FOREST RESOURCES

RESEARCH ADVISORY COMMITTEE

1979 ANNUAL REPORT

The Forest Resources Research Advisory Committee reviews all research activities of the School of Forest Resources and offers advice, direction and counsel to the School concerning the entire research program.

The year 1979 was the sixth year of progress for the Forest Resources Research Advisory Committee and another substantial step forward in coordinating and intensifying forest research efforts at the School of Forest Resources.

In 1979, the Cooperative Forestry Research Unit, funded entirely by private landowners, continued to perform as planned. Funding and membership remained stable and all three research scientists continued to make good progress in their respective fields, as evidenced in the attached report. Cooperation in the field between landowners and the scientists facilitated the various projects and served to keep costs in line. In the fall of 1979, a two-day field trip was developed by the C.F.R.U. scientists under the direction of Vice Chairman, Al Leighton. This tour enabled the landowner members and some of the corporate executives an opportunity to view on-going field projects on a first-hand basis. The weather was excellent and the tour was very informative and successful.

Several changes in the F.R.R.A.C. membership have taken place at the close of 1979- Outgoing members were Bart Blum, Donaldson Koons, Henry Saunders, Richard Anderson, and Morris Wing. New members appointed for 1980 are W. Lowell White, Superintendent, Acadia National Park; Daniel Jennings, U.S. Forest Service; John Hartranft, Woodlands Manager, Boise-Cascade; Earl Bessey, E. D. Bessey & Son; and Elizabeth Swain, Maine Audubon Society.

As retiring Chairman of your Committee, I can look back with considerable satisfaction at the progress made in forest research during the last six years in Maine. Private funding of the Cooperative Research Unit did not seem attainable when contemplated in the recession period 197/*~75- Only through the untiring efforts of a few individuals was this made possible. It seems of utmost importance that the research work accomplished under this privately funded unit continue to be accomplished under the direct guidance and supervision of the landowner members. It is my hope, that in the future, the F.R.R.A.C. never lose sight of the goal that the research projects selected be down to earth, practical projects that will benefit the landowners, improve forest productivity, and the overall general economy of the State of Maine.

Morris R. Wing, *Chairman* Allan R. Leighton, *Vice Chairman* Barton M. Blum, *Secretary*

COOPERATIVE FORESTRY RESEARCH UNIT

ANNUAL REPORT - 1979

Nineteen hundred and seventy-nine continued the excellent progress and performance of the Cooperative Forestry Research Unit. In addition to the research efforts directly funded by the CFRU coopera.tors, good progress was also made in the research efforts which were originally funded by specific cooperator donations prior to the formation of the CFRU in 1975- Both CFRU scientists and faculty members of the School of Forest Resources have presented specific results to the CFRU Advisory Subcommittee and to cooperators and the general public via publications. Progress reports on specific areas of research are included as part of this 1979 Annual Report.

During 1979 one of the original members of the CFRU Advisory Subcommittee, Mr. John Sinclair, asked to be replaced. We express our appreciation to John for his excellent advice and support during the critical early years of the CFRU. We also welcomed to the committee Mr. Cliff Swenson who has replaced John.

Two significant activities of the CFRU during 1979 were the preparation of the research proposal for the period 1981 to 1985 and participation in an extremely effective field tour conducted for cooperators in September.

The 1981-85 research proposal is extremely significant. We will need an expanded level of financial support in order to implement the proposed program. A concerted effort will be made to obtain the necessary funds and we urge current and prospective cooperators to reap the benefits that the CFRU can provide by financially supporting the program. Director Knight will make further comment on this in his Executive Summary Proposal following this report.

The September 1979 field trip was directed toward publicizing by actual field demonstrations, the research efforts of the unit and to generate support for financing an expanded program from 1981 to 1985- Overall, the tour was immensely successful, and we are confident it accomplished its major purpose. Thanks are due to Bart Blum, Bart Harvey, Max McCormack and Al Leighton for organizing the details and successfully conducting the tour under the auspices of FRP^AC.

As chairman of the CFRU Advisory Subcommittee, I am convinced that the CFRU has matured substantially in its first 4 years and that the unit has demonstrated that it "has arrived" as a significant contributor to forest resource management in Maine. I look forward to continued expansion and major contributions by the unit. I urge present and prospective cooperators to vigorously support this unique opportunity to move forward in our understanding of the productive management of Maine's most important natural resource.

H. M. Klaiber, *Chairman*
CFRU Advisory Subcommittee

EXECUTIVE **SUMMARY** PROPOSAL

FOR THE

COOPERATIVE FORESTRY RESEARCH UNIT

1981 - 1985

Status:

The Cooperative Forestry Research Unit, established January 1, 1976, has concentrated research on the intensive management of the forest resources of Maine. Cooperators selected three areas for emphasis: Silviculture, Protection and Economics/utilization. Two special projects were also approved: Forest Genetics and Forest Fertilization. The Cooperative was established with a 5~year base period and a plan to review progress at the end of 5 years. The basic fee for cooperators was a three cent per acre per year charge, with a minimum membership charge of $25-00 for those with small woodlots. Response to the venture was so favorable that initial contributions have approximated $225,000 per year for the first 5~year period. To date, CFRU scientists have 36 research reports, either published or in press, and have made numerous visits with cooperators discussing specific problems and solutions.

Need for Continuation:

The forest resource of Maine is coming under intense pressure due to mortality from the spruce budworm, accelerated harvest to salvage budworm mortality, continued white pine weevil depredations and accelerated harvest of hardwoods for home heating. This accelerated rate of harvest along with budworm caused mortality may exceed the allowable annual cut for a number of years. The result of this excess will be an imbalance in the wood supply 10 to 30 years hence. Significant capital investments in intensive forest management will be required to right these imbalances. Investment decisions must be based upon realistic financial analyses grounded in solid forest technology. There is intense need for this venture to continue in order to refine the technological base for these economic justifications and to insure cost-effective application of intensive management practices.

Proposal:

1. Continue CFRU for an additional 5 years, 1981-1985-

2. Increase fee from 3 cents an acre to ^ cents an acre to maintain existing program and compensate for inflation.

3- Make effort to expand membership of cooperative to provide funds to add research on hardwoods and white pine management.

Fred B. Knight, *Director*
School of Forest Resources

PROGRESS REPORTS ON COOPERATIVE

FORESTRY RESEARCH UNIT SPONSORED PROJECTS

Chairman Klaiber has cited the continued progress of CFRU sponsored research. Following is a summary of this progress. All projects, fully and partially funded by CFRU are reported on. As last year, the descriptions of CFRU scientist accomplishments are given separately from those not fully funded by the Unit.

REPORTS ON PROJECTS BY CFRU SCIENTISTS

MARKETING, UTILIZATION, ECONOMICS - *Dr. David B. Field*

Forest Taxation

I have continued to be involved with discussions of Maine's Tree Growth Tax Law and have worked with the Maine Forest Products Council and CFRU Cooperators to deal constructively with legislative attempts to modify the law. This work included the preparation and presentation to the Taxation Committee of the Maine Legislature of a paper (Field, 1979) which outlined some of the theory underlying the Tree Growth Tax Law and supported the law's retention.

Bud Blumenstock, Extension Forester, Al Brackley of Prentiss & Carlisle, and I conducted a full-day continuing-education workshop on capital gains taxation for members of the Maine Chapter, Society of American Foresters, in April, 1979- We expect, eventually, to publish materials used in that workshop as a Forest Taxation Manual.

Charcoal Research

Little work has been done on this project since the publication in March (Brooks and Field, 1979) of our study on the feasibility of producing charcoal in Maine for a domestic space heating fuel. I expect to continue investigations into the markets for metallurgical and filtration charcoal.

One difficult decision facing a charcoal producer is whether to locate the production unit (pyrolizer) in a remote area, thus reducing wood transportation costs and competition with existing wood users, or to locate in a developed area where there is a greater opportunity for using the low-BTU fuel gas and oil-like liquids produced as a by-product of charcoal production. It seems worthwhile to investigate a "total" low-grade hardwood utilization system in which by-products from a remotely-located pyrolizer would provide the energy (heat and electricity) for a logging camp and part of the charcoal produced would be used in gasifier units to power logging equipment and hauling trucks.

Utilization of Dead Timber

Jim Shottafer and I have completed a report (Field and Shottafer, 1979) which presents a problem analysis of difficulties encountered in the milling of dead timber. Our project was designed to identify what problems, if any, wood processors are encountering in milling spruce and fir timber damaged by the current spruce budworm epidemic in Maine.

We found that the situation in Maine is still too new for operators to have gained much experience with milling damaged timber. At the time of this survey, there was still enough sound raw material to fill demands. (More recent research indicates that about 3-^% of the pulpwood and saw-timber milled in Maine during 1978 came from dead trees.) Thus, our survey found primarily opinions and attitudes on expected, rather than experienced, difficu]t ies.

