MODELING THE DISTRIBUTION AREAS OF *Lonicera caucasica* Pall. IN THE CAUCASUS MOUNTAINS AND SURROUNDING

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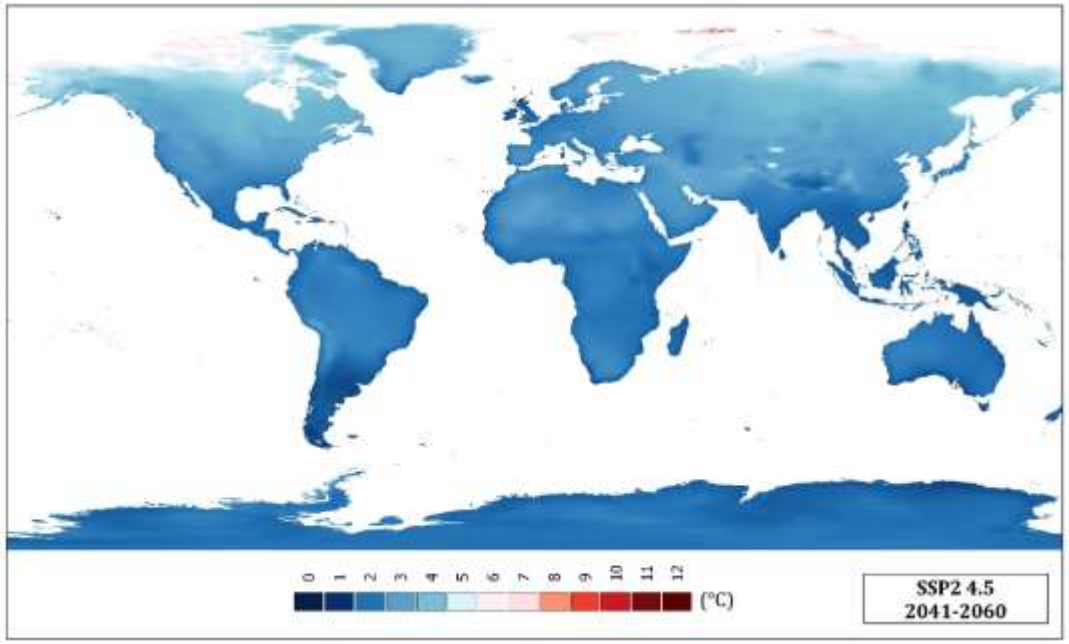
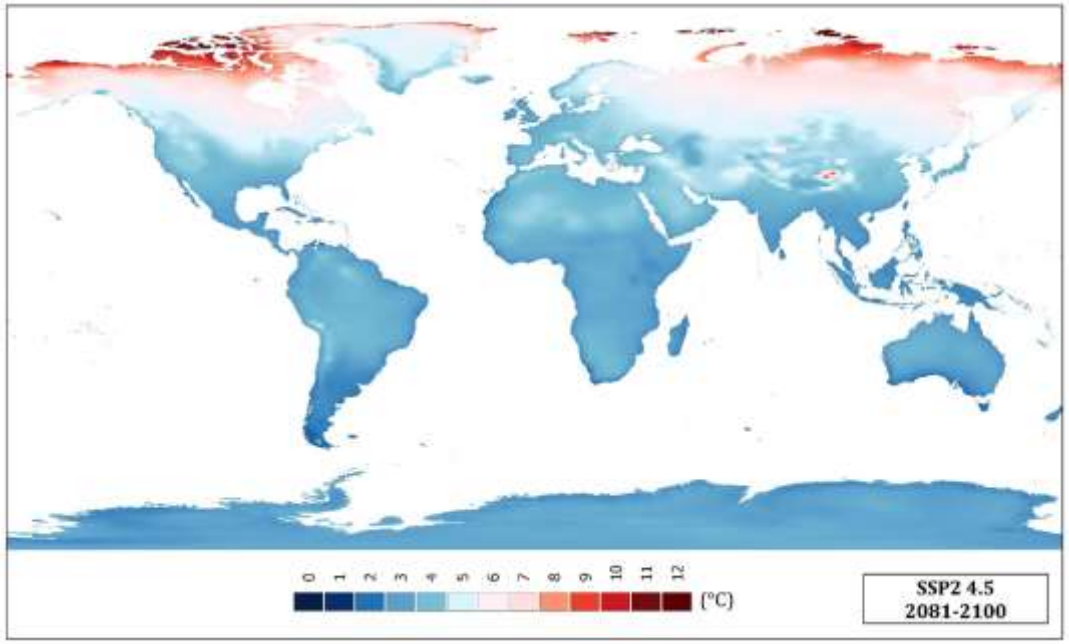
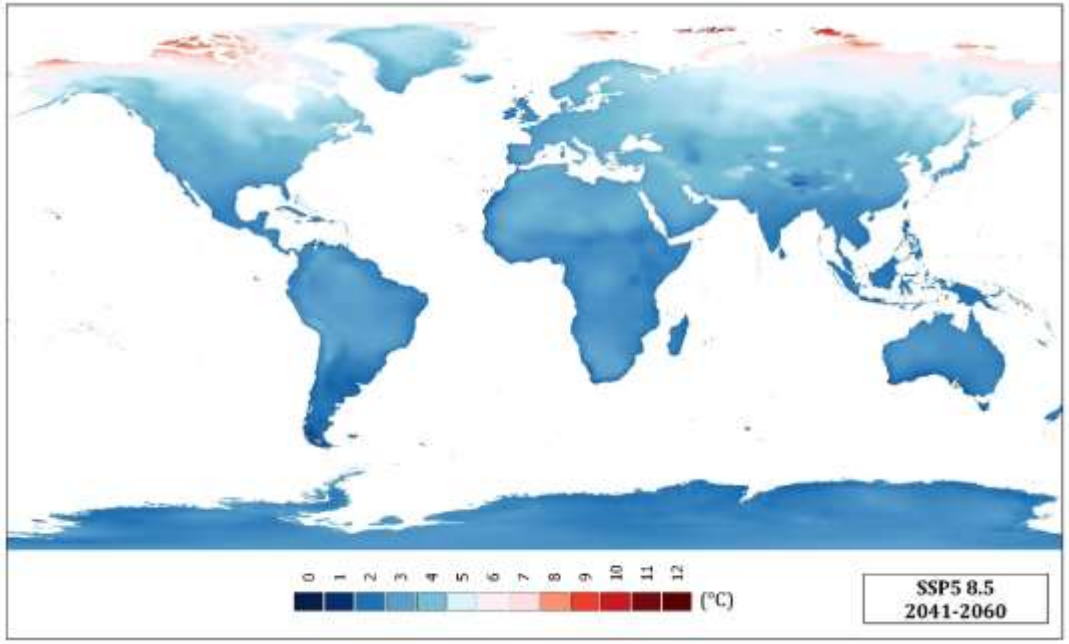
GLOBAL CLIMATE CHANGE

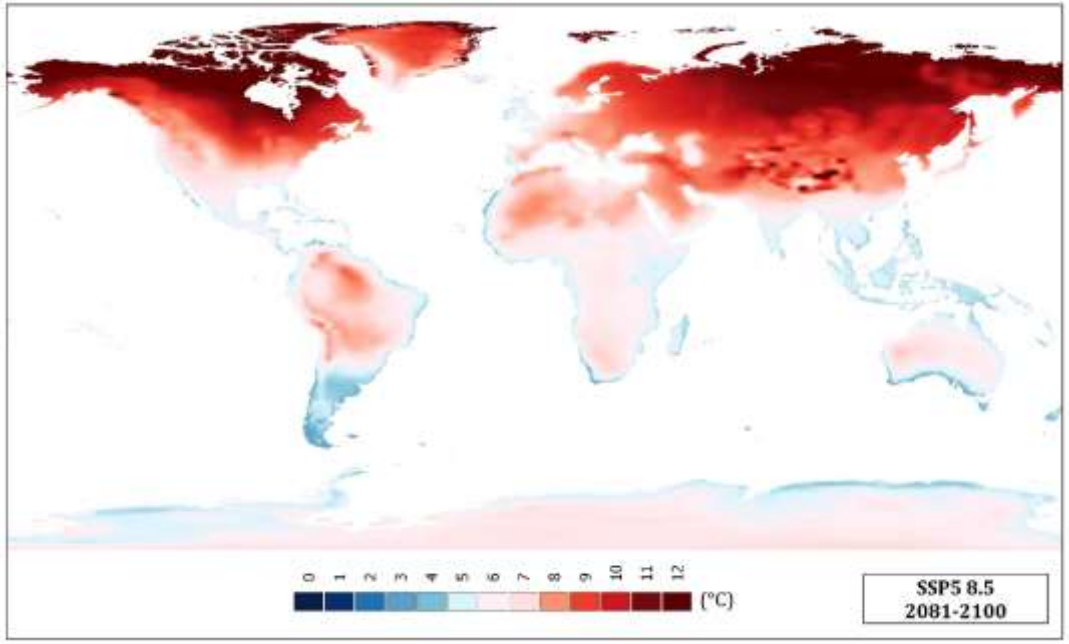
- Climate change is defined as "changes in the mean state and/or variability of the climate over a period of decades or more, regardless of the cause".

