TURKEY
LAND DEGRADATION NEUTRALITY

National Report
2016-2030

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Republic of Turkey
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Forestry and Water
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Land Degradation Neutrality

National Report
2016 - 2030

UNCCD
United Nations Convention
to Combat Desertification

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FOREWORD

Turkey is geographically positioned in the Mediterranean climate zone in an arid and semi-arid region. Located exceptionally at the intersection of Europe-Asia and African continents, the region has been home to various civilisations since the first human settlements.

However, its exceptional location also means centuries of human, animal and bird migration through its territories, leaving a trail of numerous pressures and degradation on forests, pastures, and agricultural lands.

Turkey is one of the most heavily affected countries by global warming and climate change which have been escalating particularly in the last century. Therefore, a series of intense efforts were initiated to mitigate the risks and alleviate the damages of desertification, land degradation and drought.

While forests, as one of the major carbon sinks, have been shrinking around the globe, Turkey has increased its forest areas owing to afforestation, erosion control, and rehabilitation works, and aims to increase its forest area up to 30% by 2030.

Turkey undersigned the United Nations Convention to Combat Desertification in 1998 with a view to reducing the effects of land degradation, desertification and drought, and it plays an active role in the implementation of the Convention.

In line with this purpose, the Action Plan and National Strategy to Combat Desertification was formulated, and a web-based monitoring-reporting system was established. Moreover, Turkey hosted COP 12 in October 2015, and still holds the Presidency of COP 12. Ankara Initiative, covering the years 2016-2019, is contributing actively to the implementation of Convention.

Regarding Land Degradation Neutrality (LDN) targets, Turkey participated in the 2014-2015 “Towards Achieving Land Degradation Neutrality: Turning the Concept into Practice” project. In addition, Turkey organised an LDN National Target Setting Workshop towards the African Region within the scope of “LDN Target Setting Programme”.

This report was composed by the Ministry of Forestry and Water Affairs in co-operation with other relevant institutions and organisations. I strongly believe that this effort will mark a significant milestone in setting the national LDN targets, and will set an example to other countries willing to participate in the effort.

Prof. Dr. Veysel EROGLU
Minister of Forestry and Water Affairs

ABBREVIATIONS

ÇATAK	The Environmentally-Based Agricultural Land Protection Programme
COP	Conference of Parties
DGF	Directorate General of Forestry
DSI	Turkish State Hydraulic Services
EC-JRC	European Commission Joint Research Center
EIE	General Directorate of Electrical Power Resources Survey Administration
FAO	Food and Agriculture Organisation
GAP	South-eastern Anatolia Project
GEF	Global Environment Facility
GIS	Geographic Information System
IIASA	International Institute for Applied Systems Analysis
IUSS	The International Union of Soil Sciences
LDN	Land Degradation Neutrality
MoFAL	Ministry of Food, Agriculture and Livestock
MoFWA	Ministry of Forestry and Water Affairs
NAP	National Action Plan
NDVI	Normalised Difference Vegetation Index
NDWI	Normalised Difference Water Index
NWIS	National Water Information System
PRAIS	Performance Review and Assessment of Implementation System
RIHN	Research Institute for Humanity and Nature
SFM	Sustainable Forest Management
SLM	Sustainable Land Management
SOC	Soil Organic Carbon
SWOT	Strengths, Weaknesses, Opportunities, Threats
TAGEM	General Directorate of Agricultural Research and Policies
TRGM	General Directorate of Agricultural Reform
TUIK	Turkish Statistical Institute (TURKSTAT)
UNCCD	United Nations Convention to Combat Desertification
WD	Water Database

1. LDN NATIONAL VOLUNTARY TARGETS AND STRATEGIES

Geographic location, population, and biodiversity hold an essential role in setting Turkey's targets and strategies towards National Land Degradation Neutrality. In addition, all past activities and future targets in forests, pastures, and farmlands were defined within the scope of overcoming the drivers of land degradation and desertification.

1.1 General Information on Turkey

Turkey is a transcontinental Eurasian country. Asian Turkey, which constitutes 97 per cent of the country, is named Anatolia. The remaining 3% is on the European continent, and called Eastern Thrace. Turkey's land area is 780,043 km^2. Seas on three sides encircle the country: the Aegean Sea in the west, the Black Sea in the north and the Mediterranean Sea in the south. Turkey also contains the Sea of Marmara in the northwest. Eastern Turkey has a more mountainous landscape and is home to the sources of rivers such as the Euphrates, Tigris and Aras, and contains Mount Ararat, Turkey's highest point at 5,137 metres and Lake Van, the largest lake in the country. Turkey is bordered by Georgia in the northeast; Armenia, the Azerbaijani exclave of Nakhchivan and Iran in the east; and Iraq and Syria in the southeast.

Turkey's total population is 78.7 million, and population growth rate is 13.4 per thousand. Population's 92% lives in city and county centres. While the capital city is Ankara, Istanbul is the most populated and developed city in Turkey, carrying also the title of third most crowded city in Europe. The official language in Turkey is Turkish.

Turkey is divided into seven geographical regions, namely Mediterranean, Eastern Anatolia, Aegean, South-eastern Anatolia, Central Anatolia, Blacksea, and Marmara. The enormous variety of geographical formations in Turkey is a result of ground movements that have been shaping the region for thousands of years. There are extinct volcanoes in the territory, and earthquakes are common.

Ecologically, Turkey has a rich diversity, and forests are significant in terms of both species and composition. As of 2015, 28.5% of total country area is covered by forestlands, approximately 31% by agricultural lands, and approximately 19% by pasturelands. Almost entirety of forests in Turkey is subject to the authority and initiative of the government, while private property forests are less than a thousandth of total forestlands (approximately 18 thousand hectares).

Turkey constitutes a bridge between Europe and Asia in terms of geographical and biological diversity. As it is located at the intersection of three out of 37 different phytogeographical regions (Europe-Siberia, Mediterranean, Iran-Turan), it is quite rich in biodiversity. In addition, three out of 34 biodiversity hot spots (Caucasia, Mediterranean, Iran-Anatolia) that need to be urgently placed under protection are within the borders of Turkey as well. In this regard, Turkey is one of only three countries along with China and South Africa to contain three hotspots within its borders. In the meanwhile, concerning biodiversity, it is one of the most eminent countries in the same zone as 34% (3,150) of its plant species are endemic. Turkey houses 2,783 protected sites including 40 national parks, 204 nature parks, 31 nature protection sites, and 112 natural monuments. Total of protected sites cover an area of 59,650 km^2, or 7.65% of total country area.

Turkey is highly vulnerable to desertification and drought due to its various climate and soil characteristics, and its topographical structure. Besides the climate, Anatolia has been home to civilisations throughout centuries, and been one of the first agricultural lands. The agricultural practices applied throughout history aggravated the human effect on Anatolian soils, and with the climate change's toll, lands faced desertification. Despite the negativities, this threat indeed provided a significant knowledge and experience accumulation on combating desertification.

Water erosion is one of the primary issues concerning desertification in Turkey as slope inclination in 46% of the total area in Turkey is more than 40%, and slope inclination is more than 15% for 62.5%of the total area. Different intensities of erosion affects 59% of the agricultural land, which is the biggest share of land use; affects 64% of pastures; and 54% of forest lands. The concept of erosion, and its adjacent threats such as flood damage is well known by the majority of public, but despite huge public participation in related efforts, erosion remains to be a significant issue. For instance, incorrect cultivation practices in sloping agricultural lands still pose erosion and flood risk.

In addition to erosion, degradation of agricultural lands and pastures, destruction of forests and natural ecosystems and the impacts of urbanisation are also among the main components of desertification and land degradation in Turkey. This degradation leads Turkey to undergo a revenue loss, which in return has an adverse effect on farming, where the revenue losses alter production habits in the short term, towards unsustainable methods. The need for input materials increases in order to compensate for the loss of efficiency in the aftermath of land degradation, which might drive farmers to inextricable financial difficulties. This whole process eventually means even more severe impacts of desertification and land degradation.

On the other hand, around half of Turkey's forestlands is classified as degraded and is in need of rehabilitation. Steppes as well are impacted by degradation. A significant portion of steppe lands has been transformed to agricultural lands for cultivation purposes, or been destroyed as a result of overgrazing. However, wetlands, of all natural habitats, exhibit the highest levels of degradation.

Considering the above information, Turkey is vulnerable to erosion, due to its climate conditions, topography and soil structure. Therefore, soil conservation and watershed rehabilitation works are due to prevent land degradation. The scope of erosion control activities include; planting forests in degraded forest lands exposed to erosion, and sloping lands with destroyed vegetation, transforming degraded forest lands to productive forest lands, rehabilitation of existing vegetation cover, and constructing plants in upper river basins to regulate water flow to restore natural balance. Moreover, other related works such as combating wind erosion, dune stabilisation works, and avalanche control efforts are undertaken as well. Such activities aim to prevent or mitigate flood and erosion through reduction or prevention of surface runoff. Moreover, different benefits of greenbelt afforestation include mitigating soil erosion on one hand, and providing for social needs such as recreation and health service on the other.

As a result of effective soil conservation, afforestation, and rehabilitation works, total forest area of Turkey expanded from 202,000 km^2 in 1972 to 223,000 km^2 as of 2015. In correlation, while the growing stock of forests was 0.9 billion m^3 in 1972, it soared to 1.6 billion m^3 by 2015.

1.2 Target Setting

Table 1.1 National Land Degradation Neutrality Targets

Turkey's national voluntary LDN targets are listed in the table below.

NATIONAL LDN TARGETS							
Negative Trend	Area		Corrective Measures		LDN Targets		Investment Amount
	Collect Earth (2001-2015)	(EC-JRC) (2000 – 2010) (km^2)		Unit	Amount	Date (Year)	(M Dollar)
Declination of Forest Areas	+11,542 (Increase according to Management Plan Data – 2000-2015)[1]	388	Increasing the ratio of country's forest areas	%	5[2]	2030	
			Afforestation	km^2	6,000		900
			Soil Conservation afforestation	km^2	9,000		630
			Rehabilitation of mine sites	km^2	58	2019	58
Declining Productivity in Forest land	460	2,125	Decrease in Forest Crimes	Number	1,416[3]	2017	
			Increase in Ratio of Mechanical, Biological, and Biotechnical Forest Pest Control	%	2.7[4]		
			Rehabilitation of forest lands	km^2	15,000	2030	450
			Reducing the amount of area affected per fire	ha	0.5[5]		3,060
			Reducing the number of human-caused fires	%	3[6]		
Declining productivity in pastures	3,700	2,582	Pasture rehabilitation	km^2	7,500	2030	150
Declining productivity in agricultural land	1,250	5,045	Increasing the irrigated area	km^2	22,000	2030	10,266
			Land consolidation activities	km^2	140,000	2023	3,000
			Identifying plains of great agricultural potential and registering them as agricultural lands	km^2	55,000	2023	0.3
			Amount of rehabilitated land	km^2	20,000	2030	266
TOTAL	**+6,122**	**10,140**			**274,558**	**—**	**18,780.3**

The Negative Impacts data in Table 1.1 exhibit inconsistencies due to use of different methodology and scale during data collection.

(1) Net amount of decrease in forestlands in Turkey between 2000-2015; the difference between forest assets of 2015 and 2000 reveals that there is indeed an increase in forestlands, rather than a decrease (Table 1.2 and 1.3).
(2) As of 2015, forestlands cover 28.5% of Turkey's total area. Target for 2030 consist of reaching 30% in area, by increasing another 5% within the time period.
(3) Forest crimes will be decreased down to 11,000 by 2017, from 12,416 in 2011.
(4) While mechanical, biological, and biotechnical forest pest control ratio was 87.3% in 2011, targeted ratio is 90 % for 2017.
(5) Targets for 2030 include decreasing area affected per fire to 2.2 ha from 2.7 ha.
(6) Turkey aims to decrease human-induced fires to 85% from 88% by 2030.

1.2.1 LDN Targets in Forest and Silvopastoral Lands

Almost entirety of forests in Turkey is subject to the authority and initiative of the government. In 1914, a decision was adopted to immediately implement all necessary actions to protect and sustainably manage the forests in Turkey, and the first Forest Management Regulation was issued in 1917. Since then, forests are still managed on the basis of the principle of sustainability and the forest inventory is updated regularly through aerial imaging and ground measurements.

The total forest area of Turkey was 211,887 km^2 in 2000, and finally 223,429 km^2, or 28.5% of country's total surface area, as of 2015 (Table 1.2 and Table 1.3). Turkey aims to expand its forest areas up to 30% by 2030.

Forests of Turkey are divided into two main groups based on their canopy closure. Forests of 11-100% canopy closure are considered productive (normal) forests and they constitute approximately 57% (127,000 km^2) of total forest area in the country. The remaining 43% (97,000 km^2) is covered with degraded (porous) forests whose canopy closure is between 5-10%.

A significant portion of forests in Turkey is degraded or damaged mainly due to climate factors, as well as human activities and other factors. Primary factors reducing the forest areas and productivity are classified as follows.

Table 1.2 Forest inventory for 2000

	Normal Closure		Porous Closure		Total	
	km²	%	km²	%	km²	%
Total	106,212.21	50	105,675.26	50	211,887.47	100

Table 1.3 Forest inventory 2015

	Normal Closure		Porous Closure		Total	
	km²	%	km²	%	km²	%
Total	127,041.48	57	96,387.87	43	223,429.35	100

- Canopy closure between 5-10% is classified as degraded (porous) forest, while 11-100% closure indicates a productive (normal) forest.

Forest fires: 60% of total forest area, that is, 125,000 km^2 of forestland is located in highly fire-sensitive regions, primarily the Mediterranean Region. Out of this 60%, 78,000 km^2 and 46,000 km^2 area classified as first and second degree sensitive areas respectively. Fire fighting is, therefore, the primary concern in forest conservation efforts in Turkey. Forest fires claimed 1,456 km^2 forest land between the years 2000-2015. Article 169 of the Constitution of Republic of Turkey, and the "Code of Practice in Prevention and Suppression of Forest Fires" require natural regeneration, artificial regeneration, rehabilitation and afforestation works within a year following suppression efforts in the burnt forestlands, and hence these burnt areas are continuously monitored and rejuvenated. Indeed, Turkey is the leading country in fire fighting in the Mediterranean region.

Among the forest fires in Turkey, 12% out of total is natural while 88% is human-induced. Turkey succeeded in reducing forest fires, with initial response time reduced down to 15 minutes from 45 minutes using 19 thousand personnel, approximately 2,300 vehicles and machinery, and 35 aircrafts. The target for 2030 is to stabilise this response time. As for 2021, affected area per fire will be reduced from 2.7 hectares to

2.2 hectares, while decreasing human-induced fires from 88% to 85% (DGF 2013-2017 Strategy Plan).

