

Progress Report
1984 British Columbia Cooperative
Herbicide Research Trials

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INTRODUCTION

In September 1983, the Forest Pest Management Institute (FPMI) of the Canadian Forestry Service (CFS) visited British Columbia to examine forest weed problems in five of the province's six forest regions. The visit was sponsored by the B.C. Ministry of Forests (MOF). Following the visit, the B.C. MOF proposed that the CFS undertake cooperative research in the province to expedite registration of new forestry herbicides and to assess possible environmental impacts associated with future operational use of forestry herbicides.

The September 1983 trip verified that major operational use of herbicides was anticipated on productive forest sites within the B.C. coastal zone and that a major environmental concern potentially preventing the use of forestry herbicides in the coastal zone was possible impacts on salmonids and salmon habitat. The Carnation Creek Experimental Watershed located on the western side of Vancouver Island was suggested as a prime location for evaluating possible herbicide impacts. For the past 15 years, the Carnation Creek Watershed has been an active research site for evaluating the impacts of forest harvesting and prescribed fire on salmon and salmon habitat in studies carried out by the CFS and by the Pacific Biological Station (PBS) of the Department of Fisheries and Oceans. Thus, the watershed offered an ideal, extensively studied location, where existing forestry impact studies could be extended by evaluating the impact of forestry herbicides on fish and fish habitat.

In addition, the Skeena River floodplain between Terrace and Prince

Rupert, B.C. was identified as a prime salmon habitat where the large scale use of forestry herbicides is anticipated in the future. During the September 1983 visit, both locations were visited and initial discussions were held with MOF and PBS personnel.

In December, 1983, an initial research planning session was held in Victoria to discuss possible proposed research with federal and provincial environmental regulators and to solicit their views on what the research should include and to invite their active participation in any future research. Out of this meeting was born the support and the cooperators for the current B.C. benchmark herbicide studies. The B.C. MOF quickly followed through in its support for the proposed research by committing in excess of a half million dollars of support over a three year period via a letter from the Deputy Minister, Mike Apsey, to the Director of the FPMI, George Green. Monies from the Apsey Agreement were ear-marked to support research at Carnation Creek, Skeena River and Peace River by the FPMI, the PBS and by the Pacific Forest Research Centre (PFRC), a regional laboratory of the CFS. The FPMI was designated as the lead and coordinating agency for carrying out the research and for administering the Apsey funds.

With this initial commitment, others followed suit committing additional resources to the projects. Major funding for the proposed Carnation Creek study was provided via Monsanto Canada. Dow Canada committed funding for the proposed Skeena River study and DuPont committed resources for the proposed Peace River project. In April 1984, the CFS provided additional resources for the Skeena project in the form of a \$92 thousand contract to Simon Fraser University to evaluate long-term herbicide impacts on salmon and salmon habitat.

Viewed realistically, the 1984 British Columbia herbicide studies were extremely successful. Some have alleged that the CFS proceeded too quickly with the studies, and perhaps took on too much within too short a time frame. Although this may be true, accomplishments for 1984 were enormously greater than expected or predicted by many, and quite possibly may have been far less had the CFS pursued the proposed studies less vigorously.

Although the CFS proceeded quickly with the proposed B.C. herbicide studies, it should be recognized that circumstances beyond the control of the CFS dictated the pace. The CFS normally proceeds with such studies at a slower pace, and would have preferred to have done so for the B.C. herbicide studies. However, financial resources (i.e., B.C. MOF, CFS, Monsanto, etc.) critical to the initiation of the research became available in 1983 and 1984, and it is emphatically clear that a major portion of these resources would not have been available at a later date or would have been lost had the CFS delayed (an estimate of BCMOF resources expended on the two projects is presented in TABLE 1). Caught in this financial squeeze, the CFS had no other alternative than to plan research, select sites, obtain research permits and mobilize research activities all within one year. Ideally, site selection and research planning should have taken one full year, and clearly, would have allowed greater time for involvement of regulatory advisors and other third parties in the planning process.

Despite the rush, we remain convinced that the research protocols developed continue to be sound and worthy of execution and that the research sites themselves are typical of the coastal plain sites on

TABLE 1 - Ministry of Forests Financial Resources Expended on Cooperative Herbicides Research in Fiscal 1984-85

Item	Carnation Creek	Skeena River	Total
Application Fees	\$ 16,672	\$ 37,500	\$ 54,172
Field Labour	\$ 8,270	\$ 23,496	\$ 31,766
Technical Support	\$ 99,623	\$ 11,832	\$111,455
Contract Research	\$ 58,000	\$ 6,000	\$ 64,000
Vehicle/Boat Rental	\$ 2,038	\$ 13,762	\$ 15,800
Materials & Supplies	\$ 36,351	\$ 21,530	\$ 57,881
Capital	\$ <u>1,830</u>	\$ <u>0</u>	\$ <u>1,830</u>
TOTAL	\$222,784	\$114,120	\$336,904

which intensive forest management will be practiced in British Columbia and from which environmental impact data is essential for development and implementation of environmentally conscious forest management strategies. This conviction is strengthened by the fact that the Carnation Creek research applications were executed largely as planned and a successful glyphosate application to quantify herbicide drift was conducted at the Skeena River site. While it was necessary for us to defer the major portion of the research trials planned for the Skeena River site in 1984 for reasons beyond our control, this delay has actually worked in our favour by allowing us to become more intimately familiar with this site; to accomplish extensive preparatory work on it;

to slightly revise experimental protocols for it that are in line with our improved knowledge of this particular site and to introduce modifications to accommodate concerns expressed by the fisheries sector.

With this background established, a description of what was planned and what was accomplished in 1984 follows. Deviations from 1984 protocols are explained, and the rationale for these deviations is presented.

CARNATION CREEK RESEARCH TRIALS

Proposed Research Protocols

In addition to assessing weed efficacy and crop tree growth response to glyphosate treatment, research protocols for this study called for:

- (1) monitoring short-term, immediate effects of aerial glyphosate application on salmon fry behaviour, movements and mortality in relation to measured glyphosate residue levels in flowing tributaries and isolated pools in the experimental area,
- (2) monitoring aquatic invertebrate drift resulting from glyphosate exposure,
- (3) monitoring the movement of glyphosate residues into side channels following major fall and winter storm events and the reaction of salmon to these,
- (4) monitoring fish utilization of side channels in the short and long term following glyphosate application relative to glyphosate residues in water and stream sediment,
- (5) assessing habitat changes induced by glyphosate (water temperature, changes in riparian vegetation, erosion, sediment inputs, stream chemistry, algal populations, food supply, litter inputs, etc.) in stream and side channels, and
- (6) monitoring glyphosate residue movements and kinetics and off-target glyphosate deposit assessments.