Accordingly, the report consists mostly of a literature review of problems encountered in harvesting and milling insect- and disease-damaged timber elsewhere in the U.S. and Canada, with the intent of offering some idea of comparable difficulties Maine mills may face in the future, and recommendations for future research.

Teaching

From September 1 to December 31, 1979, half of my CFRU research time was released to allow me to teach the senior forest management course in the School of Forest Resources. This appointment allowed the school to cover the temporary absence of a regular teaching faculty member. Half of my salary during this time was paid from school teaching funds.

Project 7

Research into public benefits from private forest land ownership and management in Maine continues to occupy much of my time, but most of the work still focuses on data collection. Some of this work has provided data for forest taxation and spruce budworm impact analyses, but the project should begin to generate more information during 1980.

Economic Importance of Maine's Spruce/Fir Resource

Maine's spruce/fir timber ranks first in volume and in aggregate value among all timber species and products harvested in the State. For many years, the supply of this timber relevant to demand has been abundant. There has been little incentive for landowners to manage the resource intensively and, except for fire protection, little concern over losses due to natural enemies of the resource such as the spruce budworm.

Maine's spruce/fir milling capacity has now reached a level where natural losses are a serious concern. We don't yet know if, and when, our spruce/fir annual growth will fall below the annual demand for the material, but there is some evidence that this may already have happened.

What would it mean to Maine's economy if there were not enough spruce/fir raw material to meet annual needs for that resource by the mills in existence today? What future economic opportunities might have to be foregone if wood shortages forced Maine mills to forego expansion to meet rising demands?

In October, 1979, a questionnaire was mailed to 14 industrial forest landowners and 5 land management firms representing, in total, 143 owners of Maine woodlands. Questionnaires were returned by 16 firms, 9 of whom have manufacturing facilities in Maine which use spruce and fir. The 16 firms manage about 46% of the State's private commercial forest land which is occupied by the spruce/fir type.

The information requested included gross acreages and volumes controlled by the survey group, reductions in physical acreages and volumes due to physical inoperabi1ity, inaccessabi1ity, or legal restriction, the existing structure of the respondents' spruce/fir stands, the present condition and si1vicultural objectives for these stands, and information on current trends in harvesting and milling of spruce and fir timber. Respondents were also asked to indicate current levels of employment, value added in manufacture, wages and salaries paid, and to estimate impacts on these of spruce/fir raw material. total dollars paid into Maine's economy, and levels of future reductions in the availability

To supplement this survey, I have prepared estimates of the demand for Maine's spruce/fir timber resource by 5-year intervals from 1980 to the year 2020:

Forecasts of Spruce/Fir Demand to the Year 2020

(Thousand cords)

Year	Pu1pwood	Saw logs	Total
1980	2,204	635	2,839
1985	2,357	635	2,992
1990	2,547	635	3,182
1995	2,703	635	3,338
2000	2,825	635	3,460
2005	2,965	635	3,600
2010	3,087	635	3,722
2015	3,225	635	3,860
2020	3,346	635	3,981

Results of the survey, the spruce/fir demand study, and other work on the economic importance of Maine's spruce/fir resource will be published early in 1980.

FOREST PROTECTION - *Dr. Mark W. Houseweart*

WHITE PINE WEEVIL
(Wayne N. Dixon)

Life Tables of the White Pine Weevil in Central Maine

Data collection for the 1979 field season was conducted as in 1978 in that white pine weevi1-infested leaders remained the primary sample units. Approximately 500 trees were sampled to determine the natural mortality, agents that operate on Maine's white pine weevil populations. Average mortality per weevil-infested leader for the 1977~79 populations were similar: ca. 10% for all 3 years. Primary mortality factors were pitch-drowning, intraspecific-competition, cannibalism, and natural enemies.

Data collection and analysis are nearly completed. A final report will be available by the end of 1980.

Temporal and Spatial Behavior Patterns of Spring White Pine Weevils on Eastern White Pine in Central Maine (mss.in preparation)

One of the many prerequisites to integrated pest management (IPM) is a thorough knowledge of pest/host plant biology and ecology to permit effective use of direct control as well as supportive tactics. Three ecotypes (locally adapted variants of *Pissodes strobi)* of the white pine weevil have been described, vague if not explained. Ecotype differentiation precludes assuming a standard single weevil behavior in regards to IPM development for the eastern white pine weevil. This investigation was conducted to determine the temporal and spatial activity patterns of spring white pine weevils on eastern white pine in central Maine.

Behavioral data were collected on weekly, *2k* hr. monitor days from late April to early July, 1979. Spring weevil numbers and seasonal activity peaked in early May on host trees. Diel activity was greatest at 1300 h and 1700 h checktimes; least activity occurred at 0500 h. Weevils occupied upper crown buds during dark hours, moving onto branch stems during daylight (the area and time of greatest feeding, mating, and oviposition activity). Daylight activity increased on lateral branches (vs. terminal leaders) as the season progressed regardless of whether host trees were infested by immature weevil life stages.

Differential growth responses exhibited by host tree terminal leaders appeared to be due to the degree of adult weevil feeding and oviposition activity. Intermediate levels of weevil activity (partially-attacked trees) resulted in viable terminals but internode lengths were significantly less than terminals sustaining minimal weevil visitation (not-attacked trees). Terminals subjected to the highest levels of adult and immature weevil (complete-attacked trees) exhibited the typical shepard's crook response. Further investigation into the tree-growth response to weevil attack appears to be an area of the white pine weevil research warranting further investigation.

Fall Temporal Activity and Overwintering Sites of the White Pine Weevil, *Pissodes stpobi ,* in Central Maine.Ann. Entomol. Soc. Am.72:840-4 (1979)

Fall temporal and spatial distributions of the white pine weevil in central Maine can be characterized as follows:

1. Weevils on brood tree foliage appear first in mid-to late-August; peak appearance occurs in mid-September; and adults leave the trees by mid-October.

2. Weevils are found on current year buds and stems, in the north and east crown quadrants of the upper crown level. However, some movement occurs during the day to other crown areas.

3. Most overwintering sites are at the interface between an upper zone of dry needles and a lower zone of moist organic debris.

4. Most overwintering sites are ca. 20 cm from host tree boles and in the west and north litter quadrants.

5. Fall adults are not as restricted to terminal leader(s) as are the spring adults when on trees. Usually only 1 weevil occurs/ foliage unit (apical bud, stems, first whorl) on lateral branches in the fall, while several (3~19) spring adults often occur on the terminal branches.

The temporal and spatial distributions of fall and overwintering weevils prompted 2 pilot studies to investigate the feasibility of alternate methods of suppressing weevil populations.

Helicopter Application of Insecticides for Suppression of White Pine Weevil Populations -A Pilot Study.Coop. For. Res. Unit Research Note 4.(1979)•

Four white pine plantations in southern Penobscot county were sprayed with one of 3 insecticides (permethrin, methoxychlor, carbaryl) in September 1978. One insecticide treatment, permethrin, resulted in a noticeable decline in amount of terminal leader damage the following summer.

Weevil Infestation Rates Before and After Insecticide Application.

Plantation	Treatment	Application Date	Weevil ing % 1978	1979	Amount of change
1	permethrin	9/25/78	53-5	30.0	-0.44
2	methoxychlor	9/28/78	48.0	41.0	-0.15
3	methoxychlor	9/28/78	45.5	42.0	-0.08
4	carbaryl	9/29/79	48.0	53-4	+0.11
5	control		88.0	89.0	+0.01

This pilot study indicates that fall insecticide application via helicopter *may* be a feasible means of suppressing white pine weevil populations in Maine. Further testing is necessary to refine dosage rates and to determine the best insecticide to use with minimal environmental hazards.

Fall Controlled Burns or Litter-Raking for Suppression of Overwintering White Pine Weevil Populations - A Pilot Study ('l'979-'8"o)~

The overwintering phase of the weevil life cycle remains an underutilized control target. However, in another weevil species litter removal, or habitat destruction, was found to effectively reduce population levels. Similarities between the 2 weevil species in litter occupation suggests that habitat destruction combined with incipient weevil mortality may result in considerably fewer numbers of viable spring adults.

Currently under investigation is the feasibility and efficacy of controlled burns and litter-raking in two 18 year old white pine plantations located in Bethel, Maine. Litter on burn treatment plots (three 1/10 ac and one 3 ac) was burned a minimum of 20 cm out from the tree boles to ensure maximum weevil and habitat destruction. Although the fire did not appear to burn deeper than the fermentation layer, thermoprobe recordings at the depth of weevil litter occupation (reaching +170°C) suggest that weevils were incinerated as well as the above layer of litter. Litter in the rake treatment plots (five 1/10 ac and one 3/10 ac) was removed away from the boles (with a fire rake) a minimum of 20 cm and to the depth of the mineral soi1.

Weevil infestation rates for the past 3 years were determined in all the plots and the results indicated a relatively uniform 3 year rate, ca. 70%. The plots will be checked again in July 1980 to see whether either or both treatments may provide another tool to lower the level of damage inflicted on white pine stands by the white pine weevil.

