

Development of territorial communities: aspects of natural capital conservation and budget financing

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Abstract. The development of efficient local governance and establishment of comfortable conditions for the living activity are the major strategic tasks of the public governance and authorities' decentralization system modernization that is currently underway in Ukraine. The complicated socio-environmental and economic situation faced by Ukraine due to the deployment of military and political events, the collapse of the national currency, the deformation of industrial infrastructure, the depletion of natural capital, the exhaustion of natural resources, the spread of coronavirus infection COVID-19, and other destabilizing factors constitutes an incredibly high threat to the socio-political and economic security of the state as a whole and of each territorial community (TC). In this perspective, each element of the complex national economy system is important and should be translated into the principles of intellectualization in a strategic perspective. Today, the economic systems of both the state and the TCs are largely supported by international organizations – mainly through the provision of international loans and grants. The harmonization of national legislation on the preservation and reproduction of natural capital with European directives is the priority area of the foreign policy of Ukraine. Cooperation with international organizations sets a number of requirements for Ukraine, including the transparency of financial flows and natural capital accounting. Clear regulation of accounting, storage, and reproduction of natural capital is an urgent task of the public administration system. Taking into account the fact that climate security is a global problem, adaptation of national standards to European directives will make it possible to unify the information support of public finances and form a strategy for the development of natural capital. The main factors of economic efficiency in the Republic of Poland and Ukraine are compared. The research verifies the regression relationships between budget funding of territorial communities and the population of these territorial communities and provides conclusions about the efficiency of TCs' funding in Ukraine.

1. Introduction

The decentralization of authorities and finances in favor of local governments is the mainstream reform of present times. It is impossible to achieve the goals of the decentralization reform without the adequate economic development level of respective territories, their financial sufficiency, and enough sources to generate budget revenues. Preservation and reproduction of natural capital are among the most important components of the state environmental policy strategy of Ukraine. Natural capital forms a safe



environment for human life and health, provides the population with food, medicine, and raw materials for industry, forms a natural barrier for the spread of the COVID-19 coronavirus infection. In addition, it supports the functioning of ecosystems, in particular the cycle and purification of natural waters, soil conservation, and climate stability. For the population, natural capital has economic, recreational, cultural, environmental, and other values. Ukraine, occupying only 6% of the total area of Europe, owns 35% of its biodiversity. However, the impact of human activities on its condition is very noticeable. Widespread drainage works have resulted in the destruction of landscapes. Over 80% of wetlands have lost their original importance. Significant changes have been observed in steppe natural ecosystems, which have been preserved only in fragments. Natural forest ecosystems account for 5.1 million ha, while artificially created forest ecosystems account for 4.3 million ha. The natural reserve fund of Ukraine is more than 5 million ha or only 8% of the country's territory, and it needs to be significantly increased. Preservation and reproduction of natural capital are among the key components of sustainable development strategy and ecological policy of the EU countries and globally. The efficiency of conservation of human, plant, and animal gene pool depends to a large extent on the efficiency of state and local authorities. Therefore, studying the organizational structure of the system of management of natural capital storage and reproduction processes becomes particularly important.

The article aims to solve the applied problem of conservation and reproduction of natural capital for the effective development of the united territorial communities on the basis of the introduction of new principles of socio-economic security, intellectualization of economic development, the introduction of innovative and information technologies, rational use of natural resources, and consideration of military and political security standards. Relevance of the topic is justified by the European integration processes in Ukraine and the need to take into account climate change since the preservation of natural capital is a global problem of humanity. That is why the urgent task is to raise the level of socioecological and economic security at the level of basic units of local self-government – territorial communities. The authors offer the ways to improve the implementation of budget policy of financing measures for the preservation of natural capital based on the formation of its real value and the condition of life support of the society. The research provides recommendations on regulatory and institutional support of activities in the conservation and reproduction of natural capital through harmonization of the national regulatory framework with the current EU directives in this area.

Territorial communities of Ukraine and their natural capital as the country's national wealth are the object of the study.

The process of natural capital development in Ukraine under conditions of climate change on the basis of increasing the level of social, environmental, and economic security of the territorial communities on the example of Poland is the subject of the study.

