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# Determining the Near-Future Biocomfort Zones in Samsun Province by the Global Climate Change Scenarios

İsmail KOÇ

Düzce University, Forestry Vocational School, Konuralp Campus, Düzce, TÜRKİYE
Corresponding Author: ismailkoc@duzce.edu.tr

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**Abstract**

*Aim of study*: This study aimed to determine the current and future (present, 2040, 2060, 2080) climate changes in the study area within the scope of climate change scenarios (SSPs 245 and SSPs 585) of the Coupled Model Intercomparison Project.

*Area of study*: The study area is Samsun province.

*Material and methods*: The current climate data were obtained from the measurements performed by 24 meteorology stations. Using the measurement data of the period 2000-2020 obtained from these data, the climate maps were prepared with the "Inverse Distance Weighted" method were used for this study. The biocomfort index formulas were applied to these maps, and biocomfort maps were obtained.

*Main results:* Today's average minimum and maximum temperature changes around 7-24 °C in the area. According to the two scenarios, the temperature will change between 13-19 °C from 2040 to 2080 and then stay constant in the first scenario while it will increase up to 19-25 °C in the second scenario during 2080-2100. As a result, the area will have much warmer, and there might be warm zones in Samsun in 2100.

*Highlights*: The biocomfort zones in Samsun province would remarkably change soon, especially the cooling costs, and will negatively contribute to global climate change due to energy consumption and gases used by air-conditioning systems.

**Keywords:** Biocomfort, CMIP6, SSPs 245, SSPs 585

# Küresel İklim Değişikliği Senaryoları ile Samsun İlinde Yakın Gelecekteki Biyokonfor Bölgelerinin Belirlenmesi

**Öz**

*Çalışmanın amacı:* Bu çalışmada, Eşleştirilmiş Model Karşılaştırılma Projesinin iklim değişikliği senaryoları kapsamında (SSPs 245 ve SSPs 585) çalışma alanının mevcut durum ve gelecekteki (günümüz, 2040, 2060, 2080) iklim değişikliklerinin belirlemesi amaçlamıştır.

*Çalışmanın alanı:* Çalışmaya konu alan Samsun ilidir.

*Materyal ve yöntem:* Güncel iklim verileri Meteoroloji Genel Müdürlüğü'ne bağlı 24 meteoroloji istasyonu tarafından yapılan ölçümlerden elde edilmiştir. Bu verilerden elde edilen 2000-2020 dönemine ait ölçüm verileri kullanılarak, bu çalışma için "Ters Mesafe Ağırlıklı" yöntemi ile iklim haritaları hazırlanmıştır. Bu haritalara biyokonfor indeks formülleri uygulanarak biyokonfor haritaları elde edilmiştir.

*Temel sonuçlar*: Bölgede günümüzde ortalama en düşük ve en yüksek sıcaklıklar yaklaşık olarak 7-24 °C arasında değişmektedir. İki senaryoya göre 2040 yılından 2080 yılına kadar sıcaklı 13-19 °C arasında değişecek ve daha sonra ilk senaryoya göre sabit kalırken ikinci senaryoya göre 2080-2100 arasında 19-25 °C'ye çıkacaktır. Sonuç olarak, bölge çok daha sıcak olacak ve 2100'de Samsun'da sıcak bölgeler olabilir.

*Araştırma vurguları*: Samsun ilindeki biyokonfor bölgeleri, özellikle soğutma maliyetleri başta olmak üzere, yakında önemli ölçüde değişecek ve iklimlendirme sistemlerinin kullandığı gazlar ve enerji tüketimi nedeniyle küresel iklim değişikliğine olumsuz katkıda bulunacaktır.

**Anahtar Kelimeler**: Biyokonfor, CMIP6, SSPs 245, SSPs 585

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## Introduction

The world has witnessed probably the fastest changes, such as climate and industrial and technological advancement in history in the last 20 years. These changes have significantly affected all the ecosystems and living organisms on the earth. Together with the Industrial Revolution, each person's needs and requests (such as live a good life in better environmental conditions, an adequate food supply, and energy for production) increased and diversified, and the production aims to meet these demands and needs by mining more belowground mineral sources and using them as an industrial raw material (Koç, 2021). In this process, the concentrations of various elements, which are used as an industrial raw material, in the soil, water and air (Cui et al., 2022), significantly increased, and the use of fossil fuels in meeting the energy needs significantly increased $CO_2$ concentration in the atmosphere (Cetin et al., 2019). As a result of direct and indirect effects, this process resulted in global climate change, and global climate change has become one of the world’s most critical problems, which are considered irreversible and should be solved (Cetin, 2020).

