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NATURA 2000 HABITATS FROM OLTENIA AFFECTED BY INVASIVE AND POTENTIALLY INVASIVE SPECIES (I)

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Abstract

The present paper analyzes some forest habitats from Oltenia, which are affected by different invasive and potentially invasive species. The large number of habitats present on the territory of Oltenia did not allow their unitary research. In this paper, references are made only to the habitats 91M0, 91E0, 91Y0, and 92A0. The main factor that greatly contributed to the introduction and rapid spread of these invasive and potentially invasive plants in the analyzed habitats was zoo-anthropogenic. The changes that occurred affected both the structure and the functions of these habitats. Among the invasive and potentially invasive species identified in the studied habitats, which affect their floristic composition, we mention: Ambrosia artemisiifolia L., Acer negundo L., Artemisia annua L., Asclepias syriaca L., Bidens frondosus L., Echinocystis lobata (Michx) Tor. et A. Gray, Prunus cerasifera Ehrh., Robinia pseudoacacia L., and Xanthium orientale L. subsp. italicum (Moretti) Greuter.*

Key words*: habitat, invasive, Natura 2000, Oltenia, Romania.*

INTRODUCTION

Habitats represent a key element of biodiversity, resulting from the complex interaction of biotic and abiotic factors (Gigante et al., 2016). According to some researchers, they are important indicators of biodiversity (Bunce et al., 2013) and their intermediate position between biodiversity levels grants them an important role in the assessment of the state of nature conservation (Gigante et al., 2016). Recent studies on biodiversity protection propose the conservation of habitats, of the surfaces on which they are present, and not the analysis of a single species from an idio-taxonomic point of view (Noss, 1996; Cowling et al., 2004; Nicholson et al., 2009; Berg et al., 2014; Keith et al., 2015).

In accordance with Annex I of the *Habitats Directive* (92/43/EEC), based on their distribution area, the forests under study belong to the main category designated as "Forests of Temperate Europe" and characterized by code 91. Romanian forests are also subject to European law, such as the *Habitats* and *Birds Directives*. However, there is a severe lack of enforcement at all administration levels, even in National Parks (Reif et al., 2022).

In the absence of the negative influences exerted by the zoo-anthropogenic factor on forest ecosystems, they would occupy a significant part of Romania's territory (Giurescu, 1975; Biriș, 2017). Almost half of the forests with high conservation value are under the influence of anthropogenic stress (Munteanu et al., 2021).

Climate variability and change have an impact on crop productivity globally. They also have an indirect impact on biotic constraints, which may lead to the invasion of weeds, pests, and pathogens in previously unaffected areas (Velea et al., 2021; Cotuna et al., 2022a; Cotuna et al., 2022b; Cotuna et al., 2022c).

Thus, worldwide, in the context of climate change, one of the primary concerns in the twenty-first century is agricultural production and food security, especially in vulnerable places (Paraschivu et al., 2022).

Although in Romania, the deciduous forests edified by species of *Quercus* genus are a center of taxonomic and genetic diversity (Neophytou, 2014), the climate changes of recent years have led to modifications in the floristic composition,

quality and integrity of the habitats edified by these species in Oltenia.

There are large unforested areas in the plain regions and in the Piedmont hills, where the habitats analyzed in the present paper find their range. The deforestations were conducted in order to make way for meadows that were used as pastures and for agricultural lands that provided food for the local people.

The analyzed habitats were characterized according to the Manual for Interpretation of EU Habitats in Romania (Gafta & Mountford, 2008), in relation to the vegetation associated with them.

The forests included in habitats 91M0, and 91Y0 are present in small areas, as compared to other forest habitats in Romania. Those belonging to the 91M0 habitat are located in xeric, thermophilic places, while the forests classified as 91Y0 are established on the northern hill slopes. Along with *Quercus cerris* and *Q. frainetto*, in some areas there are also found *Q. polycarpa*, *A. tataricum* and *A. campestre* (Pop, 1942, 1945; Coldea & Pop 1996; Doniță et al., 2008).

