UDC 330.3:631.1

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MANAGEMENT OF REPRODUCTION OF AGRICULTURAL NATURAL RESOURCES IN THE CONTEXT OF MODELING

УПРАВЛІННЯ ВІДТВОРЕННЯМ АГРАРНИХ ПРИРОДНИХ РЕСУРСІВ В КОНТЕКСТІ МОДЕЛЮВАННЯ

The problem of underestimating the importance of macroregulation in the conditions of transition to the market or the market itself, as a rule, leads to negative environmental and economic consequences. The indicator of the integrated ecological condition as an integral part of the methodology for calculating the efficiency of reproduction of the resource potential of the food complex will have influence on the effective indicators of the use and reproduction of environmental resources. Consideration of issues of researching the efficiency of use and reproduction of the resource potential will be more justified in the case of defining effective indicators, mentioned functions and factors that have a significant influence on them, that are called arguments. In the process of our research, indicators for the main agricultural crops, which are grown in Ukraine, such as cereals and legumes, sugar beets, sunflowers and gross production in the crop and livestock sectors, were defined as effective ones.

Key words: *reproduction, natural, resources, agricultural, modeling, analysis, effectiveness*.

Світовий досвід показує провідну роль в здійсненні альтернативних варіантів вирішення екологічних проблем, структурної перебудови продовольчого потенціалу в умовах ринку належить державі. Недооцінка значення макрорегулювання в умовах переходу до ринку або власне ринку, як правило, призводить до негативних еколого-економічних наслідків. Проблема вибору виникає в умовах обмеженості природних ресурсів традиційного споживчого розвитку суспільства, яке нарощує теми використання обмежених ресурсів навколишнього середовища, або перейти на принципи збалансованого гармонійного розвитку за прикладом розвинених країн. Системний підхід в цьому випадку означає збалансованість економічної вигоди та екологічної безпеки, взаємоузгодження екологічної політики підприємства і

державної екологічної політики, і він виступає в такому понятті визначення системно-екологічного підходу в аграрному секторі Показник інтегрованого екологічного стану як складова частина методики розрахунку ефективності відтворення ресурсного потенціалу продовольчого комплексу буде впливати на результативні показники використання і відтворення ресурсів навколишнього середовища. Розгляд питань дослідження ефективності використання і відтворення ресурсного потенціалу буде більш обґрунтованим в разі визначення результативних показників, які називаються функцій і чинників, які надають на них істотний вплив, звані аргументами. Дослідити визначення залежності результативних показників від чинників можна за допомогою аналізу. В цілому проведення кореляційно-регресійного аналізу передбачає визначення з переліком аргументів, визначення значущості їх впливу на результативний показник, на що слід визначити, які аргументи залишаємо, а які вилучаємо з процесу дослідження. Розгляд питань дослідження ефективності використання і відтворення ресурсного потенціалу буде більш обґрунтованим в разі визначення результативних показників, які називаються функцій і чинників, які надають на них істотний вплив, звані аргументами. В процесі проведення нашого дослідження результативними визначені показники врожайності основних сільськогосподарських культур, що вирощуються в Україні - це зернові та зернобобові, цукрові буряки, соняшник і виробництво валової продукції в галузях рослинництва і тваринництва.

Ключові слова: *відтворення, природні, ресурси, аграрні, моделювання, аналіз, ефективність.*

JEL Classification: *L16; L66; O13; Q24*

Formulation of the problem. The problem of reproduction, especially expanded reproduction, in the global economy is on the special place. The population of the planet is growing in quantitative terms and at the same time, the demand for and in qualitative terms is increasing. This is especially true for food, because all people want to eat organic food in sufficient quantities. And there are not enough resources for everyone and many scientists write about this, starting from the 70s of the last century. But a partial way out can be found in provision the expanded reproduction of agricultural natural resources for food purposes.

