# Planning the Environment Remediation. Policy Note

International Charitable Organization "Environment – People – Law"

# PLANNING THE ENVIRONMENT REMEDIATION

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Аналітичний документ знайомить з основними дороговказами та законодавчими основами післявоєнної відбудови економіки України з урахуванням довкіллєвого аспекту: запровадження горизонтальних і секторальних реформ, що базуватимуться на принципах збалансованого використання природних ресурсів і ефективного управління у напрямі збереження довкілля.

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# EXECUTIVE SUMMARY

The purpose of the current Note is to demonstrate major signposts and legislative basis for post-war reconstruction of Ukrainian economy taking into account the environmental aspect: implementation of horizontal and sectoral reforms based on the principles of balanced use of natural resources and effective management aimed at preserving the environment. The authors of the Policy Note believe that among the key horizontal reforms are the reform of the state environmental control and reform of legal liability for environmental offence. The purpose of the reform of state environmental control is to make it modern, effective and transparent with reducing the corruptiogenic risks to a minimum, and eliminate doubled functions of central executive authorities in the realm of environment protection. The purpose of the reform of legal liability for environmental offence is to make such liability real, proportionate and adequate to the damage caused to the environment. The ultimate goal of legal liability is to preserve and restore public resource, for the protection of which legal regulation is established, or in our case the environment.

This document offers an overview of the damage caused to the environment of Ukraine by armed aggression on behalf of the russian federation and draws attention to the fundamental role of healthy environment in ensuring public welfare. The following issues are considered in particular: pollution of atmospheric air (due to both warfare and fires caused thereby), water (surface and underground, and also due to destruction of water resource infrastructure ranging from dams to water treatment stations); soils (ranging from contamination with heavy metals caused by shelling and bombing to mechanical destruction of the soil layer structure) and mined areas (which may constitute up to 15% of the total area of Ukraine and the USD 250 billion worth of mine clearance could last up to 70 years). It is highlighted how warfare caused

by the rf aggression in Ukraine has exerted destructive influence on forests, wetland ecosystems, steppes (56%, over 1.6 mln hectars of which ended up in combat zones and/or occupied by the rf troops), natural protected areas (44% of the highest rank areas are in combat zones and/or occupied by the rf), and biodiversity, the war-related loss of which can hardly be assessed in full but can jeopardize long-term recovery and community welfare. It is emphasized that there must be improved coordination between the political goals so as to simultaneously deal with biodiversity issues, alleviation of climate change consequences and post-war economy recovery. It will enhance resource use efficiency and contribute to the goal of biodiversity preservation while adhering to sustainable development principles.

Major principles to underpin the strategic recovery plans development are outlined. Thus, key principles of post-war reconstruction of Ukraine should be 1) coherent environmental politics and country development based on the European Green Deal; 2) recovery must serve the needs of Ukrainians and facilitate sustainable development of Ukraine; 3) environmental standards at all levels of shaping and implementing the policies in environmental sphere; 4) following European environmental planning instruments in developing Ukraine; 5) efficient operation and use of trust/donor funds for post-war recovery and green economy development.

The document highlights the core of the required sectoral reforms in various branches of economy which will eventually pave the way for environmental problem solving at the stage of planning post-war recovery and its implementation. The main goal of sectoral reforms, which are an integral pre-requisite of reconstructing the environment, is to introduce changes in the use of mineral and water resources, in particular, to ensure a transparent system of using mineral and water resources, special permit distribution and assessment of environmental impact. Waste treatment is a most acute problem, which is being aggravated among others by specific waste generated by military operations. In order to reduce the impact this waste exerts on the environment, it is necessary to set up temporary waste storage facilities, divide them into categories paying special attention to hazardous waste, ensure its sorting and storage, and for local authorities to try and ensure household solid waste collection, run an inventory of the operating waste storage facili-

ties, update regional waste management plans for each region so that waste will become part of the economy and organize fundraising events for secure waste management at the level of territorial communities. A major step in this direction should be the adoption of a framework law "On waste management".

Remediation works and infrastructure renovation processes, which are likely to take place at the cost of the funds provided by the EU, must be carried out under the principles of the European Green Deal, including the EU's Biodiversity Strategy for 2030. The infrastructure and industrial facility projects should be designed in accordance with the EU Taxonomy involving the criteria of environmentally sustainable "green" projects and activities.

Land use and related environmental issues, which directly affect the food security of Ukraine and the world, and other environmental and social issues also call for immediate response, especially when the russian federation's invasion has made them critical. Thus, military operations caused changes in the legislation, simplified procedure of obtaining the right for land and shutting down of the land cadaster. Due to the rf's aggression, vast territories of Ukraine are mined and the future of the lands which cannot be promptly checked and demined needs to be resolved. Moreover, it is necessary to check the soil quality at agricultural lands on the territories of active combat inasmuch missiles and shells hitting the fields substantially deteriorate their quality, contaminate them and can adversely affect the quality, safety and scope of the harvest to be grown on this contaminated land. Furthermore, post-war land management must consider the land categories to prevent constructions on areas of the water fund or farming in the floodplains etc. A balanced land use model also needs to be introduced after the war with due respect for the European Green Deal and Ukraine's commitments under international agreements on biodiversity preservation.

One of major benchmarks for Ukraine in the branch of forestry must be the EU Forest Strategy for 2030 adopted under the European Green Deal. In order to satisfy the needs of the economy in timber while preserving the forest biodiversity and ecosystem services provided by natural forests, valuable forest area conservation needs to be prolonged and the Emerald Network protection needs to be ensured (draft law #4461). Increased forest cover index in Ukraine may be ensured by

adopting draft law #5650, which, among others, stipulates inclusion of naturally forested areas in the forest fund. It is necessary to introduce changes to the felling rules (transition to selective felling as well as converting the planted forests to match natural structures). Sustainability of the forestry sector of Ukrainian economy must be achieved by way of increasingly intensive use of non-timber forest products, in particular by promoting tourism and increased legal liability for violating the laws along with increased punishment. It is necessary to develop a relevant state programme of mined forest management, particularly to provide for its conservation. One of the mechanisms to provide funding for corresponding measures must be monetization of the forest ecosystem services.

A vital step in the conservation branch should be the development of the Nature reserve fund (NRF) (increased area and management efficiency based on scientific research) and increased capacity (from legal to financial); operation monitoring system implementation and biodiversity preservation; establishment of data infrastructure for the NRF and ensuring its accessibility; enhanced interaction between the society and NRF areas (recreation, information, public involvement).

The sources of funding the remediation and the procedure of claiming the damages from the rf have been identified. It has been suggested that the Environment Protection Fund should be reformed, namely to guarantee its independence of the Ministry of the Environment and operation transparency, to ensure public involvement in selecting effective measures and to establish an Environment Remediation Fund to accumulate earmarked funds obtained as damages from the rf and rb. The urgency of developing ecosystem service valuation methodologies has been emphasized. They will make it possible to carry out a more thorough assessment of the injury and assess the environmental damage of the Ukrainian territory inflicted by the rf's war, and as a result they will ensure collection of compensation payments. The fund will also be replenished owing to introduction and implementation of carbon credits. Thus, in international carbon markets the investors who buy land plots for example to plant a forest will be able to use the certificates proving that the plot will consume a certain amount of carbon as an instrument of so-called emissions offsetting. It is not enough to deal with the problem of environmental pollution and remediation, it should

be prevented. With this view, it is necessary to attach environmental requirements to all investments in the economy of Ukraine. These should be the requirements of compliance with the indicators and approaches stipulated in the legislation of Ukraine and legislation of the country of the investment origin, and also, in view of the EU oriented Ukrainian policy, in the corresponding legislation of the EU.

The authors describe the procedure of claiming damages from the rf. It is emphasized that a Compensation Committee must be established by resolution of the UN Security Council or General Assembly because it will facilitate prompt, objective and adequate resolution of any issues related to compensation payments to Ukraine. An option of filing reparation lawsuits to national or international courts, including those by individuals, should not be neglected either. The submission of such lawsuits, however, should largely rely on prior implementation of up-to-date damage assessment methodologies and recommendations on evidence collection. It will ensure high quality of evidence and its acceptability in court. It is equally important to develop a mechanism of individual assessment of damaged objects.

Actual cases are provided to exemplify the environment remediation and preservation. Namely, the document offers Albania's experience in demining territories, in particular their mechanisms of mine clearance and major principles of its implementation aimed at the environment preservation. Demining is a long-lasting process, therefore one quick solution to the problem of mined and contaminated areas is their conservation, which is one of the nature-based solutions to this problem. Apart from that, the feasibility of infrastructure facility reconstruction is considered based on the example of the dam on the river Oskil and arguments are provided to prove the benefit of giving up the idea of its reconstruction. Similarly, other branches of economy are referred to, such as metallurgy reconstruction. A point is made about expedience of reconstructing metallurgy plants with the implementation of decarbonising technologies, as such reconstruction has competitive advantages in contrast to reconstruction involving the mechanisms, processes and technologies which had been used earlier. As an example of economically and environmentally more expedient way of restoring the areas destroyed by war, the Note offers "approximation-to-natural" method applied to the forest areas of Luhansk region affected by fires.

# Abbreviation list

APC — armoured personal carrier
BR — biosphere reserve
GDP — gross domestic product
RES — renewable energy sources
GIS — geographic information system
SCN — state construction norms
SEI — State Environmental Inspectorate
SES — State Emergency Service
EU — European Union
ECHR — European Court of Human Rights
AFU — Armed Forces of Ukraine
CMU — Cabinet of Ministers of Ukraine
UNICJ — United Nations International Court of Justice
LA — legal act
NNP — national nature park
EIA — environmental impact assessment
LA — local authorities
UN — United Nations
SAA — surface-active agents
NR — nature reserve
NRFU — Nature Reserve Fund of Ukraine
FL — fuels and lubricants
NPA — natural protected areas
RLP — regional landscape park
SSAA — synthetic surface-active agents
HSW — household solid waste
ChNPS — Chornobyl nuclear power station
UNESCO — United Nations Educational, Scientific and Cultural Organization
rb — republic of belarus
rf — russian federation

# INTRODUCTION

Wars and armed conflicts change everything. Annihilating numerous achievements of civilization, they reduce the society affected by war to the level when the major goal of humans is not to flourish but to survive.

Armed conflicts ruin the life (in the broadest meaning of this word, from the life of individuals to violated natural processes) and livelihoods, and create chaos.

In the time of war, and sometimes in the post-war recovery period, planning horizon shifts from strategic to tactic planning. Its major goal is to ensure protection and food security for the population.

A major disadvantage of this kind of planning is that it disregards long-term consequences for the civil population and environment already affected by war. The environment is a silent victim of war.

Military operations cause pollution of air, water and soils of Ukraine. Species and habitats are injured, biodiversity is lost and nature preservation efforts are annihilated. It may take years or even decades to overcome the war-related consequences for the environment. Explosions, fires and collapsed building emit heavy metals, toxic gases and particulates into the environment. Experts are concerned about their human health effects[1].

There is an indissoluble bond between environment protection and civil population protection. Safe environment is a prerequisite of population safety.

Such war-related problems as damaged infrastructure, obstructed access to and quality of water resources, deforestation and environment pollution are long-term and require time and resources to be resolved. Moreover, their impact may be aggravated by climate change.

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[1] https://www.wsj.com/articles/russias-war-in-ukraine-could-have-environmental-impact-that-lasts-decades-11650801603?fbclid=IwAR2trxoBZ3Rll6b6GmWandBSJq3AxjtJTMWGdPQve4oE38jLMqx4iH4fyWI

Therefore, it is necessary to actively preserve and recover nature and also introduce environmentally sensitive approaches to state reconstruction in order to reduce future damage in post-war time.

In order to construct stable peace and support the communities, obviously it is necessary to assess environmental risks, protect civil population from the damage inflicted on the environment as well as help the victims of the conflicts, eliminate damage and use available environmentally safe instruments to recover the ecosystems. While certain efforts are being put into strengthening and implementation of the laws protecting the environment and bringing to justice those who caused damaged related to armed conflicts, still more needs to be done.

There is a need for robust state institutions and acting law norms, responsible leadership, supported by scientifically justified decisions which protect the ecosystems and therefore protect the life[2].

Russian invasion of Ukraine is a tragedy. The tragedy which despite the high price opens the window of opportunities for securing a higher level of safety and welfare for the Ukrainians. Will these opportunities be successfully implemented? Everything depends among others on the way the state will protect the environment.

What should be the main principle to underpin the reconstruction of the state?

We suggest choosing the principle stipulated in the Sedai Framework for Disaster Risk Reduction — "**Build Back Better**". It is this principle that most fully represents the idea of sustainable development and risk-oriented approach to reconstruction. It must serve as a major benchmark of values and methodologies while developing the Ukraine Reconstruction Programme and a corresponding plan of actions. It is worthwhile to start developing these documents already now at the level of the Cabinet of Ministers of Ukraine with wide involvement of all stakeholders. It should be noted that these documents must go through a mandatory stage of their strategic environmental assessment[3].

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[2] https://reliefweb.int/sites/reliefweb.int/files/resources/witnessing-the-environmental-impacts-of-war.pdf

[3] https://r2p.org.ua/vid-znannya-pro-ryzyky-do-stalogo-vidnovlennya/?fbclid=IwAR2Fghzk2ACZQx9ULJmJqnn40piS8Ly0Y31VmpDqiyoccSFaVLtmleN0jeU

# 1. DAMAGE CAUSED TO THE UKRAINIAN ENVIRONMENT BY THE RF'S WAR

Geography and climate of Ukraine ensured stunning abundance in flora and fauna. Its territory hosts 35% of European biodiversity. It involves 70 000 species of plants and animals, a lot of which are rare or endemic, that is found only in a certain area.

War affects natural ecosystems in multiple ways with long-term consequences and the impact depends on the kind of the ecosystem and nature of combat operations.

The extent and degree[4] of injury inflicted on the environment allow claiming that rf is committing ecocide in Ukraine (fig. 1[5]).

The Minister of Environmental Protection and Natural Resources of Ukraine has claimed that as of 24 May 2022, 254 cases of environmental damage were confirmed and fifteen hundred facts of destroyed Ukrainian environment were counted[6]. The damage inflicted by the rf's military operations only in the Exclusion Zone amounts to above UAH 2.5 billion[7].

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[4] Ecocide is mass destruction of flora and fauna, poisoning of atmosphere or water resources, as well as other actions which may cause environmental disaster (art. 441 of the Criminal Code of Ukraine). Besides, methods or means of warfare aimed at inflicting or can be expected to inflict vast long-term and major injury to the environment are banned by art. 38 of the Geneva Convention and violate the UN Charter.

[5] https://mepr.gov.ua/news/39218.html

[6] https://mepr.gov.ua/news/39221.html

[7] https://www.unn.com.ua/uk/news/1977594-zbitki-vid-rf-u-chornobilskiy-zoni-vzhe-perevischili-2-5-mlrd-grn-mindovkillya


Fig. 1. Number of facts of environmental damage due to military operations as of 17.05.22

Still, we do not understand how the information is verified without clearly elaborated guidelines on registering the environmental damage cases or how the Ministry of Environment assessed the losses and damages without developing new assessment methodologies.

Direct damage inflicted on the environment also constitutes indirect damage to the life and health of the population: the environment pollution ensuing from military operations will affect human health due to increased risk of poisoning, in particular by heavy metals, limit access to quality fresh water, damage the soil and the loss of its fertility jeopardizes food security of the Ukrainian and world population[8]. The global environmental consequences of armed conflicts result is significant adverse impact on the development of countries and cause further expenditures[9].

[8] https://www.bbc.com/ukrainian/extra/mwu5sxghvc/ukraine_war_damaged_nature

[9] https://assembly.coe.int/nw/xml/XRef/Xref-XML2HTML-en.asp?fileid=12961&lang=en

War consequences launch a continuum of effects ranging from very positive to extremely harmful[10].

This chapter offers an overview of warfare impact on major types of natural ecosystems spanning the territory of Ukraine.

## 1.1. Pollution of atmospheric air, waters, soils and area mining

Military operations in Ukraine contaminate water bodies, air, destroy harvest and will eventually cause colossal damage to the ecosystem of entire Eastern Europe, whereas the life of killed Ukrainians will never be retrieved. Apart from destroyed cities and large number of casualties, incessant shelling by the aggressor inflict major environmental damage on the country: explosions, fires, bombing, destruction of industrial facilities and service systems lead to contamination of air and water, demolition of forests and unique ecosystems (fig. 2[11]).

Air quality is deteriorating due to the emissions from fires both within natural complexes (fields, rivers, forests etc. and radioactively polluted natural complexes of the Exclusion Zone) and on certain commercial and industrial facilities (petroleum storage depots, shopping centres, warehouses, etc.), which brings harm to people's health directly or indirectly worsening the state of the environment. Moreover, a significant impact is inflicted by military equipment and emissions it has produced. Furthermore, warfare makes environmental inspections impossible, which increases the risk of unsanctioned emissions into the atmosphere produced by still operating Ukrainian enterprises.

The state of water resources of Ukraine is also deteriorating due to dam destruction and wrecking (stoppage) of water treatment facilities, and further untreated wastewater release to surface and underground waters.

In April 2022, under the project SIDA P1400 / A1900 — "INSURE: moving nature based climate solutions into Ukraine's Reform agenda" physical destruction of the soil layer in Kharkiv and Sumy regions

[10] https://cdnsciencepub.com/doi/10.1139/er-2015-0039

[11] http://epl.org.ua/human-posts/zrujnovani-infrastrukturni-ob-yekty-ta-shkoda-dovkillyu/

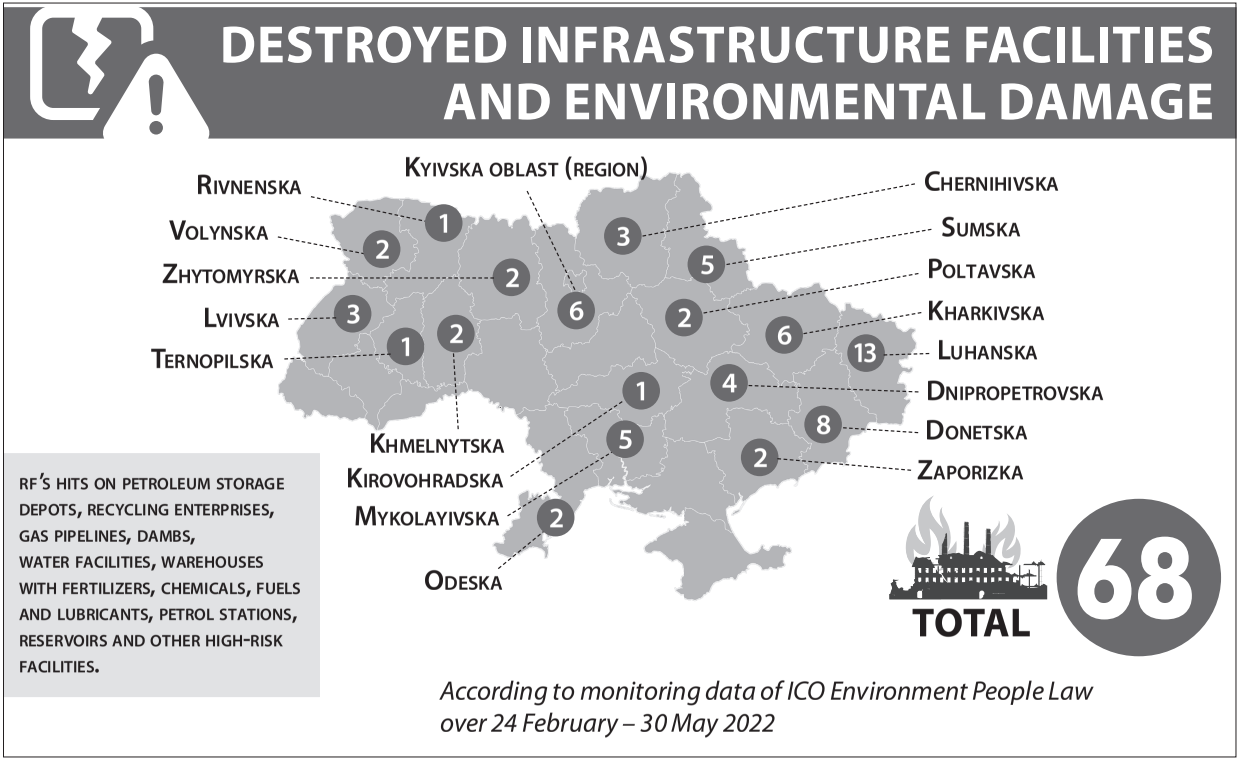


Fig. 2. Destroyed infrastructure facilities causing damage to the environment

was assessed with the help of space image analysis (Sentinel). As of 20.03.2022, 1,655,845.3 hectars of arable lands had been inspected. The damaged soil cover made up 6,582.0 hectars. The damaged winter crops area amounted to 686.3 hectars.

