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National Park Service
Isle Royale National Park

BEAVER STUDIES, ISLE ROYALE NATIONAL PARK, 1986

by

Philip C. Shelton.

Beaver studies in 1986 included observations made on the ground and by boat in the northeast portion of the island 25 July-2 August and more intensive ground and aerial work 14-22 October, by Philip C. Shelton. Douglas Smith and Shelton visited several sites together during the summer and discussed methods of comparing beaver ecology between Isle Royale and Voyageurs National Parks. A number of photographs made in the 1960's and 1970's were rephotographed during the summer and fall visits, and a selection of these is presented as part of this report. In October, oblique aerial photographs were obtained of most beaver sites known to be active in 1929-30, and comparison of these with aerial photos made in 1930, 1955, 1957, 1974, and 1978 is in progress. Fall ground work included identification of tree and shrub species cut or stored in food piles at 27 sites on the northeast portion of the island. No live-trapping was done.

The most significant results for 1986 were from the aerial survey done in 16 hours flying time 15-18 October, in a float-equipped Piper Super-Cub, piloted by Tom Wunderlich. An additional hour was flown mostly for photographs, especially of sites active in 1929-30. Mr. Wunderlich's experience and interest in the project, and excellent flying conditions, made the count fully comparable with those made in previous years. (Table 1). Locations of active colonies are shown on attached maps.

Table 1. Aerial counts of beaver colonies, Isle Royale National Park

Colonies with food piles					Sites with fresh cutting or fresh mud on house or dam	Total sites with any sign of activity	
Year	Total Number	Number (%) by habitat					
		Stream	Lake	Harbor	1936 Burn		
1962	125	84(67)	26(21)	15(12)	43(34)	-	-
1974	286	251(88)	24(08)	11(04)	102(36)	30	316
1978	129	99(77)	19(15)	11(08)	48(37)	27	156
1980	83	58(70)	17(20)	08(10)	13(22)	39	122
1982	125	93(74)	24(19)	08(06)	31(25)	28	153
1984	151	129(85)	17(11)	05(03)	53(35)	53	204
1986	204	167(82)	26(13)	11(05)	75(37)	36	240

*Stream, lake and harbor add to 100 percent.

Total colonies with food piles visible from the air was 201. Ground work on the northeast end of the island revealed that two of these food piles were at least a year old, with a few sticks peeled in 1986 floating nearby, but nothing fresh added to the food piles. Five food piles not seen from the air were found during ground work. Three of these were at sites where some fresh beaver sign was visible from the air; one was under heavy vegetation near one of the old food piles; and one was at a site in heavy vegetation where no sign was seen from the air. Three of these food piles were classed medium, one small, and one very small.

All food piles seen from the air were classified roughly into size classes as follows:

- Extra Large (LL on map) = food pile more than twice the size of an average house as seen from the air.
- Large (L) = one to two times the size of an average house.
- Medium (M) = half to equal the size of an average house.
- Small (S) = less than half the diameter of an average house.
- Very Small (VS) = few scattered limbs near house.

This was done in an attempt to quantify food pile size for comparison with surveys done in Voyageurs National Park and for comparison in future years on Isle Royale. Results are shown in Table 2.

Table 2. Sizes of food piles seen from the air, October, 1986, by habitat. (Five seen only from the ground are not included). Size classes are explained in text.

Size Class	Stream			Lake			Harbor			Totals		
	Non-burn	1936 burn	Total	NB	B	Total	NB	B	Total	NB	B	Total
Extra Large (LL)	0	2	2	1	0	1	0	0	0	1	2	3
Large (L)	16	9	25	9	4	13	1	0	1	26	13	39
Medium (M)	43	29	72	5	2	7	3	0	3	51	31	82
Small (S)	29	26	55	2	0	2	6	0	6	37	26	63
Very Small (VS)	6	2	8	2	1	3	1	0	1	9	3	12
Totals	94	68	162	19	7	26	11	0	11	124	75	199

Fresh cutting, or fresh mud on house or dam was observed from the air at 36 sites. Thus the total known sites with food piles was 204, and the total sites with some sign of beaver occupancy was 240. Assuming that the average number of beavers per colony is still approximately 6.4, as determined by live-trapping in the 1960's (Shelton, 1966) and estimating that sites with fresh sign but no food pile would have an average of two beavers, the total number of beavers on the island in fall 1986 would be calculated at: $204 \times 6.4 + 36 \times 2 = 1378$. A reasonable round figure, probably accurate within 5 percent, would be 1400 beavers on the island.

This represents a substantial increase from the 151 sites with food piles found in 1984 and indicates an acceleration of the recovery from the low of 83 colonies with food piles in 1980. The only significant change in distribution of colonies was an increase in harbor sites from 5 in 1984 to 11 in 1986. The 1936 burn, comprising 19 percent of the island, continues to have a disproportionately high number of beavers (37 percent).

As discussed in previous reports, beaver numbers are thought to be influenced primarily by wolf predation. Beavers have increased steadily since 1980, when wolf numbers were highest and beaver numbers lowest. Beavers apparently can increase whenever wolves number no more than about 25. If beaver numbers influence wolf numbers, then wolf numbers would be expected to increase in the next few years, although interactions of wolves with moose, numbers of which have also increased, would lead to the same prediction. Separation of influences of these two prey species is difficult.

Tree cutting was recorded from the air at only four sites in 1986, two of aspen and two of birch. This should not be interpreted to indicate significant change since 1984 when cutting was observed from the air at 15 sites. These observations are not done systematically, since highest priority is given to finding food piles.

At 27 sites visited on the ground, cutting was recorded at 25 and food pile composition at 25 (Table 3). These figures cannot be used for critical comparisons, but give rough indications of what beavers are cutting. Significantly, aspen, though usually cut in small quantities, is still being found regularly by inland beavers. Harbor beavers continue to rely on birch and shrubs. Some of the shrub species, especially hazel and dogwood, are potentially renewable since they are normally part of the understory. Aspen and birch, by contrast, usually are not able to regenerate vigorously because of competition with conifers and heavy moose browsing, which has become a significant factor again after a few years in the early 1980's when moose numbers were low.

