use of both public and private land is being manifested in a variety of ways, especially in relation to outdoor recreation. More and more attention is being devoted to plans for setting aside park reserves (both federal and provincial) and other recreational areas, to establishing wilderness areas, and, as road systems are extended and improved, to opening up company lands and limits to hunting, fishing, and other recreational pursuits. While the amount of forest land projected for park and wilderness use is not expected to be excessive in the immediate future, the very fact that the provincial agencies concerned have the authority to set aside (and recapture) selected limits for such purposes further complicates the tenure of company operations.

The increasing pressures on non-timber uses of forest land, which also include watershed management and grazing in pertinent sections of the country, fall for the most part within the concept of integrated land use and thus, except for wilderness areas and federal parks, do not necessarily exclude the practice of forestry. They will, however, notably increase the extent of the responsibilities of those public and private foresters who are engaged in the administration of the forested areas concerned.

Public Forestry Employment

Despite the heightening interest in more intensive forest management, the general nature of employment in the forest industries will be largely determined, for years to come, by a paramount concern for the harvesting phase of the total woodlands operation. This will mean a continuing demand for people capable of dealing with increasingly sophisticated equipment—people who can analyze requirements, design improvements, and deal with other basic engineering problems as they develop, be they foresters or engineers. At the same time, however, the increasing concern for more effective forestry practice will also stimulate the demand for foresters with qualifying biological and related scientific and economic backgrounds.

One consideration in regard to industrial employment of foresters that merits attention is the apparent attitude of many company executives toward the talents of such professionals—an attitude fostered in no small measure by the forestry graduates themselves. By virtue of the nature of their education and their often ingrained and limited concepts of their mission in life, foresters entering lower-management industrial employment, and even those in middle-management occupations, have tended to work rather exclusively in restricted compartments, with the scope of their activities limited to woods operations. Because of the prevailing executive concept that their educational background fits them only for jobs in forestry and logging, the younger foresters are generally considered for placement in the woodlands division alone. Opportunities which may exist in other areas of the company organization and for which the forester may actually be well qualified are more often than not reserved for engineers, economists, commerce and business administration graduates, and other non-forestry groups. There is real need for the professional forester to conceive his role as having to do with the total industrial organization, with unlimited potentialities for administrative and executive types of employment. It is to be hoped that, as foresters become more broadly educated, the prospects for placing them in diverse aspects of industrial (as well as public) management and administration will be enhanced, and their opportunities for advancement improved substantially.

Another area of private enterprise in which Canadian foresters are finding increasing employment opportunities is that of consulting work. In the consolidation of ownerships among the larger companies, industry is leaning more and more to the employment of consulting foresters as well as engineers for needed services. Opportunities are also to be found with smaller companies, in the sawmill, veneer and plywood, and allied industries, which are not in a position to employ foresters on a full-time basis but will have

increasing need for their part-time services in conforming to the regulations imposed on Crown land operations by the provincial governments.

In both industrial organizations and provincial agencies there is but limited demand at present for staff specialists in most areas of activity, although exceptions may be found in such fields as fire control and silviculture. Where specialists are employed, they are usually assigned to the headquarters group and made available to the field as needed. It is indicated that there may be an increased need for specialists in these organizations, but this may well be moderate at best until such time as *applied* research becomes a more vital function of both private and public forestry organizations.

In contrast, the personnel requirements of the federal forestry department are centered on specialists in the various fields in which the expanding nation-wide research program is involved. In federal research, only a few areas are more or less the exclusive province of foresters; in most projects the opportunities for forestry educated personnel are strongly influenced by the availability of research-minded graduates in other disciplines, such as biology, chemistry, economics, engineering, mathematics, and physics. These people, because of their more specific educational preparation, may be even more effective in a research capacity than men with forestry backgrounds.

The one obvious fact is that the character of the work being done by professional foresters, especially in line jobs in industry and provincial employ, is undergoing marked change. The *career* occupation of qualified professionals in such activities as cruising, regeneration studies, logging road location, tree marking, and a myriad of allied tasks may well become a thing of the past, for most of these jobs can be performed by trained technicians, likely with better results. Top administrators in both public and private forestry organizations are generally agreed that too many foresters have too long been doing work for which they were over-educated. With the increasing availability of such technicians, the supervisory responsibilities of the professional forester may be expected to increase, even in the early years of his employment. Recognition of the contributions which appropriately educated men can make to the changing concept of forestry practice and administration, as well as to operations, coupled with the increasing financial investment their employment will represent, will make it incumbent upon the organizations that hire them to take maximum advantage of their talents and place them in positions where they can make suitable return on the employer's investment.

