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General over-view of forest establishment in Turkey

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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

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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).

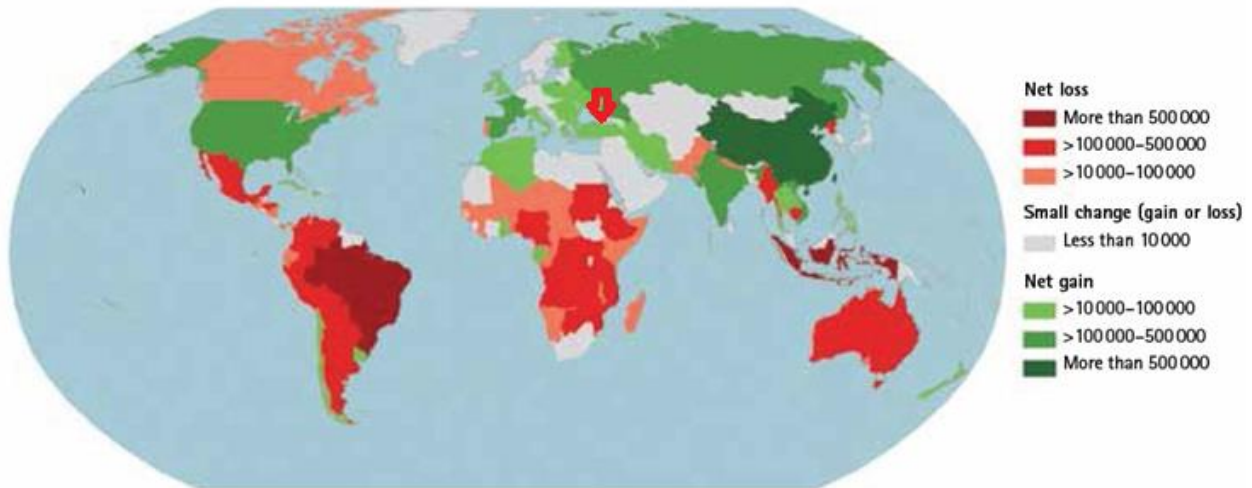


Figure 2. Annual net forest gain/loss (ha) by country (1990–2015).

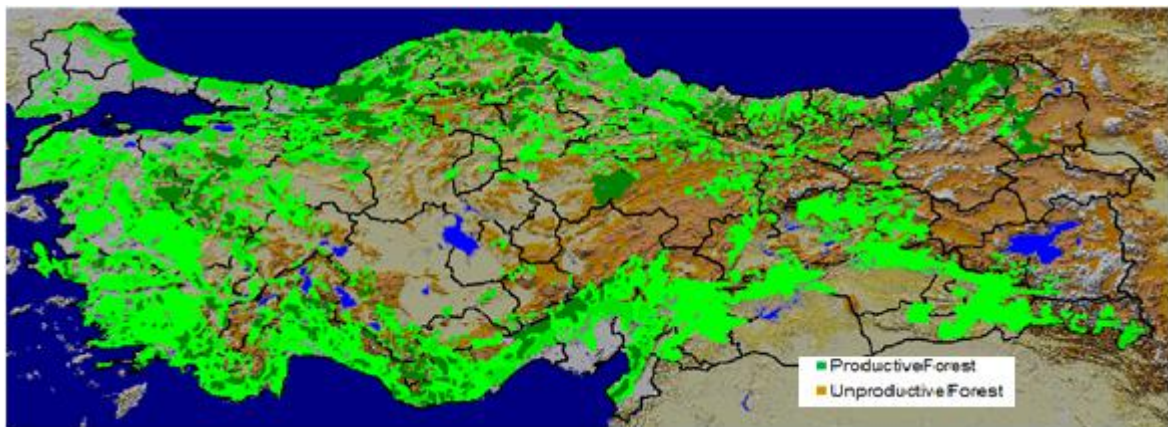


Figure 3. Present forest area of Turkey.

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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