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ZONING OF HIGHWAYS OF THE CHERKASY REGION ACCORDING TO THE DEGREE OF FORMATION OF ECOSYSTEM RELATIONS

The research is due to the great attention paid to the preservation and restoration of biodiversity in the countries of the European Union.

Purpose. Carrying out zoning of the Cherkasy region according to the degree of completeness of the formation of roadside landscapes ecosystems

Methods. From a methodological point of view, zoning is considered as one of the main methods of geographical analysis and synthesis. Zoning performs the function of a general geographic method of organizing spatial diversity in the geographic envelope and systematizing territorial formations at the regional level, which makes it an essential element of a systematic approach in geography.

Results. The monitoring parameters of the infrastructure components of the main highways of the Cherkassy region (Kyiv-Odesa and Vinnytsia-Uman) used by us can be used for zoning, provided they are combined into logically formed factor groups. In particular, we combined all the initial parameters into the following groups of factors: natural-geographic factor: geolocation (geographic coordinates), air temperature and humidity, natural radiation background; degree of anthropogenic impact: noise level, dustiness, some geochemical indicators, proximity (or remoteness) of the road surface from agricultural land; the degree of manifestation of ecosystem relations: the number of plant species and their recurrence, the presence of invasive species and those that are indicators of salinity and waterlogging, the presence of species included in the National Catalog of Biotopes of Ukraine. Based on the list of main groups of factors, the main indicator of zoning will be the degree of completeness of the formation of roadside ecosystems.

Conclusions. Taking into account the activation of ruderal flora at the exits from gas stations, or on remote sections of highways, it can be asserted that in these locations the Le Chatelier-Brown principle is fully in effect, according to which the biosphere compensates for the harmful effects from the outside with its diversity. The author sees prospects for further research in the expansion of the list of objects, in particular, it will be very interesting to investigate the formation of ecosystem relations on secondary communication routes.

KEY WORDS: *zoning, ecosystems, highways, monitoring, landscapes*

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Introduction

Zoning is one of the fundamental concepts of geographical science. The traditional idea of

zoning reduces its essence to the imaginary division of the territory into parts on any basis.

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In modern geography, there are two views on the essence of zoning. According to one of them, zoning is "detection, selection, delimitation of any habitats in any environment." Zoning refers, in particular, to the selection of contours on any typological map made by the qualitative background method.

The scientific experience accumulated by geography in the field of zoning, especially natural, allows us to give a more rigorous and meaningful definition of this concept. First of all, one should keep in mind an important limiting condition: zoning is not an abstract territorial division, but a distribution of a certain, namely, regional level, the object of which is rather large territorial formations with a more or less complex internal structure.

According to modern ideas, there are two main levels of territorial differentiation - regional and local - which fundamentally differ not only in terms of the scale of the respective allocations, but also in the laws underlying their origin. Objects of zoning are single or individual, territorially integral formations, represented on the map by a single contour, which can be assigned their own names. Typological (classification) associations of geographical objects (soils, landscapes, settlements), regardless of whether they are expressed on the map by broken contours or (which happens less often) by a continuous territorial massif, do not belong to zoning.

The object of our zoning is the ecosystem relations that are formed in the roadside landscapes of the Cherkasy region. The relevance of such research is due to the great attention paid to the preservation and restoration of biodiversity in the countries of the European Union [1].

The difficulty of defining the concept of zoning is related to the fact that it belongs simultaneously to some action (process) and to its result, and in addition, to a specialized direction or

division of science (geography in general or a separate geographical discipline).

It is possible to zone any objects in the placement of which there are regular regional differences, including individual components of the landscape or branches of the economy. Thus, we get many overlapping zoning systems (climatic, landscape, agricultural, etc.).

All zoning systems, regardless of their content, are inherently hierarchical, i.e. certain territorial units and their taxonomic subordination are distinguished at different levels. Special terms are used to designate taxa of different ranks: district, district, province, region, etc. To name a general, non-taxonomic concept that refers to regional subdivisions of any order, the term region is most suitable [2].

