

SHRUB AND TREE SPECIES USED FOR IMPROVEMENT BY AFFORESTATION OF DEGRADED LANDS IN ROMANIA

Cristian Mihai Enescu

Department of Soil Sciences, University of Agronomical Sciences and Veterinary Medicine, 59
Mărăști Blvd., Bucharest-011464, Romania. E-mail: mihaienescu@agro-bucuresti.ro

Received: 02 February 2015

Accepted: 03 June 2015

Abstract

Forests represent a veritable barrier against land degradation, being the best choice for soil erosion control. Romanian woody flora consists of more than 300 species of forestry interest. Among them, approximately 50 shrub and tree species are often used in afforestation of degraded terrains. The aim of this review paper was to highlight the most important species used in forest land reclamation. Aspects regarding the ecological requirements and the results obtained by using these species in afforestation of the degraded lands were also presented. In conclusion, it could be stated that the Romanian experience acquired in this sphere of activity is very important considering the global warming, and afforestation of degraded terrains being the best way to counteract degradation phenomena and to mitigate the effects of climate change.

Key words: degraded terrains, forest species, forest land rehabilitation, land reclamation.

Introduction

Due to their multiple productive and protective roles, the forests are among the most important elements in human evolution (Bohateret 2012). It is well known that forests represent a veritable barrier against land degradation (Greavu and Mănescu 2010, Păcurar 2012, Constandache and Nistor 2014), being the best choice for soil erosion control (Andraș et al. 2012). As a consequence of decreasing the forest area, land degradation phenomena (i.e. water and wind erosion, landslides, etc.) are amplified (Lupu et al. 2010) and active morphodynamic processes are triggered (Nedelea and Comănescu 2011).

Nowadays, the main factors responsible for land degradation are the human activities, deforestation and inappropriate agricultural techniques being the ones with the highest impact (Păcurar 2012). In addition, grazing, urbanization and industry on the one hand, and natural processes such as water and/or wind erosion, landslides, on the other hand, have a significant contribution to land degradation as well. Moreover, the abandonment or lack of land reclamation activities contributed significantly to land degradation (Mărioara 2013).

In the last decades, special attention is given to the more and more frequent effect of climate change on forest sites (Pienaru et al. 2009, Doniță and Radu 2013). Actu-

ally, climate change and land degradation processes generated by the human activities represent nowadays a certainty (Tărașu et al. 2012). By taking into consideration the values of De Martonne Aridity Index recorded during the past three decades in southwestern Romania, it was concluded that the global warming is responsible for the transformation of the local climate, which is the major cause of the aridization in that region (Pravaliu et al. 2014). Moreover, it is predicted that the global warming will cause changes in the water cycle (Păcurar 2007) and will determine the migration of plants to higher elevations (Târziu 2010). In Romania, it is estimated that the effects of climate change will increase also due to splitting the forest land into small and tiny areas (Giurgiu 2010), which will generate an inappropriate forest management. According to latest statistics, there are more than 0.85 million forest land owners in Romania (Behr et al. 2014). The present situation regarding the ownership status of the forest lands was caused by the processes of forest restitution, initiated shortly after the fall of communism. Under Law 18/1991, more than 0.35 million ha of forest lands were restituted, up to 1 ha per owner. Later on, according to Law 1/2000, all community, town or communal forests were restituted to their former owners, but with limitations (10 ha for individuals and 30 ha for churches, respectively). Forest restitution processes were finalized from the legislative point of view by Law 247/2005 (Abrudan et al. 2009). As a result, according to the preliminary data provided by National Forest Inventory, the state-owned forest land accounted only for 54 % in 2012 (National Forest Inventory Report 2012).

Taking into consideration that the Romania's forest cover per capita is lower

than the EU average, the afforestation of degraded lands represents one of the most important Governmental policies in Romania (Abrudan et al. 2009). By 2020, a forest shelterbelt protection system of about 300,000 ha is expected to be installed (Mateoc-Sîrb et al. 2014). In this context, Romania's task, received from the EU, is to increase the forest area to a percentage higher than 30 % in the next years (Barnoiaea et al. 2010). Moreover, in the present context of global warming, the forests should be regarded as a key sector for mitigating climate change, being the most important deposit of greenhouse gases (Popa et al. 2014).

