June 1967 at a depth of 90 m. below the surface of the lake. At the sampling site the maximum depth of the lake was 130 m. and the depth of the halocline was 60 m.; salinity of the sample is 26‰[8]. The strontium was separated from the brine using ion exchange chromatography and the isotopic composition was determined by mass spectrometry. Details of the procedures are given elsewhere[2].

The $^{87}Sr/^{86}Sr$ ratio for the brine at 90 m. depth of Lake Tuborg has a value of 0.7096 ± 0.0005 (1 σ), which is in satisfactory agreement with the accepted value for modern sea water. This suggests that the brine at the bottom of the lake could be sea water. However, this is not conclusive, because the dominant bedrock in the region consists mainly of marine carbonates of Early to Middle Cambrian age. The $^{87}Sr/^{86}Sr$ ratio of these rocks probably does not differ greatly from this value[9]. We analyzed one specimen of limestone of Middle Cambrian age from the Nelson Formation of the Neptune Range, Pensacola Mountains, Antarctica, and obtained an $^{87}Sr/^{86}Sr$ ratio of 0.7093.

The concentration of strontium, determined by isotope dilution using a spike enriched in ^{86}Sr, was 6.239 ppm and is somewhat less than that of normal sea water, which has a strontium content of approximately 8 ppm. Using the established relationship between salinity and chlorinity in sea water[10] and a salinity of 26‰, we find a chlorinity of 14.4‰ for the brine sample. Accordingly, the Sr/Cl ratio of this brine is 0.43. Riley and Tongudai[11] obtained an average value of 0.42 ± 0.02 for this ratio for a large suite of sea water samples. The Sr/Cl ratio of the brine from Lake Tuborg is similar to this value, which also suggests that the brine could be sea water.

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Devon Island Programs 1971

INTRODUCTION

From April to October 1971 the Arctic Institute's research base on the northeast coast of Devon Island (75°40'N., 84°40'W.) was

the seat of operations for over 50 investigators and their field assistants. The major research program was a large integrated tundra ecosystem study sponsored by the Canadian International Biological Program (IBP); see report pp. 158-161. The Base Camp was also used, though briefly, by groups of researchers from the Canadian Wildlife Survey conducting polar bear studies in northern Devon Island, and from the Polar Continental Shelf Project who were making glaciological studies of the Devon Island Ice Cap. The two AINA-sponsored projects are summarized below.

The status and condition of the Base Camp, and the logistics services, remain essentially as reported in the 1970 field summary (*Arctic*, Volume 24, Number 1, page 65), although minor improvements and repairs were made to the 8 huts, and the water and power system and local transportation facilities were improved by the addition of another skidoo, bringing the total to 3. Over 70 tons of fuel and supplies were transported from Montreal and landed near the Base Camp by the Canadian Coast Guard Ship *John A. Macdonald* in September bringing to a total of about 158 tons of fuel and supplies transported by ship to the Base Camp since the inception of the IBP program in the summer of 1970.

In 1971, as in the previous summer, the size and capacity (unfortunately not synonymous) of the Base Camp increased. Those who have visited the Camp in previous years would find little resemblance today. The Camp at present consists of 8 Parcolls and Jamesways (many of which were enlarged in 1971), which together with tents, some lent to the Institute by the Canadian Forces, provided both laboratory and living space.

A secondary camp, situated some 5 miles from Base Camp, provided a base of operations for a group of researchers from the University of Manitoba. Remote from the large population of Base Camp it made work on muskoxen and other mammals somewhat easier.

One problem that came to the fore in 1971 was how to keep to the minimum the impact of relatively large numbers of people with their equipment on the Truelove Lowland itself. All of those who lived at Base Camp cooperated in efforts to avoid any unsightliness and in fact several visitors noted the general tidiness of the area.

Outside the Base Camp, movement, particularly vehicle movement, was also kept to a minimum. During the early spring it was of course possible to use skidoos or light tracked vehicles on the snow-covered terrain. In the latter part of the summer light-tracked vehicles were used only in those instances where it was necessary to transport heavy equipment over long distances and then on the dry beach ridges wherever possible. Finally, heavier tracked vehicles were used in the late fall when the ground was frozen and snow covered again to haul the large resupply to the Base Camp for winter storage.

