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Possibilities and prospects for the recovery and sustainable development of the urbanised areas of east Ukraine

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Abstract:
The aim of the study is to comprehensively investigate the urgent problem of the future restoration of urbanised areas in eastern Ukraine - to analyse the perspectives and possibilities of restoring the territories after large-scale destruction caused by the war, and to change the post-war functional purpose of the regions. The war has caused dramatic socio-demographic and economic consequences, changed the urban-planning parameters of regional formations, destroyed single-industry settlements, and raised questions about their recovery. The uncertainty in the initial conditions for reconstructing destroyed cities will require decisions to meet the population's needs. Human potential and the demographic situation are important factors in the recovery process – motivating people to return will require creating favourable living conditions, including the reconstruction of housing, the restoration of social infrastructure, and the development of economic activity. At the level of regional planning, for urbanised areas, functional changes will require corresponding changes in form – optimisation of the settlement system, taking into account population decline and infrastructure degradation, and development of infrastructure to protect the population.

Keywords:
territorial planning, urbanised territories, urban reconstruction, conceptual decisions on urban reconstruction, transformation of territorial units

1. Introduction

While the title of this study refers to Eastern Ukraine – a macro-region encompassing the Kharkiv, Donetsk, and Luhansk regions – it is crucial to distinguish among their developmental models. The Kharkiv region has historically followed a polarisation-diffusion model based on central functions (science, education, and diversified services), acting as a strong growth pole. In contrast, the Donbas region represents a classic example of an area based on specialised functions (mining, heavy industry). Therefore, the specific analysis and conclusions presented herein concentrate on the challenges of the Donetsk and Luhansk regions, where the destruction of the mono-functional economic base requires a radically different reconstruction strategy compared to multi-functional metropolitan centres.

The Ukrainian Donbas, as a region, is located within the Luhansk and Donetsk regions. It can be classified as an old industrial region, traditionally founded on the coal and metallurgical complex. The regions are highly urbanised, with the urban population constituting nearly 90% as of early 2014. The central parts of these regions form a network of urban agglomerations connected by infrastructure, transport, and economic ties. As of the beginning of 2014, the population of the Donetsk and Luhansk regions reached over 6.6 million, which collectively exceeds that of certain small European countries.

In 2014, an armed conflict broke out in these regions. With the direct participation of the Russian Federation, this led to the hybrid occupation of parts of the territories and the artificial severing of the region's territorial and economic complex. At that time, the Ukrainian Donbas was in a deep crisis due to the contraction of its industrial base. Characteristic problems of the region included excessive ecological overloading of the territories, obsolete industrial-era technologies, the decline and contraction of the urban development base, and a decline in the working-age population. The deformed social and national structure of the population, the lumpenization of the populace, regional proximity to the border with the Russian Federation, and the weakness of the central government led to the hybrid invasion.

The most active combat operations took place during 2014-2015. Ukraine declared an Anti-Terrorist Operation (ATO), which covered the territory of the Luhansk and Donetsk regions; in 2018, it was replaced by the Joint Forces Operation (JFO). The uniqueness of the situation lay in the fact that the conflict zone was an urbanised territory where the contact line dissected the two regions of the Donbas, running along the boundaries of major agglomerations and natural barriers, and blocking several highways and railways of state importance.

The armed conflict has shaped a new political and economic reality. The urban planning situation in the regions has changed radically; the conditions and factors determining the state of the

engineering and planning organisations of the Luhansk and Donetsk regions have shifted, and a border zone has effectively formed in the east.

The development of the controlled parts of the eastern urbanised regions of the Luhansk and Donetsk regions in the period preceding 2022 was based on the assumption of stabilisation of the situation and prevention of the resumption of large-scale hostilities – preservation of the status quo [1]. The relative stabilisation of the situation enabled Ukraine to formulate the general policy framework regarding the peaceful reintegration of the temporarily uncontrolled territories of the Luhansk and Donetsk regions. Emphasis was placed on the humanitarian preservation of the region, the fulfilment of the state's social obligations, the promotion of peaceful educational initiatives, and the implementation of extensive support programs for the civilian population and Internally Displaced Persons (IDPs). A pessimistic scenario – a full-scale invasion and resumption of hostilities – was considered as a conditionally possible option in the region's development programmes. The national policy was based on the concept of sustainable, advanced regional development, which could ultimately ensure the processes and procedures for regaining Ukrainian control over the entire territory of these regions.

1.1 Analysis of post-conflict reconstruction

The events of 2014-2015 marked a shift in the scale of the Russian Federation's aggression across a series of border conflicts it instigated within the post-Soviet space. In effect, a combat front was opened using heavy weaponry across highly urbanised territories spanning hundreds of kilometres. Since World War II, the European continent has not encountered a war of such magnitude, particularly in terms of the extent of destruction. The local conflicts in the Balkans were characterised by lower-scale frontline engagement. Countries in the Middle East – specifically Syria, Lebanon, Libya, and Iraq – suffer from combat operations due to permanent political instability, with certain cities undergoing near-total destruction. However, this region has distinct characteristics: climatic, geographic, and urban.

An analysis of numerous cases of post-war recovery worldwide [2-8] demonstrates that, alongside successful examples, there are ample failures. Direct replication of successful recovery models is not immediately applicable; there are no simple recipes for success.

A specific scientific discourse has emerged in this direction, defining the following key points:

- Restoration to the pre-war state is often impossible due to the scale factor. In certain cities and territories, changes in function and form have reached a critical limit.
- The uncertain political nature of relations with the aggressor country in the post-war period is formulated as a separate issue.
- The demographic crisis in the country has acquired a special status and is undeniably a factor in post-war recovery.
- There is a noted need for large-scale donor, grant, and international assistance, without which Ukraine will not have the capacity to recover on its own.
- A separate problem is the lack of updated, modern urban planning documentation defining strategic directions for the development of cities and administrative-territorial communities.
- Accumulated experience emphasises that the absence of sustainable post-war recovery and socio-economic development leads to the reproduction of catastrophic phenomena and the provocation of new armed conflicts. Thus, sustainable development is one of the main foundations for preventing the recurrence of military conflicts.

1.2 Problem statement

The full-scale military aggression and the rapid advance of the invading troops, among other things, demonstrated that the concept of urban development in the period 2014-2022 did not meet the possibilities of the threat of external invasion, which requires a separate analysis and revision of the principles of urban, territorial and regional development. There is an urgent need to formulate recommendations and proposals for the areas of regional recovery, which should undergo significant changes and additions that take into account the consequences of the invasion as a potential future threat.