2. Critical literature review

The development of territorial communities in Ukraine should currently be considered in the context of the relationship between the natural capital and financial resources of their reserves and ways of increasing. Their interaction generates modern directions and opportunities for the use of each resource to secure the environmental and socio-economic development of a territory. Hasenko L.V. et al. [1] analyze the process of territorial communities' establishment in Ukraine and pay special attention to the sources of revenues to local budgets. They argue that the payment of land taxes is one of the major sources. K. Patytska et al. [2] offer the methodology for the diagnostics of the territorial communities' financial capacity by revenues. The methodology is directed at securing the complex qualitative and quantitative evaluation of the strengths, condition, and weaknesses of the community economy, role and place determining of the local budgets in securing the economic-socio development of the territory. The research is very important because it has detected the problems of generating the revenues to the community budget and substantiated the directions of increasing the financial capacity and preserving the natural capital. I. Hryhoruk et al. [3] and O. Panukhnyk et al. [4] consider these issues based on the development of bioresources at the territories of the newly established communities and thus pay attention to the development of entrepreneurship. The detailed research of the methodological

framework for evaluation of natural resources capacity and losses from environmental pollution based on the ecosystem approach and budgetary funding is carried out in the studies of I Khvostina et al. [5], N. Pylypiv et al. [6], M. Stehnei et al. [7], O. Dovgal et al. [8], A. Sakhno et al. [9]; B. Danylyshyn et al. [10].

It is worth noting the research of natural capital preservation conducted by V. Bondarenko et al. [11] as the authors outline the problems of efficient use of natural resources capacity in conditions of financial and administrative-territorial reform in Ukraine. They argue that the problems related to the fact that most communities weren't aware of what resources they own and how they can be used correctly for community development and financial capacity increase were the first to display themselves. H. Voznyak et al. [12] analyze the process of financial decentralization in terms of communities' financial capacity development and determine the main mechanisms for budget redistribution at different levels. H. Oleksyuk et al. [13-14] substantiate the concept of local finances as a system and argue that local finances consist of revenues, ways to get revenues, system institutes, entities and objects of the system, and relationships among them. In this regard, Siryk Z. et al. [15] examined the processes of adaptation of modern territorial entities' forms into the existing territorial system in the country. In particular, they analyze the division of competencies between various levels of authority in conditions of changing the administrative-territorial structure of Ukraine.

However, most of these studies are related to territorial development in Ukraine. In our research, we analyze the Polish experience and select the best practices for Ukraine.

3. Materials and Methods

On the basis of the system method of researching the domestic and world experience, the study develops the directions of the natural capital preservation on the basis of systematization of socio-environmental and economic safety indicators of the state across its structural elements and levels to create the complex system for definition of the integral level of climate safety. The dialectical method applied to examine the prospects for the conservation of ecosystems and their environmental functions and the sequence of information generation, which is the basis for the development of the base of indicators of socio-environmental and economic security, and identify possible ways of adaptation of domestic standards of the natural reserve fund accounting in the public and private sectors to international directives and standards. The following general scientific and special methods are used in the study:

- dialectical and abstract-logic methods – to generalize theoretical provisions and define the essence of socio-environmental and economic security of the TCs; to develop a concept of intellectualization of the economy of the UTCs for their effective socio-economic development, preservation of natural capital, its replicability, genetic information for present and future generations as an indisputable condition of the society's activity;
- system analysis – to form a generalized system of indicators of socio-environmental and economic security and its impact on the volume and cost indicators of the preservation and reproducibility of natural capital. The list of indicators should provide, on the one hand, the most reliable analysis and, on the other hand, the possibility of quick obtaining of the information and calculations;
- economic-statistical method – to assess the condition and development of the natural capital of the united territorial communities, the impact of climate change on the state and dynamics of the natural capital of the territorial units, and financial indicators of the implementation of socio-economic security measures;
- factor analysis by the method of the main components – to substantiate the weight coefficients for separate components of socio-environmental and economic security of TCs;
- economic and mathematical modeling – to build an economic and mathematical model of the UTCs' budget financing for the development of their natural capital.

