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SYSTEM OF DIAGNOSTIC INDICATORS FOR LOW-PRODUCTIVE AND DEGRADED SOILS TO ASSESS THEIR SUITABILITY FOR AFFORESTATION

Purpose. The identification of soil indicators for assessing the forest growth potential of soils for the possibility of afforestation.

Methods. The indicators were chosen among the soil parameters most often used to assess fertility: reserves and thickness of forest litters, morphological characteristics of soils, particle size distribution, acidity, humus and various forms of NPK content, composition and content of exchangeable cations. The research was carried out in natural medieval forests according to the methods generally accepted in forest inventory, typology, soil science, analytical work - according to classical agrochemical and standardized methods.

Results. The article gives an analysis of the problem of forestry typological evaluation of low-output and degraded soils (sandy, with shortened profile, salted, eroded), which were withdrawn from agricultural usage. The actual and theoretical material on the basis of which the range of issues related to the evaluation of forest land use in different natural zones is generalized, was collected and analyzed. On the main categories of low-productive lands in different natural zones of the flat part of Ukraine temporary trial areas were laid, where soil and typological investigation were conducted. The soil indicators and parameters of forest productivity of low productivity and degraded soils are determined, on the basis of which the classification of soils based on the degree of their suitable for afforestation has been developed. The suitability of soils for afforestation were evaluated in three categories: suitable for afforestation, limitedly suitable and unsuitable suitable for afforestation.

Conclusions. The experience of afforestation of low-productive and degraded soils is generalized and a system of diagnostic indicators for their forest typological evaluation on zonal and morphological basis is proposed, and an information analysis on the problem of assessing the suitability for afforestation of low-productive lands (saline, stony, sandy) that are derived from agricultural circulation is provided. The suitability of soils for afforestation is described by a system of soil indicators, in particular, their particle size distribution, humus content, common and mobile forms of NPK, and exchangeable cations. However, among these indicators, one can single out informative indicators of the level of productivity of forest lands - mineralogical (chemical) and granulometric composition of soils. At the same time, it has been proved that the granulometric composition of the soil determines such important characteristics as the content of exchange bases, common forms of phosphorus, potassium, and humus.

KEY WORDS: **suitability for afforestation, soil properties, soil indicators, eroded land, non-productive lands, natural zone**

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Introduction

Forest-land percentage of the territory of Ukraine is currently lower than necessary to achieve the landscape and ecological balance, to meet the needs of the economy and the functioning of the developed forestry and agriculture and industry. The scientifically-based level of optimal forest-land percentage for Ukraine is 20%, and for this purpose it is necessary to fill up more than 2 million hectares of land [1]. Implementation of optimal forest-land percentage in Ukraine is one of the priority tasks, which is fixed in a number of laws, decrees and resolutions of various branches of executive power, in particular, the Law of Ukraine "On the National Program for the Formation of the National Environmental Network of Ukraine for 2000-2015", the State Target Program "Forests of Ukraine" for 2010-2015, etc. According to these documents, for the purpose of increasing forest cover, it is envisaged to create protective forest plantations, protecting forest strips due to the afforestation of new lands, primarily low-productive, degraded and contaminated, which are derived from agricultural categories and transferred to the forest fund [1, 2]. Due to the low level of productivity and non-forest nature of these lands, forest cultivation should be preceded by work to determine the level of their forestry potential and overall suitability for forestation, but also the forestry typological assessment.

Research objective

Development the soil indicators of forest evaluation of lands (sandy, with shortened profile, salted, eroded), which are transmitted for afforestation, by systematization of various categories of lands and types of soils for their forestry productivity, as well as systems of soil diagnostic indicators for assessing their suitability for afforestation by natural areas of the flat part of Ukraine. Afforestation on the basis of soil and typological research will ensure perhaps optimal use of land potential in the process of afforestation.

Research methods and conditions

The research was based on the synthesis of several methodological approaches – comparative and ecological, classical methods of soil science, agrochemistry, forestry, forest taxation, typology and mathematical statistics using correlation and regression analyzes. The main methodological studies are presented in our previous publications [3, 4, 5]. On the main categories of low-productive lands in different natural zones of the flat part of Ukraine temporary trial areas (TTA) were laid, where soil and typological investigation were conducted.

