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USE OF PHEROMONE BAITED
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Use of Pheromone Baited Lindgren Funnel Traps^R
for Monitoring Mountain Pine Beetle Flights

by

A.J. Stock

February 1984

Prince Rupert Forest Region
British Columbia Ministry of Forests
Smithers, B.C.

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ABSTRACT

Experimental monitoring of mountain pine beetle (Dendroctonus ponderosae) flights with pheromone baited Lindgren funnel traps^R indicates that funnel traps can be used to assess the duration and end of mountain pine beetle flight on a local basis. Rigorous data collection and reporting procedures must be followed in order for the technique to be effective. Placement of traps near larger infestations gives best results. Data collection should be accompanied by weather observations and short, frequent examinations of beetle brood development in stands.

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The Prince Rupert Forest Region has been engaged in a major effort to manage widespread infestations of the mountain pine beetle (Dendroctonus ponderosae Hopk.) in lodgepole pine (Pinus contorta var. latifolia Engelm.) since 1981. Logging has been the main direct control technique. Hauling of infested logs during the beetle flight period has generally been restricted, in order to reduce the possibility of spreading beetle populations into new areas. This has caused problems for licensees who must either cease hauling or shift operations to uninfested cut blocks during specified time periods (see Appendix I).

It was decided to evaluate the effectiveness of Lindgren Funnel Traps^R (LFT's) for monitoring mountain pine beetle flight so that restricted hauling periods might be reduced. It was felt that development of such an approach would be inherently more accurate and flexible than a blanket restriction based solely on calendar dates.

METHODS

Lindgren Funnel Traps^R (Phero-Tec Ltd., Vancouver, B.C.) were baited with commercially available mountain pine beetle pheromone components (exo-brevicomin, trans-verbenol, and myrcene (Borden et al. 1982)) and placed in or near beetle infested lodgepole pine stands. Traps were placed off the ground, usually hung on string between two trees (Fig. 1). The collecting jars on each trap contained a small amount of soap and water to kill captured beetles. Beetles were collected from mid-June to mid-August.

RESULTS

Unusual weather patterns dominated beetle flight during the summer of 1983. May was abnormally hot and dry and some flight may have occurred¹. June, July and August were unusually cool and wet (Tables 1 and 2).

¹ Personal Observation.

