TURKIYE DESERTIFICATION MODEL AND SUSCEPTIBILITY MAP

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INTRODUCTION

DESERTIFICATION SUSCEPTIBILITY MODEL AND AHP MODEL

CONCLUSSION

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What is Desertification?

Desertification is defined as the loss of soil productivity and resistance to degradation, especially in arid and semiarid regions, as a result of natural and anthropogenic activities (Ma and Zhao, 1994; Mutlu, 2015).

The decrease in soil fertility threatens regional ecological security due to vegetation degradation and limits economic development at the national level (Helldén and Tottrup, 2008; Xu and Zhang, 2021).

Desertification is one of the world's most important environmental and socio-economic problems.

Causes of Desertification?

Climate Change:
Increasing temperatures and decreasing precipitation accelerate desertification.

Agricultural Intensification:
Continuous use of land for agriculture and incorrect agricultural practices cause the soil structure to deteriorate, reducing the fertility of the soil.

Deforestation:
Destruction of trees and vegetation leads to the loss of root structures that protect the soil to disappear, leaving it vulnerable to erosion.

Improper Use of Water Resources:
Improper irrigation methods and inefficient use of water resources cause desertification.

Population Growth and Urbanization:

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The significant increase in the desertification process due to global climate change has led researchers to conduct research on taking precautions against desertification and determining and monitoring the current desertification situation.

As in the world, desertification is one of the most important phenomena that puts pressure on ecosystems in Turkey and is increasingly becoming more effective in the soils of the arid and semi-arid regions of the country.

*By 2040, 135 million people will be forced to migrate due to the risk of desertification.

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Various approaches and models have been developed to assess the susceptibility of a region to desertification and land degradation and to create a framework to combat desertification more effectively in the future (Wijitkosum, 2016; Zakerinejad and Masoudi, 2019; Pishyar et al., 2020; Imbrenda et al., 2022).

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DESERTIFICATION SUSCEPTIBILITY MODEL

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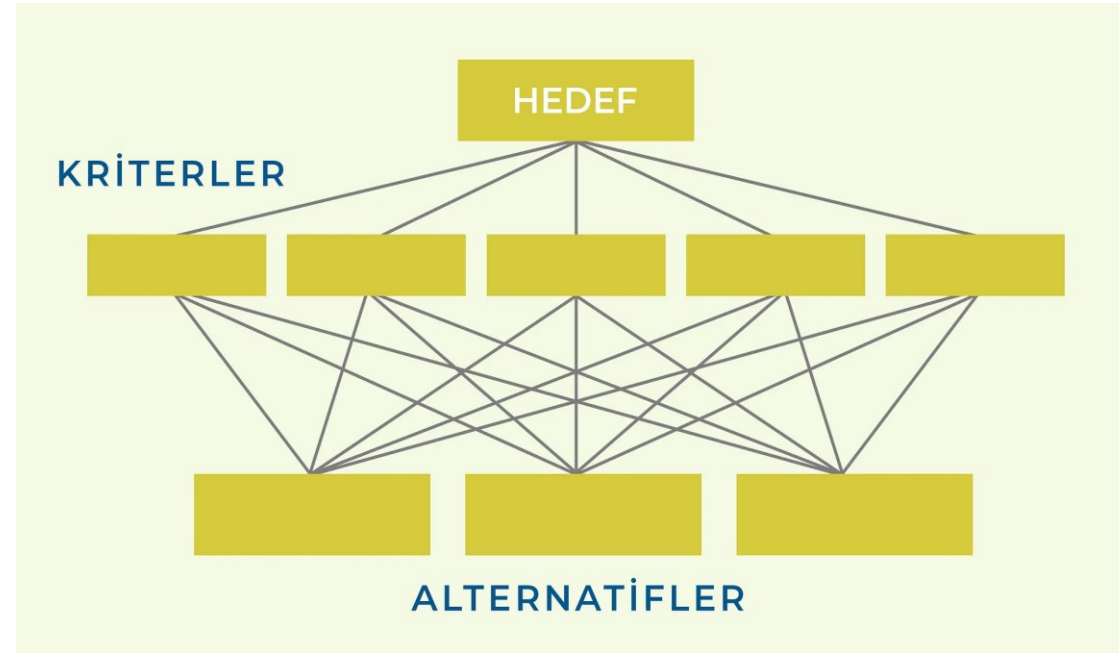
Analytical Hierarchy Process (AHP) method

AHP aims to solve complex decision problems by dividing them into a hierarchical structure.