Besides, the spread of liquid or solid particles in the air, called aerosols, resulting from human activities plays a critical role in the world's energy budget (incoming versus outgoing) and climate changes. These emitted aerosols' chemical components show a very heterogeneous structure compared to greenhouse gases, making radiative forcing (energy rate change per unit of area of the earth at the top of the atmosphere) more uncertain (Bellouin et al., 2020). The changes in climate have a direct and indirect adverse effect on plant species that resulted in some changes in seed germination, morphology, physiology (Koç, 2019; Koç & Nzokou, 2022), nutrient uptake strategies (Shults et al., 2020), and biomass allocation (Koç et al., 2021).

The second crucial problem in the world, which is considered irreversible, is urbanization. Amongst the increase in world population, the labor requirement after the Industrial Revolution and the concentration of job opportunities in industrial areas caused densification of the population in urban areas. While less than 10% of the world population, which has been around 750 million, has been living in urban areas in 1750. However, approx. 47% of the global population, which reached 6 billion in 2000, lives in urban areas (Yusufu, 2019). It is expected that the population will reach 8.5 billion in 2030 worldwide, and 60-90% of the world population will be living in urban neighborhoods (Kilicoglu et al., 2020). In Turkey, this rate is much higher; as of the year 2020, approx. 93% of the total population lives in urban neighborhoods (URL-1, 2021).

Besides that, migration still continues from rural areas to metropolitan areas, and both growing population and rural-to-urban migration necessitate opening new areas to settlement. Local authorities make decisions by using parameters that are not based on scientific evidence to meet the increasing need for residential areas. However, determining the areas to be opened to settlement is a significant point that should be planned using many criteria (Kilicoglu et al., 2021).

One of the parameters that must be considered while determining the residential areas is the climate. Climate is a factor that affects many fields, from human psychology to the physical environment of humans. The climate components within the ranges in which humans feel safe and comfortable are called biocomfort (Cetin, 2020). In cases that the values are not within the appropriate ranges, various disorders such as anger, weariness, respiratory and circulation system problems, burning eyes, and dry throat can be seen in humans (Alaud, 2019). Thus, it is recommended for both mental and physical human health to live in appropriate biocomfort areas, where the ideal range (comfortable environments) of humidity, temperature, oxygen level, and wind speed. Humans living in inappropriate biocomfort places use various heating and cooling systems to set the microclimate conditions to the biocomfort levels. However, these systems cause both environmental damages and a high level of energy consumption. For this reason, determining the appropriate areas of biocomfort in urban planning studies and opening these areas to settlement is very important for human health, comfort, welfare, and energy efficiency. Thus, various studies were carried out on determining the biocomfort zones (Aktaş, 2020).

However, it is emphasized that global climate change will cause vital alterations in climate parameters in the near future. Thus, it is vital to determine possible changes in biocomfort areas in upcoming years and consider them in urban planning studies. However, some studies are carried out mainly in highly populated cities; there is no study on this subject to date in this study area. Samsun is one of the largest and developing cities in northern Turkey due to the increasing population of immigrants and growing industries. For this reason, it was aimed to determine the changes in biocomfort zones in Samsun province according to the projected climate change scenarios.

## Material and methods

*Study Area*

The present study was carried out in Samsun province, one of Turkey's largest cities located north of Turkey (in the middle of the Black Sea region), where the climate is temperate, and the annual average temperature is 14.6 °C. In Samsun during 1929-2020, the annual minimum average temperature is 3.9 °C in February, while the maximum average temperature is 27.1 °C in August (MGM, 2020). The annual precipitation in the study area is approximately 717 mm, and the region receives the maximum and minimum precipitation in November (83.8 mm) and July (34.9 mm), respectively (MGM, 2020). Samsun is widely preferred in terms of edaphic and climatic conditions, and thus the population increases every year, and it becomes necessary to open new settlement places. The population in Samsun is approximately 1.34, 1.35, and 1.36 million in 2018, 2019, and 2020, respectively (URL-1, 2021). The geographic location of the study area is presented in Figure 1.

