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**“OPTIMIZING THE PRODUCTION OF GOODS AND SERVICES BY
MEDITERRANEAN WOODLAND
ECOSYSTEMS IN THE CONTEXT OF GLOBAL CHANGES”**

DÜZLERÇAMI /TURKEY

Prof. Dr. Nebiye Musaoglu
Assoc. Prof. Dr. Esra Erten
Dr. Aslı Aksu Bozbay
Assoc. Prof. Dr. Müfit Çetin
Dr. Orkan Özcan

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ACRONYMS AND ABBREVIATIONS

ABPRS	: Address Based Population Registration System
CO ₂	: Carbon Dioxide
EIA	: Environmental Impact Assessment
GDF	: General Directorate of Forestry
GIS	: Geographic Information System
PPM	: Pine Processionary Moth
TSI	: Turkish Statistical Institute
WIA	: Wildlife Improvement Area
YARDOP	: The Rehabilitation of Burned Areas and the Establishment of Forest With Fire-Resistent Species

BACKGROUND

I. Düzlerçamı Forest District Directory

To analyse the agents and drivers of deforestation and degradation in Turkey, Düzlerçamı forest land located in the Mediterranean coastal region of south Turkey is selected. As with all the forest land in Turkey, the Düzlerçamı forests are state-owned and administrated by the General Directorate of Forestry (GDF) under the Ministry of Forestry and Water Affairs. The regional forests are managed by the forest district directory in line with management plans that run in cycles of 10 to 20 years.

The first Düzlerçamı forest land and management plan was completed in 1929, and has been amended multiple times since then. The Düzlerçamı Forest District Directory, which is a unit of the Antalya Regional Directorate, was formed in 1961 as a lead directory. In the beginning, 5000 hectares of forest was managed by the directory. On the 7th of March, 1963, the directory name was changed to the Lead District Management Directory and covered 20,000 ha of forest. This lead directory was closed, and the new status was entitled Düzlerçamı Forest District Management Directory on 14.02.1973. The current organizational structure chart of the forest management system in Turkey can be found in Fig. 1.

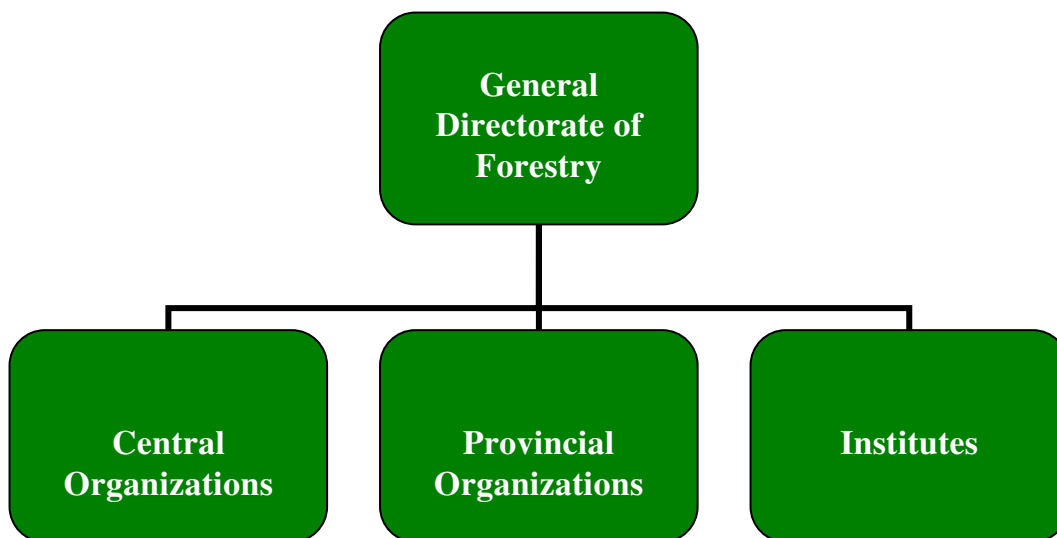


Fig. 1: Administrative organization structure of Turkey in terms of forest planning and management [1]

In the Central Organizations, there are 3 different units [1]. These are:

1-Advisory and Inspection Units

- Department of Inspection
- Internal Auditing Unit
- Legal Consultancy
- Strategy Development Department

2-Main Units

- Department of Combating Forest Pest

- Department of Forest Fire Combating
- Department of Forest Cadastre and Ownership
- Forest Management and Planning Department
- Forest Production and Marketing Department
- Department of Silviculture
- Department of Afforestation
- Department of Soil Conservation and Watershed Rehabilitation
- Department of Nursery and Seed
- Department of Non-Wood Forest Products and Services
- Department of Forest-Village Relations
- Department of Construction and Procurement
- Department of Permission and Easement

3-Supporting Units

- Personel Department
- Administrative and Financial Affairs Department
- Foreign Relations, Training and Research Department
- Information System Department
- Private Secretariat
- Public Information Department

The General Directorate of Forestry performs its tasks of protection, development and expansion of the forests, and operating the forests to provide multiple benefits to society, within the framework of a sustainable, nature-compatible forest management approach. Significant progresses have been achieved in the realization of the objectives as a result of effective and efficient use of the resources.

Each year since 1973, plans for almost one tenth of the forest area have been renewed. However, because of the frequent changes in borders and planning units, the Management Planning Department was not able to compare the results of inventories on a yearly basis until 1997. Since 1997, around 30,000 ha of forest has been planned and managed by the Düzlerçamı Forest District Management Directory.

Amongst all the reports and records studied, there was no qualitative information presented on forest use practice in the management period between 1965-1974. However, in the period between 1975 and 1984, the Düzlerçamı Forest District Management Directory reported that small areas of land were planted with pinus, highlighting the start of timber production. As shown in Table 1, after this period, the total area managed by the directory was 29,280.2 ha, an increase from 14,222 ha. This was to address growing timber production interest and decreasing native forests.

Table 1: Temporal planned areas due to Düzlerçamı Forest Management Plan [2]

Period	Coppice (ha)	%	Non-forested area (ha)	%	Total (ha)
1975-1984	10,406	73	3816	27	14,222
1985-1994	19,261.50	66	10,019	34	29,280.5
1997-2006	18,825	64	10,534	36	29,359

The Düzlerçamı Forest District Management Directory recently began a new management plan for forest functions covering 29,168.2 ha comprising of 40% non-forest, 38% logging forest and of 22% degraded forest lands, and it will culminate in 2021. By taking into account the forest functions, the 10 plan of operations showing the order and extent of forest works to be carried out during this period have been decided as shown in Table 2. Although the amount of forest cover is changing differently by operation, 10,930.5 hectares of productive forest land is available for timber production. This area has more than doubled since 1985, reflecting the increased emphasis on timber production.

Table 2: Plan of operations covering the period 2012-2021

Operations		Function	Forest (ha)	Non-forest (ha)	Total (ha)
A	Productive forest-land	Economic	882.9	10,047.6	10,930.5
B	Plantations without timber production aim		22.4	-	22.4
C	Non-timber forest products		36.2	-	36.2
D	Wildlife protection and improvement area (WIA)	Ecological	13,100.9	1029.1	14,130
E	Worse forest site		3601.1	12	3613.1
F	Seed orchard		19.5	-	19.5
G	Archeological protected areas		0.1	23.1	23.2
H	Protection of water resources	Social and cultural	15.8	343.1	358.9
I	Recreation		23.3	2.8	26.1
J	Research forest		8.3	-	8.3

II. Administrative history of Düzlerçamı

The forests managed by this directory are distributed among different administrative levels as indicated in the Table 3. Döşemealtı is the largest province in terms of land area, its historical changes in boundary conditions and administrative structure is given in detail in the following paragraph.

In Turkey there are three kinds of provincial administrations: *province*, *county*, and *district*. The province is the largest provincial administrative unit of the country. The provincial administration consists of the *governor*, the department heads of the provincial administration,

and the provincial administrative council. The governor is the head of the provincial administration. Provinces are divided into counties. As with the provincial administration, the county administration also consists of the county chief, the department heads of the county administration, and the county administration council. The district administration also has three bodies: the district administrator, the district assembly, and the district commission. Apart from these state organizations, in each provincial area, there are also local government organizations (municipalities) to meet the common needs of provincial, municipal and village residents, which are managed by mayors. The main difference between mayors and governors is that they and their members are locally elected [3]. There are also Metropolitan Municipalities whose decision-making bodies are elected by the people. The metropolitan municipalities are established in cities made up of at least three countries or first stage municipalities, and are responsible for coordination among these municipalities [3].

The administrative history of Döşemealtı Municipality: It was founded as Kırkgöz Yeniköy in 1934. 60 settlement houses were built by the government of Antalya and 60 Turkish citizens and their families from Cyprus were settled there. After the nomads who were living as immigrants in the region settled, a developing village emerged. In the 70s, because of the fact that Döşemealtı was made a sub-county, nearby villages such as Duacı, Kirişçiler, Kevşirler, Başköy, Odabaşı, Selimiye, Dereli, Çıplaklı, Kızıllı, Ekşili, Karaveliler, Killik, Camili, Ahırtaş, Bıyıklı, Kömürçüler, Yağca, Çıglık, Nebiler, Yukarı Karaman (now in Düzlerçamı), Yeşilbayır, Dağbeli, Bademağacı, which had belonged to Kepez county in terms of administration, started to be managed by Döşemealtı sub-county. After reaching a population of 2711, Kırkgöz Yeniköy became a municipality on 17.12.1977, and it has been known as Döşemealtı since then. After the foundation of Döşemealtı Municipality, Yeşilbayır, Düzlerçamı, Çıglık, Doyran were also converted to municipalities in 1994, 1998, 1988 and 1999 respectively [4]. The Antalya Metropolitan Municipality was formed in 1993. The boundary of the newly-established metropolitan municipality was extended through regulation number 5216 in 2008, and included Doyrak, Düzlerçamı, Çıglık and Yeşilbayır. In the same year, the Döşemealtı Municipality was re-formed under regulation number 5747, and it was established by the combination of four sub-counties: Döşemealtı, Düzlerçamı, Çıglık and Yeşilbayır. Since that time, Döşemealtı has been a county of the Antalya Metropolitan Municipality. After the last Metropolitan Municipality Law, which has been valid since March 2014, villages containing a forest within their administrative borders have been converted to districts. Döşemealtı forest villages' expansion and their becoming part of a metropolitan municipality has changed the socio-economic structure of the region. In Table 4. the current administrative divisions of Döşemealtı are shown. In addition to the spatial informatio given in Table 3, and Table 5 and Fig. 2 present the population of the test site. Despite a decrease in population in some districts, the latest population information indicates an alarming increase in Döşemealtı, which had a population of 3348 in 1990 and 27,995 in 2010.

Table 3: The current areas of districts covering the forests managed by the district directorate of Düzlerçamı [5]. The districts shown by * lie outside the pilot site boundary but their land-use activities have impacts on the pilot site

Country	District	Area (ha)	Percentage of the forest in the area (%)
Döşemealtı	Yukarıkaraman	7,360.9	25.2
Döşemealtı	Akkoç	5,325.2	18.2
Döşemealtı	Bademağacı	2,530	8.7
Döşemealtı	Yağca	2,465.9	8.4
Döşemealtı	Çığlık	2,363.3	8.1
Döşemealtı	Yeniköy	1,667.8	5.7
Döşemealtı	Yeşilbayır	1,639.7	5.6
Döşemealtı	Dağbeli	1,467.9	5.0
Döşemealtı	Bıyıklı	1,418	4.9
Döşemealtı	Kömürcüler	936	3.2
Konyaaltı	Aşağıkaraman	713.1	2.4
Döşemealtı	Kovanlık	528	1.8
Döşemealtı	Çıplaklı	540.2	1.8
Korkuteli	Bayatbademleri	133	0.5
Döşemealtı	Aşağıoba	76.7	0.3
Kepez	Göçerler *	0.2	0.0
Muratpaşa	Muratpaşa	11.3	0.0
Konyaaltı	Doyran	7.8	0.0
Korkuteli	Köseler *	1.4	0.0
Korkuteli	Karataş *	0.6	0.0
Korkuteli	Çaykenarı *	13.8	0.0
Korkuteli	Karakuyu *	0.7	0.0

Table 4: Current administrative divisions of Döşemealtı

Name	Administrative Level
Döşemealtı	county municipality
Bademağacı	county municipality
Dağbeli	county municipality
Ekşili	county municipality
Karaveliler	county municipality
Ahırtaş	district
Aşağıoba	district
Bıyıklı	district
Camili	district
Dereli	district
Ilıcaköy	district
Karataş	district
Kevşirler	district
Killik	district
Kovanlık	district
Kömürcüler	district
Selimiye	district
Yağca	district

Table 5: Temporal population of the districts [6]

	1990	2000	2010
Akkoç	436	364	332
Aşāıkaraman	867	1029	1331
Aşāıoıba	406	300	319
Bademağacı	3951	3850	2,167
Bayatbademleri	270	291	216
Bıyıklı	193	206	145
Çığlık	1813	2558	0
Çıplaklı	703	1050	0
Dağbeli	3702	3912	2192
Döşemealtı	3348	6261	27995
Kovanlık	1117	1221	1261
Kömürçüler	505	1086	1254
Yağca	583	652	1118
Yeşilbayır	2340	4173	0
Yukarıkaraman	1082	3117	59
Doyran	1453	2574	0
TOTAL	22769	32644	38389

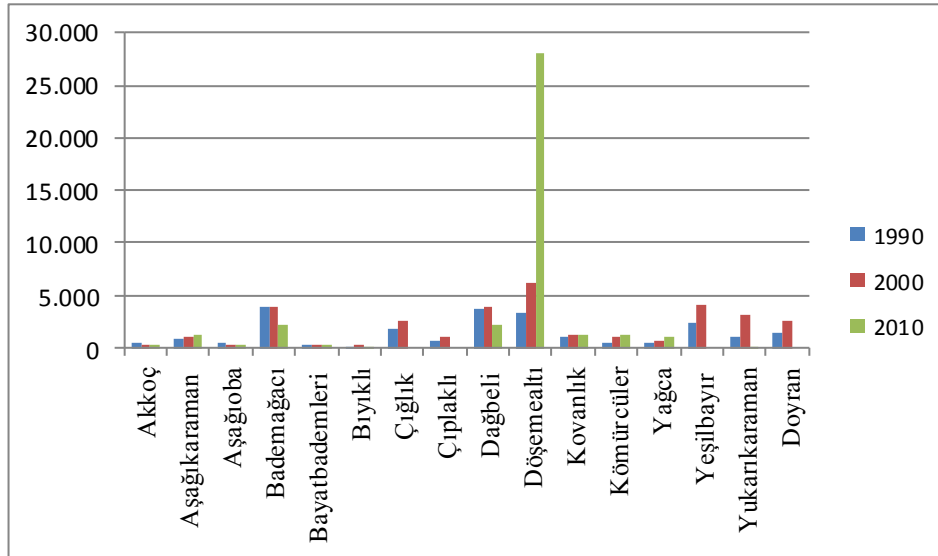


Fig. 2: Graphical representation of temporal population of districts

1. METHODOLOGY TO ANALYSE AGENTS AND DRIVERS OF DEFORESTATION IN DÜZLERÇAMI PILOT SITE

To identify the agents and drivers affecting the deforestation and degeneration in Düzlerçamı, four methodologies were assessed as follows:

- field visits to observe the forest cover dynamics
- talks and interviews with local people and state organizations, which are in charge of different land management
- the literature review to examine reports, research and evaluation studies conducted in the test site
- discussions with local experts.

Apart from office works, field visits including collecting quantitative and qualitative data and information were conducted in the test site in the 3rd week of January and the 2nd week of April, 2014. The field visits had the following components:

Social surveys with local population: In the area of study there are 22 areas that used to be villages but which are now districts. Several structured interviews were conducted with selected local people (Photo 1). An emphasis was placed on the qualitative phase of the study, which investigated the land-use changes experienced by the villagers and local people's daily lives, farming and livestock breeding practices.

For this reason, the people who are able to best represent the structure of the region have been surveyed. Data was collected through personal interviews, people met randomly or home visits. For collective interviews, teahouses (Photo 1(a), (b)) were visited and people in their workplaces have been interviewed. The headings related to the target data were stated and groups of questions were formed for each heading. Semi-standardized interviews were made according to the stated question form, see Appendix 1. The target group was selected by considering the following two criteria:

- to diminish the effects of childhood and adolescence
- to live in Düzlerçamı long enough to assess its past and natural-cultural features

Considering these criterias, the target group are people who are older than 30 and who have lived in Düzlerçamı for at least 20 years.



(a)

(b)

(c)

(d)

Photo 1: (a) Yukarikaraman Village, (b) Bademagaci, (c) Talk with people, (d) Talk with shepherd

Surveys with administrative office: The following organizations are involved in the development and management of the region:

The Ministry of Forest and Water Management; the General Directorate of Nature Protection and National Parks and the Regional Directorate for National Parks; the General Directorate for Forests and the Regional Directorate for Forests; the General Directorate for the Fight against Desertification and Erosion; General Directorate for Meteorological Services; the General Directorate for State Hydraulic Works; the Ministry of Public Works and Habitat (General Directorate for Land Registration and Cadastre); the Ministry of Science, Industry and Technology, the Scientific and Technological Council; the Ministry of Food, Agriculture and Livestock; the Ministry of Culture and Tourism; the Turkish Statistical Institute; the Ministry of Transport, the Maritime Affairs and Communication; the Ministry of the Environment and City Planning; the Ministry of Energy and Natural Resources; the State Planning Organisation; the Ministry of Finance; Ministry of National Education; the Ministry of Health; the Ministry of Justice; the Ministry of Youth and Sports; and representatives from the armed forces and local government (governor, local provincial authorities, municipal authorities, village authorities)

Among those organizations, semi-standard interviews (see, Appendix 2) were conducted with:

- the directorate of Food, Agriculture and Livestock Antalya
- the directorate of Culture and Tourism Antalya
- the directorate of Food, Agriculture and Livestock Döşemealtı
- the directorate of Forestry Antalya
- the directorate of Nature Conservation and National Parks
- the district directorate of Forestry Döşemealtı
- the Antalya branch of the Turkish Electricity Transmission Company
- the chief of Land Registry and Cadastre
- the previous and current mayor of Döşemealtı
- muhtars (the elected head of a district)
- the governor of Döşemealtı (county)

In addition to the surveys, previous research and reports related to the test site, such as information published by member states regarding management practice and laws on land consolidation, changes in boundaries were also collected (Photo 2). Here, it can be highlighted that the muhtar is the highest elected authority of a district (ex-villages) and has the most up-to-date information regarding district residents and their daily living practices. During those talks, digital and printed data such as land-use maps, a digital elevation model and Geographic Information System (GIS) files produced by local state organizations were taken for the quantitative analysis in temporal deforestation monitoring.

Between these field works, there was an election on March 30, 2014. After this election the mayor and council of Metropolitan Municipality of Antalya and the county Municipality of Döşemealtı changed. Interviews with the previous and current mayors of Döşemealtı showed the importance of the viewpoint of local governors in management. In this report, the main conclusions of these interviews are given.



Photo 2. (a) Muhtar of Yukarıkaraman Village, (b) Mayor of Döşemealtı, (c) Chef of Land Registry and Cadastre, (d) District Governor of Döşemealtı

- **Land-use/land-cover maps:** The gallery contains land management and forestry maps of the region obtained from Antalya Metropolitan Municipality, its district municipality Düzlerçamı and the Antalya Forest Regional Directorate. The maps were produced as part of the Land Use and Land Cover survey in 1997 and 2012.
- **Collection of demographic information:** Demographic information such as population groups, housing characteristics, income of Düzlerçamı neighbourhoods, prepared by the City's Social Policy Analysis and Research Unit, were obtained.

In the field work, information about the national park forest fire of 1997, which is classified as a direct cause of degradation, has also been collected. Regenerating vegetation consisting of leafy trees and cypress-dominated vegetation generated after the fire is investigated on the spot. In 2011, other silvicultural inventions such as cleaning and thinning of trees, harvesting fire-resistant and beneficial to wildlife plants (*Nerium oleander*, *Cappari spinosa*, *Spartium Junceum*, *Arbutus andrachne* and etc.) were recommended by the Antalya Directorate of Forestry and the district directorate of Forestry Düzlerçamı, based on the Rehabilitation of Burned Areas and the Establishment of Forests with Fire-Resistant Species Project. Detailed information about the forest fires held in the pilot site can be found in Section 2.4.

This oral and demographic information from the field work and land-use data obtained from the local state organizations are combined to create a series of descriptive maps, which formed the basis for a spatial analysis of the links between land-use practice and deforestation in the test site. To establish the causes of deforestation and degradation and to create these maps, GIS is used. Thanks to GIS, qualitative and quantitative local knowledge is combined to examine recent findings and trends relating to community forests.

Considering the effects of the interviews and collected data, the extent of degradation and deforestation together with their carbon impact has been determined in Table 6. The presentation and discussion of the evaluation and ranking was made during the FFEM meeting held in Antalya on May 27-28, 2014. These stakeholders consultation meeting was organized to discuss and review the assessment report. In the following chapters, each effect will be discussed in detail.

Table 6: Direct causes of deforestation and degradation in Düzlerçami

Direct pressures on forest cover		Carbon impact on forest cover	Impact
Expansion of infrastructure			
Urbanization		<p>DEFORESTATION direct impact through construction and potentially</p> <p><i>Pilot site Düzlerçami become an attractive place for immigrants to settle due to its close proximity to Antalya Metropolitan Municipality, which makes serious pressure on forested areas to be converted to urbanized area. Local authority then has to do regulations to meet the requirements of the urbanization. Besides losing of forest land, the areas subjected to urbanization are also fertile lands in terms of wood production and tree species. Especially, Pinus brutia, which has an approximately annual growth of 10 m³/ha, covers the most of the forested land. Therefore, it can be estimated that the decrease of the forested areas can cause the less carbon fixation on the pilot site.</i></p> <p>DEGRADATION through the increase of encroachments by population such as constructing high voltage transmission lines, recreation places and etc.</p> <p><i>The increased population in the test site causes forest degradation by infrastructure investment such as energy transmitting lines and new highways. These investments not only cause a deforestation, but also cause less carbon sequestration by degrading of forests.</i></p>	High
Tourism (recreation)		<p>DEGRADATION (through trampling of sprouts, soil compaction and increase of forest fire risks)</p> <p><i>The pilot site forest have unique habitat that meets recreation, ecotourism, sightseeing and hunting activities. However, due to these activities forests have faced degradation and carbon sequestration. It has to be underlined that forest recreation has been established as a</i></p>	High

		<i>locus in forest for a growing urban population.</i>	
Mining		<p>DEFORESTATION</p> <p><i>Even though mining is one of the important driver in terms of deforestation in Turkey, for the pilot site it is not an important factor because of its characterization as a Wildlife Protection and Improvement Area. However, considering entire forests in Turkey, this driver has a potential for mitigation for the fragile pilot site forests and for carbon sequestration.</i></p>	High
Agro-pastoral expansion			
Overgrazing (by local people)		<p>DEGRADATION through: grazing of sprouts and acorn assumption in oaks forests, which limit the natural regeneration and lead to progressive aging of forest</p> <p><i>2304.8 ha in the site is subject to grazing. Even if there is no serious overgrazing problem on the site, still there is grazing effect on especially maquis areas where the oak and other shrubs distributed. Therefore trees and shrubs loose the leaves where CO₂ is accumulated via photosynthesis. Additionally overgrazing has an impact on the success of natural and artificial regeneration. Even if this driver has medium impact on degradation still it may be used for mitigation via planning grazing an applying rotation system and encouraging the villagers for livestock breeding.</i></p>	Medium
Wood extraction			
Firewood, heating for a domestic purpose		<p>DEGRADATION, through the collection of branches and twings fallen from trees and shrubs for feeding animals and heating.</p> <p><i>Firewood usage due to rising CO₂ emissions decreases the carbon sequestration, and collecting/cutting green branches for feeding animals causes less CO₂ accumulation. This driver may be used for mitigation by raising the awareness of villagers that they can be made to use stone,</i></p>	Low

		<i>concrete and corrugated iron instead of wood in houses or other buildings. Also, to make saving the use of solar energy can be encouraged.</i>	
Other direct causes			
Forest fires		<p>DEGRADATION of certain types of ecosystem</p> <p><i>Even though all the burned areas have immediately reforested by forest service in Turkey, it is observed that the areas restored with reforestation present low levels of natural regeneration, and there are decreases in the level of mean annual wood production. These facts make the forest fire impact on carbon accumulation apparent. This impact may be weakened by taking some measurement and developing new firefighting systems for forest fires.</i></p>	Medium

2. INFORMATION COLLECTED FOR THE ANALYSIS OF AGENTS AND DRIVERS

2.1 Location of the pilot site in its environment

The following maps are provided to show an overview of the entire forest system and the neighbours of the test site by using GIS media (Fig.3-12).