Illegal logging, cropland clearing, grazing pressure and impacts: Rural population within or nearby forests traditionally meet their firewood and other wood needs from forests. Illegal logging used to be one of the primary causes of forest degradations, yet it has been since then largely tackled. Contributing factors include villagers' needs supplied legally for reduced costs, migration of a significant ratio of forest village population to cities and towns, and mainstreaming of other energy sources (charcoal, bottled gas, solar power, etc.). Migrations also relieved the pressure and threat of cropland clearing. However, grazing pressure and impacts are still significant degradation threats and factors in many regions. Approximately 1,090 hectares of cropland per year is illegally cleared in forests in Turkey.

Damage caused by allocation and use of forests for urbanisation, tourism, mining, energy permits and other similar permits: Building and facility demands as well as pressure by urbanisation and tourism sector grow rapidly, rendering the allocation of forests to other uses the most important threat to overcome.

Turkey's forest management data is collected and regularly updated through aerial photographing and ground surveys. These data present that mining activities, forest fires, and illegal clearings led to a decrease of 2,824 km^2 in forestlands between the years 2000-2015. Yet forest conservation and rehabilitation works, and efforts to increase existing forestlands are continued uninterruptedly with afforestation, erosion control, and rehabilitation works. Between the years 2000-2015, Turkey carried out afforestation works in a total of 15,345 km^2 land, rehabilitated 27,818 km^2 of degraded forestland, and increased its forest assets by 11,571 km^2. While there is no clear decline in in forest areas, Turkey maintains corrective measures and has set a much higher goal in work programmes than LDN targets that comprise afforestation works on 15,000 km^2 land, rehabilitation works on 15,000 km^2 and pasture rehabilitation works in 7,500 km^2 land by 2030.

As a result of erosion control, afforestation, soil conservation afforestation and pasture rehabilitation works, the suspended sediment amount decreased from 299 million tonnes (riverbed + suspended) in 1982, to 178 million tonnes by 2013 (EIE). The goal for Turkey is to reduce this amount further to 130 million tonnes per year by 2030.

1.2.2 Targets in Agriculture and Pasture Services

Agriculture:

The total amount of Turkey's agricultural lands (cultivated lands) is 240,000 km^2 (TUIK, 2015), out of which 25% is used for irrigated agriculture, 75% for dry farming, and 17% of total cultivated area is fallowed.

The amount of agricultural land allocations rose significantly since the use of machinery in farming began in 1948. However, this increase in agricultural lands halted in 1990s, and began decreasing. The main causes for this decrease was the allocation of agricultural lands to other uses, lands of certain small scale enterprises spared for other uses once the enterprise is liquidated, soil degradation due to inappropriate agricultural practices, migrations from rural areas to urban areas and property ownership related issues.

On the other hand, of approximately 50,000 km^2 cultivable land is used through uneconomic methods outside of its capabilities, and another approximately 50,000 km^2 non-cultivable land is used in agriculture despite its inconvenience, resulting in a loss of fertility due to erosion.

The drivers of land degradation in Turkey and necessary precautions are given in the summary list below.

Drivers of Land Degradation	Necessary Precautions	Targets
Shrinking and fragmented nature of agricultural establishments.	Defining optimal establishment sizes based on ecological regions. Regulations to prevent land fragmentation in the Inheritance Law.	Completing land consolidation works in 140,000 km^2 land, which constitutes the target for 2023.
Inappropriate ploughing-seeding-planting in high slope and marginal regions.	Mainstreaming soil conservation (climate-friendly) farming.	Promoting and supporting soil conservation farming. Offering trainings to trainers and farmers on the subject.
Use of farming machinery out of purpose.	Completion of land use plans. Identification of large plains of agricultural potential and registering them as agricultural conservation areas.	Enforcing all relevant articles of Soil Law No. 5403 without any compromise, and applying all necessary legislation amendments.

Drought risk and irregular precipitation regime	Establishing irrigation systems in rain-fed agricultural lands will facilitate increased productivity and reduced drought risk.	The current surface area of irrigated lands is 6.3 million hectares. Target for 2030 is to expand irrigated areas up to 8.5 million hectares.
Extreme and inappropriate irrigations	Shift to pressurised irrigation systems and refraining from over-irrigation will prevent salinization of land.	Mainstreaming pressurised irrigation systems such as sprinkling and drip irrigation will ensure saving water, prevent salinization, and reduce infiltration of plant nutritional elements.
Insufficient land rehabilitation works	Proper rehabilitation of salinized and desertificated lands by inappropriate irrigation methods.	Rehabilitation works will gain approximately 20,000 km^2 of agricultural lands.
Common stubble fires	Prevention of stubble fires that cause degradation in soil's biological, physical and chemical structure will serve to increase biodiversity.	Measures to ensure more efficient implementation of the legislation related to stubble fires.
Extreme uses of fertilisers and pesticides pollute the soil and inland waters, increasing eutrophication.	Extending control systems to prevent extreme uses of chemical fertilisers and pesticides.	Diesel, soil and fertiliser analysis supports should be up-scaled, and controlled applications should be ensured.

Numerous planning and project works aim to increase the efficiency of agricultural land management in Turkey, including irrigation per farmer, land consolidation, agricultural land improvement services, land use planning, and the establishment of a land information system/data base. Moreover, determination and registration of large plains of high agricultural potential as agricultural lands, and ensuring protection of lands with agricultural production integrity and suitable agricultural lands, etc. are essential in redirecting non-agricultural practices to less productive agricultural lands. Currently 184 plains of approximately 55,000 km^2 area have been defined within this plan. In addition to these, priority issues such as food production, security, and safety, rural development, protection and efficient use of soil/water/biological diversity are included in the 2013-2017 Strategic Plan of the Ministry of Food, Agriculture and Livestock (MoFAL) in order to serve to improve agriculture and related policy-making.

Initiating Irrigation in Rain-fed Farming Lands

The expected outcome of initiating irrigation in dry farming lands is to increase the amount of carbon stored in soil. Results of a relevant study are presented in Table 1.4.

Table 1.4 Soil Organic Matter (organic carbon) % Fluctuations in Adıyaman Region Based on Land Cultivation Types

	Rain-fed Farming		Long Term Irrigation		Irrigation since 1995	
	Organic Matter	Organic Carbon	Organic Matter	Organic Carbon	Organic Matter	Organic Carbon
Cereals	1.03	0.59	1.42	0.82	1.35	0.78

Above study was conducted within the South-eastern Anatolia Project (GAP) region located in a semi-arid and arid climate zone. Dry farming lands where irrigation will be introduced are likely to be selected from within arid and semi-arid regions. Hence, it would not be wrong to generalise the findings of this study to all lands where irrigation will newly be introduced. The study lasted approximately 20 years, and concluded that a higher amount of organic matter is produced, and thus stored by irrigated farming lands compared to rain- dependant lands.

Based on these data, an increase of at least 0.98% in soil organic matter is estimated in the newly irrigated 22,000 km^2 land across Turkey by 2030 (Table 1.5).

Table 1.5 Expected organic matter and organic carbon contents following irrigation in 22,000 km2 land in Turkey

Land Introduced to Irrigation (km^2)	Depth (m)	Bulk Density	Potential Organic Matter Increase %	Organic Matter (tonnes)	Organic Carbon (tonnes)
22,000	0.15	1.3	0.98	504,900	218,790

As the above table demonstrates, this approach indicates 218,790 tonnes of increase in soil organic carbon content in the irrigated lands by 2030 (Annex 1).

Moreover, subsidies and incentives towards organic farming, good farming practices, and soil conservation farming within the scope of sustainable land management will also positively affect land degradation neutrality.

Pasture:

According to national official data the total surface of pasturelands in Turkey is 146,166.87 km^2. Approximately 64% of pasturelands are subject to various degrees of erosion. The targets include increasing the current 5,850 km^2 rehabilitated pasturelands to 8,500 km^2 by 2023, and include an additional 7,500 km^2 by 2030.

The Pastures Law no. 4342, adopted in 1998, helps determine, confine and allocate pastures, summer pastures, winter quarters and publicly owned grassland and pasturage to village or municipality legal entities, ensuring usage of such lands in accordance with defined rules, increasing and improving their efficiency via maintenance and reclamation works, continuously inspecting and protecting their use and change of usage when deemed necessary.

Drivers of land degradation in pasturelands in Turkey, as well as necessary precautions, and the targeted results are given below.

Drivers of Land Degradation	Necessary Precautions	Targets
Pasturelands degrading and becoming dysfunctional due to uncontrolled excessive grazing for extended periods of time, invasions and other such reasons	Countrywide proper project designing and implementation towards rehabilitation of existing determined and designated pasturelands. Measures to enforce grazing plans on rehabilitated areas.	Determination, designation and allocation of pastures to village or municipality legal entities within the scope of related legislation. Rehabilitation of weak pasturelands and improvement of degraded lands across country.

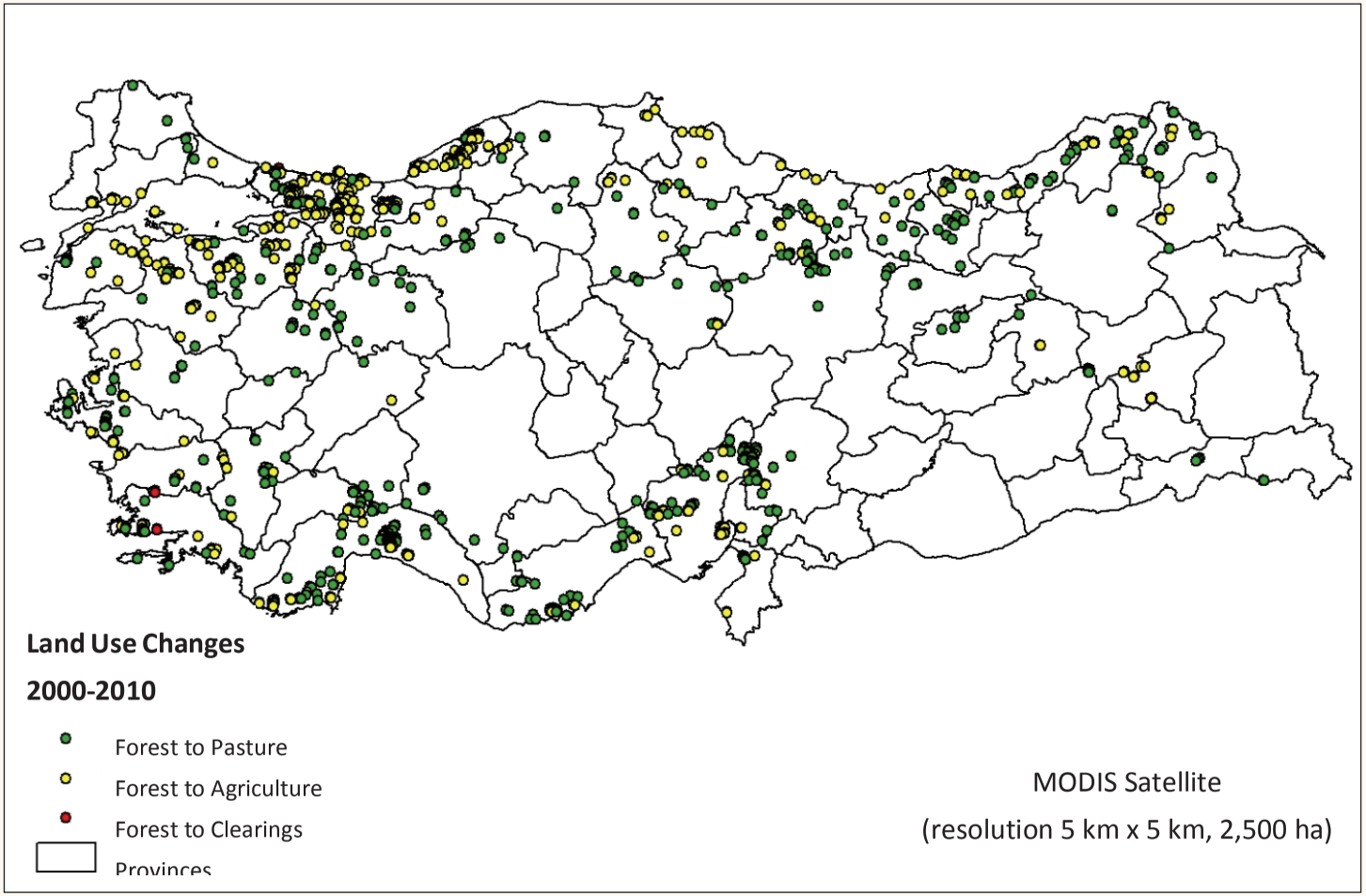
2. DIFFERENT CRITICAL PROCESSES AND CORRESPONDING MAIN FACTORS

Lands have been classified based on different land uses (forestland, meadow, pasture, agricultural land, settlements, wetlands etc.) in Turkey. Adaptation trends in arid and semi-arid regions based on conducted activities were explained within the scope of productivity trends. The soil organic carbon stock amount in agricultural lands, forestlands and pasturelands were included. Water conservation projects, irrigation systems and irrigated lands were defined within the framework of sustainable water management.

2.1 Land Cover/Land Use Changes

Data related to Turkey's land cover was produced by the European Environment Agency's CORINE programme for the period between 2006 and 2012. However, this data was not included in evaluation as it did not provide reliable results due to its low resolution not allowing accurate land cover classification. Therefore, the evaluation used data obtained from MODIS satellite images produced by European Commission Joint Research Centre (EC-JRC), and land cover data for between 2000-2015 obtained through Google Earth plugin Collect Earth developed in FAO, as well as national statistical data.

Map 2.1 shows Turkey's Land Use Changes between 2000 and 2010, compiled by the European Commission- Joint Research Centre. Study employed 250m - 5km resolution MODIS satellite images developed by NASA.



Map 2.1 Turkey's Land Use Changes between 2000-2010 (EC-JRC) (See Annex 4)

All quantitative values in Table 2.1 were extracted from Turkey's Land Use Changes Map Between 2000-2010 compiled by the European Commission- Joint Research Centre.

Table 2.1 Land use categories based on MODIS data (EC-JRC) (See Annex 4)

TURKEY - JRC- MODIS DATA									
Land-Use Category	Land area (2000)	Land area (2010)	Net change in area (2000-2010)	Net land productivity change (sq. km, 2000-2010)					Soil organic carbon (2010)
	sq. km	sq. km	sq. km	Declining	Early stage of declining	Stable but stressed	Stable not stressed	Increasing	tonnes /ha
Forest land	164,711.40	164,323.70	-387.70	2,124.90	2,941.20	6,213.70	80,142.50	72,789.80	37.768 42036
Shrubs, grasslands and sparsely vegetated areas	199,999.80	200,151.80	152.00	2,582.30	1,458.40	9,253.40	167,187.20	18,566.10	32.290 37424
Cropland	376,027.30	376,262.00	234.70	5,044.50	6,272.70	24,471.30	284,450.50	55,499.70	32.787 97195
Wetlands and water bodies	15,982.60	15,982.60	0.00	472.90	144.60	656.10	4,011.80	1,174.40	33.948 62982
Artificial areas	16,971.00	16,971.00	0.00	1,728.00	658.00	2,010.80	10,394.30	2,119.60	35.195 40836
Bare land and other areas	6,270.70	6,271.70	1.00	99.10	8.40	133.30	5,375.40	175.10	31.182 44119
Total	**779,962.80**	**779,962.80**	**0.00**						

Table 2.1 demonstrates that according to MODIS data (EC-JRC), forestlands in Turkey decreased by 387.70 km^2, shrub lands and pasturelands increased by 152 km^2, agricultural lands also increased by 234.70 km^2, while other areas showed no significant changes between the years 2000 and 2010.