The effects of beaver activity on plant succession is complex and poorly documented. Cutting of aspen and birch frequently releases conifer reproduction, especially balsam fir, and thereby speeds succession toward climax forest. Reproduction that does occur, mostly through root sprout, of aspen and birch are usually severely browsed by moose, and thus rarely produce a second stand of trees that would be potential beaver food. This occurs both in the 1936 burn area and in older forest stands. Beaked hazel stands may be able to regenerate and perhaps make up the most nearly

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Table 3. Cutting and food pile composition at sites visited,
October 1984 (12 sites) and October 1986 (27 sites)

	<u>Number of Sites with cutting</u>		<u>Number of food piles</u>	
	<u>1984(9)</u>	<u>1986(25)</u>	<u>1984(7)</u>	<u>1986(25)</u>
Aspen	2	14	1	2
Birch	5	12	2	7
Alder (species undet.)	3	7	2	7
Beaked Hazel	3	6	1	6
Black Ash	1	3	-	1
Red-osier Dogwood	1	1	-	4
Mountain Ash	1	1	-	-
Red Maple	1	-	1	-
White Cedar	-	-	-	2
White Spruce	-	-	-	1
Balsam Fir	1	-	-	-

(Most sites and food piles had more than one species.)

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sustainable food resource for beavers. Alder may also regenerate after cutting, but it is questionable how much beavers feed on alders. They cut it frequently and it usually forms the top layers of food piles, covering the more preferred food species, but it is not well established that much of it is eaten.

Sites flooded by beavers are changed radically, and succession following drainage is slow. Flooding normally kills all woody species, including alders, within one or two years, and the ponds gradually become more open as dead snags fall. Some of these snags persist for decades and provide habitat for hole-nesting birds and perches for flycatchers and small hawks. Aquatic plants, especially water lilies and water shield, invade ponds after several years, and these plants attract moose in summer, and provide significant quantities of beaver food. Dams on slow moving streams and swamps may be held in place by thick mats of grasses and sedges and remain intact for decades, even without additional work by beavers.

When ponds are drained, the bottom sediments are not favorable to tree seedling growth. Sedges and grasses invade, forming dense sods which resist encroachment by woody species for decades. Alders, especially Alnus rugosa, are the first woody plants to invade these sites. Longer term processes have not been documented.

The generalizations above are based on observations described in more detail earlier (Shelton, 1966), and on casual observations and repeated photographs made in more recent years. Detailed plant ecological studies of beaver influences on upland forests or on riparian habitats have not been done.

Reference:

Shelton, Philip C. 1966. Ecological Studies of Beavers, Wolves and Moose in Isle Royale National Park, Michigan. Ph.D. thesis, Purdue University, 308 pp.

