



**T.C. ÇEVRE, ŞEHİRCİLİK VE  
İKLİM DEĞİŞİKLİĞİ BAKANLIĞI**

# **General Directorate of Combating Desertification and Erosion**

**Erosion Control Department  
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**T.C. ÇEVRE, ŞEHİRCİLİK VE  
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# **Soil Erosion and Monitoring System**

*Ministry of Environmental, Urbanization and Climate Change  
General Directorate of Combating Desertification and Erosion*



# Soil Erosion

Soil erosion is a gradual process of movement and transport of the upper layer of soil (topsoil) by different agents, particularly water (rain), wind, and mass movement, causing its deterioration in the long term.





# Soil Erosion

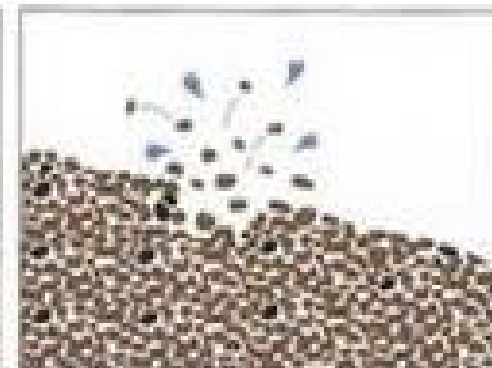
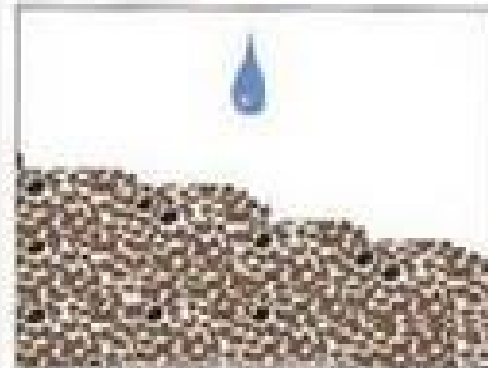
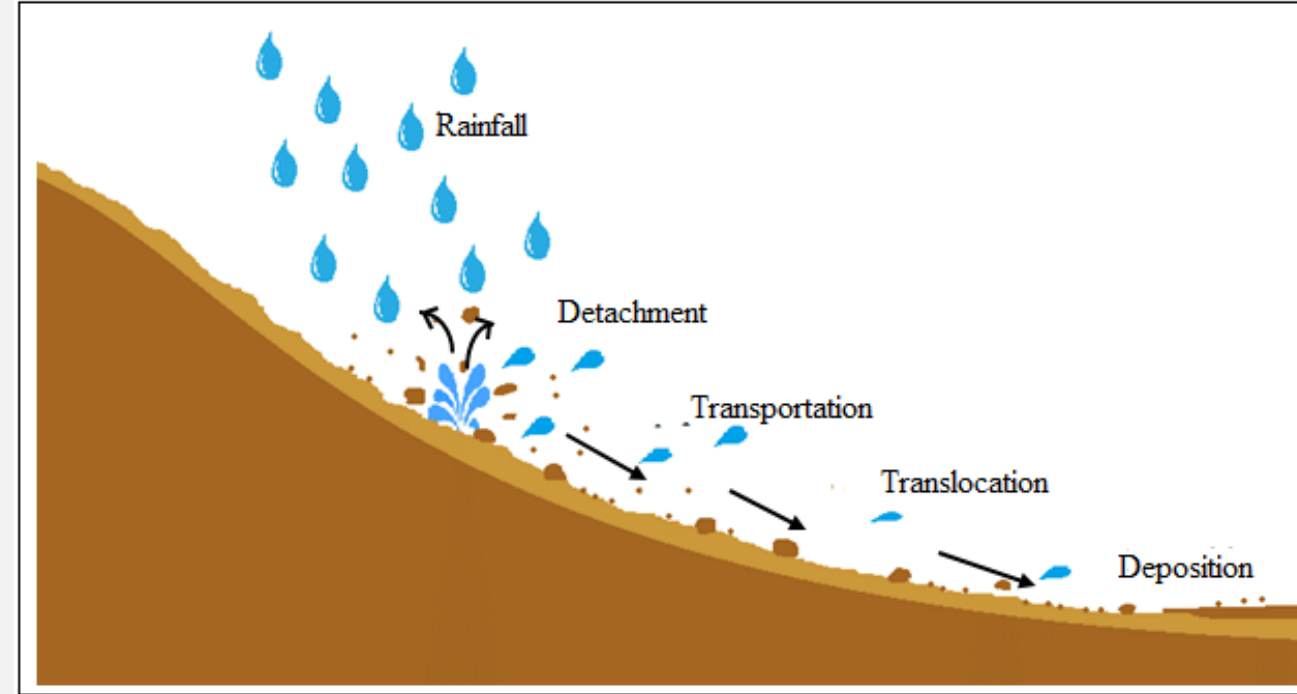
The first stage in the process of water erosion is the impact event caused by raindrops falling on the bare soil.



The second stage is runoff (soil particles, plant residues and nutrients movement) through the slope.



Transported soil and other materials deposition in dam, sea, lake and rivers.





