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Bases for Field Research in Arctic and Subarctic Canada

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ABSTRACT. There are more than 50 field stations in northern Canada. These are operated by governments, universities and private agencies. Although many have a particular disciplinary bias, such as marine science, meteorology, native studies, archaeology, limnology, glaciology or biology, most are available to all researchers as a base of operations. Approximately half of the stations are in the Northwest Territories, the remainder in the Yukon and northern parts of the provinces. A table is provided indicating seasonal availability, particular research emphases, level of services provided, accommodation available and ownership. There is no user charge at some stations; most levy a daily fee. The highest cost in 1987 was just over $200 (food and accommodation) per day for the station on the Ice Island, then located northwest of Axel Heiberg. The paper also contains mention of 25 circumpolar stations outside Canada and a bibliography.

Key words: field stations, Arctic, Subarctic, Canada, circumpolar North

RÉSUMÉ. Il existe plus de 50 stations de recherche dans le Grand Nord canadien. Elles sont gérées par des gouvernements, des universités et des organismes privés. Si beaucoup de ces stations sont orientées vers une discipline particulière comme les sciences marines, la météorologie, les études des populations autochtones, l'archéologie, la limnologie, la glaciologie ou la biologie, la plupart d'entre elles sont ouvertes à tous les chercheurs comme bases d'opérations. Environ la moitié de ces stations sont situées dans les Territoires du Nord-Ouest, le reste se trouvant au Yukon et dans les régions nordiques des provinces. On indique dans un tableau la disponibilité saisonnière, les domaines de recherches principaux, le genre de services et d'hébergement offerts, ainsi que l'organisme à qui appartient la station. Il n'y a pas de frais d'utilisation pour certaines stations, mais la plupart prélèvent un tarif journalier. En 1987, le coût le plus élevé etait légèrement supérieur à 200 $ par jour (nourriture et hébergement) pour la station de l'île de Glace, située alors au nord-ouest de Axel Heiberg. L'article mentionne aussi 25 stations circumpolaires situées à l'extérieur du Canada, et il contient une bibliographie.

Mots clés: stations de recherche, Grand Nord canadien, recherche scientifique, stations circumpolaires

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This note is largely based on an article in *Education, Research, Information Systems and the North* to be published by the Association of Canadian Universities for Northern Studies (ACUNS) in 1987. It draws heavily on Campbell *et al.* (1986), an inventory of 38 major and 14 minor northern field stations in Canada. The latter publication includes station addresses. The stations concerned are listed in Table 1 and locations of the major facilities are shown in Figure 1.

Canada's stations are placed in an interesting perspective in Kallio (1981). This is a description of and commentary on *biological* field stations in the circumpolar North (Fig. 2). It draws attention to the importance of such facilities for researchers who have to work in remote regions. Kallio discusses the advantages of particular locations for biologists, especially botanists. He brings out the contributions that some of the stations, especially the longer established ones, have made.

As might be expected, his coverage of stations in northern Canada is not exhaustive even for biological stations (see Biological Council of Canada, 1983, for a nationwide coverage). However, his circumpolar perspective does draw attention to the (biological) diversity of sites of Canadian stations and to their vast latitudinal range. Canada's contribution at very high latitudes is quite remarkable.

It is not surprising that stations in North America tend to be less venerable than those in Eurasia, Greenland and Iceland. We do not have stations that were founded at the turn of the century, such as Abisko in Sweden (see Bernhardt, 1985). However, Kallio (1981) does not cite many of these, in part one suspects because longevity is not a common characteristic of field stations. When a station's region has been more or less "covered," or when the drive that led to the station's establishment has weakened, there is a healthy tendency for someone to board up the facility and leave, never to return, often despite good intentions to the contrary.