Amount of temperature increase according to climate change scenarios

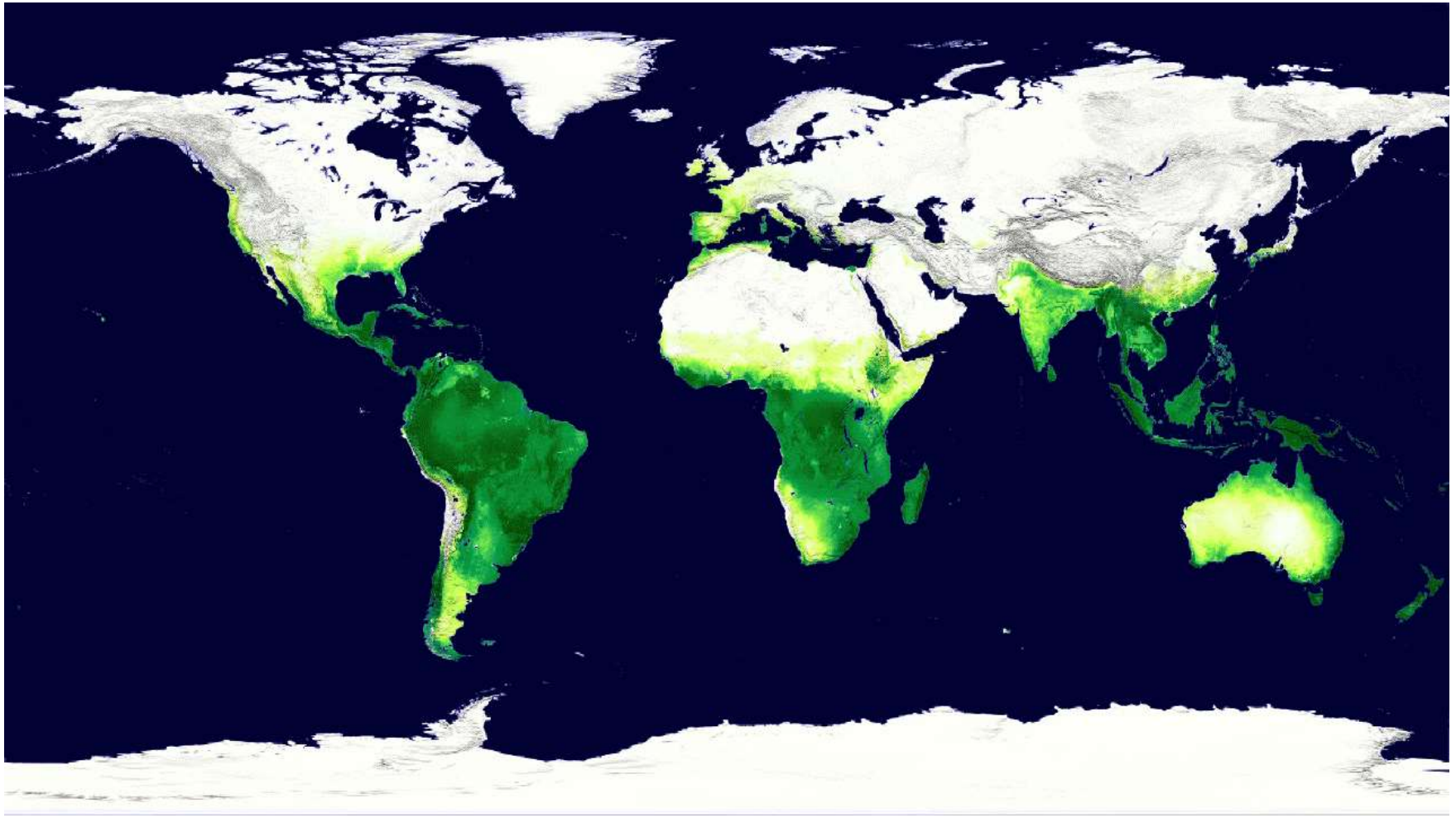




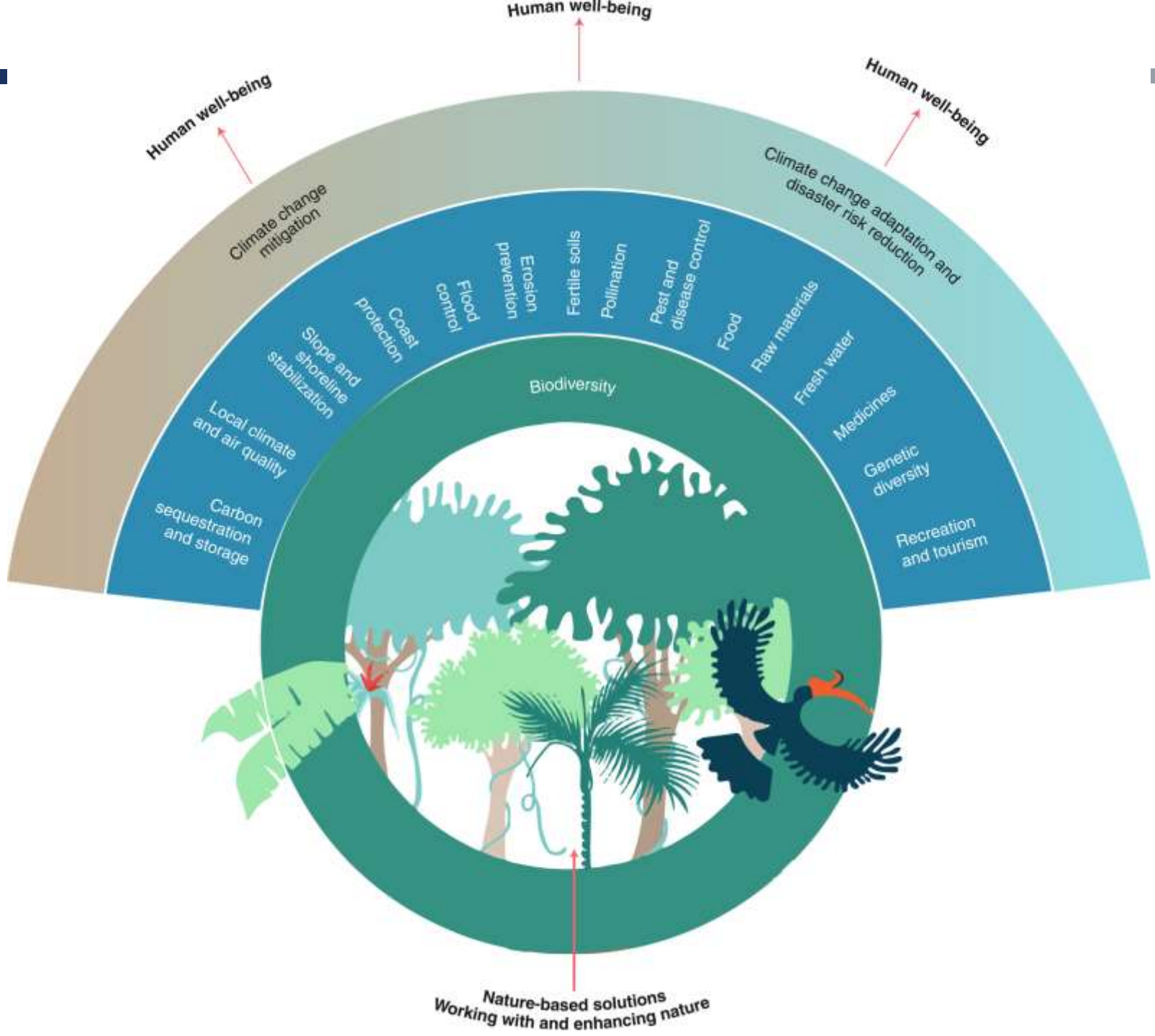




- This phenomenon, is not only an increase in temperature, but also the increase in the frequency and effect of extreme weather events such as droughts, forest fires, floods, violent hurricanes, rising ocean and sea water levels, increased acidity of oceans, and melting of glaciers.



- Plants that are dependent on many variables such as soil, light, water and nutrients to grow and to be healthy are directly affected by these factors as well as climatic factors. Therefore, global climate change plays an extremely important role in the growth of plants and their distribution areas.


Human well-being
Human well-being
Human well-being
Climate change mitigation
Climate change adaptation and disaster risk reduction
Slope and shoreline stabilization
Coast protection
Flood control
Erosion prevention
Fertile soils
Pollination
Pest and disease control
Food
Raw materials
Fresh water
Medicines
Genetic diversity
Recreation and tourism
Local climate and air quality
Carbon sequestration and storage
Biodiversity
Nature-based solutions
Working with and enhancing nature

- Due to global climate change, human communities, ecosystems and animals as well as plants are seriously affected. With the impact of climate change, the distribution areas of plants could be change and they might be occur in different geographies.

THE AIM OF THE STUDY

- In this study, the current and future distribution areas of Caucasian Honeysuckle, which appears to have a narrow distribution when we look at the world's surface area, were modeled under the influence of climate change and Turkey, Georgia, Armenia, Azerbaijan, the southernmost part of Russia and the northwest of Iranian were selected as the study area.

MATERIAL

Caucasian honeysuckle (*Lonicera caucasica*) is a species of the honeysuckle family (Caprifoliaceae). It is naturally distributed in the Western and Eastern Black Sea, Erzurum-Kars, Upper Murat-Van sub-regions of Turkey and it is recorded to have been seen in the Caucasus. It grows between 500-2790 m altitudes; in coniferous or deciduous forests and thickets. The flowers are fragrant. The plant is resistant to dry weather conditions.

