15th meeting of the Conference of the Contracting Parties to the Convention on Wetlands

"Protecting wetlands for our common future"
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COP15 Inf.2

Implementation of Resolution XIV.20: Final assessment report of environmental damage on Wetlands of International Importance in Ukraine stemming from the Russian Federation's aggression

Convention on Wetlands

Ramsar

Implementation of Resolution XIV.20

Assessment report of environmental damage on Wetlands of International Importance in Ukraine stemming from the Russian Federation's aggression

Final Report

January 2025

www.ramsar.org

1. Executive Summary

1.1. Background

At COP14, the Contracting Parties adopted Resolution XIV.20 on *The Ramsar Convention's response to environmental emergency in Ukraine relating to the damage of its Wetlands of International Importance (Ramsar Sites) stemming from the Russian Federation's aggression.*

This full assessment report is presented pursuant to Resolution XIV.20 para 18, which "*REQUESTS the Secretariat of the Convention on Wetlands to coordinate actions with the Contracting Parties and relevant national and international organizations to conduct assessments of the Ramsar Sites in Ukraine affected by aggression of the Russian Federation, and advise on appropriate mitigation and restoration measures; and FURTHER REQUESTS the Secretariat to provide a report on the assessed damage and mitigation measures to the 15th meeting of the Conference of the Contracting Parties, in addition to providing an update on the implementation of this Resolution to all intervening meetings of the Standing Committee*".

This final report relies on the process of data corroboration and triangulation by consolidating and presenting all information captured from Earth Observations, literature review, field studies, managers of the Wetlands of International Importance and stakeholder workshop.

It goes on to provide assessment of the impact of the war on Wetlands of International Importance in Ukraine and advice concerning the immediate, short, medium and long-term rehabilitation and restoration of impacted Wetlands of International Importance.

The Importance of Ukraine's Wetlands

Ukraine's Wetlands of International Importance are of significance from a number of perspectives. Within the south of Ukraine many Sites along the Azov-Black Sea are essential locations within the African-Eurasian Flyway used by millions of migratory birds for feeding and resting during their spring and autumn migrations – and are also important for fish and other marine organisms. In the north of Ukraine, the Sites account for some of the best-preserved marshes and peatlands, while the Desna, Dniester and Dnieper rivers represent important locations for both birds and fish. In the west of Ukraine, the Carpathians and the Carpathian Region are essential for the preservation of mountain biodiversity.

Finally, it should be noted that Ukraine's wetlands are highly inter-connected to wetlands in other countries through migratory bird and fish routes and through shared river basins flowing through multiple countries including Belarus, Russia, Moldova and parts of Eastern Europe.

Assessment Approach

The assessment team collected and consolidated data relating to the impacts on Wetlands of International Importance (Sites) in Ukraine related to the war through numerous different sources:

- Literature review;
- Earth Observation;
- Sites managers reporting;
- Workshop organised in Kyiv; and
- Field visits.

The assessment team then analysed all data sources for each Wetland of International Importance, triangulated all data, and compiled all findings to produce a final list of impacted Sites throughout Ukraine.

The **literature review** was the initial activity and was largely completed prior to the commencement of the Field Mission in May 2024. This involved identifying and reviewing existing data, reports, and maps to understand the pre-conflict environmental baseline and identifying potential impacts relating to the war in Ukraine.

Earth Observation (EO) data were gathered from multiple open data sources and numerous EO analyses were made to detect, confirm and reveal some changes that occurred within the Wetlands of International Importance. EO analysis included visual interpretation, change detection, land use-land cover classification, fire mapping with severity detection, flood mapping, hydrological changes over time and the use of numerous EO indices.

The field mission was undertaken during the period of 26th May to 5th June 2024 – the primary objective of which was to undertake assessments of affected, or potentially affected, Wetlands of International Importance. Throughout the mission six Wetlands of International Importance were visited which provided first-hand information regarding direct and indirect impacts of the war and also served as "proxy-sites" for occupied Sites which could not be visited due to serious security risks.

A major **workshop** was conducted in Kyiv on 31st May, 2024 - chaired by the First Deputy Minister of the Ministry of Environmental Protection and Natural Resources of Ukraine. More than onehundred professionals attended, either in-person or remotely, and comprised of management staff from each impacted Wetland of International Importance along with representatives from academic institutions and from regional state authorities and state bodies.The workshop gave individuals involved in the management of Wetlands of International Importance within, or close to, occupied areas, the opportunity to share their observations regarding the broad range of impacts related to the war.

Site managers' reports including feedback at the workshop followed by two stages of questionnaires - a preliminary collection of information before the field visits to identify the main impacts and a final collection of information to detail and quantify the impact on their respective Sites. Survey forms were received by the assessment team and consolidated into one single database. Impacts were summed up by main categories and site-specific impacts were generated summing up all impact rankings. This impact table was used by the assessment team as one source of information and was subsequently validated and verified against other data sources to address any degree of subjectivity from the Wetlands of International Importance managers' reports.

1.2. Findings

The process of data corroboration and triangulation of all information has confirmed that the vast majority of Ukraine's Wetlands of International Importance (96%), even those at a considerable distance from the territories of Ukraine suffering from direct military activities and occupation, illustrated some, or all, of three major environmental impacts along with one additional category of management related impact.

Figure 1 demonstrates examples of the main categories of impacts to the Wetlands of International Importance considered by the assessment team throughout the study.

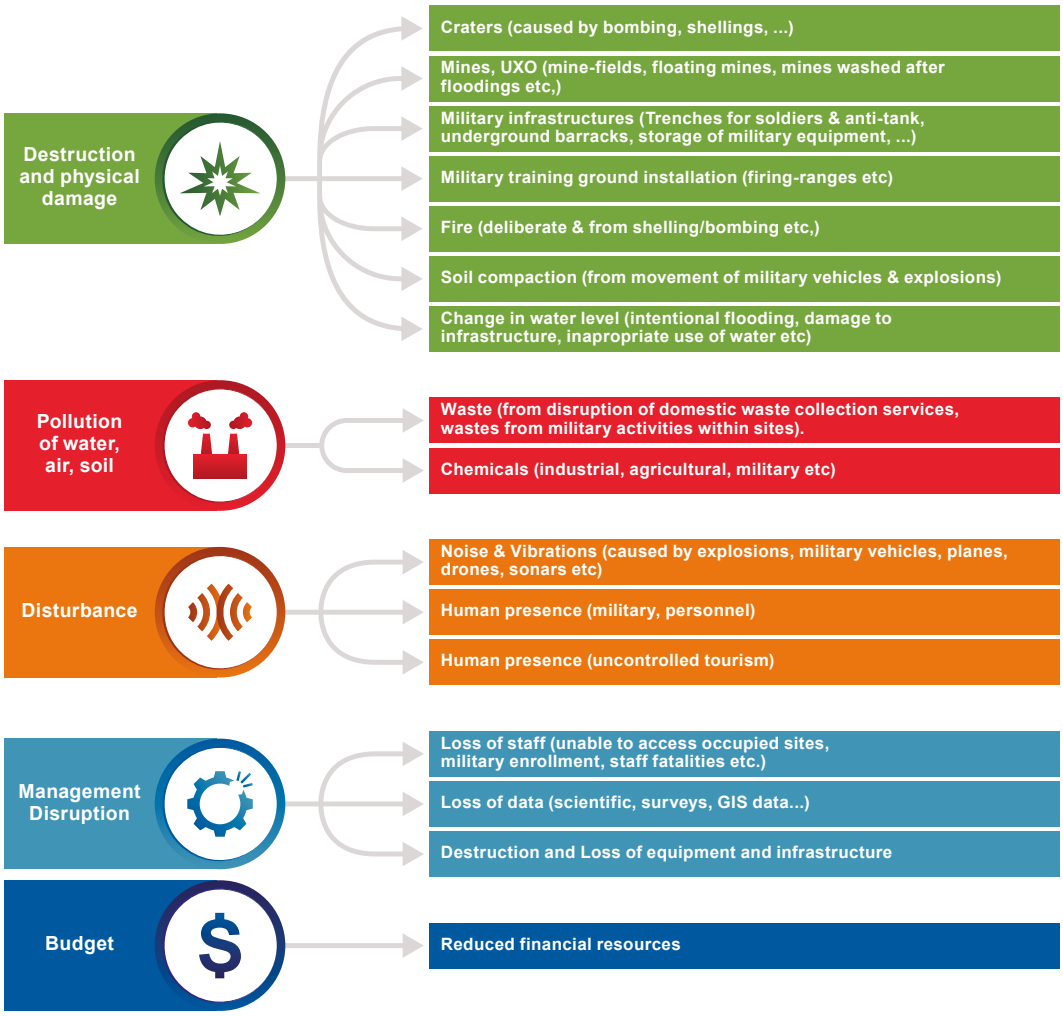

Figure 1. Main impacts to Wetlands of International Importance considered in the assessment

The above-mentioned impacts upon the Wetlands of International Importance are shown within Figure 2 as a simplified impact pathway model.

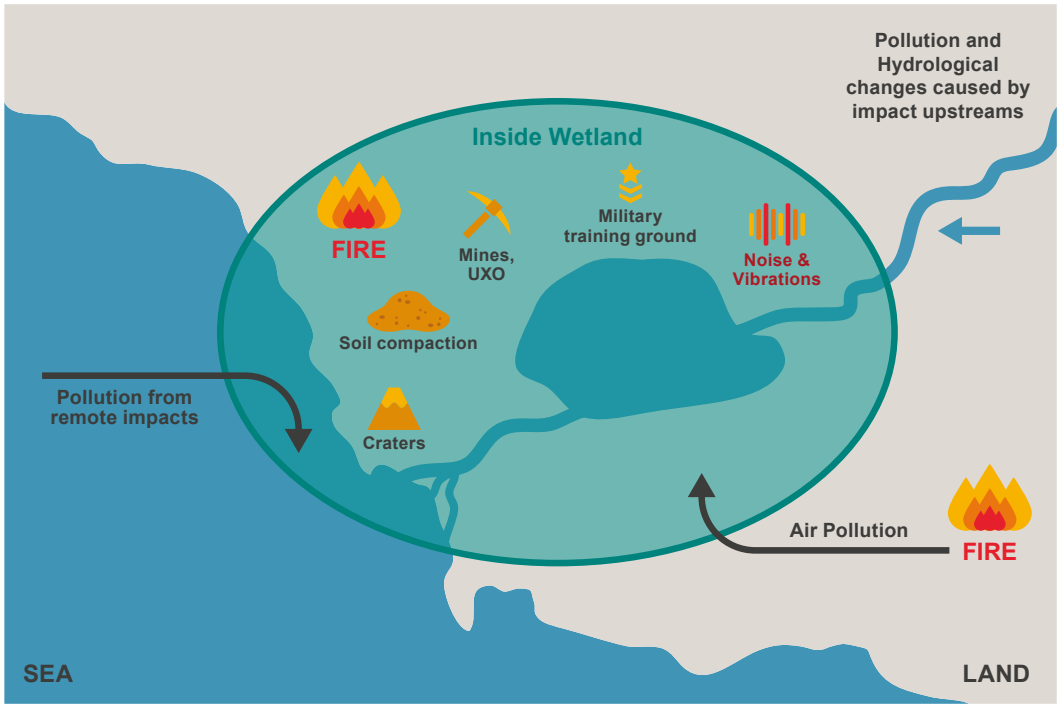

Figure 2. Simplified Impact Pathway Model

The type of impacts from the war and the resulting degree of change in ecological character upon Wetlands of International Importance are summarised in the following table in Figure 3.

Nature of Impact	Change in Ecological Character	Example of Change in Ecological Character	Number of Sites
Direct	Major	Fundamental change in hydrology resulting in the elimination of the wetland ecosystem.	4
Direct	Moderate	Occasional shelling, troop and military vehicle movements, military constructions etc.	27
Indirect	Minor	Reduction management capacity & funding and access to Ecological Services.	17
None	None	No change in ecological character	2
			50

Figure 3. Table showing ecological character change in the 50 Wetlands of International Importance

The above-mentioned changes in ecological character of the Wetlands of International Importance as a result of the war are shown within Figure 4.

Figure 4. Change of the ecological character of the Wetlands of International Importance

As can be seen in Figure 4, all four Sites demonstrating major changes in ecological character are in the south of Ukraine and are within, or adjacent to, territory occupied by the Russian military.

1.3. Recommendations

For Ukraine's Wetlands of International Importance to recover to their pre-war condition, there is a broad and complex range of restoration measures required to be undertaken over the immediate, short, medium and long-term.

These measures must not only focus upon the environmental damage but must also address the recovery of the key institutions along with measures to assist those communities whose livelihoods depend upon the wetlands.

Ahead of implementing a strategic approach, there are measures which can be taken in the immediate time-frame, even before the end of the war. These include: the enhanced use of EO to monitor damage and changes in wetland ecosystems; supporting and encouraging the remaining management staff to continue to monitor and document impacts; train and resource local authority and community rapid-response/containment teams to address immediate pollution risks through the use of containment barriers etc; and provide equipment and training for water and soil quality testing and wildlife assessments.

Thereafter, to ensure that the short, medium and long-term restoration measures are undertaken in a coordinated and strategic fashion, it is essential to undertake a detailed assessment of each Site over an initial 18–24-month period.

The information generated from the assessment should be used to develop a **Wetland Restoration Plan** (WRP) ideally to be completed by the end of the second year. The WRP should identify priority Sites, the sequencing of activities and the required resources (human, technical and financial).

The WRP should be developed in consultation with local experts – to assist with identifying the optimal time for intervention, minimising unnecessary damage to biodiversity and for monitoring the effectiveness of the remediation and nature restoration measures.

The WRP should initially prioritise the removal of explosives (mines, UXOs', etc.), oil and chemical spills, waste and debris – followed by the promotion and management of natural processes to rebuild the wetlands' ecosystem.

1.4. Conclusions

The completion of this assessment has contributed significantly to the body of information illustrating the nature and extent of impacts of the war upon Ukraine's Wetlands of International Importance, and by extension, the country's wetlands in general.

However, it should be noted that the assessment team have only been able to monitor the impacts to Ukraine's Wetlands of International Importance up until the autumn of 2024 and that the situation would have continued to deteriorate up to the present time due to the ongoing war.

The comprehensive nature of the baseline information contained within the Ramsar Sites Information Sheets has contributed significantly to the success of this assessment. This fact should encourage other countries to update their datasets within the Ramsar Informational System.

The impacts from the war can be summarised into direct impacts and indirect impacts all of which have had consequences on the Ecosystem Characteristics of Ukraine's Wetlands of International Importance. All impacts and their consequences must be factored into the immediate (before the end of the war) short, medium and long-term recovery programme.

Longer-term, there is a need for a comprehensive environmental monitoring programme to accurately determine the full range and degree of damage inflicted upon Ukraine's Wetlands of International Importance stemming from the Russian Federation's aggression.

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2. Background

The Convention on Wetlands is an intergovernmental treaty which provides the framework for national and regional actions and international cooperation for the conservation and sustainable use of wetland biodiversity and services. It was the first of the modern global multilateral environmental agreements and is devoted to a specific critical ecosystem.

At the 14th meeting of the Conference of Contracting Parties (COP14, Wuhan-Geneva, 2022), Resolution XIV.20 *The Ramsar Convention's response to environmental emergency in Ukraine relating to the damage of its Wetlands of International Importance (Ramsar Sites) stemming from the Russian Federation's aggression* was adopted.

In paragraph 12 of Resolution XIV.20, the Contracting Parties of the Convention recognized the devastating impact of the Russian Federation's aggression on the environmental situation in Ukraine, including the disruption of the ecological status of 16 Wetlands of International Importance and potential damage to another 15 Sites within Ukraine.

In paragraph 18 of Resolution XIV.20, the Contracting Parties requested the Secretariat of the Convention on Wetlands to coordinate the undertaking of assessments of the Wetlands of International Importance (Ramsar Sites) in Ukraine affected by aggression of the Russian Federation and advise on appropriate mitigation and restoration measures.

The Resolution further requests the Secretariat of the Convention on Wetlands to provide a report on the assessed damage and mitigation measures for the 15th meeting of the Conference of the Contracting Parties.

The assessment was undertaken within three distinct phases:

1. **Phase 1**: Developing an assessment methodology for evaluating the ecological changes of Wetlands of International Importance in the context of the Russian Federation's aggression – by 31st January, 2024;
2. **Phase 2:** Conducting the assessments for the Ukrainian affected, or potentially affected, Sites – by 30th June, 2024; and
3. **Phase 3:** Developing proposed mitigation and restoration measures for these Sites, considering immediate, mid-term and long-term approaches – by end of December, 2024.

3. Methodology

3.1. General Approach

Throughout the execution of the assessment, the methodology, as previously agreed with the Advisory Board, was adhered to in full. The methodology was developed based upon the team's extensive experience of conducting environmental assessments in a variety of conflict and post-conflict settings around the globe.

All data gleaned through the initial desk study was cross-referenced and corroborated through a major workshop, targeted stakeholder interviews, the latest EO observations, and actual data gathered during the site inspections.

All of the above steps have helped to ensure that a high-level of confidence can be applied to the final evaluation of the site conditions.

The various interactive steps undertaken throughout this study are shown, in a simplified fashion, in Figure 5 below.

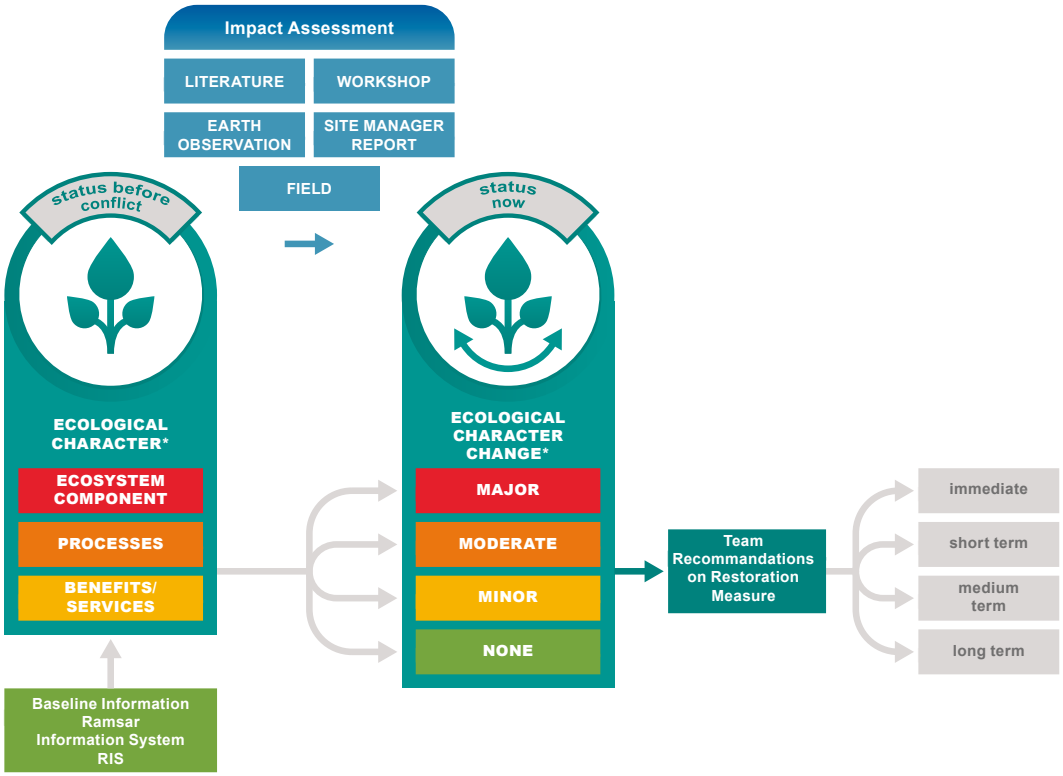

Figure 5. Diagram showing the different steps, inputs and outputs of the assessment.

3.2. Description of the steps

3.2.1. Desk review

The desk review phase of the study was largely completed prior to the commencement of the Field Mission in May, 2024. This involved identifying and reviewing existing data, reports, and maps to understand the pre-conflict environmental baseline and identifying potential impacts relating to the Russian Federation's aggression against Ukraine.

Also, EO and GIS data were gathered from multiple data sources and organized into a comprehensive database that was used to develop a simplified impact pathway model as shown in Figure 6. This was applied and modified during "ground-truthing" activities undertaken during the Field Mission in May & June, 2024.

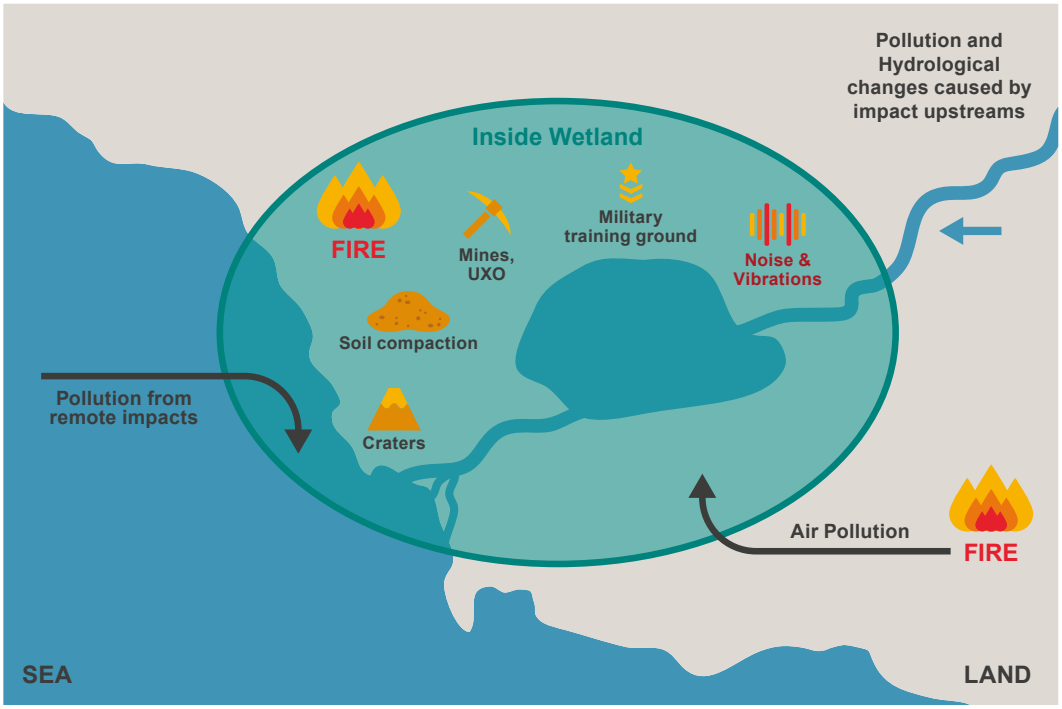

Figure 6. Simplified Impact Pathway Model.

3.2.2. Workshop

A major workshop was conducted in Kyiv on 31st May 2024 – chaired by the First Deputy Minister of the Ministry of Environmental Protection and Natural Resources of Ukraine.

A total of twenty-two (22) individuals attended in person with a further ninety-two (92) people joining remotely. The audience comprised of management staff (mainly representatives of administrations of National Parks and Biosphere Reserves) from each impacted Site, along with representatives from academic institutions and from regional state authorities and state bodies.

Communication with representatives of key stakeholders was maintained following the workshop with letters being written to key institutions for updated follow-up information and any required points of clarification.

3.2.3. Site managers' reports

Communication with the Site managers included two stages of working with questionnaires - a preliminary collection of information before the field visit to identify the main factors of impact relevant for the situation in Ukraine and a final collection of information to detail and quantify the impact at the beginning of autumn 2024.

The Site managers were provided with an Impact Reporting Survey form which they completed based upon their knowledge of how their Sites had been impacted since the beginning of the Russian aggression.

The survey form listed 21 impacts organised into 4 main categories - for each of them managers had to give i) a description of the impact ii) an indication of the impact importance choosing from 0 (no impact) to 4 (high impact) and iii) provide relevant sources for each of the impacts.