Accomplishments

To accomplish the above, the Carnation Creek watershed was aerially treated with glyphosate in early September 1984 using an Alpine Helicopter Bell-47 helicopter equipped with a MICROFOIL BOOM* to minimize aerial herbicide drift into an adjacent coho salmon bearing stream. Spraying was carried out by Rotor Vegetation Control of Calgary under the direction of the FPMI. A map showing actual spray blocks is presented in FIGURE 1 and acreages, spray dates, spray times, air temperature, wind conditions, etc. are presented in TABLES 2 and 3.

Environmental impact studies were established by the FPMI and the Pacific Biological Station (PBS) of Fisheries and Oceans Canada. Short-term salmonid toxicity was examined by PBS:

- (1) by means of caged fish maintained in an oversprayed side channel of Carnation Creek and
- (2) by monitoring fish movements into and out of this side channel using fish traps maintained on the mouth of the side channel.

Fish utilization of the oversprayed side channel was compared with that for an unsprayed control side channel.

Since treatment of the watershed was just completed in September 1984, it is understandable that only preliminary, and particularly, short-term data is currently available. An FPMI file report (No. 63) entitled "Drift responses of stream invertebrates to a glyphosate application" was completed in January 1985 and has been released. Other

*Registered trademark of Union Carbide

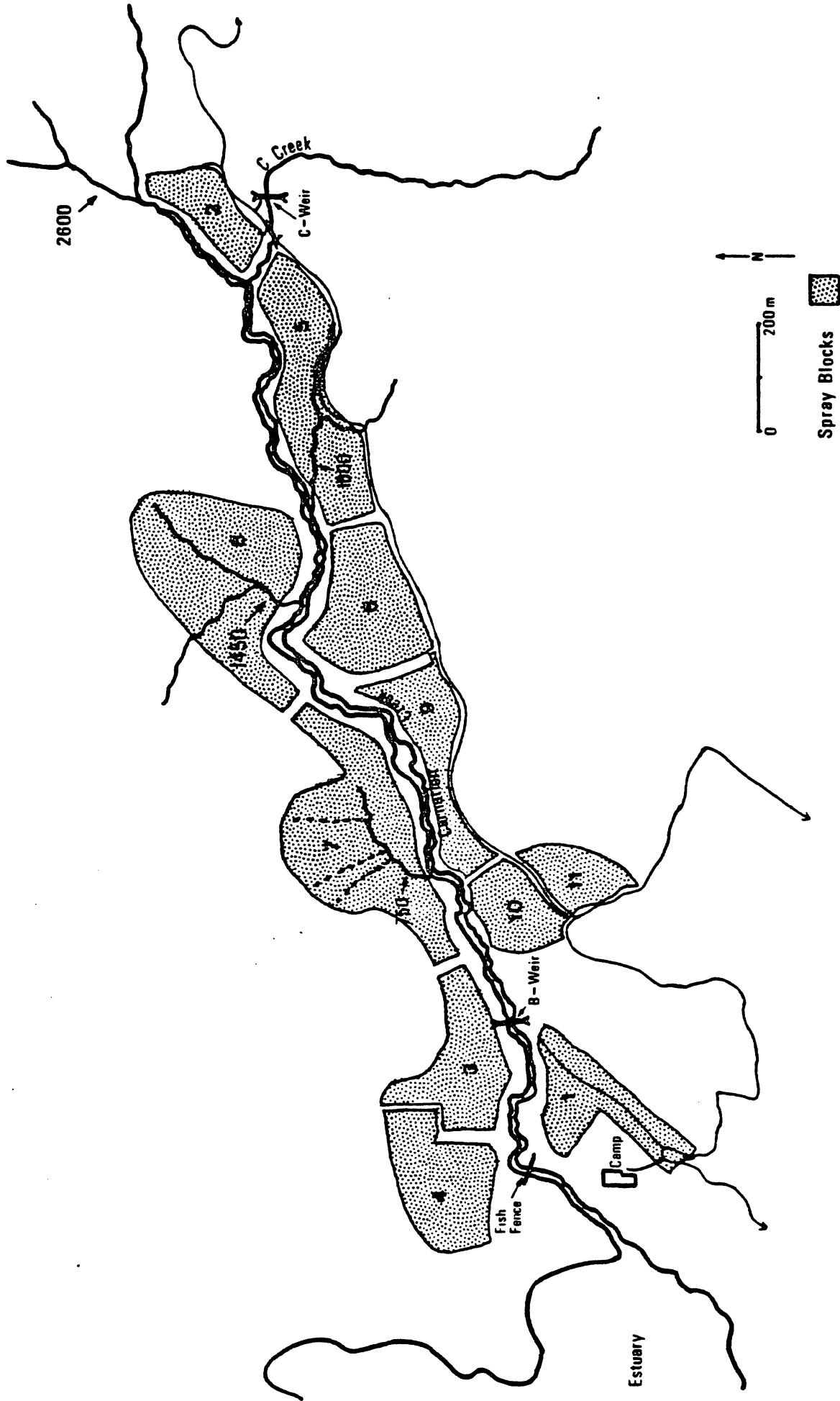


FIGURE 1 - Map of Carnation Creek Watershed showing the locations of glyphosate spray blocks.

TABLE 2 - Spray Data for Carnation Creek Watershed

Spray Block	Spray Date (Sept.)	Time Period	Application Rate (kg. a.i./ha.) (Glyphosate)	Tank Mix	Spray Volume (I.G.)	†Block Size (ha.)	Air Temp. (°C)	Wind Conditions
1	6	1900-1925	2.0	1	140	2.5	15	calm
2	6	1935-2005	2.0	1	175	3.1	15	calm
3	8	1416-1445	2.0	1	300	5.3		gusty
4	8	1913-1940	2.0	1	185	3.2		calm
5	14	1430-1539	*2.118	2	505	8.9	21	gusty
6	14	1646-1715	2.118	2	235	4.1	21	calm
7	14	1730-1814	**2.118/2.125	**2/3	290	5.1	21	gusty
8	14	1840-1849	2.125	3	63	1.1	21	gusty
9	14	1900-1931	2.125	3	285	5.0	21	gusty
10	15	1041-1050	2.125	3	100	1.7	14	calm
11	15	1053-1101	2.125	3	100	1.7	14	calm

*Residual spray solution in the tank and pumping system was assumed to be 50 Imperial gallons (I.G.) after each tank mix was used. Therefore, the concentration of active ingredient (a.i.) remaining subsequently changed the rate for tank mix #2 and tank mix #3.

**In spray block #7, the area closest to Carnation Creek received 100 I.G. from the 2nd tank mix while the area farthest from Carnation Creek received 190 I.G. from the 3rd tank mix for a total of 290 I.G.

†Based upon spray volume and calibration of spray system (56.8 I.G./ha).