With this method, the importance and impact levels of the parameters used are determined based on expert opinion and numerical values are assigned.

Making complex decisions is an effective tool for the decision maker to determine the best option.

Figure 1. Flowchart of Analytical Hierarchy Process (AHP) Method

Figure 2. Criteria Used in Türkiye Desertification Model

Figure 3. Criteria, Indicators and Sub-Indicators Used in Türkiye Desertification Model
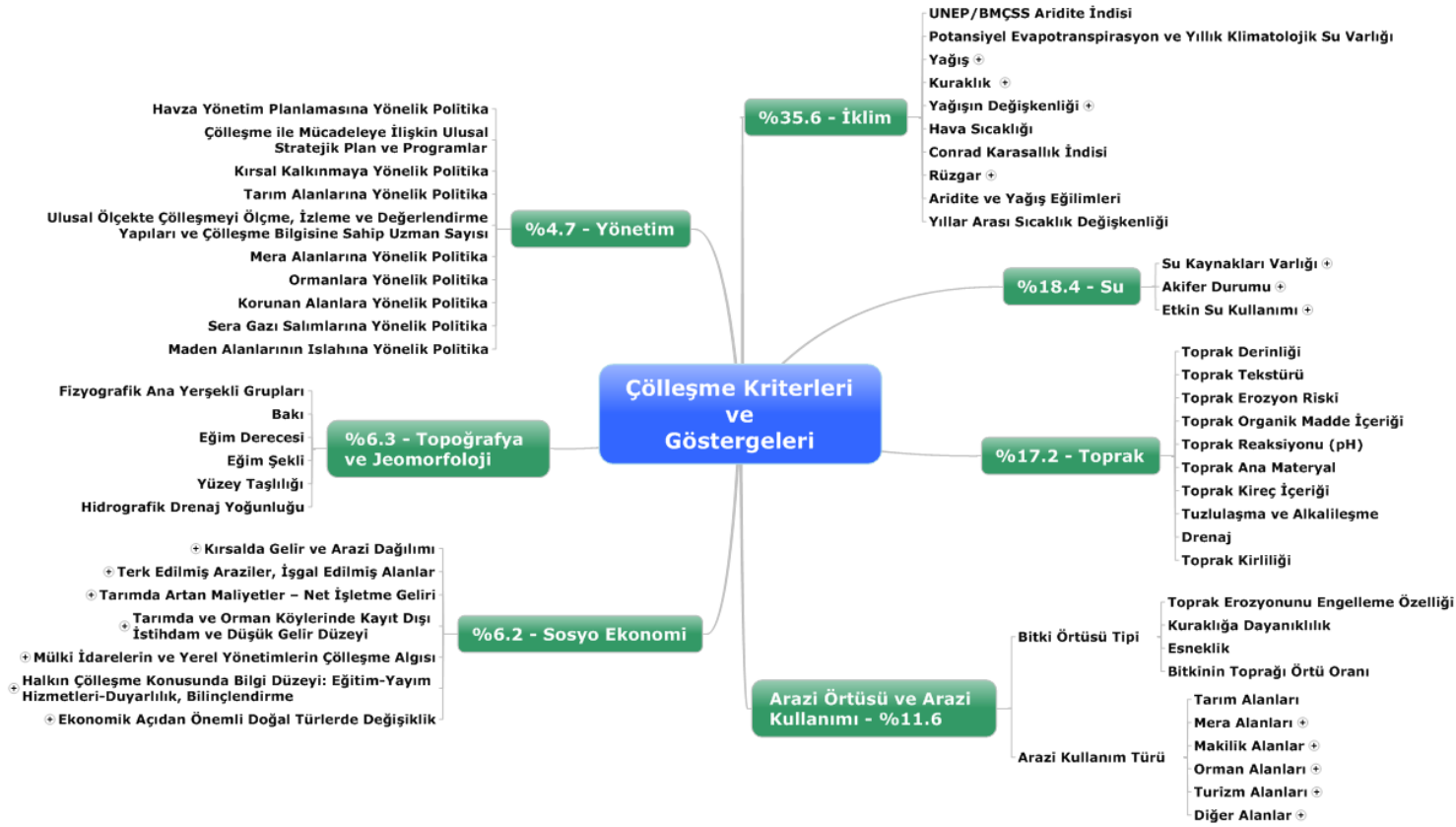
Türkiye Çölleşme Modeli Kriter ve Göstergeleri

