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Some Aspects of the Impact of Invasive Plants in Romania

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Abstract: In a larger or smaller geographical area, before human activity intervened, the distribution of plant and animal species is the result of hundreds of millions of years of evolution. Through various anthropogenic activities, this distribution has been greatly disrupted, introducing intentionally or unintentionally a number of plant or animal species in geographical areas where they would not have existed without human intervention. So this ecological balance achieved by nature in millions of years, in geological times, is threatened and destroyed by man in a very short time, years or at most decades. There is no single, unanimously accepted definition of invasive species. Most agree that the invasive species is introduced into a geographical area other than the one from which the species originated and, as a result, this species finds the conditions to spread at high speed, to the detriment of some native species, generating ecosystem problems, sometimes very large. Other specialists make a clear difference in terms of non-native species, calling exotic species, those that are present in new ecosystems, do not cause disturbances and invasive species, ie species that reach other ecosystems, cause their dysfunctions. As for invasive plants, they obviously do not have their own mobility and their invasive appearance is less obvious than in the case of invasive animal species. However, the effects of these invasive plants are often severe, and are not limited to ecological aspects but, directly or indirectly, the effects can be even serious at the economic level or in terms of human health. The Research Institute for Nature and Forest (INBO) and the Center for Ecology and Hydrology (CEH) have compiled an inventory (DAISIE - Delivering Alien Invasive Species Inventories for Europe) which currently contains 12104 allogeneic taxa for Europe. This was made possible by an international

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effort involving more than 300 researchers and funded by European funds. The database is constantly updated, with over 1650 experts constantly working on this issue. The severity of this phenomenon is illustrated by the difficult to estimate costs of invasive species, in Europe the accounting of these costs being earlier, but they are tens of billions of euros annually. By comparison, combating invasive species costs the United States more than 80 billion euros a year. Romania is no exception, the problem of invasive plants being a very important aspect with negative implications for the economy and the quality of human life.

Keywords: non-native plant species; invasive species; monetary impacts; Romania

1. Introduction

There is no unique, generally accepted definition of invasive species. Most of the specialists in the field have agreed that the invasive species is introduced in a geographical area that is different from the original area of the species and, as a result, this species find the conditions that ensure its fast spreading, against some local species, generating problems for the ecosystems, of which some are very significant. Other specialists make a clear difference between alocton species, calling them exotic species, the ones present in new ecosystems, which cause no harm, and the invasive species, namely, the species that reach other ecosystems and cause malfunctions within them. The way through which the biological and reproduction features of the allogenic plants' species determine their invasiveness is one of the key questions within the biology of invasiveness.

In a larger or smaller geographic area, before human activity intervened, the distribution of plant and animal species is the result of hundreds of millions of years of evolution. Through various anthropogenic activities, this distribution has been greatly disrupted, intentionally or unintentionally introducing a number of plant or animal species into geographic areas where they would not have existed without human intervention. So this ecological balance achieved by nature for millions of years, in geological times, is threatened and destroyed by man in a very short time, years or at most decades.

2. Describing the Problem

Extensive inventories centralizing alien plant taxa have been carried out by the Global Naturalized Alien Flora (GloNAF) and the Global Register of Introduced and Invasive Species (GRIIS) on a global scale (Pyšek et al., 2017, van Kleunen et al.,

2015), as well as by Delivering Alien Invasive Species Inventories for Europe (DAISIE) the European - scale (Pyšek et al., 2009).

The total number of naturalized foreign taxa recorded in continental regions of the globe (Pyšek et al., 2017) is shown in Table 1.

Table 1. Total Numbers of Naturalized Alien Taxa Recorded in Mainland and Island Regions (Pyšek et al., 2017)

Region	Species no.
Europe	**4139**
Africa	**3563**
Asia (temperate)	**2416**
Asia (tropical)	**2138**
Australasia	**3886**
America	**5958**
South America	**3117**
Pacific North	**2935**
Antarctica	**159**
Total sp. Mainland	**12,345**
Total sp. Island	**8019**

It is worth noting that America followed by Europe are the continents with the largest number of exotic plant species on the globe.

The latest available version of the GloNAF database (https://glonaf.org) includes 13,939 taxa representing approximately 4% of the existing global flora and spatially covering 1,029 regions (including 381 islands).

The Institute for Nature and Forest Research (INBO) and the Center for Ecology and Hydrology (CEH) compiled the DAISIE inventory, which currently contains 12104 allogeneic taxa for Europe. This was made possible through an international effort involving more than 300 researchers and financed through European funds. The database is being constantly updated, with more than 1650 experts constantly working on this issue.

Arianoutsou et al. (2021) report 6250 wild species growing spontaneously in Europe. The main routes of primary introduction of these plants into Europe are related to accidental events from ornamental and horticultural activities, and the countries in north-western Europe seem to act as the main entry areas of foreign plants. At the same time, it appears that the number of new foreign plants in Europe has stabilized in recent decades.

