Carbon balance of larch forest in Japan

Ryuichi Hirata[1]; Yoshiyuki Takahashi[2]

[1] NIAES; [2] NIES

We report three-year measurement of net ecosystem CO2 exchange (NEE) over a planted Japanese larch forest in northern Japan, which is one of the most important forests for timber production in this area, using an eddy covariance technique from 2001 to 2003. The purposes are evaluate the interannul variation in the seasonal patterns of NEE, the annual NEE, and clarify characteristic of planted larch forest for carbon balance. The planted larch forest absorbed a large amount of CO2, which account for 80-140% of annual CO2 uptake, during only a month, June, although GPP and RE accounted for about 20 and 10%, respectively. During this period, PPFD was large and temperature was not so high, and these meteorological conditions were suitable for CO2 absorption before leaf area index (LAI) reached the peak. Additionally, maximum GPP at light saturation (Pmax) was large and the leaf photosynthesis capacity also should be large. During the three-year measurement period, photosynthesis photon flux density (PPFD) in summer and temperature in spring and summer caused remarkable interannual difference of GPP, RE and NEE. In spring, snowmelt and larch foliation occurred about two weeks earlier in 2002 than in 2001 and 2003 because of higher temperature; thereby, the ecosystem began to photosynthesize earlier. In July, NEE was less negative in 2003 than in other years. The reason is that GPP became larger because of higher PPFD, larger Pmax; and RE became smaller because of lower temperature. Compared with other forests in similar forest type, the amounts of GPP and RE were large although that of NEE was almost similar. The reason is that the photosynthesis capacity of larch is originally large, PPFD is sufficient in early summer and there are no stresses of dry air and soil. Consequently, cool temperate, humid and much rainy climate in northern Japan maintains high

Compared with similar forests, the amounts of GPP and RE measured here were large, but NEE was similar. The reason is that the photosynthetic capacity of larch is naturally large: the ample PPFD, and the lack of environmental stresses from dry air or soil, consequently allows high photosynthesis rates to be maintained. Moreover, it can be inferred that RE values are enhanced by the high photosynthetic activity of larch forest during the growing season.