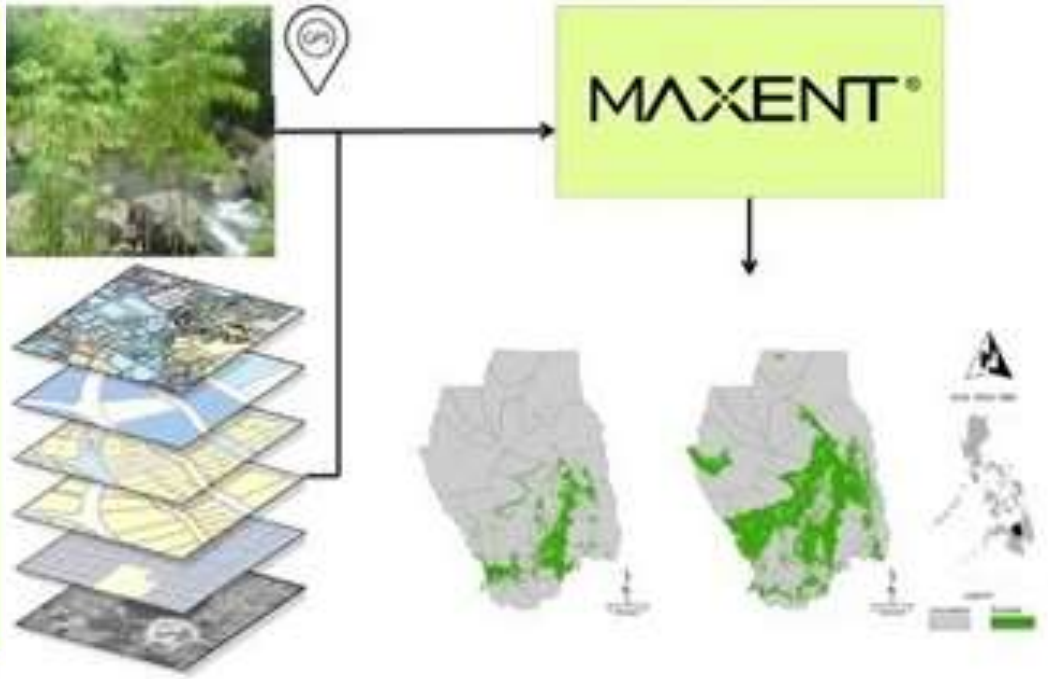
Taxonomic Hierarchy

Subkingdom: Tracheobionta
Division: Magnoliophyta
Class: Magnoliopsida
Subclass: Asteridae
Order: Dipsacales
Family: Caprifoliaceae
Genus: *Lonicera*
Species: *Lonicera caucasica*

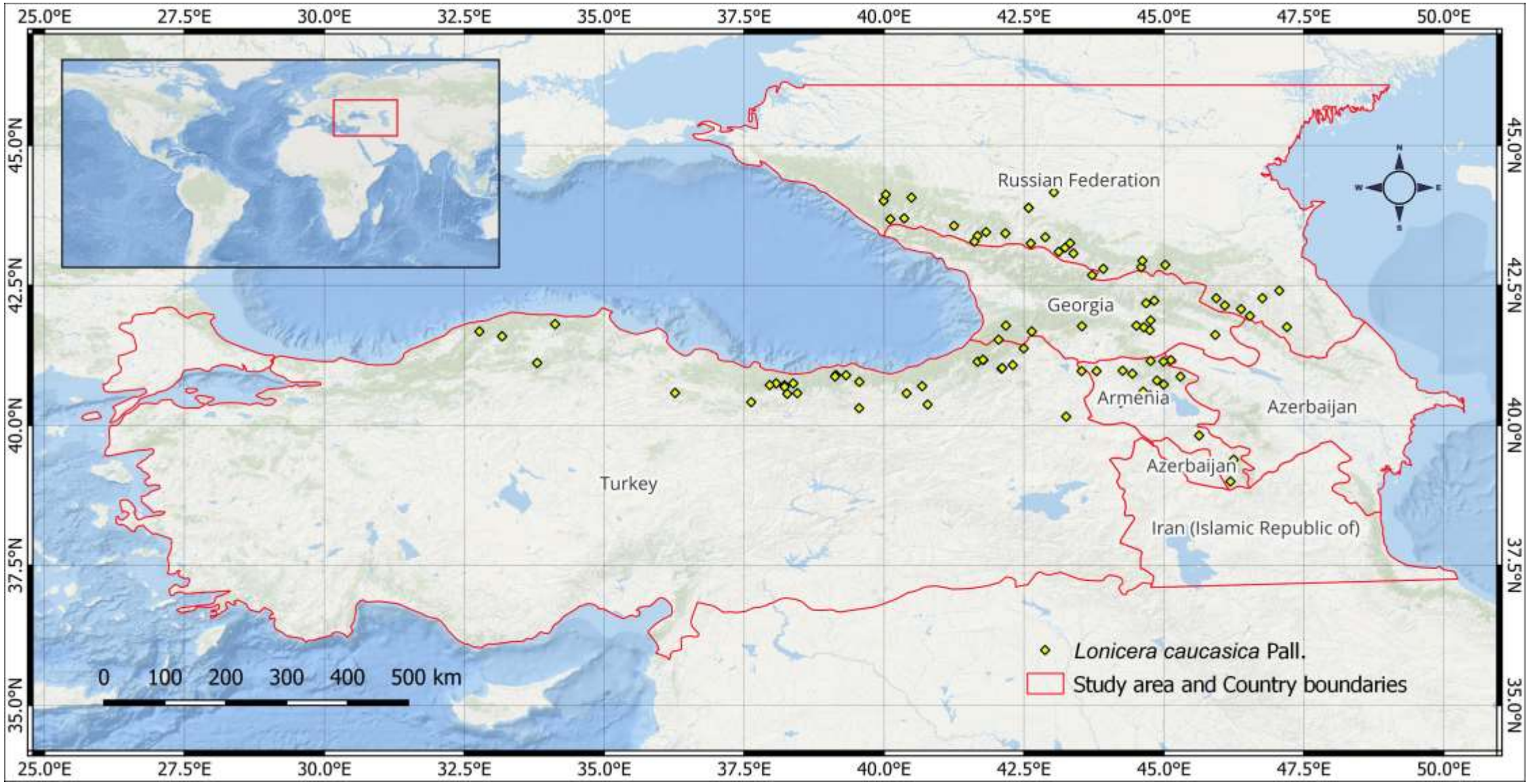
It is an upright shrubby woody species that grows 1-3 m tall. Young branches are stiff, glabrous. Leaves elliptic-ovate, 2-10 x 1.5-5 cm, sharp-pointed or abruptly tapering, rounded at the base, glabrous above, very sparsely hairy below, shortly petiolate. Inflorescence May-July, between leaf and branch; inflorescence 2-flowered, peduncle 6-14 mm, peduncle long; bracteoles ribbon-like, 3-5 mm, shorter than ovary; bracteoles obtuse, ~1 mm adjacent to leaf; petals 2-parted, pink or white, 10-13 mm, glabrous or with fine soft short hairs; tube convex; ovary paired, fused together. Fruit are edible grape-like, black, globose, 5-10 mm in diameter.

