Field Research of Dominant Vegetation and Environmental factors on the Basis of Projection on the Vegetation Change after Global Warming in the Eastern Mediterranean Region of Turkey

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1. Introduction

Climate changes especially global warming are increasingly threatening natural ecosystems as well as human-induced disturbances (Evrendilek and Wali, 2004). Our purpose is to clear the relationship between global warming and vegetation change in relation to anthropogenic impact in the eastern Mediterranean region of Turkey. We researched the species composition and structure of dominant vegetation types and some environmental factors from the coastal line to the timber line. There are various vegetation types along the climatic and topographic gradient in Turkey (Yilmaz, 1998). In this region, the most frequently occurring evergreen forests are Pinus brutia secondary forests. Other confers are Pinus halepensis in the coastal regions, and Abies cilicia and Cedrus libani in the higher part of mountains. The most commonly occurring deciduous forest trees are various kind of Quercus species such as Q. coccifera, Q. infectoria and Q. cerris. Other common trees, mostly seen in mid-altitude mixed forests, are Carpinus, Fraxinus, Styrax and some

maquis species such as *Arbutus andrachne* and *Q. coccifera* (Sano et al. 2003; Ando et al. 2004). Steppe-type vegetation is widespread in the dry and cold climatic zone, although anthropogenic, or man-made destruction is clearly visible as well as the lowlands of Central and Western Europe (Vera 2000).

2. Study area and methods

In 2003 and 2004, species composition, stand structure and environmental factors were measured at fourteen plots (Table 1 and 2) under relatively good conditions left from the Mediterranean coast to the mountain (ca. 0-2000 m a. s. l.) in the following regions; (1) Yumurtalik and Adana, (2) Catalan, (3) Karatepe, and (4) Aladag. We measured DBH and tree height for each individual, and slope direction, inclination, altitude, latitude and longitude for each plot. Cores with increment borers and hemispherical photographs using NIKON Coolpix 950 digital camera with a fisheye converter were taken in each plot.

Table 1 Stand characteristics of research plots in 2005									
Plot	1	2	3	4	5	6	7		
	Yumurtalik	Catalan	Karatepe 1	Karatepe 2	Aladag 2	Aladag 3	Aladag 1		
Dominant	Pinus	Pinus	Pinus	Arbutus	Pinus	Abies	Cedrus,		
species	halepensis	brutia	brutia	andrachne	brutia	cilicica	Abies		
Size mxm	50x40	20x20	30x20	15x6	50x30	40x40	30x20		
Inclination	2	10	21	21	10	26	12		
Direction	N50W	N40W	N45E	N30W	N65W	N60W	S35E		
Ν	36°44′49.2	37°12′04.4	37°17′45.4	37°15′48.4	37°33′32.9	37°28′06.4	37°36′20.8		
E	35°37′40.4	35°15′22.4	36°15′02.7	36°13′35.5	35°23′31.7	35°19′10.1	35°29′17.3		
Altitude	3	151	253	559	793	1223	1532		

Table 1 Stand characteristics of research plots in 2003

Table 2 Stand characteristics of research plots in 2004										
Plot	8	9	10	11	12	13	14			
	Catalan 1	Catalan 2	Aladag 1	Aladag 2	Aladag 3	Aladag 4	Adana			
Dominant	Pinus	Pinus	Pinus	Pinus	Cedrus	Abies	Quercus			
species	brutia	brutia	nigra	nigra	libani	cilicica	coccifera			
Size mxm	20x20	20x20	20x40	20x20	20x40	20x40	10x10			
Inclination	18	22	18	20	10	15	32			
Direction	S70W	S55W	N60E	N70W	N80E	N80W	N80E			
Ν	37°16′47.9	37°16′03.4	37°37′28.6	37°37′31.7	37°36′28.8	37°36′25.9	37°03′51.1			
E	35°11′16.6	35°11′37.6	35°28′13.7	35°28′43.2	35°28′53.7	35°28′51.0	35°21′18.2			
Altitude	263	329	1951	1840	1403	1379	102			

Table 2 Stand characteristics of research plots in 2004

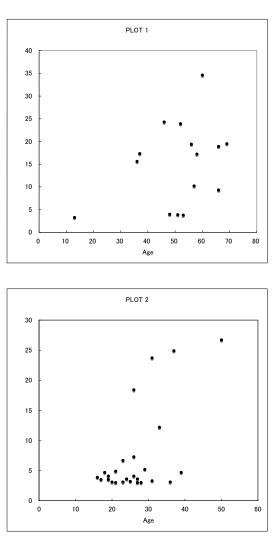
3. Results and discussion

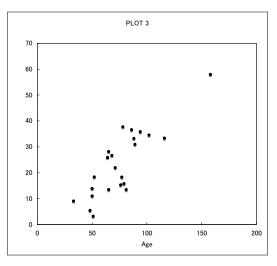
Tree species composition with relative basal area (BA%) in each plot is shown as Table 3. There were 22 species occurred in our research plots. Dominant tree species were Quercus coccifera with many maquis species in low land area, Pinus brutia in the mid-altitude regions, Abies cilicica, Cedrus libani and Pinus nigra in the subalpine region. Pinus nigra was found on relatively high-altitude area, which formed pure stands.

