Scientific Papers. Series A. Agronomy, Vol. LXVIII, No. 1, 2025
ISSN 2285-5785; ISSN CD-ROM 2285-5793; ISSN Online 2285-5807; ISSN-L 2285-5785

STUDY ON LAND SUITABILITY IN BUCU AREA, IALOMITA COUNTY, FOR FORESTRY USE

Marian MUŞAT[1], Valentina Mihaela VASILE[1], Costel DOLOCAN[2], Georgian ARGATU[2]

[1]University of Agronomic Sciences and Veterinary Medicine of Bucharest,
59 Marasti Blvd, District 1, Bucharest, Romania
[2]Patrimoniu Foundation of the Romanian Academy, 13 September Street, District 5, Bucharest, Romania

Corresponding author email: mihaelapetcu2505@yahoo.com

Abstract

The studied sector is deficient in terms of forest vegetation, with an obvious tendency to increase the average annual temperature, especially the summer ones. In order to reduce the effects caused by climate change, biodiversity conservation and implicitly the protection of agricultural land, it is intended to establish a forest on an area of 55.6 ha., with forest species suitable from a pedoclimatic point of view. As a result, a complex pedological study was carried out, in different plots, by performing a soil profile and several control surveys, in order to establish the suitability of the land for forestry facilities. The soil type identified is calcaric fluvisols, formed in Ialomita meadow, on account of alluvium, with flat configuration, clay-sandy texture and contrasting distribution. Based on these local pedoclimatic conditions, the formula for afforestation with xerophyte species was established, with fast growth and low requirements in terms of soil trophicity.

Key words*: shelterbelts, mixed forest, species composition, calcaric fluvisols, planting schemes.*

INTRODUCTION

Forest curtains are areas planted with different species of trees and shrubs, according to a well-designed scheme, with the aim of forming a barrier against winds that manifest themselves at the soil surface. They provide wind protection for homes, highways, agricultural land and represent a diversity of habitats in which different species of wildlife find shelter (Enescu, 2018; Giurgiu, 1995). This role of biodiversity is of great importance, contributing to a natural balance between pests and beneficial species, while enhancing the biological control of pests in agricultural crops. By reducing wind speed, it reduces the evaporation of water from the soil surface, conserves water in the soil by reducing capillary rise, maintains a uniform snow cover and prevents wind erosion of the soil, etc. Based on studies, forest curtains, although they occupy only 3-4% of the land, their presence can increase agricultural production by more than 35%. By creating a network of forest curtains, with an arrangement perpendicular to the prevailing wind direction, we found a 25-50% reduction in wind speed, a significant reduction in evapotranspiration and implicitly the conservation of water in the soil (Andreu et al., 2008; Mize et al., 2008). A well-established forest curtain reduces a small portion of agricultural land, and its benefits far outweigh the loss of productive land. It can be 15-20 m wide, with a 1 m shrub belt planted on both sides (Constandache et al., 2012; Chendev et al., 2015). The first field protection curtains date back to 1696, in southern Ukraine, being planted by order of Tsar Peter the Great. In Romania, the need to establish forest curtains was first mentioned by the great agronomist and politician Ion Ionescu de la Brad, in 1866, who established them on his farm in Neamt County, between 1870 and 1872. In 1960, forest curtains protected one million hectares of land in Dobrogea and the Baragan Plain in 1961, 7000 km of forest curtains protected fields and 1.400 km of protected communication routes (Costachescu, 2007). The main objectives were to demonstrate the influence on restoring and maintaining local microclimatic conditions, to improve soil fertility in its research stations, and to deepen research on the effectiveness and importance of forest protection belts. Soil is one of the most important natural resources for the survival and well-being of mankind, being a fragile resource that can easily undergo degradation processes, so that mankind must take into account the promotion of optimal land. use, maintenance and improvement of soil productivity and conservation of soil resource (Bălan Mihaela et al., 2024).