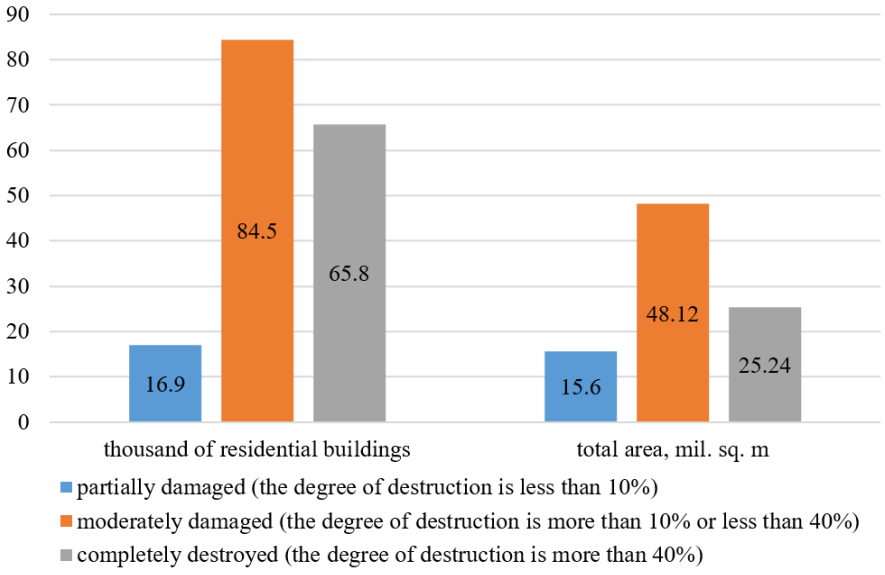

Fig. 1. Degree of destruction of the housing stock in the most affected regions of Ukraine as of 01.01.2024. Source: [10]

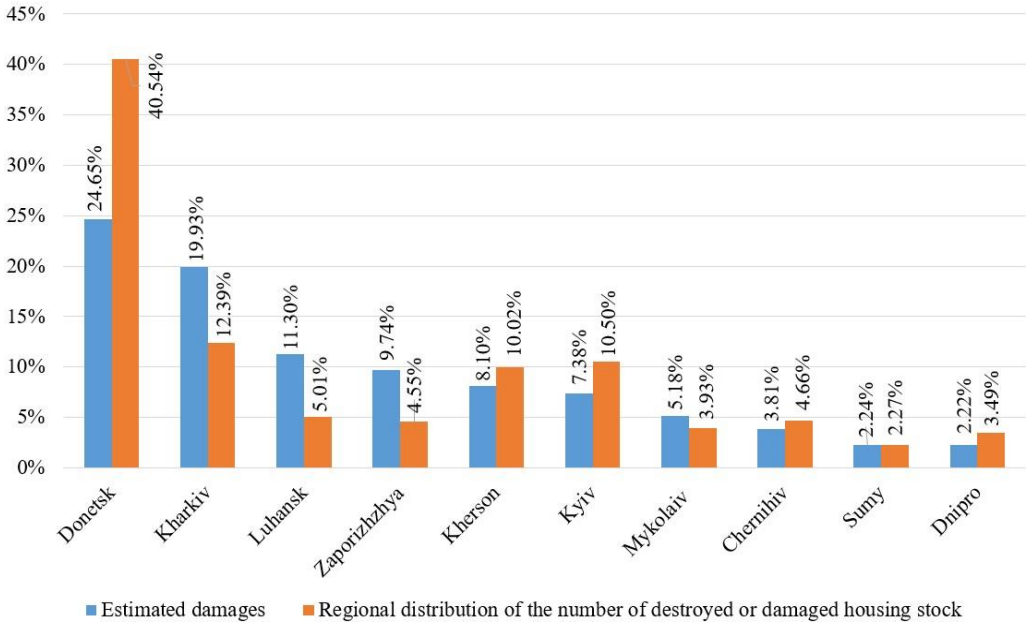

Fig. 2. Share of destroyed and damaged housing stock in the most affected regions of Ukraine as of 01.01.2024. Source: [10]

As of November 2024, experts at the Kyiv School of Economics estimate the total amount of direct, documented losses at $169.8 billion. The war continues, and the destruction continues, leading to an increase in the total amount of losses. Of the total direct losses, approximately 35.3% are attributable to the housing stock, i.e. 236,000 housing objects were destroyed or damaged as a result of the hostilities, of which 88.6% are private houses and 11.4% are multi-storey residential buildings. The total area of damaged or destroyed buildings is approximately 9% of Ukraine's housing stock [9].

A distribution by damage and degree of destruction shows that only 1/10 of all damaged buildings have minor damage (Fig. 1). Donetsk, Kharkiv and Luhansk regions are among the most affected regions with the greatest damage to the housing stock, accounting for almost 60% of the destroyed or damaged housing stock (Fig. 2).

The war caused significant socio-demographic and economic consequences, changed the urban planning parameters of regional formations, and destroyed single-sector settlements, which raises the question of their restoration. The issue of a comprehensive study of the future recovery of urbanised areas in eastern Ukraine – analysing the prospects and possibilities for restoring the territories after the large-scale destruction caused by the war and changing the post-war functional purpose of the regions – is an urgent problem.

2. Materials and methods

The study employs a multi-level, interdisciplinary approach, combined with specific urban-planning and spatial-analysis techniques, to assess the destruction and recovery potential of the urbanised areas of eastern Ukraine. The methodological framework comprises three key components: data sources, research methods, and applied techniques. The study is based on official statistical data on the resident population of the Luhansk region for the period 2014-2022. Estimates of direct infrastructure losses and housing stock destruction were derived from analytical reports and regional administration data. To assess the functional state of agglomerations during active hostilities (2022-2025), when direct statistical reporting was unavailable, satellite-based night-time light (light pollution) data were used.

Systemic analysis was applied to consider the Lysychansk-Sievierodonetsk-Rubizhne agglomeration not as separate settlements, but as a single functional territorial entity. This approach allowed us to identify shared infrastructure constraints and propose a unified transport and functional framework for recovery.

Retrospective and comparative analyses were used to compare the level of socio-economic activity (via light pollution intensity) across three periods: pre-conflict (2013), hybrid conflict (2014-2021), and full-scale invasion (2022-2025).

GIS tools were used to process satellite imagery of night-time radiance. This allowed us to visualise and quantify the urban activity of the eastern regions, determining the extent of functional degradation in the Lysychansk-Sievierodonetsk-Rubizhne agglomeration, where physical access for data collection is impossible. Based on satellite imagery analysis and damage reports, a density map of destruction for the city of Sievierodonetsk was generated. This zoning technique enabled the differentiation of territories into areas requiring total dismantling (sanitary zones) and areas suitable for reconstruction/modernisation.