Nevertheless, by the 1950s a number of stations that still exist today were becoming well established in Canada, including some at very high latitudes. Arguably (Adams, 1982), one of the most productive of these has been the McGill Subarctic Research Station at Schefferville, near the centre of the Quebec-Labrador peninsula (see Table 1). Established in 1954, this station has been in continuous, year-round operation ever since. It has been the base for work in diverse fields, including archaeology, social anthropology, linguistics, medicine, permafrost research, ionospheric research, geology, geomorphology, varied fields of biology, glaciology, limnology and climatology (see Moore, 1984, and the *McGill Subarctic Research Papers*, McGill University, Montreal). It is a base for teaching as well as research. The persistence of this station can be explained in various ways. Reasons include its location (in the geologically interesting Labrador Trough, close to the centre of deglaciation of the peninsula, near the tree line, in the discontinuous permafrost zone, etc.), the coincidence of the station's development with the rise and (recent) fall of the iron-mining town of Schefferville, access by rail and air, but not by road, resulting in a region that is accessible but that still appears remote. Through its history, this station has maintained links with the Kevo Station in Finland (see Kallio, 1979, and Kallio and Hulme, 1983), number 6 in Figure 2.

While Schefferville, at 55°N, is, as it were, near the southeastern limit of Canada's North, two other stations, also established in the 1950s, are in the High Arctic by any standards. These are the Arctic Institute of North America's station on Devon Island and McGill University's other station, on Axel Heiberg Island in the N.W.T.

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TABLE 1. Canada's northern field stations

	Typ	Man	Hab	Aff	Acm	Fac	Avb	Page[1]
Northwest Territories								
1 Adams Island, 74N, 81W (A.R.E.[2])	II	F,C	O,I,G	O	1	1	2	3
2 Alexandra Fiord Post (R.C.M.P.), 79 N, 76W	II	G	T	P,U	1	2	3	4
3 Arctic Biological Station — Field Camp, 64N, 69W	I	F	O	F	2	2	0	5
4 Arctic Ice Island (PCSP), 81N, 97W (moving)	II	F,E,C	I,O	F	1	3	1	6
5 Arctic Research Establishment, 73N, 78W	I	C	O,T	O	0	3	2	7
6 Borden Station, 74N, 81W (A.R.E.[2])	I	F,C	O,T	F,O	1	2	2	8
7 Chitty Lake Field Station, 61N, 114W	II	F	W,B	F	1	1	2	9
8 Coates Island, 63N, 83W	II	W	T	P	1	1	3	12
9 Devon Island Research Station, 76N, 85W	II	G	T	U	2	1	3	13
10 Eastern Arctic Scientific Resource Centre, 69N, 82W	I	G	O,T	F	2	3	3	14
11 Eskimo Point Arctic Research Centre, 61N, 94W	II	G	O,T	U	2	2	3	15
12 Eureka Aerological Station, 80N, 86W	I	O	T	F	1	1	2	16
13 Ikaluit Research Laboratory, 64N, 69W	I	G	T,O	F	2	3	3	17
14 McGill Axel Heiberg Station, 79N, 91W	II	E	G	U	1	1	2	24
15 Mould Bay Aerological Station, 76N, 119W	I	O	T	F	1	1	2	27
16 Nauyuk Lake Field Station, 68N, 108W	II	F	W,T	F	2	1	3	28
17 Nunguvik Arctic Centennial Station, 74N, 81W	II	C	O,T	O	1	1	2	29
18 Pearce Point Field Station, 70N, 123W	II	G	T	F	2	2	3	30
19 Polar Bear Pass High Arctic Research Stn., 76N, 98W	II(I)	G	T	F	1	1	0(2)	31
20 Resolute Bay Field Station, 75N, 95W	II	F	W,O	F		3	3	32
21 Resolute Station (PCSP) 75N, 95W	II	G	T	F	3	3	3	33
22 Saqvaqjuac Field Station, 64N, 91W	II	F	O	F	2	2	2	34
23 Sarcpa Lake Field Station, 69N, 83W	II	G	T	F	2	2	3	35
24 Tuktoyaktuk Field Station, 69N, 133W	II(I)	F	W,O	F	1	2	2	37
25 Tuktoyaktuk Station (PCSP), 69N, 133W	II	G	T,W	F	3	3	3	38
26 Western Arctic Scientific Resource Ctre, 68N, 134W	I	G	T	F	2	3	3	40
Yukon Territory								
27 Kluane Lake Research Station, 61N, 139W	I	G	B,T	U	3	3	3	19
Newfoundland/Labrador								
28 Labrador Institute of Northern Studies, 53N, 60W	I	G	M,W,B	U	0	3	2	23
Quebec								
29 Kuujjuaq Research Centre, 58N, 68W	I	F,W,H	B,T	N	0	3	2	20
30 Kuujjuaq Research Station, 58N, 68W	II	G	F,T	U	2	1	3	21
31 Kuujjuarapik Research Station, 55N, 78W	I	G	F,T	U	3	1	3	22
32 McGill Subarctic Research Station, 55N, 67W	I	G	B,T	U	3	2	3	25
Manitoba								
33 Churchill Northern Studies Centre, 58N, 94W	I	G	B,T	O	3	3	3	10
34 Institute of Arctic Ecophysiology, 58N, 94W	I	G	O,W,T	U	0	2	3	18
35 Southern Indian Lake Research Station, 56N, 98W	I	F	W,B	F	3	2	2	36
36 Tundra Biological Station, 59N, 93W	II	G	T	U	2	1	3	39
Saskatchewan								
37 Cree Lake Aerological Station, 57N, 107W	I	O	F,B	F	1	1	2	11
Alberta								
38 Mildred Lake Environmental Research Camp, 57N, 111W	I	C	B	P	3	2	2	26