SPRUCE BUDWORM RESEARCH (Cooperation with D. T. Jennings, USFS, NEFES)

With approval of the CFRU 5~year study plan on "Developing *Trichogrorma* as a Potential Suppression Strategy Against Spruce Budworm " and funding from the CANUSA Spruce Budworm Program,signifleant effort has been expended on this project. In the proposal 6 objectives were formulated:

1. Locate, characterize, and monitor forested areas having high levels of *Tr-LchogTorma* egg parasitism.

2. Identify alternate hosts and determine the alternate host sequence for 2". *Minutton.*

3. Isolate SBW kairomone(s) and test their effectiveness for increas ing parasitism levels of native and released *Tviahogramma.*

k. Establish a rearing colony for propagating and maintaining populations of *Tr-ichogr-ccmma.*

5. Develop application, release, and evaluation strategies for kairomones and parasitoids in spruce-fir forests.

6. Investigate si1vicultural methods for parasite enhancement.

The first year's progress has been substantial.

For objective 1 above, I hired 2 full-time summer forestry students to coordinate the stand measurement activities.

Before establishing field plots, we consulted Maine State Forest Service survey data (1978) for SBW egg mass densities and percent parasitism. Using plotted locations of parasitism (Fig. 1), areas were identified and selected that exhibited a range of parasitism. Ten groups of 3 plots (n=30) were selected which had high (100-44), medium (51-12), and low (8-0) percentage parasitism in 1978. Group selection was based on 3 criteria: 1) all three plots were to be in close proximity to one another using MFS grid location by letter and number, 2) all three plots should have similar budworm egg densities, and 3) sample densities should be sufficiently high to make parasitism rates meaningful.

An additional set of plots (n=30) were randomly selected where parasitism ranged through a gradient of percentages from 17-100. Diversity of stand types was accomplished by selecting plots within a central belt from Machias to Greenville, Maine. Only criterion 3 above was used in selecting these random-gradient-stand plots.

Methods for measuring and characterizing stands were as follows: the central point of the MFS egg mass survey sample plot was relocated (no small task). A fixed radius plot was then established at this central point using four 12.62 m plastic ropes at cardinal directions. The number and species of each tree over 3 cm in diameterwere tal1 led.

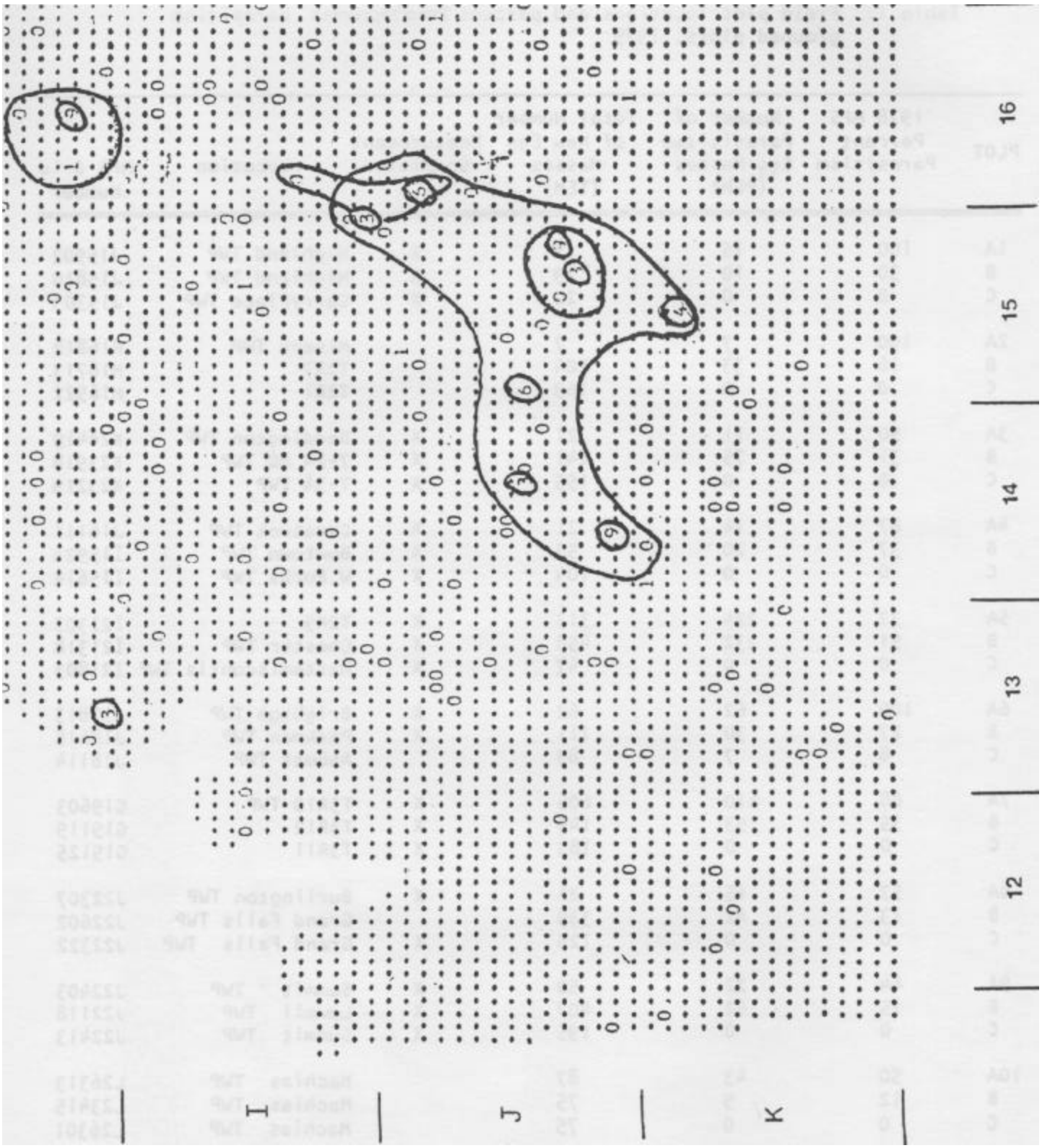
Additional data taken at the central point were: 1) crown density using a densiometer, 2) DBH and age of the dominant species in the stand, 3) 5 height measurements using an Abney level at 66 feet from the base of each tree, 4) average stand height and predominant species for 3 canopy levels, and 5) a determination of even or uneven aged stand.

Again using 4 plastic ropes and compass, the number and species of each tree over 3 cm DBH were tal1ied in a strip 6.6' wide in all 4 cardinal directions at 1/2 chain intervals (33') for a total of 5 chains.

Stand openings, streams, etc. were noted on the tally forms. In addition, a map was constructed denoting all openings within the 5 chain radius of the central point.

Progress on stand measurement is shown in Tables 1 and 2. Table 1 identifies the 10 groups of 3 plots (H, M, l_) by plot number and letter. The 1978 MFS parasitism rates ranged from 0 to 100%, based on 0 to 410 parasitized egg masses (PEM) per plot. Total number of egg masses (TEM), on which parasitism rates are based, ranged from 7 to 606. Measurements have been completed on 22 of 30 plots to date. General location and MFS grid designation are shown in Table 1.

Figure 1. Maine Forest Service 1978 Grid Map of Western Maine showing Trichogramma parasitism levels (0=0-10%, 1=10-20^, 3=30-40%,



6=60-70%, 9=90-100%).

Table Field plot locations and percent *Triehogramma.* parasitism grouped plots, 1979

PLOT	1978 MFS Percent Parasitism (PEM)	Number of Parasitized Egg Masses	Total Number of New Egg Masses (TEM)	Measurement Completed MFS Grid Number	Location	
1A	100	15	15	X	Highland TWP	J 15902
B	30	10	29	X	Highland TWP	J15810
C	0	0	20	X	CarryPlace TWP	J 15303
2A	100	7	7		Misery TWP	H16812
B	16	33	20*4		T2R?	H16?13
C	0	0	169		T2R1	HI 6522
3A	50	11	21	X	Bedding ton TWP	K24419
B	31	75	2*»)	X	7-24 MD TWP	K23918
C	0	0	155	X	T-34 TWP	K23219
4A	67	14	21	X	Caratunk TWP	J16111
B	37	20	52	X	Bow town TWP	115924
C	0	0	104	X	W. Forks TWP	115614
5A	72	*22k*	313	X	T2R9	121307
B	51	232	458	X	Chester TWP	121318
C	0	0	47	X	Mat tarn i sconti s TWP	121803
6A	100	62	62	X	Brighton TWP	J17813
B	27	30	111	X	Parkman TWP	J 184 18
C	8	7	89		Abbott TWP	J18114
7A	68	UQ	606	X	T3R10 TWP	G 19603
B	35	53	149	X	T3R12	G19119
C	0	0	183	X	T3RH	G19125
8A	57	15	26	X	Burl ington TWP	J22307
B	13	42	339		Grand Fal Is TWP	J22602
C	0	0	125	X	Grand Fa 11s TWP	J22322
9A	*kk*	22	50	X	Summit TWP	J22403
B	15	62	407	X	Lowe 1 1 TWP	J22118
C	0	0	195	X	Summit TWP	J22413
10A	50	43	87		Machias TWP	L26313
B	12	9	75		Machias TWP	L23415
C	0	0	75		Machias TWP	L26301
Total plots completed			22			