The study of forest soil properties in Ukraine according to the results of morphometry and soil chemistry was carried out on such low-fertile soils:

- sandy soils (sod-podzolic on sandy sediments);
- soils with a shortened profile on dense carbonate rocks of the Steppe (southern black soil, sod-calcareous soil);
- eroded soils of the Forest-Steppe (different types of soils);
- saline soils of the Forest-Steppe (meadow-chernozem soils of varying degrees of salinity) and Steppe (dark chestnut solonets).

The study of soil cover was carried out according to generally accepted methods in soil science, with some changes and additions, taking into account the specifics of forest soils research. Cameral processing of field materials included preparation of samples and physical and chemical analysis of soils. In the soil samples the following parameters were determined:

- content of gross forms of N, P, K (wet burning in one weighing batch followed by determination of N according to Kjeldal, P – on a spectrophotometer, K – on a flame photometer);
- humus content (according to Tyurin);
- granulometric composition of each soil horizon and layers of thickness> 5 cm according to Kaczyński (its shortened version);

- water and physical properties: field capacity (by weight method), bulk density (volumetric sounding tube by Mikhovich [6], maximum hygroscopity - saturation of soil with water steam over 10% solution of K_2SO_4;

- pH (water) by potentiometric method;

- analysis of water extraction (in saline soils full, in not saline - reduced);

- content of forms Ca^{2+}, Mg^{2+}, K^{+}, Na^{+};

- amount of absorbed alkalines (according to Kapen-Gilkovits);

Parameters of diagnostic indicators were calculated in over 300 soil samples using the statistical data processing was calculated using the confidence interval from the sample data using the critical value of t-statistics (Student's t-distribution) in the program "Statistica".

Research results

In general in Ukraine 210032.88 hectares of low-productive agricultural land and various non-productive lands were transferred to the system of the State Agency of Forest Resources (State Forestry Agency) for afforestation from 2014 to 2016. The transfer of these lands in various volumes was carried out in all natural zones and regional administrations of forest and hunting sectors (RAFHS), including 4981.9 ha in the Polissya, 13540.5 ha in the Forest Steppe, 190931.88 ha in the Steppe and in the Carpathians - 578.6 hectares (Figure 1). Among the categories of land transferred for afforestation at Polissya zone low-productive arable land (37%) and stony lands (29%) prevail. Pastures and sands make respectively 16 and 15%, hayfields - 2%. Among the categories of land transmitted for afforestation in the Forest Steppe low-productive arable land (26%), hayfields (21%) and pastures (20%) prevail. The area of ravines for afforestation is 17%, stony lands and other unproductive lands - 14%, sand - 2%. Among the categories of land transmitted for afforestation in the Steppe pasture (38%), mainly saline and stony lands (25%) prevail. The area of ravines and low-productive arable land is approximately the same - about 13%. The amount of afforestation of sandy land is the smallest - 6%. Among the categories of land transmitted for afforestation in the Carpathians pastures and stony lands predominate.