4. Results and Discussion

The development of an efficient system of natural capital conservation and reproduction to increase the level of socio-environmental and economic security of local communities will minimize the negative

impact of climate change, as well as ensure the strategic development of UTCs based on the intellectualization of the economy, and negative impact mitigate of the spread of the COVID-19 coronavirus infection. There are many scientific studies in global and domestic science addressing natural capital preservation based on the improvement of the TCs' socio-economic and environmental security and substantiation of the methodology for accumulating the information from initial economic entities to public governance entities. Therefore, there is a need to conduct a reliable evaluation of the integral level of the TCs' socio-economic and environmental security to adequately manage them and achieve the proper level of social and environmental security of the TCs' functioning. The measures of natural capital development must take into account the interests (economic, social, informational, environmental, financial, managerial) of each territorial community to ensure sustainable development and reproduction of natural capital for the safe functioning and life support of modern and future generations in conditions of instability of economic and social development, that is based on the intellectualization of the process of natural resource management.

According to the Ministry of Finance of Ukraine [16], the State Treasury Service of Ukraine [17], the State Statistics Service of Ukraine [18], the revenues to the general and specific funds of territorial communities in Ukraine in 2021 amounted to UAH 180.4 billion, the collected land payment was UAH 22.67 billion, and local taxes and fees were UAH 52.19 billion. Meanwhile, the land profitability of each community (general fund) on average amounted to UAH 40,870. The area of all communities in Ukraine was 554,740 km² as of 1 January 2021, while the number of the population residing there was 36.13 million persons. The research calculates the territorial communities' budget revenues typical for all Ukrainian regions on the example of 65 communities in Rivnenska oblast. The results are consolidated in Table 1.

Table 1. The analysis of financial budgetary resources of territorial communities, their population, and area

Community	Area, sq km	Population, thous.	Budget, million UAH	Community	Area, sq km	Population, thous.	Budget, million UAH
Antonivska	114	5.7	7.843	Mizotska	360	14.1	20.942
Varaska	600	52.9	467.347	Oleksandriyska	208	9.8	27.577
Volodymyretska	707	26.4	45.757	Ostrozka	709	42.8	91.517
Zarichnenska	1103	28.6	45.357	Rivnenska	63	254.8	1469.271
Kanonytska	170	6.2	6.381	Sosnivska	320	6.8	17.554
Loknytska	361	5.9	10.167	Shpanivska	80	10.6	39.798
Polytska	179	5.7	12.407	Berezivska	498	12	12.562
Rafaliska	111	7.3	12.828	Vyryvska	389	12.9	35.585
Bokiyimivska	195	5.5	11.581	Vysotska	298	5.7	13.587
Boremelska	105	3.2	6.93	Dubrovyska	1091	34.7	66.344
Varkovytska	148	5.4	10.234	Klesivska	344	10.5	46.914
Verbska	117	4.6	11.606	Mylyatska	431	6.2	11.055
Demydivska	312	12.01	35.547	Nemovytska	283	11.3	21.293
Dubenska	27	37.4	165.661	Rokytnivska	1591	39.5	89.845
Kozyńska	180	7.3	15.583	Sarnenska	820	66	189.331
Krupetska	300	8.9	29.955	Starosilska	274	6.9	7.155
Myrohoshchanska	115	6.8	12.035	Stepanska	224	7.1	12.294
Mlynivska	401	19.8	55.08	Klesivska	344	10.5	46.914
Ostrozhetska	138	5.8	14.781	Malolyubashanska	416	5.7	19.648
Pidloztsivska	65	1.8	5.592	Hoshchanska	484	22.9	72.019
Povchanska	92	2.9	4.601	Derazhnenska	226	6.2	12.121
Pruvilnenska	153	5.5	20.739	Dyadkovytska	157	5.8	16.119
Radyvylivska	229	18.7	62.754	Zdovbytska	150	9.9	16.721
Semydubska	214	4.5	12.203	Zdolbunivska	151	31.6	146.316
Smyzka	194	7.4	26.64	Zoryanska	193	13.4	45.059

Tarakanivska	220	7.9	17.154	Klevanska	112	13.8	76.461
Yaroslavytska	109	2.7	8.101	Koretska	530	24.4	55.802
Babynska	121	6.9	20.305	Kornynska	68	7.5	22.337
Bereznivska	1197	51.3	116.502	Kostopilska	661	44.1	150.356
Bilokrynytska	127	9.9	30.955	Malynska	201	5.6	12.188
Buhrynska	88	4.1	6.616	Velykoomelyanska	101	3.7	18.775
Velykozhmerytska	192	7.9	13.544	Holovynska	202	7.1	14.731
Horodotska	134	10.7	58.233				

Source: based on the data from the [18].

