

## Photosynthetic Production in Greenland as Related to Climate, Plant Cover and Grazing Pressure\*

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### Abstract

Photosynthetic production was studied in Greenland in ecologically well differentiated types of vegetation in areas with continental and coastal climate. The research included (1) the determination of CO<sub>2</sub> exchange at leaf, canopy and ecosystem levels as a function of various weather parameters, (2) the evaluation of change in standing biomass during the growing period, (3) the assessment of the effects of removal of green biomass on CO<sub>2</sub> exchange, (4) the identification of limiting factors, climatic and nutritional, nitrogen fixation comprised, in plant dry matter production, and (5) the testing of new techniques, such as remote sensing, as a means to generalize experimental results to larger land surfaces. Emphasis was put on the study of higher plants and lichens. Results are considered in the light of problems connected with the use and conservation of the plant cover.

Rational use and conservation of the arctic and subarctic vegetation in Greenland, implies a good understanding of the physiological behaviour of its dominant species, particularly their photosynthetic production, in relation to climate, plant cover and grazing pressure.

In the present investigations, the study of the photosynthetic production is essentially based on the measurement of CO<sub>2</sub> exchange in preference to that of standing crop. This takes into account the large variations in weather conditions from day to day and year to year which characterize the climate in Greenland. Whereas it is difficult to assess the response of the above-ground biomass to the various climatic factors, due to the long relaxation times of the growth processes involved, the response of photosynthesis and respiration to, for example, irradiance and temperature, is almost immediate.

Studies, similar in more than one respect, to those outlined here, have been conducted in Alaska by Tieszen (1978). References to other investigations in the arctic are given in Lewis and Callaghan (1976). A general survey of arctic vegetation has been published by Aleksandrova (1980). Phytosociological and edaphological studies in Greenland have been carried out by, among others, Böcher (1949), Hansen (1969) and Laursen and Ørnsholt (1979). Two research projects are currently in progress, a reindeer project and a sheep farming project, described respectively by Strandgaard (1980) and Thorsteinson (1980).

### MATERIAL AND METHODS

**Site description:** Research work was carried out in three experimental sites: Kangerlussuaq, Upernaviarsuk and Qeqertarsuaq (Fig. 1). It was accompanied, in two of the sites, by a vegetation survey, based on a partly computer aided classification of about 100 relevés according to the principles of Braun-Blanquet (Mueller-Dombois and Ellenberg 1974). These relevés are presented

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*Editorial comment:* As this study comprehensively solves a complex ecophysiological problem, it is published without subdivision, in spite of its extraordinary length.