TABLE 3 - Spray Data for Specific Carnation Creek Spray Blocks

	Spray Block					
	5		6		7	
Spray Period	Time	Duration (Min.)	Time	Duration (Min.)	Time	Duration (Min.)
1	1433-1438	5	1646-1652	6	1730-1735	5
2	1443-1445	2	1654-1659	5	1737-1741	4
3	1451-1453	2	1703-1707	4	1757-1806	9
4	1459-1503	4	1709-1715	6	1810-1814	4
5	1507-1510	3	-	-	-	-
6	1514-1518	4	-	-	-	-
7	1522-1526	4	-	-	-	-
8	1530-1534	4	-	-	-	-

Note: Spraying began closest to Carnation Creek and moved upslope away from Carnation Creek.

The overspray side channels in spray blocks 5, 6 and 7 are 1600, a connection with 1600 and 750 respectively.

similar file reports are expected throughout 1985 and early 1986 and will be provided to cooperators as they become available. Other longer-term studies are currently underway and major data collection is anticipated throughout 1985 and early 1986. These studies, which are described in the 1984 protocols, include: long-term acute toxicity; fish utilization of side channels; habitat changes; vegetative structure changes; CFS vegetation studies; erosional effects; stream chemistry changes; algae studies; community metabolism and residue movements.

Protocol Deviations and their Rationale

Research was carried out as described in the protocols with only minor deviations. The watershed was treated at 2.0 kg/ha of Roundup versus 1.7 kg/ha to more closely approximate the maximum allowable label rate and hopefully to enhance weed efficacy (spraying was late season and some of the vegetation was already senescent). However, it should be noted that previous MacMillan-Bloedel data supplied to FPMI indicates that an application rate of 1.7 kg/ha is optimal for coastal weed control.

Tributary C was not oversprayed as originally planned due to DFO regulatory restrictions and because of an agreement between PBS and DFO, Vancouver. A channel deviation of Carnation Creek near 1450 was found to contain salmonids and was buffered during spray operations. In addition, overspraying of tributary 1450 and J weir was eliminated to alleviate DFO regulatory concerns.

Because of reduced spraying near 1450, tank mix solution was left over at the conclusion of spraying. This left over tank mix solution was sprayed onto an adjoining portion of the watershed (spray block 11)

and one original spray block (spray block 9) was enlarged (spray block 10) to accommodate the left over solution. Rinseate from the helicopter spray tanks and boom was sprayed onto portions of the adjoining spray block (Number 11).

Summary

Proposed research protocols for the Carnation Creek trials were successfully carried out largely as planned. Minor deviations included an increase of glyphosate rate, no overspray of tributary C and a reduction of treatment area near tributary 1450.

SKEENA RIVER RESEARCH TRIALS

Proposed Research Protocols

In addition to assessing weed efficacy and crop tree growth response to triclopyr treatment, research protocols for this study called for:

- (1) monitoring environmental impacts resulting from an aerial triclopyr application on salmon and salmon habitat using protocols essentially similar to those described for the Carnation Creek Watershed.
- (2) monitoring the impact of an aerial triclopyr treatment on moose browse.
- (3) monitoring short-term and long-term effects of both herbicide (i.e., triclopyr and glyphosate) and manual treatments on plant community structure and succession, and
- (4) conducting glyphosate aerosol drift and canopy penetration studies utilizing a range of aerial atomizers and focusing on those that might be expected to minimize off-target herbicide drift and deposit.

Accomplishments

Work completed at Skeena in 1984 included:

- (1) glyphosate drift studies on site A involving the MICROFOIL BOOM, TVB* and conventional nozzles,
- (2) preliminary aquatic inventory studies on site A,

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- (3) preparation for soil residue studies on site A,
- (4) site mapping, establishment of permanent vegetation quadrats on site A (environmental impact site) and vegetation inventory, and
- (5) efficacy plot layout on sites C and G (FIGURE 2).

FIGURE 3 shows a map of the drift spray line and the location of drift sampling stations. A preliminary file report on the results of the drift testing is expected later this year.

Protocol Deviations and Their Rationale

In this regard, all planned work for Skeena in 1984 was completed with the exception of:

- (1) glyphosate drift studies on site G,
- (2) glyphosate drift studies with the Raindrop Nozzle system,
- (3) all triclopyr spraying, and
- (4) efficacy plot layout work on site I.

Drift studies

Drift studies with glyphosate at Skeena were completed in 1984 allowing for adjustments necessitated by

- (1) deteriorating weather conditions, and
- (2) insufficient time to conduct all planned drift trials.

Drift studies on site A were restricted to three boom systems. Satisfactory weather for conducting the tests and contractor time ran out before the raindrop nozzle could be tested or testing could occur on site G. In the end, weather was most limiting and additional contractor days would not have led to greater success either on site A or site G. It was literally too late in the season for any further testing with the onset of fall rains, leaf drop and westerly winds. Initiating the drift

