

# Country reports

## Report on Invasive Alien Species in Hungary

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### **Abstract**

The first Hungarian records of alien species date back to the early 1700s. Since then many alien species of plants and animals have been established in the country, some of them threatening the native biodiversity, human health and economy. The present paper presents a review of invasive alien species (IAS) in Hungary, including IAS lists of plants and animals. The paper also makes a review of the legal and administrative background and strategic documents related to IAS in Hungary, as well as of the current national IAS activities, including mapping and monitoring, research activities, field activities, and communication and public awareness campaigns. Three case studies/ best practices are presented: *The Conservation of Euro-Siberian steppic woods and Pannonic sand steppes in 'Nagykőrösi pusztai tölgyesek' Natura 2000 sites* LIFE+ project; The Hungarian Harlequin Project; and the Eradication of *Heracleum mantegazzianum* project.

### **Keywords**

Invasive alien species, legislation, IAS research and management activities, Hungary

## Introduction

The first Hungarian records of alien plant species - for example the black locust and asclepias species - are known from as far as the early 1700s. Some of the alien plant species were introduced as ornamentals or for forestry use, while other plants established spontaneously. The most infected habitats are open grassland like sand steppes, forest habitats mostly in lowland and along the rivers and wetlands.

Aquatic habitats and wetlands are among the most threatened habitat types in Hungary. More than 90% of Hungary's surface waters originate from beyond its borders, which is of fundamental importance in the spread of waterborne invasive alien species (IAS). In this respect crayfish, fish, slider, mussel and waterweed species have to be mentioned.

In Hungary, subspontaneous stands of perennial alien plants cover 5.5% of the country, and it does not include the area covered by alien tree plantations and annual weed vegetation of disturbed areas and arable fields. This is only slightly lower than half of the total area covered by natural vegetation (Botta-Dukát and Balogh 2008). Based on the results of the MÉTA Programme the (semi-)natural habitats are covered by invasive alien plants at the rate of 13.1% (Botta-Dukát 2009).

The Hungarian Nature Conservation Agency recognised the importance of this problem, and started a project to gather knowledge on the biology of invasive alien plant species. The results of this project were published in Hungarian in two books (Mihály and Botta-Dukát 2004; Botta-Dukát and Mihály 2006).

### 1. Legal and administrative background

Hungary is a contracting party to a number of international agreements which include some provisions related to invasive alien species, such as the Convention on Biological Diversity (CBD) and its Protocols, the Bern Convention, the Bonn Convention, etc.

On the national level, the issue of alien species is in the competence of several sectors and is governed by

different regulations in the field of environment and nature protection, agriculture, forestry, hunting, freshwater fisheries and animal welfare. In Hungary most acts of relevance that deal with nature protection or nature conservation contain provisions to protect the environment and native species, or to restore damaged habitats to their original conditions, thus indirectly leading to requirements related to IAS.

The Hungarian legislation does not contain a dedicated Act against invasive alien species providing a black list including the most dangerous species. General regulations can be found in Act. No. LIII. of 1996 on Nature Conservation:

- Article 13 (4). Preliminary authorisation of the Minister of Rural Development is needed to introduce any non-native living organism or to reintroduce any living organism to Hungary, except in the specified case in paragraph (2).
- Article 14. It is prohibited to introduce any non-native fish species into natural or semi-natural waters, or to transfer such a species from fish farms into any other wetland.

The laws in force contain the basic provisions and ensure the general protection of our native flora. There is a need for additional and detailed regulations addressing problems related to the utilisation of plant species including IAS (especially production and trade of aquatic plants and ornamental plants), which has to be incorporated into the laws of relevant sectors.

The most important sectoral laws which contain regulations dealing with IAS are the following:

- Act 53/1995 on the General Rules of Environmental Protection;
- Act 55/1996 on the Protection of Game, Game Management and Hunting;
- Act 37/2009 on Forests and the Protection of Forests during 2009;
- Act 102/2013 on Fish Farming and the Protection of Fish;
- Act 154/1997 on Public Health;
- Act 46/2008 on the Food chain and its supervising authorities.

