

B-6 Studies on Evaluation, Prediction and modeling of Carbon Dioxide Dynamics in Terrestrial Ecosystems

Contact Person Tomoyuki Hakamata
National Institute of Agro-Environmental Sciences
Ministry of Agriculture, Forestry and Fisheries
3-1-1 Kannondai, Tsukuba, Ibaraki 305-8604 Japan
Tel +81-298-38-8431 Fax +81-298-38-8199
E-mail tomo@niaes.affrc.go.jp

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Major results obtained from each study are as follows:

(1) Prediction and modeling of carbon dioxide in natural ecosystems

① Relative decomposition rate of soil organic matter in a jack pine forest at Saskatchewan, Canada was higher than that in a spruce forest due to the higher soil temperature. ② Decomposition rate of organic matter was rapid than organic matter supply, then soil had low level in a tropical monsoon forest at Khon Kaen, Thailand. ③ A compartment model has been established on a carbon cycle in a cool temperate forest and ④ average net-uptake of CO₂ is 1.2 t C/ha /year, but it has notable variation due to the differences of insolation, temperature and forest-activity in each year.

(2) Prediction and modeling of carbon dioxide in artificial ecosystems

① The annual carbon balances were estimated to be -270~-320 g C/m² for an upland single-cropping field and -160~-270 g C/m² for an upland double-cropping field. ② Soil carbon storage of artificial Larix stand was less in comparison to Abies-Tsuga stands in subalpine zone of Yamanashi. ③ Transfer to sugarcane cultivation from forests markedly decreased C content and increased δ¹³C values of soil organic carbon within 8 ~ 50 years.

(3) Quantitative evaluation and modeling of soil biological functions

① The change of microbial biomass affects CO₂ flux through the microbial biomass, but the influence is much lower than that of temperature dynamics in two cool temperate forests. ② A significant log-linear relationship was observed between the mass loss rate and annual mean air temperature. ③ Optimum temperature of cellulase activity in soil significantly correlated with annual temperature at sampling site (r = 0.602**). ④ More exact modeling of carbon process of andisols was pointed out through simulations on soil processes of carbon cycling.

(4) Modeling of global carbon cycling

① Soil respiration rates a soil organic carbon model were 1.71, 2.81, 1.87 and 3.08 Mg/ha/yr in Ushiku, Toride, Kawagoe and Satomi, respectively. ② The interannual variations of CO₂ concentration computed by a physical regional climate model including a sophisticated biological land surface model indicated the similar characteristics to those observed over Japan. ③ Concentrations of CO₂ computed by an atmospheric chemical transport model are fitted to the observed CO₂ concentrations, annual mean concentrations between 1984 to 1985. ④ A carbon dynamics model based on mass balance and kinetics of carbon shows that large amount of CO₂ could be emitted from terrestrial ecosystem, especially from soil on global warming conditions.