3. Research results

The hostilities continue, and the more intense and prolonged they are in a certain territory, the greater the scale of destruction, which will directly affect the process, duration, and feasibility of restoring the territory.

International experience shows that after the end of large-scale conflicts, post-war reconstruction extends beyond the physical destruction [11-13]. To a large extent, the strategy and directions of development are determined by the conditions and scale of the consequences of hostilities. For urbanised areas, due to the particular complexity of their systems, the consequences of war can be extraordinary [14].

For example, after the First World War, the so-called ‘red zone’ [15] exists in the north-east of France, where the territory was so destroyed that it was declared unfit for human habitation and any activity, due to both environmental pollution and a large number of unexploded ordnances. Not only were cities and villages destroyed, but also entire landscapes. After the war, the government bought up land that could not be restored, and

1200 km^2 of French territory was included in the red zone. Today, this territory has been reduced to 100 km^2 [16]. According to various estimates, the return of these lands to economic activity will take more than one century. In total, the hostilities of the First World War destroyed 7% of France's territory, or more than 33,000 km^2, which is over 25% of the area of the entire Luhansk region.

The state of Donbas is clearly characterised by changes in the level of light pollution in the region (Figs 3-6) in the periods that respectively preceded the outbreak of the conflict in Donbas in 2014 and the start of a full-scale war in 2022. A striking example is the only agglomeration of the cities of Lysychansk, Sievierodonetsk, and Rubizhne, which was controlled until 2022 and, since 2022, after the end of intense hostilities within its borders, has plunged into darkness (Fig. 7), indicating the absence of most of the functions of the agglomeration's cities and significant destruction of infrastructure.

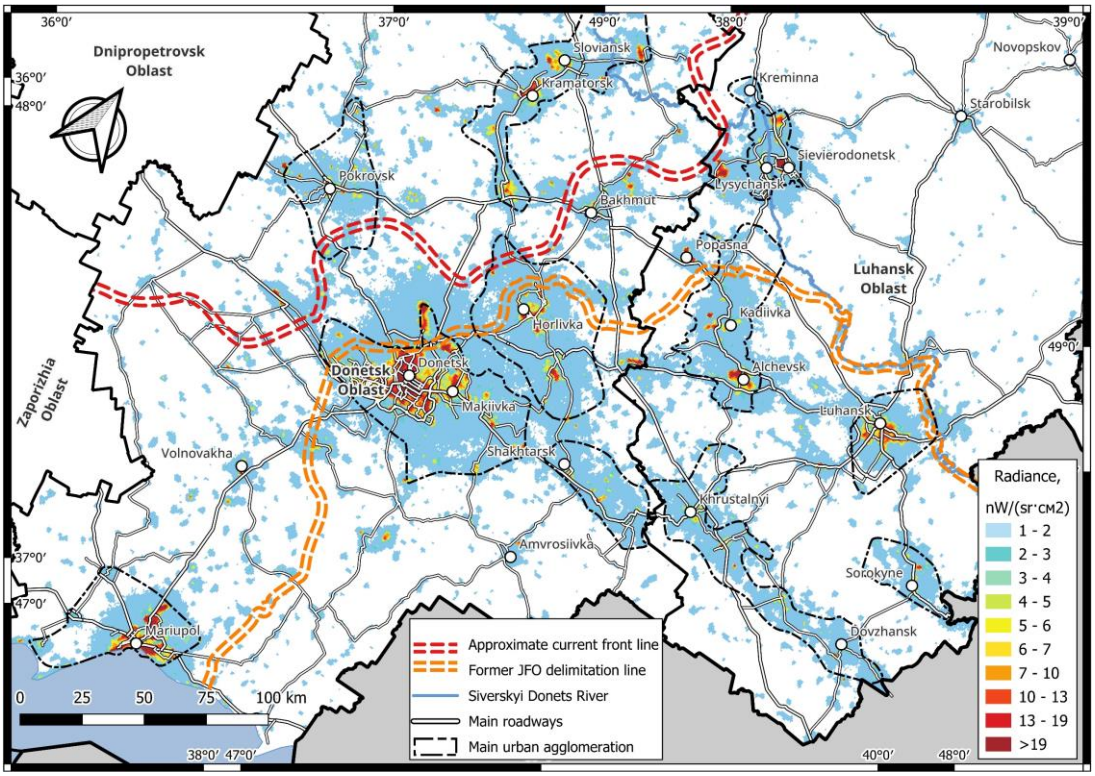

Fig. 3. Light pollution in urbanised areas of the Donetsk and Luhansk regions before the conflict in 2013. Source: own study based on [18]

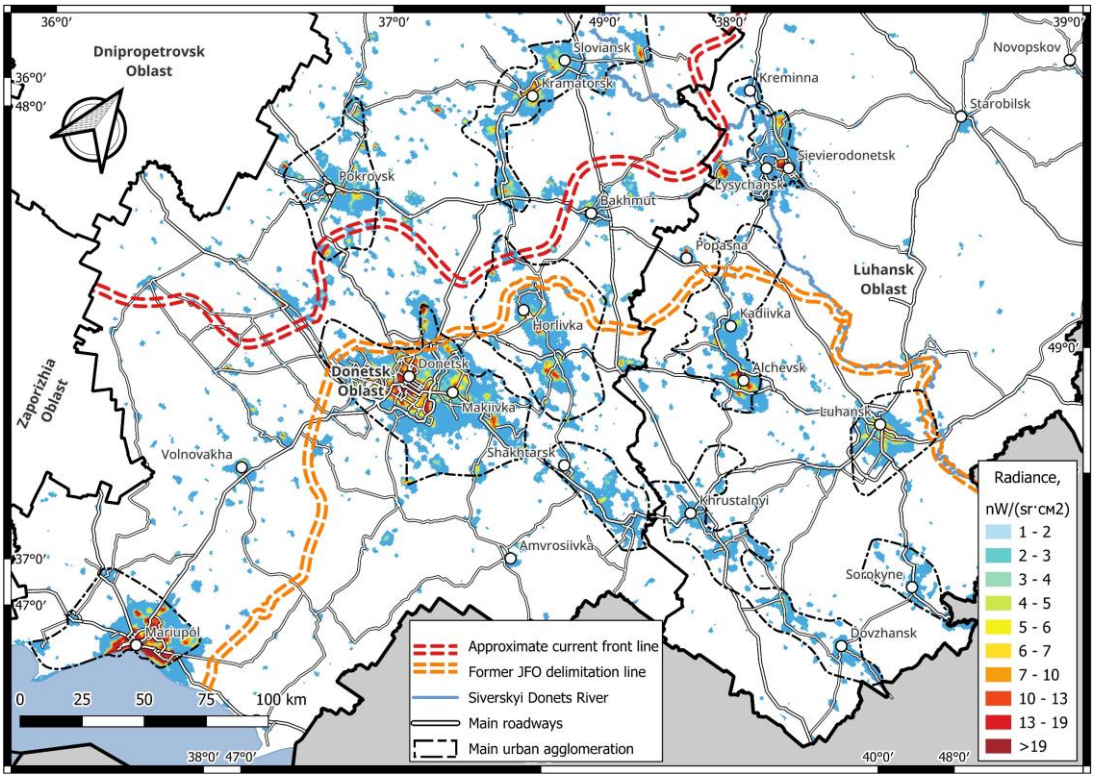

Fig. 4. Light pollution in urbanised areas of Donetsk and Luhansk regions before the full-scale invasion in 2021. Source: own study based on [18]