It is likely that areas classified as shrub land, pasture/meadow or sparsely vegetated areas by remote sensing in 5km x 5km resolution, are indeed burnt forestlands or natural or artificial regeneration. Thus, the 387.70 km^2 net decrease in forestlands between 2000 and 2010 is determined to be caused by natural or artificial regeneration areas and burnt lands between 2000-2010. Moreover, according to national data from the same period, 1,460 km^2 land was clear-cut as required by planned forestry. However, the 3,571,000 hectares of afforestation site that is recorded in national official data could not be observed and classified under the other category as they could not reach sufficient canopy closure and as the saplings were too young.

2.2 Land Productivity Status and Trends

Desertification and Greening Trends in Arid and Semi-Arid Lands

FAO employed the Collect Earth tool developed by Google Earth to analyse forests through exemplification method, to monitor Desertification and Greening Changes in Arid and Semi-Arid Regions.

According to the Arid Lands map of IIASA/FAO 2003, out of Turkey's 780,043 km^2 total surface area, 612,200 km^2 (78.13%) are within arid and semi-arid regions. During the inspection of randomly selected 3,950 points in these regions, NDVI (Normalised Difference Vegetation Index) graphic data obtained from MODIS and Landsat satellites, and satellite images from Google Earth, Bing Maps, Here maps and Yandex were used.

Following the evaluation of these images, the results demonstrated in Table 2.2 indicated a 14,250 km^2 greening in forests, shrub lands, pastures, settlements, agricultural lands, wetlands and other areas, desertification in 8,230 km^2 area, and no significant changes in 589,720 km^2 area.

Table 2.2 Collect-Earth Tool – Desertification and Greening Changes (2001-2015)

Land Use Status	2001	2015	Area Increase	Area Decrease	Net Change	Greening Area
	Area (km^2)	Area (km^2)	Area (km^2)	Area (km^2)	Area (km^2)	Area (km^2)
Forest	126,330	127,400	1,550	480	1,070	6,970
Shrub-land	29,450	31,320	1,870	0	1,870	1,090
Pasture	145,270	145,140	1,240	1,370	-130	2,950
Settlement	14,430	14,730	460	160	300	300
Agriculture	240,400	240,080	300	620	-320	2,940
Wetland	10,390	10,390	0	0	0	0
Other	45,770	42,980	160	2,950	-2,790	0
TOTAL	**612,040**	**612,040**				**14,250**

Table 2.3 Change Directions of Greening and Desertification Values (2001-2015)

Current Status	Change Direction	Greening	Desertification
		Area (km^2)	Area (km^2)
Forest	Pasture > Forest	770	-
Forest	Forest > Forest	5,420	460
Forest	Settlement > Forest	160	-
Forest	Other > Forest	620	-
Agriculture	Agriculture > Agriculture	2,640	1,250
Agriculture	Other > Agriculture	300	-
Shrub Land	Agriculture > Shrub Land	150	-
Shrub Land	Forest > Shrub Land	-	320
Shrub Land	Pasture > Shrub Land	150	300
Shrub Land	Other > Shrub Land	790	160
Pasture	Forest > Pasture	-	160
Pasture	Pasture > Pasture	2,340	3,400
Pasture	Other > Pasture	610	470
Settlement	Settlement > Settlement	150	-
Settlement	Agriculture > Settlement	0	310
Settlement	Pasture > Settlement	150	-
Other	Agriculture > Other	-	160
Other	Other > Other	-	1,240
TOTAL		**14,250**	**8,230**

The highest change ratio in greening areas was determined to be in forestlands by 6,970 km^2. Table 2.3 demonstrates the change directions of greening and desertification values in forests, agricultural lands, shrub lands, pasture lands and others.

According to the data;

- 5,420 km^2 forestland was improved through rehabilitation, natural seeding, and conservation.
- 770 km^2 pasture land gained forest characteristics through afforestation and natural seeding works.
- 160 km^2 settlement area was classified as forest by remote sensing evaluation following park and garden afforestation works, establishment of an urban forest and partial afforestation of graveyards.
- 620 km^2 of other types of land that transitioned into forestland signifies that experts could not determine the previous land use status, but the area is currently classified as a forest and graphic data exhibits greening in current status.

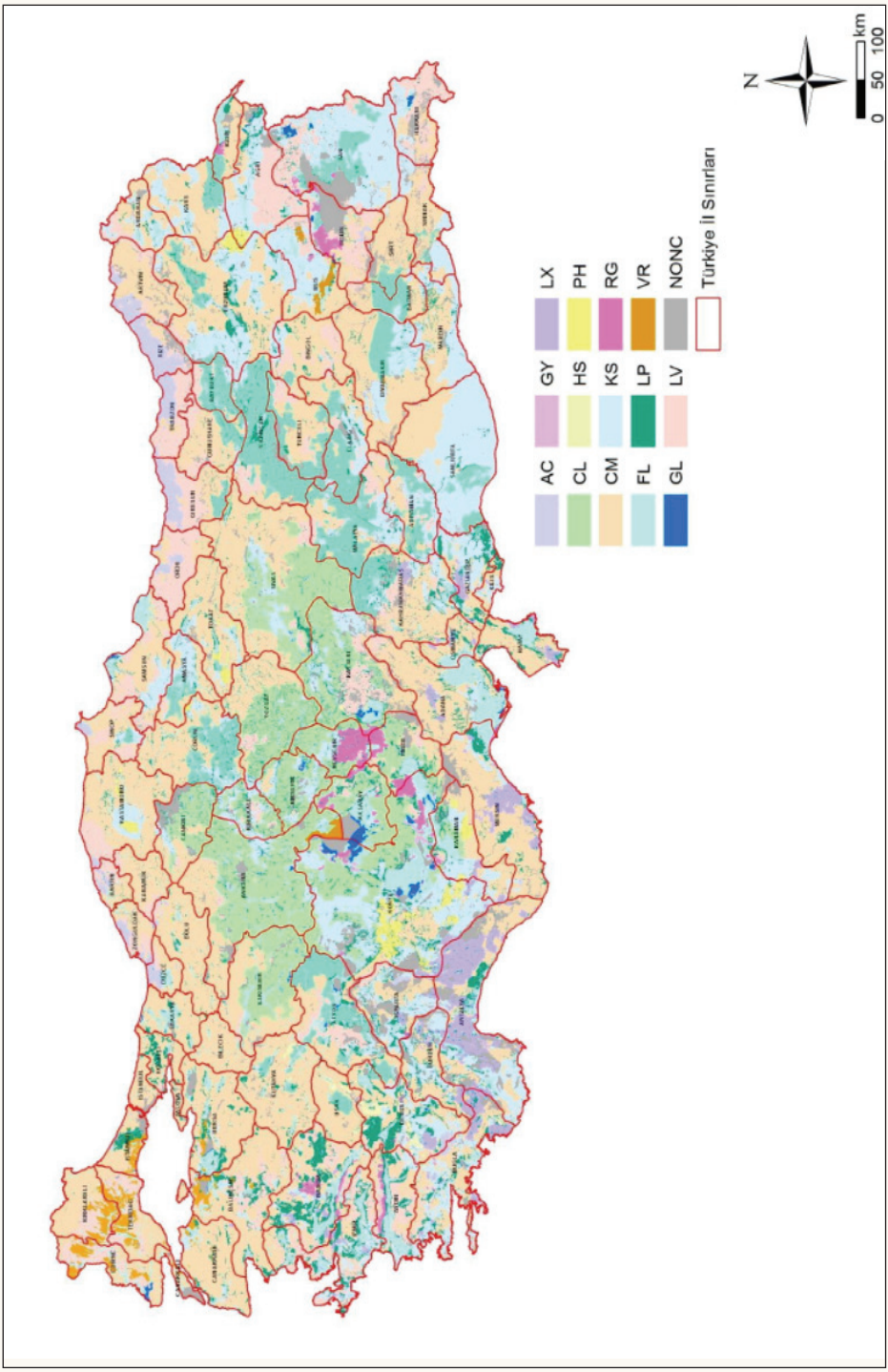
Desertification trends in the same table indicate that the highest ratio of change was in pasturelands with a 3,700 km^2 total change, namely from pasture to pasture in 3,400 km^2, and from pasture to shrub lands in 300 km^2.

- 160 km^2 forest to pasture desertification area was classified as pastureland by experts working on natural and artificial regeneration, one of the forest management methods in Turkey.
- 3,400 km^2 pastureland exhibited decrease in existing greening due to fluctuations in rainfall, and pressure caused by uncontrolled grazing.
- 470 km^2 other land type transitioned into pastureland signifies that experts could not determine previous land use, but the area is currently classified as pastureland and graphic data indicates desertification in current status.

While NDVI and NDWI data representing greening and desertification spots are in monthly and annual periods, change trends are rather easy to track; yet satellite images tend to have less resolution in certain areas and be cloudy in others, leading to a likely margin of error for the expert evaluating the direction of change.

2.3 Soil Organic Carbon Status and Trends

One of the main three criteria for LDN is the changes in soil organic carbon stocks. According to FAO soil classifications, Turkey's soils present a wide range of variety (Map 2.3). Therefore, soil organic carbon values differ greatly.



Map 2.1 Turkey's Land Use Changes between 2000-2010 (EC-JRC) (See Annex 4)

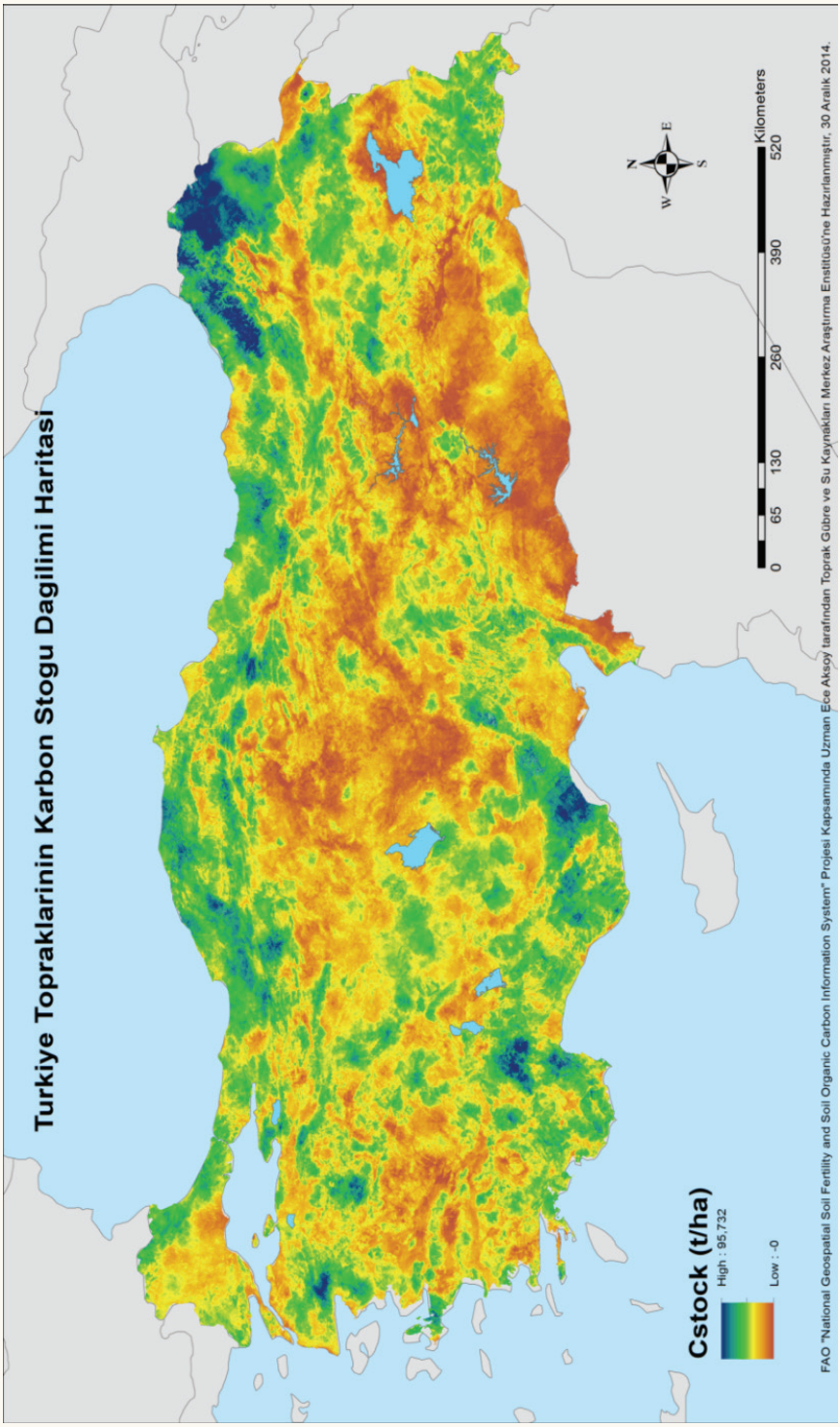
Findings of soil analysis carried out on 11,800 soil samples between the years 2007-2012 indicated an average of 34.54 tonnes/ha of organic carbon stored in 0-30 cm soil depth in agricultural lands, pastures and forests. “Carbon Stock Distribution Map of Soils in Turkey” was created based on these data (Map 2.3) (Table 2.4).

Soil types store different amounts of carbon according to their characteristics. The above map shows the Soil Classification in Turkey by FAO (Map 2.2). Research presents that organic carbon content values of soil types in Turkey vary between 20.53 t/ha and 45.86 t/ha.

Table 2.4. Soil organic carbon values in agricultural lands, forests, and pastures

	Agricultural Lands	Forest	Pasture
SOC (t/km^2)	2979	4512	3708
Area (km^2)	239,430	216,780	146,170
Soil Organic Carbon(tonnes)	713,261,970	978,111,360	541,998,360

Carbon stock (t/ha) = SOC (%)*HA (g/cm3)*Depth (30cm)
Weighted Country Average = 34.54 t/ha. (SOC).



Map 2.3 Turkey Soil Organic Carbon Stocks Map (TAGEM - FAO)

Forestlands:

According to Tolunay and Çömez's (2007) study at one (1) metre soil depth, approximately 78 tonnes per hectare of organic carbon is stored in soil in forestlands (Table 2.5). TAGEM focused more on exemplifying agricultural lands and pasturelands. By including carbon measurements in forestlands, the sample pool will be extended, enabling a more accurate determination of total organic carbon stocks across country. This study should prove highly valuable to LDN if repeated every 10 years.

Table 2.5 Soil organic carbon stocks in forest soils of Turkey (Tolunay and Çömez, 2007).