## Soil Erosion Stages Due to Water

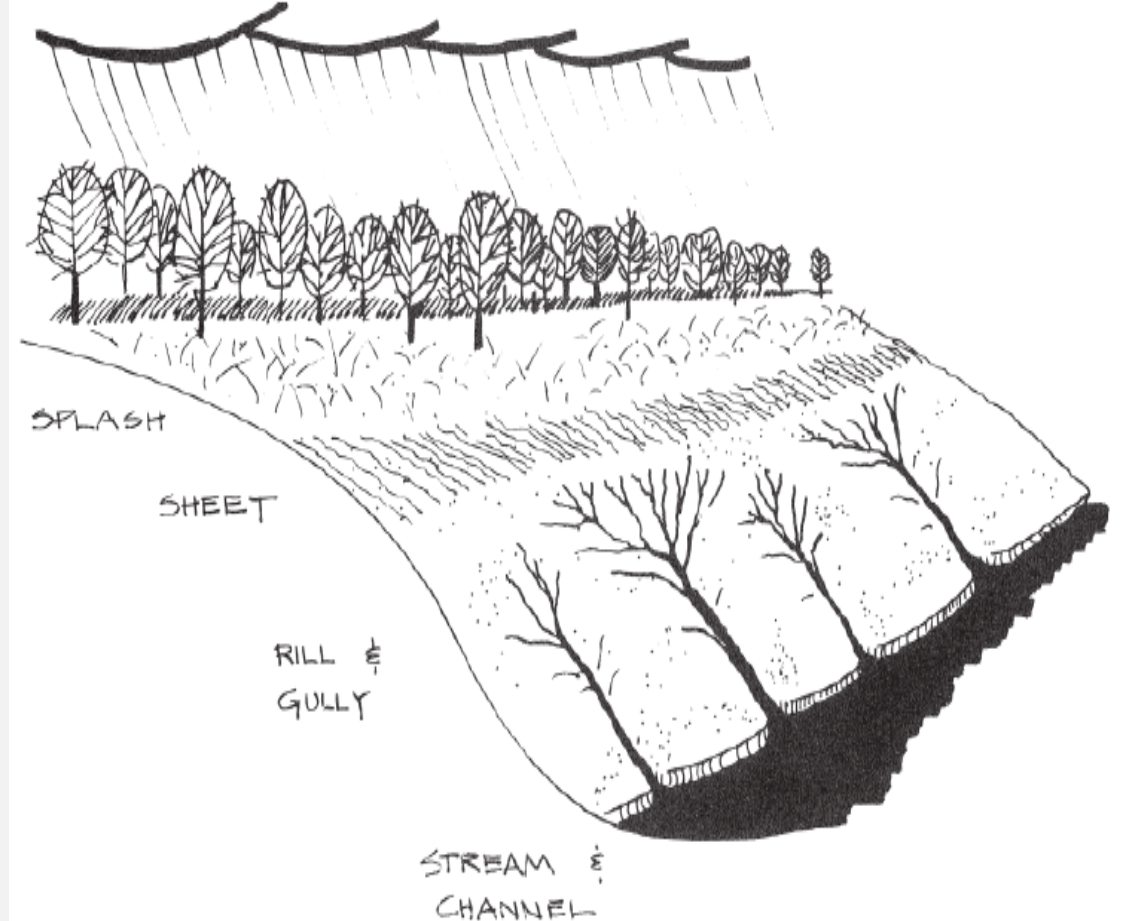
1- Splash Erosion

2- Erosion Threshold (Sheet)

3- Rill Erosion

4- Gully Erosion

5- Channel Erosion





# Soil Erosion





# Soil Erosion





**Inappropriate agricultural practices on high slop lands cause an increase on soil erosion.**







## Soil Erosion Monitoring, Evaluating and Control in Türkiye

General Directorate of Combating Desertification and Erosion develops monitoring systems that use equations for controlling soil erosion.

- Dynamic Erosion Model and Monitoring System (DEMMS)
- National Dynamic Wind Erosion Model and Monitoring System (NDWEMMS)



## Dynamic Erosion Model and Monitoring System (DEMMS)

DEMIS is complementarily established to predict soil losses at **25** main basin, **81** province levels.

