WESTERN ANATOLIA
JOURNAL OF EDUCATIONAL SCIENCE
http://web.deu.edu.tr/baed
Dokuz Eylul University Institute of Educational Sciences

ISSN 1308 – 8963

Cilt: 06, Sayı: 11, 2015, 37-46

REVEALING TEMPERATURE INVERSION THROUGH ENVIRONMENTAL EDUCATION

Ibrahim ATALAY

Head of Environmental Education Department and

Director of Educational Sciences Institute of Dokuz Eylul University

İbrahim.atalay@deu.edu.tr

Abstract

Environmental education refers to organized efforts to teach about how natural environments function, how human beings can manage their environment, ecosystem and to determine some properties of the environment in order to live sustainably. One of the main aims of environmental education is a learning process that increases people's knowledge and awareness about the ecological properties of environment through the distribution of plants characterizing the ecological properties of a given area. It can be called outdoor education and environmental education. Some special plants mostly trees and shrubs clearly show some important aspects of the natural environment assessment. For example, temperature inversion occurring in depressions can reveal the distribution of trees that resist against the given temperature. If black pine (Pinus nigra) occurs in the bottom of depression and red pine (Pinus brutia) is widespread above black pine (Pinus nigra) in the upper part of the depression it can be stated that temperature inversion takes place in such depression. Because the resistance of Pinus nigra against cold is higher than Pinus brutia. In order to assess the existence of temperature inversion in Ovacik depression located in the Boz Mountains, Aegean Region is visited with a group of students. The bottom land of Ovacik depression, which is at an elevation of 800 m, is the main occurrence areas of Pinus nigra,

while the upper part of the depression at an elevation of 1000-1200 m is the main spreading areas of pure Pinus brutia, Pinus brutia and Pinus nigra mixed forests. This situation clearly reflects the temperature inversion occurring in winter and early spring periods.

Keywords: temperature inversion, outdoor education, environmental assessment

INTRODUCTION

Environmental education is a learning process that increases people's knowledge and awareness about the environment and associates challenges, develops the necessary skills and expertise to address the challenges, and fosters attitudes, motivations, and commitments to make informed decision and take responsible actions (UNESCO, Tbilisi Declaration, 1978).

Environmental education focuses on: Awareness and sensitivity about the environment and environmental challenges, Knowledge and understanding about the environment and environmental challenges, attitude concern for the environment and help to maintain environmental quality, skills to mitigate the environmental problems, and Participation for exercising knowledge and environmental related programs.

The roots of environmental education can be traced back as early as the 18th century when Jean-Jacques Rousseau stressed the importance of an education that focuses on the environment in Emile: or, On Education. A new type of environmental education, Conservation Education, emerged as a result of the Great Depression and Dust Bowl during the 1920s and 1930s.

The modern environmental education movement, which gained significant momentum in the late 1960s and early 1970s, stems from Nature Study and Conservation Education.

Internationally, environmental education gained recognition when the UN Conference on the Human Environment in Stockholm, Sweden, in 1972, declared environmental education must be used as a tool to address global environmental problems. The United Nations Education Scientific and Cultural Organization (UNESCO) and United Nations

Environmental Program (UNEP) created three major declarations that have guided the course of environmental education.

The master degree program of Environmental Education was only established at the Institute of Educational Sciences of Dokuz Eylul University in 2009, in Turkey depending on new developments in the environmental education.

Method and Material

The study area is located in the western part of the Boz Mountains, in the middle part of the Aegean Region. It is located 50 km far from Izmir (Fig. 1). The Boz Mountains abruptly rising from the Gediz graben is in the horst structure (Photo 1). For this reason, the steep fault scarp extends in the northern slopes of Boz Mountain. Ovacik depression was formed as a result of faulting movements, so it can be called a small tectonic depression, its elevation ranges between 800 and 1500 m or relative altitude between the bottom of Ovacik depression and upland area is about 800 m (Fig. 2, 3 and Photo 2)

Geologically, the western part of the Aegean region including study area is made up of Palaeozoic metamorphic schists such as gneiss, mica schist, quartzite, and quartzitic schist. Thick alluvial deposit is found on the bottom of the Ovacik depression. On the edge of mountains encircling the Ovacik depression colluvial materials are seen.

Fig 1. Location map of the study area

Climatically, Mediterranean climatic regime characterized mild and rainy winters, hot and dry summers prevails in the study area. Mean annual precipitation excesses 800 mm.

In term of vegetation, *Pinus brutia,* which is very resistant to summer drought, is the climax vegetation of the euro-Mediterranean region and begins at the sea level and rises up to 1000/1200 m on the south facing slopes of the mountains and 600 m on the north facing slopes. It grows where yearly mean annual precipitation is over 400 mm, and mean annual temperature ranges between 18°C and 12°C. In the natural occurrence areas mean January temperature is over freezing point. It is not resistant under -15°C temperature (Atalay et al 1998). Maquis vegetation natural shrub layer of *Pinus brutia* is widespread where *Pinus brutia* forests have been destroyed.

