MONITORING SOME LAND DEGRADATION PARAMETERS IN SOILS OF BALA AGRICULTURAL ENTERPRISE

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- What is land and soil degradation?
- What is the situation of the world?
- What is the situation of the Turkey?
- What is the monitoring?

- Simple methodology of ?
- Describing the area
- Findings
- Conclusion

Land degradation will remain an important global issue for the 21st centurybecause of its adverse impact on agronomic productivity, the environment, and its effect on food security and the quality of life (Eswaran et al. 2001).

In addition to natural disasters, it is known that land degradation is occurred by the human activities which are agricultural mismanagement, overgrazing, deforestation, industry and urbanization etc. One of the main causes of land degradation is agricultural mismanagement.

GLASOD CLASSIFICATIONS (OLDEMAN, 1991)

Type of soil degradation

W Water erosion

- Wt Loss of topsoil
- Wd Terrain deformation/mass movement
- Wo Off-site effects
- Wor Reservoir sedimentation
- Wof flooding
- Woc Coral reef and seaweed destruction

C Chemical deterioration

- Cn Loss of nutrients or organic matter
- Cs Salinisation
- Ca Acidification
- Cp Pollution
- Ct Acid sulphate soils
- Ce Eutrification

E Wind erosion

- Et Loss of topsoil
- Ed Terrain deformation
- Eo Over-blowing

P Physical deterioration

- Pc Compaction, sealing and crusting
- Pw Water-logging
- Pa Lowering of water table
- Ps Subsidence of organic soils
- Po Other physical activities such as mining ar urbanisation

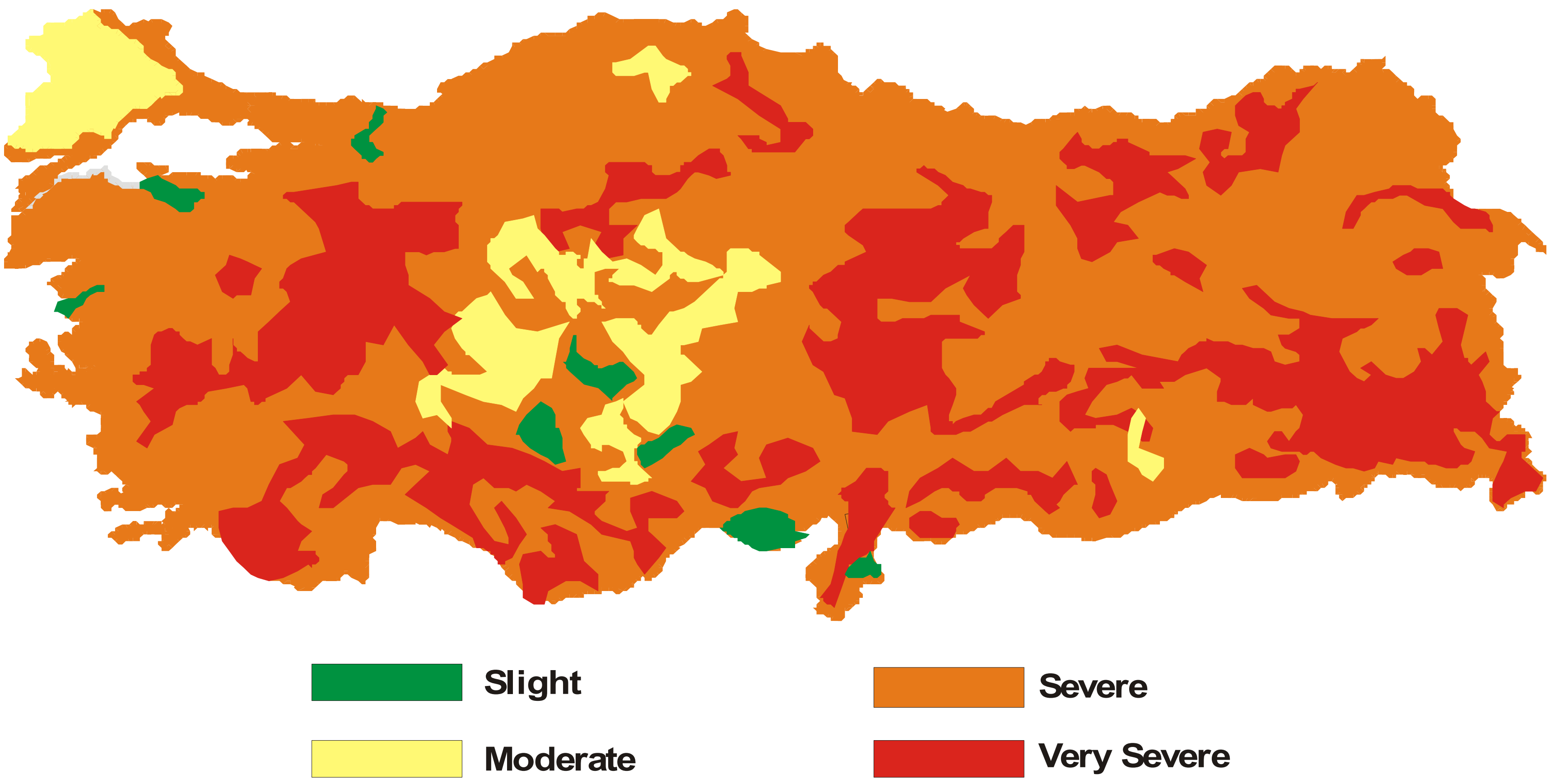
Extent of soil degradation (human induced) under different degradation types (in million ha)

Degradation type		**Degree of degradation**				**Area affected**	
		Slight	Moderate	Strong	Extreme	Total	%
Water erosion		27.3	111.6	5.4	4.6	148.9	45.3
a. Loss of topsoil (wt)		27.3	99.8	5.4	-	132.5	40.3
b. Terrain (Wd) deterioration	-	11.8	-	4.6	16.4	5.0	
Wind erosion		0.3	10.1	3.1	-	13.5	4.1
a. Loss of topsoil (wt)		0.3	5.5	0.4	-	6.2	1.9
b. Loss of topsoil / terrain deterioration(Et/Ed)		-	4.6	-	-	4.6	1.4
c. Terrain deformation /over blowing (Ed/Co)		-	-	2.7	-	2.7	0.8
Chemical deterioration		6.5	7.3	-	-	13.8	4.2
a. Loss of nutrient (Cn)		3.7	-	-	-	3.7	1.1
b. Salinization (Cs)		2.8	7.3	-	-	10.1	3.1
Physical deterioration					116.6	3.5	
Waterlogging (w)	6.4	5.2	-	-	11.6	3.5	
Total (affected area)		36.8	137.9	8.5	4.6	187.8	57.1
Land not fit for agriculture Stable terrain						18.2	5.5
Under natural condition (Sn)					31.2	9.8	
Total geographical area of India					328.7	100.0	

Source : “ Data Book on Mechanization and Agro–Processing Since Independence” by Dr.G.Singh, Director,

CIAE, Bhopal– 462038, Dec, 1997.

