Available online www.jsaer.com

***Journal of Scientific and Engineering Research*, 2018, 5(8):189-194**

Research Article

ISSN: 2394-2630
CODEN(USA): JSERBR

Impacts of Global Warming on Vegetation Zones in the Case of Forestry Region of Bartin, Turkey

Ayhan Atesoglu*, Metin Tunay, Hüseyin Şensoy

Department of Forest Engineering, Faculty of Forestry, Bartın University, 74100, Bartın, Turkey

Abstract The increase of greenhouse into the atmosphere due to industrialization has made may be felt today, signs of global climate change. In this process, the temperature is the most important factor except from moisture, precipitation, the light exposure, air movements. There are not any criteria that are reached on consensus in relation to how fast this interaction will be, how the plant species will be affected and the difficulties that the process will bring about. Therefore, to detect any possible impacts for the research areas is extremely important in terms of following the process. The field of research is the bartin forest district in the western black sea region in turkey where located a field of approximately 1750 km^2. The whole area is covered by forest community (*Quercus sp., Carpinus betulus, Castenae sativa, Fagus orientalis, Pinus sylvestris, Pinus nigra, Abies bornmülleriana* mixed forest form) with the rest being pseudo-maquis land. The average temperature changes in five-year intervals for the years of 1995-2015 have been mapped by using the method of inverse distance weight (IDW) in the environment of geographical information systems (GIS). The correlation of temperature changes with the altitude levels has been examined. The temperatures changes in the years of 1995-2015, the primary tree species in the zone of vegetation and associated with the current problems of the other species have been analyzed using GIS. In a total of 5209.13 ha area within the study area, it has been determined that the highest temperature increase with an average of 0.40 degrees every five years since 1995. The altitude of the area where the temperature is increased varies between 200 m and 1200 m. The average temperature within the study area has increased nearly 1.2 °C. This situation was having negative effects on the resistance of the beech especially which is the main tree of the region and the other species.

Keywords Forestry, vegetation zone, IDW, Global warming

Introduction

Knowledge about how the atmospheric composition affects the global climate is increasing day by day. Average global temperatures will increase depending on the concentration of CO_2 and the other gases [1-2]. With the increase of global warming, it is possible that the earth's forests, especially several plant and animal species, will be affected seriously [3-4]. It also affects the determination of climate types in the earth [5]. In his 1988 study, Schlesinger says that the temperature increase due to global warming will be about 1.2-4.2 ºC [6]. Also according to the IPCC (Intergovernmental Panel on Climate Change) report; the global temperature will increase by at least 1,1 ºC and at most 6,4 ºC at the end of the century we are in [7]. Additionally, it limited the global temperature rise to 1.5-2 ºC at the International Climate Change Conference in Paris in 2015 [8]. Temperature increases will lead to important problems, especially in land cover / use classes such as forest, agriculture and pasture [9-10].

This suggests that the common tree species specific to the climate zone may be largely restricted. When the temperature and precipitation patterns change due to global warming, it is likely that species will also change their adaptation to their locations [11]. Changes in the large scope can be seen for 100 years from now and later

for all plant species and especially for tree species [12]. The reactions of the earth's ecosystems and the possible scenarios against the global warming are not clear. Studies on species behavior and threats, especially on tree species on forested areas, are inadequate [13]. The necessary scientific foundation and studies for the extent to which the endemic species are affected on a basis of area under the global warming threat, current abnormalities and the mandatory strategies and policies that should be developed against these are inadequate.

The purpose of this study is; correlating the temperature change with the elevation steps within the boundaries of Bartın Forestry Directorate selected as research area, by determining the average temperature increase between the years 1995-2015, especially about the effects on *Fagus orientalis* species. In the zones where the temperature changes are observed, by relating the main tree types and the diffusion areas of the region to each other, to create basic concepts about the spread of the stands with the generated temperature transition zones map and to give suggestions for the stand health.

