European Commission

Invasive Alien Species of Union Concern

Version 2020

Environment

Luxembourg: Publications Office of the European Union, 2020

Print	ISBN 978-92-76-20768-9	doi:10. 2779//279449	KH-04-20-414-EN-C
Web	ISBN 978-92-76-20769-6	doi:10. 2779//791940	KH-04-20-414-EN-N

The information presented here is not necessarily comprehensive or up-to-date, and does not necessarily reflect the position of the European Commission. The species information fiches have been written by Kerstin Sundseth, Ecosystem LTD, under contract 070202/2016/742869/SER/ENV.D.3 and IUCN under contract 070202/2019/812535/SER/ENV.D.2. For more details, please refer to the underpinning risk assessments on http://bit.ly/2tkez8i

Any comments are welcome to the following e-mail address: ENV-IAS@ec.europa.eu

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Introduction

Alien species are animals and plants that have been introduced through human action to a new natural environment from other parts of the world. Some alien species have been brought to Europe deliberately, such as the American skunk cabbage as an ornamental plant, the pond slider for the pet trade, the signal crayfish for the food industry, and the nutria for fur farming. Others, such as the Asian hornet or the Indian house crow, have found their way into the EU as blind passengers on board of ships, or they have been accidentally imported as a contaminant with commercial goods.

Not all alien species cause trouble in their new environment. They often have difficulties growing and reproducing. Many are largely beneficial and impossible to think away from our lives. For others, however, including the ones mentioned above, the new natural environment turns out to be surprisingly favorable, in particular in the absence of their natural enemies. This allows them to spread and reproduce excessively, feeding on native species or out-competing them for habitat and resources; sometimes also carrying parasites and diseases that are lethal to native wildlife or dangerous to human health.

Ecological barriers like oceans and mountain ranges have allowed ecosystems to evolve independently, so that the species within them are adapted to each other and interact in a delicate balance. Moving species across those barriers can severely disrupt this balance and may even change these ecosystems entirely. Indeed, invasive alien species are recognised as one of the main drivers of species extinction and global biodiversity loss[1]. Invasive alien species also cause damage amounting to many billions of euros to the European economy every year.

Invasive alien species can easily spread across borders. This is why the EU has adopted a law - the IAS Regulation[2] - to tackle the problem in a coordinated, joint effort across all Member States. The IAS Regulation is fairly young: it entered into force in January 2015. It also implements the EU Biodiversity Strategy to 2020 which sets a specific target to combat the threat of invasive alien species in order to halt the loss of biodiversity and ecosystem services.

At the core of the IAS Regulation is a list of invasive alien species of Union concern (the Union list), including some of those species that cause the most damage to native biodiversity, and for which concerted measures are required across the EU. The IAS Regulation imposes restrictions on the keeping, importing, selling, breeding and growing of the listed species. Member States are also required to take measures for their early detection and rapid eradication, and to manage populations that are already widely spread in their territory. Prevention is the priority because established populations can be expensive to manage and difficult or impossible to eradicate.

As new information and evidence become available, the Union list gets updated at regular intervals. The process of putting new species on the list starts with a proposal by an EU Member State or by the European Commission, underpinned by a risk assessment; followed by an expert evaluation of the robustness of the available evidence and consultations with a range of stakeholders and the Member States, followed by approval by a Committee with Member States' representatives and adoption by the Commission.

This brochure presents at a glance the currently listed invasive alien species of Union concern, offering brief, non-technical and informal summaries of their origin, their present distribution in the EU, how they threaten our native biodiversity, and how the applicable restrictions and obligations will help mitigate their negative impacts. You can read more on the scientific evidence and risk assessments on the Commission's official webpage dedicated to invasive alien species[3].

[1] https://www.cbd.int/invasive/

[2] Regulation (EU) 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 (IAS Regulation)

[3] http://ec.europa.eu/environment/nature/invasivealien/index_en.htm

Acacia saligna (Golden wreath wattle)

The Golden wreath wattle is a small tree endemic to Western Australia. The species is also known under other common names, such as Golden wreath wattle or the Port Jackson wattle, or as *Acacia cyanophylla*. In its native range, the species is associated with watercourses, sand dunes and coastal plains. It was first intentionally introduced into coastal areas of several European countries in the Mediterranean region to stabilize sand dunes and for afforestation. It is now invading sand dunes and riparian wetlands across Spain, Cyprus, Italy and Portugal, with records also known from Croatia, France, Greece and Malta.

The Golden wreath wattle often forms dense stands in its introduced range through rapid growth, massive seed production, and clonal propagation, thereby affecting community composition and outcompeting native flora. In addition, this highly invasive alien species reduces surface runoff and soil water reserves, and disturbs nutrient cycling. Once introduced, the species spreads naturally, although its spread can also be facilitated by human activities related to soil protection and the ornamental plant trade.

The species is very difficult to control once established because of its high resprouting rates, root suckering and a long-lived seed bank. Therefore, setting up early warning systems for rapid eradication is the best strategy to prevent its introduction in the first place. Preventive measures include also application of best management practices for habitats and land uses that are at risk of invasion and for the construction and management of roads. EU-level action includes strengthening awareness-raising campaigns aimed at the public and horticulturalists to increase knowledge on the species and pathways for its introduction, thereby preventing its spread to other EU Member States.

Ailanthus altissima (Tree of heaven)

The tree of heaven is native to broadleaf forests of Asia, eastern China and North Vietnam. It has been introduced to Europe intentionally on a number of occasions for aesthetic and cultural reasons as early as the mid-18th century. It is now widespread across the continent, with established populations recorded in 18 EU Member States (Austria, Belgium, Croatia, Cyprus, Czechia, Denmark, France, Germany, Greece, Hungary, Italy, The Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain), and additional observations recorded in five other EU Member States.

The species is considered as one of the most invasive alien species in the EU due to its high seed production, easy dispersal by wind, adaptability to a wide range of environments rapidly forming dense stands and its capacity to resprout easily from roots and stumps. As a result, it has a major impact on native plants and ecosystems, particularly through competition, thereby altering native community composition, including in areas of high conservation value.

The species is also widely distributed in cities and spreads from there to (semi-)natural areas. Considering the tree of heaven is so widespread in the EU, efforts should be focused on controlling the spread and on management in valuable natural areas. Furthermore, applying best practices in the construction and management of infrastructure in areas that are at risk of invasion (for example, along roads and railways) is paramount. Awareness-raising campaigns targeting key stakeholder groups, including on the risks associated with the dumping of garden waste, and contaminated soil or seed movement from infested sites should be carried out.

Alternanthera philoxeroides (Alligator weed)

The alligator weed is a dense mat-forming aquatic plant native to the Parana River basin in Brazil. It is not clear how this species established itself in Europe as it is not widely traded as an aquarium plant. It might have been introduced by mistake along with other similar ornamental specimens or as a contaminant of these.

It is currently only established in France and Italy but there is a high risk that it could spread throughout the Mediterranean, as well as in countries with hot thermal springs. Once established the alligator weed rapidly chokes up riverine habitats, reducing both the quality and flow of water and preventing light and oxygen from entering the water column with drastic consequences for the ecosystem and its biodiversity.

As the plant is still in an early stage of invasion, placing it now on the Union list will help prevent it from becoming a problem across the EU, by imposing a sales ban, by possibly taking measures on the pathways of unintentional introduction and spread, as well as by taking measures for the rapid eradication of any newly emerging populations and for the management of established populations.

