2.5.2 Laboratory : Forest Hydrology

Member :	Professor	Tani, Makoto
	Assistant Professor	Kosugi, Yoshiko
	Master's Program	6
	Undergraduate	1
	Program-Specific Researcher	3

A. Research Activities (2009.4-2010.3)

A-1. Main Subjects

a) Gas exchange between forest and the atmosphere

Our laboratory is conducting long-term observations on gas exchange processes between forest and the atmosphere using the eddy covariance method to evaluate the physical and physiological control by forest ecosystem. Our main study sites are located in a Hinoki Cypress forest in Japan and a tropical rainforest in Malaysia, and new findings on uptake and emmsion characteristics of vapor and CO2 have been obtained from detailed observations on and around a tower in each site. This year, observations on soil respiration demonstrated characteristics of its spatial distributions and the ratio of autotrophic to the total soil respirationand in these two sites, contributing to an accurate assessment of the carbon budget in forest. A development of the TDLS method for a continuous monitoring of CH4 flux provided new information on its daily and seasonal variations in our Hinoki site.

b) Water quality and biogeochemistry

Detailed runoff processes and effects of their heterogeneities on biogeochemistry in forested catchments are studied to evaluate roles of forest in water and nutrient cycles. Biogeochemical processes on hillslope have been mainly studied to evaluate stream-water quality in small mountainous catchments. A strontium stable isotope ratio analysis was applied to our catchemnt to estimate groundwater movement through soil and weathered bedrock, showing a consistent tendency along a stream channel in it.A relationship between geographic and time sources of stream water was elucidated using a long-term hydrochemnical data set (Katsuyama, 2009). A simulation study on effects of forest operations on stream chemstry has started by combining a biogeochemical model with a runoff model. Nitrogen utilization of Sabina vulgariswas studied to develop a beter reforestation method in a semi-arid desert in

China.

c) Runoff control through forest management

Runoff characteristics of several small chatchments with different geologies and forest-use histories were compared to predict the dependencies of rainfall-runoff responses on human forest disturbances with soil loss. The ranges of the dependencies in each geology were specified based on the comparative analysis using a runoff model.

A-2.Publications and presentations

a) Publications

Original Papers

- Kosugi, Y., Takanashi, S., Matsuo, N., Abdul Rahim, N: Midday depression of leaf CO2 exchange within the crown of Dipterocarpus sublamellatus in a lowland dipterocarp forest in Peninsular Malaysia, Tree Physiology, 29, 505-515, 2009
- Katsuyama, M., Kabeya, N. and Ohte, N.: Elucidation of the relationship between geographic and time sources of streamwater using a tracer approach in a headwater catchment, Water Resources Research, 45, W06414, doi:10.1029/2008WR007458. 2009.
- Katsuyama, M., Fukushima, K. and Tokuchi, N.: Effects of various rainfall-runoff characteristics on streamwater stable isotope variations in forested headwaters, Eds. by M. Taniguchi, Y. Fukushima, W.C. Burnett, M. Haigh and Y. Umezawa, From Headwaters to the Ocean: Hydrological Change and Watershed Management, Taylor & Francis. pp. 51-55, 2009.
- Matsumoto, K.: Causal factors for spatial variation in long-term phenological trends in Ginkgo biloba L. in Japan, International Journal of Climatology: DOI: 10.1002/joc.1969, 2009.
- Tokuchi, N., Fukushima, K. and Katsuyama, M.: Factors controlling stream water chemistry in ten small forested watersheds with plantation forests of various proportions and ages in central Japan, Eds. by M. Taniguchi, Y. Fukushima, W.C. Burnett, M. Haigh and Y. Umezawa, From Headwaters to the Ocean: Hydrological Change and Watershed Management, Taylor & Francis, pp. 75-81, 2009.
- Fukushima, K., Tokuchi, N., Tateno, R. and Katsuyama, M. (2009) Water yield and nitrogen loss during regrowth of Japanese cedar forests after clearcutting, Eds. by M. Taniguchi, Y. Fukushima, W.C. Burnett, M. Haigh and Y. Umezawa, From Headwaters to the Ocean: Hydrological Change and Watershed Management, Taylor & Francis, pp. 97-103.