$$A = R \times K \times LS \times C \times P$$

$A$  = Average Annual Soil Loss (ton/ha/year)

$R$  = Rainfall-Runoff Erosivity Factor

$LS$  = Slope Length and Steepness Factor

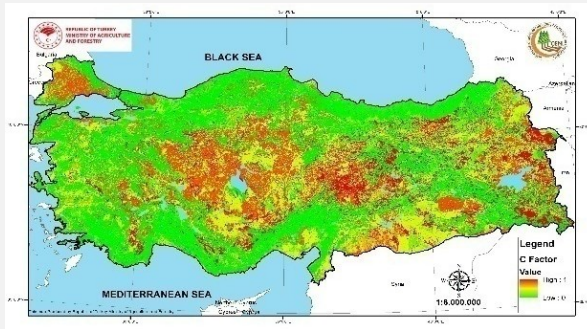
$K$  = Soil Erodibility Factor

$C$  = Cover Management Factor

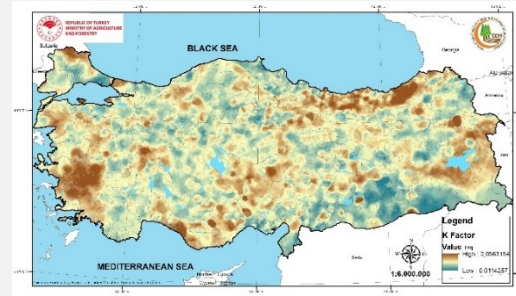
$P$  = Support Practice Factor



## Türkiye Soil Erosion Map was made by RUSLE model



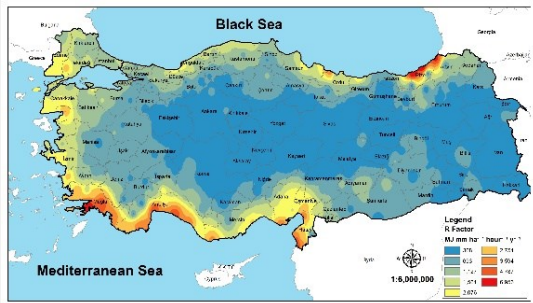
C = Cover Management Factor



K = Soil Erodibility Factor



LS = Slope Length and Steepness Factor



R = Rainfall-Runoff Erosivity Factor

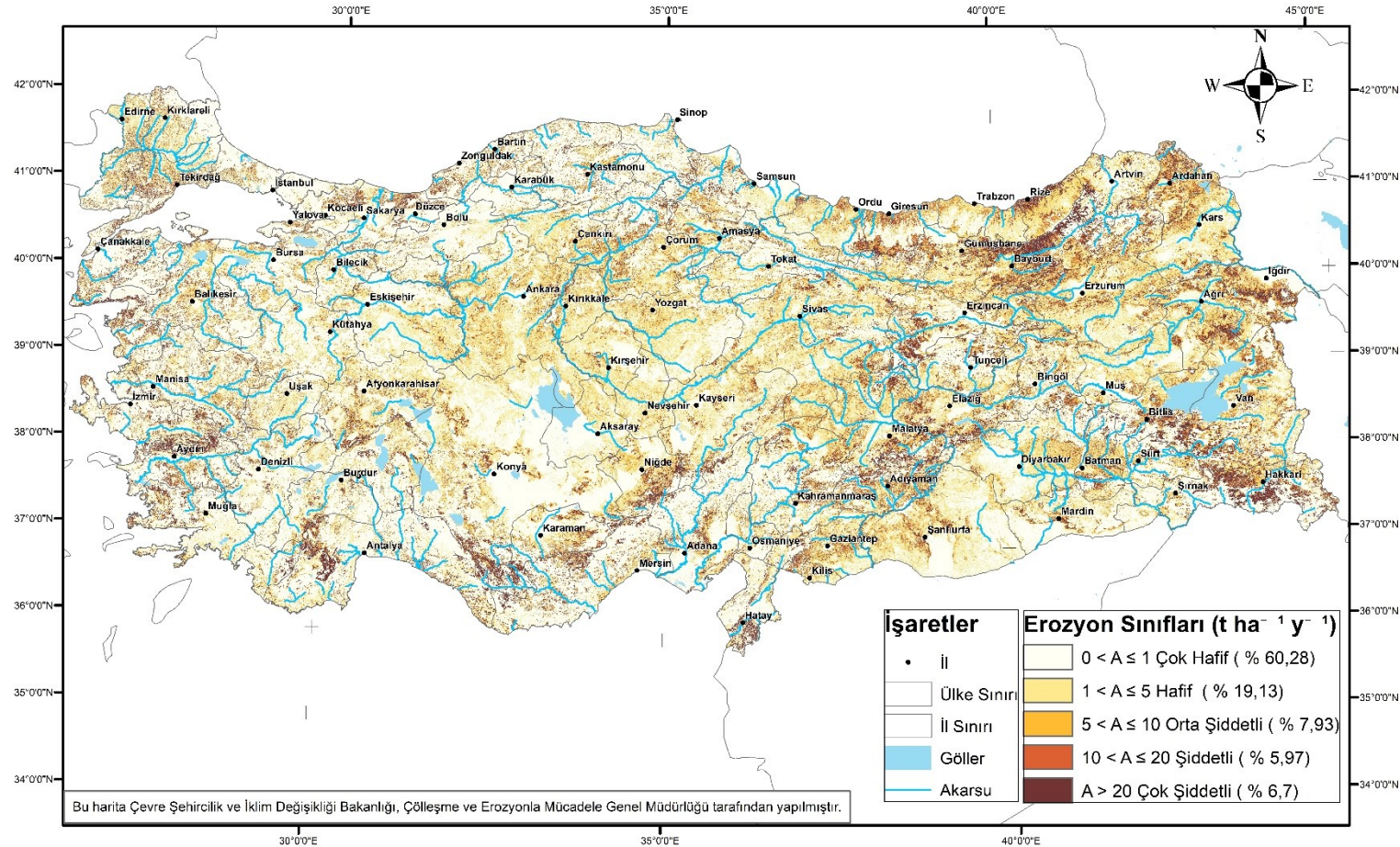
**RUSLE**  
 $A = R \times K \times LS \times C \times P$