So, zoning is a system of principles and methods of identifying, delimiting and systematizing all possible regional subdivisions (regions) of the earth's surface, more precisely the surface of the land, oceans and ocean floor. Therefore, it cannot be reduced to a purely technical procedure of division or division. Zoning is closely related to the doctrine of territorial differentiation and integration of the geographical envelope [3].

From a methodological point of view, zoning is considered as one of the main methods of geographical analysis and synthesis. Zoning performs the function of a general geographic method of organizing spatial diversity in the geographic envelope and systematizing territorial formations at the regional level, which makes it an essential element of a systematic approach in geography.

The purpose of the article is to carry out zoning of the Cherkasy region according to the degree of completeness of the formation of ecosystems in roadside landscapes using previously accumulated (including in expeditionary research) and systematized information [4].

Research results

It is necessary to emphasize the dialectical essence of zoning as a unity of division and

unification. This reflects the contradictory unity of the properties of continuity and discreteness

of the geographical space and the processes of differentiation and integration that take place in it. Therefore, the integrity of any region as a systemic entity is determined by integration processes of different nature and different scales. From this follows the main methodological principle of zoning, long recognized in landscape science: zoning should be carried out simultaneously "from below" and "from above". Translated into general scientific language, this means that when zoning, it is necessary to combine an inductive approach with a deductive one [5].

In practice, the inductive approach is expressed in the combination of lower territorial allocations to higher ones (starting with the possibility of elementary units - facies or tracts in landscape science) with successive transitions to the identification of stairs of increasingly higher ranks. The most important tool in this case is a corresponding thematic map (landscape, economic, etc.).

The deductive approach is expressed in reliance on the known regularities of territorial differentiation of a higher order (for example, latitudinal zoning) and on the existing, albeit imprecise, schemes of macro-zoning, both complex and sectoral. It is in this case that the term division can be applied to the zoning procedure. It is also carried out on the basis of maps and space photographs using all available information (literary, statistical), which allows to detail as much as possible, as well as clarify the original scheme. The separation process is continuously monitored "from below" by the results of empirical research performed inductively. The final zoning scheme is, therefore, the product of the synthesis of both approaches.

The monitoring parameters of the infrastructure components of the main highways of the Cherkasy region (Kyiv-Odesa and Vinnytsia-Uman) used by us can be used for zoning, provided they are combined into logically formed factor groups. In particular, we combined all the initial parameters into the following groups of factors:

- Natural and geographical factor: geolocation (geographic coordinates), air temperature and humidity, natural radiation background;

- Degree of anthropogenic influence: noise level, dustiness, some geochemical indicators, proximity (or remoteness) of the roadway from agricultural land;

- The degree of manifestation of ecosystem relations: the number of plant species and their recurrence, the presence of invasive species and those that are indicators of salinity and waterlogging, the presence of species included in the National Catalog of Biotopes of Ukraine [6].

Based on the list of main groups of factors, the main indicator of zoning will be the degree of completeness of the formation of roadside ecosystems. Unfortunately, we did not find a mathematical expression of this indicator, so its dimension was determined verbally:

- a high degree of completeness of the formation of roadside ecosystems; the average degree of completeness of the formation of roadside ecosystems;

- low degree of completeness of formation of roadside ecosystems; the initial degree of completion of the formation of roadside ecosystems.

The main parameters characterizing the selected regions are summarized in a table (Table 1) and also displayed on the corresponding bar charts (Figs. 1, 2). The main results of zoning are shown on the map (Fig. 3).

After a careful look at the presented map (Fig. 3), debatable questions may arise. After all, according to all definitions, zoning objects must have a continuous (extended) nature [7, 84, 8]. Indeed, it is so, but the real indicators of the width of roadside lanes - from 3 to 50 m (Table 1) do not give us the right to distort the ontological meaning of the phenomenon itself. If we were talking about the zoning of linear-network structures, then it would certainly be possible to operate with planar figures [99]. In addition, the content of the phenomenon itself (formation of ecosystem relations) in roadside strips has a rather limited spatial location.