Tree species	Point number	Weighted mean
Coniferous	751	77.1 (0.8- 448.0)
Broad-leaved	191	80.4 (2.0- 424.0)
Coniferous afforestation	148	83.2 (9.3- 316.0)
Coniferous mixed	97	62.2 (2.5- 180.6)
Coniferous- Broad-leaved mixed	33	70.8 (7.0-374.3)
Broad-leaved mixed	14	161.4 (96.1-234.4)
Weighted mean	1,234	78.0 (0.8-448.0)

Insufficient soil samples from forests and pastures gave rise to the need for the development and implementation of the Turkey Soil Organic Carbon Modelling and Mapping Project as a national target. Within this scope, multi-stakeholder interested parties (ÇEM, TAGEM, TRGM, TÜBİTAK, and DGF) formulated the Turkey Soil Organic Carbon project to be completed within the next two years. The project will be improved through calibration, verification and uncertainty analysis.

In the light of the above study, the positive impact of rehabilitation and afforestation works on Soil Organic Carbon stock amounts is explained below.

In order to increase forestlands to 30% of country's total surface area by LDN target year 2030, afforestation and soil conservation works will be carried out on a land of 10,000 km^2. When the one million hectare area to be allocated as forestland is accepted as agricultural land, and calculated considering the average organic carbon stocks based on land use in Turkey, the total amount of stocked carbon will equal 15.33 million tonnes (45.12-29.79=15.33 t/ha X 1,000,000 ha = 15,330,000 tonnes) (TAGEM-FAO)

Soil organic carbon amounts in soil 44,286.13 km^2 land between 2003-2015 (following afforestation, erosion control, rehabilitation works) was calculated as 35,606,048 tonnes. The calculation value for the organic carbon stocks in soil prior to rehabilitation was accepted as pastureland values. The difference between the average soil carbon amounts of forestlands and pasturelands was considered as carbon gain (45.12-37,0=88.04 t/ha). When by 2030, another 10.000 km2 forestland generates 15.33 million tonnes of organic carbon to the calculation; a total of 50,936,048 tonnes of organic carbon will be stored in soil. Thus, by the targeted year, a significant improvement will be observed in forestlands with a potential organic carbon contribution to LDN.

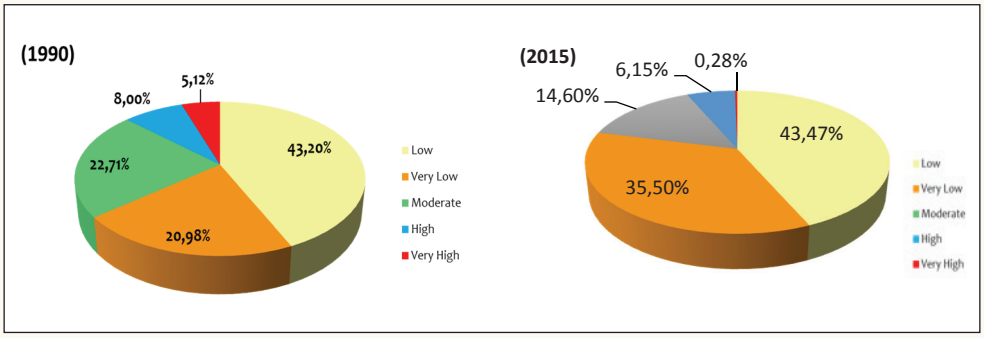


Figure 2.31 Soil Organic Carbon (SOC) Distribution Change Per Cents Between 1990 - 2015 (TAGEM)*

Based on soil samples, obtained mainly from agricultural lands, while there is not a change in the ratio of low organic matter/SOC regions, the lowest values in 1990 increased highly by 2015 (35.5% - 20.98% = 14.52%). In addition, the mediocre SOC levels decreased by 8.11%. The same decrease is evident in other values as well. The highest SOC levels from 1990, in particular, decreased from 5.12% by 0.28% in 2015. These data establish an increase in land degradation between 1990 and 2015. However, it should be noted that data from 1990 is not as accurate as soil sampling

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* *The data in the 1990 diagram was obtained from the Turkey's Soil Productivity Inventory Project carried out on a provincial basis by General Directorate of Soil and Water between the years 1982-1990.*
Data from the 2015 diagram was provided by TAGEM's Soil, Fertilizer and Water Resources Central Research Institute within the scope of Agriculture-Boron Research and Application Programme (containing approximately 7,784 soil samples and approximately 4,000 pasture project samples from between 2008-2010), as well as the results obtained from joint research with the FAO.

technology was insufficient at the time. Whereas in 2015, the relatively recent GPS technology allowed for enhanced sample sizes and locations, rendering thus the data more reliable.

2.4 Sustainable Water Management

Turkey has a total of 240,000 km^2 of agricultural lands, and out of 8.5 million hectares of irrigable land, irrigation was provided to 63,000 km^2 as of the end of 2015. Currently in Turkey, 73% of 85,000 km^2 irrigable agricultural land is irrigated.

As of 2013, 44 billion m^3 of water per year is used in Turkey, out of which 73% is used for agricultural irrigation, 16% for drinking-domestic water and 11% for industrial purposes. This amount equals to 39% of 112 billion m^3 total available water potential. During the 20-year period between the years 1990-2008, water consumption increased by 40% (Table 2.6), and estimations for the next 15 years suggest that the water demand will triple relative to today's consumption amounts. As a result of increasing demand for water, the inter-sectorial balance will be disrupted, where one sector will cause pressure on the other.

Turkey's 2023 targets include reducing the water consumption to 64% in agriculture, to 20% in industry, and to 16% in drinking-domestic water within the scope of using the existing available water, and improving irrigated farming lands to be brought into use. Within this scope, targets foresee the provision of irrigation to a wider range of areas in agriculture through modern irrigation techniques such as pressurised irrigation system, and allocation of 72 km^3 of water to irrigation works. Estimates for the drinking-domestic water consumption for 2023 suggest, considering other sectorial dynamics (population growth, urbanisation, and rapidly increasing tourism sector) it will triple to 18 km^3 from 2008 value of 6 km^3. As for industrial use, based on growth rate, it will soar to 22 km^3 from the current value of 5 km^3 (Table 2.6).

Table 2.6 Total water consumption and sectorial distribution in Turkey (ÇSB, 2011)

Year	Total amount of used water		Sectors					
			Irrigation		Drinking-Domestic Water		Industry	
	km³	%	km³	%	km³	%	km³	%
1990	30.6	28	22	72	5.1	17	3.4	11
2004	40.1	36	29.6	74	6.2	15	4.3	11
2008	43	38	32	74	6	15	5	11
2023	112	100	72	64	18	16	22	20

Distribution of population, industrial and other sectorial activities is not balanced nor homogeneous in Turkey. Estimations suggest that by 2030, when all economically irrigable lands are improved, the total amount will surpass the water potential limit and more water will be required. As industrial and domestic need for water rapidly increases, the pressure on irrigation water will likely increase in correlation. It will therefore be inevitable to adjust the irrigation system to save water, as water spared for agriculture will potentially be insufficient once the potentially irrigable agricultural lands are also irrigated.

These predictions led to efforts on more efficient use of water resources, prevention of loss and leaks, conservation of water resources, and optimal use and management of water.

Irrigation in farm lands will reduce desertification risk by ensuring continuing water existence in the area, while the improvement of water collection and storage systems will contribute to constant water provision during dry periods and seasons.

It is particularly essential to complete by 2023 the construction of the necessary irrigation facilities and to irrigate the remaining 22,000 km^2 in order to meet the food demand, to ensure balanced and continued production of agricultural products required by industry, and finding a solution to unemployment in agriculture as well as raising the living standards in the sector.

The construction of medium and high pressure pipe facilities that ensure water saving by the optimal use of water resources began in the 1990s.

While the plants can absorb only about 50-60% of water through surface irrigation, sprinkling and drip irrigation systems allow increasing this ratio up to 80-90%. Therefore, the 35-60% water loss in the conventional irrigation will be saved in pressurised systems, extending thus the area of irrigated farming. 96% of irrigation facilities to be launched in farming lands to introduce irrigation to areas are hence planned as pressurised systems. In addition, previously constructed conventional irrigation systems will be modernised into covered systems. These efforts will ultimately prevent erosion and salinization in agricultural lands.

Land consolidation and agricultural land improvement services should also be provided in all irrigation facilities if possible. Land consolidation, agricultural land draining services, land levelling and farmer's trainings should be carried out in parallel with irrigation investments in an integrated manner. Pollution of water resources leads to degradation in both agricultural lands and wetlands.

Overuse of fertilisers and pesticides in agricultural lands as well as the discharge of waste water in industrial areas pollute the water resources, degrading the quality of available water, and rendering usual demands into pressure factors. Therefore, it is essential to bear in mind the interaction between the water consumptions of different sectors both quantitatively and qualitatively.

Another goal is to allocate sufficient water to riverbeds, natural lakes and wetlands to ensure preservation and sustainability of life balance with a view to protect natural balance and biodiversity.

Control and prevention measures should be taken on the pollution of water resources, while the reuse of waste discharge waters in industry and agriculture should be promoted. Overuse of fertilisers and pesticides in agriculture will be mitigated in order to prevent the pollution of agricultural lands as well as water pollution, and focus will be put on developing clean production technologies in industry in order to reduce water demand and protect water quality.

Social, economic and environmental targets within the scope of sustainable water management must include clean drinking water and domestic water, regional development, agricultural and industrial development, water quality, support to habitats and natural life, and preservation of aesthetic and natural values. In addition, Turkey is currently working on a national water information system and a basin monitoring system in order to ensure sustainable water management.

Increasing the number of water collection and storage facilities is particularly important in Turkey as such facilities will ensure continuous water supply during dry seasons and periods, and will reduce the drought risk through expanding irrigated farming areas. Turkey has already constructed numerous dam and pond projects towards this end. Moreover, dams and ponds, as water sources, provide farmers with secure and quality water throughout the season and ensure sustained agricultural production.

2.5 Drivers of Land Degradation

The Middle East region, which contains Turkey, is within the semi-humid, semi-arid, arid, and extremely arid climate zones. As Turkey's territory hosted various civilisations throughout centuries, it is particularly sensitive to land degradation and drought.

Besides the natural erosion sensitivity of dry and semi-arid climate of the country, the land also faces desertification threat due to climate change and human activities such as inappropriate practices.

Turkey defined 7 criteria with 48 indicators and more than 100 sub-indicators tailored to country's conditions within the scope of monitoring land degradation and creating land degradation risk map and modelling (Figure 2.2).

Comprehensive studies concluded the land degradation drivers in Turkey to be climate, soil, water, topography and geomorphology, land cover and land use, socio-economy and management (Figure 2.2).

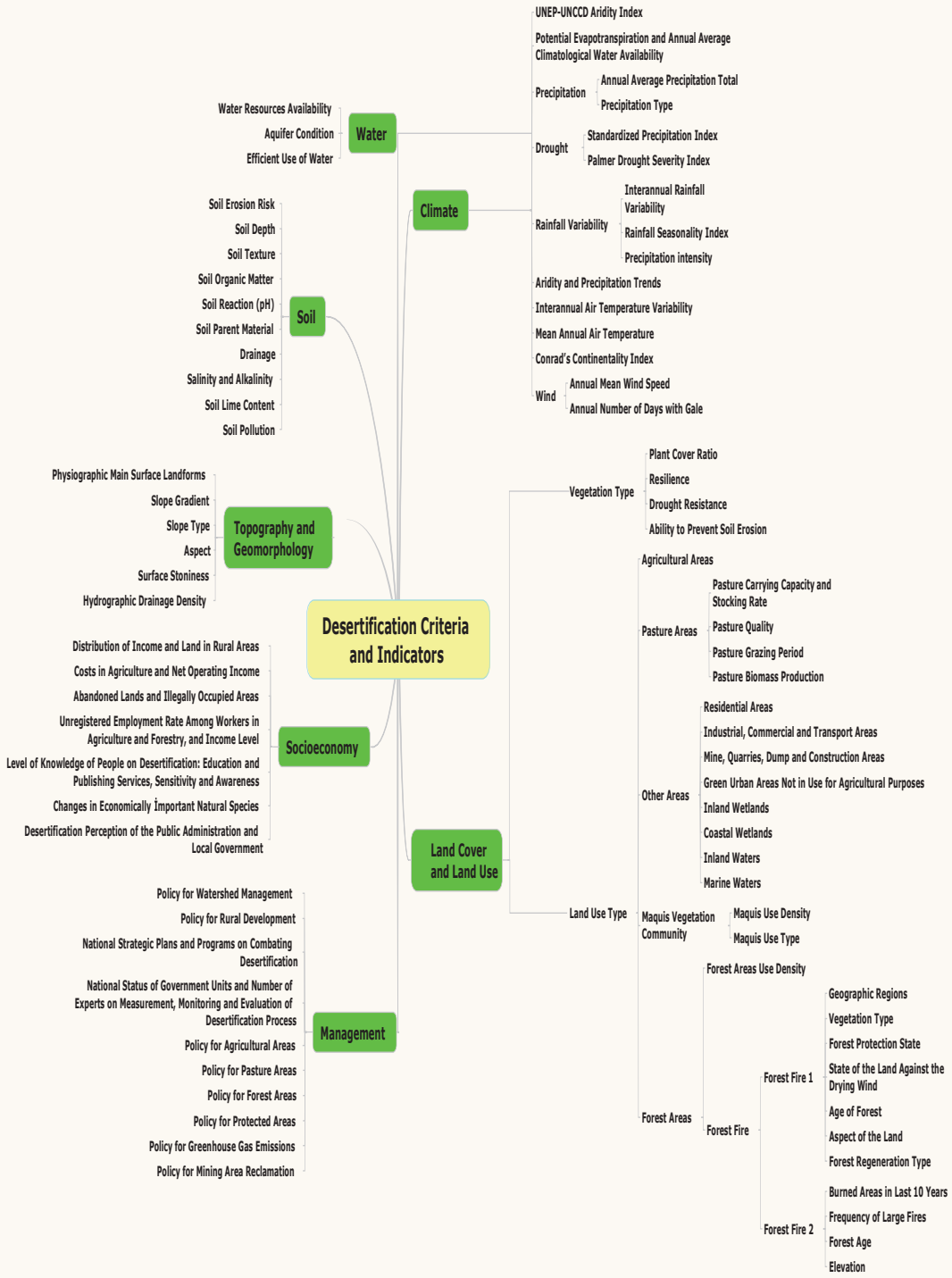


Figure 2.2 Land Degradation Criteria and Indicators (Basin Monitoring and Assessment System Project)

Climate: While there are numerous different sub-climates and precipitation regimes in Turkey, the dominant climate type is the hot/extremely hot subtropical Mediterranean with dry summers.

Turkey's geographical location and formation led to different characteristics of climates. While coastal regions are milder due to seas, height and position of mountains prevent the effects of seas from reaching inner regions. Thus, inner regions exhibit prevailing continental climate characteristics. While continental climate type demonstrates the highest daily and annual temperature differences, it negatively impacts land degradation process as it is closely related to soil formation and erosion conditions, physical and chemical disintegration and fragmentation severity, wind erosion, top soil humidity, and vegetation cover.