It should be indicated that the area of affected land can be even larger because as of the date above a lot of area (most of Sumy region) was deprived of snow cover, which significantly complicated damage identification. The expert assessment may find the area of physical damage larger by 20%.

According to "Deminers Association", as of today about 82 thousand square kilometres of Ukraine are contaminated with explosives. It makes up nearly 15% of the total area of the country. The estimated cost of demining such a vast area is USD 250 billion. For better understanding, this amount is 20% larger than the annual GDP of Ukraine in 2021. According to experts, full demining of the country will take up to 70 years[12].

## 1.2. Impact on forests

Forest ecosystems appear to suffer most from military operations. Mass use of artillery on targets located in the forest or nearby cause forest fires, which can destroy thousands of hectars of forest in drought conditions. That is what was happening, for example, during March in Chornobyl Exclusion Zone and in the vicinity. Thus, according to the State Forest Resources Agency official data, the area of forest fires is 96 times larger than in the same period last year and spanned 5,510 hectars as of 14 May[13]. Relying on EFFIS satellite images[14], EPL have calculated that as of early June the total area of fires in Ukraine was above 40 thousand hectars. Obviously, it can't be claimed with certainty so far that all these fires were directly caused by military operations. The war, however, has hampered extinguishment efforts at the fires

[12] https://www.bbc.com/ukrainian/features-61080365

[13] https://www.kmu.gov.ua/news/ploshcha-lisovih-pozhezh-zbilshilasya-u-96-raziv-derzhlisagentstvo

[14] https://effis.jrc.ec.europa.eu/apps/effis_current_situation/

caused by ordinary negligence, in particular burning of dry vegetation. These days SES units either choose to deal with higher-priority fires within people's settlements, or their engine and equipment fleet has suffered significantly, as was the case in the Chornobyl Exclusion Zone, which is a runner-up by the range of fires following Luhansk region (Fig. 3).

But even after active combat has finished, such areas are prone to increased risk of ignition and spread of fire due to a large amount of abandoned ammunition and its possible detonation. Besides, fire-extinguishing efforts are impossible on the mined areas.

Furthermore, trench warfare involves active felling by both sides in order to construct defence positions. Even though the scope of such felling is way smaller than the conventional one, the environment can be significantly damaged when such defence felling is carried out in protected natural forests, especially old-growth ones. In fact, the older is the main layer of the forest, the more time it will take to restore it.

Another hazard may be environmentally unjustified forest restoration. For example, when destroyed natural forests are replaced with man-planted woods instead of natural replenishment, even when the latter is possible. Or mass restoration of pine tree forests in the south and east of the country where in view of increasingly dry climate conditions, in a long perspective it is expedient to restore sandy steppes with woodlands. The point is that dense forests, which have evolved in these areas, will sooner or later be destroyed by fires, while the war will facilitate this process.

With this regard, forest restoration planning must necessarily involve scientists and public organization and the very restoration process must rely on flexible approaches and aim at maximum approximation of the areas in question to the natural ecosystem conditions.

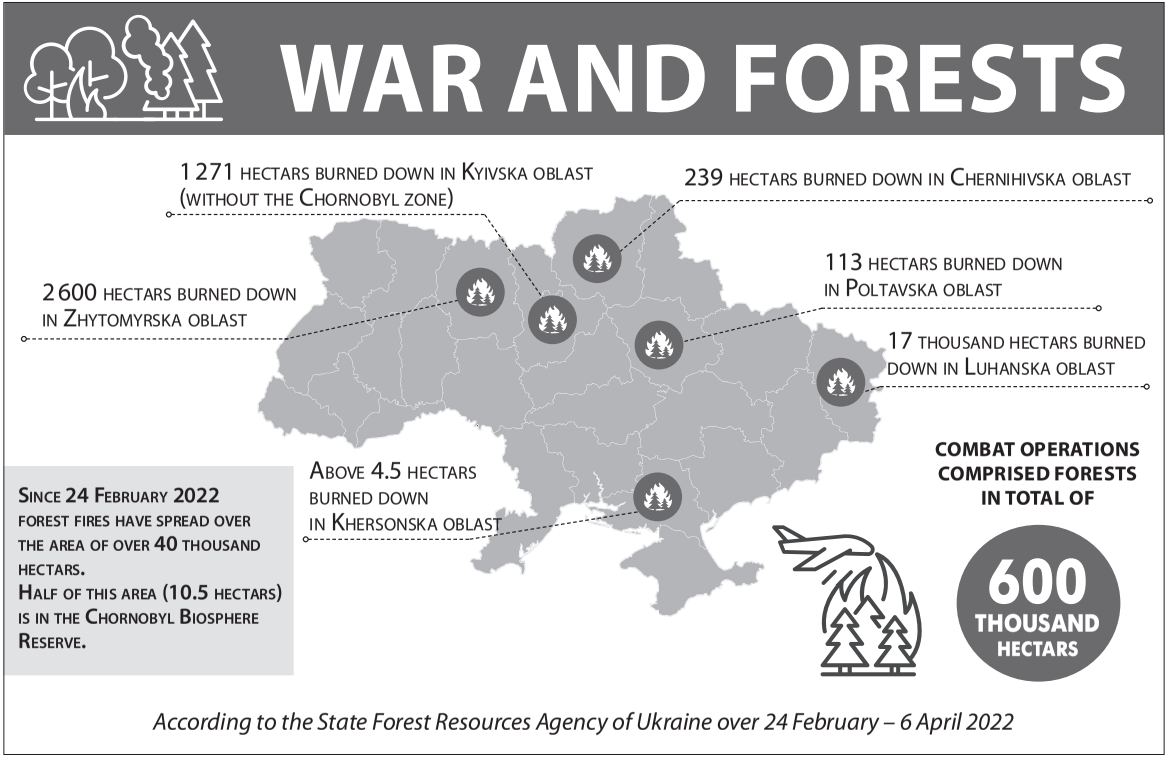


Fig. 3 The area of forests engulfed by fires caused by military operations over the period 24.02–06.04.22

## 1.3. Impact on wetland ecosystems

Intensive and random artillery and missile shelling cause contamination of water bodies with toxic heavy metals as well as missile fuel and vehicle fuel. Apart from that, active combat zones are characterized by significant disruption of fish spawning and destruction of bird nesting places due to loud explosion sounds (ammunition not infrequently explodes inside a water body). The condition of wetland ecosystems is also affected by amphibious armored vehicles crossing rivers and construction of pontoon bridges for other vehicles.

## 1.4. Impact on steppe ecosystems

The combat zone under the rf's occupation troops comprises 1,654,736 hectars of virgin steppes, which constitutes about 59% of Ukrainian steppes[15]. Even though military operations injure the steppe less than ploughing and artificial afforestation, this kind of ecosystem suffers from adverse impact as well. Thus, specific steppe microclimate causes steppe fires ignited by shelling to occur and spread even faster than in the forest. Despite steppe ecosystems being more adapted to periodic fires, spring fires inflict significant damage on biodiversity. It is at this time that most steppe plants start sprouting and most animals become active. A number of bird species start a nesting season and their nests as well as offspring of small rodents are extremely vulnerable to fire.

A more lasting in time and probably less significant in range is the impact related to soil surface and underground water pollution with heavy metals and fuel from destroyed military equipment and ammunition debris.

## 1.5. Impact on natural protected areas

The active combat zone and zone occupied by the rf comprise 44% of the Nature Reserve Fund areas of the highest protection rank

[15] https://uncg.org.ua/44-najtsinnishykh-pryrodnykh-terytorij-ukrainy-okhopleni-vijnoiu-doluchajtesia-do-initsiatyvy-riatuiemo-pryrodu-u-dni-vijny-razom/

(national parks, nature and biosphere reserves, national nature parks) and are inaccessible for Ukraine[16].

All in all, military operations affect the nature in natural protected areas in the same way as they do in unprotected areas. However, there are a number of additional problems. Thus, military operations within the Nature Reserve Fund or in the immediate vicinity thereto usually prevent security patrolling of such areas. This results in increased rate of poaching and other violations of nature reserve regulations. Moreover, the occupants often loot the administration premises in the NRF areas and in this way further aggravate the work of corresponding institutions, particularly security-related operations. The research showed that wildlife populations in reserve areas tend to grow at a slower rate or can even be destroyed during the war[17]. In addition, all scientific research is suspended, including monitoring and separate scientific projects. Another major problem, for example for most national parks, is virtually complete cessation of tourism activities while active combat operations or area demining are in progress. As a result, essential source of income and funding of nature protection measures are lost.

In contrast, sometimes armed conflicts "protect" ecosystems by eliminating anthropogenic impact on the area, whereas peace recovery facilitates its destruction due to intensive exploitation of natural resources[18].

As for natural protected areas of international importance, for example Ramsar wetlands and the Emerald Network areas, because of absence of special administrations they will be affected virtually in the same way as other similar natural areas without a protected status.

Armed conflicts cause biodiversity loss and prevent nature protection activities. They may inflict damage on biodiversity through direct injury of ecosystems, for example, due to vehicle movement or pollution, or indirect harm stimulating unrestricted felling, hunting, mineral extraction etc.

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[16] https://uncg.org.ua/44-najtsinnishykh-pryrodnykh-terytorij-ukrainy-okhopleni-vijnoiu-doluchajtesia-do-initsiatyvy-riatuiemo-pryrodu-u-dni-vijny-razom/

[17] https://www.researchgate.net/publication/322367886_Warfare_and_wildlife_declines_in_Africa%27s_protected_areas

[18] https://www.nature.com/articles/d41586-018-05397-2

This, however, is not an inevitable consequence.

Even though legal and political framework regulating biodiversity preservation seldom resolve unique local problems in the areas affected by warfare, there still are examples which demonstrate that effective management is possible even in conflict circumstances provided the right strategy and support are maintained.

## 1.6. Impact on biodiversity and its role in post-war recovery

Three months of war have inflicted a severe damage on biodiversity in Ukraine. Nevertheless, the society and the authorities can restore it by joint efforts resorting to accumulated world experience and acquiring own experience (fig. 4[19]).

As the case of Afghanistan demonstrates, biodiversity loss, whether driven by conflict itself or by other drivers, can jeopardise the long-term recovery and wellbeing of conflict-affected communities. Intact ecosystems and species communities provide a wide range of benefits, from clean air and water to food, medicine, and building materials. Biodiversity thus plays an important role in post-conflict recovery. Biodiversity governance can also contribute to post-conflict recovery, such as in Mozambique[20], where former combatants are re-integrated into civil society through employment as Protected Area rangers. In Colombia, former fighters have become citizen scientists[21].

Biodiversity can also be a key element of peacemaking and peace-building. Demilitarized zones, such as in Cyprus or on the Korean peninsula, can develop flourishing wildlife populations due to the absence of human activities, becoming geographical focal points for environmental peacebuilding efforts. Peace Parks, which are trans-boundary protected areas can serve as venues for increased cooperation among conflict actors.

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[19] http://epl.org.ua/human-posts/bioriznomanittya-try-misyatsi-vijny/

[20] https://www.researchgate.net/publication/241204953_Biodiversity_and_War_A_Case_Study_ofMozambique

[21] https://theconversation.com/peace-with-nature-helping-former-colombian-guerrilla-fighters-to-become-citizen-scientists-121695

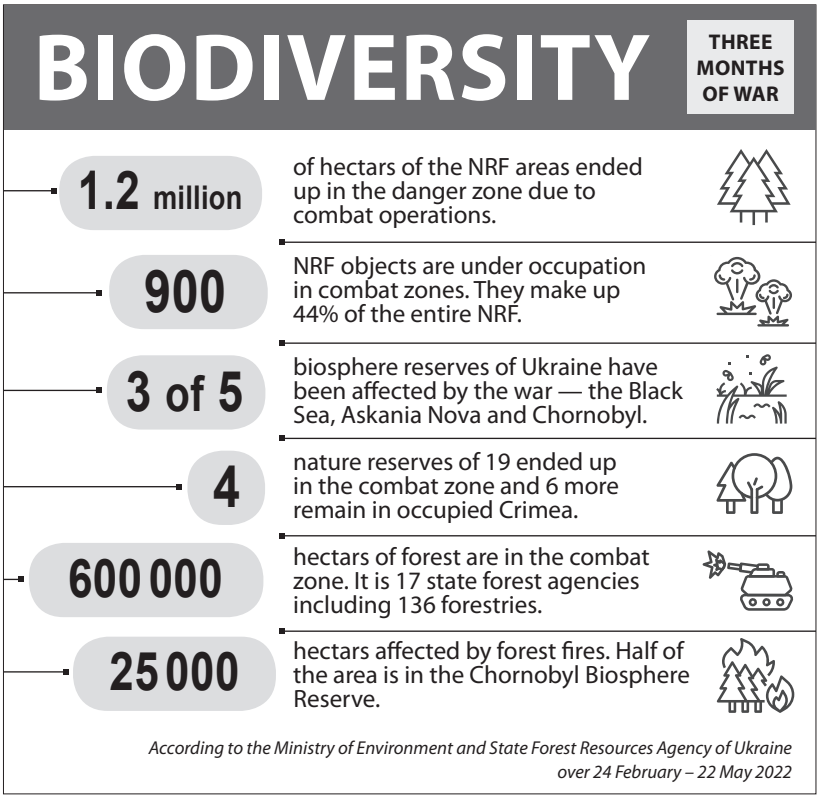


Fig. 4. Impact of war on natural areas and their biodiversity

Finally, maintaining and enhancing biodiversity can be a key component of building resilience to climate change and other external pressures for communities affected by or recovering from conflict[22].

Hence, there is an opportunity to improve coordination between political goals in order to simultaneously deal with biodiversity issues, alleviating the climate change consequences, post-war economy recovery and building of resilience (risk-oriented approach) to conflicts. This will probably improve the efficiency of the resources used in achieving the goals of biodiversity preservation, climate change handling and adhering to sustainable development principles.

[22] https://ceobs.org/do-mention-the-war-why-conservation-ngos-must-speak-out-on-biodiversity-and-conflicts/

# 2. MAIN PRINCIPLES OF ENVIRONMENT REMEDIATION

President Volodymyr Zelenskyi says[23] Ukraine will be rebuilt by means of a new Marshall Plan for Ukraine, a package of (financial) support formed by the West. The details have not been revealed yet.

Experts[24] find this approach to reconstruction (financial aid to reconstruct what has been destroyed) simplified and advise taking into account the structural problem of post-war economy. The point is that if restored to the pre-war condition the economy will be conserved as the commodity-based type, thus making Ukraine the poorest country in Europe. Therefore, there is a necessity to plan a transition and change in the economy structure to upgrade it to the technological type, developing in particular cutting-edge technologically advanced defence industry[25].

Whichever way our country will choose, the principles of sustainable development and environment preservation must underpin the economy recovery.

It is bad enough to have natural areas affected by the war and doomed to facing long-term consequences thereof, so the intact areas must not be destroyed in the name of Ukrainian economy recovery. Otherwise, the losses will be colossal. Hence, if natural areas of the NRF are destroyed, the estimated potential loss of benefits provided thereby (ecosystem services) will amount to about UAH 329 billion

[23] https://nv.ua/ukr/ukraine/events/zelenskiy-zayaviv-shcho-svit-ne-virit-u-maybutnye-rosiji-ostanni-novini-50223361.html

[24] https://www.epravda.com.ua/columns/2022/03/16/684116/

[25] Economic revival through industrial development of Ukraine. — Kharkiv: Povnokolir, 2020. — 432 p. http://www.expert.kiev.ua/docs/book2020_13.pdf

per year[26]. Such state policy will be at odds with public demand for the environment preservation. Prior to the active warfare of 24 February 2022, 66% of Ukrainian citizens believed that national authorities are not doing enough to preserve the nature[27].

Environmental protection was made a major issue in Europe yet in June 1972 at the Stockholm International Conference at which the sustainable development concept was first discussed and 26 principles of environmental protection were established. These principles underpinned all further international environmental treaties, became grounds for environmental policy of all EU states[28].

Recovery planning has to be well-balanced in terms of management, timeline and location, and adhere to the European environmental norms because assimilation of Ukrainian laws and practices on environmental protection to those of the EU is one of the preconditions for Ukraine's European integration. It has to be completely synchro-

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[26] The estimates were carried out based on the data of the Institute for European Environmental Policy on estimating the value of benefits provided by the NATURA 2000 Network of natural protected areas. The NATURA 2000 Network benefits for the EU was estimated as EUR 200-300 billion per year, the area in the EU being 110.7 million hectars. The intended area of the NRF of Ukraine is 7 million hectars till 2024. URL: https://ieep.eu/publications/estimating-the-overall-economic-value-of-the-benefits-provided-by-the-natura-2000-network

[27] "Environmental portrait of a Ukrainian citizen: comparison with the EU and recommendations. Analytical document. — Resource and analysis centre "Society and environment" (2018). The article was prepared based on a social survey of citizens aimed at revealing their attitude to environmental issues. The survey was run by a face-to-face interview method in May 2018 by the Fama Custom Research Agency. All in all, 2000 at least 15-year-old residents of Ukraine were polled. The survey was carried out on the entire territory of Ukraine except the areas uncontrolled by Ukrainian authorities (districts of Donetsk and Luhansk regions and AR of Crimea). The survey employed the Eurobarometer methodology, that is why the results are compatible with similar opinion surveys run in the EU. Ukrainian residents name wildlife protection (15%) among main associations with the concept "environment" (ecology).
Endnotes 4, 5 to the Conception of State Policy on achieving objective 9.7 "Ukrainians preserve natural ecosystems for descendants" of the CMU Programme of Activities in the nature reserve section.

[28] https://www.un.org/en/conferences/environment/stockholm1972

nized with the European Green Deal[29] and other documents adopted within its framework (the EU Biodiversity Strategy for 2030, EU Forest Strategy etc.) and other acting in Ukraine international conventions and agreements. To be successful, the recovery must rely on relevant research and development, transformations in regional development and a number of reforms in various branches of economy.