[1]Addresses from page indicated in Campbell *et al.* (1986).
[2]A.R.E. = Arctic Research Establishment.
Type (Typ): I = year-round teaching and/or research.
II = seasonal teaching and/or research.
Mandate (Man): F = fisheries, W = wildlife, E = earth sciences, H = human sciences, C = physical/chemical, G = general, O = other.
Habitat (Hab): O = marine, W = freshwater, F = forest, B = boreal, T = tundra, I = island, G = glacial.
Affiliation (Aff): F = federal, P = provincial or territorial, U = university, N = native organization, O = other.
Accommodation (Acm): O = not available, 1 = 1-10, 2 = 11-20, 3 = greater than 20.
Facilities (Fac): O = not available, I = minimal, 2 = fair, 3 = extensive.
Availability (Avb): O = closed, I = restricted, 2 = open with some restrictions, 3 = open.

The Devon Island Station (AINA, 1981) was established as a glaciological-oceanographic station, with additional studies in geology and geomorphology. In more recent years, however, it has also become a major focus for varied biological and soils work, especially that stemming from the Truelove Lowland, an official International Biological Program study site. It is also a base for training students who live in the North. This is now essentially a summer facility, although parties have overwintered there. For an early description of the station, see Ragle (1974); for an overview of IBP work, see Bliss (1977).

The Axel Heiberg Station was established by the late Fritz Müller (see Adams, 1985, and the *Axel Heiberg Research Report* series, McGill University, Montreal) as a base for multidisciplinary research but with a glaciological focus. It is a summer facility, no one ever having overwintered there. A large amount of glaciological work has been published, plus a great deal of biological (especially botanical), geological, geomorphological, climatological and limnological work among others. Within easy reach of the station there is a variety of glaciers (including one with more than two decades of mass balance records, detailed movement statistics and thermal data), a naturally acidified lake and sulphur springs. A bibliography of