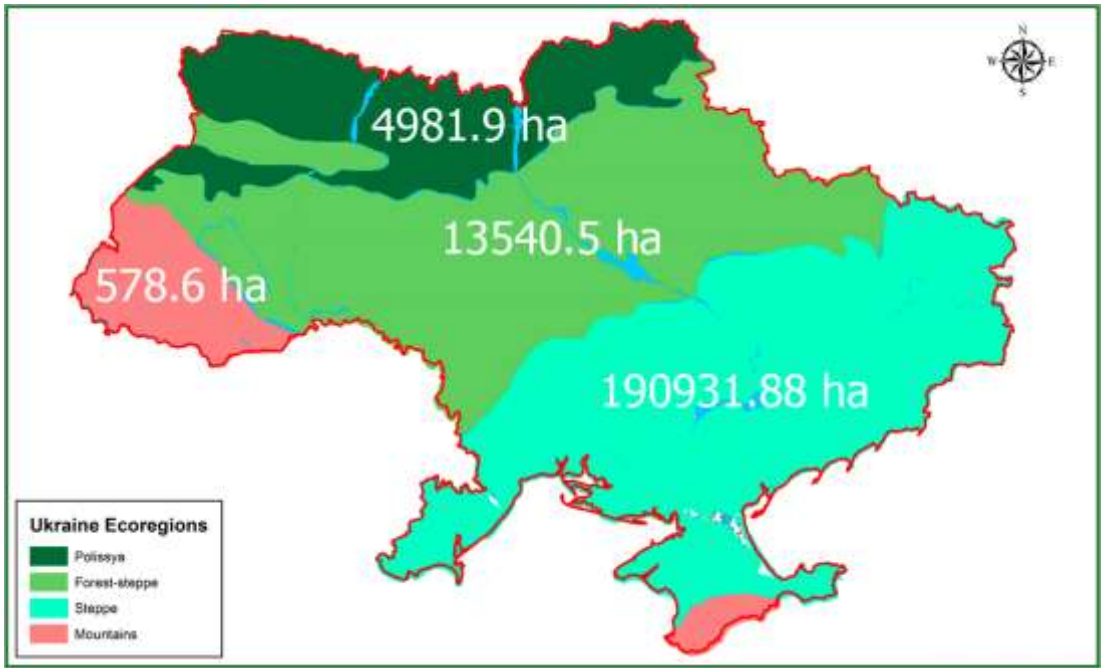

Fig. 1 – The low-productive agricultural land and various non-productive lands for afforestation from 2014 to 2016.

Determination of the suitability of soils for afforestation is evaluated in three categories :

1. Suitable for afforestation.

2. Limitedly suitable for afforestation (dry and unfertile soils).

3. Unsuitable or relatively suitable for afforestation (Primarily these are the following soils: very dry, unfertile, with limited rhizosphere zone, inaccessible or barely accessible for cultivation).

The use of degraded and low-productive lands (sandy, with shortened profile, salted, eroded) should be carried out after a complete inventory of land and taking into account the reasons that led to such a state and the nature of the former use. The first step here is to conduct a thorough soil investigation, in the process of which it is necessary to establish suitability of these lands for afforestion according to soil indicators [7].

a. Soil indicators for forest vegetation evaluation of sandy soils. To assess the forest vegetation potential of soils in unsalted sandy habitats it is enough to determine their most informative indicators (Table 1), which were calculated using statistically processed analytical data:

- toxic salts content;
- granulometric composition;
- thickness of the humus horizon;
- content of general forms of K_2O, P_2O_5;
- equilibrium density;
- depth of subsurface water level;
- mineralization of subsoil waters at their depth from the critical to 2,5 m.

Applying the data presented in the Table 1 it is possible to evaluate non-forest sandy lands transferred for afforestation for forestry typology and determine suitability for afforestation during natural investigation. The indicator range was calculated using the confidence interval from the sample data using the critical value of t-statistics (Student's t-distribution), with such an interval that it can be asserted with a given probability that the value of the estimated parameter is in this interval. The developed soil indicators that make up the forestry classification can serve as a quantitative description for the pinewood habitats (within the trophotops A, B, C) according to Alekseyev-Pogrebnyak edaphic grid, the construction of which is based on two main factors: soil richness (trophotope series: A, B, C, where A is the poorest, and C is the richest in mechanical and chemical composition of the soil) and soil moisture (a number of hygrotopes: 0, 1, 2, 3, 4, 5, where 0 is the driest soil and 5 is the wettest).The presented classification does not apply to the arenas of Nizhniodniprovsky sands whose forest-related properties differ from most sandy lands of Ukraine.