Andropogon virginicus (Broomsedge bluestem)

The broomsedge bluestem is a densely-tufted perennial grass species native to North, Central and South America. It first appeared on the European continent in Georgia and the Russian Federation in the mid-20th century, likely as a result of accidental introductions (for example, through the ornamental plant trade, contaminant of hay and machinery). In the EU, it was first recorded in a military camp in France in 2006 where it is suspected to have been introduced with NATO munitions between the years 1950 and 1967. In its introduced range in the acidic Landes, Gironde and Pyrénées-Atlantique departments of France, the species invades a wide variety of habitats from disturbed to relatively intact ones, including ruderal areas, wetlands, open pastures, grasslands, and open woodlands.

Although the broomsedge bluestem has only recently established populations in France, it has spread very quickly, and therefore poses a considerable risk of invading other regions of the EU. It is detrimental to native biodiversity as it forms dense stands that are highly competitive, even though no studies on its impacts on European's native biodiversity have been done to date. Moreover, established stands of the species also pose a risk to forest plantations and pasture land as they increase the risk of fire and cause habitat degradation.

The broomsedge bluestem is difficult to eradicate due to high seed production and fire-tolerance. Therefore, preventing its introduction should entail monitoring common pathways of introduction through official surveillance networks or citizen science schemes, while managing established populations can be done using a combination of measures.

Asclepias syriaca (Common milkweed)

The common milkweed is a large herb native to North America that gets its name from the thick white latex that emerges when parts of the plant are broken. The species was cultivated in Europe for its fibres in the late 19th century. Today, it is traded and cultivated as an ornamental and for beekeeping.

It is currently established in 13 Member States: Austria, the Czech Republic, Bulgaria, Denmark, France, Croatia, Hungary, Italy, Lithuania, the Netherlands, Poland, Romania and Slovakia. It poses a high risk to native biodiversity by overwhelming valuable habitats such as grasslands, dune areas and river valleys. Milkweed is also toxic to humans and herbivores.

Placing the species on the Union list will contain its further spread across the EU, by imposing a cultivation and sales ban, by possibly taking measures on the pathways of unintentional introduction and spread, as well as by taking measures for the rapid eradication of any newly emerging populations and for the management of established populations.

Baccharis halimifolia (Eastern baccharis)

The Eastern baccharis or groundsel tree is a long-living shrub native to North America. It was first imported into Europe as an ornamental plant and, in some areas, was also intentionally introduced to act as a windbreak along coastal dunes. It is now well established in parts of Belgium, France, Italy, Spain and the United Kingdom where it has spread into a wide range of habitats, including saltmarshes, dunes, woodlands and other coastal areas.

The shrub can grow into dense impenetrable thickets that choke all other native vegetation, altering the structure of the original habitats and causing serious damage to the ecosystem services they provide. It can also be toxic for livestock. The Eastern baccharis produces abundant amounts of seeds which increases the chances of the species spreading further into Member States.

EU-wide measures to prevent further invasion include the prohibition of sales and of keeping, planting or propagating the species. Furthermore, they provide for the rapid eradication of any newly establishing population and the management of existing populations.

Cabomba caroliniana (Fanwort)

The Fanwort is a decorative aquatic plant with feathery leaves. Native to southern Brazil, Paraguay, Uruguay and northeast Argentina, the plant was brought to Europe for the aquarium trade.

The species has since escaped into the wild where it has spread rapidly due to its ability to grow from tiny stem fragments. In many areas, the resulting dense mats have clogged up lakes, ponds and other small watercourses, causing major environmental and economic damage. It is currently present in eight Member States (Austria, Belgium, Denmark, France, Hungary, the Netherlands, Poland, Sweden) and in the United Kingdom.

The risk of the plant spreading into the Mediterranean region and Eastern European countries is high. EU-level action includes a ban on sales and any planting or keeping, including in aquaria, as well as rapid eradication of any new populations to avoid the excessively high costs associated with its management later on. In addition, appropriate management measures have to be taken where the species has become widely spread.

Cardiospermum grandiflorum (Balloon vine)

The balloon vine is a large species of climbing plant native to a wide neotropical range, from Southern Mexico to the Caribbean and Brazil. This herbaceous perennial has established in the EU in Malta, and has been recorded in France and Italy, where it was deliberately introduced via the ornamental plant trade. Additional suitable areas of establishment have been identified across the Mediterranean region, as far as Spain and Portugal, which could be colonized by different additional pathways including by wind or by debris and waste associated with human activities. Once there, the species could additionally spread further through watercourses.

Invasive alien populations of the balloon vine established in Malta spread vegetatively by suckering and root fragments. They form a dense carpet that drapes over underlying vegetation, thereby smothering native flora, depriving it of sunlight and rapidly reducing biodiversity, particularly in riparian habitats. Although the species has not yet had a significant ecological or socio-economic impact in the EU, populations in other parts of its invaded range, such as in East Africa, have been reported to impede the free movement of wildlife and livestock.

Several measures have proven successful in eradicating or controlling established populations of balloon vine. However, these methods are extremely costly, and therefore it is important to develop preventive measures, for example, awareness-raising campaigns targeting citizens and horticulturists, before invasive alien populations establish in other EU Member States within the Mediterranean biogeographical region.

Cortaderia jubata (Purple pampas grass)

The purple pampas grass is a tall, perennial grass species native to Argentina, Chile, Bolivia, Ecuador, Peru and Colombia. There are no established populations in the EU yet. However, there is extensive evidence of substantial detrimental impacts of invasions in Hawai'i, Australia, South Africa and, in particular, in New Zealand and California. It has the potential to invade and impact vast areas of the EU, as it appears capable of establishing in the Atlantic, Black Sea, Continental, and Mediterranean regions and is used as an ornamental garden plant in a number of EU countries.

In its established alien range, the purple pampas grass invades a wide variety of habitats, primarily disturbed environments such as recently burnt or disturbed vegetation, roadsides and forestry plantations. It produces an immense number of seeds (over 100,000 per plume) that are easily dispersed by wind, and forms dense, monotypic stands, outcompeting native flora and leading to a reduction in the abundance of native fauna such as arthropods and rodents. Furthermore, invasions can have particularly damaging impacts on forestry plantations as the species can compete with forestry species, and can also hinder access to plantations.

Once the purple pampas grass is established, its effective management is extremely difficult and costly, particularly due to high seed production rates resulting in frequent permanent reinvasion. Therefore, prevention and early detection are critical. This species is genetically and morphologically very similar to the pampas grass *(Cortaderia selloana)*. A survey of known introduction sites of the latter species may help verify whether any undetected populations of purple pampas grass is already present in the EU.

Ehrharta calycina (Perennial veldtgrass)

The perennial veldtgrass is native to South Africa and southern Namibia. It has a broad environmental tolerance but with a preference for sandy, well-drained soils, particularly in disturbed areas. Although the pathway of introduction is unknown, the species was first recorded in the EU in Seville, Spain, in 1982, and is now established and spreading in Spain and Portugal on dunes and rangelands, and along roadsides and open woodland.

Although its impacts on biodiversity in the EU have yet to be investigated, the species is known to dominate native plant communities in Australia and California and transform shrublands and woodlands into grasslands. Through rapid growth and shading of native seedlings, the perennial veldtgrass forms monospecific stands which promote fires, further suppressing native seedling establishment. With suitable habitats for its establishment existing across the Mediterranean region, its invasion could have important impacts on biodiversity in Member States such as France and Italy.

