UDC: 630.26

ADAPTIVE-LANDSCAPE PRINCIPLES OF APPLICATION OF FIELD-PROTECTIVE AFFORESTATION IN ODESA REGION

G.B. Gladun[1], Y.G. Gladun[1], L.V Yeterevs'ka[2]

[1]UkrainianResearchInstituteofForestry&ForestMeliorationnamedafterG. M. Vysotsky
[2]NSC «Institute for Soil Science and Agrochemistry Research named after O.N. Sokolovsky»
(*gladun@uriffm.org.ua)*

There principlesofforestshelterbeltsformingareconsideredtakingintoaccountmodernrequirements, theiroptimizedstructureandquantitativeindexesonsoil-climatic sub-zone, expectedinaccordancewiththefeaturesofnaturaltermsofregion.

Keywords: *shelterbelts, field-protectivepercentageofforestcover,agrolandscapes*

Introduction. Odessa region is the largest region of Ukraine. It covers the territory of the North-Western of Black Sea Region and on the physical-geographical zoning located in the North (gullies) Steppe, Arid Steppe and Forest-Steppe. This determines its high agroindustrialpotential and significant biological and landscape diversity. However, the geographical position of the region also causes and negative features of the region nature, in particular, its insufficient moistening and very low forest cover. Prevail in soil cover of the chernozem soils in the North –regradationand typical, in the central part - ordinary, in the South- southern; and only in the South-East lie dark-chestnut solonetzic soils. The result is unreasonably high agricultural uses and the intensive ploughing of slope lands in the region intensifies erosion and deflation of soils, which is extendedtoalmost half of the arable land.

During 2009-2011 in the area created 9367 hectares of forests, including afforestation on land not suitable for agriculture is 7240 ha. The creation of shelter forest belts and other protective trees left in the field outside the proper attention.

The importance of agroforestmeliorationmeasures for protectionof agro-landscapesfrom the negative effects of natural and anthropogenic origin specifies inclusion in the Program of economic reforms for 2010-2014 "Prosperous society, competitive economy, effective State" elaboration "Concept of agroforestmeliorationdevelopment in Ukraine" for the period until 2025, which was approved by the Cabinet of Ministers of Ukraine on 18.09.2013 № 725-p [1]. In particular, emphasized that the preservation and protection of arable land belongs to the priorities of the state and is an important condition of agrolandscapessustainable development, increasing the crop yields.

The purpose.Based on the current differentiation of the Odessa region territory physiographic zones and subzones calculate the optimal number of field-protection forest belt based on soils types and theappropriateratiosfor optimization of field-protection forest cover for administrative regions.

The state of the problem knowledge. How to optimize the protection of agricultural lands in the area of erosion and deflation processes, droughts and dry winds devoted scientific publications of *Г.І. Швебса, О.О. Світличного, С.Г. Чорного, І.К. Срібного, Г.О. Можейка, О.В. Письменного*and others. Their investigations have focused on the ecological optimization of agricultural production and lie outside the plane of the implementation protective agricultural afforestation in modern conditions of Odessa region.

Objects and methods of research. The object of research is a process of evidence-based formation of field-protectivepercentageofforestcoverof agrolandscapesbased on the basis ofadaptive-landscapesmethods. Required volumes to create field-protectiveshelter forest belts for natural Forest-steppe and Steppe zones (northern (gullies) and dry) were calculated as a result of

the potential difference between the minimum required area of shelter plantationsin the administrative districts, and their real area [2]. Thus calculated area of shelter forest belts for the prevailing soil types within natural areas and made their recalculation at the administrative structure of the Odessa region, which is important for the implementation of the results. The basis of the carried out calculations based onappropriateratios for optimization the using of field-protection forest cover in agricultural landscapes onadaptive-landscape basis [3, 4, 5, 6].

Results. The initial data for calculations is the structure of the Odessa region land fund. Agricultural lands occupy an area of 2592,4 thousand ha (77,8 %), among them arable lands-2074,4 thousand ha (62,2%); forests and other forest - covered areas -223,9 thousand ha (6,7%); degraded and marginal unproductive lands - ravines - 13.3 thousand ha; sands - 4,21; vacant lots and clearings - 16,4 thousand ha [2].

The region is belongs to forestscarceareas, the total forest cover is lower than optimal. For create the optimal forest cover of 9 %, it is necessary to create the forests on an area of about 104 thousand ha. Therefore, the priority task is to increase the forests area that will allow renewal and preserving biological and landscape diversity in the region, stabilize the ecological balance in the landscapes.

This is especially important for the Steppe part of the region, which located south of the line of high pressure air, the so-called "axis of Voiejkova (*Воєйкова)*"that affects to the character of the atmospheric circulation. After a major role in the formation of Steppe climate have the North-Eastern and Eastern continental winds and subtropical Mediterranean air masses. To mitigate their possible negative effect creates a system of field-protection forest shelterbelts.