Kategori (Kriter)	Değişken/Parametre/ Indeks/Gösterge Sayısı
İklim	10
Su	3
Toprak	10
Arazi Örtüsü ve Arazi Kullanımı	2
Topoğrafya ve Jeomorfoloji	6
Sosyo-ekonomi	7
Yönetim	10
Toplam Kriter	**48 Gösterge**

A total of 7 criteria, 48 indicators and 37 sub-indicators were used in creating the Türkiye Desertification Model.

The AHP method was used as an effective tool to determine the relative importance of different environmental and anthropogenic factors in determining areas susceptible to desertification, and was used to weight different factors and perform sensitivity analysis based on these factors, and a desertification susceptibility map was created.

Classification and Scoring of Indicators in Terms of Desertification

Weighting of Criteria and Indicators

Mapping Criteria with Alternative Methods and Determining the Most Sensitive Result

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No	Kriter	Ağırlığı (%)
1	İklim	35.6
2	Su	18.4
3	Toprak	17.2
4	Arazi Örtüsü ve Arazi Kullanımı	11.6
5	Topoğrafya ve Jeomorfoloji	6.3
6	Sosyo ekonomi	6.2
7	Yönetim	4.7

Risk Sınıfı	Sınıf	İndis Değerleri	Tanımı
ZAYIF	1	1.0 - 1.27	Düşük
	2	1.28 - 1.34	Orta
	3	1.35 - 1.40	Yüksek
ORTA	4	1.41 - 1.45	Düşük
	5	1.46 - 1.48	Orta
	6	1.49 - 1.54	Yüksek
YÜKSEK	7	1.55 - 1.60	Düşük
	8	1.61 - 1.67	Orta
	9	1.68 - 2.00	Yüksek

Table 1. The 7 most important criteria causing desertification in Turkey, their order of importance and weights

Table 2. Desertification index class ranges and definitions

In order to determine how much indicator classes affect desertification, each class is given a score value. In the scoring approach applied, **"1 values" indicates the situation that affects desertification the least, and "2 values" indicates the situation that affects desertification the most.**

Figure 4. Türkiye Desertification Susceptibility Map

According to the map; **18.0%** of Turkey's land is in the weak, **50.9%** medium, and **22.5%** high desertification risk class.

8.6% constitutes the other areas class.

Field observations were made at many points and the project consultants/experts compared the desertification risk value of the land with the risk value of the model and verified the Turkish Desertification Model.

Verification and calibration studies were carried out on a basin basis:

- Gediz Basin,
- Konya Basin,
- Eastern Mediterranean Basin,
- Yeşilırmak Basin,
- Fırat-Dicle Basin,
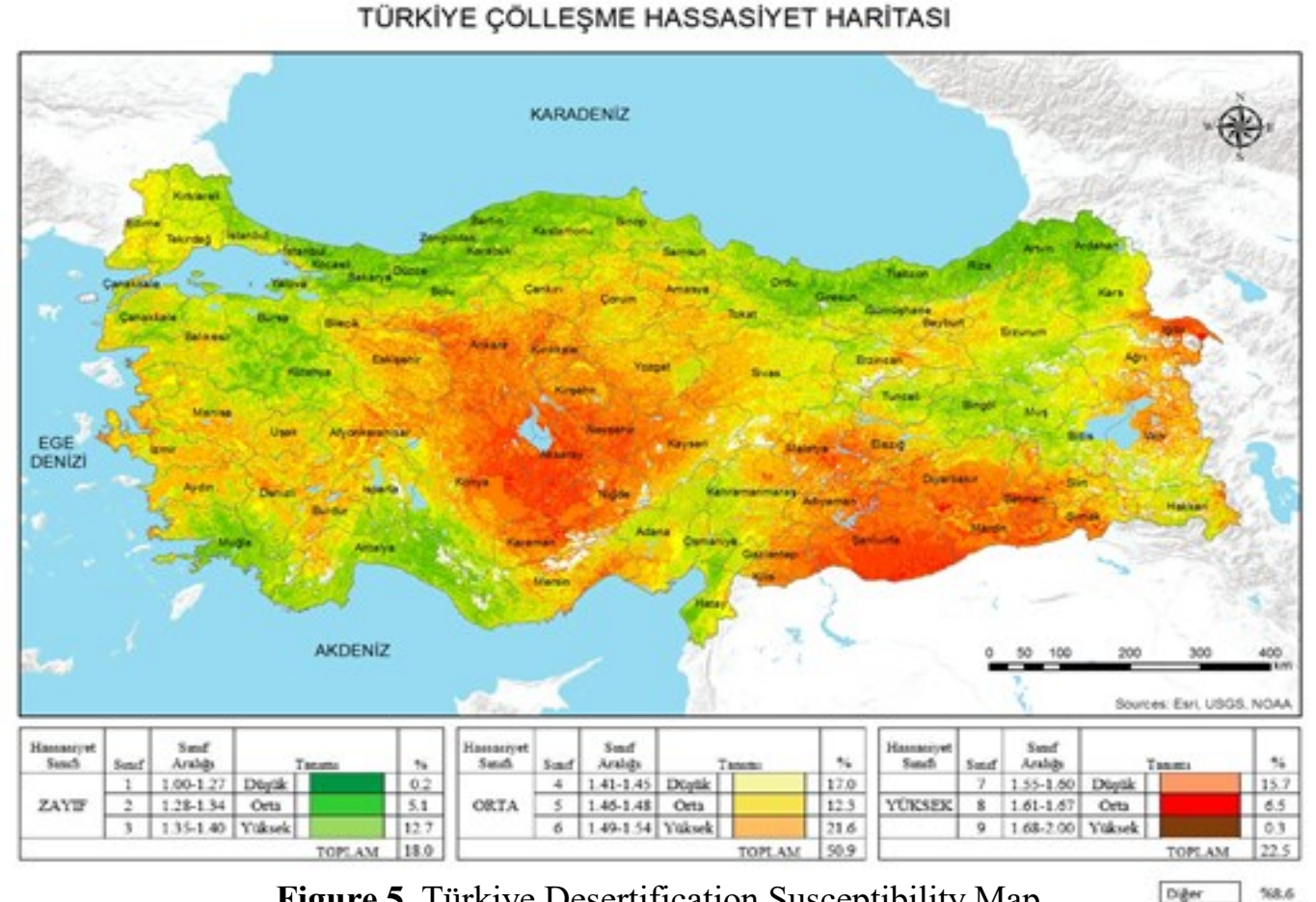- Upper Sakarya Basin were successfully completed.

- In 2016, Aksaray and Mersin provinces,

- In 2017, Çorum-Amasya-Samsun and Şanlıurfa-Adıyaman provinces,

- In 2018, Bursa-Balıkesir-Çanakkale-Edirne-Tekirdağ-Kırklareli and Iğdır-Kars-Erzurum-Ardahan-Artvin provinces,

- In 2019, Upper Sakarya Basin pilot field studies were carried out and all verification and calibration studies were completed.