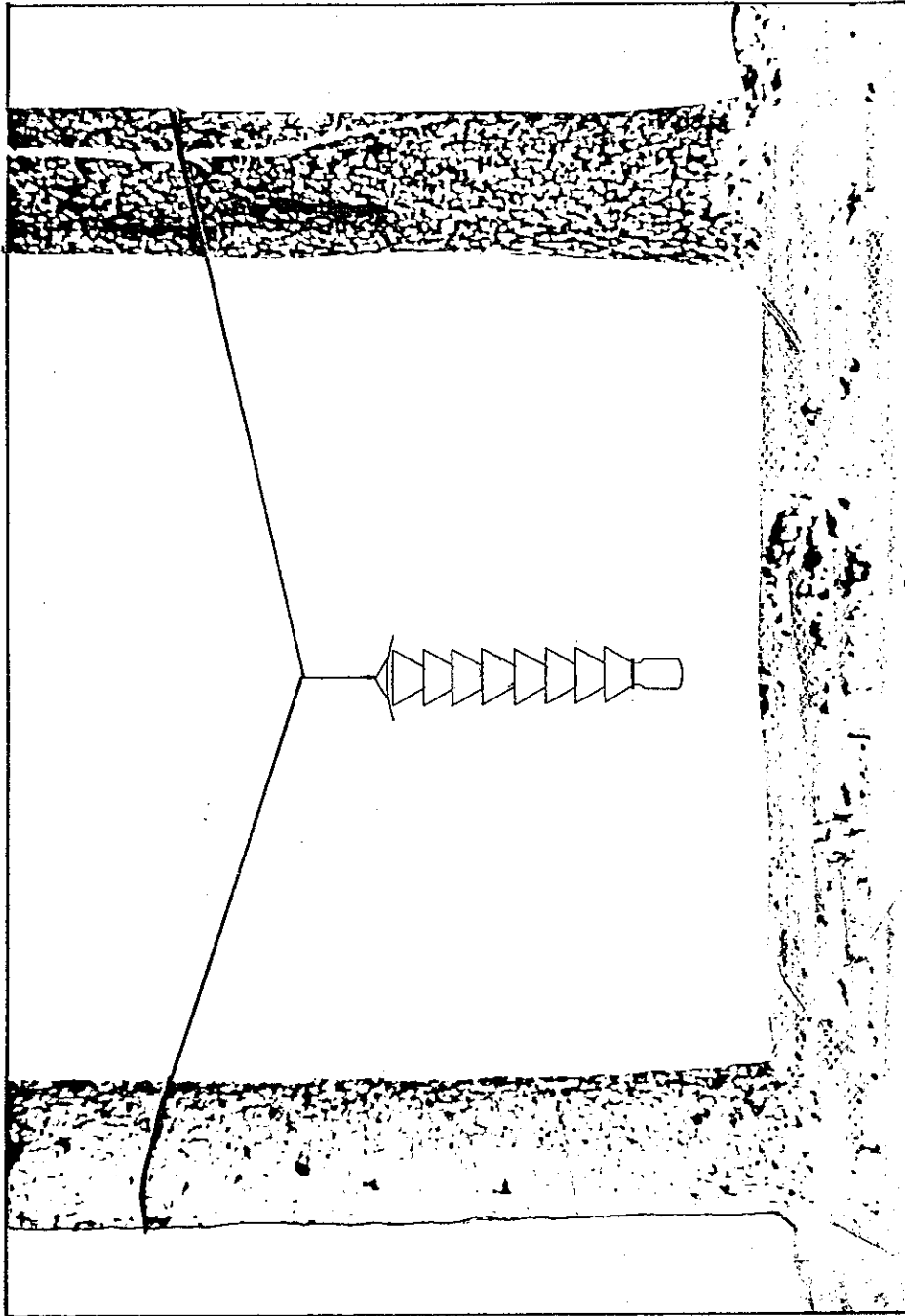


Figure 1. Installation of Lindgren Funnel Trap.

Table 1. Average monthly maximum and minimum temperatures and total rainfall for May - August, Smithers, B.C.^a

	28 Year Average (1942-1970)			1983		
	High (°C)	Low (°C)	Rain (mm)	High (°C)	Low (°C)	Rain (mm)
MAY	15.9	2.4	32.0	18.1	4.5	35.2 (0.2 cm snow)
JUNE	19.4	6.0	40.0	17.6	7.7	82.7
JULY	21.1	7.9	49.0	19.3	8.9	81.7
AUGUST	20.6	7.1	39.4	19.7	7.3	35.0

a. Data from Aviation Weather Service, Smithers Airport, Smithers, B.C.

Table 2. Daily weather at Smithers, and beetle catches by location, June - August, 1983.

Smithers Wx. Data - June 1983					Trap Location ^{c,d}								
Date	High (°C)	Low (°C)	Rain (mm)	Cloud ^a	1	2	3	4 ^f	5	6 ^f	7 ^f	8 ^f	9
					Beetles Collected								
15	19.5	10.2	2.0	0									
16	13.0	6.2	3.4	1									
17	16.1	7.0	2.3	0									
18	16.0	6.9	-	0									
19	13.6	9.0	1.2	0									
20	16.1	8.5	1.2	0									
21	22.0	4.9	-	6									
22	23.5	9.2	0.4	5									
23	26.5	9.6	-	9									
24	16.1	8.5	0.2	4									
25	17.1	10.4	4.7	0									
26	18.7	10.7	9.4	0									
27	19.5	11.7	0.8	0				1					
28	20.5	9.4	2.4	0									
29	17.0	10.2	1.0	0				2	0				
30	16.3	10.5	6.8	0									

- a. Hours with less than 60% cloud cover, from 0700 - 2000 each day.
- b. TR = trace amounts.
- c. Trap locations; see maps, Appendix II.
- d. No June data available for locations 1, 2, 3, 6, 7, and 8.
- e. "Average" catch of three beetles per day, June 15-30.
- f. Two traps, total catch.

Table 2 (cont.)