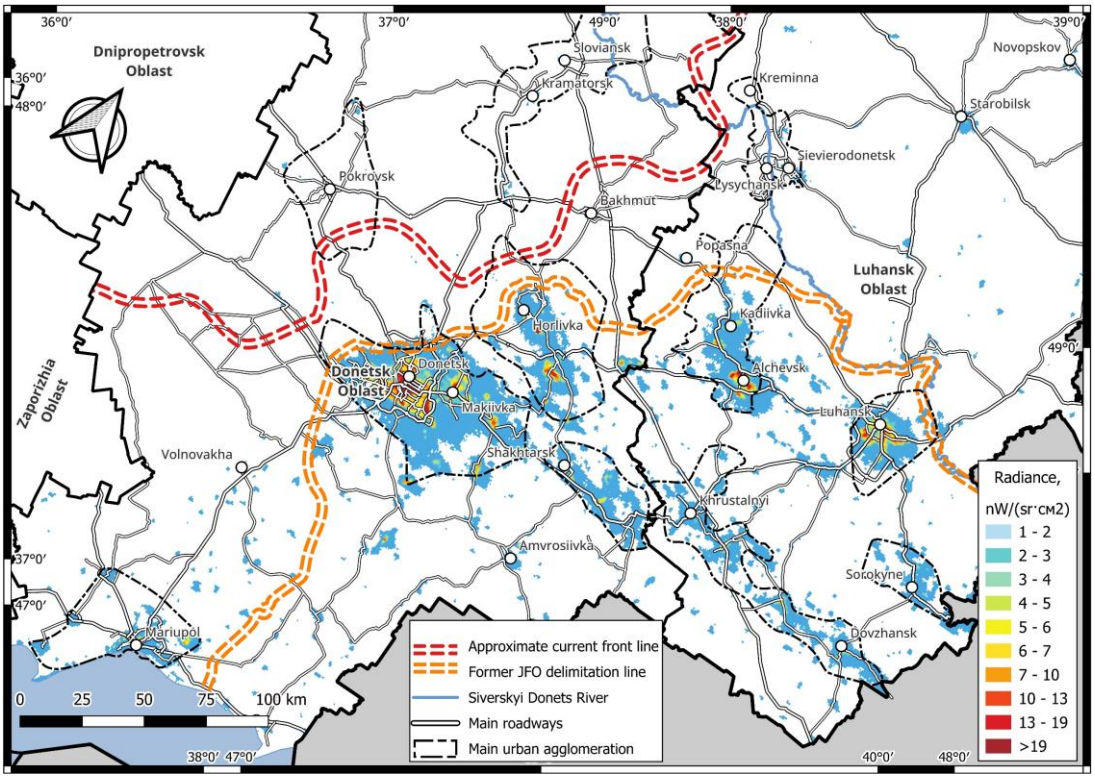

Fig. 5. Light pollution in urbanised areas of the Donetsk and Luhansk regions in 2022. Source: own study based on [18]

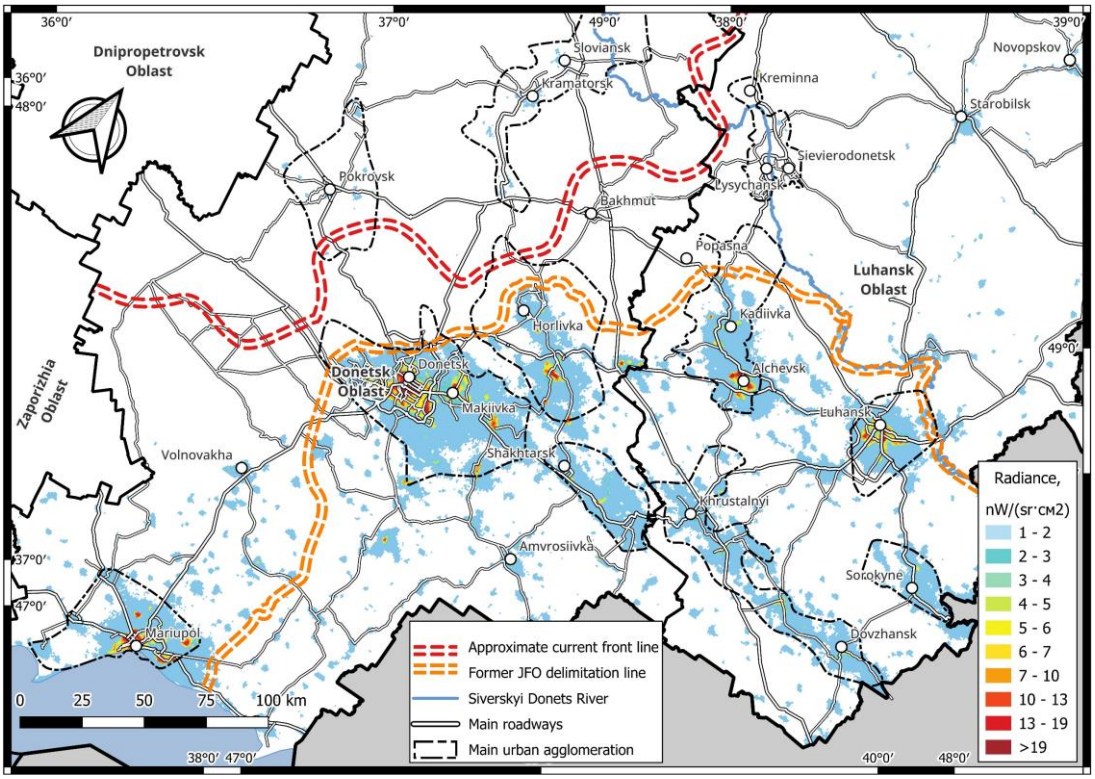

Fig. 6. Light pollution in urbanised areas of the Donetsk and Luhansk regions in 2023. Source: own study based on [18]

Thus, the war of 2022 has dramatically changed the situation and context for the restoration of the eastern regions in terms of their sustainable development – interim conclusions indicate that the situation is much worse after the end of hostilities. This applies to the scale and nature of the destruction, as well as the political, social and humanitarian situation. The situation has been further complicated by the spread of hostilities to other border and inland regions with the corresponding consequences.

