

ENVIRONMENTAL IMPACT STUDIES IN
THE ICEWATER CREEK WATERSHED

A PROGRESS REPORT FOR 1980

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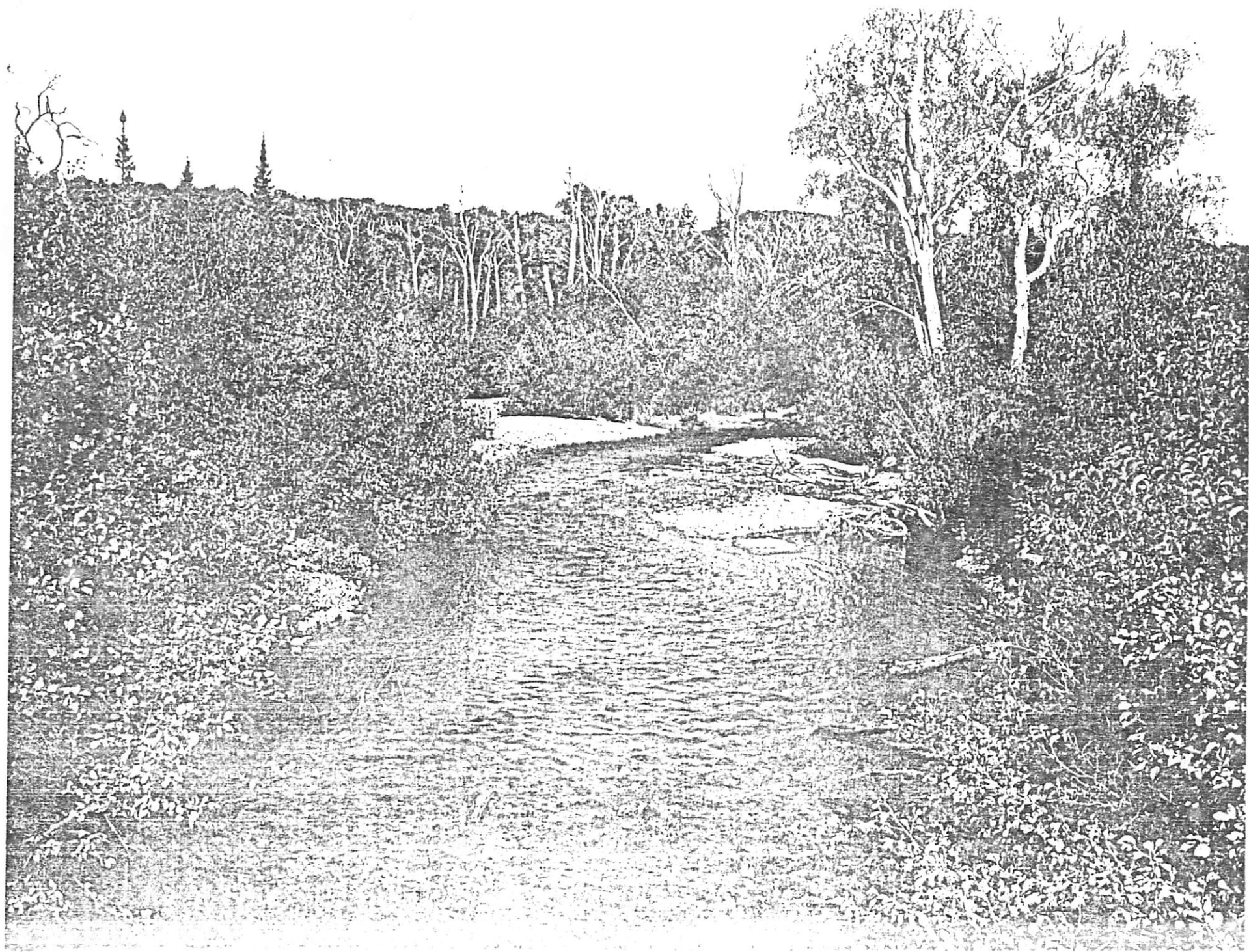
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INTRODUCTION

In 1980, the Environmental Impact Section of FPMI, through the co-operation of the Sault Ste. Marie District Office of the Ontario Ministry of Natural Resources, set up an ongoing research program in the Icewater Creek watershed about 50 km north of Sault Ste. Marie, Ontario (Figure 1).

The objectives of this program are:

To examine in depth a number of aquatic and terrestrial habitats and micro-habitats and their resident animal populations to determine:

- (1) the nature and degree of inherent risks to them posed by
- (2) their degree of actual exposure to
- (3) their actual response to

forest pest management strategies involving aerial applications of pest control agents.

The program will have three distinct phases designed to generate information on three aspects of the effects of forest pest control activities on the environment: (1) potential risk (2) actual exposure and (3) actual response. In general, the actual impact on each part of the environment is primarily a factor of the susceptibility of that portion of the ecosystem to the particular pest control procedure and its level of exposure to the pest control agent used.

i.e., Risk + Exposure = Response

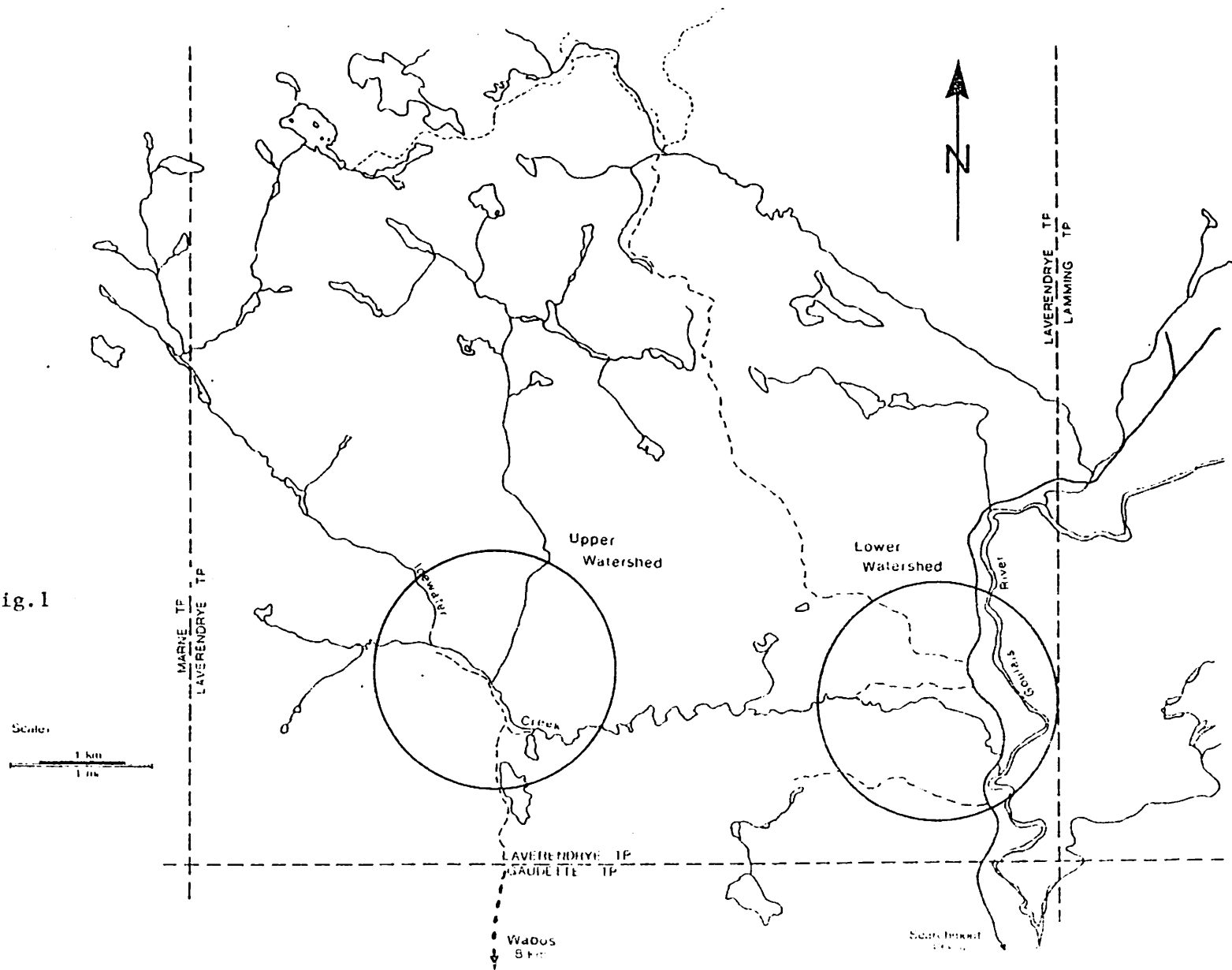
To this extent, part of the objective of the first two portions of the program will be to help predict potential hazards of any suggested pest control action. The third portion of the program will test actual responses and elucidate the nature of ecosystem responses to actual impacts. This will involve relating impacts at lower trophic levels or among specific groups of organisms to secondary impacts on higher trophic levels and changes within the ecosystem (e.g., altered food supply, changes in basic processes such as predation or pollination, etc.).

Each phase of the program will involve looking at the specific aspect under consideration with respect to variable parameters in pest management strategies, specifically:

- (1) timing of pest control actions
- (2) application procedures involved
- (3) nature of the pest control agent(s) used