The use of citizen science networks as well as resource managers' data may allow to detect perennial veldtgrass invasions before they can establish. Mechanical controls (for example, pulling) and grazing can help control the species, but few empirical studies exist to clearly demonstrate the effectiveness of these measures. Long-lived seed bank of perennial veldtgrass means that control of established populations, regardless of the measure implemented, may be difficult.

Eichhornia crassipes (Water hyacinth)

The water hyacinth is a free-floating aquatic plant native to the Amazon basin. It was imported into Europe as an ornamental plant with attractive flowers and it became popular in horticulture, from where it easily spread into the environment. The species has since invaded river basins in France, Italy, Portugal and Spain.

The plant grows extremely fast and develops into thick floating mats which, if uncontrolled, can cover entire water bodies. These mats block out the light and deplete the water of oxygen, smothering out all other native plants and animals. It also hinders water circulation, clogs up navigation routes, and causes immense damage to agriculture through increased water loss.

EU-level action includes a ban on sales and planting or keeping the plant, including in isolated ponds. Any new populations should be eradicated rapidly in order to avoid the excessively high costs associated with its management later on. Where the species has become widely spread, appropriate management measures have to be taken.

Elodea nuttallii (Nuttall's waterweed)

Native to the temperate regions of North America, the Nuttall's waterweed is an aquatic plan that was introduced into Europe as an oxygenating plant for the aquarium trade. It has since established itself in slow-flowing water bodies, lakes and ponds across 16 Members States: Austria, Belgium, Bulgaria, Denmark, France, Germany, Hungary, Ireland, Italy, Luxembourg, the Netherlands, Poland, Romania, Slovakia, Slovenia, and Sweden. It also occurs in the United Kingdom.

Due to its rampant growth, Nuttall's waterweed develops rapidly into a tangled mass. It blocks out the light and alters the entire ecosystem beneath. As a result, native aquatic plants and animals are unable to survive. The plant also causes significant economic damage by choking up water channels and hydroelectric plants and impairing water-based recreational activities.

As the species is difficult to eradicate, it is important to prevent it from spreading into other EU countries. EU-level action includes a ban on sales, planting or keeping, measures on pathways of unintentional introduction and spread and a rapid eradication obligation for newly establishing populations. Where the species has become widely spread, appropriate management measures have to be taken.

Gunnera tinctoria (Chilean rhubarb)

The Chilean rhubarb is native to South America. It looks similar to our native rhubarb on a grand scale, but is completely unrelated. It was introduced into Europe as an ornamental plant but has since escaped into the wild and is now established in four Member States: France, Ireland, Portugal (only in the Azores), and Spain, as well as in the United Kingdom.

A prolific species, it invades streams and river banks, lake and pond margins and coastal cliffs, where its large leaves prevent other plants from growing beneath, causing the local disappearance of native species and the alteration of entire ecosystems. It can also block drains and streams, degrade agricultural land and recreational areas, and cause soil erosion.

Placing it on the Union list puts an end to its growing and selling, may trigger measures on pathway management, will ensure rapid eradication of newly establishing invasions and management of established populations.

Gymnocoronis spilanthoides (Senegal tea plant)

The Senegal tea plant is a perennial aquatic herb, which can also grow in a submerged form, and is native of portions of tropical and subtropical America from Mexico to Argentina. It was first recorded in the EU in Hungary in 1988 where it is now established. It has also been recorded in Italy, likely introduced via the aquarium and ornamental pond plant trade. In its alien range, the species grows in wetlands, particularly slow moving rivers (including tidally influenced areas), reservoirs, irrigation channels, ponds, lakes, canals and ditches.

The Senegal tea plant has the potential to have a devastating impact on native flora and fauna in aquatic ecosystems. It rapidly grows large, dense mats that can quickly smoother and outcompete native vegetation, both on and below the water surface. In doing so, it prevents the wind-induced mixing of the water column, resulting in reductions in dissolved oxygen, followed by losses in invertebrate and fish biodiversity. Furthermore, these dense mats can have a considerable impact on the economy by blocking irrigation channels, access to water and navigation, increased flooding, thereby also decreasing the recreational value of waterbodies and watercourses.

Control of established populations of the Senegal tea plant is extremely time-consuming and costly, but could potentially be achieved via careful and thorough hand pulling of individuals, including roots. There is ample evidence that the species can tolerate a wide climatic gradient, and consequently, has the potential to invade vast areas of the EU. Therefore, prevention and early detection through awareness-raising campaigns and citizen science networks will be critical to avoid further introductions and spread.

Heracleum mantegazzianum (Giant hogweed)

The giant hogweed is a more than 2 meters high flowering plant native to the Western Greater Caucasus. It was first introduced into Europe as an ornamental plant but has since spread rapidly via wind and water to a wide range of semi-natural or degraded habitats. The species' appearance and environmental impacts are similar to those of the Persian hogweed and the Sonowski's hogweed.

It is now well established in 19 Member States: Austria, Belgium, Croatia, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Luxembourg, Poland, the Netherlands, Slovakia, Slovenia, and Sweden, as well as in the United Kingdom. In these countries, it has become a major pest capable of invading and completely transforming the landscape. The plant is highly phototoxic: contact with its juice can cause major skin inflammations and even severe burns upon exposure to sunlight.

EU-level action includes a ban on sales and on any planting or keeping, a rapid eradication of newly establishing populations, and appropriate management measures where the species is already widely spread.

Heracleum persicum (Persian hogweed)

The Persian hogweed is a large flowering plant native to Turkey, Iraq and Iran. It was first introduced into Northern Europe as an ornamental curiosity and has since become established in coastal habitats, wetlands and pastures in five Member States (Czech Republic, Denmark, Estonia, Finland, and Sweden), as well as in the United Kingdom.

Because of its ability to form dense impenetrable stands, the Persian hogweed has a tendency to suffocate out all other native plants and wildlife, causing significant ecological damage, particularly in Natura 2000 sites. It also has a major economic impact due to its erosive effects and impaired drainage along river courses. Contact with the plant's sap, if exposed to sunlight, can cause severe skin burns. Some recreational areas have become completely inaccessible as a result.

EU-level action includes a ban on sales and any planting or keeping, including in gardens, and a rapid eradication of any new populations to avoid the excessively high costs associated with its management later on. Where the species has become widely spread, appropriate management measures have to be taken.

Heracleum sosnowskyi (Sosnowsky's hogweed)

Sosnowsky's hogweed is a large flowering plant native to the Caucasus, Transcaucasia and North-East Turkey. It was first introduced for silage in the 1940s but has since spread rapidly via wind and water to a wide range of semi-natural or degraded habitats. The species' appearance and environmental impacts are similar to those of the Persian hogweed and the giant hogweed.

It is now well established in seven Member States (Denmark, Estonia, Finland, Hungary, Latvia, Lithuania, Poland), where it has become a major pest due to its ability to completely invade and transform the landscape. The plant is highly toxic to humans and even a few small drops of the plant's juice can cause major burns on the skin.

Once established, the species is almost impossible to eradicate because the seeds remain viable for many years and the plants can re-sprout readily. EU-level action includes a ban on sales and on any planting or keeping, including in gardens. Furthermore, as to prevent spread into other areas and avoid the excessively high costs associated with its management later on, any new populations have to be eradicated rapidly. Where the species has become widely spread, appropriate management measures have to be taken.