Industry and public agencies are looking for educated people with the ability to develop in managerial capacities. The forest industries in particular, faced with increasingly complex operational problems and greater demands of government as regards the management of Crown lands, will have a mounting need for people capable of planning and supervising their activities. Whether these are foresters, engineers, economists, or experts in other fields becomes a secondary matter in management's search for the needed talent. It is up to the forestry graduates to prove their mettle in this competition, not only in the more conventional industrial and public forestry enterprises, but in the broad resource management field as well.

Professional Education

To a notable extent, professional forestry curricula have been developed with a definite aspect of opportunism, being designed in large measure to meet the requirements of the specific jobs that were expected to confront the graduate on his departure from the university, rather than of the positions he might aspire to fill 15 to 20 years later. In the past, by virtue of the nature of that initial job preparation, technician-type (skill-oriented) training played a large role in the educational experience to which the student was exposed. A rather strong element of technician training still prevails in some of the curricula, but this aspect of education has generally been downgraded in large measure, in keeping with changes in over-all university concepts and policies as well as in recognition of the developing new employment opportunities.

Today, the nature of professional education is changing at an accelerated rate, in the face of two generally divergent circumstances. On the one hand, the pressure of rapid technological advances and economic considerations have tended to slant the educational objective toward increased specialization; on the other, academic, social, and political influences are favoring the concept of a more general education, concerned among other things with the integration of timber production and utilization with the other forest-related aspects of resource management in which the public is becoming increasingly involved. These rather diverse considerations present a definite dilemma to the forestry faculties in their endeavors to devise appropriate undergraduate curricula, and it is not surprising that the individual schools, and even individual members of the same faculty, have different viewpoints regarding the instruction best suited to the education of tomorrow's professional foresters.

One of the problems confronting the professional today is revealed on those occasions when young and inexperienced graduates, possessed of new knowledge germane to the work they are expected to perform, are unable to mesh their efforts with some managers of forestry enterprises whose own technical and general training is, at best, more than a generation old. This is nothing unique or peculiar to forestry; it is simply a manifestation of the same general problem being experienced in engineering and other professions, and so aptly pointed up by Chamberlain[6]. "The older a man grows the less professionally adequate he becomes. For a period, ... he may compensate for this obsolescence of his professional capital by the experience he acquires on his job... But the odds are yearly becoming greater that at some point in his career, while he is still in his prime ... the body of knowledge (he acquired in the university) will have changed so greatly that his lack of current professional competence will stand revealed.

"It takes no special insight to spotlight our educational processes and philosophy as the major cause of the sputter in our social engine. We are still operating as though a person can acquire in the first twenty years or so of his life all the formal education he needs to keep him on an ascending career line through the remaining forty years or so of his working life.

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[6] Chamberlain, Neil W.: Retooling the Mind, The Atlantic, September 1964.

But the fact is that the clock starts running down the moment a young man ... steps from the commencement platform, be it college or high school (or technical institute)."

It has been said of the graduate engineer that not only will half of what he has learned in the university be obsolete in a decade, but that half of what he will need to know ten years from now is not even available to him today. Surely, in the present state of forestry and allied resource development in Canada, what has been said with reference to the engineer is no less true for the professional forester. What may be different about the world of the forester is simply the greater insensitivity to the problem that seems to be encountered on occasion among the less perceptive industry and government decision-makers.

Employment and Education of Forest Technicians

The role of the forest technician is assuming increasing prominence with each passing year, in industry as well as in public service. The technician has existed for years, but has generally been a company- or agency-trained, largely self-educated individual who had the skills to perform many tasks in the woods. In many cases he has risen to positions of supervisory and even administrative importance by dint of his native ability. But with the changing times, these locally experienced people are increasingly being replaced, on retirement or other separation from the employing organization, by formally trained technicians.

As will be indicated later in this presentation, the expanding program of formal education for forest technicians has been developed to the point that the annual yield of such people now well exceeds that of professional foresters. This can only be regarded with distinct approval, in view of the pressing need to free the professional from many of his routine tasks so that he may devote his attention to more important work, concerned with planning, organization, supervision, and general administrative assignments.