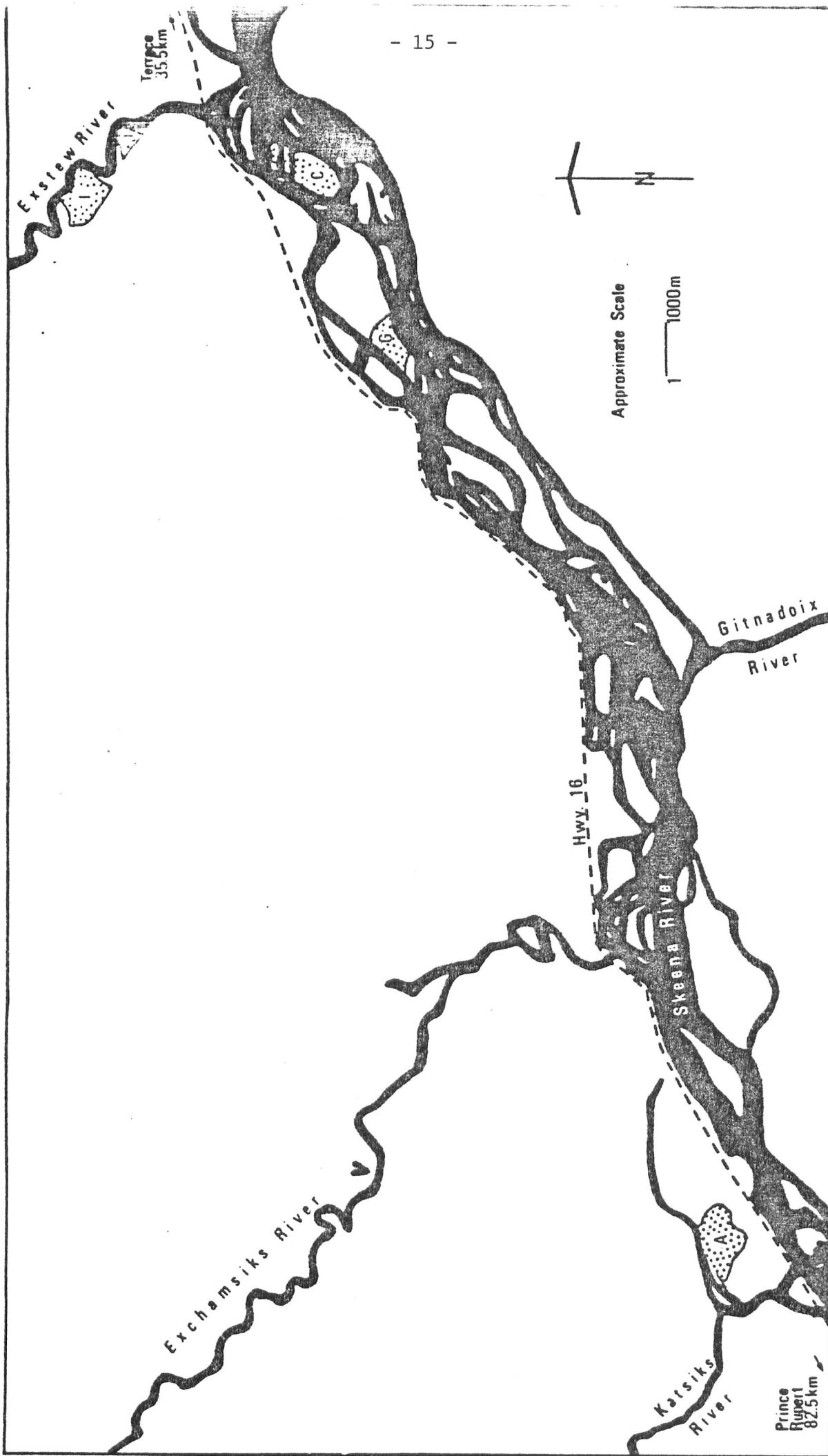


FIGURE 2 - Map showing the location of the five Skeena River herbicide Research sites.

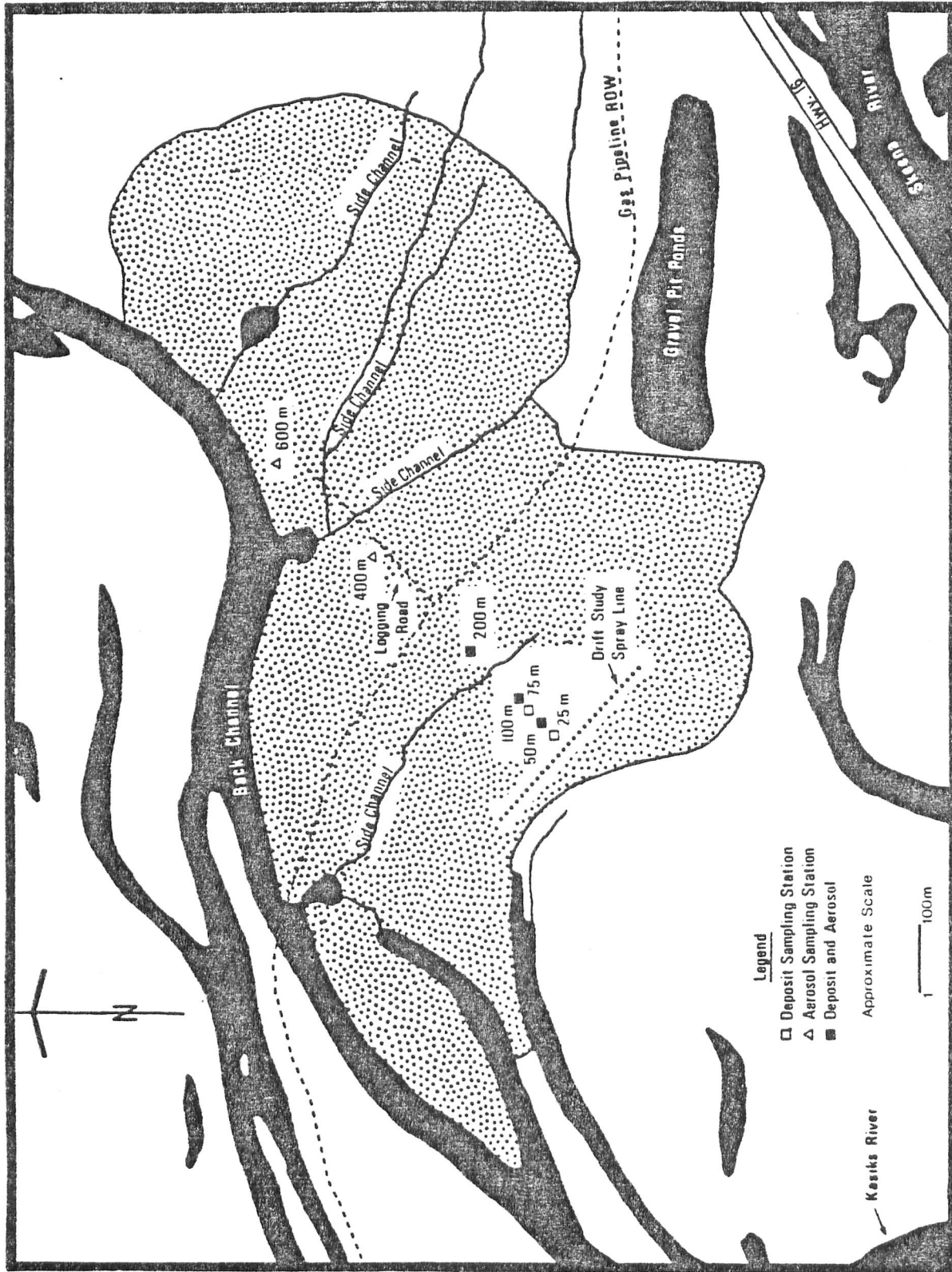


FIGURE 3 - Map of Site A showing the locations of drift spray line and downwind glyphosate aerosol and deposit samplers.

studies much earlier in September, which was not possible due to Carnation Creek spraying, may have improved our success as regards testing all boom systems on more than one site.

Site A (environmental impact studies)

Because of fisheries concerns about the proposed Skeena experiments, no triclopyr spraying at Skeena occurred in 1984. DFO concerns were focused on:

- (1) site selection,
- (2) proposed use of triclopyr ester formulation, and
- (3) proposed overspray of a side channel containing salmon.

DFO expressed concern about greater fish toxicity of the triclopyr ester formulation as compared with the triclopyr amine formulation, and felt that any overspray of fish bearing habitat would constitute a violation of the Fisheries Act.

Preliminary aquatic studies were conducted on site A at the locations shown in FIGURE 4. Experimental protocols for 1984 called for studies at locations I, II and III; however, field observations in August 1984 resulted in the establishment of sample locations IV and V as well as those proposed in the 1984 protocols. The aquatic characteristics of locations IV and V differ from those of locations I, II and III and coupled with these locations, provide a broader opportunity to assess possible short- and long-term impacts of a triclopyr (Garlon) treatment on aquatic organisms, fish (including coho) and salmon habitat.

