

The Vertical Distribution of the Vegetation on Cukurova Plain in the Eastern Mediterranean Region of Turkey

Makoto ANDO¹, Junji SANO² and Shigenobu TAMAI³

¹Field Science Education and Research Center, Kyoto University, Kitashirakawa, Sakyo-ku, Kyoto 606-8502, JAPAN

²Forest Ecology and Ecosystem Management Laboratory, Tottori University Forests, Faculty of Agriculture, Tottori University, 4-101 Koyama-minami, Tottori 680-8553, JAPAN

³Arid land Research Center, Tottori University, 1390 Hamasaka, Tottori, 680-0001, JAPAN

1. Introduction

There are various vegetation types along the climatic and topographic gradient in Turkey (Altan, 2000). Especially in the eastern Mediterranean region of Turkey, they contain a number of differing biotopes such as grassland above the timber line, evergreen coniferous and deciduous broad-leaved forests, scrubland, river beds, lagoons, coastal saltmarshes, coastal woodland, and sand dunes. And, the cold climate in the north and arid/semi-arid zones in the south, help to enhance the ecological diversity of the Anatolian Peninsula and there is a considerable diversity of flora in the mountainous region (Yilmaz, 1998). If global warming occurred, it will most likely affect the vertical distribution of the vegetation of this region through changing complexly the distribution of each species.

2. Investigation site

This region has been strongly affected by past human activities since at least the early Neolithic period. Though it is known that not only the mountainous part of the region but also the present Ceyhan and lower Seyhan plains were covered with dense oak forests in the eighteenth century, it is difficult to find natural vegetation, especially in the plains and the low elevation area of the mountains now (Yilmaz, 1998).

The field surveys of vegetation distribution and land use were done on the basin of the Seyhan and Ceyhan rivers from 2002 to 2006, and 14 permanent plots were set to investigate the stand structure of main forests in the area where natural state were remained comparatively from the Mediterranean coast to the mountain region (ca. 2,000m a. s. l.).

3. Vertical Distribution of the Vegetation

Above the timberline, which is at about 2,000m above sea level, sub-alpine grasslands, characterized by thorn-cushion formations of *Astragalus* sp. and *Acantholimon* sp., dominate.

Between 1,000(1,200)m and 2,000m, *Pinus nigra*, *Cedrus libani*, *Abies cilicica*, *Juniperus excelsa*, *J.oxycedrus* and *J.drupacea*, form a montane forest type. Various species of deciduous oak, such as *Quercus cerris*, and others like *Ostrya carpinifolia*, *Carpinus orientalis*, *Fraxinus* sp. and *Sorbus* sp. mix with conifers or dominate. *Fagus orientalis* and *Quercus libani* appear partly at the middle and lower parts of this range. *Styrax officinalis*, *Daphne oleoides*, *Sambucus nigra* etc. are seen at lower tree layer and the shrub layer, too.

Coniferous forest dominated *Pinus brutia* is to be found up to an altitude of 1,000(1,200)m. and is replaced by *Pinus nigra*. *Platanus orientalis* dominates in the riparian forest, and *Tamarix* sp., *Nerium oleander* and *Cotinus coggyria* appear. Furthermore, up to an altitude of 600m, a dense, xerophyll scrubland, called maquis, dominates and understory vegetation of *Pinus brutia* forest becomes rich. Maquis mainly consists of several species of evergreen shrub. The most common species in the maquis region is *Quercus coccifera* and mixes up *Phillyrea latifolia*, *Myrtus communis*, *Arbutus andrachne*, *Erica manipuliflora*, *Pistacia terebinthus*, *Pistacia lentiscus* etc. or deciduous trees species such as *Styrax officinalis*, *Cercis siliquastrum* *Cotinus coggyria* etc. If *Pinus brutia* forest and maquis are degraded, they are replaced by garrigue formation consisting of several dwarf species such as *Cistus* sp. (*C.salviifolius* and *C.creticus*), *Lithodora hispidula*, *Rubus sanctus*, thorn tree such as *Calicotome villosa*, *Capparis spinosa* and *Paliurus spina-christi* as well as *Myrtus communis* and *Erica manipuliflora*. Garrigue formation is common from the coast up to

approximately 500m above sea level. This is due mainly to the intensive influence of man in this region.