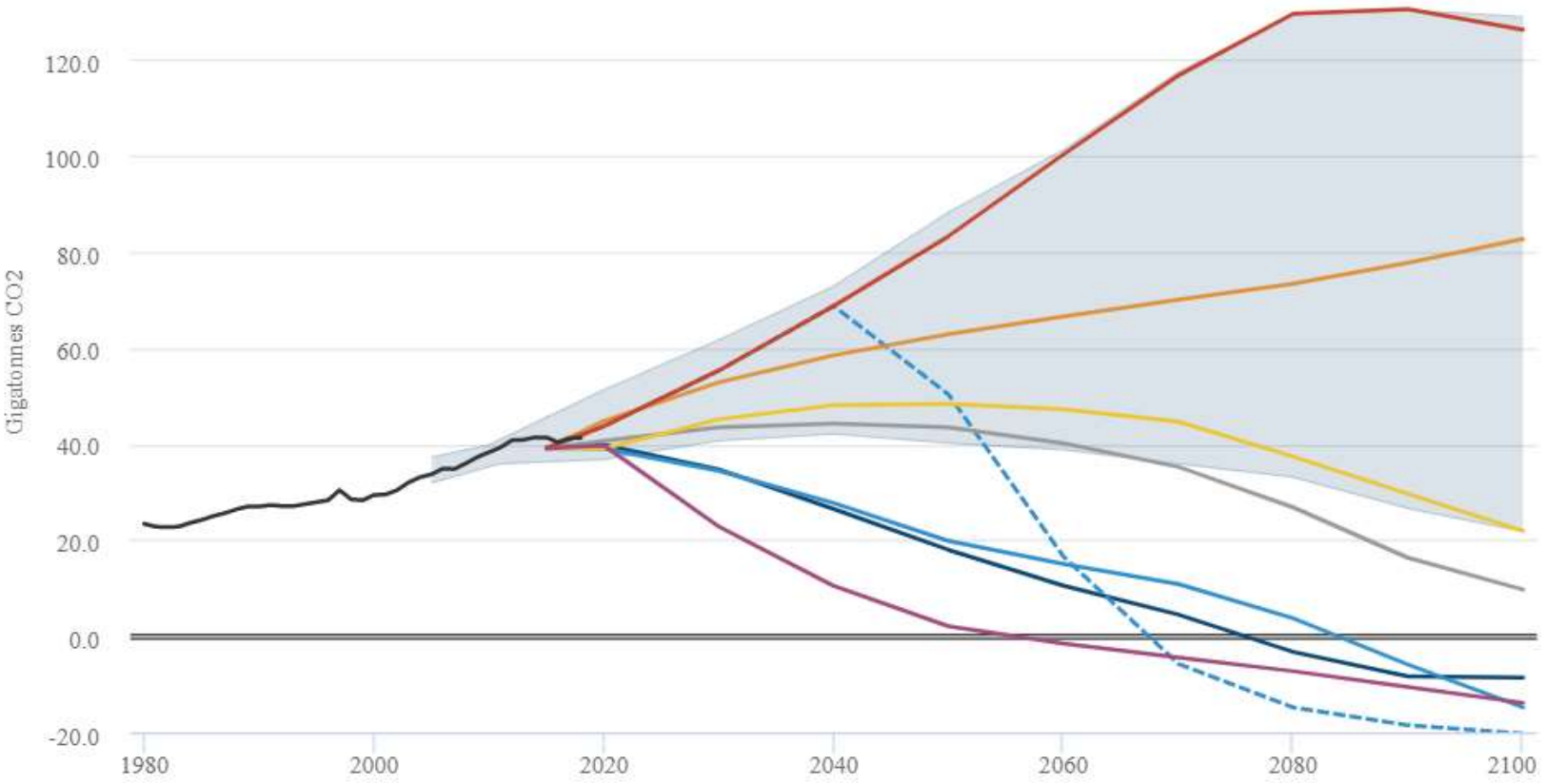
METHOD

- According to the climate change scenarios of *Lonicera caucasica Pall.*, MaxEnt program, which is the Maximum Entropy method, was used in modeling the present and future distribution areas, and QGIS, a geographic information systems program, was used for pre-process preparation. 96 sample points representing the distribution area of the species were obtained as a result of various literature searches.



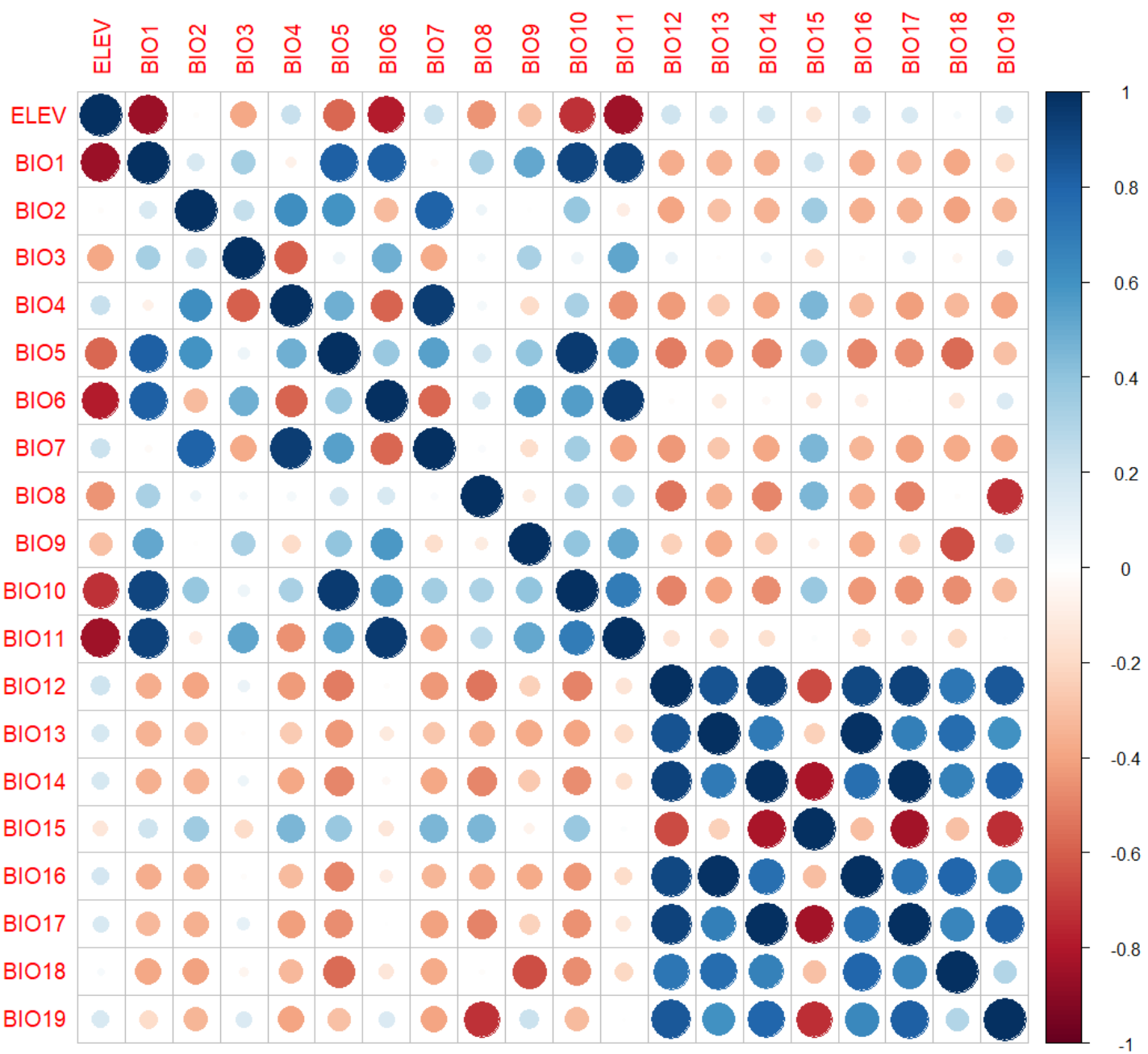
Study area and sample areas of *Lonicera caucasica* Pall.





- In recent years, many modeling tools have been used to predict the effects of climate change on the distribution of species, as well as to predict possible distribution areas of a species under different climate change scenarios.

- The IPCC AR6 energy modeling community has developed a new set of emissions scenarios driven by different socioeconomic assumptions, These are "Shared Socioeconomic Pathways" (SSPs). SSP2 4.5 and SSP5 8.5 scenarios were used in this study.

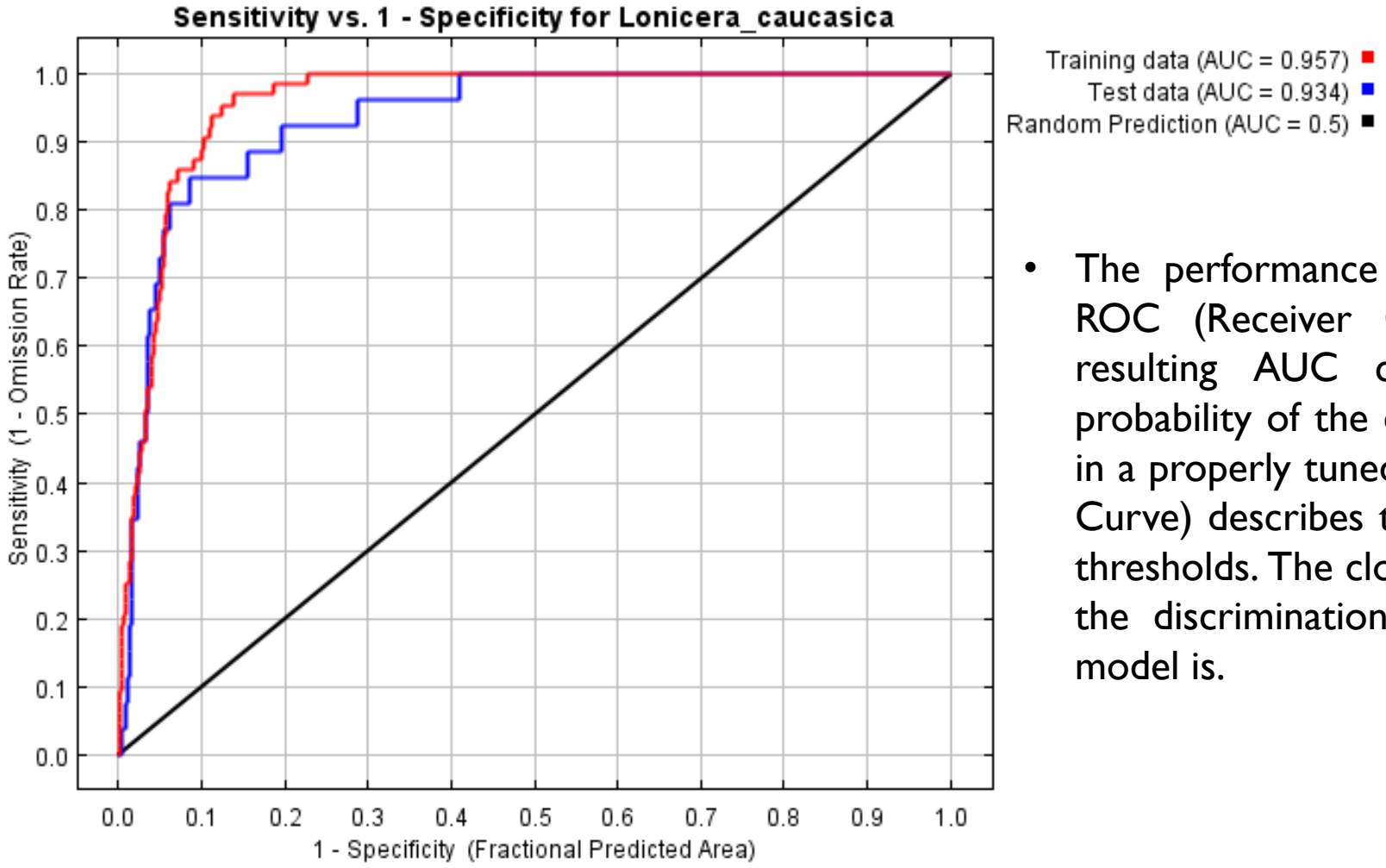


Whether 19 variables are correlated according to the demands of our species was revealed by correlation analysis. Variables that were considered to be correlated were not included in the model.