Locations of Active Beaver Colonies, Isle Royale National Park

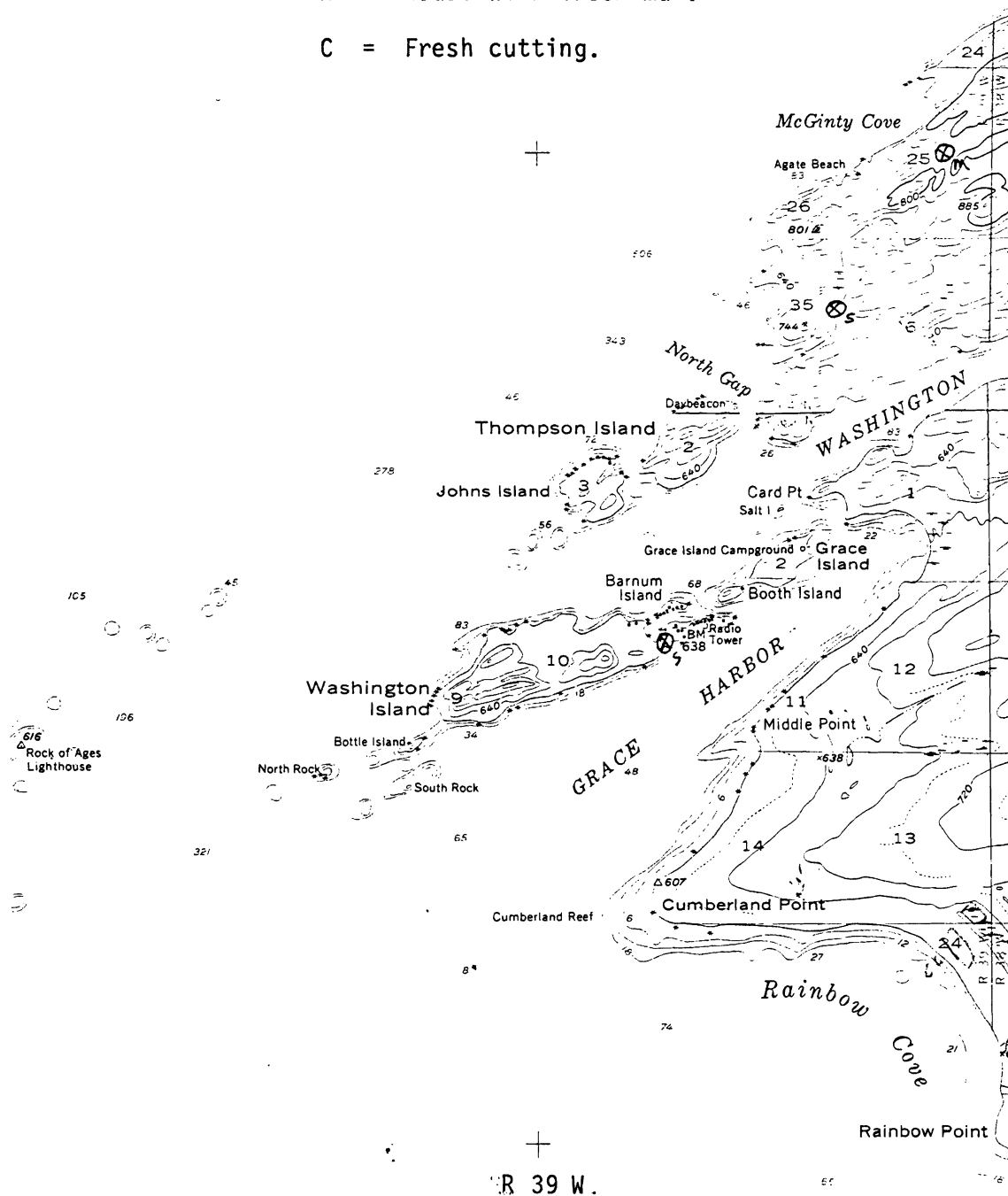
October 1986

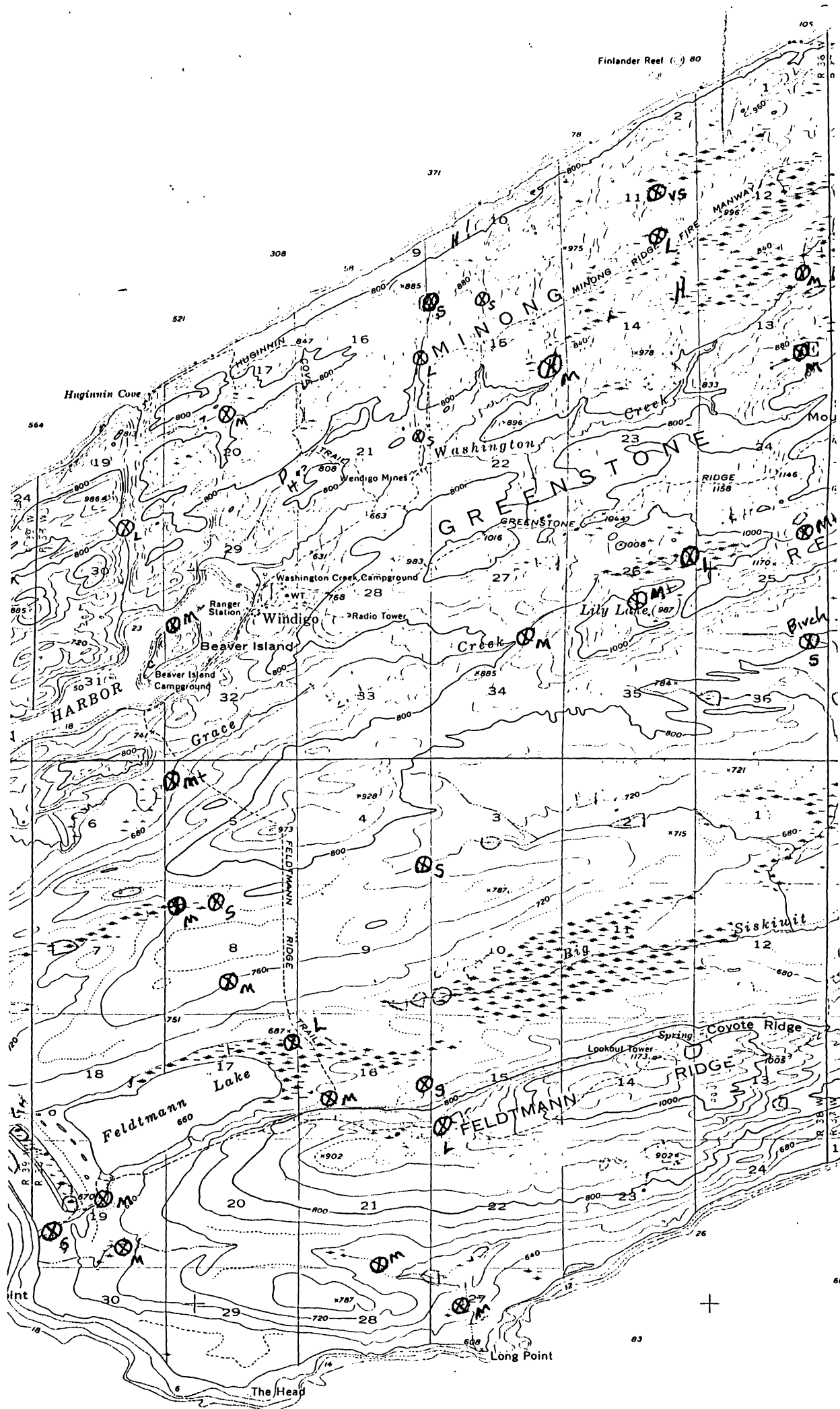
Legend: ⊗ = House with food pile. Subscripted letters indicate size of food pile (see page 3).

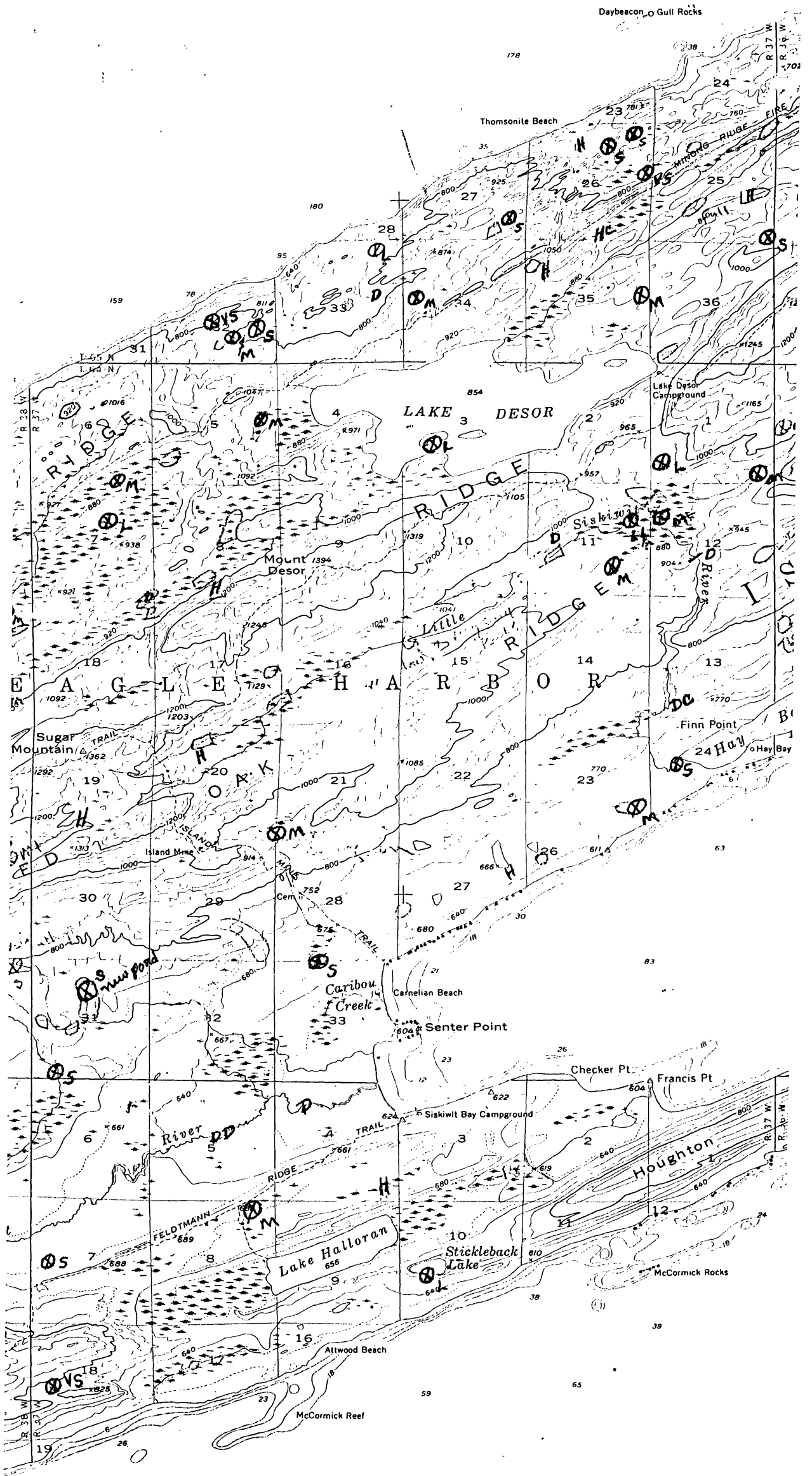
D = Dam with fresh mud.