MATERIALS AND METHODS

The experiment was carried out in the South-East of Romania, in the Bucu area, Ialomita County (Figure 1). The lithological substrate in the Bucu area, which in this case also represents the parent material of the soils, is made up in the upper part of a finer alluvial stratification but with a fairly large thickness (60-70 cm) and variable texture on which the actual soils appeared and evolved. Geographically, the area falls within the Romanian Plain, the Baragan Plain subregion, the Baragan Ialomița relief unit, the Ialomița Meadow relief subunit, being located on the left side of the sector of the Ialomița Meadow corresponding to the Amara Field, in the Strachina Plain, at an altitude of 20-23 m, in the actual Ialomița Meadow (the difference in level from the terrace being 5-7 m).

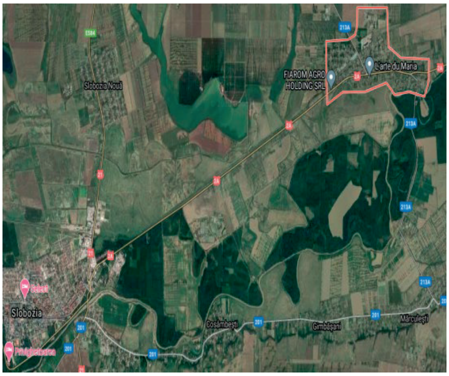

Figure 1. Bucu, Ialomita County

The research methods used in this study were those practiced according to the ICPA methodology, 1987, vol I, II and III.

Soil analysis

Analysis methods used to determine chemical properties:

- Organic matter (humus): determined volumetrically by the wet oxidation method according to Walkley-Black, in the Gogoaşă modification – STAS 7184/21-82;
- $CaCO_3$ (carbonates): gasometric method using the Scheibler calcimeter, according to SR ISO 10693:1998 (%);
- The nitrogen content was determined indirectly (by calculation) based on the humus content and the degree of base saturation:

$$IN = humus \times V / 100$$

- Accessible phosphorus (mobile P): according to the Egner-Riehm-Domingo method and dosed colorimetrically with molybdenum blue, according to the Murphy-Riley method (reduction with ascorbic acid);
- Accessible potassium (mobile K): extraction according to the Egner-Riehm-Domingo method and dosage by flame photometry;
- pH: determined potentiometrically, with a combined glass and calomel electrode, in aqueous suspension at a soil/water ratio of 1/2.5 - SR 7184/13-2001;
- Hydrolytic acidity - extraction with sodium acetate at pH 8.2;
- Sum of bases - Kappen Schoffield Chirita method by extraction with 0.05 n hydrochloric acid.

Analysis methods used to determine physical properties:

- pipette method for fractions ≤ 0.002 mm;
- wet sieving method for fractions 0.002 - 0.2 mm and dry sieving method for fractions > 0.2 mm;
- Bulk density (BD): method of metal cylinders of known volume (100 cm^3) at the current soil moisture (g/cm^3);
- Total porosity (PT): by calculation (% volume -% v/v);
- Aeration porosity (PA): by calculation (% volume -% v/v);
- Degree of settlement (GT): by calculation GT = [(PM – PT)/PMN] x 100 (% volume - % v/v), where: PMN – minimum total porosity required, varied depending on the clay content of the respective sample, is calculated with the formula PMN = 45+0.163 A (% volume - % v/v); PT = total porosity (% v/v); A – clay content (% g/g);
- Wilting coefficient (CO): by calculation, by multiplying the hygroscopicity coefficient by 1.5;
- Field water capacity (CC): by estimation based on texture and apparent density, according to MESP, 1987.

RESULTS AND DISCUSSIONS

A soil profile and three pedological surveyes were opened in different soils, which were morphologically and physico-chemically characterized, according to the guide for the field description of the soil profile and specific environmental conditions.