The azonal forests included in habitats 91E0* and 92A0 are characteristic from the viewpoint of flora and ecological conditions. They are located in the Danube alluvial plain and along the lower courses of large streams and rivers. The 92A0 habitat has a better representation in the Danube alluvial plain, while the 91E0* habitat is much more widespread in the alluvial plains along the rivers that cross the Piedmont and Subcarpathian hills of Oltenia. The 92A0 habitat consists mainly of *Salix alba*, *S. fragilis*, *Populus alba* (Oprea, 2004), while 91E0* is mostly composed of *Alnus glutinosa*, *A. incana*, and *Fraxinus excelsio* (Gafta & Mountford, 2008).

MATERIALS AND METHODS

Oltenia represents an amphitheater characterized by a great variability of soils (Ionuș et al., 2015) on which different types of vegetation develop. In the context of the general southern exposure of the relief, continental air masses induce a warmer climate (Ivan et al., 1992). Due to these climatic conditions, most of the thermophilous, southern elements are concentrated especially in the southwestern part of Oltenia. All the vegetation zones and levels in Romania can be also found in the region of Oltenia; from the geographical viewpoint, the area belongs to the Oltenia Plain (as part of the Romanian Plain), the Getic Piedmont, and the Getic Subcarpathians (Figure 1).

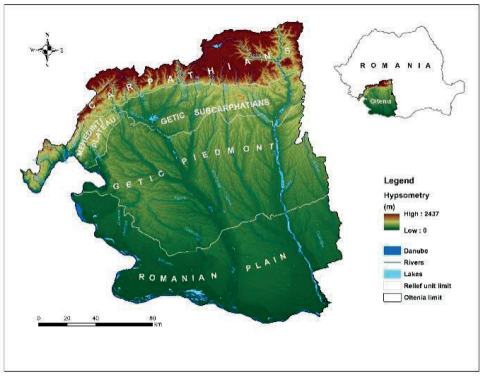

Figure 1. Map of Oltenia

The habitats under study are characterized by certain types of vegetation. Some of these prefer thermophilous, xeric places (e.g. habitat 91M0), while others are located in the alluvial plains of the main rivers (e.g. habitats 91E0* and 92A0), or at the level of the Piedmont hills (e.g. habitat 91Y0).

The present research was conducted on areas where the habitats under study have a favorable conservation status, such as those located in protected natural areas (e.g. "Silvostepa Oltenei" - Dolj County, "Prunișor" - Mehedinți County, etc.), as well as on areas identified in different parts of Oltenia, which are either privately owned or state-owned.

Our research was based on numerous field trips carried out in different stages of vegetation, in order to have a complete understanding of the areas occupied by the habitats under study. Currently, the technology of aerial photography and the use of drones offer the possibility of collecting data and carrying out activities from a reasonable distance, without affecting the areas occupied by forest vegetation (Călina et al., 2020). Their comparative analysis enabled the authors to obtain certain differences in terms of floristic composition.

Increased attention was paid to the species that are on the list of invasive and potentially invasive plants in Romania (Anastasiu et al., 2019), because they induce major imbalances in the ecosystems where they settle in a short period of time. This category of plants continues

to expand the area they occupy at an alert pace. It settles in almost all types of spontaneous vegetation in Romania, especially in those located in the plain region and up to the Subcarpathian hills. Mountain and alpine regions are not affected by these alien invasive species.
Some areas where certain habitats are located (91E0* and 92A0) are prone to flooding (Ionuș et al., 2015), this type of event inducing major changes in the structure and functions of the phytocoenoses located in those places.
The scientific names of the plants identified in the analyzed habitats are in accordance with EURO+MED 2006-.