H = House with fresh mud.

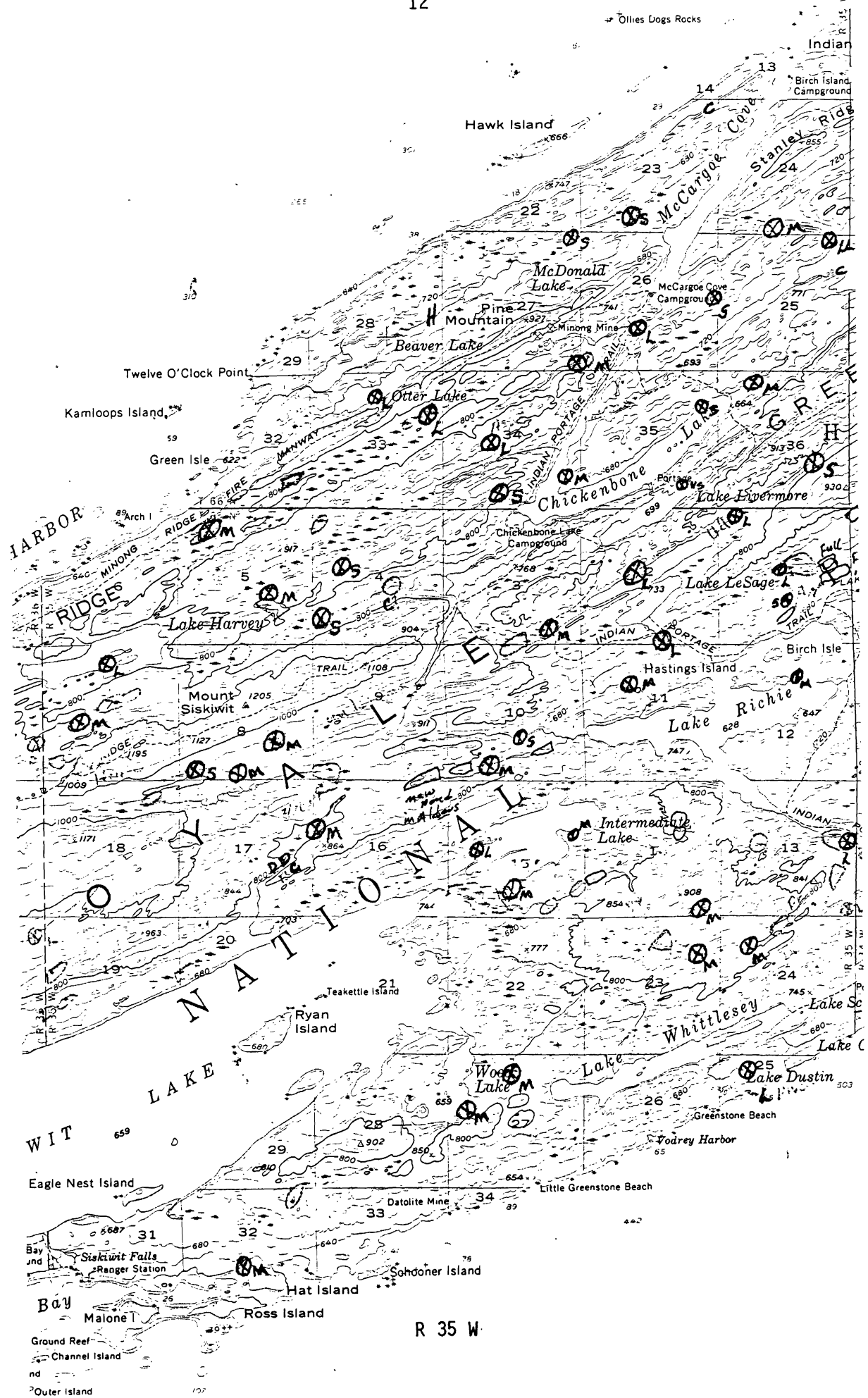
C = Fresh cutting.