- For today's potential distribution area modelling, 7 different climatic variables, which were created by using climate data of the years 1950-2000, consisting of different precipitation and temperature parameters, were used with a spatial resolution of 30 seconds (approximately 800 m). For the future projection, 7 climatic variables created by using the IPSL-CM6A-LR 2050 and 2070 SSP2 4.5 and SSP5 8.5 climate scenarios, which were prepared on the basis of the sixth IPCC report, were utilized.

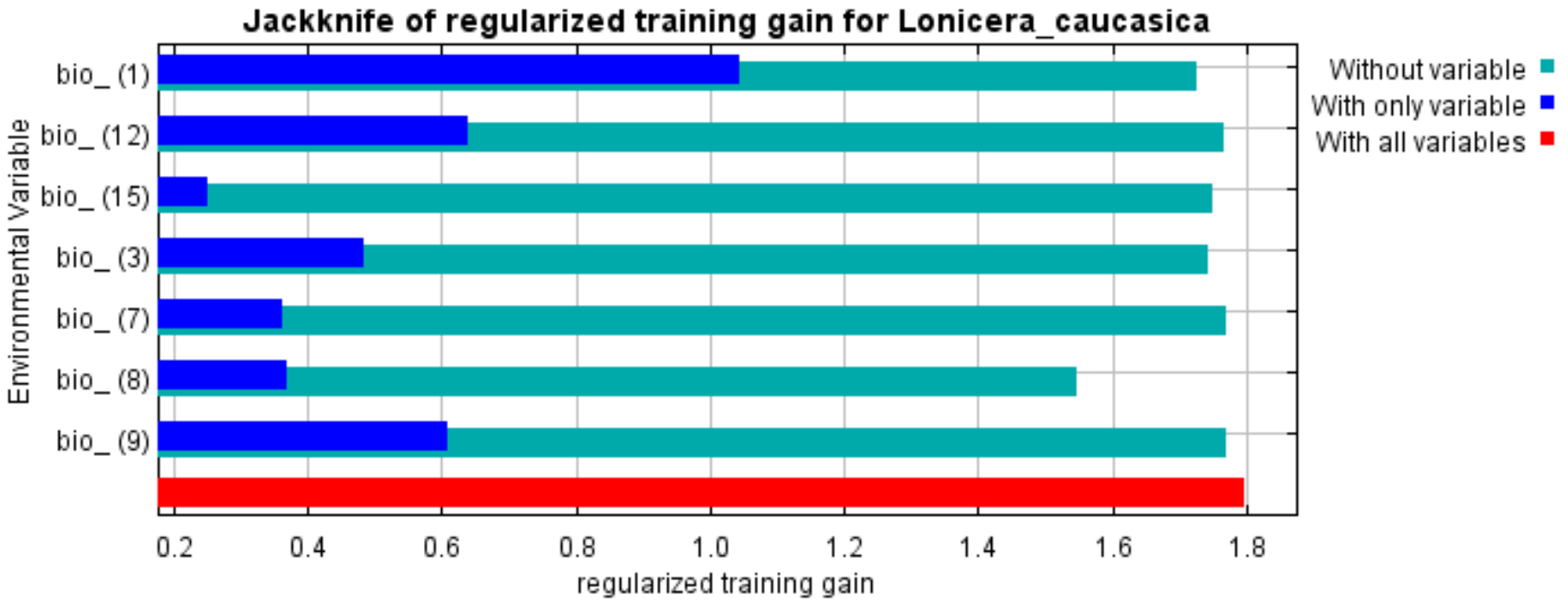
ENVIRONMENTAL VARIABLES
bio_01 = Annual Mean Temperature
bio_02 = Mean Diurnal Range (Mean of monthly (max temp - min temp))
bio_03 = Isothermality (BIO2/BIO7) (* 100)
bio_04 = Temperature Seasonality (standard deviation *100)
bio_05 = Max Temperature of Warmest Month
bio_06 = Min Temperature of Coldest Month
bio_07 = Temperature Annual Range (BIO5-BIO6)
bio_08 = Mean Temperature of Wettest Quarter
bio_09 = Mean Temperature of Driest Quarter
bio_10 = Mean Temperature of Warmest Quarter
bio_11 = Mean Temperature of Coldest Quarter
bio_12 = Annual Precipitation
bio_13 = Precipitation of Wettest Month
bio_14 = Precipitation of Driest Month
bio_15 = Precipitation Seasonality (Coefficient of Variation)
bio_16 = Precipitation of Wettest Quarter
bio_17 = Precipitation of Driest Quarter
bio_18 = Precipitation of Warmest Quarter
bio_19 = Precipitation of Coldest Quarter

RESULTS

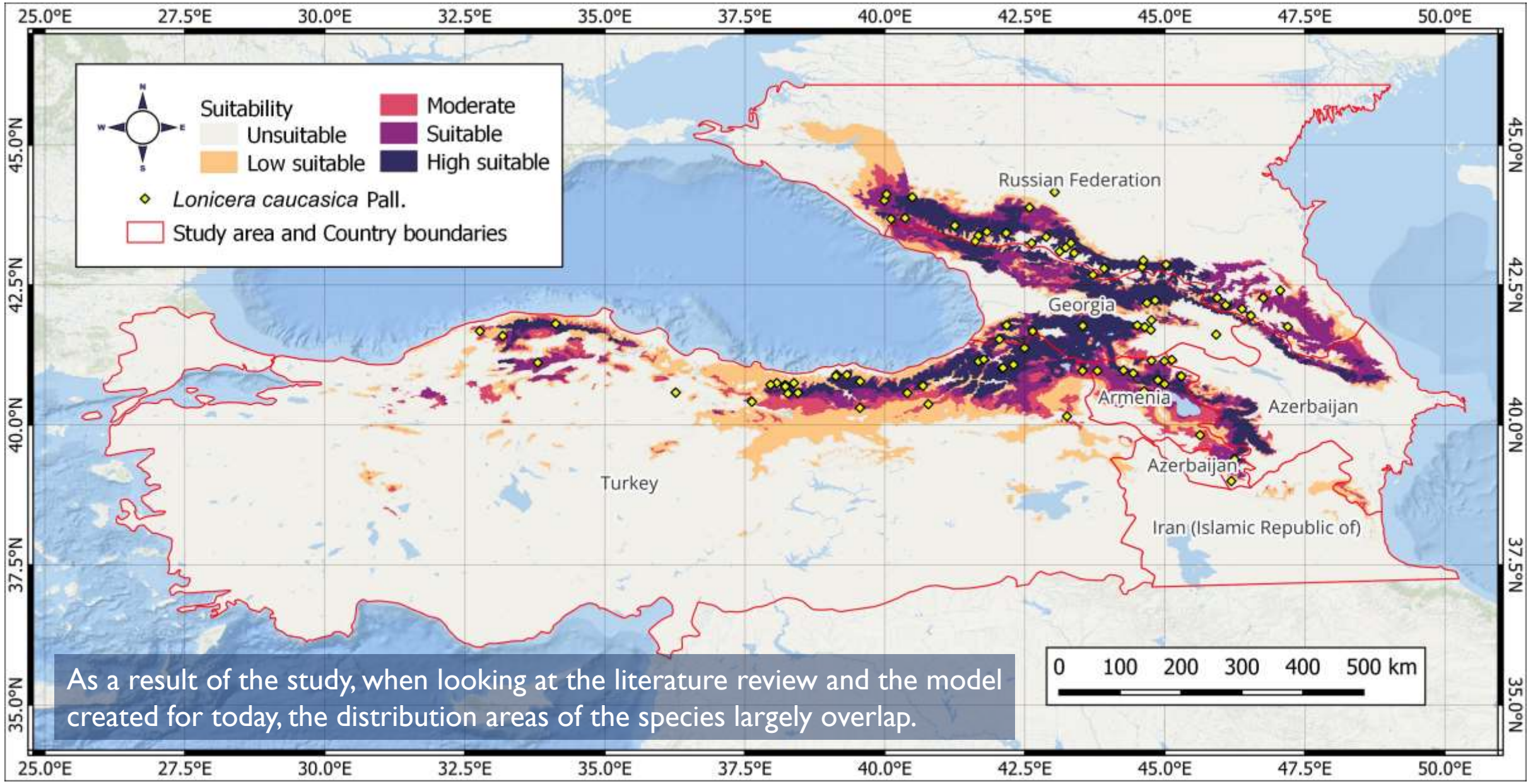


- The performance of Maxent models can be tested with ROC (Receiver Operating Characteristic) analysis. The resulting AUC can be interpreted as the estimated probability of the existence of a randomly selected grid cell in a properly tuned model. The AUC (Area Under the ROC Curve) describes the success of the model with all possible thresholds. The closer the AUC test value is to 1, the better the discrimination, the more precise and descriptive the model is.

- When the results of the Jackknife test are examined, it is seen that the environmental variables with the most impact on *Lonicera caucasica* are the Annual Mean Temperature (Bio1), Mean Temperature of Driest Quarter (Bio9) and Annual Precipitation (Bio12) respectively.