Profile 1 - Calcaric fluvisols (Figure 2; Table 1)
Coordinates: *44579387 - N and 27461041 - E*
Landscape: *meadow*
Use: *arable*
Rock: *fluvial deposits*
Groundwater: *>3.5 m*

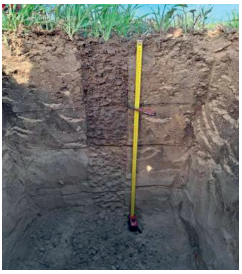

Figure 2. Calcaric fluvisol

Morphological characterization

Ao (0-28 cm): sandy loam, light brown (2.5 YR 3/2 when wet and 2.5 YR 5/4 when dry), moderately developed grain structure, small and medium, weakly plastic, weakly adhesive, very frequent thin roots from cultivated vegetation, weak effervescence, gradual transition;

AC (28-52 cm): fine loamy sand, yellowish brown (2.5 Y 3/4 when wet and yellowish brown 2.5 Y 6/4 when dry), very friable, weakly structured, non-plastic, non-adhesive, frequent fine roots, moderate effervescence in the lower half of the horizon, clear transition;

C1 (52-80 cm): coarse, yellowish loamy sand (5 Y 4/3 when wet and 5 Y 5/6 when dry), unstructured, loose, very friable, frequent $CaCO_3$ pseudomycelia, strong effervescence, clear straight passage;

C2 (80-140 cm): fine, light yellowish sand (5 Y 5/3 when wet and 5 Y 6/6 when dry), unstructured, loose, very friable, frequent $CaCO_3$ pseudomycelia, strong effervescence, clear straight passage.

Table 1. Physical and chemical analyses for Calcaric fluvisols, profile 1

Soil horizon	Ao	AC	C_1	C_2
Depth (cm)	0-28	28-52	52-80	80-140
Coarse sand (2-0.2 mm)	15.3	20.1	38.9	42.2
Fine sand (0.2-0.02 mm)	30.2	38.2	24.5	28.7
Dust (0.02-0.002 mm)	36.7	30.3	26.4	24.6
Clay (< 0.002 mm)	17.,8	11.4	10.2	4.5
Texture	SS	UF	UG	NF
pH	7.4	7.6	8.3	8.1
Humus content (%)	2.14	1.32	0.48	0.15
Bulk density (g/cm^3)	1.43	1.51	1.54	1.44
Total porosity (%)	49	48	46	48
Degree of compaction (%)	non-compacted	non-compacted	slightly compacted	non-compacted
Base saturation (V%)	96	98	100	100
Nitrogen index (IN)	2.05	1.29	0.48	0.15
Mobile P (ppm)	19	13	11	6
Mobile K (ppm)	137	118	95	81
Wilting coefficient (CO) (%)	7.2	6.1	5.5	4.6
Field capacity (CC) (%)	13.1	11.2	10.1	8.5
Available water capacity (%)	5.9	5.1	4.6	3.8
Total water capacity (%)	34	32	30	33
Humus reserves (t/ha)	85	47.8	21	-

Secondary profile 1 - Calcaric fluvisols (Figure 3)
Coordinates: *44575728 - N and 27455664 - E*
Relief: *meadow*
Use: *arable*
Rock: *fluvial deposits*
Groundwater: *>3.5 m*

Figure 3. Calcaric fluvisols secondary profile 1

Morphological characterization of the secondary profile 1

Ao (0-38 cm): sandy loam, light brown (2.5 Y 4/3 when wet and 2.5 Y 5/4 when dry), moderately developed grain structure, weak biological activity, non-plastic, non-adhesive, frequent thin roots from cultivated vegetation, gradual transition;

AC (38-70 cm): medium loamy sand, yellowish brown (2.5 Y 4/4 when wet and yellowish brown 2.5 Y 6/4 when dry), very friable, unstructured, non-plastic, non-adhesive, frequent coarse pores, frequent fine roots, moderate effervescence, clear straight transition;

C1 (70-110 cm): fine, yellowish loamy sand (5 Y 5/3 when wet and 5 Y 6/6 when dry), unstructured, loose, very friable, frequent $CaCO_3$ pseudomycelia, strong effervescence, clear straight passage;

C2 (> 110 cm): coarse, light yellowish loamy sand (5 Y 5/3 when wet and 5 Y 6/6 when dry), unstructured, loose, very friable, frequent $CaCO_3$ pseudomycelia, strong effervescence, clear straight passage.