Table 1

Characteristics of infra-ecosystem areas formed along the main highways of the Cherkasy region *

№	Name of the district (nearest settlement and polygon number)	Width of roadside lane (m)	Coordinates of the central point of the district (latitude, longitude)	air temperature C°	Air humidity (%)	Radiation background (m/sv)	The highest level of noise from transport (db)	Dustiness (Dustiness with particle size 10 µm) (µg/m ³)	Total of several species of ruderal plants (pcs)	The number of plant species by repetition is more than 3 (nocs)	The total number of recurrences of invasive plants (nocs)	Correspondence of ruderal plant species to the "National Catalog of Biotones" (nocs)	The degree of completeness of the formation of ecosystem relations **
1	Automarket, Uman (#1)	30	48°45'12,133" N; 30°15'29,041"E	25	65	0,15	89,5	42	44	10	17	12	
2	Branching towards the vil. Polyanetske (#2)	60	48°41'16,566" N; 30°14'30,468"E	25	64	0,16	98,0	40	40	2	6	8	
3	"SOCAR" gas station (#3)	40	48°36'22,057" N; 30°14'03,162"E	24	66	0,16	96,1	44	32	5	9	15	
4	Road branching towards the vil.Ryzhavka (# 4)	35	48°32'39,535" N; 30°13'43,212"E	26	62	0,15	98,7	44	24	3	4	9	
5	"Batkivska hata" (#5)	7	48°28'54,172" N; 30°13'49,073"E	25	62	0,16	95,9	29	9	0	2	3	
6	Zhashkiv (# 13)	10	48°15'35,494" N; 30°05'28,055"E	24	62	0,14	94,0	13	20	2	6	6	
7	Bus stop "Vilshanka" (#14)	15	49°10'23,531" N; 30°04'54,357"E	23	60	0,16	94,6	7	12	1	3	6	
8	Bus stop "Nesterivka" (#15)	25	48°58'38,295" N; 30°10'20,396"E	25	57	0,14	94,1	8	27	5	2	8	
9	Road market in the vil. Podibna (#16)***	6	48°55'26,212" N; 30°14'21,412"E	23	62	0,15	95,8	10	21	5	4	4	
10	Ukrnafta gas station, vil. Krasnopilka (# 17)	6	48°52'13,070" N; 30°15'35,177"E	24	60	0,16	97,5	9	18	3	4	5	
11	«Zastava» (#18)	5	48°48'43,568" N; 30°15'21,170"E	24	61	0,14	97,0	9	21	5	6	6	
12	village of Sychivka (#1)	12	48°47'35,830" N; 29°50'41,975"E	20	48	0,18	91,6	18	17	6	5	7	
13	village of Bilashki (#2)	4	48°51'21,780" N; 30°39'18,828"E	20	54	0,16	91,4	22	45	13	15	17	
14	village of Rotmistrivka (# 3)	5	49°08'46,370" N; 31°43'36,602"E	26	40	0,17	93,6	15	43	13	15	15	
15	Transport interchange after Smila (#4)	5	49°16'04,340" N; 31°52'29,786"E	27	42	0,13	89,1	20	19	3	17	9	

Table continuation													
16	Cherkasy gas filling station (#5)	6	49°23'40,469" N; 32°00'18,440"E	29	39	0,15	87,6	29	19	2	11	5	
17	Geographical Center of Ukraine (#6)	3	49°02'17,473" N; 31°27'07,639"E	28	34	0,14	93,3	21	14	1	1	5	
18	the village of Sokolivochka (# 7)	3	48°56'34,709" N; 30°44'46,682"E	30	33	0,12	90,6	15	17	5	2	6	
19	c. Pikivets (#8)	4	48°45'17,195" N; 30°16'20,555"E	29	33	0,21	91,2	8	19	5	3	4	

* When assessing the degree of completeness of the formation of ecosystem relations, only phytodiversity was evaluated, since a systematic study of zoodiversity requires long-term stationary observations, which the author hopes to conduct soon.