The ATO/JFO line of contact was replaced by a full-scale frontline that shifted dynamically throughout 2022-2023, engulfing larger and larger territories. A significant portion of Ukraine's territory came under occupation. Active combat operations resulted in the near-total destruction of the existing built-up areas of settlements. Engineering infrastructure suffered massive damage. There was a mass exodus of the population from the territories traversed by the advancing frontline and subject to active hostilities. According to estimates by the

General Staff of the Armed Forces of Ukraine, the active frontline spans more than 1000 km.

The end of hostilities will mark the rebuilding of cities, the restoration of territories, and the restoration of urban planning systems. Post-war reconstruction should aim to both restore pre-war economic activity and modernise it to support future development. The political decisions taken will shape the state's principles and strategy for the country's recovery. Regional recovery will be based on the overall recovery strategy. From a regional planning perspective, urban regeneration requires consideration of socio-economic needs, environmental constraints, resource capacities, and regional differences [17].

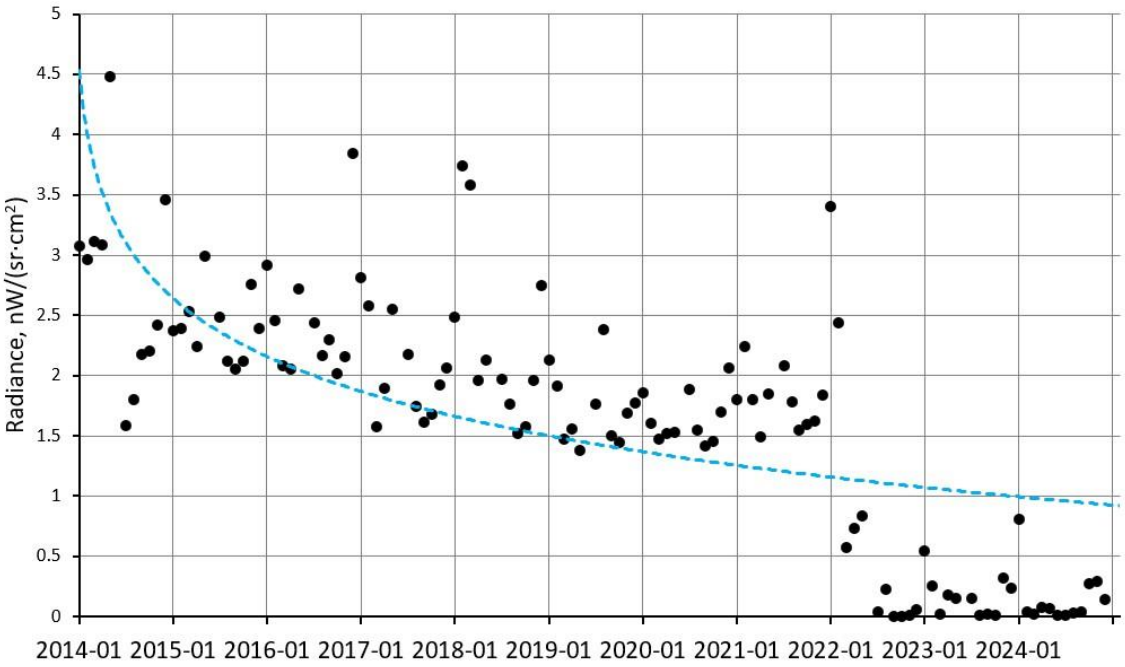

Fig. 7. Average radiance of the Lysychansk-Sievierodonetsk-Rubizhne agglomeration in the period 2014-2025 (coverage area - 381.68 km^2, centre of the coverage area at 38.4309E, 48.9640N). Source: own study based on [19]

Depending on the degree of urban environmental destruction, two main directions can be distinguished in the life cycle of a city: either it loses its functional significance or retains the ability to revive its lost potential [20]. In the second case, the recovery can be full or partial, which includes a corresponding return to pre-war or partial population and functional capacity.

An example is the scale of destruction of a fragment of the city of Popasna in the Luhansk region (Fig. 8), whose economy was mainly focused on railway transport and the coal industry, with a population of up to 20,000. Now the city is completely destroyed. The question arises: what should a programme for the reconstruction of a settlement look like, and is it even feasible to restore it? What functions are inherent in the city, and what can be done to ensure its development?

Fig. 8. Satellite image of the extent of destruction in a part of Popasna. Source: [21]

While individual buildings are completely destroyed and cannot be rebuilt, the supporting planning framework of the territories is less affected by the hostilities, which does not exclude the possibility of changing the scale and direction of communications. In a somewhat ironic sense, it should be noted that the Donbas's man-made problem is the waste heaps, which will survive the war better than anything else and preserve themselves for the future.

In making decisions on the restoration of the territories, there is a problem of determining the balance between the costs of restoring these territories and their further efficiency of use [14]. The question also arises: for whom are reconstruction measures being implemented? It should be understood that, in the case of restoring a settlement – its reconstruction – there will be a new economic model. Many of the destroyed settlements were monotowns, around a mine or other enterprise. Now these facilities have been completely destroyed, and their restoration is hardly possible.

Thus, it is unclear whether restoration is advisable at all, whether it is possible and to what extent, if the mine or enterprise around which the settlement was created is not restored. That is why, depending on the situation, a decision may be made to fully or partially restore or liquidate the settlement and reclaim the territory. The restoration of settlements depends on the impact of these processes on the country's overall reconstruction and on the development of the local and regional economy; i.e., the question arises as to what economic model will prevail in the case of settlement restoration.

A certain analogy can be drawn with the aftermath of the Chornobyl disaster, where a radical and sudden change in the regional situation actually occurred. The Exclusion Zone was created and operates outside the economic framework, based on key safety principles. A large part of the territory has been withdrawn from use, and people's residence and stay are strictly limited. At the same time, the zone remains under constant control, with a number of programmes developed to stabilise it, as well as specialised activities, construction works, and scientific research. Nevertheless, the Exclusion Zone remains unprofitable and requires significant expenditures. However, a balance is struck between minimising harmful effects and the costs of its maintenance.

Thus, if we assume the opposite, decisions about the territory will be made, as it will not disappear and will require them. Given the uncertainty of upstream conditions, this requires developing an urban planning justification that considers positive, negative, and intermediate options for the prospects of individual territorial entities and cities.

But in any case, this is a managerial, in some cases political decision, an issue that requires, among other things, proper legislative and staffing support for the specialists who will make the relevant decisions.

