

General over-view of forest establishment in Turkey

Nebi Bilir

Forestry Faculty of Suleyman Demirel University, Isparta, Turkey

✉ nebibilir@sdu.edu.tr

Abstract

Turkey has 9.64 million hectares of unproductive forests 43% of the total forest area according to 2016' forest inventory. Forest establishment including afforestation, reforestation, rehabilitation and private plantation is the most important method to convert unproductive forest into productive ones, and also to increase present productivity of product forest by improved seed and seedling materials. Turkish forest establishment is examined based on past, present, and future perspectives according to forest inventory from 1946 to 2015 in the present study to contribute present and future establishment.

Keywords

Afforestation; Forest establishment; Regeneration; Plantation; Inventory

Contents

1	Introduction	48
2	Forest establishment perspective	49
3	Conclusion	52
4	References	52

1 Introduction

Turkey has 22.3 million ha. forest area of which about half of the area (9.6 million ha) is unproductive. The forest area cover is about 28.6% of Turkey, managed by General Directorate of Forestry. Annual increment is about 1.4 m³/ha, while annual wood production is 18.3 million m³. Present forest area covers at 10.6 million (48%) by 28 pure coniferous, 7.4 million ha (33%) by that of about 70 broadleaves, and 4.4 million (19%) by their mixed area (www.ogm.gov.tr 2017). The productive forest area was 8.86 (43.85% of total forest area) million ha, 10.03 (48.29%), 10.6 (50.13%), 11.56 (53.32%) and 12.70 (56.86%) million ha according to forest inventories of 1972, 1999, 2004, 2012 and 2015, respectively. The first afforestation of Turkey was established at 2-2.5 ha in Istanbul in 1892. The main afforestation was started in 1916 and 1925. The first forest nursery was also established in Ankara in 1925. The first large afforestation project was carried out in southern part of Turkey at 850 ha by *Eucalyptus sp.* in 1939.

Forest establishment is examined based on inventorial data to contribute present and future establishment perspectives including afforestation, reforestation, rehabilitation and private plantation in the present study.

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2 Forest establishment perspective

Turkey is located at the intersection of three phytogeographic regions and is one of the world's richest flora centers. On the other hand, the natural resources of the country have been destroyed extensively for many thousands of years (Boydak and Caliskan 2015). Yildiz et al. (2017) reported that plant cover has been destroyed in significant amounts as a result of long years of grazing and agricultural activities in the arid and semi-arid regions of Central Anatolia. Especially during the last 60 years of ground cover disturbance resulted in soil erosion at an unprecedented level. The area of cultivated land increased from 6.5 million ha to 22 million ha from the 1930s to 1956. The increase in the amount of cultivated areas caused the reduction of pasture land. 46 million ha of pasture land in 1936 dropped to 29 million in 1960. Tilling the pastures to convert them into agricultural lands destroyed the protective groundcover and decreased the organic matter by increasing its decomposition over time. Organic matter, phosphorous, nitrogen, clay, dust, field capacity, wilting point and available water capacity were higher in afforested areas which was 15 years than un-afforested areas, while it was opposite for pH, sand, lime and volume weight values (Yazici and Turan 2016). It was also noted that soil depth showed generally significant differences in soil properties between areas and within the area. Ivetić and Devetaković (2016) reported that reforestation programs must take projections of climate change into consideration.

Forest establishment can make changes for countries and regions, while it is including afforestation, reforestation /artificial regeneration, rehabilitation, erosion control, avalanche control, energy forest and rangeland improvement in Turkish forestry. It is made in order to protect soil and water resources, meet the demand of raw wood material and other functions of forests for protection purposes by planting saplings, seedling or sowing (Fig. 1). For instance, up to the end of 2010, the plantation was made on 2.060.000 hectare for wood production and on 870.000 hectare for protection purposes (www.cem.gov.tr 2017). Forest establishment inventory of Turkey is presented for the establishment type and years in Table 1 (www.cem.gov.tr 2017).



Figure 1. Forest establishment by seedling (left side) and sowing (right) in *Cedrus libani*.

Table 1. Forest establishment inventory for the establishment type and years.