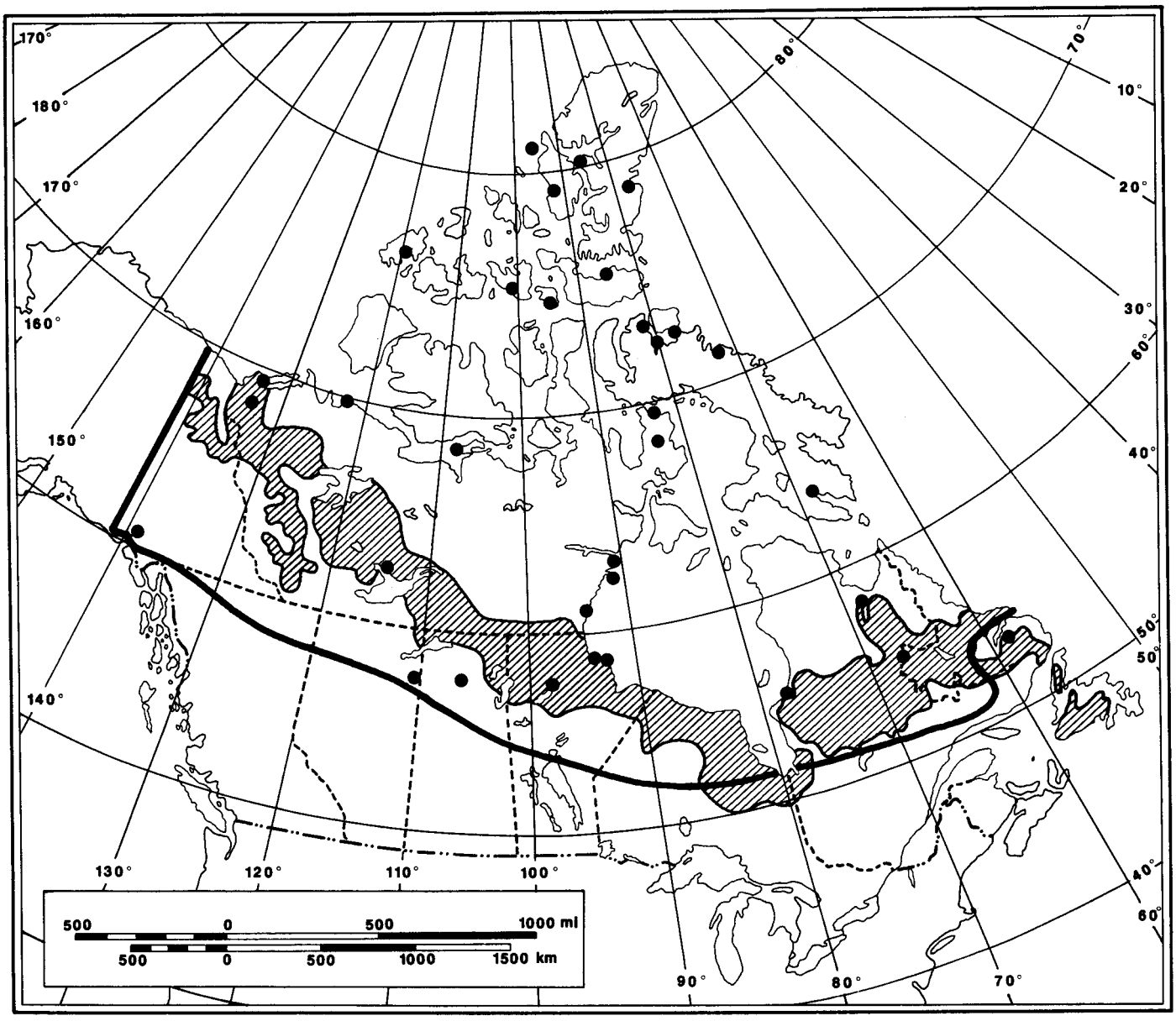

FIG. 1. Locations of field stations listed and numbered in Table 1. The shaded area is the lichen-woodland zone of Canada. The line across the country is the southern limit for use of grants under the Northern Scientific Training Program of Indian and Northern Affairs, Canada. These grants are used by hundreds of Canadian students to supplement their northern field expenses (see Finkler, 1987).

work from this station now running into many hundreds of items is soon to be published by McGill.

At another extremity of Canada's North, in the Yukon, the University of Calgary's Arctic Institute of North America maintains its station on Kluane Lake. This is a very sophisticated, year-round facility at the foot of the St. Elias Mountains. It provides access to a wide range of biological habitats and physical environments from ice fields to boreal forest. It has been the base for very varied biological and human physiological research, glaciology (including recent surging glacier work), archaeology, engineering and limnology (see AINA, 1983). It can be reached via the Alaska Highway and has its own aircraft. An indication of the range of activities at this station, and of the scope for future work, can be gained by scanning the following sample publications: in biology, Boutin (1982), Gilbert and Krebs (1981), Hannon (1982), Hoefs (1979), McLean (1982), Oosenbrug (1976), Sinclair *et al.* (1982), Allen (1982); in geomorphology, Bourgois (1981), Johnson (1980, 1981); in geophysics and glaciology, Clarke (1975, 1982); in atmosphere sciences, Holdsworth (1983); in physiology, Houston (1976a,b) and Sutton (1977); in sedimentology-limnology, Bryan (1971); in planning, Cottrell (1975). A review of early work at the station can be found in de la Barre (1977).

