



Afforestation and reforestation in Romania: History, current practice and future perspectives

Ciprian Palaghianu¹, Ioan Dutca²

¹Stefan cel Mare University of Suceava, Forestry Faculty, Suceava, Romania

²Transilvania University of Brasov, Forestry Department, Brasov, Romania

 cpalaghianu@usv.ro

Abstract

Preserving forest legacy was an important objective throughout Romanian history and so is today. Artificial forest regeneration (including both reforestation and afforestation) was widely used to ensure the forest continuity, following forest harvesting, or to create new forests on non-forest lands. As Romania has undergone various political changes that affected the socio-economic environment, these changes also left significant marks on forest cover dynamics. In this paper, we chronologically present the historical initiatives to preserve and increase forest cover in Romania, the current practices, available funding and future perspectives on artificial forest regeneration. Increasing forest cover from the current level of 27% to, and beyond European average of 33% seems an ambitious target for Romania. However, that may be achievable if the sources of funding for afforestation would diversify and increase, the available funds would be more effectively accessed, national forestry regulations would be less bureaucratic and the guidelines on artificial forest regeneration would be up to date and less restrictive. The whole framework of forestation should be revised to comply with recent social, economic and environmental realities, and modern criteria and indicators for sustainable forest management should be explicitly included. The new goals should also be tailored to the changes regarding the property type, climate related trends and new requirements of the forest certification systems.

Keywords

Romania; Afforestation; Reforestation; Forest plantation; Forest regeneration; Forestation history; Historical forest statistics

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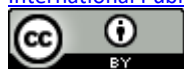
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1 Introduction

Nowadays, the forest represents more than an important renewable resource. The general public understands the concept of the forest as a key indicator of environmental responsibility. Consequently, the forest cover represents a sensitive trendy topic, often being used by media or included in NGO reports. As a reaction to the highly-publicized deforestation actions, the afforestation efforts and measures gained great interest.

According to Romanian National Institute of Statistics (INS), the forest resources of Romania covers 6.55 million hectares (INS 2016), which accounts for 27% of its total land area. Although the forest cover is higher compared to many European countries, this value is still below the average European forest cover of 33% (European Commission 2013) and much lower compared to the average EU forest cover of 42% (Forest Europe 2015). The general agreement is that Romania, should have a larger forest area, considering its climate, geographical position and relief (Giurgiu, 2010) and this idea is also sustained by historical data regarding forest cover. Pop (1943) assumed that forest cover used to be as high as 60 to 70% of the land area, this statement being supported by forestry researchers and historians (Giurescu 1975; Doniță et al. 1992). While in the last centuries, the forest cover varied around a value greater than 6 million hectares (Fig. 1), the end of the 18th century and the second half of the 19th century were two periods with extensive forest loss, estimated at nearly 3 million hectares (Giurgiu 2010; Giurescu 1975). Historical forestry data is scarce and occasionally disputed (Munteanu et al. 2016) therefore the numbers from figure 1 must also be interpreted in the context of several alterations of the Romanian territory until 1948.