Of the 50 managers contacted, 39 (78%) completed survey forms were returned while the assessment team completed the remaining 11 (22 %) forms based upon existing data and data-triangulation. Of the 11 Sites that did not respond, six were under Russian occupation at the time. All information was consolidated in one single database. Impacts were summed by main categories and Site-specific impacts were generated summing all identified impact rankings.

This impact table was used by the assessment team as one source of information and was subsequently validated and verified against other data sources to address any degree of subjectivity from the Site Managers' reports.

3.2.4. Earth Observation Assessment

Using EO technology, the EO assessment analysed environmental changes in the Wetlands of International Importance. The assessment applied a combination of passive (optical), active (radar), and thermal infrared sensors for monitoring impacts on the Sites.

Optical sensors including Sentinel-2, Landsat, Planet, and Maxar were used to assess vegetation and land cover, while radar sensors such as Sentinel-1 were used for flood and hydrological monitoring – while thermal bands from sensors on board of Landsat, MODIS, and ASTER helped detect active fires.

An effort was made to use mainly freely accessible imagery sources to facilitate further intake.

EO tools used included Google Earth Engine (GEE), Copernicus Browser, Sentinel Hub, Google Earth and QGIS.

EO analysis methods included visual interpretation, band combination, automatic image processing, and change detection over time.

The main findings of the EO assessment are described in the Findings Section of this report.

3.2.5. Field surveys

These activities were undertaken by the assessment team throughout the field mission. The Sites were selected to represent the variety of wetland environments including, to the extent possible, marshes, lakes, rivers, peatlands, and coastal areas.

The safety and security of the assessment team was of primary concern, particularly as the field mission was being undertaken whilst the war was still ongoing.

Accordingly, the team developed and applied a seven-step safety and security plan – which helped to ensure that no major safety or security incidents were incurred.

The original four categories of impacted Sites provided to the assessment team were:

1. Sites occupied in 2014 (four Sites).
2. Sites partly occupied in 2014 (three Sites).
3. Sites occupied during February-March in 2022 (nine Sites).
4. Sites under threats of extension of military activities and occupation (fifteen Sites).

These categories were provided by the Ukrainian Authorities to Ramsar Secretariat in the List of 31 Ukrainian Ramsar Sites affected - or potentially affected.

Following field work, the assessment team added a fifth category of Sites which were found to be demonstrating the consequences of indirect impacts, namely "sites not under threat of extension of military activities and occupation".

All Sites visited by the assessment team were selected from category 4 above, the fifteen Sites within the category "Under threat of extension of military activities and occupation". Due to the obvious serious security threats, no Sites within the categories 1. to 3. could be visited by the assessment team.

Before the field survey, the EO expert had prepared satellite image (Sentinel-2) for each of the Sites to be visited. The images were used by the EO expert to get familiar with the different land use - land cover type (LULC) that could be encountered inside, and close to, the Sites to be visited. For some specific Sites (763 and 764) recent changes in the landscape had also been detected when comparing satellite images acquired at different dates.

In the field, the EO expert was able to confirm some of the LULC classes identified remotely (including agricultural land and reeds) and also confirmed that some of the changes identified corresponded to the construction of defence trenches.

The Sites within Category 4 provided first-hand information regarding direct and indirect impacts from the War but also served as "proxy-sites" away from the immediate military conflict and occupied zone, but suitably representative to yield appropriate base-line data.

The different categories of Wetlands of International Importance affected, or potentially affected, by the Russian aggression along with the assessment team's route through Ukraine, commencing in the South-East and concluded in the North-West of the country, is illustrated in Figure 7 below.

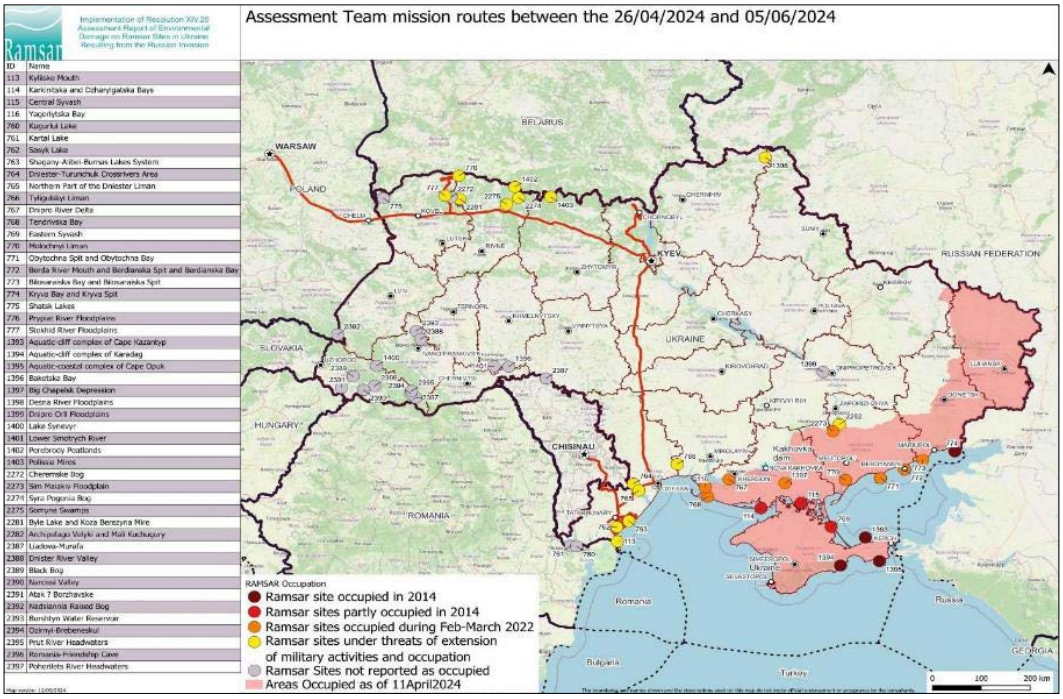

Figure 7. Illustrating the different categories of Wetlands of International Importance and the assessment team's route (red line) throughout their field mission in Ukraine

To standardise the collection and storage of Site data, the assessment team adopted a harmonised approach on each Site capturing the range of potential impacts – as provided previously in the Executive summary in Figure 1.

As well as noting the presence or absence of various impacts, the assessment team estimated the degree of impact when it was possible - determined by factors such as the size of a Site and the quantity of any given impact, such as the number of bomb-craters etc.

For changes to the ecological character of the Wetlands of International Importance, the team assessed the impact on the different components that constitute the ecological character that described in Figure 8 below.

Ecological Character Components	Ecological Character Sub-Components	Ecological Character Detailed Categories
Ecosystem Components	Biotic Components	All living organisms within the wetland (plants, animals, microorganisms)
		Diversity and abundance of species
		Vegetation types and habitat structures
	Abiotic Components	Non-living physical and chemical elements (water quality, soil, sediment types)
		Hydrological regime (water levels, flow patterns)
		Climatic conditions
Ecosystem Processes	Hydrological Processes	Water flow, flooding, groundwater recharge
	Biogeochemical Processes	Nutrient cycling, decomposition
	Ecological Interactions	Predation, competition, symbiosis

Ecosystem Benefits/ Services	Provisioning Services	Products obtained from wetlands (food, fresh water, raw materials, genetic resources)
	Regulating Services	Environmental regulation (climate regulation, water purification, flood control, erosion protection, carbon sequestration)
	Cultural Services	Non-material benefits (recreational, aesthetic, spiritual, educational experiences, tourism)
	Supporting Services	Natural processes maintaining other services (soil formation, nutrient cycling, primary production).

Figure 8. The components of Ecological Character

The ecological character table is based on the documentation of the Convention on Wetlands (Wetland Management, Planning - A Guide for Site Managers, Ramsar Guidance on Describing "Ecological Character", Section B of Ramsar Handbook No. 16, "Managing wetlands", 3rd edition, 2007).

3.2.6. Data Analysis

These inter-related tasks of data analysis and report preparation commenced once the Field Mission had been completed, and the assessment team had returned to their home offices – spanning the period from June to November, 2024.

This was an interactive process involving weekly meetings of all team members and periodic meetings with the Secretariat of the Convention on Wetlands and the Advisory Board.

As discussed within this section of the report, the assessment team collected and consolidated the impacts related to the Russian aggression through numerous different sources: literature review, Site managers' reports, workshop organised in Kyiv, Earth Observation, and field visits.

The degree of impact on any given Site along with associated change in the ecological character, was assessed by the assessment team based on an assessment and triangulation of a combination of data on impact to abiotic and biotic components, ecosystem processes and ecosystem services – as shown in Figure 9.

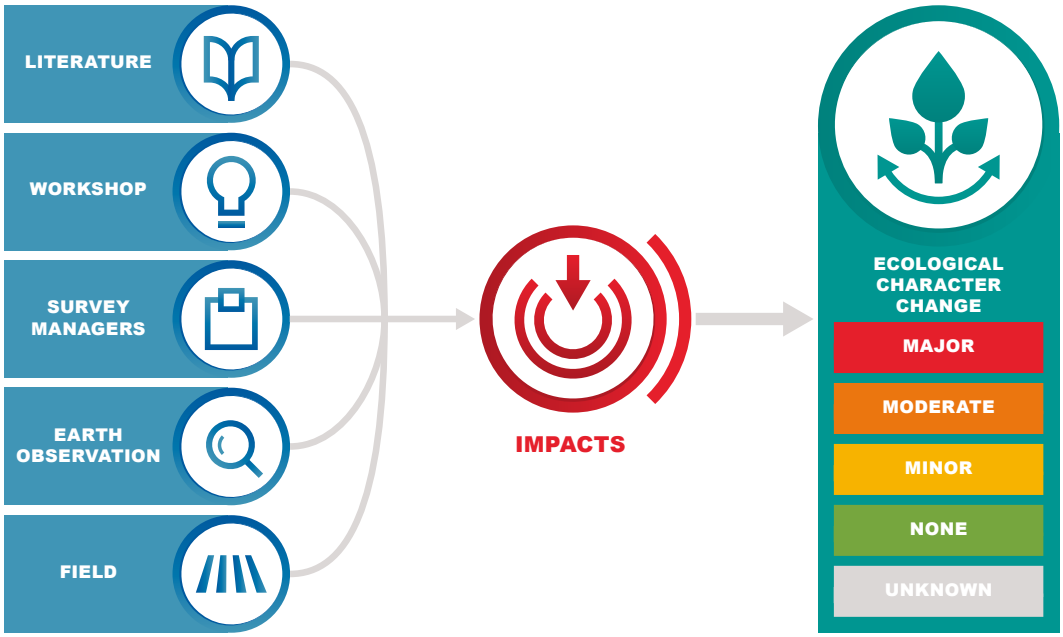

Figure 9. Data Triangulation Model

4. Findings

4.1. Literature Review

Since the start of the initial Russian aggression in February 2014 and full-scale aggression in 2022, many articles, reports, and studies have been published on the environmental impacts of the ongoing war.

The information in these texts has sometimes been anecdotal; some has been speculative, but quite a few have been based on substantial empirical observations.

This literature review focuses on reports that provide new and substantive information on the impacts related to the ongoing Russian aggression. Any information found in the survey of the literature that was directly relevant to the present report has been reflected in the appropriate places within the text.

A detailed list of references which have been reviewed by the assessment team is provided within the Annexes to this report.

4.1.1. Background

Relatively little attention was paid to the environmental aspects of military activities during historic times. However, since WW2, many publications have focused on the direct and indirect impacts of military conflicts on the environment. Some articles are of a review character, while others are based on case studies of single conflicts.

Authors have discussed the effects of disputes (conventional as well as nuclear), military training, the movement of troops, and pollution originating from military activities, as well as from the destruction of civilian infrastructure, indirectly resulting in environmental degradation (see, for example, Lawrence et al., 2015; Westing, 1980, 1996; Certini et al., 2013; Biswas, 2001; Brauer, 2009; Mahreen, 2022).

War and military activities, in general, have an overwhelmingly negative effect on ecosystem structure and function due to dramatic habitat alteration, environmental pollution, and disturbance, which inevitably lead to population declines and biodiversity losses.

However, there are cases when military activities have led to positive trends regarding certain species or habitats, especially when areas have been designated as de-militarised zones between the warring parties, as in the case of the zone between North and South Korea (Kim, 2013).

In addition, in connection with extended conflicts at sea, industrial fishing is often halted, which results in the recovery of fish stocks. This was noted, for example, after WW2 in the Northeast Atlantic and in the Arabian Gulf after the Gulf War in 1990-91 (Linden et al., 2004).

4.1.2. Environmental impacts due to the Russian aggression

Ukraine has suffered extensive environmental damage due to the Russian aggression. Natural ecosystems such as forests, rivers, wetlands, steppes, coastal lagoons, and shallow waters have been exposed to shelling, pollution, damage from military movements, fires, destructive noise, and more. The total extent of the environmental damage cannot be accurately established until after the war.

An essential source of information for the preparation of the report was through the questionnaires completed directly by the managers of the Wetlands of International Importance. The first round of questionnaires was conducted to clarify the general situation and identify the main influencing factors related to military aggression in Ukraine during April and May 2024. The answers were provided by managers of only 12 Sites directly affected by military activities (cited in the text as “Survey results”). These answers and the results of the field visit allowed for the formulation of a clear list of factors relevant to the situation in Ukraine and the development of a second questionnaire for a more detailed analysis and ranking of the impact.

According to the results of the second survey conducted in September and October 2024, up-to-date information was obtained from management teams from the 50 Wetlands of International Importance, supplemented by national expertise and other data sources, where necessary. This enabled a detailed summary and analysis of the situation within the Sites as reflected within this report.

Another important source of information regarding the impact resulting from the Russian aggression was the workshop held on May 31, 2024, in Kyiv. This was organised in cooperation with the Ministry of Environmental Protection and Natural Resources of Ukraine.

During the workshop, reports were presented on the impact of military aggression on 15 Sites directly impacted by military activities and four general reports on the effects on biodiversity.

Additionally, the discussion on research methods used to date by Ukrainian scientists provided an overview of possible methods to investigate and assess the impact of the Russian aggression on the Wetlands of international Importance.

To date, many articles and reviews have been published on the environmental consequences of the War of Ukraine. The assessment team list typical examples of such articles and reports below. In most cases, these reports are more qualitative, which is not unexpected as the war is ongoing, and comprehensive assessments of the impacts on local ecosystems are currently not possible.

Several reports discuss the destruction of infrastructure, such as water pumping-stations, reservoirs, and sewage treatment plants. From these reports, environmental damage can be indirectly assessed. However, relatively few reports consist of quantitative structured estimations of impacts on various parts of the environment for the reasons already mentioned.

Hryhorczuk et al. (2024), in an extensive integrative review of academic, institutional, and media information, discuss damages to terrestrial and aquatic ecosystems, destruction of forests, pollution of land, water, and air, fires, etc., from the start of the Russian aggression until the middle of 2024, amounting to close to $60 billion. The article states that 30% of Ukraine's water and soil have been contaminated by land-mines, unexploded ordnance (UXOs), wildfires, deforestation, and pollution. Thirty percent of the country's protected areas have been adversely affected by the war.

In a recent article, Filho et al. (2024a) discuss the ongoing war's environmental impacts and provide an extensive list of relevant literature on this topic. The authors elaborate on "sustainably oriented solutions" aimed at mitigating the effects of the war and discuss the challenges Ukraine will face after the war, when environmental recovery and restoration must compete with other needs to heal and rebuild the country.

In another article, Filho et al. (2024b) discuss the results of the investigation into the release of hazardous substances into the environment, such as pollutants and toxic chemicals, that are posing a threat to both human health and the environment as consequences of military actions. This has resulted in widespread destruction and contamination of natural habitats and resources and has disrupted wildlife populations and ecosystems. The article provides an overview of the impacts of the war on the soils in four Ukrainian protected areas, among which is Desniansko-Starohutskyi National Nature Park, which overlaps with the 1398 Desna River Floodplain. To address these aspects, this paper combined GIS analysis and secondary data, including soil samples obtained during field expeditions, to prove how ground battles, occupation, terrestrial land mines, and explosions can severely impact the soils. Practical and theoretical implications of the military actions are also discussed.

Zagorodniuk (2024) discusses the overall trends in the biota of areas subjected to the movements of front and defence lines for extended periods. Due to the prolonged war, the development of "trench fauna" consisting of opportunistic, feral, and/or alien species is observed. The article provides basis to reflect on the impact of such factors on wetlands biodiversity.

The Ministry of Environmental Protection and Natural Resources of Ukraine (2024) estimated that an area of more than 183,000 hectares of forests, wetlands, and agricultural land was affected by wildfires, causing the release of particulate matter, carbon monoxide, nitrous oxides, methane, and several other harmful substances (uwecworkgroup.info/environmental-consequences-of-the-war-in-ukraine-julu-2024). The World Bank (2023), in its report on damage to Ukraine's water facilities, reported the destruction of 724 hydraulic structures, including 71 water pumping stations and 64 sewage treatment plants.

The Ukraine War Environmental Consequences Work Group official website https://uwecworkgroup.info/ was established to share information about the war, produce expert analyses, and offer development solutions that meet the highest environmental standards to address humanitarian and environmental crises. Among the articles are regular reviews of the impact of war on protected areas and various types of ecosystems, including wetlands. On this website is an article by Vasyliuk (2024), which describes the use of the Opuk Nature (strict) Reserve and Wetland of International Importance aquatic-coastal area of Cape Opuk, for terrestrial and marine training exercises by Russian troops in Crimea during the period from 2014 to 2023.

Khrushch et al. (2023) examine a wider variety of environmental impacts and point out the inter-linkage between environmental degradation and various physical and mental health issues.

Timmins et al. (2023) analysed the state of the environment in 21 national parks and natural and biosphere reserves (among which ten overlap with Ramsar Sites), with 14 remaining at least partly occupied by Russian forces. The results of the assessments show that explosive munitions and active hostilities impacted 18 out of the 21, 16 (out of 21) exhibited pollution from explosives, 13 showed implications from fires, 15 were affected by heavy military vehicles and war infrastructure, and four showed signs of pollution from chemicals.

Shumilova et al. (2023) focus on the war's impacts on Ukraine's water resources and infrastructure. The analysis showed between 35 and 40 cases of interruptions or stopped water supply and wastewater treatment, which resulted in bacteriological pollution of downstream water courses. This study refers to the period until the end of May 2022.

The website of the ICO "Environment-People-Law" (https://epl.org.ua/environment-tax/zberezhennya- bioriznomanittya/doslidzhennya-epl-zberezhennya-bioriznomanittya/) contains several articles analysing the impact of the war on nature in Ukraine. Among them is an article on the threats to nature conservation areas along the northern border of Ukraine (EPL, 2023).

Turos et al. (2023) and the Ministry of Environmental Protection and Natural Resources of Ukraine have reported the impact of increasing concentrations of particulate matter on air pollution. During the first phase of the invasion (until March 2023), war activities damaged approximately 36 fuel storage facilities, burning about 108,000 tons of oil and oil products.

The Center for Journalistic Investigations (2024) regularly publishes materials on the impact of Russian military aggression on Ukrainian nature and protected areas. Among them are several publications that directly indicate the impact on nature conservation areas and their administrations, which are responsible for the management of Wetlands of International Importance (Baturin , 2023), development of military infrastructure (Starushko, 2024), and use of such wetlands as training grounds by Russian troops.

Vasyliuk O., Norenko K. (2019) analysed the consequences of the aggression of the Russian Federation on protected areas and the associated changes in Ukraine's defence forces from 2014 to 2019. The publication describes the actions of the Russian and Ukrainian troops in Meotida National Park (Ramsar Sites (773) Bilosaraiska Bay and Bilosaraiska Spit and (774) Kryva Bay and Kryva Spit). The authors discuss the efforts of the Ministry of Defence of Ukraine to return to use the former military training grounds that acquired the status of protected areas before 2014 (the area partly overlapping with Ramsar Sites (114) Karkinitska and Dzharylgatska Bays, (116) Yagorlytska Bay, (763) Shagany-Alibey-Burnas, (767) Dnipro River Delta, (768) Tendrivska Bay) and the successful efforts of environmentalists to protect such areas and find alternative places for military training in Ukraine.

In the publication by Blaga et al. (2017), there is a complex analysis of the state of the environment under conditions of armed conflict in eastern Ukraine during 2014-2017. The publication pays special attention to the impact of the armed conflict on biodiversity and protected areas in the Luhansk and Donetsk regions, including Meotida National Park ((774) Kryva Bay and Kryva Spit). It also describes the states' international legal obligations concerning environmental protection during armed conflict and the importance of holding those responsible for the ecological damage caused. Based on examining open sources and the results of Ukrainian Helsinki Human Rights Union (UHHRU)'s field monitoring, the situation has been defined, and significant issues related to environmental protection in eastern Ukraine have been highlighted.

4.1.3. Impacts on coastal and marine areas

Coastal and marine areas throughout Ukraine have been severely affected by the ongoing Russian aggression. Pollution from destroyed facilities on land has been distributed to the Azov Sea and the Black Sea via the many rivers that drain Ukraine.

The Conflict and Environment Observatory (2023) reported that spills of oil and other harmful substances, in addition to organic matter and nutrients, have contaminated the already stressed marine and coastal ecosystems.

The Black Sea is essentially anoxic at depths below about 100m, and the shallow Azov Sea is heavily influenced by the Don and Kuban rivers (Black Sea Commission, 2018). The recent hostilities will increase problems with pollution, anoxic deep waters, and eutrophication (CEOBS, 2023).

4.2. The EO Assessment

EO assessments indicate that since the beginning of the full-scale Russian aggression, some important changes inside and outside of the Wetlands of International Importance have occurred.

Some of these changes were clearly demonstrated in the detailed EO Assessment Report produced by the EO expert. Some of these changes are discussed in the following text.

The general EO methodology is shown in Figure 10 below.

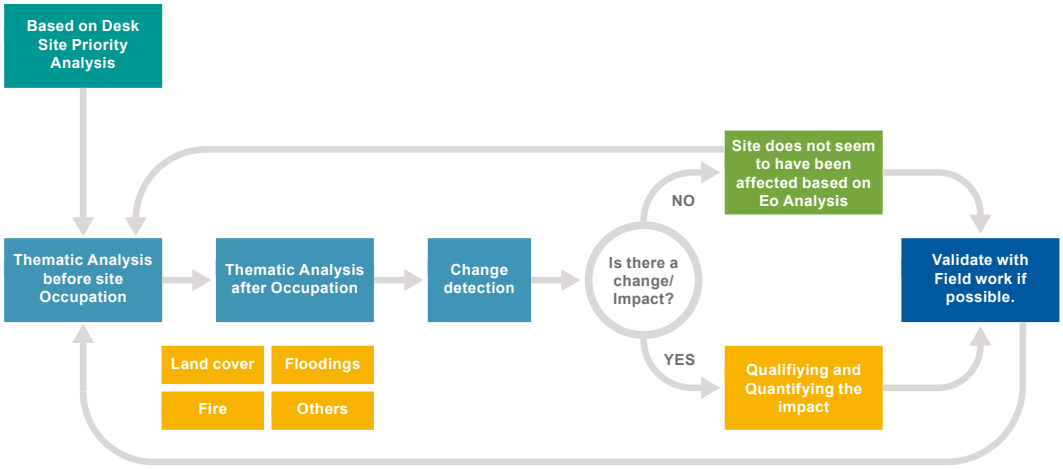

Figure 10. Earth Observation flow diagram

4.2.1. Fire

At national scale, an analysis of the available database of Active Fire, using Visible Infrared Imaging Radiometer Suite (VIIRS), from Fire Information for Resource Management System (FIRMS) seems to indicate some spatio-temporal changes in the fire distribution since the beginning of the full scale Russian aggression in February 2022 as shown in the following Figure 11.