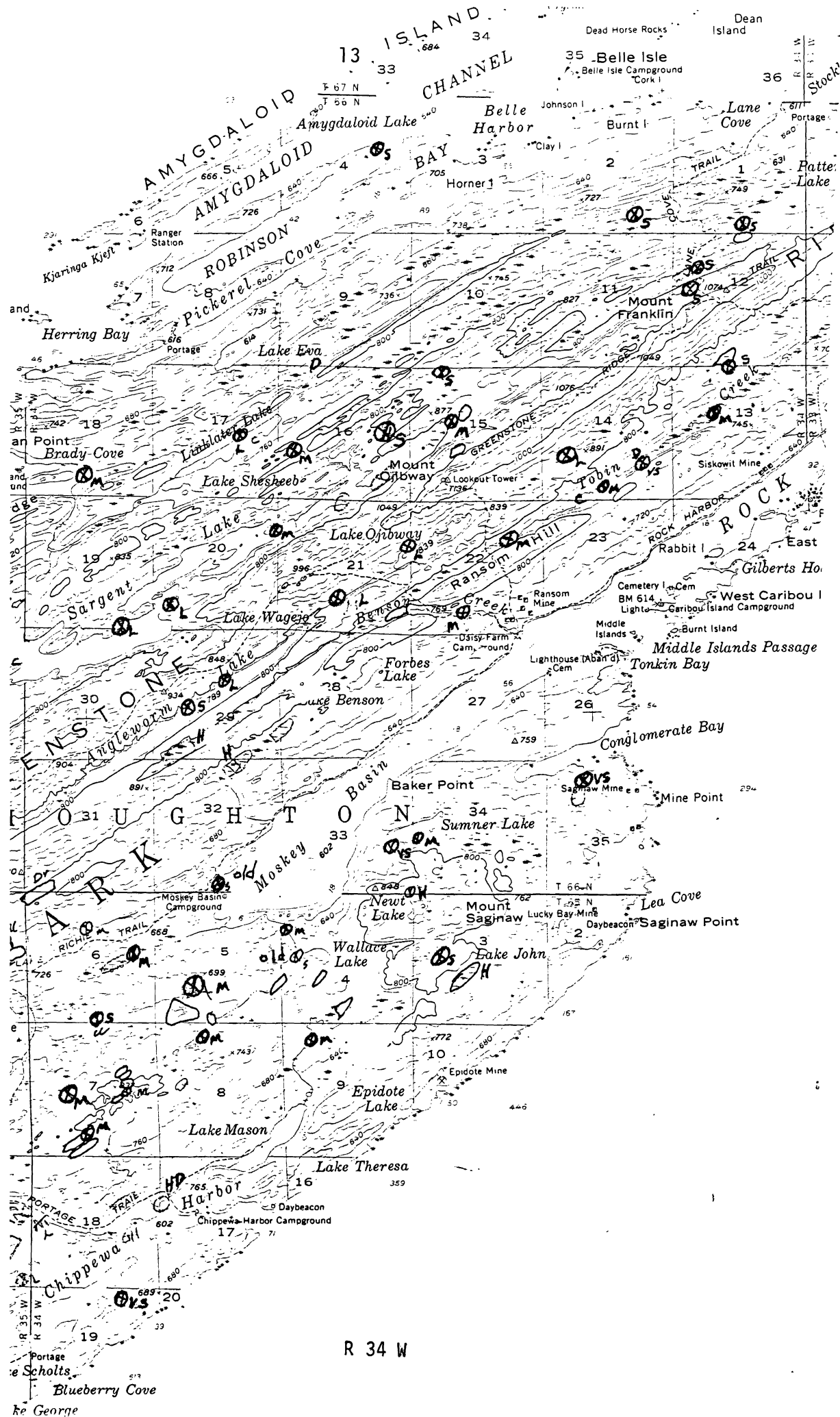














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INTRODUCTION

This series of color prints and duplicate slides illustrate changes in vegetation, including those influenced by beavers, on the northeast portions of Isle Royale from the 1960's and 1970's through the mid 1980's. Each series consists of one or more photos taken in the early 1960's or early 1970's with matched images from the 1980's, mostly 1986. Sequences are arranged roughly from northeast to southwest on the island, and a map showing locations is included. The indexing system is open-ended, allowing new sequences to be added and new images to be added to existing sequences.

Historical data are based on aerial photographs made in 1930, 1955, 1957, and 1975 in park service files and on photographs and field notes by Philip C. Shelton in 1960-63, 1969, 1973, 1978, 1980, 1982, 1984, and 1986.

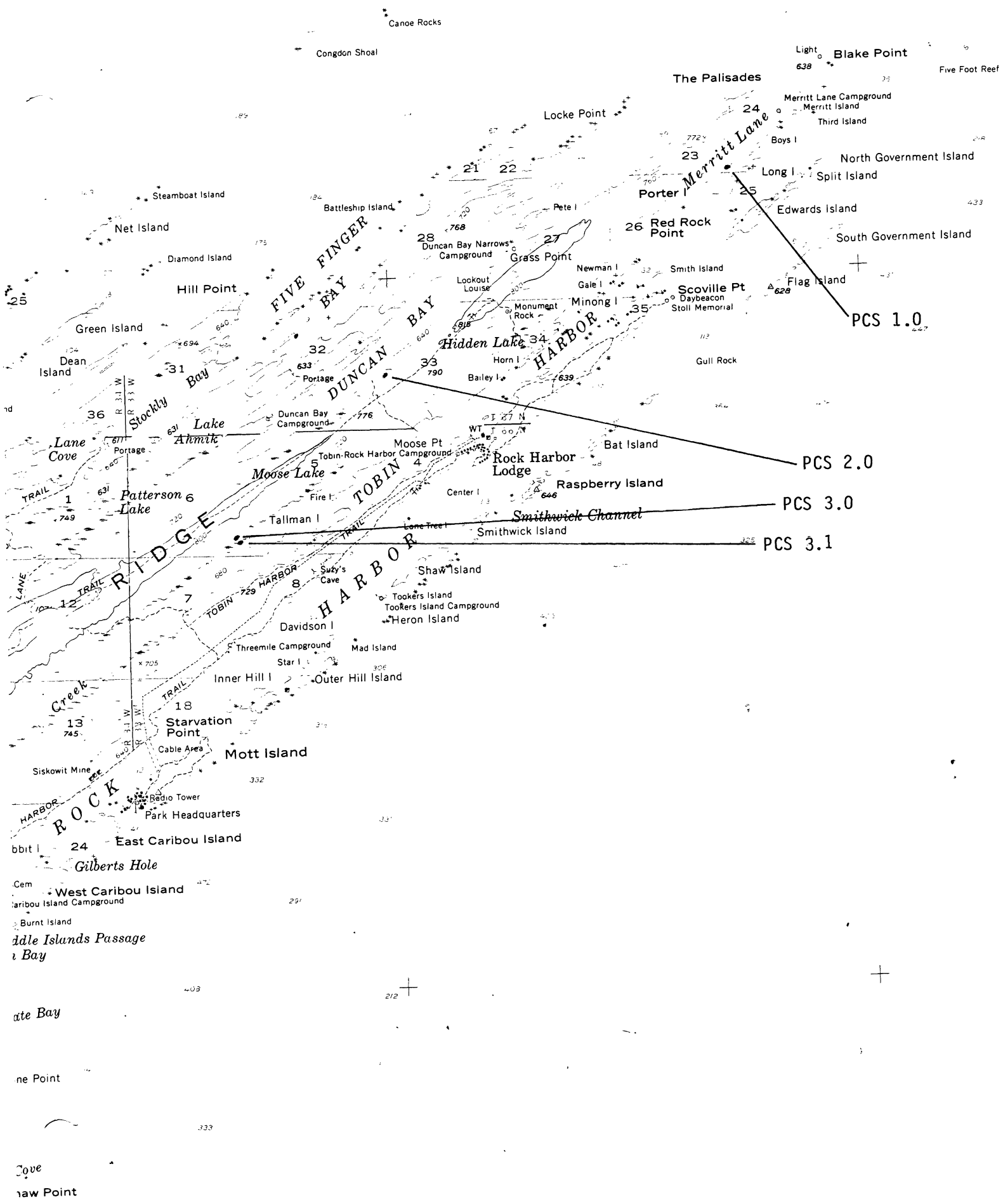
Special appreciation is extended to Robert J. Krumenaker, Resource Management Specialist, Isle Royale National Park, for encouragement and patience with this project; to Stuart L. Croll, Chief of Interpretation and Resource Management, Isle Royale National Park, for access to Park Service photographs; and to both for financial support through the National Park Service. Encouragement and assistance from Robert M. Linn is greatly appreciated.