Data and Methods

The research area is the Bartın forest district in the Western Black Sea Region in Turkey where located a field of approximately 1750 km^2. The field of study is located between 32º 06' 43" and 32º 45' 39" East longitude and 41º 34'33" and 41º 50' 31" North latitude. The whole area is covered by forest community (*Quercus sp., Carpinus betulus, Castanea sativa, Fagus orientalis, Pinus sylvestris, Pinus nigra, Abies bornmülleriana* mixed forest form) with the rest being pseudo-maquis land (Figure 1).

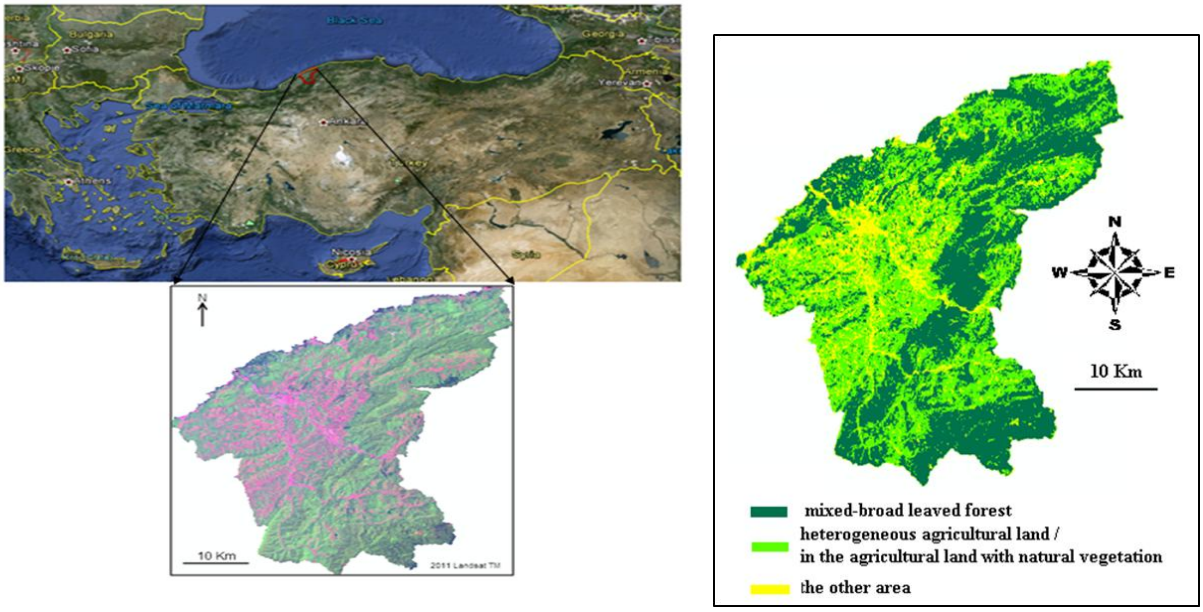

Figure 1: Study area and land use classification area map of Bartın Forest District

The average temperature of the last 20 years has been obtained with the data received from three meteorological stations. The average temperature changes in five-year intervals for the years of 1995-2015 have been mapped by using the method of inverse distance weighting (IDW) in the environment of Geographical Information Systems (GIS). The correlation of temperature changes with the altitude levels has been examined. The temperature changes in the years of 1995-2015, the primary tree species in the zone of vegetation and associated with the current problems of the other species have been analyzed using GIS.

Based on the Bartın Forestry Directorate's borders, average temperatures over the past 20 years have been obtained from the temperature data gathered from three meteorological stations (Bartın, Ulus, Amasra) located in the region. For the years of 1995-2015, average temperature values were calculated at intervals of five years. The average temperature of each five years is mapped using the IDW method in the GIS environment. The IDW interpolation technique is a commonly preferred method of generating grids by interpolation from sample point

data (Figure 2). It is based on the principle that adjacent points on the surface to be interpolated have more weight than the distant points. This technique makes a surface interpolation according to the weighted average of the sample points by decreasing the weight as it moves away from the point to be interpolated. Weighted moving averages is a widely used approach for interpolation. Variants of different weighted functions have been used, but IDW has become the most common form of GIS systems. IDW is a complete intermediate value generator (interpolator) so that it reinforces the values of the data [14-15-16].