Pilot site boundaries:

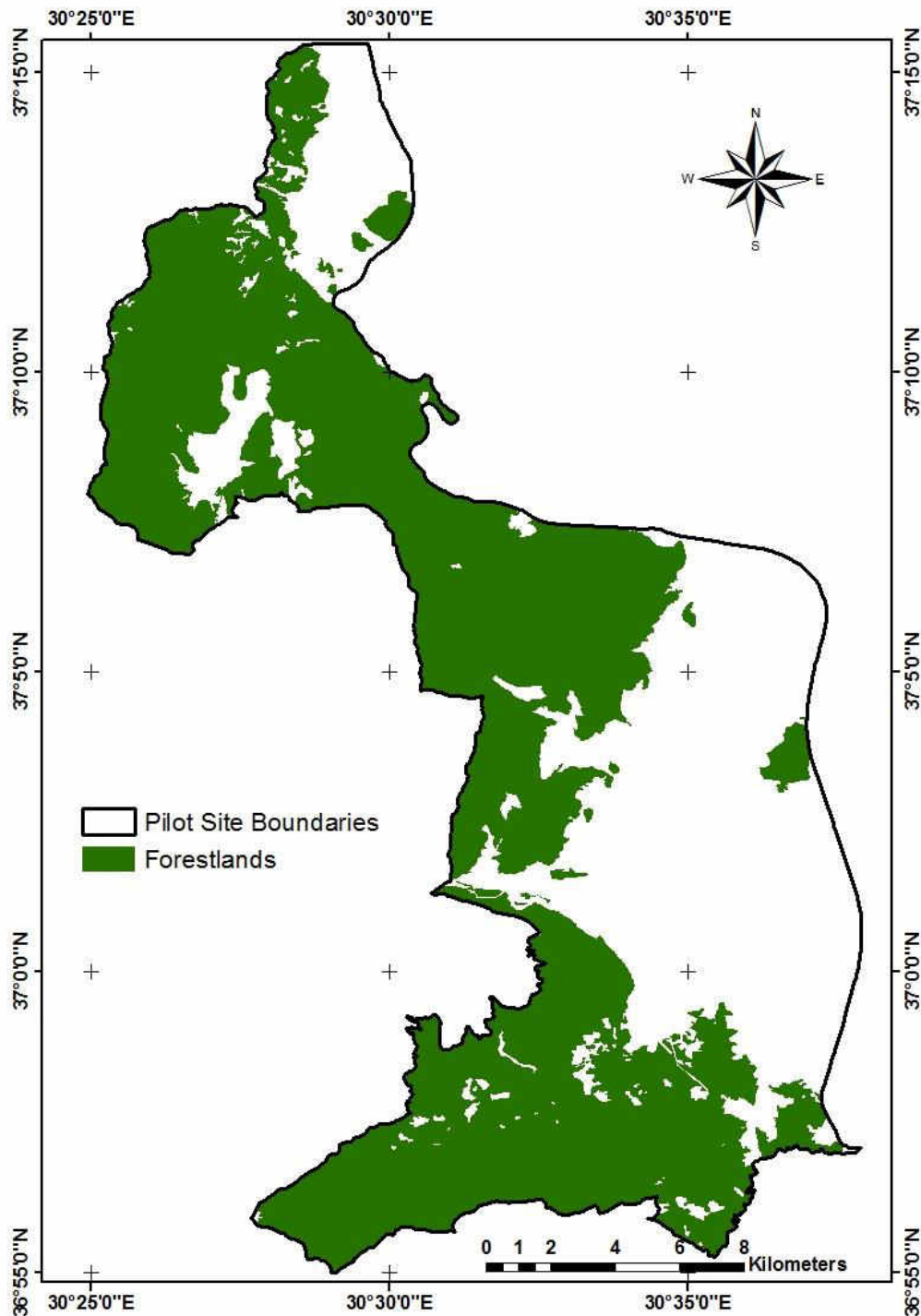


Fig. 3: Pilot site boundary

In the test site, as in Turkey, all the forests are state-owned and administrated by the General Directorate of Forestry

• Administrative categories and land use rights:

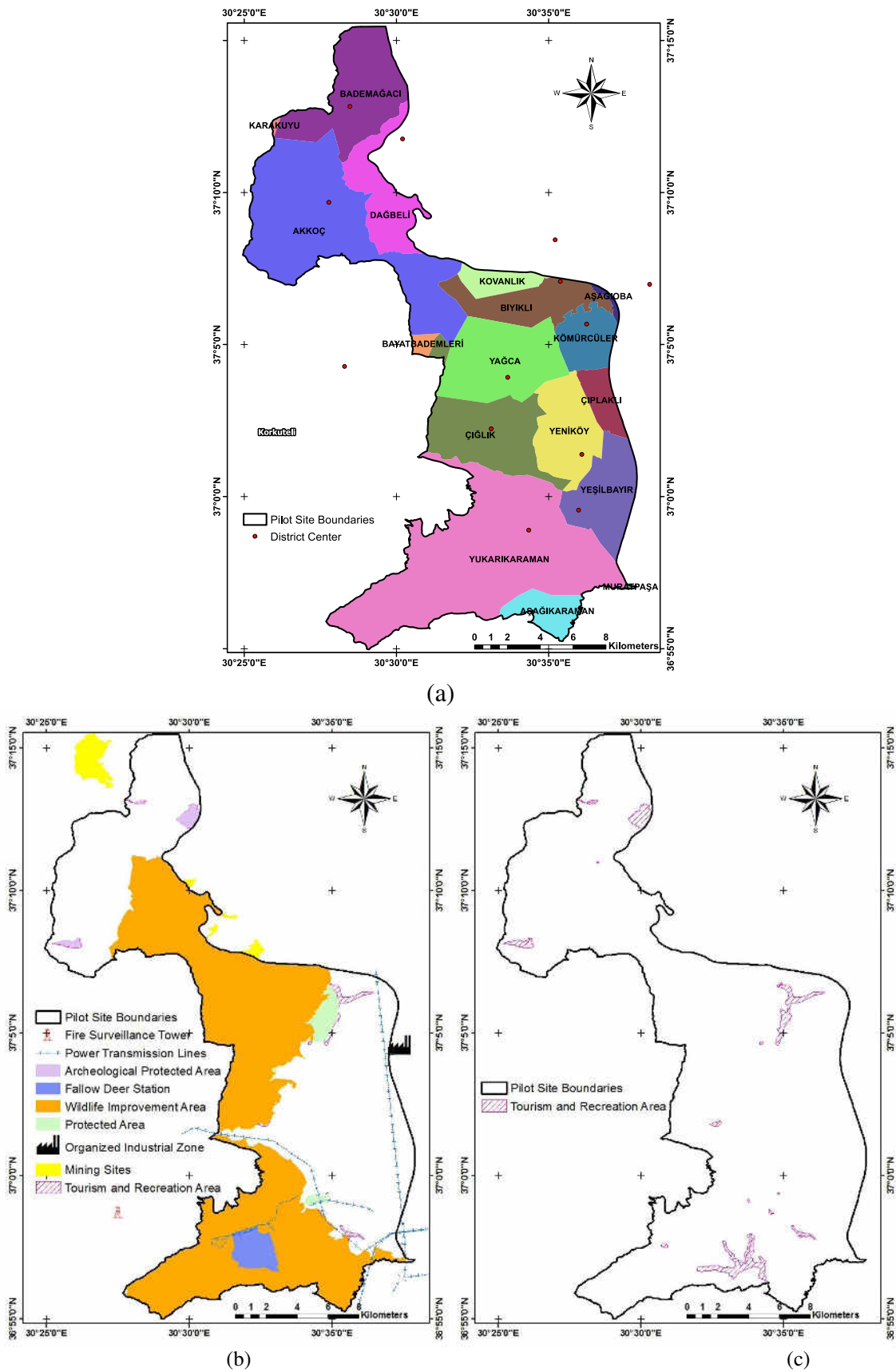


Fig. 4: (a) Administrative units in the pilot site, (b) land uses dedicated to agent groups such as residential area, rural areas, forest lands and mining c) tourism and recreation area

Forest management systems:

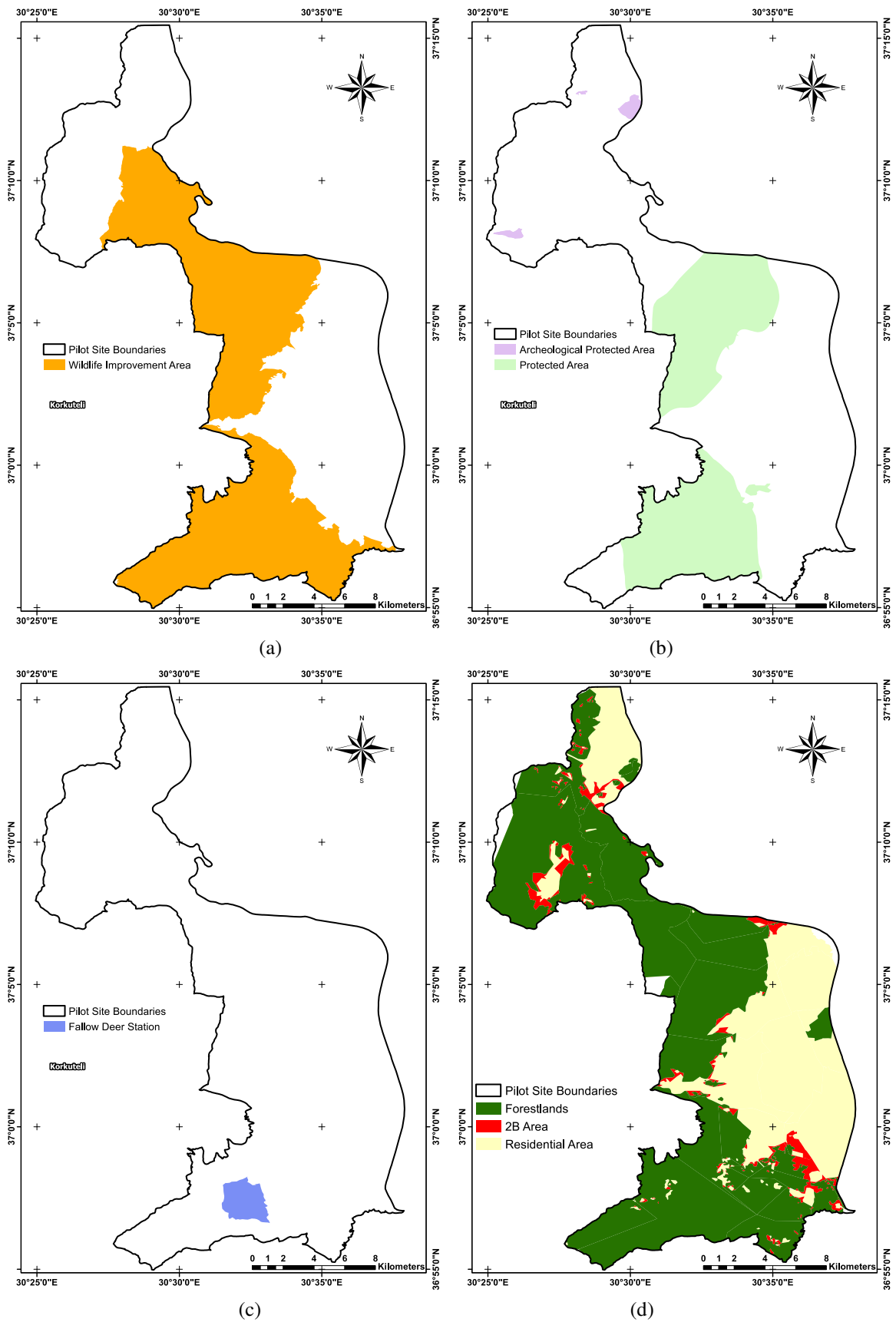


Fig. 5: Forest management units including (a) wildlife protected and improvement areas, (b) protected areas, archeological protected areas (c) fallow deer stations, (d) 2B lands

• **Biophysical data:**

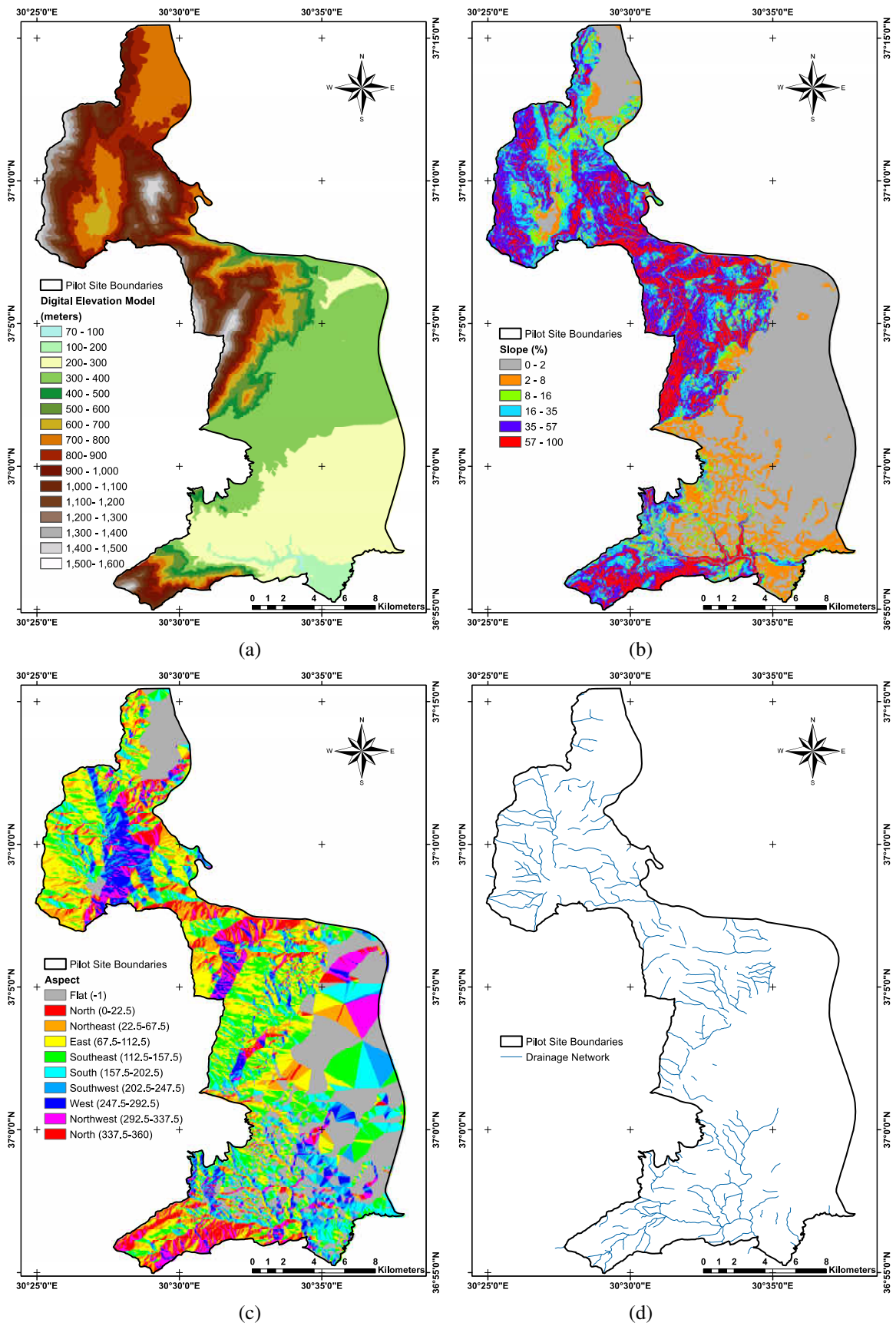


Fig. 6: Biophysical data including (a) altitude map, (b) slope map, (c) aspect map and (d) hydrographic network map produced from 1/25000 scale topographic maps

Delineation of slope classes produced from topographic map at a scale of 1:25000 shows that the further north, the less the slope (Table 7). This distribution of slopes effects land use and diversity of vegetation.

Table 7: Plan of operations in Table 2 based on slope classes going to be finished by 2021

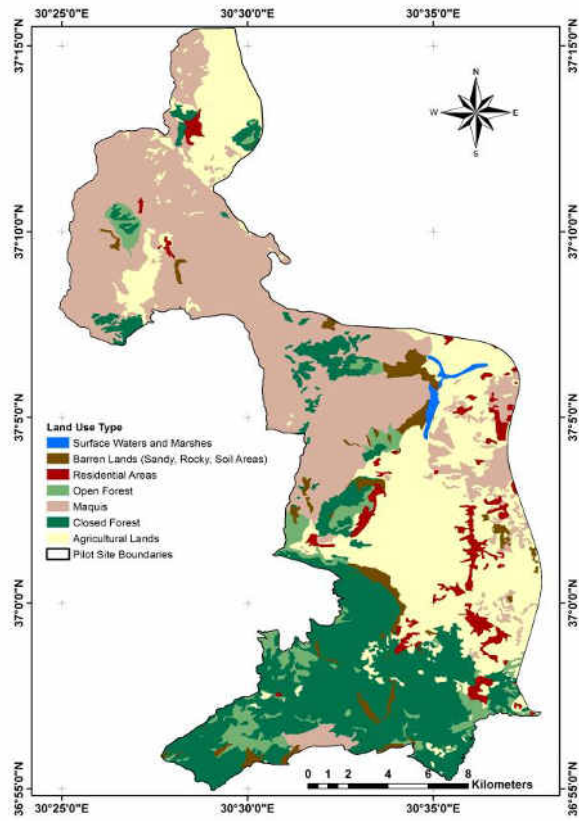
Operations	Flat <4% (ha)	4-9% (ha)	10- 17% (ha)	18-36% (ha)	37-57% (ha)	58- 100% (ha)	>100% (ha)	Total (ha)
A	430.80	184.1	3.1	75.1	114.5	4.7		812.30
C	33.20	3						36.20
D	706.60	2067.8	581.8	1643.6	2960.3	1095.6		9055.70
E		10	78.1	725.1	400.2	20.1		1233.50
F		19.5						19.50
G		0.1						0.10
H								0.00
I	21.30				2			23.30
J	7.90							7.90
Total	1199.80	2284.50	663.00	2443.80	3477.00	1120.40		11,188.50
%	11	20	6	22	31	10	0	100

- **Stand and the closure maps:**

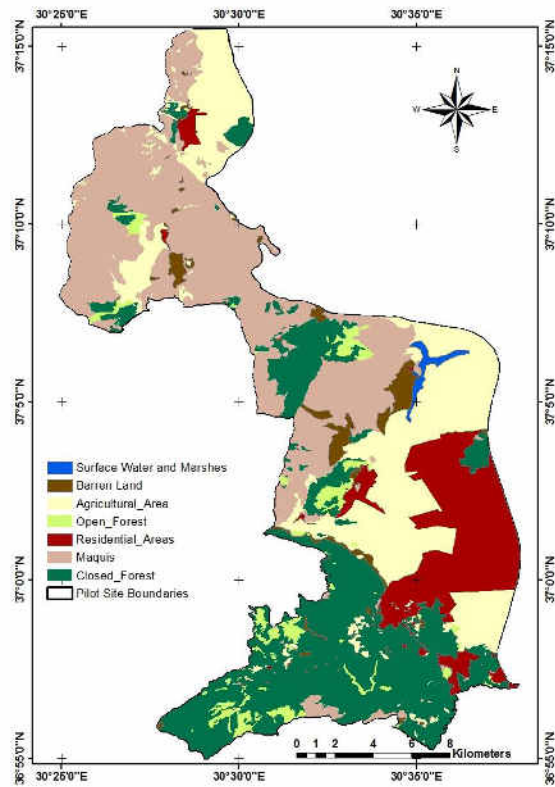
In Fig. 7, for sake of simplicity, not all the information has been shown. The maps in Fig. 5 are made from the stand maps of 1997 and 2012 by merging forest closure classes 1, 2 and 3 into a single class entitled *closed forest* and by creating a single class entitled *open forest* showing the degraded forest land. According to Turkey forest closure standards:

- Canopy covers 10% or less : degraded forest land(**B**)
- Canopy cover between 11-40% : very wide spacing(**1**)
- Canopy cover between 41-70% : medium spacing(**2**)
- Canopy cover 71% or greater : unspaced (**3**)

Closed forests occur in the south of the test site, and they continue to decrease and maquis begin to develop. Although some open forests are found in the areas having a slope more than 16%, all maquis and the associated species are found in these areas (Fig. 8).

