

Concentration of Population on the Territory of Physic-Geographical Rayons of the Chernivtsi Oblast

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Abstract

Concentrations of total and rural population within the limits of 24 physic-geographical rayons (PhGR) through 2001-2016 have been counted. Seven intervals (optimal, moderate, sufficient and excessive concentration, and moderate, sufficient and excessive sparseness) of concentration of total and rural population were suggested. Synchronic, diachronic and rating analyses of territorial specificities of the values of population's concentration in natural regions of the Chernivtsi Oblast were conducted. Regions of excessive and insufficient concentrations of total and rural population within the Prut-Dniester Elevated Plain Oblast, the Prut-Siret Elevated Oblast, and the Skybovi Carpathians have been established.

Key words: concentration of population; total and rural population; intervals of concentration; physic-geographical rayons.

Introduction. Questions of concentration of people on this or that territory are important in demographic geography since allow for the establishment of territorial specificities of population's allocation. The importance lies in the first place in the fact that the quality of the analysis of spatial concentration of population may predetermine good or wrong choice of economic specialization

within this or that territory. Qualitative analysis presupposes that allocation of people will be considered not only from the point of view of present-day vision, but, what is important, in as much possible retrospection thus providing for temporal continuity of the analysis of retrospective-modern recording of population within the limits of hierarchically different territories.

Secondly, the appropriateness of study of population's concentrations lies in the fact that its ascertainment is essential for spatial documentation of land fund available within this or that territory. It is especially important when the optimal balance between the concentration of people and various land categories is sought for. The significance of this view is explained by discrepancies between available land potential (insufficiency or overage) and population's need in it (respectively, due to excessive concentration of population or because of its territorial sparseness).

And, thirdly and finally, the nuances of consideration of surplus or deficit availability of population are preconditioned by territorial emphases put in this study. In fact, the majority of social-geographic studies that deal with spatial specificities of population's allocation, focus on people's concentrations within administrative-territorial limits, rarely – on the same within historic regional, and, as an exception – within natural-geographic limits. Our new attempt to consider concentrations of people on a physic-geographical principle allows for drawing the line from traditional orientation towards social-geographic units which we regard to be artificial and those that deform these or those phenomena considered within its limits. Physic-geographical rayons (PhGR), to our opinion, are those natural units that do not depend upon any social environment, and may therefore serve as a background for representation of a real concentration of population.

Study goals. Following calculations of the coefficient of population's territorial concentration ($C_{p.t.c.}$), we aimed at disclosure of specificities in distribution of population on the territory of physic-geographical rayons available in the Chernivtsi Oblast. The $C_{p.t.c.}$ is calculated as follows:

$$K_{T.K.H.} = \frac{1}{2}(H_i - S_i) \times 100\% \quad (1)$$

where H_i stands for the share of population number of the i -PhGR in comparison to total population of the Chernivtsi Oblast; S_i – the share of the area of the i -PhGR in the total area of the Chernivtsi Oblast. The formula allows for 3 criterion limits, when $C_{p.t.c.} = 0$, $C_{p.t.c.} > 0$, and $C_{p.t.c.} < 0$. The first means the optimal case of people's allocation with even dispersal of population on the whole territory of natural rayon. When the values are positive ($C_{p.t.c.} > 0$), this or that territory would feature excessive concentration of people, and, when they are less than 0, population

density would be regarded as insufficient.

Tracing temporal/spatial dynamics (2001-2016) of concentration of total and rural inhabitants of physic-geographical rayons has become an important particularity of the present study. This generalization finally resulted in the rating analysis of the rayons with respect to values of population's concentration. The results of average ratings allowed for ascertainment of spatial specificities of concentrations of total and rural population in PhGRs of the Chernivtsi Oblast.

Materials and methods. Materials available with the State Service for Statistics, Ukraine, Head Department for Statistics in the Chernivtsi Oblast (Form 6-3EM), and the database of the State Land Cadastre, Ukraine, were the information provisioning for this study, while Land Protection Act, Ukraine, Land Tenure Code, Ukraine, and other legal documents that concern land resources were its statutory and regulatory framework. In the process of work we have made use of the Microsoft Office (Word, Excel), and CorelDraw X7 software.