It is worth establishing a separate fund (or funds) for the environment remediation. Their establishment must take into account the omissions of special local and state environmental funds in Ukraine[30], **must comply with up-to-date European approaches to nature protection, be systematic, transparent and public and must be free of any corruption risks.**

The projects of infrastructure facility restoration to the pre-war condition must necessarily contain individual cost-benefit analysis[31] for such restoration. The assessment has to account for ecosystem services (their economic value and importance in the case when monetary value cannot be established) and sustainable development principles. These projects also have to rely on the conclusions about restoration feasibility and alternative options, in particular those including nature-based solutions.

Thus, for example, the feasibility of restoring the facilities harmful for the environment and population to the pre-war condition (employing outdated, eco-unfriendly, energy-inefficient technologies) should be questioned.

It is necessary to develop a complex convention, strategy and long-term implementation programme for the environment remediation with the core task of economic reconstruction based on the principles of "green" economy and effective adaptation to climate changes.

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[29] https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

[30] https://www.oecd.org/governance/cost-benefit-analysis-and-the-environment-9789264085169-en.htm

[31] https://www.oecd.org/governance/cost-benefit-analysis-and-the-environment-9789264085169-en.htm

Measures aimed at restoring nature protection activities, especially in the regions affected by the war must become part of state tasks in a mid-term perspective, in particular:

- Restoration and strengthening of logistical and legislative basis of nature protection in post-conflict conditions;
- Recovery, expansion and automation of environmental monitoring and reports;
- Modernization of industrial and municipal waste treatment systems;
- Modernization of water supply and sewerage systems with due account of surface waters protection and water basin approach;
- Ensuring effective operation of the NRF objects bearing in mind the need for restoring the areas affected by warfare;
- Restoration of other affected areas, water bodies, forests and shelter belts;
- Modernization of principles and practices of enterprise exploitation, closure and recultivation of mining enterprise areas.
- Raising public awareness of environmental protection, especially in the areas of active combat or affected by such operations[32].

Therefore, the following principles should be taken into account during the post-war reconstruction of Ukraine:

1. Consistent environmental policy and development of the country according to the European Green Deal.
2. Compliance of recovery with the needs of Ukrainians and sustainable development principles of Ukraine.
3. Availability of and compliance with the environmental standards at all levels of forming and implementing the policy related to the environmental protection.
4. Adhering to the European environmental planning instruments in developing Ukraine.
5. Effective operation and use of trust/donor funds for post-war recovery and reconstruction of green economy.

[32] https://www.oecd.org/governance/cost-benefit-analysis-and-the-environment-9789264085169-en.htm

The overall economy reconstruction course for Ukraine as a country with the EU integration policy must take into account the EU recommendations. In particular, the recommendations of the European Commission on socioeconomic development, including the EU Action Plan "Towards Zero Pollution for Air, Water and Soil"[33].

There must be a balance among the interests of the public, business and environment. It is necessary to take due account of the environmental policy provisions, environmental conditions and limitations in all other strategic and programme documents in all spheres of public life at all levels. It involves europeanization of the environmental legislation, ecologization of the public mind, introduction of environmental standards at all levels, facilitation of inclusive green economy development, scientifically justified governance based on the valid data, development of circular economy[34].

[33] http://epl.org.ua/eco-analytics/shlyah-do-zdorovoyi-planety-dlya-vsih/#

[34] http://epl.org.ua/eco-analytics/polisi-adzhenda-novogo-ministra-zahystu-dovkillya-ta-pryrodnyh-resursiv/

# 3. INDISPENSABLE REFORMS FOR CREATING THE INSTITUTIONAL BASIS OF THE ENVIRONMENT RECOVERY TO THE NATURAL STATE

It is vital to understand that effective regulation of existing problems is absolutely out of the question without implementing a number of horizontal reforms which would ensure a transparent, open, democratic and pro-European vector of Ukrainian official policy and, therefore, expedite the European integration processes for our state.

First and foremost, it is the reform of environmental control. As of today, the environmental control is ineffective and virtually fails to pursue the goal of environment preservation, which, correspondingly, remains polluted. The environmental control reform should involve: establishment of an independent environmental control body along with altered environmental control procedure, provision of necessary equipment and altered aim of the control operations. Moreover, it is necessary to reform the environment condition monitoring, environmental responsibility, use of funding received as damages for the environment pollution and also take measures to raise environmental awareness among the population. The introduction of these changes will make it possible to effectively protect environmental rights, ensure accessibility to the data on the condition of various environment elements with the view to making management decisions etc. Furthermore, those individuals who are using natural resources illegally will lose the source of income or incur extra expenditures on legal acquisition of timber or other resources. In the long run, the control reform will significantly reduce the adverse impact on the environment and, correspondingly, on

the health and life of all population categories. As a result, we will also manage to dispose of corruption in a large sector of state governance.

Another area to be reformed is legal liability for environmental harm. Legal liability must be real, proportionate and adequate to the damage inflicted on the environment. The ultimate goal of legal liaibility is preservation and recovery of public welfare, protected by legal regulation, or in this context of the environment. As of today, this mechanism is ineffective in Ukraine. In view of this, we suggest introducing changes to corresponding legal acts which would expand the legal entity liability basis for the environmental harm, essentially increase the fines payable for such violations, earmark all funds, acquired in the course of implementing environment-related legal liability mechanisms (fines, environmental damages and illegal benefits), to the component recovery and condition improvement in the environment injured by illegal activity. In a long-term perspective, the reform implementation will allow us to live in a healthy environment and enjoy various environmental services.

Implementation of the above mentioned reforms will become a crucial factor on the way of carrying out the provisions of Chapter 6 of the Association Agreement between Ukraine of the one part and the European Union, European Atomic Energy Community and their member states of the other part. Moreover, these reforms will facilitate the introduction of mechanisms allowing us to develop open, progressive and European state governance based on the principles of the European Green Deal.

# 4. SECTORAL REFORMS AS A PREREQUISITE FOR THE RESTORATION OF THE ENVIRONMENT TO THE NATURAL CONDITION

## 4.1. Nature reserves management

The economic recession following the war will bring about heavy use of the environment with the view of economic development, while the risk of irrational and extensive use of natural resources by impoverished population will rise significantly. It will primarily jeopardize natural protected areas.

Unfortunately, these tendencies were observed in the world and Ukraine yet before the rf waged a full-scale war in Ukraine. According to the research[35], croplands span 6% of global protected area. Even though most of them are within the mixed-use reserve zones, 22% of croplands occur in strictly protected areas, including nature reserves, national parks, sanctuaries etc.

Post-war exploitation of the environment poses a threat of increasing tendency of agricultural use of protected areas in Ukraine.

The percentage of the Nature Reserve Fund areas in Ukraine is 3 times smaller compared to that in the EU states[36]. Since 2010, the

[35] https://www.pnas.org/content/118/4/e2010121118

[36] Ukraine is significantly behind in developing the system of areas and objects of the nature reserve fund which ensure protection of natural areas (6.6% of the total country area) compared to the EU countries (21.8%) URL: https://www.eea.europa.eu/themes/biodiversity/protected-areas/facts-and-figures/number-and-size-of-protected-areas-1

nature reserve fund area in our country has increased by 21.9% and the protected area in the EU states by 42% correspondingly[37]. Military operations in the country will undeniably affect the possibility to establish new reserves and will prevent the existing NPAs from pursuing the goal of the environment protection.

With the existing policy in this sphere, the natural systems degradation due to intensified anthropogenic pressure is going to become a far greater issue and the problems related to the costs of natural disaster prevention and liquidation, water and soil purification, fighting floods, pests etc. are going to become more acute.

So far, there are a few major reasons for the existing problems related to protection of the natural reserve fund of Ukraine:

- (1) protected area network is not large enough to preserve biodiversity;
- (2) current state system of governance of the nature reserve fund areas and objects prevents their efficient preservation and restoration;
- (3) absence of free access to comprehensive data about the nature reserve fund areas and objects and associated limitations;
- (4) low public awareness of ecosystem services provided by natural protected areas.

In order to eliminate these factors, it is necessary to ensure application of established indicators of change-implementing task performance. The following are important actions in specific areas.

*About 1. The NRF expansion and biodiversity preservation.*

Increasing the nature reserve fund area (to comply with the established indicator) by way of creating new and expanding existing NPAs relying on scientific justification and spatial ecological continuity of protected areas and avoiding their fragmentation. In order to increase the area more effectively, introduction of changes to the legal acts regulating the procedure of establishing and changing the boundaries of the nature reserve fund areas and objects.

Establishing legal grounds for full-fledged operation of the Emerald Network, its expansion and protection.

[37] https://www.eea.europa.eu/data-and-maps/indicators/nationally-designated-protected-areas-10/assessment

Establishing natural protected areas of international importance, including transboundary ones.

Revision of scientific and methodological recommendations on spatial arrangement of NPAs and carrying out research on protected areas with the view to their increased efficacy.

Establishment and maintenance of a status monitoring system for the preservation of rare and endangered wild flora and fauna species and valuable habitats in Europe.

*About 2. The NRF governance efficiency.*

Devising and adopting a single conceptual document related to organization, protection and effective use of the nature reserve fund.

Stronger state governance system pertaining to the nature reserve fund areas and objects within the Ministry or by way of establishing a separate special state governance agency.

Elaboration of the Procedure of devising and adopting management plans for the NRF areas and objects and its approval by the relevant Regulation of the Cabinet of Ministers. In particular, as for the NRF areas without an administration, replacing the regulation and protection commitment with the NRF object protection management plan, which is a part of the relevant Regulation; and stipulating the need for regular monitoring of the NRF objects.

Introducing the management efficiency assessment for the nature reserve fund areas and objects, especially for BRs, NRs, NNPs and audit of the NRF object management plan fulfillment.

Reforming the state protection service for the nature reserve fund of Ukraine to meet the European standards, in particular in terms of offence prevention.

Introducing changes to the budget, specifically: in the course of decentralization processes to earmark the funding for the management plan implementation and protection regime maintenance on the NRF areas and objects at the cost of the natural environment protection funds run by local authorities and the State Budget of Ukraine; ensuring sufficient funding of the nature reserve fund institutions, including raising the salary of their employees at least to the average salary rate in Ukraine; establishing regional target programmes related to nature reserves management.

Enhancing taxation of land plots in nature reserves or other protected areas.

Improving the efficacy of separate NRF objects (grant, consultation, educational, methodological and other support).

*About 3. The NRF data.*

Establishing a single governance and communication platform in nature reserves management in order to include the data on the nature reserve fund objects in Ukraine (scientific and nature protection projects, biodiversity monitoring data (preservation of rare and endangered wild flora and fauna species and natural habitats in Europe), environmentally educational events, tourism infrastructure, etc.

Setting up an open data base of the State Cadastre of nature reserve fund areas and objects of Ukraine.

Introducing physical delineation of the NRF object boundaries and put up relevant information signs.

Access to the information on the NRF area boundaries and existing limitations according to the State Land Cadastre. Ongoing update of the Cadastre. Establishment of a separate informational layer in the State Land Cadastre (Public Cadastre Map) of the nature reserve fund areas and objects.

*About 4. Society and the NRF.*

Enhanced appeal and accessibility of tourism and recreational services provided by the nature reserve fund areas and objects.

Establishment of informational environmentally educational centres at the nature reserve fund institutions.

Expansion of the trail network in the national nature parks and biosphere reserves, including employment of interactive methods and infrastructure for the individuals with special needs.

Ensuring active and effective presence of the nature reserve fund institutions in the information field.

Launching and running information campaigns among the population about the importance of the nature reserve fund areas and objects (ecosystem services, including climate change prevention, wild animal and plant gene pool and landscape preservation etc.)

**Columbia case.** The country was exposed to a systematically weak national government poor at managing the natural protected areas and adjacent regions. Among the reasons were absence of financial, technological and operational power to register illegal land grabbing; low financial and legal capacity of reclaiming the illegally grabbed land; administrative centralization which strips regional departments of autonomy. For example, the national government failed to ensure functional institutional presence in a few NPAs. Neither law-enforcement bodies of the country, nor the special administrative unit responsible for retrieving forcefully reclaimed lands were effective. These factors allowed large landowners and other illegal individuals to grab the NPA land or adjacent thereto.

Moreover, the population in Columbia is generally very little involved in decision making related to the use of natural resources (undeveloped participation). Financial investments and economic stimuli's capacity in marginal (underdeveloped) regions is rather low.

Even though Columbia's experience may be unique, there are some general lessons to be applied to post-colonial cases.

Upon the conflict settlement and conclusion of peace, the governments need to put in coordinated efforts of all involved agents to establish effective physical and legal presence within and around natural protected areas. The environment remediation plans, i.e. necessary measures for the degraded NPAs, must not merely pursue environmental goals but also involve definitive re-establishment of state institutions in protected areas. It is of primary importance to restore regional environmental bond between the NPAs and unprotected lands based on the processes regulating on a large scale biodiversity preservation and development, which would contribute to achieving the goals under international obligations, among others Objective 11.

What is more, the governance efforts should not only be aimed at biodiversity protection but also take into account broader social and economic needs of territorial communities neighbouring the NPAs. The economic development is a key factor not only in preventing illegal activities but also reducing deforestation. Therefore, state stimuli supporting sustainable felling practices is compulsory. Moreover, when security conditions allow, ecotourism needs to be developed, which

will provide an opportunity for local economic development in buffer zones or in NPAs, where the security regime permits. Preliminary data already demonstrate that the number of tourists is increasing in Columbia, the same is true about the number of people visiting national parks. It proves a promising prospect of peace.

The nations undergoing changes, in particular those in war or post-conflict reconstruction conditions, need help in order to quickly restore environmental protection. Aid is also needed (e.g., financial grants, technical support, policy expertise) to support governments in repatriating displaced people to their rightful lands and to restore effective rule of law within and outside conservation areas. Forests and natural systems are assets with the potential to deliver resilience and sustainable benefits to society long beyond short-term profits. Their effective conservation requires an integrative, comprehensive understanding of territorial communities' needs, sustainable development, and long-term management[38].

Therefore, the natural protected areas management system in Ukraine requires fundamental transformation and development in order to secure effective implementation of existing laws against illegal use of natural resources and NPA regime violation, and for retrieving and remediating the occupied/grabbed lands.

In addition, it is necessary to develop the recommendations on specific activities and functioning of the BRs, RRs, NNPs, RLPs affected by the war (the efficacy of which was undermined by the loss of employees, offices, equipment, transport etc) and/or comprising mined areas. Demining and restoring of the NRF object administrations' ability to (effectively) carry out their functions takes a long time (probably years or even decades) and essential financial resources, which will be difficult to raise in the conditions of economic recession in Ukraine. The administrations of such NRF objects will not be able to maintain their territories in the same way as they used to prior to 24 February 2022 and need to devise new approaches in compliance with new conditions and actual state.

[38] https://www.nature.com/articles/s41598-020-61861-y.#Sec2

## 4.2. Forestry

The post-war economy recovery conditions will call for a number of reforms in the sphere of forest resource management, some of which were already launched in 2020–2021, in order to ensure conservation and sustainable use of forest resources of Ukraine. One of the major benchmarks for Ukraine in this direction must be the EU Forest Strategy for 2030 adopted under the European Green Deal.

Thus, to satisfy the economy's need for timber and at the same time preserve the forest biodiversity and natural forest ecosystem services, it is essential to carry on active reservation of valuable forested areas along with legal recognition and protection of the Emerald Network areas (draft law № 4461).

*New felling rules* must stipulate a large-scale transition to selective felling as well as converting the artificially planted forests to match the natural structures. Increased felling in Ukrainian forests[39] as suggested by some officials can actually be carried out without substantial damage to nature merely by way of increased harvesting in planted forests (that is sanitation felling, selective and gradual clearcut felling, conversion felling) while reducing exploitation load on natural forests.

Stability of the forest sector of Ukrainian economy must also be ensured through increased use of non-timber forest resource, particularly through tourism stimulation. The body responsible for balanced use of timber and non-timber forest resource and development of cooperation in this direction should be the State Forest Resources Agency or its counterpart.

A major obstacle for forest use in post-war time will be vast areas of mined or potentially mined forests. High-quality forestry will be impossible in such areas, to say nothing of tourism development. Therefore, it is necessary to devise a relevant state programme of managing the mined forested areas taking into account the experience of the countries which have faced the mining problem. The mined areas with the hardest access will most probably be never fully cleared of mines, and as a result they must become reserves for conservation and recovery of natural ecosystems. However, high-quality demining of most forested

[39] https://www.facebook.com/ruslan.strelets/posts/3317803768532727

areas on which combat operations took place is quite feasible and should be carried out with the help of world leading specialists and international funding.

The use of forest resources should be consistently governed by nature-protection legislation, and this must be ensured by reforming the state environmental control system (approval of the draft law № 3091 in the second hearing in the version supported by the environmental community and of a set of by-laws). Apart from this, it is vital to increase legal liability for violating the legislation by regular forest users while carrying out forestry activities, especially felling. To this end, a law needs to be adopted to stipulate a broader notion of illegal felling, including the felling carried out in violation of the requirements of the valid laws, as well as increased punishment for offenders.

Increased forest cover index in Ukraine may only be ensured by conservation and balanced use of naturally forested areas and creation of private forests on the degraded farmlands along with complete refusal from afforesting steppe and grassland ecosystems. To this end, it is necessary to approve in whole draft law № 5650 stipulating inclusion of naturally forested areas in the forest fund and possibility of carrying out forestry activities as desired by the land owner, buyout of private lands by the state to be further afforested and reserved, and also ban on afforesting steppe ecosystems and invasion of alien species in natural ecosystems.

In order to ensure achievement of the above mentioned goals, a number of consecutive measures need to be taken by different agents. It is only possible if a relevant action plan is adopted, which should be the National Action Plan to implement the State Forest Resource Management Strategy of Ukraine for 2035, which was devised and adopted following the principles of the European Green Deal.

One of the mechanisms of financing such measures must be monetization of the forest ecosystem services. In other words, it is involving funds of communities who receive tangible and non-tangible benefits from the forest sustainable management.

## 4.3. Land use, including mined areas

Since the 19th century (and especially in the 20th and 21st centuries) the land use practices in Ukraine have caused substantial adverse pressure on land resources, irrational land use and soil degradation.

By the ploughland percentage (56%) Ukraine occupies the first place in Europe and agricultural land use causes extensive erosions, reduced soil fertility and soil contamination with crop-protecting chemicals, and requires application of mineral fertilizers causing further contamination of land and water.

Predominant commercial interest in growing monocultures (cereal grain crops, pulses and oilseed crops), failing to ensure crop rotation and corresponding impoverishment and contamination of soils, comparatively low appeal of organic farming multiplied by decreased consumer buying capacity results in daunting future prospects for agriculture and danger of significant decrease in biological and landscape diversity (traditional agricultural landscapes).

A separate problem is uncontrollable and illegal tillage of and construction on land plots such as shelter belts, floodplains, meadows, pastures, peatlands or forests the legal status of which is not determined.

Apart from irrational agriculture, vast land areas in Ukraine are polluted by industries, or allotted for mineral production, or used to store or landfill waste.

The land-use related environmental issues directly affect food security of Ukraine and the world, and cause other environmental (water resource pollution, climate changes, biological and landscape diversity loss) and social (individual health issues, forced migration) problems.

