An Advance Report of the Vegetation Sub-group of the ICCAP in FY2005

-Field research on the vegetation productivity and the estimation of future vegetation patterns-

Vegetation Sub-group

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1. Introduction

The purpose of vegetation sub-group is to clear the relationship between air temperature and precipitation, and the species composition and productivity of vegetation in the Eastern Mediterranean Region of Turkey. As many vegetation types are found along the climatic and topographic gradient in Turkey (Yilmaz, 1998; Altan, 2000), we set some broader area as a research site to estimate the distributional patterns of vegetation. Photosynthesis rate and water potential of main tree species were measured at the research field to estimate productivity of vegetation. Also we estimate present and future potential vegetation, and assess relationships between environmental factors and vegetation patterns.

In this report we focused on the changes in vegetation distribution especially of those tree species after climate changes in this region.

2. Methods

We used two approaches for the purpose, (1) making present vegetation map by using satellite photographs (LANDSAT ETM+, resolution 30 m, 8 bands, 13 June 2000) with 100 ground control points, and (2) estimation of potential vegetation by using the Thornthwaite p/e Index (PEI) and the Warmth Index (WI) calculated from the climate data at present and the future (2070) provided from the Climate Sub-group of ICCAP. The definition of each index is as follows;

Thornthwaite p/e Index (Thornthwaite, 1931, 1948):

$p/e = 0.164\{p/(t+12.2)\}^{1.11}$ $PEI = 10\Sigma p/e$

T10: PEI<16: Perarid
T20: 16～32: Arid
T30: 32～64; Semi-arid
T40: 64～: Humid

Warmth Index (WI) (Kira, 1976):

$WI=\Sigma(t-5)$ $t>5℃$

W1: 15-45: sub-arctic zone, evergreen coniferous forest
W2: 45-85: cool-temperate zone, broadleaved deciduous forest
W3: 85-180: warm-temperate zone, evergreen forest

We combined these two indices for classification of potential vegetation.

T10W3 (13): Desert
T20W3 (33): Steppe
T30W2 (32): Woodland a
T30W3 (33): Woodland b
T40W1 (41): Evergreen coniferous forest
T40W2 (42): Broadleaved deciduous forest
T40W3 (43): Maquis

Then present and future patterns of potential vegetation were estimated.

3. Results and Discussion

First, we could find out the vegetation distribution and some environmental factors affecting on it, using satellite images and topographic maps. The present vegetation map obtained from unsupervised classification method is represented as Figure 1. We found eleven classes for land use patterns. Most abundant class was grassland (23.9 %), and wildgrass or crops (22.6 %), soil 1 (16.3 %), *Pinus brutia* (10.5 %), water (9.8 %), soil 2 (8.2 %), and mixed forest (3.9 %) were followed (See Photo 1). Maquis and *Pinus nigra* had very low values (0.8 and 0.3 %, respectively). *Pinus nigra* and mixed forests were found at higher elevation parts (Photo 2), and maquis shrubs were at lower parts. The other classes (grassland and *Pinus brutia*) were at relatively even distribution. These suggest the impact of human beings especially for lowland areas in this region.

Second, we could estimate the potential patterns of vegetation distribution using climate data at present and future. The present and future patterns of the Thornswait p/e Index and WI were estimated as Figures 2 and 3, respectively. Then we produced potential vegetation maps from the combined classification of the Thornthwaite p/e Index and WI (Figure 4). Relative areas of Steppe, Woodland a, Woodland b, Evergreen coniferous forest, Broadleaved deciduous forest and Maquis were 1, 10, 26, 1, 45, 18 %, respectively in the present patterns (Figure 5). While those of Desert, Steppe, Woodland a, Woodland b, Broadleaved deciduous forest and Maquis were different (Figure 6). The difference should indicate the strong impact of global warming and drier climate in the future prospects for potential vegetation after climate changes in this region.

4. Further studies

As the vegetation of the Eastern Mediterranean Region of Turkey had been severely disturbed by anthropogenic pressure, it is very hard to estimate vegetation in the past (Tamai et al., 2005). However, we can estimate the impact of human beings by analyzing the difference between actual and potential vegetation especially on grassland area, meadow and wheat field. Moreover, we should collect biomass data to estimate productivity of vegetation such as Maquis, *Pinus brutia, Quercus* spp. and conifers, Analyses on more environmental factors and vegetation functioning related to the distribution and productivity of vegetation such as soil conditions, physiological factors and human impact should be required. Using these data we estimate the actual vegetation distribution in 2070 and the impact of climate changes on the patterns of vegetation in this region.