Due to mismanagement of the land, some of the main degradation type in Turkey are erosion by water or wind, soil salinization and alkalisation, soil structure destruction and compaction, biological degradation and soil pollution. Due to climatic and topographic condition soil erosion is the biggest problem in Turkey and approximately 86 % of land is suffering from some degree of erosion.



EROSION LEVELS IN TURKEY

Soils are closely interrelated with ecosystems, so that changes in these systems affect soils in avery complex way (and vice versa). These processes are rather difficult to quantify. Nevertheless, they are very relevant and should be further investigated.

Why monitoring soil change?

- The general proposition that our natural environment should be monitored is widely supported by natural resource management agencies, industry groups and community organizations.
- Monitoring data can provide feedback to assess the effectiveness of natural resource policies, determine the success of land management systems and diagnose the general health of landscapes.
- •There is also a desire for a set of environmental statistics to match well-established economic and social indicators.

The primary reasons for collecting most forms of natural resource data are to:

-*Reduce risks in decision-making* -

-*Improve our understanding of biophysical processes* - This is required to:

- Create realistic models for explanation and prediction (e.g. simulation models);
- Develop sustainable systems of land-use and management; and
- Provide the scientific basis for sound policies in natural resource management (e.g. establish baselines and detect significant deviations; establish cause and effect).

The major question in monitoring is

- what to monitor and
- the time interval for the monitoring.

A the second International Conference on land Degradation in Thailand, Eswaran et. al (2001) recommend 3 steps to address the issues and problems in land degradation

1- assess ment

2- monitoring and

3- application of mitigation measures and / or technologies.

The key to land degradation monitoring is to identify indicators that are quantitative, sensitive to small changes, easy to measure, small in number, and reasonably unambiguous .

The most accurate method for assessment and detection of
degradation is the direct measurement and observation at individual sites (Torrion, 2002).

Assessment of the status of the land degradation should proceed before monitoring begin, in order to provide a base condition against which to compare later changes and to establish trends.

Overview of monitoring and natural resource information provision at various scales

Mapping **Modelling** **Monitoring**

Contintent

1:2,000,000 scale

Broad landscape types and interpreted soil properties

Predict locations of vulnerable regions

Gross simplification of landscape processes

Broad material budgets

Exploratory analysis Proxy monitoring using satellite-based methods (e.g. land cover) supported by synoptic mapping and modelling.

Region

- Soil-landscape units
- 1:100,000 scale
- Delineate vulnerable landscapes
- Limited laboratory testing
- Generalized hydrological and simplified farming system modelling
- Input data from survey and limited direct measurement
- Some capacity for validation from field experiments
- Proxy monitoring of land-use and management.
- Field verification of proxy measures
- Survey monitoring feasible Programs to improve land literacy

District

- Soil map units
- 1:25,000-1:100,00 scale
- Most sensitive lands identified to guide location of monitoring sites
- Farming system modelling at enterprise level and hydrological modelling at intermediate catchment scale
- Input data from direct measurement
- Validation from field experiments   Simple monitoring
- Network of sites for direct measurement of soil change in selected and vulnerable landscapes
- Programs to improve land literacy

Local

- *Full inventory restricted to the long- term ecological research site*
- *More detailed than 1:10,000*
- *Intensive field measurement to support experimental program Detailed deterministic modelling*
- *Comprehensive validation of models*
- *Integrated monitoring*
- *Major long-term ecological research site*
- *Direct monitoring of landscape processes*

PROJECT AREA

- The study was conducted at the Bala agricultural enterprise which is located in the southeast of Bala township, 90 km to Ankara.
- The annual average rainfall in Ankara is about 410mm. Almost whole of annual total rainfall is recorded in December- May period.
- Monthly mean temperature ranges from -2.9 0C in January to 29.8 0C in August (DMI, 2000).
- The average relative humidity changes between about 71-72% in winter to 37-41 % in summer.
- The area (8442 ha) is characterized by upland hills.
- Elevation changes from 750 to1000m.
- Land use is predominantly cropland in a rotation management system fallow-wheat (5117.2 ha), pasture (1024.8 ha), and meadow (1041.6 ha).

In order to have some updated parameters of degradation,

soil samples were collected from the reference soil profiles in Bala on the horizonation basis and analyzed for comparison, assessment and interpretation.

Reference data being used as parameter affecting land quality are a set of horizon data of the typical soil profiles (18), once obtained from the detailed soil survey of the area conducted in early 1989.

In this study likelihood changes, either negative or positive, occurred in the years between 1989 and 2002 are intended to monitor by comparing the existing data of 1989 with those obtained in 2002.

To this end, 1/16000 scale soil map of 1989 was digitized an d a soil database was generated. Following a series of in queries,

- salt-alkali,
- drainage,
- boron,
- P2O5 and
- organic matter status were displayed in map format.

Results of sampling and analyses conducted in 2002 were incorporated into the database.

For erodibility assessment TURTEM was used. The computer program TURTEM (soil erosion estimation model for Turkey) which has been developed to allow the prediction of soil erosion by rainfall. TURTEM uses the procedures of the Universal Soil Loss Equation (USLE) to predict average annual soil losses due to sheet and rill erosion. TURTEM makes recommendations on ways to reduce soil loss by way of changes to land and cover management practices (Özden and Özden, 1998).

To calculate erodibility of soils some soil texture parameters, organic matter and structure and permeability classes were used. For actual erodibility, the same procedure was applied and erodibility values were transferred into database for the preparation of K map.