Humulus scandens (Japanese hop)

The Japanese hop is an annual vine native to China, Taiwan, Japan, Korea, the Russian Far East, and Vietnam. It was introduced to the EU as an ornamental species, and is now often seen growing over trellises and fences. The species was first recorded in 1893 in France and has since been recorded in Austria, Belgium, Bulgaria, Czechia, Germany, Poland, Romania, Slovenia, Switzerland and Ukraine. In addition, it is considered established in Serbia, France, Hungary and Italy.

The Japanese hop commonly occurs in riparian habitats, particularly on the loose, bare surfaces of alluvial bars formed by rivers and stream-sides by temporary floods. It is considered a transformer species because it can have an immense impact on native plant communities by rapidly forming dense stands that outcompete and suffocate other species. By excluding other perennial herbaceous species, it may also promote erosion due to the absence of vegetation in winter.

This species is already cultivated in many gardens across Europe. Therefore, a primary strategy to prevent it from invading additional EU riversides should be by encouraging citizens not to plant it anymore and to actively eradicate it from private spaces (for example, gardens). Increased public awareness-raising campaigns are needed to upscale these efforts. In the wild, rapid eradication and control of Japanese hop can be achieved by manual pulling or multiple cuttings to prevent seed production.

Hydrocotyle ranunculoides (Floating pennywort)

The floating pennywort is a fast-growing aquatic plant native to North, Central and South America. Widely sold as an ornamental plant for aquaria and garden ponds in Europe, it has since escaped into the wild and is now present in eight Member States (Belgium, France, Germany, Hungary, Italy, the Netherlands, Portugal, and Spain), as well as in the United Kingdom.

The plant has an extremely rapid growth rate: it can quickly dominate any water body blocking out the light, depleting oxygen levels and reducing water flows and temperatures, thereby posing a major threat to biodiversity and the economy. In Belgium, it is known to halve the number of native aquatic plant species found in a typical watercourse.

There is a high risk of the species spreading further into other Member States. EU-level action includes a ban on sales and on any planting or keeping, including in isolated ponds. A rapid eradication of any new populations is required to avoid the excessively high costs associated with its management later on. Where the species has become widely spread, appropriate management measures have to be taken.

Impatiens glandulifera (Himalayan balsam)

The Himalayan balsam is native to the foothills of the Himalayas from north-west Pakistan to northern India. A tall, attractive, annual herb, it was first introduced as a garden plant in the early 19th century and has since escaped in the wild. It was also sown by beekeepers. The species has invaded most EU countries, but has not yet appeared in Greece, Malta, Cyprus and many parts of other Member States.

The species spreads rapidly by means of explosive seed heads and out-competes native species, particularly along river banks, floodplain forests and wet meadows. Die back of extensive stands of Himalayan balsam over the winter can leave river banks bare and exposed to erosion.

The listing of the species puts an end to trade and the deliberate planting and keeping of this species, e.g. for honey production. Newly establishing populations will be rapidly eradicated, and widely spread populations will be managed in order to mitigate its major impact on protected areas and vulnerable natural habitats. EU cooperation is important, taking into account that this species is spreading mostly with water courses that flow through more than one country.

Lagarosiphon major (Curly waterweed)

The curly waterweed is a delicate aquatic plant with whirly leaves. Native to South Africa, the species was introduced into Europe as an oxygenating plant for the aquarium trade. It has since established itself in slow-flowing water bodies, lakes and ponds across 10 Member States (Austria, Belgium, France, Germany, Hungary, Ireland, Italy, the Netherlands, Portugal, and Spain), as well as in the United Kingdom.

Due to its rampant growth, it develops rapidly into a tangled mass that blocks out the light and alters the entire ecosystem beneath. As a result, native aquatic plants and invertebrates are unable to survive. The plant also causes significant economic damage by choking up water channels and hydroelectric plants and by impairing boating and other water-based recreational activities.

As the species is difficult to eradicate, it is important to prevent it from spreading into other EU countries. EU-level action includes a ban on sales and any planting or keeping, including in isolated ponds. Furthermore, a rapid eradication of any new populations is required, to avoid the excessively high costs associated with its management later on. Where the species has become widely spread, appropriate management measures have to be taken.

Lespedeza cuneata (Chinese bushclover)

The Chinese bushclover is a long-lived herbaceous legume native to temperate and tropical climates in eastern Asia and eastern Australia. The species has not been recorded in natural habitats in the EU, but it has proven highly invasive in the USA, where it was introduced for soil improvement and forage, and where it occurs in grasslands, woodlands, the edges of wetlands, pastures, and disturbed sites. Large parts of the EU from the Black Sea to the Atlantic region are considered to be climatically suitable for the species and therefore the risk for invasion by this species is real.

This species is considered highly invasive as it can thrive under a variety of conditions. It also produces a large seed-set, crowding out native species by forming dense stands. In areas where both the Chinese bushclover and other native plants occur, insects seem to tend to visit the Chinese bushclover flowers more often, and so the species has the potential to disrupt pollination networks. In addition, it often replaces more palatable forage species in some habitats, and therefore, it can have a significant impact on native fauna.

Currently, the Chinese bushclover is bred and utilized for forage, and it may still be in use for erosion control (e.g., in road cuts) in Europe. Seed is also available via online retailers in the EU. Once the species has established, implementing the currently available suite of management measures is costly and ineffective for eradication. Thus, stopping the import and sale of the species in the EU is a top priority for preventing introductions. Citizens can also play an important role in preventing the spread of the species in the EU by not purchasing new plants for planting. Campaigns to raise awareness to how citizens can help keep this species out of Europe should be promoted.

Ludwigia grandiflora (Water-primrose)

The water-primrose is a herbaceous perennial plant originating from the American continent. It was introduced in France in the 19th century as an ornamental plant but has since spread into eight Member States (Belgium, France, Germany, Hungary, Ireland, Italy, the Netherlands, and Spain), as well as in the United Kingdom, where it thrives in slow flowing rivers, streams, lakes and ponds.

The plant develops into a dense impenetrable blanket covered in yellow flowers that reduces the oxygen content of the waterbody. It further releases chemicals that suppress other organisms, leading to the accumulation of toxins and the poisoning of entire water ecosystems. The plant also obstructs water bodies, disrupts drainage and increases the risk of flooding, thereby causing major economic damage as well.

EU-level action includes a ban on sales and on any planting or keeping, including in isolated ponds. The rapid eradication of any new populations is required to avoid the excessively high costs associated with its management later on. Where the species has become widely spread, appropriate management measures have to be taken.

Ludwigia peploides (Floating primrose-willow)

The floating primrose-willow is a perennial aquatic plant native to the American continent. It was imported into France in the 19th century as an ornamental curiosity and has since become established in Belgium, France, Greece, Italy, the Netherlands and Spain.

The plant is very fast-growing, being capable of doubling in extent in just three to four weeks. It not only shades out any other submerged plants but alters the chemistry of the aquatic environment, thereby reducing dissolved oxygen levels and disrupting entire freshwater ecosystems. Additionally, it blocks up economically important waterways that are used for instance for recreation, fishing or navigation, causing major economic damage.

Given its prolific nature, there is a high risk that it will spread rapidly into further Member States. Once established, the species is difficult to manage. EU-level action therefore includes a ban on sales and any planting or keeping, including in isolated ponds. Furthermore, the rapid eradication of any new populations is required to avoid the excessively high costs associated with its management later on. Where the species has become widely spread, appropriate management measures have to be taken.