5. Acknowledgments

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6. References

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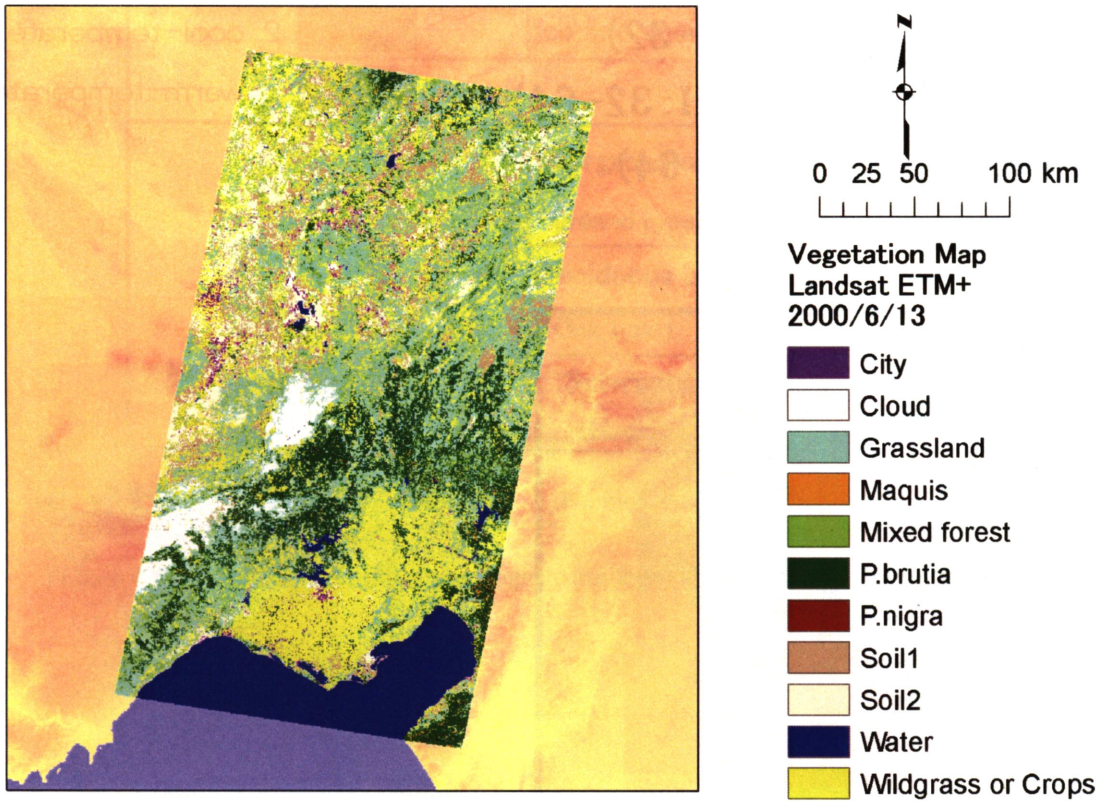

Figure 1. Present vegetation map of the research site on 13 June 2000 (LANDSAT ETM+)