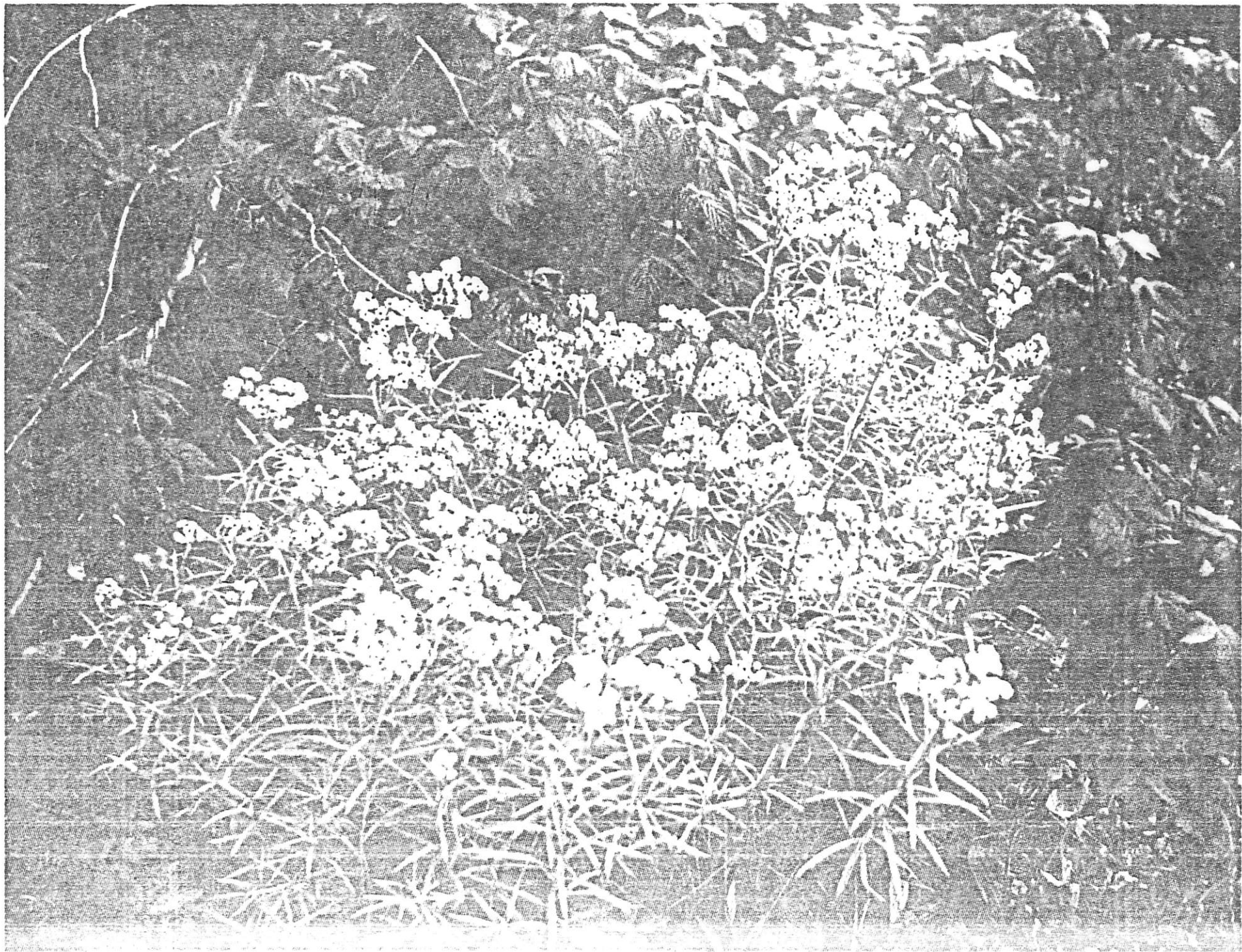
The result will be that assessments on the relative safety or hazard of a given pest management strategy can be partially predicted. This will apply to pest control actions contemplated for any time of the year and against

Fig.1



different pest species or different life stages of a given pest species. In order to try and make the findings of this program applicable to broad geographical areas with dissimilar climatic conditions, sampling activities and results reported will be tied to other "time scales" besides real time, including phenological development of tree species, pollen sources, potential target insect species and other biological groups, as well as some measurement of accumulated heat units. This will allow the results of the findings of this research program to be applied in both a predictive and dynamic sense to operational pest control programs, and will allow for testing and verification of the research results by environmental impact experimentation and monitoring activities under operational conditions.

The potential hazard of a pest control action to a specific group of organisms will depend on the presence or absence of the organism from the environment at the time the action is carried out, and other factors determined by the biology of the organism. Some of the factors to be considered in deciding in potential risk include: seasonal migrations in and out of areas; localized movements from habitat to habitat; life cycles and resultant changes in susceptibility to pest control agents; population cycles and seasonal changes in the age class structure within populations; reproductive cycles and accompanying behaviour; feeding activities and seasonal changes in food source utilization; and daily and seasonal activity patterns and the influence of environmental parameters on them. Sampling activities in the research area in 1980 were designed to gather information on these factors for different groups of organisms and to evaluate various methods for collecting this type of data. This report presents a brief summary of the work done and provides examples of some of the data presented. The data presented is purely illustrative in nature, and is no way complete or indicative of the whole range of data collected to date. A brief outline of plans for 1981 is given for each aspect of the study, and an overall work plan for 1981 is presented at the end of the report.



SITE CHARACTERIZATION STUDIES

Development of Site

During the early part of 1980 an agreement was reached between the OMNR and FPML regarding the use of crown land for research purposes. The Icewater Creek watershed was selected as the most suitable site available. Following spring break-up land-use and Algoma Health Unit permits were obtained and laboratory and meteorological monitoring trailers were moved onto a site at the lower portion of the creek watershed. Small towers equipped with weather sensing devices were erected on the three major ecological sites in this area and the computer equipped Met Van temporarily set up on the main site.

Proposals for 1981

To obtain a land use permit for the upper watershed area site and set up a small work trailer and met tower on location there.

Site Description and Vegetation Survey

Three distinct sites were selected for terrestrial ecosystem studies in the lower portion of the Icewater Creek watershed (Figure 2).

Site 1 (Uplands)

This site is relatively dry and has been cut over, burned and planted to spruce. Planting survival has been poor and deciduous growth has become dominant. Individual near mature white pine, white birch and American elm (now dead) are scattered throughout the site. Numerous openings occur devoid of tree cover but contain scattered clumps of cherry, birch and willow. The main canopy cover on S-1 is:

trembling aspen	50%
pin cherry	30%
white spruce (plantings and natural)	10%
white birch	10%

Approximately 90 shrub and herb species have been identified on the site.

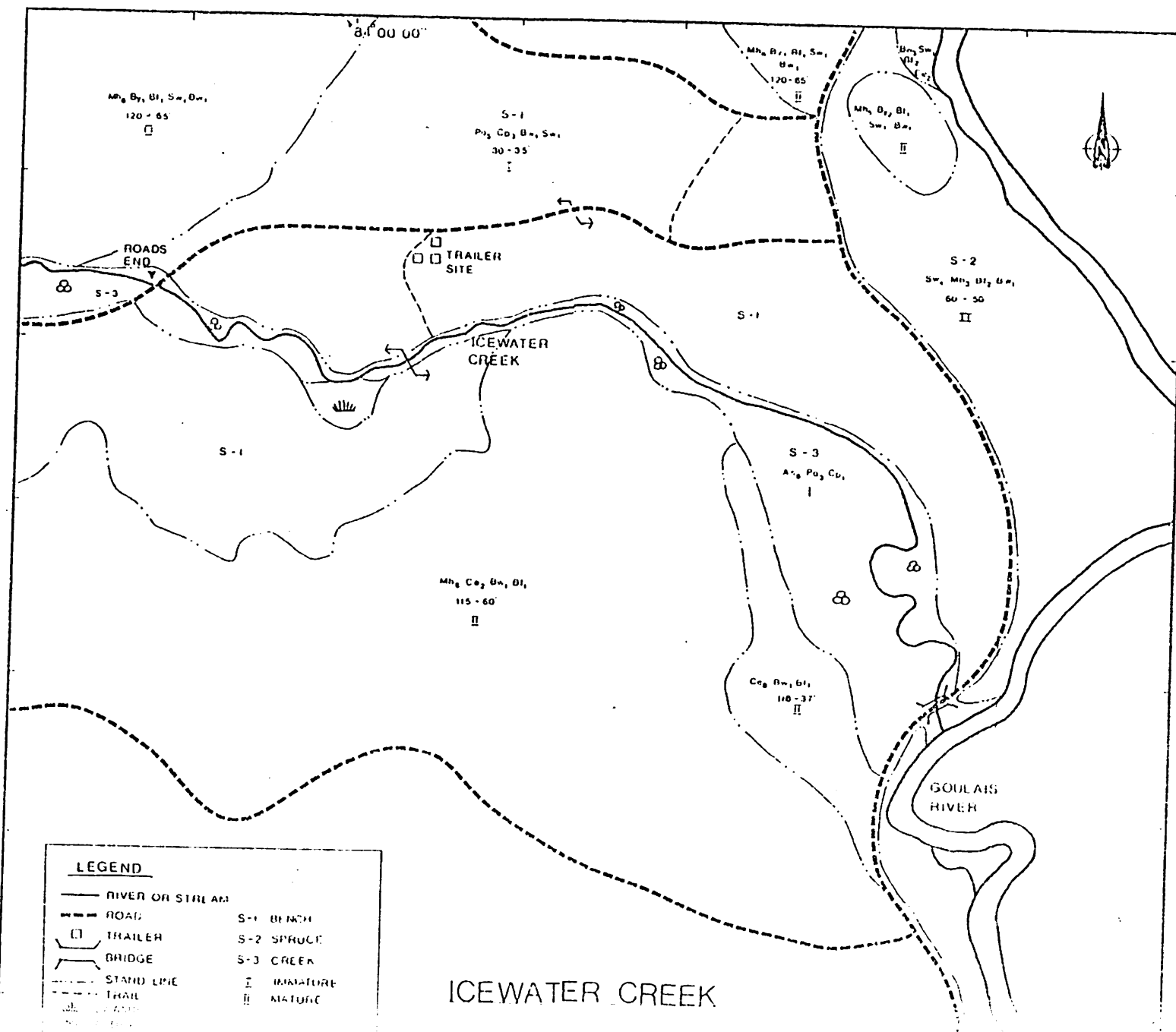
S-2 (Coniferous forest site)

A strip of uncut nearly mature spruce forest lies between the main road and the Goulais River. White spruce comprises 40% of the stand, balsam fir 20%, hard maple 30% and white birch 10%. Average diameter of the white spruce is 28 cm, average height is 15.5 meters and it is approximately 60 years old. Regeneration within the stand is 50% balsam fir, 10% white spruce and 40% hard maple. Thirty-six plant species have been identified on this site.

S-3 (Stream bottom)

This site is a very narrow strip along each side of Icewater Creek. Scattered dead elm are found along the stream banks which are generally

Fig. 2.



treed with alder and willows. Scattered white spruce and birch are also present. A small cedar swamp is located near the junction of Icewater Creek and the Goulais River. Fifty-three plant species have been recorded on this site.

Flowering Plant Survey

In conjunction with the wild pollinator programs, a survey of the three major ecological areas was carried out to document flowering plants/shrubs growing on each site. Samples of all flowering species were collected, pressed identified and placed in the section's plant herbarium and filed under site location. Pollen samples were placed on glass slides and filed in the section's pollen-slide collection. Flowering dates were recorded for each species on each site (Table 1).

Meteorological Research

FPMI's meteorological section's involvement with the Icewater Creek Project during the summer of 1980 involved the measurement of weather parameters over a wide range of instrumentation and locations (Fig. 3 & 4).

Two basis sets of measurements were taken:

- 1) A series of measurements were taken once a week over a 24 hour period. These involved three towers and provided basic weather data in detail for bird census, pollinator studies, small mammal trapping and weather comparisons between the valley bottom and the top of one of its sides (Table 2).

Parameters measured were:

Wind speed and direction
Relative humidity
Temperature--including the creek.
Barometric pressure

- 2) A series of measurements were taken 24 hours a day 7 days a week. This provided the basic weather data for Icewater Creek for the entire study period.

