Studies on the past environmental changes of the Lake Syumarinai watershed by dendrochronological analyses

Koh YASUE, Faculty of Agriculture, Shinshu University
and
Naoki OKADA, Graduate School of Agriculture, Kyoto University

The past environmental changes, especially the climatic changes, of the forest around the Lake Syumarinai were investigated using tree-ring data for hundreds years with yearly resolution.

1) Reconstruction of past summer climate since 1651

The potential usefulness of tree-ring data obtained by densitometric analysis, namely, early- and latewood width, maximum density and ring width, as indicators of climatic changes in Japan, has been evaluated. The observations on climatic responses of both conifer and hardwoods reveal that maximum density of Sakhalin spruce (*Picea glehnii* Mast.), ring width, early- and latewood width of Japanese ash (*Fraxinus mandshurica* var. *japonica* Maxim.) are significantly correlated with climate factors in summer. The summer (June to September) temperature and August precipitation in northern Hokkaido were reconstructed back to A.D. 1651.

2) Detection of climatic changes after the dam construction

The micro scale climatic changes after the construction of Uryu Dam (1943) was examined by comparison of climatic responses of tree-ring width, earlywood width, latewood width and maximum densities of Sakhalin spruce and Japanese ash. Four sampling sites for Sakhalin spruce and two sampling sites for Japanese ash were chosen. The measurement series revealed that abrupt changes in ring width of both Sakhalin spruce and Japanese ash around 1960. On the other hand, no clear changes in growth and responses to climate were found after the dam construction (Fig. 1). The result indicate that there was no clear changes in climate that affect tree growth.

3) Detection of environmental changes in the Dorokawa swamp

In order to reconstruct environmental changes in the Dorokawa swamp, we planned to analyze width, density and stable isotopes in annual rings of Sakhalin spruce and Japanese ash. In addition, seasonal changes in cambial activity was also observed from 2004 to ensure the timing of formation of xylem cells in an annual rings. The analyses on ring width, earlywood width, latewood width of Japanese ash revealed that earlywood width is negatively correlated with temperature of current June, while the chronologies of latewood are highly positively correlated with temperature of current June to August. The contrasting responses of early- and latewood widths to June

temperature and the significant relationship between earlywood widths and vessel numbers demonstrated that June temperature might affect the duration of large vessel formation, which regulate transition from earlywood to latewood. The analyses on stable isotopes (^{13}C and ^{18}O) are still in measurements. They might provide useful information on effect of water on radial growth. The two year observations on seasonal radial growth provided correct development process of annual ring (Fig.2) which should help to clarify relationships between climatic factors and the tree-ring parameters. The duration of earlywood formation was about one month and following latewood formation continues until late August. The result indicates that environmental changes occurred at different timing within a growth period can be detected by isotope analyses of sliced pieces of annual rings.