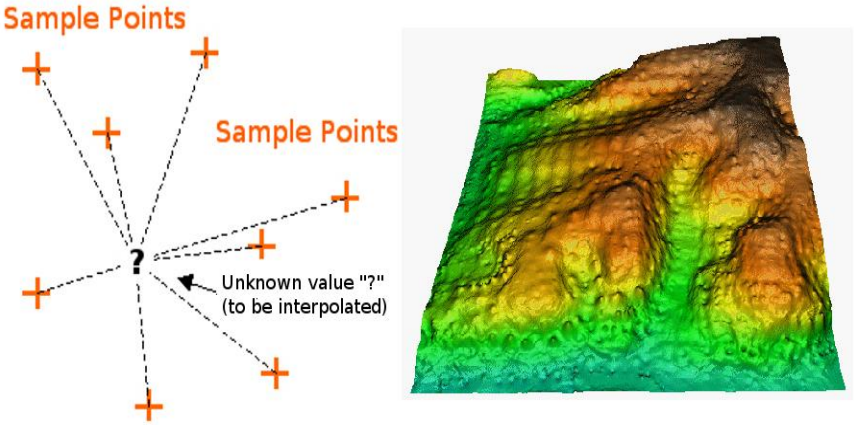

Figure 2: Inverse Distance Weight (IDW) prenciple

Results and Discussion

In a total of 5209.13 ha area within the study area, it has been determined that the highest temperature increase with an average of 0.40 degrees every five years since 1995 (Figure 3). The average temperature difference between 1995 and 2015 was calculated as 1.28 degrees.

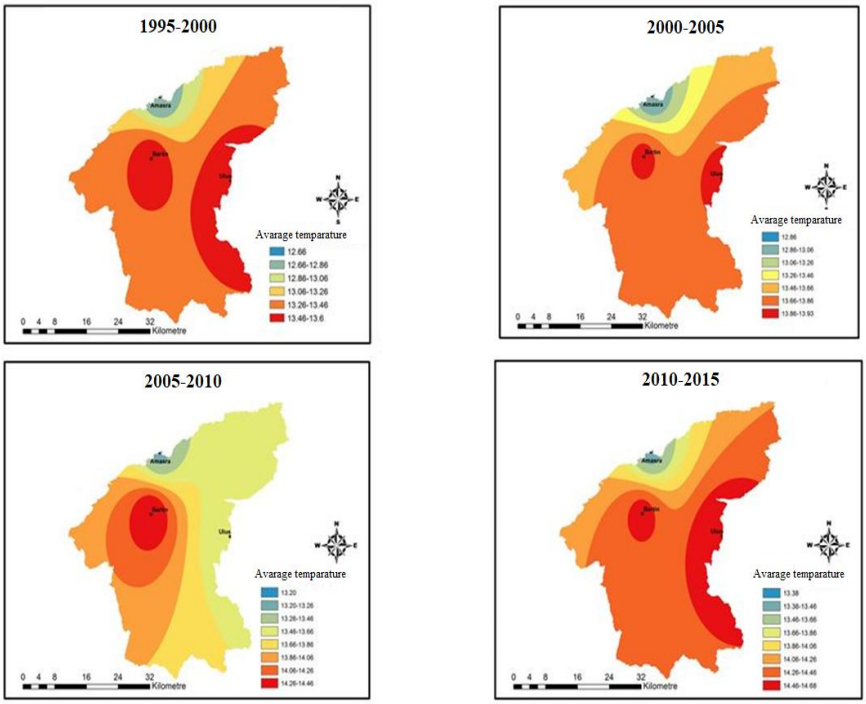

Figure 3: Tempature avarages for every five years since 1995

When the five-year average temperatures are examined, it is determined that the stands located in Ulus and its nearby in the east of the study area are the forest areas with the highest temperature increase (Figure 4).

