광릉시험림의 식생 및 바이오메스 생산

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Vegetaion and Biomass Production of Kwangneung Natural Forest in Korea

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I. Introduction

The study area, which is the KEF region (Kwangneung Experimental Forest of FRI Korea) is located at the west-central portion of the Korean peninsula and covers 2,240ha. This area was originally protected as a royal tomb forest for King Sejo during the Chosun Dynasty since 1468. Most of the original protected area of 2,286ha was designated as a experimental forest of Forestry Research Institute (FRI) Korea in 1913 (FRI of the Government-General of Korea, 1932). The area of Kwangneung Natural Reserve Forest is about 1,200ha, which has been protected from human activities. It mainly consists of unique old-growth forests composed of broad-leaved trees in the middle zone of temperate forest in Korea. It is found that about 796 native plant species have grown in this area (FRI Korea, 1994), which is dominated by typical tree species of middle temperate zone in Korea such as *Quercus* spp., *Carpinus* spp., *Cornus* spp. *Acer* spp. and *Pinus densiflora* (Lee *et al.*, 1990; Oh *et al.*, 1991). The major cause of succession in the natural Kwangneung Experimental Forest is gaps created by the deaths of trees. There are some large *Q. serrata* trees greater than 100 cm in DBH.

The objective of the study is to see the vegetation, biomass and primary production at the KEF, where is one of the typical old-growth natural forests in Korea.

II. Materials and Methods

To identify the types of vegetation of the natural KEF, 120 plots of 20×20m were investigated by Braun-Blanquet table method. To estimate biomass in the natural KEF, 81 plots of 20×20m quadrat were sampled. For all the trees larger than 5cm in DBH, species and DBH were measured. And then, the total biomass of each tree including below ground biomass were estimated by the equations driven by Lim (1998).

- For the trees whose gravities of woody parts is high, including *Quercus* spp., *Carpinus* spp., *Fraxinus* spp. and *Acer* spp (mostly broad-leaved trees).
  $B = 0.1673\ D^{2.393}$ ($R^2 = 0.964$, $p<0.001$), where, B is total biomass including below groud parts (dry matter, kg), and D is DBH(cm).
- For the trees whose gravities of woody parts is low, including *Pinus* spp. (mostly coniferous trees)
  $B = 0.086\ D^{2.393}$.

Primary production at the natural KEF was estimated by You (1994). He set three quadrats of

10×30m, near Soribong in natural KEF at which *Q. serrata, C. laxiflora* and *C. cordata* were dominants. DBH of the trees in plots were measured on December in 1991, 1992 and 1993, and the measuring position was identified by marking with paints.

III. Results and Discussion

3.1 Vegetation of the natural KEF

On the natural KEF, there was *Carpinus laxiflora* community group and classified into 4 communities of typical *Carpinus laxiflora* community, *Acer mono-Staphylea bumalda* community, *Cornus controversa-Alangium plantiflorium* community and *Rhus trichocarpa -Atractylodes japonica* community. All over the natural KEF area, *C. laxiflora* was widely distributed and showed stable size distribution. According to the result of community classification by TWINSPAN method, it was classified into two groups by soil moisture content. Vegetation represented by *C. laxiflora* and *Q. mongolica* was distributed at the relatively dry areas, and that by *A. mono, S. bumalda, Carpinus cordata* and *Callicarpa japonica* was found at the moist areas. Present vegetation map the KEF area was drawn by considering the representative species, geographical factors and their physiognomies. The vegetation units of the map was divided into 8 forest types of *C. laxiflora-Q.mongolica* forest, *C. laxiflora-Q.serrata* forest, *C. laxiflora* forest, *C. laxiflora-C. cordata* forest, *C. laxiflora-C. controversa* forest, *P. densiflora-C. cordata* forest, *P. densiflora-C. laxiflora* forest and plantation.

In view of ecological stability, *C. laxiflora* would dominate and be stabilized on the ridges and hillside, *C. cordata* on the foot mountain and valley, *Q. mongolica* at the peak mountain, and *C. controversa* and *Celtis jessoensis* at deep valley. Even though, present dominance of *Q. serrata* was the second by *C. cordata* on the foot mountain area, the dominance *Q. mongolica* was expected to be maintained when we consider it's maximum dimension and life span are much higher than those of *C. cordata*. After synthesizing the results of size distributions and analysing of possibilities of potential vegetation, the peak mountain the potential vegetation map of the natural KEF was drawn. And the vegetaion units were divided into 4 forest types of *Q. mongolica* forest, *C. laxiflora* forest, *C. cordata* forest and *C. controversa* forest.

3.2 Biomass and Primary Production of the Natural KEF

As the result, the biomass of the natural KEF was 282.8 ± 11.2 tons/ha (mean±standard error). This amount is relatively high when compared with the 35-years old *P. koraiensis* plantation in the KEF which has 109.4 tons/ha of above-ground biomass (Lee *et al.*, 1998). This is because the gravity of the *P. koraiensis* tree is low, and the plantation is not full stocked yet. This amount of biomass is much higher than 178 tons/ha estimated at the natural forest of Piagol in Mt. Chrisan (Kim *et al.*, 1982).

However, when we compare with the data of old-growth natural forests in temperate region, this value is close to them, such as 251 tons/ha at the 100 to 150 years-old *Fagus* forest in Japan (Kawahara *et al.* 1979), and from 200 to 600 tons/ha in old-growth forest reported by Whittaker and Marks (1975)

Standing biomass of the sample plots was 286.99 tons/ha, and it was much close to the estimated mean value of the whole natural KEF estimated above. Estimated primary productivity

of the natural KEF was 3.00 tons/ha/year. This value is much lower compare with that of cool-temperate region of 5 to 20 tons/ha/year (Kira and Shidei, 1967). It is widely acknowledged that biomass be accumulated with time and reach to their maximum at the steady state.

IV. Conclusions

On the natural KEF, *C. laxiflora* was widely distributed and showed stable size distribution. Present vegetation units of the map was divided into 8 forest types of *C. laxiflora-Q.mongolica* forest, *C. laxiflora-Q.serrata* forest, *C. laxiflora* forest, *C. laxiflora-C. cordata* forest, *C.laxiflora-C.controversa* forest, *P. densiflora-C. cordata* forest, *P. densiflora-C. laxiflora* forest and plantation. In view of ecological stability, *C. laxiflora* would dominate and be stabilized on the ridges and hillside, *C. cordata* on the foot mountain and valley, *Q. mongolica* at the peak mountain, and *C. controversa* and *Celtis jessoensis* at deep valley. Dominance *Q. mongolica* was expected to be maintained at the foot mountain area when we consider it's maximum dimension and life span. After synthesizing the results of size distribution patterns and analysing of possibilities of potential vegetation, the peak mountain the potential vegetation units were divided into 4 forest types of *Q. mongolica* forest, *C. laxiflora* forest, *C. cordata* forest and *C. controversa* forest. The biomass of the natural KEF was 282.8 $\pm$ 11.2 tons/ha (mean$\pm$standard error). Estimated primary productivity of the natural KEF was 3.0 tons/ha/year. This value is much lower compare with that of cool-temperate region of 5 to 20 tons/ha/year. It is conclude that the natural KEF was almost reached to their maximum at the steady state.