In Romania, it is estimated that an area of more than two million hectares are affected by land degradation processes (Șerbănescu 2007, Crăciunescu et al. 2014), the steppe and forest steppe regions being the most affected ones, especially due to the lowest afforestation rates from the country (Ungurean et al. 2013). Actually, the southern and eastern parts of the country face the consequences of the aridification process (Peptenatu et al. 2013). In this context, the issue of erosion control is a very important problem, therefore urgent action is needed in order to prevent and control this process (Hort et al. 2013). The main way to counteract the above mentioned degradation phenomena is land reclamation through afforestation (Colișar et al. 2009, Constandache et al. 2010), forests having a very important role in preventing land degradation (Costea 2013).

The aim of this review paper was to highlight the most important shrub and tree species used in Romania in forest land reclamation. Aspects regarding the ecological requirements and the results obtained in Romania by using these spe-

cies in afforestation of the degraded lands were also presented.

Shrub and Tree Species Used in Forest Land Reclamation in Romania

Romanian woody flora of forestry interest, together with the most important introduced exotic trees accounts for approximately 300 species. Among them, around 50 shrub and tree species are commonly used in afforestation of degraded terrains. The most frequently used are the following ones: Scots pine (*Pinus sylvestris* L.), Black pine (*Pinus nigra* Arn.), European larch (*Larix decidua* Mill.), Black locust (*Robinia pseudoacacia* L.), Thorny locust (*Gleditsia triacanthos* L.), Alder species (*Alnus* spp.), Ash species (*Fraxinus* spp.), Oaks (*Quercus* spp.), Cherry species (*Prunus* spp.), Common hawthorn (*Crataegus monogyna* Jacq.), Common walnut (*Juglans regia* L.), Dog-rose (*Rosa canina* L.), White mulberry (*Morus alba* L.), Elms (*Ulmus* spp.), Oleaster (*Elaeagnus angustifolia* L.), Common seabuckthorn (*Hippophaë rhamnoides* L.), Wild privet (*Ligustrum vulgare* L.), Common lilac (*Syringa vulgaris* L.), Desert false indigo (*Amorpha fruticosa* L.), and some others (Ciortuz and Păcurar 2004).

This brief review presents below the tree and shrub species that were and still are of great interest for the rehabilitation by afforestation of degraded terrains from Romania. The species are presented in alphabetical order of their scientific names, and the origin of each species is indicated.

***Acer tataricum* L. (Tatar maple; native)**

Tatar maple has great demands for high temperatures in the growing season, being also resistant to drought. Similar to Turkey oak (*Quercus cerris* L.) and Hungarian oak (*Q. frainetto* Ten.), this species can toler-

ate heavy and compact soils. Moreover, it can grow on soils with low salty content (Șofletea and Curtu 2007).

In Romania, Tatar maple exhibited good results in establishing the protective forest shelter belts from Dobrogea and Bărăgan regions on different soil types (Mănescu 2002, Greavu et al. 2012).

***Ailanthus altissima* (Mill.) Swingle. (Tree-of-Heaven; Eastern Asia)**

Tree-of-Heaven tolerates a wide variety of climatic and edaphic conditions. It grows on a broad range of degraded terrains, being tolerant even to saline and alkaline soils. *A. altissima* demands a warm climate and a long growing season, being resistant to drought and pollution (Clinovschi 2005, Șofletea and Curtu 2007), which tend to become among the most important pressure factors on forests nowadays (Chiriac et al. 2005).

This species represents a good option for afforestation of the degraded lands, especially in arid and poor sites (Enescu 2014a). Good results were obtained especially in the steppe region on carbonate-rich soils (Constandache et al. 2001, Mănescu 2002), on high eroded and skeletal soils (Greavu and Mănescu 2001) and also on terrains affected by gully erosion (Constandache et al. 2002). As a drawback, this species is highly invasive and poses a serious threat to biological diversity. Therefore, it should be used with great caution.

***Alnus glutinosa* (L.) Gaertn. (Black alder) and *A. incana* (L.) Moench. (Grey alder) (both native)**

Black alder is a light-demanding species, the maximum altitude for its natural occurrence in Romania being around 800–900 (1300) m a.s.l. (Clinovschi 2005). It rarely occurs in the Danube Plain (Netoiu et al. 2008). This species prefers a moderate

to cold climate and grows best in soils with low calcium content, being very resistant to flooding and stagnant water (Şofletea and Curtu 2007). It is sensitive to soil depth less than 40 cm and also to loose-textured loamy soils (Lato 2012). *A. glutinosa* is highly resistant to frost, but is sensitive to drought (Şofletea and Curtu 2007). This species is highly appreciated for its nitrogen-fixing ability and for its capability to grow in excessive moisture site conditions (Şofletea and Curtu 2007).