P = Support Practice Factor

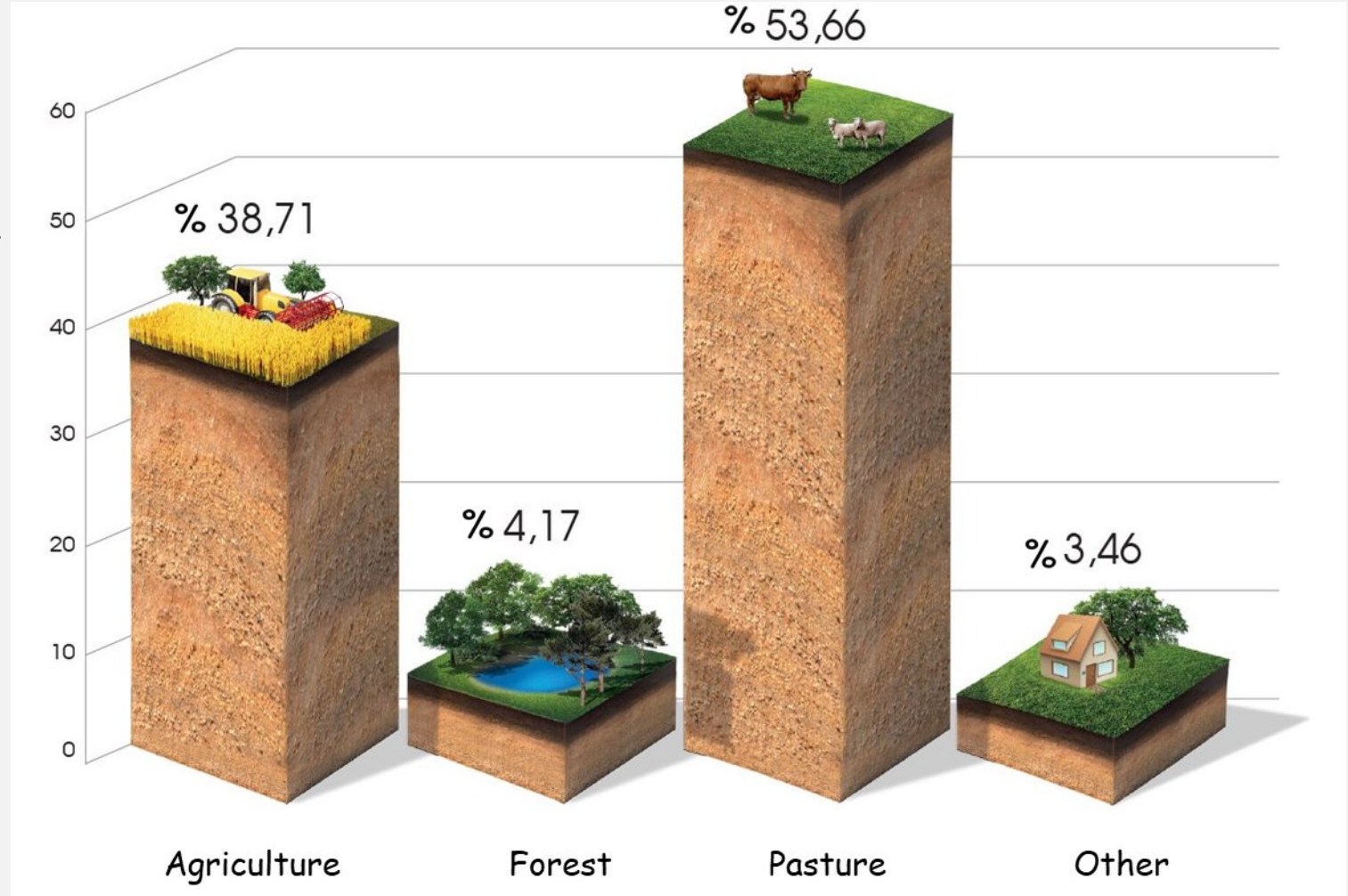


TÜRKİYE SU EROZYONU HARITASI



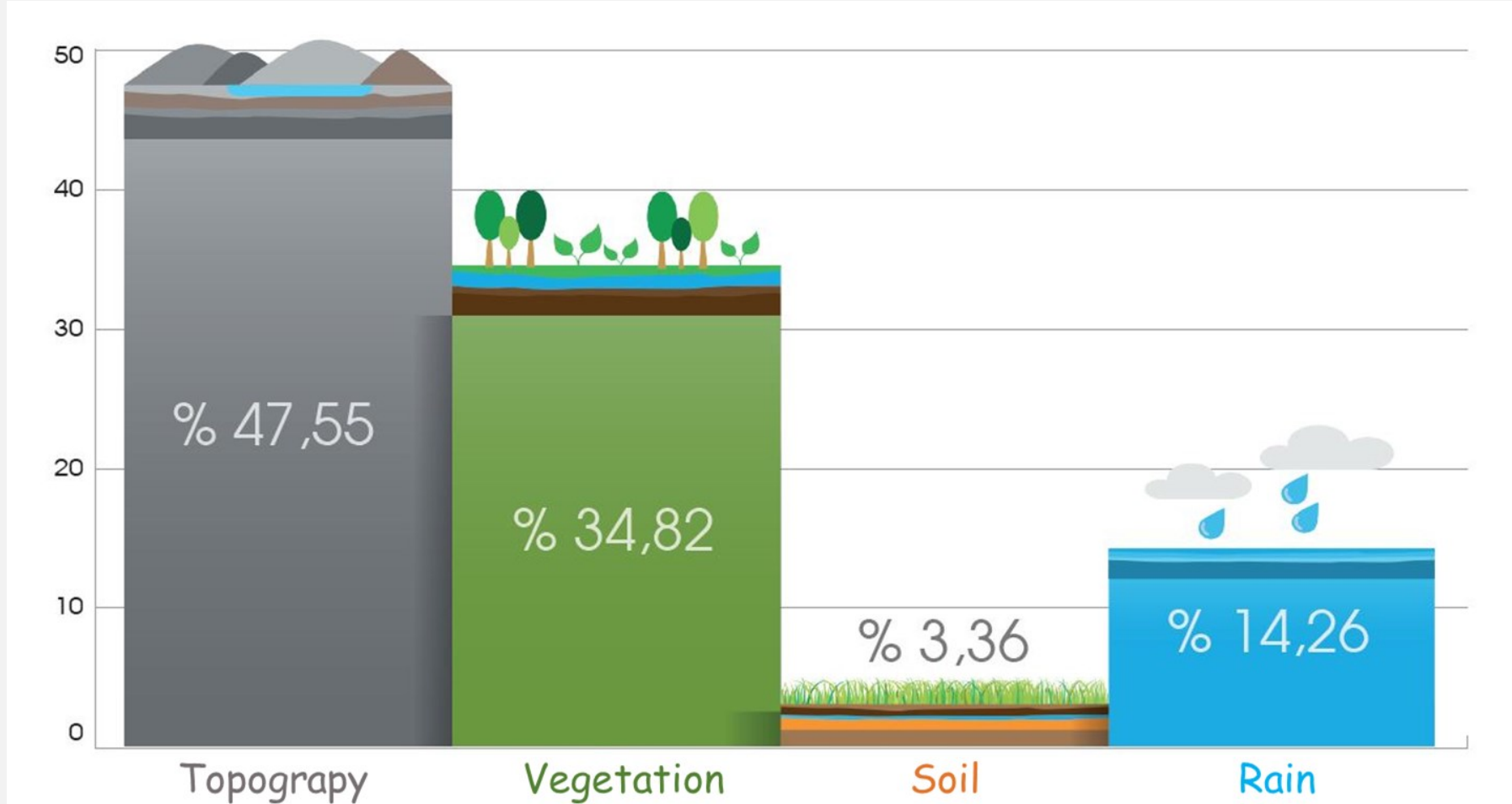


Soil erosion occurs based on land use  
% 53,66 in pasture, % 38,71 in  
agricultural land and % 4,17 in  
forest areas in Türkiye (Erpul vd.,  
2018)