Another parameter used for erosion is topographic factor of which slope length and slope percentage were produced from DEM

from the thematic maps of 1989,

some of the Soil series have been effected in *various degrees by salinisation and alkalinization*.

Lime contents of soil series are high and very high.

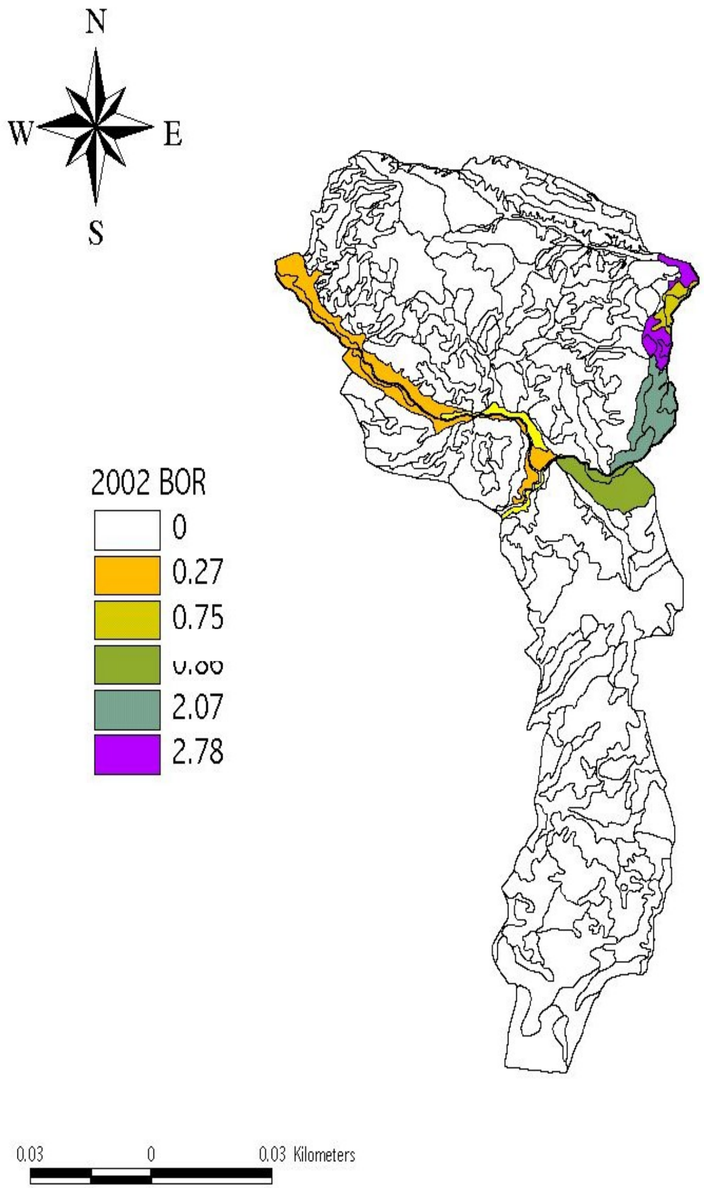
Amounts of organic matter are usually at low levels.

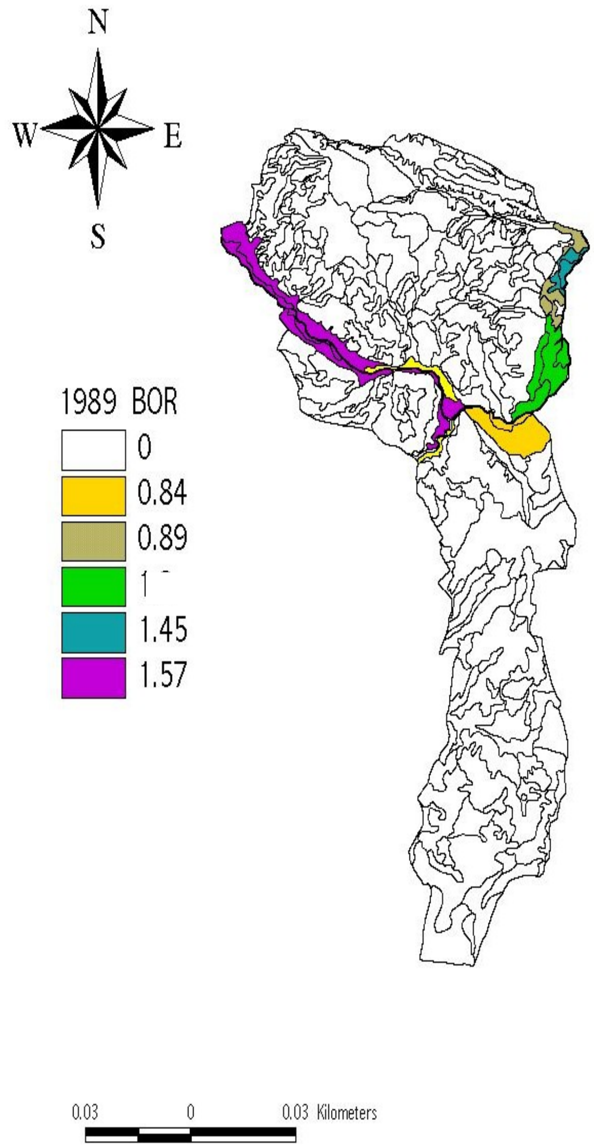
Similarly, P_2O_5 contents are low and very low, whereas