The initial prerequisites and components of the process of improving environmental management in the sectors of the national food complex is the formation of an appropriate effective mechanism. As world experience shows, the state plays the leading role in the implementation of alternative solutions to environmental problems, the restructuring of food potential in the market. Underestimating the importance of macroregulation in the conditions of transition to the market or the market itself, as a rule, leads to negative environmental and economic consequences.

The problem of choice arises in conditions of limited natural resources of the traditional consumer development of society, which raises the topic of using limited environmental resources, or switch to the principles of balanced harmonious development following the example of developed countries. But with the traditional approach, economic activity runs counter to natural reproduction: some destroy it, justifying it with the need to meet human needs, while others talk about the restoration of environmental resources, which defines the relevance of the research.

Brief literature review. A famous scientist in the field of environmental economics L.G. Melnik [5] formulated the principles for defining greening tasks as follows: an integrated approach, which makes it necessary to take into account the integral effect of action along the entire chain of the production and consumption cycle of products; focus on the causes, providing for the elimination of causes, rather than combating the consequences; separation of responsibilities provides for the establishment of targeting and the degree of responsibility of subjects and objects of eco-destructive activity; the adequacy of the tools provides for the formation of motivational tools corresponding to these circumstances; a systematic approach that provides for the influence on all objects and subjects of greening, which directly or indirectly can help to achieve the goals of greening; maximization of food efficiency, which provides for the achievement of specific greening goals with minimal losses and maximizing the return on funds, that involved in production.

The fundamental basics of the organizational and economic mechanism of the reproduction of agrarian environmental resources in the production process, including food production, developed in the scientific researches of V.G. Andriychuk [1], O.G. Beloruch [2], P.P. Borschevsky [3], V.Y. Vasebi [8], N.V. Vikhr [1], B.M. Danylyshyn [3, 4], S.I. Doroguntsova [4], O.V. Kovalova [7], L.G. Melnik [5], S.O. Lizun [8], Y.P. Odum [6], V. P. Rudenko [8], V.M. Ruchan [7], O.V. Sobkevich [7], A.D. Yurchenko [7], M.A. Khvesik [8], E.V. Khodakivska [9], E.V. Shubravska [10].

Purpose of the article is identification of actual problems of the reproduction of agricultural natural resources with the help of modeling, in particular, the effectiveness of the use and reproduction of the resource potential in the process of conducting the research. It can be used the correlation and regression analysis to investigate the definition of the dependence of productive indicators on factor indicators.

Research findings. The systematic approach in this case means the balance of economic benefits and environmental safety, the mutual coherence of the environmental policy of the enterprise and the state environmental policy, and it appears in this concept of defining a systematic environmental approach in the agricultural sector.

There are alternative methodological approaches for defining the assessment and payment for environmental management, which are not always converted in absolute terms, sources of natural-reproduction costs, reserves for the reproduction of natural resource potential. So, agricultural natural resources for food purposes should be divided into the following groups: resources, which are purchased from other legal entities and individuals; which are taken directly from the environment; property of the producer. Purchased resources of natural origin are valued at the price of the producing enterprise, which extracts and produces primary processing.

According to opinion of such famous scientists as P.P. Borschevsky [3], B.M. Danilishin [3, 4], S.I. Doroguntsov [4], L.G. Melnik [5], with who we absolutely agree, there is a certain interrelation between the functions of natural resources and the economic mechanism of nature management (Fig. 1).

The above-mentioned group includes the overwhelming share of raw materials, energy and other material resources that have passed the stage of withdrawal from nature. Agricultural natural resources withdrawn from the environment, in fact, by the producer, are estimated by the cost of compensation for its production. So, agricultural natural resources in essence and content are nothing more than natural objects that are used in the production of food and food raw materials in order to satisfy the material, cultural and spiritual needs of human life.

The harmonious balanced development of the food complex should provide the adaptive use of natural resources subject to a rational combination, that is, finding an optimum between the effective introduction of the free market and state regulation of food production (Table 1).