Climate criterion included analysis on precipitations, precipitation fluctuations, temperatures, wind, and aridity, and consequently, climate was determined to be a driver of land degradation in Turkey by 35.6%.

Water: Insufficient water availability combined with insufficient and inappropriate usage methods, could lead to rapid land degradation.

Water availability and use directly affect numerous factors including land management, vegetation cover, and socioeconomic factors. Emigrations are common in regions of insufficient water resources. Water criterion included analysis on sub-indicators such as availability of water resources, aquifers, and efficient water use; and water was determined to be a driver of land degradation in Turkey by 18.4%.

Soil criterion included analysis on factors such as soil erosion risk, soil depth, soil structure, soil organic matter content, soil reaction (PH), soil main material, drainage, salinization and alkalisation, soil lime content, and soil pollution; and soil was determined to be a driver of land degradation in Turkey by 17.2%.

Land Cover and Land Use; there is a direct positive correlation between the cover ratio of plants in a basin and the land productivity. Stock capacity, biomass production (productivity level), and biodiversity of regions of higher plant density is usually higher as well.

High vegetation cover ratio plays an important role in regulating water regime in the basin; in improving soil's physical, chemical and biological characteristics; and in reducing, mitigating and/or preventing soil erosion and land degradation.

Land Cover criterion included analysis on sub-criteria such as vegetation cover ratio, flexibility, drought resilience, and soil erosion mitigation characteristics, while Land Use criterion included analysis on agricultural lands, pasturelands, shrub lands, forestlands (usage status and fire status for forestlands) and other land types; and Land Cover and Land Use criterion was determined to be a driver of land degradation in Turkey by 11.6%.

Topography and Geomorphology; Turkey has a wide range of geographical formations and geological characteristics, and has a rather high average elevation (1,131 m). Turkey's geological location has been the least stable point on the planet throughout all geological periods.

Topography is a soil formation factor, and erosion, as one of the most severe land degradation component, is a function of topography. Geomorphology, on the other hand, signifies the physical and chemical processes that lead to the topographic formation, or in other words, the dynamism of geographical formations. Topographic-geomorphologic structure heavily affects land degradation. This criterion includes analysis on physiographic main geographic formation groups, hydrographical drainage intensity, direction of slopes, slope gradient, and the slope formation; and Topography and Geomorphology was determined to be a land degradation driver in Turkey by 6.3%.

Socio-economy is the concept of analysing the correlations between social values and economy within the scope of sociology, environment, culture, economy and politics. The inter-relations of individuals within a society, and their relations with the environment-nature including production-consumption and spatial relations are of importance in regard to the use and sustainability of natural resources. Socio-economy criterion includes analysis on rural income and land distribution, costs-net management in agriculture, abandoned and occupied lands, illegal employment and low income levels in agriculture and forest villages, people's level of awareness on land degradation; education and extension services, awareness raising, changes in economically significant natural species, and land degradation perception of civil administrations and local authorities; and socio-economy factor was determined to be driver of land degradation in Turkey by 6.2%.

Management; Management is a universal concept including communities from all levels such as universities, municipalities, ministries, governments, states, and international states. Environment-natural resources management should prioritise limiting all forms of human activities and policy implementations affecting natural

resources and climate, preventing environmental issues, and minimising the effects of climate change. Management criterion includes analysis on policies on basin management; policies on rural development; national strategic plans and programmes on combating land degradation; land degradation measurement, monitoring and evaluation systems on a national scale; number of experts on desertification; policies on forests, agricultural lands, pastures, and protected areas; policies on greenhouse gas emission; and policies on mine site rehabilitations. Management factor was thus determined to be a driver of land degradation in Turkey by 4.7% (Figure 2.3).

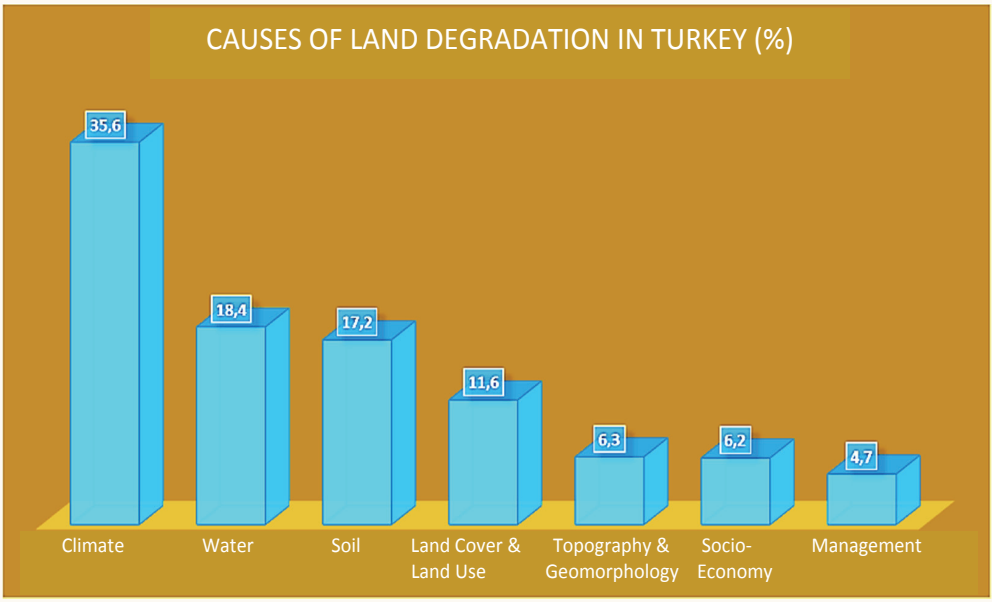
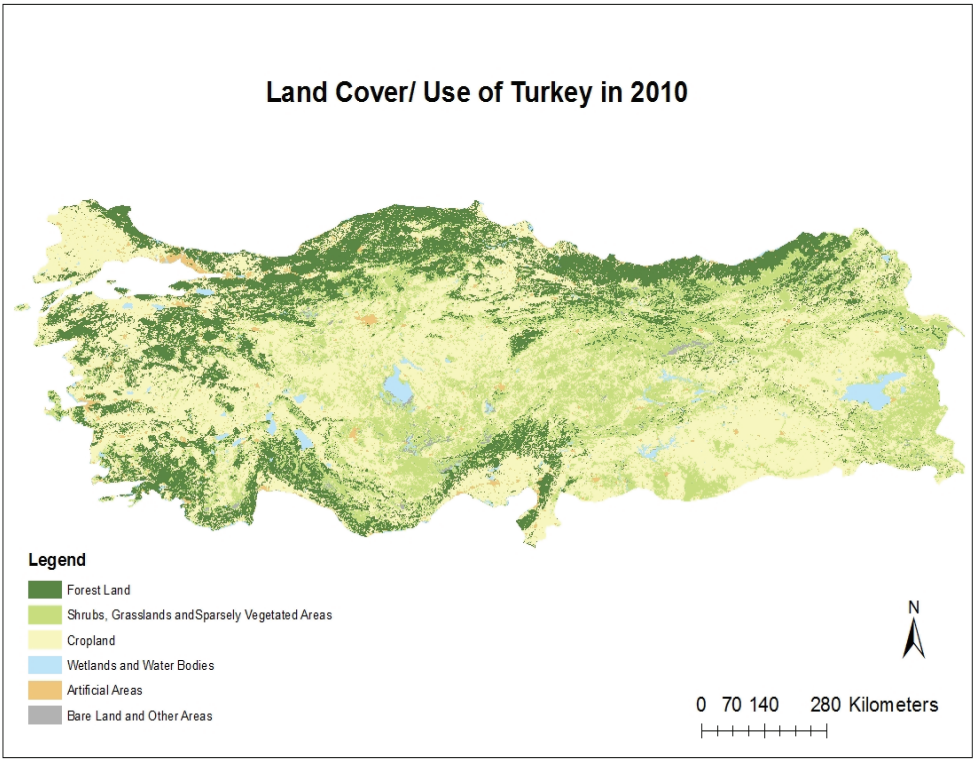


Figure 2.5 Drivers of land degradation in Turkey (Basin Monitoring and Assessment System Project)

3. NATIONAL LAND MANAGEMENT

Land Cover and Land Use

Map 3.1: Turkey's Land Cover/Use Map for 2010 was compiled through MODIS satellite data by European Commission - Joint Research Centre. Land use change values for 2000-2010 calculated based on the same data are given in Table 2.1.



Map 3.1 Turkey's land cover status as of 2010 (EC-JRC) (See Annex 4)

Table 3.1 2015 Turkey forest inventory data (2015 DGF Forest Assets)

Forestland Distribution						
Management	Normal Closure		Porous Closure		Total	
	km²	%	km²	%	km²	%
High Forest	119,190.61	54	77,006.57	34	196,197.18	88
Coppice	7,850.87	3	19,381.30	9	27,232.17	12
Total	**127,041.48**	**57**	**96,387.87**	**43**	**223,429.35**	**100**

Table 3.1 shows values based on forest management plans of DGF formulated with data collected by remote sensing methods and 10 year worth ground measurements and field confirmations.

As the Table demonstrates, of the 223,429.35 km^2 total forestland in Turkey, 127,041.48 km^2 is normal closure, and 96,387.87 km^2 is porous closure. 88% of forests is high forest, while 12% is coppice.

Table 3.2 Productive and degraded forests in dry lands and non-dry lands (2009 forestry statistics)

	Dry Lands (km²)	Non-Dry Lands (km²)	Total (km²)
Productive Forest	40,149.08	66,063.13	106,212.21
Degraded Forest	53,472.78	52,202.48	105,675.26
Total (Ha)	**93,621.86**	**118,265.61**	**213,897.83**

Dry and non-dry lands are extracted from the dry lands map that Murat Türkeş compiled in 2012. Table 3.2 shows values based on 2009 forest management data. According to these data, Turkey's total forest area is 213,897.83 km^2 as of 2009, out of which 93,621.86 km^2 is located in dry lands, and 118,265.61 km^2 in non-dry lands.

Baseline values and definitions of forests in Turkey define 11% and above canopy closure as productive (normal) forests, and 10% and below closure as degraded (porous). Therefore, while forest and afforestation sites combined are reported as forestland in Turkey's official statistics, solely productive forests are reported to international statistics, leading to inconsistencies in forest asset values.

4. SWOT ANALYSIS FOR THE LDN-ORIENTED NATIONAL ACTION PLAN (NAP)

Turkey became a party to the UN Convention to Combat Desertification, adopted in 1994, upon the publication of Council Decision numbered 98/11003 in the Official Gazette on 16 May 1998. The Convention required country Parties to each prepare a "National Action Plan", and Turkey enacted its initial "National Action Plan to Combat Desertification" with the circular (2005/2) issued on 09 March 2005 in the Official Gazette.

Since then, Turkey has regularly prepared and communicated to the UNCCD Secretariat all required reports within the scope of the Convention.

UNCCD COP 8 in 2007 adopted the "UNCCD 10-Year-Strategy" that would cover the years 2008 - 2018. The Strategy imposed the following responsibilities on the countries:

- Formulating a "National Strategy to Combat Desertification"
- Amending current National Action Plans/Programmes
- All reporting to UNCCD Secretariat adapted to recently-developed PRAIS system

In accordance with the above responsibilities, Directorate General of Combating Desertification and Erosion of the Ministry of Forestry and Water Affairs, as Convention's National Focal Point, carried out with the support of FAO and GEF the "**Alignment of Turkey's National Action Plan with UNCCD 10-Year Strategy**". The two-phase project included:

- The "National Strategy to Combat Desertification (2015-2023)" document was amended, and the "Turkey National Action Plan to Combat Desertification" drafted in 2005 was updated accordingly, to include actions towards the targets in the strategy, and was extended to cover the years 2014-2018.
- A web-based monitoring and reporting system was developed to manage the accomplishment/improvement status of ongoing actions.

Finalised in 2014, NAP was enacted upon its publication in the Official Gazette numbered 29424 on 24 July 2015 following the approval of the High Planning Council.

NAP consists of four (4) strategic and seven (7) functional targets that comprise Turkey's national targets. One of these functional targets, Sustainable Land Management, and the sustainable environment and natural resources management contributing immensely to the LDN target both hold the vision of mitigating the negative impacts of drought, reducing desertification/land degradation and rehabilitating affected lands, facilitating rural development and strengthening international co-operations through balanced exploitation, conservation and improvement.

Turkey has already defined a sub-regional LDN target launching the initial works for pilot practices based on the Action Plan, and is working on establishing technical and technological infrastructure for LDN in order to improve the decision-making mechanisms. The SWOT analysis for the Turkey's National Action Plan to Combat Desertification is detailed in the table below (Table 4.1).

Table 4.1 Strengths and weaknesses of the National Action Plan in facilitating the Land Degradation Neutrality target.

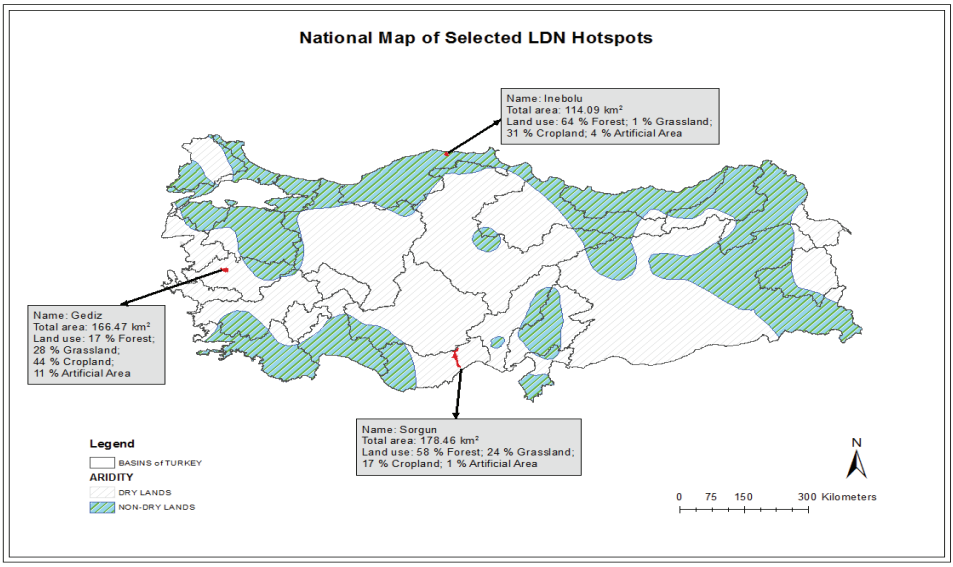
Strengths:	**Weaknesses:**
• Country-wide dispersed units, strong institutional structure and worthy knowledge and experience of the Ministry of Forestry and Water Affairs, the responsible institution for NAP and LDN implementation. • Solid technological infrastructure of the Ministry of Forestry and Water Affairs, favourable conditions to define LDN targets and to effectively set potential neutralisation activities with support from the technological infrastructure; • Policies, and institutional and legal legislations on combating desertification & land degradation; • Well-rounded action plan to attain the LDN target and to monitor, assess and report on the implementation; • Current Action Plan including identification of potential forestry activities/rehabilitation opportunities that could set a baseline for	• Frequent changes in legislations and institutional structures, and the lack of preservation/development policies; • Overlapping function and authority conflicts between separate units and institutions; • Wide range of responsibilities and lack of personnel in field application units; • Co-ordination and participation issues; • Institutions failing to formulate investment programmes within the scope of LDN principles. Lack of necessary legislation amendments and inter-institutional communication/co-ordination mechanisms to effectively implement Rio Conventions in Turkey and to create a synergy.