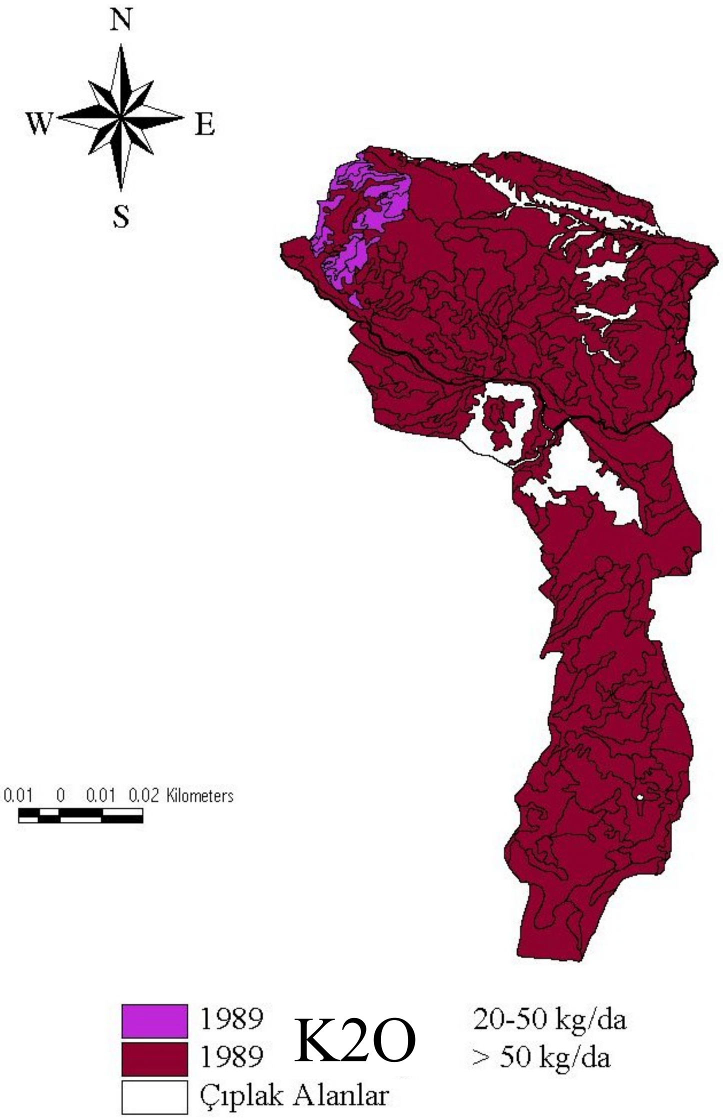
K_2O contents are high and very high in soil series.

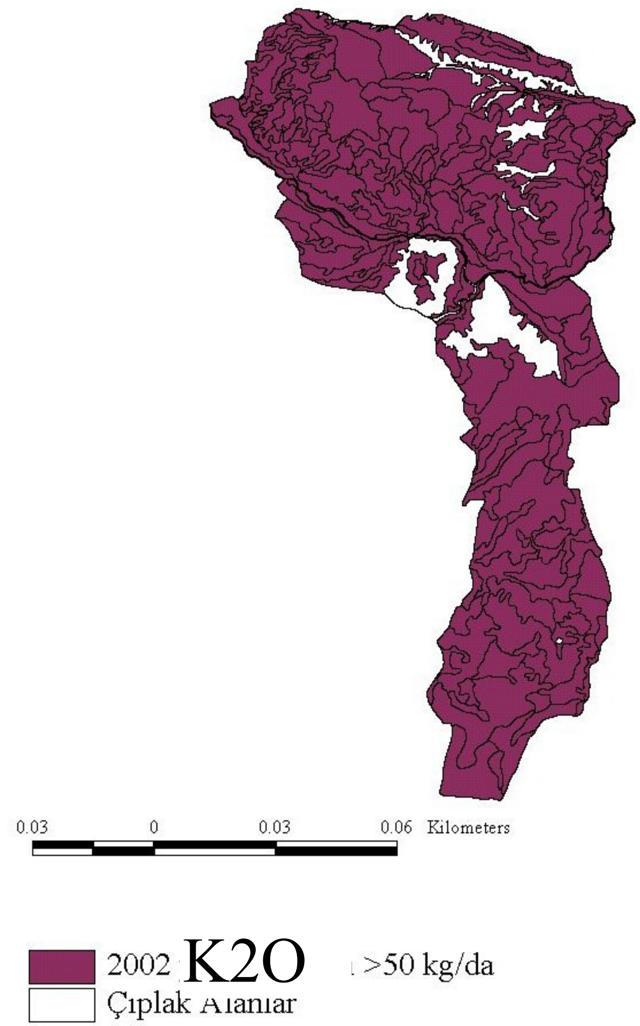
Depending on seasonal movement of water table in alluvial sediments,

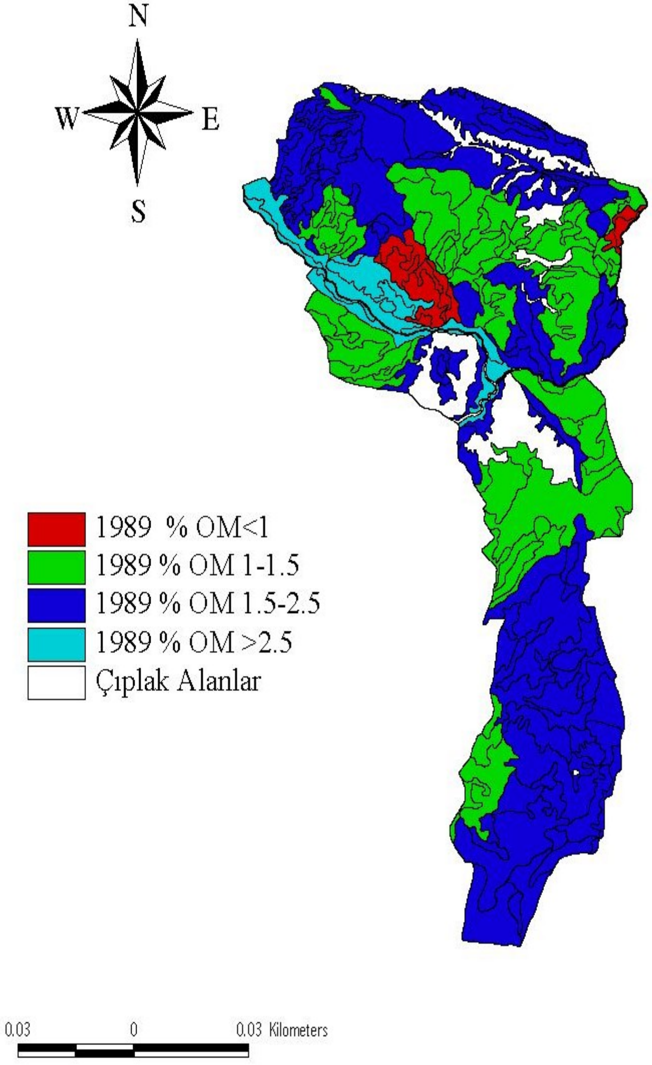
drainage conditions show variation from poor to well.