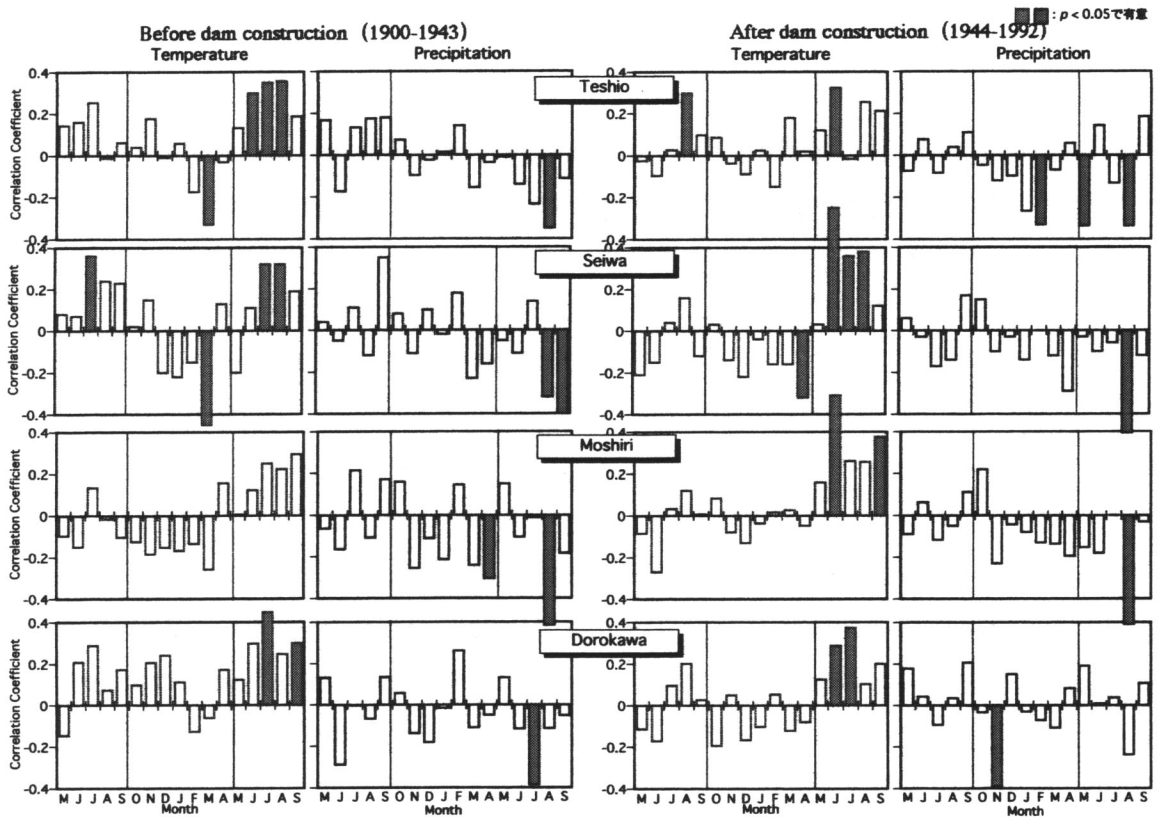

Fig. 1. Comparison of climatic responses of maximum density for Sakhalin spruce between before and after dam construction.

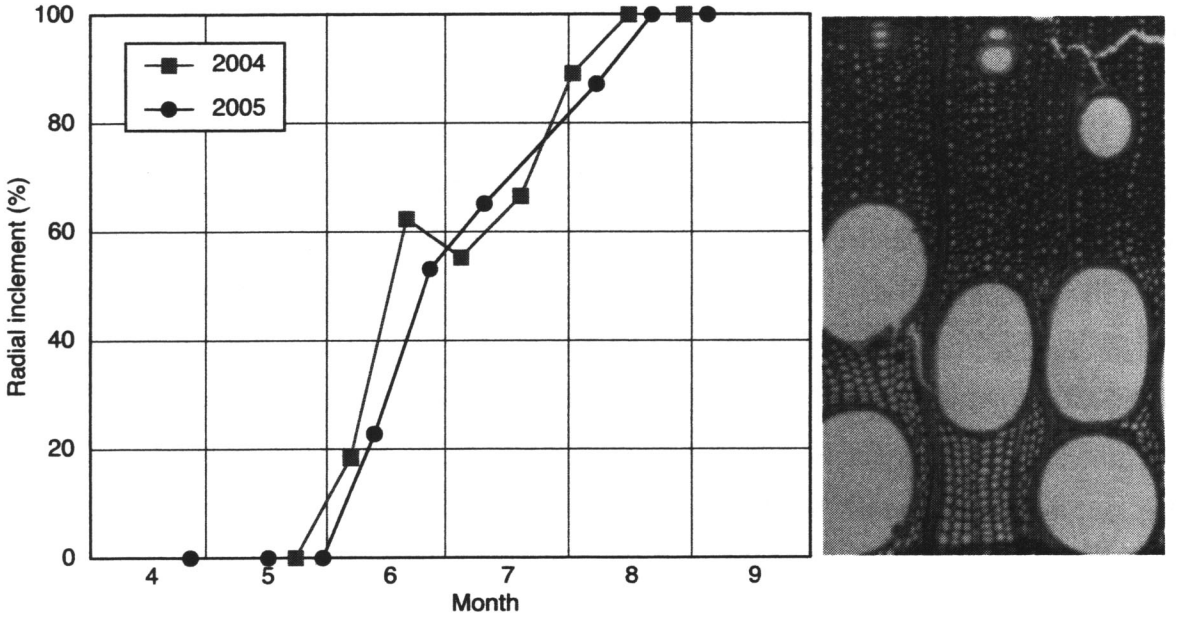

Fig. 2. Seasonal radial growth of Japanese ash growing in the Dorokawa swamp.