Parameters measured were:

Wind speed and direction
Temperature
Relative humidity
Solar radiation
Barometric pressure
Rainfall

As well as taking detailed weather measurements, equipment evaluation was carried out including a Heathkit Digital weather station used for spot weather reading, a new aluminum instrument shelter, a digital psychrometer and ideas for protecting equipment in a wide range of weather conditions.

Future Proposals

If this type of work is to continue at Icewater Creek, it is essential that a better form of continuous weather monitoring be carried out.

Such a system is available from Weather Measures Corp. for approximately \$8000. This equipment records all its data on a tape which can be played back through a computer to provide a month's data at a time.

We are taking a step into the past trying to do this type of work with strip cutting charts which cannot supply the accuracy that is required. The old way also requires many man hours to service equipment and transform data into a usable form.

Table 1. Flowering Plants and their flowering period
Icewater Creek Research Area
1980

	May				June				July				August				September				
	5-9	12-16	19-23	26-30	2-6	9-13	16-20	23-27	30-4	7-11	14-18	21-25	28-1	4-8	11-15	18-22	25-29	1-5	8-12	15-19	22-26
Strawberry spp.			x	x	x	x	x	x													
Chokecherry				x	x																
Black cherry		x	x	x	x																
Wild lily		x	x	x																	
Raspberry			x	x	x																
Wood Violets		x	x	x	x																
Prillium		x	x	x	x	x															
Marsh Marigold		x	x	x	x																
Spring beauties		x	x	x	x																
Serviceberry (Saskatoon)		x	x	x																	
Wood Anemone		x	x	x	x	x															
Wild Currant		x	x	x	x																
Star flower				x	x	x															
Yellow Cintonia				x	x	x	x														
Rose-twisted stalk				x	x	x	x	x													
Dwarf Ginseng				x	x	x															
Sour-topped blueberry				x	x	x	x														
Wild lily-of-the-valley					x	x	x	x													
Bunchberry					x	x	x	x	x												
Red-Osier Dogwood					x	x	x	x	x	x											
Wild Sarsaparilla					x	x				x	x										
Mountain Maple					x	x															
False Solomon's Seal						x	x	x													
Wild Raspberry						x	x	x	x	x											
Mountain Ash						x	x	x			x										
Labrador Tea						x	x														
Hawkweed							x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Wild Columbine							x	x	x	x	x	x									
Northern Dewberry								x	x	x	x										
Ox-eyed Daisy						x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Yarrow								x	x	x	x	x	x	x	x	x	x	x	x	x	
Hairy Honeysuckle								x	x	x	x	x	x	x	x	x	x	x	x	x	
Mountain Maple								x	x	x	x										
Hooked Buttercup					x	x			x	x											
Solomon's Seal					x	x	x	x													
Meadow Rue						x															
Sheep Sorrel							x	x	x	x											
Common Speedwell							x	x	x	x	x	x									
Wood Sorrel								x	x	x	x										
Cow Parsnip								x	x	x	x										
Smooth Hawkweed								x	x	x	x										
Bunch Honeysuckle								x	x	x	x	x	x	x	x	x	x	x	x	x	

Continued

Table 1. (cont.)

	May				June				July				August				September				
	5-9	12-16	19-23	26-30	2-6	9-13	16-20	23-27	30-4	7-11	14-18	21-25	28-1	4-8	11-15	18-22	25-29	1-5	8-12	15-19	22-26
Aster spp.								x	x	x	x	x	x	x	x	x	x	x	x	x	x
Sundrops								x	x	x	x	x	x	x							x
St. John's Wort										x	x	x	x								
Flea Bane									x	x	x	x	x	x	x	x	x	x			
Rough Bedstraw										x	x	x	x	x	x	x	x	x			
Pearly Everlasting										x	x	x	x	x	x	x	x	x	x		
Rough Cinquefoil										x	x	x	x	x	x	x	x	x		x	x
Black Raspberry										x	x	x	x	x	x	x	x	x			
White Clover										x	x		x	x	x						
English Plantain										x	x	x	x	x	x	x	x				
Pale St. John's Wort											x	x	x	x	x	x	x				
3 Flowered Bedstraw										x	x	x	x	x	x						
Heal-All										x	x	x	x	x	x	x	x				
Hairy Lettuce										x	x	x	x	x	x						
Fire Weed										x	x	x	x	x	x	x					
Marsh Skull Cap										x	x	x	x	x	x	x	x	x	x		
Bindweed											x	x	x	x	x	x	x				
Evening Primrose											x	x	x	x	x	x	x				
Goldenrod spp.											x	x	x	x	x	x	x				
Common St. John's Wort											x	x	x	x	x	x	x	x	x	x	x
Field Thistle											x	x	x	x	x	x	x	x	x	x	x
Cut-leaf Horehound											x	x	x	x	x	x					
Spreading Dogbane												x	x	x	x	x					
Virgin's Bower												x	x	x	x						
Spotted Joe-Pye-Weed											x	x	x	x	x						
Rough Hawkweed														x	x	x	x				
Meadowsweet															x	x	x				
Indian Pipe															x	x	x				
Lactuca spp.															x	x	x				
Wild mint														x	x	x	x				
Spotted Touch-me-not														x	x	x	x				
Hemp Nettle														x	x	x	x				

Table 2. Meteorological data from the upland (Tower 1)
and Creek bed (Tower 2) sites at Icewater Creek,
30-31 July 1980

Tower 1	12:30	13:00	15:00	17:00	19:00	21:00	23:00	01:00	03:00	05:00	07:00	09:00	09:20
Speed km/hr	7.4	10.1	13.5	9.3	9.3	1.7	1.9	.3 ⊕	.3	.3	.3	.3	.4
Max. Gust	17.8	25.5	28.3	20.1	21.6	4.7	5.0	.4	.4	.4	.4	.4	4.1
Direction	258	252	257	247	239	234	236	247	245	236	236	296	241
Temp. 1 10 m	23.4	24.1	24.7	25.4	24.0	17.1	13.0	10.9	10.0	9.1	8.8	16.4	17.6
Temp. 2 1 m	23.4	24.0	26.9	28.7	24.4	15.3	10.6	8.8	8.2	7.2	7.4	15.4	16.9
Temp. 3 0.3 m	25.0	25.6	25.1	24.8	22.3	14.8	10.3	8.5	7.8	6.9	7.1	15.4	16.8
Relative humidity 10 m	48.8	45.4	41.7	40.6	44.4	76.5	91.8	93.8	95.2	94.8	94.7	80.3	76.0
Relative humidity 3 m	60.9	55.8	49.8	50.4	56.5	92.8	95.8	96.1	96.0	97.2	97.5	94.1	90.9
Barometric pressure	976.8	976.8	976.6	975.6	975.5	976.3	977.6	977.7	977.4	977.1	976.9	976.6	976.6
Tower 2*													
Speed km/hr	7.4	9.1	12.9	10.9	8.6	.7	1	.3	.3	.3	.3	.9	1.1
Max. Gust	18.2	21.6	26.1	20.7	17.2	2.6	3.3	.3	.4	.3	.3	2.8	3.1
Direction	252	249	255	244	232	308	253	249	249	249	249	191	182
Temp. 1 10 m	24.2	25.0	26.6	24.7	24.7	15.9	11.1	9.3	8.3	7.8	7.8	17.0	17.8
Temp. 2 1 m	25.0	26.1	27.5	25.3	22.4	14.7	10.3	8.8	8.0	7.6	7.8	17.8	19.4
Temp. 3 creek	16.0	17.1	19.4	20.5	20.2	19.0	17.5	16.3	15.3	14.5	13.9	13.9	14.1

* Tower 2 is situated 16.3 meters lower in terrain than Tower 1.

⊕ .3 indicates no wind speed.

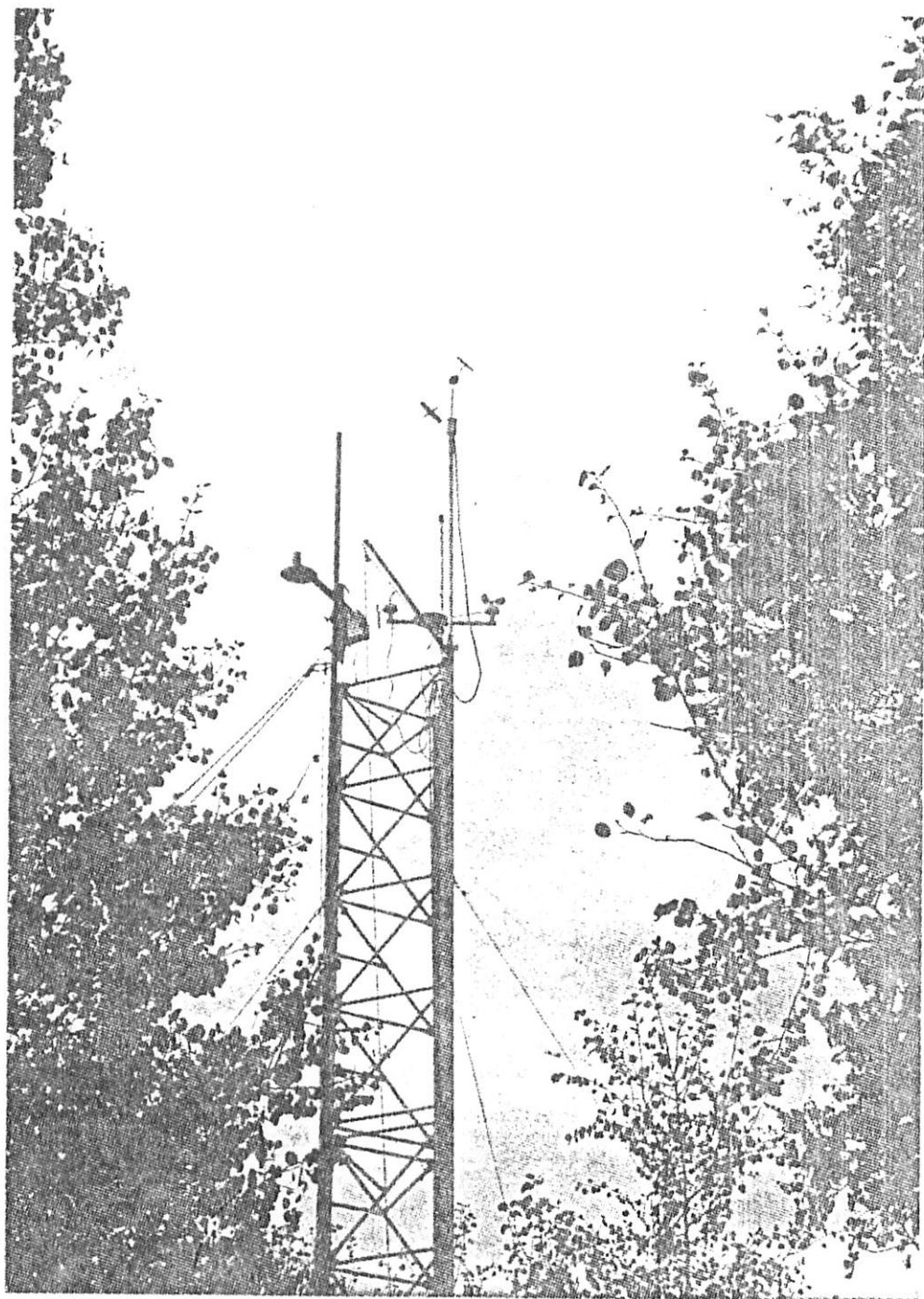


Fig. 3.--Tower with meteorological sensors set up in the Icewater Creek Research Area, 1980.