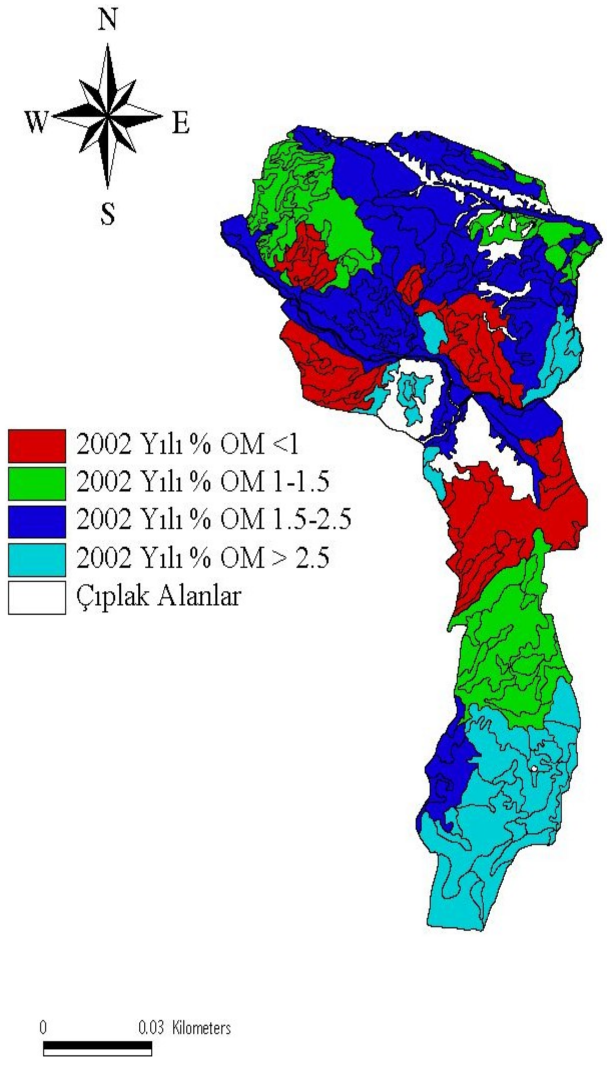

N
W
E
S
2002 BOR
0
0.27
0.75
2.07
2.78
0.03
0
0.03 Kilometers

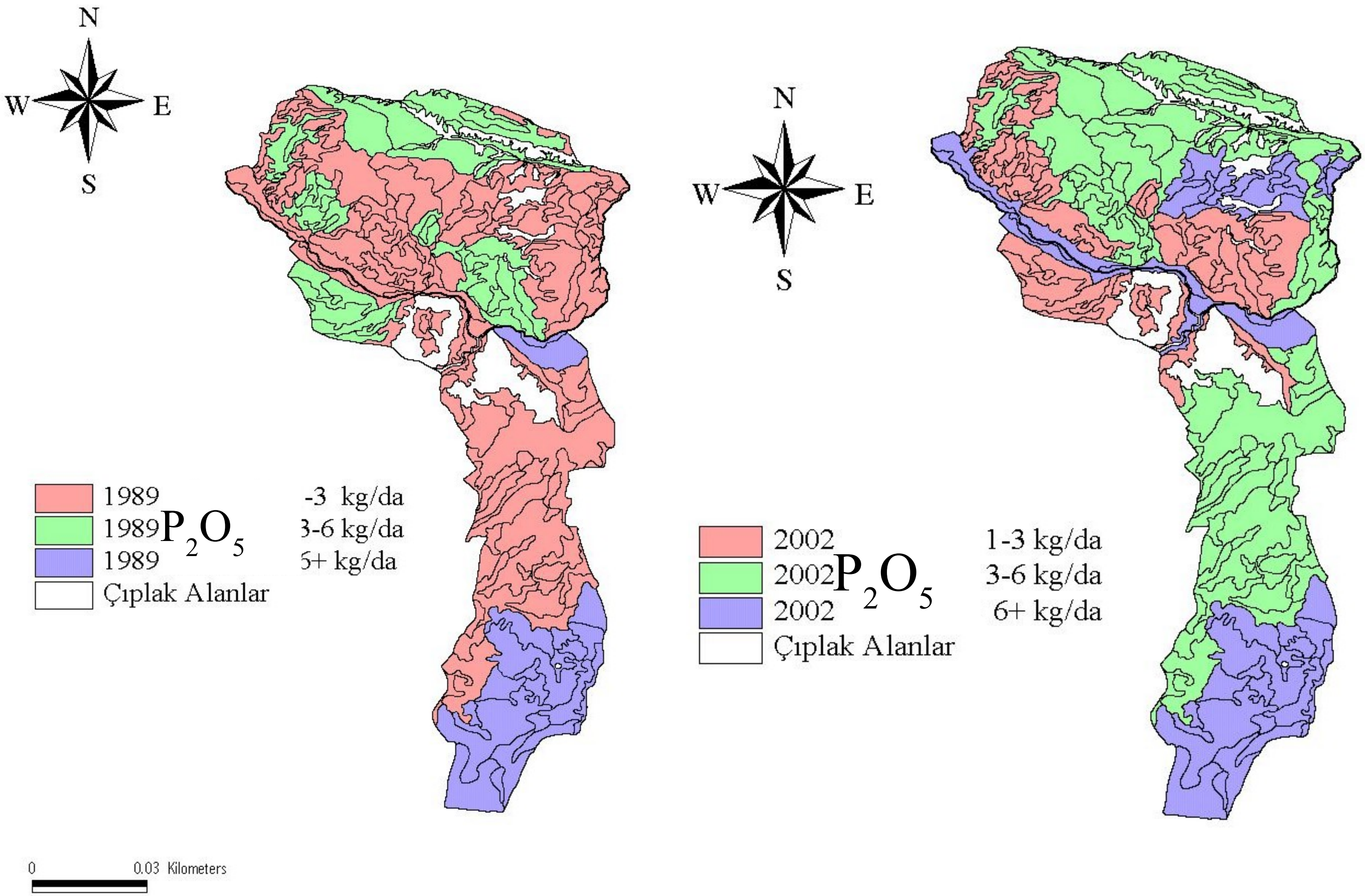

N
W
E
S
1989 BOR
0
0.84
0.89
1.45
1.57
0.03
0
0.03 Kilometers


N
W
E
S
0.01 0 0.01 0.02 Kilometers
1989 K2O 20-50 kg/da
1989 > 50 kg/da
Çıplak Alanlar