Smithers Wx. Data - July 1983					Trap Location ^{c,d}								
Date	High (°C)	Low (°C)	Rain (mm)	Cloud ^a	1 ^g	2 ^g	3 ^g	4 ^f	5	6 ^f	7 ^f	8 ^f	9
					Beetles Collected								
1	20.5	10.3	3.8	0									
2	19.7	10.2	TR ^b	0									
3	18.6	12.6	-	0									
4	17.1	10.4	8.1	0				0	0	0	0	0	
5	17.9	4.8	-	13									
6	16.9	3.3	12.2	8				0	0	0	0	0	
7	14.6	7.4	19.7	0									
8	16.9	3.2	-	2				0	0	0	0	0	
9	14.8	9.2	1.9	0									
10	16.0	8.6	0.4	0									
11	16.0	8.7	6.4	0				0		0			10
12	17.0	9.1	0.2	0					0		0	0	
13	12.4	8.0	3.9	0				0		0			
14	21.9	9.5	2.6	5					0		0	0	
15	22.0	10.8	2.8	4				0		0			
16	24.2	6.2	-	8									
17	27.1	8.5	-	12									
18	26.0	11.1	-	5	230			33	8	3	3	7	500+
19	27.8	4.4	TR	7	320			16	26	8	1	6	100
20	20.5	13.0	0.2	0	10			9	41	5	0	3	6
21	20.0	12.2	1.0	0	40	135		0	0	0	0	0	
22	19.2	9.2	0.8	0				0	3	0	0	0	
23	21.8	6.6	TR	6									
24	18.3	9.2	1.8	0									
25	15.7	10.4	2.6	0	60	40			19		0	0	
26	15.5	10.0	6.8	0	5	3		0	0	0	0	0	
27	19.8	5.7	1.0	2	0	0	0	0	0	0	0	0	
28	19.2	9.7	3.4	0	0	0	0	0	0	0	0	0	
29	18.1	8.0	0.8	0	0	0	0	0	1	0			
30	22.2	10.8	0.4	0									
31	20.0	11.8	0.9	3									

- a. Hours with less than 60% cloud cover, from 0700 - 2000 each day.
- b. TR = trace amounts.
- c. Trap locations; see maps, Appendix II.
- f. Two traps, total catch.
- g. Monitoring commenced July 15, 1983.

Table 2 (cont.)

Smithers Wx. Data - August 1983					Trap Location ^{c,d}								
Date	High (°C)	Low (°C)	Rain (mm)	Cloud ^a	1	2	3	4 ^f	5	6 ^f	7 ^f	8 ^f	9
					Beetles Collected								
1	16.6	8.8	TR ^b	0									
2	21.1	9.4	3.4	0	60	400	4						
3	18.0	7.2	0.4	3	5	5	0	6	145	18	3	7	
4	20.4	2.1	-	6	7	7	0	0	2	1	0		
5	19.0	7.2	0.9	4	5	5	0	0	0	0	0	0	9 ^h
6	17.7	9.2	2.5	0									
7	21.2	7.6	TR	9									
8	25.5	8.9	-	11	30	300	0	3	13	3	0		
9	26.5	7.2	-	13	30	500	0	20	13				
10	23.2	10.6	4.0	6	0	150							
11	20.0	11.6	0.9	0				7	4		5	18	
12	17.0	6.4	0.3	6						4		0	
13	17.8	6.8	0.6	3									
14	18.7	6.1	TR	3									
15	15.5	8.2	3.0	1				0	0	0	0	0	
16	17.7	9.9	6.1	0	5	30							

- a. Hours with less than 60% cloud cover, from 0700 - 2000 each day.
- b. TR = trace amounts.
- c. Trap locations; see maps, Appendix II.
- f. Two traps, total catch.
- h. Collected August 3-5, 1983.

Mountain Pine Beetle flight was minimal in June. A major flight occurred July 16-20 and a minor flight occurred again July 22-26 at all locations (Table 2). Major flight occurred again in July 30-August 3 and August 8-9. Major flights are clearly associated with limited periods of "sunny" weather and daily temperatures exceeding 19°C (McCambridge 1971). This may account for a lack of flight period variation between different geographical locations, which might otherwise have reflected differences in local climates.

Placement of traps within heavily infested stands results in large beetle catches during peak flight periods (locations 1 and 9, Table 2). Placement of traps near to infestations results in lower overall catches but still gives a good indication of peak flights (locations 2-8, Table 2).