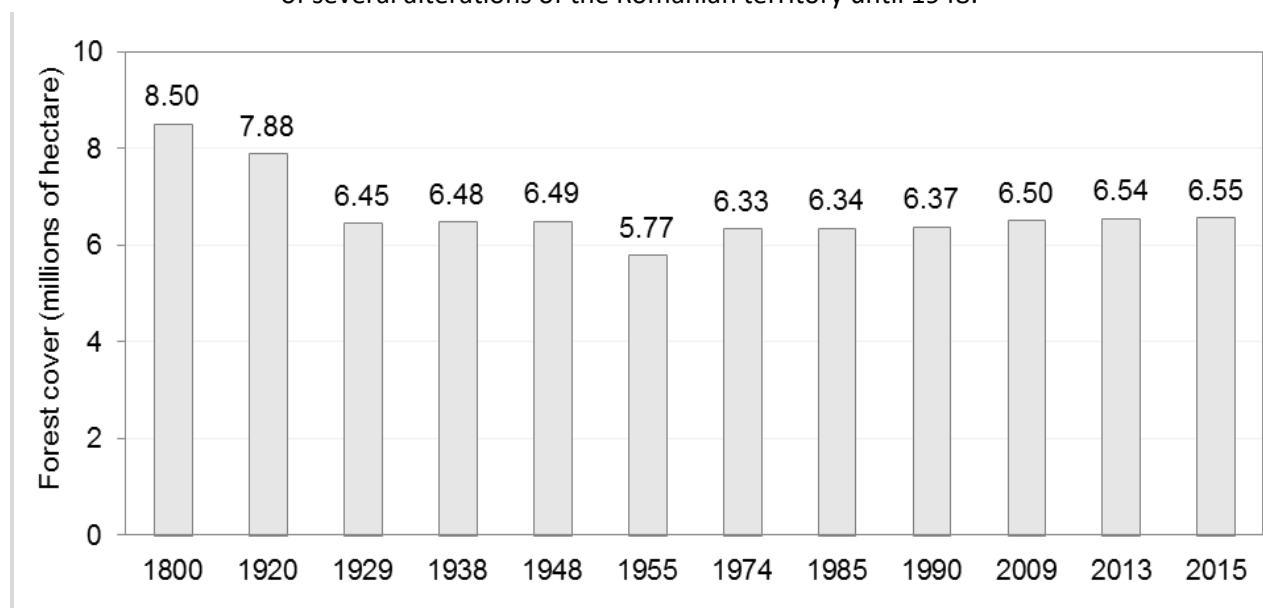


Figure 1. The dynamic of the forest cover of Romania after 1800. (data sources: Giurescu 1975; Ivanescu 1972; Giurgiu, 2010; INS 2009, 2015)

Forestation initiatives are crucial for preserving the forest resources and such actions are not specific only to modern times. In the following section, the early afforestation initiatives in Romania will be presented chronologically.

2 A brief history of reforestation in Romania

Before presenting the main forestation milestone in Romania, the terminology should be further clarified. The general term afforestation (“împăduriri” in Romanian) was mostly used in Romanian literature to designate both afforestation and reforestation or commonly the artificial installation or regeneration of the forest. This wide interpretation of the afforestation term still might be used in technical books (Damian 1978), official statistics (reports from the National Institute of Statistics up to 2010) or forestry curriculum (ARACIS 2016). In this paper the term forestation is used to encompass both afforestation and reforestation.

The historical documents on afforestation or forest regeneration from the past are scarcely available, but they illustrate early concerns regarding the permanence of forest. One of the first information on afforestation was provided by the chronicler Grigore Ureche who mentioned about the cultivation of three ‘red groves’ (Dumbravile Rosii) with oak species (Ureche 1958). At the order of Stephan III of Moldavia (Stefan cel Mare), those areas were sown with acorns, by war prisoners, immediately after Codrii Cosminului battle in 1497, in the northern part of Moldavia province (Lupe 1985).

2.1 From 1775 to 1918

Documented and more reliable information are available in Transylvanian forest regulations from 1775, which recommended the use of black locust (*Robinia pseudoacacia* L.) for its fast growth capacity, willows (*Salix* sp.) for wetlands and smoke trees (*Cottinus* sp.) for obtaining tannin compounds (Ivanescu 1972). In the western part of Romania (Banat province), detailed instructions on afforestation were also prepared by the chief forest inspector Waldfortner, in 1743, describing different methods of woody plants cultivation (by seed, seedlings or cuttings) as well as species preferences on environmental conditions, period of cultivation and quality of the reproductive material (Costea 1989). Waldfortner is considered a pioneer of modern forestry, since he was the first who organized the forestry in Banat on a rigorous European standard (Rösler 1999).

Progressive forestry instructions and norms were adopted in Transylvania – the Josephinian Forest Regulation of 30 May 1781 and later in Bukovina (1782, modified in 1785 and 1786), Moldavia and Wallachia (1792). Although these guidelines were general for the entire forestry sector, specific details on forestation were provided, such as the techniques of seed harvesting, conservation and preparation, different methods of cultivation, site preparation and recommendations on sapling density (Ivanescu 1972; Ichim 1988; Negrutiu et al. 1999).

The first known massive afforestation action was recorded in the southern Romania (Băilești and Oltenia), in 1852. An area of nearly 25,000 hectares of mobile sand dunes were stabilized by planting mainly black locust (*Robinia pseudoacacia* L.) and poplar (*Populus × canadensis*) (Chiriță and Bălănică 1938).