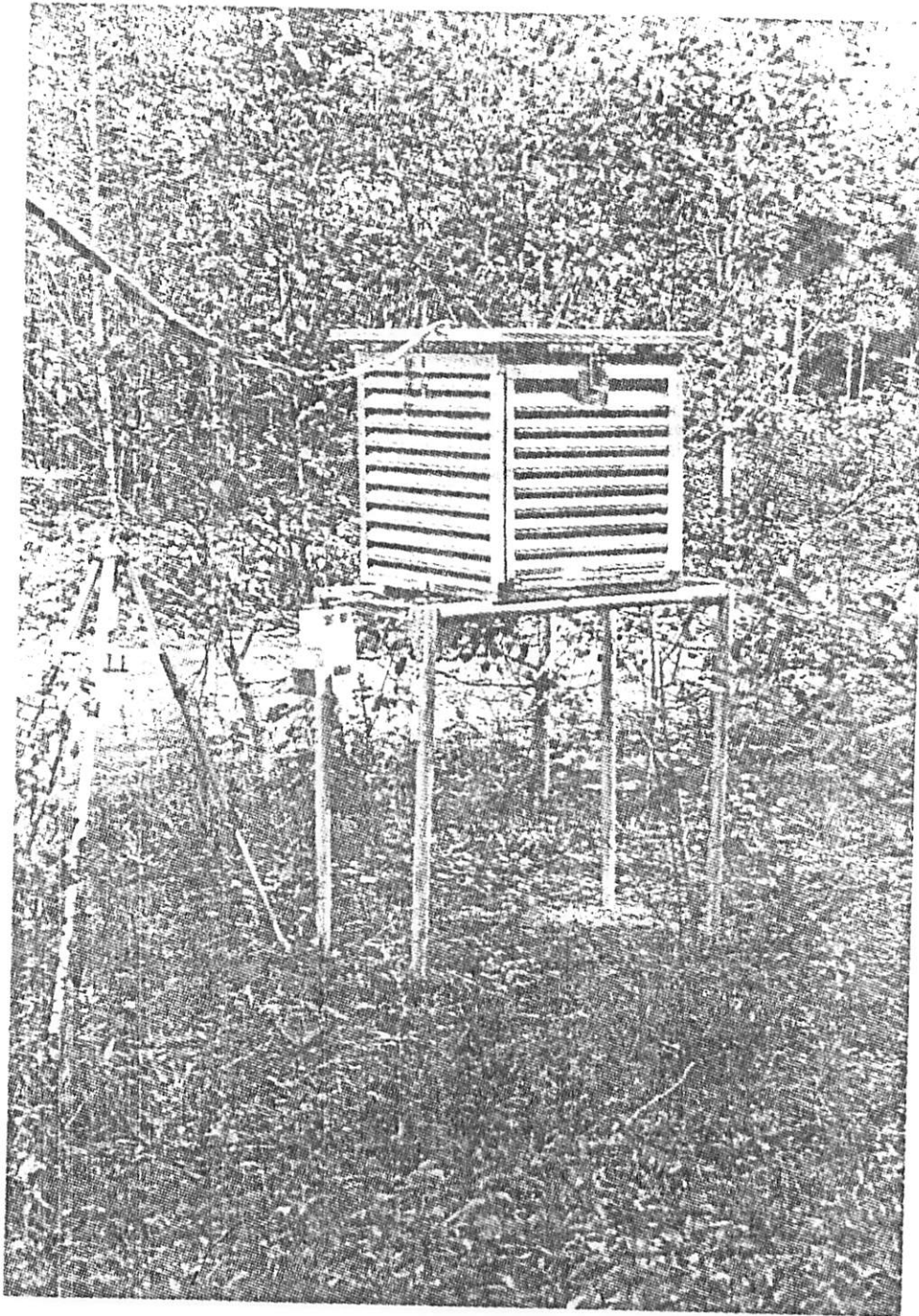


Fig. 4.--Experimental shelter being tested for suitability for housing meteorological equipment; Icewater Creek Research Area, 1980.



TERRESTRIAL INVERTEBRATE STUDIES

Honeybees

Two colonies of domestic honeybees were established on "platforms" (hopefully out of reach of bears and other predators). Each colony was equipped with monitoring equipment to record the following:

- (i) pollen, an O.A.C.* pollen trap was placed below the bottom super and collects approximately 30% of the pollen brought into the hive. The pollen trap will make it possible to record the "pollen flow" of the area throughout the season and will allow us to document peak pollen periods (Fig. 5).
- (ii) activity, an electronic activity counter is placed at the hive entrance and all exiting and entering bees cross over a series of photoelectric cells establishing an activity count. The counter will enable us to record activity in relation to weather, the presence or absence of flowering plants and seasonal activity.
- (iii) mortality, a "dead bee box" is attached to the front of each hive to collect adult bee mortality removed from the colony.

The 1980 programme centre around the establishment of domestic colonies in a forest situation and initial measurements of activity, pollen flow and natural mortality. The hives were winterized and left "on site" to determine if they could survive in the natural environment.

Proposals for 1981

- (i) establish additional colonies in the research area
- (ii) continue studies dealing with "pollen flow" and activity and relating these to phenological and meteorological events
- (iii) establish daily activity patterns under various weather conditions and try to relate these to activity of "wild hymenopterous pollinators".

Wild Pollinators

Wild pollinators play a key role in forest ecology and any disruption of populations or activity could influence seed or berry set of a wide range of plant species.

Preliminary studies were initiated to determine the overall role and nature of pollinators and pollination processes in the Icewater system. Areas of investigation were:

* Ontario Agriculture College

- (i) initiate life history and activity studies of several species of hymenopterous pollinators with emphasis on bumble bees and the Andrenidae species of solitary bees
- (ii) record "pollinator visits" to the various flowering plant species on the three major ecological sites" (Table 3)
- (iii) record "pollinator visits" to a a flower species over a "day-long" period with collaborating time--temperature data (Table 4)
- (iv) color marking of individual queen bumble bees to assist in documenting territory sizes and activity
- (v) collect, identify and place in the Section's pollinator reference collection the many species taken from flowering plants throughout the Icewater area

Proposals for 1981

- (i) select "indicator species" for activity studies
- (ii) continue and expand "pollinator visit" studies with selected flowering plants on "day long" basis as well as on an ecological site basis with collaborating meteorological data
- (iii) expand "pollinator collection"
- (iv) continue and possibly expand "Queen marking" program for territory delineation.

Ground Insects

Ground beetles have been reported as very efficient scavengers and could play a valuable role in the removal from the forest floor of insect material killed during forest pest control programmes and related residue cycling. Little data is available concerning the fate of the beetle population during pest control operations or the impact of this "scavaging" upon other forest predators such as small mammals or small forest birds. To this end, several exploratory projects were initiated in 1980 to document "ground beetle" activities to establish ground work for more intensive studies in 1981 and later:

- (i) a capture-recapture programme to study mobility of marked individuals. A total of 599 ground inhabiting insects were color marked and released, recapture results were as follows:

Total species--1.34% recaptured

Coleoptera: Carabidae 1.08% recaptured

: Meloidae 16.66% recaptured

: Scarabidae 2.70% recaptured

Arachnida 1.48% recaptured

Carabidae represented 31.05% of all specimens marked.

- (ii) A "ground insect complex" sampling programme was carried out on the three major ecological areas of the Icewater site to record abundance, diversity and seasonal activity of the "ground fauna complex". The following table summarizes the capture data

Date	Total insect captures		
	Site 1	Site 2	Site 3
21-36 May	357	195	255
27 May-2 June	232	121	193
2-9 June	52	17	75
10-17 June	102	115	218
17-24 June	95	29	92
25-27 June	74	18	63
9-11 July	75	69	75
14-18 July	89	51	76
29 - July-1 Aug.	39	21	50
12-15 August	23	20	50

- (iii) A sampling project was initiated to determine day vs night activity of the ground insect complex. The project had to be terminated after one sample:

<u>10-16 June</u>	<u>Site 1</u>	<u>Site 2</u>	<u>Site 3</u>
Am sample (dawn to dusk collection)	88	71	168
Pm sample (dusk to dawn collection)	14	44	50

Proposals for 1981

- (i) continue to sample and identify important and possibly "indicator" species on all three ecological sites
- (ii) continue and intensify the day-night activity sampling with related temperature humidity data with equipment currently being perfected by Beveridge
- (iv) re-design "capture-recapture sampling techniques"
- (v) initiate a sampling programme to determine "ground beetle" density patterns in a coniferous forest

Insect Rain

The normal transfer of insect materials from tree or shrub canopy to forest floor was measured throughout the season on the three major ecological sites. Ten "drop buckets" were placed under the canopy of the dominant tree/shrub on each site and the collection results are summarized in the following table:

Date	Site 1 (aspen)	Site 2 (white spruce)	Site 3 (alder sp.)
22-26 May	26	12	41
2 May-27 June	42	14	29
10-17 June	41	31	20
17-24 June	12	7	16
25 June-4 July (5 days)	38	16	20
14-18 July	32	32	18
29 July-5 Aug. (5 days)	12	14	4
12-15 August	21	4	9

Proposals for 1981

- (i) continue sampling on all three sites
- (ii) record day-night activity patterns of insect rain
- (iii) record related temperature-humidity data with sampling programmes

Foliage Insects

Foliage insects were sampled from tree/shrub species growing on the three major ecological sites. White spruce, trembling aspen and white birch were sampled on sites 1 and 2 while willow and alder were sampled from site 3.

Standard forest insect and disease survey techniques were employed. Five trees of each species were beaten and insects falling onto a 1 m² mat were placed in a shipping container with appropriate enclosure slip and sent to the Forest Insect and Disease Survey of the Great Lakes Forest Research Centre for identification.

Ninety-two samples were collected throughout the season (4 June - 19 August) and the results are summarized in table 5.

