Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development
Vol. 20, Issue 1, 2020
PRINT ISSN 2284-7995, E-ISSN 2285-3952

METHODICAL FEATURES OF THE DETERMINATION OF LAND SUITABILITY FOR CONDUCTING AGRICULTURAL PRODUCTION

Roman STUPEN, Oksana CHERECHON, Oksana STUPEN, Myroslava SMOLIARCHUK

Lviv National Agrarian University, Ukraine, 1, V. Velykoho str., Lviv Region, 80381, Ukraine, Phones: + 38 067 33 27 875, + 38 032 22 42 961; E-mails: romomas@ukr.net, okcherechon@gmail.com, oksanashufryn@ukr.net, murosya_s@ukr.net

Corresponding author: oksanashufryn@ukr.net

Abstract

One has researched the method of classification of the suitability of arable lands for the cultivation of basic agricultural crops. One has presented the classification of lands by suitability on the example of the landmass of limited liability company "Luhy", located on the territory of Velyki Hlibovychi village council of Peremyshliany district of Lviv region *on the basis of detailed analysis of materials of soil surveys. The mapping of the ecological suitability of the land is presented and scientific recommendations for cultivation and cultivation of crops in crop rotation for the object of study for ecological use in the system of intra-land management are offered.*

Key words**:** *ecological suitability of land, cultivation of crops, suitability classes of arable lands, in-farm land management*

INTRODUCTION

An excessive production load on agricultural lands has recently led to an increase in negative processes. Among them, in addition to erosion, the threatening state of neglecting the issues of the ecological suitability of lands for the cultivation of certain crops, in particular, is an unjustified increase of such crops as rapeseed, sunflower and others which deplete soils.

The scholars Ye. Butenko [2], N. Voitovych [11], P. Kazmir and L. Kazmir [4], N. Stupen [8], A. Tretiak [9; 10] consider the environmental assessment of the territory, firstly, as suitability for intensive use; secondly, as an assessment of fertility factors in this territory. It involves the analysis of the territory in the context of compliance of factors with the basic requirements of plants. When external conditions do not comply with the requirements of the plants, then there is the issue about the inappropriateness of the territory for the certain plant or the necessity to adapt the conditions to the plants or, conversely, the plants to environmental conditions.

Assessing the territory as a place of cultivation of plants, and considering their demand for natural factors, as well as the range of fluctuations of the demand and natural conditions on which the productivity of plants depends, we make conclusions that the degree of suitability of the territory for crops, and on the necessary measures for their improvement [1].

MATERIALS AND METHODS

We have applied the method of ecological and economic classification of the suitability of lands for growing basic agricultural crops to carry out the study [9; 10]. The study of the classification of arable land suitability is based on the indicator of the cost recovery of the partial economic evaluation of arable land, which reflects the yielding capacity of the certain crop and the cost of obtaining it, as well as soil valuation data [9]. Considering the calculations and indicators of the partial economic evaluation of arable land and soil valuation, arable lands or landownership lands are divided into three groups and five classes of suitability within the land assessment area [10].

The first group includes arable lands, which provides a level of cost recovery for growing basic crops over 1.30.

The second group includes undeveloped and poorly washed arable lands, which do not provide cost recovery for intensive crops growing (mainly sugar beets, corn for grain and others at the level of 1.30 and above).
The third group unites the middle-washed and heavily-washed arable lands. As a rule, when growing intensive crops on them, the level of cost recovery will be below 1.30 (Fig. 1). The data of such classification of arable land is used for optimization of the structure of lands and acreage, development of projects of agricultural land management of the territory of agricultural enterprises and solving other issues on the organization of rational use and land protection [7].

