

Ecosystem Approach in Dealing with Invasive Alien Species: International, European and Ukrainian Experience of Legal Regulation

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Abstract

This article is devoted to highlighting the international, European and Ukrainian experience encompassing legal regulation dealing with the invasive alien species that represent the second largest threat to global biodiversity, right after habitat destruction. It has been proved that, at the international level, primarily within the framework of the Convention on Biological Diversity, the ecosystem approach is recognized as the basis in dealing with such species. It is also gradually being reflected in the regulatory framework of the European Union. The provisions of the EU on nature protection and the relevant regulations of the European Commission define invasive species, which are prohibited from activities that may contribute to their dissemination in the environment. In the Ukrainian environmental law, a positive trend towards the recognition of the ecosystem approach in dealing with invasive alien species is observed primarily among national strategic documents, while in current national environmental legislation, these issues are regulated fragmentarily and inconsistently, which indicates the need for its early reform.

Keywords

Environmental law; Biological diversity; Invasive alien species; Ecosystem; Ecosystem approach



Introduction

One of the main environmental problems of today is the loss of biodiversity. Over the past 400 years 120 species of amphibians, 94 species of birds and 63 species of mammals have disappeared from the face of the Earth due to unreasonable human activities. Although each of the extinct species is a final and irreplaceable loss for the biosphere (evolution knows no turning back), many more of them are under the threat of extinction (Danilov-Danil'jan, Losev, Reif, 2005).

There are various causes of biodiversity loss. According to the American biologist, naturalist and writer, E. O. Wilson, they can be abbreviated as 'HIPPO', where the first letter means the most significant cause, and the following letters are arranged accordingly as the significance of the factor decreases. The letter 'H' comes from 'habitat', so the primary reason for the reduction of biological resources is the destruction of habitats of the organisms. The letter 'I' comes from 'invasion' and indicates the widespread impact of the invasion of alien species, as the introduction of these species, even with good intentions, is a biological contamination. Introduced from other parts of the world, some species are rapidly spreading and displacing native species of ecosystems. The first 'P' letter means the third problem – 'pollution', while the second 'P' letter is associated with the 'population' of humans – with the overpopulation of the planet. The last letter 'O' indicates the 'overexploitation' of biological resources – the destruction of species by hunting and fishing (Puzanova, 2010).

Thus, the second most important cause of biodiversity loss is the invasion of alien species. These are plants, animals, or other organisms that are not native to an ecosystem but introduced largely through human action, either deliberately or by accident. They can become competitors, predators, parasites, and hybridizers of native plants and animals, ultimately threatening the survival of endemic species (The Ecology Book, 2019).

In 2014, the Global Invasive Species Database compiled a list of the invasive alien species (IAS) titled '100 of the World's Worst Invasive Alien Species' (Luque *et al.*, 2014), which included the organisms that had the greatest negative impact on human activities and native species. The list includes 56 animal species, 36 plant species, 5 fungal species and 3 microbial species, some of which are the European rabbit (*Oryctolagus cuniculus*) and the cane toad (*Rhinella marina*) that caused significant damage to the endemic Australian ecosystem.

Widely known examples of IAS are also the Nile perch (*Lates niloticum*), which was introduced into Lake Victoria and caused the extinction of some 200 endemic fish species; the Caulerpa seaweed (*Caulerpa taxifolia*) invaded the Mediterranean and severely damaged the endemic aquatic flora and fauna. The introduction of the Polynesian rat into Easter Island is thought to have contributed to the deforestation of that island, with severe consequences for the human populations (Krämer, 2021).

The IAS pose a threat to biodiversity and natural ecosystems of Ukraine. Today there are about 90 invasive species reported, including over 40 transformer species. Generalist mollusk species have spread in the Sea of Azov and the Black Sea (*Mya arenaria*, *Anadara inaequalis*), and such species as *Deroceras caucasicum* and *Krynickyllus melanocephalus*, as well as *Arion lusitanicus* slug, which is rapidly spreading in Ukraine, are a cause of major concern for the country's biodiversity. Among the common alien mammals are the muskrat, American mink, and raccoon dog.¹

Considering the negative impact that IAS have on biodiversity and ecosystems, an urgent need is the legal regulation fighting against such species, based on the implementation of the ecosystem approach.

¹ Sixth National Report of Ukraine on the Implementation of the Convention on Biological Diversity (English version), December 2018, 83. Available online: <https://www.cbd.int/doc/nr/nr-06/ua-nr-06-en.pdf> [Accessed on 25 June 2021]

The IAS are investigated by many scientists, that include Smith, Bazely, Yan (2000), Genovesi, Shine (2004), Essl, Bacher, Roy (2019), Krämer (2021) and others. The ecosystem approach is developed by Smith, Maltby (2003), Morgera (2015), Platjouw (2016), De Lucia (2019), etc. From legal standpoints, the authors of this article also studied these issues in different contexts. However, it should be noted that scientific research combining such areas as the legal regulation of the implementation of the ecosystem approach and the prevention of the negative impact of IAS on the environment, unfortunately, has not been carried out to date. Such a comprehensive study is relevant for national environmental legislation in the context of the latest international legal norms, and is also promising for environmental and legal science in general. Taking this into account, the purpose of this article is to highlight certain aspects of the international, European and Ukrainian experience of legal regulation of the implementation of the ecosystem approach in dealing with IAS.

IAS-Linked Ecosystem Approach in International and European Environmental Legislation

At the international level, there are many legal documents devoted to the conservation of biodiversity and ecosystems, among which leading is the Convention on Biological Diversity² (CBD), adopted in 1992, having objectives to conserve biodiversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources (Art. 1).