DISCUSSION AND RECOMMENDATIONS

Pheromone baited LFT's appear to be suitable for monitoring occurrence of mountain pine beetle flight and probably for detecting the end of major flight activity in a season. The suitability of LFT's for helping to reduce the duration of hauling restrictions depends largely on the development of a monitoring program which includes the following elements:

- 1) Traps should be placed in the field by June 1. This date should remain in effect until annual records indicate that no beetle flight occurs until later, even on warm sunny days. Traps should remain in place until no flights are recorded over several warm sunny days, or until September 15.
- 2) A ban on hauling beetle infested pine (see Appendix I) should be imposed commencing annually on July 1. The ban can be lifted when conditions in (1) are met, or on September 15.
- 3) One or two traps should be placed in or near all cutblocks of concern. It is recommended that more than one individual be trained for each District/licensee to collect and report data.

- 4) No more than two days should elapse between collection at traps. Data from Table 2 indicate that longer collection intervals nullify the monitoring value of LFT's. Intervals may be up to four days when daily maximum temperatures do not exceed 17°C (It is recommended that Fire Weather Station data be utilized in each District.).
- 5) Frequent quick examinations of beetle populations should be done in monitored cutblocks. Percentages of adults, pupae, larvae and the occurrence of emergence holes should be noted. The occurrence of new green attack should also be noted.
- 6) Trap catches and stand examination reports should be reported to the Forest Service District office each day. This will allow coordination of trap and weather data.

The LFTs will be most useful as a supplementary tool in managing mountain pine beetle if the preceding recommendations are met. It cannot yet be said with certainty that their use will result in a shortened period of hauling restrictions. The period of restriction may be longer or shorter than previously imposed blanket restrictions, but will be more realistic in terms of beetle control.

It is recommended that LFT's be used as described for a two-year trial period.

Further research is needed to calibrate the trap catches relative to size of adjacent infestations.

ACKNOWLEDGEMENTS

The cooperation and assistance of B.C. Ministry of Forests District Offices at Houston and Burns Lake, and of Babine Forest Products Ltd., Groot Logging Ltd., and Houston Forest Products Ltd. is gratefully acknowledged. Most of the data collection and recording was done by staff from these offices.

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- Borden, J.H., J.E. Conn, L.M. Friskie, B.E. Scott, L.J. Chong, H.D. Pierce, Jr., and A.C. Oeschlager. 1983. Semiochemicals for the mountain pine beetle, Dendroctonus ponderosae, in British Columbia; baited tree studies. Can. J. For. Res. 13:325-333.
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APPENDIX I

All District Managers

Smithers, B.C.

March 9, 1983

720, Pest Mgmt.
General

SUBJECT: GUIDELINES FOR SUMMER LOGGING AND HAULING OF BEETLE
INFESTED TIMBER IN THE PRINCE RUPERT FOREST REGION

1.0 Responsibility

It is the responsibility of the District Manager and staff to determine, for each licensee, a course of action that will minimize the impact of hauling restrictions during the beetle flight period.

2.0 Spruce Beetle

There are no restrictions on the hauling or storage of beetle infested spruce, provided that some of the logs in a given load or deck are green and uninfested.

3.0 Mill Yards

All mills in or near susceptible timber types must be clear of beetle infested pine logs by June 25th or as directed by the District Manager. Susceptible timber types are P1 major, age class 6+.

4.0 Hauling Restrictions

There will be a shutdown of all hauling of beetle infested pine from June 25th to September 1st. The intent of this ban is to protect unattacked pine stands, and allow site specific application and lifting of the ban, based on commencement and completion of beetle flight.

This ban will apply to all licensees, unless the District Manager grants an exception based on the following guidelines.

4.1 Monitoring Mountain Pine Beetle Flight

Pheromone baits and collapsible plastic traps are commercially available. These traps can be used to monitor mountain pine beetle

flight on a site specific (i.e., the block(s) being logged) basis. Pheromone baited trees should be used as a backup measure. Hauling shut down could then be on a site specific basis during the main beetle flight period. Unrestricted hauling can begin again as soon as trap catches indicate that the major flight period has passed. Responsibility for monitoring the traps on a daily basis to determine special dates rests with the District Manager.

4.2 Inter-District Hauling

Special authorization to haul infested wood through uninfested susceptible types must be obtained through the District Managers involved. Each request will be considered on a site specific basis to ensure no insect spread through the chosen haul corridor.