In the process of study, we were supported by various methods, in particular, by the method of the *analysis* which was helpful in processing of mathematical data, and the one of the *synthesis*, which allowed for generalization of information obtained in the process of work with statistical materials, as well as for making respective conclusions. To establish certain regularities, we have made use of the *rating analysis* that helped disclose specificities of territorial concentration of total and rural population; the *synchronic analysis* for comparison of specificities of concentration of population in physic-geographical rayons through specific temporal periods; and the *diachronic analysis* for comparison of distribution of population through different chronological periods. The final results of this study were reached with the help of the method of *typification*, which allowed for generalization of concentration of total and rural population throughout territories, and the *cartographic* method allowing for visualization of the results of the preliminary generalization of population concentrations on the PhGRs territories.

Study results. It should be in the first place emphasized that the characteristic feature of specificities of distribution of total population's concentration (in 2001-2016) within the PhGRs territories lies in the fact that, as of 2001, it was only in 5 natural regions that the excessive concentration of people was observed (henceforward, see Table 1 with respect to concentration of total or general population in PHGRs in 2001-2016). And, for two of them (Chernivtsi and Derelui PhGRs), said concentration was a sequence higher than the same for the next two (Novoselytsia and Kitsman). In its turn, the Oseliv PhGR showed $C_{p.t.c.}$ (2,85%) that was a sequence less than the same in the previous couple of rayons. All other PhGRs from Hlyboka ($C_{p.t.c.} = -10,85\%$) to Putyla (-203,%) featured insufficient density of population's allocation.

Table 1

*Concentration of total population on the territory of physic-geographical rayons
in 2001-2016*

Physic-geographical rayons	Concentration of total population in 2001		Concentration of total population in 2016		Average rating
	%	Rating	%	Rating	
1. Zastavna	-13,2	8	-36,2	12	10
2. Knotyn	-72,55	17	-90,55	17	17
3. Dolyna-Balkivtsi	-58,4	15	-82,9	16	15,5
4. Oseliv	2,85	5	-17,15	7	6
5. Kelmentsi	-77,2	18	-101,7	19	18,5
6. Sokyriany	-135,7	22	-140,2	22	22
7. Kitsman	65,45	4	49,45	3	3,5
8. Novoselytsia	68,6	3	8,6	4	3,5
9. Hertsa	-35,2	13	-31,2	10	11,5
10. Tarashany	-28,1	10	-23,1	9	9,5
11. Derelui	439,7	2	519,7	2	2
12. Chernivtsi	756,35	1	847,35	1	1
13. Brusnytsia	-31,55	12	-33,05	11	11,5
14. Cheremosh	-28,8	11	-38,8	13	12
15. Hlyboka	-10,85	6	-9,35	5	5,5
16. Siret	-193,35	23	-175,35	23	23
17. Krasnoyilsk	-60,6	16	-57,6	15	15,5
18. Bahna	-18,6	9	-19,6	8	8,5
19. Berehoment	-99,3	19	-104,3	20	19,5
20. Shurdyn	-95,45	18	-95,45	18	18
21. Putyla	-203,8	24	-198,8	24	24
22. Maksymets	-105,35	21	-104,85	21	21
23. Yarivka	-53,68	14	-53,68	14	14
24. Chornodillia	-11,245	7	-11,24	6	6,5
Average geometrical rating					9,8

Situation as of 2016 has very little changed (when the rating of the first four PhGRs is taken into account), and even became worse (it is now 4 natural rayons with positive value of total population's concentration in 2016 if compared to 5 in 2001). Thus, the lands of the Oseliv PhGR featured insufficient concentration of population ($C_{p.t.c.} = -17,2\%$). Moreover, $C_{p.t.c.}$ positive dynamics was observed only in the Chernivtsi and the Derelui PhGRs, while these values decreased in the Kitsman and the Novoselytsia PhGR showing 49,4% and 8,6% respectively.

The number of PhGRs featuring insufficient concentration of people increased in 2016, reaching 20 territorial natural units. However, the $C_{p.t.c.}$ values of the last-ranked regions grew if compared to those in 2001. Thus, the Putyla and the Siret rayons featured insufficient concentration of total population at the levels of -198,8% and -175,4% respectively.