LDN, and respectively offering approaches to define neutrality opportunities and activities; • Current Action Plan comprising numerous approaches towards SLM and SFM which will be required once the LDN targets and activities are defined, and towards research and activities in capacity building in local farmers and establishments who will implement the works. • Action Plan comprising inter-institutional communication/co-ordination mechanisms essential to effectively formulate and implement LDN targets, and unites principle institutions in land management in Turkey; • Action Plan clearly and effectively defining mechanisms to mainstream the primary concerns of Rio Conventions in the SLM and SFM activities.	
Opportunities: • Increasing awareness and concern for ecosystem services and the significance of LDN in Turkey as well as around the world. • Strengthening non-governmental organisations and civil movements; • Technological developments and successful educational and scientific research institutions; • Developments in information technologies; • Turkey's European Union harmonization process and other related international agreements and commitments; • NAP foresees establishment of efficient co-operation on SLM and SFM approaches particularly with countries of different conditions, and comprises numerous activities to this end. Thus, Turkey holds the opportunity to share and mainstream all developed LDN approaches in mainly Africa and Central Asia through international relations and opportunities to share experiences.	**Threats:** • Pressures to exploit forests, agricultural lands, and pastures for urban settlements, tourism, mining activities and other such purposes; • Pressures to increase production in forests, agricultural lands and pastures to meet the growing demands of increasing population; • Climate change and negative impacts of drought; • Conflicts between the Ministry's targets and the benefits of other sectors.

5. LDN HOT SPOTS

3 LDN pilot sites of different characteristics were selected across Turkey based on climate, land use, and topographic characteristics (Map 5.1):

- Gediz Basin
- Sorgun Basin
- Inebolu Basin



Map 5.1 LDN hot spots and pilot sites.

Gediz Basin faces land degradation due to mainly inappropriate land use, urbanisation, industrialisation, tourism and particularly intensive agricultural activities. Erosion, on the other hand, causes serious complications, especially in agricultural lands. Considering all factors, Gediz Basin qualifies as one of the land degradation hot spots in Turkey.

Numerous rehabilitation works towards land degradation neutrality are implemented in Sorgun Basin within the scope of Eastern Anatolia Water Basin Rehabilitation Project. As the over-dependency on the natural resources in the basin cause the degradation of

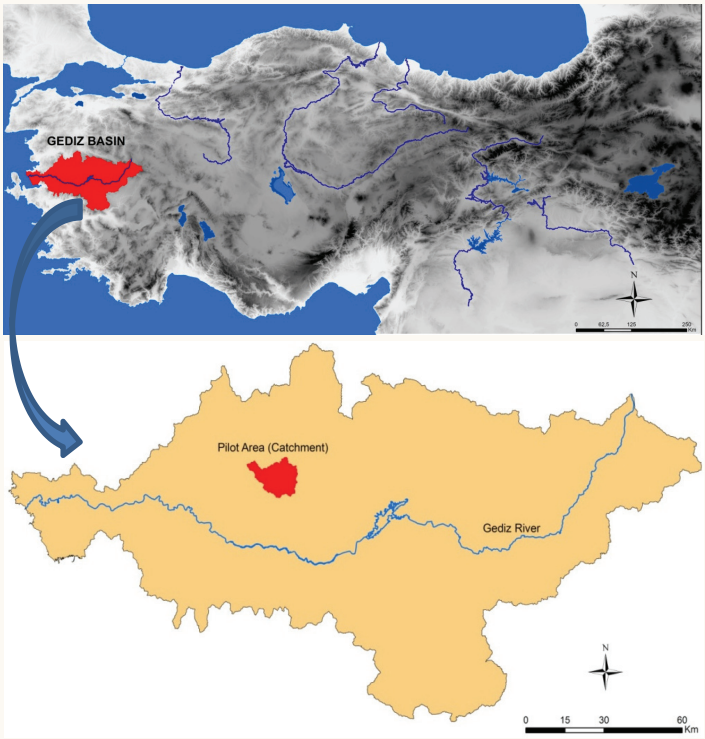
natural resources, and thus land degradation, improvement works were carried out. As such, Sorgun Basin is included in Turkey's hot spots.

Inebolu Basin is degraded due to floods and inundations. All work conducted in the basin aim to prevent or neutralise land degradation by preventing potential floods or inundations through balancing land use/cover and land productivity.

5.1 Gediz Basin, Ilıcak and Kum Çayı Microbasins LDN Pilot Studies

Gediz Basin is located at 38004'–39013' north latitudes and 26042'–29045' south longitudes. The basin covers 2.2 per cent of Turkey's total surface area. The basin's approximate size is 18,000 km^2 and population is around 2 million.

Primary reasons for land degradation in Gediz basin include inappropriate land use, urbanisation, industrialisation, tourism and particularly intensive agricultural activity. Erosion has been causing significant problems particularly in agricultural lands in the basin. Given all these facts, the basin is selected among the hot spots of Turkey in terms of land degradation.



Locations of Ilıcak and Kum Çayı Microbasins within Gediz Basin

As part of the pilot study, two adjacent micro-catchments, namely Ilıcak and Kum Çayı, have been identified within Gediz Basin, and total pilot area size is 166.47 km^2. The changes in land uses determined for pilot micro-catchments as a result of the study, and the results obtained in relation to the land productivity index are shown in Table 5.1 and Table 5.2.

Table 5.1 Change in land cover/use in Ilıcak and Kum Çayı Microbasins

Land cover/use category	2001		2015		Per cent of change between 2001 and 2015	Impact on LDN
	Km^2	%	Km^2	%		
Forest	25.35	15.23	28.56	17.16	1.93	+
Shrub, pasture, areas with low vegetation density	58.03	34.86	47.48	28.51	-6.35	-
Cultivated lands	71.28	42.82	72.75	43.70	0.88	-
Wetlands and water structures	0.1	0.06	0.1	0.06	0.00	No change
Artificial areas (settlement, road, airport, etc.)	11.71	7.04	17.58	10.56	3.52	-

Landsat7 ETM+ (Enhancement Thematic Mapper Plus) and Landsat8 OLI/TIRS (The Operational Land Imager/Thermal Infrared Sensor) satellite images were used to compare changes in land cover. Satellite images with a resolution of 30 m. compared the state of land cover in May of 2001 and 2015.

The 3.21 km^2 (1.93%) increase in the forest areas as a result of afforestation activities carried out in the region is between 2001 and 2015 is particularly noteworthy. While areas with shrubs, pastures and low vegetation density decreased by 6.35%, the increase in cultivated areas and artificial areas (settlement, road, etc.) has negatively affected LDN.

Table 5.2 Distribution of land productivity index category for Ilıcak and Kum Çayı Microbasins

Land Cover Category (LC-2015 ha)	Land Productivity Index Category									
	1		2		3		4		5	
	Decreasing productivity		Early signs of decrease		Stable but under pressure		Stable, no pressure		Increasing productivity	
	Km²	%	Km²	%	Km²	%	Km²	%	Km²	%
Forest	-	-	-	-	0.0001	-	0.022	0.01	28.59	17.18
Meadow, pasture	0.001	-	1.22	0.73	4.26	2.56	31.57	21.85	5.62	3.38
Cultivated land	21.38	12.85	39.80	23.92	11.54	6.94	-	-	-	
Artificial area	17.59	10.57	-	-	-		-	-	-	
Total/Ratio (%)	**38.97**	**23.42**	**41.02**	**24.65**	**15.80**	**9.50**	**31.59**	**21.86**	**34.21**	**20.56**

The land productivity index value within the pilot area has been obtained by combining the change in land cover identified with the help of satellite images, and the vegetation density index data obtained as a result of NDVI analyses.

When the pilot area was evaluated on the basis of land productivity index, it was found that land degradation status is stable in 21.86 percent of the region, and no negative pressure for degradation is observed in these areas. Increasing land productivity was observed inn 20.56 percent of the area. On the other hand, it has been observed that areas with decreasing land productivity and areas with early signs of degradation, with shares of 23.42 percent and 24.65 percent, respectively, consist largely of cultivated lands and artificial areas.

Images from afforestation sites in Ilıcak and Kum Çayı Microbasins

5.2 Sorgun Basin Land Degradation Neutrality (LDN) Pilot Study

Sorgun Stream is a medium size river located within the boundaries of Erdemli district of Mersin province. The basin created by Sorgun Stream is surrounded by Yelkalesi Hill (2,222 m) in the north, Meydan Alanı Hill (1,735 m) in the east, Eşik Hill (1,575 m) in the south and Armuteni (1,853 m), Üstüarkaç (2,025 m) and Göktapır Hills (2,053 m) in the west. The biggest settlement unit within the basin is Erdemli district of Mersin province, located on the coastline.

The area evaluated for land rehabilitation under this study corresponds to an approximately 178.46 km^2 micro-catchment covering Sorgun and Toros villages/ neighbourhoods under East Anatolia Water Basin Rehabilitation Project. This micro-catchment is located within a semi-arid area of Turkey.

East Anatolia Water Basin Rehabilitation Project is a project that addresses the issues of rural poverty and natural resource degradation, with funding support from a World Bank loan. The project, implemented between 1999 and 2004, aimed at the rehabilitation of natural resources in the upper parts of Sorgun Stream Water Basin and thus rehabilitate and sustain forestry, pasture and agricultural activities in micro-catchments. The project investments were completed using external funds from 1999 till 2004, and with domestic funds in 2004.

Various methods have been used to measure the impacts of rehabilitation activities carried out in Sorgun Stream Basin as a result of East Anatolia Water Basin Rehabilitation Project, on forest land. First one of these methods is the methodology adopted in Global Forest Inventory project, being executed worldwide by the United Nations Food and Agriculture Organization (FAO), as well as remote sensing techniques.

Table 5.3 Distribution of Areas with Greening Tendency within Sorgun Basin by IPCC Land Use Categories (Collect Earth) (2004-2015)

Land Degradation / Land Use Categories	Greening Tendency (Km^2)		No change (Km^2)	Land Degradation Tendency (Km^2)		Total Area (Km^2)
	Km^2	%	Km^2	Km^2	%	Km^2
Forest	6.86	9.73	63.65	-	-	**70.51**
Bush/Shrub	0.2	11.36	1.56	-	-	**1.76**
Pastures	0.78	0.90	85.83	-	-	**86.61**
Settlement Areas	-	-	0.78	-	-	**0.78**
Agricultural Areas		-	11.34	0.10	0.87	**11.44**
Wetlands	-	-	0.29	-	-	**0.29**
Other	-	-	7.07	-	-	**4.89**
Total Area	**7.84**	**-**	**170.52**	**0.10**	**-**	**178.46**

Collect Earth software and methodology has been used in the preparation of Table 5.3, many different map infrastructures have been used to analyse the area's images in different years, primarily including Google Earth, and analyses have been conducted through expert views and judgments. This study reveals a greening tendency in a total area of 7.84 km^2, including 6.86 km^2 of forest land, 0.2 km^2 of shrub land and 0.78 km^2 of pasture land, within the 178.46 km^2 Sorgun micro-catchment between 2004 and 2015. The greening tendency is 9.73% and 11.36% only in forest and shrub lands. These rates can be attributed to the afforestation and rehabilitation activities carried out between the subject years. U-In agricultural lands, however, land degradation has been identified in an area of 0.1 km^2. No change has been observed in remaining areas.

When the Sorgun Basin Management Plans for the period of 2003-2015 are compared, a positive change has been identified on the basis stand type within the micro-catchment. The afforestation and rehabilitation activities carried out in the basin have led to a 71 percent rise in productive forest area and a 55 percent decline in degraded forest area. The project training activities have led to a change in people's approach to the use of forest resources, group living on animal husbandry have given up harvesting tree branches in the forest to meet their need for livestock feed. Consequently, the perspectives of local people towards forest and nature have been positively affected and the improvement of forests has been accelerated.

Since the years when the project was implemented, the biggest changes in agricultural production have been the transition from husbandry to farming, the extension of irrigated agriculture, enhancement of marketing, and a resulting rise in farmer income.

The primary reasons for the increase in the production of irrigated agriculture have been project subsidies and the improvements made to irrigation infrastructure through the own capacities of farmers as well as contributions of the government. Upon the start of project activities in 1999, various training programs were implemented towards farmers in order to develop rural economy. These training programs have led to a shift in the irrigation water using habits of local people, and the water coming from water resources were collected in water collection pools to irrigate a larger area. Vegetative diversity of the basin has increased and a favourable environment has been created for bee-keeping. This has led to an increase in the yield of various crops and thus a rise in the economic income of people. Table 5.4 Forest Management Data of Sorgun Basin for 2003 and 2012.

Table 5.4 Forest Management Data of Sorgun Basin for 2003 and 2015

Forest Management Data of Sorgun Basin for 2003 and 2015						
Land Cover / Land Use Category	2003		2015		Change percent between 2003 and 2015	Impact on LDN
	Km^2	%	Km^2	%		
Productive Forest	49.71	27.85	84.90	47.57	+ 70.79	+
Unproductive Forest	41.59	23.31	18.46	10.34	- 55.61	-
Total Forest Area	91.30	51.16	103.36	57.92	+ 13.20	+
Pastures and Natural Rangelands	65.22	36.54	42.29	23.70	- 35.15	-
Agriculture	20.42	11.44	31.27	17.52	+ 53.13	+
Settlement	1.53	0.85	1.55	0.87	+ 1.30	+
TOTAL	**178.46**		**178.46**			

Table 5.4 has been prepared on the basis of forest management data. Forest management data is collected through integrating the methods of remote sensing, geodetic measurement and land verification.

In the 178.46 km^2 Sorgun micro-catchment, the comparison of forest management plans between 2003 and 2015 reveals that the 70.79% increase in productive forests and 55.61% decrease in unproductive forests can be attributed to land conservation

plantations and degraded forest rehabilitation activities carried out during the subject period. The reason for the 53.13% increase in agricultural lands is the forest cadastre work carried out in recent years. It stems from the fact that the unused agricultural lands shown as "forest opening" in management plans for 2003 were registered as agricultural area in cadastre works carried out afterwards.

When comparing Tables 5.3 and 5.4, the 42.29 km^2 pasture and natural grassland as shown in Table 5.4 based on management plan data rises to 86.61 km^2 in Table 5.3. These differences originate from the fact that only remote sensing method has been used according to IPCC land use categories, but geodetic measurements and land verification have not been performed. Under the IPCC method, fallow areas and abandoned agricultural areas are perceived as pasture, which has led to an overestimation of pasture and natural rangeland areas.