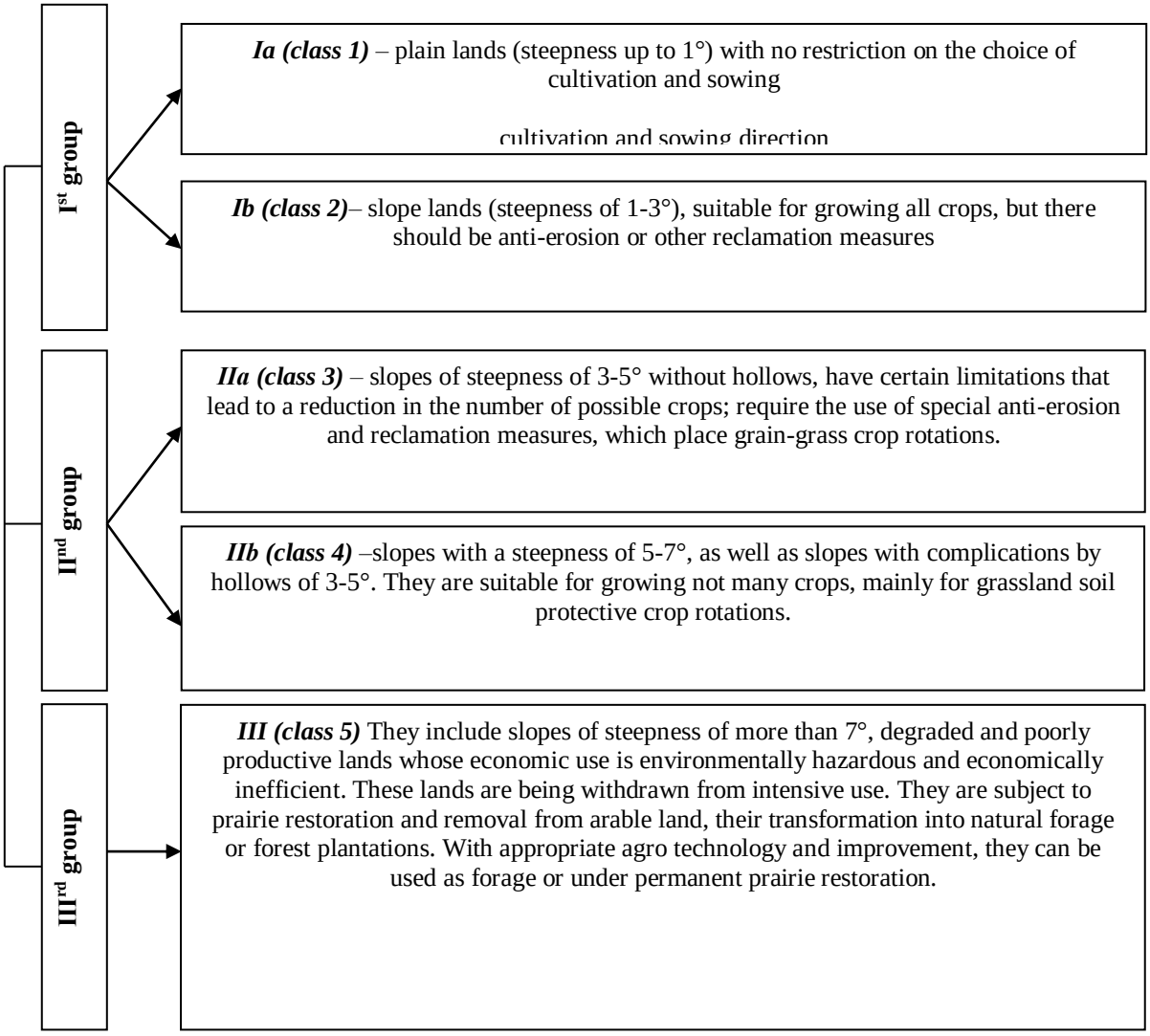

Fig. 1. Groups and classes of suitability of arable lands.
Source: on the basis of data [9, 10].

RESULTS AND DISCUSSIONS

One carries out the classification of the suitability of lands to facilitate understanding by landowners and other land users of soil maps for their practical application. This fact allows having broader generalizations based on soil potential and land use restrictions.
The object of the study is the land arrays of "Luhy" Limited Liability Company located on the territory of Velyki Hlibovychi village council of Peremyshliany district of Lviv region. The territory of this farm belongs to the Forest-Steppe Natural-Agricultural Zone, Forest-Steppe Western Natural-Agricultural Province, Dnister-Western Buh district. The average monthly air temperature during the year varies from - 7-8 to +20°-21° depending on the location of the farm. The absolute minimum and maximum of the air

temperature were -32 and + 37°. Annual precipitation varies from 400 to 560 mm [5].
On the farm, the main economic activity is mixed agriculture, where crops such as rapeseed, barley, wheat, and soybeans are grown. The average yielding capacity of rapeseed is 25.4 c/ha, barley – 47.9-59.3 c/ha and wheat within 56.3-61.2 c/ha respectively. Considering the agro-technical measures for cultivation of appropriate crops in the farm, one should determine the suitability of the land tracts for their cultivation in crop rotation, performing the selection of varieties of crops taking into account the stability, competitiveness against weeds, diseases or pests by optimizing soil cultivation system, fertilization, setting deadlines and ways of sowing, harvesting [3].
Land plots have been allocated to substantiate the suitability of landmasses for their cultivation in the farm. Their detailed analysis is given in Table 1.