The CBD defines the terms ‘biological diversity’ (the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part) and ‘ecosystem’ (a dynamic complex of plant, animal, micro-organism communities and their non-living environment interacting as a functional unit) (Art. 2). The CBD also establishes a number of provisions for the protection and conservation of biodiversity and ecosystems, in particular: establish a system of protected areas or areas where special measures need to be taken to conserve biodiversity; promote the protection of ecosystems, natural habitats and the preservation of viable populations of species in the wild; take measures to rehabilitate and restore degraded ecosystems; prevent the introduction of alien species that threaten ecosystems, habitats or species, and control or destroy such alien species, etc. (Art. 8 a, d, f and h).

The key provisions of the ecosystem approach are reflected in the decisions of the meetings of the governing body of the CBD – the Conference of the Parties (COP). At the First meeting (Nassau, Bahamas, 1994), it was confirmed that the planet’s essential goods, ecological functions and services depend on a variety and variability of genes, species, populations and ecosystems (para. 1 of Annex to Decision I/8)³, and at the Second meeting (Jakarta, Indonesia, 1995), the ecosystem approach was recognized as the basis for action under the CBD (Decision II/8).⁴ The Fifth meeting of the COP (Nairobi, Kenya, 2000) was of particular importance for the development of the ecosystem approach, as it adopted Decision V/6,⁵ which contains a description of the ecosystem approach, a list of its principles and practical recommendations for their application (sections ‘A’, ‘B’ and ‘C’).

Thus, the ecosystem approach introduced by the CBD is a means of examining the relationships within ecosystems with other systems and people for whom ecosystems are habitats and livelihoods. It involves moving from a one-sided view of marketable species – for example, accessing forests solely as a source of timber – to a multifaceted view, working on different spatio-temporal scales, using all available knowledge

²Convention on Biological Diversity (adopted on 5 June 1992). Available online: <https://www.cbd.int/convention/text> [Accessed on 25 June 2021]

³ CBD (1994). Report of the First Meeting on the COP to the CBD (UNEP/CBD/COP/1/17).

⁴ CBD (1995). Report of the Second Meeting of the COP to the CBD (UNEP/CBD/COP/2/19).

⁵ CBD (2000). Report of the Fifth Meeting of the COP to the CBD (UNEP/CBD/COP/5/23).

and involving relevant stakeholders. This approach aims to ensure the long-term sustainability of biodiversity and the significant development of today's understanding of sustainable nature (Perelet, 2006).

Returning directly to IAS, it should be noted that at its Fourth meeting (Bratislava, Slovakia, 1998), the COP invited the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) to develop guidelines for the prevention of the introduction of alien species and mitigation of its consequences and report on it at its Fifth meeting (section 'C' of Decision IV/1)⁶, and in Annex II to Decision IV/16⁷ it announced a comprehensive consideration of alien species as one of the items on its Sixth meeting.

In turn, at a meeting in Montreal (Canada), 2000, SBSTTA developed draft of the above guidelines,⁸ which are fully reflected in the Annex to Decision V/8 of the COP.⁹ This Annex establishes a definition of the terms 'alien species', which refers to a species that occurs outside its normal distribution, and 'alien invasive species', an alien species that threatens ecosystems, natural habitats or species, and declares that all measures to deal with IAS should be based on the ecosystem approach, in line with the relevant provisions of the CBD and the decisions of the COP (Guiding principle 3 'Ecosystem approach').

The most thorough provisions on IAS in general and the ecosystem approach as the basis in dealing with such species, in particular, were enshrined in Decision VI/23 'Alien Species that Endanger Ecosystems, Habitats or Species',¹⁰ adopted at the Sixth meeting of the COP (the Hague, the Netherlands, 2002), and in the Annex of which 'Guiding Principles of Preventing Invasions and Mitigating the Influence of Alien Species that Endanger Ecosystems, Habitats or Species' are contained.

Decision VI/23 sets out the basic framework for the legal regulation of the prevention of the negative impact of IAS on ecosystems. As stated in the Preamble to it, such species are a major threat to biodiversity, especially in geographically and evolutionarily isolated ecosystems, such as small island developing States, and that the risk may increase with the expansion of world trade, transport, tourism and climate change.

In accordance with the 'Guiding Principles', 'alien species' refers to a species, subspecies or lower taxon, introduced outside its natural past or present distribution; includes any part, gametes, seeds, eggs, or propagules of such species that might survive and subsequently reproduce, while 'invasive alien species' means an alien species whose introduction and/or spread threaten biological diversity (note 57). Some of the measures envisaged by Decision VI/23 on the prevention of the harmful effects of IAS on ecosystems can be proposed. So, in the process of implementing the 'Guiding Principles' and developing, reviewing and implementing national strategies and action plans for biodiversity conservation in order to address threats of IAS to the biodiversity, it is necessary to raise awareness among policy makers at all levels of government and in the private sector, officials in quarantine, customs and other border services, as well as among the general public, about the threats posed to biodiversity by IAS, goods and services provided by ecosystems, and the means to deal with such threats, and interact with trading partners and neighboring countries, at the regional level, and, as appropriate, with other countries to address the threats posed by IAS to the biodiversity of ecosystems located in two or more countries and to migratory species, as well as to address issues of common regional interest (paras 'e' and 'g' of part 10).

It also emphasizes that priority measures should consider the need to include IAS provisions in national biodiversity strategies and action plans, as well as in sectoral and intersectoral policies, strategies and plans, in order to take into account, the ecosystem approach and ensure the comprehensive implementation of

⁶ CBD (1998). Report of the Fourth Meeting of the COP to the CBD (UNEP/CBD/COP/4/27).

⁷ CBD (1998). Report of the Fourth Meeting of the COP to the CBD (UNEP/CBD/COP/4/27).

⁸ SBSTTA (2000). Item 3.4 of the Provisional Agenda. Alien Species: Guiding Principles for the Prevention, Introduction and Mitigation of Impacts (UNEP/CBD/SBSTTA/5/5).