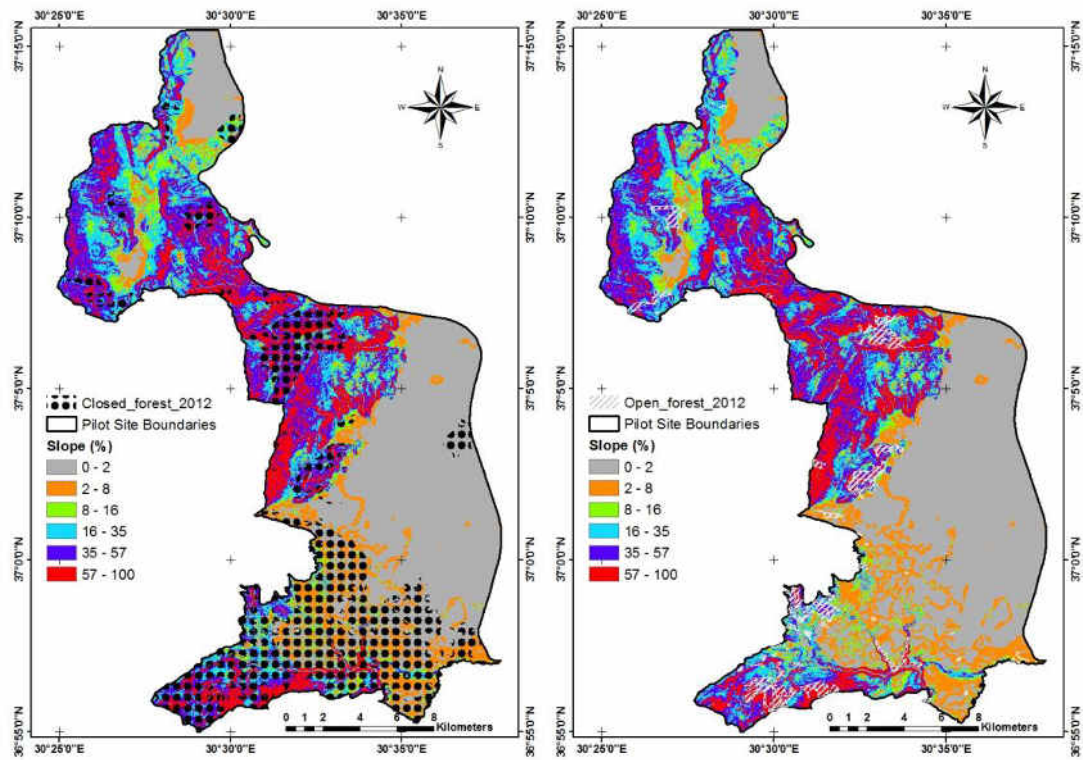


(a)



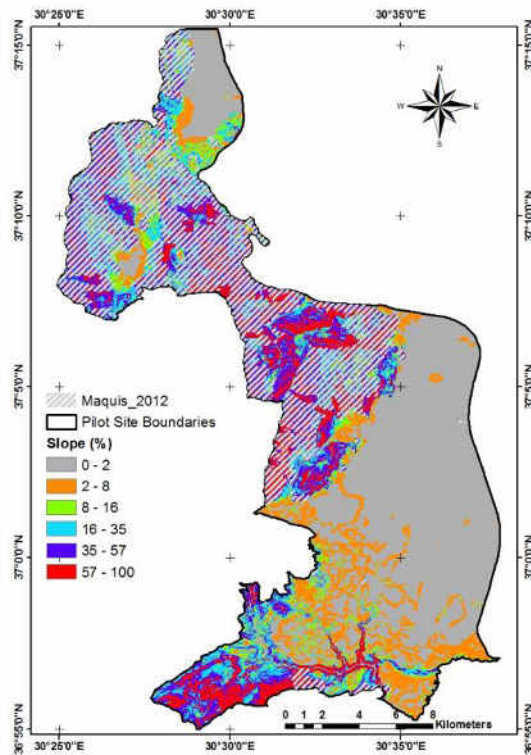
(b)

Fig. 7: Forest stand maps produced in (a) 1997 and (b) 2012



(a)

(b)



(c)

Fig. 8: Slope groups and forests, 2012 (a) closed forest (b) open forest (c) maquis

• **The level of protected area:**

The protected areas inside WIA and the distribution of vegetation in terms of species in these areas are shown in Fig. 9 and Table 8. In Fig. 6 and Table 4, forests inside the WIA and absolute protected areas are classified as protected forests, the other parts of the WIA are classified as “protected logging” areas, and places outside the WIA are classified as logging forests.

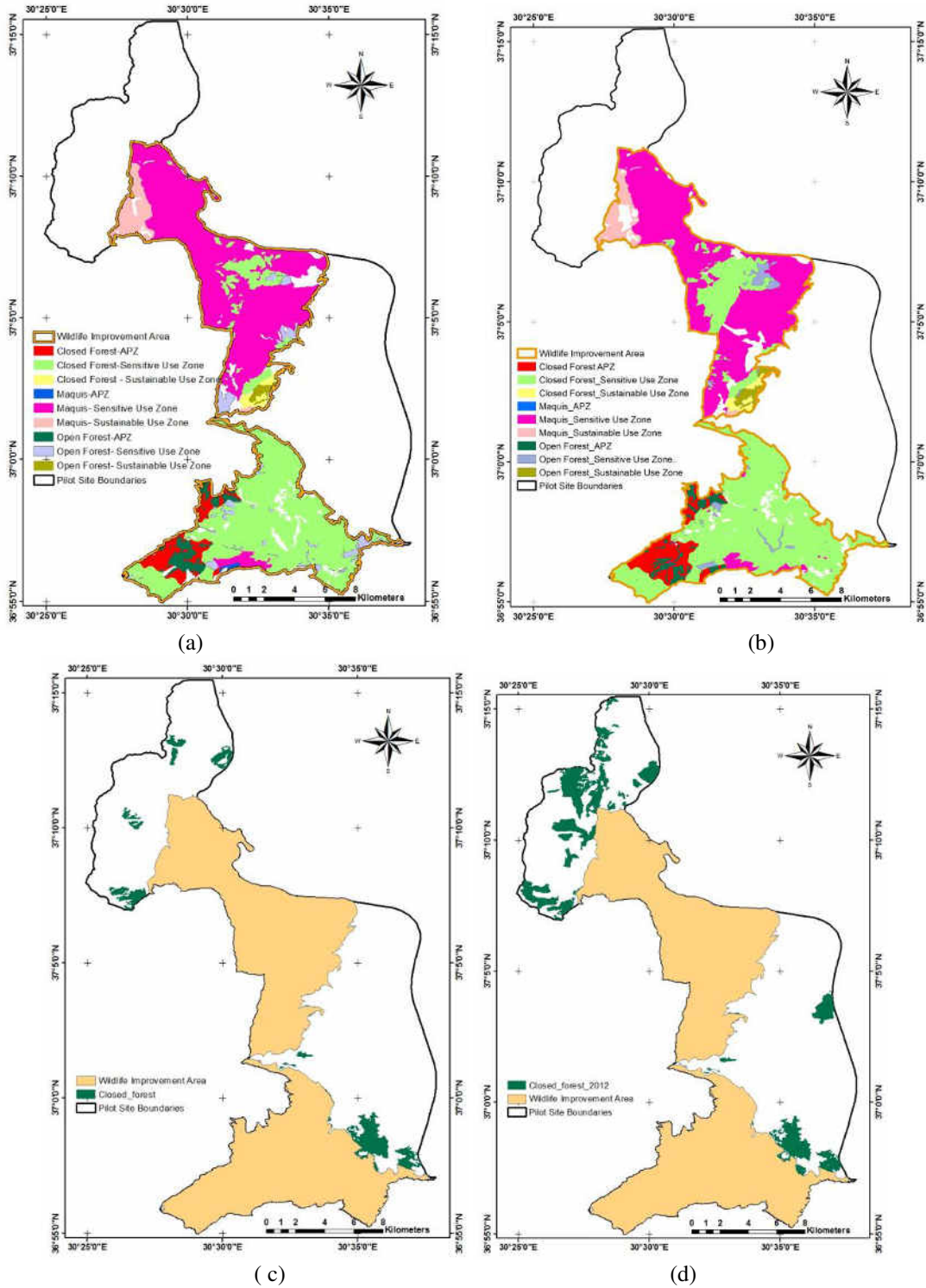


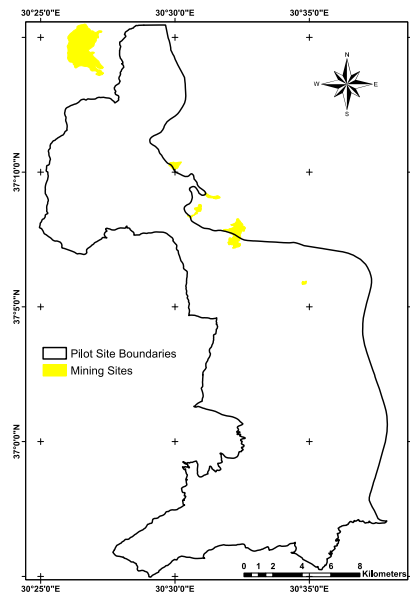
Fig. 9: The level of protected forests (a) 1997 (b) 2012 and managed forests outside WIA (c) 1997 (d) 2012

Table 8: Temporal evaluation of the forest types based on the level of protected zones

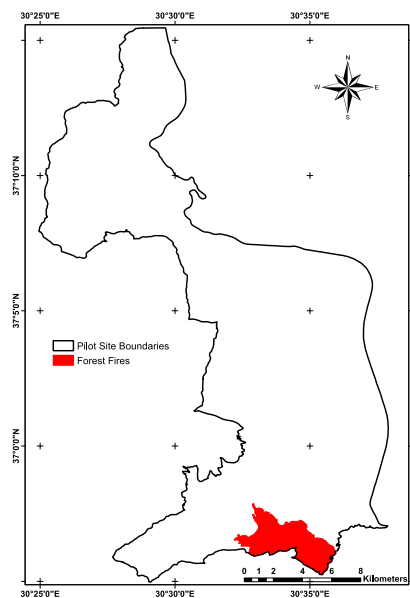
	Absolute Protected zone (ha)		Sustainable use zone (ha)		Sensitive use zone (ha)		Managed forests outside WIA (ha)	
	1997	2012	1997	2012	1997	2012	1997	2012
Maquis	32.52	6.12	572.86	484.33	5418.94	4986.97		
Open Forest	391.08	336.12	96.55	154.85	604.42	336.15		
Closed Forest	569.95	728.50	140.94	137.51	5176.58	5939.36	922.90	1134.43
Total	993.55	1070.74	810.35	776.69	11199.94	11282.48	922.90	1134.43

• **Location of mining activities and of the forest fire held in 1997:**

Location of the mining activities in the test site and in its neighbourhood are shown in Fig. 10 (a). The border of the 1997 forest fire is given in Fig. 10 (b).



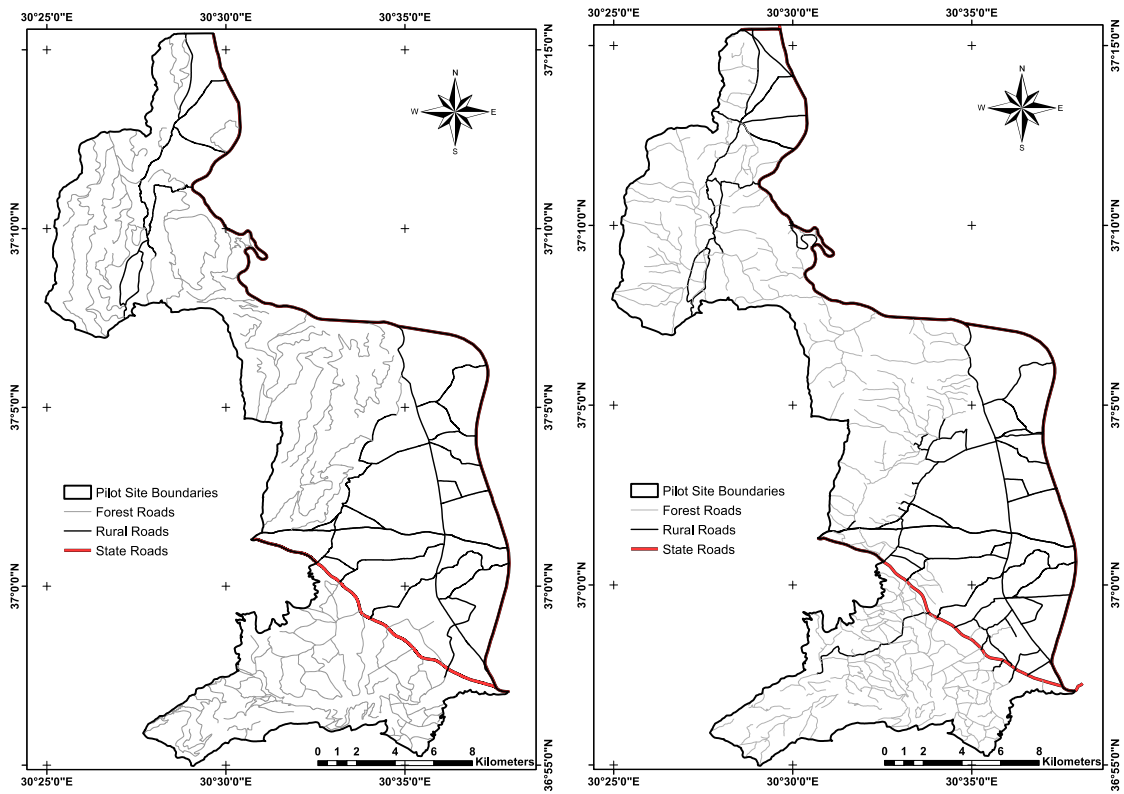
(a)



(b)

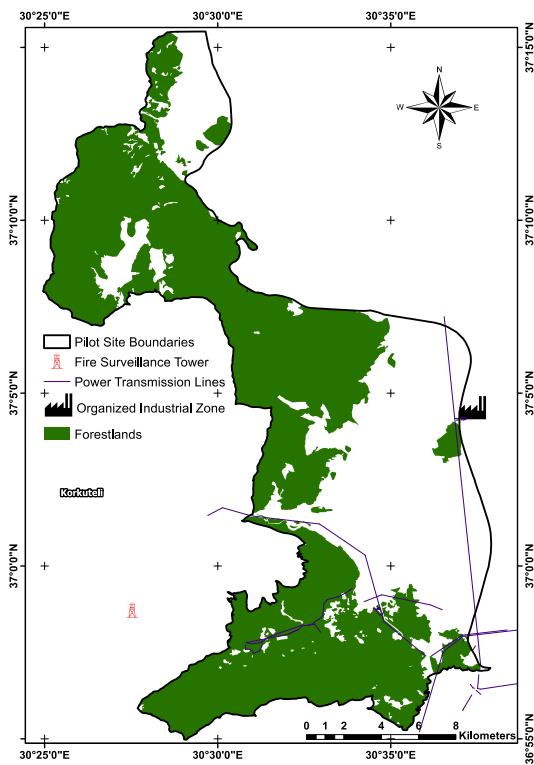
Fig. 10: (a) Location of the mining activities in the test site and in its neighbourhood (b) 1997 forest fire area

• Roads and power transmission lines:



(a)

(b)



(c)

Fig. 11: Temporal road maps produced from forest stand maps of (a) 1997 and (b) 2012 (c) power transmission lines

• Soil type and grazing plan:

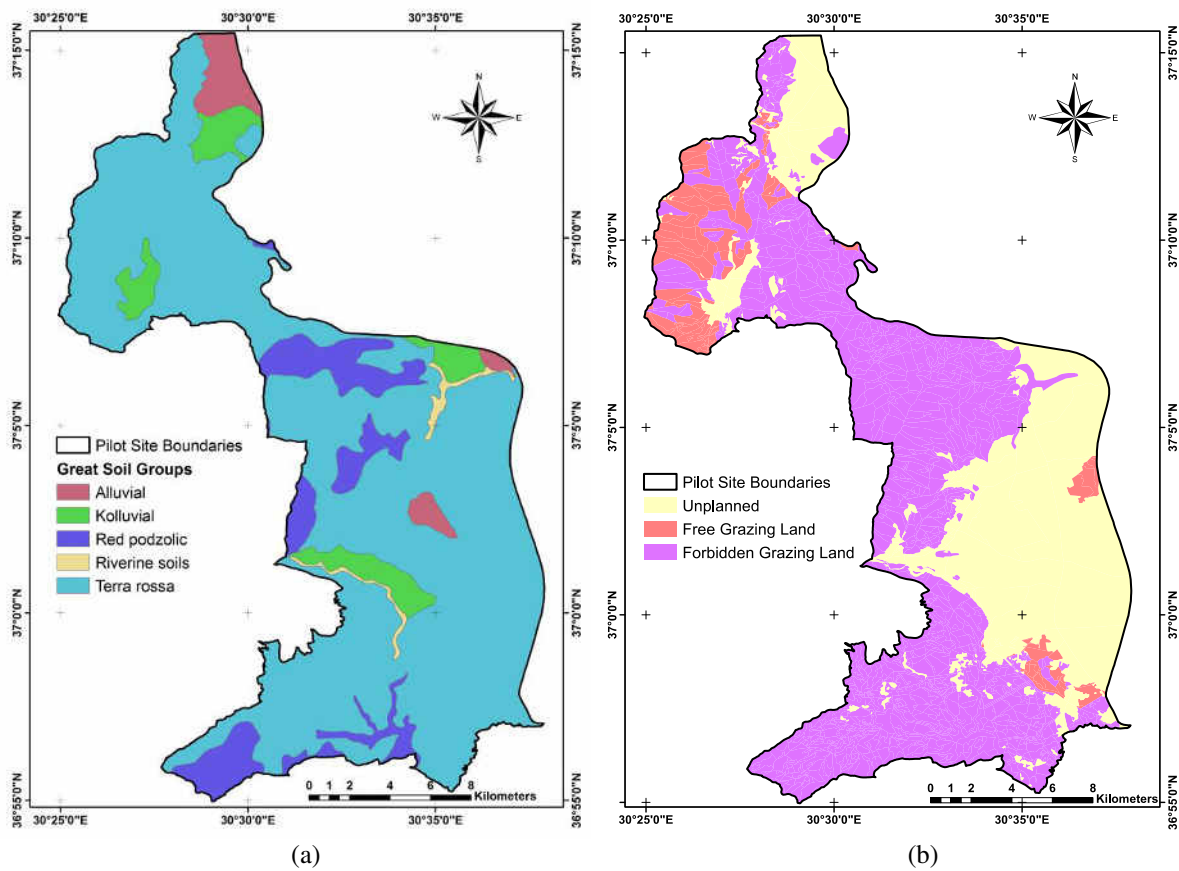


Fig. 12: Soil type (a) and (b) grazing plan

2.2 Land-use changes

2.2.1 Review on stand-map production in Turkey

To analyse the direct and indirect causes of deforestation and forest degradation temporally, the forest stand maps produced in 1997 and 2012 by the GDF due to the combination of information from various sources into one map are examined (Table 9). The existing stand maps used in this analysis are:

Table 9: Existing forest stand maps used in temporal analysis

Name and institutions	Covered dates	Scale	Characterized land uses	Data source	Used methodology	Available format
General Directorate of Forestry	1997-2006	1: 25000	See Table 2	Forest_stand Map (Fig. 7(a))	Field measurements, aerial photographs	digital
General Directorate of Forestry	2012-2021	1: 25000	See Table 2	Forest Stand Map (Fig. 7(b))	Field measurements, aerial photographs, satellite image	digital

In Turkey, the forest management plans for the whole country were completed between 1973 and 1991, studies of modernization have been done from 1991 to 2008, and functional planning started in 2008. Considering the plans from 1997 and 2012, field surveys were made according to the aerial photographs and fieldwork; however, there were differences in terms of the way they were made. In the classical approach, the operation classes are divided into categories depending on time of management and type of trees. The limits of operation classes are established either in natural or artificial routes or in stand-type borders. The fields in the same operation class are grouped under the same name. The 2012-year plan was made according to the basics of functional planning. Within this new approach, the divisions of operation classes are based on forestry functions. Contrary to the classical approach, the criteria such as the type of trees or time of management are not taken into account as to operation class divisions. The influence of these criteria comes into play spontaneously while establishing foundations and planning the flow of production. The division of operation classes due to the functional approach involves four steps as the following:

- dividing forestry functions and including the borders on the map
- sorting out the function maps by uniting them
- dividing the one-functional and multi- functional areas on the function map
- limiting the fields in the same one-functional or function group as separate operation classes and naming them [7].

According to the new approach, in the areas where functional planning will be made, a letter will be sent from the local directorate of Forestry one year in advance to relevant institutions such as local governors, non-governmental organizations and all the interest groups, informing them about the work to be done. In this way, suggestions about the lands occupied by different functions will be taken into account. Considering these suggestions and current

land use practice, a draft of the function map will be prepared. These maps will be given to the planners of the local directorate of Forestry before the fieldwork for stand map production.

To produce the 2012 stand map, a topographic map at a scale of 1:25000 produced by General Command of Mapping was used. Using this topographic map, old maps, aerial photographs, Google earth and satellite images; the draft map was produced. This stand map was controlled in the field and then finalized.

However, with stand map production, the statistical and spatial information of forest with various types has been established, which strengthen the forestry information system constantly. The main content includes quantitative and qualitative information such as seed types, tree species, silviculture and nurseries. During the 2012-stand map production campaign, the recent forest inventory was designed by following systematic grid (300 x 300 m) using ground measurements. The fieldwork included not only tree measurements, but also interviews with landowners on topics such as land use and forest requirements.

- **Types of forestry statistics**

When the plans in 1997 and 2012 are compared, all data related to the 1997 year plan could not be recovered. For this reason, the detailed analysis of the plan covering the 2012-2021 period is given. Considering the distribution according to logging classes, it can be seen that there were more productive forests in 1997 and there was an increase in degraded areas. It can be assumed that the degraded areas will have increased by 2021 (Table 10). Spatial distribution of the forestry operations held in 2012 stand map production based on closure, of tree species and of tree ages are given in Table 11, Table 12 and Table 13, respectively. Also areal expansion of open forest soil, high voltage lines and marshland given in Table 14.

