Assessment of Climate Suitability for Cherry (*Prunus avium* L.) in Turkey in a Changing Climate

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ABSTRACT

Climate is a crucial factor for agricultural production and productivity. Foreseeing climate change in the future means predicting the possible effects on agriculture, and such studies observing year-dependent variability and predicting the effects of the future climate change are valuable for both food security and economic value especially for countries which have commercial agricultural products like Turkey, as a Mediterranean Basin country with significant agricultural diversification. Cherry (*Prunus avium* L.), which is one of Turkey's most important export products is expected to be affected significantly by climate change. Therefore, it is very important to see whether it will grow in the same regions in the future due to climatic changes for cherry. Hereunder, high resolution climate data, as an input for the membership function to be applied for classification of the climate suitability index, were obtained from RegCM4.4 under the RCP8.5 scenario for the period of 2023-2050 vs. 1991-2018. Briefly, results indicate that adverse changes in climate suitability conditions for current cherry growing locations, 156 locations in the study, and the number of climate suitable locations for cherry will significantly decreases in the best part of locations in the near and mid-future.

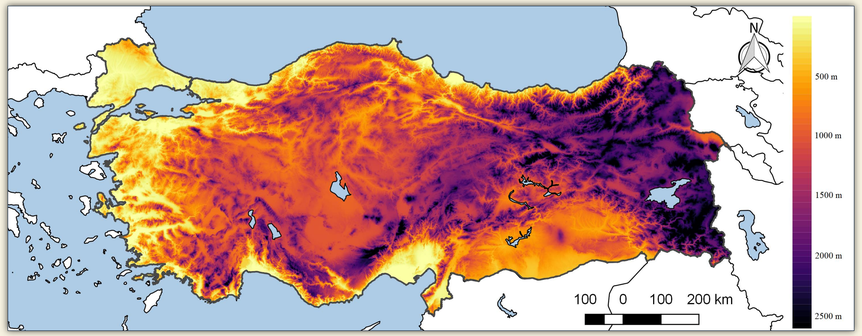

Figure 1.Domain of the Study

FORCING DATA AND EXPERIMENT DESIGN	
Domain	Turkey
Domain coordinates	Lon: 25.21E-45.28E & Lat: 35.81N-42.51N
Global Climate Model	Global Climate Model of the Max Planck Institute for Meteorology (MPI-ESM-MR)
Regional Climate Model	RegCM4.4
Grid Resolution	10 km x 10 km
Reference Time Scale	1991 - 2018
Future Time Scales	2023 - 2050
Projection Scenarios	RCP8.5 (CO_2 level in 2050: 541 ppm)
Variables	Maximum, Minimum, Mean Temperatures Precipitation Relative Humidity Duration of Sunshine Wind Speed

Table 1. Forcing Data and Experiment Design

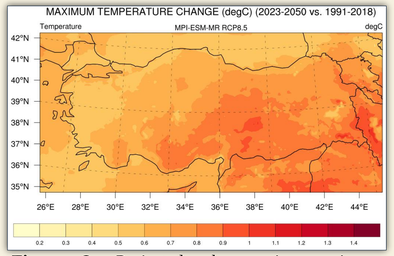

Figure 2. Projected change in maximum temperature in the future period of 2023-2050 for Turkey compared to the 1991-2018 reference period.

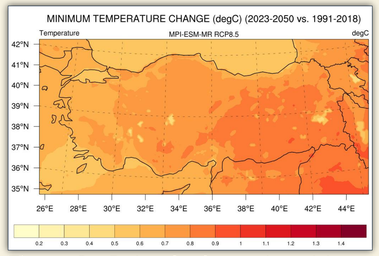

Figure 3. Projected change in minimum temperature in the future period of 2023-2050 for Turkey compared to the 1991-2018 reference period.