There are some specific regulations (governmental and ministerial decrees, parliamentary and governmental orders) containing lists of the relevant invasive alien species, for example:

- 346/2008 (XII. 30.) Governmental Decree on the protection of arboreal plants listing 6 arboreal IAS (*Robinia pseudoacacia*, *Fraxinus americana*, *Ailanthus altissima*, *Amorpha fruticosa*, *Prunus serotina*, *Acer negundo*, except their cultivars), which are prohibited to plant in public places;
- 269/2007 (X. 18.) Governmental Decree on land use prescriptions of the Natura 2000 grassland areas listing 9 arboreal and 6 non-arboreal IAS (*Robinia pseudoacacia*, *Fraxinus americana*, *Ailanthus altissima*, *Elaeagnus angustifolia*, *Pinus nigra*, *Pinus silvestris*, *Amorpha fruticosa*, *Prunus serotina*, *Acer negundo*, *Phytolacca americana*, *Fallopia spp.*, *Solidago canadensis*, *Solidago gigantea*, *Ambrosia artemisiifolia*, *Asclepias syriaca*, *Echinocystis lobata*), against which spread and settling farmers have to take preventive measures.

Other regulations set out rules concerning subsidies. For example, Governmental Decree 71/2007 (IV. 14) on the Establishment of Energy Plantation of Arboreal Species, and its implementing Ministerial Decree 45/2007 (VI. 11), Article 2(4) establishes that planting of *Robinia pseudoacacia* must not be authorised in protected natural areas and Natura 2000 sites.

Ministerial Decree 72/2007 (VI. 27) sets out rules for obtaining EAFRD subsidy for the establishment of short rotation bioenergy plantation of woody plant species. Applicants are required to have all necessary permits from the authorities (e.g. permission of nature conservation authorities if the plantation is situated in a protected area and/or Natura 2000 site), which determines among others the selection of species applied.

In parallel, Ministerial Decree 71/2007 (VI. 27.) sets out rules for obtaining EAFRD subsidy for the establishment of perennial herbaceous energy plantation. Article 4(8) establishes that the applicant has to

prevent (localise) the spontaneous spread of individuals from plantations of the genera *Agropyron*, *Elytrigia* and *Miscanthus*.

The Rural Development Agency (operating under supervision of the Ministry of Rural Development) is responsible for the monitoring and carrying out 'on-the-spot' controls.

Governmental Decree 91/2007 (VI. 26.) on determining the degree of natural damage caused and the rules for remedying the damage provides that invasive alien species must be taken into consideration during identifying the environmental elements to be monitored (Article 12(4)).

Governmental Decree 41/2010 (II. 26.) on keeping and distribution of pet animals prohibits the trade of 15 species listed in Annex 1 which are harmful to native species (e.g. *Myocastor coypus*).

Ministerial Decree 86/2012 on commercial collection and marketing of fodder plant seed mixtures intended for use in the preservation of the natural environment, corresponding to the 2010/60/EU directive, sets out rules for the cover of IAS listed in Annex 3 on the place from where seeds are collected.

## 2. Review of the alien species

### Invasive plant species

The first lists on invasive alien plant species were created in 1998 during an expert workshop, which was organised for botanists and other researchers, scientists and nature conservation experts. Later two scientific books were published related to these lists and experiences (Biological Invasions in Hungary, Invasive Alien Species). The main aspect was to recognise which species are considered to be the most harmful from a nature conservation point of view. The invasive alien species that spread on agricultural or inhabited rural areas (e.g. ragweed, marsh-elder, abutilon) and indigenous species with an invasive character (e.g. reed, wood small-reed) were excluded from the list.

The current list of invasive alien species (see Annex I) contains 33 terrestrial and 8 aquatic plant

species, which are significant and dangerous from a nature conservation point of view. These plants are aliens and have negative, dangerous effects to the indigenous species and the natural habitats in Hungary.

A list of neophytes was published in 2004 and contains seventy-one invasive plants, from which thirty-three are considered as transformers (Balogh et al. 2004). The listed plants cause significant damages to (semi-)natural and/or agricultural habitats.

### **Invasive animal species**

The list of invasive animal species (see Annex II) has been compiled through a long conciliation process and data collection by the Invasive Expert Council and the staff of the Ministry in charge of nature conservation.