At the same time, agricultural nature management takes into account the level of anthropogenic load, in particular, agricultural development of land; recreational and demographic potential of agricultural land; market conditions for food production; the influence of adaptive agricultural production on self-reproduction and self-healing of environmental resources; forecast of the level of anthropogenic load on the self-reproduction capacity of the agroecosystem.

So, in the above-mentioned Table 1, a forecast of indicators for the period up to 2025 is made, of which the indicator of the integrated ecological condition of land is structurally composed. Further, based on the use of these normative values of indicators of ecological stability of the territory, the dynamics of water intake per capita (m^3), population density (people/km^2), pesticidal and chemical loads (mineral fertilizers) per unit of agricultural land, actual values in natural units we transform to the corresponding correction coefficient.

Next, we calculate the forecast indicator of the integrated environmental status for the relevant years:

$$CC = CS * Cw * Ip * PL * CL, \quad (1)$$

where CS – coefficient of ecological stability of land; Cw – coefficient of water intake from the natural objects per capita for a one year, m³; Ip – index of population density (people/km²); PL – pesticidal load, kg/ha per year; CL – chemical load, kg/ha per year.

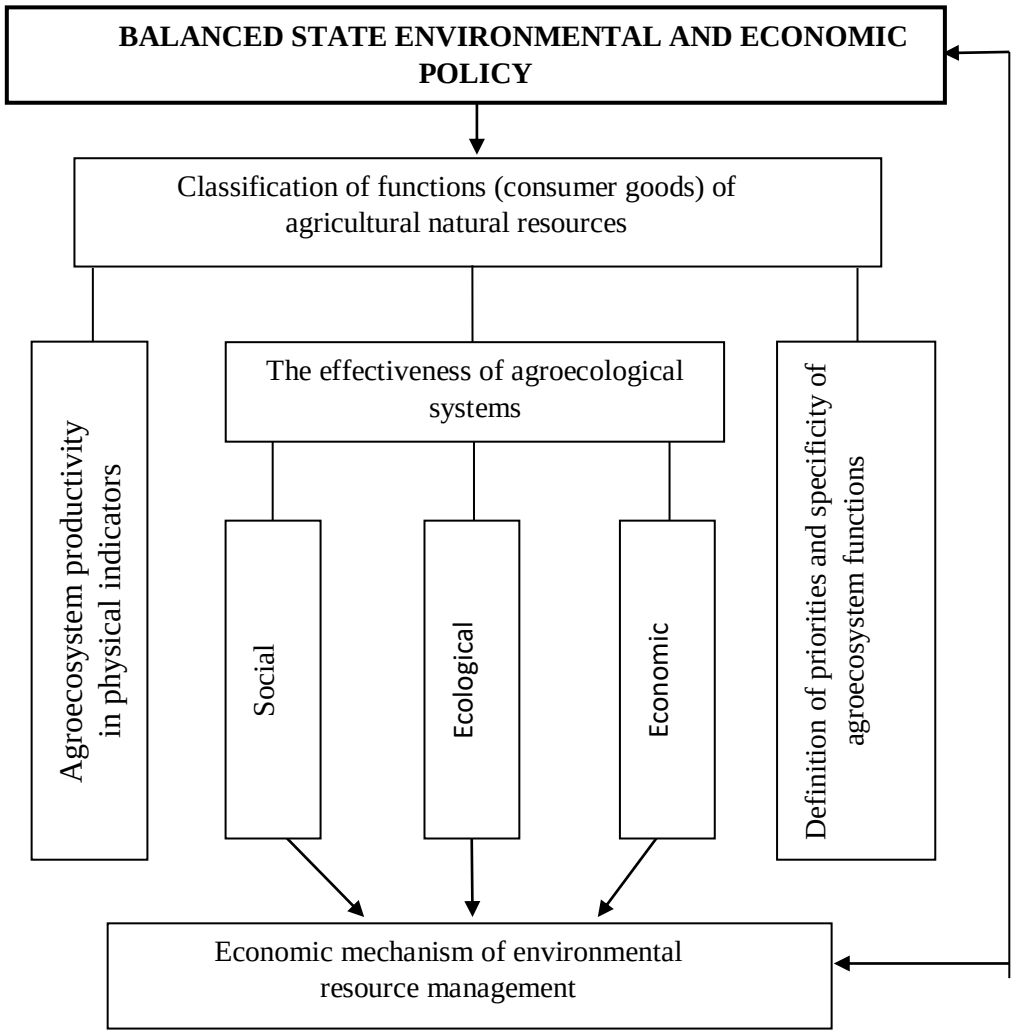

Fig. 1. The structural place of functions of environmental resources in the economic mechanism of environmental resource management