Lygodium japonicum (Vine-like fern)

The Vine-like fern is a perennial climbing fern which is native to much of south-eastern and south Asia, including as far as Papua New Guinea. In its native range the species is primarily observed in wetlands, forests, along river edges, ditches and adjacent to other aquatic areas. The species was first introduced to North America as an ornamental plant. Since then it has established and invaded many natural ecosystems, such as floodplain forests, marshes and other wetlands, pine flatwoods, but also timber plantations and disturbed sites. Although the Vine-like fern is not yet present in the wild in the EU it has the potential to establish in suitable areas in the Macaronesian, Atlantic and in the eastern part of the Mediterranean biogeographical regions.

The Vine-like fern reproduces by spores, which are abundantly produced and easily spread by wind and water. Once established, it can grow so dense that it forms a 'living wall', smothering native seedlings and other vegetation. Furthermore, in some cases it climbs vertically around trees and shrubs, resulting in a greater proportion of ground fires affecting tree canopies, with obvious detrimental implications for managed woodlots and plantations. The species can have other impacts, by impeding public access to forests for recreation and leisure.

Spores and plant fragments adhere readily to soil, water, clothing, as well as equipment and machinery. Once populations are established, treatments exist that have proven relatively successful at controlling or eradicating the species but they are expensive. Therefore prevention is best achieved by educating relevant officials tasked with surveillance and the wider public on the risks. In addition, citizen scientists should be encouraged to report sightings, increasing the likelihood of early detection.

Lysichiton americanus (American skunk cabbage)

The American skunk cabbage is a North American plant with large leathery leaves and bright yellow flowers. Its name comes from the putrid odour the flowers produce in spring. It grows in swamp forests and associated wetlands, fens, wet meadows, bogs, alluvial woodlands as well as along streams, riverbanks, lakes and ponds.

This attractive plant was first introduced into Europe a century ago as an ornamental garden plant. Having escaped into the wild, it is now present in eight Member States (Belgium, Denmark, Finland, France, Germany, Ireland, the Netherlands, and Sweden), as well as in the United Kingdom. After some years, its huge leaves build dense layers of vegetation that exclude all light and render the water beneath devoid of life. This is especially a problem in ecologically sensitive natural areas.

In view of its potentially serious harmful impact on Natura 2000 sites, sales and any planting or keeping, including in gardens, is now banned and concerted action is required to contain its invasion and prevent its spread into other countries.

Microstegium vimineum (Japanese stiltgrass)

The Japanese stiltgrass is a plant native to Asia. It has become established in Turkey but is not yet present in the EU.

The plant possesses many of the characteristics that are typical of invasive alien species: it grows quickly, fruits within a single season, produces abundant seed, and readily invades a wide range of natural habitats. Once established, it creates dense impenetrable stands that crowd out the native vegetation within 3-5 years with cascading ecological effects on other species, especially in areas of high conservation value. It also intensifies forest fires, after which it rapidly spreads in the following growing season.

A trade ban and pathway management is required to prevent this very damaging species from invading the EU. Its seeds can spread as contaminants on shoes and clothes, machinery, bird seed, soil or plants for planting.

Myriophyllum aquaticum (Parrot's feather)

The parrot's feather is a freshwater plant native to South America characterized by its distinctive green feathery leaves. The plant was first introduced into Europe for use in aquaria and garden ponds but has escaped into the wild. It is now established in 12 Member States (Austria, Belgium, France, Germany, Hungary, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Romania, and Spain), as well as in the United Kingdom, where it is found in a range of freshwater bodies including wetlands, lakes, ponds, ditches, slow-running streams and canals.

The plant can grow rapidly into dense mats that overwhelm the native vegetation and render the water beneath virtually lifeless. Entire ecosystems can be seriously disrupted by its presence. In addition, it causes significant economic damage to fisheries, water abstraction and irrigation, transport, hydropower and recreation.

Union action includes a ban on sales and any planting or keeping, including in isolated ponds. Furthermore, the rapid eradication of any new populations is required to avoid the excessively high costs associated with its management later on. Where the species has become widely spread, appropriate management measures have to be taken.

Myriophyllum heterophyllum (Broadleaf watermilfoil)

Native to the Eastern United States, the broadleaf watermilfoil is a popular plant in the aquarium and water gardening trades and can be readily obtained under a variety of names. In Europe, the species has become established in the wild in seven Member States: Austria, Belgium, Germany, Spain, France, Hungary and the Netherlands.

The broadleaf watermilfoil poses a major threat to biodiversity because of its rampant growth and the formation of dense mats of submerged plant matter through the entire water depth and on the surface. The mats impede the water flow and reduce sunlight and oxygen availability, causing the loss of native species and significant alterations to the ecosystem. It affects all types of freshwater bodies, including wetlands.

The risk of the plant spreading into other European countries is high. EU-level action includes a ban on sales and any planting or keeping, including in aquaria, as well as rapid eradication of any new populations to avoid the excessively high costs associated with its management later on.

Parthenium hysterophorus (Whitetop weed)

The whitetop weed is a vigorous aromatic plant from the daisy family that originates from the subtropics of North and South America. It is a pioneer species that grows in a wide range of habitats, including degraded pastures, crops, orchards, forests, as well as along railway tracks and roadsides, recreation areas, riverbanks and floodplains. While it is not yet considered established in the EU, its presence has been recorded in Belgium.

Its spread can be facilitated by accidental contamination of agricultural produce and farm machinery. Once established it readily outgrows native species, leading to a decline in natural habitats. It also produces substances that inhibit the growth of other plants, including crops. Frequent contact with the plant or its pollen can produce serious allergic reactions in humans and livestock, especially horses.

Addressing potential pathways of introduction and rapidly eradicating any emerging invasion should help to keep this species out of Europe.

Pennisetum setaceum (Fountain grass)

Native to Northern Africa, the Fountain grass is an attractive grass with feathery purple flower spikes. The species was first introduced into Europe as an ornamental plant but has since escaped into the wild. It is currently established in five Member States: Spain, France, Italy, Malta and Portugal. It has high dispersal ability through seeds and roots, and therefore the potential to spread rapidly throughout the Mediterranean. Its seeds can also spread accidentally via vehicles and machinery.

An aggressive plant that forms dense thickets, it can readily outcompete native plants with important negative impact on vulnerable native species, especially in protected areas. The Fountain grass is also a very inflammable species, increasing the intensity and spread of fires, and spreading even faster in the growing season following a fire.

The risk of the plant increasing its spread throughout the Mediterranean area is high. EU-level action includes a ban on sales and any planting or keeping, as well as rapid eradication of any new populations to avoid the excessively high costs associated with its management later on.

Persicaria perfoliata (Asiatic tearthumb)

The Asiatic tearthumb – sometimes referred to as the mile-a-minute plant – is a fast-growing herbaceous vine native to Asia. It is usually found in open areas along the edges of woods, wetlands, riverbanks, roadsides, and uncultivated fields where it scrambles over shrubs and other vegetation, blocking out the light, and eventually suffocating all that lies beneath.

Large infestations can reduce the biodiversity of natural habitats, resulting in the local extinction of rare native plants with restricted ranges. It can also cause economic losses to orchards, nurseries, and horticultural crops.

Although not yet established in the EU, the plant is already a major pest in other parts of the world, such as the US. Concerted action at EU level will prevent the species from being introduced to Europe by addressing its introduction pathways, such as inter alia contaminated soil, plant or seed imports, and by rapidly eradicating any emerging invasion.