These problems have been greatly aggravated by the russian federation's invasion of Ukraine with further active combat operations in Ukraine. The war has prevented agricultural use of some of the lands (loss of benefits and loss of produce in agriculture), land contamination caused by industrial facility and municipal infrastructure destruction, and contamination caused by military equipment and ammunition.

Vast areas remain mined (according to the UN, as of today Ukraine is the most mined country in the world) and/or contaminated with explosives, and consequently they are withdrawn from circulation.

In view of all the above mentioned problems, global trends in the environmental science and agriculture development, sustainable development objectives, as well as prospects of lasting, non-exhausting and sustainable land use, it is essential to take certain measures aimed at dealing with crisis phenomena and ensuring long-term sustainable and investment-attractive policy in this sphere.

**Delineation and legal status determination of reference soil plots** and conservation of their condition. 3 reference soil categories have been suggested:

a) Natural soil reference
b) Cultivated soil reference
c) Anthropogenic soil reference

All these categories are fundamental for creating a soil monitoring system, their protection, prevention of their quality deterioration, and preservation of biological and landscape diversity.

Soil reference protection implies that they should be on clearly designated land plots with appropriate security. Nature reserve fund objects may be created in natural soil reference areas or such areas may be delineated within existing objects. Protected soil reference objects, especially cultivated and anthropogenic ones, must be subject to regulated flexible security depending on the reference category.

Moreover, in order to preserve certain soil types with low resistance to anthropogenic load, it is expedient first to identify such soil types and next to introduce legislative limitations on land use in the areas comprising such soils.

**Organic farming and polyculture support.** State policy in the realm of agriculture support and attraction of investment should promote shifting away from monoculture towards polyculture farming practice, which is closely related to support and development of small and medium agricultural producers and household farms.

Special attention should be focused on supporting organic farming as a means of production and provision of produce for the consumers with minimal harm to the environment.

These steps can be taken by way of making organic farms attractive for investment as well as providing other support such as:

– Provision of free consultation for those who intend to establish an organic farm;

– Simplified access to the produce market;
– State and local authorities' support with seeds and planting material;
– Temporary exemption of land use tax;
– Promotion of organic produce on the markets and facilitation of access to markets abroad.

Development of polycuture and organic farming is a way to guarantee food security of the country and the world because it supplies the consumers and the market with main vitally important kinds of high-quality agricultural produce while reducing the anthropogenic pressure on ecosystems, decreasing the pollution level, and creating the preconditions for overcoming the demographic crisis in rural areas.

A major issue in ensuring non-exhausting and sustainable land use is **crop rotation**. Along with other measures they prevent soils from excessive loss of nutritional substances and contribute to a long-term result. Unfortunately, there are multiple cases in Ukraine when crop rotation rules are not followed, which is caused primarily by agricultural economic condition and peculiarities of growing certain crops. It leads to soil exhaustion and erosion. This issue can be dealt with by means of introducing crop rotation rules which would be mandatory for producers with stipulated compulsory application principles. The producers growing crops on the areas above 20 hectars will need to have a crop rotation passport, elaborated by an expert agronomist on scientific grounds and mandatory for implementation.

It will also be necessary to **introduce the state land resource control system** and land user responsibility to be carried out based on the monitoring data and involve not only land use control in terms of area or intended use of plots, but also control of nature protection, in particular soil protection measures and responsibility for irrational land use (fertility reduction, contamination with agricultural chemicals, use of tillage methods causing erosion etc.). Land monitoring is an integral part of high-quality land resource management. It is necessary to establish state ongoing land resource condition monitoring system, which will act as an independent body and provide data on land resource condition, dynamics, structure, pollution level, prognosis etc. in Ukraine. All land users will have to provide data on the land resource

condition in order to carry out state land resource monitoring as well as free access to the areas of necessary data collection.

As for water safety, biological diversity and ecosystem preservation, water pollution prevention, it is absolutely essential **to ensure the availability of shelter belts.** Unfortunately, their disruption has become massive and systemic. Fast economy and state infrastructure recovery cannot justify the intention to construct in the areas within forest shelter belts or floodplains, inasmuch they are indispensable in preventing water body pollution and ensuring ecosystem services provided by water bodies, serve as a barrier preventing mineral fertilizer from leaking into the water or moisture accumulation, ensure biodiversity and habitat preservation etc. The war in Ukraine and use of rivers as a water supply source, defense lines and obstacles for the enemy's operations has proved the importance of preserving natural rivers also for state defence purposes. With this regard it appears urgent to improve the situation in this sphere:

- To increase fines for disrupting the shelter belts;
- To impose stricter control of maintaining the shelter belt protection as stipulated by legislation;
- Simplified decision-making procedure related to demolition of illegally constructed houses or other buildings, restoring the affected areas to their original state and compensation for inflicted damage;
- Legal expansion of shelter belts to match the river floodplain boundaries.

In the pre-war period, Ukraine was heading towards decentralization, among others in the sphere of land relations. Thus, on 27 May 2021 the Law of Ukraine of 28 April 2021 № 1423-IX "On amendments to certain legislative acts of Ukraine on improving the administration and deregulation system in land relations" came into force. The amendments introduced by the law stipulate more powers for territorial communities in land relations. For example, since 27 May 2021, all state-owned land located beyond the settlement boundaries within a territorial community is deemed the land in the communal ownership of such a territorial community except the land stipulated in cl. 24 of Chapter X of the Land Code of Ukraine. Determined state-owned land plots which

have their own cadastre number and distinct boundaries and whose state ownership is filed in the State Register of Real Estate Rights are transferred to communal ownership since the state registration of the communal ownership right for such land plots. Other plots and lands which are not determined as land plots are transferred to communal ownership automatically since 27 May 2021. It means that lion's share of lands in Ukraine are governed by local authorities (hereinafter, LA) and it is the latter who will play a major role in using land resources in post-war reconstruction of Ukraine. The LA powers make them greatly responsible for acknowledging the land condition, determining its legal status and managing it.

Due to the fundamental role the LA play in this sphere, relevant systematic professional training is recommended for the LA employees. Training sessions need to be organized and educational events need to be held for them. Only this way does it appear possible to eventually handle these issues with satisfying the legislative requirements for the benefit of the country in whole and of the Ukrainian environment in part.

Land issue regulation has been altered during the war. Thus, the Verkhovna Rada adopted in whole the Law of Ukraine "On amendments to certain legislative acts of Ukraine concerning the creating of conditions for ensuring food security under martial law" of 24.03.2022 №2145-IX. Among others, this law stipulates the following: establishment of an electronic form for land lease agreements for land plots in state or communal ownership, and unreclaimed and undivided land plots to be leased for agricultural production under martial law, and their conclusion must be carried out without land bidding; determination of a land plot to be leased is carried out without filing the information on such land plot in the State Land Cadastre and assigning a cadastre number; in the case of receiving a land plot under simplified procedure the land plot lessee is not entitled, among others, to the right for offsetting own expenditures on improving the land plot or planting perennials on the land plot; the land plot owners and users are exempt from liability for the non-compliance with the requirement to use the land as intended ensuing from failure to use the land plot. The above mentioned changes do not facilitate but rather contradict the principles of transparency and openness of

land management. During post-war reconstruction such mechanisms and obscurity of data are unacceptable.

Therefore, we believe reconstruction of Ukraine must involve land relations based on the following principles and approaches:

*1. Openness of public cadastre map of Ukraine.*

Closure of the registers and other official information resources of the state under martial law is justified by possible enemy's attempts to steal the information they need or use it to the detriment of Ukraine, therefore it appears acceptable. However, restricted access to such information in post-war period is out of the question. Inaccessibility of information on the land plot cadastre number, its boundaries, area, kind of ownership, intended purpose according to the classifier, or existing limitations in use may facilitate abuse by businesses or authorities and prevent the public from controlling the reconstruction process. Besides, it is necessary to avoid simplified administrative procedures and decision making in land relations, and update the public cadastre map to include the impact of military operations on land resources.

*2. Simplified permit process — not for all regions of Ukraine.*

A number of introduced simplified permit processes in land use sphere, particularly those stipulated by Law №2145-IX, are now applicable to entire Ukraine. In current conditions, however, different parts of Ukraine undergo different degree of impact from military operations. Therefore, any simplified permit processes in land relations seem to be more feasible in the areas and regions where state and local authority bodies cannot duly perform their functions related to land relations.

*3. Land and soil quality assessment and inventory.*

It is necessary to launch compulsory inventory and quality assessment of the lands and soils directly affected by military operations to identify their pollution, surviving or destroyed vegetation, presence of mines etc. before making decisions about the future of these lands and their management. It is essential that the results of such assessment be reflected on the public cadastre map. To this end, additional layers should be introduced. For example, to add the category of land plot safety: still mined, under demining, demined, data unavailable. It is also

possible to add a layer reflecting soil quality: heavily polluted, moderately polluted, data unavailable. To do this, amendments need to be introduced to some legislative acts regulating the operation of the State Land Cadastre. LAs must be able to contribute to the public cadastre map of Ukraine by adding data on the condition of certain land plots upon their inventory, running pollution tests or visual examination. Local authorities should take into account the pollution data, survival or destruction of vegetation, presence of mines etc. while making decisions related to post-war reconstruction of Ukraine. StateGeoCadastre should foster cooperation with SES, SEI and LA in creating valid data (layers) of the public cadastre map.

*4. Ongoing tendency of decreasing arable lands.*

The mentioned tendency facilitates fighting climate change and is most welcome in European countries. This trend may be maintained, among others, at the cost of mined or polluted lands. The point is that purification and remediation of such areas requires substantial funding and resource expenditures. Therefore, to ensure public safety some areas may be relinquished to recover in natural conditions and not used in agriculture.

*5. Conservation of lands the use of which can harm human life and health and environment condition.*

Firstly, such conservation must be applied to **mined** areas provided their demining is impossible or must be delayed due to financial, time or human limitations. As mentioned above, natural recovery is feasible in such areas. The latter, however, has to be carried out with ensuring restricted access of people to such areas in view of safety requirements.

Secondly, the lands subject to conservation are technogenically polluted land plots (by petroleum products, chemicals, military waste etc.). Correspondingly, their conservation must be followed by the elaboration of a plan of restoring these areas to safe condition and a cost estimate for such works, and search for funding of the restoration plan implementation. Furthermore, sufficient measures have to be taken to prevent further pollution dissemination to adjacent areas or reduce the pollution scale by the efforts of SEI, StateGeoCadastre and local authorities.

*6. Reclaiming land from the lessees associated with russia or belarus.*

According to analytical data, about 110 thousand hectars of Ukrainian arable lands are leased by russian and belarusian companies[40]. Objectively, aggressor-states must be prevented from further use of natural resources of Ukraine, therefore these lands must be reclaimed from belarusian and russian lessees.

Pursuant to cl. 2 ch. 2 art. 15 of the Law of Ukraine "On the legal status of martial law", military administrations in the settlements in a certain area are authorized to ensure effective use of natural, labour and financial resources. Clause 2 ch. 2 art. 2 of the same law stipulates that military administrations in the settlements in a certain area are authorized to resolve the issues related to regulation of land relations in compliance with the legislation (except the issues related to alienation of communal land plots and letting such land plots on lease for a period exceeding 1 year).

Following the mentioned norms, a law has to be adopted to endow the military administrations with the right to independently (without a court decision) deem land lease agreements involving russian and belarusian companies to be invalid.

Separate communities or individuals may terminate agreements with such counteragents contractually or by judicial mechanisms.

Thus reclaimed lands must be let on lease to Ukrainian farmers for tillage and growing crops.

*7. Soil preservation in war conditions.*

Soils are the basis for biodiversity preservation and agriculture development, therefore the reconstruction process must involve the preservation of the soil cover and prevention of using especially valuable (in terms of soil quality) lands for construction purposes. While adopting decisions about further construction, it is necessary to take into account the soil quality data available prior to russian invasion and soil quality analysis data collected upon the invasion to identify pollution caused by shelling, fuel and lubricant spills and military operations in the area in order to decide on possible further use of these lands for agricultural purposes. Available soil analysis data collected

[40] https://bit.ly/rf_rb_land

from the bomb craters in eastern Ukraine demonstrate that soil pollution is found even years later[41].

Thus, soil analysis data testify to increased content of heavy metals as well as presence of titan, which is not normally found in soils. Besides, local residents claim that their harvest was of low quality, had poorer yield and worse taste characteristics. That is why, in order to ensure agricultural produce safety for consumers' health, the soil occurring on the croplands affected by combat operations as well as produce grown there must be subject to scrupulous analysis.

### 4.4. Infrastructure and industry development

Warfare has caused significant damage to civil infrastructure in Ukraine. Thousands of buildings, dozens of bridges, thousands of kilometres of roads have been damaged or destroyed. It is going to take a lot of time to restore all the necessary infrastructure, therefore, it seems logical that the government will wish to make the restoration time as short as possible. However, in order to improve the quality of residents' life, accommodation, social and transport infrastructure has to be restored to the up-to-date European standards, in particular in the area of environment protection, using available cutting-edge technologies. Moreover, inasmuch the infrastructure reconstruction is going to be financed by the EU countries, all the works must be performed following the principles of the European Green Deal, including the EU Biodiversity Strategy for 2030[42].

The main signpost not only for European investors, but also for investors from other corners of our globe to invest into reconstruction of Ukraine could be the updated EU Taxonomy. It is the signpost for green investments and covers all activities responsible for 80% of greenhouse gas emissions.

The European taxonomy is a green classification system intended to facilitate implementation of the EU Green Deal, because it transforms the EU climate and environmental goals into the criteria for certain

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[41] https://truth-hounds.org/en/donbas-environment-invisible-front/

[42] Biodiversity strategy for 2030 https://ec.europa.eu/environment/strategy/biodiversity-strategy-2030_en

kinds of economic activity. The EU taxonomy would provide companies, investors and policymakers with appropriate definitions for which economic activities can be considered environmentally sustainable. The EU taxonomy regulation entered into force on 12 July 2020. It sets four conditions that an economic activity has to meet in order to qualify as environmentally sustainable, and also establishes six environmental objectives: climate change mitigation, climate change adaptation, the sustainable use and protection of water and marine resources, the transition to a circular economy, pollution prevention and control, and the protection and restoration of biodiversity and ecosystems.

An activity may be qualified as green if it makes an essential contribution to meet at least one of the EU environmental and climate objectives without essential detriment to other objectives and meets minimal social standards. An essential contribution implies that the economic activity either has a positive effect on the environment or substantially reduces the adverse impact on the environment. Causing no damage means that the economic activity does not make achievement of other goals impossible and has no adverse impact on them. Thus, the taxonomy does not include waste incineration plants because of significant air pollution caused by greenhouse gas emissions produced by waste incineration. The EU has recently included gas and nuclear energy into the taxonomy despite criticism and disagreement among countries. Gas may help Europe to shift away from coal used as a fuel for 15% of power stations around Europe, whereas nuclear power, which does not produce any CO2 emissions, cannot be qualified as green due to the problem of handling radioactive waste.

Therefore, taking into account the criteria and objectives of the EU taxonomy, Ukraine can hope for gas transportation system reconstruction, repair and modernization projects provided plans are made to start using hydrogen, promote shifting away from coat etc. Special attention is paid to the use of alternative energy sources, energy efficiency implementation, electric transport development, etc.

The "dirtiest" factories must become a thing of the past or completely upgrade their equipment. Reconstruction has to be carried out by means of the best available technologies and methods. For example, it is expedient to replace blast furnaces at metallurgic plants for modern electric arc furnaces emitting significantly less toxic pollution. Similarly,

it is necessary to cut down on thermal power stations and boiler houses working on fossil fuels, in particular on coal or fuel oil.

In order to avoid excessive impact on natural habitats, the infrastructure object reconstruction should not only involve cutting-edge technologies but also, wherever possible, aim at sticking to the pre-war location of relevant objects. In other words, it is essential to avoid constructing new facility in a natural habitat when there is an alternative site, for example, the place where a similar facility used to be located but was destroyed during the war.

Transport infrastructure needs to be restored to meet modern EU standards and leading tendencies. For example, in the area of domestic passenger transportation service priority should be given to high speed railway reconstruction and/or construction projects rather than aviation infrastructure. Therefore, it is expedient to invest in high speed railway network development and railway electrification to connect all oblast centres rather than construct/reconstruct a large airport in each oblast centre.

Ukrainian transport sector not only needs reconstruction and repair of certain sections and facilities damaged by warfare, but also requires high-quality modernization, increased efficiency and competitiveness, adaptation to European norms. For instance, an obligatory component of overhaul or construction of national and international roads must be the establishment of ecoducts (wildlife crossings) for wildlife in the areas where the road goes through vast natural habitats or wildlife migration paths. For example, see the reference[43] to manual "Wildlife protection in road investments in Poland".

Infrastructure project plans must make uttermost use of energy efficiency and eco-friendliness principles and nature-oriented solutions. For example, ensuring natural lighting in a building, planning "green roof" arrangement, rainwater harvesting from the roof surface etc.

European Green Deal and European Commission have a vision of all new buildings producing zero waste by 2030, which implies minimal energy consumption by such buildings, maximum use of energy from alternative sources, no carbon emissions related to fossil fuels and esti-

[43] https://uncg.org.ua/wp-content/uploads/2021/03/Posibnyk_z_Ochorony_dykych_tvaryn-web1.pdf

mated global warming potential for the entire life cycle of the building. The EU calls for modernization of old buildings, both residential and non-residential for them to meet at least Energy Performance Certificate rating F. That is why the renovation and modernization of the damaged residential and civil buildings have to involve steps aimed at increased energy efficiency of such buildings, reduced energy from fossil fuels and transition to alternative energy sources etc. The buildings destroyed by the war now have a very good chance to be improved, become more energy-saving, warmer and comfortable.

Moreover, it is necessary to avoid building materials which are banned in the EU and are harmful for health. It primarily refers to toxic and hazardous chrysotile asbestos. Further, it is necessary to avoid leaded paints, construction materials contaminated by radioactive pollutants, materials containing polychlorinated biphenyls (PCB).

The EU places priority on the following green projects:

- Renewable energy production and use;
- Increased energy efficiency (including transport, construction, agriculture, waste disposal sectors, etc.);
- Energy accumulation and storage;
- Power grid and engineering system modernization (including centralized heating supply systems, power transportation grids, improved power grid integration).

Therefore, the reconstruction of Ukraine has to take into account these priorities and objectives, which are also the objectives of most international financial institutions, which are going to aid Ukraine in reconstructing the infrastructure destroyed by the war.

## 4.5. Subsoil use

Traditionally, subsoil use in Ukraine is the most profitable nature use business. The royalty related to subsoil use alone payable to the state budget of Ukraine over 2021 amounted to UAH 75.569 billion[44]. Besides, over recent years there have been talks about mineral extrac-

[44] https://openbudget.gov.ua/national-budget/incomes?fundType=TOTAL&monthFrom=1&month=12&year=2021&budgetType=NATIONAL&code=13030000

tion intensification in Ukraine[45]. Even a draft new Code of Ukraine on subsoil was devised with the aim of simplifying the extraction activities for businesses[46]. The share of extractive industry in the world leader countries is dozens times larger than that of Ukraine and is a major contribution to their economy development (fig. 5).