The analytical data for survey 1 in the studied area are presented in Table 2.

Table 2. Physical and chemical analyses for calcaric fluvisols, secondary profile 1

Soil horizon	**Ao**	**AC**	**C_1**	**C_2**
Depth (cm)	0-38	38-70	70-110	>110
Coarse sand (2-0.2 mm)	14.5	23.6	22.3	42.7
Fine sand (0.2-0.02 mm)	31.8	33.8	40.2	25.2
Dust (0.02-0.002 mm)	37.2	31.4	28.6	24.6
Clay (< 0.002 mm)	16.5	11.2	8,9	7.5
Texture	SS	UM	UF	UG
pH	7.3	7.6	8.4	7.9
Humus content (%)	2.1	1.22	0.39	0.11
Bulk density (g/cm^3)	1.43	1.45	1.54	1.51
Total porosity (%)	50	48	46	45
Degree of compaction (%)	non-compacted	non-compacted	non-compacted	non-compacted
Base saturation (V%)	95	96	100	100
Content of calcium carbonate (%)	0.9	3.3	6.5	7.1
Nitrogen index (IN)	1.99	1.17	0.39	0.11
P mobil (ppm)	14	10	6	4
K mobil (ppm)	127	119	75	69
Wilting coefficient (CO) (%)	5.8	5.1	4.5	4.0
Field capacity (CC) (%)	10.6	9.3	8.2	7.4
Available water capacity (%)	4.8	4.2	3.4	3.4
Total water capacity (%)	35	33	30	29
Humus reserves (t/ha)	114	56	24	-

Secondary profile 2 Calcaric fluvisols (Figure 4)
Coordinates: *44576182 - N and 27454943 - E*
Relief: *meadow*
Use: *arable*
Rock: *fluvial deposits*
Groundwater: *>3.5 m*

Figure 4. Calcaric fluvisols secondary profile 2

Morphological characterization of the secondary profile 2

Ao (0-34 cm): sandy loam, dark brown (10 YR 3/2 when wet and 10 YR 5/3 when dry), moderately developed grain structure, weak biological activity, weak plastic, weak adhesive, very frequent thin roots originating from cultivated vegetation, weak effervescence, diffuse, wavy passage;

AC (34-66 cm): fine loamy sand, light brown (2.5 Y 4/4 when wet and yellowish brown 2.5 Y 6/4 when dry), very friable, unstructured, non-plastic, non-adhesive, frequent coarse pores, frequent fine roots, moderate effervescence throughout the depth of the horizon, clear straight passage;

C1 (66-98 cm): medium loamy sand, yellowish (2.5 Y 5/3 when wet and 2.5 Y 6/6 when dry), unstructured, very friable, frequent $CaCO_3$ pseudomycelia, strong effervescence, clear straight passage;

C2 (> 98 cm): coarse loamy sand, pale yellow (5 Y 5/2 when wet and 5 Y 6/4 when dry), unstructured, very friable, frequent $CaCO_3$ pseudomycelia, strong effervescence, clear straight passage (Table. 3).