Prosopis juliflora (Mesquite)

The mesquite is a small tree native to Mexico, South America and the Caribbean. In its native and introduced (Africa, Asia and Australia) ranges, it occurs in wasteland, forests, managed and natural grasslands, coastal areas (including coastal dunes), wetlands, abandoned fields and urban areas. It was introduced to the EU in Spain in 1988, and is reported as naturalised in Almeria and in the Canary Islands, where its hardy, drought-tolerant nature has allowed it to adapt to a wide range of habitat types, from sand dunes to cracking clays. Largely frost-free, coastal and low-lying inland areas are suitable habitats, and therefore, it could spread to suitable areas of the Macaronesian and Mediterranean biogeographic regions.

Mesquite seeds can be spread by animals or over water, yet its spread globally has primarily been human-assisted, commonly for afforestation and soil protection, with seeds easily available for purchase online. The species is a very aggressive invader with the potential to outcompete and replace native vegetation. Once established, dense thorny thickets invade rangelands, limit access to irrigation channels and roads, and lead to a complete degradation of native pasturelands. It can also have large impacts on ecosystem services, primarily water resources, nutrient cycling, successional processes.

In order to manage the potential spread of the mesquite to new regions of the EU, surveillance programmes should be put in place to ensure early detection and rapid response. If individuals are observed prior to widespread establishment, mechanic eradication by felling trees and uprooting stumps should be employed. Citizen science initiatives can critically contribute to this monitoring, in articulation with national authorities surveillance systems, by reporting sightings, thereby increasing the likelihood of early detection.

Pueraria lobata (Kudzu vine)

The Kudzu vine is a densely-packed climber with large hairy dark brown stems that grow up to 15 meters in length. Native to eastern Asia, it has been imported into the EU only recently as a horticultural curiosity. So far, the species has only escaped into the wild in Italy (as well as in Switzerland).

The vine typically grows in mixed forests but has also been found in managed habitats such as road and rail embankments, pastures, conifer plantations and riverbanks. The potential for damage is high because the mass of scrambling leaves can radically alter forest areas and crowd out native shrubs and trees. It can also have negative effects on recreational facilities, as well as on forestry activities and crop production.

Once the species is well established, management becomes very difficult. EU-level action includes a ban on sales and any planting or keeping, including in gardens, and a rapid eradication of any new population to avoid the excessively high costs associated with its management later on. Where the species has become widely spread, appropriate management measures have to be taken.

Salvinia molesta (Salvinia moss)

The Salvinia moss is a free-floating aquatic fern that corresponds to a sterile hybrid of unknown origin (but probably originating from South America). It often inhabits stagnant or slow-flowing waters such as lakes, rivers, streams, wetlands, rice paddies, irrigation channels, ditches, ponds and canals. The species has established outside of its native range throughout the tropics, subtropics and warm temperate areas. In the EU, before its trade was banned, it was sold as an ornamental plant. As a result, the Salvinia moss spread to Austria, Belgium, France, Germany, Italy, The Netherlands and Portugal, although it is unclear if any established populations exist in these countries.

The species does not produce fertile spores, but the floating form of the plant propagates vegetatively and facilitates its natural spread within and between water bodies. Dense, floating mats of the Salvinia moss can completely transform aquatic environments by slowing water flow and preventing photosynthesis. As a result they can severely impact native plant communities and other aquatic organisms such as micro and macro invertebrates, fish and waterfowl. As with other invasive alien aquatic plant species, it can also block irrigation channels, drains, and cause flooding, stop livestock reaching water, as well as degrade potable water.

Inappropriate disposal of aquarium and ornamental pond contents has led to the spread of the Salvinia moss in some countries. However, listing the species on the Union list should reduce this risk within the EU. Following the ban in trade of this species at the EU level, owners of the Salvinia moss should dispose of it by drying, incinerating or deep burying the plant.

Triadica sebifera (Chinese tallow)

The Chinese tallow is a medium-sized deciduous tree native to China and Japan, where it is found in disturbed habitats at low densities. Its rapid growth, precocious, prolific seeding, and adaptability to a wide variety of soil conditions, has increased its popularity as an ornamental plant, as well as in other commercial sectors. The species was first planted for commercialisation in the EU in the 19th century, i.e. both in France and Italy, and successively in other countries, where it can be found also in botanical gardens. However, there is no documented evidence of the species being introduced and established in the wild in the EU. Nevertheless, the species is naturally dispersed by animals and water, and so it could establish and spread in suitable areas of the EU that are climatically and environmentally similar to those countries where it has become invasive, like, for example, in the USA. These include coastal habitats, woodland and forests, grasslands and heathland, particularly in the Mediterranean and in the Black Sea biogeographic regions.

Once suitable areas are invaded, the Chinese tallow can displace native plant species and establish dominant stands, for instance, transforming grasslands into woody thickets. Furthermore, the species leaf decay is toxic to both terrestrial and aquatic environments, with native amphibian and arthropod diversity affected.

Control of the Chinese tallow is very expensive because the species can easily resprout if the aboveground vegetation is killed, quickly reproduce and disperse. To prevent establishment of the species and support early detection in the EU, campaigns are needed to educate horticulturalists, natural resource professionals and citizen scientists. Homeowners who have this species in their gardens should cut down the tree or have it professionally removed but the stump should be immediately treated to avoid resprouting.

Acridotheres tristis (Common myna)

The common myna is native to Central, South and South-eastern Asia and therefore comes from tropical and subtropical climates. However, the species can adapt to a wide range of climates, and following a number of introductions, it now occurs in all continents, except South America and Antarctica. It also occurs on several islands in all oceans.

The species was first recorded in the EU in Germany in the early 20th century. It is currently also established in Portugal and Italy, and there are additional records for Austria (albeit only historical records), Belgium, France, The Netherlands, Poland and Spain. The species is commonly found in open areas, scrubland, cultivated land, as well as urban and suburban areas. It was introduced into the wild as a consequence of the pet trade. Other possible pathways of introduction include escapes from captive stocks (for instance, zoos) and via human-assisted transportation, for example, as hitchhikers on ships and ferries. The species is also capable of spreading further unaided.

The common myna has a considerable impact on biodiversity in its introduced range, in particular on other birds through competition for food and for nesting holes. The species also predates on eggs and nestlings of native birds, and can spread parasites and pathogens. Common mynas can also become agricultural pests due to their varied, omnivorous diets that include fruits and seeds.

While it is time- and resource-consuming, established populations of this invasive alien can be successfully eradicated, as was recently achieved in the Canary and the Balearic Islands. However, the success of eradication campaigns relies heavily on their rapid implementation to avoid newly introduced birds from spreading and establishing. Where eradication campaigns are unfeasible or fail, control methods are available but they are costly and require a lot of effort and coordination to implement. Therefore, EU-level action includes raising awareness to increase knowledge on the species and pathways for its introduction, thereby facilitating rapid eradication of any newly establishing population and the management of existing populations in EU Member States.

Alopochen aegyptiacus (Egyptian goose)

The Egyptian goose can be recognised by its distinctive brown eye patch and reddish brown plumage. Native to Africa, the species was first introduced to Europe as an ornamental specimen for zoological collections and urban parks. It has since escaped into the wild and is now established in eight countries: the United Kingdom, the Netherlands, Belgium, Germany, Sweden, Cyprus, Denmark and Poland.

The Egyptian goose adapts easily to a wide range of environments. It is an aggressive species that is known to hybridize with other goose and duck species and it out-competes native fauna for food and nesting sites. When present in large numbers, its impacts include overgrazing, eutrophication and spread of diseases.

