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THE GROWTH OF ILLEGAL CONSTRUCTION IN THE COASTAL PROTECTIVE STRIPS OF THE STRYI RIVER BASIN

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Currently, there is of today, there is practically no information about the current state and land use of coastal protection strips (CPS) and water protection zones in the Stryi river basin. This creates many misunderstandings and abuses during their use and leads to intensive degradation of the ecosystem of both this and other rivers of the Dniester basin into which it flows.

Using the Google Earth Pro program, an assessment of the CPS structure in the Stryi River basin was carried out by comparing space images for the past 14 years. The analysis showed that illegal construction within the CPS of the river began after 2009, which creates the danger of possible inundation during floods and the development of erosion processes. This is also a threat to the hydroecosystem of the Stryi River, due to the settlement load on the floodplain, as well as non-compliance with sanitary standards and clogging with household waste.

Key words: coastal protection strips; water protection zones; territorial erosion; exogenous processes; settlement load; anthropogenic transformations.

Introduction

EU member countries individually determine the complex of environmental legislation that is necessary for the preservation of water resources, ecological balance and sustainable development of coastal areas. Each of the countries independently chooses ways to solve this problem, the only important thing is to achieve a positive result. One of the ways to achieve the goals for the preservation and restoration of water resources in Ukraine is the formation of buffer water protection zones and coastal protection strips (CPS) around rivers and reservoirs. The requirements for the establishment of both of these limits, as well as the limitation of economic activity regimes on them, are defined in the Water and Land Codes of Ukraine, the Law on Land Management, Resolution of the Cabinet of Ministers of Ukraine No. 486, as well as in other by-laws and regulatory documents (Kozytskyi, Shevchuk and Shevchenko, 2015; Trotska, Cherkashyna and Sokolova, 2023).

In contrast to the boundaries of water protection zones, the determination of the boundaries of coastal protection strips in the Water Code is provided automatically within fixed limits, depending on the catchment area, the area of reservoirs and the steepness of the adjacent slopes. Article 89 of the Water Code of Ukraine (WCU) states that a regime of limited economic activity is established within the CPS, according to which the construction of any structures, except hydrotechnical, hydrometric and linear, is prohibited. The provisions of the WCU are mandatory norms and there are no reasons for their ambiguous interpretation regarding the determination of the width of the CPS and the possibility of their development outside the boundaries of settlements, as well as existing industrial enterprises (Kozytskyi et al., 2015; Trotska et al., 2023).

According to the Water and Land Codes of Ukraine, for small rivers, brooks and streams, as well as ponds with an area of less than 3 hectares, the width of the CPS is 25 meters, and for medium rivers (which includes the Stryi River), reservoirs on them and ponds with an area of more than 3 hectares CPS should be at least 50 m. If the slope is more than 3°, the minimum width of CPS is doubled. If the river in

a certain area has several branches or tributaries, CPS is installed on both banks of the river from the extreme branches. Coastal slopes with a steepness of more than 5°, regardless of the vegetation on them, belong to the territory of erosive activity, including ravines, gullies and runoff basins and belong to CPS (Hryb O. M., 2020; Kravchuk, 2021; Yusypenko, 2021).

Within the boundaries of settlements, the coastal protection strip is established taking into account urban planning documentation for individual land management projects. The water protection zone includes the floodplain of the river, the first floodplain terrace, banks and steep slopes of the banks, as well as adjacent arroyos and ravines. However, despite the fact that CPS land plots can be provided for use only for the purposes defined by the Water Code of Ukraine, there are frequent cases of its violation. In particular, in the land use of the mountainous part of Lviv region, the problem of establishing water protection zones and CPS due to the lack of necessary land management documentation is relevant. One of the main reasons for this is the difference between modern legislation and that which existed in the last century, at the time these land plots were provided for use. Therefore, CPS in some household instead of 25 meters, according to current regulations, is 3–5 meters, which is a violation. This was also facilitated by the typical features of the location of villages near the banks of rivers and in low relief, especially in mountainous areas (Ryabets, 2018; Lukyanchuk and Hnativ, 2023).

The purpose of the work is to analyze the changes in the state of coastal protection strips in the Stryi river basin, which occurred as a result of anthropogenic transformations using topographic maps of various scales and satellite images.