All of the above are university stations. In the northwestern "corner" of the Canadian North is the Western Arctic Scientific Resource Centre located in Inuvik, beside the Mackenzie Delta. This is an example of a different type of station, one of three well-equipped, year-round facilities operated by the Department of Indian and Northern Affairs of the federal government. The others in this group are the Iqaluit Research Laboratory (Iqaluit was formerly Frobisher Bay) and the Eastern Arctic

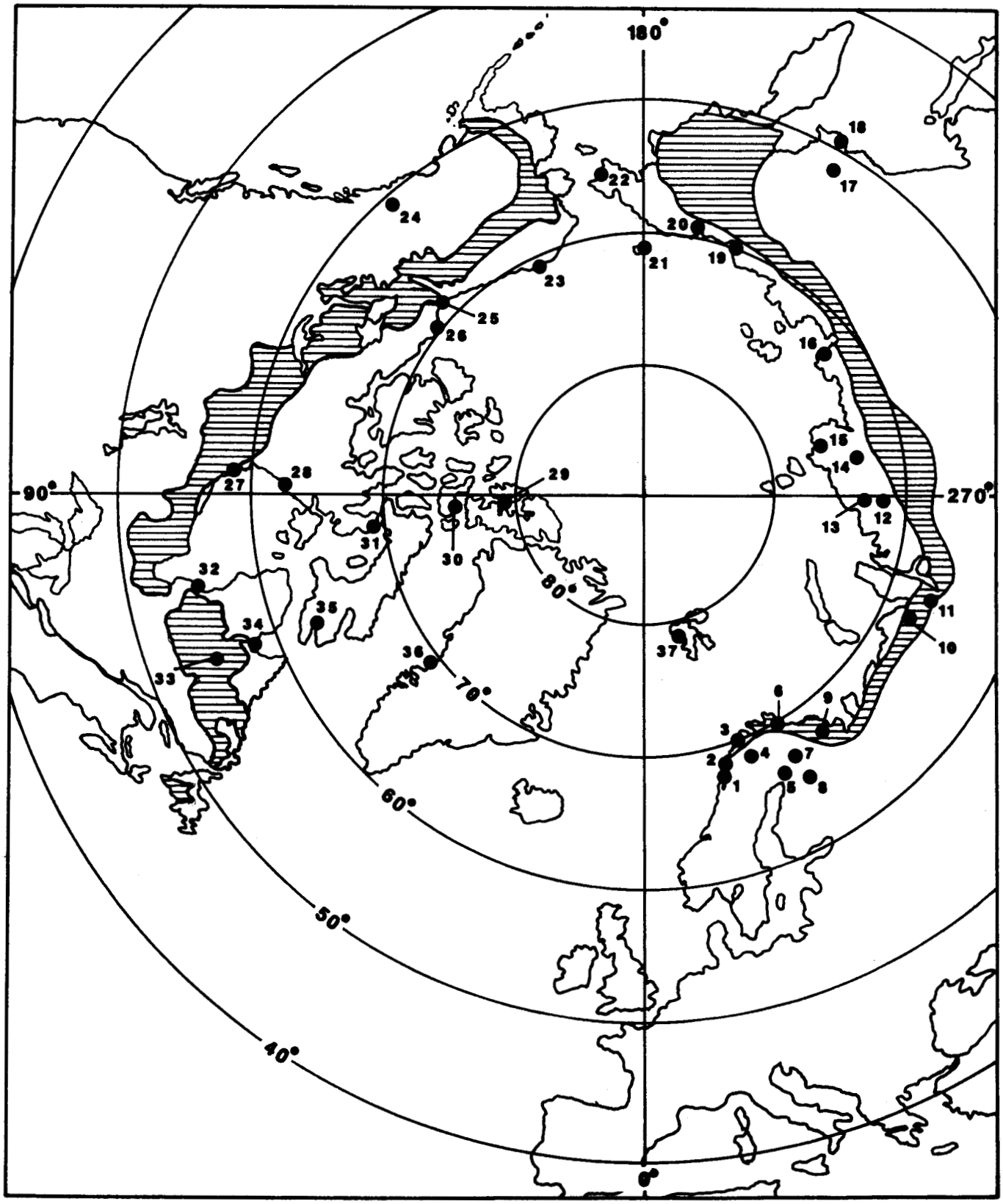

FIG. 2. Locations of major biological, especially botanical, stations in the circumpolar North from Kallio (1981). The shaded area is the "subarctic" woodland zone between the tundra and the boreal forest. There is some tendency for stations to be located in zones of rapid transition — on vegetational boundaries, rivers and coasts. From west to east, beginning in Scandinavia, these stations are: (1) Forsheim, (2) Abisko, (3) Tromso, (4) Kilpisjärvi, (5) Rovaniemi, (6) Kevo, (7) Värriö, (8) Oulanka, (9) Chibin, (10) Sivaya Maska, (11) Salekhard, (12) Agapa, (13) Tareya, (14) Ary-Mas, (15) Maria Pronchitsheva Bay, (16) Tiksi, (17) Aborigen, (18) Magadan-Sneznaya doline, (19) Pokhodsk, (20) Ust-Chaun, (21) Wrangel Islands, (22) Anadyr, (23) Barrow, (24) Kluane Lake, (25) Inuvik, (26) Tuktoyaktuk, (27) Churchill, (28) Rankin Inlet, (29) Axel Heiberg Island, (30) Devon Island, (31) Igloolik, (32) Poste-de-la Baleine, (33) Schefferville, (34) Kuujjuaq, (35) Iqaluit, (36) Disko, (37) My Alesund.

Scientific Resource Centre at Igloolik. A number of small outpost stations are associated with these facilities. The resources of the Inuvik Station provide a good indication of those at the others. It has fully equipped chemistry-soils-biology laboratories, cold rooms, libraries, visitors' office, greenhouses, etc., with a sizable year-round staff and good transportation facilities. The work at each station, naturally, varies with the nature of the region. Bibliographies of work completed are available (e.g., Castonguay and Sherstone, 1985). The best central source of information on these stations is the Circumpolar and Scientific Affairs Directorate of the Department of Indian and Northern Affairs (Ottawa, Canada K1A 0H4). A variety of detailed reports on the stations, including a cluster produced in the early 1980s, is available. Examples are Lewis (1981), Espie (1980) and Rode (1985). The stations are located in communities for which they are important resources.