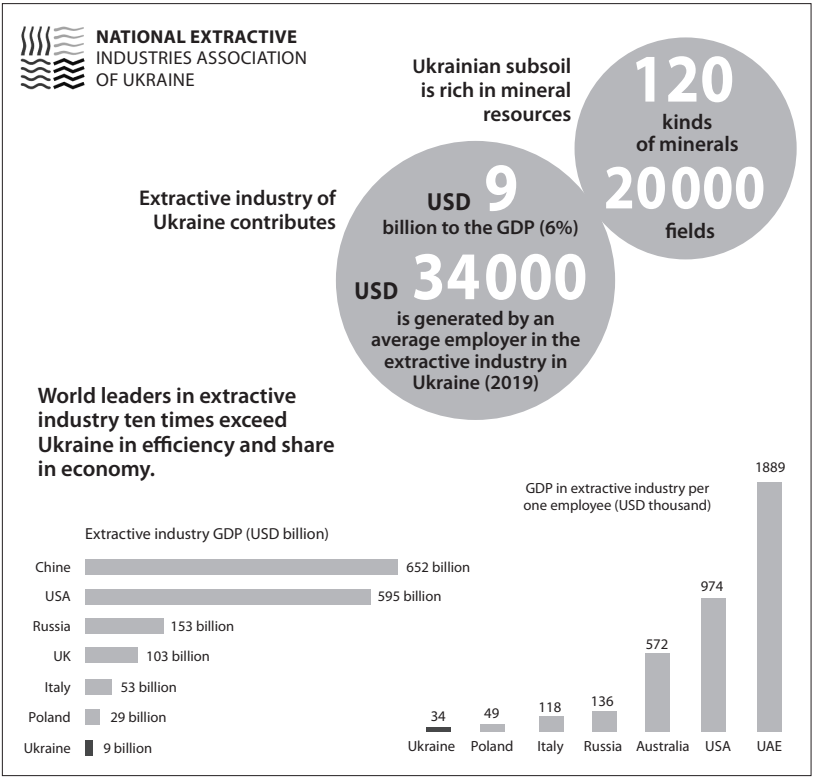


Fig. 5. Extractive industry share in the economy of world leaders and Ukraine

[45] https://www.ukrinform.ua/rubric-economy/3279732-za-10-rokiv-potencial-vikoristanna-nadr-ukraini-moze-zrosti-do-400-milardiv-smigal.html

[46] https://mepr.gov.ua/files/%D0%9F%D1%80%D0%BE%D1%94%D0%BA%D1%82%20%D0%9A%D0%BE%D0%B4%D0%B5%D0%BA%D1%81%D1%83%20%D0%A3%D0%BA%D1%80%D0%B0%D1%97%D0%BD%D0%B8%20%D0%BF%D1%80%D0%BE%20%D0%9D%D0%B0%D0%B4%D1%80%D0%B0.pdf

However, excessive business deregulation often leads to unjustified high environmental damage risks. Moreover, post-war reconstruction of numerous infrastructure facilities will require increased production of mineral resources, in particular those used in building: sand, limestone and clay (for cement production), granite etc. Inasmuch Ukraine has vast reserves of the mentioned resources, they will be more actively used during reconstruction which also implies increased risk of environmental damage caused by its changed condition.

What is more, post-war enterprise reconstruction must be accompanied by reforming the extractive industry because in its existing condition and in view of available mineral reserves it is hardly effective and has low efficiency in terms of economic contribution if compared to the leading states in the industry[47].

In order to minimize the environmental hazard and ensure effective balanced use of mineral resources during the reconstruction of Ukraine, the following steps are suggested:

1. To ensure transparent subsoil use, in particular the special permit distribution system and environmental impact assessment. The transparency will always reduce corruption risks, especially in such sphere as subsoil use, where billions of dollars circulate annually.
2. To carry out transition to environmental impact assessment procedure applicable to the subsoil objects prior to selling permits for special subsoil use. It will allow selling special permits on auctions with due respect for public opinion and imposing pre-established environmental conditions and limitations on intended operations. This way, the buyer of a special permit will be able to launch the operations the moment they receive the relevant document. The subsoil objects at which the acceptable environmental impact associated with their development cannot be ensured with available technologies will be conserved until the technologies required for safe development appear. It will prevent the situations when the enterprise has bought a special permit and the authorized body "must" issue a positive conclusion on EIA irrespective of report data and public discussions so as not to hamper return in investments.

[47] http://neiau.org/nadpu-prezentuye-reformu-nadrokorystuvannya-7-pershyh-krokiv-i-rezultativ/

3. To enhance control of the recultivation works performed by subsoil users in the areas of subsoil use.
4. To further liberalize access to geological data, and ensure openness and accessibility of geoenvironmental data. On the one hand, it will allow attracting funds for digitalization of geological data for their prompt interpretation where budget funding is unavailable; and on the other hand, it will give an opportunity to compete in international mineral resource market. Making geoenvironmental data open and providing free access to them for the public and individuals facilitates implementation of the constitutional right of Ukrainian citizens for safe environment and guaranteed right for free access to information on environmental condition (p. 50).
5. To develop unified coordinated vision of subsoil use model and its development relying on best world practices, in particular those related to ecologization.
6. To maintain appropriate interinstitutional cooperation and/or establishment of an institutional leader in this sphere. It will make cooperation between interested parties more effective, facilitate elaboration of permit procedure matrix versions, enable development of a guidebook (manual) for planning operations at different stages of subsoil use project implementation, more effectively involve various interested official bodies and allow them to perform controlling function[48].

The community actually issues a permit for mineral extraction itself, or actually resolves the issue of whether to carry out the extraction or not, but it also has to make a decision related to placing a mineral extraction facility in their territory and also designate a part of their territory (concrete boundaries, concrete location with relevant coordinates).

Within its area the community must agree on **the territorial alternative location** for the mineral extraction facility, provided the mineral production site is not delineated exclusively by geographical coordinates of the subsoil plot identified in a Special subsoil use permit. It will allow

[48] https://ua-energy.org/uk/posts/reformy-v-nadrokorystuvanni-i-na-rozdorizhzhi-i-na-chasi

attracting investment, creating jobs and placing the mineral extraction facility in the most expedient place in terms of ecology.

The parametres of determining the sanitation-protective **effect zone** of the mineral resource producing facility are outdated and cannot be relied on in current conditions because of the presently implemented reform of power decentralization in Ukraine involving the establishment of new territorial communities.

For example, let us look at a complicated case when a sanitation-protective zone of an open quarry according to the SCN was established 300 m long and 1 km away down the river from the boundary of the adjacent community and its actual impact will affect the area of the adjacent community, which under the valid legislation cannot influence the decision-making process related to placing a mineral extraction facility.

In order to eliminate such problems and in view of the interests of the community members, which may be violated by launching the planned operations, we suggest amending the valid legislation and establishing the requirement by which "if a sanitary-protective zone, established in accordance with the SCN, 10 times exceeds the distance to the nearest community, a consent of the community adjacent to the intended construction is required to locate the mineral extraction facility" and in this way to coordinate the legislation with modern-day realia.

## 4.6. Water use

While assessing the condition of water resources and hydraulic structures as separate critical infrastructure sectors in Ukraine, it is essential to keep in mind that we are one of water-stressed countries of Europe in part and the world in whole. By the amount of internal fresh water reserve per person, Ukraine is 111$^{th}$ in the world among 152 countries and territories (according to the World Bank statistics)[49] and is one of the most water-stressed country of Europe. Local river stock reserves in Ukraine per person amount to about 1.0 thousand m$^3$

[49] Rational use of water resources as a factor of ensuring the national security of Ukraine (scholarly papers of the VII Plenary Session of the Union of Economists of Ukraine and All-Ukrainian scientific and practical conference). Kyiv : 21 September 2012, 275 p. URL: seu.org.ua/wp-content/uploads/2013/12/voda.pd

a year. In contrast, the corresponding indicator in Europe is as follows: Norway — 96.9 thousand $m^3$ per year; Sweden — 24.1; Finland — 22.5; France — 4.6; Italy — 3.9; the UK — 2.7; Poland — 1.7; Germany — 1.3 thousand $m^3$ per year[50]. Water use problems in Ukraine include not only water resource scarcity in the country, but also its uneven territorial distribution and peculiarities of international integration (not to the benefit of Ukraine). Moreover, domestic economy is highly water consuming, water resources are excessively polluted and, as a result, the exploited water bodies are in an unsatisfactory condition. So, western regions of the country comprise most of the river stock providing 2–7 thousand $m^3$ per person per year, while the most industrially developed south-eastern oblasts (Khersonska, Donetska, Dnipropetrovska, Zaporizka, Luhanska) have the smallest resources of surface waters with water availability rate ranging from 0.1 to 0.5 thousand $m^3$ per person per year. Only 25% of the potential river stock resources are formed within Ukraine, all the rest coming from russia, belarus, Poland, Hungary, Moldova and Romania.

In order to maintain the enterprises with high level of water consumption, a wide network of hydraulic structures has been developed to regulate the run-off: reservoirs, canals, aqueducts, ponds etc. However, apart from water reserves accumulated by reservoirs and ponds, their use is far from reasonable. All in all, reservoirs and ponds comprise almost 12 thousand $km^2$ (the area of Chernivetska oblast is a little above 8 thousand $km^2$) and contain about 58.6 $km^3$ of water. The productive volume used to regulate run-off is merely 28.2 $km^3$ (that is, more than half of the reservoirs is not used). *Moreover, a large span of reservoirs results in significant water loss due to evaporation, filtration etc.*

An example of such irrational use is the regulation of the Southern Buh, the only large river whose basin lies entirely within the country. It is definitely overregulated, well above the critical level, which has caused a number of environmental problems related to water contamination with hazardous thermal pollution, water self-purification capacity reduction, loss of biological diversity and tourism attractiveness of the river, oxygen levels reduction etc.

[50] National presentation on the environment condition in Ukraine in 2014.

The fact that water resources can become one of the limiting factors of socio-economical development of Ukraine (in separate economy branches as well as in entire regions) was emphasized by national scientists as early as in the 1970s. Even though large-scale hydrotechnical construction was carried out in our country in the 1950s–1980s, resulting in huge reservoirs on the Dnipro, Dnister, Southern Buh and other rivers of the country capable of accumulating large amounts of water and redistribuding it over a year depending on the demand, in the final run the problem of water resource exhaustion and scarcity in the country has not only retained its urgency but is also going to pick up gravity.

Water crisis in Ukraine is systemic by nature. Overall, we can talk about low water supply, as well as irrational use of water resources in industries, agriculture and municipal engineering. 40% of wastewater in Ukraine is either not treated or does not meet the dumpsite standards. By organoleptic indicators, up to 70% of samples from water supply systems in Ukraine deviate from the standards, 23–28% do not meet the mineralization requirements, 10–16% have high levels of chemicals, 4–7% of nitrates[51]. Moreover, water loss in certain systems of municipal water supply at times hit 40%. Drinking water supply is at its worst in the eastern and southern regions of Ukraine, and military operations and occupation merely deteriorated the situation. Nowadays, statements can be made about complete destruction of drinking water supply system in Mariupol and a number of other cities in Donbas.

Ukrainian industry is highly water consuming with high levels of contaminating substance dumps into water bodies. Agricultural activity feature high levels of water loss related to transportation as well as irrational water-wasting irrigation technologies. Moreover, part of water bodies in the south and east of Ukraine have been destroyed due to combat operations.

Ameliorative systems (drainage) mostly prevent water regime regulation and in climate change conditions lead to excessive drainage in the adjacent areas and water scarcity. Moreover, some of these areas have lost their economic value and can become the area for wetland recovery with further recovery of biodiversity, water regime, climate change fight.

[51] https://labprice.ua/statti/stan-pitnoyi-vodi-v-ukrayini/

All the above mentioned negative trends, further aggravated by combat operations and mass destruction of water supply system and treatment facilities in the East of Ukraine, call for immediate and strategic action to restore the water resources of Ukraine based on the principles of sustainable development and sparing water use. Any remediation project must necessarily involve the following approaches:

- To provide high-quality drinking water to the entire population of Ukraine by way of constructing and restoring drinking water supply systems using underground water reserves, centralized water preparation and water treatment facilities;
- To ensure the sanitation regime in water protection zones of water supply sources and increased liability for violating this regime;
- To replace water preparation, water treatment and water supply equipment with the one that will ensure drinking water quality standards complying with the EU standards.
- **To switch from direct flow water supply to consecutive or reverse supply wherever possible;**
- **To design and restore the sewerage systems so as to separate storm water sewage from domestic sewage and industrial sewage; compulsory construction of treatment facilities for all types of new and restored sewerage systems;**
- To stop treating hydropower as "green energy" (except for the facilities located on artificial waterways) and further strip all new facilities constructed on natural waterways of any subsidies or benefits, including "the green tariff";
- To give preference to increased efficiency of existing hydropower facilities rather than construct new facilities;
- To assign the natural river category and ensure its protection and progress of natural processes in their hydroecosystems, including geological and hydrological processes;
- To create the central sewerage systems in compliance with the standards applicable in the EU;
- To design new treatment facilities and reconstruct the existing ones in order to ensure the wastewater treatment at least to the standard level stipulated in the EU legislation;

- To base any new irrigation projects as well irrigation system restoration projects on the principles of sparing use of water resources using undersoil (dripping) wetting on all areas where it is possible without deteriorating the water resource and land quality;
- To implement measures on reducing water loss related to filtration in main and distribution conduits, and evaporation;
- To give preference to dryland farming support and in the climate change conditions to shift to the crops which do not require artificial irrigation in Ukrainian weather conditions;
- Wherever possible to use wastewater for irrigation on condition of preventing quality deterioration and pollution of land and water resources;
- To impose mandatory restrictions on water intake and dump for all ameliorative systems and to ensure adherence to such restrictions by way of involving centralized state registration and control based on water resource balance sheets, and punishment measures against the perpetrators;
- River water transport restoration, development and maintenance projects in Ukraine must not cause damage to natural rivers and natural river areas, or reduction of biological and landscape diversity, or disruption of ecosystems (biotopes) protected at the state level in Ukraine and the EU;
- To protect wetlands with due regard of their importance as water and biodiversity habitat regulators;
- To give up ameliorative systems and water stock regulation systems (dams, dikes) wherever they have lost their economic value or critically jeopardize the biodiversity or water regime in adjacent areas, with their further disassembly and restoration of natural wetland regime to be carried out at the cost of state, regional and local budgets as well as international funding.

## 4.7. Clearing the country of waste — investments in Ukrainian economy

The problem of waste in Ukraine was especially massive and significant due to resource consuming wasteful technologies prevailing in the national economy as well as lasting absence of adequate responding

to related challenges. Extensive resource use and national economy relying on power and raw material consumption along with outdated technological basis have consistently resulted in high-level production and accumulation of industrial waste.

About 75% of annual waste is produced in the mining sector, a substantial part of which lies within the area of active combat in the east of the country. The annual industrial waste amount is 419.2 million tons and its cumulative amount in specially allotted sites or facilities is 13.27 billion tons.

The unresolved problem of household waste is no less acute.

According to the Ministry of Community and Area Development, in 2020 Ukraine accumulated over 54 million $m^3$ of household waste or over 10 million tons, stored on six thousand landfills and dumpsites with the total area of almost 9 thousand hectars (the area of such cities as Khmelnytskyi or Kremenchuk)[52].

A third of them does not comply with the environmental safety norms. Harmful substances leak into atmosphere and percolate the soil into underground waters and surface waterbodies, disrupt ecosystems and damage agriculture.

The EU recycles 47% of household waste, this figure constantly being on the rise. Ukraine recycles merely 4.5% while the remaining 93% ends up on landfills and dumpsites and 2% is incinerated. Inasmuch prior to russia's military aggression in 2022 Ukraine did not have a system of waste management, this task appears to be urgent nowadays because the recently adopted Law of Ukraine "On waste management" is just the first step on the way of a long-term waste reform. The establishment of such a system involves creation and maintenance of a national system to prevent waste formation, to collect, recycle, utilize, secure and dispose of waste in an environmentally safe way. Resolving this problem is a key to resolve the issues related to heavy energy and resource reliance of the country, and sparing natural tangible and energy resources and an urgent strategic task (priority) of state policy.

Waste disposal infrastructure development has to rely on European approaches to waste management (reflected in Framework Direc-

[52] https://www.minregion.gov.ua/napryamki-diyalnosti/zhkh/terretory/stan-sfery-povodzhennya-z-pobutovymy-vidhodamy-v-ukrayini-za-2020-rik-2/

tive 2008/98/EC on waste and repealing certain Directives; Directive 1999/31/EC on the landfill of waste; Directive 2006/21/EC on the management of waste from extractive industries and amending Directive 2004/35/EC; Directive 94/62/EC on packaging and packaging waste; Directive 2012/19/EU on waste electrical and electronic equipment (WEEE); Directive 2006/66/EC on batteries and accumulators and waste batteries and accumulators) because the future status of Ukraine as a candidate for the EU membership requires adhering to the legislation of the EU. Besides, the EU policy over the last decade has been aimed at transition to circular economy which involves waste handling throughout the life cycle of goods and products and maximum integration of waste in the production cycle. Therefore, the existing problems, which have been aggravated by the war, may in fact become solutions in future on condition of a smart approach to reconstruction, affect the choice of innovative technologies and become grounds for innovations in the sphere of waste management.

Thus, construction debris if treated (crushed) may become basis for new roads, new buildings and industrial facilities. Scrap metal must be carefully collected and returned to the production cycle. Plastic and other waste may also be crushed, added to raw material, recycled into new goods and products. Glass also has an unlimited recycling potential, so it should be collected and recycled into new glass products.

Not all waste, however, may be returned to the production cycle. Some waste is hazardous to the environment and human health and must be collected and utilized under technical regulations and requirements applicable to such waste. This applies to hazardous waste.

Special attention should be paid to asbestos as it is banned in 70 countries of the world, including the EU because it has been proved to have a carcinogenic effect on human body. Shifting away from chrysotile asbestos is one of Ukraine's commitments to the EU. Moreover, the largest producers-importers of chrysotile asbestos are russia and Kazakhstan, so giving up construction equipment containing chrysotile asbestos allows not only reducing health risks but also terminating dangerous trade with the aggressor state. Within a short period, countries, especially eastern Europe, reset their industries and started producing asbestos-free slate. Ukraine also has such industries. According to the national legislation, asbestos bearing waste is

hazardous. Asbestos bearing waste should be collected in hermetic containers (or robust hermetic plastic bags which are further sealed) and temporarily stored in special sites, breaking or crushing of asbestos bearing goods should be minimized, asbestos bearing waste disposal should be carried out by specialized organizations which have the licence from the Ministry of Environment and offer safe methods of asbestos waste treatment.

Furthermore, separate collection should also be arranged for such hazardous waste as accumulators and batteries which are found in every vehicle, electronic equipment, military equipment. Electronic waste, household devices and electronic equipment also need safe storage and recycling, that is why while clearing the rubble of the bombed buildings such waste should be collected separately. Such hazardous waste may not be incinerated or landfilled, it should be disposed of and treated in an environmentally safe way. Refrigerators often contain ozone-destructive liquids which must be isolated from the environment because evaporating they end up in the atmosphere and contribute to the destruction of the ozone layer. Unfortunately, there are no facilities in Ukraine to safely dispose of electric and electronic waste, therefore, safe places need to be established for its temporary accumulation and storage until it can be further transferred to the recycling enterprises abroad. The need for establishing modern recycling enterprises to dispose of such waste in the areas reclaimed from the occupant army must be supported by a relevant legislative basis and support on behalf of the government, international donors and investors to implement such investment and innovative projects.