On the plain, where cultivation is intensive, it is not easy to find any patches of natural vegetation. Few old, solitary trees of *Quercus ithaburensis* ssp. *macrolepis* from the former oak forest remain and *Prosopis farcta* penetrates on the cultivated land.

The margins of stream in the plain and the wetlands around coast are covered with dense reed beds (*Phragmites australis*).

Around the river estuaries, salt marshes cover large areas on the hydromorphic alluvial soils. This type of biotope has an almost uniform vegetation aspect, consisting of hallophytes such as *Arthrocnemum* sp., *Salicornia europaea* and *Atriplex portulacoides* in variable dominance. A patch of coastal woodland, remaining from a former evergreen forest, is located at Yumurtaalik Bay. This woodland community, which is surrounded by the saltmarsh, is dominated by *Pinus halepensis*. However, due to intensive grazing, the undergrowth has largely been degraded to garrigue-type vegetation with *Erica manipuliflora*, *Myrtus communis*, *Cistus* sp., *Pistacia terebinthus*, *Pistacia lentiscus*, *Tamarix smyrnensis*, *Juncus maritimus*, *Vitex agnus-castus*, *Imperata cylindrica*, *Nerium oleander*, *Cionura erecta* etc.

In the foredune zone, which is influenced directly by the sea, *Cakile maritima*-*Salsola kali* communities dominate. Other common species include *Ipomoea stolonifera*, *Pancreatium maritimum*, *Euphorbia peplis*, *Medicago marina*, *Zygophyllum album*, *Cionura erecta*, *Echinops ritro* and *Eryngium maritimum* (Yilmaz, 1998, Yilmaz and Altan personal communication, 2002-2006, Sano et al. 2003, 2004, 2004, Ando et al. 2004, Aktoklu et al.2004, Atomaca et al.2005) .

Thus, the lower area on the basin of the Seyhan and Ceyhan rivers is already considered to be close to the lower limit of the forest and to be very sensitive to environmental change.

4. Acknowledgments

We sincerely thank to Dr. Tsuguhiro Watanabe and many staff of RIHN for their great help with our research, and Drs. Turker Altan, Tuluhan Yilmaz, Ekrem Aktoklu, Mustafa Atmaca, Kayhan Kaplan, Mustafa Arter and many members of the Cukurova University and the Mustafa Kemal University for their arrangement and assistance of our fieldwork in Turkey.

In addition, this report added the investigation

results in 2004 and 2005 on the basis of the report by Ando et al. in 2004. Identification of plants referred to Davis (2000) and Yilmaz (2001).

5. References

- Ando, M., Sano, J., and Tamai, S. 2004: The Effects of Global Warming on the Tree Species Composition in Forests of the Eastern Mediterranean Region in Turkey - The Vertical Distribution of the Vegetation on the Basin of the Seyhan and Ceyhan Rivers-. The Interim Report of the Research Project on the Impact of Climate Change on Agricultural Production system in Arid Areas(ICCAP), 79-82.
- Aktoklu, E, Atmaca, M., Kaplan, K., Atik, M., Artar, M., Cincinoglu salici, A, Guzelmansur, A. and Buyukasik, Y. 2004: Natural Vegetation of Seyhan River Basin. Proceedings of the International Workshop for the Research Project on the Impact of Climate Change on Agricultural Production system in Arid Areas(ICCAP),51-56.
- Altan, T., 2000: Dogal Bitki Ortusu, Cukurova Universitesi Ziraat Fakultesi Genel Yayin No: 235, Ders Kitaplari Yayin No: A-76, 200 pp. Adana.
- Atmaca, M., Altan, T., Aktoklu, E., Kaplan, K., Atik, M. and Artar, M. 2005: Constant Monitoring Parcels' System that Set Up in Seyhan River Basin and Vegetation Analyses. Proceedings of the International Workshop for the Research Project on the Impact of Climate Change on Agricultural Production system in Arid Areas(ICCAP),25-35.
- Davis, P.H., 2000: Flora of Turkey and the East Aegean Island. Edinburgh University Press, Vol.1-11, Edinburgh.
- Sano, J., Tamai, S. and Ando, M., 2003: A Preliminary Research of the Effects of Global Warming on the Species Composition and Vegetation Productivity in the Eastern Mediterranean Region of Turkey-The Vertical Distribution of the Dominant Tree Species-. Proceedings of the International Workshop for the Research Project on the Impact of Climate Change on Agricultural Production system in Arid Areas(ICCAP), 49-52.
- Sano, J., Tamai, S. and Ando, M., 2004: Effects of Global Warming on the Species Composition and Vegetation Productivity in Arid Areas - Species Composition and Stand Structure of Predominant Vegetation Types in the Eastern Mediterranean Region of Turkey -. Proceedings of the International Workshop for the Research Project on the Impact of Climate Change on Agricultural