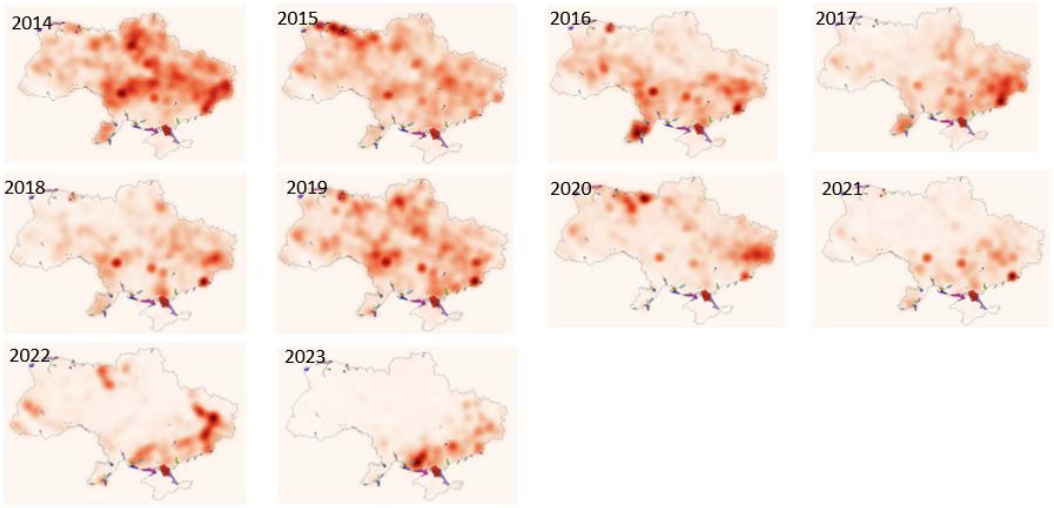

Figure 11. National fire analysis from 2014 to 2023 based on FIRMS database

In addition to the national scale fire analysis, several Site-specific fire detection analyses were conducted using multi-temporal high resolution satellite images that clearly demonstrate that important fires took place inside and outside wetlands caused by the military activities that impacted the Sites. This is illustrated in Figure 12.

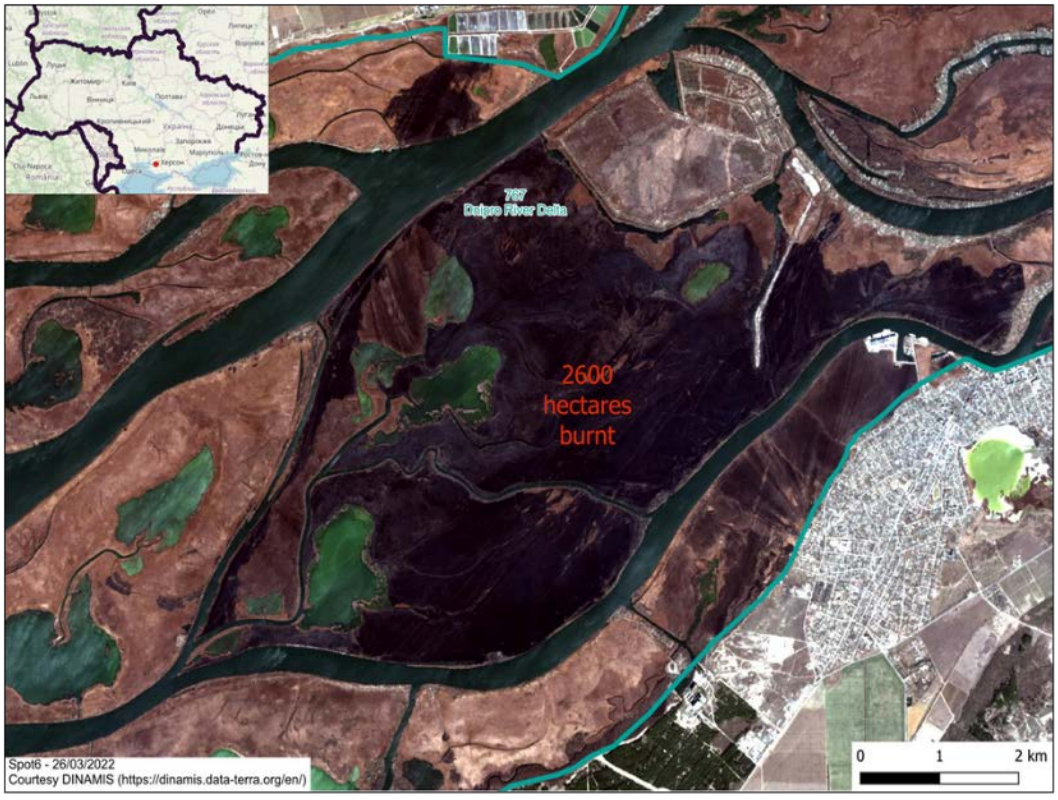

Figure 12. Detail of the burnt area within Dnipro River Delta at the beginning of nesting season.

EO also clearly shows that conflict related fires outside of Sites generated significant plumes of smoke that will have affected neighbouring Sites as shown on the Sentinel image acquired in May 2022 in Figure 13

Figure 13. Sentinel image acquired in May 2022 showing multiple fires around Wetland of International Importance

4.2.2. Kakhovka Dam flood

EO Assessment demonstrated that the Kakhovka Dam destruction caused a major flood that had an immediate and direct impact on the Sites downstream and upstream as shown in Figure 14.

Downstream, Dnipro River was flooded, and preliminary EO water analysis suggests that the water quality has changed in the following days and weeks, which can also be shown in other Sites located further south in the Black Sea.

Upstream, EO clearly shows that at least 2 Sites saw a major change in the water regime (see Figure 15 and Figure 16); this can be demonstrated by the land cover changes analyses in Figure 17.

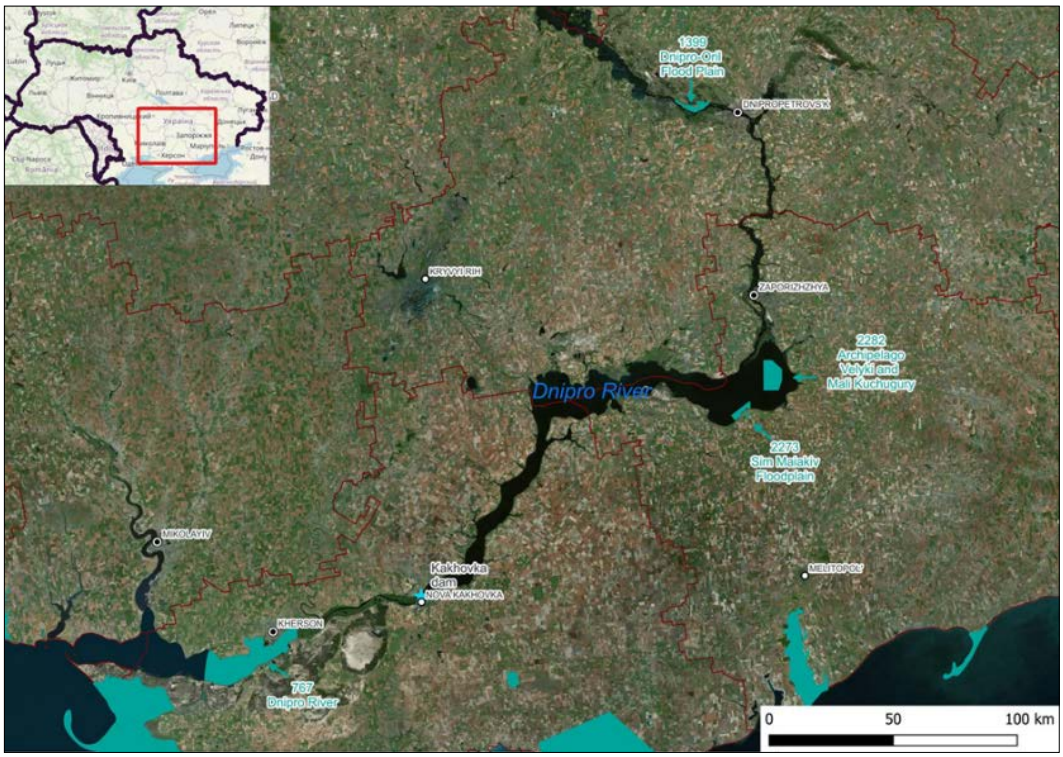

Figure 14. Hydrological connectivity of Wetlands of International Importance in the Kakhovka reservoir region

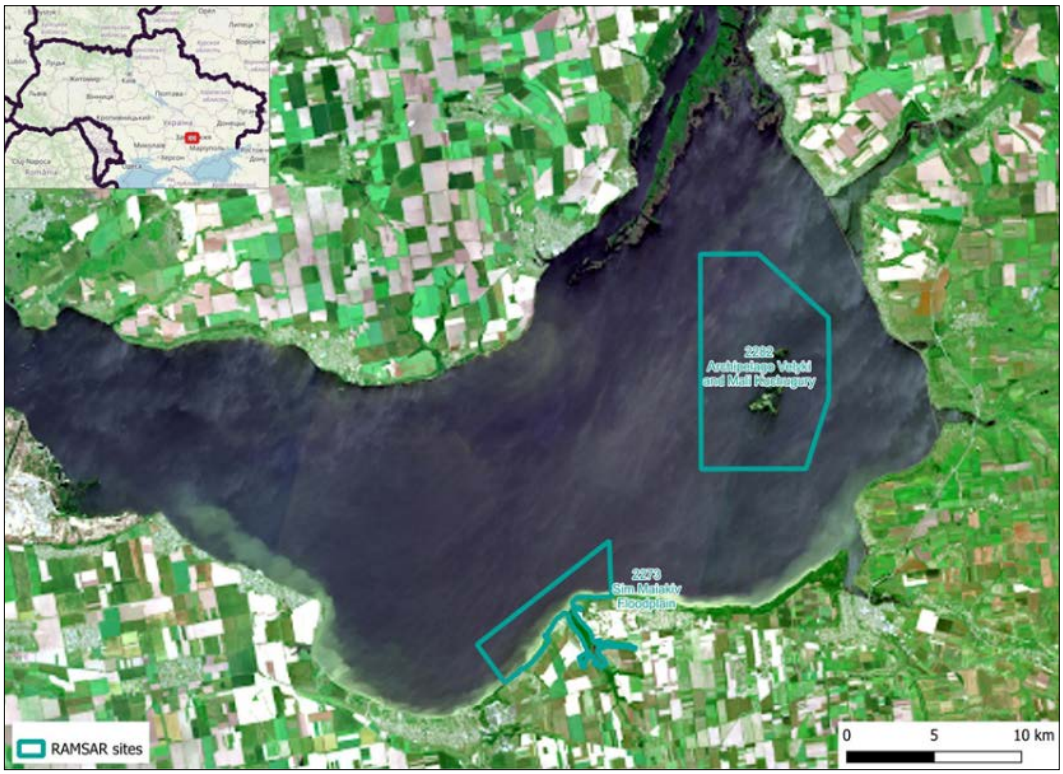

Figure 15. Sites 2273 and 2282 on the 5th of June 2023, one day before Kakhovka dam destruction (Sentinel)

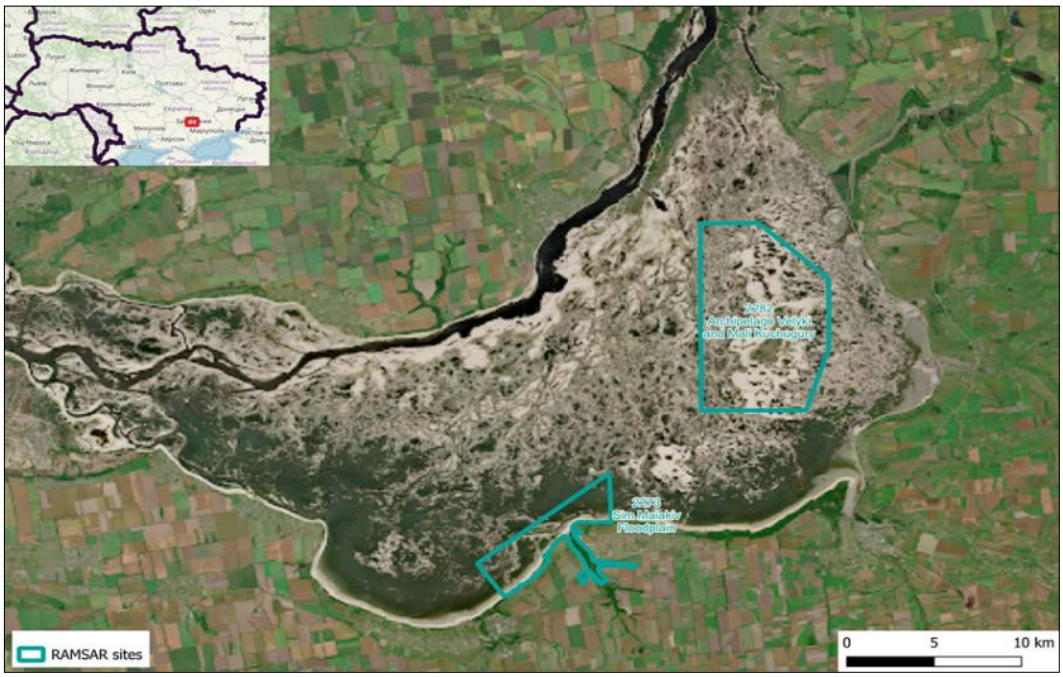

Figure 16. Sites 2273 and 2282 on the 20th of June 2023, few days after Kakhovka dam destruction (Sentinel)

Land cover changes have been quantified by the EO assessment by analysing land cover changes over time on the impacted Site upstream. The drop in water content can be shown in the yearly statistics changes. It is important to note here that the comparison is made with statistics for 2023 but the dam break happened only in June 2023, which means that the drop in water content should be much higher.

2273	2017	2018	2019	2020	2021	2022	2023
Water	85%	85%	85%	85%	85%	85%	61%
Trees	7%	8%	8%	7%	9%	8%	10%
Flooded vegetation	0%	0%	0%	0%	0%	0%	1%
Crops	4%	2%	2%	3%	1%	2%	2%
Built Area	1%	0%	0%	0%	0%	0%	0%
Bare Ground	0%	0%	0%	0%	0%	0%	22%
Snow/ice	0%	0%	0%	0%	0%	0%	0%
Clouds	0%	0%	0%	0%	0%	0%	0%
Rangeland	3%	4%	4%	4%	4%	5%	4%
	100%	100%	100%	100%	100%	100%	100%

2282	2017	2018	2019	2020	2021	2022	2023
Water	97%	97%	97%	97%	98%	98%	47%
Trees	0%	0%	0%	0%	0%	0%	0%
Flooded vegetation	3%	3%	2%	3%	2%	2%	1%
Crops	0%	0%	0%	0%	0%	0%	2%
Built Area	0%	0%	0%	0%	0%	0%	1%
Bare Ground	0%	0%	0%	0%	0%	0%	48%
Snow/ice	0%	0%	0%	0%	0%	0%	0%
Clouds	0%	0%	0%	0%	0%	0%	0%
Rangeland	0%	0%	0%	0%	0%	0%	2%
	100%	100%	100%	100%	100%	100%	100%

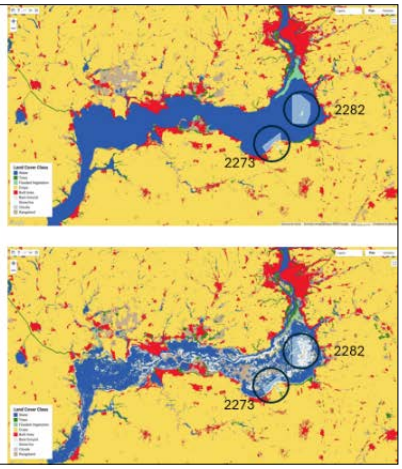

Figure 17. Evolution of land cover since 2017 (Source: ESRI), showing a drop in water content in 2023 due to Kakhovka dam break.

4.2.3. Military infrastructure

The EO assessment clearly demonstrates that massive military infrastructure like trenches, roads or training grounds have been built in the immediate surroundings of Wetlands of International Importance in the conflict zones; as well as close to the Sites in geographic areas where no battles have taken place as of November 2024. The following Figure 18 and Figure 19 show examples of military infrastructure as seen on high resolution images Sentinel 2.

Figure 18. 2 km wide military trenches and infrastructure built during the full-scale invasion very close to Site 114 (Sentinel)

Figure 19. Military infrastructure built during the full-scale invasion south of Dnipro River Delta (close to Site 767) (Sentinel)

4.2.4. EO assessment conclusion

The following table shown in Figure 20 distinguishes for all Sites the different type of impacts that can be detected through the use of Earth Observation based on open source EO datasets and studies.

The EO assessment was not exhaustive, and more advanced analyses should be made to confirm, validate and quantify more accurately some of the findings. The use of commercial imagery could also help in assessing more precisely some of the impacts.

Ramsar ID	Ramsar Name	Fire	Flood	Water Regime	Water Quality	Military Infra
113	Kyliiske Mouth	YES				
114	Karkinitska and Dzharylgatska Bays	YES				YES
115	Central Syvash	YES			YES	YES
116	Yagorlytska Bay	YES				
760	Kugurlui Lake	YES				
761	Kartal Lake					
762	Sasyk Lake					
763	Shagany-Alibei-Burnas Lakes System					
764	Dniester-Turunchuk Crossrivers Area					
765	Northern Part of the Dniester Liman					
766	Tyligulskyi Liman					
767	Dnipro River Delta	YES	YES	YES	YES	YES
768	Tendrivska Bay	YES				
769	Eastern Syvash				YES	YES
770	Molochnyi Liman					
771	Obytochna Spit and Obytochna Bay					
772	Berda River Mouth and Berdianska Spit and	YES				
773	Bilosaraiska Bay and Bilosaraiska Spit					
774	Kryva Bay and Kryva Spit					
775	Shatsk Lakes					
776	Prypiat River Floodplains	YES				
777	Stokhid River Floodplains					
1393	Aquatic-cliff complex of Cape Kazantyp					
1394	Aquatic-cliff complex of Karadag					
1395	Aquatic-coastal complex of Cape Opuk					
1396	Bakotska Bay					
1397	Big Chapelsk Depression	YES				
1398	Desna River Floodplains					
1399	Dnipro-Oril Floodplains					
1400	Lake Synevyr					
1401	Lower Smotrych River					
1402	Perebrody Peatlands					
1403	Polissia Mires					
2272	Cheremske Bog					
2273	Sim Maiakiv Floodplain			YES		
2274	Syra Pogonia Bog					
2275	Somyne Swamps					
2281	Byle Lake and Koza Berezyna Mire					
2282	Archipelago Velyki and Mali Kuchugury			YES		
2387	Liadova-Murafa					
2388	Dnister River Valley					
2389	Black Bog					
2390	Narcissi Valley					
2391	Atak Borzhavske					
2392	Nadsiannia Raised Bog					
2393	Burshtyn Water Reservoir					

Figure 20. Different types of impacts that can be demonstrated with a high confidence with Earth Observation

4.3. Site managers Information

The following table in Figure 21 provides a summary of the overall impact of the war upon Ukraine's Wetlands of International Importance as reported by the Sites managers.

However, this table only represents one source of information which the assessment team had to validate by triangulation with other data sources obtained throughout the assessment - including the literature review, the Kyiv workshop, EO, and field inspections.

Ramsar ID	Ramsar Name	Destruction and physical damage	Pollution of water, air, soil	Disturbance	Management Disruption	Budget	Global impact
113	Kyliiske Mouth	3	0	1	0	1	5
114	Karkinitska and Dzharylgatska Bays	11	2	2	11	7	33
115	Central Syvash	2	0	6	5	9	22
116	Yagorlytska Bay	10	2	4	12	3	31
760	Kugurlui Lake	0	0	0	1	0	1
761	Kartal Lake	0	0	0	1	0	1
762	Sasyk Lake	3	0	0	1	1	5
763	Shagany-Alibei-Burnas Lakes System	11	4	6	13	2	36
764	Dniester-Turunchuk Crossrivers Area	0	0	0	1	0	1
765	Northern Part of the Dniester Liman	0	0	0	1	0	1
766	Tyligulskyi Liman	0	0	0	0	1	1
767	Dnipro River Delta	15	3	8	10	2	38
768	Tendrivska Bay	13	4	5	10	7	39
769	Eastern Syvash	6	2	3	5	1	17
770	Molochnyi Liman	19	6	4	8	6	43
771	Obytochna Spit and Obytochna Bay	3	0	3	8	1	15
772	Berda River Mouth and Berdianska Spit and	16	5	4	9	6	40
773	Bilosaraiska Bay and Bilosaraiska Spit	4	0	2	13	3	22
774	Kryva Bay and Kryva Spit	4	0	5	12	3	24
775	Shatsk Lakes	1	0	0	2	0	3
776	Prypiat River Floodplains	0	0	0	4	0	4
777	Stokhid River Floodplains	0	0	0	3	0	3
1393	Aquatic-cliff complex of Cape Kazantyp	1	1	2	2	0	6
1394	Aquatic-cliff complex of Karadag	0	0	1	1	0	2
1395	Aquatic-coastal complex of Cape Opuk	3	1	2	2	0	8
1396	Bakotska Bay	3	0	2	0	0	5
1397	Big Chapelsk Depression	6	1	8	13	11	39
1398	Desna River Floodplains	10	2	6	4	2	24
1399	Dnipro-Oril Floodplains	1	1	1	3	6	12
1400	Lake Synevyr	0	0	0	3	0	3
1401	Lower Smotrych River	3	0	2	1	0	6
1402	Perebrody Peatlands	2	0	1	2	0	5
1403	Polissia Mires	1	0	0	1	0	2
2272	Cheremske Bog	0	0	0	1	0	1
2273	Sim Maiakiv Floodplain	15	6	7	15	9	52
2274	Syra Pogonia Bog	2	0	1	2	0	5
2275	Somyne Swamps	1	0	1	2	0	4
2281	Byle Lake and Koza Berezyna Mire	1	0	1	2	0	4
2282	Archipelago Velyki and Mali Kuchugury	8	0	2	15	9	34
2387	Liadova-Murafa	2	0	1	0	0	3
2388	Dnister River Valley	2	0	3	2	2	9
2389	Black Bog	0	0	0	0	0	0
2390	Narcissi Valley	0	0	2	6	4	12
2391	Atak Borzhavske	0	0	0	0	0	0
2392	Nadsiannia Raised Bog	1	0	1	0	0	2
2393	Burshtyn Water Reservoir	0	0	3	3	2	8
2394	Ozirnyi-Brebeneskul	0	0	2	6	1	9
2395	Prut River Headwaters	0	0	1	4	0	5
2396	Romania-Friendship Cave	0	0	0	4	1	5
2397	Pohorilets River Headwaters	0	0	1	3	3	7

Figure 21. Summary of impacts as reported by management staff of Wetlands of International Importance

4.4. Results of Data Triangulation

4.4.1. The Data matrix

The following matrix in Figure 22 indicates for each Site the different sources of information that were available and used for assessing the impacts. For some of the Sites, several different sources corroborated the impact, while for other Sites only one source of information could be assessed.