According to Anastasiu & Negrean (2007), in Romania, the number of adventive plants amounts to 435 species, of which 384 are neophytes (88.3%) and 51 are archaeophytes (11.7%).

According to Sîrbu & Oprea (2011), the number of adventive plant species in Romania amounts to 671, of which 593 are neophytes (88.4%), 73 archaeophytes (10.9%) and 5 with uncertain status (0.7%). Among the 671 species, the authors believe that only 112 species can be considered invasive, considering their high ability to spread within nature.

An updated list, but considered partial by the authors, includes 130 invasive species (Anastasiu et al., 2019).

Sîrbu et al., (2021) mention that 9 of the 36 species of invasive plants of concern for the European Union (EC, 2019) according to EU Regulation 1143/2014, have been reported in Romania, but consider that they currently do not constitute a real threat to our country, but only in climate change scenarios for the 2070s.

A centralization of the national and European bibliography regarding invasive and potentially invasive alien plant species in Romania, developed by a group of Romanian researchers within the POIM project - *Appropriate management of invasive species in Romania, in accordance with EU Regulation 1143/2014 regarding prevention and management of the introduction and spread of invasive foreign species*, includes a number of 1174 titles, which emphasizes the interest of researchers in these phenomena that evolving rapidly and have important consequences.
(https://invazive.ccmesi.ro/wpcontent/uploads/2020/02/POIM_120008_Subactv.-1.1.1._Bibliografie.pdf)

3. The Impact of Invasive Plant Species

The impact of invasive plant species on biodiversity is irreversible and enormous. Invasive species have features that allow them to thrive in the area they invade and can dramatically alter the functioning of an ecosystem, they compete with other organisms for territory, some plants can hybridize with native species producing hybridized invasive species that are even more difficult to remove, they occupy the territories of local species, they can be toxic for certain species, they can suffocate natural habitats (water bodies, forests), they have no natural enemies that can control these species. At the ecosystem level, the impact of invasive plant species can

manifest itself on biodiversity in general, on the floristic composition or on the fauna, the main ecological factors, on the fodder potential of meadows, etc.

Invasive plant species often settle in extremely hard-to-reach areas (abandoned land, along roads, railways, canals, etc.) so that their eradication is done at extremely high costs, regardless of whether it is done by chemical or mechanical means (https://portals.iucn.org/library/sites/library/files/documents/2008-106.pdf).

Milanović et al. (2020) approached biological invasions both from the point of view of the positive effects of invasive foreign plants (the provision of associated ecosystem services), as well as the negative effects (the growth or creation of ecosystem deservices), all of these in correlation with the morphological and reproductive features of these plants. In addressing the problems created by invasive plants, the direction of action (positive/negative) and the strength of the impact must be considered. Knowing the services and disservice produced by invasive species for each socioeconomic and environmental sector impacted can be a tool for assessing the situation to prioritize management of the affected sectors. The same trait of an invasive species can affect a particular socioeconomic sector, but bring benefits to another sector.

A biodiversity conservation problem with consistent economic impact is represented by the presence of invasive species on the territory of protected areas. Of the 174 critically threatened European species on the IUCN Red List, 65 are at risk due to introduced species (Shine et al., 2010).

For Romania, numerous recent scientific works, available in international databases (Web of Science, Scopus, Science Direct and Google Scholar) indicate this situation in National Parks or other categories of protected areas of national or international interest.

Aquatic ecosystems are also vulnerable to invasions that can occur through high connectivity between habitats, particularly human-made waterways and shipping, as well as other anthropogenic pressures.

4. Monetary Impacts

Invasive plants frequently affect (positively or negatively) six socioeconomic and environmental sectors: agriculture, forestry, infrastructure, human health, aesthetic and recreation, and the effect on the environment (Milanović et al., 2020).

In this case, we can provide the case of the United States of America as an example, according to Stohlgren and Schnase (2006), the expenses related to agricultural losses, the control of invasive species, as well as the costs regarding human health (due to invasive species) amounted to more than 120 billion dollars. According to the same authors, at the European level, approximately 12 million euros were spent annually on measures to eradicate and control invasive species. Currently, however, the cost of eliminating or limiting the impact of invasive species is probably higher and includes other types of costs such as those related to informing the population, as well as costs of treating affected people (Stohlgren and Schnase, 2006).

Between 1992 and 2006, more than 180 projects summing up to 44 million EUR were implemented at the level of the European Union, aiming to stop or slow down the spread of invasive plant species.

Although the costs of controlling plant invasions have exponentially increased over time and substantial sums are being spent, there are still gaps in the reporting of the economic impact of invasive plants at the European and global level, indicating that these costs are significantly underestimated.