Another very different set of government-operated facilities is the five stations of the Freshwater Institute, Winnipeg. These are Sagvaqjuac (near Chesterfield Inlet), Southern Indian Lake (northern Manitoba), the Resolute Bay Station (South Camp, Resolute), Chitty Lake (near Yellowknife) and Nauyuk Lake (Kent Peninsula). They focus on freshwater, with some marine, research with a strong biological focus. They tend to be operated as seasonal facilities, although Southern Indian Lake runs year-round and others have been opened in winter. These stations have made a remarkable contribution to freshwater and marine science in Canada. An indication of this can be gained from the special issue of the *Canadian Journal of Fisheries and Aquatic Science* (1984) devoted to work undertaken from Southern Indian Lake station. Another example of a contribution to circumpolar fisheries research is Johnson (1983). Yet another is the limnological work of Welch (e.g., Welch and Bergman, 1985), who is now engaged in marine work at the Resolute station.

Two interesting *non*-government stations are Arctic Research Establishment (Pond Inlet, Baffin Island) and the Kuujjuaq Research Centre (Kuujjuaq, Quebec). The former is a private operation specializing in physical-biological studies, especially marine science (Steltner, 1985), involving Inuit personnel. The latter is the field station of Makivik Corporation, formerly the Northern Quebec Inuit Association. The Pond Inlet site is especially good for work focusing on the High Arctic marine environment. It has a number of outpost stations for specific projects. The Kuujjuaq Research Centre is particularly concerned with wildlife research and management issues of interest to the local people in a region located on the tree line. Current work includes fisheries studies, salmon research and work on the eider duck. One of the focuses is the evaluation and application of Inuit knowledge of the local environment. Sample publications are Dumas *et al.* (1984, 1985) and Nakashima (1985).

However, the largest "private" facility in Canada is the Churchill Northern Studies Centre at Churchill, Manitoba. It can accommodate 50 people (20 in winter). It has well-equipped laboratories and teaching rooms and a library. It is the base for credit and non-credit courses taught by faculty from various universities in Canada as well as a base for research. The location, on the forest/tundra transition zone, near the mouth of the Churchill River and on Hudson Bay, is excellent for a variety of terrestrial and aquatic (marine and freshwater) biological studies, glaciology and geomorphology. The area is famous for its polar bear studies. The centre publishes a comprehensive report each year that includes a publications list. Current work includes lemming biology (e.g., Barker *et al.*, 1982), goose and other bird research (e.g., Bazely and Jefferies, 1983), polar bear research (e.g., Ramsay, 1982), microclimatology and climatology (e.g., Rouse, 1982a,b; Rouse and Bello, 1983) and wind energy research (e.g., Chappell, 1983).