That is to say, the indicators of the integrated ecological condition for 2025 are inherently calculated, but they are based on the forecast composite indicators, which are given in the above-mentioned formula. So, the indicator of integrated ecological condition as an integral part of the methodology for calculating the efficiency of reproduction of the resource potential of the food complex will have influence on the effective indicators of the use and reproduction of environmental resources. Consideration of issues of researching the efficiency of use and reproduction of the resource potential will be more justified in the case of defining effective indicators, mentioned functions and factors that have a significant influence on them, that are called arguments.

In the process of our research, indicators for the main agricultural crops, which are grown in Ukraine, such as cereals and legumes, sugar beets, sunflowers and gross production in the crop and livestock sectors, were defined as effective ones.

Table 1.

Forecast of the integral indicator of the ecological condition of the land of Ukraine for 2025

Indicators Economic areas Region	Forecast indicators			Estimated indicator		
	coefficient of ecological stability of land	water intake per capita, m^3	population density, people/ km^2	pesticidal load, kg /ha for a year	chemical load application of mineral fertilizers, kg/ha)	coefficient of integrated ecological condition of land
1	2	3	4	5	6	7
Ukraine	0,61	193,8	71,4	2,0	60,2	0,49
Donetsk	0,50	215,9	121,4	1,6	51,3	0,41
Donetsk	0,47	250,3	160,4	1,7	60,2	0,38
Lugansk	0,54	145,4	82,5	1,3	40,6	0,39
Carpathian	0,79	72,2	100,0	1,5	95,8	0.71
Transcarpathian	0,94	39,5	90,0	1,4	104,0	0,85
Ivano-Frankivsk	0,91	73,6	92,7	1,4	84,2	0,91
Lviv	0,81	85,2	109,4	1,2	117,0	0,73
Chernivtsi	0,55	77,2	103,9	2,2	57,2	0,50
Dnieper	0,47	380,0	70,0	1,9	43,2	0,38
Dnipropetrovsk	0,48	391,2	99,2	2,2	51,1	0,35
Zaporizhzhya	0,47	540,1	63,0	1,7	33,1	0,33
Kirovograd	0,47	54,7	39,9	1,8	43,6	0,47
Black Sea	0,49	190,6	57,9	2,2	38,9	0,44
Autonomous Republic of Crimea	0,58	202,8	70,5	2,4	49,6	0,52
Mykolayiv	0,47	195,6	45,4	1,5	33,1	0,42
Odessa	0,53	191,1	66,8	2,4	40,6	0,48
Kherson	0,50	224,3	36,6	2,4	37,6	0,45
Podilsky	0,61	70,6	63,2	2,4	163,0	0,61
Vinnytsia	0,56	71,8	59,4	2,6	85,7	0,56
Ternopil	0,62	59.2	74,2	2,3	143,0	0,62
Khmelnitsky	0,59	77,2	61,2	1,7	78,2	0,59
Polissya	0,62	105,2	42,4	1,4	84,4	0,62
Volyn	0,59	73,6	48,2	1,4	113,0	0,59
Zhytomyr	0,63	102,3	40,8	1,0	70,7	0,63
Rivne	0,69	130,1	52,9	1,8	119,0	0,69
Chernihiv	0,49	111,3	33,4	1,2	73,7	0,49
East	0,43	127,7	61,4	2,2	50,4	0,43
Poltava	0,43	182,1	49,2	3,1	58,7	0,39
Sumy	0,42	96,0	47,3	1,8	49,6	0,42
Kharkiv	0,39	110,4	83,5	2,0	43,6	0,39
Central	0,46	176,8	107,9	2,3	94,6	0,37
Kyiv	0,49	450,4	57,5	2,1	97,8	0,39
Cherkasy	0,42	175,0	59,4	3,4	91,8	0,38