Furthermore, productive (normal closure) forests in Turkey are those where the crown of trees covers the area at the rate of 11 – 100%. The forests where the crowns of trees cover less than 10 percent of the area are also expressed as porous canopy closure forests. However, these rates are different in the world forest definitions. Some globally operating organizations take the lower limit of cover rate for productive forests as 20% and do not recognize groups of trees with height of less than 5 meters as forest. These differences in forest definition (Table 5.3) are the primary reasons for the fact that the forest area shown as 103.36 km^2 in forest management data (Table 5.4) turns out to be 70.51 km^2 according to IPCC land use categories.

5.3 Inebolu Basin LDN Pilot Study

The area of Inebolu Basin has been measured as 114.09 km^2. The average slope of Inebolu Basin is 19.29%, and is categorized as very steep sloped. Approximately 60 percent of the basin consists of moderately sloped and very steep sloped areas. Inebolu basin faces mainly towards south.

For the research area, annual average temperature is 13.0 ºC, average highest temperature is 17.2 ºC, average lowest temperature is 9.5 ºC, the coldest month is February with 5.3 ºC and the hottest month is July with 21.8 ºC. When evaluated according to Thornthwaite method, Inebolu Basin has a 'Very Humid, Micro thermal, no or little water shortage, full maritime conditions" climate type.

Average altitude of Inebolu basin is 621 m. The highest point in Inebolu basin is 1,360 m, and the lowest point is 0 metre. Based on these data, the maximum basin relief (H) of this basin has been found as 1,360 m. As basin relief increases, the time by which surface waters leave the basin shortens, the speed of water flowing in creeks increases,

resulting in flood, inundation and erosion risks. Therefore, flow rates of creeks and flood, inundation and erosion risks are high in Inebolu basin.

In the choice of project location, determining factors have been the observation of precipitation in all seasons, excessive sensitivity to flood and inundation and the high possibility of floods to turn into disaster, and the big flood disasters that happened in the basin in the past. In order to prevent potential disasters from flood and inundation by keeping land cover/use in balance, studies such as soil mapping and land cover categorization using satellite images and geodetic measurements were conducted. Four flow observation stations were established to observe siltation and run-off, and there automatic meteorological observation stations were established to measure precipitation in the basin. Precipitation-flow dynamics are monitored instantaneously through flow measurement stations.

In conclusion, the area subject to land rehabilitation in Western Black Sea Inebolu Basin under this report consists of a 114.09 km^2 basin. As a result of afforestation and rehabilitation activities carried out between 2001 and 2015, greening tendency has been identified in 3.72 km^2 out of 114.09 km^2 area. When the total basin area is taken as a basis, a 3.26 % greening tendency has been identified. This rate has been found as 3.92% in forest areas (94.86 km^2) (Table 5.6).

Table 5.5 Forest Management Data of Inebolu Basin for 1999 and 2011

Forest Management Data of Inebolu Basin for 1999 and 2011						
Land Cover / Use Category	1999		2011		Change between 1999 and 2011, %	Impact on LDN
	Km^2	%	Km^2	%		
Productive Forest	35,28	30,93	60,81	53,31	+ 72,36	+
Unproductive Forest	14,51	12,72	12,48	10,94	- 13,99	-
Total Forest Area	49,79	43,64	73,30	64,25	+ 47,21	+
Pasture and Natural Rangelands	4,82	4,23	0,68	0,60	- 85,89	-
Agricultural	52,26	45,81	35,07	30,74	- 32,89	-
Settlement	7,21	6,32	5,03	4,41	- 30,23	-
TOTAL	114,09	100	114,09	100		

In the 114,09 km^2 Inebolu basin, productive forest areas increased by 72.36 percent and unproductive forest areas decreased by 13.99 percent between 1999 and 2011. The increase in productive forest area can be attributed to the growing rural to urban migration and thus reduced population pressure on forests in recent years. Likewise, the 85.89 percent decrease in pasture areas can be attributed to the transformation of lands to productive forests by various means (natural seeding, etc.) as a result of rural to urban migration and reduced human pressure. The 32.89 percent decrease in agricultural lands is a result of the abandonment of agricultural lands due to migration (Table 5.5).

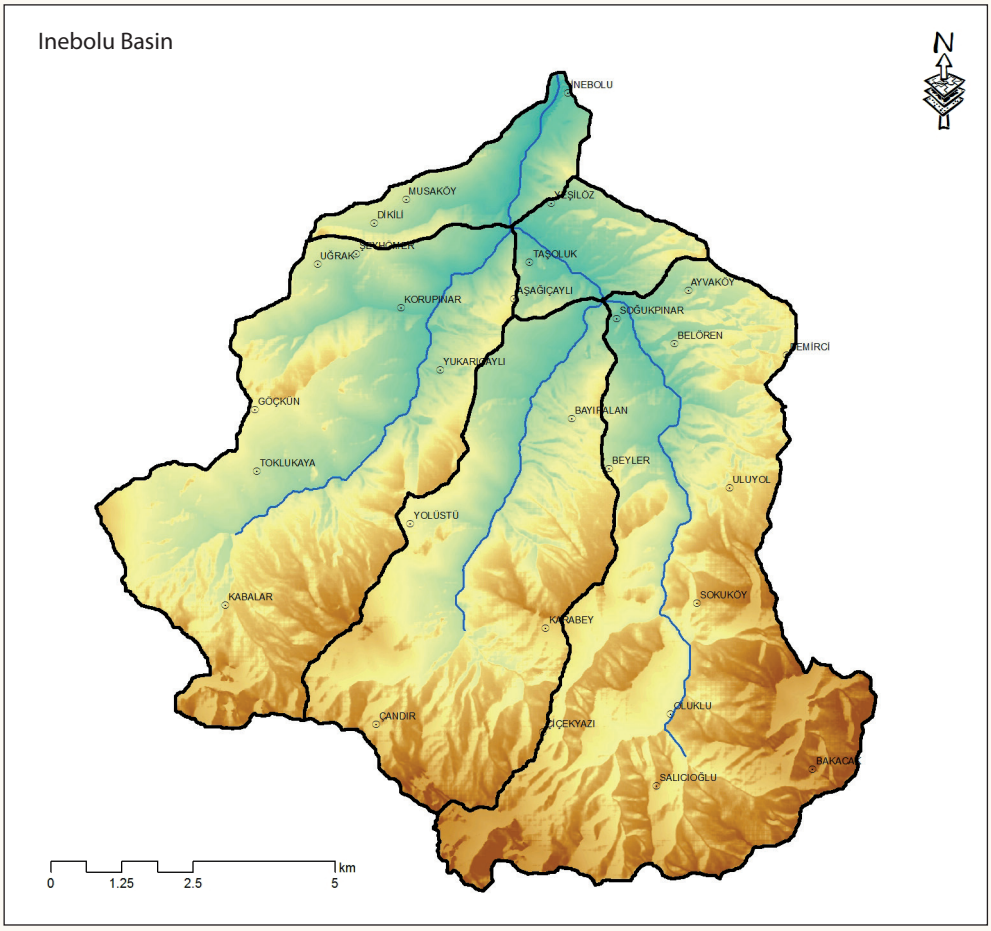


Table 5.6 Distribution of Areas with Greening Tendency in Inebolu Basin by IPCC Land Use Categories, 2001-2015 (Collect Earth)

Land Degradation / Land Use Categories	Greening Tendency (Km²)		No change (Km²)	Land Degradation Tendency (Km²)		Total Area (Km²)
	Km²	%	Km²	Km²	%	Km²
Forest	3.72	3.92	91.14	-	-	94.86
Bush/Shrub	-	-	-	-	-	-
Pastures	-	-	5.80	0.55	8.66	6.35
Settlement Areas	-	-	5.60	0.69	10.97	6.29
Agricultural Areas		-	5.35	-	-	5.35
Wetlands	-	-	-	-	-	-
Other	-	-	1.24	-	-	1.24
Total Area	**3.72**	**-**	**109.13**	**1.24**	**-**	**114.09**

The table above shows a greening tendency of 3.92 percent in the 3.72 km^2 forest area and 9.09 percent in the 0.62 km^2 pasture area, within the 114.09 km^2 Inebolu basin. No change was observed in an area of 109.13 km^2.

Table 5.5 consists of management data calculated by integrating remote sensing, geodetic measurements and land verification. Table 5.6, on the other hand, consists of data calculated by interpolating all values identified through only remote sensing method (Collect Earth) at points determined systematically according to IPCC land use categories, to the whole area. Fragmented and small pieces of agricultural lands reduce the possibility of systematically determined sample points to coincide with agricultural areas. Furthermore, in this assessment conducted through remote sensing method, existing agricultural crops such as hazelnut, apple and mulberry could possible not be distinguished from oak trees, one of the natural forest tree species of the region. For this reason, agricultural area shown in Table 5.6 seems to be smaller than it actually is.

In conclusion;

A comparison of selected pilot sites suggests that the main drivers of land degradation in western region of Gediz basin include inappropriate land use, urbanisation, tourism activities and in particular, intense agricultural activities. Erosion leads to significant issues in the basin, mainly in agricultural lands. Eastern region, on the other hand, presents higher levels of productivity. Afforestation works in the area resulted in improvements in forestlands.

Since Sorgun Basin was exposed to intense and inappropriate land uses, local population now faces rural poverty. With a view to relieve this issue, numerous activities to enhance natural resources and to reduce rural poverty were carried out within the scope of Eastern Anatolia Waterbasin Project. Such activities aiming to mitigate land degradation included soil conservation afforestation works in forestlands, rehabilitation of degraded pasturelands, and rehabilitation of degraded/unproductive forests. Moreover, in order to increase the income and prosperity levels of local population, irrigation systems were established in agricultural lands, efficient irrigation techniques were developed, and husbandry and apiculture were improved.

İnebolu Basin is located in a sub-humid region highly prone to floods and inundations, and receives year round precipitation. The works in the region improved the development of vegetation cover, and the results were detected through satellite images and ground surveys.

Remote sensing, ground surveys, expert reports, and household interviews confirmed a subsequent increase in all three main indicators of land degradation, namely land productivity, land cover, and soil organic carbon stocks in these three basins.

6. ADDITIONAL INFORMATION

6.1 National LDN Working Group

LDN NATIONAL WORKING GROUP AND STUDY METHODOLOGY

The most important agenda item of United Nations Convention to Combat Desertification 12th Conference of Parties (UNCCD – COP 12), hosted by Turkey between October 12 and 23, 2015, was the Land Degradation Neutrality (LDN) approach.

Going back to the beginning of the process; a letter of invitation sent by the UNCCD Secretariat in December 2014 notified that LDN Pilot Project would be started and a project inception meeting would be organized in Bonn on December 14-16, 2014. In the project carried out under the leadership of UNCCD with the participation of 14 countries, Turkey has been a voluntary stakeholder of the first phase of Land Degradation Neutrality Project in response to the letter of invitation. In relation to the implementation strategy of Land Degradation Neutrality; it was targeted to monitor changes in soil organic carbon content, land productivity index and land us within the project area. As a result of the meeting, it was decided to start the project in 2 or 3 basins to be identified in each country as the first phase, and our country monitored 2 micro-catchments from Gediz Basin in this scope. In the ongoing process, countries are expected to set their national targets in line with these trends.

Directorate General for Combating Desertification and Erosion, within Ministry of Forestry and Water Affairs, has been the focal point and assumed the secretariat role in our country for targets to be set within the framework of Land Degradation Neutrality Project. In this scope, meetings were held with related stakeholders (MoFWA and MoFAL) prior to UNCCD- COP 12 and a workshop was organized in Bolu in August 2015, which brought together all stakeholders. LDN Working Group has been established to identify the targets to be set for Land Degradation Neutrality, and target-setting process has been executed with the contributions of Working Group. In addition, during her term presidency for COP 12, Turkey hosted Land Degradation Neutrality Target Setting Workshop in Konya on May 28-30, 2016, for African countries as part of United Nations Convention to Combat Desertification, in cooperation with UNCCD Secretariat and Global Mechanism, with support secured through Ankara Initiative.

6.2 Responsibilities and Roles in the Implementation of LDN Strategy

Leading Ministry in Turkey for the success of LDN:

- Republic of Turkey, Ministry of Forestry and Water Affairs

Implementing Agencies:

- Ministry of Forestry and Water Affairs, Ministry of Food Agriculture and Livestock, Ministry of Environment and Urbanization, local administrations, related educational institutions, research institutes, universities and other Ministries dealing with land use, management and planning.

Targeted beneficiaries:

- LDN activities will be implemented countrywide.

Scientific support:

- TÜBİTAK, universities, civil society organizations, related academicians, research institutes, etc.

Timeframe:

- 2016 – 2030

6.3 Legal Framework of Land Management

Legal Framework of Land Management

This section covers the legal and regulatory framework to be taken as a reference in achieving LDN targets.

Existing Legislation concerning Land Degradation:

- **Soil Protection and Land Use Law no. 5403:** Objective of the law is to ensure the protection and improvement of soil as well as sustainable land use in compliance with the principle of sustainable development with priority focus on environment. In addition, an amendment has been made to this law to prevent land fragmentation, whereby minimum agricultural land size cannot

be smaller than 0.02 km^2 for absolute agricultural lands, marginal agricultural lands and special crop lands; 0.005 km^2 for cultivated lands, and 0.003 km^2 for lands where under-cover agricultural activities are performed. Agricultural lands shall not be subdivided or divided into shares below size limits set by the Ministry. However, in areas where non-agricultural land use permit has been issued or where crops requiring special climatic or soil conditions are grown, such as tea, hazelnut and olive, smaller parcels may be created through the positive views of the Ministry if smaller parcels have to be created due to land characteristics.

- **Agriculture Act No. 5488:** Determining necessary policies to support and develop agriculture sector and rural areas in accordance with development plans and strategies.
- **National Mobilization for Afforestation and Erosion Control Law No. 4122:** – The objective of this Law is to set out the principles and procedures applicable to afforestation and erosion control activities to be carried out by public agencies and organizations as well as real persons and legal entities in order to increase forest areas and growing stock, re-establish and improve the degraded balance among soil, water and plant and protect environmental assets in state forests, lands under the control and disposition of the state, lake and river banks, and lands under the ownership and disposition of legal entities.
- **Forest Act No. 6831:** Preservation, sustainable management and exploitation of forests.
- **Pasture Act No. 4342:** Determination, confinement and allocation of pastures, summer pasturage, winter quarters and publicly owned grassland and pasturage to village or municipality legal entities, and agistment, maintenance, reclamation and management of such areas.
- **Environment Act No. 2872:** Preservation of the environment, which is a common asset for all living things, under sustainable environmental and development conditions.
- **Organic Agriculture Act No. 5262:** Taking necessary precautions to develop organic products and inputs, to provide consumers with reliable and quality products.