** The colors correspond to the legend of the map (Fig. 3).

*** Data on polygons No. 16, 17, 18 on the diagrams (Fig. 1, 2) were not displayed, as they were collected later.

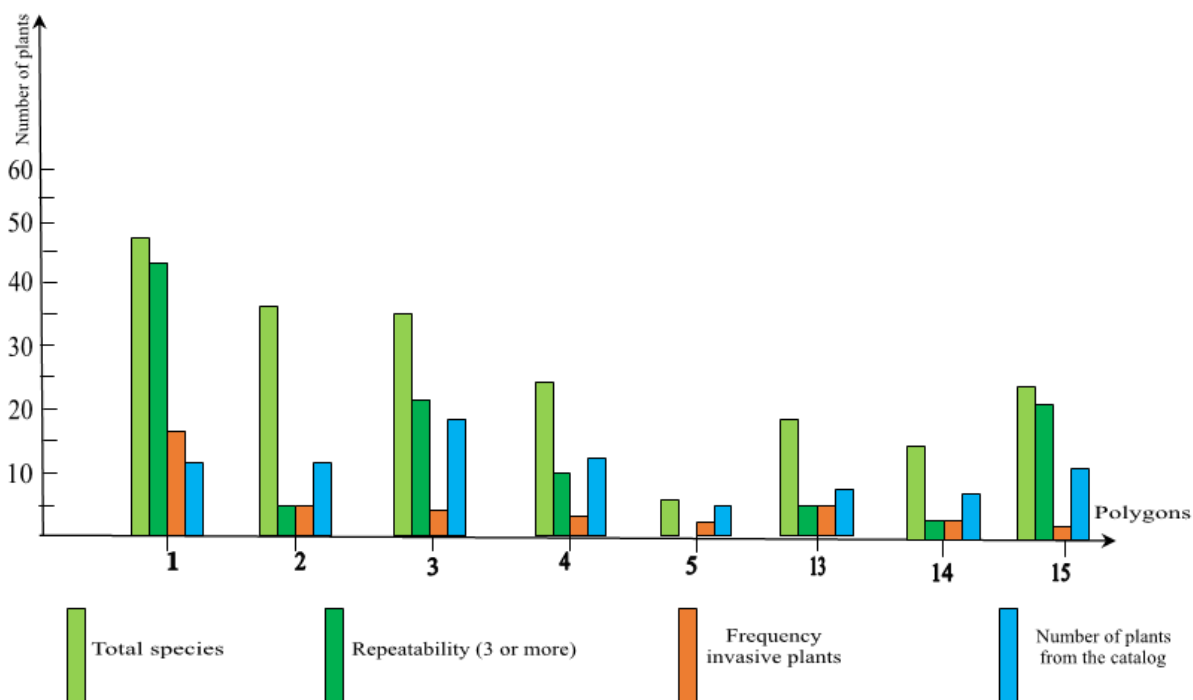


Fig. 1 – Characterization of the degree of completeness of the formation of ecosystems on the roadside of the Kyiv-Odesa highway

