

## Conference Paper

# Assessment of the Use of the Potential of Agricultural Lands in Voronezh Region

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## Abstract

The uniqueness and specifics of the land significantly affects both the organization of agricultural production and the rural area management. In order to make well-founded management decisions the economic subjects and public authorities need scientific grounding for assessment of land potential and its use efficiency. The authors suggest using three approaches to land quality and use assessment: agro-climatic potential, land quality score and agricultural production per hectare. Uniting these approaches into single assessment procedure produces a fairly objectively estimation of the economic potential of agricultural land in each selected territory.

**Keywords:** agricultural land, land potential, assessment, land quality score, cadaster cost

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## 1. Introduction

The uniqueness and specifics of the land as the key means of production significantly affects the economy and the organization of agricultural production. Land resources used in agriculture are very heterogeneous. Here we are talking about a special category of land -- land of agricultural designation. In this case, the basis of the land of agricultural designation is agricultural land -- productive land that provides for the production of agricultural products.

Within the system of agricultural production, the role and significance of land are usually considered from several positions. From a physical point of view, the land is a spatial core that serves as the basis for an individual's residence and economic activities. In the social aspect it appears as a subject of specific social relations, reflecting the relations of ownership, use and disposal. Traditionally, from the legal point of view, land is considered as an object of property. For considering land as an economic resource, an assessment of its real and potential possibilities in creating national wealth is required.

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Taking into account the peculiarities of the land as the key natural and economic resource, it should be noted that in order to realize its productive potential, the land must be involved in the production process, which will be organized within a specific site, characterized by a specific location, natural fertility, climatic conditions, relief and landscape features, burdens, etc.

## 2. Interpretation of the Term 'Land Potential'

In relation to the economy, the term "potential" means the possibilities, sources, means and reserves that can be used to achieve the priorities and goals of social and economic development [1].

Nowadays, there is no consensus on what constitutes the 'land potential' category. The variety of approaches to understanding the essence of land potential allows considering it a multidimensional concept, the content of which is revealed in the whole complex of its manifestations. Let us consider several modern approaches to the definition of this concept (Table 1).

The analysis of the presented approaches to the understanding and assessment of land potential allows considering it from two points of view. The land, like any other resource, has a certain potential, which, on the one hand, characterizes its consumer properties, and on the other hand, is the basis for assessing the effectiveness of its use in determining the level of realization of this potential.

The qualitative and quantitative characteristics of the structural elements of the land potential will make it possible to assess the level of the economic development, detect imbalances between the individual potential elements, and highlight the priority directions of state policy in land management. A competent approach to land management issues involves the study of the economic potential of land, the improvement and rational use of which should not be the final purpose of regional policy, but a means of ensuring an effective reproduction process as a whole.

Modern land transformations in agricultural production have serious drawbacks -- their implementation does not take into account the economic potential of the land. Economic evaluation of farmlands is carried out in order to identify their production capacity and determine the most efficient use in agricultural production. An important factor in the development of agricultural areas, as well as enterprises, is their provision with economic potential, an element of which, given the peculiarities of agricultural production, is land potential. The economic assessment of land potential allows objective analysis of the use of agricultural land, definition of their production capabilities,

TABLE 1: Modern Approaches to the Definition of the 'Land Potential' Category.

Author	Definition
Lysanova G.I., Sorokova A.A. [2, p. 153]	<b>Land potential</b> is the possible results of social and economic development, which are ensured by involvement of an aggregate of various lands into economic circulation, accounted for and listed in the Land register.
Parmakli D.M. [3, p. 14]	<b>Land potential</b> can be viewed as the estimated maximum possible productivity of the key means of production in agriculture on the basis of a tested set of scientific and technological achievements in the real-world weather and climate conditions of a region, area, or enterprise.
Gurnovich K.G. [4, p. 9]	<b>Land potential</b> of a region should be understood as the maximum possible results of its social and economic development, provided by a set of lands of different categories taken into account and reflected by the land register, involved in the current and future socio-economic turnover in order to improve the standard of living of the current and future generations.
Bezrukikh V.A. [1, p.76]	On the one hand, <b>land potential</b> is a combination of natural resources and conditions, the involvement of which within a given territory in agricultural use is necessary and possible, on the other hand, it is potential productivity or ability to reproduce of the soils and other components of the natural environment involved in the formation of a biologically productive mass.
Duduglo T.V. [5, p. 139]	The <b>land potential</b> of a region is not only the achieved economic and social level, but also those reserves that are located on a particular territory. In order to identify the existing reserves, it is necessary to study the land potential, the strengthening and rational use of which is a means to ensure the effective functioning of the reproductive process as a whole.

predicting changes in the economic fertility of the soil, taking into account additional investments.