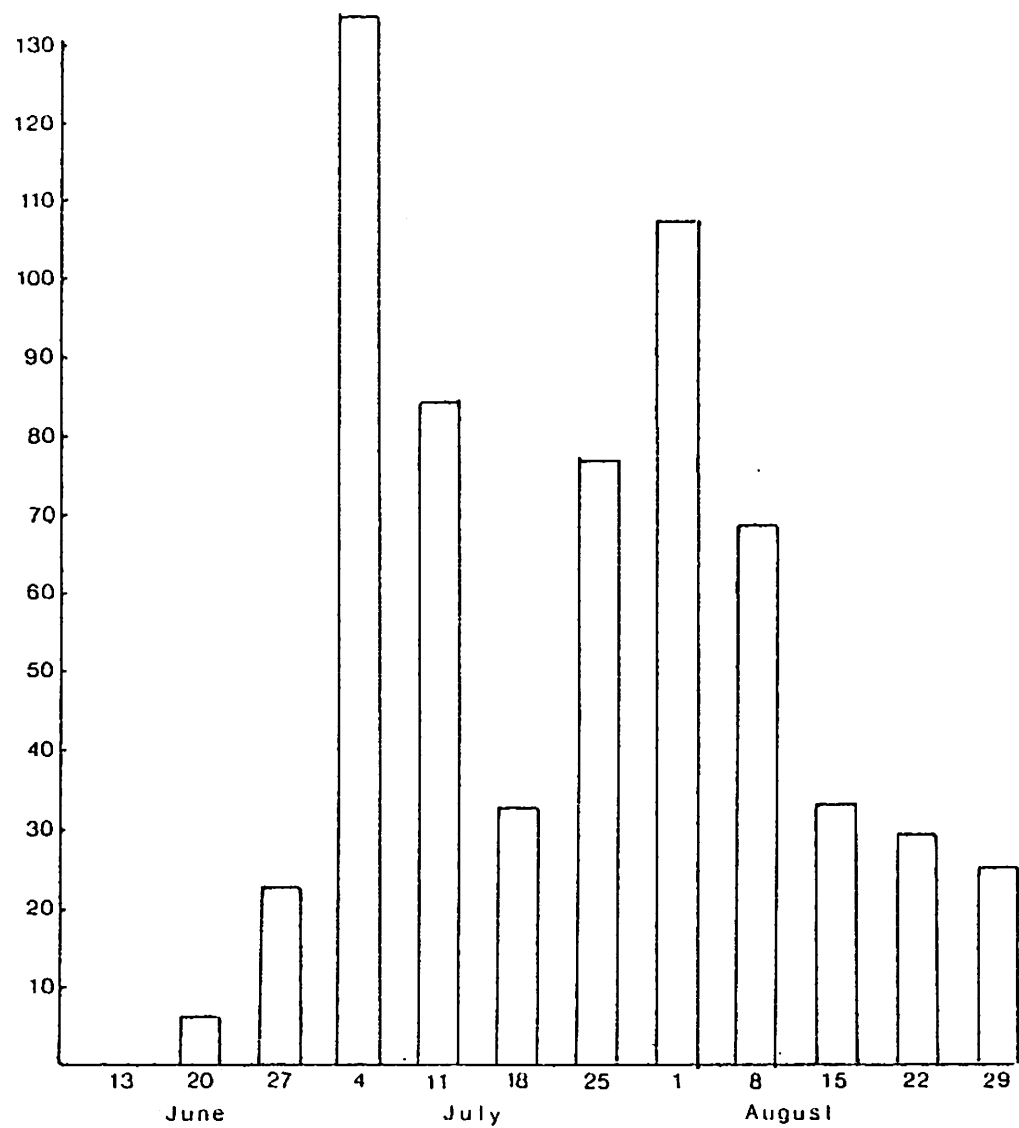


Fig.5. Weekly pollen collections (grams) from a honeybee colony set up in the Icewater Creek Lower Watershed site, 1980.

Table 3. Average number of pollinator visits to plant species
Icewater Research area
1980
(visits per 5 minute monitoring period)

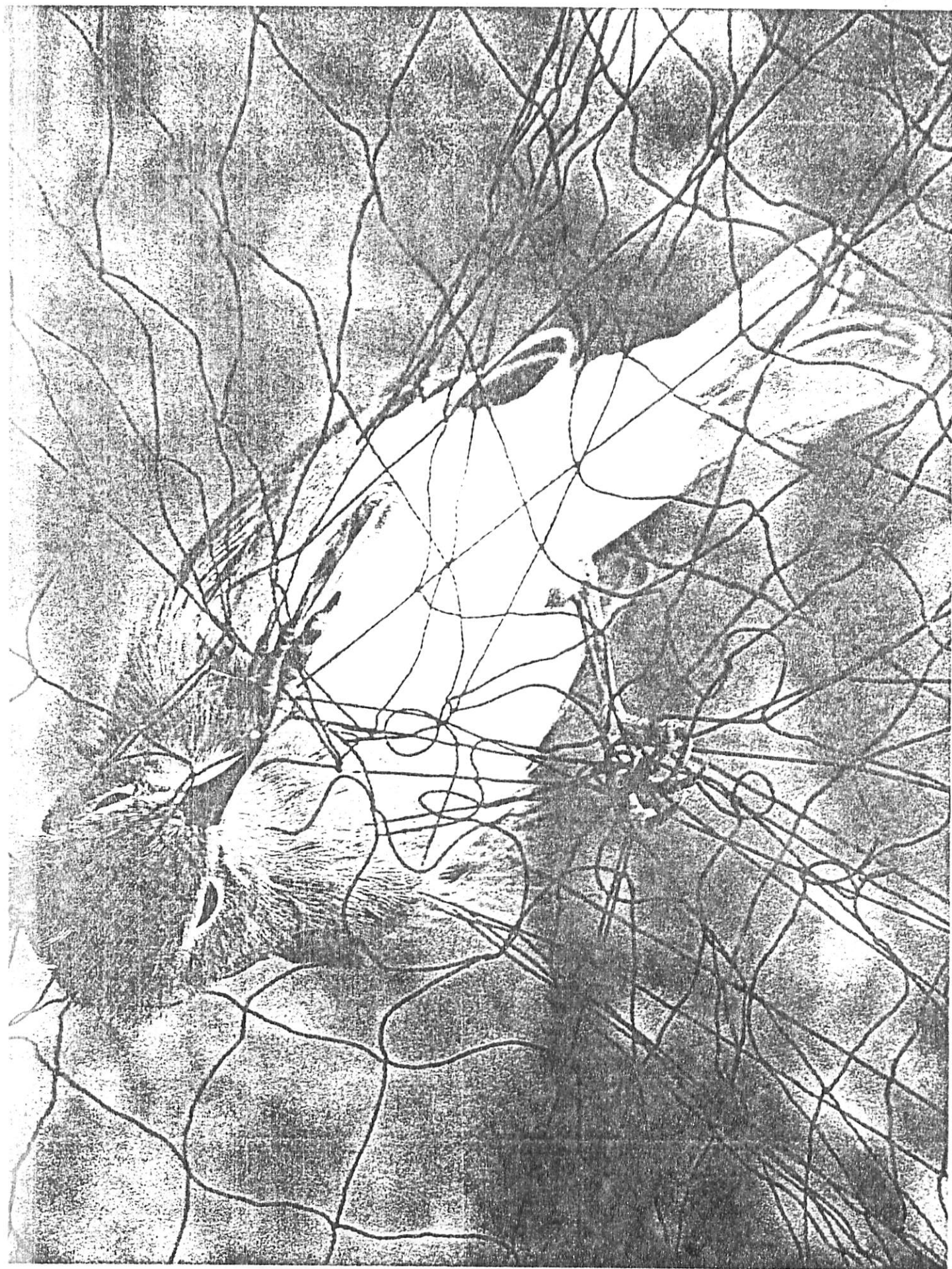
Plant Species	June														July											August		
	2	3	4	5	11	12	16	17	18	19	20	23	24	27	2	3	7	8	9	10	11	17	18	24	31	18	20	
Dogwood	0.0	-	2.0	2.8	4.3	0.6	3.3	2.0	-	0.5	-	-	-	-	-	-	1.0	-	-	-	-	19.0	-	-	-	-	-	
Strawberry	0.0	2.3	2.18	4.5	-	-	1.3	-	1.0	1.3	4.0	-	2.0	-	0.0	-	1.0	-	-	-	-	-	-	-	-	-	-	
Pin Cherry	0.2	-	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Marsh Marigold	0	-	-	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Blue Violet	0	0	0.6	0.0	-	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Blueberry	-	4.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Choke Cherry	-	2.0	8.0	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Clintonia	-	-	0.5	-	-	-	-	-	-	-	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Raspberry	-	-	-	-	-	3.5	2.2	1.5	3.2	5.0	2.4	-	5.0	1.5	-	-	4.5	0.5	0.5	-	4.5	4.0	4.3	-	-	-	-	
Ox-eyed Daisy	-	-	-	-	-	-	0.0	-	1.6	0.0	2.0	-	-	5.0	7.8	9.5	3.8	7.0	-	5.0	-	5.6	4.8	-	5.1	-	-	
Hawweeds	-	-	-	-	-	-	1.0	-	-	-	-	-	-	-	1.6	1.6	1.0	2.3	2.8	2.0	1.5	0.5	1.3	4.5	0.6	-	-	
Mountain Ash	-	-	-	-	-	-	0.5	-	1.0	-	6.5	1.0	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	
Yarrow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	2.0	-	-	6.0	-	5.0	4.4	4.0	0.0	-	-	
Goldenrod	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.0	0.7	3.0	-	
Pearly Everlasting	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	5.7	2.6	
Marigolds	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Portilacas	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Petunia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Table 4. Pollinator visits to three flower species
during three day-long activity counts
Icewater Research area
1980