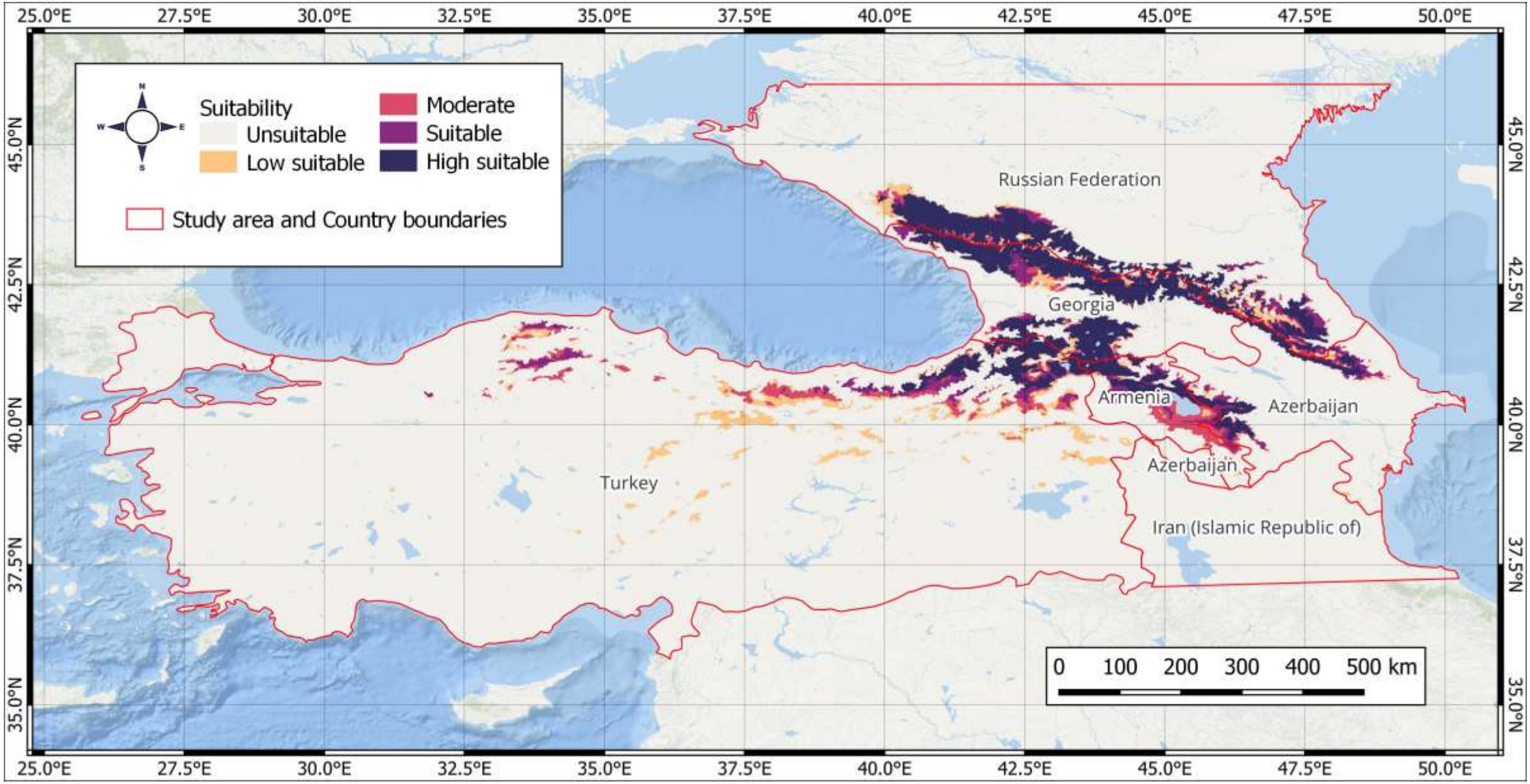


- The MaxEnt model showing the CURRENT distribution areas for *Lonicera caucasica* Pall. is shown in the figure.

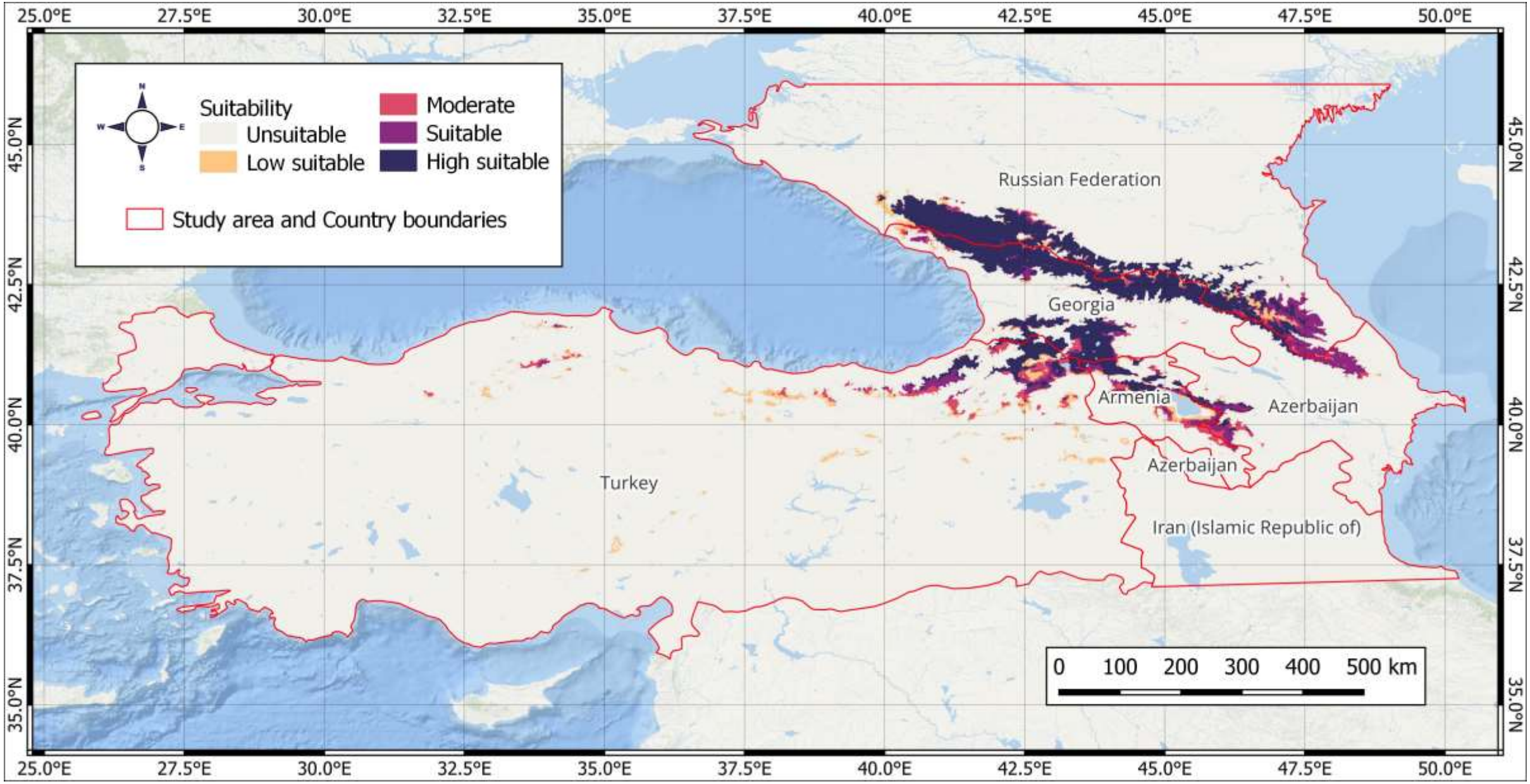


As a result of the study, when looking at the literature review and the model created for today, the distribution areas of the species largely overlap.