Thus, the economic potential of land resources is the most important factor of agricultural production and is considered here chiefly in this capacity. The level of assessment of the potential of agricultural land resources should be determined depending on the scale of the research object, as well as the target criteria for the development of economic entities. Therefore, we propose to distinguish between two levels of determining the economic potential of land resources in agriculture: the level of economic entities and the level of territories (rural settlement, municipal district, region).

### 3. Economic Assessment of the Agricultural Land Potential

The economic assessment of the potential of productive land at the level of business entities is expressed in terms of the actual amount of money that the business can receive in the process of operating the land or leasing it. In this case, the potential

is a combination of existing land resources and those that can be mobilized, used or available for the production of economic benefits.

At the same time, the assessment of the potential of land resources should be carried out on the basis of the inner essence of various forms of economic activity:

- for structures of an entrepreneurial type -- through obtaining the maximum possible amount of profit;

- for households -- through the volume of food produced for personal consumption or sale, in case of surplus;

- for cooperatives and peasant (farmer) households that do not use hired labour, -- through the volume of gross income [6].

At the level of territories (in the scale of rural areas, regions, municipalities) agricultural land is considered as a source of formation of budgets of the appropriate level, as well as a resource ensuring the production of agricultural products. In this case, the economic assessment of land potential is expressed in the value of gross crop production, which can be obtained from a limited land area in case of timely involvement in the economic turnover of all productive lands within its borders.

To assess the potential of land resources in agriculture, it is necessary to systematically collect and analyse information on the quantitative and agrochemical state of lands. It is necessary to take into account the nature of changes in these indicators as a result of human activities, to develop scientifically-based recommendations to prevent the deterioration of land quality and targeted improvement of its condition. This will ensure significant increase in both potential fertility, and the level of economic productivity of agricultural land.

A comprehensive analysis of the potential of agricultural land provides for the determination of objective fertility indicators and indicators that characterize the efficiency of land use at a given level of intensity of agriculture. To assess the land potential of municipalities of the Voronezh Region, we will use the approach based on the methodology for constructing three particular indicators that determine the natural resource potential of a district. This group of indicators includes:

- 1) Land quality score is an integral indicator of fertility; according to the land quality classification, the best lands for fertility are located within the Western forest-steppe region of the region (the Bobrov region in this case is an exception); optimal -- within the Eastern forest-steppe region, the worst -- within the Northern and Southern steppe regions.

2) Agro-climatic potential, taking into account the area of effective cultivation of a number of crops; this indicator is calculated taking into account the zoning of the region according to the method of I.I. Karmanov [5];

3) The cadastral value is determined as a result of the state cadastral valuation of land, taking into account its classification for the intended purpose

The integral indicator for assessing the potential of agricultural land by districts is calculated as the average of the standard values of the indicators of cadastral value, quality and agro-climatic potential of the area [7]:

$$\bar{x}_i = \frac{\sum_{j=1}^n \hat{x}_{ij}}{n} \cdot 100, \quad (1)$$

where  $\hat{x}_{ij}$  statutory value of the j-th indicator for the i-th district;

n -- number of indicators taken into consideration.

The statutory values of the indicators are calculated using the following formula [7]:

$$\hat{x}_{ij} = \frac{x_{ij} - x_j^{\min}}{x_j^{\max} - x_j^{\min}}, \quad (2)$$

where  $x_{ij}$  the value of the j-th indicator for the i-th district;

$x_j^{\min}$  the minimum value of the j-th indicator;

$x_j^{\max}$  the maximum value of the j-th indicator.

When calculating the normative values of the agro-climatic potential, the values of 10 and 0, respectively, are used as the maximum and minimum. The obtained results of the assessment of the potential of agricultural land in the natural-economic zones of the districts of the Voronezh region are shown in Table 2.

We can see from the analysed data of Table 2, that Panino district possesses the maximum potential. This situation is quite an objective result of the favourable economic and geographical position of the municipality. The presence of favourable agro-climatic resources predetermined the agrarian trend in the development of that district's economy. At the same time, Olkhovatsky district has the lowest potential due to the reasons directly opposite to the characteristics of Paninsky district.