July 21							July 28							August 6						
Met data					No. of pollinators visiting		Met data					No. of pollinators visiting		Met data					No. of pollinators visiting	
Time (EST)	Temp C°	R.H.	Wind kph	Cloud Cover $\frac{1}{105}$	Yarrow	Ox-eyed Daisy	Temp.	R.H.	Wind.	Cloud Cover	Goldenrod	Yarrow	Ox-eyed Daisy	Temp.	R.H.	Wind	Cloud Cover	Goldenrod	Yarrow	Ox-eyed Daisy
0630-0700	17	90	0	9	0	0	11	100	0	10	0	0	0	13	97	1	10	0	0	0
0700-0730	18	95	0	9	0	5	11	100	1E	10	0	0	0	15	95	0	1	0	0	0
0730-0800	19	88	0	8	0	5	12	100	2SE	10	0	0	0	17	80	0	1	0	1	1
0800-0830	20	91	0	8	0	6	13	100	0	10	0	0	0	20	77	4W	2	2	0	2
0830-0900	21	86	0	7	0	11	15	100	0	10	2	0	0	21	73	7W	2	1	1	2
0900-0930	22	85	0	7	5	25	17	93	2E	0	1	0	1	22	70	6W	2	13	0	3
0930-1000	23	77	1SE	6	2	13	21	76	0	0	3	0	8	22	67	8W	3	10	1	5
1000-1030	24	65	1SE	6	7	17	22	71	4S	0	1	1	3	22	67	10W	4	18	1	8
1030-1100	25	62	2SE	5	11	17	22	60	3S	0	4	0	3	22	68	7W	4	8	2	4
1100-1130	25	52	2SE	4	6	10	23	58	2SE	0	5	0	9	22	67	7W	4	8	0	2
1130-1200	26	64	2SE	5	4	16	25	55	5SE	1	3	2	7	24	59	6SW	3	8	1	2
1200-1230	28	61	2E	5	6	23	26	62	3S	1	9	1	9	24	59	10W	2	8	2	5
1230-1300	32	61	1E	4	10	15	28	60	2SE	1	7	1	2	28	58	10W	2	4	1	1
1300-1330	28	56	1E	6	9	17	28	53	1SE	1	5	2	5	29	53	7SW	1	10	2	1
1330-1400	33	58	4SE	7	0	9	28	52	1SE	1	6	3	4	28	52	7SW	1	8	1	1
1400-1430	29	64	4SE	8	2	19	28	52	3SE	1	16	7	5	27	50	8SW	1	6	2	3
1430-1500	27	64	6SE	9	7	9	28	55	1SE	3	5	5	5	26	45	5SW	0	6	4	2
1500-1530	27	63	8SE	8	3	8	28	53	3SE	3	10	6	11	27	43	6SW	0	3	2	1
1530-1600	27	63	8SE	7	2	9	31	46	4SE	1	14	10	1	27	50	9SW	0	4	1	0
1600-1630	27	60	8W	5	2	12	31	47	9SE	1	10	0	7	24	55	9SW	0	1	0	1
1630-1700	22	75	7W	3	1	5	28	58	5SE	0	6	8	2	26	54	6SW	0	0	0	0
1700-1730	23	74	6W	1	0	10	26	62	5S	5	3	5	0							
1730-1800	24	68	5SW	1	0	5	23	68	4S	6	0	0	0							
1800-1830	22	66	6SW	0	0	2	22	80	5S	10	0	0	0							
1830							RAIN													

Table 5. Insects collected from various tree species
at three sites, Icewater Creek Research Area.
1980

	White spruce		Trembling aspen		White birch							
	Date of Sample	No. of species	No. of insects	No. of species	No. of insects	No. of species	No. of insects					
Site 1	June											
	4	1	2	7	13	1	1					
	11	1	4	0	0	1	2					
	18	1	2	2	2	2	5					
	25	5	6	4	4	4	7					
	July											
	2	0	0	6	7	2	2					
	9	0	0	4	8	5	10					
	15	5	6	5	10	3	7					
	23	9	17	4	7	4	8					
	30	3	7	4	6	6	15					
	August											
	5	5	12	2	1	1	4					
	14	4	7	4	9	4	4					
	19	4	8	2	6	5	17					
Site 2	June											
	4	3	10	3	15	4	21					
	11	1	8	6	5	5	15					
	18	1	3	3	4	3	6					
	25	1	2	3	2	-	-					
	July											
	2	2	2	4	6	2	3					
	9	5	6	3	5	4	11					
	15	3	3	6	14	3	4					
	23	4	11	6	10	4	5					
	30	5	16	5	7	5	13					
	August											
	5	3	9	5	7	4	17					
	14	8	18	5	9	-	17					
	19	6	7	10	19	4	30					
Site 3	Alder sp.											
	June				July					August		
	4	11	13	25	2	9	15	23	30	5	14	19
	No. of species	4	-	3	6	3	6	4	7	2	6	4
	No. of insects	5	-	6	7	3	6	9	14	5	9	4
Willow spp.												
No. of species	1	3	3	4	-	-	4	5	4	5	2	5
No. of insects	5	11	3	5	-	-	6	9	5	7	3	5



TERRESTRIAL VERTEBRATE STUDIES

Forest Birds

The Icewater area proved to be very rich in small bird life. Populations were assessed on the three major ecological sites throughout the season. A total of 26 families representing 71 species were documented (Table 6). Fifty-eight species were recorded as "resident" to the research area and eight specimens were classed as winter residents. Migration into the valley had commenced by 22 April but intensive monitoring could not commence until 21 May when student help became available.

Small forest bird population monitoring methodology research studies were carried out in the Icewater area to determine the following aspects:

- (i) minimum number of surveys required to determine resident territory
- (ii) minimum number of days required for resident territory
- (iii) maximum activity time
- (iv) minimum activity time
- (v) which "indicator" species might be found inhabiting various ecological sites
- (vi) relating bird activity with phenological and meteorological events

Proposals for 1981

- (i) document spring migration into the Icewater area
- (ii) continue small forest bird inventory on the three major ecological sites
- (iii) field test new monitoring methodology
- (iv) color mark singing territorial males for territory delination
- (v) mist netting populations to record juvenile fledging

Small Mammals

A limited small mammal program was carried out in 1980 (Table 7). Live trapping was carried out on the three major ecological sites where all live-trapped specimens were identified, toe-clipped and released. Data was collected on recaptures, reproduction and distribution within the research area.

Proposals for 1981

- (i) Continue the small mammal inventory of the three major ecological sites.
- (ii) Initiate a "small mammal population sampling" program suitable for monitoring the impact of pest control practices upon the small forest mammal complex.
- (iii) Field test an "activity monitoring" device perfected by Beveridge for use in place of kill traps.

in the ICEWATER CREEK Research Area

1980

Family	Species	Site			Resident	Non Resident
		1	2	3		
Gaviidae	Common Loon	x	x	x		x
Ardeidae	American Bittern		x			x
Anatidae	Red-breaster Merganser			x		x
Accipitridae	Broad-winged hawk			x		x
Tetraonidae	Ruffed grouse	x	x		x	
Gruidae	Sandhill Crane	x		x		x
Scolopocidae	American Woodcock			x		x
Cuculidae	Black-billed Cuckoo		x			
Apodidae	Chimney Swift			x		x
Trochilidae	Ruby-throated Hummingbird	x		x	x	
Alcedinidae	Belted Kingfisher			x	x	
Picidae	Common Flicker		x	x	x	
	Pileated Woodpecker	x			x	
	Yellowbellied Sapsucker			x	x	
	Hairy Woodpecker	x		x	x	
Tyrannidae	Eastern Kingbird	x		x	x	
	Great-crested Flycatcher	x	x	x	x	
	Alder Flycatcher	x	x	x	x	
	Eastern Phoebe		x		x	
	Least Flycatcher	x	x	x	x	
	Eastern Wood Peewee		x	x	x	
	Olive-sided Flycatcher	x	x	x	x	
Hirundinidae	Tree Swallow		x	x	x	

Table 6 (cont.)
Forest Bird Population Census on Three Ecological Sites
in the ICEWATER CREEK Research Area

2

Family	Species	Site			Resident	Non Resident
		1	2	3		
Corvidae	Gray Jay	x	x			
	Blue Jay	x	x	x		x
	Common Crow	x	x	x		x
	Common Raven	x	x			x
Paridae	Black-capped Chickadee	x	x	x	x	
	Boreal Chickadee	x			x	
Sittidae	Red-breasted Nuthatch	x	x	x		
Troglodytidae	Winter Wren	x	x	x	x	
Mimidae	Catbird	x	x	x	x	
Turdidae	American Robin	x	x	x	x	
	Wood Thrush	x	x	x	x	
	Hermit Thrush	x	x	x	x	
	Swanson's Thrush	x	x	x	x	
	Veery	x	x	x	x	
Sylvidae	Golden-crowned Kinglet		x		x	
	Ruby-crowned Kinglet		x		x	
Bombycillidae	Cedar Waxwing	x		x	x	
Vireonidae	Red-eyed Vireo	x	x	x		
	Philadelphia Vireo	x				
Parulidae	Black and white Warbler	x	x	x	x	
	Tennessee Warbler	x		x	x	
	Nashville Warbler	x	x	x	x	
	Parula Warbler		x	x	x	
	Yellow Warbler	x		x	x	
	Magnolia Warbler			x	x	
	Cape May Warbler		x		x	
	Black-throated Blue Warbler	x	x		x	

Table 3 (cont.)
Forest Bird Population Census on Three Ecological Sites
in the ICEWATER CREEK Research Area