Analysis of the trend of the use of coastal protection strips in the Stryi river basin for illegal construction after the adoption of the Law of Ukraine dated 2.12.2010 “On Amendments to the Water and Land Codes of Ukraine on Coastal Protection Strips”.

Materials and Methods

The slopes of the Carpathians and their foothills are cut by the right tributaries of the Dniester (Bystrytsia, Strvyaz, Stryi, Limnytsia, etc.). The mountainous and foothill part occupies only 9 % of the total area of the basin. The Carpathian Upland is a ridge-hilly plain with low depressions. It is divided by river valleys into separate elongated plateaus with a height of 300–400 m. The rather long length of the Dniester River causes noticeable differences in the climatic characteristics of its basin. The Carpathians and the Volyn Upland play a major role in shaping the climate of the upper and middle Dniester. The upper part of the basin is located at the junction of the East European Plain, the Ukrainian Carpathians and the Prykarpattia. The mountainous part of the basin is characterized by a low background of air temperature and high humidity, and the southern regions belong to the Black Sea climatic subregion. Winter here is usually mild, unstable and characterized by the change of frosty periods to thaws. The spring period is characterized by the gradual transformation of air masses of moderate latitudes into tropical ones, and cloudless and hot weather arrives in May. The annual change in absolute air humidity is synchronous with the annual change in air temperature. Its maximum was recorded in July, and its minimum in January. In the basin, there is a significant difference in the amount of atmospheric precipitation, which ranges from 1200 mm and more in the Carpathian part to 500 mm in the lower reaches (Fig. 1). (Dniester River Basin Management Plan (2025–2030). Project, 2021; Hnativ, Yakhno and Hnativ, 2023).

The works of such scientists as S. A. Dubnyak, I. N. Krynko, A. A. Korobka, M. M. Sakevycha, A. V. Yatsyk and others are devoted to the issues of rational use and protection of water resources in Ukraine, as well as the formation of water protection restrictions in the use of land. At the same time, critical analysis of existing approaches to the formation of water protection restrictions in land use is insufficient. Coastal Protection Strips lands are located closer to a body of water than other lands in the water protection zone and are the ones that are potentially being considered for development by interested parties.