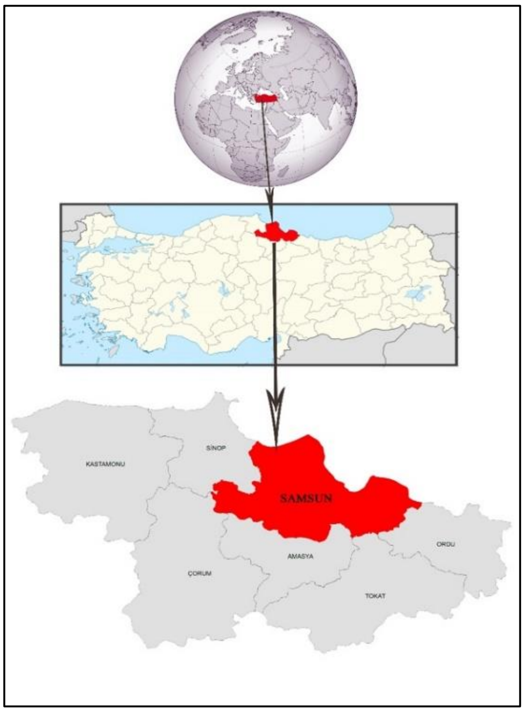


Figure 1. Geographic location of study area

*Method*

The global models within the scope of Coupled Model Intercomparison Project 6 (CMIP6) prepared by the World Climate Research Programme (WCRP) are developed by IPCC and run with IPCC climate scenarios (Hausfather, 2019). These scenarios were taken as a basis in this study because CMIP6 was used in the 6$^{th}$ assessment report of IPCC (Table 1).

The current climate data were obtained from the measurements performed by 24 meteorology stations of the MGM. Using the measurement data of the period 2000-2020 obtained from these data, the climate maps were prepared with the "Inverse Distance Weighted (IDW)" method (Bartier & Keller, 1996) for this study among other techniques (standard Kriging, Kernel Interpolation estimation, and the others) due to one of the most convenient methods and widely used. The biocomfort index formulas were applied to these maps, and biocomfort maps were obtained.

The data prepared by the Department of Energy Lawrence Livermore National Laboratory supported by the World Climate Research Programme (WCRP) in order to create high-resolution climate projections to be used in regional climate change adaptation and effect assessment studies constituted the base of the present study. Among the climate change models prepared within this scope, the data of SSPs 245 (an intermediate – radiative force is 4.5 W/m$^2$) and SSPs 585 (the most extreme - radiative force is 8.5 W/m$^2$) scenarios of the CNRM-CM6-1 model were downloaded in NetCDF file format and, by processing these data in Arcmap 10.8 software, the necessary conversion procedures were applied (Varol et al., 2021). The resultant climate data were mapped using the "Inverse Distance Weighted (IDW)" method. The basic equation of the Inverse Distance Weighted (IDW) (Eq. 1) is as follows (Loyd, 2007):

$$z(x_o) = \frac{\sum_{i=1}^{n} z(x_i).d_{i0}^{-r}}{\sum_{i=1}^{n} d_{i0}^{-r}} \quad (1)$$

$X_0$ location, where the estimations are done, is a function of n, the adjacent measurements, [z($X_{0i}$) ve i=1,2,…,n]; r is an exponent determining the assigned range of every observation, and d is the gap among observation position $X_i$ and estimation location $X_0$. As the exponent increases, the assigned weight of observations far from the estimation location decreases. The increasing exponent implies that the estimations are very parallel to the nearest observations. The mathematical formulas are as explained above, and they were calculated in ArcGIS software, and the maps were created (Cetin et al., 2019).

The biocomfort index formulas were then applied to each scenario's climate maps, and the biocomfort maps were obtained. The biocomfort maps were created using two different biocomfort indices. The first of these indices is DI (Temperature-humidity index [discomfort indices]) (Eq. 2). The Thom's index (Thom, 1959) is as implemented as follows:

$$DI=T-(0.55-0.0055xRH) \times (T-14.5) \quad (2)$$

Where; DI: Discomfort indices (Temperature-humidity index); T: Average temperature (Monthly) (°C); RH: Relative humidity (%).

According to Cetin et al. (2019), the classification of index and thermal comfort for people are shown in Table 2.

The second index used within this study's scope is Effective Temperature taking wind velocity (ET*v*) (Eq. 3). As stated by Lucena et al. (2016):

$$ETv=37-(37-T)/[0.68-0.0014RH+1/(1.76+1.4v0.75)]-0.29T(1-RH/100) \quad (3)$$

Where; T is dry bulb temperature (°C); RH is relative humidity (%); and v is wind speed (m/s).