⁹ CBD (2000). Report of the Fifth Meeting of the COP to the CBD (UNEP/CBD/COP/5/23).

¹⁰ CBD (2002). Report of the Sixth Meeting of the COP to the CBD (UNEP/CBD/COP/6/20).

national strategies and IAS action plans in accordance with the calls set out in decision V/8 of the COP (para. 'd' of part 12). A special place in Decision VI/23 is given to recommendations to facilitate research and assessments on: the parameters of invasive species and the vulnerability of ecosystems and habitats to IAS, and the impact of climate change on these parameters; measures to increase the capacity of ecosystems to resist IAS and recover from their invasions; criteria for assessing the risks associated with the introduction of IAS into biological diversity at the genetic, species and ecosystem levels (paras 'a', 'g' and 'i' of part 24). In addition, the application of these 'Guiding Principles' should pay due attention to the fact that ecosystems are dynamic over time and, therefore, the natural distribution of species can change without human intervention. One of the main guidelines is that measures to deal with IAS should be based accordingly on the ecosystem approach described in Decision V/6 of the COP (Principle 3). Research on IAS should include careful detection of IAS and documentation of: a) history and ecology of the invasion (origin, routes of entry and time frame); b) biological characteristics of IAS; and c) the associated effects on the ecosystem, species and genetic level, as well as the social and economic consequences and the nature of their changes over time (Principle 5).

Thus, emphasis is placed on cooperation with relevant organizations, which will facilitate the further implementation of Art. 8 h) of the CBD, including through the development of guidelines, sound methods and pilot projects to address the threats posed by IAS to certain habitats, including means to enhance the capacity of ecosystems to resist or recover from IAS (part 16).

Issues against IAS were discussed at almost all subsequent meetings of the COP to the CBD, in particular, the Seventh (Decision VII/13), the Eighth (Decision VIII/27), the Tenth (Decision X/2), the Eleventh (Decision XI/28), the Twelfth (Decision XII/17), the Thirteenth (Decision XIII/13) and the Fourteenth (Decision XIV/11) meetings. For example, the Tenth meeting (Nagoya, Japan, 2010) approved the Strategic Plan for Biodiversity 2011-2020 'Living in harmony with nature' and the Aichi Biodiversity Targets (Annex to Decision X/2).¹¹ The Plan contains a list of strategic objectives in this area, including taking measures to address the causes of biodiversity loss, as well as reducing the direct burden on it (paras 'a' and 'b' of part 10). Targets 8 and 9 of 'Strategic Objective B. Reduction of direct pressures on biodiversity and promotion of sustainable use' envisage that by 2020 environmental pollution, including from excess nutrients, should be brought to levels that do not cause harm the functioning of ecosystems and biodiversity, and the identification and prioritization of IAS and their distribution routes, priority species will be regulated or destroyed, and measures will be taken to regulate movement routes to prevent their introduction and implementation.

Additionally, a number of acts have been developed to implement the CBD and to actively combat harmful species at the international level, including: The Global Invasive Species Programme, 1999, The Global Strategy on Invasive Alien Species, 2001, The European Strategy on Invasive Alien Species, 2002, etc. For instance, the Global Strategy on Invasive Alien Species states that these species are currently recognized as one of the greatest biological threats to the ecological and economic well-being of our planet, as IAS are alien species whose creation and distribution threaten ecosystems, plant species or their habitats, harm the economy or the environment (McNeely *et al.*, 2001). That is why the European Strategy on Invasive Alien Species states that transboundary and subregional cooperation is a priority, as many of these territories cross the national borders. That is, ensuring the application of a precautionary approach to IAS decision-making in accordance with international law, as part of a risk analysis that takes into account the possible effects on internal biodiversity and ecosystem functions, and the need to promote an ecosystem approach as an appropriate basis for assessing planned actions and policies applies to IAS (Genovesi and Shine, 2004).

At the regional level, common legal procedures ensure the control of pests and diseases that adversely affect the condition of plants, animals, life and human health, in contrast to IAS that threaten biodiversity and

¹¹ CBD (2011). Strategic Plan for Biodiversity 2011-2020 and the Aichi Biodiversity Targets. Decision X/2 (UNEP/CBD/COP/10/27).

ecosystem functions. The above document provides for a number of key actions, including: empowering the competent authorities to take appropriate mitigation measures; revision of lists of species and conservation strategies to ensure legal protection against IAS; make better use of existing legal measures (for example, to control the spread of weeds); establishing responsibilities within reasonable limits for landowners, users and relevant stakeholders to prevent or control the further spread of IAS, etc.

Since an ecosystem is a set of species of living organisms that have adapted to living in a certain environment, that is why legal regulation and measures to regulate the negative impact of IAS on ecosystems should be based on the main types of ecosystems. It will be recalled that the CBD distinguishes terrestrial, marine and other aquatic ecosystems. The division into main types of ecosystems corresponds to the thematic areas studied under the CBD. The use of these spatial units for analysis ensures consistent reporting under the CBD and also allows for thematic, regional and global reviews. It is expected that countries will use more detailed data on key typical ecosystems for practical purposes. Such a hierarchical ecosystem allows for general reviews at different levels, both in individual countries and at the inter-State level. The main types of ecosystems include: marine and coastal areas, forests, freshwater bodies, tundra, arid and sub-humid lands, meadows, agricultural lands, and built-up lands, etc.¹²

It should be noted that issue of preserving ecosystems from IAS at the international level has been consolidated not only in the CBD and decisions of its COP, but also in other important international agreements. For example, the Framework Convention on the Protection and Sustainable Development of the Carpathians,¹³ which in the context of implementing ecosystem approach has established certain requirements for many spheres, including preservation and sustainable use of biological and landscape diversity (Art. 5). Protocols to this Convention have been adopted in various years, which also reflect certain aspects of the ecosystem approach, in particular the control of IAS. Thus, in the Protocol on Conservation and Sustainable Use of Biological and Landscape Diversity¹⁴ IAS are recognized as the cause of deterioration of quality and value of environmental functions, its degradation, their next definition is provided (‘non-native species introduced intentionally or unintentionally outside their natural habitats where they have settled, reproduced and disseminated in ways that harm the environment into which they have been imported’) (Art. 2 f and j), and the Parties are obliged to cooperate in order to prevent the import, control or destruction of IAS that threaten ecosystems, habitats or local species of the Carpathians (para. ‘b’ of Art. 1), prevention of their introduction or release (Art. 13), etc.