Based on mathematical modeling and correlation-regression analysis, the dependence between the funding of territorial communities and the population in each TC was detected (Table 2).

Table 2. Regression statistics and model values

Regression Statistics					
Multiple Correlation coefficient R			0.966264022		
Coefficient of determination R-square			0.933666159		
Adjusted R-square			0.932613241		
Standard error			49.07216862		
Cases			65		
Indicators	df	SS	MS	Fisher's Cr. (F)	Significance F
Regression	1	2135342.413	2135342.413	886.7414803	7.93659E-39
The rest	63	151708.8972	2408.077733	Fcr	3.993364924
Total	64	2287051.311		tcr	1.998340543
Standard Error	t-Statistics		P-value	Coefficients	Upper 95%
6.936926579	-4.79448519		1.03482E-05	b0=-33.25899	-19.39665012
0.186223649	29.77820479		7.93659E-39	b1=5.5454059	5.917544216

Source: the authors' own calculation.

The choice of the analytical form of the model, which describes the dependence between the amount of budget funding of territorial communities and the population in these communities, is based on the constructed scattering diagram, which is a graphical representation of the selected statistical sample. The relationship between the amount of budget funding of territorial communities and their population is close to linear, so in this case, as a relationship between variables, it is advisable to choose a linear function. The selective linear regression function, in this case, will look like this:

$$\hat{y} = b_0 + b_1x \quad (1)$$

where \hat{y} – estimation of mathematical expectation of the dependent variable model (budget funding of territorial communities); x – independent model variable (the number of the population of territorial communities); b_0, b_1 – selective regression parameters.

Accordingly, the model of dependence between the budget funding of territorial communities and the population is:

$$Y = -33,258 + 5,545x \quad (2)$$

The rates of the TCs' budgetary funding and the data on the number of the population were used to determine the b_0, b_1 model parameters estimates (table 1).

The verification of the model for adequacy, quality, and significance was carried out to check if the choice of the structure of the model of dependence between the funding and population of a territorial community in the form of linear regression is correct. The determination and correlation coefficients are used to assess the quality of this model. The model's statistical significance has been tested on the basis of criteria of Student and Fisher.

To assess the adequacy of the model with statistical data, the value of this determination coefficient R^2 is calculated. Since the value of the coefficient of determination $R^2=0.9336$, the impact of population on the budget funding of territorial communities is quite significant. The strength of the linear

relationship between the model variables is estimated using the correlation coefficient. Based on the value of $R = 0.9662$, the close linear relationship between the indicators of the model is detected. The following F-statistics (Fisher's F-criteria) are used for verification:

$$F = \frac{R^2}{1 - R^2} \cdot \frac{n - k}{m} \quad (3)$$

which has a Fisher distribution with degrees of freedom $v_1 = m$ and $v_2 = n - k$.

According to the statistical tables of Fisher's F-distribution at a given level of significance $\alpha = 0.05$, the critical value of Fisher's criterion $F_{cr} = 3.9934$. Since Fisher's criterion is $F = 886.74$, which is more than its critical value of $F_{cr} = 3.9933$, the model is adequate and statistically significant. To determine the significance of which parameters of the model provides the overall statistical significance, t-statistics was used (Student's criterion):

$$t_{b_j} = \frac{b_j}{\hat{\sigma}_{b_j}}, \quad j = \overline{0, m} \quad (4)$$

where b_j – estimation of the parameter β_j of the theoretical regression, $\hat{\sigma}_{b_j}$ – standard error of the j parameter of the model.

According to the significance selected level of $\alpha = 0.05$ and freedom degrees according to the statistical tables of the Student's t -distribution, the Student's criterion critical value $t_{kr} = 1.9983$ has been found. The values of $b_0 = -33.2589917$ and $b_1 = 5.545405949$ exceed the critical value $t_{cr} = 1.998340543$, which also confirms the adequacy and significance of this regression model (table 2).

The verification of the model of dependence between budget funding of territorial communities and the population indicates the adequacy of the model and the existence of a close linear relationship between its variables, as well as the significance of the model as a whole and its parameters.