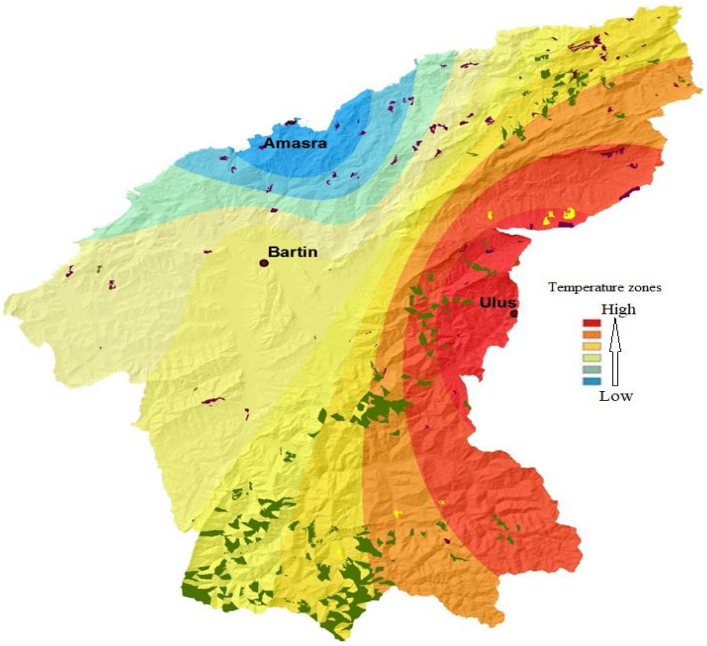

Figure 4: Average temperature increase zones (1995-2015)

The average elevation is 400 meters. When examined as a forest area, 534.99 hectares of beech stands, 161.22 hectares of fir stands, and 36.93 hectares of hornbeam stands are pure in the region (Figure 5).

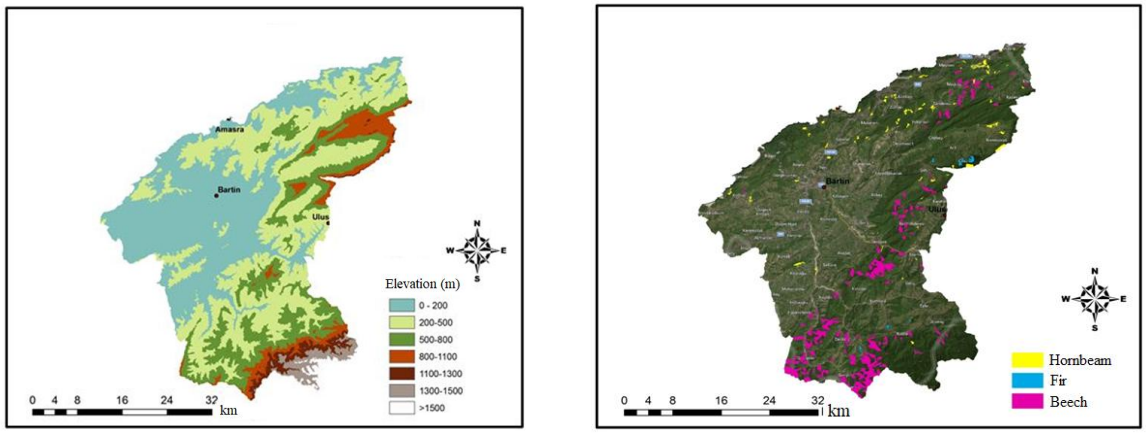

Figure 5: Elevation map (left), pure natural stand (right)

The largest area of mixed stands is consist of beech-dominated mixed stands (1125.69 ha). The total area of the other mixed stands is 1099.57 ha. Other mixed stands is consist of hornbeam, black pine and other broad-leaved species (Figure 6).

In relation to *Castanea sativa*, Katırcıoğlu et al. [17], in the scope of the project conducted between 2006-2010, where cancer cases are evaluated in 2010, provided information about the chestnut tree-related cancer cases heaving into sight and biological fight methods against this In the study, it was stated that the cancer related disease in the Western Black Sea Region spreads naturally. The assumption claiming that the cancer spread naturally in chestnut trees as a consequence of the increase in temperature detected in the region is highly probable. Atesoglu et al. [18], in 2014, found that the insect damage caused by *P. curvidens* within the boundaries of the Ulus Forestry Directorate between 2007-2011 was excessive primarily in pure, then in dominant stands. Between 2007-2011 the daily minimum maximum and average values as meteorological data and temperature values related to the flight time of the insects, especially in March April and May were examined. In this context, it has been found that the temperature increase in the region increases the beetle activation and causes more damage on the fir stands. Studies conducted in the region confirm that the increase in temperature due to global warming has adversely affected tree species.