The regulatory framework for IAS is also being actively developed by the European Union, which is a Party to the CBD and has certain obligations under Art. 8 h) to prevent the introduction of alien species that endanger ecosystems, habitats or species. Thus, Council Directive 92/43/EEC of 21 May 1992 on the Conservation of Natural Habitats and of Wild Fauna and Flora (the Habitats Directive)¹⁵ aims to promote the maintenance of biodiversity, taking account of economic, social, cultural and regional requirements, emphasizing the need to adopt provisions for additional measures for the re-introduction of certain natural species of flora and fauna and the possible introduction of alien species.

¹² CBD (2003a). Monitoring and indicators: designing national-level monitoring programmes and indicators. (UNEP/CBD/SBSTTA/9/10).

¹³ The Framework Convention on the Protection and Sustainable Development of the Carpathians (signed on 22 May 2003). Available online: <http://www.carpathianconvention.org/text-of-the-convention.html> [Accessed on 25 June 2021]

¹⁴ The Protocol on Conservation and Sustainable Use of Biological and Landscape Diversity to the Framework Convention on the Protection and Sustainable Development of the Carpathians (adopted on 19 June 2008). Available online: http://www.carpathianconvention.org/tl_files/carpathiancon/Downloads/01%20The%20Convention/1.1.2.1%20BiodiversityProtocolFinalsigned.pdf [Accessed on 25 June 2021]

¹⁵ Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, OJ L 206, 22.7.1992, p. 7–50.

In support of the achievement of the aims of the Habitats Directive, as well as the Water Framework Directive¹⁶, the Marine Strategy Framework Directive¹⁷ and the Birds Directive¹⁸, EU Regulation 1143/2014 of 22 October 2014 (on the prevention and management of the introduction and spread of invasive alien species)¹⁹ approved the relevant requirements for risk assessment, procedures for measures to prevent the penetration of IAS into the EU, rapid identification and removal of new IAS, management of species that are already widespread in the EU, etc. The document states that a significant proportion of alien species can become invasive and have a serious negative impact on biodiversity and related ecosystem services, as well as other social and economic consequences that should be prevented. About 12,000 species in the EU and other European countries are alien, of which about 10-15% are invasive.²⁰ In accordance with this regulation, a list of IAS for EU countries was subsequently adopted Commission Implementing Regulation (EU) 2016/1141 of 13 July 2016 adopting a list of invasive alien species of Union.²¹

It is worth noting that the EU Regulation 1143/2014 and its monitoring were discussed in detail by Krämer (2021), in order to see, what lessons can be learnt from the cooperation and concertation of the different states with regard to IAS. The author concludes that in order to reach results, within the EU or at international level, close cooperation between neighbouring countries is necessary. It is not sufficient to leave the implementation and effective application of international agreements or of EU legislation to the goodwill of the countries concerned. The COP to the CBD as well as the European Commission will, therefore, have to do more to ensure an effective application of the existing provisions (Krämer, 2021).

To date, a group of scientists was a comprehensive work on developing a list of invasive alien species likely to threaten biodiversity and ecosystems in the European Union. They present these species highlighting the potential negative impacts and the most likely biogeographic regions to be affected by these potential IAS. Furthermore, researchers recommend conducting regular reviews of both the species rankings and future potential IAS that could threaten the EU, as demanded by the EU Regulation (Roy *et al.*, 2019). For this purpose, dedicated species accounts should be considered and kept updated in the species data repository formally endorsed by the EU Regulation i.e., EASIN – European Alien Species Information Network (Roy *et al.*, 2019).

Concluding the common review of international and European experience in the legal regulation of the introduction of the ecosystem approach in the fight against IAS, it should be mentioned that an extraordinary event in the field of EU biodiversity and ecosystems was the adoption on 20 May 2020 by the European Commission (2020) of a new EU Biodiversity Strategy for 2030: Bringing nature back into our lives,²² which is called ‘the most ambitious environmental document in human history’ and according to which EU countries seek not only to preserve their biodiversity and related ecosystem services, but also to become a world leader in nature conservation and restoration for a decade (EU Biodiversity Strategy, 2020). The Strategy contains specific commitments and actions to be implemented in the EU by 2030, including control

¹⁶ Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, OJ L 327, 22.12.2000, p. 1–73.

¹⁷ Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy, OJ L 164, 25.6.2008, p. 19–40.

¹⁸ Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds, OJ L 20, 26.1.2010, p. 7–25.

¹⁹ Regulation (EU) No. 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species, OJ L 317, 4.11.2014, p. 35–55.

²⁰ Regulation (EU) No. 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species, OJ L 317, 4.11.2014, p. 35–55.

²¹ Commission Implementing Regulation (EU) 2016/1141 of 13 July 2016 adopting a list of invasive alien species of Union concern pursuant to Regulation (EU) No 1143/2014 of the European Parliament and of the Council C/2016/4295, OJ L 189, 14.7.2016, p. 4–8.

²² Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions EU Biodiversity Strategy for 2030 Bringing nature back into our lives, COM/2020/380 final

of IAS. It is noted that IAS can significantly undermine efforts to protect and restore nature, facilitate the outbreak and spread of infectious diseases, posing a threat to humans and wildlife. Of the 1,872 species now considered threatened in Europe, 354 are under threat from IAS. Without effective control measures, the rate of invasion and the risks it brings to nature and health will continue to rise.²³

Ecosystem Approach in dealing with IAS in the Environmental Legislation of Ukraine

The main problem in developing legal mechanisms to regulate the prevention of IAS in national legislation is not taking into account all existing species of different ecosystems. The type of ecosystems to be invaded include freshwater, marine, terrestrial, etc., and the type of invaders include plants, animals, microorganisms, etc. In this context, it would be useful to give examples from some countries of the introduction of an ecosystem approach to the regulation of IAS at the national level.

For example, one of the means of public awareness used in USA is a list of IAS called ‘The Dirty Dozen’, which are some of the least desirable alien species in USA. Although these 12 species differ from each other in many ways, they all have one thing in common: they cause problems to native species and ecosystems. The species on this list represent many different organisms, a variety of ecosystems, and a wide geographical range, from Hawaii to Florida and from Maine to California (Wittenberg and Cock, 2001).

The next example is Canada, which in pursuance of Art. 8 h) of the CBD, that, in 1995, developed the Canadian Biodiversity Strategy, and in 2004, the Invasive Alien Strategy for Canada. Subsequently, the national IAS strategy led to the development of two action plans for terrestrial IAS plants and plant pests and aquatic IAS, respectively, as well as a national strategy for wildlife diseases (Smith, Bazely and Yan, 2013).

Particular attention needs to be paid to marine and freshwater ecosystems, which are considered very vulnerable to the invasion of alien species. That is why international instruments relating to the aquatic environment emphasize the need for precautionary measures related to the introduction of alien species (Shine, Williams and Gündling, 2000). Geographically isolated ecosystems are particularly vulnerable to invasive species. That is why it is necessary to cite the example of island States, for which the provision of an ecosystem approach is extremely important for the conservation of all biological diversity. The IAS is a major threat to the vulnerable marine, freshwater and terrestrial biodiversity of the Caribbean and to the people whose livelihoods depend on it. The Caribbean States have recognized the need for a regional strategy and have expressed interest in pooling their national efforts to implement Art. 8 h) of the CBD, which will lead to the joint development of the Global Environment Facility (GEF) funded project entitled ‘Mitigation the Threats of Invasive Alien Species in the insular Caribbean’. The aim of the project is to mitigate the threat to local biodiversity and the economy from IAS in the Caribbean islands, including terrestrial, fresh and marine ecosystems (Krauss, 2010). Therefore, the legal framework should provide a basis for regulating the invasion of alien species into any type of ecosystem, as well as for monitoring and managing their use wherever this occurs. However, today the legal regulation of terrestrial ecosystems is much broader than for coastal and marine environments or inland water ecosystems (Shine, Williams and Gündling, 2000).

While exploring the foundations of legal regulation of this issue in Ukraine, it should be noted that Ukraine, ratifying the CBD²⁴ and other environmental treaties, has undertaken international legal obligations to

²³ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions EU Biodiversity Strategy for 2030 Bringing nature back into our lives, COM/2020/380 final

²⁴ Law of Ukraine (1994). On Ratification of the Convention on Biological Diversity, Law of Ukraine 257/94-VR of 29 November (1994), Verkhovna Rada of Ukraine, 1994. Available online: <https://zakon.rada.gov.ua/laws/show/257/94-bp#Text> [Accessed on 25 June 2021]

preserve and restore natural ecosystems and the implementation of the ecosystem approach in national environmental policy and law, including dealing with IAS. Ukraine also has certain obligations for the conservation of biological diversity and natural ecosystems in the framework of the Association Agreement with the European Union,²⁵ including the implementation of the Habitats, Birds and Water Framework Directive (Annex XXX). However, according to experts, in the light of the newly adopted EU Biodiversity Strategy 2030, the full implementation of all objectives set by the Agreement will be insufficient to achieve Ukraine's indicators relevant in the EU after the adoption of the Strategy. Therefore, this document can be considered without achieving indicators of which further European integration steps will be difficult to imagine (EU Biodiversity Strategy, 2020).

The main strategic document of environmental orientation in Ukraine is the Law 'On Basic Principles (Strategy) of the State Environmental Policy of Ukraine for the period up to 2030',²⁶ which was adopted on 28 February 2019, and came into force on 1 January 2020. Adoption of this document was an important step towards the formation of a modern national environmental policy, as it is aimed at reviewing its priority tasks related to the signing of the Association Agreement between Ukraine and the EU, and ensuring gradual approximation of environmental legislation with the EU directives. This Strategy should become a reference point for further systematization of environmental legislation in the context of European integration processes (Getman *et al.*, 2019).

A comprehensive analysis of the provisions of the Strategy indicates that significant attention is paid in it to the conservation and restoration of ecosystems and the implementation of the ecosystem approach, since the ecosystem component is clearly manifested as the goal of the state environmental policy, as well as among the expected results of its implementation, since in accordance with Section VI in 2030 year, Ukraine must achieve such a level of balanced (sustainable) development, in which dependence on the use of non-renewable natural resources and environmental pollution will be reduced to ecosystemically acceptable levels.

The Strategy does not explicitly indicate the need to implement an ecosystem approach in dealing with IAS, but it states that one of the tasks to reduce environmental risks in order to minimize their impact on ecosystems (Objective 4) is the prevention of the spread of invasive species and the control of their occurrence and distribution in natural ecosystems, including marine ones.