To investigate the determination of the dependence of productive indicators on factor indicators, it can be used correlation and regression analysis. In general, conducting such an analysis involves defining with a list of arguments, defining the significance of its influence on the effective indicator, which should be defined which arguments are left and which are removed from the research process. According to the classical provisions of the economy, attention is focused on the fact that the study of any production process is associated with the determination of the dependence and regularity of the use of production factors so as labor, land and capital. According to this, in the research of the dependence of the productivity of the main agricultural crops on the initial arguments in its correlation with the main production factors, we have chosen: by the labor factor is the number of workers; by the land factor is the area of arable land in thousand ha and the loss of humus from erosion t/ha area. Since the general division of capital is divided into 2 groups – the main and working capital, the cost of the main assets per 100 hectares of arable land is defined by the main capital arguments the number of combine harvesters per 1000 hectares of cultivated area by grain crops, and the volume of pesticidal and chemical loads by working capital. From the point of view of our research, it is important to study the influence of the environmental condition on the solution of production issues. In the research, a general indicator characterizing the ecological condition is an integral indicator of the ecological condition.

The depention of productivity on the selected arguments is characterized by a multiple regression coefficient of – 98.1%, R-square – 96.3%. The data selected for analysis are reliable, as evidenced by the larger value of the Fisher coefficient over the table. The significance of all the arguments is confirmed by the large value of the Student coefficients of individual factors over its tabular values and the absence of the phenomenon of multicollinearity.

The dependence of the influence of the arguments on the yield of grain and leguminous crops (U1) is characterized by the following equation:

$$U1 = 26,78 + 0,01\ X1 - 0,3\ X2 + 0,0042\ X3 + 0,05\ X4 + 0,07\ X5 + + 0,019\ X6 + 0,27\ X7, \quad (2)$$

where X1 – quantity of employees; X2 – area of arable land, thousand ha; X3 – losses of humus from erosion of t/ha of sown area; X4 – the cost of the main assets per 100 hectares of arable land, mln. UAH; X5 – the number of combine harvesters per 1000 ha of sown area; X6 – pesticidal load, kg per ha per year; X7 – chemical load, kg per ha per year.

The dependence of yield from the selected arguments is characterized by a multiple regression coefficient – 98.1%, R-square – 96.3%. A meaningful interpretation of the regression equation means that productivity growth involves the use of ways to intensify production – this also increases its capital supply and chemical and pesticidal loads. The increase in yield for the future will not be associated with an increase in the labor force involved, while it will to some extent occur against the background of a decrease in the number of cultivated areas, which also confirms the direction of intensification. The flip side of the increase in intensification of production of grain and leguminous crops is the increase in soil loss from erosion.

The dependence of the influence of the arguments on the yield of sugar beet (U2) is characterized by the following equation:

$$U2 = 103,1 + 0,03X1 - 0,27X2 + 0,0079X3 + 0,073X4 + 0,032X5 + 0,41X6, \quad (3)$$

where X1 – quantity of employees; X2 – area of arable land, thousand ha; X3 – losses of humus from erosion of t/ha of sown area; X4 – the cost of the main assets per 100 hectares of arable land, mln. UAH; X5 – pesticidal load, kg per ha per year; X6 – chemical load, kg per ha per year.