Years of Inventory	Establishment Type						
	Reforestation + Afforestation	Rehabilitation	Erosion Control	Rangeland Improvement	Private Plantation	Energy Forest	Avalanche Control
1946-1968	280049	-	59146	10019	-	-	-
1969-1980	490822	-	56476	25643	-	12531	-
1981-1991	1194433	-	140818	28902	3378	410309	-
1992	43027	-	3660	-	490	22531	-
1993	50672	-	7458	880	263	26989	-
1994	65185	-	10280	2408	835	13146	-
1995	47127	-	6114	3455	1317	12808	-
1996	61006	-	26329	3834	1744	11588	-
1997	66231	-	26124	3120	2282	5573	-
1998	39461	3135	29430	2885	7245	10274	-
1999	32822	8739	22571	4096	2494	11048	-
2000	38318	6502	30449	4995	4189	12627	-
2001	40330	4089	32780	3800	2499	13194	-
2002	42681	2093	18608	440	2199	13100	-
2003	47445	5187	42042	2500	4943	14812	-
2004	49753	48013	42136	3240	8624	13577	-
2005	31419	65260	47493	4259	10503	18771	-
2006	38898	285179	60776	5315	11002	-	-
2007	31200	313659	42984	4163	8190	-	-
2008	42591	336910	53917	4642	9034	-	-
2009	61251	374728	50352	5521	9535	-	-
2010	49916	346902	61401	7968	17306	-	-
2011	50395	344570	67088	10114	8566	-	-
2012	54967	347719	83131	9635	4944	-	-
2013	55577	106182	83964	9920	1975	-	340
2014	51119	100432	80517	16383	3984	-	-
2015	48165	94411	75009	23843	3012	-	130
Total	3121344	2793710	1261053	201980	130553	622878	470

As seen from Table 1, there are large differences in forest establishment areas among the years. It could be said that forest types are getting more diverse over the years. For instance rehabilitation is started in 1992, while energy forest is carried out at 622878 ha between 1969 and 2005 (Table 1). Total forest establishment is the highest for afforestation and reforestation combination also supported by artificial regeneration, while it was lowest for avalanche control purpose.

Bilir and Gulcu (2015) reported that the average of annual afforestation was 32500 ha, while it varied between 478 and 120000 ha according to Turkish forest inventory between 1946 and 2013. It is known that present forest establishment also supports 2.5 million ha based on "National Afforestation and Erosion Control of Campaign" by private and governmental foundations between 2008 and 2012 (www.cem.gov.tr 2017). It could be said, based on the inventory, that productive forest area increased from 8.86 million ha. to 12.70 million ha by forest establishment between 1972 and 2015. Bilir and Gulcu (2015) emphasized that Turkish forest area covers 27.6% of Turkey according to the inventory of 2013, and 26.1% in inventory of 1973. The increasing is also supported by FAO report (Fig. 2) included between

1990 and 2015 (www.fao.org, 2016), and Turkish inventory (Fig. 3, www.cem.gov.tr 2017). Turkey is also shown in one of the afforestation/reforestation in drylands: the champion countries by United Nations Economic Commission for Europe and Executive Committee (www.unece.org 2011).