Table 10: Forest distribution according to logging class

Plan date	Operations	High Forest(ha)				Degraded (ha)	Coppicie (ha)		Forested Area (ha)	Non-Forested (ha)	TOTAL (ha)
		Productive					Productive	Degraded			
		71-100% closed	41-70% closed	11-40% closed	Total 11-100 %	0-10%					
1997-2006	A	3370	2558	941	6869	11353		603	18,825	10,534	29,359
		11%	9%	3%	23%	39%		2%	64%	36%	100%
2012-2021	A	572.5	176.2	63.6	812.3	70.6			882.9	10,047.6	10,930.5
	B									22.4	22.4
	C		30.9	5.3	36.2				36.2		
	D	6232.7	2146.6	676.4	9055.7	4045.2			13,100.9	1029.1	14,130
	E	980.8	215.5	37.2	1233.5	2367.6			3601.1	12	3613.1
	F		19.5		19.5				19.5		19.5
	G		0.1		0.1				0.1	23.1	23.2
	H						15.8		15.8	343.1	358.9
	I	5.8	17.5		23.3				23.3	2.8	26.1
J	5.5	2.4		7.9	0.4			8.3		8.3	
TOTAL		7797.30	2608.70	782.50	11,188.50	6499.60	0.00	0.00	17,688.10	11,480.10	29,132.00
Difference (%)		15		-1	15	-17			-4	3	-1

Table 11: Tree species distribution due to the stand map of 2012

Tree species distribution(ha) 2012														
Operations	<i>Pinus brutia</i>	<i>Cedrus sp.</i>	<i>Juniperus sp.</i>	<i>Pinus pinea</i>	<i>Cupressus sempervirens</i>	<i>Pinus halepensis</i>	<i>Platanus orientalis</i>	Ocaliptus	Almond	Maquis	Mixed Coniferious	Mixed Decidious	Coniferious +Decidious	Total
A	816.40									7.9			58.6	882.90
C				30.9					5.3					36.20
D	6359.00	1.3	509.1	28.6	0.7	2.2		1.1		4819.9	545.1	171.2	662.7	13,100.90
E	150.60									3275.3			175.2	3601.10
F	19.50													19.50
G	0.10													0.10
H										15.8				15.80
I	21.30						2							23.30
J	6.70				0.5					0.4	0.7			8.30
Total	7373.60	1.30	509.10	59.50	1.20	2.20	2.00	1.10	5.30	8119.30	545.80	171.20	896.50	17,688.10
%	41.7	0	2.9	0.3	0.0	0.0	0.0	0.0	0.0	45.9	3.1	1.0	5.1	100.0

Table 12: Spatial distribution of the forestry operations held in 2012-stand map production based on closure

Operations	High Forest (ha) (Closure)					Total(ha)
	3 (71%-100)	2 (41%-70)	1 (11%-40)	Total (11%-100)	Degraded (0%-10)	
A	572.50	176.2	63.6	812.30	70.6	882.90
B				0.00		0.00
C		30.9	5.3	36.20		36.20
D	6232.70	2146.6	676.4	9055.70	4045.2	13,100.90
E	980.80	215.5	37.2	1233.50	2367.6	3601.10
F		19.5		19.50		19.50
G		0.1		0.10		0.10
H				0.00	15.8	15.80
I	5.80	17.5		23.30		23.30
J	5.50	2.4		7.90	0.4	8.30
Total	7797.30	2608.70	782.50	11,188.50	6499.60	17,688.10
%	44.1	14.7	4.4	63.3	36.7	100.0

Table 13: Forest ages obtained in 2012-stand map

Age Class	A	B	C	D	E	F	G	H	I	J	TOTAL
I	119.1		5.3	1579.6	738.5						2442.5
II	362.4		25.7	2171.8	364				7		2930.9
III	148.8		5.2	976.7	33.4	19.5			0.9		1184.5
IV	152.4			523	20.1						695.5
V	65.4			210.9							276.3
VI	12			417.2			0.1		6.5		435.8
VII	301.8			675.9	1.7						979.4
VIII	425.3			1413.1	75.8				1.3		1915.5
IX				105.1							105.1
X				666.1							666.1
XI				105.1							105.1
XII				211.2					15.5		226.7
TOTAL	1587.2		36.2	9055.7	1233.5	19.5	0.1		31.2		11,963.4

Table 14: Areal expansion of open forest soil, high voltage lines and marshland-2012 stand map

Operations	Forested land (ha)	Open Forest Soil(ha)	High Voltage Line(ha)	Marshland(ha)	Open Mining Area
A	882.90	39.8	8.6		3.1
B					
C	36.20				
D	13100.90	77.4			33.8
E	3601.10				
F	19.50				
G	0.10				
H	15.80			161.5	
I	23.30				
J	8.30				
Total	17688.10	117.20	8.60	161.50	36.9

The 2012 stand map includes also the class of agricultural land, orchard (planted fruit), vineyards etc. In the region mostly pomegranates are produced as well as other fruits and vegetables. Since 2010, in the 7 districts of Antalya, the following amount of pomegranates have been produced (Table 15):

Table 15: Average of two years yield for pomegranates in the districts of Antalya

Aksu	1280 tons
Döşemealtı	12,044 tons
Serik	12,009 tons
Kepez	10,043 tons
Finike	6075 tons
Konyaaltı	5817 tons
Kumluca	4000 tons

Since 2012, 104421 tons of pomegranates have been produced in Antalya, which represents the 33.13% of all pomegranate production in Turkey.

The amount of production of some of the fruits related to 2011 and 2012 have been obtained and given in Table 16 and 17 to give a general idea about the products of the region. Additionally, pine nut and almond are gourmet non-wood forest products in the region (Table 18). However, the commercial importance of these products for nearby local communities is underestimated.

Table 16: 2011 and 2012 annual apple/orange/grape/tangerine yields

Fruits (Ton)	Apple		Orange		Grape		Tangerine	
	2011	2012	2011	2012	2011	2012	2011	2012
Antalya	186,562	185,181	470,761	487,754	28,039	29,354	36,436	37,514
Döşemealtı	295	347	1644	1674	2000	1350	164	172

Table 17: 2011 and 2012 annual wheat/barley/corn/potato yields

Grain (Ton)	Wheat		Barley		Corn		Potato	
	2011	2012	2011	2012	2011	2012	2011	2012
Antalya	278,480	259,798	157,451	122,892	99,395	169,800	35,355	37,010
Döşemealti	10403	10441	3831	4410	13750	18000	1050	1079

Table 18: 2012 annual pine nut and almond yields

Non-wood products	Area (Ha)	Growing Stock (m3)	Volume Increment(m3)
<i>Pinus pinea</i>	25.7	596	38
<i>Pinus pinea</i>	5.2	553	15
Almond	5.3		
Total	36.2	1149	53

An other aim of the production of stand maps is to have a sustainable forest management. In the forests operated by sustainable forest management, reforestation is realized through silvicultural techniques, which stimulates natural regeneration. Lots of forests have been operated by this way without any negative influence on their fertility or other functions for centuries. Carbon emissions during harvest is offset by means of regrowth and even harvested forestry products such as wood, keep and store carbon until it burns or decays. Reforestation and nature regeneration play an important role in stabilizing the climate. Nature regeneration enhances the quality of the forest and increases its capacity for carbon stock. The maintenance and regeneration of the forests in the field in Düzlerçamı are carried out according to the law in a planned way. The maintenance and regeneration made can be seen in Table 19 and 20.

Table 19: Annual regeneration operations done by the district directory of Düzlerçamı

Year	Regeneration (m ³)	Forest Tending Operations(m ³)	Harvested Wood Product (m ³)	TOTAL (m ³)
1997	1229		330	1559
1998	18102	4669	4564	27335
1999	1875	8007	1376	11258
2000	621	6500	36	7157
2001	-	3829	1328	5157
2002	-	859	865	1724
2003	-	7317	547	7864
2004	548	1677	2568	4793
2005	850	2422	1002	4274
2006	3577	1987	781	6345
SUM	26802	37267	13397	77466

Table 20: Temporal regeneration operations managed by the Directorate of Forestry

Düzlerçamı		1997-2006 (ha)				2012-2021 (ha)		
		Regeneration Land	Successful Regeneration	Unsuccessful Regeneration	Unstarted Regeneration	Re-Generation In Regenerated Areas	New Regeneration Area	Total Regeneration Area
Date	Type							
1997-2006	A	729.5	713.8	4.3	11.4			
2012-2021	A						32.7	32.7
	B							
	C							
	D					15.7	135.6	151.3
	E							
	F							
	G							
	H							
	I							
	J							
Total		729.5	713.8	4.3	11.4	15.7	168.3	184
%		100	97.8	0.6	1.6	8.5	91.5	100.0

- **Pests**

Harmful insect pests and diseases cause as much damage to forest areas at least as much as forest fires, reducing renewal ability, quality and quantity of forest resources. In Turkey, around 50 varminths (insect pests, fungi, etc.) have a harmful impact on approximately 2 million hectares of wooded land every year and cause the loss of an average of around 1 million m³ of wood products. Works are carried out throughout the county aiming to transfer bird nests and ant colonies, to increase the production of beneficial insects, to set up beneficial insect laboratories and to improve their production capacity, and to increase the resistance of forests against forest pests by appropriate silvicultural techniques (Photo 3) [8].



Photo 3: (a) Bird nest (b) Production of *Calosoma sycophanta* L. (c) Trap tree

GDF continuously monitors pests and diseases, and combats approximately on 500,000-800,000 ha infected area each year, through mechanic, chemical, bio- technique and biological methods (Table 20). The annual cost of this work is around 2-4 million \$[9].

Table 21: Turkey's annual pests and diseases combat [8]

	2008 (ha)	2009 (ha)	2010 (ha)	2011 (ha)	2012 (ha)	2012 (Turkish Lira)
Biological	128475	144109	178987	163279	108641	1283027
Biotechnical	127479	136375	120875	103545	94913	1068726
Mechanical	231558	203855	188276	144781	93991	949268
Chemical	102415	113550	76184	59681	39741	506627
Total	589927	597889	564322	471286	337286	3807648

In the pilot site, *Thaumethopoea pityocampa*, *Orthotomicus erosus*, *Blastophagus piniperda*, *Rhyacionia buoliana* and *Tomicus destruens* are harmful pests for the forestland. The General Directorate of Antalya monitors pests and diseases and combats especially bio-technique and biological methods (Table 22).

Table 22: Antalya's annual pests and diseases combat [10]

Year	2006	2007	2008	2009	2010
Number of bird nests	225	3095	3000	3550	3000
Number of ant Transplantation			44	50	30
Number of production of beneficial insects	10,000	10,000	10,500	22,670	27,260
Number of laboratory of beneficial insect	2	2	2	5	6
Number of personnel	7	7	6	15	15
Budget (Turkish Lira)	345,607	311,802	398,081	395,364	311,778

Any important effect due to harmful insects has not been observed neither in the field work in the pilot site nor in the interviews with authorities. However, there are few studies on risky areas. Under the General Directorate of Forestry, there is a unit entitled Department of Combating Forest Pes. One of the aims of the strategically plan of Antalya Forestry Directorate from 2010 to 2014 is to increase the capability to fight against harmful things in the forests and within this framework to enhance mechanical, biological and biotechnical fight.

In the chemical fight, chemical medicines are used. In order to fight Pine Processionary Moth (PPM) biologically predator insects are produced in the laboratory. The produced *Calasoma* larvas are put in nature where PPM gives harm to the environment. The General Directorate of Antalya has done the following operations in Düzlerçamı test site in 2013:

- By building 130 islet (Photo 4), PPMs have been biologically fought in a 2600 ha area.
- 3000 bird nests have been built to enhance the bird population
- *Orthotomicus erosus* is fought using biotechnical methods.



Photo 4: An example from islet

In 2013 in a 1885 ha area there was a biotechnical fight against *Orthotomicus erosus* (in 900 ha), *Orthotomicus tridentatus* (in 100 ha) and *Thaumethopoea pityocampa* (in 200 ha) using pheromones.

- **Carbon Budget**

Carbon is stored in different amounts in different closure percentages, and changes in vegetation cover are used in order to find out the yearly changes in carbon in the particular area [11]. When we examine the data related to closure in Table 23, it can be seen that there has been a 15% increase (4427.3 ha) in the closed forests having the closure class 3, a 0.1% increase (50.7 ha) in the closed forests with the closure class 2 and a 1% decrease (4319.5 ha) in the closed forest characterized by the closure class of 1. These differences are due to the development of forests, changes in closure or evaluation of the chief engineer who is responsible for planning. There has been a 12% decrease (4853.4 ha) in degraded areas and a 2% increase (946.1 ha) in deforested areas.

Table 23: Temporal regeneration operations and clousere managed by the directorate of Forestry

Düzlerçamı		High Forest (ha)				Coppice (ha)			Total Forest	Total Unforested	Total
Plan date	Operations	Productive				Degraded	Productive	Degraded			
Closure		71-100	41-70	11-40	11-100	0-10%					
1997-2006	A	3370	2558	941	6869	11353		603	18825	10534	29359
		11%	9%	3%	23%	39%		2%	64%	36%	100%
2012-2021	A	572.5	176.2	63.6	812.3	70.6			882.9	10,047.6	10,930.5
	B									22.4	22.4
	C		30.9	5.3	36.2				36.2		
	D	6232.7	2146.6	676.4	9055.7	4045.2			13,100.9	1029.1	14130
	E	980.8	215.5	37.2	1233.5	2367.6			3601.1	12	3613.1
	F		19.5		19.5				19.5		19.5
	G		0.1		0.1				0.1	23.1	23.2
	H					15.8			15.8	343.1	358.9
	I	5.8	17.5		23.3				23.3	2.8	26.1
	J	5.5	2.4		7.9	0.4			8.3		8.3
TOTAL		7797.30	2608.7	782.50	11,188.50	6499.60	0.00	0.00	17,688.1	11,480.10	29,132.0
Difference (%)		15		-1	15	-17			-4	3	-1

In this study, the carbon storage and amount is calculated depending on the diversity of vegetation and the amount of its oven-dry weight. In the calculations it is assumed that in one ton oven dry weight, there are 0.45 tons of carbon and this amount is equivalent to 3.66 tons of CO₂ [12]. In these studies, the biomass (the trunks, branches and leaves of trees) above ground is determined, then the underground biomass can be predicted [13]. For the calculations, the coefficient numbers from the study of [14] have been used. Moreover, the data related to carbon storage and amount for the forests in the test site have been given in Table 24 based on the 2012 stand map production report [2].

As it is also known, the amount of oxygen produced by forests around the world is 8-13 in average for each hectare and this amount is three or four times more than the amount of oxygen produced in the meadow. The amount of oxygen production calculated for Düzlerçamı is shown in Table 25.

Table 24: Estimation of carbon storage and amount from the 2012 stand map production

Carbon storage and accumulation							
Stand Type	Biomass (Ton)				Carbon (Ton)		
	Above ground	Below ground	Dead wood	Total	biomass	Forest soil	Entire forest ecosystem
Deciduous	6849	1027	3150	11026	4962	2878	7840
Coniferous	635,093	127,018	304,844	1,066,955	480,130	278,475	758,605
Total	641,942	128,045	307,994	1,077,981	485,092	281,353	766,445

Table 25: Biomass expansion factors from the 2012-stand map production

Biomass expansion (Ton)				
Stand Type	Biomass (Ton)			Oxygen production (Ton)
	aboveground	belowground	Total	
Deciduous	264	39	303	364
Coniferous	21,137	4228	25,365	30,438
Total	21,401	4267	25,668	30,802

- **Analysis of Time-series Land-use/Land-cover datasets**

The stand maps have 7 classes with which to characterize the region land-use (see Fig 7). As summarized in Table 25, urbanization has been recognized as an important parameter in terms of temporal land-use change. Urbanization has converted 1063 ha of primary logged closed forest to a residential area. These are areas, as shown in Fig. 5 (d), were formerly classified as logged closed forest and known as “2B lands”. In these lands, any kind of construction and agricultural practices are not allowed. However, due to the population and real estate market growth these lands were exploited without the developers having any legal right to do so and without their paying taxes or rent fees to the state (the owner of forests). Under the new forest law valid since 19th of April 2012, 2B lands became eligible for construction.

In the Metropolitan Municipality of Antalya there are 14,225 ha of 2B land, which is 10.3% of the total area. The 2B land in Antalya is used for different purposes such as residential and agricultural areas, industrial places or tourist destinations. These areas were sold through a

law enacted in 2012. In the field of study there are 1076 ha of 2B lands. The current situation of the 2B land in the study area can be seen in Fig.13 over the updated Google Earth image. It can be seen from the figure that these lands have been turned into agricultural areas, empty spaces or residential areas, especially in the southern part of the region.

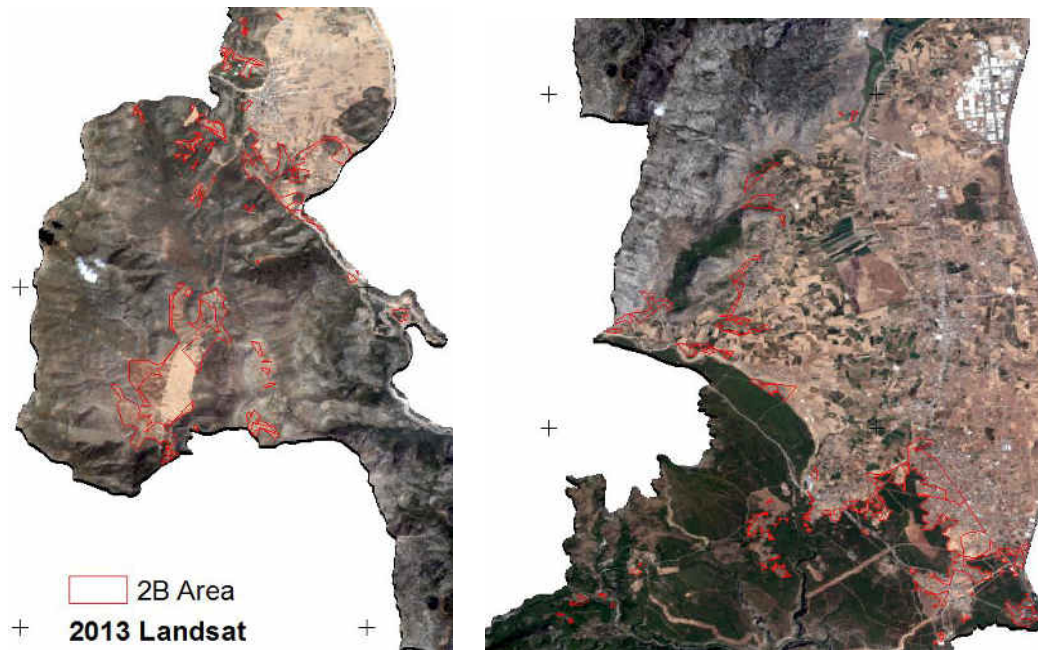


Fig.13: The vector files of 2B Land over the current Google Earth images

Time analysis of stand maps shows overall trends but does not show change trajectories (Table 26). To show transitions between the above defined land-use categories, in Table 27, the land-use change matrix is given. Evaluation of this temporal change analysis from the 1997 and 2012 stand maps indicates that areas for agricultural practice in 1997 had been converted to residential areas by 2012. Additionally, the areas covered by maquis type vegetation in 1997 have low urbanization but high forestation rates, representing the increase in storage of carbon.

Table 26: Area of land uses calculated from forest stand maps produced in 1997 and 2012. Here, it can be remembered that the original stand maps give much more detailed land cover information, however, for sake of simplicity, some species of trees and plants are combined due to the forest experts

LC/LU Class	1997 Area (ha)	2012 Area (ha)	Change (ha)
Surface Water and Marshes (1)	137.02	161.54	24.52
Barren Land (Sandy Rocky Soil Areas) (2)	868.38	790.17	-81.21
Residential Area (3)	966.05	3723.21	2757.16
Open Forest (4)	1474.39	1006.92	-467.47
Maquis (5)	10484.68	8847.75	-1636.93
Closed Forest (6)	6813.35	7870.89	1060.54
Agricultural Area (7)	8440.98	6784.37	-1656.61

Table 27: Land-use area change matrix resulting from 1997 and 2012 stand maps

Area (ha)		1997							Total Area
		1	2	3	4	5	6	7	
2012	1	107.73	2.57	0.00	0.00	0.06	0.00	51.18	161.54
	2	12.58	189.58	6.43	76.21	413.53	53.96	37.88	790.17
	3	0.25	96.84	595.25	56.66	386.54	34.19	2.553.48	3723.21
	4	0.00	134.32	1.45	475.99	221.24	147.49	26.43	1006.92
	5	0.33	288.76	14.98	309.01	8.082.70	65.23	86.74	8847.75
	6	0.00	83.13	5.10	475.85	790.36	6.451.49	64.96	7870.89
	7	16.13	73.18	342.84	80.67	590.25	60.99	5.620.31	6784.37
	Total Area	137.02	868.38	966.05	1474.39	10,484.68	6813.35	8440.98	29,184.85

Additionally to statistical examples above, photos taken during the field works, seen in Photo (5), show some of the human-induced removal of forest cover and replacement with recreation areas and mining areas.

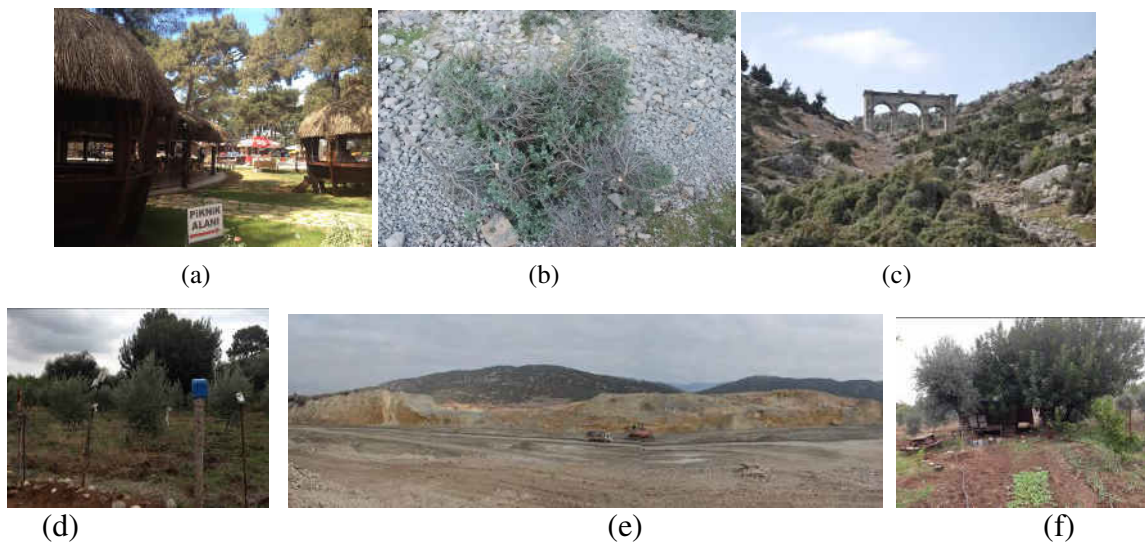


Photo 5. Current examples of land use/cover (a) Recreation area (b) maquis-type shrublands (c) touristic destination (Ariassos) (d) taken precautions for agricultural fields against wild life animal (e) mining area (f) a hut in the natural protected area

2.3 Agents of deforestation and degradation

2.3.1 Identification of deforestation and degradation agent groups

Undertaken activities	Agent group 1: local people 1 (urbanized area)	Agent group 2: local people 2 (rural area)	Agent group 3: breeders	Agent group 4: wood extractors	Agent group 5: mining operators	Agent group 6: tourists
Sedentary livestock	✓		✓	✓		
Transhuman livestock						
Subsistence agriculture						
Commercial agriculture						
Subsistence fuel wood collection			✓	✓		
Commercial fuel wood collection						
Subsistence charcoal production						
Commercial charcoal production						
Subsistence lumber collection						
Commercial lumber collection						
Subsistence collection of non-timber forest products*			✓	✓		
Commercial collection of non-timber forest products						
Urbanization	✓	✓	✓			✓
Tourism (trampling)	✓	✓				✓
Mining (including quarry)	✓	✓	✓		✓	
Industrial infrastructures	✓	✓				✓
Road infrastructures	✓	✓			✓	✓
Forest fires	✓	✓	✓	✓		✓

2.3.2 Socio-economic characteristics of global population

Global population	Information	Data source	Method of production	Quality Assessments															
Number of families living in the pilot site	13000	public authority	resident registration system	TSI*															
Average size of the families living in the pilot site	5	public authority, mayor, muhtar**	resident registration system, interview	TSI															
Number of families affecting forest ecosystems within the pilot site	<p>All families affect the forest ecosystem in many complex/different ways. Some examples include hunting, removing of water, causing pollution, using the land as a recreational purpose and cutting down trees for feeding animals and domestic uses such as heating.</p> <p>Even though these examples mainly characterize the people living in the pilot site, people from neighbouring towns, as indicated in Fig. 2, also use the forests in the test site.</p>	governor, mayor, muhtar**	interview																
Evolution over time of the number of inhabitants living within the pilot site boundaries	<p>44,272 / 42,433 / 40,555 / 40,637 2011 / 2010 / 2009 / 2008</p> <p>The population projections of Antalya and its unit Döşemealtı are given according to the Master Zoning Plan of Antalya.</p> <table border="1"> <thead> <tr> <th></th> <th>2015</th> <th>2020</th> <th>2025</th> <th>2030</th> </tr> </thead> <tbody> <tr> <td>Antalya</td> <td>1,236,175</td> <td>1,469,535</td> <td>1,798,675</td> <td>2,00,5340</td> </tr> <tr> <td>Döşemealtı</td> <td>49,190</td> <td>77,580</td> <td>116,580</td> <td>167,430</td> </tr> </tbody> </table>		2015	2020	2025	2030	Antalya	1,236,175	1,469,535	1,798,675	2,00,5340	Döşemealtı	49,190	77,580	116,580	167,430	public authority	resident registration system	TSI
	2015	2020	2025	2030															
Antalya	1,236,175	1,469,535	1,798,675	2,00,5340															
Döşemealtı	49,190	77,580	116,580	167,430															
Evolution over time of the number of inhabitants affecting the ecosystem of the pilot site boundaries	14,139 / 14,438 / 14,128 / 14,448 2011 / 2010 / 2009 / 2008	public authority	resident registration system	TSI															
Main socio-economic and cultural characteristics of the population living within the pilot site	The subareas in the pilot site differ in their socioeconomic and cultural characteristics (see agents entitled local people 1 and 2). The impact of urbanization is clear in terms of	administrative units, local people	interview																

	characteristics of a population.		
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TSI* Turkish Statistical Institute, for detailed information please visit <http://www.turkstat.gov.tr/Start.do>
Muhtar ** the elected head of a village and/or district

2.3.3 Socio-economic characteristics of the different agent groups

Agent group 1: local people 1 (urbanized area)	Information	Data source	Method of production	Quality Assessments
Evolution over time of the size of the agent group	30,133 / 27,995 / 26,427 / 26,189 2011 / 2010 / 2009 / 2008	public authority	resident registration system	TSI
Which percentage of the agent group affecting the forest cover of the pilot site lives within the pilot site?	low	field work	interview	Since law protects the forests inside the test site, the effect of this stakeholder is not high in terms of area . However, logged closed forests covered areas are thought to be giving way to the growing pressures of urbanization. It is hard to give quantitative information.
Average size of the families for this agent group pilot site	5	public authority	resident registration system	TSI
Main socio-economic and cultural characteristics of this agent group	All members of agents work and live in the city center. The agents can be separated into two income groups including retired people and people working in governmental organizations. Young members of some of the families work in either mining companies or industrial areas as a worker and driver.	field work	interview	
Privileged location of the agent group in the pilot site	Residential area in Fig. 7.			