It is worth mentioning that the parameters of local budgets execution show the overall economic and social condition of the respective territory and its capacity to develop sustainably. The availability of enough resources in local budgets provides a territorial community with an opportunity to provide more diversified and qualitative services to its residents, implement infrastructural projects and good social decision, create conditions for the attraction of investment capital and the entrepreneurship development, fund other activities for comprehensive improvement of living standards for the community residents.

Compared to other middle-income countries, in a short time Poland became a high-income nation. The annual growth in Poland, in 2009-2019, according to the data of the World Bank, has averaged to 3.6%. It happens due to the successful macroeconomic management, good investment in human capital, increasing of productivity, strengthened institutions. In 2019, the Polish GDP grew by 4.1%, boosted by higher wages and increased domestic consumption [19]. In 2020, however, the growth has declined only to 0.4%. The worldwide lockdown pandemic COVID-19 had a far-reaching impact on the whole Polish economy state, when businesses closed down.

The authors of this study have reviewed the Polish and Ukrainian economies prior to the global pandemic and highlighted the main four challenges these countries faced on their road to economic recovery [20]. In 2020, the economy of Ukraine faced about UAH 60 billion damage due to the coronavirus pandemic. According to data of International Monetary Fund, in 2016, Ukraine's economy had 50th place in the world in terms of GDP (Gross Domestic Product) at PPP (Purchasing Power Parity) – \$ 353 billion. The Ukrainian SSR economy played an important role in the USSR's whole economy. Donbas (Donetska and Luhanska oblasts), the Dnipro River area (Dnipropetrovska and Zaporizka oblasts), as well as the cities of Kharkiv, Lviv, Kyiv and Odessa are the most economically developed regions of Ukraine [21].

In 1972, the Convention concerning the Protection of World Cultural and Natural Heritage was adopted by the General Conference of UNESCO. At present, over 150 countries have signed the document. It is considered the major universal international legal tool for cultural and natural heritage protection [24]. The territories located in the North-East part of the country ("Polish Green Lungs") and Subcarpathia are of special value. There are 23 beautiful national parks on the Polish territory. South-

East Poland is acknowledged as a region with unique natural features. The most valuable natural areas are protected by law. There are two national parks (the third one is planned), 70 nature reserves, 11 landscape parks, 21 landscape reserves, and over 1200 natural landmarks. The mentioned protected areas account for 50% of the Polish part of the Carpathian Euroregion. Polish national parks cover less than 1% of the total area. The protected area is not allocated at all in some national natural parks, so recreation areas and tourist routes cover almost the entire park area. Babigórski National Park – the modern tourist Mecca of Poland – is an example of such an organization. Almost all Polish national parks can be visited without a guide. The only exception is the full protection zone of Białowieża National Park, where the size of the group of visitors is limited and the visits must be accompanied by a guide. Yet, the number of groups of visitors is not limited. So the groups can visit the full protection zone literally one after another [25].

The data in the Table 3 shows that natural capital is preserved in a range of nature reserve areas and objects. Most of them are nature landmarks both in Poland and Ukraine, although the largest area in Ukraine is covered by protected landscapes – 1.39 million ha and in Poland – 6.9 million ha, respectively, i.e. five times more. Overall, the nature reserve fund of Poland covers over 10 million ha, which is twice more than in Ukraine. National parks are considered the major component of the natural capital protection system. They are ranked the highest among the nature protection forms in Poland. In late 2021, the number of objects of this type reached 1, 463 and their total area was over 164,000 ha (0.5 % of the country's area and 1.6 % of the nature reserve fund area of the country) (Table 3).

Table 3. The comparative characteristics of Polish and Ukrainian nature reserve funds

The nature reserve fund category	The Republic of Poland		Ukraine	
	The number of areas and objects	Area, ha	The number of areas and objects	Area, ha
National parks	23	314474.5	49	1311637.834
Nature reserves	1463	164202.1	24	685741.42
Landscape parks	121	2 529 022.0	81	786025.3491
Protected landscapes	386	6 990 047.7	3167	1389674.793
Natura 2000 areas	967	9 362 632.0	-	-
Environmental lands	6877	51 029.5	-	-
Nature and landscape complexes	318	93 463.6	572	13288.759
Documented sites	155	885.2	98	4230.82
Nature landmarks	36293	-	3441	29769.1795
Total	45636	10 143 124.6**	8245	4318224.126

**excluding the Natura 2000 areas.

Source: based on data from the [26].