Table 2. Field plot locations and percent *Triehogramma* parasitism random plots, 1979

PLOT	1978 MFS Percent Parasitism	Number of Parasitized Egg Masses (PEM)	Total Number of New Egg Masses (TEM)	Measurement Completed	Location	MFS Grid Number
8	19	39	204	X	Oakfield TWP	F23621
9	17	28	165	X	Houlton	F24508
11	22	41	185	X	Hodgdon	F24912
17	40+	77	191	X	Crystal	G22214
20	24+	34	144	X	Woodville	122201
21	47	57	120	X	T3R9NWP	120313
22	24	49	201	X	Maxfield	120624
2k	33	29	87	X	Seboeis Pit.	121403
25	61	89	147	X	T3R9 NWP	121116
27	39	60	153	X	Seboeis Pit.	121420
29	38	21	55	X	Wyman TWP	J14519
33	20	19	94	X	Bald Mt. TWP	J16319
34	20	6	28	X	Concord TWP	J 16823
35	50	27	55	X	Dover Foxcroft	J 18307
37	22	12	53	X	Guilford	J 182 13
k6	21	67	322	X	Meddybemps TWP	J26906
48	24	52	218	X	Woodland	J26123
49	43	16	36	X	Kingfield	K15212
50	43	77	178	X	T32MP	K22109
51	27	22	82	X	Great Pond	K22310
52	17	6	36	X	Aurora	K22319
53	50	11	23	X	Amherst	K22514
56	25	5	22	X	Osborn Pit.	K23707
59	42	64	154	X	T4R9 NWP	H20724
60	42	84	197	X	Grindstone	H21210
63	40	10	26	X	Big Squaw	117201
6k	22	44	201	X	Williamsburg	119520
65	25	7	29	X	Sebec	119818
66	19	18	94	X	Bowerbank	119718
68	100	5	5	X	Devereaux	K23616
	Total plots completed			30		

Table 2 lists the 30 random plots by the same format as in Table 1. Measurements have been completed on all 30 random plots.

All field data have been checked and coded onto IBM coding forms for input into the University computer. Once in the computer library file, regression and ANOVA techniques will be used for data analyses. The following computations and conversions will be made for both fixed plot and directional tallies:

- number of trees by species and DBH (cm)
- number of trees/hectare
- number of trees/hectare at 1/2 chain intervals
- number of trees/hectare within 5 chain radius
- BA/hectare by species
  (using the formula: BA/ha=0.0000785^ $(DBH)^2$ X number trees/ha.)
- percentage BA/hectare by species

Regression variables are: Y (dependent variable) = MFS % parasitism rate; Xi_y4 independent variables = average height, stand age, average age, DBH of dominant species, crown densities, stand density, composition, and basal area by the following species: alder, apple, ash, beech, cedar, cherry, balsam fir, gray birch, hemlock, hop hornbeam, larch, mountain maple, oak, poplar, red maple, red pine, spruce, sugar maple, striped maple, willow, white birch, white pine, and yellow birch. Notes on openings caused by streams, roads, trails, blowdown, swamp, fields, bogs, etc. will also be added as input variables.

Work on objective 2 (Alternate Hosts) was initiated this spring, primarily hiring a classified employee, Scott Pease, from CANUSA funds. Scott started work in June, and had to "hit the ground running" to sample for alternate hosts, while researching the literature for potential alternate hosts utilized by *Tp-Lchogramma* that are found in Maine's forests. We felt this work to be very important because 1) earlier Canadian researchers identified high levels of parasitism of SBW egg masses to be dependent on the presence of alternate hosts; 2) yearly parasitism rates seem to fluctuate (as alternate host populations may), reaching as high as *11%,* but usually are ca. 15%. C. A. Miller working in New Brunswick attributed the parasitism rate of *lk%* in Maine, and *k8%* in New Brunswick to increases in parasite densities on alternate hosts in the spring before budworm eggs were attacked. Unfortunately, these alternate hosts were not identified.

From our literature search we found over 100 species of insects that are attacked by *Trichogramma*. We then reduced this list to A9 species known to occur in northeastern forests. Further reduction to what are thought to be "key" alternate hosts found in Maine's forests are shown in Figure 2.

Collections are currently in progress and will continue throughout the year in order to identify potential overwintering hosts and hosts available before budworm oviposition.

In summary, 289 foliage samples have been collected from 13 deciduous and 7 coniferous tree species. Foliage samples were examined in the laboratory and potential host eggs reared for *Trichograrma*. A total of 33 samples yielded *Triehogramma* parasitoids which are currently being identified by a specialist.

EGG PERIODS OF TRICHOGRAMMA HOSTS
IN NORTHEASTERN FORESTS

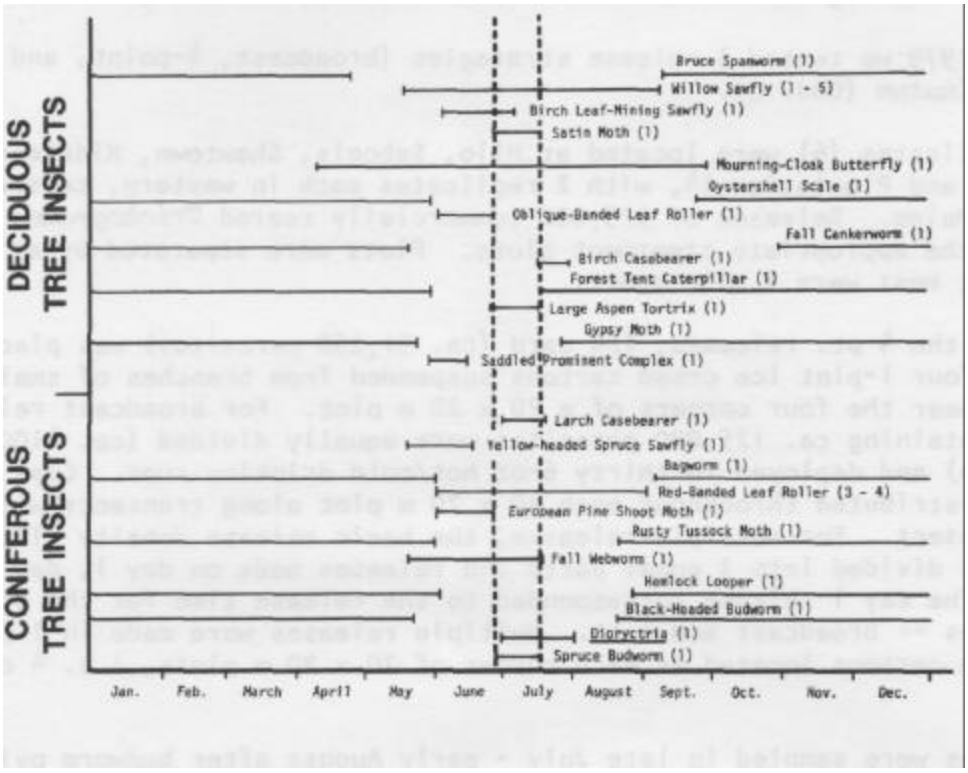


Fig. 2. Egg periods of *Triahogramma* hosts in Northeastern forests as determined from Baker (1972) and Craighead (1950).

Preliminary steps were taken to accomplish objective 3 (Kairomones). I contracted with the Canadian Forestry Service in Sault Ste. Marie, Ontario to send Dr. Richard Jones at the University of Minnesota 300,000 dead adult SBW moths. The wing scales from these moths were used by R. L. Jones, a research insect physiologist, to produce a crude SBW hexane kairomone extract. Small scale tests were initiated near Howland and Machias, Maine. Jones was invited to participate in the Machias experiments by Dan Jennings, USFS. Analysis is not yet complete, but preliminary indications are that there may have been an over abundance of natural kairomone, thereby reducing the effectiveness of the sprayed kairomone.

Little work has been accomplished on objective A (Rearing Colony) other than consultation with managers of various established commercial and governmental rearing facilities in Texas, California, and Georgia.

In 1979 we tested 3 release strategies (broadcast, A-point, and multiple) for *T. minutian* (OBJ. 5).

Replicates (6) were located at Milo, Seboeis, Shawtown, Middlesex, Machias, and Plantation 1A, with 2 replicates each in western, central and eastern Maine. Releases of 125,000 commercially reared *Tri-chogramma* were made at the appropriate treatment plots. Plots were separated by at least 0.5 mile; most were 1 mile apart.