The depention of sugar beet productivity on the selected arguments is characterized by a multiple regression coefficient – 98.6%, R-square – 97.2%. The data selected for analysis are reliable,

which is confirmed by the excess of the actual values of the Fisher and Student coefficients over the table ones. The dependence of the influence of the arguments on the yield of sunflower (U3) is characterized by the following equation:

$$U3=12,2+0,007X1-0,24X2+0,0035X3+0,037X4+0,009X5+0,19X6, \quad (4)$$

where X1 – quantity of employees; X2 – area of arable land, thousand ha; X3 – losses of humus from erosion of t/ha of sown area; X4 – the cost of the main assets per 100 hectares of arable land, mln. UAH; X5 – pesticidal load, kg per ha per year; X6 – chemical load, kg per ha per year.

The depention of sunflower yield on the selected arguments is characterized by a multiple regression coefficient – 99.4%, R-square – 98.9%. The data selected for analysis are reliable, which is confirmed by the excess of the actual values of the Fisher and Student coefficients over the table ones.

At the preliminary stage of correlation and regression calculations, such argument as "integral indicator of the ecological state" had to be removed from the analysis. The paired correlation coefficient of its influence on the yield of grain and leguminous crops was 4,9 percent, for sugar beets is 6,1, for sunflower is 5,8, but the actual value of Student coefficients was less than the table, which indicated the need for their removal. But even from such calculated data, it can be concluded that the yield growth of the main agricultural crops is insignificantly dependent on the environmental condition. However, since the ecological condition is crucial for humans, the need to develop problems of the ecological balance of agricultural production and increase its environmental stability is very important.

Conclusions. Consideration of issues of researching the efficiency of use and reproduction of the resource potential will be more justified in the case of defining effective indicators, mentioned functions and factors that have a significant influence on them, that are called arguments. In the process of our research, indicators for the main agricultural crops, which are grown in Ukraine, such as cereals and legumes, sugar beets, sunflowers and gross production in the crop and livestock sectors, were defined as effective ones. Correlation and regression analysis can be used to investigate the determination of the dependence of productive indicators on factor indicators. In general, conducting such an analysis involves defining the list of arguments, defining the significance of its influence on the effective indicator, as a result of which it is necessary to define, which arguments are left and which are removed from the research process.

References

1. Andriychuk V.G. (1990) *Povyshenie effektivnosti agropromyshlennogo proizvodstva: monografiya* [Improving the efficiency of agricultural production: monograph] / Andriychuk V.G., Vikhr N.V. - K .: Harvest, 1990- 217 p.

2. Belarus O.G. (2003) *Ekonomicheskaya sistema globalizma: monografiya* [The economic system of globalism: monograph] / Belorus O.G. - K .: KNEU, 2003 - 379 p.

3. Borschevsky P.P. (1991) *Ekologicheskie problemy razvitiya pishevoj promyshlenosti: monografiya* [Ecological problems of food industry development: monograph] / P.P. Borschevsky, B.M. Danylyshyn. K .: Knowledge, 1991- 55 p.

4. Danylyshyn B.M. (1999) *Prirodno-resursnij potencial stalogo rozvitku Ukrayini* [Natural resource potential of steel development in Ukraine] / B.M. Danylyshyn, S.I. Doroguntsov, V.S. Mishchenko and in. K.: RPS of Ukraine, 1999- 288 p.

5. Melnik L.G. (2001) *Ekologichna ekonomika: monografiya* [Ecological economy: monograph] / Melnik L.G. Sumi: Universitetskaya book, 2001 - 350 p.

6. Odum Yu.P. (1986) *Svojstva agroekosistem.Selskohozyajstvennye ekosistemy: monografiya* [Properties of agroecosystems . Agricultural ecosystems :monograph] / Odum Yu.P. / Per. from English; under the editorship of L.O. Karpachevsky. - M.: Mir, 1986 .- S. 17 - 56.

7. Sobkevich V.O. (2013) *Resursnij potencial agrarnoyi sferi: problemi ta zavdannya efektivnogo vikoristannya* [Resource potential of the agrarian sphere: problems and problems of

effective victoriousness] /O. V. Sobkevich, V. M. Rusan, A. D. Yurchenko, O. V. Kovalova [that in.]. - K.: NISD, 2013 . 76 p.