Table 3 Species composition and dominance (BA %) of trees in each plot along elevation

									%) of tre						10
$ \begin{array}{c cccc} \hline Pinus & 100.0 \\ halepensis \\ Quercus & 78.6 & 0.5 & 2.1 & 0.0 & 20.3 \\ coccifera & & & & & & \\ Cistus & & & & & & & \\ Pistacia & & 1.6 \\ terebinhus \\ Philtyrea & 2.4 & & 0.3 \\ latifolia & & & & & \\ Philtyrea & & & & & & & \\ Philtyrea & & & & & & & \\ Philtyrea & & & & & & & \\ Philtyrea & & & & & & & \\ Philtyrea & & & & & & & \\ Philtyrea & & & & & & & \\ Philtyrea & & & & & & & \\ Philtyrea & & & & & & & \\ Philtyrea & & & & & & & \\ Philtyrea & & & & & & & \\ Philtyrea & & & & & & & \\ Philtyrea & & & & & \\ Philtyrea & & & & & \\ Philtyrea & & & & & \\ Philtyrides & & & & & \\ Olea & & & & & \\ Olea & & & & & & \\ Olea & & & & & & \\ Olea & & & & \\ Olea & & & & & \\ Olea & & & & & \\ Olea & & & & \\ Olea & & & & & \\ Olea & & & & \\ Ole$	Plot	1	14	2	3	8	9	4	5	6	13	12	7	11	10
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Relationship between tree age and size (DBH) in each plot is shown as Figure 1. Generally showing positive relations that size increased along age, it had great variance of size for a given age, which means difference of growth in each tree.





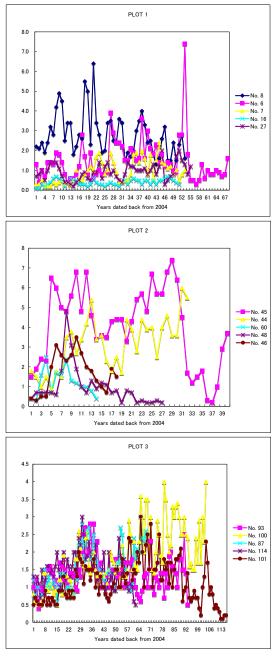
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Age

Fig. 1. Relationship between tree age and DBH in each plot

Annual tree growth of radius in each plot is shown as Figure 2. It had growth variations year by year. The fluctuation, however, did not show the obvious pattern of the evidence of climate change. Further research and analysis are required to reveal the issues on the relationship between tree growth and climate.



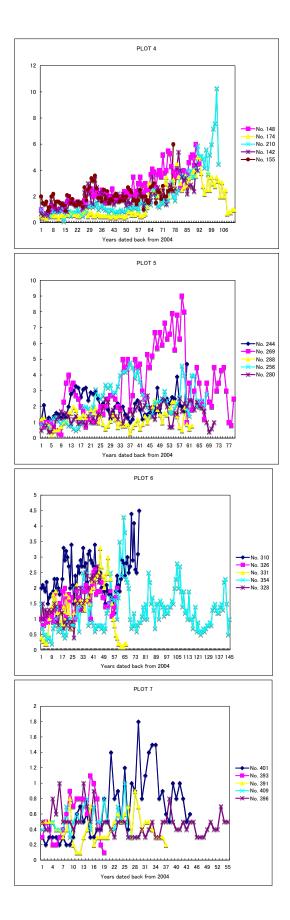


Fig. 2. Annual growth of radius along age in each plot

		14	ble 4 Callopy		ten plot		
Plot	1 Yumurtalik	2 Catalan	3 Karatepe 1	4 Karatepe 2	5 Aladag 2	6 Aladag 3	7 Aladag 1
Date	20030823	20030829	20030827	20030828	20030825	20030825	20030824
Mean	49.024	72.587	71.745	78.139	64.862	84.502	80.718
SD	12.111	2.642	3.638	4.957	3.593	3.082	3.870
CV	24.704	3.640	5.070	6.344	5.540	3.648	4.794
Max	62.190	76.021	76.735	86.375	71.074	88.626	87.878
Min	24.698	69.642	67.141	73.160	57.988	81.607	77.497

Table 4 Canopy cover (%) in each plot

Canopy cover in each plot is shown as Table 4. It seems to be depend on elevation.

Canopy cover was extremely low at Plot 1 in Yumurtalik because of scarce distribution of canopy trees dominated by *Pinus halepensis* (Figure 3a). On the other hand, relatively high covers of canopy trees were shown at Plot 6 and 7 in Aladag, higher part of this region (Figure 3b).

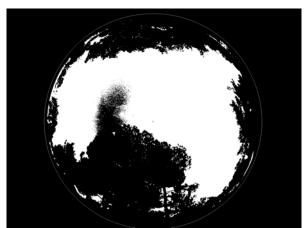


Fig. 3a. Hemispherical photograph at Plot 1 in Yumurtalik

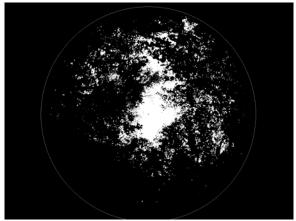


Fig. 3b. Hemispherical photograph at Plot 7 in Aladag

Long-term monitoring and sustainable management of natural resources are required for future generations (Kilik et al. 2003). We should pay attention to the vegetation change with climate change in future.

4. Acknowledgements

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5. References

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