We consider a species invasive when there is evidence that in the past the species could overcome a geographical barrier by intentional or unintentional human assistance. So, all those currently expanding species where one cannot decide whether the expansion is natural or caused by anthropogenic factors are excluded from the list (e.g. the Golden Jackal or the Ponto-Caspian gobies). Climate change may also force to change the distribution area of many species, which are not included in the current list either.

The main purpose of this list is to identify the species that may require active intervention to successfully protect the natural flora and fauna. Therefore species causing significant economic or human health effects were excluded from the list, such as the House mouse, Brown rat or a number of introduced ant species. The identification of damage and changes in the natural flora and fauna caused by alien animal species is much more difficult than to recognise the effects in case of alien plant species. There is no scientific evidence on the effects of many species in Hungary yet, so we have to base our consideration on the analysis of international papers and experience.

## **3. Review of current activities on IAS in Hungary**

### **Legislative processes**

See detailed description in Chapter 1.

### **Strategic documents**

Control of invasive alien species is incorporated into the National Nature Conservation Master Plan, as well as the National Biodiversity Strategy and Action Plan. The timescale of the National Nature Conservation Master Plan (NCMP) is six years. The fourth NCMP was elaborated in 2013 and covers the 2014-2019 period. In line with the European Biodiversity Strategy until 2020, it contains the most important objectives related to IAS in a separate chapter.

The “Prioritised Action Framework (PAF) for Natura 2000” lists the aggressive spreading of invasive alien species among the most dangerous pressures threatening species and habitats of Community interest. Measures targeting the control of invasive alien species feature under most national nature conservation priorities of the PAF for 2014-2020.

### **Mapping and monitoring activity**

- Three national programmes were implemented in the early 2000s, which among others provide data about the distribution of invasive alien plants. These are the Mapping of the Hungarian Flora Programme (Király 2003; Balogh et al. 2008), MÉTA Programme (Ecological Vegetation Database & Map of Hungary) (Botta-Dukát 2009) and the Fifth National Weed Survey on Arable Land in Hungary (Novák et al. 2009).
- The Hungarian Biodiversity Monitoring System (HBMS) includes programmes focusing on IAS:
  - Ecosystem diversity and its changes at the landscape level are monitored by habitat mapping based on the National Habitat

Classification System (NHCS). A total of 125 5x5 km quadrants were selected for mapping, taking into account nature conservation aspects, regional problems and considerations of general landscape representativeness. Maps are produced at a scale of 1:25000. Habitat mapping must be repeated every ten years for each quadrant. Five invasive plants (*Ailanthus altissima*, *Asclepias syriaca*, *Amorpha fruticosa*, *Solidago gigantea* and *S. canadensis*) are surveyed in each quadrant. The maps show the degree of infestation in each habitat patch.

- *Cabomba caroliniana* has been monitored since 2001 in canals situated in the Danube-Tisza Interfluve, where it spreads rapidly and is capable of entirely supplanting the native floating vegetation. Its year-to-year expansion has been examined.
- A regional monitoring programme is run to examine the spread of the signal crayfish (*Pacifastacus leniusculus*) in the western part of Hungary. It occurred in the Rába River, but currently it is found in the Mura River catchment area as well.
- Some other programmes collect data about IAS, although they do not directly aim to examine IAS. For example, monitoring of fish communities by electrofishing or sampling macroinvertebrate communities according to the AQEM protocol.
- The effectiveness and success of eradication of IAS implemented from different grant funds has been continuously monitored.

## Research

- Examination of allelopathic effects of several invasive and potentially invasive alien plant species is carried out by the West Hungarian University (Csiszár et al. 2012) using a stan-

dardised method, the so called Juglon-index that compares the allelopathic potential of different species.

- An experiment was carried out by the Eötvös Loránd University to examine the possibility of biological control of the Common Milkweed (*Asclepias syriaca*) by the European rabbit. Mother rabbits were fed with milkweed in order to habituate their sucklings. The young rabbits thus can develop a preference for milkweed.