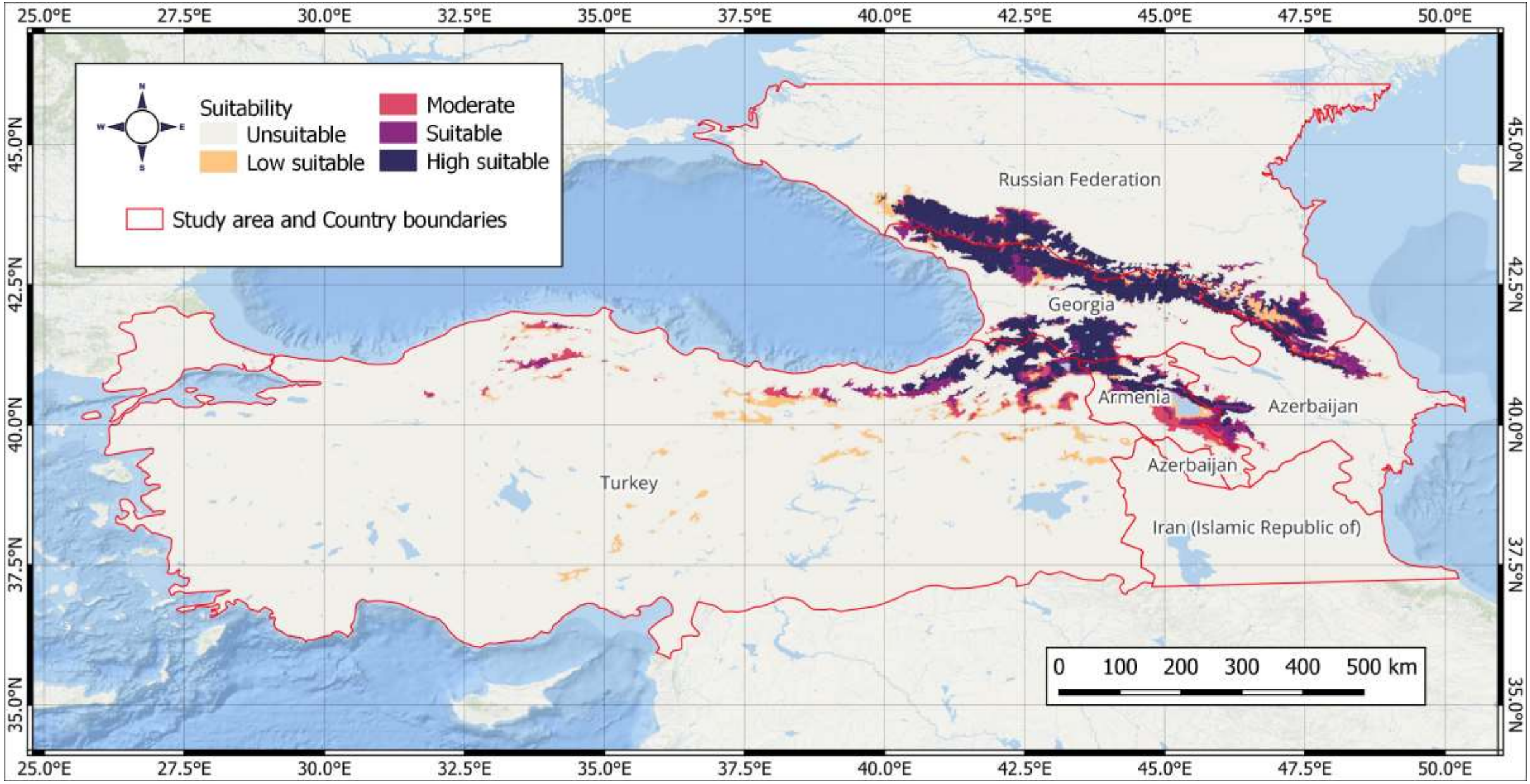
The future projection according to the environmental variables in IPSL-CM6A-LR SSP2 4.5 in the 2041-2060 period.



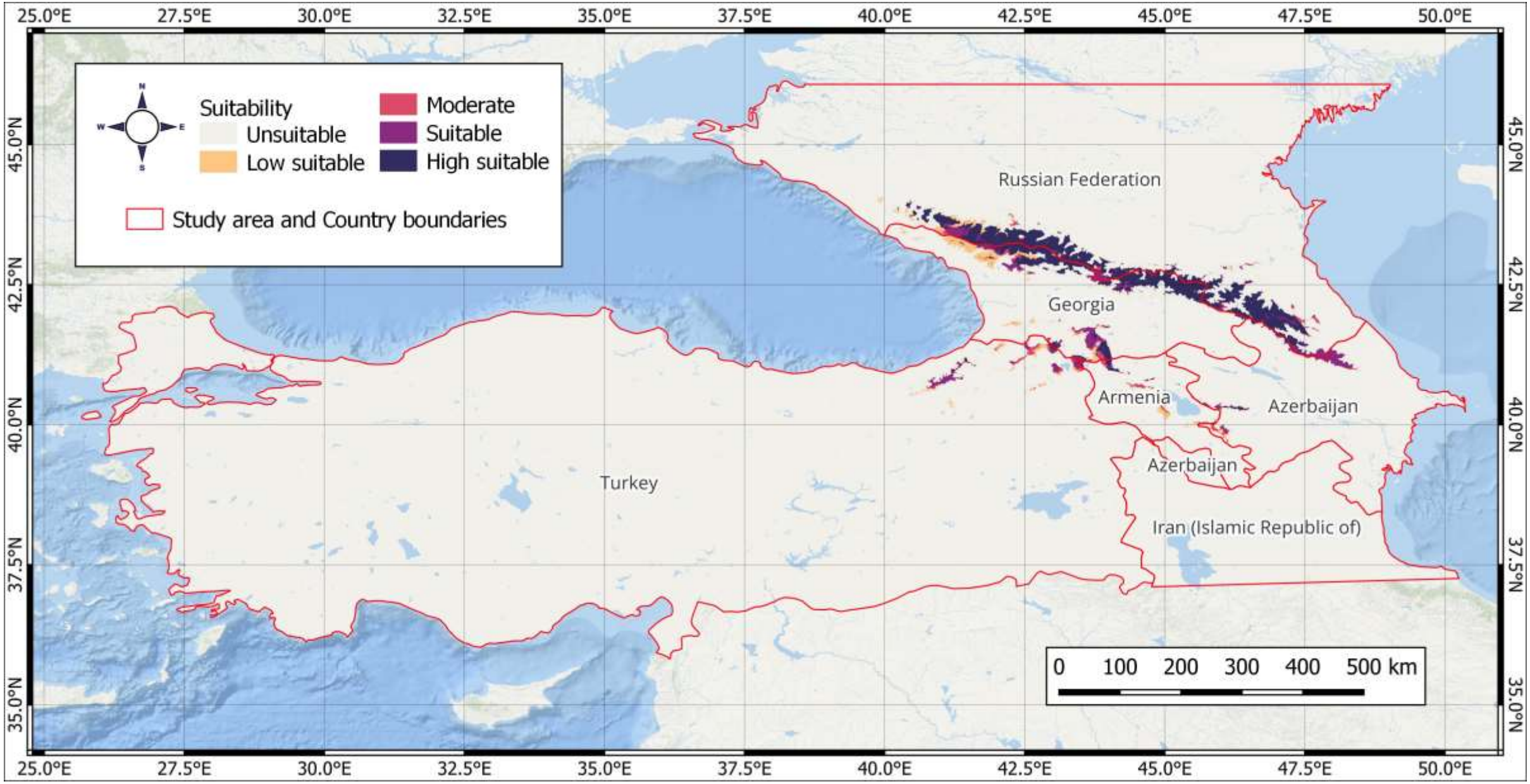
The future projection according to the environmental variables in IPSL-CM6A-LR SSP2 4.5 in the 2081-2100 period.

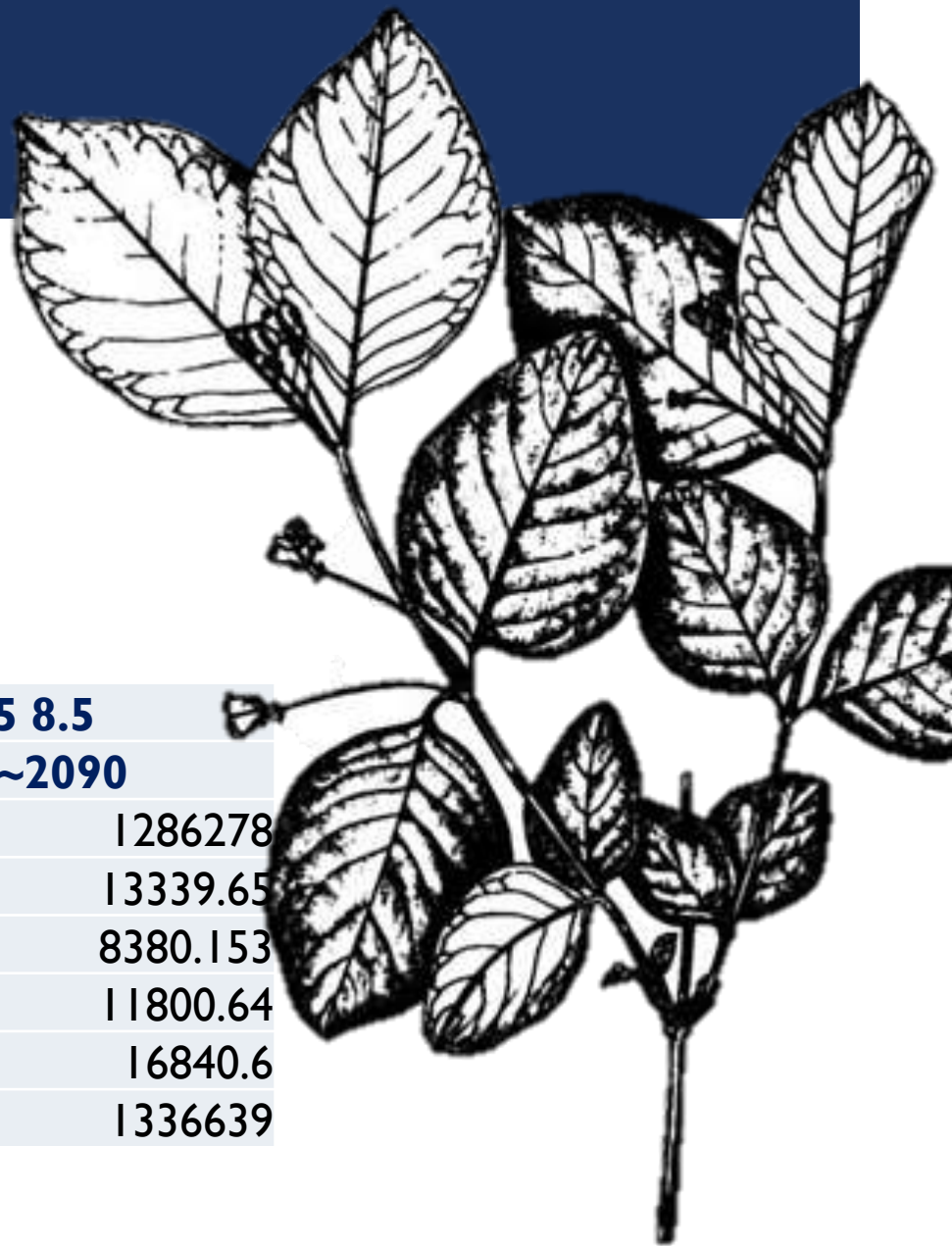


The future projection according to the environmental variables in IPSL-CM6A-LR SSP5 8.5 in the 2041-2060 period.