FIGURE 4 also shows the locations of soil and litter sampling stations (VI and VII) established in 1984. These studies were proposed in 1984, but the locations for the studies were undesignated at that time.

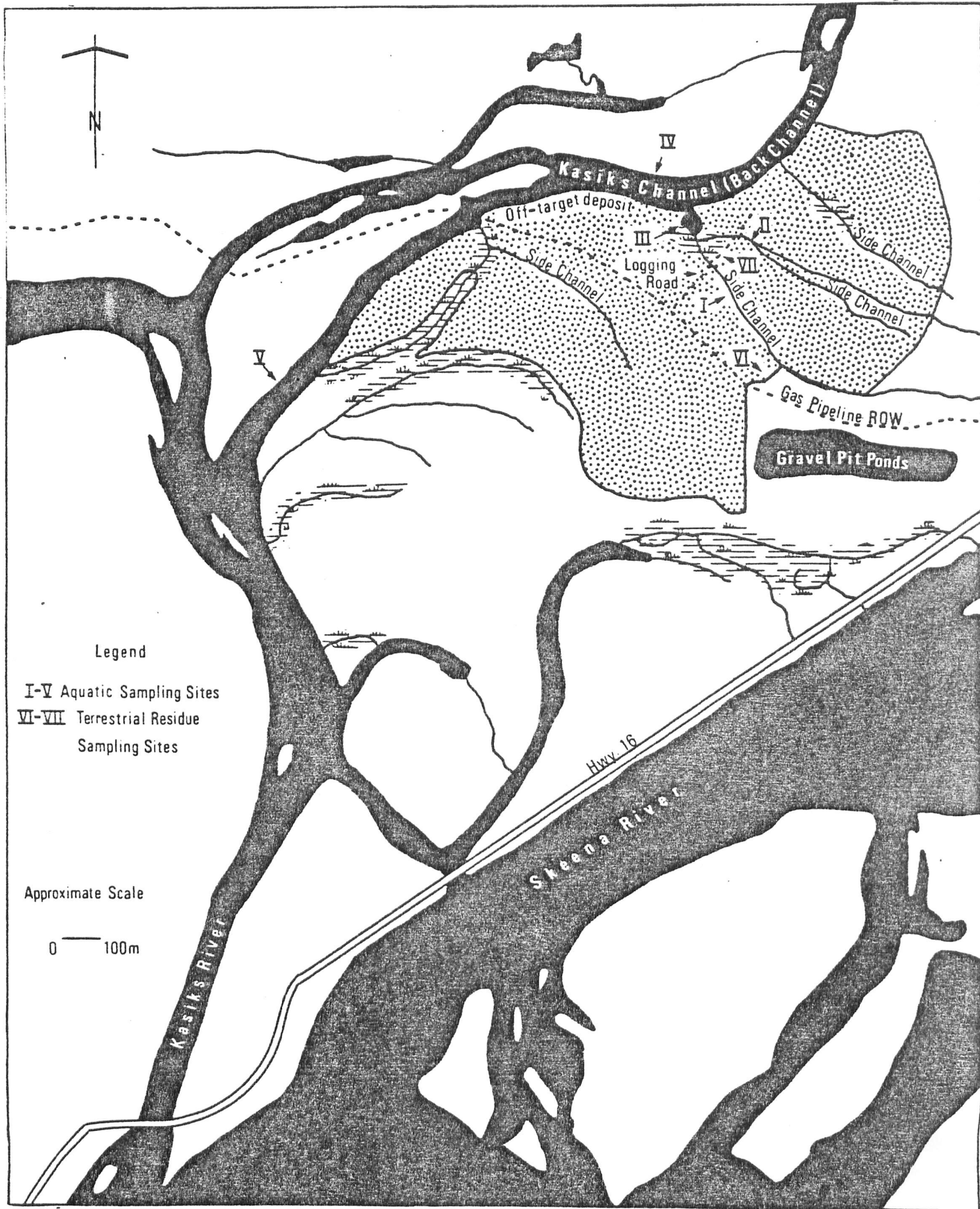


FIGURE 4 - Map of Site A showing the locations of various aquatic and residue sampling sites.

Site mapping, quadrat establishment and vegetation measurements on site A were carried out in greater depth than described in the protocols and required considerably greater time to complete due to unknown site conditions and progressively deteriorating weather. Due to weather some of the work was completed by field assistants hired through MOF after our departure in mid-October. Since the site will be utilized in the future as the prime environmental impact site, accurate mapping was deemed crucial. Nearly 70 quadrats were established on an evenly distributed grid across the site (FIGURE 5) and the precise locations of riparian channels and vegetation recorded. Data collected will be used to generate computer vegetation maps of the site showing the location of terrain features in relationship with vegetation type.

Sites C and G (efficacy trials)

Plot layout work on sites C and G was modified because of space restrictions. Protocols called for a greater number of test plots, each 2 ha in size, on each site than was feasible. Plots layed out on site C were for the most part 2 ha in size except for a few smaller plots intended for use as controls or manual clearing. On site G, plot sizes were reduced to 1 ha due to greater space restrictions, and a number of smaller plots were established for use as controls or manual treatments. Site C (FIGURE 6) has nine 2 ha plots and site G (FIGURE 7) has nine 1 ha plots.

Reductions in plot number and size will have two implications. These include:

1. A reduced number of possible treatments (i.e., herbicides, herbicide combinations) and/or treatment rates.

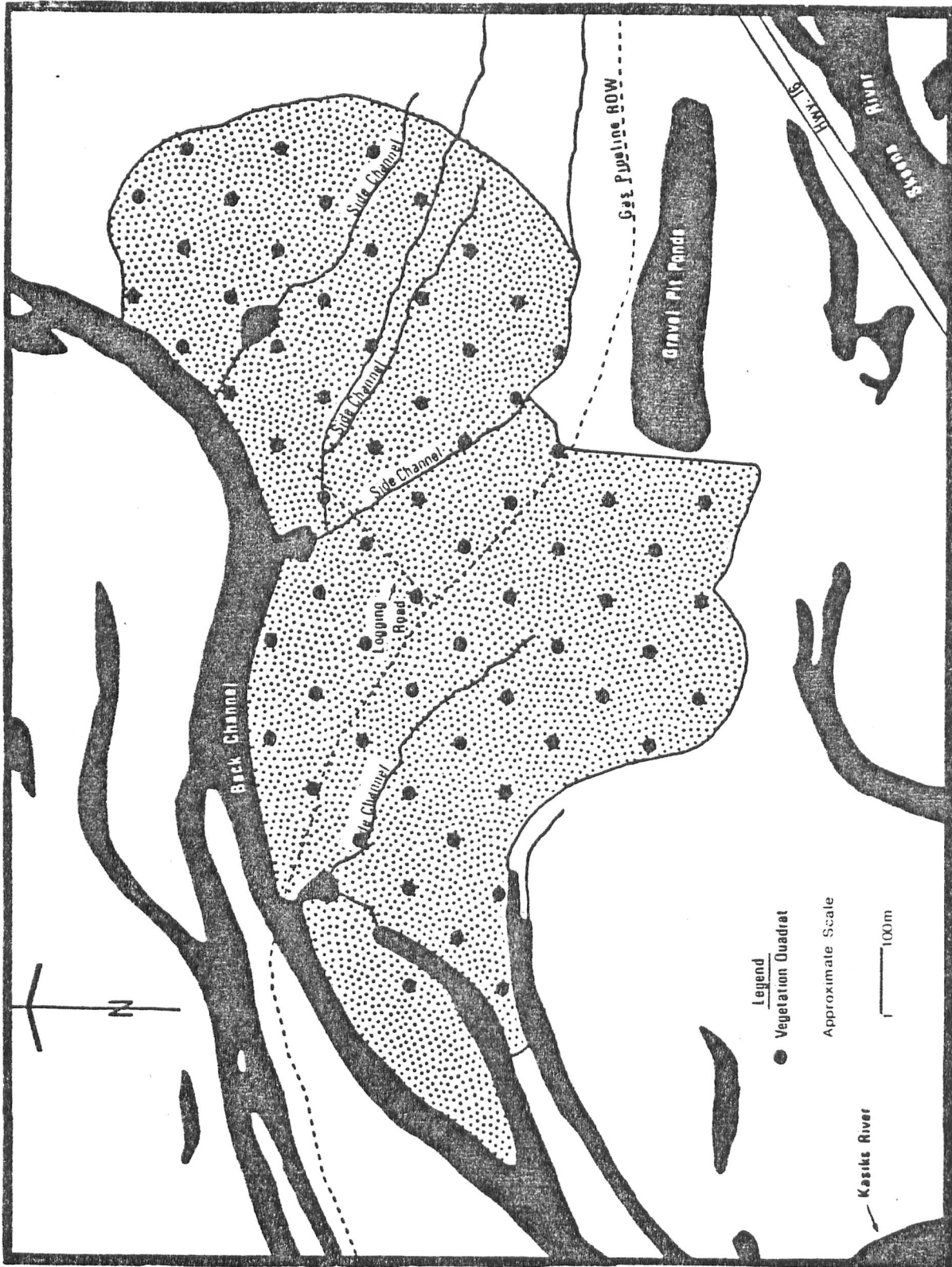


FIGURE 5 - Map of Site A showing the vegetation sampling quadrats.

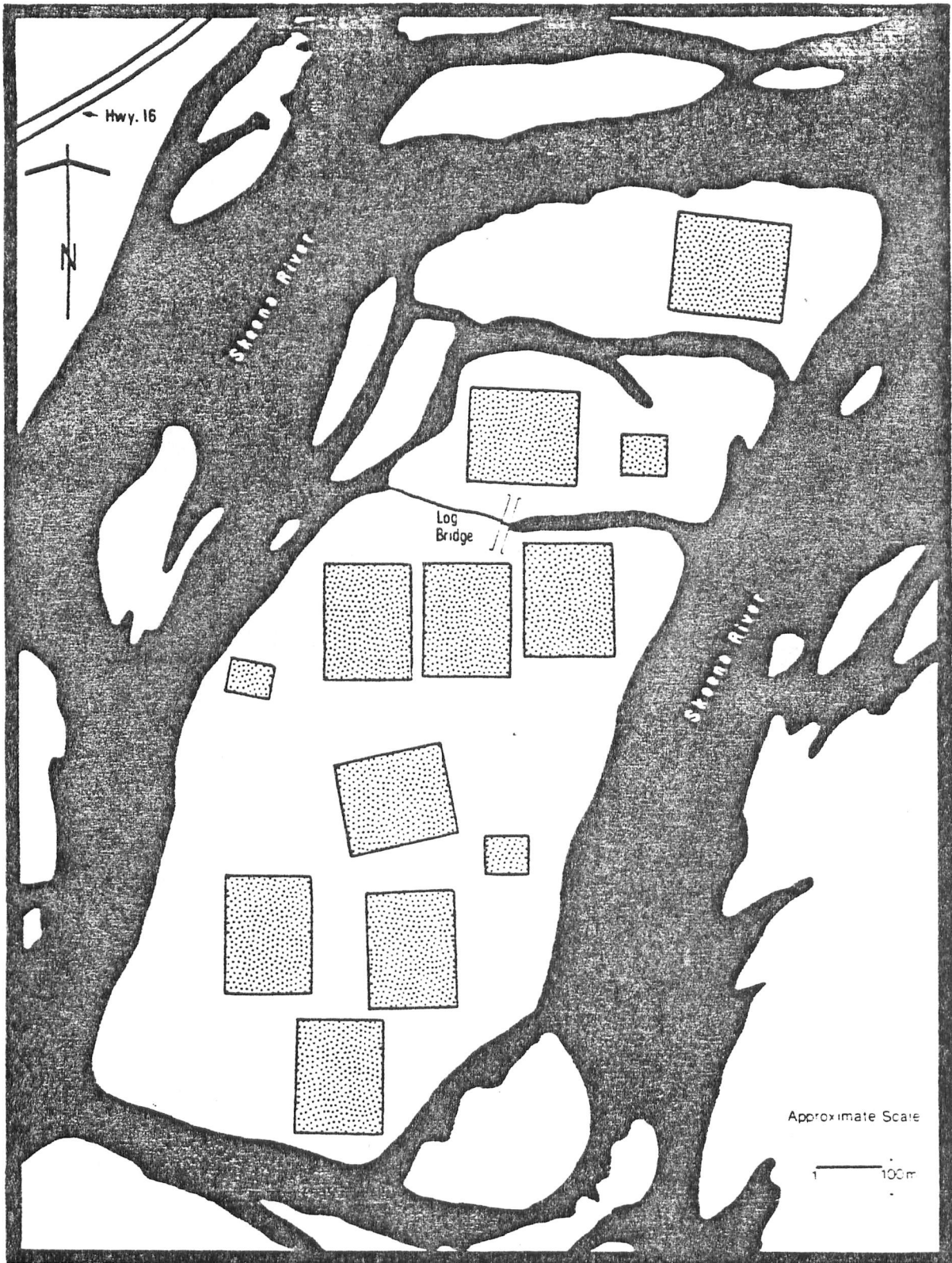


FIGURE 6 - Map of Site C showing the locations of herbicide (larger Rectangles) and manual or control (small Rectangles) treatment plots.