## Communication and public awareness

- A new comprehensive book was published in 2012 by the West Hungarian University (Csiszár 2012), it summarises the results of the Mapping of the Hungarian Flora Programme concerning the IAS.
- Websites:
  - The official website of nature conservation ([www.termesztvedelem.hu/ozonfajok-magyarorszagon](http://www.termesztvedelem.hu/ozonfajok-magyarorszagon)) shares information about IAS, publishing the list of IAS and the most important publications.
- In October 2013, a two-day seminar was organised for colleagues of NPDs, NGOs, forestry companies, experts and researchers to share and discuss experiences, best practices and results of different eradication methods used against the most common invasive plant species.
- A poster was issued during the Hungarian Presidency in 2011 about “*Invasive species of aquatic habitats and wetlands*” aiming to draw public attention to this area.
- A leaflet and a poster presenting the neophyton hydrophytes of Hungary originating from subtropical or temperate regions were published. A smaller part of these species escaped from agricultural hydro cultures or appeared with the help of animals, while a greater part were introduced with thermal waters. The

poster presents photos and habitus drawings of the species concerned and describes their life form and morphology.

- Hungary joined the NatureWatch initiative as a test country. The NatureWatch programme of the European Environmental Agency (EES) enables citizens to report the spread of invasive alien species in Europe and to work in communities to learn more about such species. These voluntary contributions help to fill knowledge gaps about the spread of invasive alien species across Europe. Hungary as one of the first contributors built up her community and runs a test phase of the project. In parallel, our knowledge on the distribution of harmful plant and animal species is expected to grow significantly, as well as the awareness and knowledge of the general public.

### Field activities

In Hungary national park directorates (NPDs) are appointed as the regional bodies officially responsible for the management of protected areas and Natura 2000 sites. As part of their efforts to ensure the conservation of protected and endangered species and habitats they carry out field interventions targeting the eradication of IAS regularly. Many of these activities are financed from EU funds such as LIFE+, the European Regional Development Fund and other international sources of financing. IAS actions and projects of NPDs are often implemented in cooperation with non-governmental organisations, universities and research institutes. The affected territory varies from several hundreds of hectares to several thousands per year.

## 4. Case studies/ Best practices

Conservation of Euro-Siberian steppe woods and Pannonic sand steppes in 'Nagykőrösi pusztai tölgyesek' Natura 2000 sites (LIFE+ project)

In the frame of this LIFE+ project measures focusing on the removal of arboreal invasive alien species

using mechanical and chemical methods were carried out on an extended target area of approximately 420 hectares. The aim of this action was to improve the conservation status of the remnant Euro-Siberian oak steppe forest, a priority habitat type around Nagykőrös. As a result of the project, invasive alien species (mainly black locust) were eliminated at approximately 90-95% of their territory. Although there had been some experience on the control of invasive alien species in Hungary before the project, the issue of volume induced new considerations, which resulted in shifts in the applied technology. The management activities included logging and stump treatment, post-treatment of sprouts, game exclusion wire fence and electric fence, partial soil preparation and first plantation and post-treatment of forestations. The applied method was fit to the local circumstances, for example in the forest stands used for recreation, a less intensive, gradual removal of introduced species was implemented. Indigenous shrub-layer was treated differently depending whether it was in an artificial forest regeneration patch or not. For the elimination of invasive species stem injection, logging and stump treatment of trees were combined. Applying the stem injection alone was not possible due to the high costs of this technology and the high risk of fire as a result of the large amount of woody debris remaining in the field. All this led to the preference of stem cut instead of stem injection in certain cases. In case of heavy sprouting species, in particular the black locust, at the beginning of the project modified stump treatment was used, which was later replaced by stem injection. Experiencing the continuous post-treatment need of stump treated sites, as well as the relating costs and technological problems of sprout treatment, finally the stem injection proved to be the most sustainable and effective method for woody control. This project was selected as one of the best LIFE+ nature conservation project.

### The Hungarian Harlequin Project

The Harlequin or Multicoloured Asian Ladybird, *Harmonia axyridis* (Pallas, 1773) was introduced to

several Western European countries and the USA, and it was used successfully as a biological control agent. The species, however, soon established reproducing populations in the wild, and competed and preyed on native ladybirds, hoverflies and other insects of similar size. In 2008, *H. axyridis* was detected in Hungary.