After the Union of the Romanian Principalities in 1859, the emulation of modernism was also extended to forestry. In 1860, numerous procedures regarding forestation were designed and several large afforestation projects were planned. Unfortunately, many of the projected actions and measures were not implemented or remained uncompleted. However, that momentum was consolidated in 1864 in three large forest nurseries of 50 hectares each, located in Braila, Iasi and Ismail counties.

Other two smaller forest nurseries (25 hectares each) were established in Giurgiu and Ialomița counties, soon after 1864 (Negrutiu et al. 1999).

One consistent step towards modern forestry was made by promulgating the first Romanian Forest Code in 1881, by the king Carol I. The Forest Code included regulations regarding the overall forest management system (e.g. regeneration, exploitation and protection of forests). In the same time afforestation actions were promoted to limit the land degradation, landslides and soil erosion. As a result, in 1889 was founded the 'National service for afforestation and torrents control'. Thereafter, lots of efforts were concentrated on prevention and control of land erosion. Black locust was the main species used for afforestation in the southern part of Romania, for fixing mobile sands. Large areas were afforested, between 1860-1870 in Desa (Dolj county), between 1872-1878 in Pătulele and Drincea (Mehedinți county), and between 1886-1898 in Sadova (Dolj county), on the sands from southern Oltenia (Chiriță and Bălănică 1938). Similar actions were conducted in the south-east of Romania, at the beginning of the 19th century in Hanu-Conachi (Galati county) (Iliescu 1934) and Dobrogea province (Radulescu 1928).

There are historical records showing an increased interest in obtaining high quality reproductive material. For example, the first cone drying facilities for seed extraction in Romania were established in Frasin (Suceava county, 1893) and Bicz (Neamt county, 1894) (Ichim 1988). Despite of many accomplishments of that period, several faults cast a shadow on it. For instance, even though the forest harvesting companies had the obligation to reforest the harvested areas resulted from clear cuttings, the guarantee funds asked from these companies were underestimated, the cost of reforestation being higher than the guarantee. As a result, these companies often abandoned the guarantee funds, without finalizing the necessary plantings, with important further negative repercussions on forest cover (Ivanescu 1972).

2.2 From 1918 to 1948

The forestry reforms and forestation actions continued after 1918, the year when the Greater Romania was founded. Between the two World Wars the reform of the forestry sector continued based on the guidelines of the Forest Code (1910) with repeated appended regulations in 1919, 1920, 1921 and 1923. There was an emphasis on the importance of afforestation and there were stricter procedures on compliance with the forest regeneration guarantee fund requirements. Tangible measures have also been taken so that between 1920-1929 approximately 91,000 hectares were afforested and reforested (Giurescu 1975).

In 1934, nearly 64 million of coniferous saplings were used to artificially regenerate 19,000 hectares that resulted from clear-cut loggings in the Tisza, Someș, Cris, Mures, Caras and Nera river basins (Negrutiu and Palaghianu 2015). Simultaneously, consistent activities to mitigate soil erosion and degradation were developed between 1930 and 1947, when 97,000 hectares of degraded land were stabilized by afforestation (Crăciunescu et al. 2014). A year later, in 1935, started the substitution of black locust in several forests from Dridu (Ialomița county) and Jegălia-Bazarghideanu (Călărași county) (Damian and Negrutiu 1972).

The expansion of forest area raised the concern over the health and stability of the newly established forest ecosystems. Consequently, in 1933 the Forestry Research and Experimentation Institute were founded. Several experimental initiatives were

developed in the field of standardization of seed quality, producing the seedlings in forest nurseries and establishing seed orchards. As a result, in 1938 the cumulative nursery area reached 1540 hectares (Negrutiu et al. 1999).