0.03 0 0.03 0.06 Kilometers
2002 K2O >50 kg/da
Çıplak Alanlar


N
W
E
S
1989 % OM<1
1989 % OM 1-1.5
1989 % OM 1.5-2.5
1989 % OM >2.5
Çıplak Alanlar
0.03
0
0.03 Kilometers


N
W
E
S
2002 Yılı % OM <1
2002 Yılı % OM 1-1.5
2002 Yılı % OM 1.5-2.5
2002 Yılı % OM > 2.5
Çıplak Alanlar
0
0.03 Kilometers


N
W
E
S
1989 -3 kg/da
1989 3-6 kg/da
1989 6+ kg/da
Çıplak Alanlar
P_2O_5
2002 1-3 kg/da
2002 3-6 kg/da
2002 6+ kg/da
Çıplak Alanlar
P_2O_5
0
0.03 Kilometers

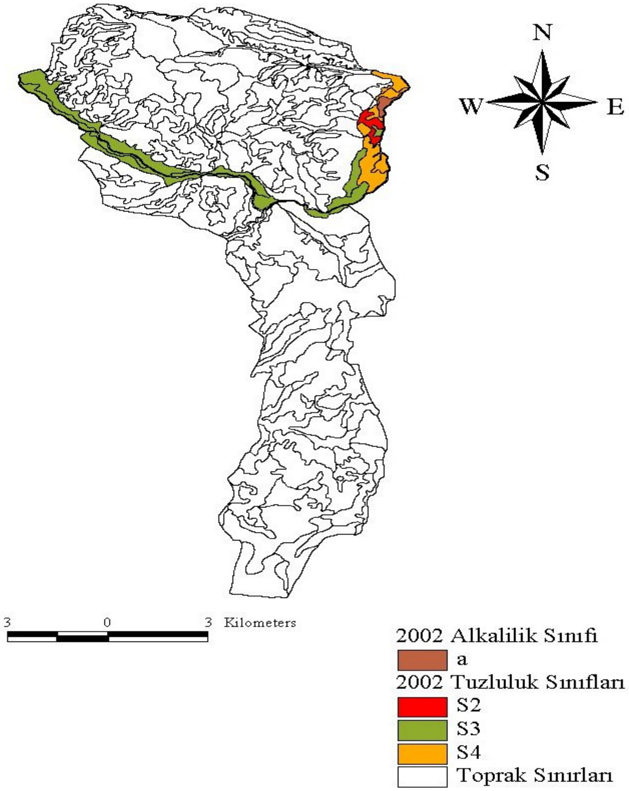
Almost all of soil series seem have become more erodible in 2002. Erodibility values of 1989 ranges from 0.1 to 0.4, except 4. Pompa series. According to the findings of 2002 , most of K values changed between 0.2 and 0.4, however, K values in four series were calculated more than 0.4

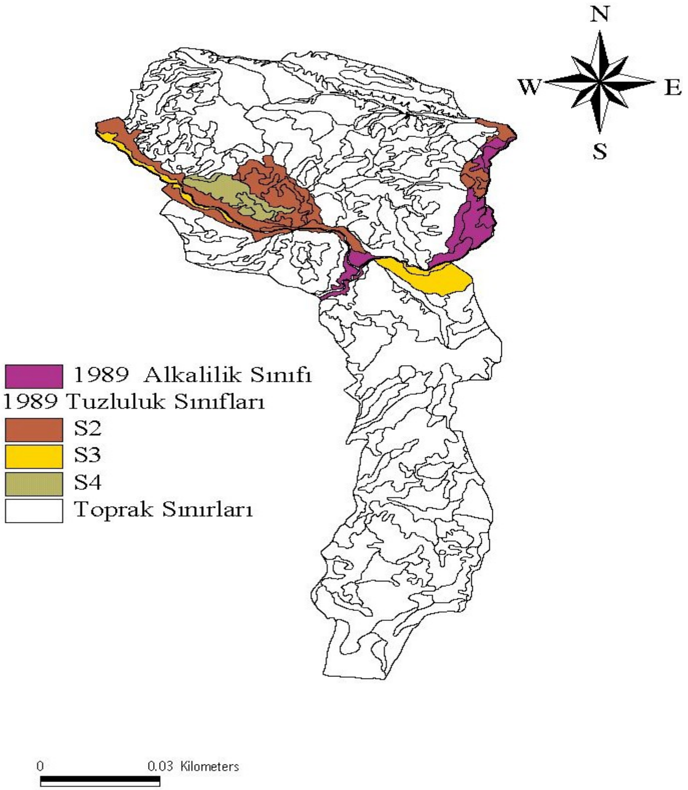
Bare area
very little erodible
erodible
medium degree erodible
high erodible
very high erodible

Series	Medium
İşletme Altı Serisi (IA)	0.172
Ağıl Serisi(AG)	0.173
KumsekiSerisi(KU)	0.175
Yaslı Serisi(YA)	0.183
Sıgırcılık Serisi(SI)	0.187
Bahçe Arkası Serisi(BA)	0.192

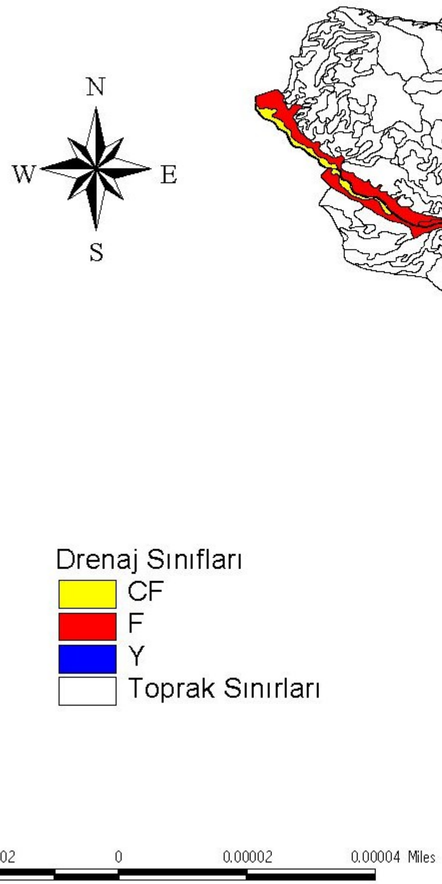
Bare area
very little erodible
erodible
medium degree erodible
high erodible
very high erodible