The main objective of the Hungarian Harlequin Project is to map and monitor the Hungarian distribution of this species. The Hungarian Harlequin Project has been running since 2009, as a sub-project of a non-governmental organisation supported only by a handful of volunteers. A website is operating in the frame of the Project enabling the general public to record sightings of any Coccinellidae species, especially *H. axyridis*. The website contains various pieces of information about the Harlequin Ladybird, including general morphology, its influence on native species, the chronology of its spread and possibilities of protection against the beetle in human environment. The website attracted a high number of visitors collecting nearly 70000 hits by the end of 2013. Observers from the general public can report their sightings by uploading a photo of the beetle and providing basic information on location and time of observation. All the records are then validated by an expert and transferred to a permanent database. Sightings can be reported also by e-mail and there used to be a possibility to send beetles on post but this latter option has been disabled due to staff shortage. The ladybird database lists over 1200 entries (December, 2013) and this number is increasing rapidly. According to the data, *H. axyridis* has become a widespread species in Hungary recorded in ca. 20% of the 10 x 10 km UTM gridcells, from almost every part of the country by the end of 2013. This project illustrates both the problem of alien species through the Harlequin Ladybird and the potential of civil science for biological recording.

### **Eradication of *Heracleum mantegazzianum***

In the Balaton Upland National Park a “pilot project” on eliminating *Heracleum mantegazzianum* was

carried out. There are only some small and local populations of this species. Colleagues of NPD and the National Food Chain Safety Office used combined methods to eliminate the species. As the first step, the stems were cut in protective garment, which was followed by inserting glyphosate chemicals into the hole of the stem. Further treatment was needed just in a few cases; the eradication was successful at local sites.

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- Nature Conservation homepage <http://www.termeszetvedelem.hu/>

Annex I. List of invasive alien plants in Hungary (the most harmful invasive alien species are presented in **bold** style).

## Terrestrial invasive alien plant species

Scientific name	English name
<b>Acer negundo</b>	Maple ash or Box-elder
<i>Ailanthus altissima</i>	Tree of heaven
<b>Amorpha fruticosa</b>	False indigo
<i>Asclepias syriaca</i>	Asclepias
<b>Aster lanceolatus (beleértve A. tradescantii), A. novi-belgii, A. ×salignus</b>	North-American asters
<i>Celtis occidentalis</i>	Nettle-tree
<i>Cenchrus incertus</i>	Coast sandbur
<b>Echinocystis lobata</b>	Wild cucumber
<b>Elaeagnus angustifolia</b>	Oleaster
<b>Fallopia japonica, F.×bohemica, F. sachalinensis</b>	Knotweeds
<b>Fraxinus pennsylvanica</b>	Green ash
<b>Helianthus tuberosus s. l. (H. decapetalus auct.)</b>	Jerusalem artichoke
<i>Heracleum mantegazzianum</i>	Giant hogweed
<i>Heracleum sosnowskyi</i>	Sosnowski's hogweed
<i>Hordeum jubatum</i>	Foxtail barley
<i>Humulus scandens</i>	Japanese hops
<b>Impatiens glandulifera</b>	Himalayan balsam
<i>Impatiens parviflora</i>	Small balsam
<i>Juncus tenuis</i>	Slender rush
<b>Padus serotina</b>	Wild black cherry
<i>Parthenocissus inserta</i>	Thicket creeper
<i>Parthenocissus quinquefolia</i>	Virginia creeper
<i>Phytolacca americana</i>	American pokeweed
<i>Phytolacca esculenta</i>	Chinese pokeweed
<b>Robinia pseudoacacia</b>	Black locust
<i>Rudbeckia laciniata</i>	Cutleaf coneflower
<b>Solidago gigantea</b>	Giant goldenrod
<b>Solidago canadensis</b>	Canada goldenrod
<i>Vitis vulpina</i>	Frost grape

## Aquatic invasive alien plant species

Scientific name	English name
<i>Azolla caroliniana</i> ( <i>A. filiculoides</i> ), <i>A. mexicana</i>	Azolla species
<i>Cabomba caroliniana</i>	Green cabomba
<i>Elodea canadensis</i>	Canadian waterweed
<i>Elodea nuttallii</i>	Western waterweed
<i>Hydrocotyle ranunculoides</i>	Water pennywort
<i>Lemna minuta</i>	Least duckweed
<i>Pistia stratiotes</i>	Water lettuce

Annex II. List of invasive alien animals in Hungary (the most harmful invasive alien species are presented in **bold** style).