Ramsar ID	Ramsar Name	Questionnaire	Field Visit	Earth Observation	Workshop	Literature
113	Kyliiske Mouth	■	■	■		
114	Karkinitska and Dzharylgatska Bays	■		■	■	■
115	Central Syvash	■		■	■	■
116	Yagorlytska Bay	■		■	■	■
760	Kugurlui Lake	■		■		
761	Kartal Lake	■				
762	Sasyk Lake	■	■			
763	Shagany-Alibei-Burnas Lakes System	■	■			
764	Dniester-Turunchuk Crossrivers Area	■	■			
765	Northern Part of the Dniester Liman	■	■			
766	Tyligulskyi Liman	■				
767	Dnipro River Delta	■		■	■	■
768	Tendrivska Bay	■		■	■	■
769	Eastern Syvash	■		■	■	■
770	Molochnyi Liman	■			■	■
771	Obytochna Spit and Obytochna Bay	■				■
772	Berda River Mouth and Berdianska Spit and	■		■	■	■
773	Bilosaraiska Bay and Bilosaraiska Spit	■				■
774	Kryva Bay and Kryva Spit	■				■
775	Shatsk Lakes	■				
776	Prypiat River Floodplains	■	■	■		
777	Stokhid River Floodplains	■	■			
1393	Aquatic-cliff complex of Cape Kazantyp	■			■	
1394	Aquatic-cliff complex of Karadag	■			■	
1395	Aquatic-coastal complex of Cape Opuk	■			■	■
1396	Bakotska Bay	■				
1397	Big Chapelsk Depression	■		■	■	■
1398	Desna River Floodplains	■			■	■
1399	Dnipro-Oril Floodplains	■				
1400	Lake Synevyr	■				
1401	Lower Smotrych River	■				
1402	Perebrody Peatlands	■				
1403	Polissia Mires	■				
2272	Cheremske Bog	■				
2273	Sim Maiakiv Floodplain	■		■	■	■
2274	Syra Pogonia Bog	■				
2275	Somyne Swamps	■				
2281	Byle Lake and Koza Berezyna Mire	■				
2282	Archipelago Velyki and Mali Kuchugury	■		■	■	■
2387	Liadova-Murafa	■				
2388	Dnister River Valley	■				
2389	Black Bog	■				
2390	Narcissi Valley	■				
2391	Atak Borzhavske	■				
2392	Nadsiannia Raised Bog	■				
2393	Burshtyn Water Reservoir	■				
2394	Ozirnyi-Brebeneskul	■				
2395	Prut River Headwaters	■				
2396	Romania-Friendship Cave	■				
2397	Pohorilets River Headwaters	■				

Figure 22. Sources of data used in the assessment for each Wetland of International Importance

4.4.2. Site specific data

The analysis of events and facts by the assessment team revealed that military activities resulted in direct impacts on 31 Wetlands of International Importance (4 experiencing a major change in ecological character, 27 a moderate change) while a further 17 Sites were affected by indirect impacts resulting in a minor change to their ecological character. Only two Sites were found to have experienced no impacts and no changes to their ecological character.

A selection of Sites with major and moderate changes to their ecological character are described below in order of decreasing level of the impact. The structure of these short descriptions includes:

- Part «a» describes the main characteristics of the Site;
- Part «b» describes the management of the Site;
- Part «c» describes the military impact on the Site;
- Part "d" describes changes to ecological character for "major" impacted sites;
- Part «e» describes the main ideas for the Sites possible restoration.

(2282) Archipelago Velyki and Mali Kuchugury:

a. The Site is located in the lower reaches of the Dnipro River within Kakhovka reservoir area and consists of a number of sandbank islands, as well as the surrounding shallows in the upper reaches of the Kakhovka Reservoir. The Site was designated in 2013 and has an area of 7,740 ha. The Ramsar Information Sheet (RIS) includes information specific to 2015 and indicates that this Site meets criteria 1, 2, 3 and 4 for identifying Wetlands of International Importance (Archipelago..., 2020). This Site is a very important nesting ground for waterfowl. The shallow waters with rich benthos and good protection from the wind and storms are attractive to birds during moulting periods and seasonal migrations. A ridge of sand dunes, which are the largest location of the endemic Centaurea konkae, helps to protect the plant diversity. The Site is valuable as a reproduction area for the development of fish stocks throughout the Kakhovka Reservoir, and so the wetland also influences the status of many game and fish species. The wetland is of great importance as a natural filter of fresh water within the Reservoir. In the shallow part of the reservoir, water extraction is conducted not only for irrigation of agricultural landscapes, but also as a drinking water resource.

b. The Site is part of the National Nature Park "Veliky Lug" whose administration has lost access to the areas and the ability to manage the Site since occupation by Russian troops in March, 2022. The property of the park administration was damaged and expropriated by the Russian military forces (Survey results).

c. The Site was shelled and under fire in September 2022 and suffered from the water level fluctuations associated with non-compliance with the operating regime of the Kakhovka Reservoir by the occupying forces from the time of the capture of the dam in February 2022 until its destruction in June 2023 (Survey results; Крамаренко, 2022; Янковський, Бадюк, 2023, Timmins et al., 2023). The Site is completely drained due to the destruction of the Kakhovka Dam and the emptying of the reservoir (Survey results; Workshop results; EO results).

d. Taking into account the relief of the landscape and the fact that these islands were the only islands in the Kakhovka reservoir, it can be assumed that the area of the Site is now the driest part of the exposed bottom of the reservoir (EO results). Given the situation, it is concluded that there has been a change in abiotic and biotic components of the ecosystem, the species composition of flora and fauna related to aquatic ecosystems, change in vegetation, the hydrological regime and related ecosystem processes, and the corresponding change in ecosystem service, that lead to a major change in the ecological character of the whole Site.

e. The area still has some nature conservation value as part of the larger Dnieper exposed floodplain system, which is self-regenerating at a rapid pace (Workshop results; Kuzemko et al. 2024). The feasibility of preserving the international status of this Site should be investigated after the end of the war. The restoration of the Site could be linked to the refilling of the Kakhovka reservoir, which is considered by the Ukrainian government as a priority option (Уряд..., 2023). An alternative option could be the restoration of the entire Dnipro River floodplain instead of the Kakhovka reservoir (Workshop results).

(2273) Sim Maiakiv Floodplain:

a. The Site is a deep tertiary river channel with a small steppe river that forms a unique complex of floodplain forests, wet meadows and reed beds where it meets the Kakhovka reservoir, and karst system. The Site was designated in 2013 and has an area of 2,140 ha. The RIS includes information actual for 2015 and indicates that this Site meets criteria 1, 2, 3 and 4 for identifying Wetlands of International Importance (Sim..., 2020). The Site constitutes a unique refugium for biodiversity in the steppe region. The karst system is important for groundwater recharge and discharge, for the provision of fresh drinking water for the local population. The livestock and agricultural practices in the surrounding areas depend upon the stability and quality of water from the reservoir and the steppe river.

b. The Site is part of the National Nature Park "Veliky Lug" whose administration has lost access to the areas and the ability to manage the Site since occupation by Russian troops in March, 2022. The property of the park administration was damaged and expropriated by the Russian military forces (Survey results).

c. According to the information provided by the Park administration, the wetland serves as military ground for the Russian troops since the time of occupation, and is partially destroyed due to the construction of trenches and movement of heavy military vehicles, wooded and grassland vegetation has been damaged, along with being mined, polluted (Survey results; Workshop results; Timmins et al., 2023), and partially drained due to the destruction of the Kahovka Dam. Small lakes remain throughout its territory, but mostly habitats of aquatic flora and fauna have been destroyed. After water runoff, the areas are subjected to erosion and partial overgrowth of purslane, amaranth, setaria, etc., as well as self-seeded poplar, willow, maple and Robinia pseudoacacia. (Survey results; Workshop results; Янковський, Бадюк, 2023).

d. It is concluded that there has been a change in the species composition of flora and fauna related to aquatic ecosystems, change in vegetation, the hydrological regime and related ecosystem processes, and the corresponding change in ecosystem service, that led to a major change in the ecological character of the Site.

e. The restoration of the Site could be linked to the refilling of the Kakhovka reservoir, which is considered by the Ukrainian government as a priority option (Уряд, 2023). An alternative option could be the restoration of the entire Dnipro floodplain instead of the Kakhovka reservoir (Workshop results; Kuzemko et al. 2024). At the same time, the issues of eliminating trenches and restoring the landscape, as well as its demining, which may take many years, are priorities.

(767) Dnipro River Delta:

a. The Site is a delta of Europe's fourth longest river and includes swampy areas, floodplain forests, sandy ridges and a lake complex. The Site was designated in 1997 and has an area of 34,425.8 ha. The RIS includes information actual for 2018 and indicates that this Site meets criteria 1, 2, 3, 4, 5, 7 and 8 for identifying Wetlands of International Importance (Dnipro..., 2022). The diverse vegetation consists of hydrophilic communities, islands of floodplain forest, and reed thickets, all of which provide important habitats for endemic and nationally rare species. The Site provides one of the largest water transport paths between Ukraine and the Black Sea countries and is an important source of water for drinking and irrigation. Human activities include aquaculture, fishing and recreation.

b. The Site coincides with the Nizhnyodniprovsky National Nature Park, which lost the ability to manage the Site due to the occupation in the first days of the full-scale Russian invasion at the end of February 2022 (Survey results).

c. The nearest large city, Kherson, on the right bank of the Dnieper River, was liberated by the Ukrainian military forces in November 2022. Since then, the Site has been on the front-line and under periodic shelling that has destroyed vegetation and caused fires on an area of 7,443 ha. The coastal areas are mined, probably quite heavily and hostilities take place here from time to time (Survey results; Workshop results; Timmins et al., 2023). The Site was completely flooded as a result of the destruction of the Kakhovka Dam, which led to pollution, the destruction of several islands and a significant change in the hydrological regime (Survey results; Workshop results; EO results).

d. Changes in the hydrological regime and periodic shelling and the associated destruction of vegetation cover and fires cause a fairly high-intensity pressure to change the composition of flora and fauna species, ecosystem processes and services, which leads to a conclusion about the major change in the ecological character of the Site.

e. Given the ecological peculiarities of delta ecosystems and their dynamism, it can be assumed that this Site will recover fairly quickly after the cessation of hostilities and its significance will not be lost. However, de-mining the reeds, islands and coasts and removing unexploded ordnance will be a complex, long-term process that will continue to affect this Site for many years.

(770) Molochnyi Liman:

a. The Site is a brackish lagoon with a half-closed water body, periodically connected to the Azov Sea. The Site was designated in 1997 and has an area of 29,151.8 ha. The RIS includes information actual for 2018 and indicates that this Site meets criteria 1, 2, 3, 4, 5, 6 and 8 for identifying Wetlands of International Importance (Molochnyi..., 2022). It includes sandy-shell islands and peninsulas. In years when the lagoon is connected to the Sea, the brackish water supports high biodiversity. When the water level is low, the lagoon is disconnected, its salinity increases, and fewer specialized species predominate. To stabilize the situation and preserve the value of the Site for birds and fish, an artificial canal was created, providing a stable connection to the sea. The vegetation around the lagoon consists of reedbeds, saline meadows and marshes. The Site is important for waterfowl: up to 23,000 birds in winter at the Site and 95,000 during the year. It is important as a migration stopover for many vulnerable waterflow species. It is a spawning ground for the commercially important fish. Human activities include conservation education, recreation, aquaculture and fishing.

b. The Site is a part of the Priazovsky National Nature Park, which lost the ability to manage the Site since the Russian occupation in March 2022, but continued monitoring for some time. The property of the park administration was damaged and expropriated by the Russian military forces (Survey results).

c. This area has been used for training of the Russian artillery forces since August 2022, which led to the complete destruction of the parts of the Site chosen as targets, numbers of fires, loss of nesting ground for the birds and a significant impact on birds and hydrobionts. Lack of maintenance of the canal that connects the estuary to the sea, leads to depreciation of the hydrological regime and an increasing salinity of the estuary. Sand extraction for construction needs and fishing is carried out with the permission of the occupation authorities, including using fishing methods and places that are prohibited in the Park in accordance with Ukrainian legislation (Starushko, 2023;Timmins et al., 2023; Survey results; Workshop results).

d. The certain change in the hydrological regime, a significant factor of physical disturbance and noise pollution, and the unregulated use of natural resources, causing changes in biological components, as well as associated changes in ecosystem processes and services. It can be estimated that there have been major changes in the ecological character of the Site.

e. Ensuring the connection of the estuary to the sea is critical to restoring the ecological character of the Site. However, the removal of UXOs and metal remains from the estuary bottom will be a prolonged factor and may impact the Site for many years.

(772) Berda River Mouth and Berdianska Spit and Berdianska Bay.

a. The Site consists of a sand-shell spit with islands in a shallow bay of the Sea of Azov and a delta area of the Berda River with numerous estuarine lakes. The Site was designated in 1997 and has an area of 8,419.9 ha. The RIS includes information actual for 2018 and indicates that this Site meets criteria 1, 2, 3, 4, 5, 6, 7 and 8 for identifying Wetlands of International Importance (Berda..., 2022). It is important as a nesting ground and migratory stop for waterfowl. Between August and October the Site supports up to 46,000 birds. Juvenile sturgeons and other fish depend on the Site as a fattening ground. Vegetation includes emergent and submergent species, with the Site's saline floodplain swamps supporting nationally threatened and endemic plant species. Human activities are conservation education, fishing and recreation.

b. The Site is located within the Priazovsky National Nature Park, which has been used as a base for Russian troops including the construction of military fortifications from autumn 2022. The property of the Park administration were damaged and expropriated by the Russian military forces (Survey results).

c. The Site is being used as a location for Russian troops who are building trenches and various defensive structures, which entails the destruction of vegetation by heavy military

vehicles and construction works, establishment of a minefield, fuel pollution, accumulation of garbage of different types. Overflight of military airplanes and helicopters at critically low altitudes and landing of aircraft is accepted here. Deliberate burning of reeds, bushes and steppe endemic vegetation has been recorded in order to carry out repressions against resistance forces of Ukrainian patriots and to set up military defense facilities. Large-scale commercial fishing is conducted in the bay with the permission of the occupation authorities. Decrease in avifauna abundance and other animals has been observed here. In the summer of 2024, dozens of dead dolphins were noted. After the sinking of military ships near the port of Berdyansk, the fuel pollution within the aquatoria of the Berdiansk Spit was recorded from 2022-2023. The Site is located near a fairly large city, which is also a strategic port and a popular vacation spot, which generally increases the threats (Survey results; Workshop results; Timmins et al., 2023)

(768) Tendrivska Bay:

a. The Site is a relatively large saltwater lagoon that features small islands, numerous lakes and temporary waterbodies; sand spits separate the bay from the Black Sea. It was originally designated in 1976 by the Soviet Union and redesignated in 1997 by Ukraine and has an area of 55,022 ha. The RIS contains information actual for 2018 and indicates that this Site meets criteria 2, 3, 4, 5 and 6 for identifying Wetlands of International Importance (Tendrivska Bay..., 2022). It is important for birds owing to its location at the crossing of flyways, ice-free waters during winter and diversity of habitats supporting up to 85, 000 birds. The Site is important for supporting the region's largest breeding colony of white pelicans (Pelecanus onocrotalus). Sturgeons and other fish and dolphins depend on the Site as a fattening ground. Human activities include fishing, recreation and nature conservation. As part of a core zone of the Black Sea Biosphere Reserve, the Site is significant for long-term monitoring and scientific education.

b. The Site was under management of the Black Sea Biosphere Reserve, whose administration was forced to cease activities on the first day of the occupation of the Reserve office, which is located in the town of Gola Prystan in March 2022. The property of the Reserve administration was damaged and expropriated by the military, and completely destroyed as a result of the flooding of the city after the explosion of the Kakhovka Dam. The Russian occupation authorities took over the administration of the Reserve and appointed their own director (Baturin, 2023)

c. The Russian military occupation of the Site took place in March-May 2022. The Sites suffered from coastal mining and the construction of a number of military strongholds and trenches along the coast. Also, there is periodic shelling and combat operations and associated vegetational fires. The end of the Tentrivskaya Spit is a strategic location where Russian troops are based and where battles occasionally take place. An important factor is the rather intensive movement of heavy military transport, which causes disturbance of the soil cover and vegetation (Survey results; Workshop results).

(116) Yagorlytska Bay:

a. The Site is a relatively large saltwater lagoon, including several islands, saline lakes and temporary water bodies. It was originally designated in 1976 by the Soviet Union and redesignated in 1997 by Ukraine and has an area of 39,692.7 ha. The RIS includes information for 2018 and indicates that this Site meets criteria 2, 3, 4, 5 and 6 for identifying Wetlands of International Importance (Yagorlytska..., 2022). It is one of the least-disturbed wetlands in the Black Sea coastal region and supports a high level of biodiversity with many endemic species. Located at the intersection of two migration routes, it is an important resting place and wintering area for many birds and support an estimated population of 43,600 birds. Sturgeons, other fish and dolphins depend on the Site as a fattening ground.

b. The Site is mostly located and managed within the Black Sea Biosphere Reserve, part of the Site is within the National Nature Park "Biloberezhja Svyatoslava".

c. The military land occupation of the Site took place gradually and was established in May 2022. The northern part of Yagorlytska Bay is adjacent to a settlement that serves as the location of Russian troops. The Sites suffer from coastal mining and the construction of military strongholds and trenches along the coast. There is periodic shelling and combat operations and associated vegetational fires. According to the EO observation data, the vegetation on the Kinburnska Spit, which separates the bay from the Dnipro-Buzhsky Estuary and the Black Sea and can be considered as front line, was significantly damaged

by shelling and fires (Baturin, 2023; Timmins et al., 2023; Survey results; Workshop results).

(1397) Big Chapelsk Depression:

a. The Site is an inland wetland, a natural shallow landscape depression filled by water from precipitation and underground water in the Lower Dnieper region. The Site was designated in 2003 and has an area of 2,359 ha. The RIS includes information actual for 2018 and indicates that this Site meets criteria 1, 2, 3, 4, 5 and 6 for identifying Wetlands of International Importance (Big..., 2021). It is covered with natural steppe vegetation and surrounded by arable land. The lake in the centre of the depression never dries up or freezes because of continuous water flow from underground artesian wells, and so it provides wintering opportunities for water birds. The Depression lies at a crossroads of bird migration routes in the northern Black Sea region and serves as a very important stopover point in the region, more than 150,000 birds visit during their autumn and spring migrations, many of them with protected status. The adjacent Askania-Nova zoological park hosts many reintroduced indigenous species and during the summer, animals from the zoo, including exotic species such as zebras and wildebeest, graze on the wetland meadows maintaining good grassland condition. Birdwatching, research and tourism are popular activities.

b. The Site is located within and under the management of the Biosphere Reserve "Askania-Nova". The administration of the reserve continued to work in full during the first year of occupation and monitored the situation until recently which is why the military impact on this Site is quite well documented. The normal management of the Site ceased with the establishment of the new administration by the Russian occupation regime in March 2023, which led to the termination of the work of the reserve and the relocation of the staff to the territory controlled by Ukraine. Instead, the new administration plans to develop mass tourism in this area (Baturin, 2023).

c. There is a certain impact on the hydrological regime of the Site due to change in use of underground water and fluctuation of the water level in the lake, and an impact on vegetation due to the movement of vehicles, occasional shelling and fire. Also, animals suffer from unusual disturbances such as noise pollution from low-flying aircraft, inadequate medical care in zoos and a reported practice of illegal exchange and trade of CITES species with zoos in the Russian Federation. (Baturin, 2023; Timmins et al., 2023; Survey results; Workshop results).

(114) Karkinitska and Dzharylgatska Bays:

a. The Site contains two shallow Black Sea bays comprising several island spits and surrounding waters. It was originally designated in 1976 by the Soviet Union and has an area of 147,556.7 ha . The RIS includes information specific to 2018 and indicates that this Site meets criteria 1, 2, 3, 4, 5, 6, 7 and 8 for identifying Wetlands of International Importance (Karkinitska..., 2022). Vegetation consists of steppe and coastal communities including reedbeds, vast aquatic meadows, salt-tolerant plants and grasses; many species are endemic. The Site features one of the largest uninhabited islands in Europe – Dzharylgach. It is an important area for waterbirds, with up to 150,000 migratory and 130,000 wintering individuals. The shallow bay provides habitat for endemic and threatened fish including four endangered sturgeon species, as well as marine mammals. Human activities include commercial and recreational fishing, hunting, livestock and grazing. People benefit from the Site's resources such as fish and molluscs. The Bay's morphology and water level are strongly influenced by winds and currents.

b. Karkinitska Bay was under the management of the Crimean Nature Reserve, which came under occupation by Russian fores and ceased normal operations in 2014. The Dzharylgatska Bay is located within the boundaries of the Dzharylgach National Nature Park, which was occupied and ceased nature conservation activities in March 2022. The Russian occupation authorities took over the administration of the Park and appointed their own director (Baturin, 2023).

c. According to separate reports, a network of defensive structures and military strongholds has been created on the coast of Crimea, as well as the mining of certain locations. However, Dzharylgach Island is used by Russian troops for training, which compromised the water exchange of the bay with the sea due to the road construction, and vegetation cover was impacted primarily from movement of heavy military vehicles, construction of tranches and fires. Hunting is also allowed here, which goes against the restrictions

established for the activities in the Parks in Ukraine (Starushko, 2023; Timmins et al., 2023; CEOBS, 2024; Survey results; Workshop results).

(774) Kryva Bay and Kryva Spit:

a. The Site is situated in the coastal area of the Sea of Azov. This shallow sea bay is made up of three sandy-shell spits, beaches, silt islands, and shallow lakes. The Site was designated in 1997 and has an area of 11,861 ha. The RIS includes information specific to 2018 and indicates that this Site meets criteria 2, 3, 4, 5, 6, 7 and 8 for identifying Wetlands of International Importance (Kryva..., 2022). Several thousand water birds winter there and one of the largest palearctic colonies of sandwich tern (Thalasseus sandvicensis) with up to 30,000 pairs can be found. The shallow bay provides habitat for endemic and threatened fish including three endangered sturgeon species. Human activities include conservation education, recreation and fishing.

b. The Site was under the administration of the Medotida National Nature Park until the Russian occupation in 2014.

c. Throughout 2014 to 2015 military training was undertaken here by Russian troops along with the termination of all nature conservation activities. This has led to the destruction of the region's largest colony of gulls, terns and waders, and the cessation of nesting of the dalmatian pelican (Pelecanus crispus) in the region. The territory and infrastructure of the Park continue to be used by the military, in particular the bird observation tower is used for military purposes. Also, due to the rapid occupation and changing situation, the Park lost all its property, equipment and a significant part of its scientific data and staff. In recent years, the occupation authorities have repeatedly raised the issue of commercial development of this territory, in particular for aquaculture or the creation of entertainment entities (Blaga et al., 2017; Vasyliuk, Norenko, 2019; Timmins et al., 2023; Survey results; Workshop results).

(773) Bilosaraiska Bay and Bilosaraiska Spit:

a. The Site includes a sandy-shell spit and a shallow bay of the Azov Sea, and features shallow lakes, dunes and silt islands. The Site was designated in 1997 and has an area of 11,280.8 ha. The RIS includes information actual for 2018 and indicates that this Site meets criteria 2, 3, 4, 5, 6, 7 and 8 for identifying Wetlands of International Importance (Bilosaraiska..., 2022). Its salt marshes and meadows, swampy areas and thickets of reeds and rushes provide habitats for numerous endemic and nationally rare plants and relic fish species. The bay reaches a maximum depth of five metres; its bottom is overgrown with Zostera marina and other aquatic plants, which provide abundant feeding resources for fish and birds. The Site is important for several thousand wintering ducks and geese, including smew ducks. Species of critically endangered sturgeons and other fish depend on the Site as a feeding ground. Human activities include conservation education, recreation and fishing.

b. The Site was under the administration of the Medotida National Nature Park until the Russian occupation in March 2024. Due to the rapid occupation and changing situation, the Park lost all its property, equipment and a significant part of its scientific data and staff.

c. The termination of the nature conservation regime and the use of the spit for military purposes, disturbance of the vegetation cover as a result of the construction of military infrastructure and fires has resulted in the disappearance of the bird colony (Starushko, 2023; Timmins et al., 2023; Survey results; Workshop results).