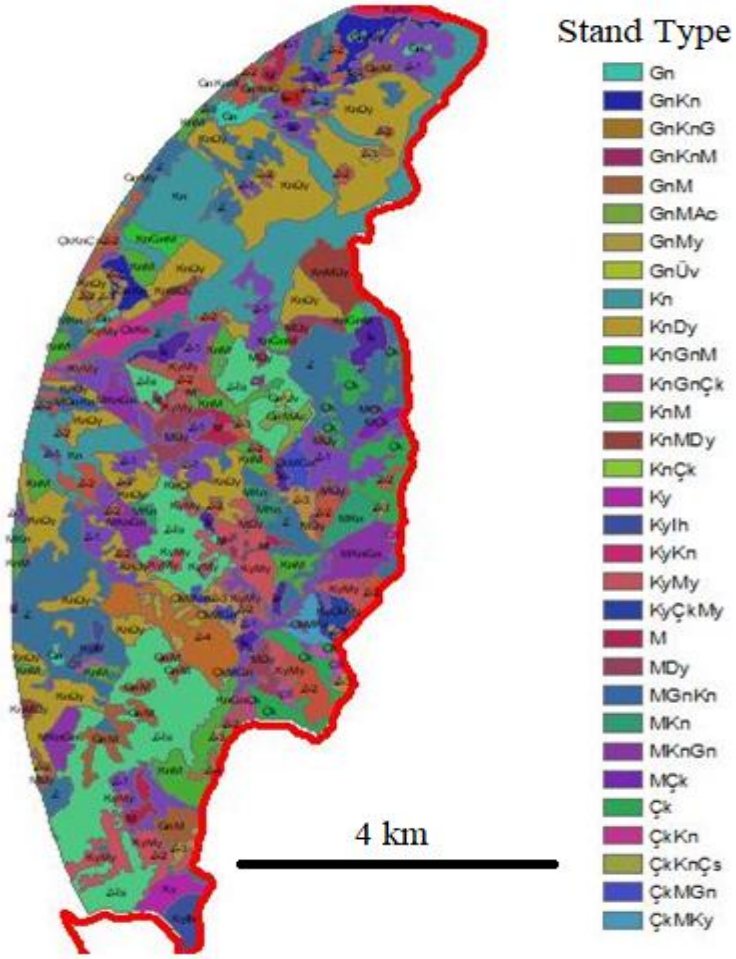

*Figure 6: Mixed natural stand**

*Gn: *Carpinus betulus*; Kn: *Fagus orientalis*; G: *Abies bornmülleriana*; M: *Quercus sp*; Çk: *Pinus nigra*; Çs: *Pinus sylvestris* Ks: *Castanea sativa*; Dy: Other leafy

Conclusions

In this study, the distribution of tree species within the boundaries of the Bartın Forestry Directorate was associated with the average temperature increase between 1995-2015. Within the study area, the influence limits of the temperature increase dependent on the global climate change have been determined. In general, the following conclusions have been reached:

- ✓ The average temperature within the study area has increased nearly 1.2 °C.
- ✓ This situation will have negative effects on the resistance of the beech especially which is the main tree of the region and the other species.
- ✓ The cancer cases is seen in the chestnut stands in the region are spreading naturally due to the increase in temperature.
- ✓ In addition, fir bark infestation in the past years within the study area which is directly proportional to the increase in the average temperature in the region. This situation confirms that different adverse effects on other tree species can be observed.
- ✓ The measures can be taken to prevent direct or indirect damage caused by global warming to our forests should be increased. The controls should be intensified and more frequent observations should be made.

Acknowledgements
This study was presented in the International Symposium on Ecology which was regulated on June 19-23, 2018 in Kastamonu.