4.3 Water Storage

No restrictions are necessary where infested timber has been submerged in water for four weeks prior to July 15th. Beetle development in these logs will be severely retarded and no flight will occur. Some beetles may emerge from logs on top of floating bundles - it is therefore advisable to process the bundles as quickly as possible at the mill.

4.4 Log Sorting at Landings

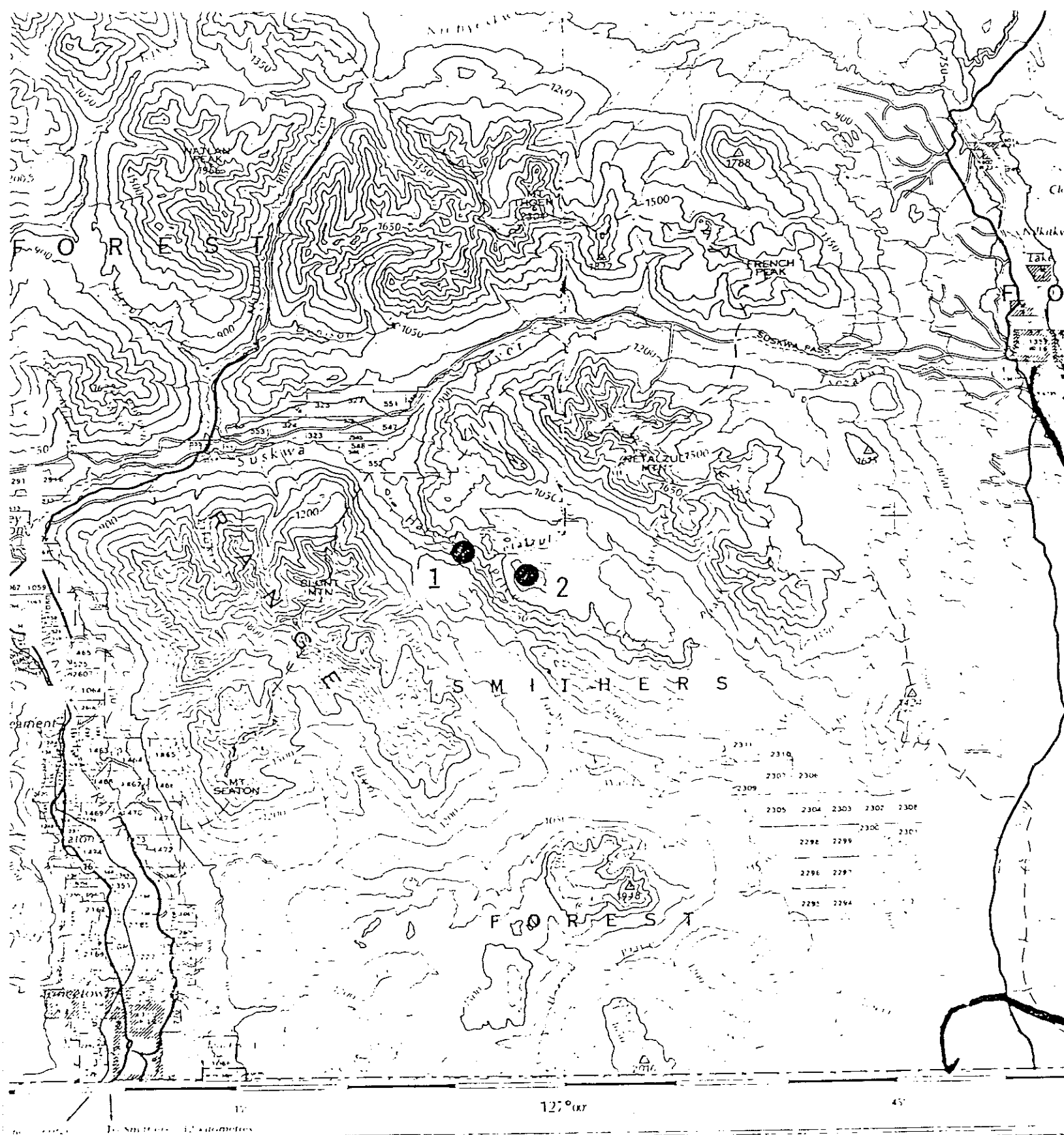
Specially trained sorters can identify beetle infested pine at the landing. The uninfested pine can be hauled and the infested pine can be set aside on the landing. This option would be most effective when the cut block is divided up into cut leave patches designed so that uninfested pheromone baited patches are left standing adjacent to the landings in order to absorb beetles which emerge from infested decks.

