

AGROECOLOGICAL CONDITION OF ARABLE FARMLANDS
IN VINNYTSIA REGION

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The study provides the first integrated assessment of agroecological condition of farmlands in Vinnytsia Region. The performed calculations have served as basis to make an agroecological zonation of the area. The obtained data were analyzed, current agroecological condition of agro-landscapes was determined and recommendations on their further improvement are given.

INTRODUCTION

Recent political, economic and ecological events bring changes to agrosphere (land and agrarian reforms, changes in land ownership, global economic crisis) [1] and set a burning issue of further balanced development of agrarian sector.

A main element of agriculture is agro-landscape. It is a source of raw materials and a main object for investment. Its ecological condition, sustainable use, protection and continuous maintenance are major tasks for agribusiness owners.

OBJECTIVES AND METHODS

The purpose of the study is to identify agroecological condition of farmlands at the district level for further analysis, zonation, sustainable use and protection.

Ecological condition of agro-landscapes was assessed on the basis of information fund materials, statistics and field data, and results of eco-agrochemical categorization of fields and land plots. The following methods were used: "Assessment of the level of ecological imbalance in ratio of lands", "Assessment of ecological condition of agricultural lands according to manifestation of main degradation processes", "Quality assessment of arable lands by main fertility indices", "Method of agroecological assessment of farmlands by a set of indices" [2-4].

RESULTS AND ANALYSIS

Interrelations between components of agroecological condition assessment are shown in the scheme below (Fig. 1) [2].

Agroecological condition of agro-landscapes is calculated as an averaged value of initial indices by the formula [2-3]:

$$I = \frac{Bc_1 + Dc_2 + Rc_3}{c_1 + c_2 + c_3}, \quad (1)$$

where

I – integral index of agroecological condition of lands (in points);

B – index of fecological-agrochemical condition of soils (in points);

D – degradation index of soil cover (in points);

R – ratio between arable (AR) and eco-stabilizing lands (ESL) (in points);

c₁ – c₃ – weight-coefficient of index (B=3, D=2, R=1).