For the purpose of the ensuing discussion, the technician is considered as a man who has completed at least eight to nine months of formal training related to forestry. He may be the product of a one-year ranger school or its equivalent or a graduate of a two-year (in one case a three-year) course in a technical institute or institute of technology, a community college, or even a university offering a program of the indicated type. Successful completion of such programs is generally indicated by the award of a certificate or diploma.

The technician-training programs are typically geared to the specific kinds of jobs now being performed at the lower-management level in the local forest industries and public agencies, and in most cases the curricula may be definitely influenced by the recommendations of advisory committees comprised largely of representatives of the employing organizations. For the most part these programs are intended to be terminal in nature, but graduates of some of the two-year courses do on occasion enter the university to study for a professional degree. In fact, more than half of the graduates of one institution are reported as proceeding more or less directly to a professional forestry education.

In his early employment, the professional will likely take on work at the

normal technician level in order to gain essential experience in the field operations of his employing organization. As increasing numbers of technicians become available, the tendency will sometimes be to place them in certain jobs along with professional neophytes, with the better men among them rising to the top regardless of their preparation. To the extent that this is done, the two groups will be competitive, but the odds are naturally very long in favor of the professional. In a real sense, the work of the two groups should be complementary and compatible, and not significantly competitive.

To indicate the role of the forest technician, I can do no better than to excerpt a paragraph from a progress report of the SAF Committee on Training of Forest Technicians[7]. "The forest technician requires an education and training sufficient to enable him to understand the reasons for, and the purposes of, the operations for which he is responsible. He should speak the same language as the professional forester, and appreciate the professional point of view. [He] does not need either the depth or extent of scientific understanding required of the forester, but he does need a practical working knowledge of the same subject matter."

In general, it may be said that technicians are normally expected to perform tasks in the lower-management area, up to the foreman's level. But this is in no sense a ceiling on their advancement and those individuals who have the necessary intellectual capacity and native ability may move steadily up the management ladder, unless their progress is limited by legal restrictions. It is not uncommon to find qualified technicians holding down jobs in industry in such categories as logging superintendent, district superintendent, and other assignments involving some degree of decision-making and administrative responsibility. Their movement into such higher-level jobs may be, in part, a reflection of a dearth of professional personnel. It may also be influenced in the future by the fact that the training provided the technician is becoming increasingly concerned with advanced technical aspects of forestry, with more and more emphasis on the "why" of the procedures involved in forest practice and operations. There is more than fanciful thinking in the observation that the technicians of tomorrow will be comparable to many of today's professionals in their responsibilities and the nature of the jobs they perform.

Demand for Professional Foresters and Technicians

A wide diversity of opinion has been expressed as regards the demand for professional foresters in the years ahead. In some instances, and especially in the case of industrial concerns with highly centralized administrative organizations, the prediction is that, without a notable increase in intensity of forest management, fewer foresters will be needed in the future, with the field jobs being largely taken over by trained technicians. This same thinking is advanced in cases where consolidation of companies and increased mechanization are tending to reduce the need for supervisory (middle-management) personnel.

In this general vein, one British Columbia company indicates that, while it now employs six foresters on one of its logging areas, it could probably get

[7] Journal of Forestry, 65(7): 484-487. July 1967.

along with one experienced professional, filling out the balance of its requirements with technicians. Another concern, this one in Ontario, indicates a current use of one field forester per 1,000 square miles of present operating area; under more intensive forest management, the only expected change would be to increase the size of the area for which the forester is responsible, with technicians being hired to take up any slack. Still another company, operating in both Ontario and Quebec, reports almost a 20 percent drop in number of professional foresters in its employ over the past two years, during which period its cut was increased by 50 percent, reputedly as the result of mechanization and computer use.

In contrast to the above opinions, other organizations, both public and private, foresee the need for substantial additions to their professional personnel, based on anticipated increases in industrial development, in provincial government programs, and in federal research. They point to a considerable backlog of jobs currently either vacant or filled inadequately. They also emphasize the growing need for more foresters in the field, as additional management units are established for greater efficiency in operation, as the requirements for forest practice on Crown lands are intensified by provincial edict, and as companies and provinces move ahead and adopt as standard practice some of the things with which they are now experimenting. A particularly heightened demand is foreseen as second-growth management comes into its own.