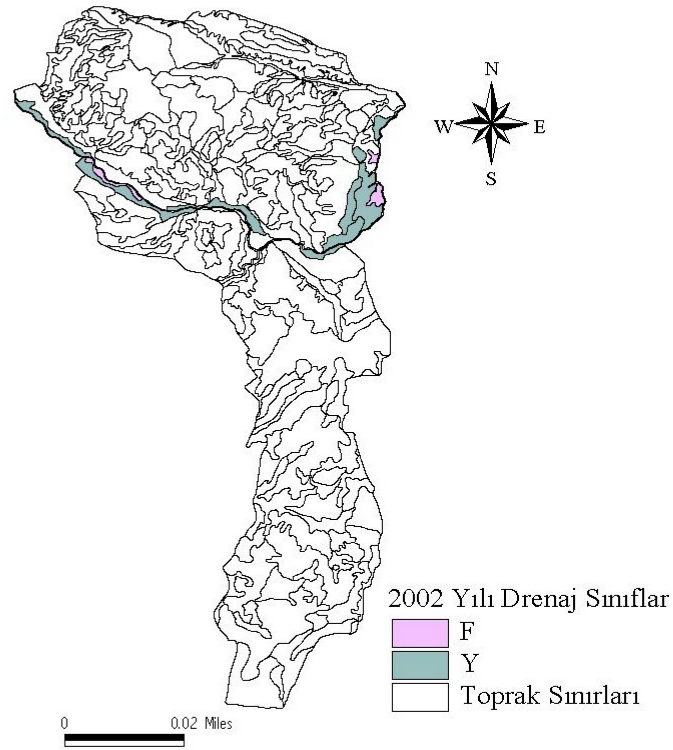
Series	High degree
Çit Serisi(CT)	0.200
Çiftekum Serisi (CI)	0.203
Büvelek Serisi(BU)	0.224
Omohun Serisi(OM)	0.227
Purlu Serisi(PU)	0.228
Şeritler Serisi (SE)	0.234
Tavukçuluk Serisi(TA)	0.236
Uyku Tepesi Serisi(UY)	0.254
Sarı Sırtı Serisi(SA)	0.274
Evcioglu Serisi(EV)	0.280
Höyük Serisi(HO)	0.326
İşletme Serisi (IS)	0.357