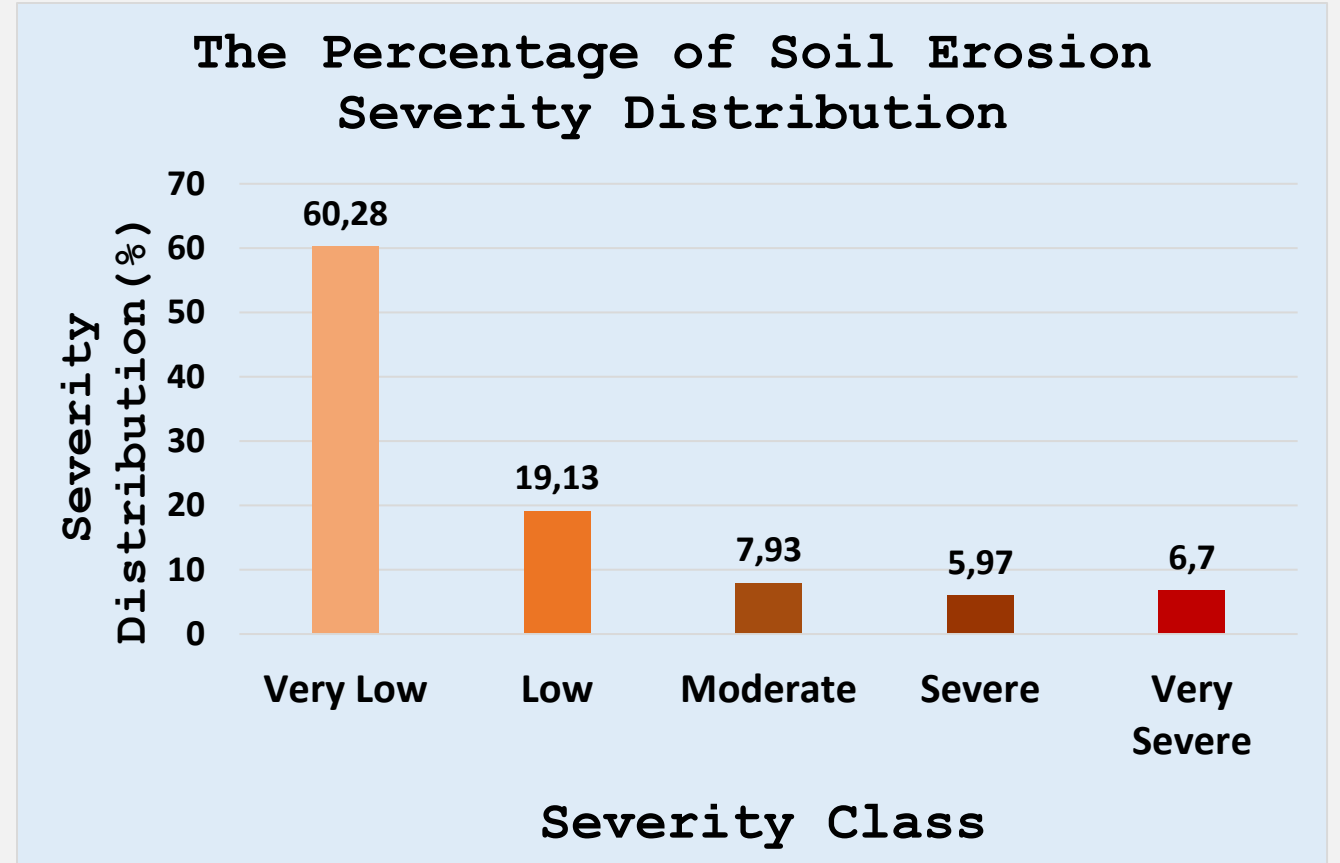


## Effect rates of factors that impacts on soil erosion



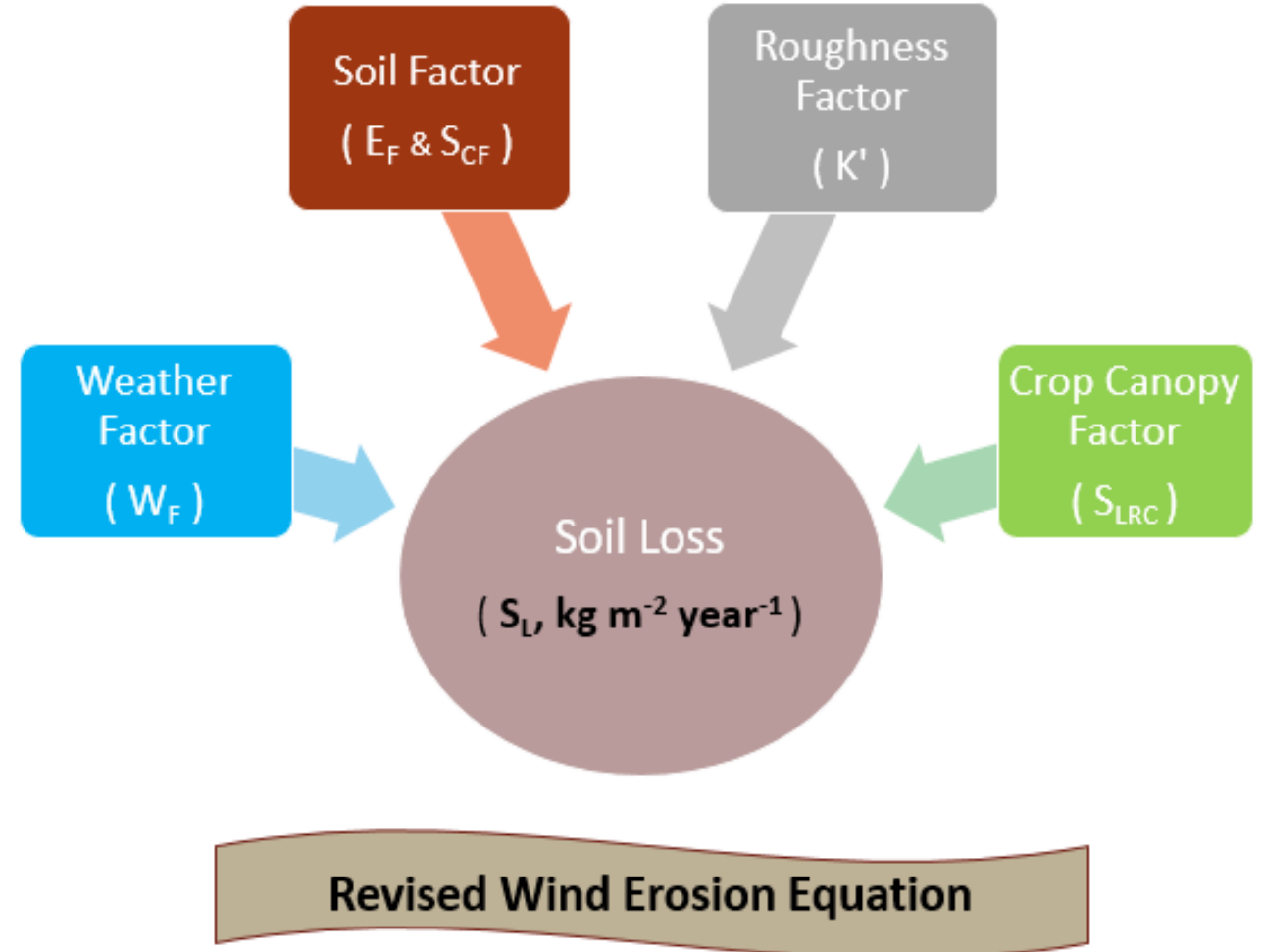


The distribution of soil erosion according to severity classes is very low 60.28%, low 19.13%, moderate 7.93%, severe 5.97%, and very severe 6.7% in Türkiye (Erpul vd., 2018).





- ✓ National Dynamic Wind Erosion Model and Monitoring System (UDREMİS) has been developed by General Directorate of Combating Desertification and Erosion to monitor wind erosion at national scale.







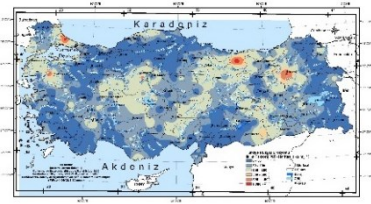
Wind sill velocity  
initiating wind  
erosion: 2 meters  
high - 5m/sn  
(18km/sn)

341 OMGİ  
Data  
(Climate,  $W_F$ )

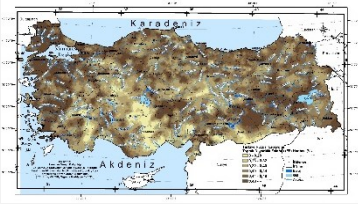
14.801 Soil  
Surface Sampling  
Data (Soil,  $E_F$  &  
 $S_{CF}$ )

14 different land  
roughness coefficients  
for 44 different land  
uses, CORINE 2012  
(Roughness,  $K'$ )

$W_F$  ( $\text{kg m}^{-1}$ )



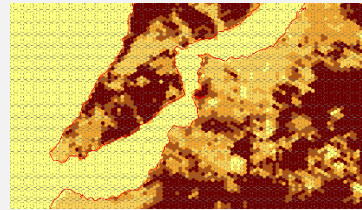
$E_F$  (%)



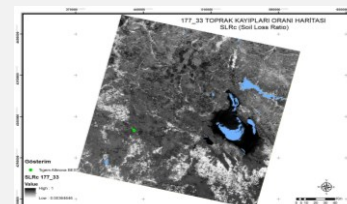
$S_{CF}$  (%)



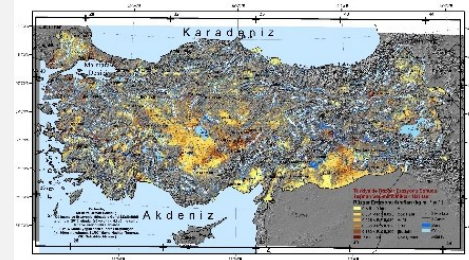
$K$



$S_{LRC}$  (%)