Grey alder represents a very important species for protection of the riversides, by fixing the degraded terrains within the torrential watersheds (Şofletea and Curtu 2007). It is also suitable for afforestation of the terrains affected by gully erosion and landslides (Constandache et al. 2002). Moreover, *A. incana* has a high annual production of fast-decomposing leaves which generate a high quantity organic matter, in the form of raw humus. According to the results obtained 15–20 years after planting, the organic matter content in the first 15–20 cm of the soil profile ranged between 2.5 and 5.1 % (Traci et al. 1981).

***Amorpha fruticosa* L. (Desert false indigo; North America)**

Desert false indigo is known to be a rustic species which has low demands regarding the soil and climatic conditions, being able to grow on degraded, poor, sandy or dry soils and to survive in adverse climatic conditions (Şofletea and Curtu 2007, Sărăteanu 2010). It is also resistant to dryness and floods (Clinovschi 2005, Şofletea and Curtu 2007).

This species was planted in Romania mainly in steppe region, on soils rich in calcium carbonates, on degraded and extremely degraded terrains, such as slopes of gullies and torrents (Untaru et al. 2003). For example, the survival rate of Desert false indigo

individuals 18 years after planting was approximately 80 % and the average height was 2.8 m (Greavu and Mănescu 2001). It was also used with success in wood-steppe regions on lands affected by high-intensity sheet erosion (Constandache et al. 2001). Like Tree-of-Heaven, desert false indigo is highly invasive and represents a serious threat for biological diversity. Hence, this species should be used with great caution and only if no other option is available.

***Cornus mas* L. (Cornelian cherry) and *C. sanguinea* L. (Common dogwood) (both native)**

Both species are recommended to be used in soils with moderate humus content and with low to moderate carbonate-soils (Constandache et al. 2006). *C. sanguinea* was successfully used to control soil erosion on degraded lands in the Transylvanian Plain (Vlasin et al. 2013).

***Cotinus coggygria* Scop. (Smoke tree; native)**

Cotinus coggygria can grow in full sun, at high elevations, or in partial shade, in plains or hilly regions. This species tolerates a broad range of soils, but it prefers the dry ones, located on south-facing limestone slopes (Şofletea and Curtu 2007, Netoiu et al. 2008).

In Romania, good results were obtained in steppe region on limestone substrate, with moderately to highly eroded soils. For example, after 18 years of establishing the forest plantation, the seedling survival rate was almost 75 % (Greavu and Mănescu 2001). Satisfactory results were recorded also by using smoke tree individuals in mixed-hardwood forests corresponding to the vegetation layer dominated by sessile oak (Untaru et al. 1988) and in the composition of the protective forest shelter belts from Dobrogea and Bărăgan regions (Greavu et al. 2012).

***Elaeagnus angustifolia* L. (Oleaster; Middle Asia)**

Due to its well-developed root system, Oleaster is known as a shrub species suitable for planting in terrains with landslides phenomena (Şofletea and Curtu 2007). It grows very well in terrains affected by sheet erosion from steppe wood region, with skeleton and carbonate-rich soils (Constandache et al. 2001). According to a research conducted in a mixed plantation in steppe region, on highly eroded lands, the average height of the young individuals 18 years after planting was 2.9 m, while the survival rate accounted for 84 % (Greavu and Mănescu 2001). Moreover, *E. angustifolia* can grow also on alluvial or moderate salty soils (Negrea et al. 2013, Constandache and Nistor 2014), or even on tailing dumps, like it was the case in Moldova Nouă (Căntar et al. 2014).

It is commonly used in Romania on marginal rows of the mixed plantations because it forms a barrier against grazing, thanks to its well-developed thorns (Mihăilă et al. 2010).

***Fraxinus* spp. (Ash species)**

Common ash (*Fraxinus excelsior* L.; native), Pennsylvania ash (*F. pennsylvanica* Marsch.; North America) and Manna ash (*F. ornus* L.; native) are the most important ash species for afforestation of degraded lands in Romania. Both Common ash and Pennsylvania ash are used as main species in the afforestation compositions on soils with excess water, located in meadows of the forest and forest steppe regions (Constandache and Nistor 2014).

F. excelsior provided good results in wood-steppe region (Mănescu 2002) and in degraded lands of Transylvanian Plain (Vlasin et al. 2013).