The average cost of agricultural products produced per hectare of agricultural land in 2015, estimated in comparable prices of 2012, should be used as the base for calculating the efficiency indicators and the level of utilization of the potential of agricultural land in the Voronezh region. The results of the ranking of areas according to the efficiency of agricultural land use and the average for the Voronezh region are shown in Table 3.

Voronezh Region are extremely heterogeneous in terms of their economic potential. The ranking of municipalities in terms of the efficiency of the agricultural land use

TABLE 2: Assessment of the Potential of Agricultural Lands for the Districts of Voronezh Region on the Basis of Land Quality Score, Cadastral Value of Land and Agro-Climatic Potential, 2015.

Position	District	Land quality score	Cadaster cost of 1 hectare of the agricultural land, ths. rubles	Agro-climatic potential	Integral assessment	Position	District	Land quality score	Cadaster cost of 1 hectare of the agricultural land, ths. rubles	Agro-climatic potential	Integral assessment
1	Panino	89.8	81.22	7.3	90.72	17	Kalach	73.2	49.81	6.7	53.62
2	Verkhnyaya Khava	85.8	81.68	7.3	87.05	18	Povorino	71.1	51.65	6.7	52.76
3	Ertil	84.4	78.94	7.3	84.03	19	Liski	69.2	46.42	7.3	49.47
4	Kashirskiy	79.1	76.92	7.3	77.61	20	Borisoglebsk	68.3	43.32	7.1	46.27
5	Anna	81.0	72.55	7.3	76.87	21	Novokhopersk	67.2	46.33	6.7	45.45
6	Semiluki	81.0	68.72	7.5	75.14	22	Kamenka	68.7	40.44	7.1	44.95
7	Talovaya	81.6	64.08	7.3	72.42	23	Bobrov	56.7	57.71	7.3	44.07
8	Novaya Usman	79.2	64.92	7.3	70.35	24	Pavlovsk	67.2	39.94	7.1	43.07
9	Ternovka	79.3	62.22	7.1	68.07	25	Ostrogzhsk	66.1	38.61	7.3	41.86
10	Nizhnedevitsk	76.8	60.31	7.5	66.11	26	Petropavlovka	65.4	38.31	6.7	39.01
11	Khokhol	77.2	61.08	7.3	66.11	27	Kantemirovka	64.9	36.51	6.7	37.42
12	Buturlinovka	77.2	56.04	7.1	62.45	28	Boguchar	68.8	25.73	6.7	34.85
13	Vorobievka	77.3	54.42	7.1	61.77	29	Verkhniy Mamon	62.2	34.17	7.1	34.72
14	Gribanovskiy	76.3	55.05	7.1	60.95	30	Rossosh	61.4	32.41	7.1	32.87
15	Repievka	73.6	52.88	7.3	57.58	31	Podgorenskiy	61.0	31.71	7.1	32.05
16	Ramon	71.1	51.58	7.5	55.48	32	Olkhovatka	56.1	27.63	7.1	24.81

Source: author's calculations based on the official data from the Federal service for public registration, cadaster and mapping [7]

allows us to classify 12 of 32 districts into a group exceeding the average regional level of agricultural production per point-hectare of agricultural land potential. It should also be noted that high potential is not always an indicator of significant results. For example, Panino district, having the highest rates of land quality, cadastral value and integrated assessment, produces only 313 rubles of agricultural products per 1 point-hectare of the agricultural land potential, 316 rubles per 1 point-hectare of the land quality, and 349 rubles per 1000 rubles of the cadaster cost of 1 hectare of agricultural land.

From the analysis of the data presented in Table 3, it can be seen that the municipalities of the

The assessment of the use of the agricultural land potential can be made by comparing the ranking of areas by the level of potential assessment and the amount of agricultural production per 1 hectare of land resources. The resultant attribute in this study is the average cost of agricultural products for 2015, in comparable prices of 2012, produced within a certain area per 1 hectare of agricultural land (Fig. 1).

A positive interdependence between performance and potential indicators should be noted: trend lines of cadastral value and land quality decrease as the trend of performance decreases, but trends in agricultural production per 1 hectare and cadastral value are almost parallel. According to the deviation of the line of the actual series from the trend line, it can be concluded, what is the efficiency of the agricultural land potential use of a particular region is used.