During the 1971 summer, as in the past, the Camp was fortunate to have a number of visitors. Dr. E. F. Roots of the PCSP; Dr. S. D. MacDonald of the National Museum of Natural Science and some visitors of his Bathurst Island camp; Dr. M. Haycock the noted artist; Dr. W. D. Billings of Duke University; Dr. C. Jonkel and Dr. D. Muir of the Canadian Wildlife Service among others provided all with a welcome change of pace.

ECOLOGICAL STUDIES OF SEDGE DOMINATED MEADOW TUNDRAS

Recently proposed increases in the use of tundra resources have caused considerable concern regarding the ability of these systems to withstand serious perturbations resulting from development. Present research activities in a number of arctic locations include disturbance studies, oil spillage evaluation and the replanting of disturbed tundra with non-native plant materials. Little observational information or experimental data on the reproductive biology of native arctic plant species are yet available. Until more information of this sort accumulates, land management decisions for those areas will necessarily remain somewhat speculative.

Meadow tundras represent landscape units potentially susceptible to severe disturbances. The presence in many of these sites of substantial surface organic matter, fine textured, frost susceptible subsoils and high soil moisture contents (as water or often as ground ice) present conditions under which significant erosion or congeliturbation may occur if the vegetation mantle is compacted or removed.

The most common plant cover over many of these meadow systems are grasses (Gramineae) or sedges (Cyperaceae). To understand more fully the biology of sedge-dominated meadow tundras, field studies were initiated during July 1971 in the general area of the Base Camp. Concurrently comparative studies were initiated in similar sedge-dominated meadows in the alpine tundra zone of Mount Washington, New Hampshire (44°16'N., 71°16'W.).

Previous synecological studies of the coastal lowlands surrounding the Devon Island Base Camp indicate that the most extensive plant association of the area is the Caricetum stantis, a hydric meadow dominated by *Carex*

stans Drej. This vegetation assemblage has been subdivided into two subassociations, the Caricetosum stantis which is found either at the margins of ponds and lakes or immediately below outlet channels where seasonal melt water passes through raised beach areas. This unit is the most hydric of the area and is dominated completely by *Carex stans* Drej. The second subassociation is the Caricetosum membranacei. This is the most commonly encountered unit on the lowland. It is immediately distinguished from the previous unit by pronounced microrelief similar in pattern to the "string bogs" developed over the Kellett soils of northwestern Banks Island. These hummock-like areas provide drier microsites which allow the invasion of *Carex membranacea* Hook, which frequently codominates with *C. stans*. To a limited degree *Carex stans* also dominates the margins of shallow fresh water ponds found scattered throughout the lowland. It was in these locations that a majority of the summer's field observations were concentrated. Limited work was also undertaken with *Carex misandra* a caespitose sedge found in a wide variety of habitats and plant associations.

Present studies at Devon Island have attempted to define the field performance of the above taxa. Twenty-one semipermanent mapped quadrats have been established in several microenvironments. Continued observation of these areas will provide information on seasonal and annual changes of population structure and species performance.

Carex stans and *Carex membranacea* both produce extensive underground rhizome systems. In order to evaluate rhizome behaviour complete excavations of rhizome systems were mapped on quadrats at 2 high density sites. In addition a number of complete individual rhizome systems were excavated at other locations. It is hoped that future work will concentrate on rhizome growth and performance in the field. Rhizome invasion into unoccupied sites was studied at 4 pondside sites (2 drained ponds and 2 filled ponds). Present vegetation boundaries were marked and photographed. Future measurements at these sites should establish rates of invasion into uncolonized localities.

Extensive collections of flowering *Carex* populations were collected from a variety of environments for the evaluation of floral development, seed set, germination response and comparative morphology. Information from these populations will be compared with similar data recorded from populations collected in other tundra locations.

Of the 7 species of *Carex* at present known to occur in the area, 5 were returned to the ecology laboratories at the University of Massachusetts where they are now growing under controlled environmental conditions. Experimental work on the comparative growth and flowering responses of these species to a variety of environmental conditions is under way.