Pinus nigra is climax tree of Oromediterranean belt and is common on *Pinus brutia* forest. It grows transitional region between maritime climate and semiarid continental climate on which mean yearly precipitation is over 400 mm, and mean annual temperature ranges between 12°C and 8°C (Atalay 1994, Atalay and Efe 2010). For this reason this pine begins after *Pinus brutia* and rises up to upper boundary of natural timberline of mountains in Mediterranean climatic region. Chestnut (*Castanea sativa*) grows only on the north facing slopes of the Mountains.

In the study area, *Pinus nigra* is widespread on the bottom of Ovacik depression. Some fruit trees belonging to cherry-tree, apple-trees and plum-tree appear within the garden of Ovacik village. On the lower south facing slopes of Ovacik depression *Pinus nigra* and *Quercus* sp. clusters are seen. *Pinus nigra*, pure *Pinus brutia* and mixed *Pinus brutia* and *Pinus nigra* communities are found between 1000-1200 m on the north facing slopes of Ovacik depression. Some *Castanea sativa* mixed cluster with *Pinus brutia* and *Pinus nigra* clusters are found on the valley and north facing slopes.

As to the soil, as a general rule brown forest soil showing slightly acid reaction is common under the dense forest cover. Intrazonal soils reflecting physical and chemical properties of

the parent materials appear on the steep slopes with scarce vegetation. These soils are in the sandy and gravelly texture. Alluvial soil is seen on the bottom of Ovacik depression.

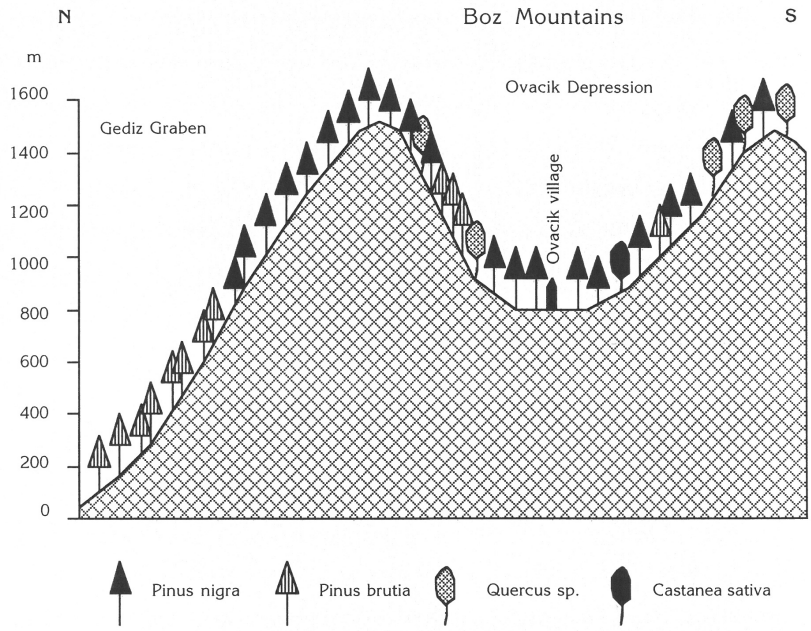

Fig. 2. Topographic and vegetation profile of the study area

Findings

The temperature inversion

In meteorology and climatology, an inversion is a deviation from the normal change of an atmospheric property with altitude. In the depressions temperature inversion occurs frequently during the winter period. During the winter night, when the sky is clear, the air is calm and the snow cover is exist the ground surface in the upper parts encircling the depression rapidly radiates long wave energy into atmosphere above it. The ground surface with snow temperature drops rapidly and the overlying air becomes colder. The cold air mass accumulates within the depression. So, the temperature of the bottom of the depression falls below the freezing point. While the upper part of the depression temperature again rises a few centigrade degrees (Fig. 3).