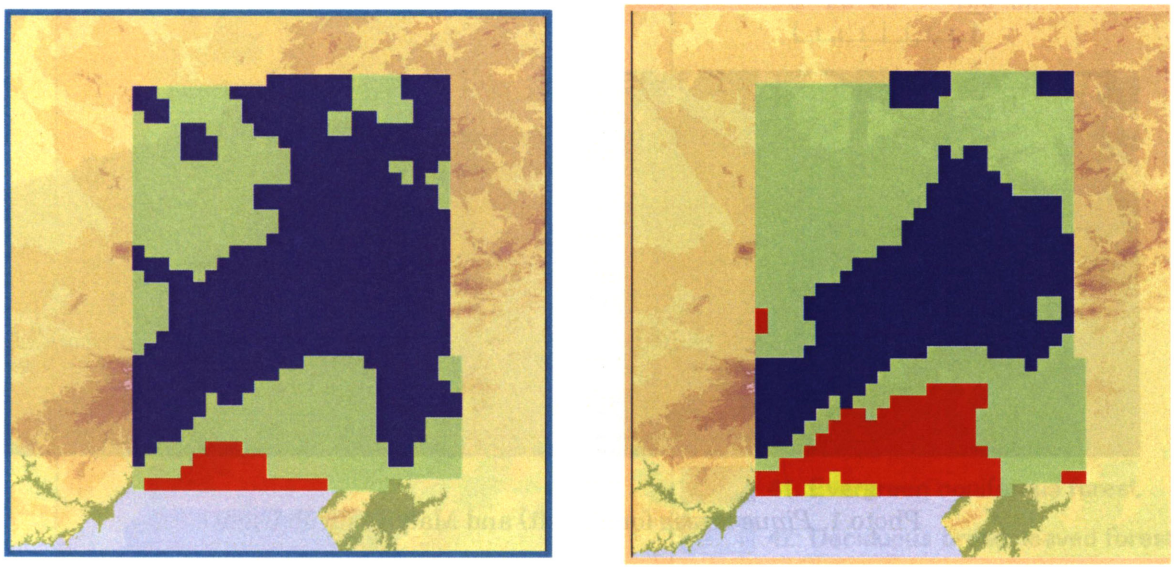

Figure 2. Thornswait p/e Index maps at present (left) and in future (right).
See next page for legends.

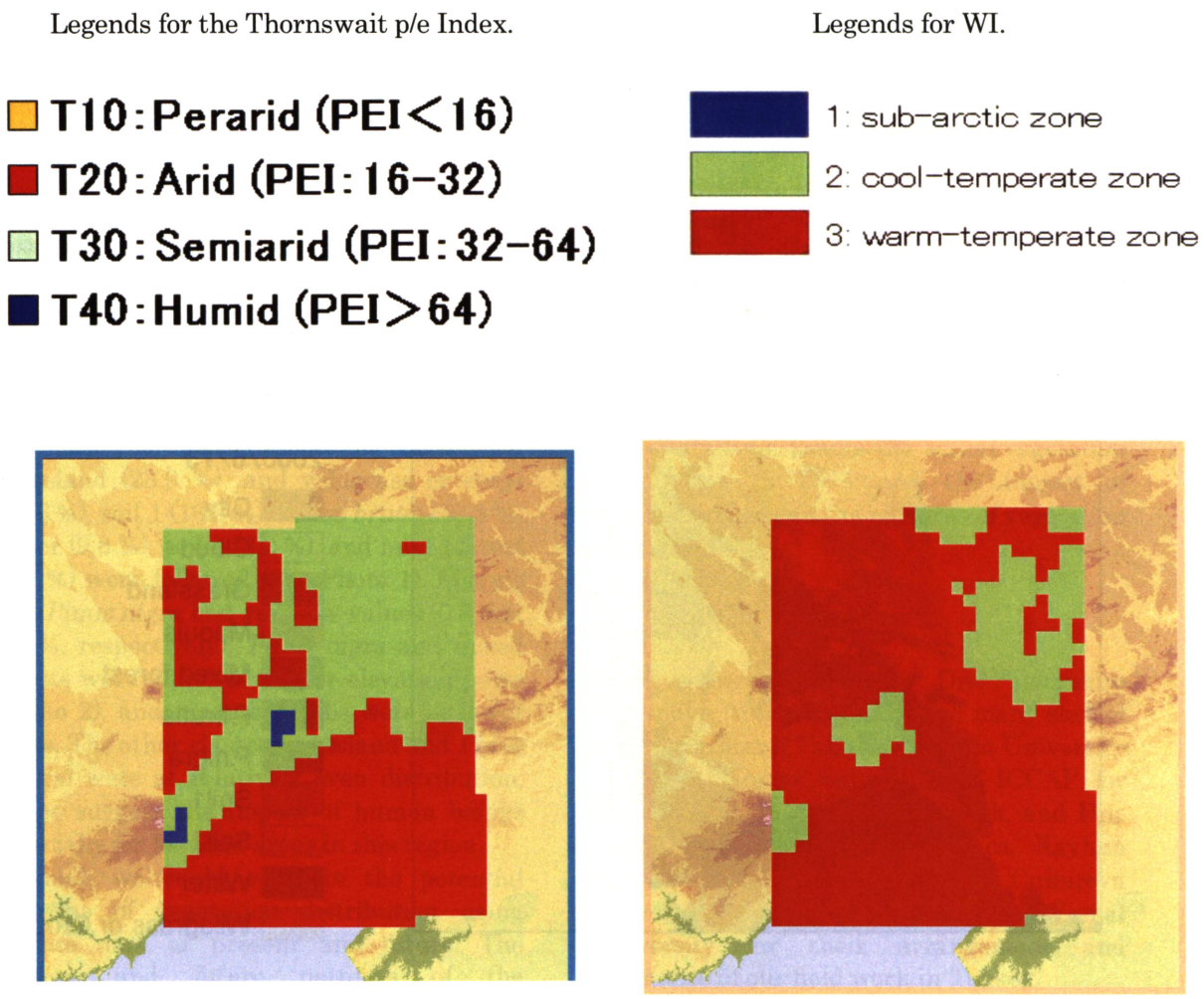

Figure 3. WI maps at present (left) and in future (right).