According to Lucena et al. (2016), the categories of ET*v* values are shown in Table 3.

Within this study's scope, the biocomfort maps were created first by using the current meteorology stations' data. By adding the current data with the climate parameter changes projected according to SSPs 245 and SSPs 585 scenarios of the CNRM-CM6-1 model, how the biocomfort zones will be shaped if these scenarios occur was determined by using ID and ETv indices.

## Results

*Models Created Using DI Method*

The map created using the DI method and illustrating the biocomfort zones' future conditions ins 2020, 2040, 2060, 2080, and 2100 in Samsun according to SSPs 245, and SSPs 585 scenarios are seen in Figure 2.

Table 1. Information about the projections used in this study.

| Projection | Scenario | Projection period | Resolution |
|---|---|---|---|
| Present | Directorate of Meteorology local measurement data | 2000-2020 | 50 km |
| **CMIP6** | SSPs 245 | 2021-2040<br>2041-2060<br>2061-2080<br>2081-2100 | 50 km |
| | SSPs 585 | 2021-2040<br>2041-2060<br>2061-2080<br>2081-2100 | 50 km |

Table 2. Classification of index and thermal comfort for people (Cetin et al., 2019).

| Index values (DI) | Thermal comfort classifications for people |
|---|---|
| < − 40.0 | Extremely ice |
| − 39.9 to − 20 | Freezing cold |
| − 19.9 to − 10 | Extremely cold |
| − 9.9 to − 1.8 | Very cold |
| − 1.7 to + 12.9 | Cold |
| 13.0 to + 14.9 | Cool |
| 15.0 to + 19.9 | Comfortable |
| 20.0 to + 26.4 | Hot |
| 26.5 to + 29.9 | Very hot |
| > + 30.0 | Extremely hot |

Table 3. Categories of ET*v* Values (Lucena et al., 2016).

| ET (°C) | Thermal Sensation | Degree of Physiological Stress |
|---|---|---|
| ET < 5 | Very cold | Extreme cold stress |
| 5 ≤ ET < 10 | Cold | Extreme cold stress |
| 10 ≤ ET < 13 | Moderately cold | Shivering |
| 13 ≤ ET < 16 | Quite cool | Cooling of the body |
| 16 ≤ ET < 19 | Slightly cool | Slight cooling of the body |
| 19 ≤ ET < 22 | Mild | Contraction of blood vessels |
| 22 ≤ ET < 25 | Comfortable | Thermal neutrality |
| 25 ≤ ET < 28 | Warm | Slight sweating, Dilation of blood vessels |
| 28 ≤ ET < 31 | Quite hot | Sweating |
| 31 ≤ ET < 34 | Hot | Profuse sweating |
| ET > 34 | Very hot | Thermoregulatory failure |

As a result of the calculation performed using the DI method, it can be seen that the comfort zones generally increased in the following years in both SSPs 245 and SSPs 585 scenarios. The province examined within the present study consists of cold zones by 78.26%, cool zones by 19.84%, and comfortable zones by 1.90% in 2020. As a result of calculations made according to the SSPs 245 scenario, it was projected that the province would consist of cold zones by 62.97%, cool zones by 32.99%, and comfortable zones by 4.04% in 2040, cold zones by 8.34%, cool zones by 67.46%, and comfortable zones by 24.20% in 2060, cold zones by 52.97%, cool zones by 39.5%, and comfortable zone by 7.53% in 2080, and cold zones by 25.57%, cool zones by 55.93%, and comfortable zones by 18.50% in 2100.

As a result of calculations made using the SSPs 585 scenario, it was projected that the province would consist of cold zones by 74.14%, cool zones by 23.75%, and comfortable zones by 2.11% in 2040, cold zones by 35.24%, cool zones by 47.67%, and comfortable zones by 17.09% in 2060, cold zones by 1.27%, cool zones by 60.01%, and comfortable zone by 38.72% in 2080, and cool zones by 1.72% and comfortable zones by 98.28% in 2100. As a result of these calculations, it was determined that there would be no cold zone in 2100, and the majority of the province will be comfortable.

*Models Created Using ETv Method*

The map created using the ET*v* method and illustrating the future conditions of biocomfort zones in Samsun province for the years 2020, 2040, 2060, 2080, and 2100 according to SSPs 245, and SSPs 585 scenarios are seen in Figure 3.