3

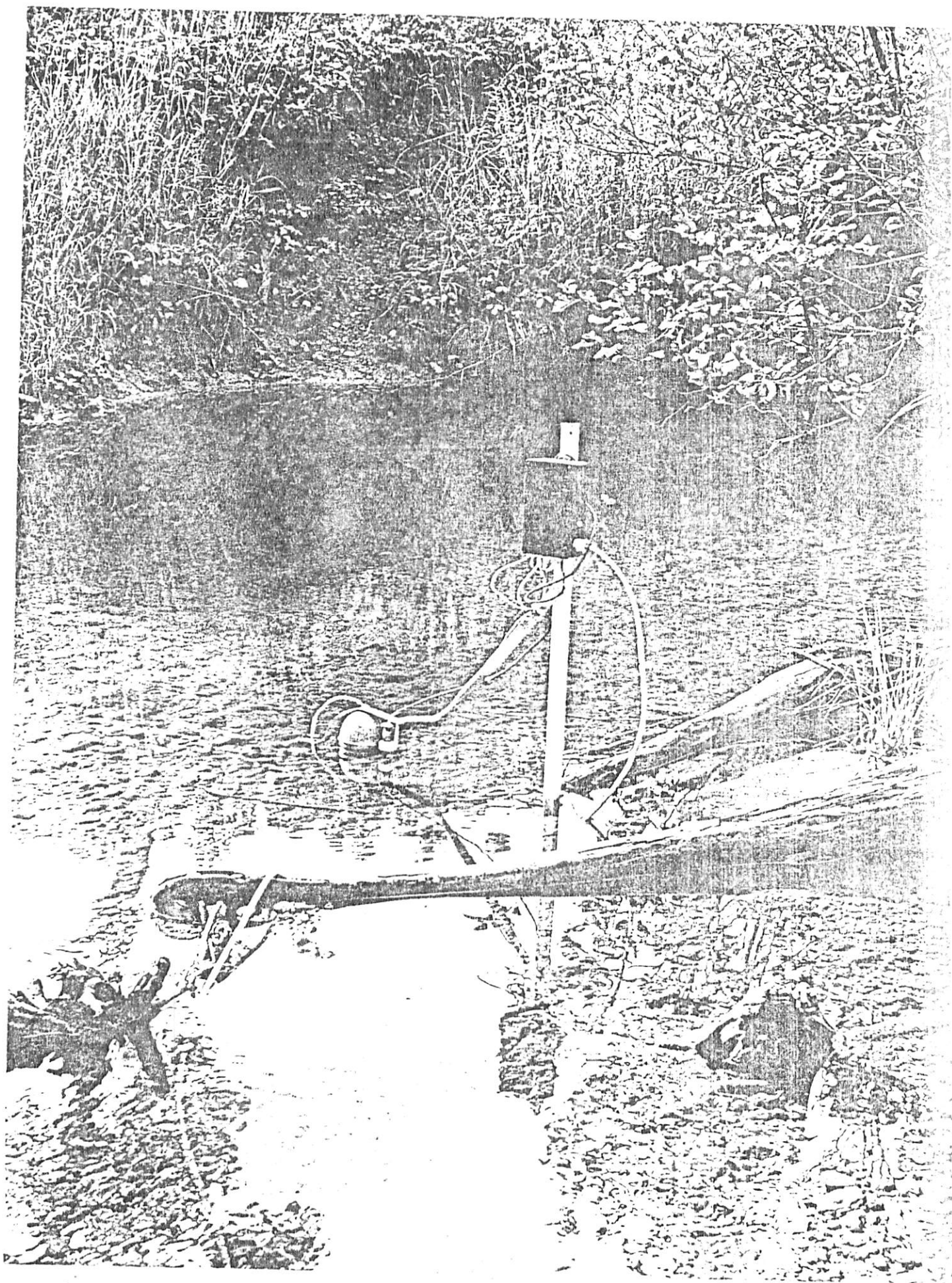
Family	Species	Site			Resident	Non Resident
		1	2	3		
Parulidae contd.	Yellow-rumped Warbler	x	x	x	x	
	Black-throated Green Warbler		x	x	x	
	Blackburnian Warbler	x	x		x	
	Chestnut-sided Warbler	x	x	x	x	
	Bay-breasted Warbler		x		x	
	Blackpoll Warbler	x			x	
	Ovenbird	x	x		x	
	Northern Waterthrush		x	x	x	
	Mourning Warbler	x	x	x	x	
	Yellowthroat	x	x	x	x	
	Canada Warbler	x		x	x	
	American Redstart	x	x	x	x	
Icteridae	Brown-headed Cowbird		x			x
Fringillidae	Rose-breasted Grosbeak	x	x	x	x	
	Evening Grosbeak			x		x
	Purple Finch			x		x
	Pine Siskin			x		x
	American Goldfinch		x	x	x	
	Rufous-sided Towhee			x		x
	Chipping Sparrow	x	x	x	x	
	White-throated Sparrow	x	x	x	x	
	Song Sparrow		x	x	x	

Table 7
Small mammal complex
Icewater Research Area 1980
(The following list of small mammals were taken
in live traps from three major ecological areas)

Family	Species	Site			Resident	Non resident
		1	2	3		
Soricidae	Masked shrew	x			x	
	Short-tailed shrew	x		x	x	
Talpidae	Hairy-tailed male	x			x	
Sciuridae	Eastern chipmunk	x		x	x	
	Western chipmunk	x	x	x	x	
	Northern flying squirrel	x			x	
Cricetidae	Deer mouse	x	x	x	x	
	Southern bog lemming	x	x	x	x	
	Red-backed vole	x	x	x	x	
Zapodidae	Zapus hudsonius			x	x	
Mustelidae	Ermine			x	x	

The following list of animals have either been seen
or have been tracked in the Icewater Creek Research area

Leporidae	Varying hare	x	x	x	x	
Sciuridae	Woodchuck	x			x	
	Red squirrel		x		x	
Castoridae	Beaver			x	x	
Erethizontidae	Porcupine	x			x	
Canidae	Timber Wolf	x				?
	Domestic dog	x	x	x	x	x
	Red fox	x				?
Ursidae	Black bear	x		x		?
Mustelidae	Mink	x		x	x	?
	striped skunk	x		x		?
Cervidae	white-tailed deer	x	x			?
	moose	x	x			?



AQUATIC STUDIES

Aquatic studies in the Icewater Creek watershed were concentrated in two areas; the lower portion of the creek close in its confluence with the Goulais River and an area 5-6 km upstream where the creek divides into two major tributaries. Temperature, water quality and stream discharge data were collected from stations in these areas throughout the spring, summer and fall (Table 8). Invertebrate drift patterns were measured over 24 hour periods simultaneously at two tributary and a downstream station on eight occasions in 1980, providing information on seasonal changes in the diurnal drift of aquatic invertebrates and terrestrial arthropods entering the stream (Figure 6). Benthos populations at the various stations were sampled on a weekly basis throughout the summer and to a less extensive degree in the spring and fall.

A variety of artificial substrate sampling systems were evaluated in side-by-side tests in Icewater Creek to compare their suitability for studying changes in aquatic invertebrate populations, and some work was carried out to examine the rates of colonization of the most promising types of artificial substrate. Some attempts to evaluate fish populations in the watershed were made but were frustrated by low numbers of fish encountered and lack of sufficient manpower and sampling equipment due to commitments to programs in Quebec and New Brunswick. Preliminary evaluations of one small lake and a nearby stream were made to investigate their potential for future studies.

Proposals for 1981

- (i) continuation of collection of water quality, discharge and aquatic invertebrate data from various portions of the watershed
- (ii) incorporation of suitable artificial substrate sampling systems in the seasonal studies of benthic populations
- (iii) fish population studies within the watershed including establishment of a portable weir to measure seasonal upstream-downstream movements of fish within the system
- (iv) further data collection from lakes and streams in the area to determine their suitability as control or experimental sites

Table 8
WATER TEMPERATURES, ICEWATER CREEK
JULY - AUGUST
1980

Time E.D.T.	July 9-10	July 16-17	July 23-24	July 30-31	Aug. 6-7	Aug. 13-14
13:00		14.5	16.6	17.1	17.8	
13:15		14.5	16.8	17.5	18.1	
13:30	16.7	14.6	16.8	17.8	18.3	
13:45	16.9	14.8	17.0	18.1	18.4	
14:00	17.2	15.1	17.1	18.4	18.7	14.3
14:15	17.5	15.3	17.2	18.7	18.9	14.3
14:30	17.7	15.3	17.3	18.9	19.2	14.2
14:45	18.0	15.3	17.6	19.1	19.4	14.2
15:00	18.2	15.5	17.8	19.4	21.1	14.1
15:15	18.4	19.3*	18.2	19.6	21.8	14.1
15:30	18.6	18.1	18.4	19.8	20.8	14.1
15:45	18.7	18.0	18.6	19.9	20.2	14.0
16:00	18.9	17.4	18.7	20.1	20.2	14.0
16:15	19.0	18.4	18.9	20.2	20.3	14.0
16:30	19.1	18.3	19.0	20.3	20.4	14.0
16:45	19.2	17.7	19.1	20.5	20.5	14.4
17:00	19.2	17.7	19.2	20.5	20.6	14.4
17:15	19.3	17.9	19.2	20.5	20.6	14.4
17:30	19.3	17.9	19.2	20.5	20.6	14.3
17:45	19.3	17.8	19.2	20.5	20.6	14.3
18:00	19.3	17.7	19.2	20.5	20.6	14.2
18:15	19.2	17.9	19.2	20.5	20.6	14.2
18:30	19.1	18.5	19.2	20.5	20.5	14.2
18:45	19.0	18.4	19.1	20.3	20.5	14.2
19:00	18.9	18.5	19.0	20.2	20.4	14.2
19:15	18.7	18.6	18.9	20.2	20.3	14.2
19:30	18.6	18.7	18.7	20.1	20.2	14.2
19:45	18.5	18.3	18.6	19.9	20.0	14.1
20:00	18.4	17.9	18.4	19.8	19.9	14.1
20:15	18.2	17.7	18.2	19.6	19.7	14.0
20:30	18.0	17.7	18.1	19.4	19.6	14.0
20:45	17.8	17.6	19.1*	19.2	19.4	13.9
21:00	17.6	17.4	18.8	19.0	19.2	13.9
21:15	17.4	17.1	18.5	18.9	19.1	13.9
21:30	17.2	17.4	18.3	18.7	18.9	13.9
21:45	17.0	17.3	18.0	18.5	18.7	13.9
22:00	16.8	17.3	17.7	18.3	18.6	13.9
22:15	16.6	17.1	17.6	18.1	18.4	13.9
22:30	16.4	17.2	17.3	17.9	18.2	13.8
22:45	16.2	17.2	17.1	17.7	18.0	13.7
23:00	16.1	17.1	17.1	17.5	17.9	13.7
23:15	15.9	17.0	17.0	17.4	17.8	13.7
23:30	15.7	17.1	16.8	17.3	17.7	13.7
23:45	15.6	16.9	16.6	17.1	17.5	13.6
24:00	15.4	16.9	16.4	17.0	17.3	13.6
24:15	15.4	16.9	16.3	16.8	17.1	13.7
24:30	15.3	16.9	16.1	16.6	17.0	13.7
24:45	15.2	17.0	16.0	16.5	16.8	13.7