It seems important to trace specificities of the values of concentration of total population indirectly for the period of 2001-2016, which can be done with application of rating analysis proceeding from the average (arithmetical) rayon observed through two time periods (2001 and 2016). The average geometrical rating for the Chernivtsi Oblast was 9,8, this is why the values within 8,1-10,0 should be regarded as the limits of the *optimal interval*. These limits are formed by the Bahna, Tarashany and Zastavna PhGRs (henceforward, see Fig. 1 with respect to spatial specificities of rating analysis of concentration of total population in PhGRs of the Chernivtsi Oblast). Though no excessive concentration of population was observed on the territories of any of these rayons ($C_{p.t.c.}$ range from -13,2% to -36,2% in the Tarashany Rayon), we may, proceeding from general values of concentration of population in 24 PhGRs, nonetheless regard them as those possessing *conventionally optimal* sparseness of total population.

The same conventionality accounts for the next three natural regions – Hlyboka, Oseliv and Chornodilla that feature the intervals of 5,1-8,0. Despite the fact that, according to ranking parameters, these rayons must feature *moderate concentration* of population, it is only on the territory of one of them (Oseliv PhGR that the $C_{p.t.c.}$ exceeded the zero value (+2,85% in the same Oseliv Rayon).

Two physic-geographical rayons show *satisfactory concentration* of total population (interval: 2,1-5,0). The same is observed on the Prut's left bank in the form of continuous lengthwise strip coming from the west to the east and covering territories of the Kitsman and the Novoselytsia natural rayons. It is for these rayons that concentration of population has acquired real sense with their $C_{p.t.c.}$ having reached notable values (from +49,45% to +68,6%). The Novoselytsia PhGR is the only exception where said parameter decreased to +8,6%.

Since territories of the Chernivtsi and the Derelui PhGRs cover the bigger part of the City of Chernivtsi, these lands featured the *excessive concentration* of total population through 2001-2016, which allowed them to take two highest ranks (interval $\leq 2,0$ points). These two rayons form on the Prut's right bank focuses of the biggest concentration of people ($C_{p.t.c.}$ ranges within +439,7% - +847,4%).

It should be noted that, in general, the Prut River represents an axis that divides the Chernivtsi Oblast approximately into halves and along which there are territories with the highest concentrations of total population. These lands feature PhGRs with sufficient and excessive concentrations of population, forming an all-over territorial association of lands with positive values of people's concentration. However, these all are surrounded by PhGRs possessing negative $C_{p.t.c.}$ values.