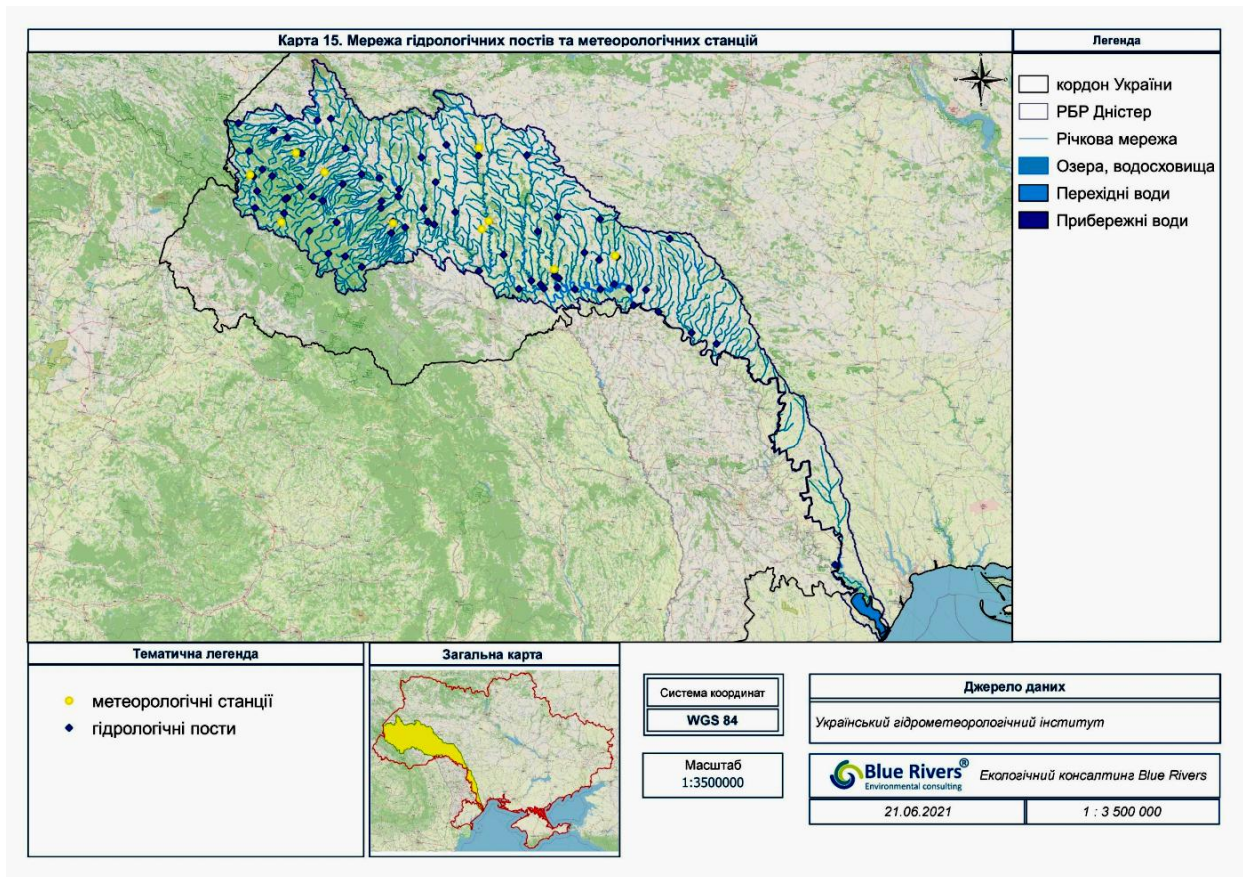


Fig. 1. The network of hydrological posts and meteorological stations in the Dniester River basin

However, the coastal protective strip is a nature conservation area with a regime of limited economic activity. The coastal protective strip prevents the destruction of aquatic ecological systems, landslides, erosion, and the appearance of unreasonable construction (Dubnyak, 2021; Yatsyk, 2003; Yatsyk, 2004; Hnativ et al., 2023; Alves et al., 2020; Angnuureng et al., 2023).

Results and discussion

The analysis of space images from various times over the last decades shows the large scale of construction of the CPS, especially the banks of the Dnieper, Desna, Kozinka, Irpin, etc., as well as the sea coast. The analysis of cadastral maps confirms that the leased plots are located not only within the CPS and islands, but also within the water areas of the rivers themselves, obviously with the prospect of their washing and further development (Kozytskyi et al., 2015; Trotska, et al., 2023).

The water permeability of sod-podzol-glazed soils of Precarpathia is 3–6 times lower on agro-developed lands than on forest soils. The forest cover is able to significantly reduce the harmful slope runoff of water. However, during anthropogenic activity, the forest cover of Precarpathia was transformed into field land, which created the prerequisites for an increase in the level of erosion danger. The presence of a significant number of erosion-dangerous slopes with a steepness of more than 10° , as well as excessive atmospheric moisture (about 740–930 mm of precipitation per year) with significant plowing of the territory in combination with low forest cover, cause the intensification of erosion processes due to surface water runoff. 12 % of the total area of the Precarpathian region and 23 % of agricultural land are subject to these processes (Ryabets, 2018; Lukyanchuk and Hnativ, 2023).

The rapid growth of floods, the formation of landslides and destructive mudflows are facilitated by the hydrogeological features of the region. Half of the areas of the Carpathian slopes are affected by landslide processes, and 70 % of mountain catchments are subject to mudslides of varying intensity. At the same time, the regime of coastal protective strips is violated almost everywhere, no measures are

taken in accordance with environmental protection programs regarding their planting and afforestation. This additionally increases the activity of surface runoff, increases water erosion and siltation of riverbeds and sources that feed them (Hnativ et al., 2023; Sai, 2008; Hnativ et al., 2022).

In order to reduce the danger of the development of exogenous processes and create a favorable regime on rivers, it is important to establish along rivers, including small rivers, coastal protection strips, and also to take appropriate anti-erosion measures in areas with increased risk.

There is practically no information on the current state and land use of coastal protection strips (CPS) and water protection zones in the Stryi river basin today, which creates many misunderstandings and abuses during their use and leads to intensive degradation of the ecosystem of both this and other rivers of the river basin Dniester, into which it flows. Topographic maps of various scales, satellite images of this area were used to determine the current state of the CPS in the Stryi river basin, which occurred as a result of anthropogenic transformations (Hryb, 2020; Kravchuk, 2021; Yusypenko et al., 2021; Ryasnyanska et al., 2023).