It was determined that the desertification model and sensitivity map produced **84%** consistent results on a micro-basin basis within a **90%** confidence interval with the field studies.
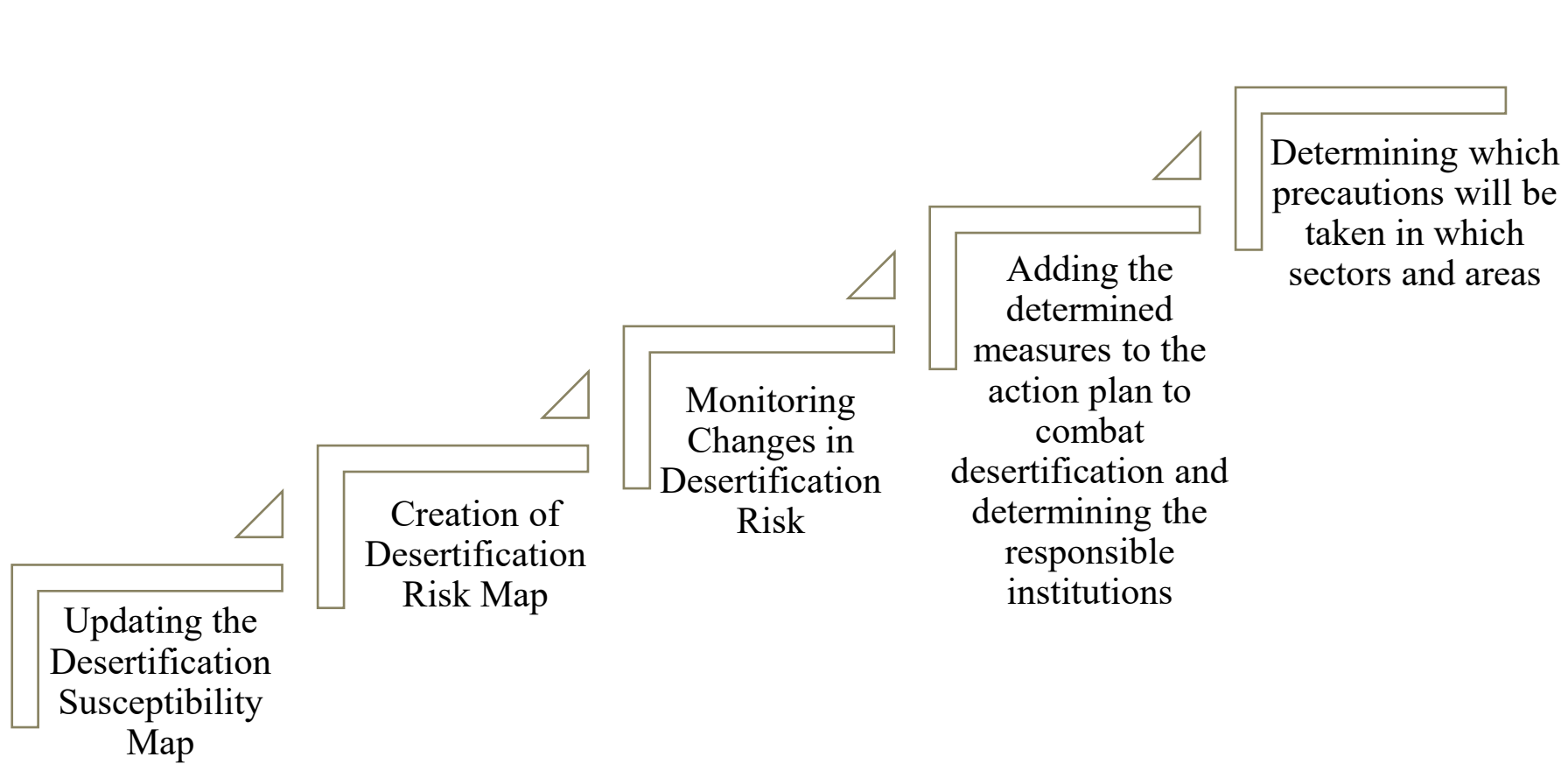
A susceptibility map was created by determining the areas that are sensitive to desertification in Türkiye.

According to the model of desertification:

- Konya Basin and Ankara and Eskişehir regions in the Central Anatolia Region,

- Şanlıurfa, Mardin and Diyarbakır regions close to the Turkish-Syrian border in the Southeastern Anatolia Region,

- Iğdır and Aralık and Doğu Beyazıt regions were determined as highly sensitive areas against desertification.

Figure 5. Türkiye Desertification Susceptibility Map

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Updating the Desertification Susceptibility Map

Creation of Desertification Risk Map

Monitoring Changes in Desertification Risk

Adding the determined measures to the action plan to combat desertification and determining the responsible institutions

Determining which precautions will be taken in which sectors and areas

Thank you...