(115) Central Syvash:

a. The Site is part of an extremely large shallow lagoon situated between the mainland of Ukraine and the Crimea peninsula connected to the Sea of Azov. The Site was designated in 1976 and has an area of 80,000 ha. The RIS published at the Ramsar Sites Information Service (RSIS) includes information specific to 1998 and indicates that this Site meets criteria 1d, 2c, 3a for identifying Wetlands of International Importance (Central..., 1998). The RIS updated in 2006-2009 indicates that this Site meets criteria 1, 2, 3, 4, 5 and 6 (Directory..., 2006). The Site includes spits, islandsand saline lowlands. Vegetation consists of salt-tolerant species consisting of halophytic grasses and fringed by extensive areas of steppe, and diverse meadow, grass-marshy and aquatic plant communities. The Site supports numerous species of rare, vulnerable or endangered waterbirds and raptors and internationally protected numbers of waterbirds and waders. Nesting wetland birds consist

of 10,000 pairs, and up to 1,000,000 waders and waterbirds molt, stage and winter at the Site. Human activities include fishing, recreation, and hunting.

b. The Site partly overlaps and was managed by the Azovo-Syvashckyi National Nature Park, which partly lost the possibility to manage the Site in 2014 and stopped work in February 2022. The Russian occupation authorities took over the administration of the park and appointed their own director in 2023 (Baturin, 2023).

c. The Site is located in the Kherson region and the Autonomous Republic of Crimea and has been partially occupied since 2014 and was fully occupied in the first hours of the full-scale Russian invasion in 2022. From 2014 to 2022, the impact on the Site was associated with the construction and development of the border and defence structures, which includes the construction of trenches and observation posts and the creation of minefields. With the beginning of a full-scale war, the main impact is associated with the increased passage of military transport and the bombing of infrastructure, as well as aircraft overflights. Military training is being conducted at certain locations (Starushko, 2023; Timmins et al., 2023; Survey results; Workshop results).

(769) Eastern Syvash:

a. The Site is part of a extremely large coastal lagoon, is a shallow saltwater bay and includes numerous spits, islets, saline lowlands, and a peninsula along the Sea of Azov (Eastern..., 2024). The Site was designated in 1997 and has an area of 165,000 ha. The RIS published at RSIS includes information actual for 1998 and indicates that this Site meets criteria 1d, 2c, 3a for identifying Wetlands of International Importance (Eastern..., 1998). The RIS updated in 2006-2009 and indicates that this Site meets criteria 1, 2, 3, 4, 5 and 6 (Directory..., 2006). Vegetation consists of halophytic grasses fringed by extensive areas of steppe. The area serves as an important nesting, wintering, molting and staging area for internationally important numbers of various species of waterbirds and waders. A number of these species are rare, vulnerable or endangered. Human activities include fishing, recreation, and hunting.

b. A small part of the Site overlaps and is managed by the Azovo-Syvashckyi National Nature Park. The main part of the Sites' territory is located in Crimea and has been occupied since 2014, and the whole Site was fully occupied by Russian troops in the first hours of the start of full-scale aggression in 2022.

c. Fighting took place in some areas in 2014 and 2022, mainly around strategic locations and gas wells. Chemical and noise pollution is also noted here. Within the Sites are minefields, trenches and other military infrastructure, which affects both vegetation and birds. Military training is being conducted at certain locations (Starushko, 2023; Timmins et al., 2023; Starushko, 2024).

(771) Obytochna Spit and Obytochna Bay:

a. The Site is a sand spit on the Sea of Azov creating a bay. The Site was designated in 1997 and has an area of 6,917 ha. The RIS includes information actual for 2017 and indicates that this Site meets criteria 1, 2, 3, 4, 5 and 6 for identifying Wetlands of International Importance (Obytochna, 2022). The vegetation of the Site is composed of reed-swamp vegetation and saline meadows fringed by steppe vegetation. The Site supports rare and endemic species of plants. Up to 80,000 great cormorants (Phalacrocorax carbo) nest, profiting from the great abundancy of round goby (Neogobius melanostomus) as their prey. Two endangered sturgeon species and other fish species can also be found. Human activities include conservation education, recreation and fishing.

b. The Site overlaps with the reserve managed by the Forestry Administration, which ceased its activities at the beginning of the Russian occupation in March, 2022.

c. Information about this Site is limited, but it is known that the area is used by Russian troops for both poaching and recreational activities (Timmins et al., 2023).

(1398) Desna River Floodplains:

a. The Site features numerous meanders, lakes, swamps and meadows with abundant semiaquatic and floodplain meadow vegetation, and small areas of floodplain forests. The Site was designated in 2003 and has an area of 4,270 ha. The RIS includes information actual for 2018 and indicates that this Site meets criteria 1, 2, 3, 4, 5, 6, 7 and 8 for identifying Wetlands of International Importance (Desna..., 2021). The Site is one of the most pristine stretches of the Desna River, and supports nationally protected aquatic

plant communities and internationally protected species. Up to 70,000 birds stop over on the Site during their migration, and more than 1,500 individuals breed there including rare species of ducks, terns, waders and gulls. The absence of dykes and the excellent hydrological conditions make the Site a valuable spawning ground for many threatened, rare and commercially important fish species. The wetland contributes to freshwater purification, mitigates flooding and influences the local microclimate. The associated National Park plays an important role as a recreational area and hosts many environmental education activities.

b. The Site is managed by the National Nature Park "Desniansko-Starogutskyi". However, the Park administration has almost no access to the Site due to the danger and the area is largely controlled by the Ukrainian military.

c. Due to its location in the north of Ukraine near the border with the Russian Federation, the Site is under periodic artillery fire and part of the territory is mined (Timmins et al., 2023; Filho et al., 2024; Survey results; Workshop results).

(763) Shagany-Alibei-Burnas Lakes System:

a. The Site consists of three shallow Black Sea "limans" (brackish lagoons) which are separated from the sea by a sandy spit. The Site was designated in 1997 and has an area of 27,600 ha. The RIS contains information actual for 2018 and indicates that this Site meets criteria 1, 2, 3, 4, 5, 6, 7 and 8 for identifying Wetlands of International Importance (Shagany…, 2022). The Site includes a sandy-shell bar, peninsulas and islands. Vegetation consists of salt meadows and aquatic plants. Up to 45,000 birds stop over on the Site during their migration. The Site is important for many nationally threatened waterbirds, for nesting and during migration: it supports more than one percent of the regional population of red-breasted goose (Branta ruficollis). The Site is very important for feeding young fish. Human activities include traditional fishing, recreation, conservation and education.

b. The Site is managed by the National Natural Park "Tuzlivski Lymani".

c. Although this Sites is located quite far from the front-line, the areas have been shelled several times. It is believed that several dozen unexploded shells are at the bottom of the lagoon. During the period of naval battles in this region, dozens of dead dolphins were found on the shores. Some areas of the Site are guarded by the Ukrainian military due to the risk of a possible landing of Russian troops. Accordingly, military infrastructure has been constructed and some shore areas are known to be mined. Access to such areas is prohibited for managers of the Site, as well as for local residents and tourists (Timmins et al., 2023; Survey results; Field visit results; Workshop results).

(762) Sasyk Lake:

a. The Site is an artificially desalinated reservoir on the Black Sea coast north of the Danube Delta. The Site was designated in 1997 and has an area of 23,488.4 ha. The RIS includes information actual for 2018 and indicates that this Site meets criteria 2, 3, 4, 5, 6, 7 and 8 for identifying Wetlands of International Importance (Sasyk…, 2022). The low salinity is maintained through the inflow of fresh water through the Danube-Sasyk Canal. The vegetation consists of emergent and submergent plants including nationally rare species. The Site is important for migrating, breeding and moulting waterbirds. Floodplain areas and permanent freshwater marshes provide habitat for seasonal concentrations of up to 35,000 birds. The Site supports several commercially important fish species and two endangered sturgeon species. Human activities include fishery, forestry, reed harvesting, recreation and scientific research. The Lake is a source of water for livestock.

b. The Site partly managed by Danube Biosphere Reserve.

c. Although this Site is located quite far from the front-line, the areas have been shelled several times and the result is several-meter-wide craters on the dam separating the lake from the Black Sea. During the period of naval battles in this region, dozens of dead dolphins were found on the shores. Some areas of the Site are guarded by the Ukrainian military due to the risk of a possible landing of Russian troops. Accordingly, military infrastructure has been constructed and areas are known to be mined. Access to such areas is prohibited for managers of the Site, as well as for local residents and tourists (Survey results; Field visit results; Workshop results; Timmins et al., 2023)

(113) Kyliiske Mouth:

a. Kyliiske Mouth is part of the Danube Delta near the Romanian border. It comprises numerous channels, swamp areas, floodplain forests, freshwater lakes and sandy spits enclosing bays. It was originally designated in 1976 by the Soviet Union and redesignated in 1997 by Ukraine and has an area of 44,904.3 ha. The RIS includes information actual for 2018 and indicates that this Site meets criteria 1, 2, 3, 4, 5, 6, 7 and 8 for identifying Wetlands of International Importance (Kyliiske..., 2022). The vegetation includes hydrophilic communities, reed and sedge marshes and dune communities. The Site provides habitat for large numbers of wintering, migrating, breeding and moulting waterbirds, as well as favourable environments for many fish and amphibians. More than one percent of the respective populations of the pelican species Pelecanus onocrotalus and Pelecanus crispus visit the Site. Since 2009 large-scale restoration works have been carried out to recover important habitats on an island within the river mouth. Human activities include fishing, livestock grazing, reed harvesting and recreation. Water is used for irrigation of rice paddies, aquaculture and household needs by the nearby town of Vilkove.

b. The Site is managed by the Danube Biosphere Reserve.

c. The Site was slightly damaged by shelling, a sea-mine explosion and a relatively small fire. As a consequence of the war, the Bystry channel is now used by cargo ships for the transportation of grain and other goods more intensively than before the Russian full scale aggression. The Site is situated on the state border and now under the strict control of the Ukrainian military forces, so activities such as mowing reeds, fishing and recreation have terminated due to safety reasons. Thus, access to ecosystem services common to local populations is limited (Timmins et al., 2023; Survey results; Workshop results).

(1399) Dnipro-Oril Floodplains:

a. This floodplain terrace at the confluence of the Dnipro and Oril Rivers is one of the last remaining pristine floodplain landscapes along the Dnipro. The Site was designated in 2003 and has an area of 2,560 ha. The RIS includes information actual for 2018 and indicates that this Site meets criteria 1, 2, 3, 4, 7 and 8 for identifying Wetlands of International Importance (Dnipro..., 2021). This system of watercourses and floodplains with numerous lakes, mires and marshes hosts communities of white willow and aquatic plants. The Site is a key point on the Dnipro bird migration route and an important nesting place. The Site supports the internationally protected European otter (Lutra lutra); the snakes Coronella austriaca and Vipera renardi; and the toad Pelobates fuscus. The Site neighbours the cities of Dnipro and Kamianske as well as other large settlements and it is popular for ecoeducation.

b. The Site is managed by the Natural (strict) Reserve “Dniprovsko-Orilskyi”.

c. The Site is located at a considerable distance from the front-line, but close to a large and strategically important city, so suffers from shelling targeting the city’s energy and industrial infrastructure. Within the Site, wreckage of missiles and drones was found on three separate occasions (Survey results).

(1395) Aquatic-coastal complex of Cape Opuk:

a. The Site represents a combination of steep limestone rocks on the Black Sea seaside (marine boundary lines along 6 meter isobath), sandy-coquina spits, and a salt lake. The Site was designated in 2003 and has an area of 775 ha. The RIS includes information actual for 2003 and indicates that this Site meets criteria 1, 2, 4, 6, 7 and 8 for identifying Wetlands of International Importance (Aquatic...Opuk, 2003). The RIS updated in 2006-2009 also confirms compliance with the criteria 1, 2, 4, 6, 7 and 8 (Aquatic... Opuk, 2006). The Site is important for the conservation of a number of species of rare and protected algae and plants, dolphins and fish. The area is important for wintering waterfowl, including more than 1% of the respective population of the white-fronted goose. Environmental education activities and scientific research were carried out annually.

b. The Site is under the management of the Opuk Natural (strict) Reserve.

c. Since the occupation by Russian Federation in 2014, the main factors of impact are the frequent reorganization of reserve administration and the reduction of the capacity to manage the Site and monitor the biodiversity. The Russian Federation has expanded the nearby military training ground and increased the intensity of training which also affects the territory of the Site. Training is conducted both in the water and on land. Training at sea involves the use of artillery and other weapons that cause high-power explosions.

Such types of training are dangerous for dolphins and ichthyofauna. Ground training involves the movement of heavy military transport, which disrupts vegetation and creates a disturbance factor for animals (Workshop results; Vasyliuk, 2024) .

(1393) Aquatic-cliff complex of Cape Kazantyp:

a. The Site is a coastal area of the Sea of Azov composed of pebble and detritus-coquina bays with thickets of macrophytic algae. The Site was designated in 2003 and has an area of 251 ha. The RIS includes information actual for 2003 and indicates that this Site meets criteria 1, 2, 4, 6, 7 and 8 for identifying Wetlands of International Importance (Aquatic…Kazantyp, 2003). The RIS updated in 2006-2009 confirms compliance with the criteria 1, 2, 4, 6, 7 and 8 (Aquatic…Kazantyp, 2006). It is an important spawning ground for crustaceans and rare fish species and maintains a significant proportion of indigenous fish species. The Site is used as a nesting ground for some species and important migration stop-over for waterfowl. Marine mammals visit the area. Environmental education activities and scientific research were carried out annually.

b. The Site is managed by the administration of the Kazantyp Natural (strict) Reserve.

c. Since occupation by Russian Federation in 2014, the main factors of impact are the frequent reorganization of reserve administrations and the reduction of their capacity to manage Ramsar Sites and monitor the biodiversity. Also, there is active tourism development and associated constructions of a glamping area inside of the reserve (Workshop results).

(2393) Burshtyn Water Reservoir:

a. The Site is a reservoir constructed in 1965 to cool a thermal (fossil fuel) power plant. The Site was designated in 2003 and has an area of 1,260 ha. The RIS includes information actual for 2003 and indicates that this Site meets criteria 2, 3, 4, 5, 6 and 7 for identifying Wetlands of International Importance (Burshtyn…, 2020). Because of its function, the Site's water temperature is slightly higher than that of other water bodies in the region, preventing it from freezing during winter. This provides favourable conditions for foraging and wintering birds. As of 2019, the construction was ongoing of an artificial island in the reservoir, which should provide more breeding and roosting areas for birds during migration periods. The Site is close to local towns and factories, and used for fishing and, recreation and scientific and eco-education.

b. The Site is managed by the Galickyi National Nature Park.

c. The power station near the Burshtyn Reservoir was destroyed as a result of the bombing, which impacted negatively on the local environment and damaged the Park`s equipment for bird observation. This likely caused contamination, but information about the extent of the destruction of energy infrastructure and the corresponding consequences is restricted. Due to the cessation of the power plant, the temperature of the reservoir will depend on the weather, and the reservoir will likely lose its attractiveness for wintering birds due to its possible freezing. Site managers also noted a decrease in tourism levels but the increasing pressure of recreational and commercial fishing on the Site, which is associated with the worsening economic situation and the search for alternative sources of livelihoods for the local population (Survey results).

(2388) Dnister River Valley:

a. The Site is located in the middle course of the Dniester River in western Ukraine. The Site was designated in 2003 and has an area of 820 ha. The RIS includes information actual for 2003 and indicates that this Site meets criteria 1, 2, 3, 4, 6, 7 and 8 for identifying Wetlands of International Importance (Dniester…, 2020). The Dnister River Valley contains the free-flowing river, its riparian zone, several islands and oxbow lakes. It is a biodiversity hotspot, with a combination of diverse rare wetland habitat types, floodplain vegetation communities and a large number of protected species, including birds,bats and fish. The Site is the most important wintering place for waterbirds in the upper and middle stretches of the River. It also provides local people with drinking water and protection against flash floods, while providing opportunities for recreation, water tourism and fishing.

b. The Site is managed by the Galickyi National Nature Park.

c. The use of the Dniester canyon to hide the path of missiles during Russian attacks on the energy infrastructure situated upstream is noted here and has resulted in impacts from noise pollution. Site managers also noted a decrease in tourism levels but the increasing

pressure of recreational and commercial fishing on the Site, which is associated with the worsening economic situation and the search for alternative sources of livelihoods for the local population (Survey results).

(1401) Lower Smotrych River and (1396) Bakotska Bay and (2387) Liadova-Murafa:

a. The Sites (1401) Lower Smotrych River and (1396) Bakotska Bay are located in the middle course of the Dniester River and are part of the Dniester Reservoir and are managed by the National Nature Park "Podilski Tovtry" and Site (2387) Liadova-Murafa is located below the Dniester hydroelectric power station on the border with Moldova and is managed by the state regional authority. The Sites 1401 and 1396 were designated in 2003 and the areas of the Sites are 1,480 ha and 1,590 ha. The RISs include information actual for 2018 and indicate that the Sites meet criteria 2, 4, 7 and 8 for identifying Wetlands of International Importance (Lower..., 2021; Bakotska..., 2022). Both Sites are very important for bats and fish and for rare birds. The Sites are also important places for the conservation of endemic and protected species of plants and vegetation. The Site 2387 was designated in 2019 and has an area of 5,394.3 ha. The RIS includes information actual for 2018 and indicates that this Site meets criteria 1, 2, 3 and 4 (Liadova-Murafa, 2019).

b. The Sites 1401 and 1396 are managed by the National Nature Park "Podilski Tovtry". The Site 2387 overlaps with Regional Landscape Park managed by the Regional State Authority of Vinitca.

c. Here also, the use of the Dniester Canyon to hide drone attacks (like Shahed) was noted. Significant fluctuation of the water-level of the Dniester reservoir and River were observed in connection with the regulation of the energy system by emergency use of the hydro-power station after the Russian attacks during the spring and summer of 2024. Official services claim that the permissible norms of water use are being observed. However, media photos show that the water level of the river and reservoirs has decreased by half. A sharp discharge of water causes the level below the reservoir to rise. Such sharp fluctuations in water have a negative impact on fish and other aquatic species, which is exacerbated in the summer by rising water temperatures. Ukraine's energy system is under regular attack and is becoming less and less stable. It is expected that during the winter, existing hydropower capacity will be used at a high level. The exposure of the bottom and sharp fluctuations in water in the winter lead to the death of a significant number of aquatic organisms (Survey results; Ukrhydroenergo press service, 2024).

(775) Shatsk Lakes, (776) Prypiat River Floodplains, (1402) Perebrody Peatlands, (1403) Polissia Mires, and (2274) Syra Pogonia Bog:

a. These Sites are located near the border of Belarus and are managed by the respective parks and reserves authorities. The Sites consist of freshwater lakes, rivers, large mires and peatlands. Due to their inaccessible location, the wetlands have been preserved in a natural state. Transitional communities of sedge-sphagnum mires, fens, willow thickets and pine lychees with blueberries are typical plant communities here. The Sites are important for the conservation of the typical boreal mire flora and fauna. The mires and small forested islands provide important breeding and foraging grounds for globally threatened species. The peatlands are important for flood control, water retention and water purification. Human activities include the gathering of mushrooms, blueberries, cranberries, recreation and long-term monitoring and scientific activities (Shatsk..., 2024; Prypiat..., 2024; Perebrody..., 2024; Polissia..., 2024; Syra..., 2024).

b. The Site (775) Shatsk Lakes is managed by Shatskyi National Nature Park. The Site (776) Prypiat River Floodplains is managed by Pryriat-Stokhid National Nature Park. The Sites (1402) Perebrody Peatlands and (2274) Syra Pogonia Bog are managed by Rivnenskyi Nature (strict) Reserve. The Site (1403) Polissia Mires is managed by Polissia Nature (strict) Reserve.

c. These Sites suffer from military construction on both sides of the border, plus the establishment of minefields for defence purposes, although information on this impact is limited due to security concerns. Such constructions on the border cause disruption of the hydrological regime of the peatlands, which can affect the water level in rivers and lakes far beyond the boundaries of these Sites. Also, constructions on the border create obstacles for migrating mammals, in particular for bison and other ungulates, lynx, wolves, and others. Visiting the border territories is prohibited for both local residents and tourists, as well as for Parks and Reserves employees. The strip along the state border will be removed from the management of Parks and Reserves administrations and transferred to the border guard service (EPL, 2023; Law, 2023; Survey results; EO results).

4.5. Ecological Character Change

4.5.1. From impact to ecological character change

Data on the impacts to the Wetlands of International Importance as a result of the Russian aggression is generally quite limited. The most available data relates to direct impacts such as the presence or absence of hostilities or bombing, military training, the number and extent of fires, the likelihood of land-mining, changes in the hydrological regime, the movement of heavy military vehicles and equipment, the construction of trenches and defensive structures, incidents of pollution with fuel, chemicals and/or household sewage or garbage of various kinds, and finally the use/exploitation of ecosystem services or a ban on their use.

Biodiversity data is available in exceptional cases and is limited to broad observations of general declines in bird or animal numbers, unusual behaviour or animal deaths, and estimates of burned or disturbed vegetation areas.

The impact on the ecological character of the Sites was assessed by the assessment team based on an assessment and triangulation of a combination of data on impacts to abiotic and biotic components, ecosystem processes and ecosystem services.

Given the nature of wetlands, changes in the hydrological regimes caused by events directly, or indirectly, related to the Russian aggression were selected as the main factor determining the change in the ecological character.

On four Sites (2282, 2273, 767, 770) it was assessed as a "**major change of the ecological character"** as the data indicated significant impact on all components of the ecological character, in particular to the hydrological regime.

The exact degree of change in the ecological character of other Sites cannot be accurately assessed based on the available data and under the prevailing conditions on the ground. This issue should be further investigated after the end of the Russian aggression with the establishment of safe conditions for conducting research.

At the same time, it is obvious that the existing military impacts have caused changes in the biotic and abiotic components of the Wetlands of International Importance. For some Sites, short-term changes in the hydrological regime are noted while most ecosystem processes remain stable.

However, the use of ecosystem services has reached a scale not previously permitted by Ukrainian legislation in all Sites located in the zone occupied by Russian troops and on the Black Sea coast and along the border with Russia and Belarus.

Therefore, for all Sites where a fairly strong impact on ecological components, processes, or services was noted, associated with military actions, defensive actions, or a change in the hydrological regime as a result of remote hostilities, are classified as those where a "**moderate change of the ecological character**" occurred.

The impact on the Sites outside the zone of occupation, or military hostilities, largely relates to indirect impacts. These include a reduction in management capacity, funding and in some instances equipment – plus reduced access to some ecosystem services. In such cases, it was determined that a "**minor change of the ecological character"** occurred.

These impacts and subsequent changes in ecological character are summarised in the following table (Figure 23).

Nature of Impact	Change in Ecological Character	Example of Change in Ecological Character	Number of Sites
Direct	Major	Fundamental change in hydrology resulting in the elimination of the wetland ecosystem.	4
Direct	Moderate	Occasional shelling, troop and military vehicle movements, military constructions etc.	27
Indirect	Minor	Reduction management capacity & funding and access to Ecological Services.	17
None	None	No change in ecological character	2
			50

Figure 23. Summary of ecological character change

The change of ecological character table for all 50 Wetlands of International Importance is described in Figure 24.