From a regulatory point of view, it should be noted that the Law of Ukraine 'On Regulation of Urban Development' [22] provides that a Comprehensive Restoration Programme for the region/territory of a territorial community be developed by the relevant executive authority's decision. The said Comprehensive Recovery Programme includes, in particular, the following information:

a) information on the technical feasibility, economic viability of restoring settlements, engineering and technical infrastructure;
b) information on the availability of urban planning documentation and its relevance; analysis of the territory's resources for restoring life;
c) information on the need to prepare the territory, namely demining, dismantling of destroyed buildings and structures, and land reclamation;
d) proposals for changing the functional purpose of certain areas, relocation of industrial facilities;
e) general approaches and proposals for comprehensive recovery and development of the region and measures for their implementation;
f) calculation of measures and sources of funding to ensure comprehensive recovery.

In accordance with the Law of Ukraine 'On the Principles of State Regional Policy' [23], the documents developed for the recovery and development of regions and territories include the 'Regional Recovery and Development Plan', which includes regional recovery plans, and the 'Territorial Community Recovery and Development Plan'. These documents should be in line with the region/territorial community's comprehensive recovery programme, if any.

In addition, according to the draft Law of Ukraine 'On the Principles of Restoration of Ukraine' [24], which is currently being developed and discussed, the procedure and criteria for recognising a settlement as destroyed or significantly damaged are determined by the Cabinet of Ministers of Ukraine, and such a question is raised by the relevant local council or the military-civilian administration of the settlement. To consider the issue of recognising a settlement as destroyed and significantly damaged, a Commission is established to review the materials submitted by the administrations of the settlements and make a relevant decision. Such materials may include comprehensive recovery programmes.

However, the draft Law of Ukraine 'On the Principles of Reconstruction of Ukraine' [25,26] does not define or outline such options as: full or partial reconstruction, or liquidation of the settlement with subsequent reclamation of the territory. In other words, the main criteria for determining the degree of settlement destruction, the indicators and methods for assessing them, and the decision-making process for assigning a settlement to a specific destruction category are not defined. The draft also notes that restoration can be carried out on a site-by-site basis, through the implementation of individual restoration projects, or through the comprehensive restoration of settlements, implemented as a set of restoration projects.

Thus, the existing legislation on post-war restoration of territories has already been formed to some extent, but the process of its development and harmonisation is still ongoing.

Key factors such as the socio-political situation, demographic changes, environmental conditions, economic circumstances, and others will influence the choice of conceptual solutions for the restoration of eastern cities. The uncertainty of the initial conditions dictates the need to make decisions based on fundamental principles.

The basic principles of the post-war restoration of urbanised areas remain focused on meeting the needs of the population [27]. Urban planning is based on indicators, the main of which is the population. If we consider the Luhansk region in 2014-2022, which was mainly an outsider in the ranking of socio-economic development of the regions of Ukraine, it was characterised by a general decrease in population and an increase in the demographic burden (Fig. 9). The war and its consequences will significantly worsen the human potential of the region, which can be used for recovery in the future.

The demographic situation must be taken into account in recovery planning. Identify whether to rebuild or, conversely, to

dispose of the destroyed infrastructure, as it may not be feasible to rebuild it on the same scale as before due to the reduced need.

There is a correlation between the conditions of revival – the extent of urban preservation – and the factors of revival – the able-bodied population. Last but not least, people determine whether recovery will take place – that is, one of the conditions for recovery is the presence of consumers of transformation. And vice versa, the restoration of normal urban activities and the reproduction of key urban functions will contribute to the absorption of the population.

Thus, the human factor, the demographic situation will not least determine the prospects for urban recovery, and people in this situation gain subjectivity – the ability to influence the object of transformation with their own internal motivation, to influence the formation and decision-making on the development and organisation of the territory, which determines the possible options for the urban planning situation [29]. A city-forming group is a category of the population that significantly impacts the city's formation and development and sustains its subjectivity through its base organisations, enterprises, and infrastructure, which create jobs and drive economic development.

In particular, the Law of Ukraine 'On the Principles of State Regional Policy' defines the restoration of regions and territories as a set of priority measures aimed at restoring critical and social infrastructure, housing, etc., to a state that allows for the return of internally displaced persons and the creation of favourable conditions for the activities of all business entities.

If a significant proportion of residents do not intend to return, this means that there is a conditional object – the territory of the city – but no entity that would take on the reconstruction of this territory. This means that we need to fight for people – to encourage their return. Different social groups may have different motives for returning or not returning. It is necessary to identify these social groups that are subject to influence in the urban planning situation. There are two ways to motivate them: either by coercion (directive approach) or by encouragement. The first option is wrong. In the latter case, it is necessary to determine which factors are the most motivating for certain categories.

For example, if we consider the city of Sievierodonetsk, which in 2014-2022 was actually the regional centre of the government-controlled territory of the Luhansk region, where, according to various sources, most of the buildings in the city suffered varying degrees of damage – from complete destruction to some localised damage (Fig. 10). The city's engineering infrastructure, such as heat supply companies and sewage treatment plants, sustained significant damage [31]. Some surrounding villages that belonged to the territorial community were almost completely destroyed. All bridges across the Siverskyi Donets River within the agglomeration were destroyed.

The city's industrial zone was destroyed. The 'Azot' chemical plant, a city-forming enterprise, suffered significant damage. In the current circumstances, there is not enough information and expertise to make a forecast on the feasibility, possibility, sources of funding and conditions for the restoration of the enterprise. However, there are basic principles – in the event of the decommissioning of the main city-forming enterprise, the urban planning environment changes dramatically. In fact, we are recording a powerful factor that can significantly impact the direction of a city's development or decline.

As for the city's reconstruction, in terms of territorial reconstruction, the existing planning structure of the city should be preserved, which requires minimal investment in territorial transformation, as the street and road network of the compact city provides convenient pedestrian and transport accessibility. There was also an industrial and warehouse area along Bohdana Lishchyny Street, the facilities of which have suffered significant damage, and it is advisable to consider dissolving this area and creating a sanitary protection zone in this place.

It is advisable to consider reconstruction for each neighbourhood and district separately. For example, the development of neighbourhoods in the 'old' part of the city did not meet modern standards for the improvement of residential areas – there were not enough places for children's and sports grounds, recreation areas and parking spaces. When considering the reconstruction of such residential neighbourhoods, it is necessary to take into account the standards for placing amenity facilities upon dismantling the destroyed facilities, and to assess the possible reconstruction of existing residential buildings to increase their number of storeys.