For the *k* pt. releases, 1A card (ca. 31,250 parasites) was placed in each of four 1-pint ice cream cartons suspended from branches of small trees located near the four corners of a 20 x 20 m plot. For broadcast releases, cards containing ca. 125,000 parasites were equally divided (ca. 4100 parasites/cup) and deployed in thirty 6-oz hot/cold drinking cups. Cups were evenly distributed throughout each 20 x 20 m plot along transects with 5 cups/transect. For multiple releases, the basic release density (125,0007 plot) was divided into 3 equal parts and releases made on day 1, day 5 and day 8. The day 1 release corresponded to the release time for the other strategies -- broadcast and A pt. Multiple releases were made in 1 pint ice cream cartons located at each corner of 20 x 20 m plots, i.e. *k* cartons/ plot.

Trees were sampled in late July - early August <u>after</u> budworm oviposition and egg development were complete. Initially, 20 balsam fir trees were sampled for egg masses within each 20 x 20 m plot pi us 16 trees, 2 at each of 8 cardinal directions (N, NE, E, SE, etc.) one chain (20 m) distant from the plot edge. In addition to these samples from large trees, we subsequently sampled 20 small trees (2-3 m) on each plot. Thus, a total of 13^ samples was taken on each plot.

In the laboratory, branches were examined by 6 trained observers. All egg masses found were categorized (new, old, parasitized) and then measured to determine total number of eggs.

Our primary objective in testing release strategies -- broadcast, multiple, and 4-point -- was achieved. Since release densities were the same for all treatments, differences among strategies (Table 3) are due to release techniques. For the variables, percent, EMPERC, STARPAR, and STARPEM, the broadcast release showed the highest parasitism rates. Although

Table 3. Results of 1979 *Triehograjnma* Release Strategy Test

VARIABLE	RELEASE STRATEGY[1]				
Name (Formula)	Broadcast	Multiple	4-Point	Control	F Ratio[2]
Total Egg Masses (TEM)	12.65[3]	I6.06[b]	19.23[b]	17.10[b]	.0002
Total Eggs (TE)	203- 34[a]	269- 52[b]	312. 88[b]	268. 74[b]	.0001
Parasitized Eggs (PE)	17.85	24.66	25-99	25.24	.1185
Total Foliage (TLFOL)	788. 46[b]	788. 29[b]	798. 66[b]	732. 72[a]	.0192
Mean TE (TE/TLFOI_)X 100	27.31[3]	35.05[b]	39.47[b]	37.35[b]	.0005
Mean PE (PE/TLFOL)X 100	2,49	3.20	3.28	3.24	.3263
Cunit (xEM/600cm^{2}FOL)	10.21[a]	12.56[b]	I4.57[b]	I4.28[b]	.0004
Percent (PE/TE)X 100	11.35	8.35	8.74	9.95	.1682
EMPERC (PEM/TEM)X 100	I8.17[b]	13.00[a]	I4.45[ab]	I6.30[ab]	.0294
STARPAR (PE/TE/TLFOL)X 10^5	I6.75[ab]	11.53[a]	12.10[a]	13.l4[ab]	.0948[3]
STARPEM (PEM/TEM/TLFOL)X 1 O^5	26.63[b]	17-93[3]	19.78[ab]	22.52[ab]	.0193

1. Means for 6 replicates, n = 216 per treatment.
2. Different superscript letters denote significance at .05 [a], SNK Range Test.
3. Different superscript letters denote significance at .10 [a], Duncan's Multiple Range Test.

some treatments are not greatly different, significant differences were detected by ANOVA and multiple range tests, as shown by superscripts and F ratios in Table 3- Treatment differences over the control plots were disappointing, but may be due to the relatively low release density, i.e 125,OOOAOOm^2 plot.

Additional analyses are being made in an attempt to explain some of the variability in parasitism rates. Specifically, we are looking for differences in stand composition among replicates. Obviously, important parameters will be the SBW egg density and the quality of foliage these parasitoids must search.

Regression analyses will also be performed on the data where STARPAR, STARPEM, PERCENT, and EMPERC are the dependent variables. Independent variables are: total eggs, total egg masses, wind speed, wind direction, defoliation, total foliage, release directions (1-9), and two computed ratios (i.e. egg masses per foliage—CUNIT and EGG PFOL). Other independent variables are the stand measurement parameters stated in objective 1.

The next logical step in our study objectives is to test varying release densities by the broadcast method. We believe an aerial broadcast release is needed. Such strategy will provide an even distribution of parasitoids over a large area, eliminate some of the problems associated with small plots (i.e. dispersal of parasitoids out of the plot), and place *Tx"i.cho gramma* in upper crown levels where spruce budworm egg densities are the highest. Also the operational feasibility of aerial releases needs to be tested and evaluated in spruce-fir forests.

Little progress has been made on objective 6, other than stand measurements taken for objectives 1 and 2. From these data, stands will be characterized and relationships examined between habitat diversity and parasitism levels. Specifically we need to:

1) identify which tree species are important enhancers of *Tyichograrma* parasitism via providing alternate host habitats.

2) determine specific habitat requirements (both physical and biotic) for *Triehogvconma* attacking spruce budworm eggs. Since parasitism seems to be greater in upper crown levels than in lower levels, factors which may be important are tree height, available light, crown closure, and stand density.

3) consult with foresters and research si 1viculturists to determine possible methods (compatible with existing forestry practices) for converting stands or selecting tree species that influence *Tvichogvamna* parasitism.

k) and, test and evaluate si1vicultural treatments for parasite enhancement.

OTHER SPRUCE BUDWORM STUDIES

Since most of the research effort on the spruce budworm in 1979 has been directed toward *Tviohogvcmna.,* only a mention of the status of the following studies is warranted.

Study	Years Involvement	Status
Pheromone Blend Experiment	1977	Completed, Public, being Prepared
Pheromone Trap Saturation & Density	1977,78	Pub!ic. in Review
Mite Parasites on SBW Adults	1977,78	Public, due in Canadian Entomologist in Jan-Feb. 1980
Dispersal of Small SBW Larvae	1977,78,79	Completed, analysis proceeding
Ground Invertebrate Inventory	1977,78	Completed, analysis proceeding, species identification to be done
Trap Nesting Wasps	1977,78	Completed, species identification to be done
SBW Antifeedants	1978	IP Co. research ongoing

SPRUCE BUDWORM GROWTH IMPACT STUDY
(Robert K. Lawrence)

The fifth season of annual data collection was completed in 1979- On-plot training sessions for this year's field crews were conducted at Baxter State Park, Woodland, Millinocket, Greenville, and Ashland, Maine. Thirteen crews from paper companies, land companies, the U.S. Forest Service, and the Cooperative Forestry Research Unit collected data from the 407 active growth impact plots during the period of mid-July to mid-October.

The random 10! check (42 plots) of plot measurements was conducted by CFRU field crew. An analysis of these check cruise data is in progress.

The first report on the comprehensive analysis of this 5-year project will be published in mid-1980. Breakdown of the data by geographic regions, based on topography and land management history, will supplement the county analyses of previous progress reports. Detailed analyses of some categories, such as the insecticide application history of study plots, are expected to be released in subsequent reports.

SILVICULTURE - *Dr. Maxuell L. MoCormaak, Jr.*

AERIAL APPLICATION OF HERBICIDES FOR MANAGEMENT OF UNDESIRABLE VEGETATION IN MAINE FORESTS

During 1979 the permanent sample plots and treatment blocks of the Austin Pond and Alligator Lake study sites were carefully evaluated. This carried appraisal of treatments through the second growing season. Dr. Michael Newton, Oregon State University, devoted a portion of his sabbatical leave to this effort and a summary of results has been presented (McCormack and Newton, 1980).

The results have been encouraging. Suppression of previously difficult to manage species has been achieved at reasonable rates of herbicide delivered in five to ten gallons of water per acre. Rates effective for suppression of undesirables have not injured spruces, fir, and white pine. Triclopyr (Garlon*) has exhibited outstanding effectiveness on soft maples.

Our research program with glyphosate (Roundup^) progressed from an Experimental Use Permit to a label for the State of Maine which provides for aerial application in forestry. A summary of results and the status of glyphosate use was presented at the Northeastern Weed Science Society annual meeting (McCormack, Lynn, and Sprague, 1980).

Commercial applications and new herbicide research possibilities were deterred as the result of an herbicide spray incident near Dennysville in Washington County, Maine. Problems attributed to herbicide drift were misrepresented and required investigation for documentation of the incident.

Cooperative support has been provided for herbicide studies conducted on the Northern Experiment Forest of International Paper Company in Howland, Maine. This work includes an evaluation of timing of glyphosate applications and preliminary appraisal of glyphosate-triclopyr combination treatments. Also included was a study of a pelletized form of hexazinone (Velpar Gridball^) for suppressing woody brush species. First-year results of the hexazinone study have been reported (Saviello and McCormack, 1980).