A sales ban, the phasing out from zoos, collections and any other ownership, a rapid eradication of any newly emerging populations and the management of established populations should prevent the species from becoming a wider problem across the EU.

Arthurdendyus triangulatus (New Zealand flatworm)

The New Zealand flatworm is a terrestrial flatworm native to New Zealand's temperate South Island, where it is commonly associated with disturbed habitats and southern beech *(Nothofagus)* forests. It was first recorded in the EU in Ireland in 1984, and is now well established in Ireland and Britain, with genetic evidence suggesting it has been introduced on multiple occasions.

The New Zealand flatworm appears to be well suited to the mild, maritime climate of Ireland and Britain. Therefore, the species could successfully establish in Atlantic coastal regions of other EU Member States. Its unintentional introduction and spread is primarily facilitated by the movement of soil, for example, with the ornamental plant trade, agricultural produce, or with topsoil.

The species is an aggressive predator of earthworms. This negatively impacts not only plant productivity by lowering numbers of nutrient-cycling earthworms, but also has a significant impact on other native species which prey on earthworms, such as birds and mammals.

Once established, New Zealand flatworm invasions become very difficult and expensive to control. Additionally, because they are soil-dwelling organisms, measures directed against them could also negatively affect native soil biodiversity. Therefore, the most effective way to stop it is by preventing its introduction in the first place. Since New Zealand flatworms can be translocated with soil in potted plants, EU-level action includes tighter controls over plant trade to avoid their introduction. Ornamental plant traders and farmers can also help in preventing the introduction and spread of this invasive alien species by, for example, inspecting pots or trays carefully (especially if they come from an area where findings of the flatworm have been reported). Farmers should also consider inspecting all silage and hay bales they bring onto their farm. However, where the species has become widely spread, additional appropriate management measures have to be taken (for instance, crop rotation, manure input, etc.).

Callosciurus erythraeus (Pallas' squirrel)

The Pallas' squirrel is a red-bellied tree squirrel native to South East Asia. It was first introduced in the 1970s to Southern France as a pet. Following escapes and intentional releases, it has since established itself in forests, parks and gardens, in both suburban and rural areas. It is currently present in four Member States (Belgium, France, Italy and the Netherlands).

The Pallas' squirrel is a particularly successful invasive alien species because it is highly adaptive and opportunistic, feeding on almost anything from insects to nuts. Feral populations can start from a few individuals and expand rapidly, thereby out-competing, and sometimes completely eradicating the native red squirrel. Its habit of stripping the bark off trees can also bring about significant economic damage for the forestry sector.

The import of this species has already been banned through the EU Wildlife Trade Regulation, but its inclusion on the Union list of Invasive Alien Species will ensure further concerted action to contain its invasion and prevent its spread into other countries.

Corvus splendens (Indian house crow)

The Indian house crow is a medium-sized black crow with a distinctive grey shawl across the back of its neck. It is native to the Indian sub-continent and most likely came to Europe by accident as a stowaway on a ship. It has since established itself in the Netherlands.

The species is closely associated with human settlements, scavenging on discarded food and refuse dumps, making it a potential danger to human health. It also causes damage to crops and, because it is known to predate on other bird species and small mammals, it could have a serious impact on native species as well.

Although only present in one Member State so far, the Indian house crow has the capacity to establish itself in any urban area within Europe. Therefore, EU-level action will address its potential pathways of introduction and ensure its early detection and rapid eradication to prevent its further introduction and spread into other areas and countries.

Eriocheir sinensis (Chinese mitten crab)

The Chinese mitten crab is native to eastern Asia. It owes its name to the distinctive dense mat of hair on its claws. It probably entered Europe in the early 1900s on board merchant ships hidden inside the vessels' ballast waters. It is now established in Belgium, Czech Republic, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Poland, Portugal, Romania, Slovakia, Spain and the United Kingdom, where it has spread rapidly from marine and estuarine habitats to inland freshwater systems.

The species is a disruptive "ecosystem engineer" causing major economic and ecological damage to riverbanks and flood defences through its burrowing activities. It also damages commercial fishing gear and has a negative impact on biodiversity due to predation and competition with native species.

Once established, the Chinese mitten crab is very difficult to control. Therefore, it is important not only to manage the existing populations but also to prevent them from being introduced and spread out further. Management measures could include its consumption as a source of food or animal feed, subject to the control of their pollutant concentrations and provided that this is integrated in the management measures of the Member State.

Herpestes javanicus (Small Indian mongoose)

The Small Indian mongoose is a small mammal whose natural range extends from Iran to northern India and Indochina. The species was deliberately introduced to a number of Croatian islands in the early 20th century to control populations of the venomous horned viper. However, being an opportunistic feeder, it has also devoured significant numbers of native reptiles, amphibians and farmland birds, causing a major loss of biodiversity as well as significant economic damage.

Because the species is so adaptable, it could readily spread to other Southern European countries (Bulgaria, Cyprus, France, Greece, Hungary, Italy, Malta, Romania, Slovenia, Portugal and Spain) if the opportunity arose. The species is already a major pest in many locations across the world and it is listed by the International Union for Conservation of Nature among the world's 100 worst invaders.

A sales ban, the phasing out from zoos, collections and any other ownership, and a rapid eradication of any newly emerging populations should prevent the species from spreading further within the EU. On the invaded Croatian islands, appropriate management measures have to be taken.

Lepomis gibbosus (Pumpkinseed)

The pumpkinseed is a freshwater fish native to eastern North America, inhabiting lakes, ponds and small rivers, particularly those with high vegetative cover. It was first introduced to Europe in the 1880s as an ornamental fish for outdoor ponds and aquaria. It has since been released in multiple water basins in the EU, accidentally or deliberately for sport fishing and fish cultures. The pumpkinseed is established in all EU Member States, apart from Estonia, Malta and Sweden.

A high reproductive success and a highly varied diet make establishment of the species in habitats outside their native range very difficult to control. The impact of pumpkinseed invasion on native species and abiotic conditions of water bodies is so high that they are considered 'ecosystem-altering' invasive alien species. The species outcompetes native fish as it has an aggressive behaviour, and predates upon their eggs and juveniles. There is evidence it is also responsible for considerable declines in local invertebrates and endangered amphibians, including several species listed in the Habitats Directive, and as such protected by the EU legislation. For this reason, the pumpkinseed can have a remarkable impact on a natural and semi-natural habitats as well in recreational fishing waters.

Eradication of established pumpkinseed from large water basins is virtually impossible due to a number of technical constraints. Therefore preventing further introductions and spread through public awareness-raising campaigns is critical. Although unlikely to be effective in the long-term, the removal of this species through over-fishing may be useful in decreasing the impact of pumpkinseed invasions on native biodiversity, particularly in smaller water bodies.

Lithobates catesbeianus (American bullfrog)

The American bullfrog is the largest of the North American frogs, weighing up to half a kilo. Its name comes from its distinctive bellowing calls. Originally introduced into Europe for consumption and as a pet, it has since escaped into the wild, colonising a wide range of habitats, including ponds, swamps, reservoirs, marshes and irrigation channels.

Its size, breeding capacity, and voracious appetite enable it to outcompete and displace other native amphibian species. It is also known to pass on lethal diseases to wildlife, such as the chytrid fungus, implicated in massive die-offs of amphibians worldwide.