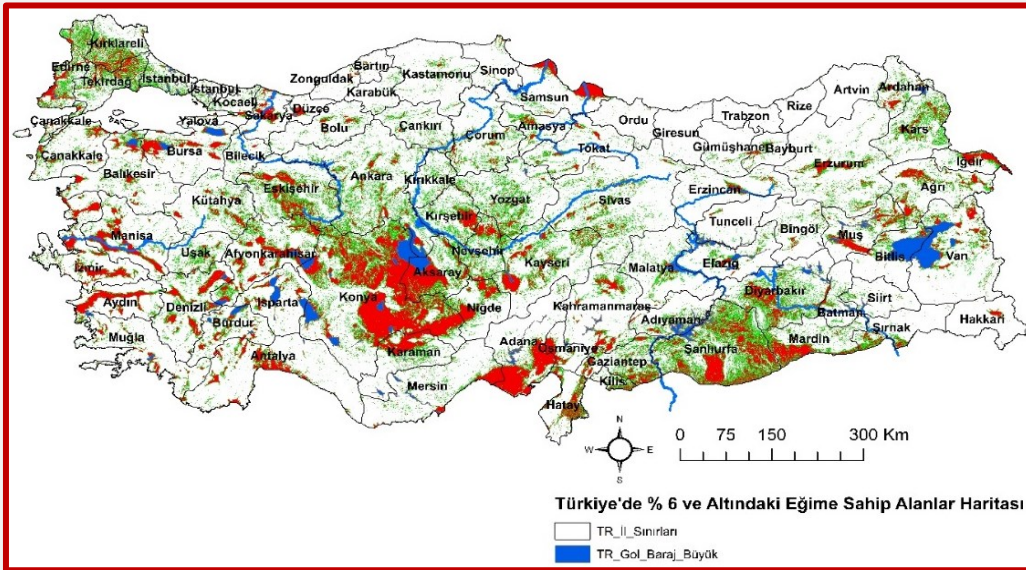


$S_L$  ( $\text{kg m}^{-2} \text{ yıl}^{-1}$ )

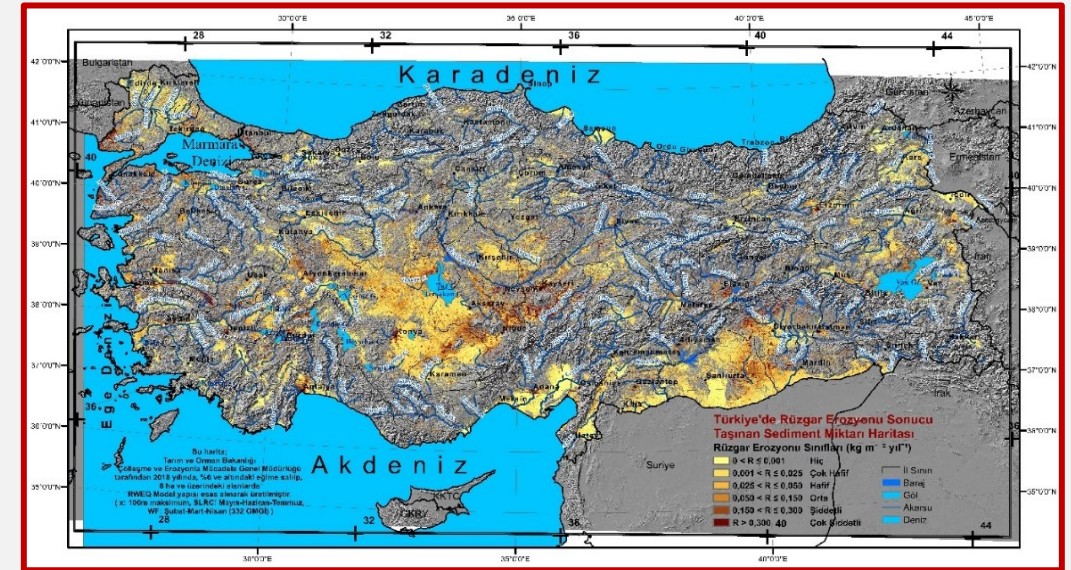




- ✓ In Türkiye, the rainfall is generally less than 400 mm; wind erosion is a big problem in Central Anatolia and Southeastern Anatolia Regions.
- ✓ There is a very severe wind erosion problem in an area of 1.3 million hectares throughout our country.



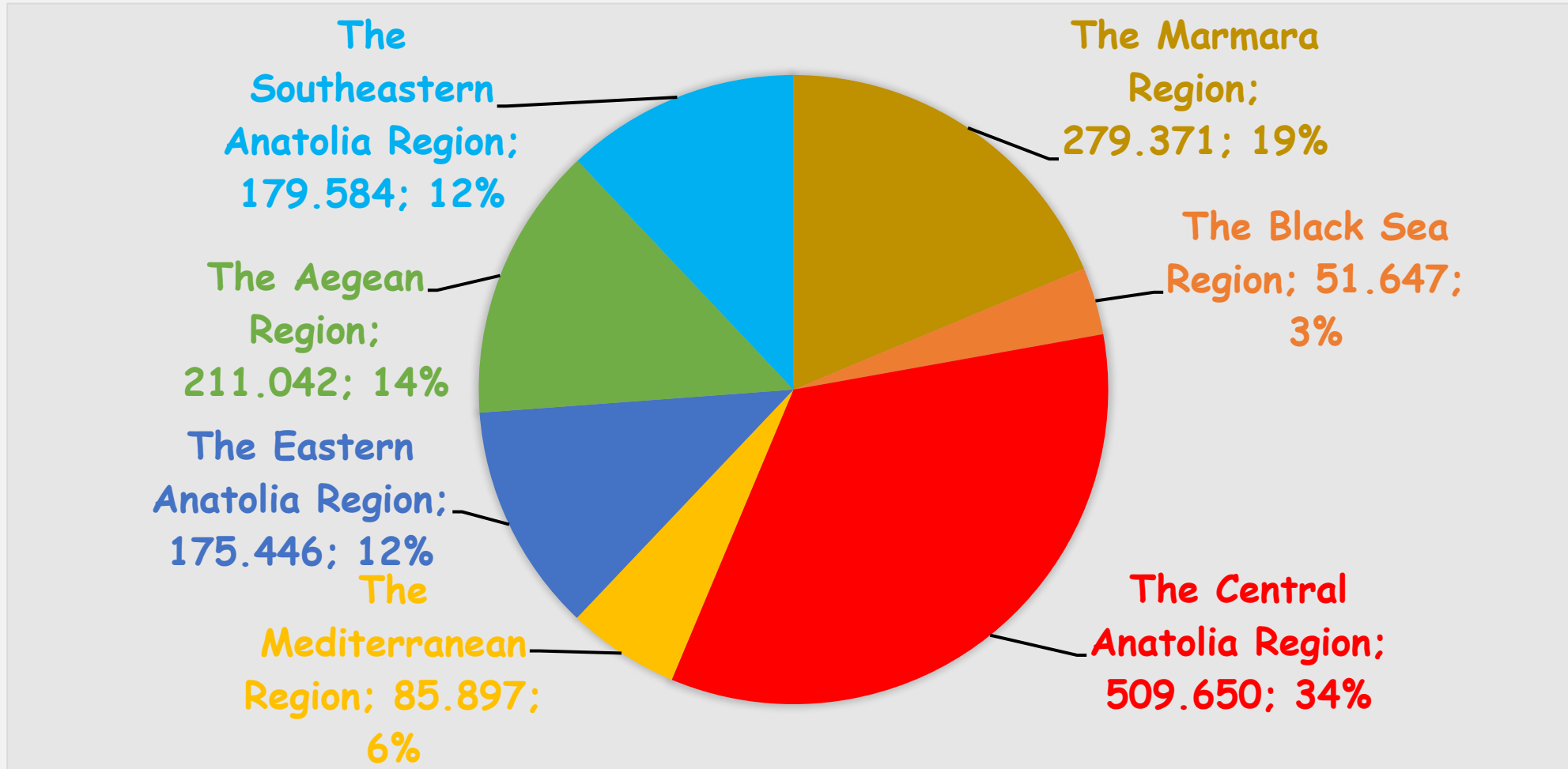
Map of Potential Wind Erosion Risk Areas in terms of Topography in Türkiye