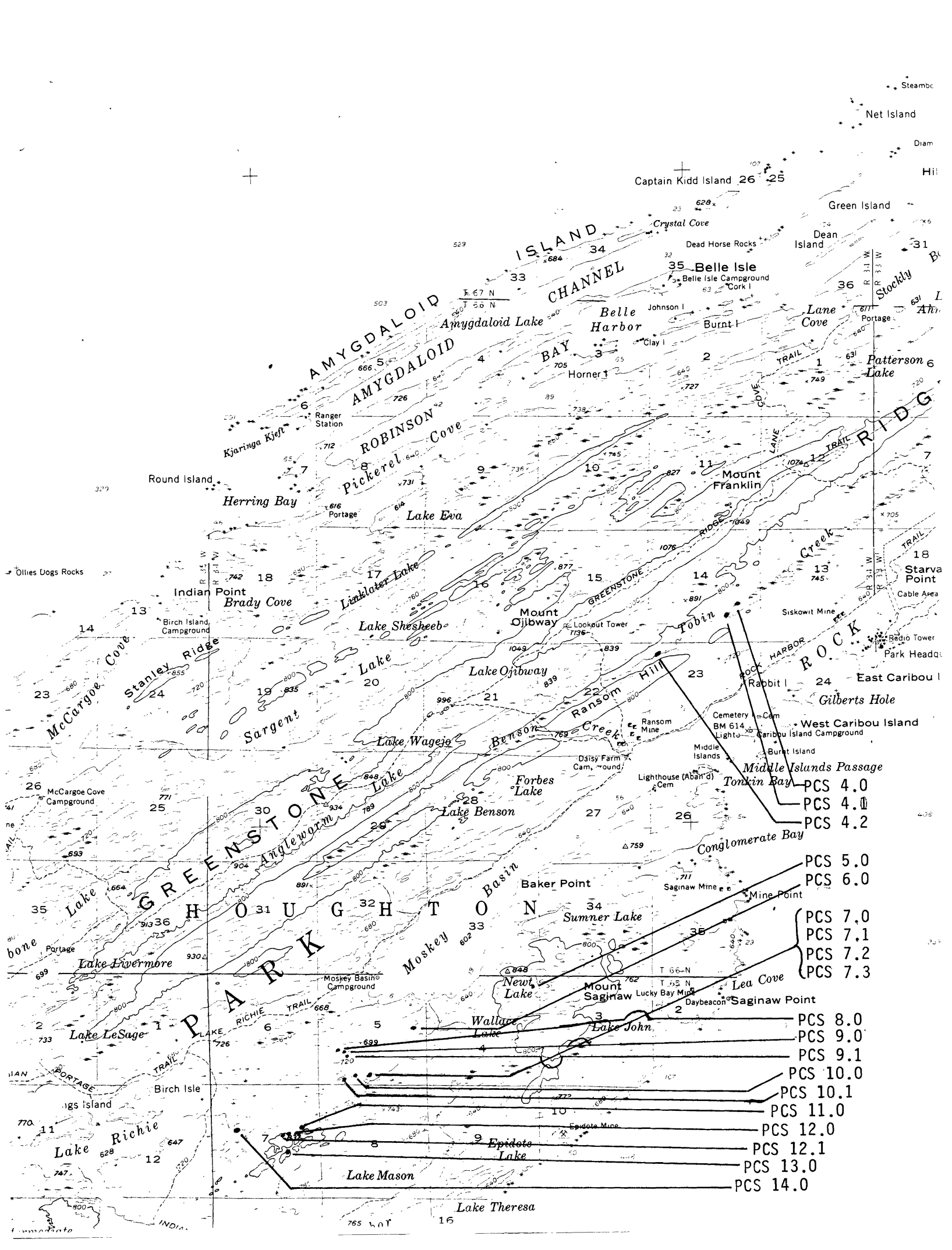
Comments and suggestions from any user of this set will be welcomed.

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Steambo

Net Island

Diam

Hill

Green Island

Dean Island

Captain Kidd Island 26 25

Crystal Cove

Dead Horse Rocks

Belle Isle

Belle Isle Campground

Cork I

Johnson I

Belle Harbor

Clay I

Burnt I

Horner I

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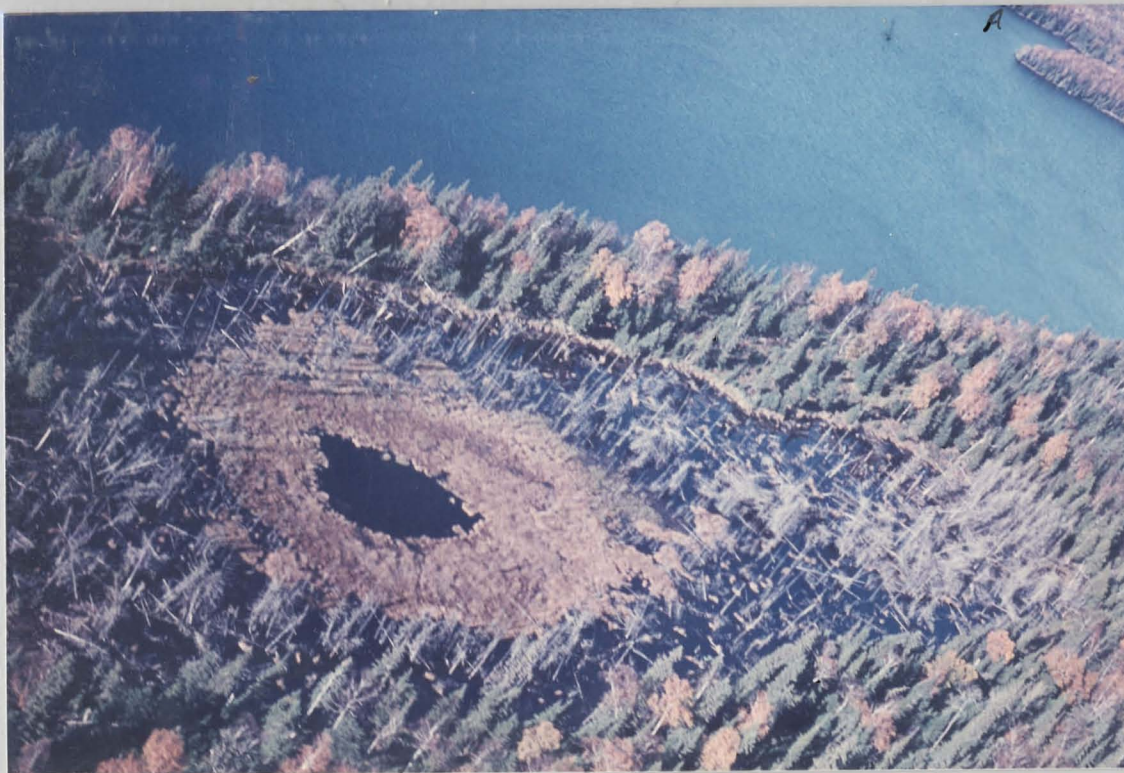
3 1/2 x 5 1/4 PRINTS



PCS 1.0 A. 18 May 1962
 B. 12 October 1974
 C. 18 October 1986

Northwest side of Porter Island, from Merritt Lane.
SE 1/4 SE 1/4 Sec 23 T67N R33W

Beavers cut birch close to water in the 1950's and 1960's. Balsam fir reproduction is evident in 1962, and it rapidly closed out all other vegetation by 1974. Large birches beyond the range of beaver cutting persist, but no regeneration of birch occurred in the cut area.