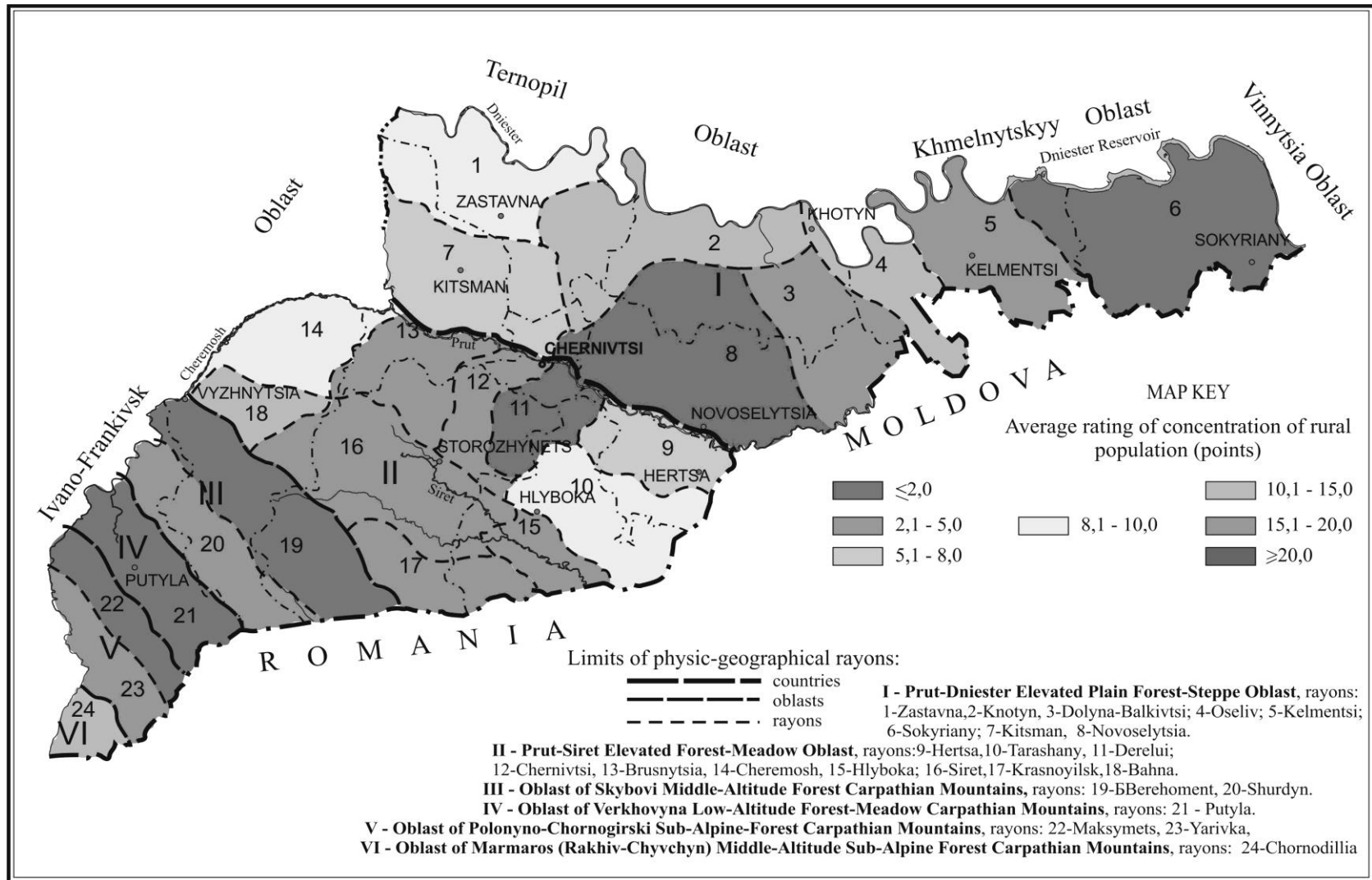


Fig.1. Concentrations of total population in physico-geographical rayons in 2001-2016

Distribution of territories with insufficient concentration (sparse spreading) of total population also has its own specificities of falling under three intervals of 10,1-15,0 points (moderate sparseness); 15,1-20,0 (satisfactory sparseness); and $\geq 20,1$ (excessive sparseness). Having this in mind, we would draw your attention to the fact that two focuses of sparse allocation of urban and rural inhabitants are observed in the Prut-Dniester inter-stream area. One of these, represented by the Khotyn and the Dolyna-Balkivtsi PhGRs, is characterized by negative $C_{p.t.c.}$ values, thus witnessing that concentration of people there is sufficiently sparse. The other focus is located on the most remote east of the Prut-Dniester Elevated Plain Oblast, covering the territories of the Kelmentsi and the Sokyriany rayons. This area is distinctive for sufficient and excessive sparseness of total population.

The biggest areas of insufficient concentration of people are observed in the mountainous regions and in the Prut-Siret Elevated Oblast. Insufficient concentration here is continuous and uninterrupted beginning from the Yarivka and until the Brusnytsia and the Cheremosh PhGRs that feature moderate sparseness of total population. The aforesaid natural units are interspersed with the lands of sufficient (Krasnoyilsk, Berehomet and Shurdyn PhGRs) and excessive (Siret, Putyla and Maksymets) urban and rural sparseness. And it is only the Hertsa PhGR with its moderate sparseness of total population that stays separately beyond all other territories possessing negative values of concentration of total population.

Principally different was the distribution of *concentration of rural population* when it was already in 11 PhGRs that positive $C_{p.t.c.}$ values were observed (as of 2001). Among these, 2 rayons – Novoselytsia and Derelui – are clearly distinctive for the biggest concentration of rural people (313,6% and 203,2% respectively). The most weighing was the group of natural units with moderate concentration of rural inhabitants. This was represented by the Zastavna, Dolyna-Balkivtsi, Kitsman, Hertsa, Tarashany, Brusnytsia, Cheremosh and Hlyboka PhGRs with $C_{p.t.c.}$ values ranging from 75,1% to 21,9% (henceforward, see Table 2 with respect to concentration of rural population in PhGR in 2001-2016). The Khotyn natural unit stays separately since features the least positive concentration of inhabitants of rural settlements (3,45%).