Manna ash was used in different site conditions corresponding to wood-steppe

or steppe regions, in moderate and highly eroded soils (Greavu and Mănescu 2001, Mănescu 2002). It can be used also in mixed plantations established in the vegetation layer corresponding to sessile oak (Untaru et al. 1988). It is also suitable for afforestation of the terrains affected by gully erosion and landslides (Constandache et al. 2002). In all cases, *F. ornus* should be planted only on sunny slopes (Constandache et al. 2006).

***Gleditsia triacanthos* L. (Thorny locust; North America)**

Thorny locust has a poor resistance to drought conditions (Negrea et al. 2013) and it requires moderate deep soils with moderate humus content (Constandache et al. 2006).

Good results were obtained in carbonated soils, such as chernozem (Constandache and Nistor 2014) or even in regosol type (Hernea et al. 2008). In Dobrogea (southern-eastern Romania), this species was planted on heavy soils, where Black locust failed (Discuteanu 1954). Thanks to its thorns, which can be up to 10 cm long, this species is often used in mixed plantations in the marginal rows in order to provide additional protection against grazing and human impacts (Mihăilă et al. 2010).

***Hippophaë rhamnoides* L. (Common sea-buckthorn; native)**

Common sea-buckthorn is regarded as a very useful multi-purpose shrub species with a high potential for forest land reclamation (Enescu 2014b). This is mainly due to its modest ecological requirements, compared with the rest of the shrub and tree species from Romania, being able to grow in a broad range of lands, even in the most degraded ones (Frangu et al. 1991).

It has a very well-developed root system, which significantly contribute to fixing the lands. Moreover, this species is

able to assimilate atmospherically nitrogen directly by roots, having an important ameliorative effect to the soil (Proorocu 2013). Last but not least, Common seabuckthorn could be used in the composition of the protective forest shelterbelts that are surrounding the big and polluted cities (Bica et al. 2014).

***Juglans regia* L. (Common walnut; native)**

Common walnut is a species with special demands regarding the site conditions. In Romania, it prefers the regions with high temperatures and mild winters, without frosts (Netoiu et al. 2008). It is also restrictive in regard with the soil conditions, preferring the types with pH values ranging between 6.5 and 7.5 (Șofletea and Curtu 2007). *J. regia* can be easily propagated in both generative and vegetative ways (Netoiu et al. 2008). It is also a fast-growing tree species, being able to grow up to 1 meter in height in the first years of its life (Șofletea and Curtu 2007).

In order to obtain good results, it is recommended to use this species in lands with additional supply of moisture, on soils with moderately or high humus content, from steppe to forest area (Constandache et al. 2006). Exceptionally, Common walnut was used to fix the sandy soils from southwestern part of Romania (Nută 2005).

***Ligustrum vulgare* L. (Wild privet; native)**

Wild privet is generally known as a shade-tolerant species (Șofletea and Curtu 2007). Due to its high ecological amplitude (Clinovschi 2005, Șofletea and Curtu 2007, Constandache et al. 2012), *L. vulgare* is able to tolerate a wide spectrum of soil conditions, ranging from salinized soils in the southern part of the Danube Delta (Strat 2013) to soils with extremely low trophicity in the steppe region (Neșu 1999). It is also resistant to drought (Neșu

1999). This species is suitable for several categories of degraded lands (eroded soils, landslides, etc.). In the hilly regions, corresponding to the vegetation layer dominated by beech-sessile oak mixtures, it can provide good results on soils with medium to heavy textures, on lands with high to very high levels of soil erosion, on terrains with land slide or crumbling phenomena and on slopes with different inclinations. In steppe regions, it can be used on skeletal soils, on lands with shallow soils and on soils with sandy or fine textures (Bălănică et al. 1955).

L. vulgare can also play an important role in sand dune fixation, as it was demonstrated in the South-Eastern Romania (Nută 2005). Moreover, Wild privet is suitable for land reclamation and ecological restoration in coastline areas, providing a better protection of the rehabilitated area and an improvement of biodiversity (Zagas et al. 2010).

***Picea abies* (L.) Karst. (Norway spruce; native)**

Norway spruce is the most common softwood species in Romania, reason for which it is intensively planted on several types of terrains. According to some specialists (Nicolescu et al. 2003), the planting density in the case of a pure spruce culture should be reduced from 5000 to 2000–2500 saplings per hectare. By doing this, the young saplings benefit of more space for their development. Like in the case of pines, higher sapling survival and growing rates were obtained by using saplings grown in polypropylene pouches (Geambașu 1980).