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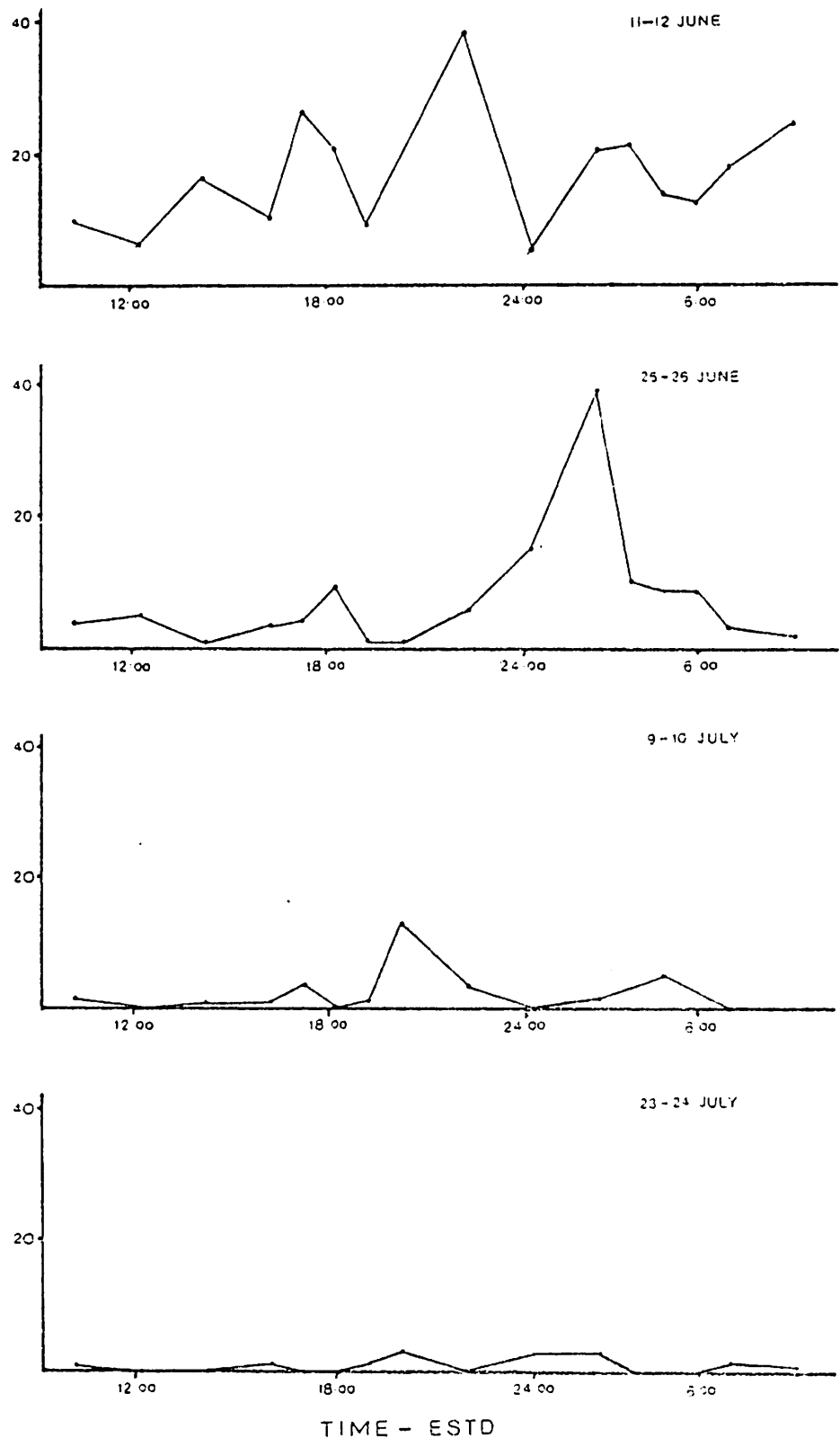
Table 8 (cont.)
WATER TEMPERATURES, ICEWATER CREEK
JULY - AUGUST
1980

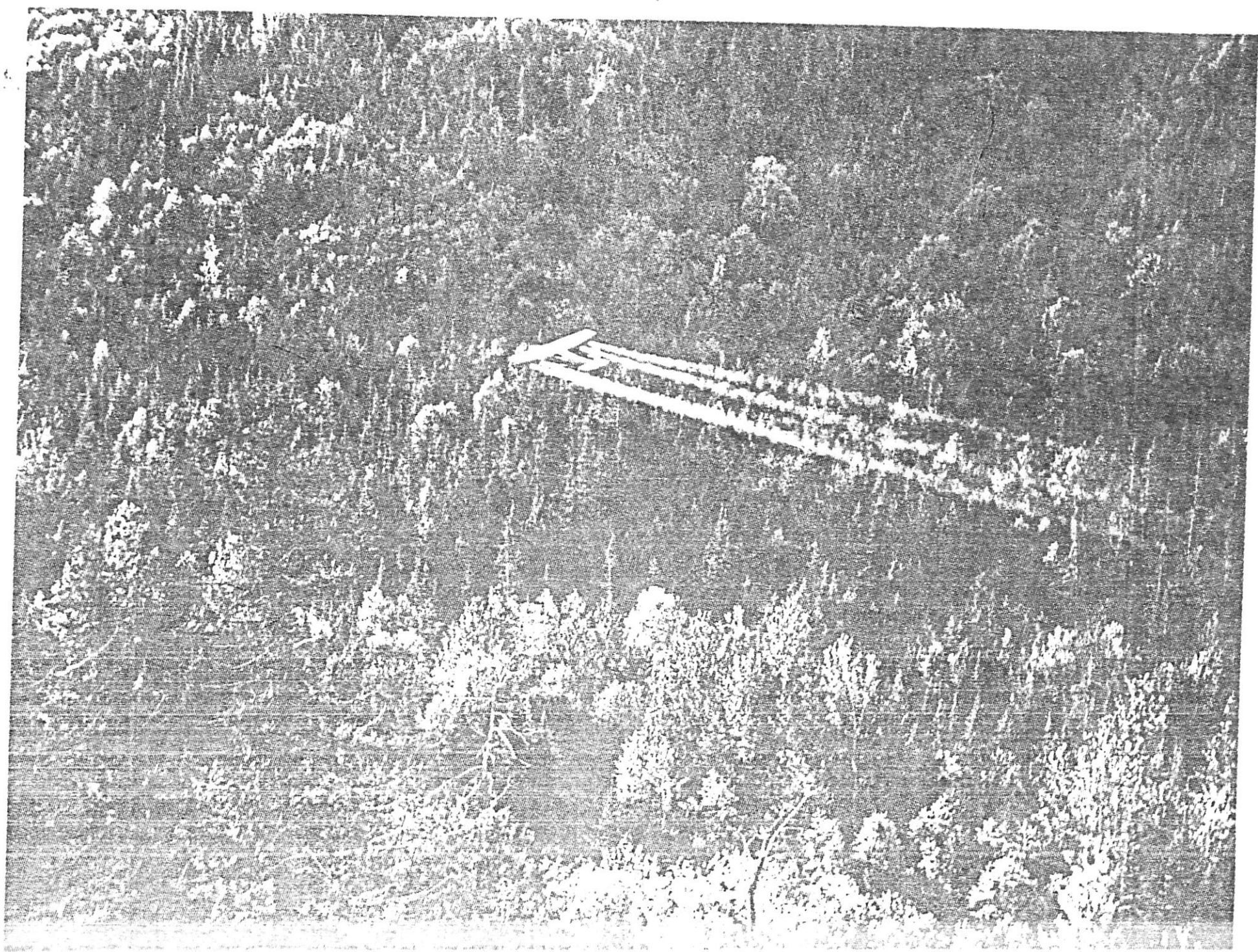
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Time E.D.T.	July 9-10	July 16-17	July 23-25	July 30-31	Aug. 6-7	Aug. 13-14	Aug. 20-21
1:00	15.1	17.0	15.8	16.3	16.7	13.6	16.1
1:15	14.9	17.0	15.7	16.2	16.5	13.6	16.1
1:30	14.8	16.9	15.6	16.0	16.4	13.6	16.0
1:45	14.7	16.8	15.5	15.9	16.2	13.6	15.9
2:00	14.6	16.8	15.5	15.8	16.1	13.6	15.9
2:15	14.4	16.8	15.4	15.6	16.0	13.6	15.9
2:30	14.3	16.9	15.3	15.5	15.8	13.6	15.8
2:45	14.2	16.9	15.2	15.4	15.8	13.6	15.8
3:00	14.1	16.9	15.1	15.3	15.6	13.6	15.8
3:15	14.0	16.9	15.0	15.2	15.5	13.7	15.7
3:30	13.9	16.8	14.9	15.1	15.4	13.7	15.7
3:45	13.9	16.8	14.8	14.9	15.3	13.7	15.6
4:00	13.9	16.7	14.7	14.8	15.2	13.6	15.6
4:15	13.7	16.6	14.7	14.7	15.1	13.6	15.6
4:30	13.7	16.4	14.6	14.6	15.0	13.6	15.6
4:45	13.6	16.4	14.5	14.6	15.0	13.6	15.6
5:00	13.5	16.4	14.4	14.5	14.9	13.6	15.5
5:15	13.4	16.5	14.4	14.5	14.8	13.6	15.5
5:30	13.3	16.7	14.4	14.4	14.8	13.6	15.5
5:45	13.3	16.7	14.7	14.3	14.7	13.7	15.5
6:00	13.2	16.6	14.6	14.2	14.7	13.7	15.5
6:15	13.1	16.6	14.5	14.1	14.6	13.6	15.5
6:30	13.1	16.6	14.6	14.1	14.5	13.6	15.5
6:45	13.0	16.6	14.9	14.0	14.5	13.6	15.5
7:00	13.0	16.5	14.8	13.9	14.5	13.6	15.5
7:15	13.0	16.5	14.7	13.9	14.4	13.6	15.5
7:30	13.0	16.6	14.7	13.9	14.4	13.6	15.5
7:45	13.0	16.6	14.7	13.8	14.4	13.6	15.5
8:00	13.0	16.7	14.8	13.8	14.4	13.6	15.6
8:15	13.0	16.7	14.7	13.8	14.4	13.6	15.6
8:30	13.1	16.7	14.8	13.9	14.4	13.6	15.6
8:45	13.2	16.8	15.5	13.9	14.4	13.7	15.5
9:00	13.3	16.9	15.3	13.9	14.4	13.7	15.5
9:15	13.5	17.0	15.2	14.1	14.4	13.8	15.5
9:30	13.6		15.2			13.8	15.5
9:45	13.9		15.3			13.9	15.5
10:00	14.0		15.5			14.0	15.5
10:15	14.1		15.7			14.1	15.5
10:30	14.4		15.9				15.5

* sudden changes accompanied by dramatic changes in local weather conditions

Fig. 6.
Mayfly nymph catches in 15 minute drift net sets
at the East Tributary station, Icewater Creek.
June-July 1980.





OVERALL PROGRAM PLAN - 1981

Development of Exposure Measurement Capability

In order to carry out the second phase of the research program, namely the measurement of actual exposure of different groups of organisms to an aerially applied pest control agent, suitable tracer materials and techniques for measuring them on forest substrates must be identified and/or developed. This will require intensive involvement by FPMI personnel with deposit assessment, formulation chemistry, application technology and analytical chemistry expertise. Familiarity with the specific habitats available for study gained in 1980 has allowed for the setting down of specific essential and desirable characteristics and capabilities required to maximize the usefulness of tracer material sprays. It is hoped that suitable systems can be developed during 1981 and that the first application can be made in the late summer or early fall, in the form of a simulated herbicide application. This application would serve as a field test of the exposure measurement system's capabilities, with the selection of a coarse spray droplet spectrum and a fairly remote portion of the upland site as the treatment area mitigating against introduction of the tracer into the major biological study areas until a second full season of baseline data has been generated.

Overall Work Plan Summary for 1981

- (1) Biological and meteorological studies will be continued within the three characteristic stand types present in the lower watershed of Icewater Creek. A second full year's baseline data will be gathered prior to exposure measurement trials commencing on these sites in 1982.
- (2) Facilities at the upper watershed portion of Icewater Creek will be developed with the installation of a small work trailer and met tower. Aquatic studies within the two tributary streams and small lake accessible from the site will be intensified, and meteorological and terrestrial ecosystem studies will be initiated to collect baseline data from forest types in the vicinity.
- (3) A suitable exposure measurement system will be developed and field tested late in the season in preparation for the second phase of the study to be initiated in 1982.