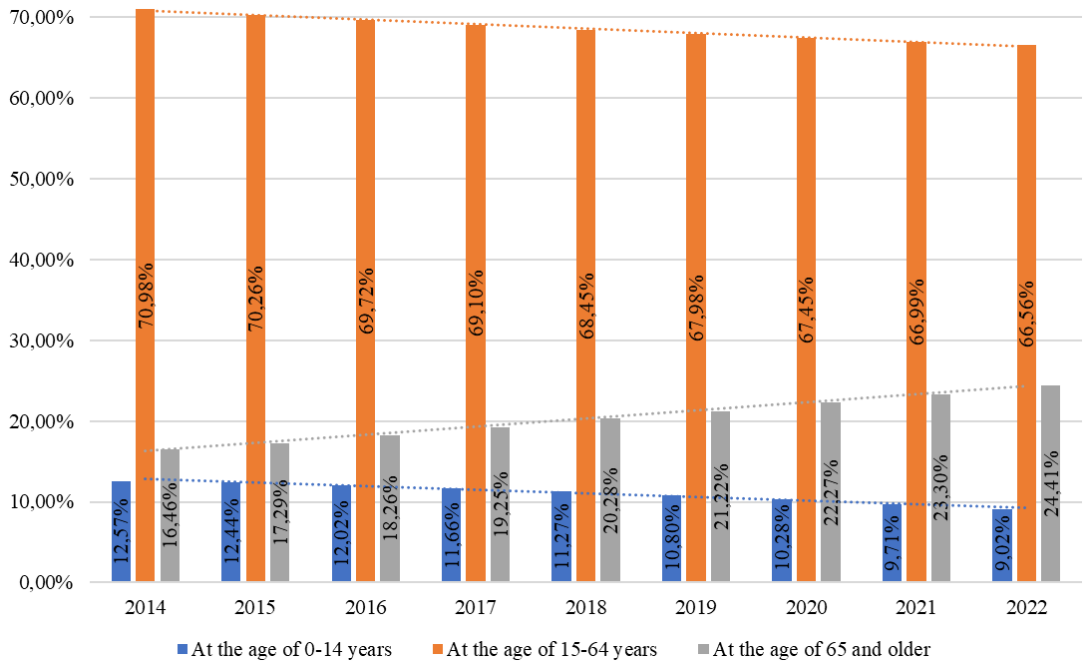

Fig. 9. Distribution of the resident population of the Luhansk region by main age groups in 2014-2022. Source: [28]

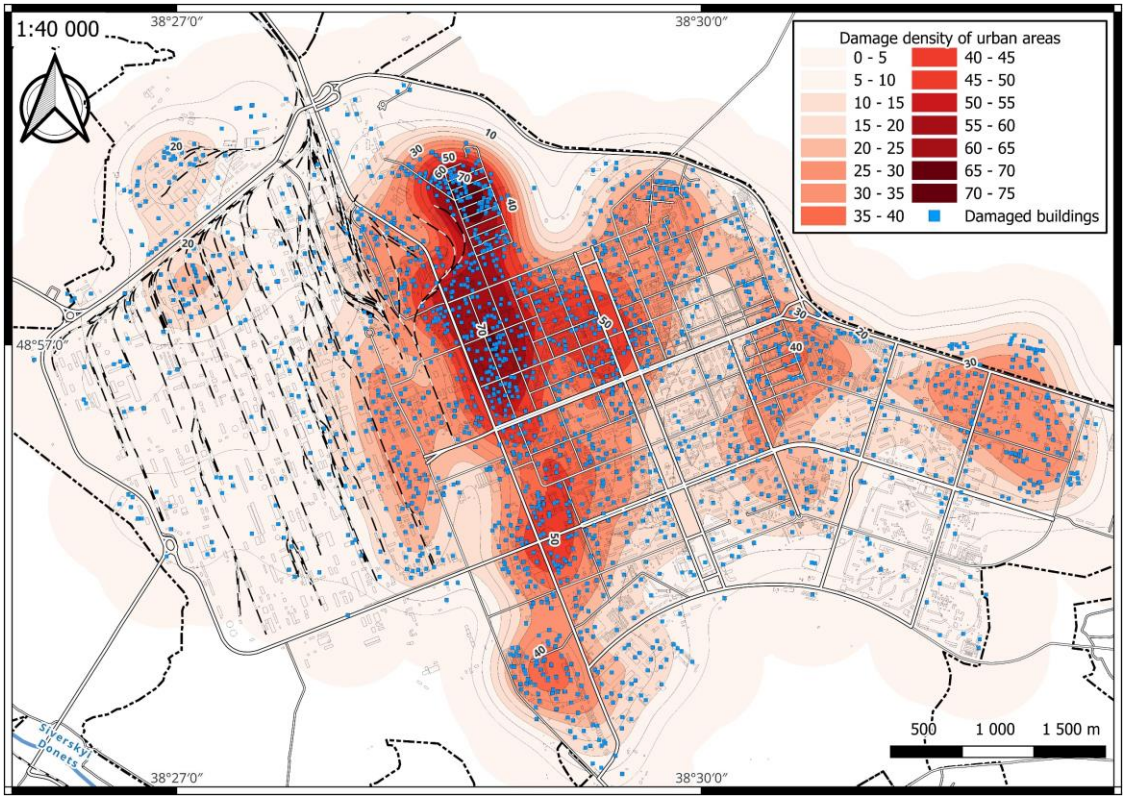

Fig. 10. Map of the density of damage to the urban area of Sievierodonetsk. Source: own study based on [30]

A separate challenge will be the lack of district heating systems following the destruction of the city's heat-generating enterprises, raising the question of centralised or individual heat supply. An integrated approach may involve autonomous heating and modular block heating units.

Thus, almost immediately, we conclude that the reconstruction of buildings and structures in this case is part of a comprehensive reconstruction of urban development. From the design solutions at the object level, we proceed to solutions at the scale of the reconstruction programme, which spans many years and has not only specific parameters but also defined stages, periods, and target programme benchmarks.

It is considered expedient to consider reconstruction measures that do not have burdensome negative consequences in the long term. These are the tasks of accompanying reconstruction at the level of urban facilities, and functional and planning reconstruction that ensures the restoration of transport links and infrastructure in accordance with the needs of the territories and defence; ensuring sustainable energy supply and a high level of energy security, preservation and creation of new jobs; development of the region's education system; implementation and support of infrastructure projects that ensure the quality of the urban environment and environmental conditions.

An important role in the pre-design analysis will be played by the construction typology of the damaged facilities [32]. Analysis of the building typology of civilian buildings, calculation of the estimated remaining life, and correct assessment of the technical and technological capabilities of the current level will allow for the most rational options for reconstruction in local conditions.