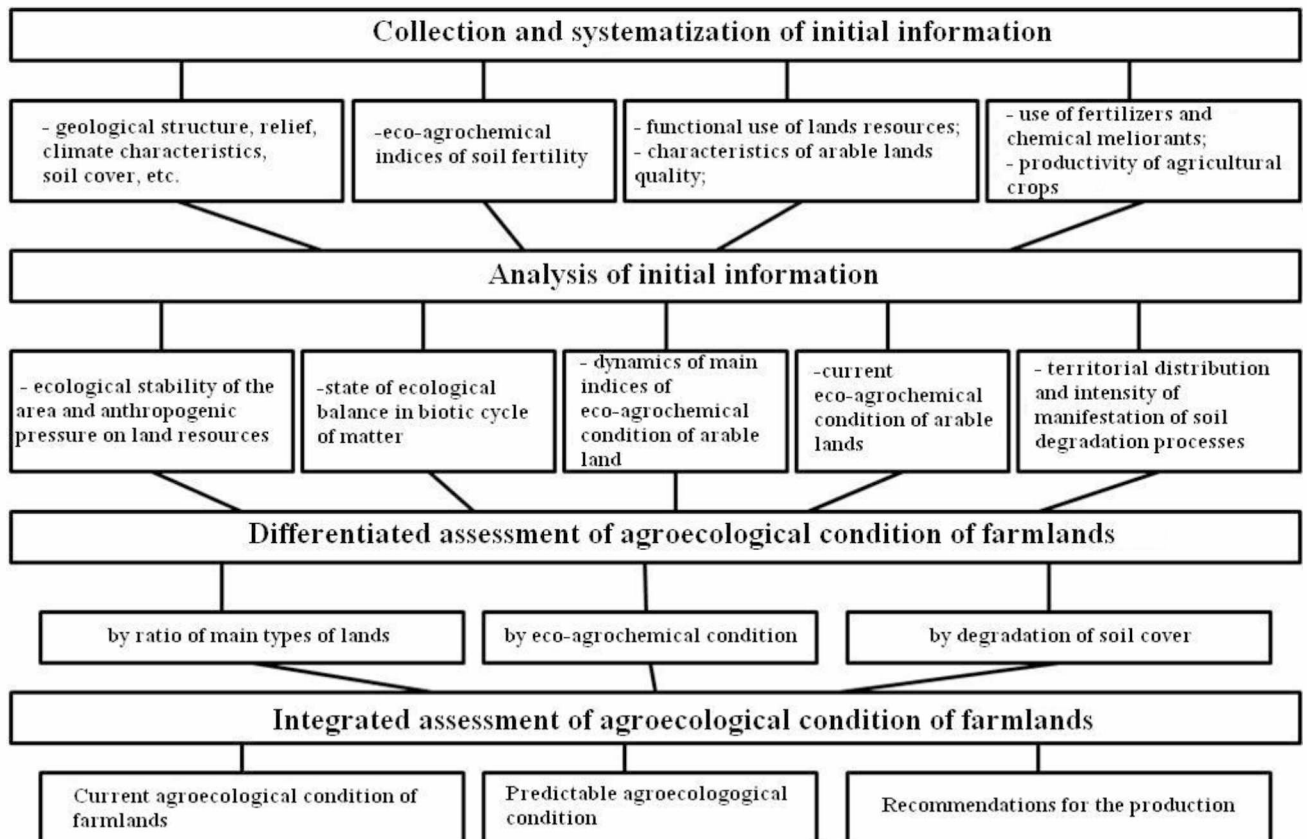


Fig 1. Scheme of integrated assessment of agroecological condition of farmlands

The scheme above (Fig. 1) and the calculation formula 1 show that the method of integrated assessment of ecological condition of agro-landscapes requires a systematic approach and using a set of indicators: eco-agrochemical condition of arable lands, degradation of soil

cover, ratio between arable lands and eco-stabilizing lands to calculate a single composite index. It was proposed a five-point assessment scale where the lower points relate to better agroecological condition, and higher of those describe deterioration of ecological conditions (Table 1) [2-3].

Table 1. Scale to assess agro-landscapes by complex characteristics

Points	Ratio AR:ESL, %	Eco-agrochemical condition of lands, quality (in points)	Degradation of soil cover, integral index	Agroecological condition
1	<20: >80	61-70	<1.4	Good
2	20-36: 64:80	51-60	1.4-1.7	Satisfactory
3	37-55: 45:63	41-50	1.8-2.1	Unsatisfactory
4	56-70: 30:44	31-40	2.2-2.5	Critical
5	>70: <30	21-30	>2.5	Crisis

Integrated assessment of agroecological condition of agro-landscapes was made in 4 phases: 1) ratio between arable and eco-stabilizing lands; 2) eco-agrochemical condition of agro-landscapes; 3) degradation of soil cover; 4) finally, assessment of agroecological condition of lands.

1. An ecological assessment, by a modified 5-point scale, of ratio between arable lands (AR) to eco-stabilizing lands (ESL) (forests, meadows, pastures, shrubs, marshes, bodies of water) has revealed that only Lityn District corresponds to ecotype III (unsatisfactory condition of agro-landscapes) with the ratio equaling 68.74:31.26 (AR:ESL). The rest of districts relates to ecotype IV (critical condition of agro-landscapes).

2. An ecological assessment, by a modified 5-point scale, of ratio between arable lands (AR) to eco-stabilizing lands (ESL) (forests, meadows, pastures, shrubs, marshes, bodies of water) has revealed that only Lityn District corresponds to ecotype III (unsatisfactory condition of agro-landscapes) with the ratio equaling 68.74:31.26 (AR:ESL). The rest of districts relates to ecotype IV (critical condition of agro-landscapes).

Table 2. Scale to assess agroecological condition of agro-landscapes (AL)

Points	Integral index (in points)	Agroecological condition of AL	Agroecological zonation of area
1	1.0-1.7	Good	Zone of economically profitable land use
2	1.8-2.5	Satisfactory	

3	2.6-3.3	Unsatisfactory	Zone of land use under protection regime
4	3.4-4.2	Critical	Zone of ecologically adapted land use
5	4.3-5.0	Crisis	Zone of land use under restoration regime

3. Eco-agrochemical condition of agro-landscapes is determined by a set of agro-physical, agrochemical and biological properties, with the land quality as an integral indicator. The highest score of quality is recorded in the districts of Khmilnyk (53), Koziatyn (52) and Yampil (51), where it amounts to 2 points by 5-point scale (satisfactory). Other districts (12 in each group) have 3 (unsatisfactory) and 4 (critical) points.