THINNING SPRUCE AND SPRUCE-FIR STANDS IN MAINE

Again in 1979 the major silviculture research effort was expended on thinning studies. The short-term phase, conducted by Frank J. Conlon, Jr. (Boise-Cascade Fellow), involved evaluation of data gained from detailed stem analyses accomplished in 1978. Data from the 100 residual trees (summarized in the 1978 Annual Report) have been submitted to a thorough analysis and computer techniques have been utilized to diagram curves of height and radial growth as well as stem profiles. The accompanying Figures 1 and 2 are examples of the direct computer output for a portion of the data from one of the study trees.

The data have shown that growth rates of native spruces and fir can be enhanced by thinning. Data indicate that increased diameter growth is not correlated with height growth. Evaluations of crown development show crown expansion to be independent of the other growth responses. Relationships between crown characteristics and stem growth responses to release

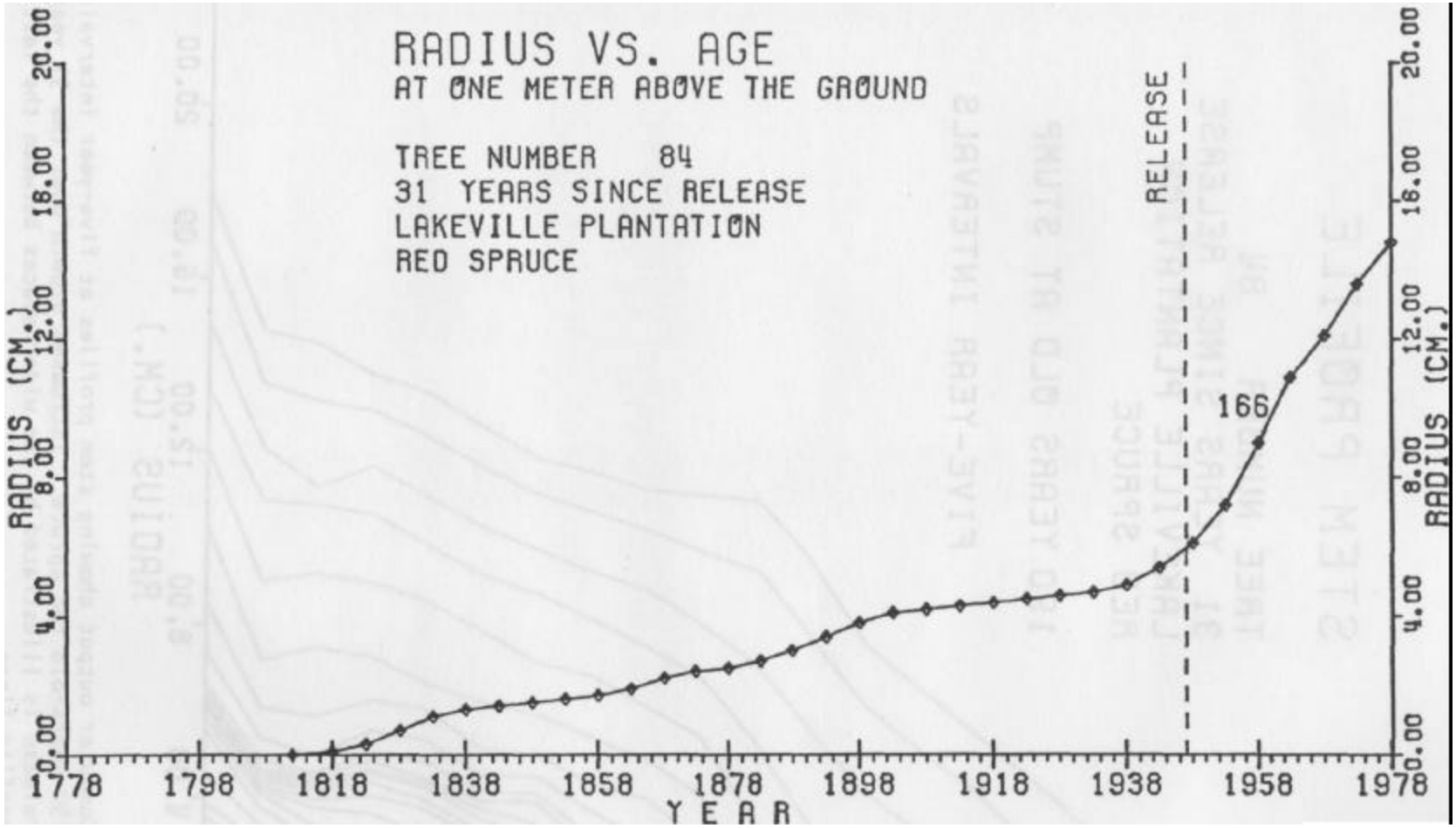
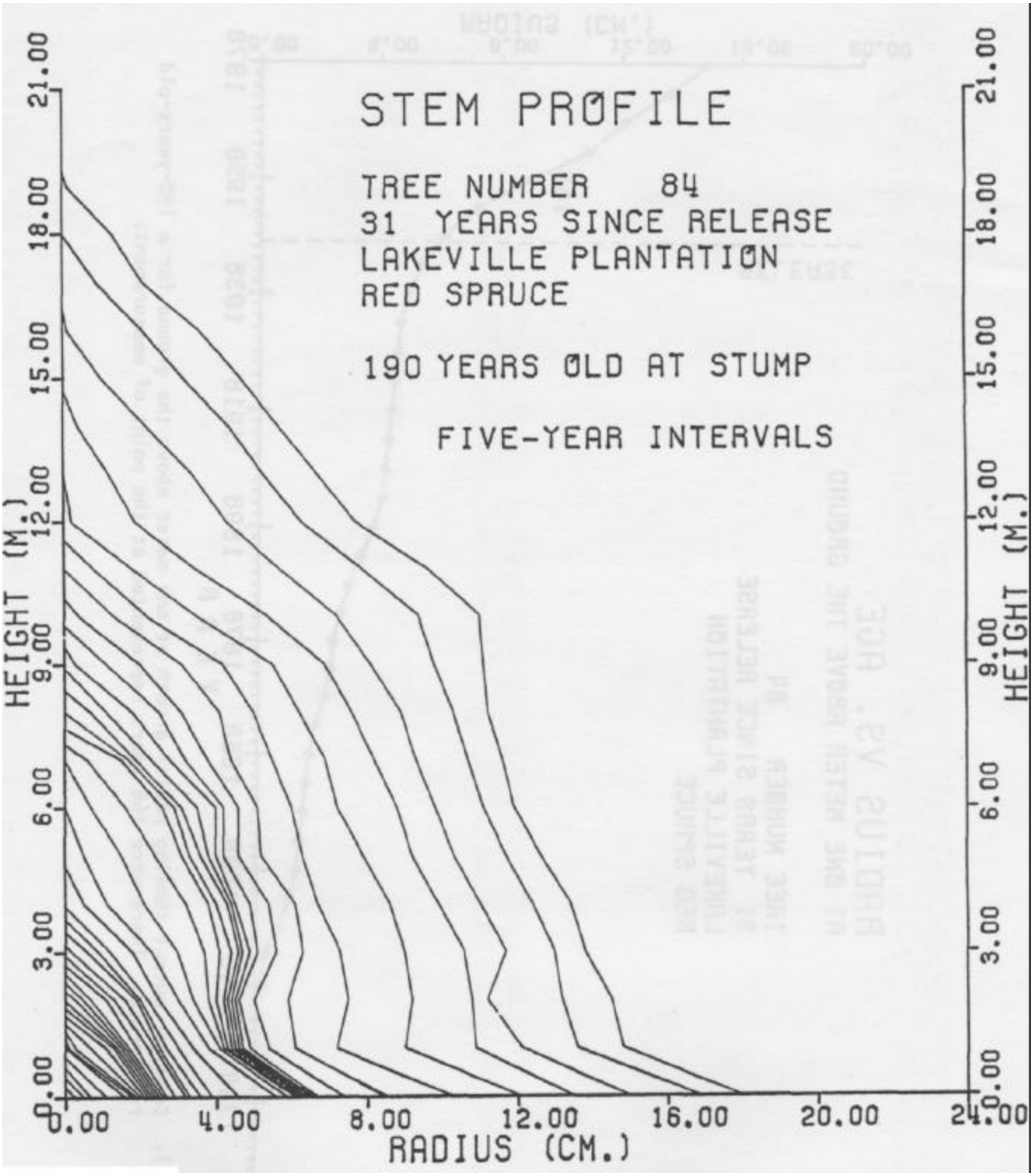


Figure 1. Computer output showing radial growth at one meter above the ground for a 190-years-old red spruce. There were 166 years represented at the point of measurement.