As in DI method, the results obtained from calculations using ET*v* method showed that, according to both SSPs 245 and SSPs 585 scenarios, the comfort zones in the province increased in general. Currently, the province consists of cold zones by 1.97%, moderately cold zones 43.69%, quite cool zones by 36.84%, slightly cool zones by 10.37%, mild zones by 7.06%, and comfortable zones by 0.07%. The results obtained from calculations performed using SSPs 245 scenario showed that the province would consist of moderately cold, quite cool, slightly cool, mild, comfortable zones by 2.08, 54.76, 32.84, 9.6, 0.72 % in 2040, respectively. In year 2060, the province will consist of quire cool zones by 8.56%, slightly cool zones by 63.92%, mild zones by 23.49%, and comfortable zones by 4.03%. It was also projected that the province would consist of moderately cold zones by 0.77%, quite cool zones by 35.34%, slightly cool zones by 46.05%, mils zones by 14.38%, and comfortable zones by 3.46% in 2080 and moderately cold zones by 0.63%, quite cool zones by 31.42%, slightly cool zones by 51.08%, mild zones by 13.95%, and comfortable zones by 2.92% in 2100.

As a result of the calculations made according to the SSPs 585 scenario, it was projected that the province would consist of cold zones by 0.69%, moderately cold zones by 12.89%, quite cool zones by 62.12%, slightly cool zones by 16.27%, mild zones by 7.51%, and comfortable zones by 0.52% in 2040, moderately cold zones by 1.56%, quite cool zones by 54.16%, slightly cool zones by 35.18%, mild zones by 9%, and comfortable zones by 0.1% in 2060. Moreover, the province was estimated to consist of quite cool zones by 31.33%, slightly cool zones by 52.17%, mild zones by 14.38%, and comfortable zones by 2.12% in 2080 and slightly cool zones by 0.82%, mild zones by 63.67%, and comfortable zones by 31.67% in 2100. Furthermore, the warm zones that there have never been before will form and they will constitute approx. 3.84% of the province.

**Discussion**

Using the SSPs 245 and 585 under intermediate and most severe, the results indicated that the biocomfort zones are gradually increase during 2020-2100 in Samsun province. Even though this might seem like a positive outcome, it can be seen that, when examining the change in comfort zones, the change in climate parameters will be very sharp and will occur in a short time. This change will reach a significant level in 2100, and the climate parameters will have been significantly changed throughout the province.