4.5 Mechanical De-Barking at Landings

De-barking infested pine logs on the landing will solve the hauling problem. (The availability and cost of mechanical de-barkers may present problems.)

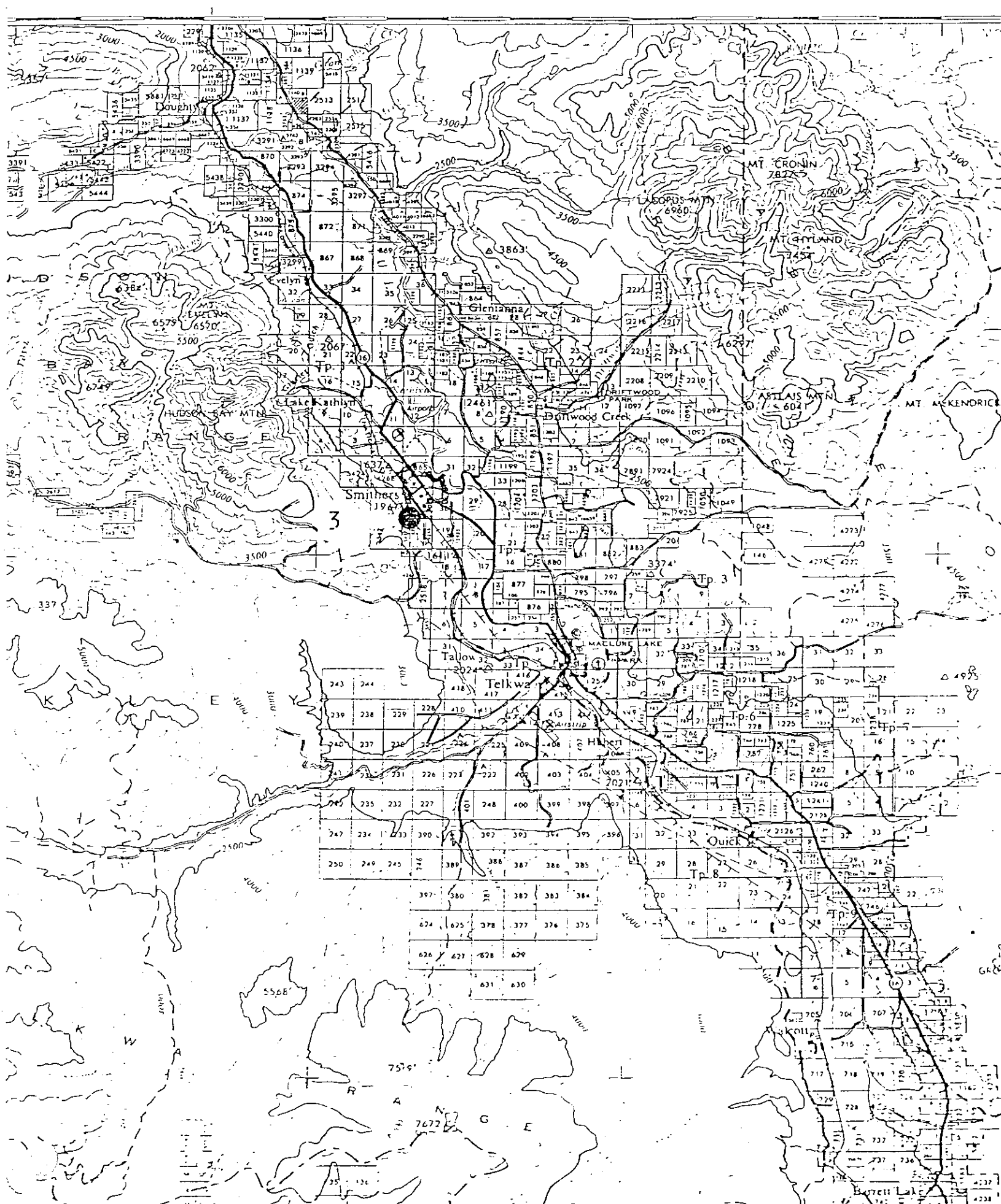
J.A. Biickert
REGIONAL MANAGER

APPENDIX II