In the northern part of the Odessa region, which is the part of the Right-Bank Forest-Steppe, is also problematic rainfed agriculture. Although most environmentally sustainable in the region is the land areas of the Forest-Steppe, still allowable excess tillage here is 13.3 %, and the territory mastered by 78.9 %. Forests and other wooded areas occupied by 35,8 thousand ha (12.5 %). The necessary transformation of the land fund structure in the area of Forest -Steppedue to the conclusion of the arable land marginal and degraded land with area of 54.4 thousand ha [6].

In the Forest-Steppepart of the region (as of 01.01.2010) concentrated 12.3 thousandhaof field-protection shelter forestbelts and their total area in the region - 49.8 thousandha. The calculations of predictive requirements of protective forest strips for the Forest-Steppe in Odessa region, which is characterized as probably the best shelter afforestation in Forest-Steppe zone are summarized in Table 1. Normative calculation used with current recommendations [5], provides shelter forest cover 2.7% of the arable land area.

On the basis of ratio calculated the area of forest belts, which should be created for completing the protection on arable land in every administrative district related to the Forest-Steppe of the region. It is supposed to create an additional 3695.6 haof field-protection forest strips, except Kotovsky and Frunzivskyareas where there is no such need.

1. The calculation of the minimum required area offield-protection forest strips in the districts of Odessa region related to the Forest-Steppe zone

District	The area of the lands category, thousand ha					
	arable land	field-protection forest shelterbelts			otherprotecti veforestplant ations	existing forested areas
		existing	necessary	shouldcreatean additional		
Anan'evsky	64,8	0,87	1,75	0,87	-	14,55
Baltsky	70,9	1,1	1,92	0,81	0,25	22,34
Kodymsky	42,0	0,56	1,13	0,57	0,49	15,17
Kotovsky	59,6	2,36	1,61	-	0,73	12,52
Krasnooknyansky	61,8	1,53	1,67	0,14	2,69	6,29

Lyubashevsky	72,9	0,94	1,97	1,03	0,07	5,74
Savransky	37,0	0,73	1,00	0,27	0,08	12,05
Frunzivsky	56,8	4,21	1,53	-	4,98	9,92
Total	465,8	12,3	12,58	3,69	9,29	98,58

For protection ofagrolandscapes as part of forestmelioration complex in Forest-Steppe provided by other categories of field-protectivepercentageofforestcover, particularly plantations in ravine and rocky lands - 3.6 and 1.6 thousand ha respectively, and eroded pastures are subject to afforestation on an area of about 30,6 thousand ha. It is also advisable to create a protective strip in the gardens 0.8 ha, vineyards - 1,1 thousand ha and protective forest plantations on grasslands linear forms over an area of 1,72 thousand ha. Also protective plantings are necessary to protect infrastructure, in particular roads and measures to limit the negative impact of harmful emissions in the adjacent land plots. The area of such plants shall be at 5.3 thousand ha [8].

Listedtypes of field-protectivepercentageofforestcover and the system scattered forests on the aggregate of the synergy effects also create the necessary preconditions for ecological stabilization of agricultural landscapes.

In other parts of the region protective afforestation requires optimization according to modern rations. For the western and central districts of Odessa region related to the North (gullies) Steppes, determined the structure of agricultural landscapes lands and on this basis calculated in the desired area of field-protectivepercentageofforestshelterbelts (Table 2). The ratiowasused to calculate from current recommendations; it provides field-protectivepercentageofforestshelter belts cover 3.7 % of the arable land area in the administrative district [5].

2. Thecalculationoftheminimumrequiredarea of field-protectivepercentageofforestshelter belts inthedistrictsofOdessaregionrelatedtothesub-zoneofNorthern (gullies) Steppe

District	The area of the lands category, thousand ha					
	arable land	field-protection forest shelterbelts			otherprotectiveforestplantations	existing forested areas
		existing	necessary	shouldcreateanadditional		
Artsizsky	99,92	4,12	3,70	–	0,45	5,69
Berezovsky	114,37	1,79	4,23	2,45	0,52	6,20
Bolgradsky	90,63	2,35	3,35	1,01	0,50	6,07
Velykomikhaïlovskiy	94,23	1,45	3,49	2,04	1,58	8,50
Ivanivsky	78,65	1,59	2,91	1,32	2,13	5,55
Razdel'nyansky	91,00	3,62	3,37	–	2,40	6,06
Saratsky	106,99	2,37	3,96	1,59	0,44	5,48
Tarutinsky	108,05	3,58	3,99	0,41	6,49	10,30
Tatarbunarsky	103,61	2,06	3,83	1,78	0,03	3,41
Shyryayivsky	98,19	1,23	3,63	2,40	0,10	6,41
Total	985,64	24,16	36,46	13,00	14,64	63,67

Additional number of forest shelter belts, which are necessary to create herereaches 13.0 ha. A characteristic feature is that in Artsyzsky and Razdel'nyansky districts areasof forest shelter

belts correspondtothe current minimum required ratio of forest cover relative to arable lands, andtherefore, planting is not planned. The total area of forest shelter belts in this region should be 36.5 thousandha.