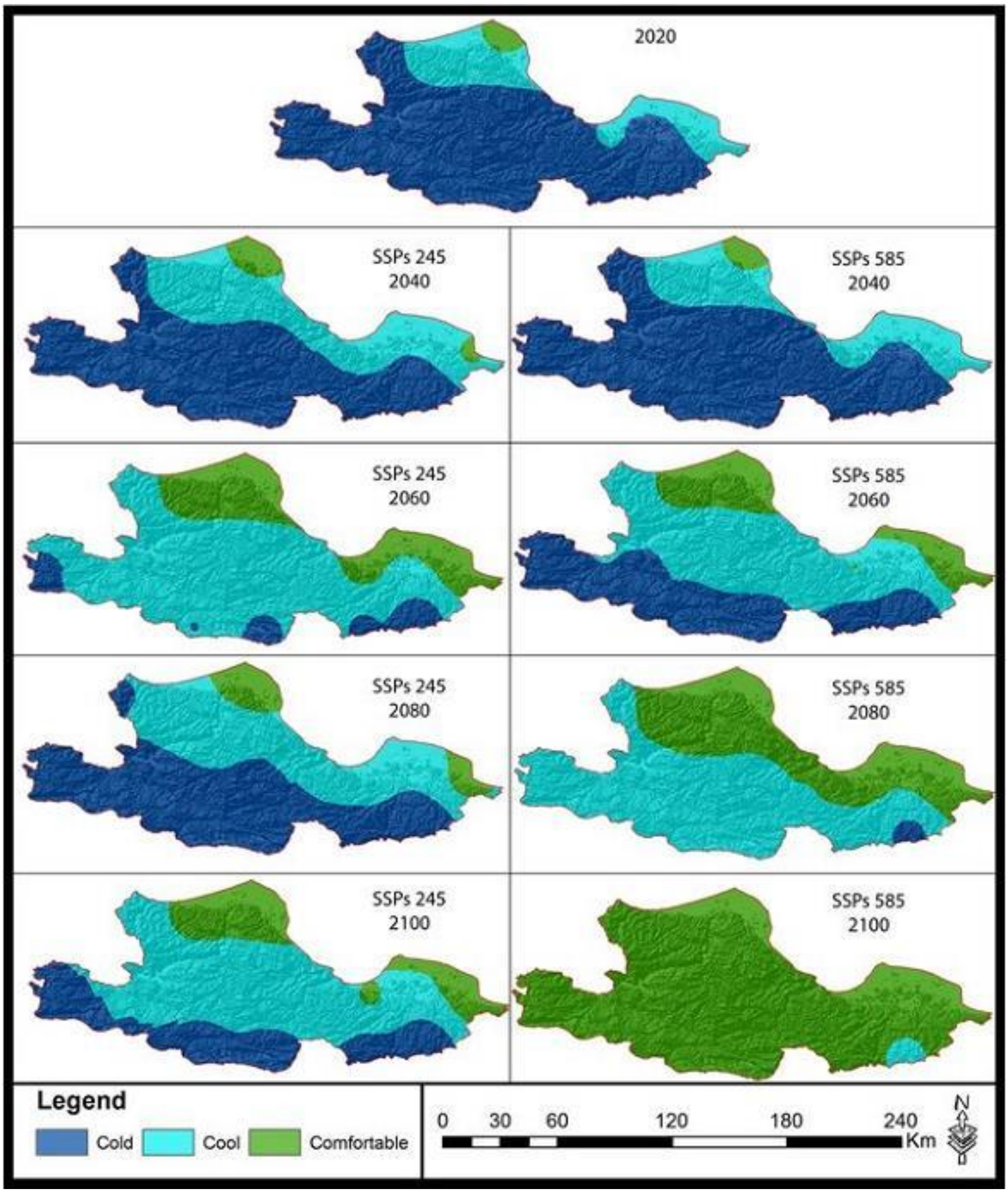

Figure 2. Models created using DI method

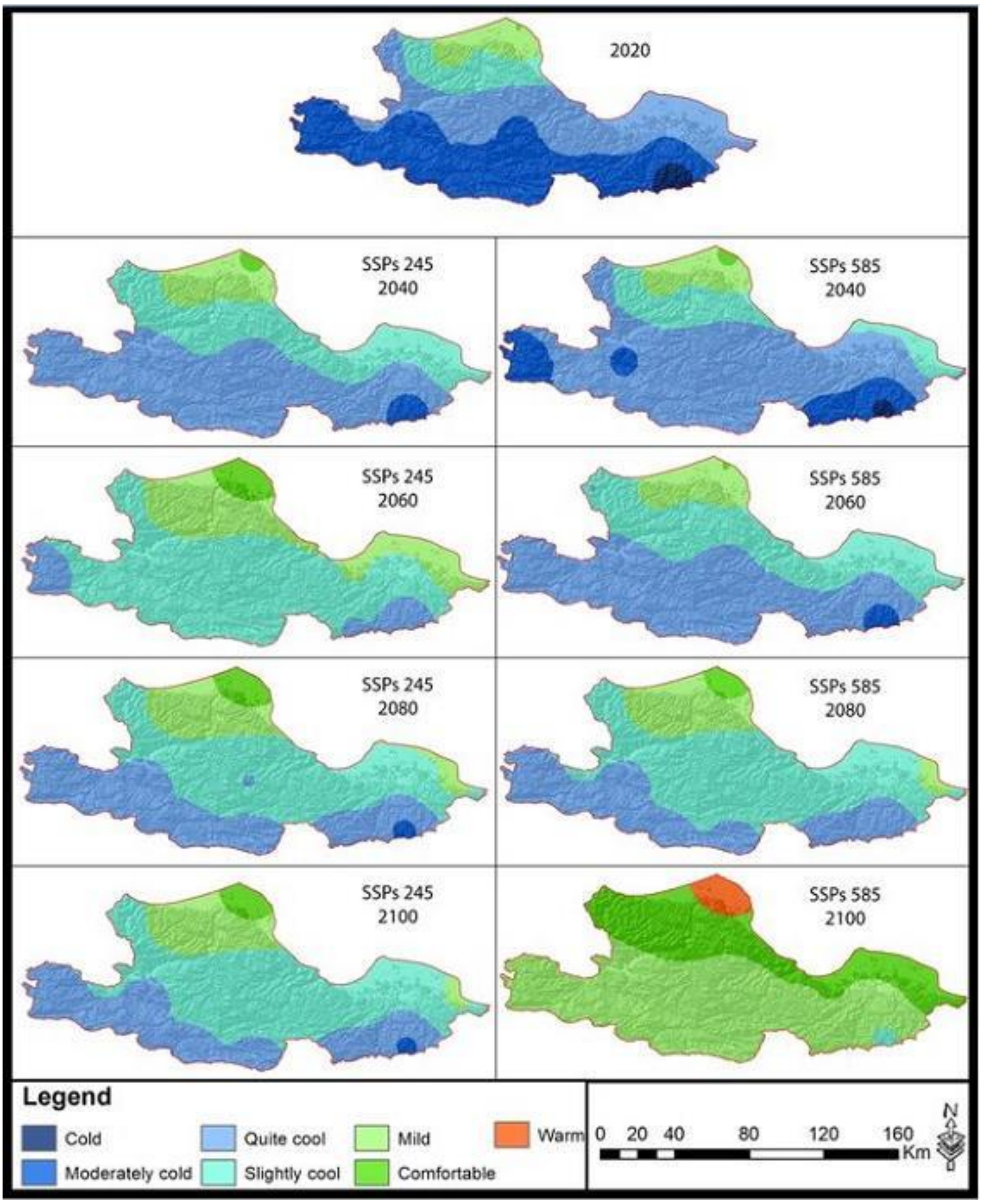


Figure 3. Models created using ET*v* method

Biocomfort is a critical factor in determining the residential areas. Human life is significantly influenced by the weather and climate. The environment should be within a specific humidity, temperature, and wind range for humans to feel comfortable and relax. When the biocomfort values exceed beyond the suitable ranges for humans, individuals feel uncomfortable in these areas and want to leave (Cetin, 2020).

While temperature levels higher or lower than these values may cause conditions such as anger or weariness, it may also result in various problems in respiratory and circulatory systems, burning eyes, and dry throat. Thus, by using clothes and heating or cooling systems, individuals make an effort to adjust the environmental conditions to a suitable level. However, adjusting the outdoor climate conditions to humans' ranges would require significant energy consumption and, consequently, cost very much. It is expected that the global energy consumption in 2030 will be 60% greater than the current level in the world and that the energy consumption of our country will be two folds of the current consumption. Considering that the population will grow only by 1% concurrently, it can be perceived how high the escalation in the consumption of energy will be. In this energy consumption, the energy consumed for cooling and heating has a substantial share (Kilicoglu et al., 2020).

Given the energy, which should be consumed in order to adjust the thermal conditions to the comfortable range for humans and human satisfaction, and the costs of this energy consumption, it can be seen that how important considering the biocomfort zones is especially in determining the new residential areas (Cetin et al., 2019). Numerous studies have been carried out on determining the biocomfort zones after then revealing the biocomfort effects on human health (Cetin, 2020).