Table 3. Physical and chemical analyses for calcaric fluvisols, secondary profile 2

Soil horizon	**Ao**	**AC**	**C_1**	**C_2**
Depth (cm)	0-34	34-66	66-98	> 98
Coarse sand (2-0.2 mm)	13.2	17.4	17.1	41.7
Fine sand (0.2-0.02 mm)	31.3	42.3	46.7	27.3
Silty (0.02-0.002 mm)	37.6	29.2	26.8	22.5
Clay (< 0.002 mm)	17.9	11,1	9.4	8.5
Texture	SS	UF	UM	UG
pH	7.5	7.8	8.3	8.6
Humus content (%)	1.94	1.32	0.61	0.16
Bulk density (g/cm^3)	1.37	1.35	1.49	1.46
Total porosity (%)	52	50	48	49
Degree of compaction (%)	non-compacted	non-compacted	non-compacted	non-compacted
Base saturation (V%)	94	98	100	100
Nitrogen index (IN)	1.82	1.29	0.61	0.16
P mobil (ppm)	14	11	9	6
K mobil (ppm)	134	127	95	72
Wilting coefficient (CO) (%)	6.9	6.6	5.7	4.8
Field capacity (CC) (%)	12.5	12.0	10.4	8.7
Available water capacity (%)	5.6	6.0	4.7	3.9
Total water capacity (%)	38	37	32	33
Humus reserves (t/ha)	90	57	29	-

Secondary profile 3 Calcaric fluvisols (Figure 5)
Coordinates: *44582140 - N and 27459925 - E*
Relief: *meadow*
Use: *arable*
Rock: *fluvial deposits*
Groundwater: *>3.5 m*

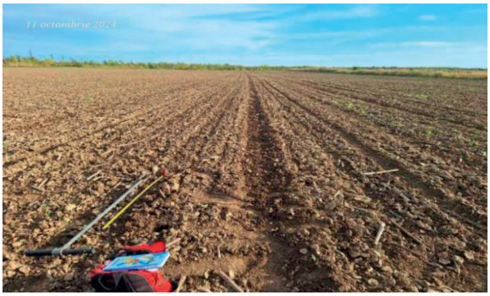

Figure 5. Calcaric fluvisols secondary profile 3

Morphological characterization of the secondary profile 3

Ao (0-26 cm): sandy loam, dark brown (10 YR 3/2 when wet and 10 YR 4/3 when dry), moderately developed grain structure, moderate biological activity, weak plastic, weak adhesive, very frequent thin roots originating from cultivated vegetation, weak effervescence, gradual transition;

AC (26-70 cm): medium sandy loam, light brown (2.5 Y 4/3 when wet and 2.5 Y 5/4 when dry), crumbly, weakly structured, non-plastic, non-adhesive, frequent coarse pores, frequent fine roots, moderate effervescence, clear transition to the underlying horizon;

C1 (70-125 cm): medium loamy sand, light yellow (2.5 Y 5/3 when wet and 2.5 Y 6/4 when dry), unstructured, re-flowing, very friable, frequent pseudomycelia and $CaCO_3$ concretions, strong effervescence, clear straight passage;

C2 (> 125 cm): fine loamy sand, pale yellow (5 Y 5/2 when wet and 5 Y 6/3 when dry), unstructured, re-flowing, very friable, frequent $CaCO_3$ concretions, strong effervescence, clear straight passage.

Analytical data for secondary profile 3 in the studied area are presented in Table 4.

Table 4. Physical and chemical analyses for calcaric fluvisols, secondary profile 3

Soil horizon	**Ao**	**AC**	**C_1**	**C_2**
Depth (cm)	0-26	26-70	70-125	> 125
Coarse Sand (2-0.2 mm)	12.5	1.4	23.9	20.9
Fine Sand (0.2-0.02 mm)	30.9	37.3	39.6	45.6
Dust (0.02-0.002 mm)	38.2	29.5	25.8	24.2
Clay (< 0.002 mm)	18.4	16.8	10,7	9.3
Texture	SS	SM	UM	UF
pH	7.6	7.8	8.5	8.7
Humus content (%)	1.86	1.19	0.44	0.19
Bulk density (g/cm^3)	1.43	1.46	1.52	1.53
Total porosity (%)	50	49	46	46
Degree of compaction (%)	non-compacted	non-compacted	non-compacted	non-compacted
Base saturation (V%)	98	100	100	100
Content of calcium carbonate (%)	0.5	3.1	7.2	8.3
Nitrogen index (IN)	1.82	1.19	0.44	0.19
Mobile P (ppm)	19	15	11	8
Mobile K (ppm)	141	132	107	96
Hygroscopicity coefficient (%)	5.2	4.7	4.1	3.9
Wilting coefficient (%)	7.8	7.0	6.1	-
Field capacity (%)	14.2	12.8	11.2	-
Available water capacity (%)	6.4	5.8	5.1	-
Total water capacity (%)	35	33	30	-
Humus reserves (t/ha)	69	76	37	-