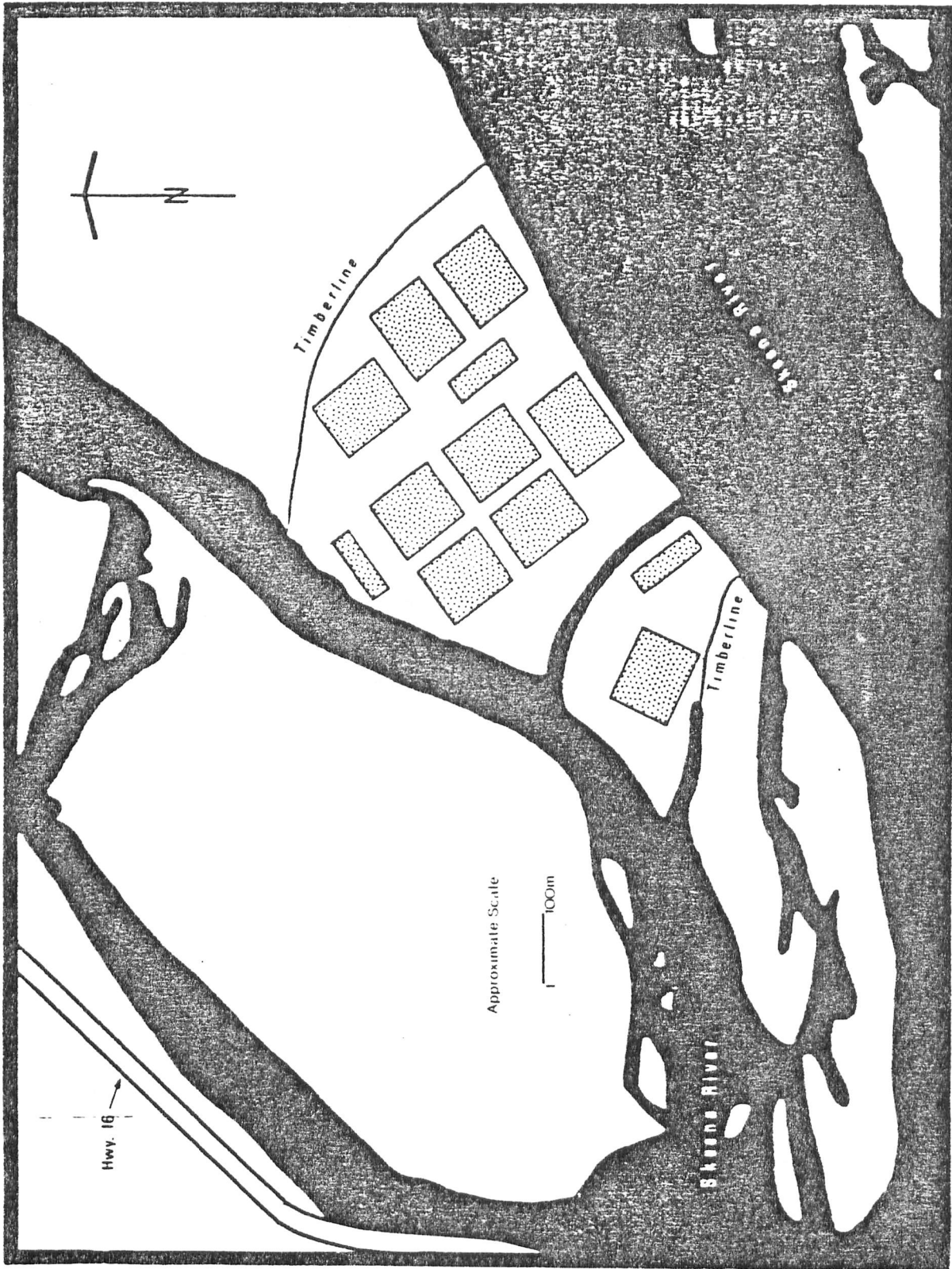


FIGURE 7 - Map of Site G showing the locations of herbicide (larger Rectangles) and manual or control (small Rectangles) treatment plots.

2. Treatment plots for controls and manual treatments will be smaller than plots used for herbicide treatments.

Although access to sites C and G was feasible, it is important to note that plot layout work would not have been completed or would have required considerably longer if it were not for helicopter airlifts (total cost, \$1,511) of essential field materials. Transport of these materials by boat would have taken days and efficient movement of materials on site would have been greatly hindered by dense brush, heavy slash and deep, wide, water-filled side channels sub-dividing the islands. The use of the airlift and large field crews (i.e., simultaneous crews on both islands) made the difference between successful versus unsuccessful plot establishment. Accessibility was a significant factor clearly underestimated in pre-planning phases. Despite their often glamorous proportions, the airlifts were cost saving and saved precious time. If success is measured in terms of available time, their use was justified.

Sites I and J (efficacy trials)

Plot layout work on site I was abandoned in 1984 due to insufficient time to initiate this work and because of site conditions which would have significantly increased the time required to complete this work. Virtual jungle-like conditions exist on site I, requiring a machete to cut one's way. Similar conditions were noted on site J. Actively growing brush conditions were not apparent on the two sites during a MOF helicopter reconnaissance in March 1984. Heavy snow conditions, at that time, precluded an accurate assessment of ground cover or shrub layer conditions.

Sites I and J were determined in August to be more inaccessible by boat than sites C or G. Whereas the latter are islands in the main channel of the Skeena, sites I and J are nearly two miles upstream on the Exstew River, a tributary of the Skeena. During August when river levels are dropping daily, access to the Exstew River is safely accomplished via a jet boat. Failure to budget for a jet boat in 1984 precluded reasonable access to sites I and J. A parallel logging road next to the Exstew River made access to the sites via a trailered boat feasible, but not practical without several boats. Leaving a boat chained and available at the end of the logging road was considered risky due to security concerns.

Use of site I was intended to investigate advanced conifer release with older crop trees and larger weed species than occurred on site C. Site J was targeted for plant succession studies making a comparison of treatment with Roundup versus Garlon. Because of these problems, both sites will be abandoned in 1985. Most studies proposed for sites I and J will be conducted on site A. Because of these problems, both sites will be abandoned in 1985. Most studies proposed for sites I and J will be conducted on site A.

Summary

In summary, a great deal was accomplished at Skeena in 1984. We initiated successfully herbicide research in the Skeena floodplain. Considerable time spent in Terrace enhanced our rapport with local officials, generated support for our project among the local population, and helped to diffuse certain criticism and opposition to our work by answering questions on a one-on-one basis. Preliminary research conducted in 1984 has greatly strengthened our data base, made our discussions with others more credible, and aided our acceptability by the local community. Studies in 1984 enabled us to get our foot in the door at the local level. Greater familiarity with site conditions in 1985 should enable us to accomplish a better quality study in 1985 which in turn has a broader base of acceptability.