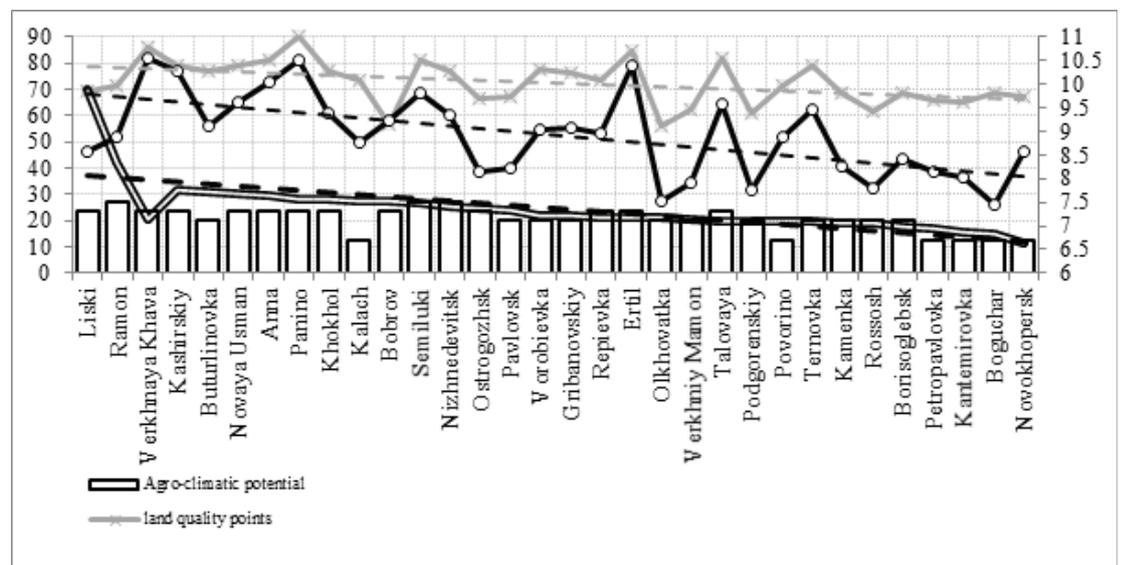


Figure 1: Indicators of the agricultural land potential and the results of its use in Voronezh region in 2015 (agro-climatic potential is shown on the right axis).

TABLE 3: Rating of the Districts of Voronezh Region in Terms of Agricultural Land Use Efficiency.

Position	District	Agricultural production in average, in comparable prices of 2012 (ths. rubles per/hectare)	The integral assessment of the agricultural land potential (points)	Agricultural production, rubles per hectare calculated per:		
				1 point of the integral assessment	1 point of land quality	1 ths. rubles of cadaster cost
1	Liski	70.15	49.47	1418	1015	1511
2	Olkhovatka	21.09	24.81	850	376	763
3	Ramon	42.29	55.48	762	592	820
4	Bobrov	27.28	44.07	619	480	473
5	Podgorenskiy	19.75	32.05	616	324	623
6	Verkhniy Mamon	20.62	34.72	594	332	603
7	Ostrogozhsk	24.44	41.86	584	370	633
8	Rossosh	19.08	32.87	580	311	589
9	Pavlovsk	23.91	43.07	555	356	599
10	Kalach	27.38	53.62	511	374	550
11	Buturlinovka	30.87	62.45	494	400	550
12	Verkhnyaya Khava	40.83	87.05	469	475	500
13	Petropavlovka	16.94	39.01	434	259	442
14	Boguchar	15.11	34.85	433	220	587
15	Kamenka	19.10	44.95	425	278	472
16	Novaya Usman	29.86	70.35	424	377	460
17	Khokhol	28.03	66.11	424	364	459
18	Kantemirovka	15.80	37.42	422	243	433
19	Kashirskiy	31.88	77.61	411	403	415
20	Anna	29.49	76.87	384	364	406
21	Nizhnedevitsk	25.32	66.11	383	329	420
22	Borisoglebsk	17.62	46,27	381	258	407
23	Povorino	19.60	52,76	371	275	379
24	Repievka	21.18	57,58	368	288	400
25	Gribanovskiy	21.58	60,95	354	283	392
26	Semiluki	26.59	75,14	354	328	387
27	Vorobievka	21.80	61,77	353	282	401
28	Panino	28.37	90,72	313	316	349
29	Ternovka	19.59	68,07	288	248	315
30	Talovaya	19.80	72,42	273	242	309
31	Novokhopersk	11.71	45,45	258	175	253
32	Ertil	21.10	84,03	251	250	267
Average among districts		24.67	55.93	471	349	479

Source: author's calculations based on the official data from the Federal service for public registration, cadaster and mapping [7]

In general the highest values of the agricultural land potential use are typical for Liski, Ramon, Ostrogozhsk, Buturlinovka, Pavlovsk, Verkhniy Mamon, Olkhovatka, Podgorenskiy, Rossosh, and Boguchar districts. Nevertheless, in some districts of Voronezh region the indicator of the agricultural land potential use in agriculture is rather low (Anna, Verkhnyaya Khava, Panino, Semiluki, Erti, Nizhnedevitsk, Ternovka, and Talovaya districts).