Churchill can be reached by train as well as by air. In its vicinity there are two other stations, the Institute of Arctic Ecophysiology and the Tundra Biological Station. The former is affiliated with the University of Manitoba; Laurentian University, Ontario; and the University of Oslo, Norway. It is a base for quantitative research on bears and other large arctic wildlife as well as being a local education centre. Long-term studies of the beluga whale and the raven are under way. Examples of institute publications are Hurst (1981), Hurst *et al.* (1987a,b), Watts (1982) and Oritsland (1980).

The Tundra Station is particularly well known for its bird, notably geese and duck, studies. This research has attracted national and international acclaim. A very limited selection of the work concerned is Cooke and Harmsen (1983), Cook *et al.* (1983), Findlay and Cooke (1983) and Geramita and Cooke (1982).

Another interesting "set" within Table 1 is formed of three High Arctic aerological stations operated by Atmospheric Environment Service, Canada (AES, 1985). These are Cree Lake, Saskatchewan; Eureka, Ellesmere Island; and Mould Bay on Prince Patrick Island. They are year-round weather stations that can be used, with advance notice, by visiting research workers. Work from these stations is not restricted to studies of weather! Research of various sorts has been carried out from them since 1946 (see Met. Div., 1951).

Lastly, an interesting recent addition to the list of Canada's field stations is the ice island, Hobson's Choice (see, for example, Jackson, 1986). This is a piece of shelf ice that, at the time of writing, is off the northwest coast of Axel Heiberg Island, N.W.T. During the next decade or so, it is hoped that it will move out into the Arctic Ocean and do circuits of it. The Polar Continental Shelf Project of Energy, Mines and Resources, Canada, has established a runway and a number of buildings on it as the base for a variety of scientific projects, including marine and ocean floor studies and weather. Automated stations on it transmit weather and seismic data year-round. This is a station yet to come into its own.

My purpose here is not to describe all of the field stations in northern Canada exhaustively. A great deal of information about the stations can be obtained from the references — Campbell *et al.* (1986) and Biological Council of Canada (1983) — cited at the beginning of this article. My purpose is rather to stimulate the reader to consider how an existing facility might be of use to him or her. The stations are a national resource that tends to be underused. Virtually all stations encourage cooperative, multidisciplinary, multi-institutional use, but in reality, for quite natural reasons, they tend to be identified with certain groups or individuals so that others tend not to consider them. It should be realized that a station primarily devoted to, say, weather or limnology may also be a good base for, say, archaeological or sociological projects. There is enormous scope for savings in the cost of northern research through shared use of such facilities and shared use of transportation to and from them. Many stations are actively seeking to expand their research horizons; many more would benefit from quite modest, long-term, advance commitments from researchers or teachers. The Natural Sci-

ences and Engineering Research Council of Canada is already, through its infrastructure grants program, encouraging cooperative use of such facilities (Lillycrop, 1987). Multiple use has academic benefits in an age when arctic researchers have increasingly to be aware of developments in fields other than their own.

Stations are of particular value as bases for teaching programs. Some — for example, the Labrador Institute in Goose Bay, Labrador — regard teaching of local and "southern" students as their principal function. The field stations located in communities are especially good for teaching. They allow northerners and southerners to meet, work and learn together. Stations are also good bases for those, notably students, undertaking research projects in the North for the first time.

Fieldwork in the North is expensive, but costs of accommodation in these stations are not prohibitive. Some can be used free of charge; others will provide a schedule of fees. In 1987 there were stations that charged as little as $30 (Canadian) per day, including food. The highest daily cost, again including food, was over $200 per day on the Ice Island. Even this last is *not* expensive in comparison to hotels in the South or North. Costs without meals were, of course, lower. Many stations will make special arrangements for groups and will provide advice on transportation in and out and in the local area.

No field station is an end in itself. The worth of each can only be measured in terms of work undertaken and experience gained there. Canada has a fine network of stations that is often neglected by our northern teaching and research community.

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