Agent group 2: local people 2 (rural area)	Information	Data source	Method of production	Quality Assessments
Evolution over time of the size of the agent group	14,139 / 14,438 / 14,128 / 14,448 2011 / 2010 / 2009 / 2008	public authority	resident registration system	TSI
Which percentage of the agent group affecting the forest cover of the pilot site lives within the pilot site?	All	field work	interview	
Average size of the families for this agent group pilot site	5	public authority	resident registration system	TSI
Main socio-economic and cultural characteristics of this agent group	<p>People in this agent group are directly linked to the ecosystem. There are many environmental parameters where people interact with nature including the domestic garden and pasture. Social practices associated with the production and uses of environmental setting are dynamic including grazing, producing daily food and milk etc.</p> <p>Additionally, some districts such as Bademağacı, Bayatbademler and Yukarıkaraman are good choice for summerhouses because of its clean air, landscape and cooler summer temperatures compared to Antalya. These houses create job opportunities with cash for local people including gardening, cleaning and selling dairy products.</p>	field work, mayor	interview, resident registration system	TSI
Privileged location of the agent group in the pilot site	Rural area and forestlands in Fig.7.			

Agent group 3: wood extractors	Information	Data source	Method of production	Quality Assessments
Evolution over time of the size of the agent group	Since the test site includes protected forest area, the state authority (GDF) manages its resources, such as wood. To benefit from the forests, forest villagers cooperate with GDF according to relevant law (please, see the table entitled Fuel wood for detailed information).			
Which percentage of the agent group affecting the forest cover of the pilot site lives within the pilot site?	The state forestry authority has full responsibility for managing wood extraction.			
Average size of the families for this agent group pilot site	The families living in the districts marked in Table I with plus sign are the stakeholders of this agent. The average size of families is 3.			
Main socio-economic and cultural characteristics of this agent group	This agent group presents the forest villagers living in the protected forest area. The main difference compared to the agent 2 is their incomes only depend on forest resources, and they have a lower living standard than other districts. To support them, the directorate of Forestry gives priority to co-operation in wood production and forest cleaning and maintenance [5].	Field work, public authority	interview, resident registration system	TSI
Privileged location of the agent group in the pilot site	Forest villages highlighted in Table 1 and Fig. 4 (a).			


Agent group 4: mining operators	Information	Data source	Method of production	Quality Assessments
Evolution over time of the size of the agent group	15.0 ha / 32.9ha / 36.9/46.2 ha 1990* / 2006* / 2012** /2013*	Satellite images	*digitizing from Google Earth **[2]	< 10m ²
Which percentage of the agent group affecting the forest cover of the pilot site lives within the pilot site?	100%	field work, office work	interview, monitoring by satellite images and ground observations by experts	
Average size of the families for this agent group pilot site	5			
Main socio-economic and cultural characteristics of this agent group	Mining operations are based on short distance communities whereby employees live in small villages around the mining companies. In the agents' family, at least one member is connected to the agent group 2 and the agent group 1.	field work, mayor	interview	
Privileged location of the agent group in the pilot site	Mining sites in Fig. 10 (a).			

Agent group 5: tourists	Information	Data source	Method of production	Quality Assessments
Evolution over time of the size of the agent group	<p>Two groups form the agent. The first is made up of people living in the neighbouring region such as Antalya, and the second one are those visiting the test site. The second group has almost no environmental impact at the global level. However, the first group effects the ecosystem through recreational activities at campgrounds and picnic areas.</p> <p>In springtime, recreation places draw more than five thousand people a week, twice the number in summer time. In terms of temporal evolution, it can be stated that as cities become large and</p>	Döşemealtı Municipality Parks and Garden Directorate		

	<p>more densely populated, recreation places become more crowded.</p> <p>For quantitative information, please see direct causes Table entitled Tourism.</p>			
Which percentage of the agent group affecting the forest cover of the pilot site lives within the pilot site?	<p>People living within the pilot site have almost no negative effect on forest cover. However, according to the resident's, people living in Antalya visit the recreation forest areas on a daily basis making the recreational forest areas crowded and causing soil compaction.</p>	field work and governors	interviews, tourism ticket system	public authority
Average size of the families for this agent group pilot site	5	field work	interviews	public authority
Main socio-economic and cultural characteristics of this agent group	<p>Even though there is no scientific analysis to examine the spatial availability of a variety of recreational resources by neighbourhood income and race/ethnicity, according to the locals, it can be said that people with lower economical status often spend time in recreational areas.</p>	field work	interviews by local people	Although there are disparities in leisure-time activities by race and socioeconomic position, for the recreation places such an analysis has not been found.
Privileged location of the agent group in the pilot site	<p>Tourism and recreation area in Fig. 4 (c).</p> <p>People living in Antalya are used to picnicking not only in recreational areas, which are managed by the state authority, but also in the natural forest. This was observed during the fieldwork.</p>			

2.4 Direct causes of deforestation and degradation

Urbanization (legal)	Information	Data source	Method of production	Quality Assessments
Urbanized area within the pilot site	3723.21	Forest stand maps	Directorate of Forestry Antalya	
Location of this urbanized area	Please see Fig. 7.			
Historic evolution of the urbanized area	<p>According to the series of stand maps (see Fig. 7) between 1997 (966.05 ha) and 2012 (3,723.21 ha), urbanization has been recognized as an important contributor to land use change.</p> <p>Since 2004, Döşemealtı has grown to cover almost the entire test site. This expansion has caused the construction of dense buildings in the areas devoted primarily to agricultural and forestry use.</p>	Forest stand maps	Directorate of Forestry, Antalya	
Urban expansion management	<p>Under the control of Antalya Metropolitan Municipality [15]</p> <p>Antalya Metropolitan Municipality vision 2030 aims at making Antalya and its districts a more polycentric and balanced urban system through sustainable spatial development by 2030 [16]. The vision has been developed through the use of all-inclusive stakeholders.</p>			
Impact of urbanization on forest cover	<p>Urbanization directly changes forest ecosystems by fragmenting forest cover, and also indirectly alters the forest ecosystem by changing the hydrological cycle and pollinating important plants. In the test site, a change in the forest area may hide the fact that natural forests are kept stable in terms of area but not biodiversity. Additionally, urbanization modifies the goods provided by forests such as food products, wood products, domestic animals, tourism and recreation.</p> <p>The urbanization effect can be particularly seen in logged closed forest areas (Photo (6)).</p>	Field work and research plan	Interview and office work	

	 <p>(a)</p> <p>(b)</p> <p>Photo 6: (a)Summer houses through maquis-infested areas (b) new settlements</p>		
Existing urban expansions plan	<p>The Antalya Metropolitan Municipality Master Zoning Plan, which will be completed by 2030, shows the location of new motorways and industrial areas, which are currently covered with mainly maquis [15]. According to the current projections of population growth underlined in this plan, the population in Döşemealtı is currently growing by 4.72 %, and it is estimated that the population will reach 177,100 by around 2030.</p> <p>Additionally, the pasture area of district Kömürcüler will be replaced by a hippodrome, which makes the surroundings available for the construction of a hotel and conference surfaces.</p>	Antalya Metropolitan Municipality	Master Zoning Plan
Possible evolution of illegal urbanization	-	-	-

Activities to mitigate the impact of this direct cause on forest cover	
Urban Zoning Plan	<p>To minimize the damage in ecological sustainability due to the new constructions, the forested nearby areas should not be included in zoning plans after the roads and the industrial area built.</p> <p>The standards for sustainable forest roads defined by FAO should taken into account [17].</p>
Protected Areas	<p>According to the local people, it seems that Protected Areas (Figure 3) could be among the most effective tools for protecting the villages/districts from urbanization and human-induced threats. However, it is also underlined that in Turkey there are some problems in practice. The absence of clear legislation decreases the life quality of the local people living in the protected areas. For example, they are not allowed to modernize their own houses (Photo 5(d)). Additionally, the existence of a fallow deer station (see Fig. 5 (c)), which is the only place that dama dama are found, effects the agricultural activities (Photo (7)) [7]. Local people protect their gardens from dama dama with rudimentary fencing.</p> <div data-bbox="1077 639 1655 1026" data-label="Image"> </div> <p data-bbox="1137 1031 1368 1054">Photo 7: Dama dama</p> <p>If well-planned and managed, protected areas can tackle the problem of the extinction of biodiversity and of change of villagers' daily life.</p>

Local breeding system : sheep and goats	Information	Data source	Method of production	Quality Assessments																																																											
Species and total number of individuals managed under the same practices	39,593 goats and 19,802 sheep	Public authority	Farm Animal Identification and Registration System	the database of General Directorate of Food, Agriculture, Livestock																																																											
	<p>Small flocks are up to 60 animals and big flocks consist of 150-300 animals.</p> <p>Mostly small flocks are seen in the test site.</p>	field work	interview																																																												
Free range area used by the herd within the pilot site	<p>2472 ha for all area. Detailed information from grazing plan given in Table 28. As in shown in Table 28, Çığlık, Yağca and Bıyıklı districts don't have free grazing land.</p>	public authority	grazing plan (see Fig. 12 (b))	The District Directorate of Forestry Düzlerçamı																																																											
	<p style="text-align: center;">Table 28: Areal expansion of grazing lands</p> <table border="1" data-bbox="421 762 1541 1273"> <thead> <tr> <th data-bbox="421 762 622 938">District</th> <th data-bbox="622 762 835 938">Total Area (ha)</th> <th data-bbox="835 762 958 938">Free Grazing Land Area (ha)</th> <th data-bbox="958 762 1126 938">Forbidden Grazing Land Area (ha)</th> <th data-bbox="1126 762 1283 938">Unplanned Area (ha)</th> <th data-bbox="1283 762 1406 938">Number of Goats</th> <th data-bbox="1406 762 1541 938">Area per Goat (m²)</th> </tr> </thead> <tbody> <tr> <td data-bbox="421 938 622 978">Akkoç</td> <td data-bbox="622 938 835 978">5,521.20</td> <td data-bbox="835 938 958 978">1,338.70</td> <td data-bbox="958 938 1126 978">3,730.60</td> <td data-bbox="1126 938 1283 978">451.90</td> <td data-bbox="1283 938 1406 978">13500</td> <td data-bbox="1406 938 1541 978">991,63</td> </tr> <tr> <td data-bbox="421 978 622 1018">Bademağacı</td> <td data-bbox="622 978 835 1018">3,356.90</td> <td data-bbox="835 978 958 1018">634.60</td> <td data-bbox="958 978 1126 1018">1,182.20</td> <td data-bbox="1126 978 1283 1018">1,540.10</td> <td data-bbox="1283 978 1406 1018">523</td> <td data-bbox="1406 978 1541 1018">12.133,84</td> </tr> <tr> <td data-bbox="421 1018 622 1058">Bıyıklı</td> <td data-bbox="622 1018 835 1058">1,202.70</td> <td data-bbox="835 1018 958 1058">0.00</td> <td data-bbox="958 1018 1126 1058">430.10</td> <td data-bbox="1126 1018 1283 1058">772.60</td> <td data-bbox="1283 1018 1406 1058">715</td> <td data-bbox="1406 1018 1541 1058">0,00</td> </tr> <tr> <td data-bbox="421 1058 622 1098">Çığlık</td> <td data-bbox="622 1058 835 1098">6,422.10</td> <td data-bbox="835 1058 958 1098">0.00</td> <td data-bbox="958 1058 1126 1098">3,300.50</td> <td data-bbox="1126 1058 1283 1098">3,121.60</td> <td data-bbox="1283 1058 1406 1098">3000</td> <td data-bbox="1406 1058 1541 1098">0,00</td> </tr> <tr> <td data-bbox="421 1098 622 1137">Kömürcüler</td> <td data-bbox="622 1098 835 1137">1,893.20</td> <td data-bbox="835 1098 958 1137">167.20</td> <td data-bbox="958 1098 1126 1137">0,00</td> <td data-bbox="1126 1098 1283 1137">1,726.00</td> <td data-bbox="1283 1098 1406 1137">542</td> <td data-bbox="1406 1098 1541 1137">3.084,87</td> </tr> <tr> <td data-bbox="421 1137 622 1177">Yağca</td> <td data-bbox="622 1137 835 1177">1,004.30</td> <td data-bbox="835 1137 958 1177">0,00</td> <td data-bbox="958 1137 1126 1177">995.80</td> <td data-bbox="1126 1137 1283 1177">8.50</td> <td data-bbox="1283 1137 1406 1177">3159</td> <td data-bbox="1406 1137 1541 1177">0,00</td> </tr> <tr> <td data-bbox="421 1177 622 1217">Yeşilbayır</td> <td data-bbox="622 1177 835 1217">1,099.50</td> <td data-bbox="835 1177 958 1217">96.50</td> <td data-bbox="958 1177 1126 1217">5.40</td> <td data-bbox="1126 1177 1283 1217">997,60</td> <td data-bbox="1283 1177 1406 1217">780</td> <td data-bbox="1406 1177 1541 1217">1.237,18</td> </tr> <tr> <td data-bbox="421 1217 622 1273">Yukarıkaraman</td> <td data-bbox="622 1217 835 1273">8,684.90</td> <td data-bbox="835 1217 958 1273">235.00</td> <td data-bbox="958 1217 1126 1273">6,489.10</td> <td data-bbox="1126 1217 1283 1273">1,960.80</td> <td data-bbox="1283 1217 1406 1273">2492</td> <td data-bbox="1406 1217 1541 1273">943,02</td> </tr> </tbody> </table>				District	Total Area (ha)	Free Grazing Land Area (ha)	Forbidden Grazing Land Area (ha)	Unplanned Area (ha)	Number of Goats	Area per Goat (m ²)	Akkoç	5,521.20	1,338.70	3,730.60	451.90	13500	991,63	Bademağacı	3,356.90	634.60	1,182.20	1,540.10	523	12.133,84	Bıyıklı	1,202.70	0.00	430.10	772.60	715	0,00	Çığlık	6,422.10	0.00	3,300.50	3,121.60	3000	0,00	Kömürcüler	1,893.20	167.20	0,00	1,726.00	542	3.084,87	Yağca	1,004.30	0,00	995.80	8.50	3159	0,00	Yeşilbayır	1,099.50	96.50	5.40	997,60	780	1.237,18	Yukarıkaraman	8,684.90	235.00
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Area of pastures used by the herd within the pilot site		public authority		The district directorate of Forestry Düzlerçamı						
Evolution over time of the surface of free range areas and pastures occupied by this breeding system and of the number of individuals in the pilot site	<p>The previous grazing plan by the district directorate of Forestry Düzlerçamı was not available. To give rough idea, you can find the temporal change of maquis (-1636.93) covered areas, which can be characterized as free range areas:</p> <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th style="text-align: center;">1997</th> <th style="text-align: center;">2012</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Maquis</td> <td style="text-align: center;">10,484.68 (ha)</td> <td style="text-align: center;">8847.75 (ha)</td> </tr> </tbody> </table>		1997	2012	Maquis	10,484.68 (ha)	8847.75 (ha)	public authority	Stand maps	The district directorate of Forestry Düzlerçamı
	1997	2012								
Maquis	10,484.68 (ha)	8847.75 (ha)								
Breeding management norms	<p>Even though there is a common belief that intensive livestock breeding has led to deforestation, if it is controlled and planned well breeding can be useful for protecting the forests from forest fire. This will not only ensure a useful breeding strategy, but also contribute to quality of dairy products.</p> <p>According to Forests Law numbered 6831* clause 19, stock-breeding activities shall not be allowed in forests.</p> <p>In order to manage forests properly, the amendment to the law was done in 2012 and published in Turkey Legislation and Official Journal 28350. Though this amendment, livestock-breeding in forests can be managed and exploited by the state authority, if it is required.</p>	Directorate of Forestry Düzlerçamı Grazing Plan								
Location of the cause “overgrazing” in the massif	<p>In Antalya every year grazing plans are made and announced to the farmers by the Governorate of Antalya and the Directory of Food, Agriculture and Livestock. To give an idea, the announcement related to the grazing plan in 2014 is given as follows:</p> <p><i>“In our town, the season of grazing will start on the 20th of April, 2014 and finish on the 15th of May, 2014 in the coastal area; and start on the 15th of May, 2014 and finish on the 15th of September, 2014 in the plateau.”</i></p>	public authority	grazing plan (see Fig. 12 (b))	The district directorate of Forestry Düzlerçamı						

	<p>According to the 27th article of Pasture Law, the grazing rights of those who do not obey the rules or meet their responsibilities in the areas where Grazing Plan is put into effect will be invalidated temporarily for 7 to 30 days of one grazing season. If the offence is repeated, they will be banned from grazing for a year.</p> <p>To avoid overgrazing, there is a grazing plan managed by the district directorate of Forestry Düzlerçamı.</p>			
Do the herds pasture on lands outside the project area?	Yes, herds graze in mountain meadows of Korkuteli.	field work, public authority	interview	
Are there any forest protection practices to avoid cattle entering the pilot site? If there is, what are the concerned surfaces in the site?	Secure fencing surrounds the <i>Forbidden Grazing Lands</i> in Fig. 12 (b).	public authority	grazing plan (see Fig. 12 (b))	The district directorate of Forestry Düzlerçamı
Characterization of the impacts on forest cover (positive or negative)				
Grazing of sprouts?	Goats graze the seedlings in a maquis-type shrubland and prevent them from becoming established. They tend otherwise to mature and grow.	field work	interview	
Cutting branches/the top of the trees?	Villagers having only 2-3 goats instead of a goatherd cut the leaves and branches of the trees through the year. Goats graze the fresh parts, and leave behind the less digestible branches and thorns, which are used for domestic purposes (Photo 8).	field work	interview	




Photo 8: Grazing goats

<p>Soil compaction and degradation?</p>	<p>According to talk with the experts from Regional Directorate of Forestry, the presences of goats brings concrete benefits such as preventing forest fires by allowing goats to eat flammable underbrush (especially red pine). In these talks, the experts underline the importance of controlled grazing.</p> <p>Instead of goats, the influence of people on soil compaction is a problem.</p>	<p>field work, public authority</p>	<p>interview, research report</p>
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Use of fire for livestock management?	Controlled or prescribed burning is used in forest and farming practice.	field work, public authority	interview	
Livestock management				
Quantity of (gross) production by head and for the total herd	There is no commercial dairy product and milk production. Goats and sheep are raised for commercial fattening purpose. Meat: goat : 8749 head sheep: 4471 head	public authority	Farm Animal Identification and Registration System	the database of General Directorate of Food, Agriculture, Livestock
Level of products processing	Fattening of male goats is the most intensive commercial activity.	field work	interview	
Destination of products	Brokers	interview		
Livestock intensification level	Goat farming and investment in goat business is financially supported by the Ministries of Agriculture. According to Farm registry system, the current goat population is monitored and their owners can benefit the feed subsidy program. Without registration, farmers cannot make use of the subsidy program.	public authority	Farm Animal Identification and Registration System	the database of General Directorate of Food, Agriculture, Livestock
Estimation of the average net profit per ha	The value of goat meat is affected by religious practice. The price per weight of goats is highest during the <i>sacrifice festival</i> .	field work	interview	
Other carbon potential linked to breeding activities				
Is there any tendency of converting the pastures into	Yes there is a tendency to convert the pastures into construction areas, please see Table 20.	mayor	interview	


another land use type?			
Silvopastoral pasture management	Agroforestry systems like silvopasture are not usual in Turkey.		
Is it relevant to increase tree density in pastures? Why?	No. Even if there are sheep and goats, the goats are the principal animals in the test site, indicating that there is no need to make rehabilitation <u>of</u> pastures. The interview responses confirmed that goats are natural browsers, preferring to eat twigs, vines and shrubs. They do not prefer to eat short, tender grasses in pastures as sheep do.	field work	interview
Quantity of manure produced by the herd	Since there is no (official) manure management, there is no quantitative information about the manure practice. However, it does not mean that the villagers do not make use of manure; they use it in their greenhouses.	field work	interview
Existing manure management practices	There is no manure management practice.		
Would it be relevant to implement new manure management practices?	Yes. Manure can be recycled back onto agriculture as an inexpensive source of organic fertilizer.		
Activities to mitigate the impact of overgrazing on forest cover			
Incentive plan	Under the Incentive plan launched by Republic of Turkey Ministry of Food, Agriculture and Livestock, the government supplies the supplement concentrate feed for goats and sheep which reduces their appetite and causes them to graze just the top leaves and not the entire plant.		
Grazing plan	To tackle overgrazing, the district directorate of Forestry Düzlerçamı prepares grazing plan.		
Other relevant information			
Controlled grazing	Although there are pasture areas for goats, the majority of them graze freely state-owned lands, including forests. In a controlled grazing system, goats can be allowed to eat flammable underbrush in order to prevent forest fires, which could also tackle the soil compaction problem.		