Insufficient concentration of rural inhabitants was observed in the lands of 13 PhGR, with entirely negative values featured by 3 of them – Putyla, Berehomet and Sokyriany, where $C_{p.t.c.}$ was less than -100%. Similar 3-component group was formed by rayons with moderate negative values of concentration of rural population. The group is composed of the Bahna, the Chornodilla and the Oseliv PhGRs with $C_{p.t.c.}$ values ranging within -7,6 and -15,2%.

A big number of natural rayons are organized into a group with vividly insufficient concentration of rural people. This group comprises seven PhGRs beginning from the Kelmentsi PhGR ($C_{p.t.c.} = -36,7\%$) to the Maksymets PhGR ($C_{p.t.c.} = -93,85\%$). Save for the Kelmentsi, all other PhGRs are located within the Prut-Siret elevated Oblast and the Skybovi Carpathians.

Table 2

Concentration of total population on the territory of physic-geographical rayons in 2001-2016

Physic-geographical rayons	Concentration of rural population in 2001		Concentration of rural population in 2016		Average rating
	%	Rating	%	Rating	
1. Zastavna	36,8	8	19,3	10	9
2. Knotyn	3,45	11	-18,55	13	12
3. Dolyna-Balkivtsi	75,1	3	48,1	7	5
4. Oseliv	-15,15	14	-28,65	15	14,5
5. Kelmentsi	-36,7	15	-84,2	20	17,5
6. Sokyriany	-103,2	22	-89,7	21	21,5
7. Kitsman	57,95	5	51,45	6	5,5
8. Novoselytsia	313,6	1	253,6	1	1
9. Hertsa	38,8	7	56,3	5	6
10. Tarashany	21,9	10	40,4	8	9
11. Derelui	203,2	2	238,2	2	2
12. Chernivtsi	-43,65	16	-40,15	16	16
13. Brusnytsia	58,95	4	67,95	3	3,5
14. Cheremosh	35,7	9	34,7	9	9
15. Hlyboka	47,65	6	57,65	4	5
16. Siret	-85,35	20	-25,35	14	17
17. Krasnoyilsk	-81,1	19	-73,1	18	17
18. Bahna	-7,6	12	-7,6	11	11,5
19. Berehoment	-115,3	23	-112,8	23	23
20. Shurdyn	-80,95	18	-78,95	19	18,5
21. Putyla	-165,8	24	-152,8	24	24
22. Maksymets	-93,85	21	-91,35	22	21,5
23. Yarivka	-53,65	17	-53,65	17	17
24. Chornodillia	-11,24	13	-11,24	12	12,5
Average geometrical rating					9,8

The trend of worsening of situation with total population concentrations has also preserved for rural people. Thus, the number of PhGRs with positive $C_{p.t.c.}$ values decreased to 10 in the course of 2001-2016, with the Khotyn PhGR falling out. It is only the Novoselytsia and the Derelui natural units who have preserved their ranking positions (the 1st and the 2nd respectively). The remaining PhGRs either improved their $C_{p.t.c.}$ ratings (Tarashany, Hertsa, Busnytsia and Hlyboka), or worsened (Zastavna, Dolyna-Balkivtsi and Kitsman). As of 2016, the values ranged from +19,3% (Zastavna) to +67,95% (Brusnytsia).

Though the total number of PhGRs featuring sparse concentrations of rural inhabitants increased to 14 within 2001-2016, the majority of the rayons showed improvement of absolute values of their $C_{p.t.c.}$. The exceptions were observed only in the couples of the Oseliv and Kelmentsi, and the Yarivka and Chornodilla natural rayons. The first two, probably due to reduction of the number of rural population, showed the decrease in concentration to -28,65% for the Oseliv and to -84,2% for the Kelmentsi PhGRs, while the last couple of natural units has concentration of people in rural locality left

unchanged.