***Pinus sylvestris* L. (Scots pine) and *Pinus nigra* Arn. (Black pine) (both native)**

Both Scots pine and Black pine are suitable for afforestation of the terrains affected by gully erosion and landslides

(Constandache et al. 2002). Moreover, mixed cultures with Scots pine/Black pine and Common sea-buckthorn proved their efficiency in stabilizing lands with gully erosion on slopes with an inclination lower than 25 degrees (Untaru et al. 2003). In some cases, at the age of 15–20, due to the reducing of stand density, the high amounts of heavy snow caused damages to pine trees, by breaking their branches (Constandache 2004).

Scots pine is a veritable rustic and a pioneer tree species, being used for afforestation on degraded terrains within the sites with the lowest quality (Clinovschi 2005, Șofletea and Curtu 2007). It was successfully used on sandy soils from Oltenia region, located in southern-western Romania (Nută 2005). By decomposing of the needles, *P. sylvestris* is contributing to raw humus formation. For example, according to the results obtained 18 years after planting, the organic matter content in the first 5 cm of the soil profile was 1.4 % (Traci et al. 1981). In extremely degraded terrains, cultures with pine saplings grown in polypropylene pouches produced higher technical efficiency (Untaru et al 1980).

Black pine is an excellent species for afforestation of the degraded lands with sunny and steep slopes and carbonate-rich, skeletal and undeveloped soils (Clinovschi 2005, Șofletea and Curtu 2007, Lato 2012). Very good results were obtained by planting Black pine in degraded lands situated in the steppe region, on limestone (Greavu and Mănescu 2001) or on chernozem soils, with medium to high edaphic potential, but with severe moisture deficit (Ungurean et al. 2012). In the first situation (steppe with limestone), after 21 years from planting the maintenance percent of the seedlings was 92 % (Mănescu 2002). It was used also on allu-

vial soils (Dragomir and Jianu 2010) or on sterile dumps (Cărbășiș et al. 2011).

***Prunus* spp. (Cherry species; all native)**

In Romania, the most common Cherry species used in forest land reclamation are: Wild cherry (*Prunus avium* (L.) Moench.), Cherry plum (*Prunus cerasifera* Ehrh.) and Mahaleb cherry (*Prunus mahaleb* L.).

Wild cherry is a light demanding species, which needs a long growing season (Clinovschi 2005). It is recommended to use this species in terrains with additional supply of moisture, with deep and humus-rich soils (Constandache et al. 2006). *P. avium* provided good results in mixed plantations with pines (Scots pine and Black pine) on eroded soils. For example, in Vrancea County, on highly eroded soils, 25 years after planting, the average height of the wild cherry trees was 11 m (Frangu et al 1991).

In the case of *P. cerasifera*, due to its high ecological amplitude, this species is used in steppe and wood-steppe regions to establish protective forest shelterbelts on degraded terrains (Șofletea and Curtu 2007). It is recommended to use cherry plum on sunny slopes (Constandache et al. 2006).

P. mahaleb is regarded as an excellent species for controlling soil erosion within degraded terrains, in areas with warmth and high dryness (Șofletea and Curtu 2007). Due to its light demanding character, it is recommended to use this species only in sunny slopes (Constandache et al. 2006). Its culture provided good results in steppe region on limestone (Mănescu 2002), and satisfactory and good results in steppe-wood regions, on different substrates (Untaru et al. 1988, Mănescu 2002). For example, in steppe region, on limestone substrate, the survival rate of Mahaleb cherry trees 18 years after plant-

ing was approximately 60 % and the average height of the young individuals was 2.7 m (Greavu and Mănescu 2001).

***Quercus* spp. (Oaks; all native)**

Among the seven Oak species from Romania (Șofletea and Curtu 2007), Greyish oak (*Quercus pedunculiflora* K. Koch), Pubescent oak (*Q. pubescens* Willd.), Pedunculate oak (*Q. robur* L.) and Sessile oak (*Q. petraea* (Mattuschka) Liebl.) are of interest to afforestation of degraded lands.

Q. pedunculiflora and *Q. pubescens* are regarded nowadays as valuable resources, in the current context of global warming, already reported in several regions across Romania (Păcurar 2014). Greyish oak was used as main species in the composition of field and communication paths protective forest shelterbelts from southern and southern-eastern parts of the country (Greavu et al. 2012). It was also planted in the lowlands forest steppe on chernozem soils (Constandache and Nistor 2014) or on limestone, granite or schist substrates (Mănescu 2002).