ForfullprotectionofagriculturallandscapesoftheNorth (gullies) Steppecalculatedthenecessaryareas ofthe othercategoriesof field-protectivepercentageofforestshelter belts, inparticular, onravine and rocky lands - 3.6 and 1.6 thousandha, respectively, onerodedpastures - 33,6 thousand ha, in the gardens - 1,0 thousand ha, on the vineyards - 3.4 thousand ha, on the hayfields - 0,89 thousand ha, fortheprotectionofroads - 6.4 thousandha [8].

To the arid Steppe in the southernmost part belongs to Black Sea Lowlandwhich is characterized by the spread of subtype dry Steppe landscape with dark chestnut and chestnut soils that developed under sagebrush- grass Steppes. Forests and other wooded areas occupy 35.8 thousand ha (3.5%).

Agricultural land southern administrative regions are normally divided into natural subzones, which require consideration in the design of agroforestry reclamation measures.However,it should keep the governing principle of administrative division of protective forest plantations for practical implementation agroforestry activities in modern agricultural landscapes.

For effective management of the environmental state of agricultural landscapes and for the safe land use, especially in arid areas, it is necessary to create a minimum number of agroforestry plantations. The main producing area in agricultural landscapes is arable land, requiring immediate measures to protect forest reclamation facilities. The ratio for calculating the area of forest strips belts used from the existing recommendations; in accordance with it forest cover should be 4.8 % of the arable land area [5]. The calculations show (Table 3),that in the modern structure of land area shelter plantings should be: 29.52 thousand ha of field-protection forest shelter belts and 6.02 thousand ha of runoff regulated [8].

3. Thecalculationoftheminimumrequiredarea of field-protectionforestshelter beltsinthedistrictsofOdessaregionrelatedtothe sub-zoneofDrySteppe

District	The area of the lands category, thousand ha					
	arable land	field-protection forest shelterbelts			otherprotectiveforestplantations	existing forested areas
		existing	necessary	shouldcreateanadditional		
Belgorod-Dniestrovsky	118,4	2,77	5,69	2,91	0,34	4,29
Bilyaivsky	91,1	1,95	4,37	2,42	1,12	7,51
Izmailsky	79,7	1,69	3,82	2,13	0,62	4,83
Kiliysky	67,0	0,88	3,21	2,33	1,56	2,45
Kominternovsky	98,6	2,43	4,73	2,30	1,40	4,76
Mykolayivsky	79,4	1,71	3,81	2,09	0,09	8,11
Ovidiopolsky	47,2	1,30	2,27	0,97	0,73	2,03
Renijsky	33,8	0,60	1,62	1,02	0,16	1,81
Total	615,2	13,33	29,52	16,17	6,02	35,79

Forthe complete protection ofagricultural landscapesinthe dry Steppeestablishedareasof other categoriesof field-protection forest shelter belts,particularly onravine and rockylands- 3.2and 0.6thousandha respectively,on pastures- 8,8ha, gardens -1.3ha,on the vineyards- 1.9haonhayfields-0.21ha,in the right stripsof highways- 4.4ha[8].

Formed by the field-protectivepercentageofforestcoverecological framework in different

natural conditions creates quasi natural systems, integrated on a single functional principle. The creation of field-protectiveforestshelter beltscompleted systemsand other categories of protective forest plantations, and artificial forests on degraded and unproductive lands will lead to forest anthropogenic landscapes - agroforestry landscapes which characterized by elevated levels of agricultural productivity, conservation and enhancement of biological diversity, and consequently, become self-regulation and self-healing features inherent in natural landscapes [9, 10].

Incaseofcreationestimatednumberoffield-protectiveforestshelter beltsintheregionthat willincreasethe effectiveness ofagroforestry protect ofagriculturallandscapes, and their prognostic forested reaches 10.5%. As a result, thetotalforestcoverofOdessaregioncanbeincreasedto 14.0 % and willhavepositivelyimpactnotonlyonagriculturalland, butalsooninfrastructureas a whole[8].

Conclusions.It was revealedthatintheterritoryoftheOdessaregionisnecessarytocreate field-protectionforeststripsintheareaes: theForest-Steppe - 3,69 thousandha; intheNorth (gullies) Steppe - 13,0 andDrySteppe - 16,17 thousand ha through the use of local regulatory action parameters of the forest shelter belts to protect arable lands from adversenaturalphenomena.