The weighted average geometrical value of the mean rating of concentration of both total and rural population has made 9,8 points in 2001-2016. Thus, to establish spatial specificities of concentration of rural population, we may apply similar intervals as it was with total population, namely, excessive ($\leq 2,0$ points), sufficient (2,1-5,0), moderate (5,1-8,0), optimal (8,1-10,0) concentrations, and moderate (10,1-15,0), sufficient (15,1-20,0) and excessive ($\geq 20,1$) sparseness.

The most essential thing to be accentuated on is the total dominance of positive $C_{p.t.c.}$ values in rural population for the intervals of their optimal, sufficient and excessive concentrations. Moreover, qualitative characteristics of concentration that correspond to ranking positions of their quantitative parameters were in correlation with $C_{p.t.c.}$ average values (average geometrical) of each of the positive interval. Thus, the optimal concentration of rural population corresponded to the coefficient's average value of 30,3%; moderate – 50,5%; sufficient – 58,4%, and excessive – 249,1%.

Attention should be drawn to the fact that concentration of inhabitants of rural settlements on the left bank of the Prut River was formed with the bigger strip (from the west to the east) along all stream within the limits of the Chernivtsi Oblast, having covered the Kitsman, Novoselytsia and Dolyna-Balkivtsi PhGRs (henceforward, see Fig. 2 with respect to spatial specificities of concentration of rural population in 2001-2016). The Novoselytsia Rayon represents the center of the strip featuring the excessive concentration of rural inhabitants.

The Prut's right bank features no continuity of spreading of natural units with intervals that would be higher than optimal concentration of rural population. These lands show either single (Brusnytsia PhGR) or group (Derelui and Hertsa PhGRs) focuses of allocation. Besides, the far southern part of the Prut-Siret Elevated Oblast features a single and the smallest physic-geographical rayon within the region of this study – the Hlyboka PhGR – where there was a sufficient concentration of rural people in 2001-2016.

And, if compared to total population, the 14 remaining PhGRs with sparse concentration of rural people featured the bigger territorial integrity since inited into two big groupings. The first combines the Khotyn, Oseliv, Kelments and Sokyriany natural units where concentrations of rural people become more and more sparse from the west to the east – from moderate (the Khotyn PhGR) to excessive (the Sokyriany PhGR).

The second grouping entirely covers all mountain and pre-mountain rayons (Bahna, Siret and Krasnoyilsk) of the Prut-Siret Eleveated Oblast, with the Chernivtsi PhGR being a sole exception. This one is located along the Prut, and, due to small number of rural inhabitants (20th ranking place) possesses rather sparse population, which represents an exception for the territory of the Prut's right bank.