2.3 From 1948 to 1989

After the World War II, Romania was occupied by Soviet Union and the Communist Party was enforced to power. All the properties were nationalized, including forests. The state became the sole owner of all the resources and took responsibility for their management. The forests were under a lot of pressure due to the war reparations paid to Soviet Union. SOVROMs or Soviet-Romanian companies (Sovrom-Lemn was the Soviet-Romanian timber company) have been created in order to manage the concentrated activity of recovering the full amount of compensations. During that period the Romanian forests suffered a major drawback in the 50's, over 700 thousand hectares of forest (especially coniferous) being cut down in the northern part of the country (Grothusen 1977; Banu 2004). Due to massive deforestation including steep slope terrains, erosional processes were activated and a supplementary 600 thousand hectares of land were degraded. Consequently, at the national level an ambitious reforestation plan was projected in order to reforest 1 million hectares. The struggle was consistent and remarkable and the final objective was achieved in 1963. It was an outstanding struggle of reforestation, with an average of nearly 70 thousand hectares per year. 1953 was recorded as the year when the largest area was reforested in Romania (98,400 hectares) (Negrutiu et al. 1999). By 1976, around 2 million hectares were forested, cumulating the afforestation and reforestation efforts (Law no. 2/1976).

Although the communist period was generally harmful for the Romanian society, the impact on forest had also some positive aspects. The communist management system was enforced by some strict Technical Guidelines, published in 1948 and then revised in 1953, 1966, 1969, 1977 and 1987. The forest management was finely balanced and demonstrated a constant interest in forestation, therefore the effort continued in the following years with large planted areas: 78,649 ha (1960), 52,679 ha (1970), 84,400 ha (1972), 85,490 ha (1973), 87,200 ha (1974) (Negrutiu et al. 1999; Negruțiu and Palaghianu 2015). A solid forestation infrastructure was also designed, by creating many large forest nurseries in order to boost the seedlings production. There were also established seed stands, seed orchards, cone/fruit/seeds processing facilities, showing a particular interest in obtaining not only large seedlings production but also high-quality forests. The standards for seed quality assessment were initially published in 1951 and were periodically revised (1963, 1973 and 1983) (Damian 1978; Negruțiu and Palaghianu 2015).

After 1976, the influence of the soviet forest management system, based mainly on large area of clear cuts and cultivation of fast-growing species, weakened and an ambitious National Program for the preservation and development of the forestry fund was set for the 1976-2010 period (Law no. 2/1976). The new program limited the annual wood harvest to 20 million m³ and reduced the maximum contiguous area of the clear cuts to 10 hectares (and only 5 hectares for pure spruce stands) in an effort to set new management principles and promote the natural regeneration of the forest. New objectives were sketched for the following 5-years, which included afforestation of 325,000 hectares (1976-1980) and 220,000 hectares for the following quinquennia, with a special focus on plantations. An outstanding objective was also set for the nurseries

production: 250 million of seedlings per year, which seemed to be manageable considering the intention to increase the degree of mechanization of nurseries' activities. The new program started vigorously but it was interrupted by the fall of communism in 1989. A year later, in 1990, the Law no. 2/1976 was abolished.

2.4 After 1989

Romania faced radical changes after the communist period has ended. The new structure of the property and the shifting paradigm of the management systems were challenging not only to forest sector, but also to society, numerous scientific investigations being focused on forestry sector dynamics (Bouriaud 2005; Ioras and Abrudan 2006; Abrudan et al. 2009; Dutcă and Abrudan 2010; Olofsson et al. 2011; Griffiths et al. 2012; Knorn et al. 2012; Munteanu et al. 2016; Palaghianu and Nichiforel 2016; Scriban et al. 2017).

At the moment, Romania has 6.55 million hectares of forest (INS 2016). Although the state is no longer the only landowner and manager of this valuable resource, with nearly 50% of the forest, it still remains the most significant landowner. These forests are managed by the National Forestry Administration (Romsilva). The property pattern suffered a swift alteration since 1990 when the state share of forest was 100%. In 2000, the amount of state-owned forest, managed by Romsilva, was still consistent (92%) but decreased rapidly in 2010 to 53 % (Nichiforel et al. 2015). The latest official reports evaluate the current state of state-owned forest to a percentage of 48.8% (MMEDIU 2016). Under these circumstances the state centralized system of forest planning and control became obsolete considering the property type shift. However, similar regulations are mandatory to both state-owned and private-owned forests.

The total wood harvest diminished after 1989 (Munteanu et al. 2016) and foresters adopted a new paradigm, better targeted towards the natural regeneration to the detriment of artificial regeneration (Schulze et al. 2014). Consequently, the reforestation efforts began to slow down and forested areas have become smaller year by year. In addition, the forest restitution generated not only an excessive fragmentation of the property but also additional negative effects (Munteanu et al. 2016). The solid infrastructure that supported the massive forestation projects suffered damages because some of the restituted forest nurseries and seed orchards were neglected or destroyed by the new owners (Palaghianu 2016).