Among the modern methods of researching the condition of CPS, one of the most effective is the method based on the use of remote sensing data of the Earth. The use of this method is relevant if it is difficult and expensive to carry out regular field research. The assessment of the CPS structure in the river basin was carried out by comparing space images for the last 14 years (from 2009 to 2024) using the Google Earth Pro program. After analyzing satellite images of the territory near the city of Turka, Lviv region, for different years, significant CPS violations were found. In particular, the placement of households with residential and commercial buildings too close to the flow of the Stryi River, the closest of which is only 13.32 meters from the water's edge (Fig. 2, 3).

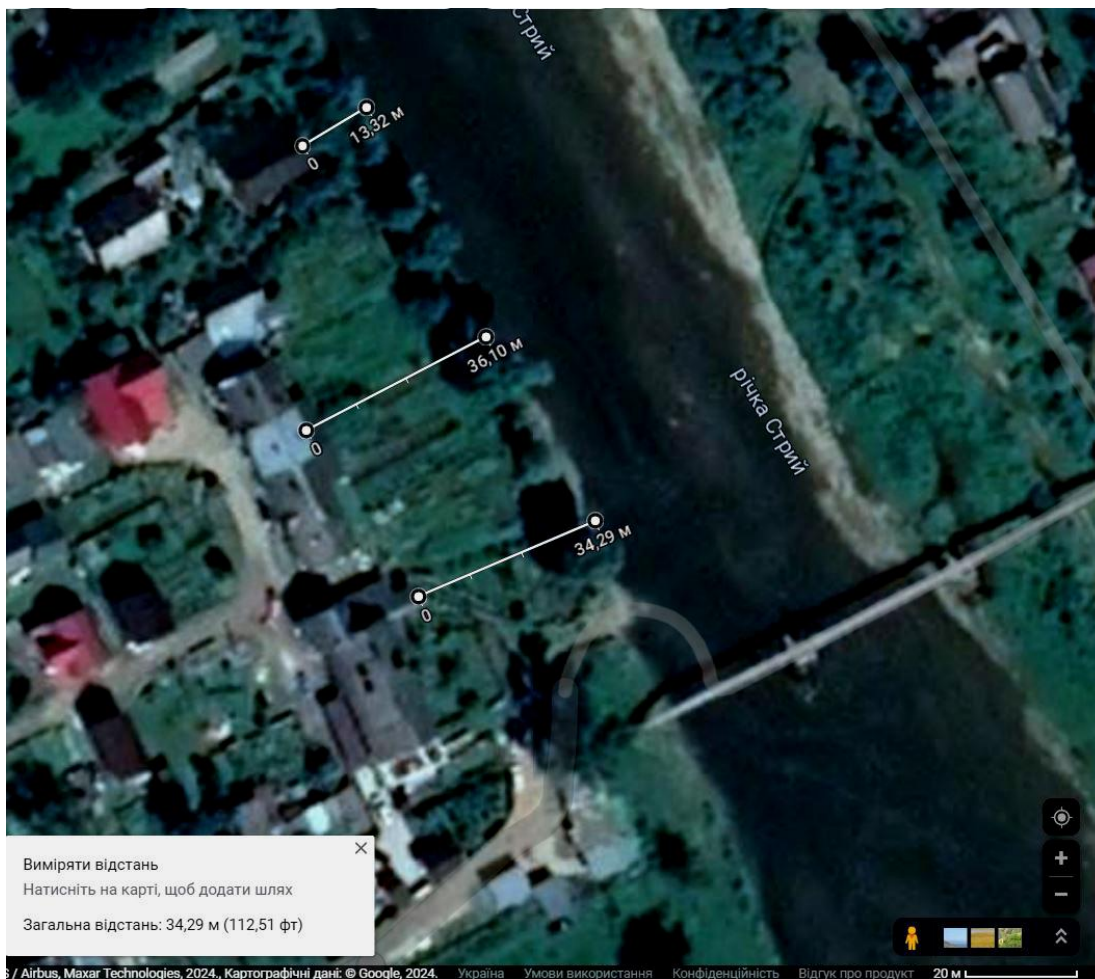


Fig. 2. Detected CPS violations are shown on satellite images of the coastal area north of the Central District Hospital of the city of Turka