Table 1. Analysis of land plots

№	Total area, ha	Agro-production groups of soils		
		code	name	area, ha
1	1.2557	45g	dark gray podzolic soils and black soils with podzolic gleysolic light-loamy ones	1.0922
		51d	dark gray podzolic soils, degraded soils, and podzolic black soils and medium-loamy, heavily washed degraded ones	0.1635
2	1.2592	45g	dark gray podzolic soils and podzolic gleysolic light-loamy black soils	1.2592
3	0.1718	49g	dark gray podzolic and degraded soils and podzolic black soils and gleysolic light-loamy lightly-washed degraded ones	0.1718
4	0.7859	45g	dark gray podzolic soils and podzolic gleysolic light-loamy black soils	0.2390
		51d	dark gray podzolic soils, degraded soils, and podzolic black soils and medium-loamy, medium washed degraded ones	0.5469
5	0.7501	45g	dark gray podzolic soils and podzolic gleysolic light-loamy black soils	0.7501
Total		4.2227		

Source: on the basis of data [6].

One used a large-scale soil survey of Velyki Hlibovychi village council of 1992 to analyze the soil cover of the selected land plots. As we see in Table 1, the land plots are represented mainly by dark gray podzolic soils and black soils with podzolic gleysolic light-loamy ones (code 45g) [6]. The depth of the humus profile in them is determined at the level of 80-100 cm, where the humus content is 4-5% [5].
Having analyzed the location of soils on the investigated land plots, we can state that the cartograms of the arrays of the ecological suitability of the lands are proposed as a scientific prerequisite for their ecological use.
One has shown the territorial location of groups of arrays of ecologically suitable lands in Figure 2, by way of qualitative localized background or hatching, depending on the intensity of land use. Taking into account the above-mentioned information, one can observe that the lands of the first group of ecological suitability arrays are shown in red, the second group – orange, the third group – yellow, the fourth group – mustard and the fifth one – green.
Table 2 presents the explication of land plots according to suitability classes.

Table 2. Explication of land plots according to suitability classes.

№	Area, ha	Agro group code / Suitability class		
		45g	49g	51d
1	1.2557	1.0922 / I		0.1635 / III
2	1.2592	1.2592 / I		
3	0.1718		0.1718 / II	
4	0.7859	0.2390 / II		0.5469 / IV, V
5	0.7501	0.7501 / I		
Total	4.2227	3.3405	0.1718	1.7104

Source: it is done by the author on the basis of data [6].

