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Devon Island Programs 1970

INTRODUCTION

The Arctic Institute's research base on Devon Island was used by over twenty-five investigators and their field assistants during the 1970 summer field season, from late April to mid-September. There were two separately directed, but related, programs. One, a large integrated ecosystem study, was directed by L. C. Bliss of the University of Alberta and sponsored by the Canadian International Biological Program (IBP); the other was an Arctic Institute-sponsored comparative ecology project, under the direction of James A. Teeri.

Substantial improvements were made to the Base Camp (located in the Truelove Lowland), and a total of 8 Parkall and Jamesway huts are now available as sleeping quarters, laboratories, warehouse, kitchen, and storage areas. In addition, a separate field camp was established about 8 km. east of the base to facilitate the study of muskox, fox, and weasel. Local transportation was by two skidoo motortoboggans, a double-tracked Ranger V vehicle and trailer, and a Massey-Ferguson tractor and trailer. Transportation between Resolute and the Base Camp was by Otter and Beaver aircraft.

IBP TUNDRA BIOME PROGRAM*

The Devon Island Tundra Biome Project was initiated at the request of the International IBP Tundra Steering Committee. Following several planning meetings in 1969, the Arctic Institute's base on Devon Island was selected as the study site, for a number of reasons. Numerous studies, in a variety of disciplines, had been carried out in the area annually since 1960, and thus AINA's facilities and administrative experience were available to enable the project to go forward on relatively short notice. Also, the International Committee had urged that Canada select a high-arctic study site.

The study is being conducted in the Truelove Lowland, in the northeastern part of Devon Island (75°40′N., 84°40′W.). The area is bounded on two sides by 37 km. of shoreline. Salt lagoons account for 1 per cent of the land area. Maximum elevation is 65 m. The lowland contains 3 large lakes (Phalarope, the largest, is approximately 2.5 km. in length and 1 km. at its widest); 10 of medium size; and many small lakes and ponds. Open water occupies about 22 per cent of the surface. Raised beach ridges form a conspicuous feature, with a total extent of 9 per cent of the area. These ridges, often 2 m. to 10 m. above the surrounding lowlands, may extend for 1 or 2 kilometres in length and 20 m. to 200 m. in width. Outcrops of granite and calcareous rock occupy about 12 per cent of the lowland and rise no more than 20 m. above the surrounding land. Moist to wet meadows of sedges and grasses occupy the rest of the lowland (about 57 per cent).

Cliffs east and south of the lowland rise 250 m. to 300 m. to a plateau; the eastern portion is covered by a large icecap. A major effect of the cliffs is to draw prevailing winter winds into the lowland, which keeps the snow cover relatively constant. In spring the cliffs act as a heat sink and reflector, which results in a more rapid snow melt along the base and thus earlier use of the vegetation by muskox and snow geese. In spring and early summer katabatic winds or chinooks sweep in to the lowland, which greatly accelerates the rate of snowmelt.

Jones Sound is ice-covered except from August to October. This reduces the marine influence of fog and produces relatively higher summer temperatures. Permafrost underlies the entire area. Maximum depth of the active layer is 25 cm. to 30 cm. in the sedge meadows, and 75 cm. to 100 cm. on the raised beach ridges. Refreeze begins in late August. Ice wedge polygons on beach ridges, and unsorted and sorted rock circles, soil boils and solifluction terraces and lobes are quite common features, especially on the plateau.

The most common plant communities in the lowland are wet and mesic meadows of *Carex stans,* usually with considerable amounts of standing water early in the summer. Associated species, though typically present in minor numbers, are *Polygonum viviparum, Salix arctica,* and *Dryas integrifolia.* Mosses are abundant in many sites. Along the base of the cliff a more continuous cover of *Carex stans* occurs. Here the surface contains many mosses, and there is little open water in early summer. These communities are important habitat for musk-

*Contribution #2, IBP Devon Island Project.

ox, snow geese, and ducks; the meadows adjacent to raised beaches support lemming (*Dicrostonyx groenlandicus*) in winter.

Raised beach ridges, the result of isostatic rebound following ice retreat, are dominated by lichens and scattered cushion plants. The coarse gravels are well-drained in summer, become free from winter snow in June, and are exposed to wind, resulting in quite xeric habitats. Lichens account for 20 per cent to 30 per cent of the general surface cover. Most ridges can be divided into the following units: transition to sedges, fore-slope, crest, back-slope, and transition to sedges.

The transition has the most complete plant cover with *Carex misandra, Cassiope tetragona, Dryas integrifolia*, and mosses as dominants. On the fore- and back-slope zone, *Dryas integrifolia* and *Saxifraga oppositifolia* predominate, along with many lichens, but plant cover is less here. On the crest, *Saxifraga oppositifolia* and *Carex nardina*, with some *Dryas* and many lichens, predominate; cover is least here. These ridges are important habitat for muskox in winter, and lemming and nesting snow bunting in summer. The intensive meteorological and primary production research was established on a beach ridge and mesic sedge meadow about 2 km. from Base Camp. Part of the lemming and insect research is conducted here, along with the decomposer and soil nutrient studies. Data on primary production, lemming, invertebrates, and decomposers are being gathered in two other sedge meadows and on two other beach ridges to enable a better estimate of standing crop and productivity in the lowland. Additional data will be gathered in other representative sites. Each intensive study site is instrumented to determine temperature profiles, aboveground and belowground. Wind, total and net radiation, atmospheric moisture, precipitation, and soil moisture data are also gathered. Additional wind, temperature, and precipitation data are taken from the Base Camp, the cliff base station, and a rock outcrop station. Heat and water flux studies on important plant and animal species will be made in 1971. The lowland soils will be classified according to the Canadian system of soil classification. Productivity of the lowland will be based on a biophysical classification. Soil development and nutrient status is being studied in the cushion plant beach ridge and sedge meadow communities. Mycorrhizae of woody and non-woody species in relation to nutrient uptake is also under study. Heat flux within the active layer of the major communities is being determined.