The criteria regarding the establishment of forest species were the classical ones, which also apply for the establishment of tree-wine plantations, with reference to the physical-geographical conditions of the area but also those characteristic of forest species. Taking into account the current pedoclimatic conditions in the studied areas, based on the criteria presented in the M. O. of 14.02.2022, the main forest species recommended for afforestation were established and presented. In order to establish technical solutions for the realization of forest or forest curtains, it was taken into account the general stationary framing of the analyzed territories and the pedostatic conditions identified in the field.

Afforestation solutions were established on types and subtypes of soils with ecologically similar characteristics, correlating the ecological requirements of the species with the ecological characteristics of the soils, provided that the component species are adapted to the conditions of increased aridity.

The composition or formula of afforestation includes the percentage participation of the species to be introduced in the afforestation of a given land. The afforestation, nominally indicates, by symbols, the component species specifying the proportion of participation of each species. In the case of landscaping (forest curtains or forests), for the protection of the field, the choice of species and their proportion of participation for different types of afforestation. Solutions was carried out according to the bioclimatic framing and current **pedostatic** conditions, taking into account the appropriate Indigenous basic species.

The station sheet for this area was drawn up, according to Table 5.

Table 5. Stationary unit sheet, Bucu area, Ialomita County

1. Unity and form of relief: Meadow 2. Configuration of land: plane3. Slope: <2 % 4. Exposition X 5. Altitude20-23 m 6. Vegetation: segetal herb												
7	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*
Horizon	*Depth (cm)*	*Humus (%)*	*Soil Texture*	*Colour*	*Skeleton content*	*Structure*	*Humidity*	*Compaction*	*pH*	*Effervescence*	*Soluble salts*	*Concretions*
Ao	*0-28*	*2.14*	*Dusty sandy clay*	*Light brown*	*-*	*grainy moderately developed*	*Ue1*	*Non-compacted*	*7.4*	*light*	*-*	*-*
AC	*28-52*	*1.32*	*Sandy clay fine*	*Yellowish brown*	*-*	*Light structured*	*Ue1*	*Non-compacted*	*7.6*	*moderately*	*-*	*-*
C1	*52-80*	*0.48*	*Sandy clay coarse*	*yellowish*	*-*	*unstructured*	*Ue 1-2*	*Non-compacted*	*8.3*	*strong*	*-*	*common*
C2	*80-140*	*0.15*	*Fine sandy*	*Light yellow*	*-*	*unstructured*	*Ue 2*	*Non-compacted*	*8.1*	*strong*	*-*	*common*
20. Parent materials: river deposits				*24. Zonal and local climate: Continental temperate, specific of meadow*						*28. Type and subtipe of soil: Calcaric fluvisols*		
21. Morphological depth: 130 cm				*25. Groundwater: >3,0 m*						*29. Humus of type: mull calcic*		
22. physiological depth: 40 cm				*26. Hydrological and humidity regime; H 1*					*30. Proposal for works: - establishement of forest plantation - energic mobilization of soil*			
23. Wind erosion: poorly eroded				*27. Character of floods: unenviable*								
Stational groupe: GS 14			*Composition of afforestation: 40 St.b (St, Ce, Gr) 30 Aj (Mj, Pă, Ju, Dd) 30 Arb (Lc, Pd, Co, Mc)*									
Observation: Several condition of station (dry-arid climate, carbonate soil, natural regeneration occurs with difficulty												

CONCLUSIONS

● The studied territory belongs to the urban area of Bucu, Ialomita County, geographically located in the Baragan Plain, Mostistea subunit, characterized by a temperate continental climate, specific plain relief, with groundwater at over 3 m.