Industrial waste is a grave problem predominantly in the east of Ukraine which suffers from active combat operations and is a location for waste formation and storage in large volumes. In the pre-war times there was no complex system of safe waste treatment, therefore, this waste was often stored in random places and enterprises carried on producing it uncontrollably and neglecting the norms related to preventing environmental pollution with such waste. In order to reduce the environmental impact of this waste, it should first be divided into categories, the accumulated volume should be assessed, the waste storage facilities should be inventoried, the waste storage sites should be registered, industrial waste management plans should be devised

involving its maximum integration in the production process and funds should be found for their implementation.

Military waste: over 2 months of the military conflict in Ukraine, here remained about 1100 tanks, 2600 vehicles, 195 planes and 155 helicopters, 1900 automobile units and cisterns with fuels and lubricants, 40 special machines, 500 missile launchers and the actual scope can only be assessed when the military operations are over. The value of these items lies primarily in the non-ferrous metals they contain as they can become the source of scrap metal. However, not all metal parts and objects are safe, they may contain hazardous substances, hazardous waste, fuels and lubricants, batteries, etc. To secure human and environmental safety, such waste should be brought to special sites with waterproof flooring in order to safely disassemble military equipment with due involvement of representatives of the AFU and SES, separate various components, sort and arrange them separately, store and recycle them or treat them in any other appropriate way. Special attention should be paid to hazardous waste and explosives occurring in such military items in order to prevent their uncontrollable release into the environment and access of outsiders to military debris which can detonate. Because of this, such waste should be isolated from civil citizens in the first place for their own safety.

The war also altered the logistics of collecting, storing, recycling and disposing of HSW in a lot of regions of Ukraine. In some areas, these services will no longer be needed because there is no one to produce waste anymore, in other places waste collection and landfill services have not been provided at all, especially in the time of war, therefore local authorities are facing a major challenge of organizing the logistics of HSW treatment almost from scratch. For this, it is worthwhile to choose a site for constructing a modern HSW landfill (1–2 per region), develop the landfill, equip it with sorting line, arrange for waste temporary storage and categorization in large communities, arrange container plots for mixed waste and scrap in residential areas, ensure collection of other categories of waste, including hazardous, large, construction one etc. To identify the need for garbage trucks and trucks, attract necessary transport and plan its acquisition in the quantities required for a certain community. New logistics should rely on the data stipulated by the draft regional waste management plans, which were elaborated in

the pre-war period by regional state administrations. These projects should be updated to account for the consequences of military operations. Scrap recycling facility construction may be the first task for new up-to-date investment projects and ideas, innovative technologies. In addition, environmentally safe use of different category waste should be encouraged at all levels in development and reconstruction, in new industries and processes.

Automobiles withdrawn from exploitation or damaged by military operations have become a landmark of the regions where the occupant's army "has acted". This kind of waste should be placed on a specially allotted site to be stored, disassembled to scrap, plastic should be separated, hazardous waste (accumulators, electric components) should be carefully collected, oils should be poured together, and all these components should be stored to be transferred for further treatment or disposal. These sites must be waterproof.

So, it is necessary to construct hangars or warehouses in the regions affected by the war to store waste which requires sorting, identification of the environmental and health hazard rank, safekeeping and packaging in special hermetic containers and temporary storage. Such premises need to be waterproof so as to be protected from precipitation, to be divided into sections, and have rainwater sewerage and a fence to prevent trespassing. Liquid hazardous waste should also be kept in hermetic containers with relevant labeling, and be isolated from precipitation or runoff.

Special treatment should be ensured for the soils polluted with fuels and lubricants, soils from bomb craters and soils polluted with hazardous substances and waste. The soil test results will determine further steps of their safekeeping.

The restoration plan for Ukraine must involve the parliament including into its agenda the law "On waste management" 2207-1d and a number of other related regulations necessary for Ukraine to launch waste treatment systems in compliance with the European standards[53].

[53] https://paxforpeace.nl/news/overview/environment-and-conflict-alert-ukraine-a-first-glimpse-of-the-toxic-toll-of-russias-invasion-of-ukraine

# 5. SOURCE OF FUNDING

## 5.1. The reform of the State Environment Protection Fund and establishment of the Environment Remediation Fund

According to the Law of Ukraine "On environmental protection", the environmental protection measures are funded by the environmental funds specially established for this purpose at the local and state level. The main source of monetary inflow into these funds is the environmental tax payable by the enterprises polluting the environment. So far, these environmental funds are facing a number of challenges, particularly lack of transparency in funding distribution; implementation of measures which are not in fact aimed at environmental protection; lack of integrity, systematicity, consistency and efficiency in solving environmental issues; absence of monitoring of environmental protection measures efficiency etc.

Failure to solve these problems entails a high price consisting in deteriorated environment condition and this price is not only increasing day to day but is further multiplied by military operations and their consequences as well as by climate change.

This problem may be solved following the experience of the EU countries and establishing the Environmental Protection Fund as a separate legal entity independent of the Ministry of Environment. The Fund will fully accumulate the environmental tax and allocate funding to resolving local environmental problems through regional territorial branches. The following legislative, institutional and budget changes also need to be implemented:

– To unify the procedure of using the environment protection fund. For this purpose it is necessary for the CMU to devise and adopt a regulation "On the procedure of using the capital of the environmental protection funds";

– To establish a working group to devise the afore mentioned regulation of the CMU;
– To set up an online platform to ensure the publicity of funding distribution procedure;
– To establish a State Environment Remediation Fund with amending the budget code;
– To repeal, amend, devise and adopt the regulations necessary for transparent and efficient operation of the State Environment Protection Fund;
– To enhance control of using the capital of the fund (audit and legislative)[54].

The Environment Remediation Fund will receive payments in the form of financial reparations claimed from the russian federation, grants and credits from the USA, EU, World Bank, European Bank for Reconstruction and Development etc. The Environment Remediation Fund must have an online platform to ensure the transparency, publicity and management of the Fund's capital and run an annual audit involving international auditors. The Environment Remediation Fund must also have annual environment remediation plans. These plans need to stipulate clear goals, expected outcome, performance indicators. Draft plans must go through public discussion before being approved by the government. At the end of the calendar year, the Environment Remediation Fund will prepare annual reports on fulfilling annual plans. These reports have to go through public discussion before being approved by the government.

## 5.2. Ecosystem service valuation methodology development

The rf's military operations in Ukraine have not only damaged natural resources, but also injured natural complexes and their ability to provide ecosystem services.

[54] http://epl.org.ua/eco-analytics/gromadskyj-kontrol-za-vykorystannyam-koshtiv-fondiv-ohorony-navkolyshnogo-pryrodnogo-seredovyshha/; http://epl.org.ua/eco-analytics/chyste-dovkillya-zdorove-majbutnye-nova-polityka-vykorystannya-koshtiv-spetsialnyh-fondiv-ohorony-navkolyshnogo-pryrodnogo-seredovyshha/

Ecosystem services are the benefits people obtain from ecosystems. These include provisioning services such as food and water provision; regulating services such as flood and disease control; cultural services such as spiritual, recreational and cultural benefits; and supporting benefits such as nutrient cycling that maintain the conditions for life on Earth[55].

Therefore, the condition of ecosystems, their components and biodiversity all in all depends on their ability to maintain economic capacity and provide an environment for human life.

All ecosystem services are free because people do not pay for using or consuming them. This does not imply, however, that they have no economic value. It is rather the opposite — their value is so high and diverse that it is complicated to carry out its economic evaluation (monetization). The available scientific methods make it possible to monetize or evaluate in monetary terms only part of such services. The deeper the ecosystem services are analyzed, the higher is their value and hence economic benefit[56].

In view of the value attached to biodiversity and ecosystem services, their inclusion in decision-making processes at all levels is being considered.

The EU has developed The Common International Classification of Ecosystem Services, CICES, of European Environment Agency (EEA)[57], suggested a unified definition and standardized typology of ecosystem services, and launched ecosystem service mapping and valuation.

The tools and methodologies to assess the value of ecosystem services, in particular such as TEEB, IPBES, ESMERALDA are under development[58]. Particularly, according to the global initiative The Economics of Ecosystems and Biodiversity (TEEB), the estimated annual value of ecosystem services in the entire world is USD 125 trillion per year[59].

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[55] https://www.millenniumassessment.org/documents/document.300.aspx.pdf

[56] https://uncg.org.ua/wp-content/uploads/2020/09/EcoPoslugy_web_new.pdf

[57] https://cices.eu/

[58] https://ec.europa.eu/environment/nature/capital_accounting/pdf/eu_es_valuation_review.pdf

[59] https://doi.org/10.1016/j.gloenvcha.2014.04.002

The monetary valuation, however, does not include non-monetary benefits provided by ecosystem services.

There are a few aspects of ecosystem services which are hard to be monetized, especially ecosystem services related to culture and those realized on the planetary scale. It is a huge problem to carry out valuation of ecosystem services and potential outcomes (benefits) when they incur losses (injuries). Therefore, it is extremely hard to value (monetize) the loss of ecosystem services caused by ecosystem destruction[60].

Overall, the ecosystem service valuation process involves the methods such as GIS analysis, statistical modelling, compilation of published information, economic valuation, field work and expert opinion[61].

For example, the German Federal Environment Agency in the publication *Economic Valuation of Environmental Damage — Methodolocical Convention 2.0 for estimates of environmental costs* lays down the following grounds for environmental loss assessment[62].

1. Describe the target.
2. Specify the subject of analysis and define system boundaries for: the responsible actors and/or activities, the relevant sources of environmental impact and the relevant protected assets or types of damage that are to be subjected to analysis; regional, temporary, related to a project system boundaries etc.
3. Describe the relevant environmental impacts.
4. Describe cause-effect relationships (impact assessment).
5. Assign to economic utility and cost categories.
6. Perform economic valuation of disutility effect on people. (Depending on the subject of the analysis and the applicability of economic valuation methods, it is also important to point out which types of environmental damage cannot be subjected to economic valuation. The extent of such effects should be described in qualitative terms.)
7. Present and interpret the results in the context of the valuation target.

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[60] https://wesr.unep.org/media/docs/assessments/loss_and_damage.pdf

[61] https://www.millenniumassessment.org/documents_sga/Portugal%20MA_State_of_the_Assessment.pdf

[62] https://www.umweltbundesamt.de/en/publikationen/economic-valuation-of-environmental-damage-0

It is recommended to employ methods from different groups to valuate the environmental damage:

- Valuation methods based on market prices (added value methods, estimating costs of reducing damage, costs of compensating for environmental damage etc.);
- Indirect valuation methods (hedonic valuation method, expenditure and travel expenses methods etc.);
- Direct valuation methods (contingent valuation, conjoint analysis approaches, participatory valuation methods etc.);
- Valuation by means of avoidance costs and costs of achieving the target (avoidance cost approach).

Ecosystem service valuation methodology development will enable a more thorough valuation of damage and assessment of injuries inflicted on the environment in Ukraine by the rf's war.

## 5.3. Carbon credits for natural areas

In November 2021, a Climate Change Conference COP26 was held where Ukraine and above 100 other countries signed a Declaration on Forests and Land Use.

The Declaration stipulates preservation and restoration of forests and other surface ecosystems; facilitation of policies that promote sustainable development and production, and consumption of goods which do not involve felling of forests and land degradation; reduced vulnerability and enhanced resilience of rural communities etc.

Relying on this initiative the Ministry of Environment has announced that they are working on a draft law on carbon credits.

The existing practice of using carbon certificates implies that the investor who has bought a cropland plot and grown a forest there or has bought a plot of naturally forested area is entitled to a credit representing the amount of carbon consumed by this plot. This credit may be traded in the international market as an instrument of so-called emission offsetting. There is a risk that the polluters will purchase such credits without actually reducing emissions[63].

[63] https://mepr.gov.ua/news/38348.html

It is vital that the draft law clearly determined the areas which cannot be subject to offsetting.

The most urgent priority, however, is to ensure emission reduction at enterprises and only then is offsetting possible. Afforestation and natural area preservation alone cannot fully offset the damage the emissions inflict on the environment.

## 5.4. Compulsory environmental component of investments

The economy of Ukraine has long featured a number of environmentally critical tendencies. Despite some progress in environmental policy in recent years, which involved adoption and approval of environmentally significant legal acts, the environmental effect in different branches of economy has not changed fundamentally. Among the reasons for this was the absence of investments in the spheres related to environmental protection and absence of a system which would ensure the preconditions for satisfying the provision that "an investment has a positive environmental impact". Let's consider agriculture. Even though the proportion of agricultural and ploughed lands is the highest in Europe, the area of ploughland kept being increased, monoculture farming was promoted, and chemicals (including cheap ones and occasionally substances from obscure producers banned in the EU) were used in excess causing numerous cases of poisoning people, fauna and flora. Like in the past, heavy industry has been based on mining, metallurgical and power producing enterprises constructed in the 1950s-1980s when the environmental impact of industry was often neglected for the sake of achieving economic indicators. As a result, these branches have turned into the largest source of atmospheric air pollution and at times the largest pollutants of water resources. Low environment pollution fees (based on the "polluter pays" principle) have not contributed to the ecologization of such enterprises either, so the economic approach has not worked to promote pollution reduction. Unbalanced approach to the definition of "green energy" and the policy of granting excessive economic benefits to producers of such energy may have caused investment boom in this sphere but has also caused partial disruption of energy system and transfer of investments

into a narrow sector, and as a result the programmes of environment parameter improvement in other sectors (for example, nuclear energy) have been discontinued. Moreover, absence of environmental criteria and mistakes in defining which energy production is actually green (in particular, hydroelectric power stations, which were in fact destroying river ecosystems, were recognized "green" and have been obtaining payments by "green tariff") have had an adverse impact on the public opinion on "green energy" in whole.

No qualitative changes have occurred in the sphere of water use and water protection from pollution. In particular, virtually no new water treatment facilities, which by themselves are quite expensive and require significant capital investment both in construction and reconstruction, have been built and only very little reconstruction has been carried out. Therefore, despite the decline in industrial production in the most water consuming branches compared to the 1980s, the major waterway pollution remained almost at the same level, while the domestic sewage pollution, especially by SAA and phosphate compounds, has even increased in some places. Underground water reserves keep deteriorating in quality and keep being exhausted due to industrial pollution and agriculture. Heavy reliance on crops requiring artificial irrigation, especially in the south of Ukraine, has given rise to plans on increasing irrigation areas. Nowadays, however, artificial irrigation causes land salinization, especially in the Black Sea and Azov Sea regions, underground aquifer pollution and available fresh water resource reduction.

The transport system development is expected to bring about changes in the qualitative parametres of the Ukrainian transport system, attract investments in infrastructure and also alter the way the transport is used. All the related solutions must involve introduction of the best available technologies and investments with due respect for current transport ecologization trends.

Environmental issues in Ukraine are not limited to the boundaries of the country and have regional or, in the case of climate change, global consequences. That is why, investments in the reconstruction of Ukraine without due regard of their environmental relatedness may further aggravate the environment condition on the national, regional and global scale. Moreover, over the last years, the environmental component

has been considered one of the principles of investment sustainability and a way to avoid unfair competition, when competitive benefits are achieved by sparing costs of nature protection measures or employing dirty technologies.

The international legislative basis for this approach is the Declaration of the United Nations Conference on the Human Environment (1972), Rio Declaration on Environment and Development (1992), in particular, Principle 2, Principle 4, Principle 12, Principle 14, Principle 16, commitments under international legislative acts to which Ukraine is a party. Furthermore, it is necessary to establish a principle stipulating that any investment in the Ukrainian economy must comply with environmental requirements and meet the indicators and approaches laid down in the legislation of Ukraine, legislation of the country of investment origin as well as legislation of the EU (in view of the EU-oriented Ukrainian policy).

# 6. PROCEDURE FOR RECOVERING DAMAGES FROM THE RUSSIAN FEDERATION

## 6.1. Compensation Commission as a tool to compensate for environmental damage

Over the past century, the world has seen only a few conflicts between states, which have led to reparations for their victims. This is Iraq's invasion of Kuwait in 1991, the Ethiopia-Eritrea War in 1998–2000, Uganda's invasion of the Republic of Congo. The obligation of a state that has violated the norms of international law to carry out reparation is a fundamental doctrine enshrined in the decisions of international courts.

One of the legal mechanisms for paying reparations is the provision of a peace agreement, often bilateral, between a country that has won the conflict and a country that has violated international law and invaded another state. The inclusion of reparations in the text of a peace agreement depends on many factors, including the willingness of the parties and their negotiating position. Provisions on the payment of reparations provided for in such an agreement are binding on the parties who have signed such an agreement.

Another legal mechanism for initiating reparations could be a multilateral commission or a mechanism to manage this process (for example, the UN Compensation Commission).

In 1991, Iraq committed an act of aggression against its neighbor Kuwait. Iraq's invasion of Kuwait started on 2 August1990. The Iraqi army seized Kuwait without lasting warfare in two days. That aggression involved significant damage of the environment not only in Kuwait but also in the neighboring countries. Therefore, about 10,8 mln barrels of oil were deliberately released in the Persian Gulf by the Iraqi troops.

As a result, 600 kilometers of the Saudi Arabia coastline were polluted. About 1 bln barrels of oil were burned or spilled as the Iraqi troops exploded about 600 oil wells causing pollution of ground water and desert ecosystems. Further damage to the Kuwait desert ecosystems was caused by the construction of military facilities, fortifications, trenches, bunkers etc. About 1.6 mln. mines and 109 000 sq.m. of ammunition which never detonated remained scattered across Kuwait including on the beaches, along the coastlines and in the desert.

To compensate for environmental damage and other damage, the UN established a separate body — the UN Compensation Commission[64]. This body registered, assessed and awarded compensation for clean-up and restoration for purification and recovery from the damage inflicted on the soil, water, coastal ecosystems and other damages. The UN Security Council condemned Iraq's actions as a violation of international peace and security in accordance with the requirements of the UN Charter, and found Iraq responsible for damage, losses or traumatizing.

In its activities, the Commission was guided by the powers conferred on it by the Secretary-General of the United Nations: the Commission is neither a court nor an arbitral tribunal to which the parties appear. It is primarily a political body performing the function of establishing facts, assessing claims for compensation, confirming their truthfulness and validity, assessment of damages, assessment of the amount of recalculations and resolving disputes, which is partly a quasi-judicial function.

According to UN Security Council Resolution 687 of 1991, Iraq is liable under international law for any direct damage, loss, including environmental damage and destruction of natural resources, as a result of Iraq's unlawful intervention and occupation of Kuwait.

As of 2022, Iraq has paid about 52.4 billion in damages on all claims of all categories. This total includes $5.26 billion spent on assessment, restoration and remediation of environmental damages. Satisfied claims were paid from the United Nations Compensation Fund established by UN Security Council Resolution 1483 (2003)[65], which until 2017 received 5% of revenues from export sales of Iraqi oil and petroleum

[64] https://uncc.ch/home

[65] http://unscr.com/en/resolutions/1483

products. In 2018, the percentage of revenues to the fund was reduced to 0.5%, in 2019 it was 1.5% and 3% in 2020.