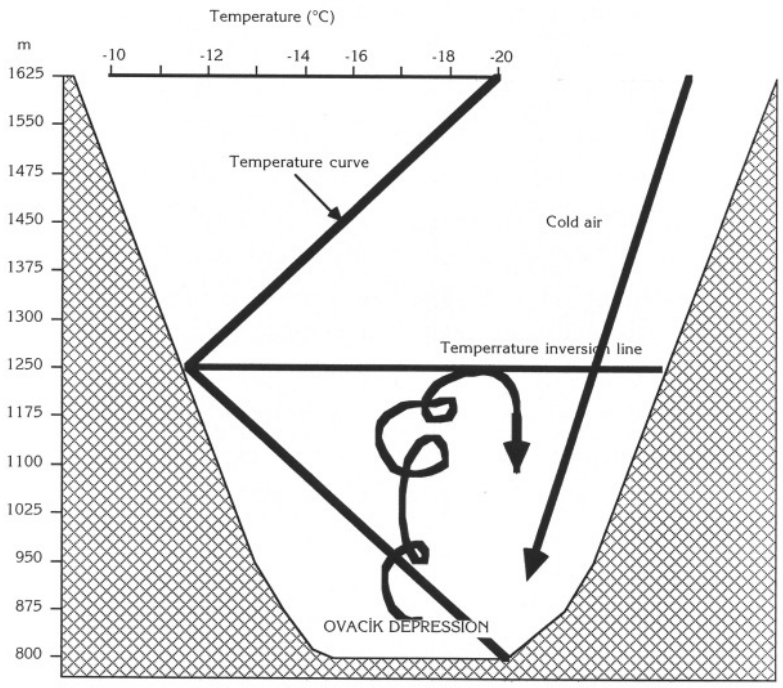

Fig. 3. The formation of temperature inversion in Ovacik Depression

In the field observations, the existence of the *Pinus nigra* which is resistant to the low temperature and *Pinus brutia*, which is sensitive to cold air, is only seen on the slope of Ovacik depression exercises or indicates the occurrence of temperature inversion (Photo 3, 4).

On the other hand, the existence of *Pinus nigra* or absence of *Pinus brutia* shows to have fallen the temperature below -15°C. Because *Pinus brutia* does not survive under -15°C, while *Pinus nigra* grows where the temperature is below -35°C. Communication with peasants living in Ovacik village indicated "in some days of winter, thick ice covers all ground, and severe cold conditions prevail." It can be said that the temperature of bottom of Ovacik depression falls as low as -20°C.

The same situation also occurs in the wide and deep karstic depressions of the Taurus Mountains. For example the Taurus fir (*Abies cilicica*) occurs on the bottom of depression and *Pinus brutia* is seen upon *Abies cilicica* in the vicinity of Akseki town, Middle Taurus Mountains (Atalay 2010).

The student group who observed the study area learned about forest trees distribution in the vertical direction depending on temperature inversion (Gökler 2012).

Results

Some results can be depicted from the outdoor education carried out in the Ovacik depression:

1. Ecological learning of trees is one of the key factors in the determining of environments,

2. Excluding heat island occurring in big cities especially industrial centres, the temperature inversion is easily determined through the environmental education based on tree ecology,

3. To understand some properties of the environment, it is necessary to apply environmental education studies.

References

Atalay, I. (1987). Türkiye jeomorfolojisine giris (Introduction to Geomorphology of Turkey). Ege Univ. Ed. Fak. No: 9.

Atalay, I. (1994). Türkiye vejetasyon coğrafyası (Vegetation geography of Turkey). Ege Universitesi Basımevi, İzmir.

Atalay, I., Sezer, L.I. and Cukur, H.,(1998). Ecology of *Pinus Brutia* and its regioning In terms of seed transfer. Forest Trees and Seed Breeding Directorate Pub. No. 4.

Atalay, I. (2002). Ecoregions of Turkey. Orman Bakanlıgı Yay. No. 163.

Atalay, I.,(2008). Ekosistem ekolojisi ve cografyası (Ecosystem Ecology and Geography). Meta Press, İzmir.

Atalay, I., (2010). Uygulamali klimatoloji (Applied climatology). Meta Press, İzmir.

Atalay, I. ve Efe, R., (2010). Ecology of the Anatolian Black Pine (*Pinus nigra* subsp. *pallasiana* (Lamb.) Holmboe) and its dividing in terms of seed transfer. Forest Trees and Seed Breeding Institute Directorate Pub. No. 37.

Atalay, I. (2011). Toprak olusumu, sınıflandırılması ve cografyası (Soil formation, classification and geography). Meta Basım, İzmir.

Atalay, İ. and Efe, R., (2012). Ecological attributes and distribution of Anatolian black pine (*Pinus nigra* Arnold. subsp. *pallasiana* Lamb. Holboe) in Turkey. Journal Environment Biology. 33, 509-519.

Gökler, F., (2012). Doğal ortamda yürütülen çevre eğitiminin orta öğretim 9. sınıf öğrencilerinin akademik başarısına etkisi: Ocücık örneği. Dokuz Eylül Üniversitesi Eğitim Bilimleri Enst. Çevre Eğitimi Anabilim Dalı Çevre Eğitimi Programı yüksek Lisans Tezi, İzmir.

Vikipedia, the free encyclopedia Environmental Education

Photo 1. A general view from Boz Mountain to Gediz graben in the W of Ovacik depression

Photo 2. General view of Ovacik Depression in the Boz Mountain

Photo 3. Black pine (*Pinus nigra*) forest which is cold resistant on the bottom of the Ovacik depression at an elevation of 800 m.

Photo 4. Red pine (*Pinus brutia*) which is not resistant cold on the south facing slopes of Ovacik Depression