Thus, it can be assumed that the application of the ecosystem approach in the fight against IAS follows from a broad formulation of the goal of the State environmental policy, which is based on the need to implement this approach in all spheres of socio-economic development. Nevertheless, it is obvious that this wording needs further clarification, which, incidentally, is stated in the recommendations of the parliamentary hearings approved on January 14, 2020 on the topic: 'Priorities of environmental policy of the Verkhovna Rada of Ukraine for the next five years',²⁷ in which it is recommended that the relevant Ministry together with the central executive authorities should consider the specification and clarification of the above Law, mechanisms to ensure its implementation, as well as streamlining environmental legislation of Ukraine by systematizing it for each of the natural resources with the ecosystem approach.

²⁵ Association Agreement between the European Union and its Member States, of the one part, and Ukraine, of the other part, Official Journal of the European Union L 161/3, 29.5.2014. Available online: [https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:22014A0529\(01\)&from=EN](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:22014A0529(01)&from=EN) [Accessed on 25 June 2021]

²⁶ Law of Ukraine (2019). On Basic Principles (Strategy) of the State Environmental Policy of Ukraine for the period up to 2030, Law of Ukraine 2697-VIII of 28 February (2019), Verkhovna Rada of Ukraine, 2019. Available online: <https://zakon.rada.gov.ua/laws/show/2697-19#Text> [Accessed on 25 June 2021]

²⁷ Resolution of the Verkhovna Rada of Ukraine (2020). On the Recommendations of the Parliamentary Hearings on the Topic: 'Priorities of the Environmental Policy of the Verkhovna Rada of Ukraine for the Next Five Years, Resolution of the Verkhovna Rada of Ukraine 457-IX of 14 January (2020), Verkhovna Rada of Ukraine, 2020. Available online: <https://zakon.rada.gov.ua/laws/show/457-20#Text> [Accessed on 25 June 2021]

Issues of IAS control, albeit briefly, are enshrined in the Concept of the National Biodiversity Conservation Program for 2005-2025.²⁸ It provides for measures to preserve flora and fauna, along with their groups, complexes and ecosystems, and notes that the implementation of this Program will allow to recreate degraded ecosystems, promote the conservation of endangered species, prevent the introduction of species characteristic of other natural regions that may adversely effect on ecosystems, local species or public health.

The latest strategic document, which is likely to replace or supplement the previous one, should be the Biodiversity Strategy to 2030, which is currently being developed and will be the basis for all environmental decisions. This strategy will not only become a comprehensive document aimed at biodiversity conservation but will also demonstrate a European approach to nature protection in Ukraine.²⁹ The objectives of the Strategy are: ensuring monitoring of the state of biodiversity in Ukraine; introduction of the concept of ecosystem services; formation of an integrated approach to the conservation of species and the fulfillment of international obligations for the conservation of biodiversity. We hope that due attention in the Strategy is paid specifically to the issues of conservation and restoration of ecosystems and the implementation of the ecosystem approach in dealing with IAS.

Equally important in this area is the draft order of the Cabinet of Ministers of Ukraine ‘On approval of the National Strategy for the management of invasive alien species of flora and fauna in Ukraine until 2030’,³⁰ designed to improve state environmental policy to prevent penetration and control of introduction of IAS into natural ecosystems, destruction and mitigation (minimization) of adverse effects of such species on natural ecosystems, economic activity and human health (Art. 2). Within this aim, the following objectives and tasks are identified:

1. Raising awareness and scientific and methodological support of measures for the management of IAS.

Tasks within this objective:

- conducting special research on the ecological and biological properties of alien species and identifying potential IAS;
- development of criteria for assigning species to the category of IAS and assessing the level of their impacts on biodiversity, ecosystems, public health and economic activity;
- approval and periodic updating of lists of IAS by level of danger for local species, ecosystems and human health by individual taxonomic units or their groups; and
- creation of a database on IAS by all taxonomic groups, etc.

2. Improving public policy, regulatory framework and institutional capacity to prevent the intrusion, destruction, control of the introduction of IAS into natural ecosystems and mitigate (minimize) their adverse effects. The following tasks are distinguished within this objective:

- taking into account in state strategic documents the issues of IAS management;
- formation of the regulatory framework for the effective prevention of penetration and control over the spread of IAS, their destruction, minimizing the impact or mitigation of the consequences of the invasion;

²⁸ Order of the Cabinet of Ministers of Ukraine (2004). On Approval of the Concept of the National Biodiversity Conservation Program for 2005-2025. Order of the Cabinet of Ministers of Ukraine 675-r of 29 September (2004), Verkhovna Rada of Ukraine, 2004. Available online: <https://zakon.rada.gov.ua/laws/show/675-2004-p#Text> [Accessed on 25 June 2021]

²⁹ V Ukraini rozpochato rozrobku proiektu Stratehii okhorony bioriznomanittia do 2030 roku. Available online: <https://spilno.org/news/v-ukraini-rozpochato-rozrobku-proyektu-stratehii-okhorony-bioriznomanittya-do-2030-roku> [Accessed on 25 June 2021]

³⁰ Draft order of the Cabinet of Ministers of Ukraine (2019). On Approval of the National Strategy for the Management of Invasive Alien Species of Flora and Fauna in Ukraine for the Period up to 2030. Official portal of the Ministry of Environmental Protection and Natural Resources of Ukraine (2 May 2019). Available online: <https://menr.gov.ua/news/33368.html> [Accessed on 25 June 2021]

- approval of criteria for classifying species as IAS, assessment of their impact on biological diversity and economic activity, public health, structural and functional organization of ecosystems; and
- approval of lists of IAS, etc.

3. Development and implementation of practical measures to prevent the penetration, control of the spread, destruction and mitigation of the effects of IAS invasion at the local and state levels, which provides for the following tasks:

- development and approval of a system (plans) of measures to prevent the penetration, control of the spread, destruction and mitigation of the consequences of the invasion of IAS at the local and state levels; and
- development of measures to control the spread and control of IAS within the territories and objects of the nature reserve fund in order to preserve the natural state of ecosystems, rare aboriginal species and groups.
- determination of responsible executors for the implementation of such measures.