References

[1]. Schneider S.H., Londer R. (1984). The coevolution of climate and life Sierra Club Books, San Francisco 563 pp.
[2]. Peters R.L. (1990). Effects of global warming on forests, Forest Ecology and Management, 35, 13-33.
[3]. Pielke R.A., Schellnhuber H.J., Sahagian D. (2003). Non_linearities in the Earth system Global Change Newsletter, 55: 11–15.
[4]. Hlásny T., Holuša J., Štěpánek P., Turčáni M., Polčák N. (2011). Expected impacts of climate change on forests: Czech Republic as a case study, Journal of Forest Science, 57(10): 422–431.
[5]. Ford M.J. (1982). The Changing Climate.Allen and Unwin, London, 190 pp.
[6]. Schneider S.H. (1988). The greenhouse effect: What we can or should do about it. In: J.C. Topping, Jr. (Eds), Proc. First North American Conference in Preparing for Climate Change: A Cooperative Approach. Government Institutes, Rockville, MD, pp. 19-34.
[7]. IPCC (2007). Summary for Policymakers in: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press.
[8]. IPCC (2014). Climate Change 2014, In: R.K. Pachauri and L.A. Meye (eds) Synthesis Report Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.
[9]. Lewis S.L. (2016). The Paris Agreement has solved a troubling problem. Nature, 532. (7599). p. 283. ISSN 0028-0836 https://doi.org/10.1038/532283a
[10]. Marshall C.H., Pielke R.A., Steyaert L.T. (2004). Has the conversion of natural wetlands to agricultural land increased the incidence and severity of damaging freezes in south Florida Monthly Weather Review, 132: 2243-2258
[11]. Pielke A.R., Mahmood R., McAlpine C. (2016). Land's complex role in climate change Physics Today, 69, 11, 40; doi: 10.1063/PT.3.3364.
[12]. Hlásny T., Turčáni M. (2009). Insect pests as climate change driven disturbances in forest ecosystems. In: Strelcova K., Matyas C., Kleidon A., Lapin M., Matejka F., Blazenec M., Škvarenina J., Holecy J. (eds): Bioclimatology and Natural Hazards. Berlin, Springer:, 165–178.
[13]. Baker R.G. (1983). Holocene vegetational history of the western United States In: H.E. Wright, Jr. (Eds), Late-Quaternary Environments of the United States. Vol. 2, The Holocene. University of Minnesota Press, Minneapolis, pp. 109-125.
[14]. Demircan M. (2011). Basic approach to climate monitoring products and climate monitoring products in WMO RA VI, Meeting of the Commission for Climatology (CCl) (OPACE 2) Task Team on National Climate Monitoring Products, Geneva, Italy.
[15]. Demircan M., Arabacı H., Bölük E., Akçakaya A., Şensoy S., Ekici M. (2013). İklim normalleri ve 1981-2010 sıcaklık normallerinin coğrafî bilgi sistemleri ile topografya kullanarak yüksek çözünürlüklü grid veri setinin üretilmesi, 6. Atmosferik Bilimler Sempozyumu, İstanbul Türkiye.
[16]. Loyd C.D. (2007). Local Models for Spatial Analysis, CRC Press, Boca Raton, Florida, 226 pp., ISBN 0-415-31681-2
[17]. Katırcıoğlu Z.Y., Maden S., Akıllı S., Serçe U.Ç. (2010). Karadeniz bölgesinde kestane kanserinin biyolojik mücadelesi üzerine araştırmalar, Ankara Üniversitesi Bilimsel Araştırma Projeleri, Ankara, , 83 page. Proje No: 06 B 4347004.
[18]. Atesoglu A., Tunay M., Kaygın A.T., Yıldız Y., Kavaklı Z. (2014). Zonguldak Ulus Orman İşletme Müdürlüğü Ormanlarında Büyük Göknar Kabuk Böceği Zararının CBS Ortamında Analiz ve Sorgulanması, Tam Metin Bildiri, Türkiye II. Orman Entomolojisi ve Patolojisi Sempozyumu.