PEACE RIVER RESEARCH TRIALS

Proposed Research Protocols

Proposed experiments for this study location (1985) called for:

- (1) monitoring crop tree growth response and weed efficacy in response to aerial glyphosate and hexazinone (soil and foliar applied) treatments,
- (2) quantifying soil persistence and leaching of hexazinone for soil applied treatments, and
- (3) conducting herbicide (hexazinone and glyphosate) aerosol drift and off-target deposit studies utilizing a range of aerial atomizers and focusing on those that might be expected to enhance weed efficacy while minimizing off-target herbicide drift and deposit.

Work proposed for Peace River in 1984 was intended to prepare for the above research planned for execution in 1985.

Accomplishments

All work proposed for 1984 was postponed to a later date. All cooperators agreed to postpone the proposed Peace River research indefinitely. Original research protocols (1984) are currently in abeyance until a decision is made to modify, to proceed with or to abandon the proposed plans.

Protocol Deviations and their Rationale

During 1984, efficacy plots were to have been installed at Peace River in preparation for 1985 spring and summer spraying. Plans calls for pre-spray vegetation assessments on the plots to be sprayed in May

1985. Plans for plot layout north of Fort St. John were abandoned in the field during July 1984. Factors contributing to this decision included:

- (1) the unavailability of a site of suitable size to accommodate all proposed efficacy trials,
- (2) concerns about possible duplication of on-going or planned MOF efficacy trials with hexazinone and glyphosate at the Sunset Research Area (Dawson Creek), and
- (3) insufficient time to complete vegetation plot layout work near Fort St. John and still allow for adequate time to prepare for efficacy trials and vegetation assessments at Carnation Creek and Skeena River.

During March 1984, two sites (CP-6-1 and 73-40 Plantation) were tentatively selected for efficacy trials north of Fort St. John. Under heavy snow conditions in March, the sites appeared:

- (1) to be large enough for intended uses,
- (2) to be accessible by road, and
- (3) to have a uniform vegetation cover type.

One site (CP-6-1) appeared to be ideal for use. By July 1984, a natural gas flare pit fire had overrun this site and road access to the alternate site (i.e., 73-40 Plantation) was found to pass through a marsh, making the site accessible only by air or by use of a tracked vehicle.

An alternate site, CP-6-2, was identified near the original CP-6-1 site and examined for suitability. Although the site had an acceptable vegetation cover, it was about half as large as the original CP-6-1

site and only large enough to accommodate the spring 1985 treatments. A desire to have both spring and summer treatments on the same site, due to ecotypic considerations, resulted in the abandonment of the CP-6-2 site as a possible alternative.

The requirement for a very large, vegetatively uniform site resulted in the conclusion that the only available site was the Os location (800 ha). Use of the Os site in 1984 was ruled out because of temporary site accessibility problems. During early 1984, road access to Os was greatly improved, but road access to the site is still partly dependent upon a tracked vehicle. The MOF (Fort St. John) indicated that further road improvements were planned for late 1984 - early 1985, and that provisions for improvements would be ensured if future use of the site by the CFS was assured. Future use is also dependent upon establishing an acceptable road grid on the site itself. Recognizing the necessity of these improvements, future work on the Os site was delayed.

The decision to delay use of the Os site was based primarily on accessibility problems. However, a field tour of the site in July 1984 lead to a commitment by the MOF (Fort St. John) to conduct a preliminary ecological survey of the site in 1984. Pending the survey, which will determine site variability, it was considered wise to defer plot layout until 1986. In addition, it was decided that additional time would allow for the CFS to gain a greater familiarity with previous and proposed MOF vegetation management trials at the Sunset Research Area (Dawson Creek). It is likely that proposed Peace River protocols will be revised to eliminate unnecessary duplication of existing research and

to ensure that any new research will seek to answer legitimate environmental concerns which may tend to obstruct operational use of forestry herbicides in the Peace River region.

Summary

While working in the Fort St. John area, the CFS encountered and experienced local weather-dependent driving conditions which will have a bearing on future operations. Even where good dirt roads exist in the Peace River region, accessibility can be and often is a major obstacle to site use and research success. Gumbo soil conditions develop with the slightest amount of rainfall, and road hazards increase, unacceptably, until the soils dry. There appears to be no immediate solution to this problem; however, there are a number of implications. These include:

1. Field conditions in the Peace River District make working there more difficult than on island sites in the Skeena River. Our 1984 field experience verified this observation.
2. Because of undependable site accessibility, greater time is required to accomplish given tasks than elsewhere. Given other commitments in 1984 (i.e., Carnation Creek, Skeena River) we simply did not have adequate time to accomplish our goals at Peace River. Although our 1984 research plans were admittedly ambitious, not enough time was allocated for unforeseen contingencies at Peace River, and we simply ran out of under-budgeted time to accomplish our goals there without jeopardizing work elsewhere.
3. Site accessibility and weather-dependent road conditions at Peace River have a great bearing on future proposed drift studies there.

As learned from Skeena, drift studies are time-consuming, costly and inordinately sensitive to near perfect weather conditions. If Peace River constraints are superimposed on these requirements, then chances for success are further diminished unless special provisions are anticipated and made to avoid delays due to showers.

CONCLUSIONS

In the final analysis, 1984 was a notable year of research accomplishments. Proposed glyphosate (Roundup) research for the Carnation Creek Watershed was fully implemented with only minor deviations from the original protocols. In addition, successful drift testing was implemented near Terrace, B.C. as part of the proposed Skeena River project. The latter included testing of three boom systems including the MICROFOIL BOOM, the TVB and conventional nozzles. Pre-spray aquatic, residue and vegetation studies were conducted on three Skeena sites during 1984 in preparation for proposed 1985 triclopyr (Garlon) treatments.

To date, one file report on short-term aquatic impacts for Carnation Creek has been released, and additional reports are expected throughout 1985. Acquisition of proposed long-term habitat impact data for Carnation Creek should be complete by April 1986. Short-term residue analyses for Carnation Creek are nearing completion, and long-term residue data should be available by the close of 1985. As regards Carnation Creek, it is proposed to hold a symposium on the research in late 1986 and to publish initial proceedings of the research at the time of the symposium.

We look forward with great anticipation and enthusiasm to completing the proposed Skeena treatments with triclopyr in August 1985. Based upon this schedule, we would anticipate the release of Skeena triclopyr data to parallel the timetable for Carnation Creek by approximately one year. It is likely that preliminary file reports on the Skeena project will be provided to cooperators throughout 1986 and it would be our intent to sponsor a second symposium on this research in late 1987. Initial proceedings of the Skeena research would be published at the time of the symposium.

In view of the various problems and concerns which surfaced in 1984, the CFS feels that a great deal was accomplished in 1984, and that experiences gained in 1984 should vastly improve our chances for success in 1985. We are confident that any remaining concerns pertaining to our proposed research will be eliminated in the very near future, and that all research proposed for 1985 will proceed smoothly, with a minimum amount of deviation from proposed protocols. The CFS is most grateful for MOF support received to date. With the MOF's continued confidence and support, the CFS is committed to making 1985 a year to remember in forestry herbicide research.