Ramsar ID	Ramsar Name	Ecological character change
113	Kyliiske Mouth	MODERATE
114	Karkinitska and Dzharylgatska Bays	MODERATE
115	Central Syvash	MODERATE
116	Yagorlytska Bay	MODERATE
760	Kugurlui Lake	MINOR
761	Kartal Lake	MINOR
762	Sasyk Lake	MODERATE
763	Shagany-Alibei-Burnas Lakes System	MODERATE
764	Dniester-Turunchuk Crossrivers Area	MINOR
765	Northern Part of the Dniester Liman	MINOR
766	Tyligulskyi Liman	MINOR
767	Dnipro River Delta	MAJOR
768	Tendrivska Bay	MODERATE
769	Eastern Syvash	MODERATE
770	Molochnyi Liman	MAJOR
771	Obytochna Spit and Obytochna Bay	MODERATE
772	Berda River Mouth and Berdianska Spit and	MODERATE
773	Bilosaraiska Bay and Bilosaraiska Spit	MODERATE
774	Kryva Bay and Kryva Spit	MODERATE
775	Shatsk Lakes	MODERATE
776	Prypiat River Floodplains	MODERATE
777	Stokhid River Floodplains	MINOR
1393	Aquatic-cliff complex of Cape Kazantyp	MODERATE
1394	Aquatic-cliff complex of Karadag	MINOR
1395	Aquatic-coastal complex of Cape Opuk	MODERATE
1396	Bakotska Bay	MODERATE
1397	Big Chapelsk Depression	MODERATE
1398	Desna River Floodplains	MODERATE
1399	Dnipro-Oril Floodplains	MODERATE
1400	Lake Synevyr	MINOR
1401	Lower Smotrych River	MODERATE
1402	Perebrody Peatlands	MODERATE
1403	Polissia Mires	MODERATE
2272	Cheremske Bog	MINOR
2273	Sim Maiakiv Floodplain	MAJOR
2274	Syra Pogonia Bog	MODERATE
2275	Somyne Swamps	MINOR
2281	Byle Lake and Koza Berezyna Mire	MINOR
2282	Archipelago Velyki and Mali Kuchugury	MAJOR
2387	Liadova-Murafa	MODERATE
2388	Dnister River Valley	MODERATE
2389	Black Bog	NONE
2390	Narcissi Valley	MINOR
2391	Atak Borzhavske	NONE
2392	Nadsiannia Raised Bog	MINOR
2393	Burshtyn Water Reservoir	MODERATE
2394	Ozirnyi-Brebeneskul	MINOR
2395	Prut River Headwaters	MINOR
2396	Romania-Friendship Cave	MINOR
2397	Pohorilets River Headwaters	MINOR

Figure 24. List of the 50 Wetlands of International Importance and the change of the ecological character as concluded by the assessment team

Figure 25 shows the location of the 50 Wetlands of International Importance throughout Ukraine indicating the change of ecological character based on the definition of the ecological character.

Figure 25. Location of the 50 Wetlands of International Importance throughout Ukraine indicating the change of ecological character.

Figure 26 shows the breakdown of the ecological character change by the occupation status from the initial list provided to the Secretariat by the Ukrainian authorities.

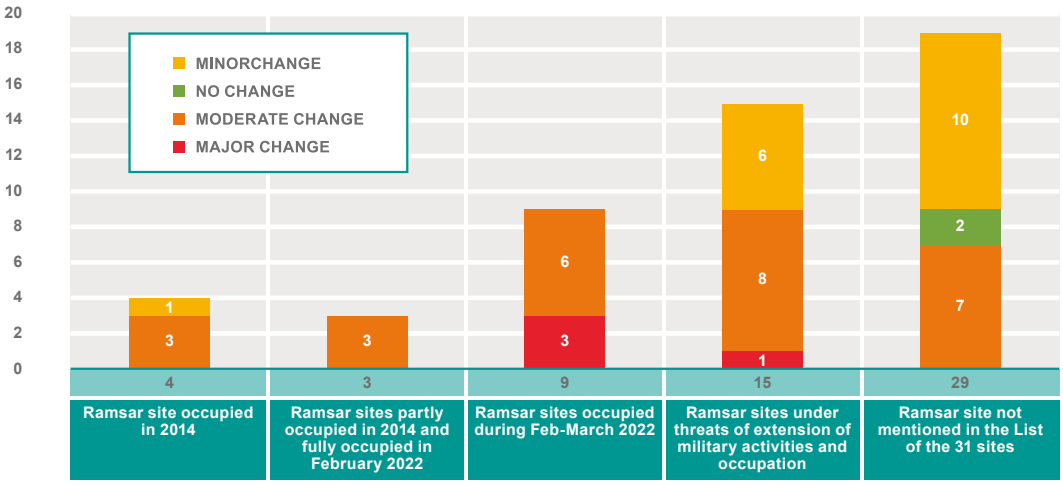

Figure 26. Ecological character change related to the occupation status from the initial list of Sites provided to the Secretariat.

5. Recommendations

Post-war, restoring Ukraine's society and landscape will be high on the political agenda. Restoring infrastructure, housing, industry, and agriculture will most likely be prioritised over rehabilitating the natural environment, including wetlands.

Ecosystem restoration, including the restoration of wetlands, should be viewed as essential nature-based solutions helping to address critical societal and environmental problems - such as water supply and water purification, agricultural output, etc.

However, there are several measures which can be either reinforced or introduced to help to reduce the environmental impact upon Ukraine's Wetlands of International Importance ahead of the cessation of the war.

5.1. General Restoration Considerations

5.1.1. Immediate Actions

Ahead of implementing a strategic restoration plan, there are measures which can be taken in the immediate time-frame, even before the end of the Russian aggression.

These will involve:

- The enhanced use of EO, in conjunction with international partners, to monitor damage and changes in wetland ecosystems;
- Supporting and encouraging the remaining park management staff to continue to monitor and document impacts;
- Provision of equipment, training and working with local environmental authorities and local community groups to:
  - Form rapid-response teams to address immediate pollution risks, such as oil and chemical spills, through the use of appropriate techniques such as the use of containment barriers and methods to reduce migration such as fixation/cementation etc;
  - Undertake water and soil quality testing and wildlife assessments;
  - Provide support measures for the hydrological regime if possible.

5.1.2. Wetlands Restoration Plan

Following the implementation of immediate actions, the short, medium and long term activities should be undertaken in a strategic fashion.

This will require the development of a Wetland Restoration Plan (**WRP**) following the completion of detailed assessments of each Wetland of International Importance.

The WRP should determine where and when to undertake restoration activities and identify what resources are required.

The WRP should be developed in consultation with local experts to assist with selecting the most appropriate time for intervention, minimising unnecessary damage to biodiversity.

The WRP should initially prioritise the removal of explosives (mines, UXOs, etc.), oil and chemical spills and waste and debris.

An equal priority is the restoration of the hydrology of the wetlands. Water is key to the wetland ecosystem and if ditches and channels have been established, these should be back-filled and attempts made to restore the normal (pre-war) water levels.

International donors, organisations, NGOs, and national stakeholders can be expected to contribute to the recovery program. Therefore, the WRP must provide adequate coordination for all actors - both national and international.

Once restoration measures have been implemented it can be expected that in many cases, natural processes will rebuild the wetlands' ecosystem if the surrounding landscape is intact. An example of such natural recovery can be observed in the area around Chornobyl in Ukraine, where nature has returned the ecosystem to a condition similar to its original state.

But it is acknowledged that natural successional processes take considerable time and may be complicated by a range of factors including climate change and the spread of invasive alien species.

5.1.3. Institutional Recovery

In addition to ecological considerations, the overall WRP should consider institutional aspects including the management issues along with staff training and capacity-building needs.

As a result of the Russian aggression the management of Ukraine's wetlands has reached a virtual standstill, as many staff have been called up for military service, became internally displaced people (IDPs) or migrated abroad. In addition, funding was significantly reduced.

It may take several years before staffing is back to levels necessary to meet all the requirements for the restoration and management of the country's wetlands.

Therefore, the WRP must help to identify training and capacity-building needs, potential international partners, as well as organise training courses, seminars, etc.

5.1.4. Build Back Better

The WRP should endorse the concept of building back better than before the Russian aggression. There may, for example, be opportunities to minimise pollution from surrounding urban or agricultural areas along with the opportunity to remove objects of human origin that have encroached in, or near to, the wetland.

The Global Platform on Disaster Risk Reduction (https://globalplatform.undrr.org/2025/about-gp) and the World Reconstruction Conferences (started in 2011, the latest held in October 2024) (https://recovery.preventionweb.net/) have consolidated the experiences and given a higher profile to the concept of build-back-better.

5.1.5. Timing to minimize damage

Many impacted Wetlands of International Importance, particularly large ones, will require a lot of effort, funds and resources to remediate them. Such activities will require the movement of heavy machinery and people within the wetlands to undertake a range of activities, including excavating and transporting contaminated soil and sediment; mechanical de-mining; and removal of UXOs and military wastes.

All these activities have the potential to further damage the natural ecosystems so these activities should be carried out through a phased approach.

This should involve dividing Sites into smaller lots, with each lot being de-mined and remediated separately. Such activities should be phased over several years.

While remediation is underway within designated zones within one Site, similar activities should be prohibited in similar wetlands located at distances sufficient for birds` movement to promote the establishment of alternative colonies, forage, or wintering.

Remediation activities should be carried out during seasons of low biological activity (preferably winter) to minimise the stress the Site will be subjected to.

By way of an example of this type of approach, there are areas within northern France that have not been completely de-mined from WW1 and WW2. Such areas have been designated as nature reserves and are classified as no-go zones ("zones rouges").

5.1.6. Pollution

Pollution from the Russian aggression should be dealt with as a priority particularly where there is a risk of contamination spreading. A wealth of experience in cleaning up oil-spills and most other common pollutants exists internationally.

The first step of clean-up is containment, to reduce the spread of the pollution footprint. This can be achieved using containment booms and techniques such as fixation/cementation.

5.1.7. Waste Products

Where war related wastes exist but are contained and are not likely to spread pollution, such items may be considered a lower priority and can be dealt with after more acute problems have been resolved. However, such waste and the places where it is to be disposed of/stored must first be inspected for explosive hazards.

5.1.8. Military Structures

Physical remnants from the Russian aggression, such as trenches, bomb-craters and fortifications should be removed to restore the landscape to its original condition.

However, such work may not be an immediate priority and can wait until a later phase. It should be timed so that it doesn't occur during periods of high biological activity.

It is recognized that removing such military structures has a high political and national security dimension.

5.1.9. Transition Zones

The use of transition zones (edges and ecotones) around the wetland should be promoted. Ideally these should be vegetated with grass, bushes and trees and be able to capture some of the stress in the form of pollution from surrounding agricultural and urbanised areas. The wider such transition zones are, the better.

5.1.10. Re-Introduction of Species

Additional measures to support the recovery of the wetland's ecological functions will vary from Site to Site. Good information regarding the pre-war conditions in the Wetlands of International Importance are available in the Ramsar Information Sheets recently updated by the Ministry of Environmental Protection and Natural Resources of Ukraine.

Based on such knowledge, decisions can be made if certain species need to be reintroduced, but this would first require the completion of detailed research.

Techniques such as seed collection, seeding, and planting may be carried out to accelerate succession and ecosystem development. Small-scale experimental plots can be established to test various restoration methods and techniques.

Re-establishing a functioning and self-supported wetland ecosystem requires monitoring and often maintenance to direct the development of the wetland toward the desired end-point ecosystem.

5.1.11. Invasive Species

A constraint on wetland restoration, especially near agricultural or urban areas, is the prevalence of invasive alien species, both plants and animals. Some of the widely spread plants and animals in Ukraine's wetlands are in fact invasive alien species that have been present for a long time.

Where the wetlands' ecological balance has changed due to the Russian aggression - such as due to fire or changed hydrological conditions, the invasive alien species may become more common.

Presently in Ukraine there are about 400 species of animals and 200 species of plants that can be considered invasive. It is expected that the disturbance of soil and plant cover by military vehicles, shell craters and trenches will help to spread common ragweed (Ambrosia artemisiifolia), curly-top gumweed (Grindelia squarrosa), common sandbur (Cenchrus pauciflorus), Russian olive (Elaeagnus angustifolia) and other invasive plants.

Efforts to eradicate invasive species frequently result in a stalemate, so constant vigilance and action are necessary to keep the invaders in check.

5.1.12. Micro-Habitats

Where rare micro-habitats may have been established in, for example, bomb-craters, they may host amphibians during their reproductive stages.

Therefore, before being back-filled, biological inventories of craters and trenches should be carried out, and areas where such biotopes exist should be protected, at least in the short term.

5.1.13. Vegetation Management

As mentioned previously, many management tasks have come to a halt including harvesting of wetland vegetation such as cattail (Typha), common reed grass (Phragmites), rushes (Juncus), and sedges (Carex) within critical areas to maintain open, flowing water.

Such management activities must be re-established to avoid the wetlands gradually becoming dryer environments as more sediment accumulates in the wetlands - transitioning the environment from wetlands into freshwater forests and ultimately dryer forests.

In the context of Ukraine, this applies in particular to inland wetlands, such as Perebrody Peatlands (1402), Polissia Mire (1403), Somyne Swamp (2275) and Byle Lake and Koza Berezyna Mire (2281).

5.1.14. Sites Important for birds

Many of the wetlands in Ukraine, especially wetlands of international importance situated in the southern region of Ukraine, close to the Black Sea and the Sea of Azov, are of key importance for waders and waterfowl during periods of migration and nesting and wintering.

In such sites, it is necessary to avoid clean-up during critical periods and carefully choose short periods (two to three weeks) when the smallest number of birds can be disturbed by such activities.

5.1.15. Domestic Tourism

Many areas of these wetlands are popular locations for domestic tourism, particularly in the summer months. Following the end of the Russian aggression, the return of this phenomenon will stimulate clean-up activities, but touristic access should be restricted to areas near to settlements which have been de-mined while other areas should be cordoned off to prohibit access to the public.

A return to domestic tourism will also create anthropogenic pressure on these wetland Sites which need to be identified and managed - thus it is important to regulate the return of domestic tourism.

Lithuania provides a regional example of a country with a relatively well-developed system of protected areas with different regulations covering public access depending on what type of ecological values are present at the Sites. The management approaches applied in Lithuania may serve as a model when rebuilding the environmental management of Wetlands of International Importance in Ukraine following the Russian aggression.

5.2. Site Specific Recommendations

5.2.1. Coastal wetlands

Beaches have been the main strategic points for possible military landings – and as such have been heavily mined and/or military infrastructures have been built there by both Russian Federation and Ukrainian forces.

This includes the following locations: (114) Karkinitska and Dzharylgatska Bays, (116) YagorlytskaBay, (762) Sasyk Lake, (763) Shagany-Alibey-Burnas, (768) Tendrivska Bay, situated in the Black Sea, and probably (115) Central Syvash, (769) Eastern Syvash, (770)

Molochnyi Liman, (771) Obytochna Spit and Obytochna Bay, (772) Berda River Mouth, (773) Bilosaraiska Bay and Bilosaraiska Spit, and (774) Kryva Bay and Kryva Spit, situated in the Sea of Azov.

The situation with the mining of remote areas, such as sandbars and spits, raises the issue of needing to re-plan protected areas and allocate strictly protected zones of national parks and reserves in places that are not only valuable for nature conservation, but are also dangerous for people due to the presence of mines.

It is proposed to rapidly clear such areas, possibly with the help of mechanical means, prioritising areas near villages and towns while limiting access to other locations (by way of warning signs, fencing etc.).

De-mining saltwater lagoons and marshes, sand-dunes, steppe areas, and pine and alder trees forests may require different approaches.

Cleaning of important areas for birds and other groups of biotas should be planned in accordance with their phenology and life-cycles of the key species and carried out in a way that does not harm these and other species and the ecosystem as a whole.

For example, no Site works should take place during the nesting period, but there may be critical periods to avoid during other periods such as moulting and migration. For southern Ukraine, short intervals of two weeks to a month can be chosen in mid-summer and autumn, when there are fewest birds on the Sites.

5.2.2. Deltaic and floodplain wetlands

The processes of inspection and cleaning of deltaic and floodplain river ecosystems can be quite complex and location specific.

The situation with the (767) Dnipro River Delta is a case in point. It has been under constant artillery and mortar attacks for two years and will be especially difficult due to the considerable size of this area, the risk from UXOs & mines and the consequences of the Kakhovka Dam destruction.

Areas of shorelines near settlements and bridges should be remediated first. However, it is recognised that it will be difficult to survey the entire territory of the Dnipro Delta and define areas containing mines or UXOs, as well as in similar ecosystems of thickets of reeds such as in (113) Kyliiske Mouth in Danube Delta and (1398) Desna River Floodplain in the northern part of Ukraine.

Based on available information, (2273) Sim Maiakiv Floodplain, situated on the left bank of the former Khakovska Reservoir, will require the following sequence of activities:

- Clearance of mines and UXOs;
- Cleaning of soil from fuel and chemical contamination (in-situ where possible);
- Removal of military waste;
- Elimination of military infrastructure such as trenches & fortifications; and
- Restoration of vegetation after heavy military transport including promoting desired species and removing invasive species.

The hydrological regime of this area and that of (2282) Archipelago Velyki and Mali Kuchugury has changed significantly as a result of the destruction of the Kakhovka Reservoir, natural successional processes and the associated change in the ecological character of the wetland.

Therefore, in this, and similar instances, the best approach following the remediation of these areas is to observe natural processes and prevent the spread of invasive species.

Since (2282) Archipelago Velyki and Mali Kuchugury were islands in the Kakhovka Reservoir and are now probably the driest part of the exposed base of the reservoir, the question arises as to the status of this area in general.

At the same time, despite the dramatic change in the ecological character of this area, the base of the Kakhovka Reservoir is a historical floodplain of the Dnipro River, which in the opinion of several Ukrainian scientists, may represent even greater ecological value as a single large wetland - thus are opposed to the restoration of the reservoir.

Internationally, there are strong arguments to avoid rebuilding such dams. For example, the World Commission on Dams encourages countries to restore the status of aquatic ecosystems, while the European Water Framework Directive and the recent Nature Restoration Law

encourages member states to restore nature, including watercourses, and remove barriers such as dams wherever possible.

Accordingly, the restoration of the floodplain of Dnipro River (historical name Great Meadow) could become one of the largest wetland restoration projects not only in Ukraine, but also in Europe.

5.2.3. Wetlands on the Border with Belarus

A separate issue will be the restoration of Wetlands of International Importance, mainly peatlands, which are located in the north of Ukraine on the border with Belarus and which have suffered in liaison with the construction of military defence structures on both sides of the border.

Interference of the hydrological regime of some parts of (775) Shatsk Lakes, (776) Prypiat River Floodplain, (1402) Perebrody Peatlands, (1403) Polissia Mires and the creation of obstacles for animal migrations as a result of the construction of military defence structures will have impacted the ecological character of these wetlands, which may also be exacerbated by climate change.

However, the possibility of restoring these wetlands, which should be undertaken on both sides of the border, will depend on the political situation and the normalisation of nature conservation co-operation between the two states, which was quite active before the Russian aggression.

5.2.4. Inland wetlands

Meanwhile, relatively minor damage in Site (1397) Big Chapelsk Depression which will require a restoration of vegetation cover in some areas damaged by explosions, fire and heavy military vehicles, and normalisation of the groundwater use.

5.3. Restoring Ecosystem Services

The text above has focused on the ecological aspects of wetland restoration - but there is also a pressing need to restore ecosystem services, allowing communities to recover and livelihood opportunities to be recreated. Recommended measures are divided into five broad categories below.

5.3.1. Livelihood Support

i. Eco-tourism Development: Investing in eco-tourism infrastructure such as trails, birdwatching platforms, and visitor centres can provide additional income to local communities.

ii. Sustainable Fishing and Agriculture: Providing training in sustainable techniques and providing access to alternative livelihoods, such as aquaculture.

iii. Crafts and Local Production: Supporting traditional crafts, like reed-weaving or other wetland-based industries, could help provide an income while preserving local cultural practices. Development of fair-trade markets can ensure that these products are valued appropriately.

5.3.2. Social and Economic Infrastructure

i. Capacity Building and Education: Enhanced education in sustainable land-use practices, wetland conservation, promoting long-term stewardship opportunities.

ii. Access to Financing: Make available microfinance programs or grants for green businesses and sustainable development projects.

iii. Job Creation in Conservation Work: Employing local people in the conservation and restoration of impacted wetlands, including roles in habitat management, monitoring, and guiding tourists.

5.3.3. Governance and Policy Support

i. Community Participation in Decision-Making: Engaging communities in post-war reconstruction and in the management of wetlands.

5.3.4. Health and Well-being Support

i. Mental Health and Trauma Care: Post-war recovery for these communities should also consider the mental health impact of the conflict. Programs that support healing and well-being are important for rebuilding resilient communities.

ii. Food and Water Security: The wetlands often provide essential ecosystem services such as water purification and food resources. Ensuring these functions are restored quickly can help prevent food and water insecurity during the recovery phase.

5.3.5. Long-term Monitoring and Research

i. Monitoring Wetland Health: Include community-based monitoring in long-term monitoring programs to track the recovery and functioning of the wetlands.

ii. Research on Climate Change Resilience: Undertake research focusing upon how the wetland ecosystems and their dependent communities can be made more resilient to future climate impacts.

The following table summarises the sequencing and details of the immediate, short, medium and long-term remediation activities.

Immediate Activities (while war ongoing)	Short term (Year 0-2) Priority 1	Medium term (Year 3 -10) Priority 2	Long term (Year 11-25) Priority 3
1. The enhanced use of EO to monitor damage and changes in wetland ecosystems; **2.** Supporting and encouraging the remaining wetlands management staff to continue to monitor and document impacts; **3.** Provision of equipment, training and support to local environmental authorities and local community groups to: • Form rapid-response teams to address immediate pollution risks, such as oil and chemical spills, through the use of containment barriers etc; • Undertake water and soil quality testing and wildlife assessments; • Provide support measures for the hydrological regime if possible.	**1.** Identify, demarcate and fence-off areas that are mined and contain UXOs. **2.** De-mine areas close to settlements first. **3.** Undertake national assessment of Wetlands of International Importance and identify priority Sites. **4.** Develop the national Wetlands Restoration Plan (WRP). **5.** Prioritise Sites that can be restored within a short time frame. **6.** Assess if microhabitats consisting of, and supporting, vulnerable fauna and flora have developed and arrange for protection of these Sites. **7.** Prioritise removal of pollution hot-spots/spills. **8.** Avoid large-scale remediation operations over extended periods by adopting a phased approach, dividing Sites into smaller remediation lots & undertake activities during times of low biological activity. **9.** Promote use of ecological transition zones. **10.** Investigate micro-habitats, such as bomb-craters before backfilling. **11.** Action on invasive alien species. **12.** Re-introduction of required species.	1. Commence institutional strengthening & staff training activities. 2. Seek to normalise cross-border cooperation with Belarus on wetlands management. 3. Continue de-mining and removal of UXOs within smaller plots of land during periods of low ecological activity (winter). 4. Commence restoration activities within second-priority category of Sites to include: reinstatement of desired hydrological regimes, action on invasive alien species, re-introduction of selected species, assessment of micro-habitats etc. 5. Commence interventions to assist impacted communities dependent upon wetlands for livelihoods.	1. Continue with removal of mines and UXOs and intervention to support impacted communities. 2. Commence removal of military fortifications and infrastructure. 3. Grant Sites protected status due to presence of mines, UXOs and military infrastructure – to restrict public access.

Figure 27. The sequencing and details of the immediate, short, medium and long- term remediation activities

6. Conclusions

The completion of this assessment has contributed significantly to the body of information illustrating the nature and extent of impacts stemming from the Russian Federation's aggression upon Ukraine's Wetlands of International Importance, and by extension, the country's wetlands in general.

However, it should be noted that the assessment team have only been able to monitor the impacts to Ukraine's Wetlands of International Importance up until the autumn of 2024 and that the situation is likely to have continued to deteriorate up to the present time due to the ongoing war.

The comprehensive nature of the baseline information contained within the Ramsar Sites Information Sheets has contributed significantly to the success of this assessment.

The impacts can be summarised into direct and indirect impacts which must be factored into the immediate (before the end of the war) short, medium and long-term recovery programme for Ukraine's Wetlands of International importance.

The majority of Ukraine's Wetlands of International Importance have been impacted both directly and indirectly. In terms of ecological character, four Sites (8%) show major changes, 27 Sites (54%) show moderate changes, 17 Sites (34%) show minor changes while only two Sites (4%) show no changes.

Direct impacts include changed hydrology (in some cases, drastic changes), fires, shelling, pollution, construction of military infrastructure, and hunting of wildlife by military personnel.

Indirect impacts include a significant loss of staff and operational budgets collectively undermining the ability to properly manage these Sites.

Longer-term, there is a need for a comprehensive environmental monitoring programme to accurately determine the full-range and degree of damage inflicted upon Ukraine's Wetlands of International Importance stemming from the Russian invasion.

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Annex 2 – Earth observation illustrations

This Annex present illustrations of conflict impact from Earth Observation analyses.