The Law of 16 April 2004 defines nature reserve as an area that covers the spaces preserved in unchanged or slightly changed condition, ecosystems, biotopes of plants, animals, mushrooms, and objects and components of inanimate nature that have specific natural, scientific, cultural, or landscape values. The landscape parks are created in the areas that have natural, historical, cultural, and landscape values for preservation and promotion of these values in conditions of balanced development. The park is designated to serve local recreation, i.e. tourism, leisure, and education. A network of Natura 2000 areas is the complex European environmental network created in Europe to preserve endangered natural biotopes and species. In Poland, this form of protection was introduced in 2004. These spaces are planned to cover about 15–20 % of the country's area. The network stipulates the establishment of a system of spaces connected by environmental corridors, i.e. landscape elements, which contribute to migration, spread, and exchange of the genetic fund of species. The network aims to preserve biodiversity by protecting both the most valuable and rare nature elements and the most typical and common natural systems peculiar to biogeographical areas [26]. Therefore, such natural capital preservation objects are the “business card” of territorial communities, and in the future, they will

become the ground for the marketing strategy of their development and positive territorial image promotion.

5. Conclusions

The value of the proposed studies lies in a multidisciplinary approach to the substantiation of indicators of socio-environmental and economic safety of the TCs based on the approaches of modern economic theory with an in-depth analysis of their compliance with international standards of accounting and financial reporting, which, unlike the existing ones, take into account the formation of an information environment in fuzzy logic. The value of the study results lies in the improvement of the concept of sustainable development and the application of tools of "green" economy, which is the basis for a new strategy for the preservation and reproduction of natural capital, increasing the level of socio-environmental and economic security of territorial communities, their favorable socio-economic development based on the intellectualization of local economies. The theories of biodiversity conservation known to world science will be supplemented with new concepts and theories, taking into account the economic value of the natural reserve fund, assimilation functions of natural capital, and the level of economic, environmental, and social security of local communities.

The authors conclude that the natural capital preservation objects (nature reserve fund areas and objects) are the "business card" of territorial communities, and in the future, they will become the ground for the marketing strategy of their development and positive territorial image promotion. As the data in the Table shows, the natural capital is preserved in a range of nature reserve areas and objects. Most of them are nature landmarks both in Poland and Ukraine, although the largest area in Ukraine is covered by protected landscapes – 1.39 million ha and in Poland – 6.9 million ha, respectively, i.e. five times more. Overall, the nature reserve fund of Poland covers over 10 million ha, which is twice more than in Ukraine. Therefore, Ukraine should develop the national nature parks network as the major component of the natural capital protection system.

The research detects an interdependence between budget funding of territorial communities and their population. The verification model's results indicated the adequacy of the model to statistics and the existence of a close linear relationship between its variables, as well as the significance of the model as a whole and its parameters. The correlation coefficient is close to 1.0 and is 0.93. This means that 93% of the change in the annual funding rate of a territorial community depends on the population of that community and not on the available natural resources as a natural resource.

The unstable financial and economic situation of Ukraine and the tense military and political situations of the country are the major risks to the Ukrainian economy. However, the need for systematic research aimed at ensuring the transparency of information provided to public authorities at the level of Ukraine and the international community is maximally connected with the need for close cooperation with international financial organizations, among the requirements of which are transparency of budget indicators and comparability of environmental, economic and information security indicators. However, even within our state, the distortion of information flows does not allow making the right decisions in the implementation of budgetary and financial policy. In addition, the financing of measures to preserve natural capital is carried out from the state budget based on a residual principle. All this brings certain risks and the need to find new ways to finance nature protection. That is why the justification of the new methodology for calculating the norms for the distribution of financial resources in the preservation of natural capital between the different levels of the budget system and the effective functioning of the TCs based on the intellectualization of their development for a reliable assessment of the integral level of the components of national security of the state are among the important tasks in today's conditions of military and political instability, climate change, and the spread of coronavirus infection (delta virus, omicron, deltacon, etc.).

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