The establishment of forest shelter belts system on the basison scientifically formed rationswillprovideconditions for long-termsupport of positive ecological balance of the agrolandscapesin region and is an important prerequisite for obtaining stable yields.

References

1. Про схвалення Концепції розвитку агролісомеліорації в Україні / Розпорядження КМУ від 18 вересня 2013 р. № 725-р. [Електронний ресурс]. – Режим доступу: http://www.nau.kiev.ua/druk.php?name=443969-18092013-0.htm (*The concept of development agro-forest-improvements in Ukraine/ The order of the Cabinet of Ministry of Ukraine)*(Ukr.).

2. Державний земельний кадастр Одеської області станом на 01.01.2011р. //Одеське обласне управління земельних ресурсів. – Одеса, 2011. – (*The State Land Cadastre of the Odessa region)*(Ukr.).

3. Рекомендації щодо принципів застосування лісових меліорацій на ландшафтно-екологічній основі / Г.Б. Гладун, М.Н. Агапонов, В.Г. Келеберда та ін. – Харків, 2009. – 34 с. (*Recommendations for forest ameliorations application on landscape-environmental base.G.B.Gladun, M.N.Agaponov et al.)*(Ukr.).

4. Рекомендації щодо використання площ лісомеліоративного фонду та проведення комплексу заходів, спрямованих на підвищення еколого-меліоративної ефективності агролісомеліоративних насаджень / Г.Б. Гладун, В.Ю. Юхновський, Ю.В. Плугатар та ін. – Харків, 2009. – 76 с. (*Recommendations for use of the meliorative land fund and carrying out of actions for increase of efficiency of land improvement.G.B.Gladun,V.Yu.Yuhnovsky et al.)*(Ukr.).

5. Рекомендації щодо покращання стану та підвищення меліоративної ефективності захисних лісових насаджень різного цільового призначення / Г.Б. Гладун, М.Н. Агапонов, А.Г. Андрієнко та ін. – Харків, 2010. – 120 с. (*Recommendationsforstateimprovingandracingofameliorativeefficiencyofprotectivewoodplantingsdifferentspecial-purposedesignation.G.B.Gladun,M.N.Agaponov, A,G,Andrienko et al.)*(Ukr.).

6. Гладун Г.Б. Оптимізація насаджень лісомеліоративного комплексу на адаптивно-ландшафтній основі / Г.Б. Гладун. Ю.Г. Гладун,В.Ю. Юхновський // Науковий вісник Національного університету біоресурсів і природокористування України. Серія „Лісівництво та декоративне садівництво". – К., 2013. – Вип. 187. ч.2.– С. 104–111. (*G.B.Gladun, Yu.G.Gladun, V.Yu.Yuhnovsky. Optimizationofplantingsofwood-meliorativecomplexonadaptive-landscapebasis)*(Ukr.).

7. Кульчицька Л.А . Географічні закономірності екологічної стійкості агроландшафтів Одеської області / Л.А. Кульчицька // Аграрний вісник Причорномор'я. Сільськогосподарські науки 2009. – Вип. 51. [Електронний ресурс] – Режим доступу: http://www.nbuv.gov.ua/portal/Chem_Biol /AVPCh/ Sg_T_E_n /2009_51/121.(L.A.Kul'chycka.*Geographical laws of ecological stability of landscapes of the Odessa region*(Ukr.).

8. Гладун Г.Б. Удосконалення організаційно-структурних параметрів полезахисного лісорозведення / Г.Б. Гладун // Посібник українського хлібороба // Науково-практичний щорічник. – К., 2013. – Т.1. – С. 175–179.(*G.B.Gladun. Improvement of organizational-structural parameters field-protecting woodcultivations)*(Ukr.).

*9. Гладун Г.Б .*Сучасні лісові меліорації: теорія, методологія, стан, перспективи / Г.Б. Гладун // Лісівництво і агролісомеліорація. – Харків: «САМ», 2004. – Вип. 105. – С. 140–146.(*G.B.Gladun.* Modern wood land improvements: the theory, methodology, a condition, prospect)(Ukr.).

*10. Гладун Г.Б .*Визначення потенційної мінімально необхідної захисної лісистості агроландшафтів рівнинної частини України / Г.Б. Гладун // Наукові праці ЛНАУ. – Вип. 9. – Львів: РВВ НЛТУУ, 2011. – С. 36–41. (*G.B.Gladun.* Definition of potential minimal necessary protective percentage of forest land agro-landscapes in a flat part of Ukraine) (Ukr.).

ReceivedbyEditorialBoard28.10.2013