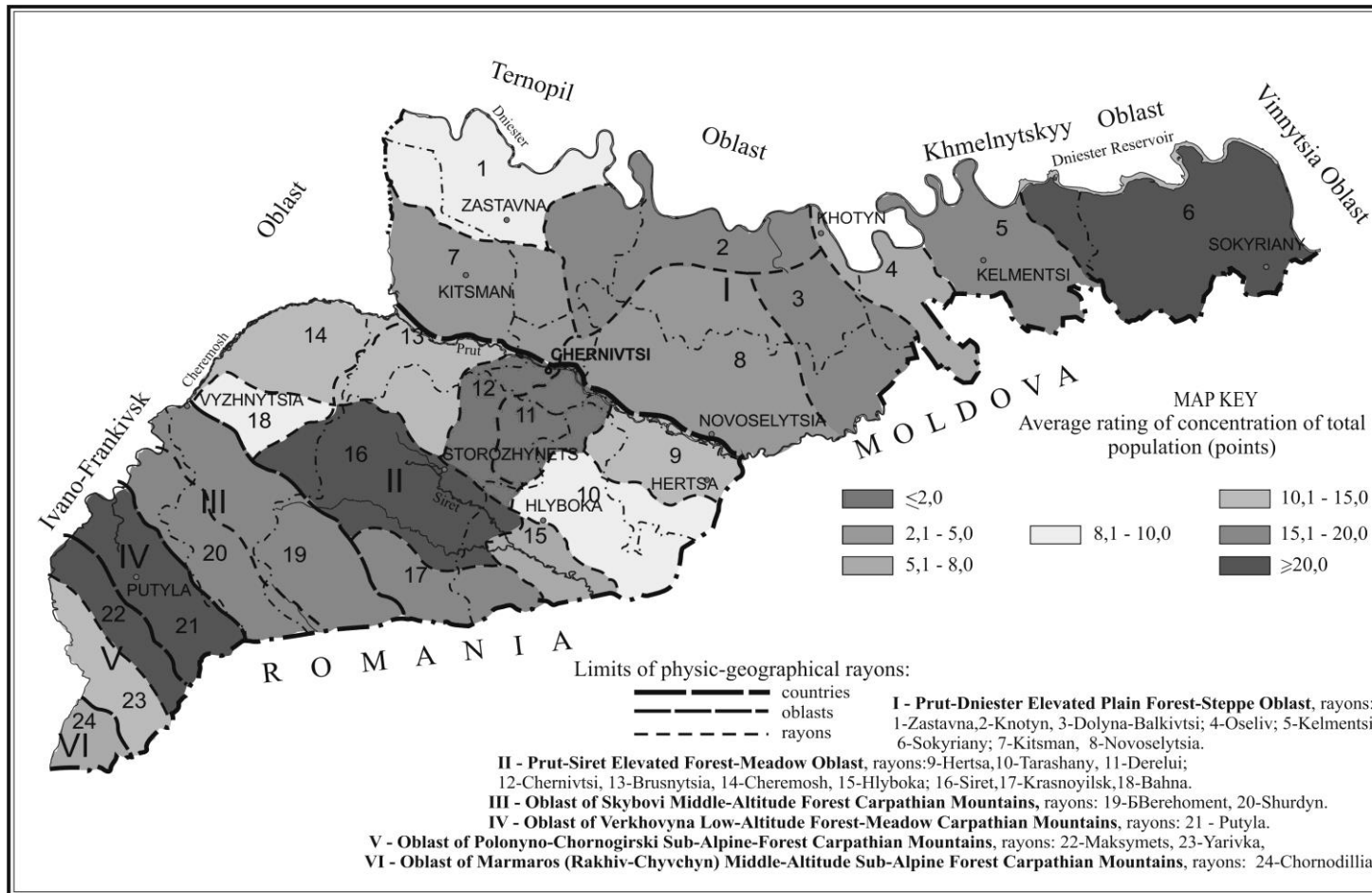


Fig.2. Concentrations of rural population in physico-geographical rayons in 2001-2016

The half of the mountainous PhGRs of the Skybovi Carpathians features the excessive sparseness of rural population (Putyla, Maksymets and Berehomet). Two more rayons (Shurdyn and Yarivka) are distinctive for sufficient sparseness of rural inhabitants. And, the Chornodilla – the most remote PhGR – due to its small number of people and total area shows moderately insufficient concentration of rural population.

Conclusions. Concentration of total population within the region of study is specific for fact that the Prut River represents a kind of an axis that divides the Chernivtsi Oblast approximately into halves with territories of highest concentrations of total population being located along this axis. The territories are represented by physic-geographical rayons that feature sufficient and excessive concentrations of people and form continuous strips of lands possessing positive values of people's concentration. Said territories are surrounded by physic-geographical rayons with negative Cp.t.c. values.

Concentration of inhabitants of rural settlements has its own specificities. Rural people are concentrated along the Prut's left bank in the form of a continuous strip that spreads from the west to the east along the whole river's stream within the limits of the Chernivtsi Oblast and covers the Kitsman, Novoselytsia and Dolyna-Balkivtsi PhGRs. The strip has its center in the Novoselytsia Rayon whose lands feature excessive concentration of rural inhabitants.

The territory of the Prut's right bank features no continuity of spreading of natural units with intervals exceeding optimal concentration of rural population. The lands here feature either single (Brusnytsia PhGR) or group (Derelui and Hertsa PhGRs) focuses of allocation.

The analysis of the proportion of concentration of different-category lands within the PhGR limits and concentration of population within the same is believed to become the next perspective stage of our studies. We regard it important to disclose deterministic links between available potentiality of land resources and its correspondence to geo-demographic values represented here as the values of territorial concentration of population (total and rural).

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