The Compensation Commission mandate included processing claims for incurred direct environmental damage to and depletion of natural resources including the damage to and costs of:

1. Abatement and prevention of incurred direct environmental damage, including the costs of extinguishing oil fires and purging of coastal and international waters of oil.
2. Adequate measures already taken to purify and remediate the environment or future measures the documents wherefor prove their necessity for purification and remediation of the environment.
3. Adequate monitoring and assessment of environmental damage with the view of assessing and abating the damage and remediation of the environment.
4. Adequate monitoring of public health and medical screening in order to investigate and overcome increased health hazard caused by the environmental damage.
5. Depletion of or damage to natural resources, etc.

In order to create such a body in the situation of the Ukrainian-Russian war, a UN decision is needed first of all. Such a decision could be a UN Security Council resolution establishing a special commission to pay compensation for damage, losses and incurred costs to foreign governments, citizens and corporations caused by russia's illegal military invasion of Ukraine on February 24, 2022. Because of the veto in the UN Security Council, it is worth considering taking a similar decision by the UN General Assembly or concluding a relevant multilateral agreement, possibly under the auspices of an authoritative international body whose decisions may be binding on russia.

Reparations can also arise from court decisions at the national or international levels. These may be cases between states in the International Court of Justice, criminal cases in the International Criminal Court or national courts in criminal proceedings, or individual claims for damages and losses before national courts.

It is recommended that such a compensation commission be established under the auspices of the UN General Assembly, which will facilitate the efficiency, objectivity and appropriateness of the commis-

sion's consideration of issues related to the payment of compensation to Ukraine.

## 6.2. Claims to international courts as a tool to compensate for environmental damage

**I. The International Court of Justice (hereinafter — the UN ICJ)**

The UN ICJ can hear two types of cases: legal disputes between states (contentious cases) and requests for advisory opinions on legal questions referred to it by United Nations organs and specialized agencies (advisory proceedings). Only states (UN members and other states that have become parties to the Statute of the Court or have accepted its jurisdiction under certain conditions) can be parties to contentious cases.

As there is no special International Court of Justice Bar, there are no conditions that must be met by state representatives to exercise the right to appear before the UN ICJ, the only exception being that they must be appointed by the government.

Proceedings may be instituted in one of two ways:

1. Through the notification of a special agreement: this document, which is bilateral in character, can be lodged with the Court by either or both of the States parties to the proceedings. A special agreement must indicate the subject of the dispute and the parties thereto.
2. By means of an application: the application, which is unilateral in character, is submitted by an applicant State against a respondent State. It is intended for communication to the latter State and the Rules of Court contain stricter requirements with regard to its content. In addition to the name of the party against which the claim is brought and the subject of the dispute, the applicant State must, as far as possible, indicate briefly on what basis — a treaty or a declaration of acceptance of compulsory jurisdiction — it claims that the Court has jurisdiction, and must succinctly state the facts and grounds on which its claim is based. The original application is signed either by a representative of the applicant State or by a diplomatic representative of this party in the country where UN ICJ is located, or by another properly authorized person. If the application is signed

by a person who is not a diplomatic representative, the signature has to be verified by the latter or by a competent authority of the Ministry of International Relations of the applicant. The certified copy of the application is immediately handed to the respondent State by the Registrar.

According to the Statute of the UN ICJ, its official languages are English and French, but per Part 3 Article 39 of the Statute of UN ICJ, at the request of any party, the UN ICJ allows that party to use a language other than French or English. In this case, in accordance with the Rules of the UN ICJ, a translation into French or English, certified as accurate by the party submitting it, is attached to the original of each application.

UN ICJ "gives its own clear assessment of the weight, reliability and value of evidence". As the issue of evidentiary requirements is not enshrined in either the Statute or the Regulations, it should be based on the jurisprudence of the UN ICJ. A study of the jurisprudence shows that, although the UN ICJ provides some guidance on how it evaluates certain types of evidence, it tends to apply a very open, discretionary standard of evidence. The UN ICJ requires proof "the level of certainty of which commensurate with the seriousness of the allegations." Case law shows that the UN ICJ sets the standard of proof on an ad hoc basis and that the standard is revealed only at the end of the process, when the UN ICJ makes its decision.

**II. International Criminal Court (hereinafter — ICC)**

The ICC may administer justice in situations where genocide, crimes against humanity, war crimes, crimes of aggression were committed on or after 1 July 2002, and:

1. The crimes were committed by a State Party national, or in the territory of a State Party, or in a State that has accepted the jurisdiction of the Court; or
2. The crimes were referred to the ICC Prosecutor by the United Nations Security Council (UNSC) pursuant to a resolution adopted under chapter VII of the UN Charter.

In the absence of a UNSC referral of an act of aggression, the Prosecutor may initiate an investigation on her/his own initiative or upon request from a State Party. Ukraine has not yet ratified the Rome Statute

of the UN International Criminal Court, so its ratification will greatly facilitate the court's consideration of crimes committed by russia in Ukraine.

At the request of the ICC Prosecutor, the ICC Secretary may, on a confidential basis, ask a State which is not a Party to the Statute or which has become a Party to the Statute after its entry into force whether it intends to submit an application to the ICC about crimes subject to ICC on its territory.

When a State submits an application or declares to the Registrar its intention to apply to the ICC for crimes in its territory, it shall inform the State concerned that such an application results in recognition of the ICC's jurisdiction over crimes listed in the Rome Statute. It also informs that the provisions and rules concerning the States Parties will apply to the State concerned.

The situation is referred to the Prosecutor in writing.

The state should provide available evidence of crimes, as the Prosecutor assesses the seriousness of the information received. To this end, he or she may request additional information from States, United Nations bodies, intergovernmental or non-governmental organizations or other reliable sources deemed appropriate by him or her, and may obtain written or oral evidence at the seat of the Court. In this regard, in order for the ICC Prosecutor to start an investigation, he/she must have a strong evidence base.

The relevance of the evidence, its probative value and weight are the fundamental criteria of evidence for the ICC. The Torture Reporting Handbook, published by the Human Rights Center at the University of Essex, describes the formula for obtaining the best quality evidence: "Received from first hands + detailed + internally consistent +proved from different points of view + proving sustainable action +new= the highest standard evidence". Also, even if the evidence is relevant, it must be "acceptable" for use in the trial. Before recognizing the evidence as valid, the ICC examines the origin of the evidence. In other words it studies where this information was obtained. In order for a document to be considered valid, its origin must be clear. Any decision to take evidence in a confidential manner must be in writing and consistent with a common policy.

**III. The European Court of Human Rights (hereinafter — the ECHR)**

The ECHR, under the conditions specified by the Convention for the Protection of Human Rights and Fundamental Freedoms (hereinafter — the Convention), may consider applications submitted by persons who complain of violations of their rights. A person may apply to the ECHR if he or she considers that he or she is personally a victim of a violation by one of the States Parties to the Convention of the rights or fundamental freedoms protected by the Convention and its Protocols. According to Article 32 of the Convention, the jurisdiction of the European Court of Human Rights extends to all matters concerning the interpretation and application of the Convention and its Protocols and referred to it in accordance with Articles 33, 34 and 47 of the Convention. The ECHR may consider only those applications which are directed against States which have ratified the Convention and the relevant Protocols and which relate to events after the date of ratification. The ECHR does not consider applications against individuals or non-governmental institutions.

Pursuant to Article 35 § 1 of the Convention, the ECHR accepts applications only after all domestic remedies have been exhausted and only within six months from the date of the final judgment. This period is calculated from the moment the applicant or his/her lawyer got acquainted with the final court decision, based on the results of the national appeal procedure, or, if there is no effective remedy for such a violation at the national level — from the moment of alleged violation. This period shall be terminated upon receipt by the ECHR's of the first letter, which clearly states the subject of the application or the completed application form.

In accordance with Rule 47 of the ECHR Rules, the application must: summarize the facts complained of, indicate the rights guaranteed by the Convention or the protocols thereto that are allegedly violated; name the national remedies that have been exhausted; provide a list of decisions of courts (or other state bodies) in the case, indicating the date of each decision and the body that issued it, as well as brief information about the content of this decision. Copies of the decisions must be attached to the letter. Rule 45 of the ECHR Rules states that the application shall be signed by the applicant or his/her representative.

The official languages of the ECHR are English and French, but it is possible to address the ECHR Secretariat in the official language of one of the states that have ratified the Convention. If the ECHR declares the application admissible on the basis of the documents submitted, decides to invite the Government to state its position on the applicant's complaints, the Court will correspond in English or French, and the other parties must, as a general rule, submit further observations in English or French.

**IV. Avoiding the recognition of claims as ill-founded**

The ECHR is one of the best examples of using an effective filter against ill-founded claims. The ECHR finds a complaint to be manifestly ill-founded if the application merely refers to one or more articles of the Convention, without explaining how they have been breached, or if the application fails to provide sufficient evidence. In interstate litigation, although such a mechanism does not exist in the applicable procedure of ICC, for dispute resolution bodies under the United Nations Convention on the Law of the Sea, a special procedure for dismissing ill-founded claims is provided, although to date it has largely never been used. The logic of classifying claims as ill-founded is similar to the logic in the example of the ECHR.

In conclusion, in order for lawsuits against international judicial institutions to be appropriate and to be resolved positively, regardless of the type of judicial institution, the highest quality evidence should be submitted, arguing its position in detail with reference to the relevant rules and interpretation of their applicability in each particular case and also complying with procedural requirements. Understanding and complying with the requirements described in this section is the key to successful review of lawsuits by Ukraine and Ukrainians claiming damages from the aggressor. Ukraine is facing a difficult path of setting new precedents in international jurisprudence, due to the complexity of the existing situation, as well as because of the lack of even similar cases that have been already resolved. Therefore, only on condition of observance of the specified requirements it is possible to create for our country positive precedents that will promote fast, full and appropriate compensation of damages and bringing to justice the persons responsible for them.

## 6.3. Development of modern methodologies of damage assessment and evidence collection

Currently, the Ministry of Environment and Natural Resources of Ukraine is developing and approving methodologies for calculating the amount of damage caused to the environment.

The Methodology for calculating fugitive emissions of pollutants or mixtures of such substances into the atmosphere due to emergencies and/or during martial law and determining the amount of damage entered into force on April 29, 2022[66].

The Methodology for determining the amount of damage caused to land, soil due to emergencies and/or armed aggression and hostilities during martial law, was approved by order of the Ministry of Environment №175 of 04/13/2022[67].

The Ministry of Environment involves environmental activists into the process of documenting environmental crimes committed by the russian army, and also engages scientists and professionals to develop algorithms for calculating the damage, expands categories for damage assessment and indicators being assessed.

Unfortunately, these methodologies developed by the Ministry are not perfect and need significant methodological improvements, even more so because many of them were adopted more than 10–15 years ago[68]. Thus, in order to fulfill the task of developing methodologies for damage assessment, there is a need to involve specialized scientific institutes of the National Academy of Sciences and other academies of Ukraine, as well as world research centers. It is also important to ensure state support of research projects in this area on a competitive basis and through grant funding.

However, there is not only a need to develop modern methodologies of calculating losses and to adopt new regulations to approve modern

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[66] https://www.kmu.gov.ua/news/zabrudnennya-povitrya-vid-rosijskih-bombarduvan-obsyagi-vikidiv-ta-zavdani-zbitki-rozrahovuvatimut-za-specialnoyu-metodikoyu-mindovkillya, https://zakon.rada.gov.ua/laws/show/z0433-22#n14

[67] https://zakon.rada.gov.ua/laws/show/z0406-22#Text

[68] https://www.dei.gov.ua/posts/2225

methodologies of calculating the damage caused by hostilities in Ukraine, but also a need to develop compensatory measures for damaged natural ecosystems and ecosystem services derived from them[69].

However, it should be noted that all methodologies of calculating losses, damages, and costs of restoring to the natural state should be preceded by the development of clear instructions for documenting the destruction of the environment. The Ministry of Environment should have developed such instructions at least three months ago.

It is also necessary to develop instructions or guidelines for gathering evidence. The guidelines should include algorithms of actions on evidence gathering and defined criteria of requirements to the received evidence. In terms of collection procedure, requirements should be set for admissibility of the data collected. That is, for the evidence provided to be recognized in any state or international judicial institution, its origin must be clear and authoritative. Instructions should be developed on streamlining the system of declaring evidence in a unified system and defining the criteria for officials who may be responsible for collecting such evidence. As regards evidence relevance criteria, methodological recommendations or guidelines should prescribe a detailed mechanism of ensuring relevance, reliability, acceptability and sufficiency of the evidence.

Finally, as a result of following the recommendations described in the instructions or guidelines, we should be able to obtain the evidence that will comply with the formula of the highest quality evidence: "Received from first hands + detailed + internally consistent +proved from different points of view + proving sustainable action +new= the highest standard evidence".

## 6.4. Assessments of individual damaged objects

In 2015, EPL conducted an assessment of the damage caused to land resources as a result of artillery shelling in Donetsk region.

Using satellite images, the dimensions of the explosion funnels were identified and the scale of soil destruction in the Amvrosiivskyi and

[69] http://epl.org.ua/wp-content/uploads/2022/04/Vplyv-vijny-na-dovkillya_oglyad_25-03-2022_fin.pdf

Shakhtarskyi districts of the Donetsk region was estimated. There were found 1137 explosion funnels with a total area of 21,138 m2 in the territory of Amvrosiivskyi district and 9987 explosion funnels with a total area of 161,914 m2 in the territory of Shakhtarskyi district.

The explosion funnels were formed as a result of the use of fragmentation and high-explosive mines, shells of towed guns and self-propelled howitzers, as well as multiple rocket launchers Grad ("Hail") and Uragan ("Hurricane").

Soils were contaminated with heavy metals — lead, strontium, titanium, vanadium, cadmium, manganese, nickel. Using the method of calculating the amount of damage in accordance with the national legislation, it was found that the amount of damage caused by contamination of land resources in the Amvrosiyivsky and Shakhtarskyi districts on the area of 18.3 hectares at the site of shell bursts, was more than 9 million UAH[70].

[70] http://epl.org.ua/wp-content/uploads/2015/07/1817_WEB_EPL_Posibnuk_ATO_Cover_Ukrainian.pdf

# 7. THEMATIC EXAMPLES (CASE STUDIES)

## 7.1. Key steps towards full demining through the prism of the Albanian experience

After the 1999 Kosovo crisis, the Albanian government responded quickly, trying to protect civilians in the first place. However, this was done without taking into account the International Mine Action Standards (IMAS), and all areas had to be re-cleared. Therefore, all demining activities should be carried out in accordance with International Mine Action Standards (IMAS).

An inter-ministerial body, the Albanian Mine Action Committee (AMAC), was established in Albania in October 1999 to properly coordinate mine action. This body is the executive body and the body that develops mine action policy in Albania. The Deputy Minister of Defense heads this committee, which also includes representatives of the Ministry of Environment, local self-government, persons responsible for decentralization, health care, public order, representatives of the Ministry of Foreign Affairs, Finance and Economy; Permanent Representative of the United Nations Development Program, UN Representatives for Health, the Red Cross and other major donors.

The tasks of the committee are as follows:

1. Ensuring the state's attention to mine action.
2. Seeking donor funding and assistance for a demining program.
3. Ensuring priority of the issue of demining in Albania.
4. Informing the international community about the mine threat in Albania.
5. Compliance with the Ottawa Treaty on the Destruction of Anti-Personnel Mines.

For the proper organization of mine action in Ukraine, it seems appropriate to create a similar body.

In 2006, a detailed "National Mine Action Plan to Complete Demining" for the period of 2007–2010 was prepared as part of the Completion Initiative. The Albanian government represented it at various international mine action conferences and distributed it to various donors in search for possible funding.

The program has become a comprehensive, well-coordinated and accepted by all key stakeholders document. Donors unanimously stated that their funds were used effectively. This should be considered a worthy achievement, given the level of complexity of mine action management, the remoteness and underdeveloped infrastructure of the Kukes area, where most of the mines were located.

The program had many achievements that are worth noting, including:

- there have been no landmine casualties in Albania since 2005;
- all victims received medical care and support, and a wide range of people with disabilities benefited from the victim assistance program;
- the mine action program is closely coordinated with regional development priorities and territorial planning;
- effective coordination of the program by the committee, including the involvement and support of a wide range of parties: representatives of national and local authorities, donors, national and international non-governmental organizations and local communities.

At the same time, an operational body, the Albanian Mine Action Executive, was set up under the leadership of the committee to implement the mine action program.

Functions of this body are as follows:

- developing and facilitating the implementation of the mine action program;
- coordination, supervision and monitoring of all mine action activities that meet the committee's priorities;
- accreditation and confirmation of the quality of demining management activities;

– collection, verification and dissemination of statistics related to mining and other explosives in Albania;
– control and reporting on the progress of demining;
– survey and marking of mine-contaminated areas;
– development and maintenance of demining procedures based on UN standards;
– investigation of all mine incidents and emergencies;
– liaising with foreign mine action authorities.

In order to develop and improve the Mine Action Program, various national seminars were held, at which the vision, mission, some priorities and demining plans were formulated. As a result of such measures, a number of fundamental decisions were made. It is important that Albanians not only developed the Mine Action Program, but also created a body responsible for its implementation. After all, quite often planning acts remain just plans, taken lightly.

It is important to note that the material support of the Albanian government from 1998 to 2003 for the implementation of mine action programs and disposal of explosives amounted to 1,583,600 US dollars.

In addition to the allocation of funds, Albania ratified the Ottawa Treaty on 29 February 2000, after which a mine clearance project was launched with the assistance of Canada. Demilitarization was based on the return of mines and explosives, and recycling was a major aspect of the project.

Advantages of this project for Albania:
– Albania's compliance with Article 4 of the Ottawa Treaty;
– raising the status of Albania as a responsible party to the Ottawa Treaty;
– increasing national and regional security;
– socio-economic benefits for the people of Albania;
– strengthening the opportunities for demilitarization in the region;
– establishing the rate of destruction of stockpiles of mines and other similar devices in South-Eastern Europe.

The Geneva International Center for Humanitarian Demining assessed the Albanian Mine Action Program as follows: 1) the program benefited from close working relationships with highly effective and committed implementing partners; 2) the international community

has provided the consistent funding needed to meet the needs of the program since its inception in 1999.

Thus, by applying the above mechanisms, Albania was able to actually solve the problem of mining, moreover, to receive positive feedback from the world community in this area. In connection with the above, we consider the experience of this country relevant and useful for Ukraine. Authorities and individuals in Ukraine should take into account the legal mechanisms and tools used by the government of Albania to address the same problem throughout our country that has been or is being mined. Adoption of this experience will allow to pass a way from dangerous mined zones across all territory of the state to quite safe situation much faster, and also to avoid deaths and injuries of our citizens.

## 7.2. The practice of dealing with mined or contaminated areas

Germany's experience of dealing with territories where hostilities took place is interesting. This experience implies creating protected areas on such territories. For example, the southern part of the Hainich National Park (German "nationalpark Hainich") called Kindel (Fig. 6) had been used by the Wehrmacht for military purposes since 1935. After the Second World War, this target area was further expanded by the Soviet Army and only in 1991 was it allowed for civilian use. The park was established on December 31, 1997.

Fig. 6. Photo from Hainich National Park, Germany

The military created large devastated space. But as it turned out, forest is difficult to destroy. In the national park, the successive areas of the former military training range are gradually but surely turning into forests.

Hainich's beech forests, along with four other beech forests in Germany, in 2011 were included in the UNESCO World Heritage Site "The Ancient and Primeval Beech Forests of the Carpathians and Ancient and Primeval Beech Forests of Germany".