The interest in forestation was consolidated at normative level by laws and technical regulations. The first consolidated version of a post-communist Romanian Forest Code was released in 1996 (Law no. 26/1996) and the second was published in 2008 (Law no. 46/2008), being currently in force. One central objective of the Forest Code (Law no. 46/2008) was the afforestation of 2 million hectares of degraded lands. This goal was first endorsed by the National Afforestation Programme (2004) and later consolidated by the Law no. 100/2010 on afforestation of degraded lands. Regrettably, later forms of the National Afforestation Programme (2010 and 2013) adjusted consecutively this ambitious objective from 2 million hectares to 0.422, respectively 0.229 million hectares (Palaghianu 2016).

The forestry regulations on afforestation and reforestation were republished in 2000 (MAPM 2000a) with minor adjustments from the 1977 and 1987 versions. The new regulations are based on the similar guidelines used in the communist period and the

recommendation on species composition found on the so called “ecological groups” has not been scientifically substantiated, yet. The same mandatory regulations, including the controlling mechanisms of the regenerating areas (MAPM 2000b) are applying to state owned and private owned forested area.

More attention was paid to the quality of the forest reproductive material (FRM). As a consequence, in 2011 a new framework on FRM was set out by the Law no. 107/2011. The regions of provenance for FRM were also established, an essential condition in specifying and guaranteeing the sources of FRM. A year later, in 2012, the national catalog of approved basic materials for the production of FRM was compiled (MMEDIU 2012).

In 2017, a draft on the National Forest Strategy for 2018-2027 was published (MMEDIU 2017), putting an emphasis on sustainable management of the national forest fund. However, offering just a strategic view, that doesn't provide more details on that particular subject.

Currently, there is a general negative public perception on forest administration, not only because of media exposure of illegal logging, but also because the public is not familiar with foresters' activities (Palaghianu and Nichiforel 2016). The most visible action is wood harvesting, which is often confounded with (illegal) deforestation (MAP 2017). There is an obvious need for a solid awareness campaign on forest resources and management since foresters don't provide a proper dissemination of their actions and become less credible (Palaghianu and Nichiforel 2016). Moreover, few public documents and declarations explain in-depth the available data and information and there are often overlooked by the general public (Abrudan et al. 2009; FORDAQ 2015; Munteanu et al. 2016; Palaghianu and Nichiforel 2016; Palaghianu 2016).

Recently, a lot of persuasive and debatable environmental media campaigns have focused on the recent loss of forests. The most notorious report is the Russian Greenpeace report on Romanian forest (Greenpeace 2012), which stated that 3 hectares of forest are 'disappearing' every hour. This highly-impact but inaccurately interpreted statement (Palaghianu and Nichiforel 2016) is still used and it is often associated with illegal logging. Public perception was altered by media pressure and by misinterpretation of the authorized clear-cutting with illegal logging (MAP 2017; Greenreport.ro 2016), even if modern GIS/GPS wood traceability system were implemented: SUMAL, Radarul padurii and Inspectorul padurii (MMA 2017). This perception is contradicted by numerous sources that indicate no significant change in forest cover during the past decades (Dutcă and Abrudan 2010; Knorn et al. 2012; FORDAQ 2015; Munteanu et al. 2016; INS 2016). However, there are consistent evidences that at least some of the Romanian forests have suffered structural alterations during the past 27 years, especially after being restituted (Bouriaud 2005; Olofsson et al. 2011; Greenpeace 2012; Griffiths et al. 2012; Knorn et al. 2012, RCA 2013; Munteanu et al. 2016).

3 Current practice regarding forestation in Romania

3.1 The background

This section presents a short characterization of the Romanian forest practice of artificial forest regeneration, regarding the practical and normative framework. A summary of forestation funding schemes, projects and plans is also presented.

As the rates of wood harvesting in Romania declined after 1989 (Munteanu et al. 2016) and the maximum allowed contiguous area of the clear cuts was reduced to 3 hectares (Law no. 46/2008) the forest regeneration became more focused on natural regeneration (Schulze et al. 2014). Considering the historical evolution of the forest management in Romania, this was a return to the previous pre-socialist system which also promoted natural regeneration (Munteanu et al. 2016).