8. Rudenko V.P.(2001) *Prirodno-resursnij potencial prirodnih rajoniv Ukrayini* [Natural resource potential of natural regions of Ukraine]. V.P. Rudenko, V.Ya. Waseba. Chernivtsi: Ruta, 2001 - 268 p.

9. Khvesika A.M. (2013) *Suchasni napryami ekonomichnogo zabezpechennya racionalnogo prirodokoristuvannya v Ukrayini* [So far, straightforward, economical care of the regional nature conservation in Ukraine] / M.A. Khvesika, S.O. Lizuna, 64 p.

10. Khodakivska O.V *Ekologizaciya agrarnogo virobnictva: monografiya*.[Ecology of agrarian virobnosti: monograph]. K.: NSC IAE, 2015- 350 p.

11. Shubravska O.V.(2002) *Stalij rozvitok agroprodovolchoyi sistemi Ukrayini: monografiya* [Steel development of the agri-food system of Ukraine: monograph] / O.V. Shubravska. - K .: II NASU, 2002 - 204 p.

12. Seregeldin I. (1996) Sustainabiliti and the Wealth of Nations: First Steps in an Ongoing Journey. // Environmentally Sustainable Development Studies and Monograph Series. Washington D.C. : World Bank. No. 5 P. 25-78.

13. World Bank. Monitoring Environmental Progress: A Report on Working Progress // Environmentally Sustainable Development. Washington, D.C. : World Bank, 1995. 115 p.

Список використаної літератури

1. Андрийчук В.Г., Вихрь Н.В. Повышение эффективности агропромышленного производства: [монография] , К.: Урожай, 1990. 217 с.

2. Белорус О.Г. Экономическая система глобализма: [монография]. К.: КНЕУ, 2003. 379 с.

3. Борщевский П.П., Данилишин Б.М. Экологические проблемы развития пищевой промышлености: [монография]. К.: Знание, 1991. 55 с.

4. Данилишин Б.М., Дорогунцов С.І., Міщенко В.С. Природно-ресурсний потенціал сталого розвитку України. К. : РПС України, 1999. 288 с.

5. Мельник Л.Г. Екологічна економіка: [монографія]. Суми: Університетська книга, 2001. 350 с.

6. Одум Ю. П. Свойства агроэкосистем. Сельскохозяйственные экосистемы [монография] / Одум Ю. П. / Пер. с англ.; под ред. Л. О. Карпачевского. М.: Мир, 1986. С. 17 - 56.

7. Ресурсний потенціал аграрної сфери: проблеми та завдання ефективного використання : аналіт. Доп. / О. В. Собкевич, В. М. Русан, А. Д. Юрченко, О. В. Ковальова [та ін.]. К. : НІСД, 2013. 76 с

8. Руденко В. П., Вацеба В. Я. Природно-ресурсний потенціал природних районів України / В. П. Руденко. Чернівці: Рута, 2001. 268 с.

9. Сучасні напрями економічного забезпечення раціонального природокористування в Україні; [за наук. ред. акад. НААН України, д.е.н., проф. М. А. Хвесика, д.г.-м.н., проф. С. О.Лизуна; Державна установа «Інститут економіки природокористування та сталого розвитку Нац. акад. наук України»]. К. : ДУ ІЕПСР НАН України, 2013. 64 с.

10. Ходаківська О. В. Екологізація аграрного виробництва: моногр. К. : ННЦ ІАЕ, 2015. 350 с.

11. Шубравська О. В. Сталий розвиток агропродовольчої системи України: [монографія]. К.: ІЕ НАНУ, 2002. 204 с.

12. Seregeldin I. Sustainabiliti and the Wealth of Nations: First Steps in an Ongoing Journey. // Environmentally Sustainable Development Studies and Monograph Series. Washington D.C. : World Bank, 1996. №.5 P. 25-78.

13. World Bank. Monitoring Environmental Progress: A Report on Working Progress // Environmentally Sustainable Development. - Washington, D.C. : World Bank, 1995. - 115 p.