Pubescent oak is regarded as a peerless species in terms of its contribution to rehabilitation of degraded lands, often representing among the few solutions for installation of woody vegetation in areas deficient in rainfall and with soil and atmospheric dryness from extremely warm sites (Șofletea and Curtu 2007).

Pedunculate oak is suitable for plains and low hills region, being able to grow on different soil types such as: cambisols, chernozem or fertile alluvial without salts soils. Sessile oak prefers almost the same soil types, but it requires wetter areas (Constandache and Nistor 2014). Recently, it was reported that *Q. robur* can grow on sterile dumps, like it was the case in Jilt Basin (Cărăbiș et al. 2011).

***Robinia pseudacacia* L. (Black locust; North America)**

Black locust is a very shade intolerant and a thermophilous species, with an optimum average temperature ranging from 9 to 11 °C in Romania (Șofletea and Curtu 2007). It grows well in warm regions with long vegetation period, on sandy soils (Ciuvăt et al. 2013b), the best site conditions for its culture being Oltenia region (southern-western Romania) (Ivanschii et al. 1969). Due to its fast growing rate, exceptional vegetative propagation by sprouting capacity, this species represents an ideal one for degraded land reclamation (Ciuvăt et al. 2013b).

In Romania, Black locust was used for establishing both productive and protective (especially control of wind erosion, reclamation of disturbed sites and site improvement) plantations (Enescu and Dănescu 2013). It was planted mainly in sandy soils from southern-western part of the country (Stringer et al. 2009, Ciuvăt et al. 2013a), but also in chernozem soils with low carbon content and medium to high edaphic potential (Ungurean et al. 2012, Constandache and Nistor 2014). Exceptionally, Black locust was used in the mountain region, up to 800 m altitude, in order to control soil erosion (Traci 1960).

This species is suitable also for rehabilitation by afforestation of the sterile dumps, like in Jilt Basin case (Cărăbiș et al. 2011), and also for establishing protective shelterbelts near big and polluted cities, such as Timișoara (Bica et al. 2014).

***Syringa vulgaris* L. (Common lilac; native)**

Common lilac is an important species for fixing skeletal limestone slopes (Șofletea and Curtu 2007). It satisfactorily grew in mixed plantations established in wood-steppe region and Sessile oak vegetation

layer (Untaru et al. 1988). Moreover, good results were obtained in steppe region, on limestone substrate, on highly eroded soils. In one case, after 18 years of setting the forest culture, the survival rate of Common lilac individuals was 80 % (Greavu and Mănescu 2001).

***Ulmus pumila* L. (Siberian elm; Asia)**

U. pumila is a species with a high potential to adapt to different site conditions (Șofletea and Curtu 2007). Siberian elm grows on a broad range of degraded lands, being tolerant to different types of soils, even to regosols or erodisols (Constandache et al. 2006). It can tolerate also the very compact, rocky, salty or calcareous soils (Clinovschi 2005).

It is a thermophilous species (Netoiu et al. 2008) and it is characterized by a high resistance to drought stress (Constandache et al. 2006) and it prefers to grow in full sun (Șofletea and Curtu 2007), but it is also tolerant to the semi-shade conditions (Netoiu et al. 2008). Except its high ecological amplitude, Siberian elm is also appreciated for its fast-growing rate and its well-developed root system (Discuteanu 1954), being a suitable species for establishment of protective forest shelterbelts in arid and poor lands.

In Romania, it was mainly used in the composition of the communication paths and field protective shelterbelts from the southern-eastern (Dobrogea) and southern (Bărăgan) parts of the country (Greavu et al. 2012). Siberian elm was planted also on salty or alluvial soils (Constandache and Nistor 2014).

Conclusions

In the last decades, the issue of land degradation became a very important prob-

lem in Romania, especially due to dividing the forest stands into many very small parts, which makes impossible their proper management. Several other factors contributed significantly to the increasing of the degraded lands surface, such as deforestation, inappropriate agricultural techniques, grazing, urbanization, and industry.

Special attention should continue to be given to the very fragile forest stands located in the southern part of the country, known as the most arid area of Romania. Counties such as Teleorman, Dolj, Olt, Giurgiu, Călărași, Ialomița and Galați have the lowest percentage of forest cover, below 10 % (Vasilescu 2003).

As a general conclusion, it could be stated that the Romanian experience in land reclamation is extensive and very important. The information obtained could be considered in the perspective of global warming. The afforestation of lands affected by the different frequent degradation phenomena represents the best way to control soil degradation processes and to mitigate the consequences of climate change.

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