Map of Sediment Transported by Wind Erosion in Turkey (kg /m<sup>2</sup>/year)



## Distribution of Wind Erosion (Very Severe) in Türkiye





## Wind Erosion Damages

### On Field Damages

- Soil loss
- Loss of organic matter and nutrients
- Worsening of physical soil properties
- Product loss

### Off-site Damages

- Deterioration of air quality
- Closing of roads
- Filling of irrigation channels
- Traffic accidents
- Causes fatal health problems (lung and skin cancer, asthma, infection diseases)



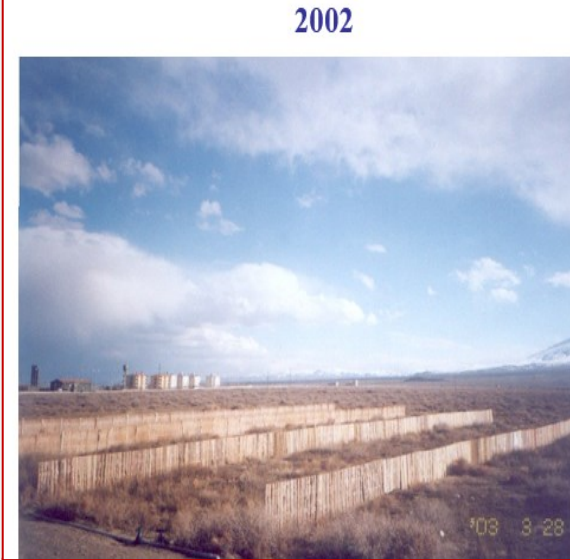


## Wind Erosion Control Methods (Iğdır-Aralık)



2002

2016

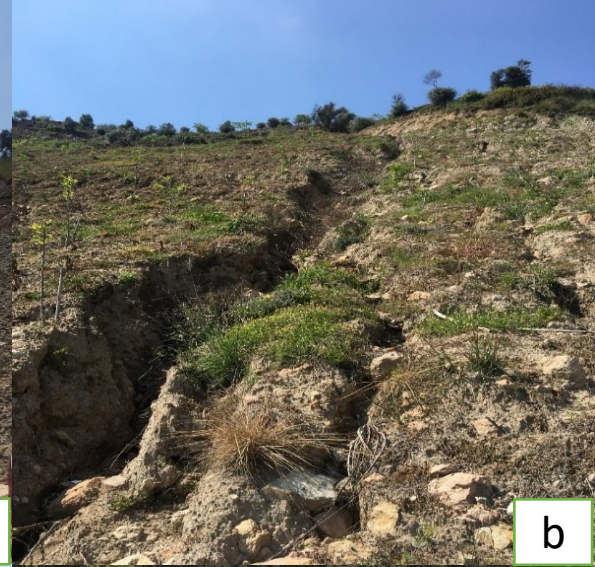




- **Gully erosion** is the **erosion** of the soil surface and the masses of the soil by increasing the **surface flow** of water as a result of **high intensity rain** or snowmelt, and the crevices that are too large to be corrected with normal tillage tools.
- Gully erosion first occurs as a result of **scouring** or **rupture** of small pieces of soil in areas where surface **runoff** intensifies.
- The **scour widens** and **deepens** in the direction of **increasing slope**.



Due to the special conditions that characterize **semi-arid** areas, such as **intense rainfall** events and **deforestation**, **gully erosion** can be considered an important source of **land degradation** (a, b, c and d).





Gully erosion is generally classified into two main types: “permanent” and “temporary” gullies.

Permanent gullies are wide and deep gullies (a, b and c) whose tillable soil and parent materials are eroded by intense surface runoff and cannot be removed by normal tillage operations.



a



b



c



d



e



f





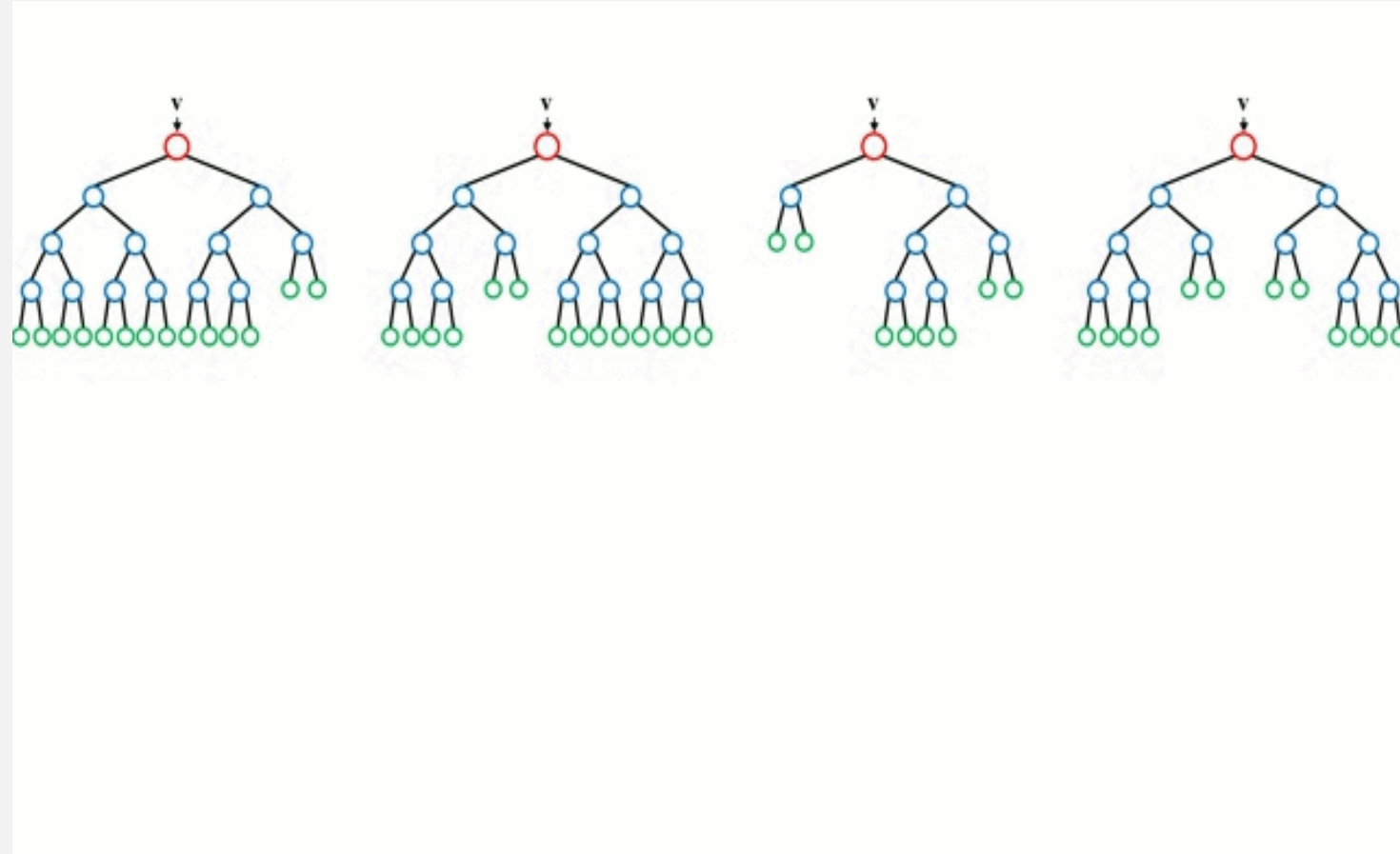
## Study Site (Aydın)