In both the sedge meadow and beach ridge sites, data on aboveground and belowground live and dead standing crop, litter, annual production of shoots and roots, caloric content, nutrients, chlorophyll, and leaf area index are being gathered.

Insects are being studied in the various habitats to determine numbers and weight per unit area, species diversity, and host-parasite, pollination, and host-prey relationships. Preliminary data indicate that in the sedge meadows, soil fungi, bacteria, and soil invertebrates are greater in species diversity and numbers.

Snow bunting (*Plectrophenax nivalis*) and Lapland longspurs (*Calcarius lapponicus*) are being studied. Fifteen bunting nests and four Lapland longspur nests were observed in the lowland. Predation by small mammals, mostly weasel, was about 25 to 30 per cent. Longspurs started nesting later than bunting. The birds switched from seeds prior to nesting to spiders during early nesting. Insect consumption then increased; following fledging, seed consumption again became more important. Data were gathered on energy cost of nesting and weight changes of eggs during incubation. Adults, eggs, nestlings, and fledglings were collected for weight changes, caloric data, sexual development, and condition at moult. Quantitative data were gathered on all species of birds each day by an abundance index based on walking known distances in relation to time.

Lemming per hectar were greatest on one area of high-centre polygons, and lower on raised beach ridges, rock outcrops, and mesic grass meadows. There was little or no evidence of them in wet sedge meadows. While the lemming peak was in 1969, the average biomass in 1970 was similar to that for small mammals of the IBP Matador Grassland study. High mortality probably occurred this spring following the rapid snow melt from the chinook. This forced the lemming from their winter areas before the summer burrows thawed. The average density of 2.2 lemming/ha compares favourably with reported densities in a year following a peak at Baker Lake, Northwest Territories, and at Point Barrow, Alaska. Winter predation by weasel appears to be an important factor.

The fox (*Alopex lagopus*) population appears to be at a low, with a total of 4 or 5 animals present in mid-summer. With a low in lemming and a general low in bird populations, the fox have diverted more to birds, but their food supply is limited. They were found to scavenge on seal and muskox kills, and prey upon lemming, bunting, sandpiper, gull, geese, ptarmigan, and arctic hare. Scat and food scraps were collected for analyses.

In 1971 greater emphasis will be placed on weasel as carnivores.

A census of muskox *(Ovibus moschatus)* was taken from 15 May into early September. Animals were marked during the summer, mostly on the horn. There are more than 50 animals in the Truelove and adjacent lowlands to the east, with approximately 20 animals in the Truelove Lowland all summer. Reproduction, while not high, did occur this year. Four exclosures have been established (50 m. by 50 m.) and the vegetation clipped from small plots (2 dm. by 10 dm.) inside and outside of the exclosures for caloric, nutrient and weight determinations. Feces have been collected, along with plant samples for the same determinations.

Studies are also being conducted on the manipulation of the plant-animal-soil surface. The research design includes removal of surface vegetation, driving track vehicles over natural vegetation, and the application of fertilizer and diesel fuel to natural vegetation. These researches are done in conjunction with the beach ridge and sedge meadow communities.

Two generalized compartment work models have been developed, one for energy flow and one for nutrient flow. In addition, more detailed subset models have been developed by each group working on a given compartment. Data are being gathered to provide compartment information on numbers, weight, nutrient and caloric content, species diversity per unit area, and flow rates of nutrients and energy between compartments. Through the combination of aerial photography and ground information, an ecosystem model is planned for the entire lowland area. Models are also planned for the two major plant-animal-soil topographic units, meadows and beach ridges, and the subset or individual compartment models.

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COMPARATIVE ECOLOGY OF HIGH ARCTIC SPECIES OF SAXIFRAGA

During the 1970 field season, the mechanisms of adaptation of species of *Saxifraga* were studied in several microenvironments in the Truelove Inlet region. Emphasis was on the adaptations of populations of *S. oppositifolia* L. to varying conditions along gradients in space, time, and substrate. Mechanisms of local population differentiation were studied at the levels of population, genetic structure, and physiological responses of individuals within the populations. These studies included field measurements of stomatal and tissue water potential responses to changing environmental conditions; transpiration rates; comparative respiration rates under varied conditions; and studies of relative drought and flooding tolerance. Intensive quantitative observations were made of the breeding systems of species of *Saxifraga.* Pertinent detailed microenvironmental data were obtained along a gradient of microhabitats, ranging from polar desert environments to sedge meadows. Experimental work on transplant and seedling material from the lowland is now under way in the controlled environmental facilities of the Duke University Phytotron.

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The Icefield Ranges Research Project, 1970

In 1970 the Icefield Ranges Research Project (IRRP) conducted its tenth consecutive summer of interdisciplinary basic research in the St. Elias Mountains, Yukon Territory, and in the valley and plateau region to the east where all aspects of the environment reflect the influence of those mountains. Summer field investigations began in April and ended the last week in August. And for the first time since the Project's inception in 1961, two programs have continued through the winter (1970-71). This opportunity to continue studies all the year round was made possible by the winterization of a log house; the work, begun in 1967 on the north side of the runway near the Kluane Base Camp, was completed with modern facilities in June 1970.

This short paper briefly reviews the programs which were accomplished during the