*Since 1937 Turkey has had two main Forestry laws numbered 3116 and 6831[18].


Local breeding system : cattle (cows, oxen)	Information	Data source	Method of production	Quality Assessments
Species and total number of individuals managed under the same practices	Cows, oxen 10559	public authority	Farm Animal Identification and Registration System	the database of General Directorate of Food, Agriculture, Livestock
Free range area used by the herd within the pilot site	<p>Since cattle is being grazed in barns, there is no impact of cattle livestock on deforestation</p>  <p>Photo 9: Cows from Bademagacı District</p>			
Area of pastures used by the herd within the pilot site		-		
Evolution over time of the surface of free range areas and pastures occupied by this breeding system and of the number of individuals in the pilot site		-		
Breeding management norms		-		
Location of the cause “overgrazing” in the massif		-		
Do the herds pasture on lands outside the project area?		-		
Are there any forest protection practices to avoid cattle entering the pilot site? If there is, what are the concerned surfaces in the site?		-		
Characterization of the impacts on forest cover (positive or negative)				



Grazing of sprouts?			-
Cutting branches/the top of the trees?			-
Soil compaction and degradation?			-
Use of fire for livestock management?			-
Livestock management			
Quantity of (gross) production by head and for the total herd	Milk: 4043 (cows) x 16 kg x 300 days = 19,407 tons/period ~300 days Meat: 2458 (heifer and young bull) x 140 kg x 300 days = 103,236. tons/period		Farm Animal Identification and Registration System
Level of products processing	There are two large milk tanks (milk-cooling container) in the test area which can be used by hundreds of families to store their milk.	field work, public authority	interview
Destination of products	Big fabrics producing dairy products and slaughterhouse	field work, public authority	interview
Livestock intensification level	Intensification of livestock is not high because villagers cannot earn enough money to live.		
Estimation of the average net profit per ha	It is not easy to calculate the average net profit since it changes rapidly through the test site.		
Other carbon potential linked to breeding activities			
Is there any tendency of converting the pastures into another land use type?	Yes there is a tendency to convert pastures and barns into industrial areas and settlements.	field work, public authority	interview
Silvopastoral pasture management	No		
Is it relevant to increase tree density in pastures? Why?	In test area, there are mainly goats, which are natural browsers, preferring to eat twigs, vines and shrubs in free lands. They do not prefer to eat short, tender grasses in pastures as sheep do. For this reason, increasing tree density in pastures is not relevant.		
Quantity of manure produced by the herd	The quantity of manure produced from livestock is not known because of the absence of a manure management plan.		
Existing manure management practices	There is no manure management practice	field work, public authority	interview
Would it be relevant to implement new manure	Yes. Because of the fact that cattle are being fed in barns, it would be feasible to implement manure		

management practices?	management practices.
Activities to mitigate the impact of overgrazing on forest cover	
-	
Other relevant information	
Integrated Cattle Management System	<p>The Directorate of Food, Agriculture and Livestock is planning to build Integrated Cattle Management System in the test site.</p> <p>Gathering cattle practice can cause several benefits. First, it reduces the amount of labour required to move a large number of cattle. In addition, by this way it can be possible to gather large amount of the manure to utilize. Lastly, intermediaries can be eliminated, allowing the villagers to earn more.</p>

	 <p style="text-align: center;">Photo 11: Brushwood in the test site</p>
<p>Management norms for fuelwood collection</p>	<p>According to Forestry Law 6831, the directorate of Forestry Düzlerçamı can manage the wood extraction and deadwood. This law allows local people to collect deadwood on the ground and woody species for domestic purposes without a permit, if the diameter of brushwood is less than 5 cm. Brushes with larger diameters are characterized as timber, and the regional directorate of forestry is in charge of managing them. This local state authority has to ensure that all activities including fuelwood collection are consistent with forest laws and regulations.</p> <p>Additionally, there is a new Forest Management Bill of 2013. It was taken from the Forestry Act but amended to clarify forest operations on permanent timber production zone. This clause ensures that the Forestry Corporation established under the Forestry Law continues to exist but it also provides that the Minister may, by order, declare state land to be permanent timber production zone land.</p>
<p>Volume of standing trees affected by fuelwood collection (in m³,</p>	<p>There is no quantitative information about volume of standing trees for fuelwood collection, since the regional directorate of forestry manages the entire test site. The</p>

including losses due to harvest)	locations of fuelwood collection areas change annually.									
Evolution over time of collected and damaged quantity of wood	Since the District Directorate of Forestry Düzlerçamı is in charge of planning, there is no significant temporal volume change.									
Actual proportion of the different species in the quantity of collected fuelwood	In the District Directorate Forestry Düzlerçamı, there are only red pines for timber production. <i>Quercus coccifera</i> and <i>Phillyrea latifolia</i> are the species collected in the maquis areas for fuelwood.									
Wood density of those different species (if specific national information exists)	For redpine (<i>Pinus brutia</i> Ten.) average density changes between 0.397 and 0.59 g/cm ³ [19].									
Percentage of the fuelwood quantity dedicated to domestic uses	In the villages brushes having a diameter less than 5 cm are neither bought nor sold, but collected only for home use. However, there is no quantitative information on this amount.									
Percentage of the fuelwood quantity dedicated to commercial uses	Most of the forests inside the test site are characterized as Wildlife Protection and Improvement areas, instead of Natural Parks, this is the reason that entire forests is managed/run by the district Directorate of Forestry Düzlerçamı (please see Fig. 5).									
Sale price of fuelwood (commercial use)	<p>The fuelwood producer the district Directorate of Forestry Düzlerçamı sets the following prices for a stere in 2014:</p> <table border="1"> <thead> <tr> <th></th> <th>Turkish Lira (TL)</th> <th>Euro(€)</th> </tr> </thead> <tbody> <tr> <td>forest villagers</td> <td>27.85</td> <td>9.8</td> </tr> <tr> <td>others</td> <td>46.40</td> <td>16.3</td> </tr> </tbody> </table>		Turkish Lira (TL)	Euro(€)	forest villagers	27.85	9.8	others	46.40	16.3
	Turkish Lira (TL)	Euro(€)								
forest villagers	27.85	9.8								
others	46.40	16.3								
Existing energetic alternatives	Charcoal is also used.									

Tourism	Information	Data source	Method of production	Quality Assessments
<p>Description of the area accessible for tourism</p>	<p>There are basically two types of touristic destinations: <i>recreational facilities</i> and <i>sightseeing places</i>, including Karain cave, Güver cliff, Thermessos, Kirgöz and Evir Han Caravanserai.</p> <p>Karain Cave is known as one of the oldest human settlements in Anatolia and Güver Cliff, which has charming scenery due to the rushing river, are an important, and popular stop for nature-loving tourists (Photo (12)). Yearly tourist numbers are high, however this has no impact on forest cover. Instead, recreation activities cause heavy soil compaction and disturbance in the natural forested areas.</p> <p>Hunting is another popular touristic activity.</p> 	<p>Public authority</p>	<p>the database of Ministry of Culture and Tourism</p>	

	<p style="text-align: center;">(a)</p>  <p style="text-align: center;">(b)</p> 		
<p>Touristic frequentation</p>	<p>Photo 12: (a) Karain Cave and (b) Güver Cliff (c) Kırkgöz Caravanserai</p> <p>Considering the recreation activities and sightseeing, there is no major tourist season in the test site due to its temperate climate. However, the hunting season is</p>	<p>Public authority</p>	<p>the database of Ministry of Culture and Tourism</p>

	only from August through March.												
Tourism management	<p>The Yukarıkaraman and Düzlerçamı recreation places are the two big recreation places managed by the local municipality. The municipality complies with each recreation management condition of the agreement done by the directorate of Forestry. According to the agreement, all trees in the recreation places are under the care and supervision of the state (the Directorate of Forestry Düzlerçamı), and the local municipality carries out landscaping and gardening.</p> <p>However, sightseeing places such as Karain Cave belong to the Ministry of Culture and Tourism. Number of the visitor for Karain Cave are:</p> <table border="1"> <thead> <tr> <th>Year</th> <th>Visitor</th> </tr> </thead> <tbody> <tr> <td>2013</td> <td>23880</td> </tr> <tr> <td>2012</td> <td>29359</td> </tr> <tr> <td>2011</td> <td>22011</td> </tr> <tr> <td>2007</td> <td>13214</td> </tr> </tbody> </table> <p>Considering the hunting, wild animals under risk of extinction are protected by Terrestrial Hunting Law 4915. This Law sets forth rules and principles for the following: habitat of hunting sport and wild animals; their protection and development; hunting and wildlife</p>	Year	Visitor	2013	23880	2012	29359	2011	22011	2007	13214	Public authority	the database of Ministry of Culture and Tourism
Year	Visitor												
2013	23880												
2012	29359												
2011	22011												
2007	13214												

	<p>management; establishment and management of hunting grounds; organization and regulation of game, hunting tourism, and production and trading of wild animals.</p> <p>The Ministry of Environment and Forestry have the authority to ban or restrict hunting of certain species. Individuals who want to hunt are obliged to obtain a hunting certificate from the Ministry. Travel agencies that are involved in hunting tourism shall obtain permission as well from the Ministry of Environment and Forestry. The Law prescribes sanctions and fines to be paid for illegal activities.</p> <p>The wild goat breeding station was closed on the 10th of March, 2008 by the General Directorate of Forestry because it was in the calabrian forest and this caused problems related to natural nutrition and morphological changes in the species. However, wild goats still live in the area and they are hunted in a controlled way.</p>		
<p>Impacts of tourism on forest cover</p>	<p>Touristic activities such as sightseeing in the test site have no significant impact on forest cover but the effect of recreation activities, particularly on forest degradation and hunting on wildlife populations (implicitly biodiversity), cannot be ignored.</p> <p>Unfortunately, people are not only using recreation places for picnics, but are also indulging in activities have negative influences on wildlife including annoying wild animals, beekeeping, causing forest fires, allowing pets to graze and illegal hunting.</p>		


Activities to mitigate the impact of this direct cause on forest cover			
Sustainable ecotourism	Instead of recreation planning, sustainable ecotourism encompassing the reasonable use of natural resources including transhumance and cultural tourism would be encouraged and planned by the local municipality cooperated with the Directorate of Forestry.		
Visitor management system	It is anticipated that the demand for the area will be higher in the following years because it is very close to tourist destinations and there is an increasing interest in the wildlife. A well-organized visitor management system is required to monitor negative impacts on the environment.		
Other relevant information			
Recreation activities	<p>More than 5000 people per weekend in eight months visit recreational areas, which are popular for picnicking and relaxing. This number can exceed 10,000 in the summer period (Photo (12)).</p> 	public authority	Municipality Düzlerçamı and the directorate of Forestry Düzlerçamı



Photo 12: General views from Duzlercami Recreation Area

The overall economic impact of national park and natural forested areas is substantial for the municipality and some regions that rely on park tourism. However, the soil compaction and logging due to recreational activities are a cause for concern.

Mining : Quarry	Information	Data source	Method of production	Quality Assessments						
Area dedicated to mining within the pilot site	<p style="text-align: center;">Mineral extraction sites</p> <hr/> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">Inside Boundary (ha)</td> <td style="text-align: center;">Outside Boundary (ha)</td> <td style="text-align: center;">TOTAL (ha)</td> </tr> <tr> <td style="text-align: center;">46</td> <td style="text-align: center;">515</td> <td style="text-align: center;">561</td> </tr> </table>	Inside Boundary (ha)	Outside Boundary (ha)	TOTAL (ha)	46	515	561	GoogleEarth	digitizing	~24m ²
Inside Boundary (ha)	Outside Boundary (ha)	TOTAL (ha)								
46	515	561								
Location of mining	Mining companies are located close to the main (state) roads. The main roads, which are constructed through the forests, are intended to serve these mining activities. See Fig. 4.	Döşemealtı Municipality and Google Earth	field and office work	~24m ²						
Description of mining practices	In mining quarry of the test site, stone, rock, construction lime, marble, sand, gravel have been excavated as an open-cast mine.	field work	interview							
Historic evolution of mining	<p>Currently there are over 1000 small quarries in the province Antalya, and most of the stone quarries have been established after the 2000s.</p> <p>In Turkey, Mining Law 25483 was put into practice on 5th of June in 2004. Since then, an EIA* report has not been required to operate a quarry. After this law, mining and quarrying activities expanded by an estimated 60%.</p>	public authority	Republic of Turkey Ministry of Energy and Natural Recourses							
Mining management	<p>Quarry rights and surface rights are defined by the municipality or township for which a council is established under the provisions of the Local Government act. These capital rentals also generate revenue for the township.</p> <p>Considering the test site quarries (stone), they are inside the Wildlife Protection and Improvement Area managed by the district Directorate of Forestry Düzlerçamı, which</p>	public authority	Republic of Turkey Ministry of Energy and Natural Recourses							


	<p>makes getting license for quarry more difficult. The district Directorate of Forestry Düzlerçamı stated that the license of the Denizli Çimento will expire by 2015, and it will not be renewed.</p> <p>Section 16 of the Forestry Law numbered 6831 introduces a new system of quarrying activities in forests including operations in quarry and standards for resurfacing after closing quarry, which is valid since 30th of October, 2010.</p>		
<p>Impact of mining on forest cover</p>	<p>Quarries established in forested land directly cause deforestation and indirectly soil degradation, water pollution and big changes in vegetation and topography. (Photo 12).</p> 	<p>Field works and research report</p>	<p>interviews</p>



Photo 12: Effects of mining

Considering the quarries around the pilot test site, it has been realized that mining and its associated activities of drilling, blasting and transportation mainly cause the following problems:

- Air and water pollution caused by heavy

	<p>quarrying activities</p> <ul style="list-style-type: none"> • Traffic congestion and off-road vehicle traffic (especially in summer) • Forest health hazards (The blowing sand and dust from the quarries has been posing a health hazard to forests by causing early leaf abscission and dryness, and this may lead to cause of death and insect production in the long term). 		
Development plans of mining activities	Licenses are subject to a number of conditions, which are set out in the license agreement. According to the license, after closing the quarry, the owner of the quarry certifies that the land affected by mining will be rehabilitated. However, even if the law guarantees the rehabilitation, the lack of and auditing results in significant damage.		
Possible evolution of illegal mining activities (if so)	Since the test is under the control of the directorate of forestry, there is a very low possibility that illegal mining activities can exist.		
Activities to mitigate the impact of this direct cause on forest cover			
New Mining Law	In the Antalya case, there should be a new law that every mining company must make an EIA report before they can start mining activities and this report must be updated each year. This is not the only solution, as an audit of the law is very important as well. Considering the test site quarries (stone), they are inside the Wildlife Protection and Improvement Area managed by the district Directorate of Forestry Düzlerçamı, which makes getting license for quarry more difficult, and does not present a major problem for ecosystem sustainability.		
Other relevant information			
Closed-gallery	<p>Closed-gallery mining shall be assured by law, which can be used to avoid dust pollution.</p> <p>The dust produced during mining operations, damages the forest vegetation, decreases growth and causes issues such as arboreal diseases at the site. Additionally, findings from interviews with local residents indicate that the dust has a negative impact on their everyday lives and their agricultural activities such as olive production (Photo 13).</p>	filed work and research report	interviews



Photo 13: Lime plant located nearby the river Kirgöz


<p>Water quality</p>	<p>The impact of quarries, especially lime plants, on water resources is apparent in the test site. Quarrying results in areas of contaminated water and threatening the nearby Kirkgöz river, which is the most important water supply of Antalya. In addition to the pollution, mining explosions change the waterways. See in Photo 13.</p>  A photograph showing a wide river with a dark, possibly polluted, water surface. The riverbank on the right is rocky and has a white car with a red roof rack parked on it. The background shows a hazy, overcast sky and some trees along the far bank.	<p>field work</p>	<p>interviews</p>
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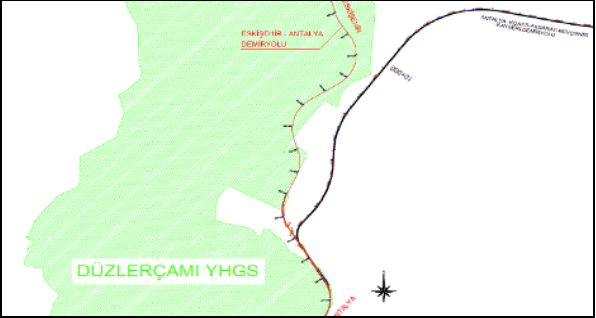


Photo 13: Kırkgöz water resource

*EIA: environmental Impact Assessments

Environmental Impact Assessment (EIA) is the process by which the anticipated effects on the environment of a proposed development or project are measured. If the likely effects are unacceptable, design measures or other relevant mitigation measures can be taken to reduce or avoid those effects [20].

Infrastructures: Roads	Information	Data source	Method of production									
Map of existing roads in the pilot site	Please see temporal road maps in Fig. 11.	Döşemealtı Municipality	Forest management plan by the directorate of Forestry Düzlerçamı and Master Zoning Plan by Döşemealtı Municipality									
Historical evolution of road construction	<p>Antalya is in a historical area. In the upper part of the region, there is an antic road, called the “Döşemealtı Yolu”, behind the Mercimek Mountain and leads to the village of Ilıca. It is said that tourists visited the road and the villagers made money by selling traditional handicrafts and handmade food. Today Antalya is connected to other cities through five main corridors. These are the road to Mersin (E90) in the east, the road to Isparta (D685) and Burdur (D650) in the north, the road to Denizli(E87) in the north-west, and the road to Kemer (E90) in the west.</p> <p>According to the GIS based temporal road analysis (Fig. 11), the road network grew by almost 3.5 km per year between 1997 and 2012.</p> <table border="1" data-bbox="846 742 1411 842"> <thead> <tr> <th></th> <th>1997</th> <th>2012</th> </tr> </thead> <tbody> <tr> <td>Rural roads</td> <td>126.25 (km)</td> <td>173.10 (km)</td> </tr> <tr> <td>Forest roads</td> <td>349.39 (km)</td> <td>358.16 (km)</td> </tr> </tbody> </table>		1997	2012	Rural roads	126.25 (km)	173.10 (km)	Forest roads	349.39 (km)	358.16 (km)		
	1997	2012										
Rural roads	126.25 (km)	173.10 (km)										
Forest roads	349.39 (km)	358.16 (km)										
Road infrastructure planning	Rural roads are updated based on Metropolitan Municipal Road Management Plan											
Impact of roads on forest cover	<p>Densely constructed roads divide forests into patches, reducing their habitat value for wildlife. They also act as barriers to wildlife movement.</p> <p>In the test site, as shown in Fig.11 , there is access to the whole forest due to the dense road infrastructure. The opening of roads in this way increases the pressure on the Wildlife Protection and Improvement area by</p> <ul style="list-style-type: none"> • increasing forest fire risk, 		[2]: project report entitled <i>Inventory and Classification of Informations Intended for Functional Planning Based Forest Ecosystem in Düzlerçamı Forest Ranger District</i>									

	<ul style="list-style-type: none"> • cutting trees, • having an easy access to natural forests, <p>which is not easy to control in terms of its huge spatial distribution.</p>	
<p>Road infrastructure expansion plans</p>		<p>According to 1/25000-scale Antalya Metropolitan Municipality Master Zoning Plan, there are plans for two new industrial lines connecting Antalya downtown-Döşemealtı and Antalya downtown-Aksu by 2030. In addition to these lines, the municipality is planning new motorways as well. These motorways and lines might have negative ecological consequences [15].</p> <p>Additional to the Master Zoning Plan, a new rail line to connect Antalya with Kayseri will be constructed as in Fig.14, which passes through the surroundings of the pilot site. Even though most of the line will be in a tunnel right under the forest area, a 50 m corridor will pass through the Wildlife Protection and Improvement area (causing direct deforestation). In the EIA report for the railway project of Antalya-Kayseri, it is underlined that this new railway will have a negative effect on the ecological sustainability of the Wildlife Protection and Improvement area.</p>  <p>The map shows a green hatched area representing the Düzlerçamı YHGS (Wildlife Protection and Improvement Area). A red line indicates the planned railway route, which is labeled 'ANTALYA-KAYSERİ DEMİRYOLU'. The route starts from the bottom left and curves towards the top right. A black line represents the 'KAYSERİ-ANTALYA DEMİRYOLU'. A north arrow is located in the bottom right corner of the map.</p>
<p>Other relevant information</p>		<p>Fig. 14: The view from the plan of Antalya-Kayseri railway project</p>

Devastating impacts on wilderness	Roads through forest cut off grazing area of cattle, goats and sheep, and they can have disastrous consequences in terms of ecological sustainability. Additionally, it is seen that roads shape artificial corridors for wildlife movement, which become barriers for them over time.	field work	interview
High voltage lines	High voltage lines are constructed through forests causing directly deforestation and indirectly forest fire risk (Fig. 11(c)).	field work	interview

Forest fires

To validate the history of the forest fires inside the pilot test site, the records of annual burned area is given in Table 29 with their date and the source. It can be easily seen from the table that two forest fire sources entitled “interest-based” and “inattentiveness” are apparent in the region; both sources can be classified as human-induced forest fires. Since 1979, 62 forest fires held in the pilot site, accounting for the burning of nearly 1908 ha. Almost all of this area includes *Pinus brutia* and maquis.