Therefore, in the recent years the percentage of forestation (artificial regeneration) dropped to a share of nearly one third of the forest regeneration: 33% according to NFA Romsilva reports (Romsilva 2014) and 40-46% at national level according to the National Institute of Statistics (INS 2011, 2012, 2105, 2016).

Regarding the technical aspects, plantation methods are predominantly used (an average of 99.02%) in the detriment of direct sowing procedures, according to data provided by the National Institute of Statistics for the period 1990-2016 (INS 2006, 2007, 2009, 2010, 2011, 2012, 2015, 2016).

Currently the National Forest Administration Romsilva produces annually only around 50 million seedlings in 7 large central nurseries and 580 district nurseries scattered all over the country (Romsilva 2017c). Still, both the number of seedlings and the number of nurseries have fallen in recent years (Romsilva 2012, 2013, 2014, 2015, 2016). Since 1990 private forest nurseries were also established, but they are more focused on ornamental species for tree alignments, parks and gardens and no statistics were provided regarding their activity. The bare root seedlings represent the most frequently produced and used type of seedling (Romsilva 2012, 2013, 2014, 2015, 2016), although the containerized seedlings were experimentally used for more than four decades (Damian 1978).

The degree of mechanization during forestation activities was low because of the reduced amount of investments in modern equipment, relatively cheap labor, and also as a result of natural limitation, considering some restrictive steep slopes on hilly or mountain areas.

The artificial forest regeneration normative framework is highly standardized by strict technical regulations (MAPM 2000a, 2000b). However, the strong regulatory agenda affects the entire forest sector. Lately, several reports and researches draw attention on the strict regulatory framework which has a negative impact on the forest management in Romania (FORDAQ 2015; Nichiforel et al. 2017; Scriban et al. 2017).

It is mandatory to perform annual inspection and maintenance works in plantations, until they are declared forest stands (generally in 5 to 10 years from the initial setting up). The technical regulations also control the species composition and the tree density at the moment of installation. This particular aspect is mostly criticized in the context of emergence of new forms of ownership for the Romanian forest. The former centralized management system had set precise and common objectives for the whole forest, and the technical regulations were tailored to meet those goals. Today, the new owners wish to have the freedom to set new goals for their forests, but they

are forced to comply with the same old requirements regarding the species composition or sapling density. Several researches recommended planting density lower than the usual 5,000 trees per hectare (Barbu 1982; Nicolescu et al. 2003) especially for Norway spruce (*Picea abies* L. Karst) which is often affected by windthrows. However, the new proposed schemes of 2,000-2,500 trees per hectare were never implemented.

It became obvious that new social, economic and environmental realities demand major changes of technical regulations. In 2016 there was an official attempt to modify technical regulations, but the initiative was blocked for bureaucratic reasons and lack of consensus (MMAP 2016a, 2016b).

3.2 Funding of afforestation

Since 1990, when the amount of afforestation was 25,489 hectares per year, the forestation capacity has slowly declined (Fig. 2). Statistics of the first years of democracy showed an average that dropped fast at nearly 10 thousand hectares per year and a similar amount of natural regenerated areas (Georgescu and Daia 2002). Afterwards the rhythm of forestation ranged widely between 10 to 15 thousand hectares per year, with some peaks between 2002-2006 (caused by heavy windthrows) and an average of 13,067 hectares per year. A consistent collection of years was grouped around the value of 10 thousand hectares per year: 1993: 10,346 hectares; 1997: 10,641 hectares; 1998: 10,607 hectares; 2007: 10,716 hectares; 2009: 10,962 hectares; 2010: 10,106 hectares; 2013: 10437 hectares (INS 2006, 2007, 2009, 2010, 2011, 2012 and 2015).