However, biocomfort is a phenomenon that changes depending on the climate parameters, and it is projected that global climate change will cause a sudden change in the global climate in the future. Thus, several studies are being performed on the effects of changes in climate parameters on both plant cover and climate types. The results of previous studies indicate that the climate types in our country will remarkably change in the near future (Cetin, 2020). For instance, while the very-humid or humid climate in Emberger climate classification dominates the entire Mersin province nowadays, it was estimated that, based on RCP 8.5 scenario, the sub-arid climate would cover approx. 80.5% of this province in 2070 (Cetin, 2020). In a similar study, Aktaş (2020) reported that aridification will extent high levels in Konya in 2070, that the deserted zones that do not currently exist will form, and those humid areas will almost evanesce. Similar results were reported in numerous studies, and it was emphasized that global climate change would have significant and destructive effects throughout the world (Lee et al., 2019). It is expected that Turkey will be affected by this process at most. It is projected that the temperature increase is limited at 3°C for the early part of the period 2013-2099, but, according to RCP8.5, the country-wise temperature increase might reach 6°C (Demircan et al., 2017).

The results of the present study are in line with those reported in previous ones in terms of increased comfort zones due to temperature increases. Even though the increase in biocomfort zones might seem positive for humans, it indicates that the reflections of climate changes will be extreme, and this change will take place in a short time. It is projected that global climate change will destructive and irreversible effect on living organisms and ecosystems, it will increase the ecological degradation and climate-related natural disasters such as pollution, drought, floods, desertification, forest fires, and erosion, and that the critical effects will be the rise in temperature and reduce in water resources (Lee et al., 2019).