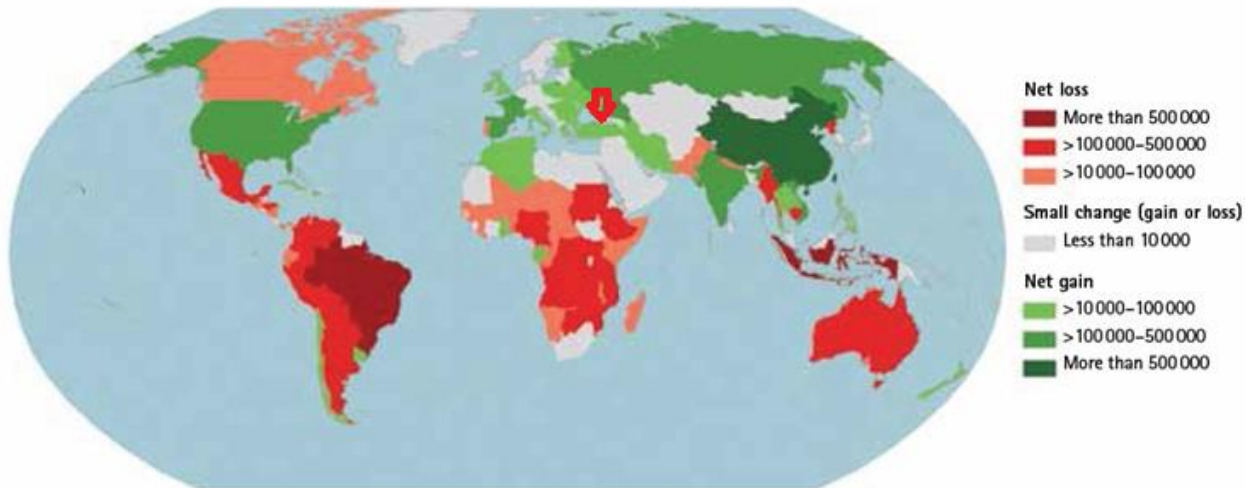


Figure 2. Annual net forest gain/loss (ha) by country (1990–2015).

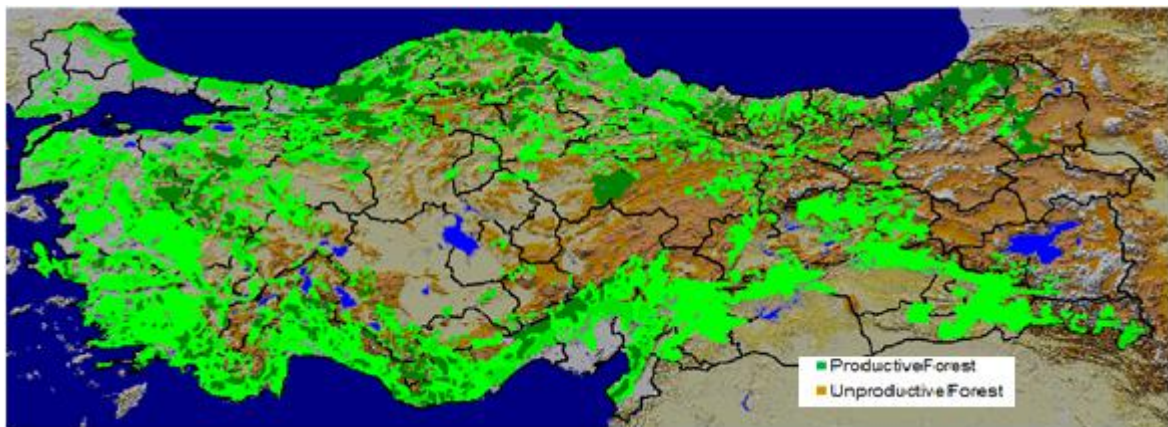


Figure 3. Present forest area of Turkey.

As mentioned above, most of the forests in Turkey are governmental forests. They are managed by the General Directorate of Forestry. The Directorate is supported by the national budget of Turkey. It could be effective on amount of forest establishment. There is also a relation between forest establishment practices and seed/seedling production. The relation is emphasized by forest establishment and seed/seedling production when previous years are examined (Table 2, www.cem.gov.tr 2017).

Table 2. Forest establishment and seedling production over the years.

Year	Forest Establishment (ha)	Seedling Production (x1000)
1995	70821	184730
1996	104501	271000
1997	103330	241502
1998	92430	220744
1999	81740	111949
2000	97080	126288
2001	96692	128540
2002	79121	116516
2003	116929	170297
2004	165343	200495
2005	177705	250209
2006	401170	350551
2007	400196	400000
2008	463592	389669
2009	501387	436764
2010	483493	424523
2011	480734	509441
2012	500396	471157
2013	257958	401300

3 Conclusion

Improved seed and seedling material should be used in forest establishment to increase the rate of success. Forest establishment programs should take into consideration disadvantages areas with disadvantages such as arid area based on climate change. Private forestry and private companies should be supported financially in forest establishment.

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