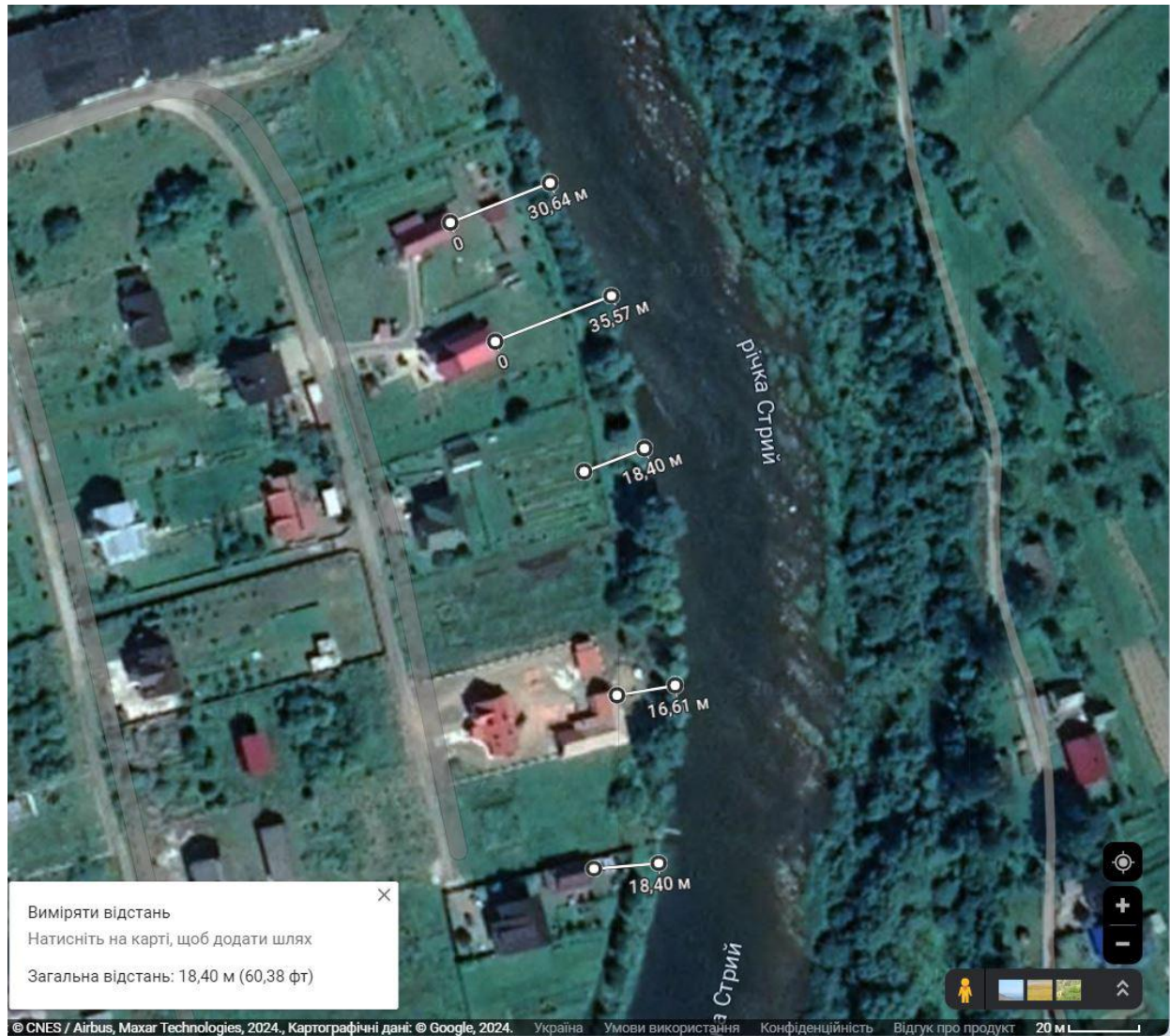


Fig. 3. Detected CPS violations are shown on satellite images of the coastal area south of the Central District Hospital of the city of Turka

The problem of establishing the boundaries of the CPS became even more acute in connection with the adoption of the Law of Ukraine dated 2.12.2010 No. 2740-VI “On Amendments to the Water and Land Codes of Ukraine on Coastal Protection Strips”. The law amended Article 88 of the Civil Code and Article 60 of the Civil Code, according to which the CPS limits of all water bodies, without exception, must be established according to separate land management projects developed in accordance with the law. In accordance with the requirements of the Law of Ukraine “On Land Management”, the order of organization, state standards, norms and rules for the implementation of land management works, their composition and content are established by normative legal acts on the implementation of land management (Kozytskyi et al., 2015; Trotska et al., 2023; Kulikov et al., 2021).