Table 29: Annual burned area since 1979

Year	Date	Time of beginning	Area (ha)	Species	Source
1979	15.04.1979	23.40	0.10	<i>Pinus brutia</i>	interest-based
1979	01.08.1979	15.00	50.00	<i>Pinus brutia</i>	interest-based
1979	19.09.1979	17:00	0.10	Degr. <i>Pinus brutia</i>	interest-based
1980	24.06.1980	15:05	2.00	<i>Pinus brutia</i>	inattentiveness
1981	03.04.1981	10:00	4.00	<i>Pinus brutia</i>	unknown
1981	26.04.1981	14:00	4.50	<i>Pinus brutia</i>	interest-based
1982	04.08.1982	14:15	0.20	<i>Pinus brutia</i>	unknown
1982	08.11.1982	19:00	0.10	<i>Pinus brutia</i>	inattentiveness
1983	09.08.1983	11:30	0.80	<i>Pinus brutia</i>	interest-based
1985	05.09.1985	07:30	0.70	<i>Pinus brutia</i>	unkown
1987	22.09.1987	15:00	6.00	<i>Pinus brutia</i> Maquis	inattentiveness
1987	03.10.1987	03:00	0.50	<i>Pinus brutia</i>	inattentiveness

History of forest fires


		1988	08.08.1988	20:45	0.10	Degr. <i>Pinus brutia</i>	thunderbolt
		1988	13.09.1988	12:15	7.00	<i>Pinus brutia</i> Maquis	interest-based
		1989	21.10.1989	06:00	1.00	<i>Pinus brutia</i>	unkown
		1990	23.05.1990	15:00	1.00	<i>Pinus brutia</i>	unkown
		1990	30.09.1990	11:30	28.00	<i>Pinus brutia</i>	unkown
		1991	25.01.1991	12:45	3.00	<i>Pinus brutia</i>	inattentiveness
		1991	27.03.1991	18:00	3.00	<i>Pinus brutia</i>	unkown
		1991	14.06.1991	11:00	0.10	Degr. <i>Pinus brutia</i>	inattentiveness
		1991	23.07.1991	11:30	0.50	<i>Pinus brutia</i> Maquis	unkown
		1991	01.10.1991	16:45	2.50	<i>Pinus brutia</i>	inattentiveness
		1993	10.11.1993	20:00	0.20	<i>Pinus brutia</i>	inattentiveness
		1994	16.08.1994	09:00	2.00	<i>Pinus brutia</i>	interest-based
		1997	31.01.1997	03:00	1.00	Degr. <i>Pinus brutia</i>	unkown
		1997	14.07.1997	06:40	6.00	<i>Pinus brutia</i>	unkown
		1997	21.07.1997	13:00	1715.00	<i>Pinus brutia</i>	inattentiveness
		1997	02.09.1997	19:00	0.50	maquis	inattentiveness
		1998	07.07.1998	11:15	0.30	<i>Pinus brutia</i>	thunderbolt



		1998	05.10.1998	12:45	0.05	Afferosati on Area	unkown
		1999	15.06.1999	12:04	0.10	Afferosati on Area	inattentiveness
		1999	14.07.1999	08:00	0.06	Afferosati on Area	inattentiveness
		1999	28.10.1999	10:40	0.06	Afferosati on Area	inattentiveness
		1999	01.12.1999	13:10	0.10	<i>Pinus brutia</i>	inattentiveness
		2000	17.06.2000	13:30	10	maquis	inattentiveness
		2000	07.07.2000	13:40	0.5	Degr. <i>Pinus brutia</i>	inattentiveness
		2000	03.08.2000	21:40	0.1	Afferosati on Area	interest-based
		2000	14.09.2000	07:00	0.2	<i>Pinus brutia</i>	inattentiveness
		2001	14.09.2001	11:35	0.01	<i>Pinus brutia</i>	inattentiveness
		2001	29.09.2001	16:20	0.10	Maquis	inattentiveness
		2002	20.06.2002	23:55	1	<i>Pinus brutia</i> Maquis	inattentiveness
		2002	22.07.2002	14:05	0.2	-	High voltage line
		2003	02.07.2003	12:20	1.00	Degr. <i>Pinus brutia</i>	inattentiveness
		2004	14.07.2004	11:45	0.01	<i>Pinus brutia</i>	inattentiveness
		2004	15.10.2004	14:15	0.01	<i>Pinus brutia</i>	unkown
		2007	17.07.2007	03:45	2.00	<i>Pinus brutia</i>	interest-based
		2007	04.10.2007	12:15	0.01	<i>Pinus brutia</i>	thunderbolt
		2008	05.11.2008	11:50	0.20	<i>Pinus</i>	unkown

				<i>brutia</i>	
2009	02.08.2009	13:45	40	<i>Pinus brutia</i>	unknown
2009	04.09.2009	13:50	0.60	<i>Pinus brutia</i>	thunderbolt
2010	04.04.2010	17:30	0.01	<i>Pinus brutia</i>	inattentiveness
2010	27.07.2010	15:20	1.5	<i>Pinus brutia</i>	inattentiveness
2011	29.06.2011	15:35	0.3	-	intereset-based
2011	18.09.2011	13:00	0.01	<i>Pinus brutia</i>	unkown
2011	09.11.2011	08:00	1.50	<i>Pinus brutia</i>	unkown
2011	14.12.2011	09:10	2.50	<i>Pinus brutia</i>	unknown
2012	23.08.2012	12:20	1.00	<i>Pinus brutia</i>	inattentiveness
2012	26.08.2012	16:50	5.00	maquis	waste management
2012	06.10.2012	08.00	0.26	<i>Pinus brutia</i>	thunderbolt
2013	10.07.2013	11:25	0.01	<i>Pinus brutia</i>	High voltage line
2013	01.08.2013	12:55	0.0	-	unkown
2013	02.08.2013	09:58	0.03	-	unkown

Since 1997, there has not been any heavy forest fire in the test site. The potential for forest fire is going down each year due to the investments done by the directory of forestry. Firstly, the forestry department has enough equipment (pools, helicopter and etc.) and local fire crews compared to the past. Secondly, forest villagers have become more aware of their forest resources, making them more protective of forests.

Small scale forest fires in the test site have been recognized 6 times in last decade, destroying a total surface of 2.54 ha. This state that an average of 0.25 ha were burnt annually. Natural and artificial tree

	regenerations have been made a 12-year period after the 1997 Forest fire. About 187 ha out of the total deforested area of 625 ha were naturally fertilized, and about 438 ha out of 625 ha were seeded with pines.
Forest Fire in 27ha of national park in July 1997	
The origin of forest <u>fires</u>	<p>The purpose of the forest fire in the National Park remains a mystery. However, there has been a common belief that human-related activities caused the fire.</p> <p>According to the European Union's classification of fires, the cause of the fire can be considered to be <i>voluntary</i> and <i>interest-based</i>.</p>
The impact of fires on forest cover	<p>1715 ha of forest burned.</p> <p>Even when the originally deforested area has been reforested, with the disappearance of the original forest, many species such as <i>Collema nigrescens</i> (Huds.) DC., <i>Lecanora expallens</i>, <i>Phycia stellaris</i> (L.) Nyl., <i>Physconia perisidiosa</i> (Erichsen), <i>Toninia diffracta</i> (A.Massal.) Zahlbr., <i>Cladonia convoluta</i> became extinct [21].</p>
Prevention measures	
Since then, there is a special training course for local people entitled “ <i>The fire fighters</i> ”	Local people have become more aware of how to protect forests.
Precautions done by the state authority	<p>Forest fire precautions taken by the directorate of Forestry Antalya: fire watching towers, pools, 24-hours helicopter availability with their pilots and local fire crews living inside the test site (Photo 14).</p> 
	Photo 14: Houses of the local fire crew

<p>The boundary of picnic areas are defined by governors</p>	<p>The municipality has defined the permitted areas for picnic (see Fig. 4 (c)), which decreases the impact of a human induced forest fire.</p>
<p>International Fire Training Center managed by General Directorate of Forestry [22].</p>	<p>The International Fire Training Center, which is located in the test site, was opened in 2013 (Photo 15). It includes watch-towers, helicopters, large pools etc. In addition to these facilities, the level of training supply to improve disaster preparedness, to increase the understanding of and use of advanced technology and to be more aware of vegetation types and the efficient use of water.</p> <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <p style="text-align: center;">Photo 15: Scenes from International Fire Training Center</p>
<p>Rehabilitation of Burned Areas and the Establishment of Forest With Fire-Resistant Species Project (YARDOP)(2011) [21]</p>	<p>In the forest fire area, silvicultural inventions such as cleaning and thinning of trees, sanitation, harvesting fire-resistant and plants that are beneficial to wildlife (<i>Nerium oleander</i>, <i>Cappari spinosa</i>, <i>Spartium Junceum</i>, <i>Arbutus andrachne</i> etc.) have been recommended by the Rehabilitation of Burned Areas and the Establishment of Forest With Fire-Resistant Species Project. According to this project, tree density maintenance and thinning have been done by the district directorate of Forestry Düzlercami across 718.9 ha and 213.5 ha respectively to prevent and to handle forest fires. In terms of road maintenance, harvesting has been done across an additional 85 ha (Photo (16)). As the geometrical structure of forest is very important to minimize a fire-spreading area, the project also includes the following works:</p> <ul style="list-style-type: none"> - Flammable types such as red pines have been moved away, and trees with a low flammability rate have been used as barriers. - Cypress have been planted along the sides of forest roads and fire breaks to contribute forest fire

protection by creating windbreaks and by preventing heat radiation because of their longer ignition delay times (Photo (16)).



Photo 16: Fire protection road

2.5 Indirect causes of deforestation and degradation

Indirect causes			
Economic factors	Local breeding: Cattle	Cash economy	Breeding and the milk production are the most cash-generating activities in the test site, highlighting their relationship with cash-economy. Big producers earn almost five times more than the villagers that intermediaries should be eliminated to make the villagers earning a viable living.
	Local breeding: Sheep and goats	Cash economy	The very slight changes in animal prices in recent years have put producers under a strain in economic terms. Due to the lack of a model of sales from producers to consumers, sheep and goats breeding, particularly its subsidiary sectors like milk production, is not financially attractive. As a result of this, livestock farming has predominated in the district, while the subsidiary products have remained underdeveloped.
	Urbanization	Real estate market growth	<p>Since 2004, according to Law no:5216 on Metropolitan Municipality, Döşemealtı covering the almost entire test site is a county as a unit of Antalya Metropolitan Municipality. Döşemealtı's widening in this way and becoming part of metropolitan municipality has changed a lot the village life. With the construction law on the same year, villages became officially part of the city. These regulations on conversion of villages to districts have caused the construction of dense buildings in the areas devoted primarily to agricultural and forestry use.</p> <p>Owing to the areas of steep slope and the presence of very deep water resources in the northern part of the region, as well as to the vast areas of forest in its southern part, agricultural practices are not prevalent. Stock-breeding activities are more predominant in these parts. Considering the factors such as irrigation, slope, soil fertility, the most cultivable lands of the region lie in the south of Kırkgöz water resource.</p> <p>However, according to the Landscape Plan at a scale of 1/100,000, which has been designed for Antalya-Burdur-Isparta Planning Area, approved on 15/04/2014 as per Article 7 of the Decree-Law No. 644 and prepared for the Republic of Turkey, Directorate General of Spatial Planning of the Ministry of Environment and Urban Planning, and in accordance with Antalya Metropolitan Municipality Landscape Plan and Report, at its whole scale of 1/50,000, which went into effect upon approval on 03/03/2005 by the Directorate General of Technical Research and Application of the Ministry of Public Works and Settlement:</p>

			<p>Some parts of the agricultural lands around the district centre of Döşemealtı are indicated as the Urban Development Zone. In this scope, the agricultural lands in the region are recommended to be utilised as specific areas for:</p> <ul style="list-style-type: none"> - Public housing - Urban research outside housing sites - Natural gas stock and delivery - Sub-centres <p>As an urban development zone in the north, Bademağacı is also included in the plan at a scale of 1/100,000.</p> <p>It is seen that the trend has already reflected on the change matrix for the categories of land cover / land use between 1997-2012 (See the Change Matrix).</p> <p>The section map with no N25-D4 of the Zoning Plans at a scale of 1/25.000 also shows that a large hippodrome is planned for the limited pasture lands in the area. Despite the lack of activities related to horse riding or horse breeding in the region, preferences for such a function bring the idea of economic concerns.</p> <p>To encourage landowners to keep their land as a construction free area, local breedings and agriculture may be supported by the state authority. Real estate market presents a problem for landowners who are practising breeding. Because selling the land is a good but short-term income, instead breedings and agricultural practicing may be a life-term income if it is well managed.</p> <p>It is also observed that significant lines of transportation such as Antalya-Konya-Kayseri Railway Line, Eskişehir-Antalya Railway Line, northwestern peripheral highway (350), and northern peripheral highway (650) pass through the pilot area, which encourages activities related to urbanisation besides trade and transport.</p> <p>A way to reduce the pressure of urbanisation over the area is considered as the improvement of agricultural and stock-breeding practices. Accordingly, the recommendations introduced in Antalya Agricultural Master Plan, dated 2011 and prepared for the Provincial Directorate for Agriculture of the Republic of Turkey Governorship of Antalya, are as follows:</p> <ul style="list-style-type: none"> - In order for the meat deficit in Turkey to be eliminated, projects involved in research on animal
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			<p>breeding and efforts to increase the number of maternal animals should be developed. Fodder crops should be encouraged for sowing and price stability in production costs should be achieved in order that input expenses for stock-breeding enterprises can be reduced.</p> <ul style="list-style-type: none"> - Meadows, pastures, mountain pastures and winter quarters are among the most important sources of roughage for our livestock, and studies on their identification, restriction and allocation should be implemented in the earliest time. - Our biological richness in pastures, most of which is comprised of endemic species, should be under conservation. - Meadows and pastures should be improved via the proper methods; better vegetation should be achieved; perennial plants of meadows and herbaceous covers should be formed. - Administration units of pastures should be established in the pastures with completed studies of improvement and forest management, and the sustainability of these areas should be achieved. <p>The strategies specified in 2013-2017 Strategic Plan of the Provincial Directorate General of Food, Agriculture and Stock-Breeding also support these recommendations[23].</p> <p>However, as it is inferred from the agricultural production indicators of the master plan in question, Döşemealtı district falls behind the other districts in terms of agricultural production. It is observed that along with almost no cultivation of greenhouse and foliage plants, the area is representative of very few target kinds (almond and oil) in fruit growing (see Antalya with the selected indicators-the Table of Direct Causes), and it is insufficient in cultured fishery.</p> <p>Moreover, due to the rises in the values of lands around, local people tend to make a living by selling lands to larger extents, which leads them to greater consumption, rather than production.</p>
	Tourism	Income for local municipalities	<p>The most important source of income for municipalities is picnic areas. Except for the officially-run picnic areas available, attraction sites, such as Kırkgöz water resource and its immediate surroundings, are also utilised as picnic areas because of their natural potentials. The effects of this practice, such as contamination in the water resource, soil compaction and deterioration of vegetation, have indirect impacts on forests, as well.</p> <p>Also, favourable climatic conditions cause picnic areas to be used through four seasons. Models of rehabilitation should be developed for those exposed to intensive use.</p> <p>The annual forest rent for hunting activities is the main income for forest management and</p>

			community development.
	Mining	Job creation	The quarries propose a creation of little job opportunities for local people.
Policy and institutional factors	Local breeding : cattle	Integrated Cattle Management System (required)	Integrated Cattle Management System in the test site can cause several benefits such as reducing the amount of labor and gathering large amounts of the manure to utilize.
	Local breeding: Sheep and goats		The grazing plans prepared by the Regional Chief Office of Forest Service (see Figure 12 (b)) encourage the provision of mutual benefits from practices. It is particularly stated that controlled grazing is beneficial in order to reduce the risk of forest fires. Likewise, especially goats prefer ligneous vegetation. Pastures are not so convenient for the grazing of goats. These areas are more convenient for sheep. There are large pasture fields in the area, but the practice of small cattle rising in the region is predominantly based on goats. The grazing of sheep is not common, so joint operations with the Chief Office gain greater significance for maquis areas.
	Urbanization	Formal policies	Law no:5216 on Metropolitan Municipality adopted on the 10 th of June 2004. Then, the amendment of his law numbered 5393 was applied in 2011. This amendment enabled villages in the vicinity of cities to join the metropolitan municipalities. In this framework, the villages become districts in the test site. Law no:6831 on Forestry adopted on the 19 th of April, 2012. Since then, 2B lands were eligible for construction, which address the problem of rapid urbanization. Since these areas are generally connected with forest areas, they have indirect effects on deforestation. The large number of protected areas such as the Conservation Sites of Wildlife, Natural and Archaeological Sites, are the mechanisms that restrain the pressure over land use in these areas.
	Tourism	Increasing recreation areas	Being an important income of the local municipality tends to raise the recreation areas.
	Mining	Formal policies	In Turkey, Mining Law numbered 25483 was put into application on 5 th of June in 2004. Since then, <i>Environmental Impact Assessments</i> report has not been required anymore to run quarry. After this law, mining and quarrying activities expanded by an estimated 60%. Kırkgöz is a water resource that contributes substantially to the water supply of Antalya Province,

			<p>with its significance on the regional scale. However, it is adversely influenced by the quarry and lime plant in its immediate vicinity.</p> <p>Mining Law Numbered 3213: (Additional subsection: 10/06/2010-5995 Law No./Article 3.) Provided that the acquired rights shall be reserved, and that coyote hole blasting method is not used for the 1000-2000 meters wide line from the maximum water level of drinking and utility water reservoirs, and that water is not discharged directly unless the receiving environment is purified, mine exploration, management and infrastructure facilities which are scientifically and technically proved to be friendly with the environmental and human health are permitted. Mine hoisting and all kinds of facilities, the establishment of which is approved as per the environmental impact report, may be built within the protection area after 2000 metres. However, it is mandatory to comply with the limits stipulated by the Regulation regarding the discharges to the receiving environment during the activity.</p> <p>The Environmental Impact Assessment must be made obligatory.</p>
	Local breeding: Sheep and goats	Social transformation	<p>Farm and pasture land change has occurred due to the urbanization resulting in changing the cultural and social characteristics.</p> <p>Urbanisation is influential on the change in the basic sources of income for the settlements. Organised Industrial Zone provides remarkable employment opportunities, and the young are inclined to have paid-jobs by quitting the traditional practices (like stock-breeding). To comply with the metropolitan law, the villages become districts and lose their rural qualities, but inhabitants of the villages, not having left their characteristics as villagers yet, lead to a major conflict with the place, having lost its quality as a village. There are conflicts between the socio-economic and administrative structures.</p>
Cultural or Socio-political factors	Local breeding: cattle	Social transformation	<p>Stock-breeding is the main source of income for the locals. Along with the rise in public works permit in recent years, the real estate market is seen as an attractive source of income, but the most important factor that paralyzes stock-breeding is the inclination of the new generation towards different sectors in line with their preferences for paid-jobs. This poses a threat for the future of stock-breeding, which is also a part of the cultural structure of the region.</p> <p>Antalya Organised Industrial Zone provides remarkable employment opportunities, and the young are inclined to have paid-jobs by quitting the traditional practices (like stock-breeding).</p>
	Urbanization	Social transformation	<p>To comply with the metropolitan law, the villages become districts, resulting in the loss of their rural qualities, but inhabitants of the villages, not having left their characteristics as villagers yet,</p>

			<p>lead to a major conflict with the place, having lost its quality as a village. Nomads (Yörüks), particularly in the north of the region, are involved in agriculture and stock-breeding, but such practices are dwindling as the young population is not interested in agriculture and stock-breeding. Promotion of agriculture and stock-breeding via the modern methods could encourage the young population to get involved in these activities. Also, support and training to be offered for other activities in the region, like the carpet sector, could enable the sustainability of such practices. There are conflicts between the socio-economic and administrative structures. Stock-breeding particularly in the sites near the district centre is not a viable option for the local administrators.</p>																																										
	Mining	Pollution	<p>Mining does not create lots of job opportunities for local people, pollution to water, air and vegetation by the mine is a key concern raised by local people.</p>																																										
Demographic factors			<p>Antalya is seen as a region that attracts greater external migration throughout the province (See Table 30). The same trend also goes for Döşemealtı. New job opportunities created through urbanisation in the area has slowed down migration from the settlements. Owing to the district centre located closely to the city centre, the population is not affected by a lot of external migration for work. Due to the closeness of rural areas to the Organised Industrial Zone, besides stock-breeding and agricultural activities, external migration is not witnessed there, either. External migration is more common for educational purposes of the young population. In contrast, especially the settlements at high altitudes including Bademağacı, Bayatbademleri, Yukarıkaraman receive external migration as a result of their fresh air and favourable bioclimatic comfort. Therefore, the construction of secondary houses is predominant in these areas.</p> <p style="text-align: center;">Table 30: Internal and external migration to Antalya [24]</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th colspan="6">Period</th> </tr> <tr> <th>Antalya</th> <th>1985-1990</th> <th>2007-2008</th> <th>2008-2009</th> <th>2009-2010</th> <th>2010-2011</th> <th>2011-2012</th> </tr> </thead> <tbody> <tr> <td>Internal migration (indiv.)</td> <td>123,737</td> <td>92,031</td> <td>75,696</td> <td>86,907</td> <td>89,731</td> <td>83,596</td> </tr> <tr> <td>External migration (indiv.)</td> <td>41,000</td> <td>55,806</td> <td>58,632</td> <td>61,662</td> <td>62,875</td> <td>62,893</td> </tr> <tr> <td>net migration (indiv.)</td> <td>82,737</td> <td>36,225</td> <td>17,064</td> <td>25,245</td> <td>26,856</td> <td>20,703</td> </tr> <tr> <td>net migration rate (‰)</td> <td>80</td> <td>19.70</td> <td>8.90</td> <td>12.80</td> <td>13.20</td> <td>9.94</td> </tr> </tbody> </table> <p>In Döşemealtı district, it is seen that the young population decreases while the population over 65</p>		Period						Antalya	1985-1990	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	Internal migration (indiv.)	123,737	92,031	75,696	86,907	89,731	83,596	External migration (indiv.)	41,000	55,806	58,632	61,662	62,875	62,893	net migration (indiv.)	82,737	36,225	17,064	25,245	26,856	20,703	net migration rate (‰)	80	19.70	8.90	12.80	13.20	9.94
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increases over the years (Fig.15). This proves the migration of young population for educational purposes. The increase in the aged population indicates that the retired population prefers to live here due to the high-quality of life. Additionally, the interviews have concluded that families are more conscious about the number of children they want to have. The average number of children for families has been reduced to around 3. This data also goes in line with the decrease in the young population

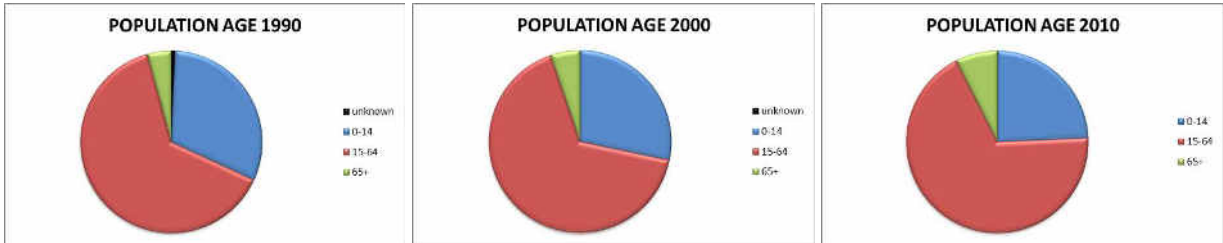


Fig. 15: Antalya population age [6]

According to the local administrators’ assessment of the demographic situation, the acreage of the district is very big in proportion to its population. The local administrators state that the small population in proportion to the total acreage also brings little amounts from the collected taxes, which cast adverse reflections on the service quality. The number of zoned parcels simply in the district centre is between 50,000 and 60,000, which means a population of 700,000. The current rate of occupancy is about 10%. As to the rural areas, the structuring rate of zoned fields in the sites (plateaus) attractive for constructing summer house is around 40%.

Particularly with their visitors from other places at weekends, picnic areas and excursion sites increase the population of the district. Such a densification of the population is a factor which constrains the capacity of natural potentials.