● The area studied within TC Bucu, Ialomita County, is 55.6325 ha, arable land, from which 24 soil samples were collected and analysed.

● The purpose of the work was to know the properties of the soil in order to use it judiciously, determine the quality class and suitability of the land for forest species.

● The soil cover in the studied area is consistent with the physical-geographical conditions of the area, with only one type of soil with a local character being identified (calcaric fluvisols).

● The parent material is predominantly composed of fluvial deposits.

● The texture of this soil unit is generally coarse, with contrasting distribution (sandy clay in the bioaccumulative horizon, loamy sand in the transition horizon and coarse towards the base of the soil profile).

● The main limiting factor of production potential is the poor rainfall during the growing season, combined with the less favorable physical properties of the soil.

REFERENCES

Andreu, M.G., Tamang, B., Friedman, H., Rockwood, D. (2008). The benefits of windbreaks for Florida Growers. *Historical factsheets of UF, UF School of Forest Resources and Conservation, 6:* 1–5, https://journals.flvc.org/edis/article/view/117445 .

Balan Mihaela, Popescu C., Nitu Oana Alina. (2024). The evolution of soil agrochemical propertis, under the influence of mineral fertilisation and water erosion, on a natural grassland located at the Preajba Experimental Centre in the Gorj County. *Scientific Papers. Series A. Agronomy,67*(1), 25–31.

Chendev, Y.G., Sauer, T.J., Ramirez, G.H., Burras, C.L. (2015). History of East European Chernozem Soil Degradation; Protection and Restoration by Tree Windbreaks in the Russian Steppe. *Sustainability, 7*(1)*,* 705–724.

Constandache, C., Nistor, S., Untaru, M. (2012*)*. Research on the behavior of some species of trees and shrubs in the composition of forest protection curtains in Romania*. Revista de Silvicultură şi Cinegetică, 30:* 34–44 (In Romanian).

Constandache, C., Peticilă, A., Dincă, L., Vasile, D. (2016). The usage of sea buckthorn (*Hippophaë rhamnoides* L.) for improving Romania's degraded lands. *AgroLife Scientific Journal, 5*(2), 50–58.

Costăchescu, C., Dănescu, F., Mihăilă, E., Niţu, D., Ianculescu, M. (2012). Technical solutions for the construction of curtain networks for afforestation of agricultural lands in the Romanian Plain and the Dobrogea Plateau. *Revista de Silvicultură şi Cinegetică,* 30. 48–55 (In Romanian).

Dănescu, F., Costăchescu, C., Petrila, M. (2007). Substantiation study of the need to install shelterbelts to protect the field in Constanţa County. *Analele ICAS: 1-8. (In Romanian).*

Enescu, C.M. (2018). Which shrub species should be used for the establishment of field shelterbelts in Romania? *Scientific Papers, Series A. Agronomy,* LXI. 464-469.

Giurgiu, V., 1995. Protection and sustainable development of Romania's forests. *Editura Arta grafică, Bucharest* (In Romanian).

Mize, C. W.; Brandle, James R.; Schoneberger, M. M.; and Bentrup, G., "Ecological Development and Function of Shelterbelts in Temperate North America" (2008). *USDA Forest Service / UNL Faculty Publications. Paper 40.* http://digitalcommons.unl.edu/usdafsfacpub/40.

Mușat M., Dolocan C., Argatu G. (2024). Pedological and agrochemical study on the lands of the Romanian Academy, *Romanian Academy Publishing House.*

***INCDPA (1987). Methodology for elaborating pedological studies. Vol. I, II, and III.