COMPARATIVE ECOLOGY OF HIGH ARCTIC SPECIES OF SAXIFRAGA

During the 1971 field season, studies were continued on adaptations of local populations of species of *Saxifraga*, to a variety of local habitat conditions. The work was carried out in the general Truelove Lowland area. A series of investigations concerned the mechanisms of pollinator-plant interactions, pollen flow, and general breeding behaviour of *Saxifraga oppositifolia*. Transplant gardens, habitat manipulations, and controlled-environment studies have been used to demonstrate and quantify different modes of reproductive behaviour of several genetically distinct populations of *S. oppositifolia*. Metabolic activity in the field was studied by means of monitoring processes of respiration by O_2 and CO_2 exchange and enzyme activity. Physiological responses of various populations to severe drought conditions on polar desert microsites were studied in terms of differential survival, stomatal responses, comparative growth rates and flowering responses. Experimental studies of field-collected transplants and seed populations are continuing in the controlled environment chambers of the Duke University Phytotron.

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The research in 1971 continued to emphasize the physical environment and the biological response of organisms on meadows (*c.* 49 per cent of the lowland) and raised beach ridges (*c.* 15 percent of the lowland) in the Truelove Lowland. The lakes (22 percent) were not included in the studies and all data are expressed on the basis of a 3,300 ha. land area. As in 1970, the research was concentrated on a typical mesic meadow (soils, meteorology, primary production, nitrogen fixation, invertebrates, decomposition) with additional data gathered in 2 to 5 other meadows (extensive sites), depending upon the research unit. The intensive beach ridge site, approximately 7,500 years old, was studied with the same components of research as the master meadow site. In addition, 2 to 11 other beach ridges (extensive sites), and a site on the plateau (*c.* 300 m. above sea level) were studied in varying detail (soils, meteorology, primary production, and invertebrates). In all, 22 separate research projects were conducted in 1971.

Two flights for aerial photography of the Truelove Lowland were made. The Atmospheric Environmental Service of the Department of Transport photographed black and white and an infrared scan in late July, and the Inland Waters Branch photographed black and white imagery at 3,330 and 830 m. and infrared false colour at 1,660 m. in mid-August. The 1:20,000 scale photography will be used to produce a photographic map devoid of horizontal and vertical distortions and will be able to resolve height differences of 1 m. The 1:5,000 scale photography will be used for detailed mapping of land and vegetation features, enabling the interpretation of features 1 m. in diameter.

Eleven holes were drilled in the major terrain units of the lowland and one on the plateau. The holes varied in depth from 1 to 9 m. and each contained a series of 12 thermocouples. July temperature data of the permafrost ranged from −9°C. to −15.6°C. at depths of 3 to 9 m. From the summer and winter data, and determinations of thermal conductivity of the granite gneiss, limestone, dolomite, and sandstone, estimates will be made of permafrost thickness in the lowland and on the plateau.

Soils of the intensive beach ridge and mesic sedge meadow were mapped, based upon a total of 111 and 137 small pits respectively. Profile samples from 9 pits were collected for physical and chemical analyses. The extensive sampling program included descriptions and soil collections from an additional 14 profiles from meadow, beach ridge and outcrop sites scattered over the lowland.

The microclimatic studies initiated in 1970 at the 2 intensive sites and the 3 extensive ones (rock outcrop, cliff base, and Base Camp) were continued. Additional stations were set up on the plateau and near the sea (Rocky Point). An additional "roving" station was placed for 2-week periods each on Beschel Hill, a hydric sedge meadow, and a coastal sedge meadow.

In general the microclimate of the Truelove Lowland in 1971 was very different from that of 1970. Lake ice was thinner (1.5 *v.* 2.3 m.) and average snow cover was greater in 1971. Both June and July were sunnier in 1971. The lakes were free of ice for 2 days in late August 1970, but from late July until late August in 1971. August 1971 was cloudy and cool. The lowland experienced 2 Chinooks (26 June, 29 to 31 August) in 1970 and 3 in 1971 (August, September, October). The week of maximum temperatures lagged the solar high by 3 weeks in 1970 and by 4 weeks in 1971. In mid-June warming was greatest in the areas of more massive rock outcrop away from the coast. From the end of June and through mid-July there were three areas of local heating (plateau edge, Beschel Hill and near intensive study sites).

Water flux studies using both lysimeters and sod blocks were conducted on the 2 intensive study sites. While temperature at 1.5 m. was very similar in the 2 sites, microclimatic conditions (temperature, wind, vapour pressure deficit and soil moisture) were very different. Foliose and fruticose lichens nearly doubled the rates of evaporation com-