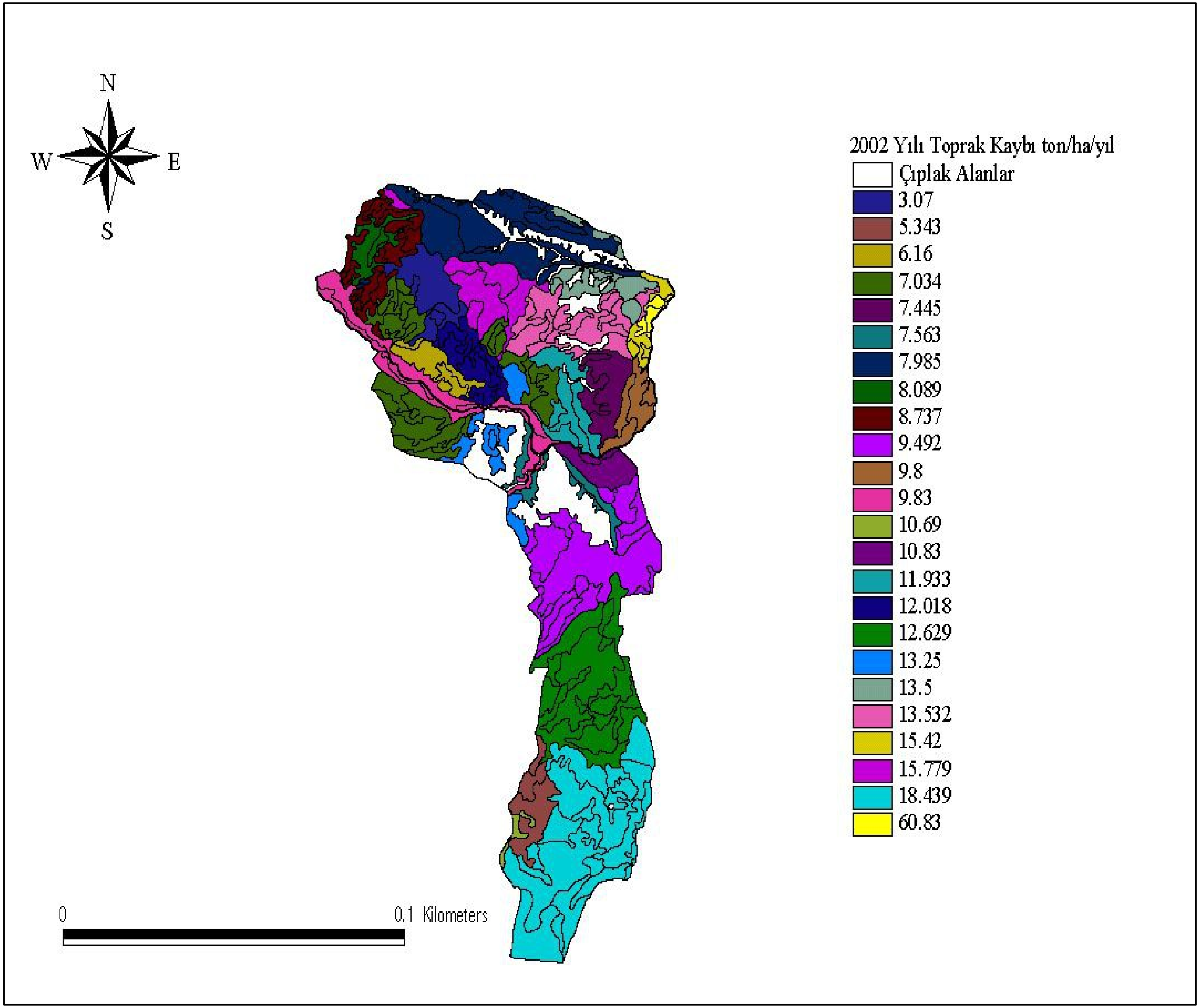




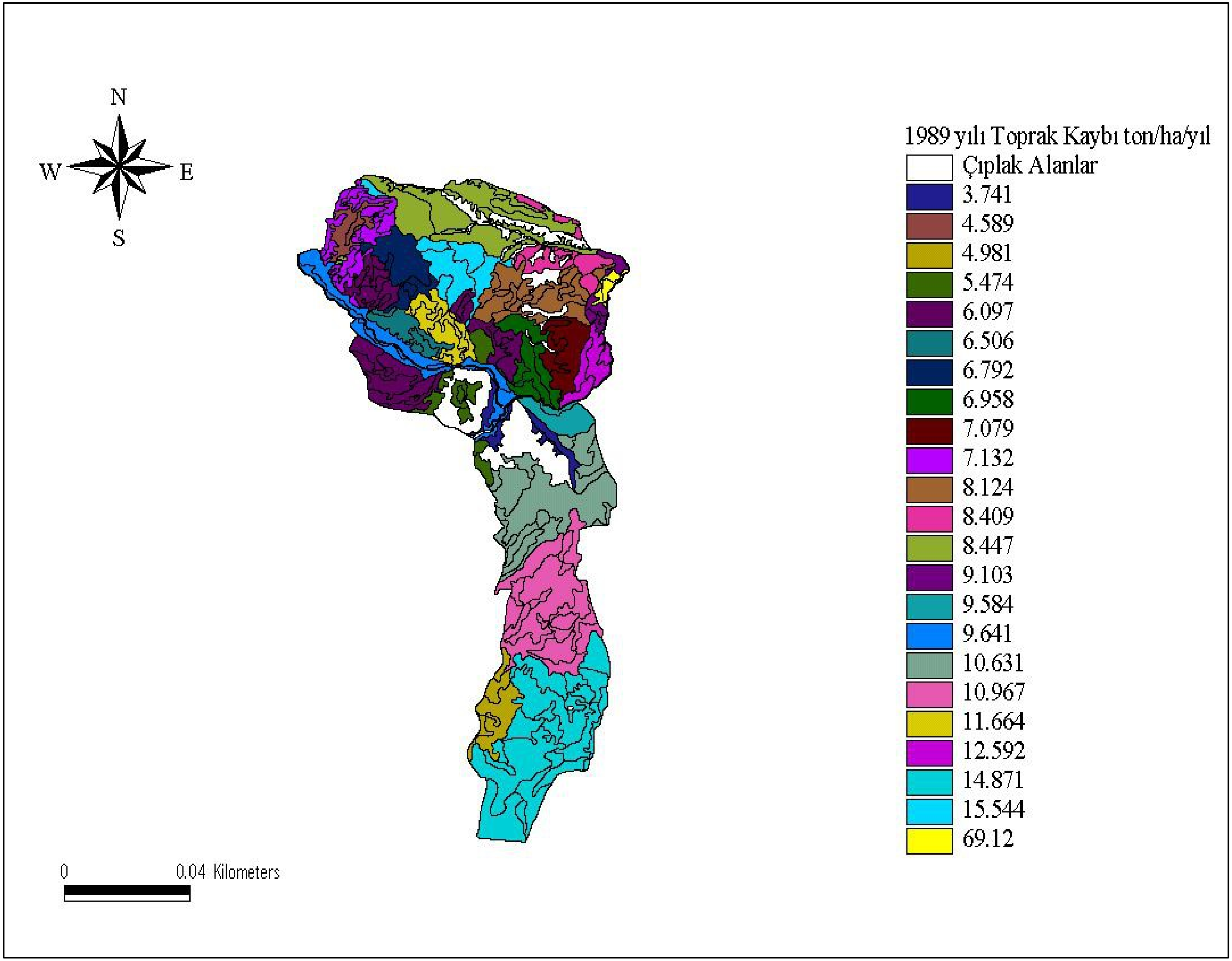
Generally, an outstanding improved condition in drainage was observed in the study area in 2002. Some conversions from very poorly drainage to imperfectly and well drainage associated with the decrease in water table were observed in some parts of Mezarlık series. In addition to improved drainage conditions, alkaline properties of the series disappeared in 2002.


N
W
E
S
Drenaj Sınıfları
CF
F
Y
Toprak Sınırları
0.00002
0
0.00002
0.00004 Miles


N
W
E
S
2002 Yılı Drenaj Sınıflar
F
Y
Toprak Sınırları
0
0.02 Miles



N
W
E
S
2002 Yılı Toprak Kaybı ton/ha/yıl
Çıplak Alanlar
3.07
5.343
6.16
7.034
7.445
7.563
7.985
8.089
8.737
9.492
9.8
9.83
10.69
10.83
11.933
12.018
12.629
13.25
13.5
13.532
15.42
15.779
18.439
60.83
0
0.1 Kilometers


N
W
E
S
1989 yılı Toprak Kaybı ton/ha/yıl
Çıplak Alanlar
3.741
4.589
4.981
5.474
6.097
6.506
6.792
6.958
7.079
7.132
8.124
8.409
8.447
9.103
9.584
9.641
10.631
10.967
11.664
12.592
14.871
15.544
69.12
0
0.04 Kilometers

CONCLUSION

It can be concluded that because of topographic character of the study area which is apt to erosion, textural compositions (relative distribution of fractions in texture) of top layers and amount of some macro nutrients have changed and organic matter contents and have decreased within 13 years.

In order to implement a monitoring scheme, availability of a set of reference data, which developing countries usually lack is a must. To facilitate such a program, detailed soil data, preferably maps indicating soil variables at phases level are unquestionably indispensable materials.

CONCLUSION

The proposed soil monitoring and assessment framework is seen as an important step to improve soil information at Country level.
This step is very urgent

- It should be developed guidelines on what exactly needs be measured and which data aggregation levels are required. Before this request can be answered, priority issues and indicators have to be selected.

CONCLUSION

A twofold approach should be pursued: a short-term approach, based on data already available and should be aimed to get immediate results; and a long-term approach, based on the establishment of a TURKEY soil monitoring network (TUKEYSoilNet).

In order to identify data gaps and encourage the organizations to participate, existing and derived data should be used to develop indicators in the short-term.

Thank you