The future projection according to the environmental variables in IPSL-CM6A-LR SSP5 8.5 in the 2081-2100 period.

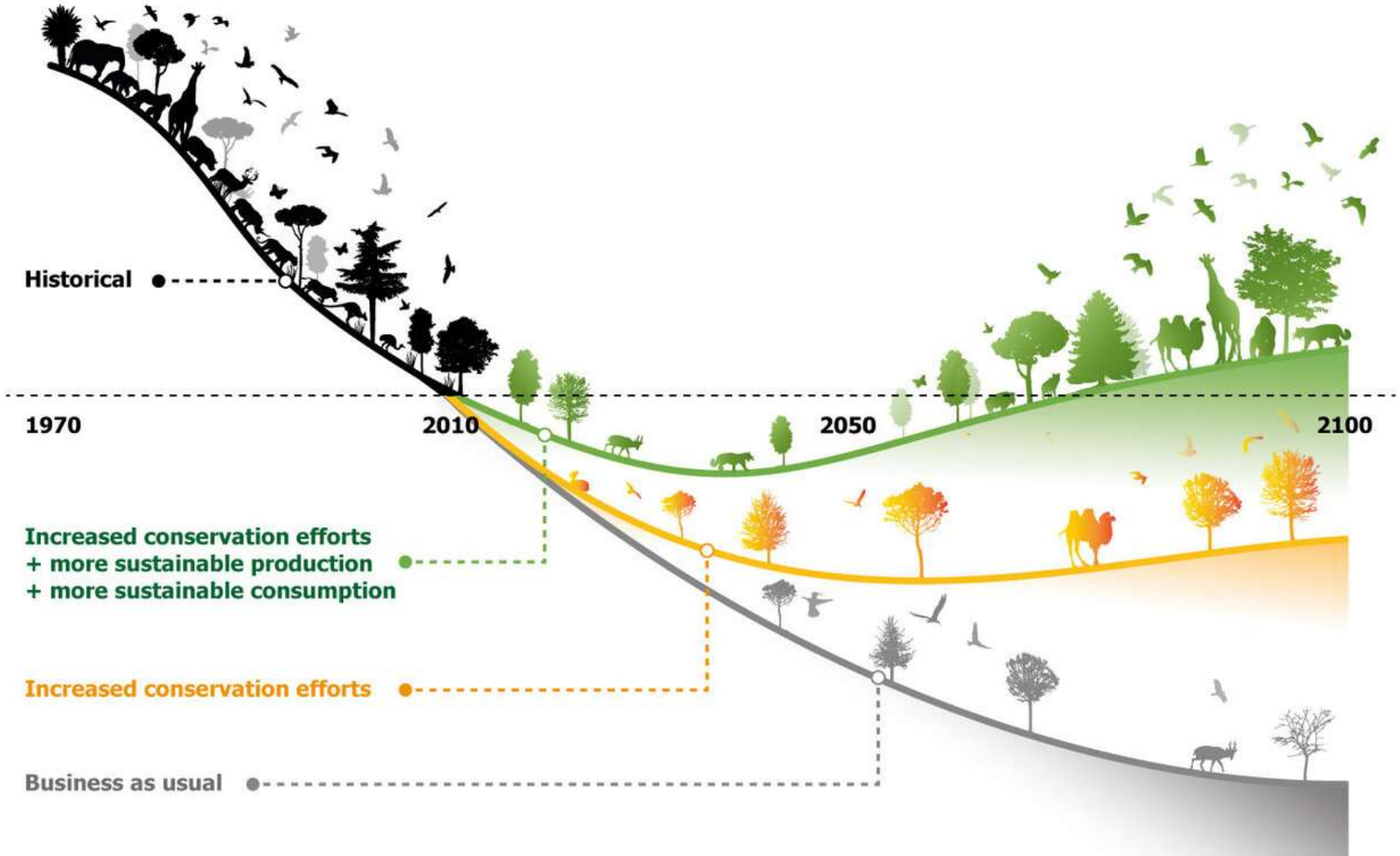


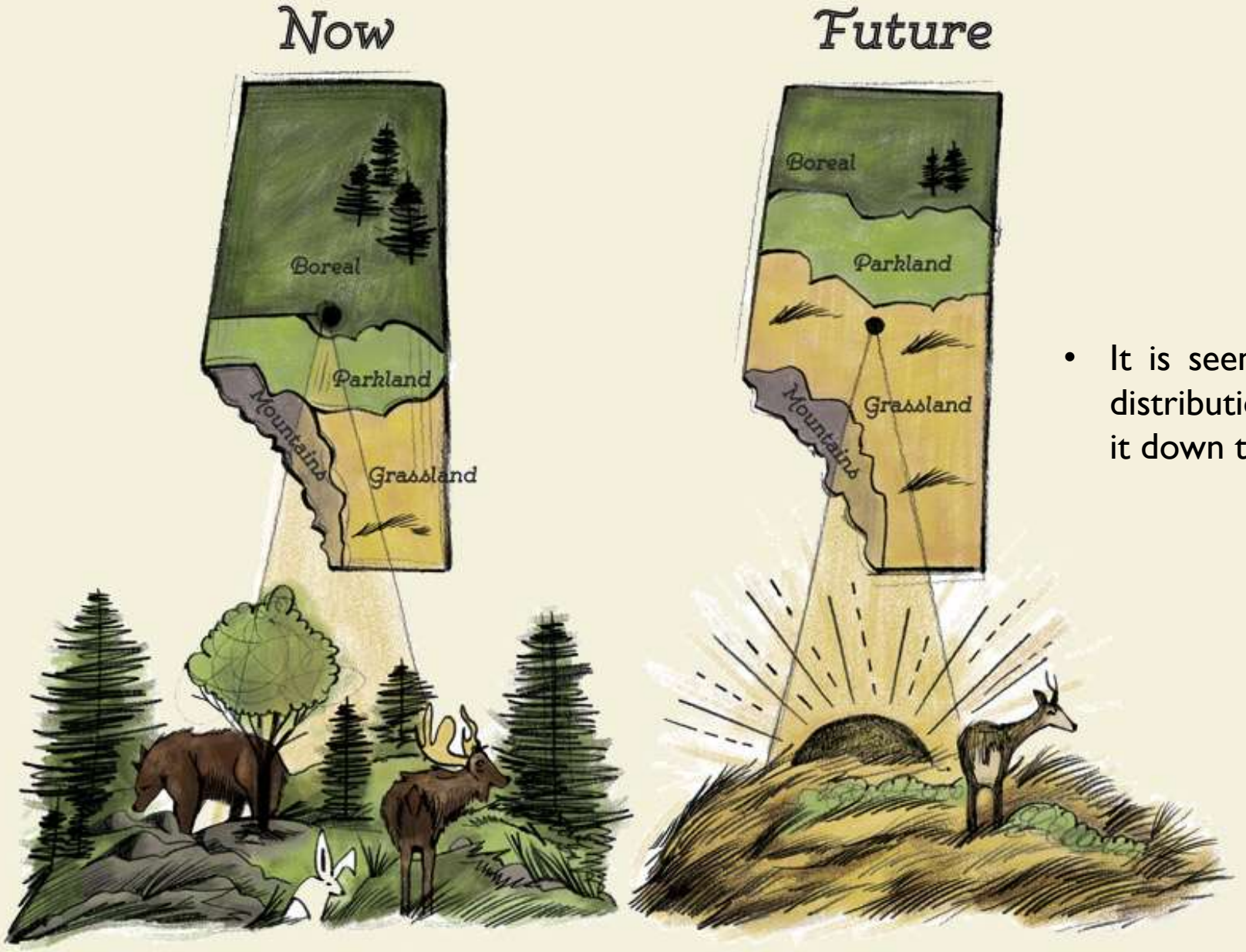


	(km²)	SSP2 4.5		SSP5 8.5	
Suitability	**Current**	**~2050**	**~2090**	**~2050**	**~2090**
Unsuitable (<0.2)	1059831	1173760	1217048	1191896	1286278
Low Suitable (0.2-0.4)	108839.8	49395.41	31812.76	43486.54	13339.65
Moderate (0.4-0.6)	57804.55	32066.09	20230.36	26107.4	8380.153
Suitable (0.6-0.8)	55468.5	30506.34	22644.46	27876.03	11800.64
High suitable (0.8-1)	54695.38	50911.02	44903.48	47273.67	16840.6
Total	1336639	1336639	1336639	1336639	1336639

DISCUSSION

- In the models created for future periods, it is estimated that there will be gradual decreases in the distribution areas of the species, and that there will be a slight distribution in local areas in Turkey, Armenia and Azerbaijan for the period SSP5 8.5 ~2090, and that there will be no distribution in the northwestern part of Iranian.





- It is seen that the species will continue its general distribution in the Caucasus Mountains by narrowing it down to the peaks.

- Named after its narrow distribution in and around the Caucasus, Caucasian honeysuckle is cultivated and traded as an ornamental plant. At the same time, its edible fruits play a very important role for wildlife due to the altitude and location conditions in which it grows.

- In the models created for the coming years, it is seen that the already limited distribution of the species will be even more restricted. Within the framework of all these, it would be beneficial to conduct in-situ and ex-situ studies to ensure the sustainability of the species.

THANKS FOR LISTENING…