B-12 Evaluation of the Global Warming Effects on Plants (Final Report)

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The effects of global warming on plants and ecosystems were investigated by the following studies.

(1)Prediction of the Effects of Global Warming on Ecosystems

a)The potential vegetation distribution shift in Japan and China caused by global climatic change was predicted by the direct transfer function approach. b)The probable effects of climate changes on geographical distribution of net primary productivity (NPP) of natural vegetation in East Asia were estimated. c)The maps of effects on phenology (the date of blooming, budding, leaf-color change, leaf-falling) in Japan were made. The strong correlations were found between phenological dates and latitude, longitude and height. d) Impacts of ENSO on plant phenology, agricultural production and natural hazard in East Asia were studied. e)Flora in the Nansei-shoto Islands was investigated to estimate the responses to climate change. f)The combined water temperature-ecological (WT-ECO)model was developed. The ECO model was used to estimate the effect of grobal warming on a lake's ecological dynamics.

(2)-1 Global Warming Effects on the Distribution Pattern of Natural Vegetation
－Japanese Forest Area－

The objective of our studies is to predict the effects of the global climate change on local ecosystems through the investigation of habitat conditions of representative plant communities. The target vegetation includes subalpine coniferous forest, alpine scrubs, alpine meadows. The following studies on climatic, edaphic biological conditions, and their influences were studied in northern and middle Japan as: estimation of snowfall by ground air temperature, modeling of melting process of snowpatch, phenological change of snowpatch vegetation, growth and distribution of *Pinus pumila* scrub, effcts on litter decomposition rate.

(2)-2 Effects of the Global Warming on the Vegetation on a Humid Tropical Mountain

The leaf longevity of the major tree and shrub species, and net soil nitrogen mineralization potentials on two types of geological substrates were investigated at a range of altitudes with varying temperatures on the south slope of Mount Kinabalu, Borneo. Results suggest that, with increasing temperature, both the leaf longevity of a common wide-ranging species and the net mineralization potentials of the global warming may trigger a feedback of greater nitrogen supplying power to greater net primary productivity through faster leaf turnover.

(3) Experimental Studies on the Effects of Global Warming on Plants

The effects of carbon dioxide (CO_2) concentration, air temperature and/or relative humidity on the growth and the transpiration of several crops (C_3 and C_4 plants) were investigated using the environment-controlled growth cabinets. The growths of dry weight and leaf area were accelerated by an increase in CO_2 concentration but reduced by an increase in air temperature or a decrease in air humidity. These environmental factors modified the several growth parameters, the transpiration rate and the water use efficiency. The relative humidity and CO_2 concentration or air temperature functioned independently in many cases. The effects of global warming on the fertility of rice plant were also studies and the rice yield in Japan under 2 $\times CO_2$ (640ppm) climate scenarios was simulated.