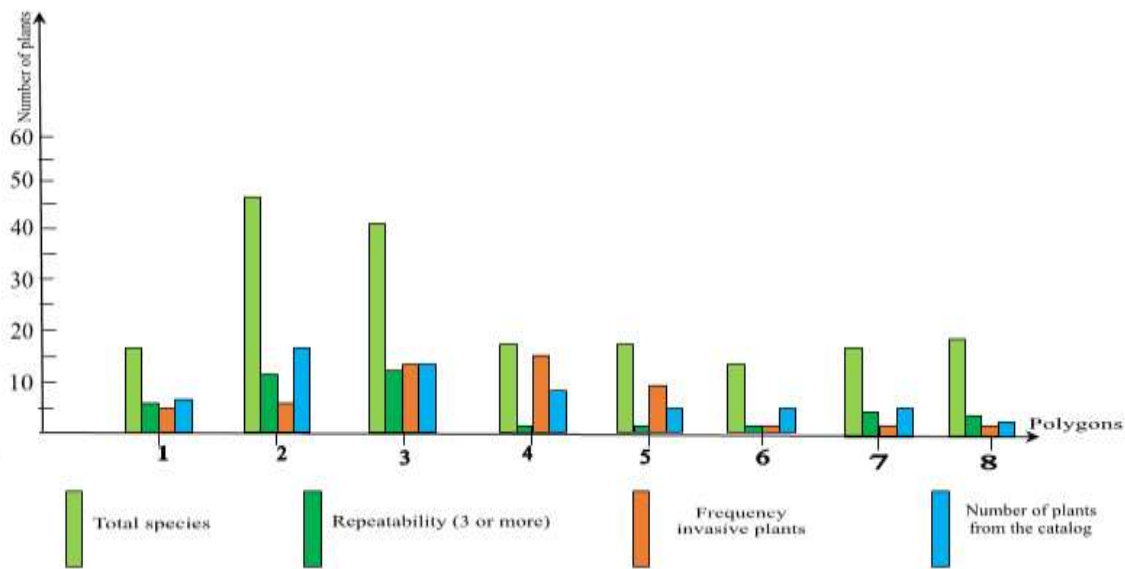
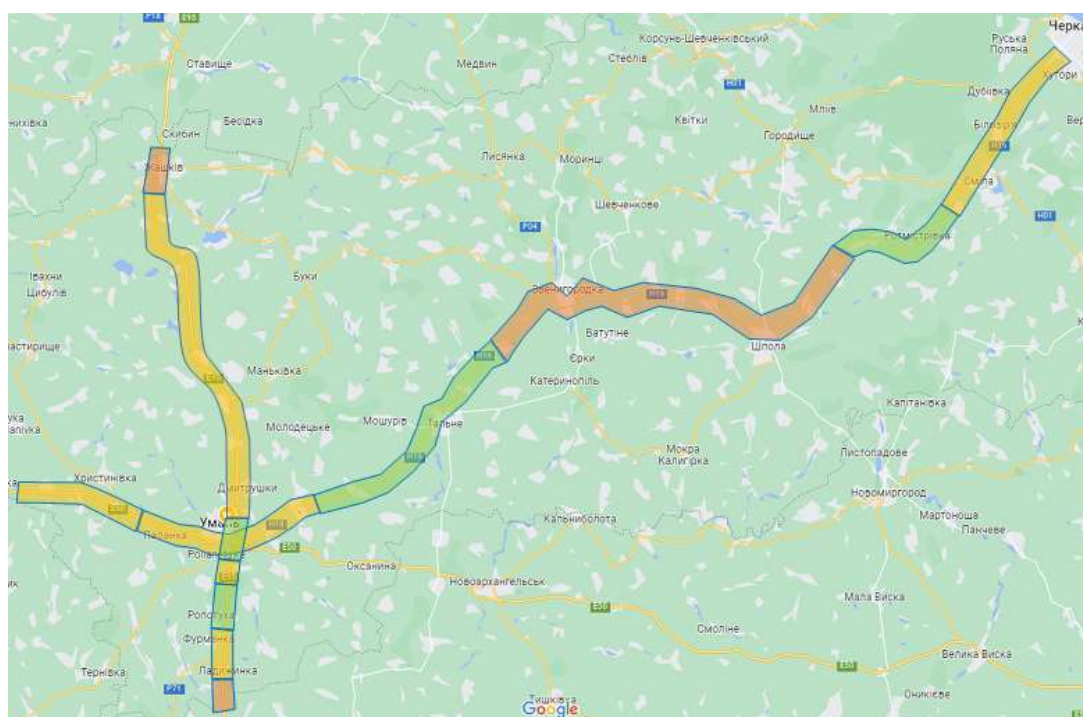


Fig. 2 – Characterization of the degree of completeness of the formation of ecosystems on the side of the highway Vinnytsia-Cherkasy



Legend:

- I. A high degree of completeness of the formation of roadside ecosystems (not detected) - [Dark Green Box]
- II. The average degree of completeness of the formation of roadside ecosystems - [Light Green Box]
- III. Low degree of completeness of formation of roadside ecosystems - [Yellow Box]
- IV. The initial degree of completeness of the formation of roadside ecosystems - [Orange Box]

Fig. 3 – Zoning of the main highways of the Cherkasy region according to the degree of completion of the formation of roadside ecosystems (parameters characterizing each district are given in Table 1)

Conclusions

A visual comparison of the values of individual indicators (according to the relevant groups of factors) with the degree of completeness of the formation of roadside ecosystems did not reveal a clear connection. Probably, in the future, it will be necessary to use special methods of mathematical statistics (factor, cluster analysis, etc.) to establish the closeness of this connection.