3. FEEDBACK BETWEEN CAUSES

The Düzlerçamı forests have three main functions: economic, ecologic and socio-cultural. Among them, timber production has been the most reliable source of income for both the nation and the local people living in and around the forests. However, they must be considered a Wildlife Protection and Improvement area due to their biodiversity and water quality as well as social and cultural demands. The district directorate of Forestry of Düzlerçamı has to balance and guide the trade-off between these functions. Table 31 shows the percentage of functions in the test site in 2006, and its projection for the period 2012-2021 [2], which has been prepared by the district directorate of Forestry. As illustrated in Table 30, the big investment in the new policy will be with regard to ecological functions, which are negatively affected by sociocultural (recreational activities, hunting etc.), and economic functions. There is a plan to minimize the sociocultural function and to decrease timber production by 2021. Additionally, it can be easily seen that since the test site is characterized as a Wildlife Protection and Improvement Area, the forest area will not be much affected, but the trade-offs between different functions and their drivers will have to be managed.

Table 31: The percentage of functions in the test site as prepared by the district directorate of Forestry of Düzlerçamı

	2006		2012-2021 period	
	Area (ha)	%	Area (ha)	%
Economic	4322.3	23	919.1	6
Ecologic	11,528.5	62	16,721.6	94
Sociocultural	2708.6	15	47.4	-

Taken together with the Düzlerçamı forests projections, the result of the work carried out for this report has been introduced in terms of *Component 4* of the *FFEM* project. Here, it underlines the following three main problems as having a high impact on deforestation and degradation, which must be considered in sustainable forest management.

- Political decisions:

Forest management includes conversion of biological diversity, recreational facilities, extraction of wood/non-wood products, and licensing quarries is carried out according to laws 3116 and 6831. However, in practice, there are legal loopholes in these legislations which include unregulated quarries, timber-oriented forest management and qualified foresters changed frequently, as well as short-term laws and regulations.

- Interaction problem between government organizations:

According to the Permit Regulation Law (published in the Official Journal dated June 21, 2005 and numbered 25852), the local municipality can run recreational areas, and these provide a very profitable income for the local municipality. Even though for tree maintenance the district Directorate of Forestry is in charge, especially in practice, the municipality has full authority to make decisions regarding the running of the recreation places. This causes soil compaction and reduced plant growth which results in decreased forest quality. Since the test site is defined as a Wildlife Protection and

Improvement Area, the total temporal area of the forest is fairly stable. However, it is apparent from biological indicators (missing bird and plant types) that the forest quality has significantly declined.

- Lack of state assistance in livestock and farming:

The ecosystem consists of all the living things such as forests, animals, and plants that are connected to each other. Human disturbances make some of the components weaker, which affects the entire ecosystem. In the Düzlerçamı pilot site, urbanization is one of the major threats to degradation and is one of the outcomes associated with the economic situation of the local villagers. Since 2004, Döşemealtı has expanded to cover almost the entire pilot site, and has become a county within the Antalya Metropolitan Municipality. Döşemealtı's widening and its becoming part of a metropolitan municipality has changed a lot the village life. With the construction law of the same year, villages officially became part of the city. The regulations on the conversion of villages to districts have caused the construction of dense buildings in areas previously devoted primarily for agriculture and livestock. In addition to the direct loss of rangeland and farmland, irregular structuring poses indirect social and economic problems to the local community. Instead of livestock and farming, local people prefer to benefit in the short-term by selling their land. If they were able to make a good living by making use of their land, they would not only protect the environment but also provide a good future for themselves.

Taking into consideration these results and the positive impacts on forest cover given in the report, the following suggestions for sustainable land use management at the local level are given.

- To overcome decreasing forest quality due to recreational facilities; the district directorate of forestry should have much more authority to make decisions regarding the running of the forests.
- To encourage landowners to keep their land as a construction-free area, local animal breeders and farmers should be supported by the state authority.
- The villagers living close to forest area should be more aware that there are many ways to earn a living from the forest without causing damage. If landowners can earn a living from forests, they will take more care of the forests and will not have the tendency to sell their land.
- Forty-eight (48) types of non-timber value added forest products exist in the pilot site (Table 32). Despite their existence in the Düzlerçamı pilot site, their economic power is still underestimated. Even though non-timber products have not brought socio-economic development to the inhabitants yet, they remain a substantial contributor to the forest ecosystem. Considering their economic and ecological value, a sustainable non-timber product management system should be implemented for their tracking, conservation and commercialization.

Table 32: Value added non-timber forest products of Düzlerçamı

Species	
<i>Cotinus coggyria</i> L.	<i>Stachys cretica</i> L. subsp. <i>Mersinaea</i> (Boiss.)Rech.f.
<i>Pistacia terebinthus</i> L. subsp. <i>palaestina</i> (Boiss.) Engler	<i>Lavandula stoechas</i>
<i>Capparis spinosa</i> L. subsp. <i>inermis turra</i>	<i>Laurus nobilis</i> L.
<i>Chondrilla juncea</i> L.	<i>Ceratonia siliqua</i> L.
<i>Cichorium intybus</i> L.	<i>Malva neglecta</i> Wallr.
<i>Helichrysum stoechas</i> (L.)Moench	<i>Morus alba</i> L.
<i>Ricinus communis</i> L.	<i>Ficus carica</i> L.
<i>Hypericum aviculariifolium</i> Jaub. & Spach subsp. <i>Avicularifolium</i>	<i>Myrtus communis</i> L.
<i>Hypericum aviculariifolium</i> Jaub. & Spach subsp. <i>Depilatum</i> (Freyn & Bornm.) Robson	<i>Ophrys attica</i> (Boiss. & Orph.) Soo
<i>Hypericum origanifolium</i> Willd.	<i>Ophrys vernixia</i> Brot. subsp. <i>Vernixia</i>
<i>Hypericum perforatum</i> L.	<i>Orchis anatolica</i> Boiss.
<i>Hypericum polyphyllum</i> Boiss.& Bal. subsp. <i>Subcordatum</i> Robson & Hub.-Mor.	<i>Orchis punctulata</i> Steven ex Lindley
<i>Juglans regia</i> L.	<i>Orchis sancta</i> L.
<i>Coridothymus capitatus</i> (L.)Reichb.	<i>Orchis simia</i> Lam.
<i>Melissa officinalis</i> L. subsp. <i>altissima</i> (SM.) Arcangel	<i>Pinus brutia</i> Ten.
<i>Mentha spicata</i> L. subsp. <i>Spicata</i>	<i>Pinus pinea</i> L.
<i>Origanum onites</i> L.	<i>Portulaca oleracea</i> L.
<i>Satureja thymbra</i> L.	<i>Rosa canina</i> L.
<i>Thymbra spicata</i> L.	<i>Rubus sanctus</i> Schreber
<i>Thymus revolutus</i> Celak.	<i>Styrax ofcinalis</i> L.
<i>Phlomis bourgaei</i> Boiss.	<i>Anethum graveolens</i> L.
<i>Sideritis condensata</i> Boiss. &Heldr. apud Bentham	<i>Urtica dioica</i> L.
<i>Stachys aleurites</i> Boiss. & Heldr. apud Bentham	<i>Urtica pilulifera</i> L.
<i>Stachys cretica</i> L. subsp. <i>anatolica</i> Rech. f.	<i>Vitex agnus-castus</i> L.

- Considering the test site, it is apparent that these Protected Areas can be among the most effective tools for protecting districts from human threats. However, as stated above, communities living in the area are very restricted in the ways they can use the land and have only limited usage rights. The disparity between the protection and the use of forest should be reduced.
- Even though roads are essential for loggers and miners, environmental factors must be considered during construction. Road construction is one of the main causes the decreasing water quality and extinction of wild animals in the Düzlerçamı pilot site. Additionally, the villages within the pilot site have no accessibility problems.
- Because of the steadily growing urbanization, new high-voltage power lines, which

threats forests and migrating birds, are needed to keep up with demand. Forest fire risks have to be considered while building power lines.

- Although there are grazing plans, a lack of inspection can cause overgrazing. However, in a *controlled grazing system*, goats may be allowed to eat flammable underbrush in order to prevent forest fires, which can also tackle the soil compaction problem.
- Instead of recreation planning, sustainable ecotourism encompassing the reasonable use of natural resources including transhumance and cultural tourism should be encouraged and planned by the local municipality in co-operation with the Directorate of Forestry.
- Ecologically-sensitive development, including an educational program to inform and empower local communities to protect their environment and to reduce the demand for natural sources, should be considered.
- Sociocultural sustainability with respect to modernity, traditions and naturality has to be insured by investments and subsidies instead of forcing people to work in a quarry or a service industry. People have become more urbanized and are without jobs. At the same time, there is a big demand for dairy products and livestock. This leads to a requirement for more sustainable ways of land use. For example, when considering the test site, beekeeping and carpet-weaving used to be woodland based enterprises which contributed to a higher quality of life and low poverty levels. However, beekeeping and carpet-weaving has ceased, and livestock and farming face extinction.
- It has been observed that hunting and nature tourism have become popular as important sources of economic income; hence, the establishment of sustainable wildlife management is required for providing economic development in game hunting and ecotourism while preserving the forests, water resources and the natural landscape.
- Raising goats for milk production has decreased rapidly in recent years. Goat owners, who raise goats for their meat, can also be supported by the state to establish a cooperative for milk production. A co-operative for dairy production can also be established for cattle, as well as goats. By encouraging these co-operatives, farmers and villagers can eliminate the costs associated with intermediaries.
- There are two stone quarries inside and one cement plant outside the pilot test site. Since they are in the Wildlife Protection and Improvement Area managed by the district Directorate of Forestry of Düzlerçamı, getting a license for a quarry is more difficult in the pilot site compared to the rest of Turkey. The district Directorate of Forestry of Düzlerçamı stated that the license of the few mining companies will expire before 2015, and it will not be extended. This approach should be consistent.
- In the region, in addition to agriculture and stockbreeding, transportation, quarries, tourism and trade are some of the sources of living. The local people are attracted to the city center as well as to the touristic and industrial areas. It can be observed that when people start to work in a forest, they embrace and protect the forest. By raising the awareness of people, they can be made to use stone, concrete and corrugated iron instead of wood in houses or other buildings. In addition, the use of solar collectors

can be encouraged. For example, in the Düzlerçamı pilot site, solar panel installation could be a profitable and eco-friendly alternative to firewood.

- Within the framework of the Rehabilitation of Burned Areas and the Establishment of Forest With Fire-Resistant Species (YARDOP) plan, to regenerate plants and to have an access to a place during fire, a dense network of wide roads are built, which leads to pressure on wild life.
- According to the map plans of the District Directories of Forestry of Düzlerçamı, Antalya and Doyran, there is a 508.5-hectare private property, 150.0 hectares of which are fields where the animal population is too high. Some of these fields are surrounded by wire fences. This situation causes a problem since it encroaches on the red deer habitat.
- The potential of the annual carbon sequestration of Turkey's forests rise steadily. The net stock increment in 1990 was 12.02 Mton/ year, reaching up to 15.64 Mton/year in 2009; leading to a similar increase in the carbon stock from 44.08 Mton/year to 57.36 Mton/year [25]. The most important carbon pools in which CO₂ is absorbed in the terrestrial ecosystems is forestry ecosystems. There has been improvement in the quality and amount of vegetation due to maintenance and reforestation. This enhances carbon storage. Taking into consideration its geographical zone, it is estimated that Turkey stores 51% carbon for the coniferous trees and 48% carbon for deciduous trees. In the test site where there are a lot of pine trees, the places converted into forests from maquis enhance the capability of carbon storage. In the forests recovery, protection and tree planting should be carefully planned.

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5. APPENDIX

APPENDIX-1

SEMI-STRUCTURED INTERVIEW TECHNIQUE
1. The socio-economic characteristic of population
What is your main source of living?
What is the educational level of the local community?
Are the families mostly nuclear or extended?
What do you think about the changes in population in time? Are there any spot events which effects population since 2000? What do you think will happen in ten years? If there have been changes what do you think are the reasons?(decrease and increase in population, immigration, etc.)
What is the main socio-economic structure? (social or religious groups, main sources of income, etc.)
Are there any immigrant families?
What are the effects of economic sources on population? Can young people find jobs? Do they immigrate in order to find a job?
2- Livestock
What is the general characteristic?
Does the government support you?
Which animals are bred mostly?
What are the meat and dairy products? What are the economic income of these products?
Are there production establishments? If yes, where are they?
Where and how are products sold? (Are they sold in different towns?)
Are there production establishments? If yes, where are they?
Where do the herds graze mostly?
Are herds fed additionally? Where and how are foods provided? How is health managed?
Is there a grazing plan? If yes, is it followed?
Are there any measures taken to prevent animals from grazing in the forest?

Is there yaylacı hayvancılık? If yes, where and what kind of animals?
If yes, what is its difference from yerleşik hayvancılık?
What are the main problems you face?
3-Timber Production
How is timber provided?
Who has the right to have timber and how much?
In which region is timber collected mostly?
Is timber used at home or traded?
Are there available alternative energy resources? (geothermal, etc)
Is timber produced?
What are the non-timber products? Who collect these and how?
4- Urbanization
What about the zoning status in your residence?
Is there any uncontrolled housing? If yes, how?
Are there any people coming from neighbouring districts? If yes, what is the general profile? (summer house vacationist, civil servants, etc)
Are there 2B lands? If yes, what is the situation?
5- Tourism
Are there any tourists? What about touristic potential?
What is the general profile of the tourists? What are the advantages or disadvantages of tourists visiting here?
Do tourists have any contribution in terms of economy?
What do you think are the properties of this place that can be made use of in terms of tourism? (plateau, gastronomy, outdoor sports, etc)
6- Mining
Is there a mine or quarry in the district? If yes, what is its type and location?

Is there an economic advantage of mines and quarries in the region? Are there any disadvantages?
7- Forest fires and other extreme events
Has there been any forest fire in the neighborhood I recent years?
If yes, when and where?
What caused fire?
What are its effects on you?
In addition to forest fires, have there been any extreme events such as draughts, floods and frosts?
Are there any hazardous insects such as çam kese bceği? Are there any collective destructions of forests? (due to reasons other than fire)
8- General Evaluation
How is management? When did the management change? (the hierarchy of town, village, district) How do the changes in terms of management affect you? (metropolitan municipality law, management changes, etc)
Is there anything you want to add on the topic we have discussed?

APPENDIX- 2

A- Socio-economic characteristics of global population

Data needs to be collected	Possible data source	Important issues
Number of families living in the pilot site	Turkish Statistical Institute-General Directorate of Civil Registration and Nationality	The pilot site does not have administrative border.
Average size of the families living in the pilot site	Turkish Statistical Institute-General Directorate of Civil Registration and Nationality	The pilot site does not have administrative border.
Number of families affecting forest ecosystems within the pilot site	Turkish Statistical Institute-General Directorate of Civil Registration and Nationality	
Evolution over time of the number of inhabitants living within the pilot site boundaries	Turkish Statistical Institute-General Directorate of Civil Registration and Nationality	The pilot site does not have administrative border.
Evolution over time of the number of inhabitants affecting the ecosystem of the pilot site	Turkish Statistical Institute-General Directorate of Civil Registration and Nationality	
Main socio-economic and cultural characteristics of the population living within the pilot site	Turkish Statistical Institute-General Directorate of Civil Registration and Nationality	The pilot site does not have administrative border.

B- Agent groups

Local people
Breeders
Wood extractors
Mining operators
Tourists
Farmers
Local administrators

C- Socio-economic characteristics of the Agent Group (this evaluation must be done for each group)

Data needs to be collected	Possible data source	Important issues
Evolution over time of the size of the agent group	Turkish Statistical Institute-General Directorate of Civil Registration and Nationality	The pilot site does not have administrative border.
Which percentage of the agent group affecting the forest cover of the pilot site lives within the pilot site?	Turkish Statistical Institute-General Directorate of Civil Registration and Nationality	
Average size of the families for this agent group	Turkish Statistical Institute-General Directorate of Civil Registration and Nationality	The pilot site does not have administrative border.
Main socio-economic and cultural characteristics of this agent group	Turkish Statistical Institute-General Directorate of Civil Registration and Nationality	The pilot site does not have administrative border.
Privileged location of the agent group in the pilot site	Literature	
Public or private institutional agents	Antalya Chamber Of Commerce And Industry- Antalya Metropolitan Municipality, Döşemealtı Municipality, Turkish Statistical Institute	

D- Direct causes of deforestation

Local breeding

Data needs to be collected	Possible data source	Important issues
Species and total number of individuals managed under the same practices	Directorate of Food, Agriculture and Livestock (Antalya and Döşemealtı)-Mukhtar	
Free range area used by the herd within the pilot site	Maps	Grazing Plan
Area of pastures used by the herd within the pilot site	Maps	Grazing Plan
Evolution over time of the surface of free range areas and pastures occupied by this breeding system and of the number of individuals in the pilot site	Maps	

Breeding management norms	Republic of Turkey Ministry of Food, Agriculture and Livestock, Directorate of Food, Agriculture and Livestock	
Location of the cause “overgrazing” in the massif	Maps, satellite images	
Do the herds pasture on lands outside the project area?	General Directorate of Forestry, Directorate of Food, Agriculture and Livestock	Grazing Plan
Is there any forest protection practices to avoid cattle entering the pilot site? If there is, what are the concerned surfaces in the pilot site ?	General Directorate of Forestry, Mukhtar	
Characterization of the impacts on forest cover (positive or negative)		
Grazing of sprouts?	General Directorate of Forestry	
Cutting branches/the top of the trees?	General Directorate of Forestry	
Soil compaction and degradation?	General Directorate of Forestry	
Use of fire for livestock management?	General Directorate of Forestry	
Other (please specify)	Interview	
Livestock management		
Quantity of (gross) production by head and for the total herd	Directorate of Food, Agriculture and Livestock, Mukhtars	
Level of products processing		
Destination of products	Directorate of Food, Agriculture and Livestock, Mukhtars, cooperative societies	
Livestock intensification level		
Estimation of the average net profit per ha	Statistical data and maps	

Other carbon potential linked to breeding activities		
Is there any tendency of converting the pastures into another land use type?	Maps, satellite images	
Silvopastoral pasture management	Maps, satellite images	
Is it relevant to increase tree density in pastures? Why?	Maps, satellite images, General Directorate of Forestry	
Quantity of manure produced by the herd	Directorate of Food, Agriculture and Livestock, Mukhtars, cooperative societies	
Existing manure management practices	Directorate of Food, Agriculture and Livestock, Mukhtars, cooperative societies	
Would it be relevant to implement new manure management practices?	Directorate of Food, Agriculture and Livestock, Mukhtars, cooperative societies	
Activities to mitigate the impact of overgrazing on forest cover		
Describe potential activities that could be implemented to mitigate the impact of this direct cause on forest cover	General Directorate of Forestry	
Other relevant information	Interview	
For each animal species		

Transhumant pastoralism

Data needs to be collected	Possible data source	Important issues
Species and total number of individuals managed under the same practices	Directorate of Food, Agriculture and Livestock	
Origin and period of grazing within the pilot site	Maps, General Directorate of Forestry, Directorate of Food, Agriculture and Livestock, district governorship	Grazing Plan
Surface of free range area dedicated to transhumant herds within the pilot site	Maps, General Directorate of Forestry, Directorate of Food, Agriculture and Livestock, district governorship	Grazing Plan
Evolution over time of the surface of free range areas and pastures occupied by this breeding system and of the number of transhumant individuals in the pilot site	Maps, General Directorate of Forestry, Directorate of Food, Agriculture and Livestock, district governorship	
Transhumant breeding management norms	Maps, General Directorate of Forestry, Directorate of Food, Agriculture and Livestock, district governorship	
Location of the cause “transhumant overgrazing” in the massif	maps, General Directorate of Forestry, Directorate of Food, Agriculture and Livestock	
Characterization of the impacts on forest cover (positive or negative)		
Are the impacts different from those caused by local herds?	Haritalar-Uydu görüntüleri-Orman Bölge Müdürlüğü	
Livestock management	İl Gıda Tarım ve Hayvancılık Müdürlüğü-T.C. Gıda, Tarım ve Hayvancılık Bakanlığı	
Are the characteristics of herd management different from those of local herds?		
Activities to mitigate the impact of “transhumant overgrazing” on forest cover		

Describe potential activities that could be implemented to mitigate the impact of this direct cause on forest cover	General Directorate of Forestry	
Other relevant information	Interview	
For each animal species		
Fuelwood collection		
Data needs to be collected	Possible data source	Important issues
Volume of fuelwood collected from the pilot site (m ³)	Stand Maps	
Location in the massif	Stand Maps	
Impacts on forest cover	General Directorate of Forestry	
Management norms for fuelwood collection	General Directorate of Forestry	
Volume of standing trees affected by fuelwood collection (in m ³ , including losses due to harvest)	General Directorate of Forestry	
Evolution over time of collected and damaged quantity of wood	General Directorate of Forestry	
Describe potential activities that could be implemented to mitigate the impact of this direct cause on forest cover	General Directorate of Forestry	
Other relevant information	Interview	
Urbanization		
Data needs to be collected	Possible data source	Important issues
Urbanized area within the pilot site	Maps, satellite images	
Location of this urbanized area	Maps, satellite images	
Historic evolution of the urbanized area	Maps, satellite images	
Urban expansion management	Municipality	
Impact of urbanization on forest cover	General Directorate of Forestry	

Existing urban expansion plans	Municipality	
Possible evolution of illegal urbanization	Maps, satellite images	
Describe potential activities that could be implemented to mitigate the impact of this direct cause on forest cover	General Directorate of Forestry	
Other relevant information	Interview	
Tourism		
Data needs to be collected	Possible data source	Important issues
Description of the area accessible for tourism	Antalya Culture and Tourism Directorate	
Touristic frequentation	Antalya Culture and Tourism Directorate	
Tourism management	Antalya Culture and Tourism Directorate	
Impacts of tourism on forest cover	General Directorate of Forestry	
Describe potential activities that could be implemented to mitigate the impact of this direct cause on forest cover	General Directorate of Forestry	
Other relevant information	Interview	

Mining

Data needs to be collected	Possible data source	Important issues
Area dedicated to mining within the pilot site	General Directorate of Mineral Research & Exploration	
Location of mining	General Directorate of Mineral Research & Exploration	
Description of mining practices	General Directorate of Mineral Research & Exploration	
Historic evolution of mining	General Directorate of Mineral Research & Exploration	
Mining management	General Directorate of Forestry	

Impact of mining on forest cover	General Directorate of Mineral Research & Exploration	
Development plans of mining activities	General Directorate of Mineral Research & Exploration	
Describe potential activities that could be implemented to mitigate the impact of this direct cause on forest cover	General Directorate of Forestry	
Other relevant information	Interview	

Forest fires

Data needs to be collected	Possible data source	Important issues
The historical evolution of burnt areas (since 1975)	General Directorate of Forestry	
The origin of forest fires	General Directorate of Forestry	
The impact of fires on forest cover (affected strata, impact on tree growth...)	General Directorate of Forestry	
If available, characterize the evolution of the future fire regimes (according to expert opinions)	General Directorate of Forestry	
What are the prevention measures implemented to limit fire risks (tracks, watering places, firebreaks...) and precise which impact (positive or negative) they had on forest cover (for example : positive impact of firebreaks by limiting fire risks but negative impact while they are installed due to the removed forest area)	General Directorate of Forestry	
Which additional measures could be implemented in the future to limit fire risks and its impact on forest cover?	General Directorate of Forestry	