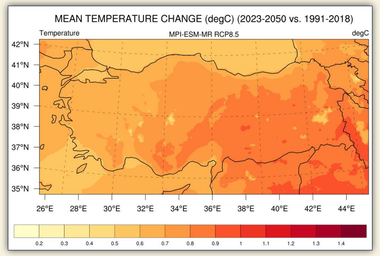

Figure 4. Projected change in mean temperature in the future period of 2023-2050 for Turkey compared to the 1991-2018 reference period.

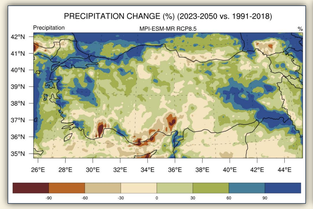

Figure 5. Projected change in precipitation in the future period of 2023-2050 for Turkey compared to the 1991-2018 reference period.

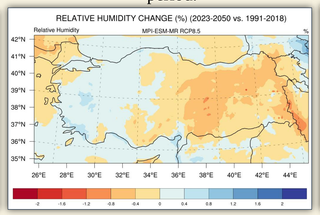

Figure 6. Projected change in relative humidity in the future period of 2023-2050 for Turkey compared to the 1991-2018 reference period.

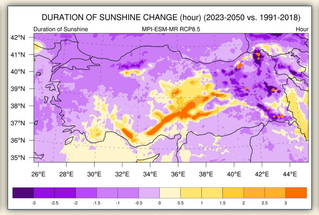

Figure 7. Projected change in duration of sunshine in the future period of 2023-2050 for Turkey compared to the 1991-2018 reference period.

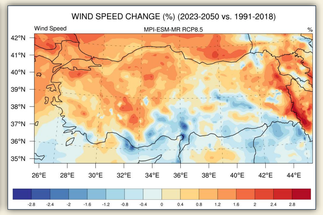

Figure 8. Projected change in wind speed in the future period of 2023-2050 for Turkey compared to the 1991-2018 reference period.

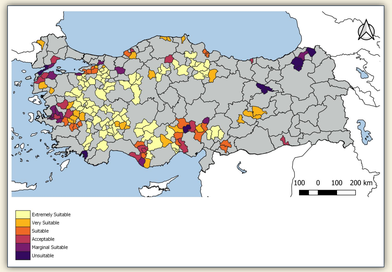

Figure 9. Location-based spatial distribution of the cherry climate suitability classification (CSI) for the period of 1991-2018.

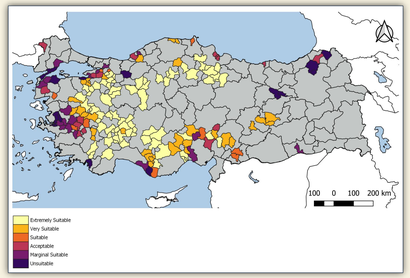

Figure 10. Location-based spatial distribution of the projected cherry climate suitability classification (CSI) under RCP8.5 for the period of 2023-2050.

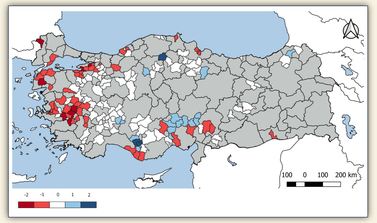

Figure 11. Change of location-based spatial distribution of the projected cherry climate suitability classification under RCP8.5 for the period of 2023-2050 with respect to the period of 1991-2018.

CONCLUSIONS

Model projections under the RCP8.5 scenario for 2023-2050 with respect to the baseline period of 1991-2018 indicate that changing climate in Turkey, particularly in West of Turkey, which is considered the homeland of cherry cultivation, may cause a negative effect on cherry growing regions and lead to reduce in climate suitability. Aegean and Marmara regions are mostly affected areas with negative climate suitability change. Minor changes are expected in Central Anatolia and slightly increasing climate suitability on southern parts of Central Anatolia and Northern parts of Mediterranean region. The membership function was applied in the climate suitability index calculation and the classification was made according to the natural break method. The results show that in the near and medium future, there will be a decrease in climate suitability in more than half of the locations where cherry are grown. Considering the commercial value of cherry, adaptation strategies especially for prone locations become more substantial because of future production.

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