

### 2.2.3 Laboratory : Forest Utilization

Member:	Professor	Osawa, Akira, Ph.D.
	Associate Professor	Okada, Naoki, Dr. Agric. Sci.
	Assistant Professor	Dannoura, Masako, Dr. Agric. Sci.
	Doctor's program	4
	Master's Program	7
	Undergraduate	3

#### **A. Research Activities (2009.4-2010.3)**

##### **A-1. Main Subjects**

###### **a) Stand development and carbon dynamics of boreal forests**

Stand development and carbon accumulation and dynamics after large-scale disturbances are studied in boreal forest ecosystems, particularly of high-latitude coniferous forests in the northern hemisphere. Chronosequence stands have been selected, their stand structures measured, and carbon dynamics patterns estimated by the ecological summation method in jack pine forests and black spruce forests of northern Canada. Sum of fine-root ingrowth and mortality was estimated. It was suggested that approximately 80% of NPP of these forest ecosystems goes to the fine-root increment. Generality of this estimate needs to be examined by further analyses. In addition, a new research on reconstructing forest structure in a forested area of about several square kilometers was initiated by applying the method of silvichronology.

###### **b) Growth of tropical trees**

Wood anatomical methods for detecting growth rings were applied to Leguminosae species in seasonally dry forests in Thailand, and crossconfirmed with the method of carbon isotope analysis. Vessel traits (mean lumen diameter, proportion of lumen area and vessel number per cross sectional area) showed cyclic changes along radius, indicating that the traits are under the influence of the growing environment. Mean lumen diameter and proportion of lumen area showed negative correlations with the carbon isotope ratio of xylem, whereas vessel density showed a positive one. The results indicated that the difference of soil moisture availability between the wet and dry seasons causes the variation of both carbon isotope ratio and vessel traits.

### c) Structure and function of broad-leaved trees

Tree species with homobaric and heterobaric leaves growing in a deciduous broad-leaved forest were compared with respect to their water relations. To evaluate the degree of heterobaric, compartment size index (CSI) was defined. CSI is the number of intersection points of 1 cm line and leaf vein. Drought tolerant species tend to have larger CSI values. Resource allocation within each first year branch was compared based on Huber value (cross sectional area of a shoot/ total leaf area) between ring-porous and diffuse-porous species. The former tend to have lower HV than the latter, but the trend was not so clear as observed for current year shoots. When we compared (water-conducting area of the branch/ total leaf area) among two groups, Ring-porous species had lower values than diffuse-porous species.

### d) Analysis of forest carbon dynamics with stable carbon isotope labelling

In a CATS (Carbon Allocation of Tree and Soil) project in France for carbon stable isotope labelling experiment, measurements of 1) continuous soil respiration for estimation of the velocity of photosynthate allocation to roots and 2)  $^{13}\text{C}$  carbon concentration in roots were conducted. The velocity of photosynthate allocation to belowground organs differed among three main tree species: beech, oak, and pine. It took 10-32h for the photosynthate to reach root systems in the angiosperm trees (beech and oak), but it was 40-120h, nearly four-folds in required time, in the gymnosperm (pine). The velocity of carbon movement in pine root was 0.09m/h in the pine.

## A-2.Publications and presentations

### a) Publications

#### Books

- Osawa, A., O.A. Zyryanova, Y. Matsuura, T. Kajimoto, and R.W. Wein (eds.): Permafrost Ecosystems: Siberian Larch Forests (Ecological Studies). Springer-Verlag, Berlin (2010)
- Osawa, A., O.A. Zyryanova: Introduction. In: A. Osawa et al. (eds.) Permafrost Ecosystems: Siberian Larch Forests (Ecological Studies). Springer-Verlag, Berlin (2010)
- Osawa, A., T. Kajimoto: Development of stand structure in larch forests. In: A. Osawa et al. (eds.) Permafrost Ecosystems: Siberian Larch Forests (Ecological Studies). Springer-Verlag, Berlin (2010)
- Osawa, A., Y. Matsuura, T. Kajimoto: Characteristics of larch forests in Siberia and potential responses to warming climate. In: A. Osawa et al. (eds.) Permafrost Ecosystems: Siberian Larch Forests (Ecological Studies). Springer-Verlag, Berlin

(2010)