The results of the assessment of the level of the agricultural land potential use in Voronezh region, calculated as the ratio of the actual level of agricultural production per point-hectare to its possible value, are presented in Table 4.

The results of the assessment of the level of the agricultural land potential use in Voronezh region, calculated as the ratio of the actual level of agricultural production per point-hectare to its possible value, are presented in Table 4.

The obtained results of the calculations grouped the areas differently than in the assessment of agro-climatic parameters (Table 2). The Liski district, which has the highest concentration of livestock, received high position. The municipalities where the level of potential use is higher than the average for the region include the 12 districts stated above. There are 19 districts in the region with the potential use level between 50 and 95.8 %. The worst ones in this respect are Novokhopersk, Erti, Boguchar, and Talovaya districts.

In our opinion, the presented approach makes it possible to fairly objectively assess the economic potential of agricultural land in each district, its use and the effectiveness of land management activities, the creation of conditions for further economic development on the part of the authorities and local government.

## 4. Results

According to the research, it should be noted that the methodological apparatus for assessing the potential of agricultural land is not studied enough and needs scientific research of theoretical and practical provisions. We propose to begin the study of the problem of assessing the potential of agricultural land with the consideration and analysis of a specific system of indicators. In particular, as part of this system, along with agro-climatic indicators, it is necessary to single out the resulting and cost indicators describing the level of the land potential use, as well as those influencing the formation of priority directions of state policy in land management.

At the same time, the absolute values of the considered indicators for municipalities and territories will allow assessing the current use of land resources. The specific

TABLE 4: Assessment of the Level of the Agricultural Land Potential Use in the Districts of Voronezh Region, 2015.

Position	District	Agricultural production per 1 point-hectare		Potential use level, %	Position	District	Agricultural production per 1 point-hectare		Potential use level, %
		possible	actual				possible	actual	
1	Liski	24.0	70.1	292.1	17	Semiluki	28.5	26.6	93.3
2	Ramon	25.1	42.3	168.5	18	Panino	31.3	28.4	90.8
3	Verkhnyaya Khava	30.6	40.8	133.3	19	Rossosh	21.1	19.1	90.5
4	Bobrov	23.1	27.3	118.2	20	Vorobievka	26.2	21.8	83.2
5	Buturlinovka	26.3	30.9	117.4	21	Repievka	25.5	21.2	83.1
6	Kalach	24.7	27.4	110.9	22	Gribanovskiy	26.2	21.6	82.4
7	Kashirskiy	29.2	31.9	109.2	23	Kamenka	23.4	19.1	81.6
8	Novaya Usman	27.7	29.9	107.9	24	Povorino	24.7	19.6	79.3
9	Ostrogzhsk	22.7	24.4	107.5	25	Petropavlovka	22.3	16.9	75.8
10	Olkhovatka	19.7	21.1	107.1	26	Borisoglebsk	23.5	17.6	74.9
11	Pavlovsk	23.0	23.9	103.9	27	Kantemirovka	22.0	15.8	71.8
12	Khokhol	27.0	28.0	103.7	28	Ternovka	27.3	19.6	71.5
13	Anna	28.8	29.5	102.4	29	Talovaya	28.1	19.8	70.4
14	Verkhniy Mamon	21.5	20.6	95.8	30	Boguchar	21.5	15.1	70.2
15	Podgorenskiy	21.2	19.7	92.9	31	Ertil	30.2	21.1	69.9
16	Nizhnedevitsk	27.0	25.3	93.7	32	Novokhopersk	23.4	11.7	50.0

Source: author's calculations based on the research data

indicators calculated as the ratio of the actual level of agricultural production to its possible value will characterize the potential for improving the use of land acreage of the region and its districts. In our opinion, the application of these indicators will make it possible to assess the state of the land potential of a particular district, as well as the expected impact of various factors on this potential, including differences in natural conditions and the level of development of productive forces in agriculture.

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