Photo 1. *Pinus brutia* forest (left) and Maquis shrub (right).

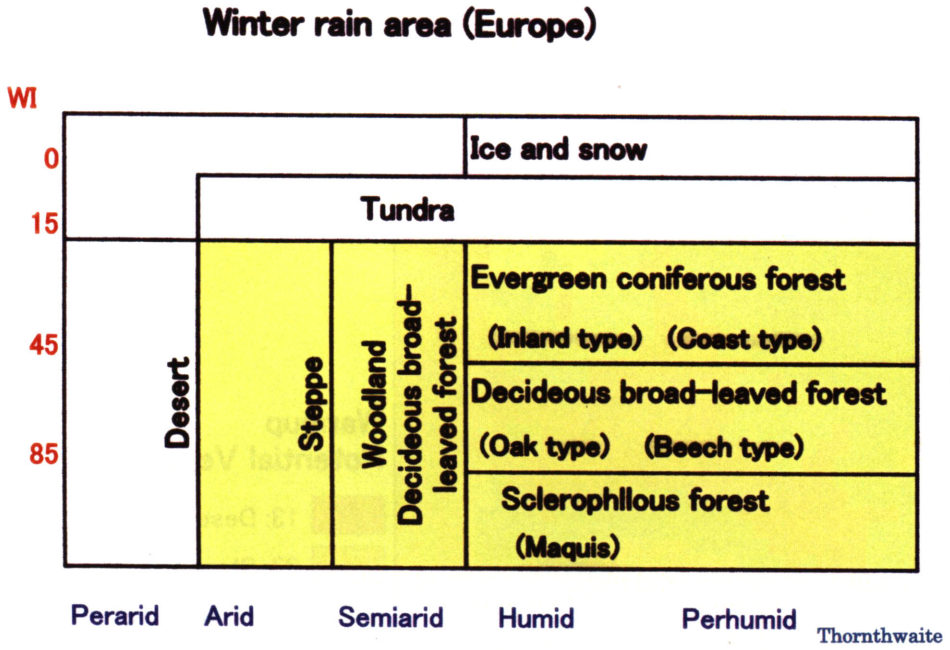

Figure 4. Classification of potential vegetation from the Thornswaite Index and WI