Scientific name	English name
<b>VERTEBRATES</b>	
<b>Mammals</b>	
<i>Ondatra zibethicus</i>	Muskrat
<i>Nyctereutes procyonoides</i>	Raccoon dog
<i>Dama dama</i>	Fallow deer
<i>Ovis musimon</i>	Mouflon
<b>Fishes</b>	
<i>Acipenser baeri</i>	Siberian sturgeon
<i>Clarias gareipinus</i>	North African catfish
<i>Ctenopharyngodon idella</i>	Grass carp
<b><i>Perccottus glehni</i></b>	Amur sleeper
<b><i>Carassius gibelio</i></b>	Prussian carp
<i>Hypophthalmichthys molitrix</i> X <i>H. nobilis</i>	Silver carp X Bighead carp
<i>Ameiurus melas</i>	Black bullhead
<i>Pseudorasbora parva</i>	Stone moroko
<i>Lepomis gibbosus</i>	Pumpkinseed
<i>Micropterus salmoides</i>	Largemouth bass
<i>Oncorhynchus mykiss</i>	Rainbow trout
<i>Ameiurus nebulosus</i>	Brown bullhead
<i>Gasterosteus aculeatus</i>	Stickleback
<b>INVERTEBRATES</b>	
<b>Beetles</b>	
<i>Harmonia axyridis</i>	Multicolored Asian ladybird
<b>Crustaceans</b>	
<i>Orconectes limosus</i>	Spiny-cheek crayfish
<i>Pacifastacus leniusculus</i>	Signal crayfish
<i>Eriocheir sinensis</i>	Chinese mitten crab
<b>Molluscs</b>	
<i>Arion ater</i>	Black slug

Scientific name	English name
<b>VERTEBRATES</b>	
<i>Helix lucorum</i>	Turkish snail
<i>Helix aspersa</i>	Brown garden snail
<i>Potamopyrgus antipodarum</i>	New Zealand mudsnail
<i>Arion lusitanicus</i>	Spanish slug
<i>Gyraulus parvus</i>	Ash gyro
<i>Physella acuta</i>	Acute bladder snail
<i>Sinanodonta woodiana</i>	Chinese pond mussel
<i>Corbicula fluminea</i>	Asian clam
<i>Corbicula fluminalis</i>	
<i>Dreissena polymorpha</i>	Zebra mussel
<i>Dreissena bugensis</i>	Quagga mussel

### Species that are potentially hazardous to the natural flora and fauna but have not settled in Hungary yet

Scientific name	English name
<b>VERTEBRATES</b>	
<b>Mammals</b>	
<i>Sciurus carolinensis</i>	Eastern gray squirrel
<i>Tamiasciurus hudsonicus</i>	American red squirrel
<i>Castor canadensis</i>	American beaver
<i>Myocastor coypus</i>	Coypu
<i>Procyon lotor</i>	Raccoon
<i>Mephitis mephitis</i>	Striped skunk
<i>Mustela vison</i>	American mink
<i>Cervus nippon</i>	Sika deer
<b>Birds</b>	
<i>Cygnus atratus</i>	Black swan
<i>Branta canadensis</i>	Canada goose
<i>Alopochen aegyptiacus</i>	Egyptian goose
<i>Oxyura jamaicensis</i>	Ruddy duck
<b>Reptiles</b>	
<i>Chrysemys picta</i>	Painted turtle
<i>Trachemys scripta elegans</i>	Red-eared slider
<b>Amphibians</b>	
<i>Bombina orientalis</i>	Oriental Fire-Bellied Toad
<i>Rana catesbeiana</i>	Bullfrog
<b>Fishes</b>	
<i>Mylopharyngodon piceus</i>	Black carp
<i>Salvelinus fontinalis</i>	Brook trout
<i>Channa spp.</i> , <i>Parachanna spp.</i>	Snakehead species