- Kajimoto, T., A. Osawa, V.A. Usoltsev, A.P. Abaimov: Biomass and productivity of Siberian larch forest ecosystems. In: A. Osawa et al. (eds.) *Permafrost Ecosystems: Siberian Larch Forests (Ecological Studies)*. Springer-Verlag, Berlin (2010)
- Mori, S., S.G. Prokushkin, O.V. Masyagina, T. Ueda, A. Osawa, T. Kajimoto: Respiration of larch trees. In: A. Osawa et al. (eds.) *Permafrost Ecosystems: Siberian Larch Forests (Ecological Studies)*. Springer-Verlag, Berlin (2010)

#### Original Papers

- Mori S., K. Yamaji, A. Ishida, S.G. Prokushkin, O.V. Masyagina, A. Hagihara, R.A.T.M. Hoque, R. Suwa, A. Osawa, T. Nishizono, T. Ueda, M. Kinjo, T. Miyagi, T. Kajimoto, T. Koike, Y. Matsuura, T. Toma, O.A. Zyryanova, A.P. Abaimov, Y. Awaya, M.G. Araki, T. Kawasaki, Y. Chiba, M. Umari. (2010) Mixed-power scaling of whole-plant respiration from seedlings to giant trees. *Proceedings of the National Academy of Sciences, USA*. (2010).
- Tran V. D., A. Osawa, and T.T. Nguyen. Recovery process of a mountain forest after shifting cultivation in northwestern Vietnam. *Forest Ecology and Management* (2010).
- Ohashi, S., N. Okada, T. Nobuchi, S. Siripatanadilok, and T. Veenin (2009): Detecting invisible growth rings of trees in seasonally dry forests in Thailand: isotopic and wood anatomical approaches. *Trees - Structure and Function* -, 23, 813-822.
- Ohashi, S., N. Okada, S. Siripatanadilok, and T. Veenin (2009): Detecting tree rings of Leguminosae in tropical seasonal forests by wood anatomy. In: *Tropical Forestry Change in a Changing World*, 17-20, November 2008, Bangkok, vol. 2: *Tropical Forests and Climate Change*, 1-13.
- Eguchi, S., N. Okada, S. Siripatanadilok, and T. Veenin (2009): Opal phytolith fossils in the soil of tropical seasonal forest in Sakaerat, northeast Thailand. In: *Tropical Forestry Change in a Changing World*, 17-20, November 2008, Bangkok, vol. 5: *Dry Forest Ecology and Conservation*, 149-156.
- Partitioning of respiratory CO<sub>2</sub> fluxes from a C<sub>3</sub> turfgrass field, Kosugi, Y., Itoh, M., Matsubara, T., Takanashi, S., Osaka, K., Mizota, Y., Dannoura, M., Shimamura, T., and Makita, M., *J. Agric. Meteorol.*, 2010, in press.
- Seasonal patterns of root production of Japanese oak seedlings and dwarf bamboo grown in the rhizoboxes, Fukuzawa, K. Dannoura, M., Kanemitsu, S., Kosugi, Y., *Plant Biosystems*, 2010, in press.
- Fine root morphological traits determine variation in root respiration of *Quercus serrata*., Makita N., Hirano Y., Dannoura M., Kominami Y., Mizoguchi T., Ishii H. And

Kanazawa Y..Tree Physiology. 29, 2009, 461-481.

- Biomass and distribution of roots in a Pinus densiflora forest estimated by methods of destructive block sampling, trench wall and ground penetrating radar, Makita N., Hirano Y., Dannoura M., Yamase E., Aono K., Igarashi T., Ishii M. and Kanazawa Y., Root Research, 18(2), 2009.
- Tracing of recently assimilated carbon in respiration at high temporal resolution in the field with a tuneable diode laser absorption spectrometer after in situ <sup>13</sup>CO<sub>2</sub> pulse labelling of 20-year-old beech trees, Plain C., Gerant D., Maillard P., Dannoura M., Dong Y., Zeller B., Priault P., Parent F., and Epron D., Tree Physiology, 2009,