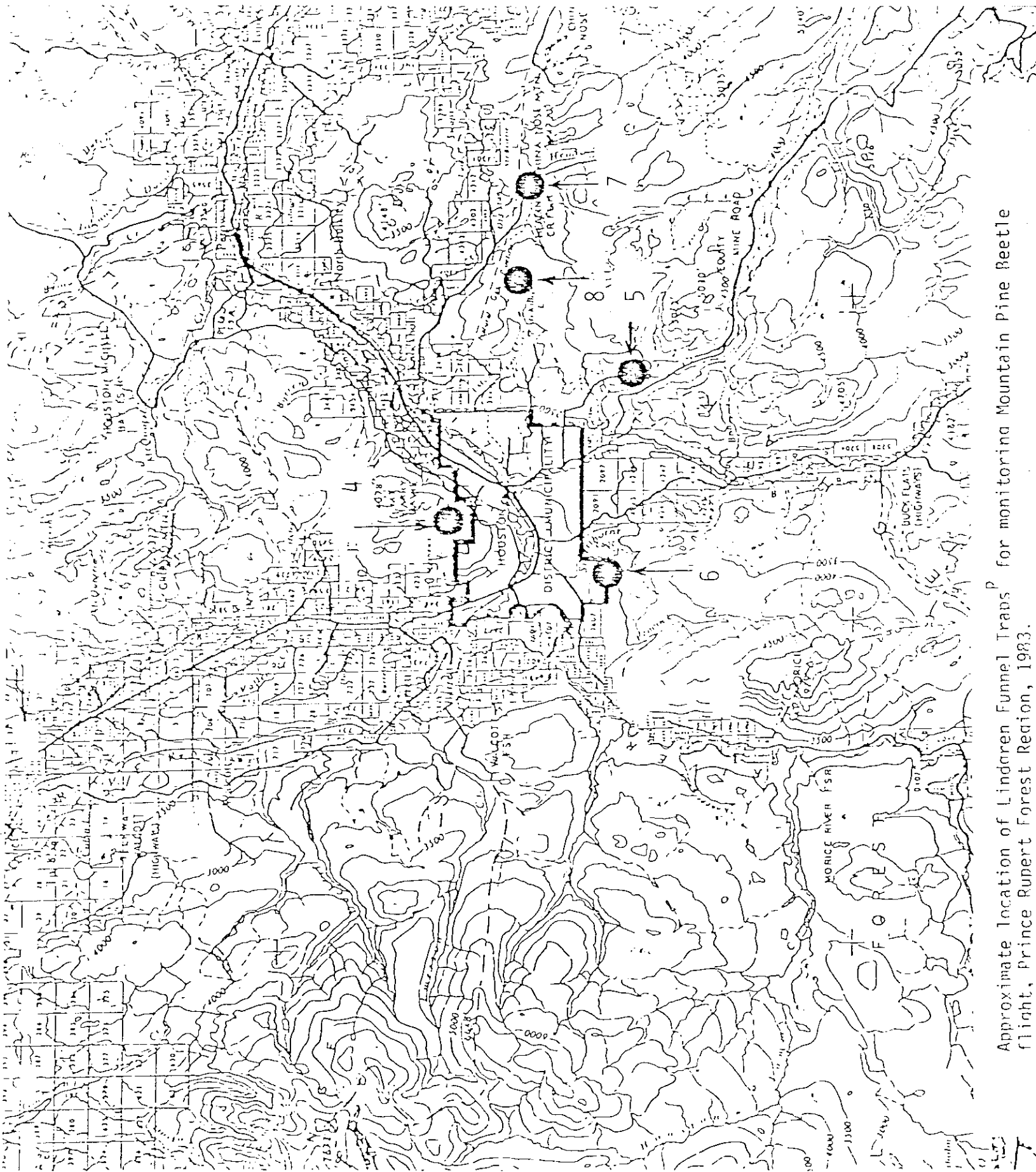


HAZELTON

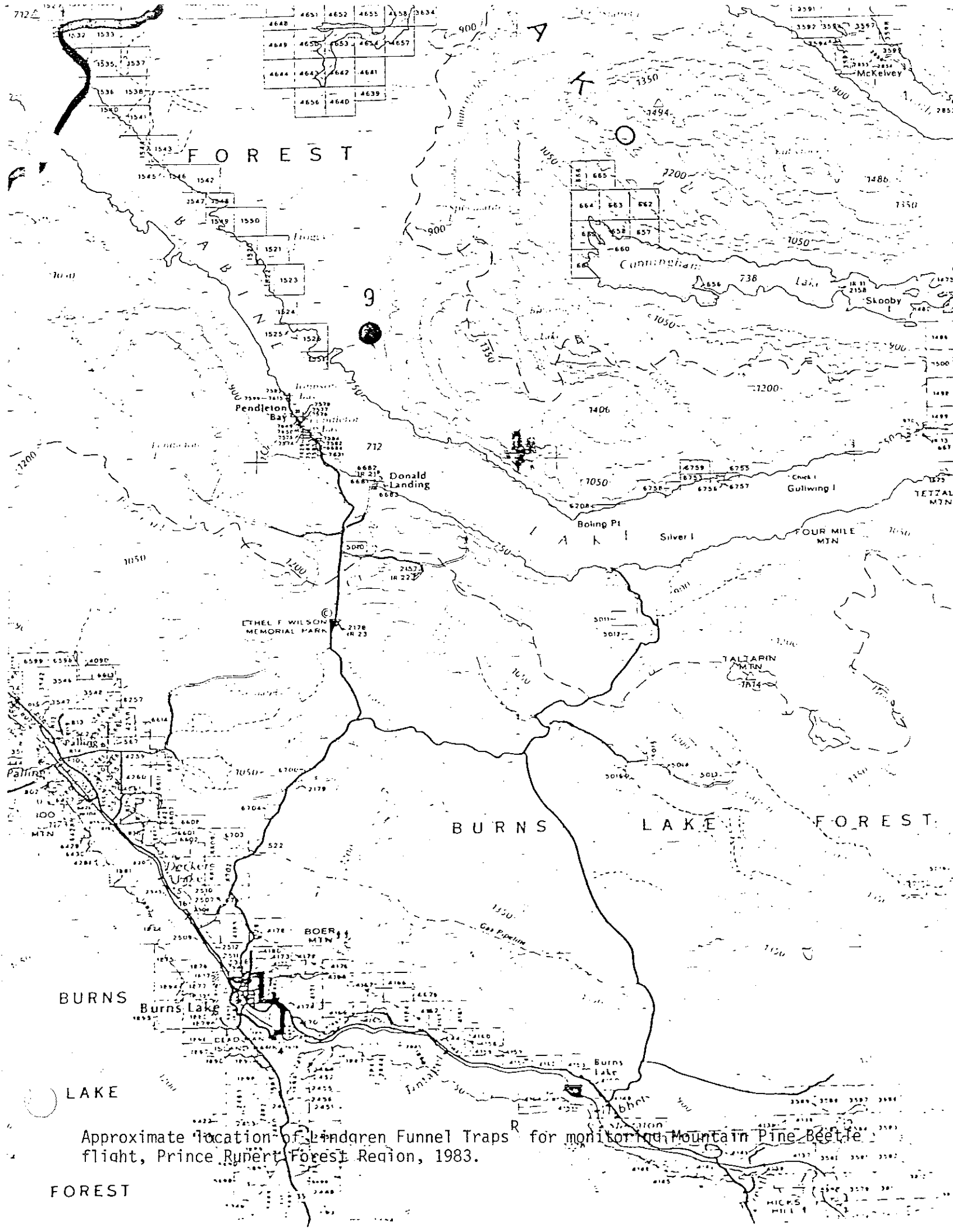
BRITISH COLUMBIA
 CASSIAR LAND DISTRICT
 Scale 1:250 000
 (1 Centimetre = 2.5 Kilometres)



Approximate location of Lindgren Funnel Traps^R for monitoring Mountain Pine Beetle flight, Prince Rupert Forest Region, 1988.



Approximate location of Lindgren Funnel Traps^P for monitoring Mountain Pine Beetle flight, Prince Rupert Forest Region, 1983.



Approximate location of Landgren Funnel Traps for monitoring Mountain Pine Beetle flight, Prince Rupert Forest Region, 1983.

FOREST