Table 1

Diagnostic indicators[1)] for determining the suitability for afforestation of sandy land of Ukraine (Polissya, Forest Steppe, Northern Steppe)

Indicators	Indicator range		
	Condition suitable for afforestation, 1 group	Condition limitedly suitable for afforestation, 2 group	Condition unsuitable or relatively suitable for afforestation, 3 group
1. Toxic salts content in equivalents of Chlorum (layer 0-50 cm), mEq/100 g	< 1,0	1,0-3,5	> 3,5
2. Silt and clay content, %	6-12	3-6	<3
3. Thickness of the humus horizon [2)], cm			
- Polissya	>20	5-20	<5
- Forest Steppe, Northern Steppe	>25	10-25	<10
4. K_2O content, %[3)]	>0,05	0,01-0,05	<0,01
5. P_2O_5 content, %	>0,04	0,01-0,04	<0,01
6. Equilibrium density (layer 0-30 cm), g/cm^3	<1,3	1,3-1,9	>1,9
7. Depth of subsurface water level, m	> 2,5	From critical to 2,5	< critical
8. Mineralization of subsoil waters at their depth from the critical to 2,5 m, g/dm^3	< 1,0	1,0-5,0	> 5,0

Note:

1) - the reliability level of data value - 95%.

2) – capacity of the humus horizon includes the horizons - He + Hp (PH).

3) - the K_2O content is determined in the sulfuric acid extract (Ginzburg method).

b. Soil indicators for forest vegetation evaluation of steppe soils with shortened profile. These soils are confined to the exits to the earth's surface of limestone and are spread in the Donbass, Mykolaiv, Odesa regions and the Crimea. Their main characteristics are: high carbonation and effervescence as evidence of carbonate presence from the surface, the granulometric composition is predominantly medium and heavy clay loam, the thickness of the soil profile varies from 15 (and less) to 65 (85) cm. To assess the forest vegetation potential of soils with a shortened profile it is enough to determine their most informative parameters (Table 2):

- toxic salts content;
- granulometric composition;
- thickness of the humus horizon;
- occurrence of dense carbonate rock;
- equilibrium density.

The indicator range was calculated using the confidence interval from the sample data using the critical value of t-statistics (Student's t-distribution).

Table 2

Diagnostic indicators[1)] for determining the suitability for afforestation of land with shortened profile (small-profile soils) on the dense limestone of Ukraine (steppe zone)

Indicators	Indicator range		
	Condition suitable for afforestation, 1 group	Condition limitedly suitable for afforestation, 2 group	Condition unsuitable or relatively suitable for afforestation, 3 group
1. Toxic salts content in equivalents of Chlorum (layer 0-50 cm), mEq/100 g	< 1,0	1,0-3,5	> 3,5
2. Silt and clay content, %	>7	5-7	<5
3. Thickness of the humus horizon [2)], cm	>20	5-20	<5
4. Occurrence of dense carbonate rock, cm	>40	15-40	<50
5. Equilibrium density (layer 0-20 cm), g/cm^3	<1,3	1,3-1,9	> 1,9

Note:

1) - the reliability level of data value - 95%.

2) – capacity of the humus horizon includes the horizons - He + Hp (PH).

c. Soil indicators for forest vegetation evaluation of saline lands. For determining the suitability of saline soils for afforestation we have taken into account not only the total content of highly soluble salts, but also the depth of their occurrence, the mechanical composition of the soils and the degree of salt stability of certain wood species and shrubs, the determination of the level of ground waters and their mineralogical composition, as well as the ratio of absorbed sodium to the sum of exchangeable cations to evaluate the degree of soil alkalinity. These indicators constitute a system of diagnostic indicators in assessing the land suitability for afforestation of steppe and semi-desert areas (Table 3). The indicator range was calculated using the confidence interval from the sample data using the critical value of t-statistics (Student's t-distribution).

Saline soils should be removed to create only recreational, greening, protective and water-protective plantings. Herewith the landscape principle of placement should be applied. It should be striped, spherical. Before the plowing the most saline soils should be eliminated from afforestation under and left for the crossroads. It is inappropriate to generate afforestation of general purpose for the production of timber in all types of saline soils. It is allowed to work with highly saline soils of a large area only, in exceptional cases, in fairly wet or irrigated areas [8, 9, 10].

d. Soil indicators for forest vegetation evaluation of eroded soils. The degree of soil erosion must be assessed solely on a zonal and regional and typological basis, that is within a specific physiographic region [11]. The indicator range was calculated using the confidence interval from the sample data using the critical value of t-statistics (Student's t-distribution).