STEM PROFILE
TREE NUMBER 84
31 YEARS SINCE RELEASE
LAKEVILLE PLANTATION
RED SPRUCE
190 YEARS OLD AT STUMP
FIVE-YEAR INTERVALS
HEIGHT (M.)
0.00
3.00
6.00
9.00
12.00
15.00
18.00
21.00
0.00
4.00
8.00
12.00
16.00
20.00
24.00
RADIUS (CM.)

are proving to be one of the most interesting aspects of this phase of the thinning studies.

The long-term phase has continued on two fronts. First, an additional study site has been established near Ashland. This area adds a new set of conditions to this comprehensive study since it is composed of white spruce planted on an abandoned farm field. Tree and site data will be collected during the 1980 field season.

Second, individual evaluation trees were identified, numbered, and measured on the four study sites previously reported. Characteristics of each tree have been entered into a computer system for evaluation over the long-term of this phase of the study. This information, combined with Frank Conlon's short-term phase information, will provide practical guidelines for crop tree selection and thinning decisions.

Study tree data include tree dimensions and descriptions with particular emphasis on tree conditions and crown characteristics. The nature and position of competing trees has also been included in the descriptions of each tree. The following table summarizes the individual evaluation trees characterized thus far.

SUMMARY OF INDIVIDUAL EVALUATION TREES ON
FOUR LONG-TERM THINNING STUDY SITES

Study Site	Red Spruce	White Spruce	Black Spruce	Bal sam Fir	Total
Scott Brook	40	18	15	lit	87
Rowel 1 Brook	145	--	--	15	160
Clayton Lake	67	—	72	--	139
Lakeville Plantation	115	--	—	15	130
Total	367	18	87	*kk*	516

INTENSIVE FOREST HARVESTING, RESIDUE MANAGEMENT PRACTICES, AND NUTRIENT CYCLING IN THE SPRUCE-FIR TYPE OF NORTH-CENTRAL MAINE

The study proposal of C. Tattersall Smith, Jr., Ph.D. student, has been completed and field work has been initiated. This study is intended to provide information for evaluating effects of different harvesting practices and different levels of utilization of forest-grown biomass on short-term nutrient cycling and on long-term site nutrient capital. Three residue management alternatives; (1) complete removal, (2) residue chipped and scattered on the site, and (3) residue scattered on the site; as options within a mechanical full-tree harvesting system will be studied. Soil properties, subsurface water quality, and residue decomposition dynamics will be evaluated.

A pair of watersheds suitable for the study has been defined on the ground in the southwest corner of T^R12 WELS between Mud Pond and Chesuncook Lake. A topographic map with grid system has been drafted. Sixteen study plots have been located, measured, and installed with porous ceramic cup pressure-tension lysimeters for collection of subsurface water samples.

Base data will be collected through the 1980 field season. In 1981, through cooperation with Great Northern Paper Company, one of the watersheds (118 acres) will be clearcut as a commercial operation. Evaluations of the residue management alternatives will be conducted following the cutting and comparisons will be made with the adjacent uncut watershed.

PROGRESS ON PROJECTS PARTIALLY SUPPORTED BY FUNDS FROM THE COOPERATIVE UNIT

TREE IMPROVEMENT - *Dr. David S. Canavera*

Tree planting activities continued at a high level in 1979 with Georgia-Pacific, St. Regis, and Great Northern being the most active of the CFRU membership. Cone production was quite variable for most species throughout the state, although that for balsam fir *(Abies balsamea* (L.) Mill.) was generally good. Christmas tree growers made extensive collections of balsam fir this year; however, there was little cone collecting done for other species even in those areas that had good to moderate cone crops. This is unfortunate for all those involved with reforestation programs since it means that seed for another year will again have to be purchased from untested seed sources furnished by commercial seed dealers. Very likely significant reductions in growth rate, frost resistance, survival, etc. can result from this indiscriminate use of untested seed sources. This unsound management practice must be halted as soon as possible. Next year would not be too soon.

Provenance Collections and Species' Trials

One of the first steps involved in the process of developing improved varieties of forest trees is to assemble, test, and evaluate new germ plasm collections. In 1979, we established *k* field plantings of the species listed below. Detailed information on seed source data, plantation lay-out, and exact geographic location of the plantations is available in mimeographed form and will be provided to any interested cooperator upon request.

Norway spruce *(Pioea abies(L.)* Karst.). Four plantings of A9 sources were established on land owned by International Paper Company (Howland), Diamond International Corporation (Summit), Great Northern Paper Company (Telos) and Scott Paper Company (Bingham). Many of the sources used are from eastern Europe; control source is from Scott Paper Company's Brazier plantation located near Bingham.

Scotch pine *(Pinus sylvestris* L.). Three plantings of 50 sources, all originating in the USSR, were established on land owned by Georgia-Pacific Corporation (Crawford), Scott Paper Company (Smith Town), and Great Northern Paper Company (Ragmuff). This is a unique collection assembled by the Forest Service, USDA, and is the first time they have been tested in the Northeast.

Douglas-fir *(Pseudotsuga menziesii* (Mirb.) Franco). Four plantings of 112 interior sources ranging from Arizona to Idaho were established on land owned by Robbins Lumber Company (Searsmont), St. Regis Paper Company (First Machias Lake), Great Northern Paper Company (Telos), and Scott Paper Company (Bingham). These sources are all frost hardy and should survive under our conditions. They undoubtedly will provide valuable seed source information for Christmas tree growers and longer range information on the potential use of this species as a timber species in Maine. Another small planting of six sources of the

coastal variety from the high Cascades of eastern Oregon was established on International Paper Company land in Dover-Foxcroft.

European alder *(Alnus glutinosa* (L.) Gaertn). A single planting of a combination progeny/provenance test of 48 sources (mostly from northern Europe) was established on St. Anne-Nackawic Pulp and Paper Company land near Nackawic, New Brunswick. This species is rapid growing and represents an excellent source of fiber. This material was assembled by Iowa State University and is being tested at several locations throughout the United States and Canada.

Individual-Tree Selections

Two plantings were established of paper birch *(Betula papyrifera* Marsh.) by St. Anne-Nackawic. The first was a comparison of plus-tree selection methods started by Brian Stanton, who wrote his Master's thesis on the greenhouse results. Brian's work will be published as a CFRU research bulletin in 1980. The second planting consists of inter-provenance hybrids which were made by Knud Clausen when he worked at the Institute of Forest Genetics in Rhinelander, Wisconsin.

Another graduate student, Kevin Kenlan, raised his open-pollinated black spruce *(Piaea mariana* (Mill.) B.S.P.) selections in our greenhouse in winter 1979 and transplanted this material to the State Forest Nursery in June. The seedlings were measured this fall and will be remeasured next fall. Kevin will use these data for his thesis which will be completed by December 1980. The seedlings will be kept in the nursery for another year after which they will be used to establish seedling seed orchards in spring 1982.

Ron Tebbetts has completed second-year growth measurements on white spruce *(Picea glauca* (Moench) Voss.) seedlings originating in southeastern Ontario. Ron will also use these data for his thesis which will be completed in May 1980. Seedling seed orchards of this material will be established in spring 1981. Previous research data have shown that 15 to 20 percent height-growth gains can be expected by using seed from these sources.

Plantation Growth and Yield

Jim DiGennaro is in the process of analyzing his field measurements of older red pine *(P-inus resinosa* Ait.) and white spruce plantations located throughout the state. Jim is currently teaching in Sitka, Alaska, but will be returning to Orono to complete his thesis this coming summer.

Seed Col lections 1979

Numerous seed collections of balsam fir, white spruce, red spruce *(Picea rtibens* Sarg.), and tamarack *(Larix laricina* (Du Roi) K. Koch) were made throughout the state this past fall by CFRU cooperators and staff of the School of Forest Resources. The purpose of these collections is to assemble germ plasm from the various climatic zones of Maine to evaluate how they grow when planted in their own and other zones. This work will continue next fall. Cooperation from all members of the CFRU is necessary

to assure that we get adequate representative samples from throughout the state. Your cooperation in seed collection is needed if the tree improvement program is to be a success.

FOREST FERTILIZATION PROJECT - *Dr. Robert K. Shepard, Jr.*

Efforts during the past year have been placed on applying treatments to plots established in 1979, establishing new plots,,and locating stands in which to establish plots in 1980. Seventy-two plots were fertilized near Rangeley. These plots are in thinned and unthinned red spruce (predominantly) stands and in a thinned white spruce stand. Treatments consisted primarily of different levels of nitrogen. These stands are, however, being threatened by the spruce budworm. Eighteen plots were fertilized in a thinned Norway spruce-white spruce plantation near Orono, the objective being to observe the effects of different levels of nitrogen as well as the effect of fertilization at a relatively low level in successive years vs. that of a single, higher-level application. Plots were established in two white spruce plantations and an unthinned red spruce stand in north central Maine.

White pine and hardwoods have received more attention than previously. Eighty-four plots have been established in white pine stands in the Bethel area, and 50 plots in hardwood stands near Monticello, Patten, and Rangeley are ready to be fertilized. Increasing emphasis will be placed on locating additional study areas in white pine and hardwood stands in southwestern Maine.

