Meetings

Tundra Biome Program

The extreme sensitivity of the Arctic tundra ecosystem to physical, thermal, or biological changes is the result of the delicate equilibrium that exists among the climate, vegetative cover, soils, and underlying permafrost. Disturbances, whether natural or man-made, frequently result in destructive and often irreversible changes in the landscape. The Tundra Biome Program of the U.S. International Biological Program (US-IBP) is pursuing several objectives which are designed to establish a firm scientific platform from which questions concerning resource management and the quality of the tundra environment can be judged. These objectives are:

1) Bring basic environmental knowledge to bear on problems of degradation, maintenance, and restoration of the temperature-sensitive and cold-dominated tundra/taiga ecosystems.

2) Develop a predictive understanding on how the wet tundra ecosystem operates, particularly as exemplified in the Barrow, Alaska, area.

3) Obtain the necessary data base from throughout the circumpolar tundras so that the behavior of these cold-dominated ecosystems can be modeled and simulated.

In conjunction with this USIBP Tundra Biome Program, a meeting attended by some 65 Biome participants was held at the University of Colorado's Institute of Arctic and Alpine Research (28 October–1 November 1969). The broad objectives of this meeting were (i) to assess the present state of knowledge and on-going research on tundra, particularly the wet tundra of northern Alaska; (ii) to determine how to analyze, interpret, and apply the existing environmental and ecological data; and (iii) to develop a scientific framework and strategy for future tundra research. The urgency of the impending environmental crises facing northern Alaska and lack of meaningful coordinated action presented ominous overtones throughout the meeting [*Science* **166**, 85 (1969)].

The majority of the scientific discussions focused on the Arctic tundra in connection with an NSF grant to San Diego State College entitled "The analysis of the structure and function of the wet tundra at Barrow, Alaska." A plan and schedule for compiling, analyzing, and modeling the diverse but detailed set of biological, physical, and atmospheric data from Barrow were decided. Several ecological modeling approaches were discussed and priorities for modeling the Barrow environment were set so that preliminary results would be available for designing new tundra field research for summer 1970. These include both abiotic modeling of the energy balance at several scales and a first-generation model of primary terrestrial production. A generalized Barrow ecosystem model was defined (Fig. 1). This model consists of three principal terrestrial and one aquatic habitat arrayed in a complex geomorphic mosaic. Steep microelevational and moisture gradients and shallow ponds exist on the dominant polygonal ground.

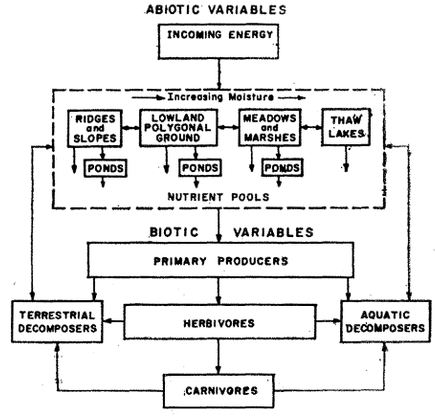

Fig. 1. Simplified diagram of the Barrow ecosystem emphasizing the predominance of ponds and the importance of a moisture gradient in terrestrial habitats.

Simulation of the resulting models will yield insight into such questions as: Will reduction of the grazing by lemmings significantly reduce soil thaw? What effect will an areal increase of surface water cover or oil spill have on the permafrost regime? How do unusually cloudy or cloudless summers influence the primary production?

Accomplishments of the analysis and modeling activities will undoubtedly be applicable to the somewhat similar Prudhoe Bay tundra, the site of intensive oil exploration and region of considerable environmental alteration.

The meeting produced a consensus of opinion and a series of resolutions concerning the needs of future tundra research. This strategy indicates that emphasis and priority should be placed on initiating a coordinated, multidisciplinary, environmental research program in northern Alaska for summer 1970. Another summer's delay in launching an ecologically significant series of applied and basic research projects will indicate the scientific community's inability to respond to questions and problems generated by the rapid development and impact of oil exploration on the cold-dominated, permafrost environment. A core program at Barrow would consist of short- and long-term, process-oriented studies, both abiotic and biotic, and will be designed around a centrally supported research area. Emphasis will be on field experimentation or manipulation rather than on routine environmental observations. Comparative investigations, for instance, along the proposed Alaskan pipeline route in the Prudhoe Bay region and the alpine would be conducted for purposes of monitoring seasonal and annual changes in the environment. Both programs would be used to validate detailed and more general tundra ecosystem models. It was agreed that new and substantial fundings to sustain a meaningful research program are required with the need for both government and industry participation. Resolutions concerning the preservation of tundra areas for future long-term research were prepared.

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