To assess the potential of eroded soils it is enough to determine their most informative

Table 3

Diagnostic indicators for determining suitability for afforestation of saline lands (steppe zone)

Indicators	Indicator range		
	Condition suitable for afforestation, 1 group	Condition limitedly suitable for afforestation, 2 group	Condition unsuitable or relatively suitable for afforestation, 3 group
1. Toxic salts content in equivalents of Chlorum (layer 0-50 cm), mEq/100 g	< 1,0	1,0-3,5	> 3,5
2. Ratio Ca/Na in water extract (layer 0-50 cm)	> 2,5	0,5-2,5	< 0,5
3. Na^++K^+ (layer 0-30 cm), % out of absorbed cations amount: clayed and heavily clay-loam soils	< 3	3-10	> 10,0
medium-, light loam, sandy loam and sandy soils	< 5	5-12	> 12,0
4. Silt and clay content, %	>5	3-5	<3
5. pH water, layer 0-30 cm	< 7,8	7,8-9,5	> 9,5
6. HCO_3^--Ca^{2+} (layer 0-30 cm), mEq/100 g of soil	< 0,5	0,5-2,0	> 2,0
7. CO_3^{2-}, (layer 0-30 cm), mEq/100 g of soil	< 0,1	0,1-0,9	> 0,9
8. Depth of occurrence of the salinity horizon upper boundary, cm	>200	50-200	0-50
9. Equilibrium density (layer 0-30 cm), g/cm^3: heavy soils	1,1-1,3	1,3-1,7	> 1,7
light soils	1,2-1,5	1,5-1,8	> 1,8
10. Depth of subsurface water level, m	> 2	From critical to 2	< critical
11. Mineralization of subsoil waters at their depth from the critical to 2,5 m, g/dm^3	< 1,0	1,0-5,0	> 5,0

indicators (Table 4) from the sample data using the critical value of t-statistics (Student's t-distribution):

• granulometric composition;

• degree of destruction of genetic horizons;

• content of general forms of K_2O, P_2O_5;

• equilibrium density;

• factor of dispersion;

• beginning of the occurrence of dense rocks.

Indicator of the degree of soil erosion on the loose parent rocks of the heavy (loamy-clay) composition is the capacity of the genetic horizons, especially the humus, as well as other available parts of the soil. To determine the level of forest vegetation potential of eroded soils, capacity of horizons of the eroded soil is compared with the standard, that is, with the same but undamaged erosion, the soil unit. Standard soils, as a rule, are modal soils of plodders. The hygrotop of eroded habitats is determined by the confinement to a certain forest typological area [4].

To provide forest typological evaluation of eroded soils formed on heavy parent rocks it is necessary to determine the trophotop:

• typical soil identity;

• the degree of destruction of the genetic horizons relatively to the modal soil (determined by the morphological features of the horizons that go out to the earth's surface) [12, 13].

For forest typological evaluation of eroded soils formed on the light (sandy, sandy loam) it is necessary to determine:

• the degree of destruction of the genetic horizons relatively to the modal soil (determined by morphological features of the horizons that go out to the earth's surface);

• the content of physical clay.

To assess the degree of suitability for afforestation of eroded soils on dense rocks it is necessary to determine:

• the depth of bedding of dense rocks;

• genesis of the parent rock.

The genesis of the parent rock (magmatic, sandstone, shale, limestone-marl, limestone, etc.) causes the differentiation of habitats on acidophilic and calcicole variants, according to which the establishment of agrotechnics and types of forest plantations are determined.

Table 4

Diagnostic indicators for determination of suitability for afforestation of eroded lands of Ukraine (Polissya, Forest Steppe, Steppe)