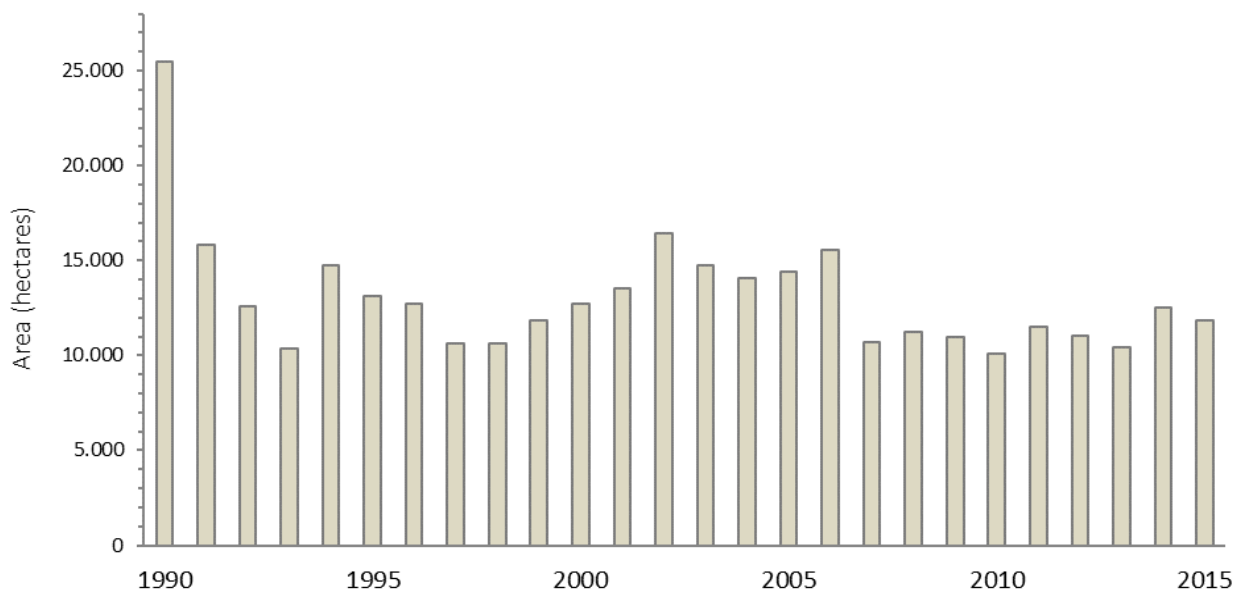


Figure 2. The amount of forestation actions performed in Romania between 1990 and 2015.

(National Institute of Statistics data, INS, 2006, 2007, 2009, 2010, 2011, 2012, 2015)

Regardless of ownership changes and forest fragmentation, the state-owned national administration company (Romsilva) represents the most active and noticeable entity involved in forestation projects (Romsilva 2017a). At the same time the mechanisms of funding forestation have diversified and Romsilva has been used

different types of funding (its own budget, the special fund for the improvement of the lands with forest destination, the fund for forest conservation and regeneration, funds from the state budget), but the results were still capped at a low level compared to the situation before 1990.

In the last 25 years, forestation projects were supported mainly through three different funding mechanisms: Special Accession Program for Agriculture and Rural Development (SAPARD) (Law no. 316/2001), the Environmental Fund (Law no. 73/2000, completed by Government Emergency Ordinance no. 196/2005) and the European Union funding instruments implemented through the National Program for Rural Development (PNDR) actions (Government Decision no.1.284/2008 for 2007-2013 and no. 226/2015 for 2014-2020) (PNDR 2017).

SAPARD Program was the first implemented funding mechanism and was carried out between 2000 and 2006. Forestry sector was able access funds from the budget associated with the Measure 3.5. These funds totalized 7,445 million euro for afforestation projects and 3,722 million euro for establishing forest nurseries. The official reports on SAPARD's funding (MADR 2011) showed that the funding absorption rate for the Measure 3.5 was 1.3%, the outcome being represented by 3 afforestation projects and one established nursery.

Environmental Fund, created in 2005 (Government Emergency Ordinance no. 196/2005), was initially considered a good funding alternative for afforestation projects. Unfortunately, the bureaucracy and the numerous revisions of the funding guidelines have led to poor results: only one project funded (40.5 hectares) by 2012, according to a report of Romanian Court of Auditors (RCA 2013).

After joining European Union (EU), the range of potential funding options of afforestation in Romania has expanded. The National Program for Rural Development (PNDR) contained several measures for accessing EU funds which were explicitly designed for the forestry sector, including afforestation.