It is assumed that the achievement of the objectives of the National Strategy will be carried out in two stages: the first – 2020-2023, and the second – 2023-2030. This Strategy will become a book of rules for the treatment of IAS of flora and fauna in Ukraine. It will establish legal mechanisms for the management of IAS, in particular, regulations, guidelines will be approved, as well as appropriate amendments to existing regulations on agriculture, fisheries, forestry, hunting, housing and communal services, transport infrastructure, natural reserve fund, veterinary medicine, quarantine and plant protection, sanitary and epidemiological well-being of the population, customs.³¹

Thus, it is observed that the National Strategy provides the basic principles for preventing the negative impact of IAS on biodiversity and ecosystems of Ukraine, and, therefore, its adoption will facilitate the implementation of the CBD and other international and European instruments in this area into national legislation. However, the National Strategy, essentially needs further refinement, taking into account the ecosystem approach. Although among the national strategic documents, there is a positive trend towards the recognition of the ecosystem approach in dealing with IAS, the situation with the recognition of this issue at the level of current regulatory environmental legislation of Ukraine is much more complicated.

It should be noted that the key environmental law in Ukraine ‘On Environmental Protection’³² does not contain any rules for the preservation and restoration of natural ecosystems, the introduction of an ecosystem approach and the prevention of negative impacts of IAS on biodiversity and ecosystems. In addition, according to this Law, the ecosystem is not recognized as an object of legal protection at all (Art. 5), just as it not only lacks definitions, but also never mentions the words ‘ecosystem’ and ‘invasive alien species’, which are a significant shortcoming that needs to be addressed as soon as possible. Such legal uncertainty creates a significant barrier to the introduction of an ecosystem approach to IAS for all ecosystems, not to mention the need to take into account certain features of legal regulation regarding their different types. Also, the Land Code of Ukraine does not contain any legal norms on ecosystems³³, although the ecosystem definition of ‘land’ is enshrined in the Law of Ukraine ‘On Land Protection’³⁴, according to which land is a land surface with soils, minerals and other natural elements that are organically combined and function with

³¹ Minprirody rozroblylo Natsionalnu stratehiu shchodo povodzhennia z vydamy-vselentsiamy invaziinymy chuzhoridnymy vydamy flory i fauny v Ukraini na period do 2030 roku. Available online: <https://mepr.gov.ua/news/33369.html#:~:text=Інвазійні> [Accessed on 25 June 2021]

³² Law of Ukraine (1991). On Environmental Protection, Law of Ukraine 1264-XII of 25 June (1991), Verkhovna Rada of Ukraine, 1991. Available online: <https://zakon.rada.gov.ua/laws/main/1264-12#Text> [Accessed on 25 June 2021]

³³ Law of Ukraine (2001). Land Code of Ukraine, Law of Ukraine 2768-III of 25 October (2001), Verkhovna Rada of Ukraine, 2001. Available online: <https://zakon.rada.gov.ua/laws/show/2768-14#Text> [Accessed on 25 June 2021]

³⁴ Law of Ukraine (2003). On Land Protection, Law of Ukraine 962-IV of 19 June (2003), Verkhovna Rada of Ukraine, 2003. Available online: <https://zakon.rada.gov.ua/laws/main/962-15#Text> [Accessed on 25 June 2021]

it (Art. 1). Neither the ecosystem approach nor IAS are mentioned in the Water Code of Ukraine³⁵, although in the Procedure for state water monitoring³⁶ significant attention has been paid to the protection of ecosystems from the negative impact of IAS.

It would seem that the key role in this area should belong to floristic and faunal legislation, especially since the list of activities related to environmental measures includes measures to prevent the introduction and spread of alien plant species in natural ecosystems. Instead, in the Law of Ukraine ‘On Flora’³⁷ there are no references to the ecosystems or ecosystem approach, only the ecosystem definitions of ‘flora’ (the totality of all plant species, as well as fungi and their groups in a given area) and ‘natural plant communities’ (a set of plant species that grow within certain areas and are in close interaction with each other and with environmental conditions). This Law provides a definition of ‘introduction’ (artificial introduction of a species into the plant world outside its natural range) (Art. 3) and states that the requirements for the introduction of wild plants are determined by the relevant Regulation, the responsibility for the development and approval of which rests with the relevant Ministry (part 3 of Art. 33). In a very general way, the ban on the introduction of IAS is provided for the legal protection and use of greenery in human settlements, as in accordance with paragraphs 6 and 7 of Section IV of the Standard Rules for Landscaping a Settlements³⁸ of aboriginal flora and their decorative forms are used for landscaping such areas, while the use of plant IAS is prohibited.

In contrast to the analyzed acts, the Forest Code of Ukraine³⁹ shows some tendency to implement an ecosystem approach, in connection with the implementation of some international acts.⁴⁰ In Art. 1 of this Code, the ecosystem definition of ‘forest’ is enshrined, which means a type of natural complexes (ecosystem) combining mainly woody and shrubby vegetation with relevant soils, grasses, fauna, microorganisms and other natural components that are interrelated, and linked in their development, affect each other and the environment. In addition, this article was supplemented by ecosystem definitions of natural forests (natural forest ecosystems), virgin forests (virgin forest ecosystems) and quasi-virgin forests (conditionally virgin forest ecosystems) (parts 7-9). At the same time, only one article in the Code (Art. 85 ‘Conservation of biodiversity in forests’) is devoted to the issue of combating IAS, according to which such conservation is carried out by forest owners and permanent forest users at the genetic, species, population and ecosystem levels by, in particular, prevention of genetic contamination of aboriginal species and invasions of introduced species into natural ecosystems.