Morphologic, anatomic, and phenological characteristics of living organisms are shaped under the effects of genetic structure and environmental conditions (Sevik et al., 2019). The continuity of life is possible only when various outdoor conditions fit in an appropriate range. Particularly, the climatic factors are the most effective factors playing a role in the development and spread-out of plants (Ertugrul et al., 2021). The changes in precipitation and temperature, among the most important climatic factors, negatively affect many living organisms' lives (Canturk & Kulaç, 2021).

The organisms experiencing this adverse effect at the highest level are the plants. This is because plants have no effective and fast migration skills. Thus, since many plant types will not adapt sufficiently fast to the effects to emerge as due to the future climate changes, the populations of many species may significantly decrease and the species having a limited range of propagation may become completely extinct. It was reported that the potential area of dispersion of *F. sylvatica* would decrease by up to 56% (Thurm et al., 2018). It was stated that *Picea abies*, *Larix decidua*, *Pinus sylvestris*, and *Betula pendula* species would be the species that will be most affected by the climate changes in Europe (Dyderski et al., 2018). Hence, the fact that the plants cannot sufficiently rapidly adapt to climate change effects might result in various problems such as the extinction of species (especially the rare and endemic ones), ecosystem losses, and biodiversity losses.

The adverse effects of climate change on the ecosystem will also negatively affect human life, which also is a part of the ecosystem. A rapid increase in biocomfortable areas might also have destructive effects on food and water resources, which are among humans' fundamental needs. Thus, considering the results from different aspects, it can be stated that the changes that will significantly affect the lives of all the living organisms throughout the world will take place in a short time.

## Conclusion

In conclusion, the biocomfort zones in Samsun province would remarkably change in the near future; this change will show up as general warming, and that warm zone might form in Samsun in 2100. According to the study results, it can be interpreted that, for human comfort, the cooling costs will significantly increase in the future. The cooling systems increase global climate change because of the energy consumption and gases that these systems use. Hence, the temperature increase will result in further use of these systems, and the increase in the use of these systems will result in a further increase in temperature.

It is emphasized in many studies that global climate change will have direct or indirect effects on almost the entire world. Of course, the most effective way of avoiding these effects is to decelerate the global climate change first and then stop it. However, it does not seem possible at all. In this case, the most effective defense mechanism against global climate change is predetermining the possible changes and taking measures in this parallel. Local and regional measures play critical roles in the struggle with the global climate change effects. The present study shows that the comfort zones in Samsun province will shift from north to south. Thus, while planning for new residential areas, it is necessary to plan them for southern parts of the province.

Besides, in order to minimize the adverse effects of irreversible global climate change, it is crucial to decrease the effect of greenhouse gas by taking measures such as decreasing the use of fossil fuels, which have an essential role in the formation of this process and using renewable energy sources instead of fossil fuels. Moreover, it is known that one of the most important effects of this process will be on the water, which is an inevitable source of life. Thus, it is necessary to take immediate measures such as ensuring water-saving, decreasing the factors polluting the waters, recycling the wastewaters, and using them in agricultural irrigation.

While making these applications, new biocomfort areas should be considered, especially considering that the rate of benefiting from solar energy will increase throughout the province. In addition, forest management plans and orchard plantations should be designed according to these results, considering that tree species that cannot be grown in the southern parts of the province today (which want a warmer climate) can grow. When authorities make an agricultural plan, they should consider the average temperature will increase, especially in the southern parts of the province. In this way, agricultural products that cannot be grown in these regions due to the temperature demand today will be able to be grown by turning them into an opportunity, especially for agricultural applications.

The study results show that the rate of comfortable space for people will increase throughout the province. However, a general temperature increase is predicted throughout the region. This situation may adversely affect especially locally distributed plant and animal species. Conservation strategies should be developed and implemented for endangered, rare, and endemic plant and animal species, especially assuming that this situation will significantly affect the bird sanctuary region in the north of the province.

**Ethics Committee Approval**

N/A

**Peer-review**

Externally peer-reviewed.

**Author Contributions**

Conceptualization: İ.K.; Investigation: İ.K.; Material and Methodology: İ.K; Supervision: İ.K.; Visualization: İ.K.; Writing-Original Draft: İ.K.; Writing-review & Editing: İ.K.; Other: Author has read and agreed to the published version of manuscript.

**Conflict of Interest**

The author has no conflicts of interest to declare.

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