An extensive number of examples can be cited to back up these latter opinions. One provincial forest service indicates that by 1970 there will be a 70 percent increase in its need for professional foresters, as compared with the 1965 table of organization; on the basis of actual employment in 1965, the 1970 requirements represent almost a three-fold enlargement in professional staff. Another provincial organization points up a present average of 4,000 square miles of Crown land per professional forester on its timber management staff; under intensive management (for multiple use) and with an adequate staff of technicians, the area for which each forester would be responsible is placed at 1,000 square miles, implying a possible four-fold increase in demand for professional personnel. One company forecasts a need under intensive management of one forester per 100,000 acres, implying a demand for 28 professional foresters, compared to the present level of five plus three unfilled positions. Another company indicates a present need for a 55 percent increase in forestry graduates in its forestry and operations departments; still another speaks of the possibility of a 20 to 30 percent increase.

A rational appraisal of the widely divergent estimates of the demand for professional foresters throughout Canada in the years ahead is difficult to make, because of the various technical, economic, social, and political implications which introduce a strong element of "crystal ball gazing" in many of the projections. Also to be considered is the factor of potential competition which may be provided, not only by the more capable forest technicians, but by professionals and scientists from other resource-oriented disciplines. At stake, of course, is the position of leadership in the broad area of total natural resource management.

The majority of respondents in both industry and the public agencies support my own view that at least a moderate increase in the demand for professional foresters is to be expected over the next 15 years and more. In fact, the requirements may be on the substantial side in some organizations, especially until the current backlog of middle-management jobs is filled and planned expansion programs are well established.

As regards employment of formally trained technicians, there is widespread agreement that the current shortage of such people is more acute than in the case of professional foresters. This belief is supported by the contention that, as the use of qualified technicians is increased, relatively corresponding numbers of already employed professionals can be moved from lower- to middle-management positions for which their education should better fit them. In projecting the demand beyond the stage of filling the existing backlog, it is considered that the need for technicians will continue to exceed that for professionals by a substantial degree. This opinion is confirmed by comparisons of present and projected future ratios of technicians to professional foresters, which currently show a wide diversity even in the same organization, depending largely on the nature of the work involved. In one consulting firm, for example, the present ratio varies from no technicians per forester on precise feasibility studies to as much as 10 to 1 on certain inventory jobs.

Among the *forest industries* reporting in the Education Study, the current range is indicated as within the general limits of from 1:1 to 6:1, with an overall average of slightly less than 3 technicians per professional employee. Projecting the requirements of these same companies into the next 5 to 10 years, the predicted ratio range falls within the limits of from 1½:1 to as much as 10:1, with an average estimate of almost 4½ technicians per forester. The present range in the *provincial forestry services* is indicated as from 1:1 to about 8:1, with an average of approximately 3 to 1; predictions for the future provide an estimated increase to from 2:1 to 10:1, for an average ratio of over 5 technicians to each professional. Figures for the *federal government* in its research and allied activities in forestry are much more precise and uniform than for the other two classes of employers; they reflect a current range of from 1:1 to 2:1, with a predicted future uniform ratio of two technicians per scientist for the federal organization as a whole.

It must be noted, in connection with the above ratios for both the forest industries and the provincial governments, that they do not necessarily relate to formally trained technicians alone; in quite a few instances the number of technicians reported obviously includes a large proportion of local experienced people who are currently included in such a job classification. This circumstance is considered to have a much greater influence on the present situation than it will in the future, when a much more adequate supply of trained people will be available to fill the appropriate jobs.

Significant to the changing ratio is the comparative annual production of technicians and professional foresters in very recent years. In 1965, the seven institutions involved graduated a total of 395 technicians, as compared with 106 foresters from the four professional schools, a ration of 3.7 to 1. In 1967, the corresponding figures are expected to be 500 (from 10

institutions) and 114, respectively, for a 4.4 to 1 ratio. With three and possibly more additional institutions beginning to graduate technicians in another year or two, and with proportionately greater increases in enrollment anticipated for most of the existing technician-training programs than are predicted for the forestry schools in the immediate future, the ratio may be expected to increase steadily over the next five years or so.

Influence of Technicians on Professional Education

The notable development of formal technician-training programs has certain obvious implications as regards the educational requirements of professional foresters in Canada, just as it has in the United States.