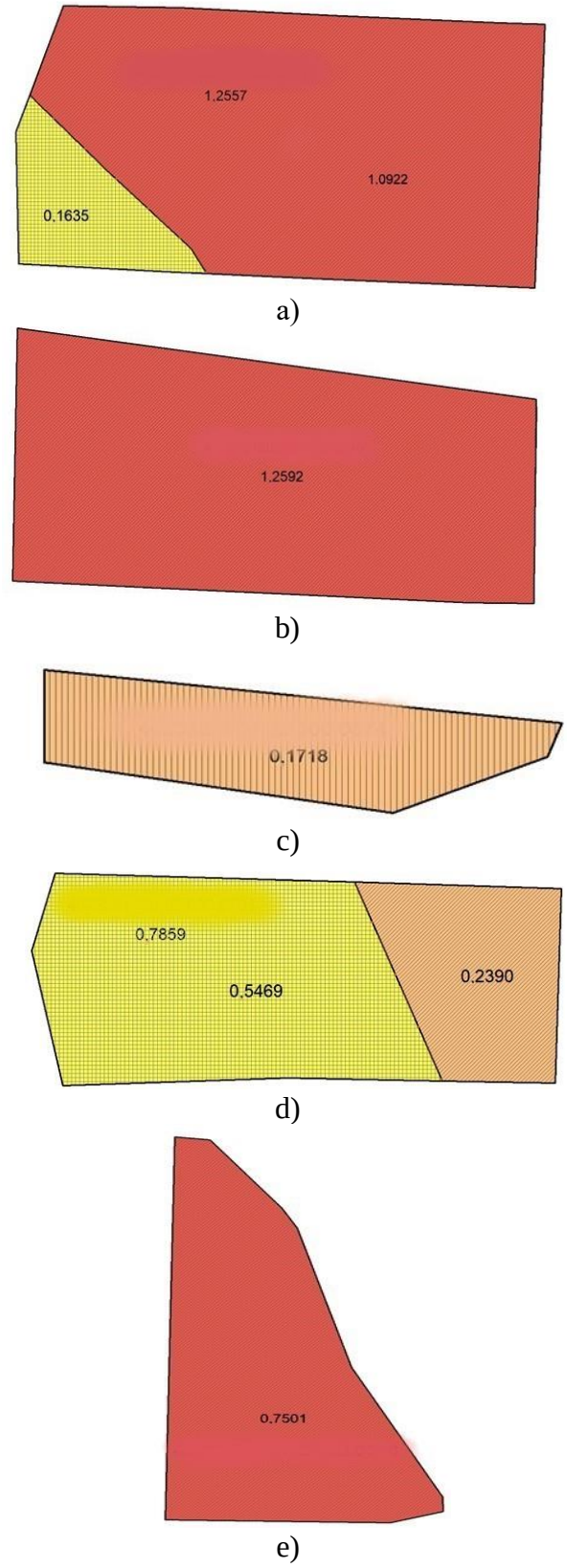

Fig. 2. The cartogram of environmental suitability chart of land plot, the area of a) 1.2557 hectares; b) 1.2592 ha; c) 0.1718 ha; d) 0.7859 ha; e) 0.7501 ha.
Source: on the basis of data [6].

Table 2 shows that the largest area of the investigated lands is agro group 45g – 3.3405 ha. These are the undisturbed soils that belong to the 1st and 2nd technological groups, and they are mainly included in the first class of suitability, where it is possible to grow all regional crops including row ones by intensive technologies. However, a small part of them – 0.2390 hectares is included in the second class of suitability, where it is obligatory to cultivate and sow across or at an acceptable angle to the slope. One also includes parts of land plots, adjacent to the highly washed soils, that is they are on slopes 3-5˚ in the second class (Fig. 2c), 2d). We suggest to include soils of agro group of 49g, with an area of 0.1718 to the second class of suitability, as these are lightly washed soils located on the slopes of 3-5˚. A small area of 0.1635 hectares on the land plot of agro group 51e - highly washed soils can be included in the third class of land suitability (Fig. 2a). The land plot, the main area of which is 0.5469 ha, is occupied by highly washed soils (code 51e) is shown in Fig. 2d).

CONCLUSIONS

In the farm we offer two land use options, namely:

Ist option – withdrawal from intensive cultivation and prairie restoration (the 5th class of suitability) for the lease period;

IInd option – considering that it is a leased land share - for limited use (the 4th class of suitability) with the introduction of grassland soil protective crop rotation (on slopes 5-7 °, where heavily washed soils predominate).

The location on such lands of cultivated crops is excluded. In grassland crop rotations the proportion of perennial grasses will be from 40-50 to 80%.

The conducted research on the example of an agricultural enterprise allows to more reasonably solving the problem of organization of crop rotations, as an essential part in the system of agricultural land management.

REFERENCES

[1] An analysis of the suitability of arable lands, 2019, The classification of arable lands by the suitability of soils for crop production. Characteristics of the criteria by which agricultural groups of soils are carried out: genetic convergence of soils, degree of negative processes, https://knowledge.allbest.ru, Accessed on 01.12.2019.
[2]Butenko, Ye., 2012, Ecological and economic assessment of agricultural land use due to market conditions: monograph, Kyiv, 158 p.
[3]Institute of Agriculture of the Carpathian region of National Academy of Agrarian Sciences of Ukraine, 2019, Features of Growing Winter Crops Technologies for the 2019 Harvest (Autumn Works): Recommendations, Obroshyno, 48 p.
[4]Kazmir, P., Kazmir, L., 2007, Land management design: organization of lands and crop rotation and landscaping of crop rotation: a lecture course, Lviv, 97p.
[5]Martyn, A., Osypchuk, S., Chumachenko, O., 2015, Natural and Agricultural Zoning of Ukraine: Monograph, Kyiv, 328 p.
[6]Polupan, M., 2005, Classification of Soils of Ukraine, Kyiv, 300 p.
[7]Stupen, M., Stupen, R., Ryzhok, Z., Stupen, O., 2019, Methodological foundations of the organization and protection of lands in the context of the balanced nature use. Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, 19(1): 565-571.
[8]Stupen, N., Bohira, M., Stupen, O., Ryzhok, Z., 2019, Prospects of the application of European practice on efficient agricultural lands use in Ukraine. Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, 19(3): 563-569.
[9]Tretiak, A., Druhak, V., Leonets, V., Tretiak, R., Hunko L., 2019, Methodological recommendations of ecological and landscape land management of agricultural enterprises, Kyiv, 92 p.
[10]Tretiak, A., Tretiak, R., Shkvar, M., 2011, Guidelines for environmental stability assessment of agricultural landscapes and agricultural land use, Kyiv, 15 p.
[11]Voitovych, N., 2015, Ecological aspects of valuation of arable lands, Scientific Bulletin of Stepan Gzhytskyi National University of Veterinary Medicine and Biotechnologies, 3 (63): 377-380.