From the perspective of reconstruction activities, this includes detailed project planning, preparation of initial restoration measures, and implementation of pilot projects to develop and test approaches for subsequent reconstruction. For destroyed facilities that have become unusable, it is necessary to dismantle them and rehabilitate the territory. The housing stock to be demolished and the housing stock to be preserved have been preliminarily identified. The housing stock requiring demolition includes buildings with physical deterioration of 70% or more. It is advisable to use the 'wave' method when restoring areas of mass housing that have suffered extensive destruction – the priority construction of new buildings, with the gradual demolition of existing ones that cannot be reconstructed, and the subsequent resettlement of residents into newly built buildings [32].

The agglomeration of the cities of Sievierodonetsk-Lysychansk-Rubizhne should be considered as a single territorial entity [33,34], since separate development of master plans for the period of urban reconstruction and further development will prevent the achievement of a unified planning structure of the three-centre agglomeration and will not contribute to the complexity of solutions for the development of the entire agglomeration, leading to duplication of certain functions and a decrease in the overall potential of the agglomeration structure.

Developing solutions on a common basis will provide conditions for the integrated development of its constituent elements. This approach to planning implies that the agglomeration is perceived not as a sum of settlements, but as an urban formation with new integration opportunities [35,36].

Thus, in the conditions of very close location of cities, it is advisable to have a single modified network of transport services for the population of the agglomeration, to resolve the issue of location of external intercity transport facilities, to optimise vocational education institutions, to resolve the issue of localisation of higher education institutions focused on the needs of the region's development.

Although the transformation of individual settlements into a single urban planning system will require somewhat increased financial and material costs, in addition to those required for the

development of individual settlements, the development of strategies and methods for such an organisation of space will contribute to the achievement of not only economic but also social goals.

From the point of view of regional planning, each region is a structural unit of socio-economic activity in space, the activity and significance of which depend on its location within the country and its functional purpose [33]. The main categories of the typology of urban planning objects are function and form; the connection between them is that functional needs and tasks determine which structures and objects will be located on the territory (function) and how they will look and interact with one another (form) [37].

The typology of urban development objects allows the determination of classification differences and similarities, thereby enabling recommendations for the design of similar objects. This approach contributes to the rational and efficient use of territories.

In 2010, the Donbas Euroregion was established in the Donetsk and Luhansk regions of Ukraine and the neighbouring regions of the Russian Federation to enhance cross-border cooperation. The Euroregion has become the largest in Europe in terms of population and area. Since 2014, the agreement on establishing the Euroregion and the work of its coordinating bodies have been suspended [38].

At present, the issue of cross-border cooperation is off the agenda for both the eastern and northern regions adjacent to the state border. The change in the region's function requires identifying the most relevant regional function – there is a need to introduce a new typological feature that focuses on restrictive and security functions. A border region is being formed, within which the concept of 'cross-border cooperation' assumes the function of border control, requiring appropriate changes to the planning organisation.

The form of use of the territory changes as a result of the war, which in turn determines the change in its function. Conversely, the change in function will determine the change in form during the post-war reconstruction period.

The state will face two factors shaping the problem of changing the region's territorial planning organisation. The factor of the border and the factor of the region's reintegration. The task is to functionally streamline the planning structure, taking into account the change in form. The main formative aspect is the state border. Military facilities and areas that form the supporting framework of the security belt are also a derivative element.

For the border region, the zone of influence correlates with the depth of the frontline – up to 30-50 km is the first zone of existential danger, and up to 100 km is the general area of the border region that will be affected by the border with a hostile state.

The first zone is expected to implement restrictive measures, structural transformation of communication routes and roads in terms of changing the priorities for their restoration and construction, formation of new transport corridors, reduction of the population and settlement network – relocation of people from small settlements within 5 km of the border, construction of storage facilities in a 30-50 km wide zone adjacent to the border, development of building rules in border regions that would take into account new safety rules, consideration of technical requirements for buildings, such as fire safety, security, and protection of the environment. In the general zone, this involves establishing connections between settlements oriented towards the centre, and reclassifying lateral roads that run parallel to the border and connect key cities.

4. Conclusions

Donbas is facing a crucial urban-planning crisis. The region's urbanised areas are degrading, and the resource base for recovery is depleted. Some agglomerations have formed continuous urbanised areas. Excessive settlement density is a problem in the context of a shrinking resource base, primarily the population. At the same time, the regions' planning and transport frameworks are well established, with convenient transport links to the elements of the settlement system. Thus, the structure of the existing supporting planning and transport framework is virtually unchanged.

The basic factors that influence the conceptual solutions for the restoration of cities in eastern Ukraine include the following:

a) The regions of Luhansk and Donetsk have almost exhausted their rural-urbanisation reserve.
b) The regions are likely to remain highly urbanised with a possible change in the nature of the planning framework of the settlement system (ruralisation is unlikely).
c) Cities' new functional role as border regions, which creates a demand for a change in the form related to national security.
d) Ending the extensive development of Donbas by attracting both natural and labour resources.
e) Limited internal resources for recovery due to the difficult demographic situation, lost potential for transport cooperation, export potential, unfavourable environmental conditions, and outdated production technologies.
f) A large proportion of the disabled population is unable to work, which means there is a shortage of labour. There are insufficient human resources to restore the previous population levels in the Luhansk and Donetsk regions, and the region is unable to support the excess population, placing it in the category of subsidised regions.
g) Uncertainty of political factors.

In light of the functional shift from a cross-border region to a frontier zone, limitations on economic activities and development trajectories are to be anticipated. The overall population density and the number of settlements are likely to decrease. The issue of optimising the region's settlement system will arise. The fundamental impossibility of reurbanisation will result in the presence of deserted settlements.

It is important to note that the world's agricultural land has been declining steadily. Therefore, it is the land for this purpose that should be preserved as much as possible. Certain areas of industrial districts and those adjacent to transport corridors have their own primary value, determined by their convenient location and low development costs. This means that certain areas, planning units, and networks can be reused for further regional development. This will constitute a complex task of transforming and restoring the region's settlement system for the long term.

There can be no development of a single city with outperformance in the destroyed area. Concentrating resources in a single locality will not be effective for restoring the entire region. Similarly, 'smearing' a thin layer will not ensure its development, which requires identifying growth points and areas of advanced development. Targets for the development of the territory may include the preservation of promising developed urbanised centres, the development of communication routes, increased accessibility of settlements, and environmental protection.

The scenario for the region's transformation can be conservation (decline), stabilisation (absence of development), or

integrated development (improving the region's urban planning situation). To a large extent, the implementation of recovery programmes will be determined by resource availability, cost, and time.

The main decisions on the transformation of territorial entities should be implemented within the framework of updated comprehensive plans for the spatial development of the territorial community and of master plans for settlements.

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