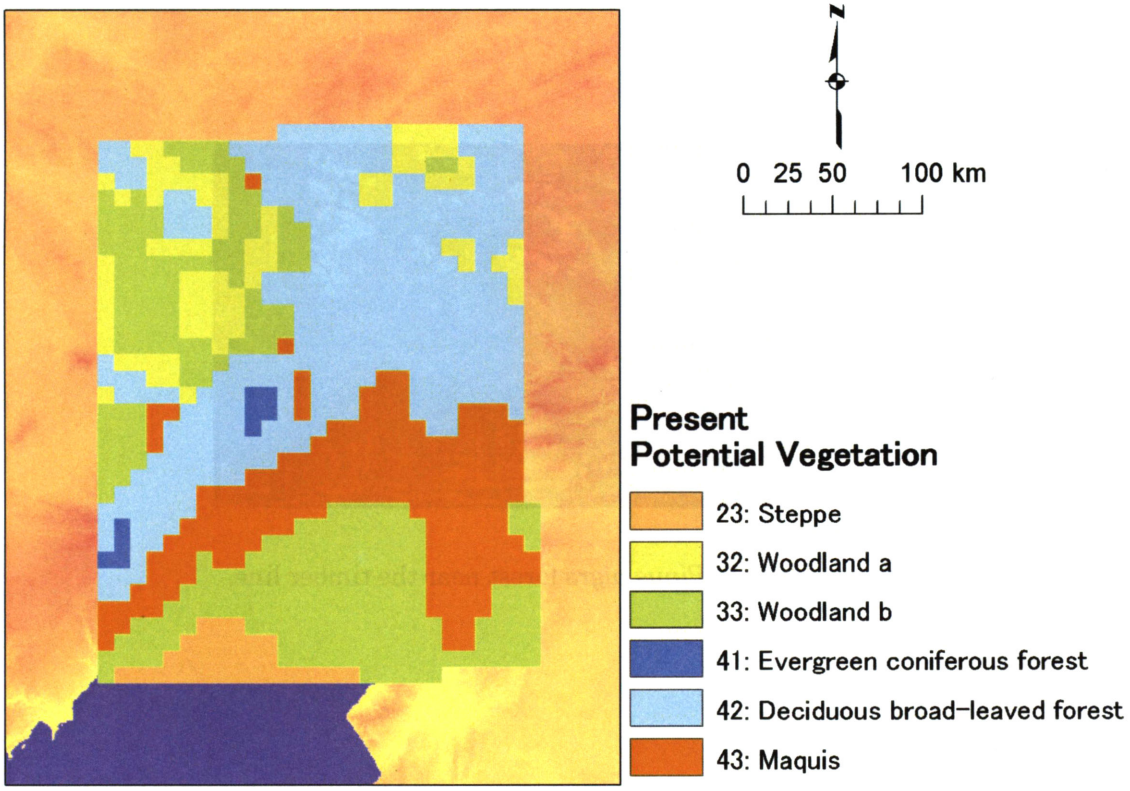

Figure 5. Estimated potential vegetation map at present

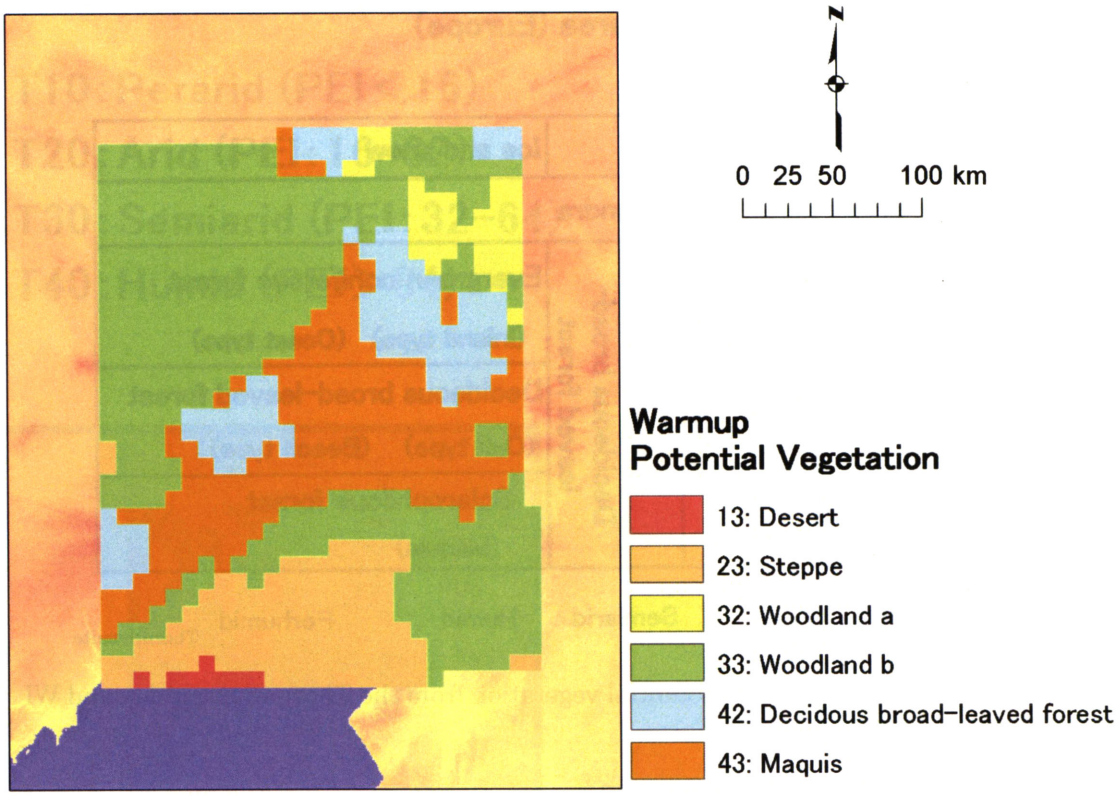

Figure 6. Estimated potential vegetation map after warming up in the future (2070)

Photo 2. *Pinus nigra* forest near the timber line.