- Colluvial and alluvial soil structure (easily erodible soils),
- Tillage agriculture in areas with broken land structure and slopes (30%),
- Irregular rainfall regime and occurrence of floods,
- The density of gully areas, different slope, elevation, aspect and density of gully locations in different landuse types



## The model Running

Forest-based and  
Boosted Classification  
and Regression (Spatial  
Statistics)





## Model Results

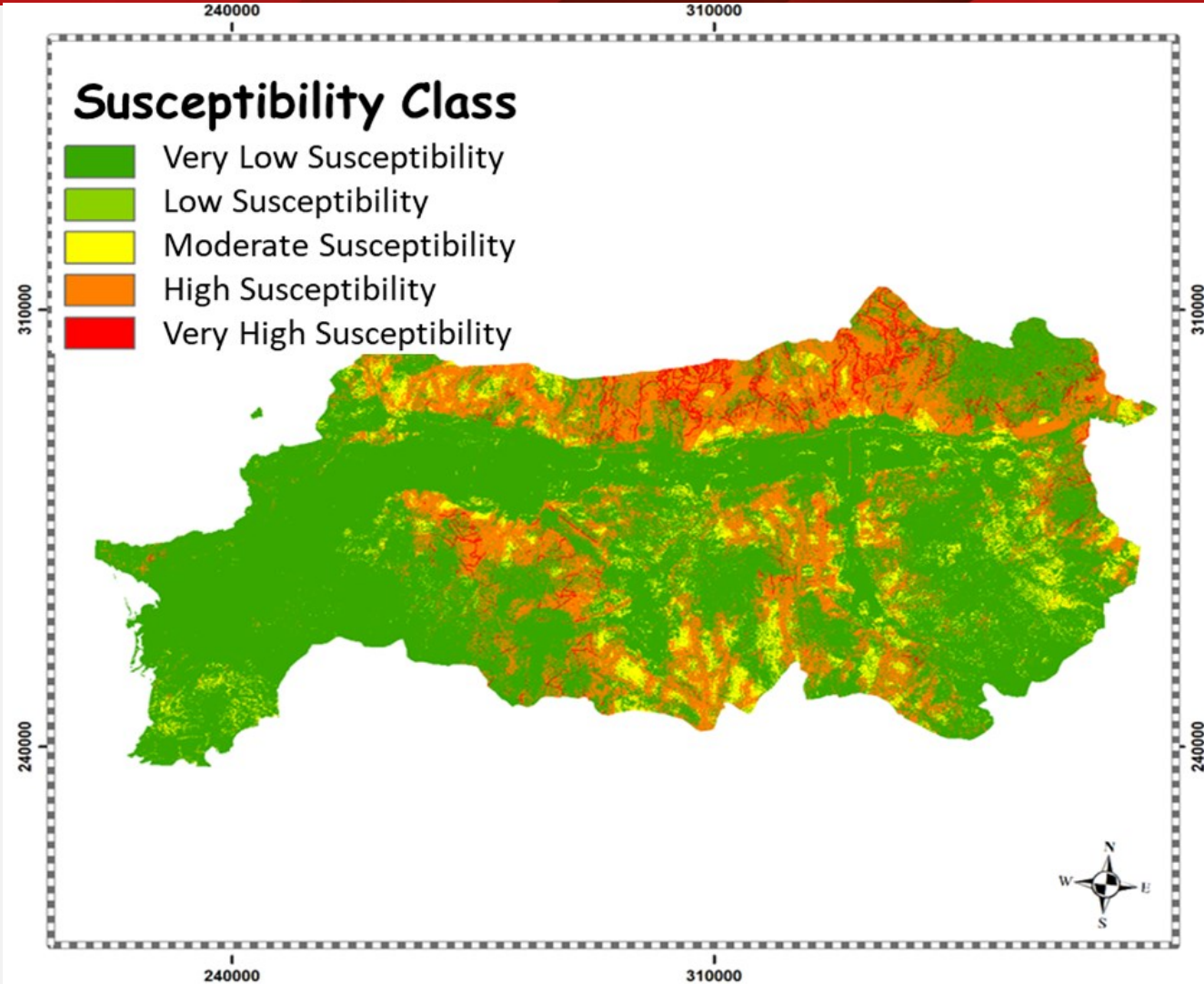
Distribution Rate of  
Susceptibility Areas  
to Gully Erosion in  
Aydın Province (%)

Province	Susceptibility Class	Rate (%)
Aydın	Very Low Susceptibility	68,1
	Low Susceptibility	0,09
	Moderate Susceptibility	7,4
	High Susceptibility	22
	Very High Susceptibility	2,4



## Model Results

### Map of Susceptible Areas to Gully Erosion in Aydın Province





# Soil Erosion Control

## Soil Erosion Control Research and measurements in Türkiye

- There are many projects and plans (executive, cultural, vegetative and engineering methods) for soil erosion control based on precedence and severity in Türkiye
- **OGM** and **ÇEMGM** establish vegetative cover and produce sustainability for vegetation by afforestation, reclamation and protect the existential vegetation to control soil erosion in Türkiye.
- **OGM** and **ÇEMGM** apply **terracing** and **diversion ditch** while land preparation to control soil erosion in addition to these knitted fence and flood structure (levee) built in hillslope areas.



# Soil Erosion Control





# Soil Erosion Control





**Thanks**