PCS 2.0

A. 18 October 1962

B. 15 October 1986

Small bog pond off southeast side of Duncan Bay. NW $\frac{1}{4}$ SW $\frac{1}{4}$ Sec 33 T67N R33W.

This small pond was flooded by beavers between 1930 and 1955; known to be active since 1960 only in 1978.



The bog mat floated and remained intact when beavers raised the water level. By 1986 the water level had dropped about half way back to the original level, and the formerly flooded area has been invaded by sedges and grasses.

Increased dominance by conifers, especially close to the water, is evident.

PCS 3.0 A. 25 August 1963
 B. 18 October 1973
 C. 15 October 1974
 D. 21 October 1986

Slope above large beaver pond north of
west end of Tobin Harbor.
SE¼ SE¼ Sec 6 T66N R33W. Looking south.

Aspen stumps visible in 1963 probably
were cut in the late 1940's or early
1950's. Stumps had almost disintegrated
by 1973. Birch cut into foreground in
1974; log still intact in 1986. A
small conifer fell into foreground by
1986.

Aspen did not regenerate after cutting.
Spruce and fir have increased.





3 1/2 x 5 1/4 PRINTS



PCS 3.1 A. 25 May 1963
 B. 15 October 1974
 C. 21 October 1986

Large beaver pond north of west end of Tobin Harbor. SE $\frac{1}{4}$ SE $\frac{1}{4}$ Sec 6 T66N R33W. Looking northwest.

Pond built between 1930 and 1955; active continuously since 1962, except for 1978.

The northeast of three houses in this pond is on the right side of point on northwest side. Conifers have flourished on this point and in the foreground. Snags slowly disappear in pond.

Lack of waterlilies in B. and C may be a function of season.

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PCS 4.0 A. 26 May 1962
 B. 20 October 1986

Beaver peeled birch (cut fall 1961)
 Tobin Creek. SW $\frac{1}{4}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$ Sec 14 T66N R34W.
 Looking southwest.

Adjacent to two ponds built by 1930.
 Lower pond was full in 1955 and 1957;
 both were full and active in 1961 and
 1962. Not known to be active again
 until 1984, and in 1986 a small pond
 above these two was occupied.

Area around the birch was denuded of
 hazel and thimbleberry by beavers in
 1961. By 1986 the log and stump had
 almost completely disintegrated.
 Alders grew up in moist soil along
 beaver canal in foreground. Grasses
 dominated ground around stump.
 No birch regeneration occurred.

Alders grew up in moist soil along
 beaver canal in foreground.





PCS 4.1 A. 22 October 1974
 B. 20 October 1986

Small pond on Tobin Creek
 NW $\frac{1}{4}$ SW $\frac{1}{4}$ SE $\frac{1}{4}$ Sec 14 T66N R34W
 Looking northwest.

Pond built between 1957 and 1969;
 active 1969 and 1974. Dam breached by
 1978, but later a lower dam backed
 water into this pond.

Dam and house became overgrown with
 grasses and sedges. Alders regenerated
 on the dam. Hazel regenerated on the
 slope in foreground, where beavers had
 cleared it in 1974.





PCS 4.2 A. 20 June 1961
 B. 18 October 1980

Large beaver house, Tobin Creek.
 NW $\frac{1}{4}$ NW $\frac{1}{4}$ NW $\frac{1}{4}$ Sec 23 T66N R34W
 Looking northeast.

Pond and house were built between 1957 and 1960. Active 1960, 1961, and 1969; drained by 1973; reflooded and active in 1978; abandoned in 1980 and 1982; active in 1984; abandoned in 1986.

The house is overgrown with a variety of herbs, grasses and sedges. Alders regenerated in the moist soil of the old pond margin.





PCS 5.0

- A. 2 June 1963
- B. 22 September 1974
- C. 19 October 1980
- D. 21 October 1986

Aspen cutting on ridge about 100 metres west of Newt Lake. NE $\frac{1}{4}$ NE $\frac{1}{4}$ Sec 4 T65N R34W. Looking northeast.

Trees were cut in fall 1962 by beavers from Newt Lake. By 1974 stumps and logs had decayed to the point of crumbling; only traces of them remained by 1986.

Moose browsing kept aspen sprouts trimmed and decadent.

Conifers, primarily white spruce, increased in dominance on the more moist slope off the ridge top.

In 1930 this area was an open ridge top with scattered trees.





PCS 6.0 A. 2 September 1960
 B. 28 July 1986

East across Wallace Lake from rocky flat. SE $\frac{1}{4}$ NE $\frac{1}{4}$ Sec 5 T65N R34W 1936 burn.

The original view of the lake is blocked by conifers, mostly white spruce. The juniper at lower left grew up and out. Herbs and grasses spread little.

In 1930 this appeared to be small opening in a birch-aspen forest.





PCS 7.0

A. 12 October 1974

B. 19 October 1986

Rocky flat, 0.5 mile southsouthwest of Moskey Basin. SE $\frac{1}{4}$ SE $\frac{1}{4}$ SW $\frac{1}{4}$ Sec 5 T65N R34W. 1936 burn. Looking west.

Birches that escaped moose browsing have continued to grow, but small shrubs, including Amelanchier, and birch sprouts growing on thinner soil have succumbed to moose browsing. Conifers, especially white spruce, thrive.

Lichens have thickened on rock outcrops.

This area supported an open stand of hardwoods, probably aspen and birch, in 1930.





PCS 7.1 A. 12 October 1974
 B. 19 October 1986

Rocky flat, 0.5 mile southsouthwest of
 Moskey Basin (same as 7.0).
 SE $\frac{1}{4}$ SE $\frac{1}{4}$ SW $\frac{1}{4}$ Sec 5 T65N R34W.
 1936 burn. Looking northnorthwest.

Conifers have grown rapidly; lichens
 have spread over rocks; broad-leaved
 shrubs and tree reproduction have
 largely disappeared.





PCS 7.2 A. 12 October 1974
 B. 19 October 1986

Rocky flat, 0.5 mile southsouthwest of
 Moskey Basin (same as 7.0)
 SE $\frac{1}{4}$ SE $\frac{1}{4}$ SW $\frac{1}{4}$ Sec 5 T65N R34W. 1936 burn.
 Looking north.