Third year growth data were collected from red spruce stands near Ashland and Monticello that were fertilized in 1977- These data indicate that fertilization increased diameter growth by from 15 to ^0 percent. As previously, nitrogen was the element responsible for producing the increase. Unfortunately, results have been somewhat affected by spruce budworm defoliation.

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COOPERATIVE FORESTRY RESEARCH UNIT ADVISORY COMMITTEE

MEMBERSHIP AS OF DECEMBER 31, 1979

The members of the CFRU Advisory Committee appointed to set priorities and review proposals for the Cooperative Forestry Research Unit are as follows:

Mr. E. Bart Harvey, Jr., Woodlands, Great Northern Paper Co.
Dr. Barton Blum, Project Leader, U.S. Forest Service
Mr. Harold M. Klaiber, Chief Forester, Scott Paper Co. - Chairman
Dr. Fred B. Knight, Director, School of Forest Resources
Mr. James L. Robbins, Robbins Lumber Co. - Secretary
Mr. Clifford L. Swenson, Vice President, Seven Islands Land Co.
Dr. Charles D. Webb, Manager, Northern Research Center, Int'l. Paper Co.
Mr. George W. Wei land, Vice President, Dead River Co.

COOPERATORS OF THE FORESTRY RESEARCH UNIT

ON DECEMBER 31, 1979

Baskahegan Co.
J. H. Beards ley
Earl Bessey
Charles Blood
Marvin Blumenstock
Boi se-Cascade
P. H. Chadbourne
Ralph Clifford
Dead River Co.
Dow Chemical Co.
Dunn Timberlands
E. I . du Pont de Nemours & Co.
Fredrickson's Tree Farm
Georgia-Pacific Co.
Great Northern Paper Co.
Hall, Inc.
Hanington Brothers
Louis Hi 1 ton
Huber Corp.
International Paper Co.
I.T.T. Rayonier
Irving Pulp & Paper Co.
Kennebec Equipment Co.
James R. LaCasce
Abbott Ladd
Perry Lamb
Ray McDonald
Monsanto Chemical Co.
Dwight E. Newman
Pierce Farms
Henry Plummer
Prentiss & Carlisle Co.
A. Redmond
Robbins Lumber Co.
St. Regis Paper Co.
Saunders Brothers
Scott Paper Co.
Seven Islands Land Co.
James W. Sewall Co.
Douglas and Dennis Smith
Smith Timberlands
Sprowl Brothers, Inc.
Clayton Totman
J. J. Tree Farm
Ted Tryon
Western Maine Forest Nursery
Leon Williams

OTHER ORGANIZATIONS PROVIDING SUPPORT FOR CFRU PROJECTS

Maine Forest Service USFS,
Northeastern For. Expt. Sta. USFS,
State & Private Forestry Diamond
International
St. Anne-Nackawic
Pejepscot
Sherman Lumber Co.
Mclntire-Stennis Formula Funds

SCHOOL OF FOREST RESOURCES

STUDENT PROFILE

Year	Four-Year Undergraduates			Two -Year Forestry	Graduate	FE, NR, RPM	TOTALS
	Freshmen	Soph. Forestry	Jr. Sr. Wildlife				
1964	71	108	42	0	9	5	235
1969	104	95	92	63	25	2	381
1974	134	225	151	95	44	68	717
1976	140	289	186	87	52	121	875
1979	131	216	109	81	58	148	743

FACULTY AND STAFF OF THE SCHOOL

(DECEMBER 31, 1979)

Fred B. Knight, Director and Dwight B. Demeritt Professor of Forest Resources;
Associate Director of Maine Life Sciences £ Agriculture Experiment Station
Malcolm W. Coulter, Associate Director for Wildlife and Professor of Wildlife
Resources Marshall D. Ashley, Associate Director for Administration, Director of Summer Camp
Programs and Professor of Forest Resources Thomas J. Corcoran, Professor of Forest Resources Ralph H. Griffin, Professor of Forest Resources Maxwell L. McCormack Jr., Research Professor of Forest Resources Ray B. Owen, Jr., Professor of Wildlife Resources James E. Shottafer, Professor of Wood Technology and Head, Forest Products
Laboratory Harold E. Young, Professor of Forest Resources and Head, Complete Tree Institute

FACULTY AND STAFF OF THE SCHOOL (continued)

David S. Canavera, Associate Professor of Forest Resources
David B. Field, Associate Research Professor of Forest Resources
Richard A. Hale, Associate Professor of Wood Technology
Benjamin F. Hoffman, Associate Professor of Forest Resources
Floyd L. Newby, Associate Professor of Forest Resources
Voit B. Richens, Cooperating Associate Professor of Wildlife Resources, and
Assistant Leader, Cooperative Wildlife Research Unit Wallace C. Robbins,
Associate Professor of Forest Technology and Head, Two-Year
Forest Management Technology Program James A. Sherburne, Cooperating Associate
Professor of Wildlife Resources, and
Leader, Cooperative Wildlife Research Unit
Chester F. Banasiak, Associate Research Professor of Wildlife Resources Thomas B.
Brann, Assistant Professor of Forest Resources James R. Gilbert, Assistant Professor
of Wildlife Resources Mark W. Houseweart, Assistant Research Professor of Forest
Resources Malcolm C. Hunter, Assistant Research Professor of Wildlife Resources
Richard Jagels, Assistant Professor of Wood Technology Terry A. May, Assistant
Professor of Wildlife Resources Robert K. Shepard, Jr., Assistant Professor of
Forest Resources Charles P. Williams, Assistant Professor of Forest Technology J.
Louis Morin, Instructor in General Engineering (College of Engineering and
Sciences) and Forest Resources
Ronald P. Tebbetts, Instructor in Forest Resources
Marvin W. Blumenstock, Extension Forestry Specialist and Extension Instructor
William D. Lilley, Extension Safety Specialist and Extension Instructor Timothy G.
O'Keefe, Extension Forestry Specialist and Assistant Extension
Educator (On leave of absence with U.S. Forest Service)
Roger F. Taylor, Superintendent of University Forest William
P. Kemp, Associate Scientist Jay H. Krall, Associate Scientist
George J. Matula Jr., Research Associate in Wildlife Resources
Robert S. Seymour, Associate Scientist Norma E. DeHaas, Assistant
Forest Technologist Norman C. Famous, Assistant Wildlife
Technologist Susan Heinemeyer, Assistant Forest Technologist Karl
Imdorf, Assistant Forest Technologist Gary Lamb, Assistant
Wildlife Technologist Robert Lawrence, Assistant Forest
Technologist Paul Messier, Assistant Forest Technologist James
Ringelman, Assistant Wildlife Technologist Harvey Schiltz,
Assistant Forest Technologist Ellis Sprague, Assistant Forest
Technologist Jeffrey Thorpe, Assistant Forest Technologist Charles
Todd, Assistant Wildlife Technologist

Cooperating Faculty with Joint Appointments

John W. Butzow, Associate Professor of Environmental Education (College of
Education) Richard J. Campana, Professor of Forest Pathology (Botany and Plant
Pathology
Dept.) John B. Dimond, Professor of Forest Entomology (Department of
Entomology)

Harold C. Gibbs, Professor of Wildlife Resources (Department of Animal and Veterinary Sciences) Roland A. Struchtemeyer, Professor of Forest Soils (Dept. of Plant and Soil Sciences)

Faculty Associates

Barton M. Blum, Project Leader, U.S. Forest Service
Hewlette S. Crawford, Research Wildlife Biologist, U.S. Forest Service
Robert M. Frank, Research Forester, U.S. Forest Service
Lloyd C. I Hand, Director of Bureau of Public Lands, Department of Conservation
Jerry R. Longcore, Biologist, U.S. Fish & Wildlife Service
Gordon D. Mott, Research Forester, U.S. Forest Service
Ralph S. Palmer, Retired from New York State Museum & Science Service; Current Lecturer in Zoology Dept., UMO
Sarah F. Redfield, Assistant Attorney General, Attorney General's Office
Thomas B. Saviello, Northern Forest Research Center of International Paper Company
Dale S. Solomon, Research Forester, U.S. Forest Service Howard E. Spencer Jr., Leader, Migratory Bird Project, Maine Department of Inland Fisheries and Wildlife Charles D. Webb, Manager, Northern Forest Research Center of International Paper Company

Professors Emeritus

Gregory Baker, Professor Emeritus of Forestry
Frank K. Beyer, Associate Professor Emeritus of Forestry
Lewis P. Bissell, Extension Forestry Specialist Emeritus
Edwin L. Giddings, Associate Professor Emeritus of Forestry
Howard L. Mendall, Professor Emeritus of Wildlife Resources
Albert D. Nutting, Director Emeritus
Henry A. Plummer, Associate Professor Emeritus of Forestry
Arthur G. Randall, Associate Professor Emeritus of Forest Technology