Indicators	Indicator range		
	Condition suitable for afforestation, 1 group	Condition limitedly suitable for afforestation, 2 group	Condition unsuitable or relatively suitable for afforestation, 3 group
1. Silt and clay content, %	> 6-12	3-6	<3
2. Erosion of horizon HP	<1/2	>1/2	In full
3. Equilibrium density (layer 0-30 cm), g/cm^3: heavy soils	<1,3	1,3-1,6	> 1,6
light soils	<1,5	1,5-1,7	> 1,7
4. K_2O content, %	>0,06	0,01-0,06	<0,01
5. P_2O_5 content, %	>0,04	0,01-0,04	<0,01
6. Air-dried aggregates content (0,25-10 mm), layer 0-30 cm, %	> 60	40-60	< 40,0
7. Water resisting aggregates content (> 0,25 mm), layer 0-30 cm, %	> 35	25-35	< 25,0
8. Dispersity agent by Kachynsky (layer 0-30 cm), %	< 10	10-30	> 30,0
9. Beginning of occurrence of dense rocks, cm: - Polissya	> 30	10-30	< 10
- Forest and Steppe, Northern Steppe	> 40	20-40	< 20
- Southern Steppe	> 50	30-50	< 30

On all degraded and unproductive lands that are transmitted for afforestation strict statistical records of all agrometeorological and agrotechnical measures should be carried out, with their detailed technological characteristics (terms, methods and norms of fertilizers, meliorants and pesticides, types of cultivation, etc.) [14, 15].

It is necessary to use soils with good (suitable for afforestation) soil and ecological condition as ordinary land for afforestation of this zone. Land with satisfactory (limitedly suitable for afforestation) condition should be used after appropriate agrotechnical, chemical and agromelioration measures (use of salt-resistant crops, meliorants, etc.), aimed at their improvement and the possibility of returning to the category of suitable for afforestation. Lands with unsatisfactory condition (non-suitable and relatively suitable for afforestation) should also be used after appropriate agrotechnical, chemical and agromelioration measures (the use of salt-resistant crops, meliorants, etc.) for the possibility of their conversion into a category of limitedly suitable for afforestation, and land non-suitable for afforestation that is not possible to use due to soil and ecological condition should be removed from forest use.

Forestries must carry out rational organization of the territories, preserve and increase the fertility of these soils, protect from overgrown with weeds and shrubs, may temporarily conserve degraded lands if other ways can not restore the fertility of such soils.

Conclusions

The experience of afforestation of low-productive and degraded soils is generalized and a system of diagnostic indicators for their forest typological evaluation on zonal and morphological basis is proposed, and an information analysis on the problem of assessing the suitability for afforestation of low-productive lands (saline, stony, sandy) that are derived from agricultural circulation is provided. The actual material is collected and analyzed, which allows us to generalize the issues related to the study of the suitability for afforestation of low-productive lands by natural zones, as well as the experience of afforestation of these lands. The soil indicators and parameters of forest productivity of low productivity and degraded soils are determined, on the basis of which the classification of soils based on the degree of their forestry potential has been developed.

Conflict of interest

The authors declare that there is no conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

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СИСТЕМА ДІАГНОСТИЧНИХ ПОКАЗНИКІВ ДЛЯ МАЛОПРОДУКТІВНИХ ТА ДЕГРАДІВНИХ ҐРУНТІВ ДЛЯ ОЦІНКИ ЇХ ПРИДАТНОСТІ ДО ЛІСОНАСАДЖЕННЯ

Мета. Виявлення ґрунтових індикаторів для оцінювання лісорослинного потенціалу ґрунтів для можливості лісонасадження.

Методи. Індикатори обирали серед ґрунтових показників, що найчастіше використовуються для оцінювання родючості: запаси й потужність лісових підстилок, морфологічні ознаки ґрунтів, гранулометричний склад, кислотність, вміст гумусу та різних форм NPK, склад та вміст обмінних катіонів. Дослідження проводили за загальноприйнятими в лісовій таксації, типології, ґрунтознавстві методиками, аналітичні роботи – за класичними агрохімічними та стандартизованими методиками.

Результати. У статті аналізується проблема лісогосподарської типологічної оцінки малопродуктивних та деградованих ґрунтів (піщаних, укороченого профілю, засолених, еродованих), що вилучені з сільськогосподарського використання. Зібрано та проаналізовано фактичний та теоретичний матеріал, на основі якого узагальнено коло питань оцінки використання лісових земель у різних природних зонах. На основних категоріях малопродуктивних угідь у різних природних зонах рівнинної частини України закладено тимчасові пробні площі, на яких проводилися ґрунтово-типологічні дослідження. Визначено ґрунтові показники та параметри продуктивності лісу низькопродуктивних та деградованих ґрунтів, на основі яких розроблено класифікацію ґрунтів за ступенем їх придатності для заліснення. Придатність ґрунтів до лісонасадження оцінювали за трьома категоріями: придатні для заліснення, обмежено придатні та непридатні для заліснення.

