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Ecophysiological studies on the primary production process in a high-arctic tundra ecosystem of Ny-Alesund, Svalbard.

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Current global warming predictions indicate that warming will be more pronounced at high latitudes in the Northern Hemisphere (IPCC 2001). Revealing the mechanisms of carbon exchange by terrestrial ecosystems in the arctic region is thus of great importance. Evaluation of the carbon cycle and its probable changes due to meteorological shifts requires qualitative and quantitative knowledge about the relationships between biotic and environmental components of the system. Plant ecophysiological properties, such as photosynthetic and respiratory responses to environmental factors and their seasonality, are basic components determining carbon balance. In addition, these knowledge would lead us to scale these ecological phenomena for time and space, which is necessary for the accurate evaluation of climate change effects on the ecosystems.

Since 1994, we have been trying to reveal the ecosystem carbon dynamics and budget in the deglaciated area of Ny-Alesund, Svalbard. Research has been made for soil respiration, plant distribution and biomass, and plant ecophysiology. In this paper, we will show the leaf photosynthetic characteristics (CO_2 gas exchange and chlorophyll fluorescence) of major vascular plant species; *Salix polaris*, *Dryas octopetala* and *Saxifraga oppositifolia*, and their potential net primary production (NPP) which is the key parameter of carbon fixation capacity of the ecosystem. The studies have been conducted from 2000 to present, and is now going to gain insights into the mechanisms and temporal and spatial scaling procedure by modelling.

Light-saturated rate of photosynthesis (Amax) on the basis of leaf biomass of the three species differed remarkably; about 124.1 nmol CO_2 g^{-1} s^{-1} for Salix, 57.8 for Dryas and 24.4 for Saxifraga. These data and leaf nitrogen concentration (N) indicated that N determines Amax, but not electron transport rate (ETR). These observations suggest that the soil nitrogen availability and nitrogen acquisition capacity of the species influence the ecosystem scale carbon gain. Measurements of spectral profile of reflected radiance for various vegetation density (biomass) by using spectroradiometer revealed that the biomass distribution in this region can be evaluated by remote sensing. Distribution of Salix and Dryas is restricted to the area where soil nutrient availability is high. Saxifraga can be established on the front of glacier where nutrient availability is low, while this species tends to be covered by other vascular plants in the area of high nutrient availabi

lity. These research suggest that responsible plant species for ecosystem CO_2 uptake changes with successional status of the arctic terrestrial ecosystems.