More than 90% of the territory of the park is not used for economic purposes. Natural processes take place here corresponding to the motto of all German national parks "Natur Natur sein lassen" ("Leave nature to its own devices", "Let nature be nature")[71].

In Germany, there is also the practice of restoring mining areas (Fig. 7), reclamation of land and functioning of relevant scientific and practical (R&D) organizations, such as the Research Institute for Post-Mining Landscapes (FIB)[72]. The landscape of such territories after restoration becomes close to its pre-industrial state, is turned into recreational parks and/or tourist attractions[73].

The German Federal Environmental Fund (Deutsche Bundesstiftung Umwelt) (DBU) has seized approximately 4,370 hectares of former mining land. The territories that used to be mining areas similar to areas affected by hostilities became a sanctuary for many endangered species of animals and plants. These territories become for the species habitats characterized by structural diversity and natural dynamics.

As an example of dealing with radioactively contaminated areas can serve the practice of granting them the status of a protected area.

The created protected areas in the radioactively contaminated territories perform the following key tasks: restoration and preservation of natural ecosystems; providing habitats for populations of native and

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[71] https://www.nationalpark-hainich.de/en;https://doi.org/10.1002/9783527678471.hbnl2018001

[72] https://fib-ev.de/en/start_en/ — The Research Institute for Post-Mining Landscapes (FIB)

[73] https://www.weforum.org/agenda/2019/06/germany-is-turning-its-old-mines-into-a-tourist-hotspot/; https://www.researchgate.net/publication/233583065_Reclamation_conditions_of_opencast_mining_in_the_Rhenish_Lignite-mining_Region_Germany

migratory species; conservation of endangered species; providing opportunities for joint research.

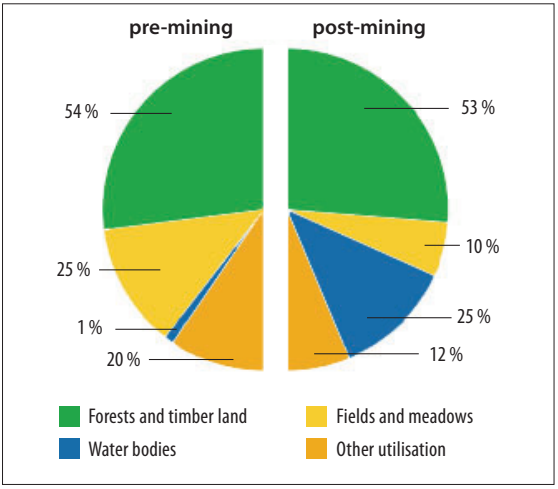


Fig. 7. Change in land use in the mining region of Lusatia

The following are examples of such protected areas:

- East Ural Nature Reserve, russia. It is located on the territory of the East Ural Radioactive Trace, which was formed after the Kyshtym catastrophe — the first radiation accident in the USSR, which occurred in 1957. In 1968, the nature reserve was established on the territory affected by the explosion with the purpose to prevent the spread of radiation pollution. Currently, the radiation level on the majority of the nature reserve territory is quite high.
- Rocky Flats National Wildlife Refuge, Colorado, USA, was created in the buffer zone of the former nuclear weapons plant (Fig. 8). Reclamation measures have been taken. They cost 7 billion dollars. (1993).

The Chornobyl Radiation and Ecological Biosphere Reserve in Ukraine and the Polissya State Radiation and Ecological Reserve in belarus were established in the territories affected by radiation pollution as a result of the Chernobyl accident.

Bikini Atoll in the Marshall Islands, a former US nuclear test site, is a UNESCO World Heritage Site. It has no official protected status, but

has certain restrictions on the use of environmental resources for the purpose of conservation and restoration of biodiversity[74].


Fig. 8. Changed appearance of the nuclear weapons plant

In case the territories affected by hostilities cannot be granted protected status or used for agricultural purposes, nature based solutions are to be applied[75]. For example, explosion funnels are converted into forest "islands" and ponds (Fig. 9).

A damaged terrain of the field can be transformed into a new landscape, useful for agriculture — more sustainable and productive in the near future. Accordingly, the modified agro-landscape will provide the following numerous ecosystem services to an agricultural producer or a farmer free of charge:

- Preventing soil erosion by reducing wind speed.
- Stabilizing microclimatic indicators of the field, increasing the humidity of the air, soil, reducing evaporation.
- Reducing the number of field pests by sheltering hundreds of insectivorous birds, a kind of "biological weapon" against pests.
- Promoting fertility by increasing the humus content by 20–40% and soil porosity by up to 9%. Introducing wood and other natural elements in agricultural landscapes activates metabolic processes.
- Depositing carbon in woody plants and accumulating organic carbon in the soil.

[74] https://www.researchgate.net/publication/251819871_Scales_of_Eden_Conservation_and_Pristine_Devastation_on_Bikini_Atoll

[75] https://portals.iucn.org/library/efiles/documents/NGW-001-En.pdf — IUCN Conflict and Conservation

- Reducing the level of chemical pollution, because tree plantations absorb and bind chemical elements in different layers of soil and contribute to the purification of groundwater.


Fig. 9. Example of applying nature based solutions in response to damage to arable land as a result of hostilities

Diverse agricultural landscapes with mosaic patches of shrubs or trees will enhance the recreational attractiveness of the regions. The aesthetic and cultural value of such mosaic agro-landscapes is growing[76].

### 7.3. Is it necessary to restore the dam on the Oskil river?

On April 2, 2022, as a result of hostilities near the village of Oskil, one of the gates of the Oskil Reservoir was destroyed, which made environmentalists calculate environmental consequences that this

[76] https://latifundist.com/blog/read/2884-vijskovi-shrami-na-ukrayinskih-polyah-abo-yak-vidnoviti-agrarnij-landshaft-pislya-bombarduvannya?fbclid=IwAR2zw3tLg-F1JwC88Ka38cVVCcy

situation has already caused and will cause in the future. This is also important for the discussion whether it is necessary to restore the dam after the war (Fig. 10).

EPL supports the position that it is necessary to refrain from restoration and completely demolish at least part of the dam to restore full water flow in the river. What are the benefits of this?

First of all, it should be understood that the filling of the reservoir will take at least a year, given that it is the largest reservoir in the Left Bank Ukraine. It should be mentioned that as a result of the hostilities that caused destruction of industrial enterprises, there is no point in collecting so much water. Therefore, based on this becomes void the main purpose of the mentioned reservoir, which was to accumulate water in order to maintain water level of the Donets river, most of the runoff of which was taken to the Siversky Donets-Donbas canal.


Fig. 10. Restored natural riverbed of the Oskil river in the area of the lowered reservoir. Image as of 28.05.2022

However, all this relates rather to economic consequences, and as for the environmental ones, there are a few positive points. As the destruction of the gate led to the leakage of water, large areas of the bottom will eventually dry out, which will be the first step towards the creation of typical natural ecosystems and the transformation of shallow water into meadows. Given that the river water flow will be restored and the

barrier to hydrobionts migration will disappear, a large number of species in need of running water will return to the Oskil river above the current dam, which in turn will serve to renew and enrich the forage base for birds dwelling on the territories nearby. All of the above factors will lead to the return and settlement of areas with rare species of flora and fauna and creation/restoration of habitats. According to the current legislation of Ukraine, these territories will be subject to being granted a protective status, which will help increase the percentage of protected areas in the country and comply with the goals of the 2030 Strategy of the State Environmental Policy of Ukraine.

Moreover, the restoration of the dam can lead to increased water transparency, due to the retention of river sediments, which in turn will greatly affect coastal and aquatic ecosystems of the landscape reserve "Synychynskyi".

It is worth remembering that increasing the area of water bodies is not a guarantee of increasing fish populations. It is necessary to take into account the needs of the species living there. Smaller bodies of water sometimes have more biodiversity due to the fact that such an aquatic habitat is better suited to them. In addition, the water in the reservoir is more susceptible to eutrophication than running water, and this creates a threat of water bloom and perish of all fish in it. The discharge of water from the Oskil reservoir also means a decrease in the area of the water mirror, and thus a significant reduction in evaporation and increased runoff in the lower flow of the Oskil and further in the Siverskyi Donets, which will positively affect river and coastal ecosystems in conditions of increasingly arid climate.

We believe that Ukraine needs to review the current water management system through the prism of advanced global trends, which take into account not only the necessity to meet water needs, but also take into account environmental interests, preserving and/or restoring natural complexes and their ability to provide ecosystem services. For example, in the United States more than 1,100 dams have been removed over the past 40 years[77].

[77] https://riverwatch.eu/sites/default/files/uploads/Dams/AmericanRivers_NatlDamProjectManagerGuide_06112015.pdf

It is necessary to change the existing paradigm of water resources management in Ukraine and move to the application of modern sustainable principles based on nature based solutions. This necessitates further training of relevant officials and environmental education of the population. However, as the practice of EU countries shows, this is quite real. In addition, the public itself is usually interested in restoring rivers and prefers natural wetlands.

It should also be noted that as of the beginning of the summer the occupiers had already restored the blown gateways of the dam and started refilling the reservoir in order to reduce water level in the Donets and simplify river crossing, which will have negative consequences for the Donets ecosystems. But in the conditions of the ongoing war, we understand that the dam can be blown up again, and therefore we must be prepared for this and have action plans ready.

## 7.4. Restoration and reconstruction of the metallurgical industry of Ukraine

Steel production in Ukraine is an important industry. Together with its impact on other sectors, the metallurgical contribution to GDP was about 12% and 23% of Ukrainian exports of goods in 2018.

$CO_2$ emissions in the Ukrainian metallurgical sector are significant. In 2019, they amounted to 47.4 million tons. This estimate is probably the lower limit, as due to the old asset base, the Ukrainian metallurgical industry is probably more emission-intensive than the international average one.

The global trend towards decarbonisation of industry is a challenge for Ukrainian steel producers. However, modernization and decarbonisation are needed: production costs must be reduced though application of more modern equipment and methods. Production of low- or zero-carbon steel could soon become very important for steel sales in important markets.

The European Parliament's Committee on Industry, Research and Energy (ITRE) has released the study entitled "Moving towards Zero Emission Steel. Technologies Available, Prospects, Timeline and Costs", which summarizes the efficiency, availability of and barriers to nine

different technologies for decarbonising the steel sector in Europe[78]. The EU is already discussing the introduction of a "Carbon Border Adjustment Mechanism", the $CO_2$ tax for steel.

Therefore, in the post-war reconstruction of the metallurgical industry, it is important to focus on the practical aspects of the introduction of new technologies to reduce $CO_2$ emissions and transition to carbon-free steel production. This means refusal to rebuild industrial enterprises in the form in which they existed earlier, and focus on introduction of technologies for metallurgy decarbonization.

Ukrainian Metinvest is already developing a plan for green steel production until 2050[79].

Ukraine has every chance to become a supplier of DRI[80]-products and carbon-free steel on the world market. The market is expected to increase demand for DRI and raw materials for its production (DR-pellets). Ukraine has the opportunity to occupy its niche in this market, because it has the ability to produce DR-pellets. Ukrainian iron ore companies are already taking the first steps in this direction. In particular, in 2020 Ferrexpo and Central Iron Ore Enrichment Works (Metinvest) began producing DRI-pellets. In 2021, after the closure of the sinter plant, the Southern Iron Ore Enrichment Works announced plans to build a pelletizing plant that will produce DR pellets.

It is obvious that in order to start DRI production in Ukraine, it is necessary to solve a number of complex issues, including those related to increasing domestic natural gas production, if DRI production will be launched in the short term perspective. In the context of Ukraine's European integration, these problems are easier to solve, including

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[78] https://www.europarl.europa.eu/RegData/etudes/STUD/2021/695484/IPOL_STU(2021)695484_EN.pdf

[79] https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/metals/020422-ukraines-metinvest-rolls-out-plan-for-green-steelmaking-by-2050

[80] Direct reduced iron (DRI) — iron obtained by direct production, direct production of iron in the process of relatively high-temperature direct (bypassing the blast furnace production of pig iron) reduction of iron from ores. The process makes it possible to eliminate the use of fossil fuels in the production of pig iron and steel, using renewable ("green") hydrogen instead of gas. Today, the production of "green" hydrogen is, rather, an experimental technology, not ready for industrial use. The main part of DRI is produced using natural gas.

through access to European sources of funding. The realization of these opportunities will depend on the efforts of enterprises and economic policy of Ukrainian and European public institutions[81].

The transition to a low-carbon economy, particularly in the metallurgical industry, depends on the political will and ability of the Ukrainian government to facilitate it. The main task of the latter is to comply with European recommendations provided, in particular in the framework of international projects, such as outlined in the report "Towards decarbonisation of the metallurgical industry of Ukraine", Low Carbon Ukraine project, which aims to support the Ukrainian government in transitioning to low carbon economy[82].

It is much better to restore the industry based on sustainable economy principles, as provided for in the European Green Deal, rather than to reconstruct a non-viable fossil fuels-based economy, which will have to be transformed again in the future. It will be a leap forward into a green future that will surely come for all economies without having to go through another brown phase, another phase of dirty industry[83]. This will ensure concrete integration of Ukraine's economy into the economy of the European Union.

## 7.5. Restoration of natural landscapes of Luhansk region on the site of burned forests

Most of the forests of Luhansk region are located on the left-bank terraces and floodplain of the Siversky Donets, where active hostilities have been going on since March. That is why this region has suffered the most from the forest fires caused by the war. According to the State Environmental Inspectorate, more than 17,000 hectares of forest have already been destroyed in the region, and the accrued losses amount to UAH 38.4 billion[84].

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[81] https://gmk.center/ua/opinion/misce-ukrainskoi-metalurgii-v-zelenih-lancjuzhkah-postavok/

[82] https://www.lowcarbonukraine.com/wp-content/uploads/Towards-a-decarbonisation-of-Ukraines-steel-sector.pdf

[83] https://tol.org/client/article/green-membership-for-ukraine.html

[84] State Ecological Inspectorate of Ukraine. URL: https://www.dei.gov.ua/posts/2242

In view of continuing active hostilities along the Siverskyi Donets, the total area of forest fires may increase significantly and exceed the scale of 2020, when the fire covered up to 35 thousand hectares of forests[85].

It is quite logical that after the end of the war the State Forest Agency will try to restore the forests destroyed by fires as soon as possible, in particular the already mentioned 52 thousand hectares in Luhansk region, as mass reforestation after fires in 2020 is still in the plans. An additional "incentive" for foresters will be the program to plant a billion trees "Green Country"[86], which has not been canceled.

However, when planning the restoration it is important to take into account the specifics of burnt plantations and climate conditions. Thus, most of the forests of Luhansk region and the vast majority of plantations destroyed by fires are pine monocultures, which are the most fire-hazardous forests in Ukraine. Forests with a predominance of deciduous species have suffered less, as they usually grow in wetter areas and are more resistant to the spread of fire. Taking into consideration the above, as well as the fact that fairly dry climate of Luhansk region will become drier and hotter in the coming decades, the restoration of pine forests in the form that existed before the fires is not only environmentally impractical but also economically unviable.

It is worth remembering that typical ecosystems of sand terraces are sandy steppes and sparse pine forests. Therefore, it will be ecologically expedient to restore a stable landscape on the terraces of the Siversky Donets, which consists of areas of pine forests (instead of the current dense plantations following the example of Polissya), an increased share of deciduous and mixed forests and sandy steppes.

[85] New types of fires — 9 lessons to be learned after the 2020 fires. URL: https://nubip.edu.ua/node/85635

[86] https://zelenakraina.gov.ua/

# CONCLUSIONS AND RECOMMENDATIONS

The consequences of russia's military aggression on the territory of Ukraine are devastating. The environment of Ukraine and the world is severely damaged as a result of these military actions. A safe environment is the basis of national security, the key to economic development and an unconditional component of ensuring healthy life and well-being of the population. Therefore, the planning of post-war reconstruction of Ukraine should take into account the mandatory environmental component.

The primary task is to study and analyze the damage caused to the environment. The key in this direction is the establishment of a system of permanent collection and accounting of data on verified facts of environmental damage; analysis of such data and professional interpretation of the facts of harm and their impact on the environment and population; development of methodological bases for work with environmental damage assessment (methods of collection, accounting and analysis, quantitative and cost assessment of direct and indirect damage, including various types of ecosystem services) with the involvement of leading international scientists using state and international support; reflection of findings in normative legal acts and adoption of new ones if necessary (in particular, approval of methods of calculating damage and losses, the procedure of maintaining the cadastre of losses, etc.). The next task will be to develop methods for comprehensive restoration of the environment affected by hostilities, including the restoration of natural ecosystems, as well as the development of compensation measures for damaged natural ecosystems and ecosystem services derived from them. In the process of implementing these methods, it is necessary to follow the developed recommendations for mitigating environmental impact of explosive ordnance and demined lands[87], priorities for environmental restoration, in particular in eastern Ukraine[88].

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[87] https://www.mineactionreview.org/documents-and-reports/mitigating-the-environmental-impacts-of-explosive-ordnance-and-land-release

[88] https://www.osce.org/files/f/documents/6/3/362581_0.pdf

In order to effectively address the existing problems, a number of horizontal reforms are needed to ensure adherence to a transparent, open, democratic and pro-European direction, which will accelerate Ukraine's European integration processes, ensure the formation of modern pro-European institutions that will make decisions based on the principles of transparency, openness and participation. For the post-war reconstruction of the country it is vital to implement the recommendations on a wide range of sectoral reforms outlined in this document. To this end, it is critical to adopt key legislation that also approximates Ukrainian legislation to EU legislation and implements a new policy on waste management, subsoil, forestry, and biodiversity.

It will be possible to ensure implementation of scientifically grounded advanced measures of restoring the war-damaged environment to the natural state if the reform of the State Fund for Environmental Protection is implemented and the Environmental Restoration Fund is established. It is also important to introduce carbon certificates, European taxonomy in financing investment projects to take into consideration ecosystem services in making decisions about the use of natural resources.

There is an urgent need for a detailed analysis of international environmental, humanitarian and criminal law through the prism of environmental issues and for inclusion of the environmental component in international lawsuits, Ukraine's claims against russia in order to obtain reparations to restore the environment to the natural state. It is also important to advocate inclusion of the environmental component in other sectors of the country's reconstruction. The government must choose a strategy of bringing russia to justice. One of the strategic decisions may be on creation of a Compensation Commission at the UN General Assembly. Other solutions are to use the mechanisms of the UN International Court of Justice, the ICC or to set up an ad hoc tribunal. To this end, Ukraine must also ratify the United Nations Rome Statute.

An important approach is to study and implement the best international practices (from horizontal, sectoral reforms and up to combatting pollution caused by hostilities) to address the challenges of post-war reconstruction of the country. Environmentalization of the economy can be boosted through introduction of circular economy principles

and key provisions of the European Green Deal, which will promote harmonization of the Ukrainian economy with the EU economy, facilitate the export of domestic products and goods, reduce barriers to investments. Importantly, the focus should be put on low-carbon economy, and accordingly on projects with minimal $CO_2$ emissions, which is fully in line with Ukraine's international obligations.

Maximum consideration of the environmental component in planning and implementation of Ukraine's reconstruction is the basis for building peace, security and prosperity of the entire region of Eastern Europe with a clean and healthy environment.

*Information and analytical publication*

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# PLANNING THE ENVIRONMENT REMEDIATION

Policy Note

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