Висновки. Узагальнено досвід заліснення малопродуктивних та деградованих ґрунтів та запропоновано систему діагностичних показників для їхньої лісотипологічної оцінки за зонально-морфологічною ознакою, а також дано аналіз інформації з проблеми оцінки придатності для заліснення низькопродуктивних земель, виведених із сільськогосподарського обороту. Придатність ґрунтів до лісонасадження описується системою показників ґрунту, зокрема, їх гранулометричним складом, вмістом гумусу, загальних і рухомих форм NPK, обмінних катіонів. Проте серед цих показників можна виділити найінформативніші індикатори рівня продуктивності лісових земель - мінералогічний (хімічний) та гранулометричний склад ґрунтів. При цьому доведено, що гранулометричний склад ґрунту визначає такі найважливіші його характеристики, як вміст обмінних основ, загальних форм фосфору, калію, гумусу.

КЛЮЧОВІ СЛОВА: придатність до лісонасадження, властивості ґрунту, показники ґрунту, еродовані землі, непродуктивні землі, природна зона

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СИСТЕМА ДИАГНОСТИЧЕСКИХ ПОКАЗАТЕЛЕЙ МАЛОПРОДУКТИВНЫХ И ДЕГРАДИРОВАННЫХ ПОЧВ ДЛЯ ОЦЕНКИ ИХ ПРИГОДНОСТИ К ЛЕСОНАЖДЕНИЮ

Цель. Выявление почвенных индикаторов для оценки лесорастительного потенциала почв для возможности лесонасаждения.

Методы. Индикаторы выбирали среди показателей, наиболее часто используемых для оценки плодородия: запасы и мощность лесных подстилок, морфологические признаки почв, гранулометрический состав,

кислотность, содержание гумуса и различных форм NPK, состав и содержание обменных катионов. Использованы общепринятые в лесной таксации, типологии, почвоведению методики, аналитические работы – по классическим агрохимическим и стандартизированным методикам.

Результаты. В статье анализируется проблема лесной типологической оценки малопродуктивных и деградированных почв (песчаных, с укороченным профилем, засоленных, эродированных), выведенных из сельскохозяйственного использования. Собран и проанализирован актуальный и теоретический материал, на основе которого обобщен круг вопросов, связанных с оценкой использования лесных земель в различных природных зонах. По основным категориям малопродуктивных земель в различных природных зонах равнинной части Украины заложены временные опытные участки, на которых проводились почвенно-типологические исследования. Определены почвенные показатели и параметры продуктивности лесов малопродуктивных и деградированных почв, на основании которых разработана классификация почв по степени их пригодности для облесения. Пригодность почв к лесонасаждению оценивалась по трем категориям: пригодные для облесения, ограниченно пригодные и непригодные для облесения.

Выводы. Обобщен опыт облесения малопродуктивных и деградированных почв и предложена система диагностических показателей для их лесотипологической оценки по зонально-морфологическому признаку, а также дан анализ информации по проблеме оценки пригодности для облесения низкопродуктивных земель, выведенных из сельскохозяйственного оборота. Пригодность почв к лесонасаждению описывается системой показателей почвы, в частности, их гранулометрическим составом, содержанием гумуса, общих и подвижных форм NPK, обменных катионов. Однако среди этих показателей можно выделить информативные индикаторы уровня продуктивности лесных земель - минералогический (химический) и гранулометрический состав почв. При этом доказано, что гранулометрический состав почвы определяет такие важнейшие его характеристики, как содержание обменных оснований, общих форм фосфора, калия, гумуса.

КЛЮЧЕВЫЕ СЛОВА: пригодность к лесонасаждению, свойства почв, показатели почв, эродированные земли, непродуктивные земли, природная зона

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