Conifers and lichens have increased and
 deciduous shrubs and tree sprouts have
 decreased.





A

PCS 7.3 A. 12 October 1974
 B. 19 October 1986

Rocky flat, 0.5 mile southsouthwest of Moskey Basin. (same as 7.0).
 SE $\frac{1}{4}$ SE $\frac{1}{4}$ SW $\frac{1}{4}$ Sec 5 T65N R34W. 1936 burn.
 Looking northeast.

Conifers and lichens thrive while
 deciduous trees and shrubs decline.

Aspen at right of center and spruce
 just left of center were dead in 1986.



B



PCS 8.0 A. 2 October 1974
 B. 19 October 1986

Open flat 0.6 mile southwest of Moskey Basin. NW $\frac{1}{4}$ SW $\frac{1}{4}$ Sec 5 T65N R34W. Foreground was in 1936 burn; background not burned. This area was open in 1930, and probably made a natural firebreak.

Two large aspens shown in 1974 had fallen by 1986. They were not cut by beavers. Spruces grew rapidly relative to aspens except for the single sapling in front and at right of white spruce right of center.

Junipers and lichens have spread in foreground.



PCS 9.0 A. 5 October 1974
 B. 19 October 1986

Beaver pond 0.6 mile southwest of Moskey basin. NW $\frac{1}{4}$ SW $\frac{1}{4}$ Sec 5 T65N R34W 1936 burn. Looking northwest.

Pond built between 1930 and 1955. Known to be active in 1973, 1974, 1978, and 1986.

Small isolated stand of aspen and birch on the northwest side of the pond escaped the 1936 fire, but were being cut by beavers in 1974. All but one were cut or windthrown within a few years after 1974. No regeneration occurred. Conifers have grown rapidly.





A

PCS 9.1

A. 9 October 1974

B. 19 October 1986

Beaver pond 0.6 mile southwest of Moskey Basin (same as 9.0). NW $\frac{1}{4}$ SW $\frac{1}{4}$ Sec 5 T65N R34W. 1936 burn. Looking east from edge of stand of aspen and birch that escaped the 1936 fire.



B

Rapid growth of conifers and moose browsing on sprouts prevented regeneration of birches and aspens cut during the 1970's.



PCS 10.0

A. 10 October 1974

B. 19 October 1986

Slope above north end of dam of "Y" shaped pond 0.8 mile southwest of Moskey Basin. SW $\frac{1}{4}$ Sec 5 T65N R34W. 1936 burn.. Looking north from dam.

The well-rotted log in foreground in 1974 had disappeared by 1986.

Birch clump in background grew, but not as vigorously as white spruces.

Deciduous shrubs, probably mostly Amelanchier, with some aspen and birch sprouts, had mostly disappeared by 1986.

Grasses and lichens dominate open ground and rocks, respectively.

This area was densely wooded, probably with birch and aspen, in 1930.





PCS 10.1

- A. 29 May 1963
- B. 9 October 1974
- C. 18 October 1980
- D. 22 October 1984
- E. 19 October 1986

"Y" shaped beaver pond, 0.8 mile southwest of Moskey Basin (same as 10.0)
SW $\frac{1}{4}$ Sec 5 T65N R34W. 1936 burn
Looking northeast



Pond built between 1930 and 1955; full of water since 1955. Active at least in 1962, 1969, 1973, and 1984.

Many snags have disappeared in the pond.

White pine at left grew rapidly during the period, although moose pruned the limbs they could reach.

Conifers in background and at far right increased in dominance.

Lichens increased on rocks.





PCS 11.0 A. 11 October 1974
 B. 19 October 1986

Jack pine and white spruce, about 1.4 miles southwest of Moskey Basin. SW $\frac{1}{4}$ SE $\frac{1}{4}$ NE $\frac{1}{4}$ Sec 7 T65N R34W 1936 burn. Looking north.

Conifers, especially white spruce, have proliferated at the expense of broad-leaved shrubs and birch and aspen reproduction. Small spruces are barely visible in 1974.





PCS 1210 A. 10 November 1962
 B. 19 November 1986

Middle of five pond complex 1.5 miles
 southwest of Moskey Basin.
 E $\frac{1}{2}$ Sec 7 T65N R34W.
 1936 burn. Looking east.

House was active in 1962, with large
 food pile beyond house; also active
 in 1980; abandoned 1982 through 1986.

Snags and stumps of alders and other
 trees killed by flooding had disappeared
 by 1986. House diminished in size and
 overgrown with grasses and sedges.

Birches grew significantly on far side
 of pond, but not as rapidly as conifers.



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3 1/2 x 5 1/4 PRINTS



A



B



C

PCS 12.1 A. 11 November 1962
B. 3 October 1974
C. 19 October 1986

Middle pond of five pond complex, 1.5 miles southwest of Moskey Basin, E₁ Sec 7 T65N R34W (see PCS 2.0) 1936 burn. Looking east.

Small bog in 1930; flooded by 1955 and continuously since; active in 1962 and 1980.

Conifers and lichens have grown faster than birches and deciduous shrubs. Bog mat island has moved, but retained its size. Alders killed by flooding had disappeared by 1986.

The moose moved,



PCS 13.0 A. 11 October 1974
B. 19 October 1986

Beaver pond 1.5 miles southwest of Moskey Basin. NE $\frac{1}{4}$ NW $\frac{1}{4}$ SE $\frac{1}{4}$ Sec 7 T65N R34W 1936 burn. Looking northeast. Next to highest of five pond complex.

Pond built between 1930 and 1955; continuously full since 1955; active in 1986.

Conifers have proliferated both in foreground and background. Many snags have fallen in the pond. Deciduous shrubs in foreground have mostly disappeared. Lichens obvious in lower right in 1986 would not have been shown in 1974 photo.



PCS 14.0 A. 7 October 1974
B. 19 October 1986

Drained beaver pond 1.7 miles southwest of Moskey Basin. SW $\frac{1}{4}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$ Sec 7 T65N R34W 1936 burn. Looking east.

Pond built between 1930 and 1955; active in 1962; drained between 1969 and 1973 and not flooded since.

Three of four snags on ridge still stand; more than half those in pond have fallen. Conifers on skyline are outgrowing birches. Spruce in foreground shows healthy growth. Alders have spread over east and south portions of meadow.

Aspen sapling at right had been broken, probably by moose, and a new sprout from the same root system had replaced it by 1986. The new sprout had been browsed by moose also.

Deciduous shrubs in foreground, apparently mostly willows, disappeared by 1986. Grasses continue to occupy shallow soils and lichens have spread over rocks.