- **Agriculture Reform Regarding Land Arrangement in Irrigation Areas Law No. 3083:** Land provision for farmers without land, in-farm development services, organizing land consolidation works.
- **National Parks Law No. 2873:** Selecting and defining national parks, nature parks, natural monuments and nature preservation areas to national or international standards, preserving, developing and managing these without damaging their special properties.
- **Underground Waters Law No. 167:** All kinds of research, exploitation, use and registration of underground waters.
- **Water Framework Law:** The objective of this Law is to protect, develop and improve water resources and ensure their sustainable use in line with priority needs. There are many laws and regulations in this field. Draft "Water Framework Law" has been prepared to prevent conflicts of power among agencies, ensure more efficient and coordinated management of water, and necessary work is underway for its enactment.
- **Afforestation Regulation:** Afforestation, rehabilitation, erosion and flood control, avalanche and landslide prevention, pasture reclamation, tree reclamation, seed and sapling growth for forest trees, shrubs and flora, managing nursery and amelioration works.
- **Good Agricultural Practices Regulation:** Ensuring an agricultural production without any harm towards environment, human or animal health, preservation of natural resources, ensuring traceability and sustainability, and supply of reliable products in agriculture.
- **Soil Pollution Control and Point Source Pollution Sites Regulation:** Prevention of soil as receiving environment, determining sites and sectors where there is pollution or risk of, defining principles for monitoring and cleaning polluted soil or sites in accordance with sustainable development.
- **Domestic and Urban Domestic Sludge Use on Soil Regulation:** Defining principles of taking precautions for sewage sludge use on soil in accordance with sustainable development.
- **Organic Agriculture Regulation:** Preserving ecological balance, conducting organic agriculture practices, administrating organic agricultural product and marketing of, and intensification.

- **Wetlands Preservation Regulation:** Preservation and development of wetlands, especially to practise Internationally Important Wetlands as Water Birds Habitat Agreement (Ramsar Convention), and ensuring cooperation and collaboration between institutions in charge of these subjects.

Final limitations encountered in the enforcement of laws and regulations

One of the most important pillars required for the achievement of LDN targets is the availability and enforcement of a sufficient legal basis. Some of the problems encountered in the enforcement of existing legislation are as follows:

- While land use plans (Article 10), determination and preservation of plains with high agricultural potential (Article 14), determination and preservation of erosion sensitive areas (Article 15) have not been efficiently put in practice, despite being enacted in the Soil Protection and Land Use Law No. 5403.
- Although Pasture Law No. 4342 includes comprehensive provisions about the use of pastures in line with rules, their maintenance and rehabilitation, increasing and sustaining their productivity, supervision of their use, and their protection, enforcement is mainly focused on determination, designation and allocation.
- First generation land aggregation could not yet be completed as part of the land aggregation activities carried out in our country to prevent land fragmentation, which is a key problem for agriculture.

Measures envisaged to overcome existing limitations

- An LDN policy, which will ensure full enforceability and applicability of the above-mentioned legislation and address the mentioned limitations and practical short-comings will be developed to achieve LDN targets.
- Cooperation will be developed among related agencies and organizations.
- Clear and understandable campaigns will be developed to ensure the adoption of national LDN targets nationwide and advertisements and public spots will be produced as necessary.

6.4 LDN Monitoring, Evaluation and Reporting

This section explains the LDN monitoring, evaluation and verification system to be applied.

LDN is a phenomenon experienced at a global scale and negatively affects both human communities and natural environment as well as the organisms living within that environment. It is very important to have knowledge about the current state and trends in LDN in order to reverse negative developments and disseminate the positive results from the activities carried out as good practices. LDN monitoring system must be capable of identifying land degradation and monitoring the progress towards combatting Desertification / Land Degradation and achieving LDN targets as well as land degradation trends.

As part of efforts to combat Desertification / Land Degradation, Turkey has carried out significant activities, building on the National Strategy and Action Plan for Combatting Desertification and Land Degradation. In this scope;

- Turkey has identified national scale desertification criteria and indicators, developed a desertification model to monitor desertification and created a desertification risk map for Turkey.
- A web-based monitoring, evaluation and reporting system has been established and launched for the NAP updated in 2015. This system has enabled active monitoring of activities, production of reports at national scale as well as reporting to PRAIS system.
- Erosion monitoring system has been established and erosion risk map has been produced to combat erosion effectively.
- A soil database, which enables geographical-based archiving and monitoring of soil map and profile information in plans and projects developed countrywide as part of forestry activities, was created between 2013 and 2016. The soil data obtained from agricultural pasture lands will be developed and updated continuously by integrating them with the systems of related agencies.

- In addition to these initial efforts exerted within the framework of national target setting process aimed at monitoring soil organic carbon content, land productivity index and changes in land use, as well as setting out the land degradation trends towards the achievement of Land Degradation Neutrality targets;
- A project has been developed to create a model and develop a monitoring system to diagnose the current state about identification of Soil Organic Content and determine the amount of soil organic carbon in Turkey, and the project will be completed by the end of 2018.
- Pilot field work has been carried out at the local scale to monitor land use changes, and a project has been developed to identify land uses and changes by observing the current state and changes on a land of approximately 0.005 km^2 at points (40-50 thousand) to be selected systematically to be representative of the whole country; to follow up the existing trends and vegetation processes; and obtaining quantitative data for the assessment of dry lands with necessary statistical results, within the next one year.
- In order to follow up land use change and productivity trends, our National Land Cover Classification will be reviewed by stakeholder agencies, and an appropriate-scale and geographic-based **National Monitoring System (2017-2019)** will be established and developed through remote sensing methods using our national satellites such as Göktürk and Rasat.

Following the completion of all these activities, an LDN monitoring system whereby the systems created separately for each of 3 basic indicators are synchronized within the framework of an acceptable model will be established.

Data Source:

National agencies and organizations that will provide data to systems established for 3 basic indicators of LDN will be required to produce and share reliable data.

Data Collection Method:

First of all, reliable data produced by stakeholder agencies and organizations will be supplied to the systems established for 3 basic indicators of LDN. The missing data required for national scale LDN monitoring will be derived from field studies for soil organic carbon, and land cover data and land productivity index from satellite images.

Data Processing Method:
To be defined by responsible agency.

Periodic Repetition:
In order to monitor progress, the values of 3 basic indicators (land cover /use change, land productivity dynamics and soil organic carbon content) should be updated every 5 years.

Responsible Agency, Stakeholder Agency and Scientific Support
The agencies responsible for the execution of the system and providing scientific support will be Ministry of Forestry and Water Affairs, Ministry of Food Agriculture and Livestock, and Ministry of Science, Industry and Technology. Stakeholder agencies are Ministry of Forestry and Water Affairs, Ministry of Food Agriculture and Livestock, Ministry of Environment and Urbanization, Ministry of Development and Ministry of Energy and Natural Resources.

6.5 Detailed Budget and Financing Plan (Costing)

Costs have been calculated by proportioning the funds spent by Forestry Directorate General in the following areas in 2015, to realisation areas. A 10% increase has been envisaged for 2016.

Approximate Costs for Works:
Afforestation cost: 1,500 $/Ha

Erosion control and soil conservation cost: 700$/Ha

Rehabilitation cost: 300$/Ha

Pasture rehabilitation cost: 200$/Ha

Irrigation system cost: 4,666 $/Ha

Land consolidation cost: 214 $/Ha

Rehabilitation of agricultural lands: 121 $/Ha

Table 6.1. National LDN Targets and Estimated Costs

Corrective Measures		LDN Targets		Investment Amount
	Unit	Amount	Date (year)	(Million Dollars)
Afforestation	km^2	6,000		900
Soil conservation afforestation	km^2	9,000		630
Forestland rehabilitation	km^2	15,000	2030	450
Decrease in area per fire	ha	0.5[5]		3,060
Reduce in the number of human-induced forest fires	%	3[6]		
Mining site rehabilitation	km^2	58	2019	58
Pasture rehabilitation	km^2	7,500	2030	150
Increase in irrigation area	km^2	22,000	2030	10,266
Land consolidation works	km^2	140,000	2023	3,000
Identifying plains of great agricultural potential and registering them as agricultural lands	Km^2	55,000	2023	0.3
Rehabilitated land area	km^2	20,000	2030	266
TOTAL		**274,558**		**18,780.3**

7. ANNEXES

ANNEX 1

National Forestry Data for 2000-2015

Hectare (ha)	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	TOPLAM (ha)
Amount of area allocated to mining activities	2,503	2,214	4,582	3,780	3,558	4,257	4,689	7,907	10,693	8,041	5,440	10,032	6,336	5,872	11,754	8,765	**100,423**
Amount of burnt area	26,353	7,394	8,514	6,644	4,876	2,821	7,762	11,664	29,749	4,679	3,317	3,612	10,454	11,456	3,117	3,219	**145,631**
Area cleared illegally in the forest	1,218	1,299	1,496	1,051	1,017	1,199	984	988	963	741	986	1,024	890	853	836	856	**16,400**
Afforestation	28,683	28,171	30,846	41,857	42,640	31,942	36,321	26,418	48,501	56,407	59,162	48,533	46,953	48,631	44,309	41,998	**661,372**
Erosion control	30,449	32,780	18,608	42,042	42,136	47,493	60,776	42,984	53,917	50,352	61,401	67,088	83,131	84,304	80,517	75,139	**873,117**
Pasture rehabilitation	4,995	3,800	440	2,500	3,240	4,259	5,315	4,163	4,642	5,521	7,968	10,114	9,635	9,920	16,383	23,843	**116,738**
Rehabilitation	6,502	4,089	2,093	5,187	48,013	65,260	285,177	313,659	336,910	374,728	346,902	344,570	347,719	106,182	100,432	94,411	**2,781,834**
Artificial leaf gathering	13,824	14,658	14,034	10,531	15,746	10,021	13,579	12,972	18,471	14,366	8,620	10,068	12,356	8,918	10,793	9,197	**198,154**

ANNEX 2

Potential Changes After Irrigation In Soil Organic Material And Organic Carbon

In Turkey, agricultural irrigation is mostly concentrated in the semi-arid Mediterranean, Southeast Anatolia and Aegean regions. Average soil organic matter varies from 1 to 2 percent in these regions. (Dinç et al. 2001). While it is known that agricultural activity reduces organic matters relative to lands with no agricultural activity, many studies suggest that irrigation has a positive effect on the organic matter content of agricultural soil relative to non-irrigated soil. (Wu et al. 2003; Trost et al. 2013). It has been found that organic matter increase in semi-arid climates after irrigation ranges from 11 to 35 percent (Trost et al. 2013).

The data taken as a basis in this study were obtained as a result of the studies conducted in Adıyaman and Şanlıurfa province in 2012 RIHN (Research Institute for Humanity and Nature) C09 Project in Adıyaman.

As part of the C09 study, samples have been taken from the same soil series, classified as Calcaric Cambisol (Calcareous Brown) under IUSS WRB Soil Classification (at 700-730m altitude from sea level, with <%1 slope, 120cm depth, 7-10% lime, silty clay), which had been irrigated from the wells and rivers in the region, irrigated under GAP project after 1995 and also used in dry agriculture. A total of 20 samples were taken from 15cm depth. As a result of the organic matter content analyses conducted on samples it was observed that irrigation increased organic substance content (Table 7.1). The coefficient 0.58 has been used when converting organic matter to organic carbon.

Table 7.1 Per Cent Changes in Organic Matter (organic carbon) content of Soil in Adıyaman Province by Types of Cultivation

	Dry Agriculture		Long-term Irrigation		Irrigation after 1995	
	Org. Matter	Org. Carbon	Org. Matter	Org. Carbon	Org. Matter	Org. Carbon
Grain	1.03	0.59	1.42	0.82	1.35	0.78

Table 7.2 When average soil volumetric weight is taken as 1.4g/cm3 for Adıyaman Region, the organic matter and carbon quantities per hectare can be expressed as follows.

1 ha (10,000m²)	Sample Depth (m)	Volumetric Weight (g/cm3)	% Organic matter	Organic matter (kg/ha)	Organic carbon (kg/ha)
10,000	0.15	1.4	1.03	2,163	1,254.54
10,000	0.15	1.4	1.42	2,982	1,729.56
10,000	0.15	1.4	1.37	2,877	1,668.66

As a result of the analysis, it has been found that irrigation increases organic matter content by 37 percent in the long term and 31 percent in the short term. In this context, assuming an expected average increase of 34 percent in 3 million hectares of land that will be opened to irrigation in Turkey (average of short and long-term irrigation), it can be argued that potential rise will be 298.350 t as organic matter content of 1.5% will rise to 2.025% (Table 7.3).

Table 7.3 Organic matter and organic carbon growth expected in 30,000 km² of land after irrigation

Area to be opened to irrigation (thousand km²)	Depth (m)	Vol. weight	Potential increase in organic matter, %	Organic matter (tons)	Organic carbon (tons)
30	0.15	1.3	0.51	298.350	173.043

ANNEX 3

Methodology for monitoring the trend of change in land cover and vegetation

Method: Using Collect Earth program, an extension of Google Earth, developed within FAO In order to conduct a synchronized forest sampling analysis, an evaluation has been conducted according to land categories in arid and semi-arid areas of Turkey.

Prior to the evaluation, 3,950 points were randomly distributed in the study area. Each trial area covers a square area of 70×70 m (appr. 0.5 ha). In each trial area, a total of 49 squares were placed, each sized 2×2 m (4 m2), with spaces of 10 meters, to help the exert staff conduct evaluation in the region.

Evaluation Tools:

To evaluate each trial area, images containing high-resolution (~1 m) data were used through Collect Earth program. For the evaluation of randomly selected points by expert staff, Google Earth Pro, Here Maps, and Bing Maps satellite images operating interactively with Collect Earth program, as well as graphical databases within Earth Engine Playground were used.

The tools used and their general characteristics:

- Google earth; main window by which we can examine each trial area containing points through high-resolution data, allowing for their interpretation together with past data, depending on the image capture date. Thanks to Collect Earth extension, it allows the expert staff to enter data through a data entry interface within Google Earth.
- Bing Maps and Here Maps; In cases where certain areas captured with medium resolution in Google Earth or where capture date cannot be identified; this interface can offer a broad perspective to the expert staff and enable interpretation for each point through association with their environs.
- Google Earth Engine; It is a window that allows monitoring of different changes for each trial area and its environs, containing image data used to investigate the correctness of interpretations. In particular, it is an interface with Windows for the interpretation of Top of Atmosphere (ToA) reflection values for Landsat 7 and 8 data as well as the land according to greenness values.
- Earth Engine Playground; It is a graphical data interface containing changes in NDVI (Normalized Difference Vegetation Index) and NDWI (Normalized Difference Water Index) data, compiled using Google infrastructure, by months and long years.

In conclusion, quantitative data have been produced using the system offered by Collect Earth program, to observe the current state and changes in defined points, identify land uses and changes, follow up the current trend and vegetation process and evaluate Drylands together with necessary statistical results.

ANNEX 4

Joint Research Centre Land Cover / Land Use Change methodology

The data presented in the table have been compiled by European Commission Joint Research Centre (EU-JRC) using the "Good Practice Guidelines for Land Use, Land Use Change and Forestry" (GPG for (LULUCF) prepared under Intergovernmental Panel for Climate Change (IPCC). The study used MODIS data with ground resolution of 250m-1 km, developed by NASA.

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