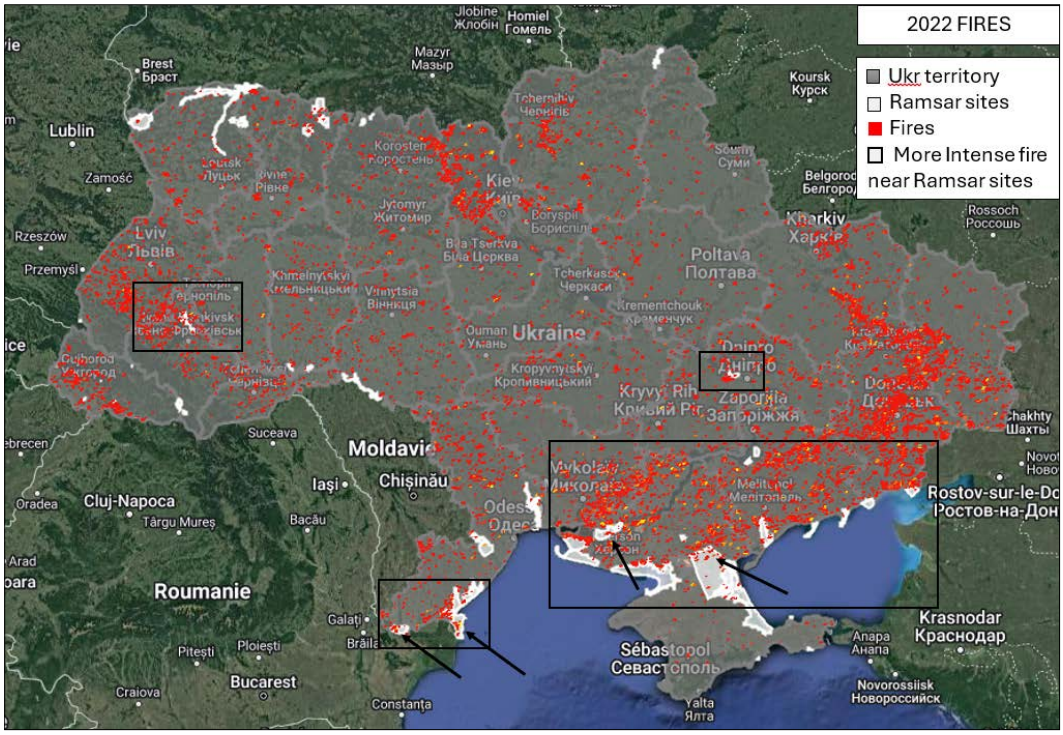

Figure 28. National fire analysis in 2022 and position of Ramsar Sites (source: FIRMS through google earth engine)

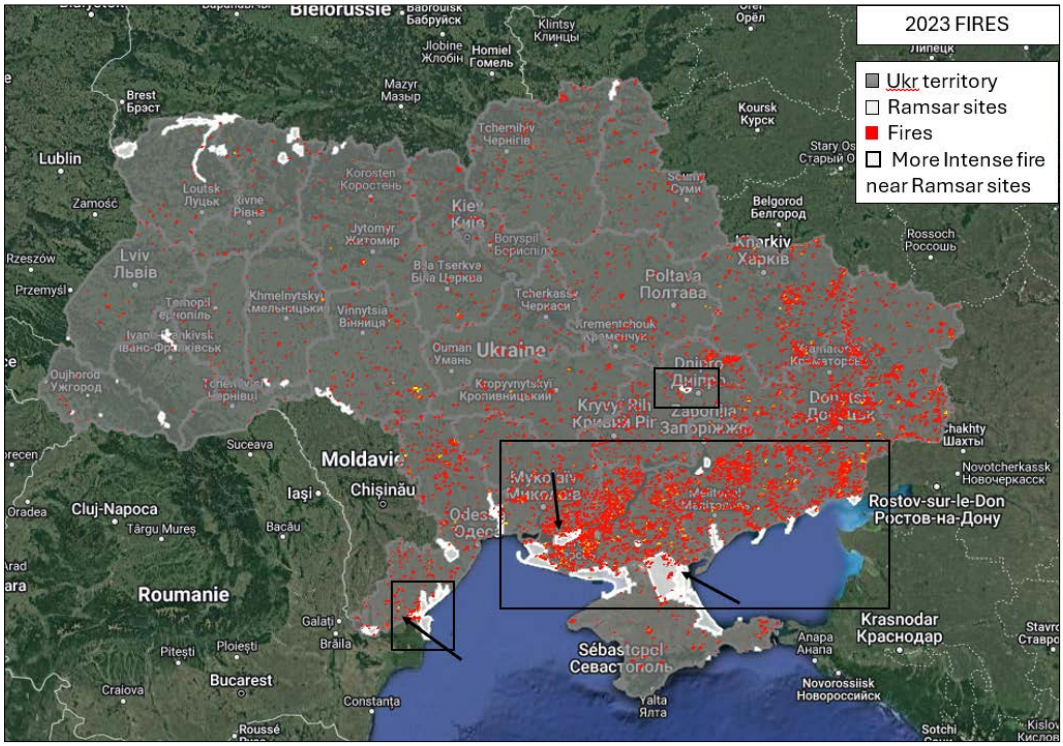

Figure 29. National fire analysis in 2023 and position of Ramsar Sites (source: FIRMS through google earth engine)

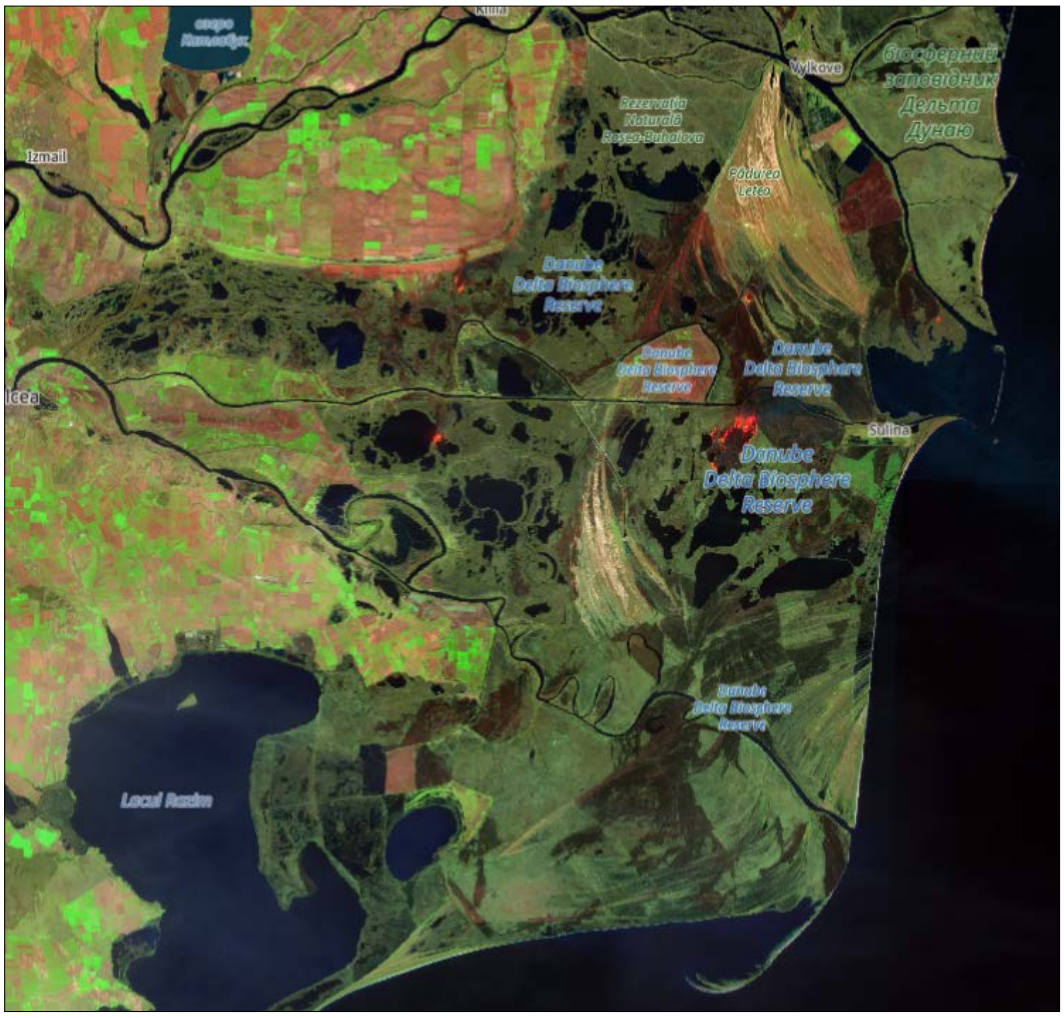

Figure 30. 113- Kyliiske Mouth - (Odessa Oblast) fires on 28/08/2022 (ESA/Sentinel)

Figure 31. 760- Kugurlui Lake (Odessa Oblast) - fires on 17/10/2022 (ESA/Sentinel)

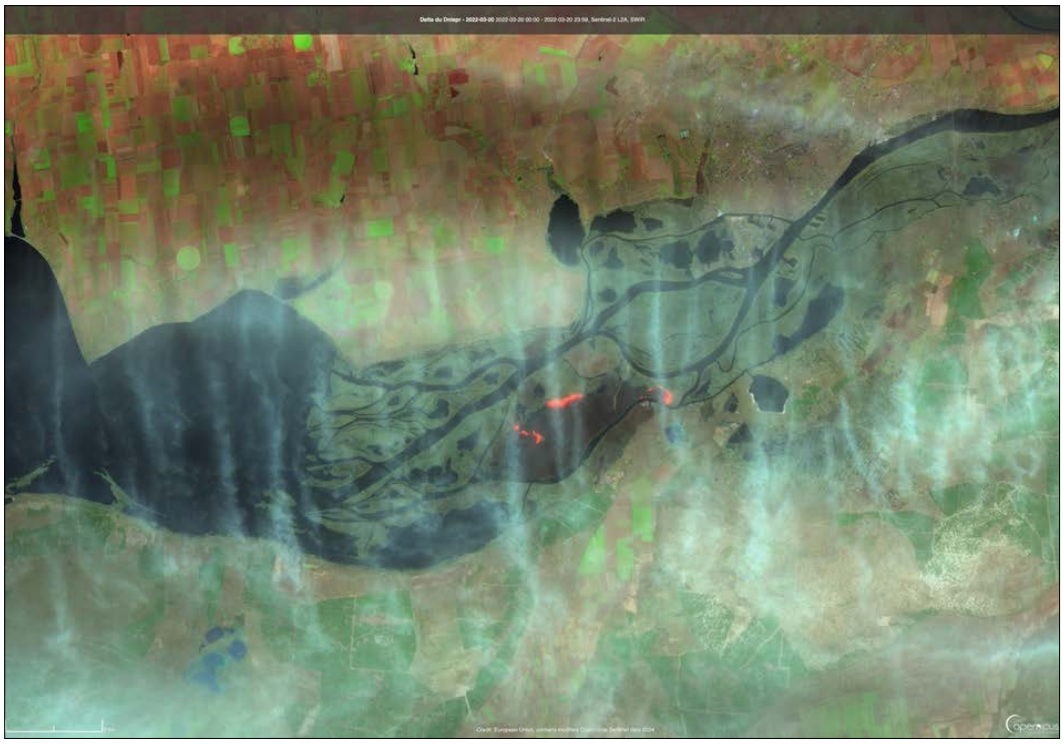

Figure 32. 767– Dniepr river delta (Kherson Oblast) - fires on 20/03/2022 (ESA/Sentinel)

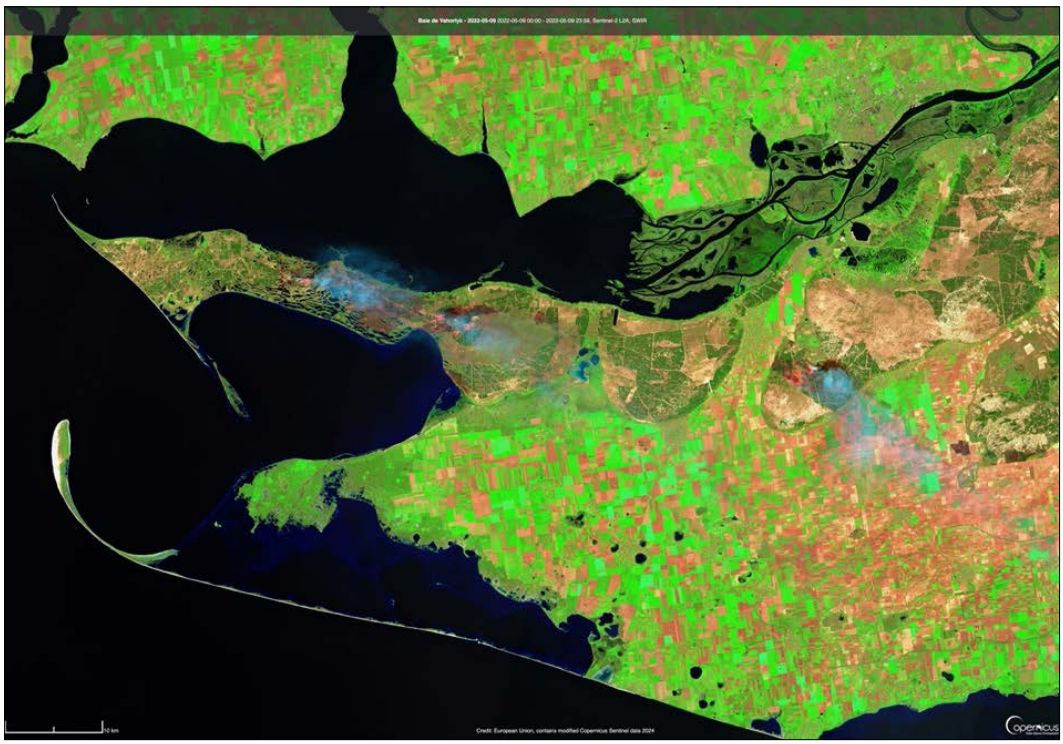

Figure 33. 116 - Yagorlytska Bay (Kherson Oblast) - fires on 05/09/2022 (ESA/Sentinel)

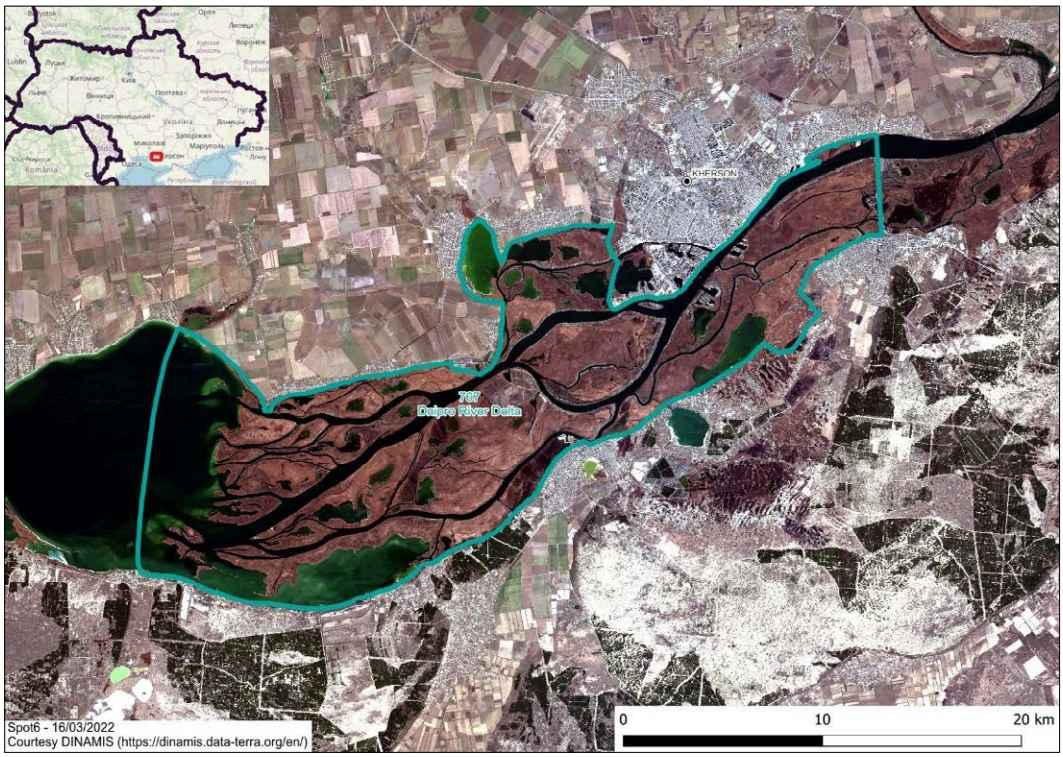

Figure 34. Spot 6 image acquired on the 16/03/2022 over Site 767 - Dnipro River Delta (Airbus Defense)

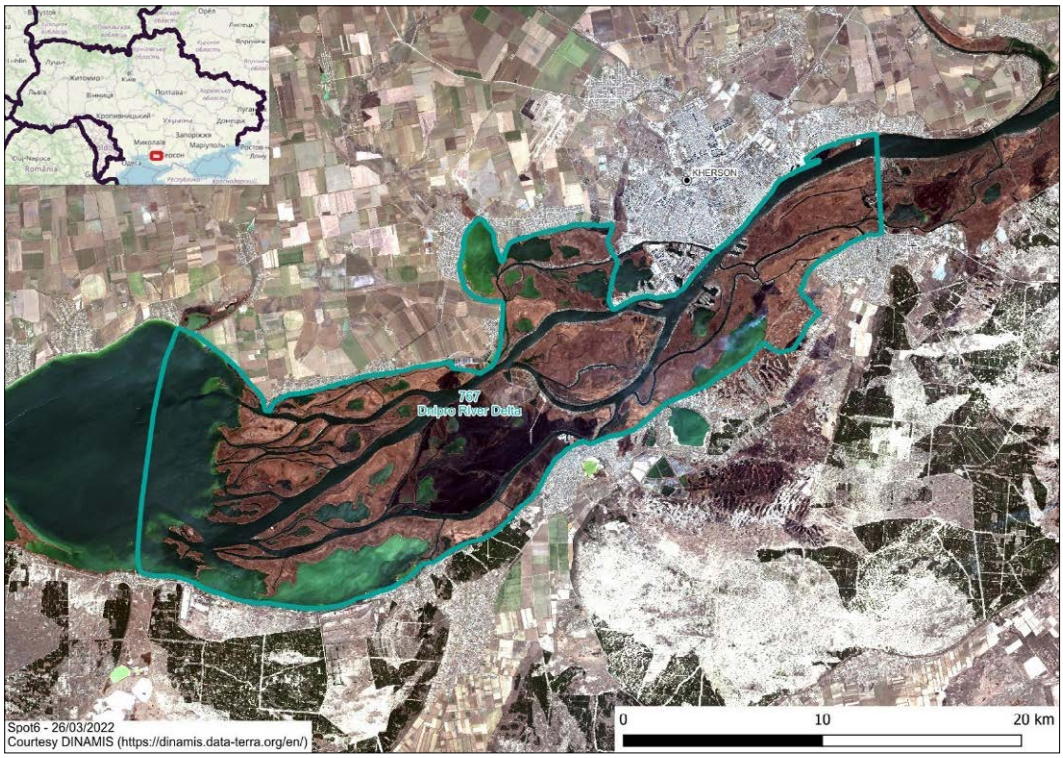

Figure 35. Spot 6 image acquired on the 26/03/2022 over Site 767 - Dnipro River Delta (Airbus Defense)

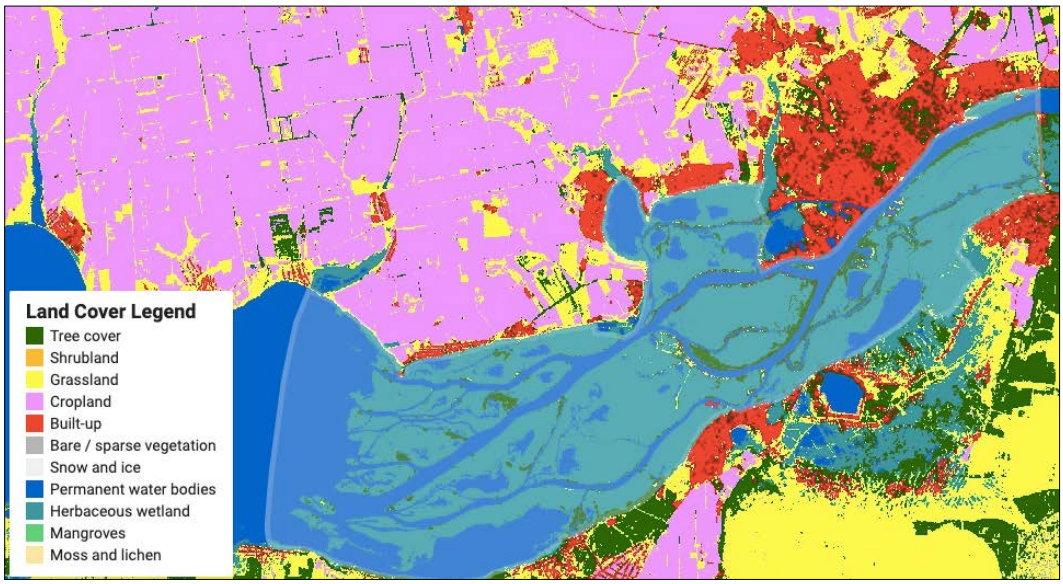

Figure 36. 767-Dniepr River Delta landcover and around in 2021

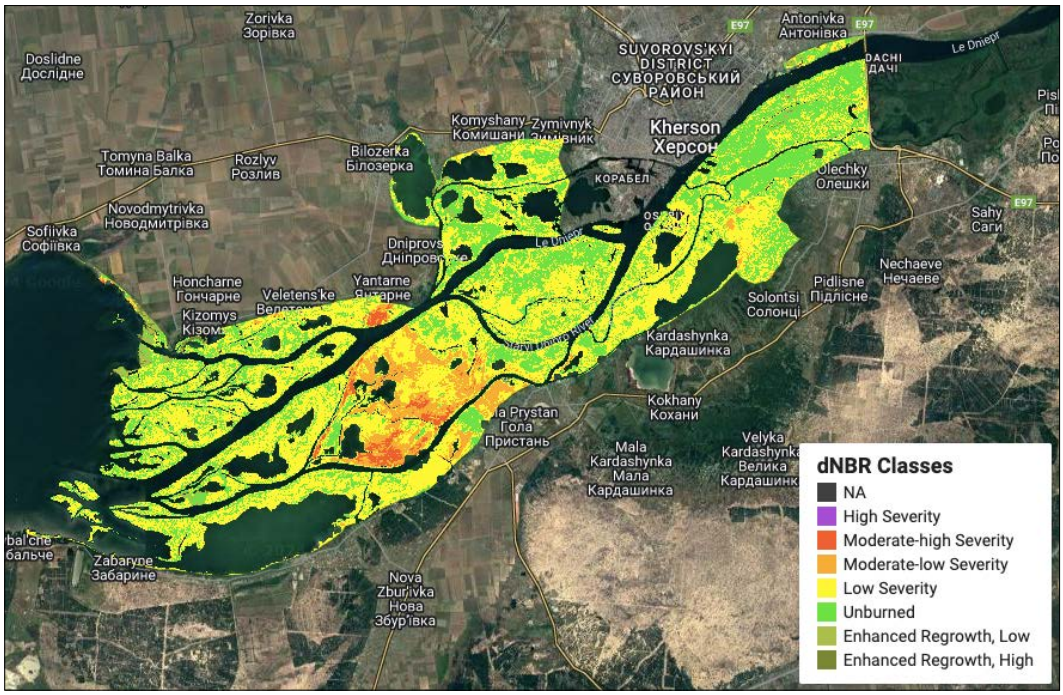

Figure 37. Severity of Dniepr river delta fire through Google earth engine dNBR analysis