b) Conference and seminar papers presented

- The 19th Ann. Meet. Jpn. Soc. Trop. Ecol. (2 presentation)
- The 26th Ann. Meet. Jpn. Soc. For Sci. Studies on Cultural Properties (1 presentation)
- The 24th Ann. Meet. Jpn. Soc. Vegetation History (1 presentation)
- The 57th Ann. Meet. Jpn. Ecol. Soc. (2 presentation)
- 「Second mini symposium on the use of stable isotopes in tree physiology and forest ecology.」Nancy University, France, 3 Jul 2009, Poster 1件
- 「International symposium Root Research and Applications (RootRAP)」BOKU, Austria, 4 Sep 2009, Poster 1件
- 「AsiaFluxWorkingShop2009」28 Dec 2009, Hokkaido Univ., Japan, Poster 1件
- 「Analysing post labelling experiments COST Action: ES0806」3 Mar 2010., Nancy University, France, Oral 1件

**A-3.Off-campus activities**

Membership in academic societies

- Osawa, Akira, Ph.D. : Jpn. Forest Soc. (member), Jpn. Ecol. Soc. (member)
- Okada, Naoki, Doc. Agr. Sci. : Jpn. Forest Soc. (member), Jpn. Ecol. Soc. (member), Jpn. Soc. Trop. Ecol. (member), Jpn. Wood Res. Soc. (member)
- Dannoura, Masako, Doc. Agr. Sci. : Society for Root Studies (Advisory Board), Jpn. Forest Soc. (member)

Research grants

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

- Monbu-Kagakusho Research Grant: Scientific Research (B) (Overseas) : Osawa Akira :  
Silvichronology: Reconstruction of past increment in forest biomass, analysis of its variation,

and prediction for future growth

- Monbu-Kagakusho Research Grant: Scientific Research (B) (Overseas) : Okada Naoki :  
Forest fire and vegetation changes in the tropical seasonal forests in Thailand

## 2.Other Research Grants

- JSPS Japan-Russia Bilateral Exchange (Joint Research) : Osawa Akira : Plant species diversity  
and productivity in permafrost larch ecosystems of Central Siberia

## **A-4.International cooperation and overseas activities**

### International meetings(country,roles)

- Dannoura Masako : Asia Flux (member)

### International joint research, overseas research surveys

- Silvichronology: Reconstruction of past increment in forest biomass, analysis of its variation,  
and prediction for future growth, Osawa Akira, Canadian Forest Service, Pacific Forestry  
Centre, and Aurora Research Institute, Canada

- CATS (Integrated Monitoring Carbon Allocation in Tree and Soil project), Daniel EPRON,  
FRANCE

### Visiting Research Scholars

- Professor 1 (France)

## **B.Educational Activities(2009.4-2010.3)**

### **B-1.On-campus teaching**

#### a) Courses given

- Undergraduate level: Measuring tropical forests (Okada), Social and environmental  
changes under sustainable development in Monsoon Asia(Okada),  
Basic Science for Forest and Biomaterials IV (Osawa), Forest  
Utilization (Osawa), Tree Physiology (Okada), Mushroom Science  
(Okada), Reading of Foreign Literature II (Osawa), Seminar in  
Forest Utilization (Osawa, Okada, Dannoura), Introduction to  
Research (Osawa, Okada, Dannoura), Comprehensive Practice in  
Forest (Okada, Dannoura), Practice for Forest Utilization (Osawa,  
Okada, Dannoura), Laboratory Course in Forestry and Biomaterial  
Science IV (Okada),
- Graduate level: Scientific writing and presentation in English (Okada), Seminar in

Forest Utilization (Osawa, Okada, Dannoura), Laboratory course in  
Forest Utilization (Osawa, Okada, Dannoura)

### **B-3.Overseas teaching**

#### International students

- International students : Doctral 1 (Vietnam) Research Students 1 (France)

#### Lectures and seminars

- Osawa Akira

Global warming, carbon, and what goes on in jack pine forests(講師) : Wood Buffalo  
National Park, カナダ国立公園局(カナダ)

Forest carbon dynamics: boreal forests and other biomes(講師) : ベトナム森林科学研究所  
(ベトナム)

- Dannoura Masako

Contribution a l'etude de la variabilite spatiale des composantes du bilan de carbone d'un sol  
de foret tropicale humide(Examineur(博士論文審査官)) : ナンシー大学(フランス)

### **C.Other Remarks**

- Osawa Akira : Environment Agency, Integrated Global Environmental Studies Project,  
Advisory Board