Costs regarding invasive species can be broken down into management expenses, the costs of damage that can be directly quantified, but also various indirect costs that are harder to quantify (the impact on human health, on native species or on ecosystem services, costs regarding the specialists' remuneration, etc.).

There are large differences between European countries in terms of the distribution of the types of costs and the percentages by which the affected socioeconomic sectors contribute to them. Such a situation of reliable costs, without taking into account estimates of non-reproducible costs and expected costs, is presented in figure 1, after Haubrock et al., 2021. This reconfirms the large share that the agricultural sector has in limiting the effects invasions, in most European countries.

Thus, considering the same source, in terms of only observed reliable costs, the UK reported a total of 6.89 billion USD, followed by European Russia with costs of 1.82 billion USD, then Romania (1, USD 61 billion) and Ukraine (USD 1.51 billion). These costs are related to GDP (gross domestic product) and place Romania among the Eastern European countries with high invasion costs, along Ukraine, Serbia, Moldova and Hungary (Figure 2) (Haubrock et al., 2021).

To get a global overview of the economic costs associated with biological invasions, researchers and the public have access to InvaCost - an up-to-date, comprehensive online database, based on a systematic and standardized methodology to collect

information from peer-reviewed articles and gray literature, while ensuring data validity and method repeatability for other inputs. (Diagne et al., 2020; https://www.invasivespeciescentre.ca/invacost-the-cost-of-invasive-species/).

Figure 1. Percentage Contributions of Different Sectors Affected and Types of Costs in European countries (Haubrock et al., 2021)

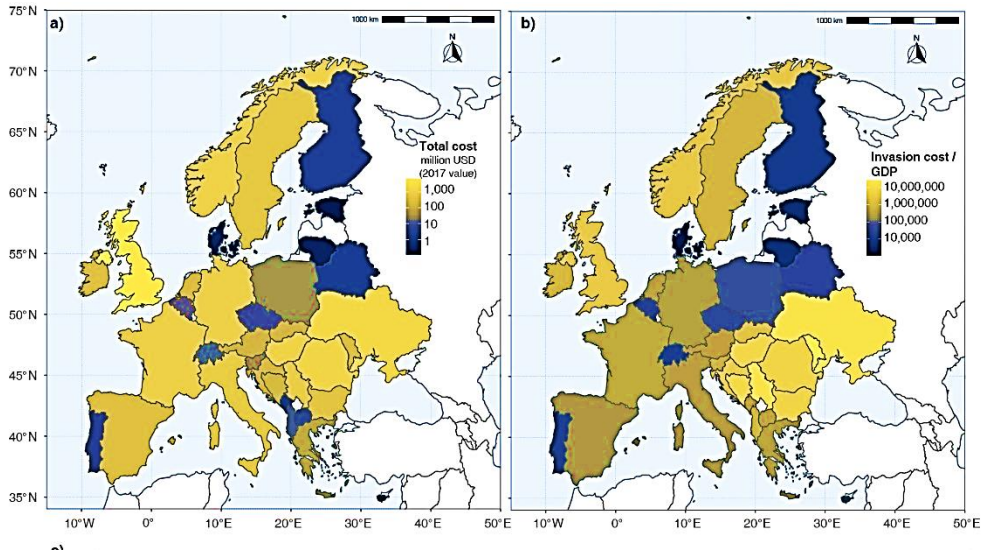

Figure 2. a) IAS costs in million USD for the period 1960–2020 for each European country where reliable, observed data were available, excluding non-reproducible cost estimations and expected costs; b) observed reliable total costs of IAS standardized by GDP. The data comes from InvaCost (Diagne et al., 2020; Haubrock et al., 2021)

Cuthbert et al., 2021, based on the processing of 5682 records published since 1971 in the InvaCost database, claimed that aquatic invasive species have probably costed the global economy at least 345 billion USD, of which only 6% is attributed to plants and only 1% came from marine species. The highest costs were reported in North America (48%) and Asia (13%) and were mainly the result of resource damage (74%); only 6% of recorded costs were from management. According to the same authors, of the 13,867 exotic species established worldwide, 26% are associated with aquatic habitats, compared with 74% associated with terrestrial habitats.

5. Conclusions

There is no doubt that invasive species have had, have and will increasingly, have a major and often harmful impact on wildlife and the economy.

In the context of recognizing the invasion of foreign (adventive) species as a major problem at the global level, as one of the greatest threats to biological diversity, the economy and human health, the studies of their characteristics are of great practical importance in the hard fight waged worldwide to stop the disastrous effects of plant

invasions. Biological species invasions are an important component of global environmental change.

In Romania, it is necessary to implement a much more rigorous monitoring of invasive species, to identify their areas to find the best solutions to fight them, to limit the negative economic and environmental effect. Total eradication of these is almost impossible.

The costs of implementing such procedures at the national level would be hundreds of times lower than the cost of fighting them or than the losses generated, e.g., in agriculture, due to the expansion of these invasive elements.

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