A similar situation can be traced with regard to faunal legislation. The Law of Ukraine ‘On Fauna’⁴¹ does not contain a definition of ‘fauna’, but recognizes its ecosystem character, because not only objects of fauna

³⁵ Law of Ukraine (1995). Water Code of Ukraine, Law of Ukraine 213/95-VR of 6 June (1995), Verkhovna Rada of Ukraine, 1995. Available online: <https://zakon.rada.gov.ua/laws/main/213/95-вр#Text> [Accessed on 25 June 2021]

³⁶ Resolution of the Cabinet of Ministers of Ukraine (2018). On approval of the Procedure for the implementation of state monitoring of waters, Resolution of the Cabinet of Ministers of Ukraine 758 of 19 September (2018), Verkhovna Rada of Ukraine, 2018. Available online: <https://zakon.rada.gov.ua/laws/show/758-2018-р#Text> [Accessed on 25 June 2021]

³⁷ Law of Ukraine (1999). On Flora, Law of Ukraine 591-XIV of 9 April (1999), Verkhovna Rada of Ukraine, 1999. Available online: <https://zakon.rada.gov.ua/laws/main/591-14#Text> [Accessed on 25 June 2021]

³⁸ Order of the Ministry of Regional Development, Construction, Housing and Communal Services of Ukraine (2017). On Approval of the Model Rules for the Improvement of the Territory of a Settlement, Order of the Ministry of Regional Development, Construction, Housing and Communal Services of Ukraine 310 of 27 November (2017), Verkhovna Rada of Ukraine, 2017. Available online: <https://zakon.rada.gov.ua/laws/show/z1529-17#Text> [Accessed on 25 June 2021]

³⁹ Law of Ukraine (1994). Forest Code of Ukraine, Law of Ukraine 3852-XII of 21 January (1994), Verkhovna Rada of Ukraine, 1994. Available online: <https://zakon.rada.gov.ua/laws/main/3852-12#Text> [Accessed on 25 June 2021]

⁴⁰ Law of Ukraine (2017). On Amendments to Certain Legislative Acts of Ukraine on the Protection of Virgin Forests under the Framework Convention for the Protection and Sustainable Development of the Carpathians, Law of Ukraine 2063-VIII of 23 May (2017), Verkhovna Rada of Ukraine, 2017. Available online: <https://zakon.rada.gov.ua/laws/show/2063-19#Text> [Accessed on 25 June 2021]

⁴¹ Law of Ukraine (2001). On Fauna, Law of Ukraine 2894-III of 13 December (2001), Verkhovna Rada of Ukraine, 2001. Available online: <https://zakon.rada.gov.ua/laws/show/2894-14#Text> [Accessed on 25 June 2021]

(wild animals, their parts and products of their vital activity), but also their habitat and migration routes are under protection (Art. 3). Moreover, Art. 36 of this Law, which determines the content of wildlife protection, stipulates that such protection provides a comprehensive approach to studying the state, development and implementation of measures to protect and improve the ecological systems in which the wildlife is located and is an integral part (part 2). At the same time, one of the ways to protect animals is to prevent the invasion of alien species of wild animals and to take measures to prevent negative consequences in the event of their accidental penetration (Article 37).

Certain reservations regarding IAS are also contained in the Law of Ukraine 'On Aquaculture'.⁴² It provides definitions of aquaculture objects (aquatic organisms used for breeding, keeping and cultivation in aquaculture conditions), their introduction (activity on the introduction of aquatic organisms (introducers) into water bodies (their parts) located outside their natural habitat) and alien species of aquatic organisms (species or subspecies of aquatic biological resources that appear outside their natural range and outside the zone of their natural potential distribution) (Art. 1). Also it imposes on aquaculture entities the obligation to prevent unauthorized, including accidental, ingress of alien and non-native species into water bodies (parts thereof) (part 2 of Art. 5), and in the case of use of these species in the field of aquaculture to ensure their uncontrolled spread in new habitats, the absence of negative impact on the state of populations of local species of aquatic biological resources and the conditions of functioning of aquatic ecosystems (part 1 of Art. 20).

Conclusion

The study concludes that, at the international level, the ecosystem approach can rightly be considered as the basis for combating IAS, which is explicitly stated in Decision VI/23 of the COP to the CBD. EU environmental policy also aims to regulate the implementation of the ecosystem approach to the IAS, as evidenced by the Biodiversity Strategy 2030, which pays due attention to the implementation of the ecosystem approach to achieve its objectives, including the control of the IAS.

Having ratified the CBD, Ukraine has taken international legal obligations to preserve and restore natural ecosystems and the implementation of the ecosystem approach in environmental policy and law. Analysis of Ukrainian environmental legislation shows that a positive trend towards the recognition of the ecosystem approach in dealing with IAS is observed primarily among national environmental strategic documents. Also important in this area should be the Biodiversity Strategy until 2030 and the National Strategy for the management of invasive alien species of flora and fauna in Ukraine until 2030, which are currently in the process of development and approval.

In contrast to the specified strategic documents, in other acts of Ukrainian environmental legislation, in particular in the Law of Ukraine 'On Environmental Protection' and resource legislation (Land, Water, Forest Codes of Ukraine, as well as the laws of Ukraine 'On Flora', 'On Fauna', etc.), the issues of IAS control on the basis of the implementation of the ecosystem approach are regulated in fragments and inconsistently and therefore need significant reform.

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⁴² Law of Ukraine (2012). On Aquaculture, Law of Ukraine 1593-VI of 18 September (2012), Verkhovna Rada of Ukraine, 2012. Available online: <https://zakon.rada.gov.ua/laws/main/5293-17#Text> [Accessed on 25 June 2021]

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Authors' Declarations and Essential Ethical Compliances

Authors' Contributions (in accordance with ICMJE criteria for authorship)

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Collected the data	Yes	Yes
Contributed to data analysis & interpretation	Yes	Yes
Wrote the article/paper	Yes	Yes
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