RESULTS AND DISCUSSIONS

Currently, the areas occupied by forests in Romania (including Oltenia) are much smaller, accounting only for 30% of the country's surface (Forest Europe, 2020).
The reduction of the surfaces was induced by the increased accessibility of people and domestic animals to these ecosystems, as well as by climate changes characterized by increasingly intense manifestations during recent years, such as high temperatures, very low precipitation (almost absent for a rather long period), especially in Oltenia.
All these factors led to obvious changes in the floristic composition of the analyzed habitats, especially through the appearance of numerous invasive and potentially invasive species. Some of these are found in a few specimens (e.g. *Abutilon theophrasti* Medik., *Cytisus scoparius* (L.) Link., *Oenothera biennis* L., *Galinsoga parviflora* Cav. or *Matricaria discoidea* DC.), while others go through a luxuriant development in a short time interval (e.g. *Ambrosia artemisiifolia* L., *Xanthium orientale* subsp. *italicum* (Moretti) Greuter, *Erigeron canadensis* L., etc.).
The 91M0 habitat comprises the xero-mesophilous - thermophilous oak forests that are present in Oltenia, whether on flat surfaces or on slopes with southern, eastern or western exposures. They grow on soils with seasonal humidity fluctuations (excessively wet in spring and dry in summer) (Răduțoiu, 2008). They are well represented in the plain region and in the Piedmont hills, where they occupy the largest areas. In some regions of Oltenia, there were identified forests belonging to this habitat, where uncontrolled clearings are practiced; in other areas, young regenerating forests were found.
By analyzing the floristic composition of the areas where the influence of the zoo-anthropogenic factor is greater, the authors identified the presence of some invasive and potentially invasive species that are favored by human activities. Among these, we mention: *Acer negundo* L., *Ailanthus altissima* (Mill.) Swingle, *Ambrosia artemisiifolia* L., *Erigeron annuus* (L.) Pers. subsp. *annuus*, *Gleditsia triacanthos* L., *Morus alba* L., *Phytolacca americana* L., *Prunus cerasifera* Ehrh. and *Robinia pseudoacacia* L.
The sessile oak forests included in the 91Y0 habitat are located on the upper edge of the forests comprised in the 91M0 habitat, or on the northern slopes of the Piedmont hills. They have a good representation in Oltenia, in the upper part of the Getic Piedmont and in the Subcarpathian hills.
Unlike the 91M0 habitat, the sessile oak forests included in the 91Y0 habitat comprise fewer species from the category of invasive and potentially invasive alien plants.
In some areas of Oltenia, the 91Y0 habitat includes a mixture of species that cannot be assigned to a certain type of vegetation mentioned in the specialized literature for this habitat in Romania.
Among the invasive and potentially invasive plants identified in the areas occupied by the 91Y0 habitat, there are to be mentioned: *Acer negundo* L., *Ambrosia artemisiifolia* L., *Erigeron canadensis* L., *Erigeron annuus* (L.) Pers. subsp. *strigosus* (Muhl. ex Willd.) Wagenitz, *Gleditsia triacanthos* L., *Phytolacca americana* L., *Veronica persica* Poir.
The analysis of invasive and potentially invasive allogenic plants from the researched habitats that are located on the territory of Oltenia, with a special view to their population typology, enabled the authors to achieve a classification concerning the aggressiveness shown by these plants (Table 1). It can be noticed that the forests included in habitats 91M0 and 91Y0 have few invasive species, but some of them show high aggressiveness on certain surfaces: *Robinia pseudacacia* L., *Acer negundo* L., as well as *Ailanthus altissima* (Mill.) Swingle in the southwestern part of Oltenia.