Production system in Arid Areas(ICCAP), 57-59.
 Sano, J., Tamai, S. and Ando, M., 2004: Effects of Global Warming on the Species Composition and Vegetation Productivity in Arid Areas - Species Composition and Stand Structure of Predominant Vegetation Types in the Eastern Mediterranean Region of Turkey -. Proceedings of the International Workshop for the Research Project on the Impact of Climate Change on Agricultural Production system in Arid Areas(ICCAP), 57-59.
 Sano, J., Tamai, S. and Ando, M., 2004: An Interim Report of the Effects of Global Warming on the Species Composition and Vegetation Productivity in the Eastern Mediterranean Region of Turkey - Species composition and environmental factors

along the vertical distribution of trees in Cukurova Plain -. The Interim Report of the Research Project on the Impact of Climate Change on Agricultural Production system in Arid Areas(ICCAP), 83-87.
 Yilmaz, K. T., 1998: Ecological diversity of the Eastern Mediterranean region of Turkey and its conservation. *Biodiversity and Conservation* 7: 87-96.
 Yilmaz, K. T., 2001: Akdeniz Dogal Bitki Ortusu. Cukurova Universitesi Ziraat Fakultesi Genel Yayin No: 141, Ders Kitaplari Yayin No: B-13, 179 pp. Adana. Altan, T. 2000. Dogal Bitki Ortusu. 200 pp. Cukurova Universitesi Ziraat Fakultesi Genel Yayin No: 235, Ders Kitaplari Yayin No: A-76, Adana.



Pinus nigra at the timberline of Mt.Akinek(2,023 m)



Cedrus libani forest at KeciKelesi(ca 1,400 m)



Pinus brutia forest at Aladag (793 m)



Maquis at Mt.Karli Kayatepe(600 m)



Halophyte community at the mouth of the Ceyhan River



Dune at the Mediterranean Sea coast



Astragalus sp.



Acantholimon sp.



Pinus nigra



Cedrus libani



Abies cilicica



Juniperus excelsa



Juniperus oxycedrus



Quercus cerris



Ostrya carpinifolia



Carpinus orientalis



Fagus orientalis



Styrax officinalis



Daphne oleoides



Sambucus nigra



Pinus brutia



Platanus orientalis



Tamarix smyrnensis



Nerium oleander



Cotinus coggyria



Quercus coccifera



Phillyrea latifolia



Myrtus communis



Arbutus andrachne



Erica manipuliflora



Pistacia terebinthus



Pistacia lentiscus



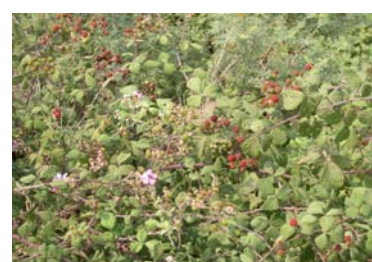
Cercis siliquastrum



Cistus sp.



Lithodora hispidula



Rubus sanctus



Calicotome villosa



Capparis spinosa



Paliurus spina-christi



Quercus ithaburensis



Prosopis farcta



Phragmites australis



Arthrocnemum fruticosum



Salicornia europaea



Atriplex portulacoides



Pinus halepensis



Juncus maritimus



Vitex agnus-castus



Imperata cylindrica



Cionura erecta



Cakile maritima



Salsola kali



Saccharum ravennae



Ipomoea stolonifera



Panicum maritimum



Euphorbia peplis



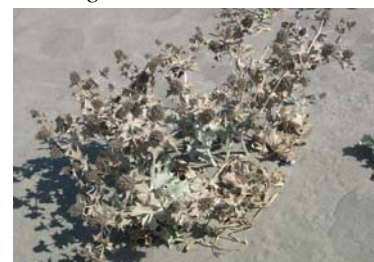
Medicago marina



Zygophyllum album



Echinops ritro



Eryngium maritimum