As a consequence of the pent-up demand for personnel in both categories, the impact of the increasing availability of technicians on the education of professional foresters is apparently more potential than actual at the present time. At least the recent revisions of forestry school curricula have scarcely been influenced by any serious concern for possible replacement of university graduates in beginning, lower-management jobs. Rather they are based on a realistic regard both for the wide-ranging scientific and associated technological advances in fields relevant to forestry and for the compelling socio-economic and political considerations that are coming to bear both on forestry itself and on the broad aspects of renewable resource management. The revisions appear to reflect a growing conviction that the traditional forestry instruction of the past will no longer serve to prepare tomorrow's graduates for effective professional participation in increasingly complex and diversified fields of public and private employment.

The increasing availability of technicians is expected to lead to a significant reorientation of employment opportunities for professional foresters, largely removing the latter from any prolonged involvement with routine field activities for which university graduates will become increasingly over-educated. This will be all to the good for, if the professional is to become the person of influence and responsibility we contend he should be, performance of the tasks associated with the day-by-day vocational aspects of the management of a forest property should have little place in his career, other than during an initial short-term probationary period of training in the routine applied operations of the employing agency or organization. To that end, the vocationally oriented content of the curriculum can be greatly reduced, or even eliminated, in favor of more concentrated attention on those aspects of university education which will better qualify the graduate for planning, decision-making, and other administrative responsibilities associated with the management of a forest enterprise, be it in the public or private sector, or for research if that be the forester's bent.

Improvement of university-level educational standards may be expected to extend the field of employment for professional foresters, and also increase the demand for technicians to assist them. Concurrently, it will require a general upgrading of faculty personnel, if the forestry schools are to attract their fair share of the better young minds on the campus and to provide the necessary academic challenge and professional inspiration to incite such outstanding students to careers in forestry. The same threat of outmoded

knowledge that faces the professional practitioner also presents a problem of major significance to the teacher and, consequently, to the particular faculty and university he serves. Even though he may develop marked competence in the *technique* of imparting knowledge to his students, by the time he reaches the midpoint in his academic career the teacher may well suffer a critical obsolescence in his technical and scientific background. This may particularly be the fate of instructors who are continuously burdened with heavy undergraduate teaching responsibilities. The question may well be asked, if the members of our faculties are to be given academic tenure, do they not also have the responsibility for constantly updating the knowledge they are imparting to the neophytes in our profession? Any realistic attempt to answer such a question would bring us to consideration of our growing concern for continuing education, not only for academic personnel but for the practising forester and researcher, and even the technician, as well. But this is a separate chapter in any review of professional education and technician training and, accordingly, beyond the purview of today's discussion.

SCHOOL OF FORESTRY

ESTIMATED ENROLLMENT 1972- 1973

	1967 1968	1968 1969	1969 1970	1970 1971	1971 1972	1972 1973	1973 1974	1974 1975
Forest Technology I	60	70	75	80	85	90	95	100
Forest Technology II	23	40	45	55	60	64	70	75
Forest Technology III (Research)	10	15	10	10	8	8	10	10
Forest Technology III (Logging)	-	-	10	12	15	16	20	20
Forestry Degree I - Year I	17	20	25	30	35	35	40	45
Year II	4	10	15	20	25	28	30	30
Year III	-	-	-	10	18	22	25	25
Year IV	-	-	-	-	10	18	20	20
TOTAL	114	155	180	217	254	281	310	325

Appendix C

UNIVERSITY OF TORONTO

Some Facts and Figures

	Approximate Figures
Total Graduates, 1910 to 1967	963
Deceased	97
Living	866
Of the 866:	
Those who belong to both the CIF and OPFA	308
Tbose who belong to the CIF but not the OPFA	172
Those who belong to the OPFA but not the CIF	77
Those who belong to neither	309
Of the 866: Regarding employment:	
Ontario Department of Lands and Forest	170
Ontario Hydro	15
Ontario Conservation Authorities	16
Ontario - Other Departments	20
Canada Department Forestry & Rural Development	50
Armed Forces	11
Canada - Other Departments	21
B.C. Government	5
Saskatchewan Government	6
Newfoundland Government	2
Pulp & Paper Companies	165
Other Wood-using Industries	60
Teaching in Secondary School	75
Teaching at University	35
Graduate Studies	15
Consulting (Full time)	10
Bell Telephone	5
Retired	50
Law Practice	5
Insurance	5
Chartered Accountancy	5
Missionary	1