As can be seen from Fig. 4, it was after 2009 that illegal construction began within the CPS of the river, which creates the danger of possible flooding during floods and the development of erosion processes. From satellite images of the area Fig. 5 shows that construction on the territory of these households continued to expand in 2020. This is also a threat to the hydroecosystem of the Stryi River, due to the settlement load on the floodplain, as well as non-compliance with sanitary standards and clogging with household waste.



Fig. 4. Dynamics of illegal construction near the city of Turka, Lviv region in 2009–2012



Fig. 5. Dynamics of illegal construction near the city of Turka, Lviv region in 2017–2020

Conclusions

The literature review showed that, as of today, there is practically no information about the current state and land use of coastal protection strips (CCS) and water protection zones in the Stryi river basin. This creates many misunderstandings and abuses during their use and leads to intensive degradation of the ecosystem of both this and other rivers of the Dniester basin into which it flows. Topographic maps of various scales and satellite images of the given territory were used to determine the current state of the CPS in the Stryi river basin, which occurred as a result of anthropogenic transformations.

Using the Google Earth Pro program, an assessment of the CPS structure in the Stryi River basin was carried out by comparing space images for the last 14 years (from 2009 to 2024). After analyzing satellite images of the territory near the city of Turka, Lviv region, for different years. As a result, significant CPS violations were revealed, in particular, the placement of households with residential and commercial buildings too close to the flow of the Stryi River, the closest of which is only 13.32 meters from the water's edge.

The analysis showed that illegal construction within the CPS of the river began after 2009, which creates the danger of possible inundation during floods and the development of erosion processes. This is also a threat to the hydroecosystem of the Stryi River, due to the settlement load on the floodplain, as well as non-compliance with sanitary standards and clogging with household waste.

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ЗРОСТАННЯ НЕЗАКОННОГО БУДІВНИЦТВА У ПРИБЕРЕЖНИХ ЗАХИСНИХ СМУГАХ БАСЕЙНУ Р. СТРИЙ

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Одним зі способів досягнення цілей для збереження та відновлення водних ресурсів в Україні є утворення навколо річок, водойм буферних водоохоронних зон і прибережних захисних смуг. На відміну від меж водоохоронних зон, визначення меж прибережних захисних смуг у Водному кодексі передбачено автоматично, у фіксованих межах, залежно від площі водозбору, площі водойм та крутизни прилеглих схилів. Для зменшення небезпеки розвитку екзогенних процесів та створення сприятливого режиму на річках важливо встановити вздовж річок, зокрема малих, прибережні захисні смуги, а також вживати належні протиерозійні заходи на ділянках із підвищеним ризиком.

Сьогодні практично немає інформації про теперішній стан та використання земель прибережних захисних смуг (ПЗС) і водоохоронних зон у басейні річки Стрий. Це створює багато непорозумінь та зловживань під час їх використання та призводить до інтенсивної деградації екосистеми як цієї, так і інших річок басейну річки Дністер, до якого вона впадає. Для визначення сучасного стану ПЗС у басейні р. Стрий, які відбулися унаслідок антропогенних перетворень, використано топографічні карти різних масштабів та супутникові знімки цієї території.

Використовуючи програму Google Earth Pro, ми оцінили структуру ПЗС у басейні річки Стрий, порівнявши космічні знімки за останні 14 років. Аналіз показав, що незаконне будівництво в межах ПЗС річки розпочалось після 2009 р., що створює небезпеку ймовірного підтоплення під час повені та розвитку ерозійних процесів. Це є загрозою й для гідроекосистеми р. Стрий, внаслідок селітебного навантаження на заплаву територію, а також недотримання санітарних норм та засмічення побутовими відходами.

Ключові слова: прибережні захисні смуги; водоохоронні зони; ерозія територій; екзогенні процеси; селітебне навантаження; антропогенні перетворення.