- Takanashi, S., Kosugi, Y., Ohkubo, S., Matsuo, N., Tani, M., Abdul Rahim, N: Water and heat fluxes above a lowland dipterocarp forest in Peninsular Malaysia, Hydrological Processes, 24, 472-480, 2010.
- Ohkubo, S., Yokoyama, N., Kosugi, Y., Takanashi, S., Matsuo, N., Tani, M.: Estimating vertical distribution of CO2 efflux in a temperate cypress forest, Journal of Agricultural Meteorology, 65, 339-348, 2009.
- Makita N., Hirano Y., Dannoura M., Kominami Y., Mizoguchi T., Ishii H. And Kanazawa Y. Fine root morphological traits determine variation in root respiration of Quercus serrata., Tree Physiology, 29, 461-481, 2009.

b) Conference and seminar papers presented

- The 120th Annual Meeting of Japanese Forestry Society: 7 topics.
- The Annual Meeting of Japan Society of Hydrology and Water Resources: 2 topics.
- The 74th Convention of the Japanese Society of Limnology: 1 topic.
- The 56th Annual Meeting of Japanese Ecological Society: 2 topics.
- Japan Geoscience Union Meeting: 3 topics.
- American Geophysical Union Fall Meeting: 3 topics.
- BIOGEOMON 2009 1 topic.
- AsiaFlux Workshop 2009: 2 topics.
- 8th IAHS Scientific Assembly: 1 topic.
- Annual Meeting of Agricultural Meteorology: 4 topics

A-3.Off-campus activities

Membership in academic societies

- Tani, Makoto : Vice president, Japan Scoiety of Hydrology & Water Resources.
- Kosugi, Yoshiko : AsiaFlux Network (Member of News Letter Editorial Board), Japan Flux Network (Member of steering committee)
- Katsuyama, Masanori(Researcher) : Japan Scoiety of Hydrology & Water Resources (Member of Editorial Review Board of Hydrological Research Letters)

Membership in Science Council of Japan, etc.

- Tani, Makoto : National Committee Member of IAHS

Research grants

1. Grants-in-aid for Scientific Research(KAKENHI)

- Scientific Research (A) : Tani, Makoto : Prediction of flood and drought runoff from ungauged basins based on the development of bedrock-soil-vegetation-atmosphere continuum model
- Scientific Research (A) Oversea research : Kosugi, Yoshiko : Gas exchanges of Southeast Asian tropical rainforest
- Scientific Research (B) : Kosugi, Yoshiko : The use of TDLS for the estimation of trace-gas dynamics in terrestrial ecosystem
- Scientific Research (A) Oversea research : Hirano, Takashi (Kosugi, Yoshiko member) : Elucidating forest-atmosphere interactions in South-East Asia based on the tower-observation networking
- Scientific Research (B) : Ohte, Nobuhito (Tani, Makoto member) : Study on ecosystem functions for water quality conservation in forested catchment and development of those evaluation procedures

2.Other Research Grants

- Mitsui & Co., Ltd. Environment Fund : Tani, Makoto : Strategic study on an utilaization of forest functions in hydrological processes to the watershed management
- Global COE Program : Sugihara, Kaoru (Tani, Maokoto member) : Search of Sustainable Humanosphere in Asia and Africa
- Industry-academia-government collaboration : Kousgi, Yoshiko : Modelling photosysnthesis and growth of warm season (C4) turf grasses

A-4.International cooperation and overseas activities

Membership in academic societies

- Tani, Makoto: IAHS/ICCLAS National representative

International meetings(country,roles)

- Tani, Makoto : 8th IAHS Scientific Assembly (Oral presentation)

International joint research, overseas research surveys

- Field investigations under Grants-in-Aid 'Gas exchanges of Southeast Asian tropical rainforest' (Kosugi, Yoshiko) (Forest Research Institute Malaysia)
- Official trip to France based on joint research project between FRANCE (INRA) – JAPAN (JSPS) on ‘the use of stable carbon isotope to understand the carbon cycle in the forest’ (Kosugi) (Nancy University and INRA)

B.Educational Activities(2009.4-2010.3)

B-1.On-campus teaching

a) Courses given

- Undergraduate level: Basic Science for Forest and Biomaterials 3 (Tani), Forest and Biomaterials Sceince 3 (Tani), Forest Hydrology (Tani), Interaction of Forest and Environment (Kosugi, Tani), Laboratory Course in Forest and Biomaterials Science 3 (Tani, Kosugi), Laboratory Course in Physics of Forest and Biomaterials (Kosugi), Laboratory Course in Forest Hydrology and Erosion Control (Tani, Kosugi), Practice in University Forest 2 (Tani, Kosugi).
- Graduate level: Special Lecture on Forest Hydrology (Tani), Seminar of Forest Hydrology (Tani, Kosugi), Special Laboratory Work in Forest Hydrology (Tani, Kosugi)

B-2.Off-campus teaching etc.

Part-time lecturer

- Tani: Kyoto Prefectural University, Faculty of Life and Environmental Sciences(Forest Hydrology)