Within the first financial framework that Romania took part on (2007-2013), PNDR allocated 1.2 billion euro for forestry related measures, out of a total of 7.5 billion euro. There were two measures targeting afforestation: Measure 221 (The first afforestation of agricultural land) and Measure 122 (Improving the economic value of forests). The Measure 221 had a total budget of 229 million euro and was specifically designed for funding afforestation projects. Official reports recorded only 29 funded projects at the end of the active period. The budget allocated for these 29 projects was 185 thousand euros, which leads to an absorption rate of 0.08%. Many complaints aimed at the heavy bureaucracy and the low standard costs per hectare. The second measure (Measure 122) targeted the afforestation indirectly. Measure 122 aimed to fund some other forestry related activities, including the establishment of nurseries. The total budget for this measure was 135 million euro and the payments amounted to 1 million euro. In this case, the absorption rate of 0.8%, was higher compared to Measure 221, however, both measures have failed achieving their aims.

European Union continues to implement its funding instruments in the new stage of PNDR (2014-2020). Taking into account the weak results from the previous period, PNDR announced a budget of only 300 million euro for forestry related measures from the total 8 billion euros. The new measure for afforestation (Measure 8.1) has just been released in the spring of 2017. The total budget was capped to 105 million euro. In order to address the criticisms from the previous stage of PNDR, the

standard costs for the afforestation have been greatly increased in hopes of increasing the fund absorption rate.

As the issue of climate change due to high levels of CO₂ in the atmosphere has risen rapidly in importance lately, one of the solutions was to sequester the excess carbon dioxide in forests. Being one of the largest suppliers of emission reductions in Europe (Kelly and Jeffery 2004, Lecocq 2005), Romania was among the first countries to access funds for afforestation from World Bank's Prototype Carbon Fund (PCF) for Romania. A total of 6033 hectares were planted in the plain area of Romania (Brown et al. 2002). The main scope of these plantations was to sequester carbon dioxide and generate carbon credits. Even if Romania represents a terrestrial carbon sink (Olofsson et al. 2011), increasing the forest cover (e.g. by afforestation of degraded land) could offer significant potential benefits for carbon sequestration.

4 Future perspectives

Forestation represents a crucial instrument that can significantly influence the amount of forest resources. Its importance is particularly recognized at European level (Council Regulation 2080/92; Council Regulation 1257/1999), where numerous national forest strategies comprise afforestation programs (Mather 1993) and specific funding mechanisms were developed.

One of the main objectives of Romania in the forestry field is to increase the forest cover to an extent which is much closer to the European average. With only 27% of forest land, Romania is far enough from the 33% of Europe forest cover, and afforestation seems a suitable tool for achieving the objective. Considering 4-6 thousand euro the average afforestation cost per hectare, or even 8-10 thousand per hectare in the case of degraded land or extreme sites, the bill for reaching the European target would be expensive.

Solely from the economic perspective, afforestation represents unappealing investments in which capital recovery occurs in a very long period. Still, the benefits cannot be assessed only from the economic perspective, but also from the environmental and social perspective. Therefore, the state must encourage afforestation by fiscal measures or tax incentives and provide solid funding mechanisms. Assuming the standard UE funding schemes could be unproductive without specific adjustments, robust afforestation policies and vigorous support from the state should be implemented.

Considering the latest unsatisfying results, Romania seems to still struggle to restart its afforestation 'engine'. New funding mechanisms, forest policies or fiscal incentives might be decisive and convincing. The new PNDR 2014-2020 may bring some optimism as the Measure 8.1 for afforestation seem to have addressed most of the previously reported issues regarding the heavy bureaucracy and the low standard costs. Although not very common yet, the concept of transferable carbon credits could potentially contribute to increasing forest area in Romania and carbon sequestration projects such as PCF, could represent viable opportunities for future afforestation.

Concluding, funding is not the only problem of afforestation in Romania. Currently Romanian forestry still forge the future forests using a normative and technical background tailored to socialist era, without taking into account restructured objectives regarding social needs, economic benefits, climate change mitigation or the new types of property. The whole framework of afforestation and reforestation should

be adjusted to take into account the new realities. The technical regulations have to become more flexible regarding the species composition or tree density and take into consideration wider and more complex objectives for the future stands. Furthermore, adopting new technologies and acquiring modern equipment could also give some momentum to afforestation efforts.

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