The most "bright" indicator, which certifies the degree of completeness of the formation of roadside ecosystems, is the indicator of the correspondence of the identified species of ruderal flora to that specified in the "National Catalog of Biotopes": landfill No. 1 (Uman auto market) - 12 species; landfill No. 3 ("SOCAR" gas station) - 15 types; landfill No. 2 (Bilashki village) – 17 species; landfill No. 3 (Rotmistrivka village) – 17 species. In the rest of

the districts, this indicator does not exceed 5-6 species.

Taking into account the activation of ruderal flora at the exits from gas stations, or on remote sections of highways, it can be asserted that in these locations the Le Chatelier-Brown principle is fully in effect, according to which the biosphere compensates for the harmful effects from the outside with its diversity. Indeed, according to Orkusha, the formation of road anthropogenic landscapes by humans is one of the most active types of nature management.

The author sees prospects for further research in the expansion of the list of objects, in particular, it will be very interesting to investigate the formation of ecosystem relations on secondary communication routes. According to our feelings, they should be more developed there. But this is a hypothesis that needs scientific confirmation.

Conflict of interest

The author declares that there is no conflict of interest regarding the publication of this manuscript. In addition, the author fully complied with ethical standards, including plagiarism, falsification of data, and double publication.

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РАЙОНУВАННЯ АВТОШЛЯХІВ ЧЕРКАСЬКОЇ ОБЛАСТІ ЗА СТУПЕНЕМ СФОРМОВАНOSTІ ЕКОСИСТЕМНИХ ВІДНОСИН

Актуальність досліджень зумовлена великою увагою, яка приділяється збереженню та відновленню біорізноманіття в країнах Європейського Союзу.

Мета. Проведення районування Черкаської області за ступенем повноти формування екосистем природних ландшафтів.

Методи. З методологічної точки зору районування розглядається як один з основних методів географічного аналізу та синтезу. Зонування виконує функцію загальногеографічного методу організації просторової різноманітності географічної оболонки і систематизації територіальних утворень на регіональному рівні, що робить його істотним елементом системного підходу в географії.

Результати. Використані параметри моніторингу складових інфраструктури основних магістралей Черкаської області (Київ-Одеса та Вінниця-Умань) можуть бути використані для зонування за умови їх об'єднання в логічно сформовані групи факторів. Зокрема, усі вихідні параметри об'єднано в такі групи факторів: природно-географічний фактор: геолокація (географічні координати), температура та вологість повітря, природний радіаційний фон; ступінь антропогенного впливу: рівень шуму, запиленість, деякі геохімічні показники, близькість (або віддаленість) дорожнього покриття від сільськогосподарських угідь; ступінь прояву екосистемних зв'язків: кількість видів рослин та їх повторюваність, наявність інвазійних видів та тих, що є індикаторами засолення та заболоченості, наявність видів, занесених до Національного каталогу біотопів України. Виходячи з переліку основних груп факторів, основним показником районування буде ступінь повноти формування придорожніх екосистем.

Висновки. Враховуючи активізацію рудеральної флори на виїздах із АЗС, або на віддалених ділянках автошляхів, можна стверджувати, що в цих місцях повною мірою діє принцип Ле Шательє-Брауна, згідно з яким біосфера своєю різноманітністю компенсує шкідливий вплив ззовні. Автор вбачає перспективи подальших досліджень у розширенні переліку об'єктів, зокрема, дуже цікавим буде дослідити формування екосистемних зв'язків на шляхах вторинних комунікацій.

Ключові слова: районування, екосистеми, магістралі, моніторинг, ландшафти

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