Table 1. Invasive and potentially invasive plants from the analyzed habitats

Scientific name	Population typology				Type of introduction
	Habitat 91M0	Habitat 91Y0	Habitat 91E0*	Habitat 92A0	
Robinia pseudoacacia L.	5	5	1	1	accidental
Acer negundo L.	3	2	1	-	accidental
Ailanthus altissima (Mill.) Swingle	4	-	1	3	accidental
Ambrosia artemisiifolia L.	1	1	4	4	accidental
Morus alba L.	1	1	2	4	accidental
Amorpha fruticosa L.	-	-	2	5	accidental
Amaranthus powellii S.Watson	1	-	1	1	accidental
Erigeron annuus (L.) Pers. subsp. *strigosus* (Muhl. ex Willd.) Wagenitz	2	1	2	2	accidental
Asclepias syriaca L.	-	-	1	5	accidental
Armoracia rusticana P.Gaertn., B.Mey. et Scherb.	-	-	1	1	accidental
Artemisia annua L.	-	-	1	2	accidental
Galinsoga parviflora Cav.	-	-	2	1	accidental
Erigeron canadensis L.	1	1	2	2	accidental
Cytisus scoparius (L.) Link.	1	-	-	-	accidental
Abutilon theophrasti Medik.	-	-	1	1	accidental
Echinocystis lobata (Michx) Torr. et A. Gray	-	-	1	5	accidental
Veronica persica Poir.	1	1	2	2	accidental
Datura stramonium L.	-	-	1	2	accidental
Xanthium orientale L. subsp. *italicum* (Moretti) Greuter	-	-	3	5	accidental
Sorghum halepense (L.) Pers.	-	-	1	1	accidental
Bidens frondosus L.	-	-	4	5	accidental
Elaeagnus angustifolia L.	1	-	-	1	accidental
Gleditsia triacanthos L.	2	1	1	1	accidental
Helianthus tuberosus L.	-	-	1	4	accidental
Phytolacca americana L.	1	1	4	3	accidental
Bassia scoparia (L.) A. J. Scott	-	-	-	1	accidental
Lycium barbarum L.	1	-	2	2	ornamental
Oenothera biennis L.	-	-	1	1	accidental
Oxalis dillenii Jacq.	-	-	2	2	accidental
Oxalis corniculata L.	-	-	1	1	accidental
Populus × canadensis Moench	-	-	-	1	accidental
Prunus cerasifera Ehrh.	1	1	1	1	accidental
Quercus rubra L.	1	-	-	-	ornamental
Reynoutria japonica Houtt.	-	-	1	1	accidental
Solidago canadensis L.	-	-	2	2	accidental
Xanthium spinosum L.	-	-	1	1	accidental

Population typology: 1- solitary individuals; 2- rare populations, on surfaces < 10 m^2; 3- rare populations, on surfaces > 10 m^2; 4- dense populations, on surfaces < 10 m^2; 5- dense populations, on surfaces > 10 m^2.

Among the researched habitats, those classified as 91E0* and 92A0 have the most invasive and potentially invasive species. The shrub and grass layers are severely affected because of these invading species that form real impenetrable jungles. Such situations were observed in habitat 92A0, developed in the Danube Alluvial Plain and in the lower sector of the Jiu Alluvial Plain, where *Asclepias syriaca* L., *Amorpha fruticosa* L., *Echinocystis lobata* (Michx) Torr. et A. Gray și *Xanthium orientale* subsp. *italicum* (Moretti) Greuter have become invasive on some surfaces (Figures 1, 2, 3, 4) and eliminated almost all species characteristic of this habitat.

In the case of habitats 91M0 and 91Y0, the species that affect their structure and functions are perennial (e.g. *Acer negundo*, *Ailanthus altissima*, and *Robinia pseudacacia*), while in the case of habitats 91E0* and 92A0, the annual species have a good representation on certain surfaces, inducing major changes in the floristic composition of these habitats (e.g. *Asclepias syriaca*, *Echinocystis lobata*, and *Xanthium orientale* subsp. *Italicum*).

In certain habitats (e.g. 92A0), natural and man-induced hazards have led to the appearance of dangerous invasive species that are on the Invasive Alien Species of Concern for the European Union (e.g. *Asclepias syriaca*). Thus, to improve the management of dangerous phenomena represents a key requirement (Licurici et al., 2011).

Figure 1. *Asclepias syriaca* in the Jiu Alluvial Plain, near the confluence with the Danube

Figure 2. *Amorpha fruticosa* in the habitat 92A0 from the Danube Alluvial Plain

Figure 3. *Echinocystis lobata* invasive in the Danube Alluvial Plain

Figure 4. *Xanthium orientale* subsp. *italicum* from the habitat 92A0 located in the Jiu Alluvial Plain

CONCLUSIONS

The forests edified by Quercus species, which are included in the habitats 91M0 and 91Y0 and are located in Oltenia, still represent a precious archive of biodiversity. Therefore, it is necessary to take urgent measures in order to limit the influence of the human factor, which represents the main responsible for the decrease of these areas occupied by forest vegetation and for the alarming expansion of invasive and potentially invasive species.

Among the four forest habitats analyzed in the present paper, those located along the Danube and the main rivers and streams within Oltenia (i.e. 91E0* and 92A0) are the most affected, either by internal grazing, or by overexploitation or dumping of household waste.

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