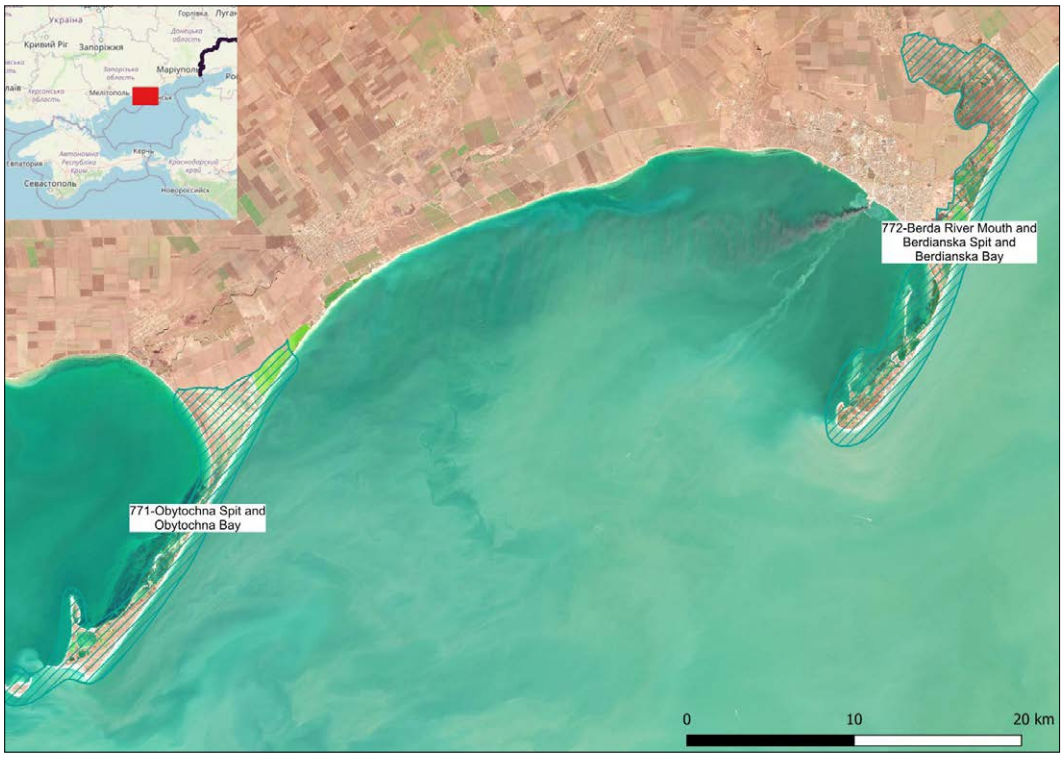

Figure 38. Sentinel image showing a Fire caused by bombing in the port of Berdiansk on the 24 March 2022, very close to Ramsar Site 771 and 772. (ESA/Sentinel)

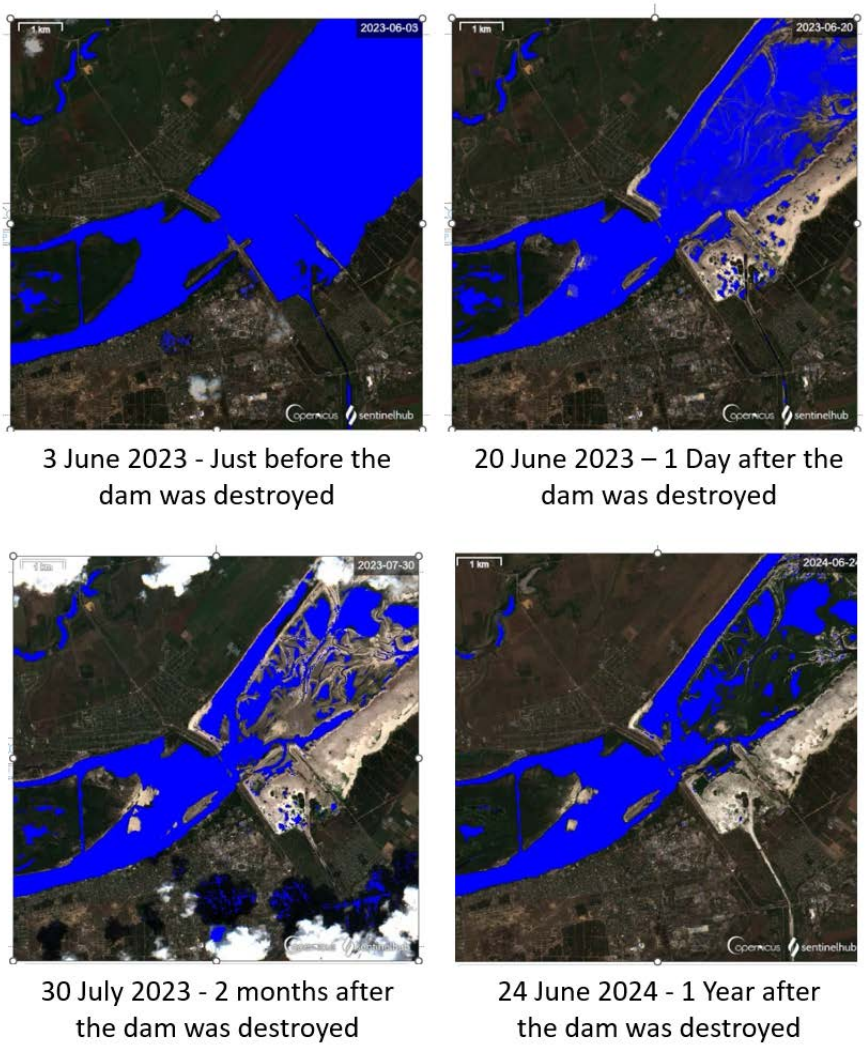

Figure 39. Simple Water Body Mapping (SWBM) script used to detect water at different dates before and after Kakhovka dam destruction. (Sentinel Hub).

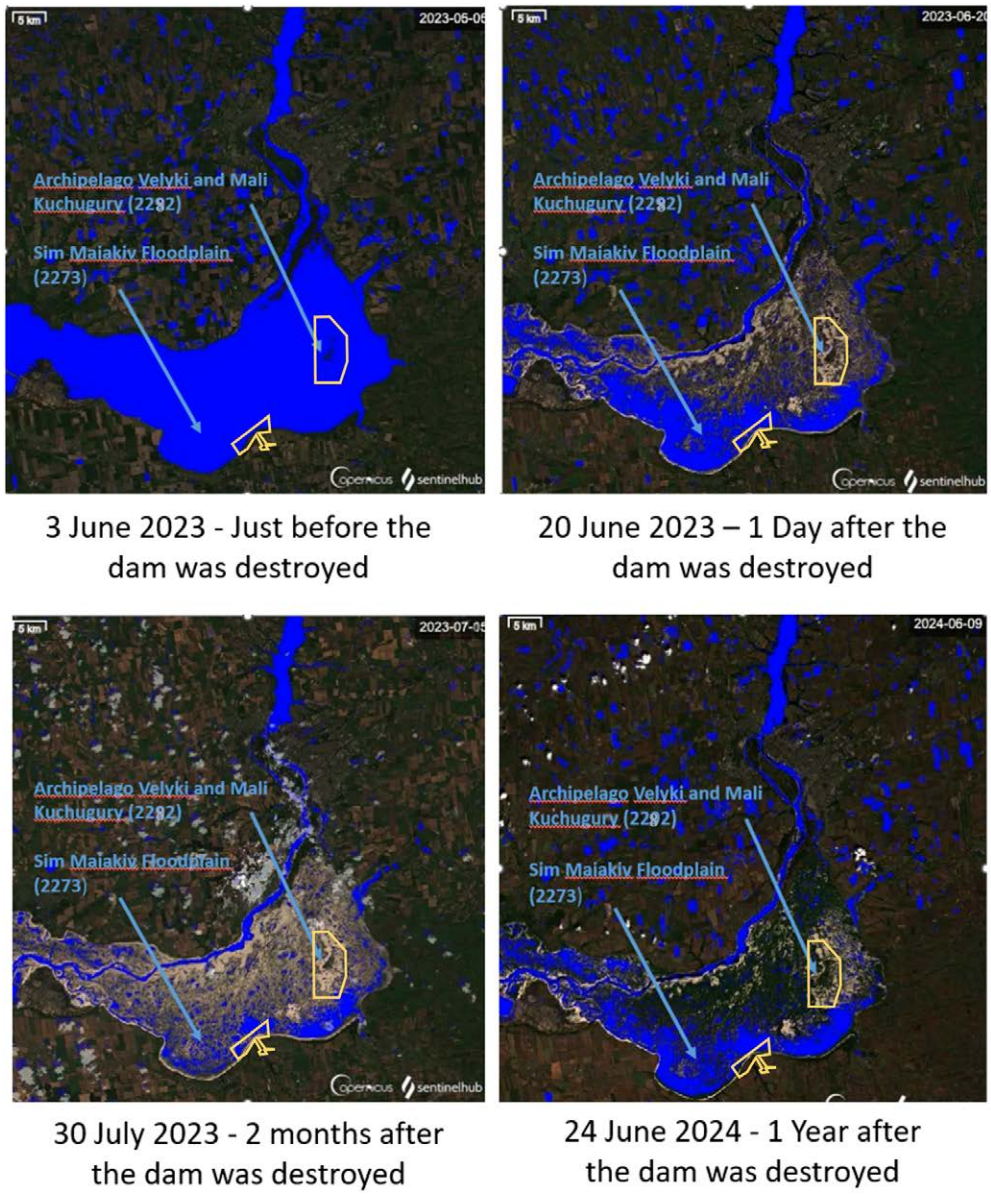

Figure 40. Simple Water Body Mapping (SWBM) script used to detect water at different dates before and after Kakhovka dam destruction (Sentinel Hub).

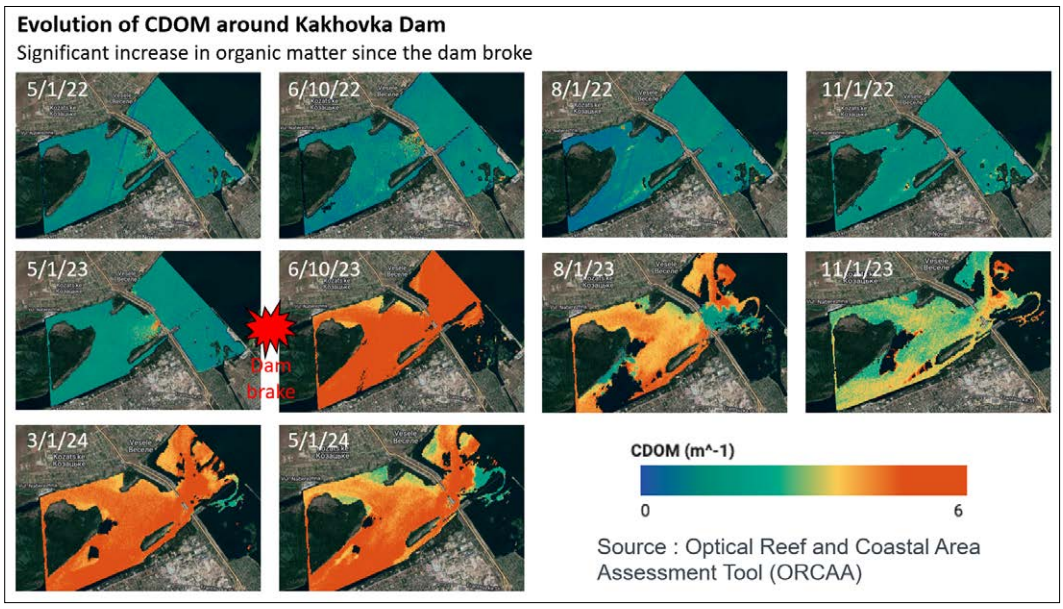

Figure 41. Time series showing the variation of CDOM around Kakhovka dam before and after the collapse. (Sentinel Hub).

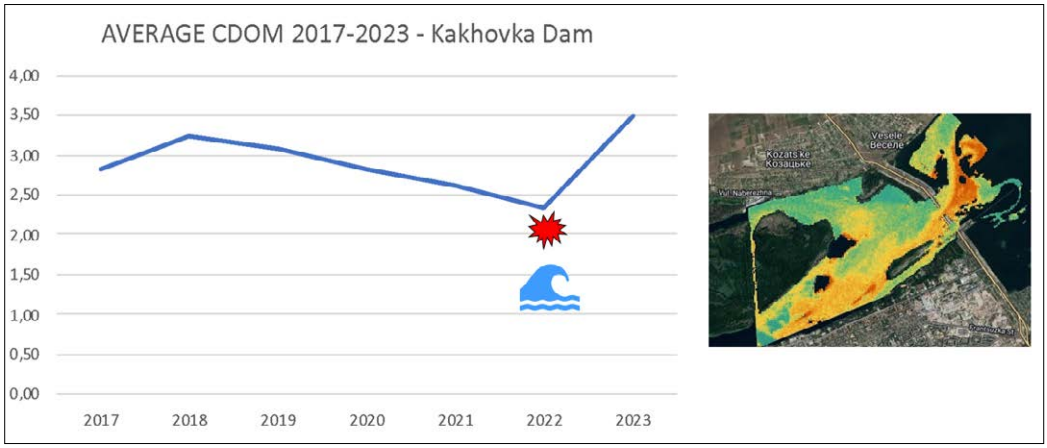

Figure 42. Graph showing CDOM value from 2017 to 2023 (Sentinel Hub).

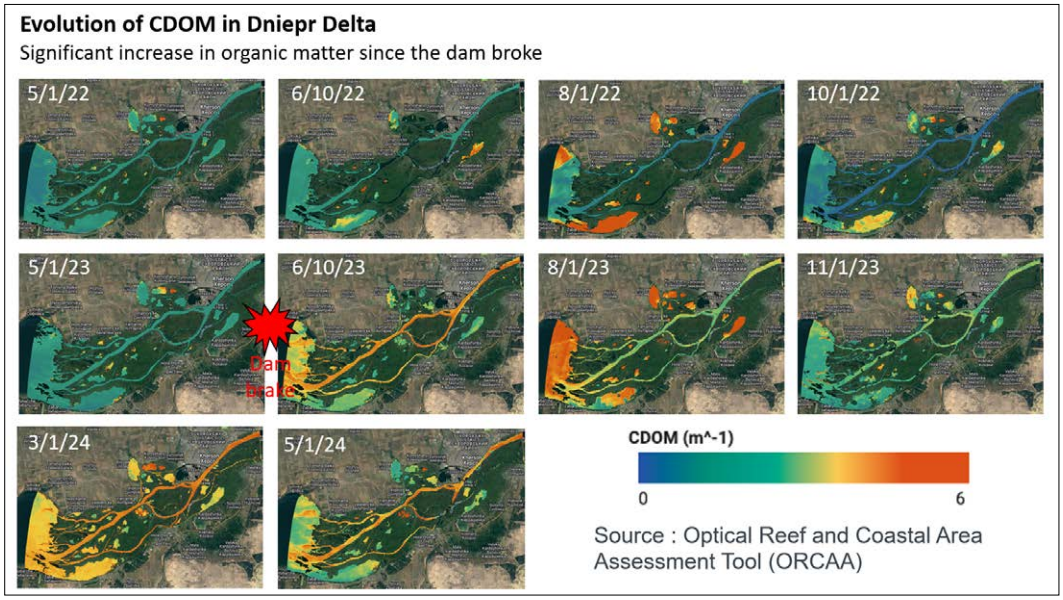

Figure 43. Time series showing CDOM variations in the Ramsar Site 767 Dnipro River before and after the dam collapse. (Sentinel Hub).

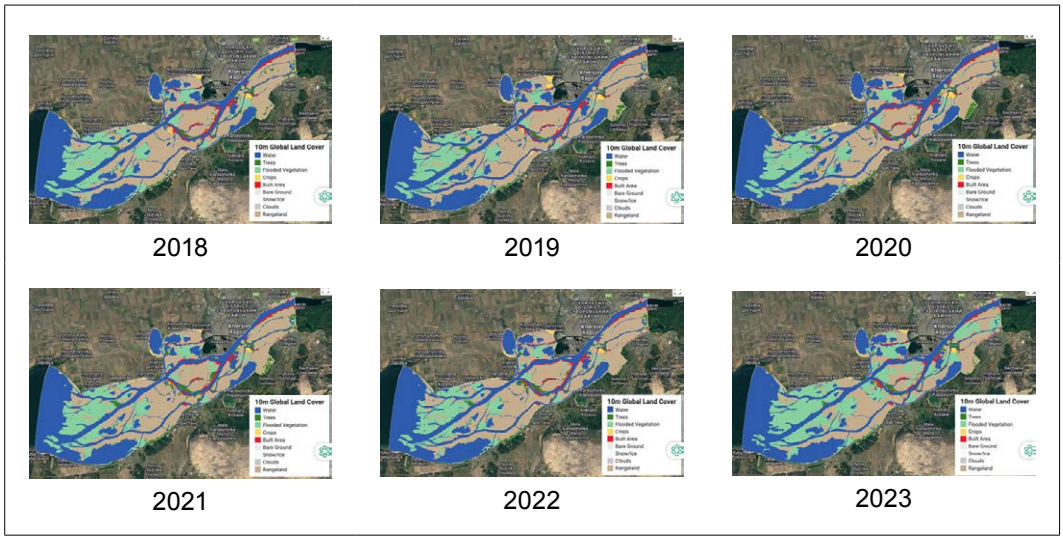

Figure 44. Dnipro Delta River landcover from 2018 to 2023 (source ESRI)

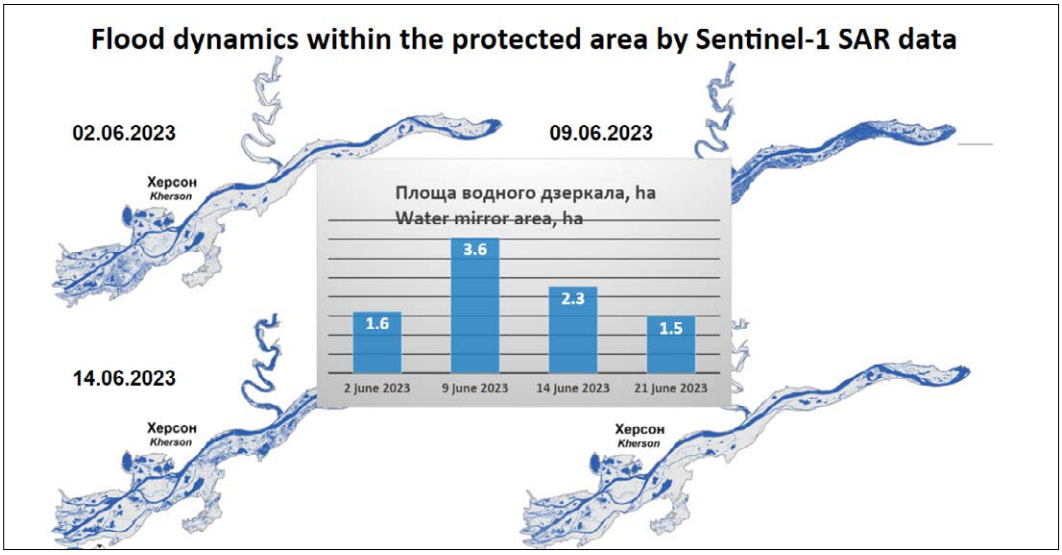

Figure 45. Slide on Kakhovka flood extent based on radar imagery by the Scientific Centre for Aerospace Research of the Earth (CASRE).

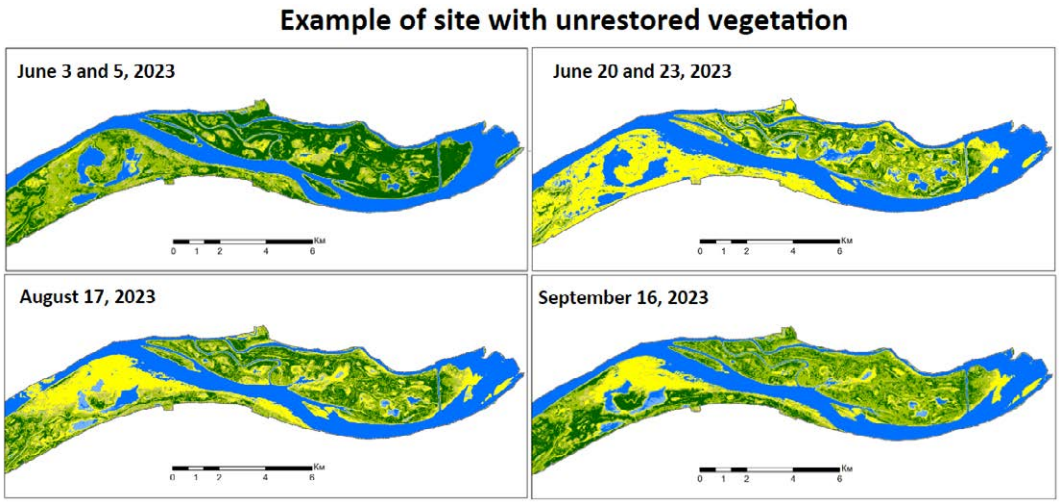

Figure 46. Example of a Site with unrestored vegetation after the flood.

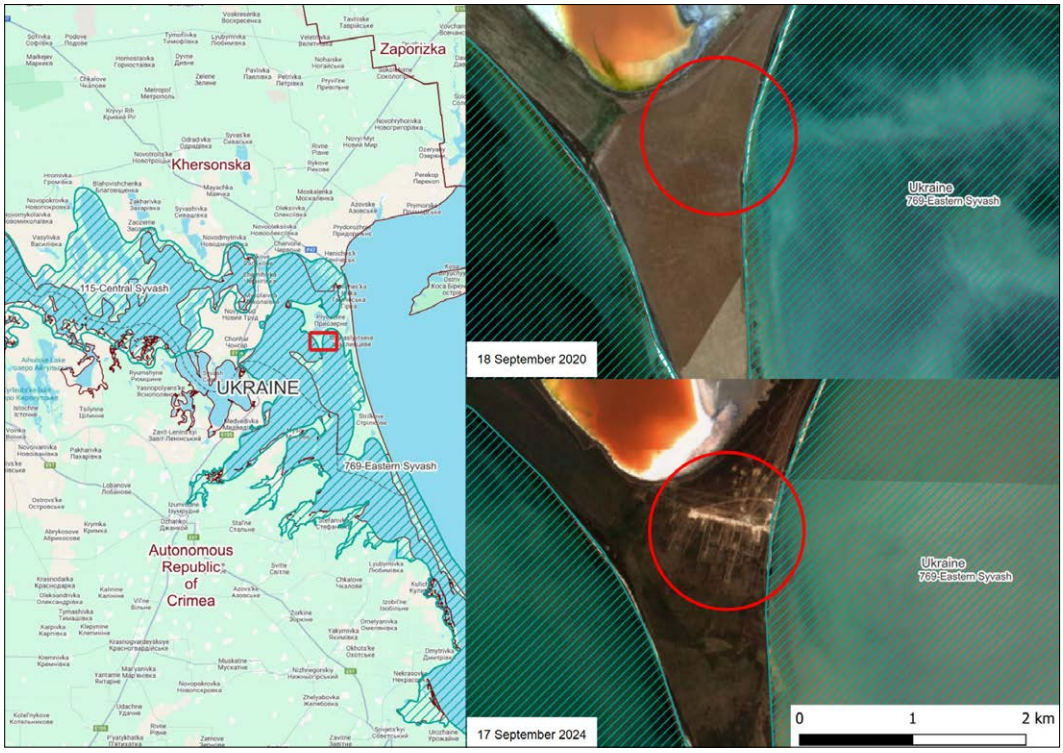

Figure 47. Military training ground close to the Eastern Syvash observed on ESA (ESA/Sentinel).

The Convention on Wetlands

The Convention on Wetlands is a global inter-governmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.