4. The following parameters were used for evaluating the integral index of soil degradation: dehumification; nitrogen, phosphorus and potassium depletion in soil; radionuclide pollution. It was found that 6 districts (Khmilnyk, Koziatyn, Yampil, Pishchanka, Trostianets, Teplyk) have no degradation processes; Tyvriv and Chechelnyk Districts possess *high level* of soil degradation; *significant level* is in the districts of Orativ, Tulchyn, Tomashpil, Kryzhopil, Bershad; *moderate level* in Nemyriv and Haisyn; the rest of 12 districts has *low level* of soil degradation.

5. The whole set of the above parameters was used to evaluate agroecological condition of farmlands in administrative districts of Vinnytsia Regions. (Table 3).

The integral index of agroecological condition of arable lands was identified and agroecological zonation was made. We have determined that according to agroecological condition the lands of Vinnytsia Region can be divided into satisfactory, unsatisfactory and critical.

Satisfactory (2 points) – districts of Khmilnyk, Koziatyn, Yampil, Pishchanka, Trostianets, Teplyk. According to agroecological zonation these are areas of economically profitable use, where land use can be implemented without special restrictions wherever soil exploitation is economically feasible and ecologically sound.

Table 3. Assessment of ecological state of agro-landscapes in administrative districts of Vinnytsia Region

District	Points	District	Points	District	Points
Bar	3	Kryzhopil	3	Sharhorod	3
Bershad	4	Lityn	3	Teplyk	2
Chechelnyk	4	Lypovets	3	Tomashpil	3
Chernivtsi	3	Nemyriv	4	Trostianets	2
Haisyn	4	Mohyliv-Podilskyi	3	Tyvriv	4
Illintsi	3	Murovany Kurylivtsi	3	Tulchyn	4
Kalynivka	3	Orativ	3	Vinnytsia	3
Khmilnyk	2	Pishchanka	2	Yampil	2
Koziatyn	2	Pohrebyshche	3	Zhmerynka	3

Unsatisfactory(3 points) – districts of Bar, Vinnytsia, Zhmerynka, Illintsi, Kalynivka, Kryzhopil, Lypovets, Lityn, Mohyliv-Podilskyi, Murovany Kurylivtsi, Orativ, Pohrebyshche, Tomashpil, Chernivtsi, Sharhorod. According to agroecological zonation these are areas of land use under protection regime. This zone puts certain restrictions on the types and intensity of farmland use which may lead to quality deterioration and growth of degradation processes in agro-landscapes.

Critical(4 points) – districts of Bershada, Haisyn, Nemyriv, Tyvriv, Tulchyn and Chechelnyk. In agroecological zonation these are areas of ecologically adapted land use. Agro-landscapes of the zone are in critical condition. Land use is based on full exploitation of natural potential of the land. Some types of agro-landscape use are prohibited because of probable disturbance of landscape-conserving function of soils.

The proposed agroecological zonation of the area can be used as a basis for further ecologically safe and cost-effective farming.

CONCLUSION

Thus, we established that current agro-landscapes of Vinnytsia Region are in critical condition (it is caused by many factors, one of which is a considerable portion of arable lands (85.7%) out of the total area of farmlands [5] that is confirmed by the above described indices which we evaluated).

To improve ecological situation in agro-landscapes as a first step toward the balanced development we propose as follows [2, 6-8]:

- to reach balance in ratio between arable lands and eco-stabilizing lands;
- to implement scientifically-based crop rotation, erosion preventive measures in land cultivation, and resource-saving technologies of chemical melioration for the improvement of eco-agrochemical condition of soils;
- to transit to partial biological farming using organic fertilizers;
- to take from cultivation and put into further land conservation the strongly degraded and low-yield lands.

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АГРОЭКОЛОГИЧЕСКОЕ СОСТОЯНИЕ ПАХОТНЫХ ЗЕМЕЛЬ СЕЛЬСКОХОЗЯЙСТВЕННОГО НАЗНАЧЕНИЯ ВИННИЦКОЙ ОБЛАСТИ

М.Н.Ганчук

В работе впервые для территории Винницкой области была проведена комплексная оценка агроэкологического состояния земель сельскохозяйственного назначения. На основе проведенных расчетов осуществлено агроэкологическое зонирования территории. Проанализированы полученные данные, установлено современное агроэкологическое состояние агроландшафтов и даны рекомендации по их улучшению.