The American bullfrog is currently established in six Member States (Belgium, France, Germany, Greece, Italy, and Slovenia), as well as in the United Kingdom, and it could easily invade other countries. The import of this species has already been banned through the EU Wildlife Trade Regulation, but its inclusion on the Union list of Invasive Alien Species will ensure further concerted action to contain its invasion and prevent its spread into other countries.

Muntiacus reevesi (Muntjac deer)

Muntjac deer is a small deer native to South Asia. It was first introduced into European country parks in the early 1900s and has since become established in the wild in five Member States (Belgium, Denmark, Germany, Ireland, the Netherlands), as well as in the United Kingdom. It is mostly associated with forest edges and dense woodlands.

In large numbers, the muntjac deer has a profound impact on the structure and ground layer of native woodlands and can destroy a wide range of natural habitats that are important for native wildlife. The species can be problematic particularly in Natura 2000 sites where it can overgraze rare plants and prevent coppice growth. In forestry, trees often require protection from deer during their early years.

A sales ban, the phasing out from zoos, collections, and any other ownership, a rapid eradication of any newly emerging populations, and the management of established populations should prevent the species from establishing itself and causing further serious damage to Europe's biodiversity.

Myocastor coypus (Coypu)

The coypu or nutria is a large rodent from South America. It was first introduced into Europe in the 19th century for fur farming. While farming has been abandoned in the meantime, the species has since colonised coastal marshes, swamps and other wetland areas in no less than 19 Member States (Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, the Netherlands, Poland, Romania, Slovakia, Slovenia and Spain). It has, however, already been eradicated from the United Kingdom.

Considered a major pest across much of the EU, the coypu is estimated to cost over 65 million euros a year in economic damage and management costs. Because of its voracious appetite, it severely disrupts the natural habitats and alters the composition of local plant communities. Additionally, it degrades river banks and irrigation systems through its extensive burrowing activities and has a major impact on agriculture.

A ban on sales, a phasing out of any ownership, a rapid eradication of any newly emerging population, and the management of established populations should help to contain the invasion.

Nasua nasua (Coati)

The coati is easily recognised by its ringed tail and long snout. Native to South America, it was first imported into Europe for the pet trade and has since established itself in a number of key Natura 2000 sites on the island of Majorca in Spain. It also survived out of captivity in France and Germany.

Its rapid spread in Majorca demonstrates the strong invasive potential of the species. Being an opportunistic feeder, the coati can cause the local decimation of rare native species, such as the Majorcan midwife toad. Further potential risks could include economic damage to agriculture and the transmission of diseases to farmed animals and humans.

A sales ban, the phasing out from zoos, collections and any other ownership, a rapid eradication of any newly emerging populations, and the management of established populations should prevent the species from being introduced or spreading into other Southern European countries.

Nyctereutes procyonoides (Raccoon dog)

The raccoon dog is native to Eastern Asia. It is named for its superficial resemblance to the North American raccoon to which it is not closely related. In Europe, the raccoon dog has spread rapidly in the wild after escaping from fur farms or from pet owners, as well as following massive introductions into the wild in the former Soviet Union in the first half of the 20th century. Wild populations are now established in 14 Member States: Bulgaria, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Latvia, Lithuania, Poland, Romania, Sweden and Slovakia.

The raccoon dog is one of the most successful alien carnivores in Europe thanks to its high reproductive capacity, flexible feeding habits and adaptive behaviour. It has a major impact on biodiversity, predating on many native species such as waterfowl, amphibians, rodents, reptiles and insects. It is also a very important vector of rabies, parasitic worms, ticks, sarcoptic mange and other parasites and diseases dangerous for native wildlife, as well as for humans.

Union level action includes a ban on keeping and selling the species, a rapid eradication obligation of newly emerging populations and the management of established populations in order to prevent the species from becoming a wider problem across the EU and to keep them out of protected areas.

Ondatra zibethicus (Muskrat)

The muskrat is native to North America. The species was originally introduced for fur farming in the early 1900s but has since escaped or been deliberately released into the wild. It is currently established in 19 Member States: Austria, Belgium, Bulgaria, Croatia, Czech Republic, Estonia, Finland, France, Germany, Hungary, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Romania, Spain, Sweden, having been successfully eradicated in Ireland and in the United Kingdom in the 1930s.

Muskrats are a fast growing, gregarious species, with a high reproductive potential and a nomadic lifestyle, which makes them highly adaptable to different freshwater environments. They change the composition and structure of native wetland vegetation, which in turn affects aquatic invertebrates and destroys fish nurseries. Their burrowing activities degrade river banks and affect river flow. They can also exert a strong predation pressure on endangered species such as the freshwater pearl mussel. The economic impact of the muskrat is no less significant. It causes extensive damage to crops, irrigation systems, roads, railroads, dams and flood protection systems.

Union level action includes a ban on keeping and selling, a rapid eradication of newly establishing populations and containment of the invasion, especially keeping them out of protected areas.

Orconectes limosus (Spiny-cheek crayfish)

The spiny-cheek crayfish is a small North American crayfish that was deliberately introduced into Europe to supplement dwindling stocks of Europe's native crayfish (*Astacus astacus*). Although it failed as a commercial venture, the species has managed to colonise rivers, streams, ponds and lakes in 18 EU Member States (Austria, Belgium, Bulgaria, Croatia, the Czech Republic, France, Germany, Hungary, Italy, Latvia, Lithuania, Luxemburg, the Netherlands, Poland, Romania, Slovakia, Slovenia, and Spain), as well as in the United Kingdom.

As other invasive alien crayfish, its high reproductive rate and tolerance to a wide range of environmental conditions has enabled it to spread far and wide. It is now one of the primary causes of the decline of native European crayfish species, through both competition for resources and the spread of the crayfish plague.

A ban on releasing or restocking the species, rapid eradication of any newly emerging populations, and the management of established populations should contain the species. Part of the management solution also lies in its continued commercial fishing, provided that their pollutant concentrations are monitored, and provided that this is integrated in the management measures of the Member State.

Orconectes virilis (Virile crayfish)

The virile crayfish, native to North America, was imported to Europe for the aquarium trade. It was first recorded in the wild in 2004 in the Netherlands and is now also present in the United Kingdom. It is most likely to have been deliberately released into the wild due to the disposal of unwanted aquarium collections.

As with other invasive alien crayfish, the virile crayfish can spread very rapidly into new waterbodies due to its high reproductive rate and fast growth. High population density impacts heavily on freshwater habitats since they consume massive quantities of food and disrupt the natural food chain.

In view of the species' strong invasive potential, a ban on keeping, including in aquaria, or releasing the species, a rapid eradication of any newly emerging populations, and the management of already established populations should prevent the species from spreading or being introduced to other areas or Member States. At present there is no easy or cost-effective way to control any of the non-native crayfish populations once they become established.

Oxyura jamaicencis (Ruddy duck)

The ruddy duck, native to North America, was first introduced into Europe as part of a wildfowl collection in the 1940s but it has since escaped into the wild in 11 Member States (Austria, Belgium, the Czech Republic, Finland, France, Germany, Hungary, Ireland, Italy, the Netherlands, and Portugal), as well as in the United Kingdom.

Ruddy ducks can interbreed with the much rarer native white-headed duck *(Oxyura leucocephala)*, which was originally present throughout southern Europe but is now only breeding in Spain. If the ruddy duck's range is allowed to spread further into the remaining breeding ranges of the white-headed duck, it will almost certainly lead to the extinction of the native species. The only real solution would be to eradicate the species completely from Europe.

Its import has already been banned through the EU Wildlife Trade Regulation, but placing it on the Union list will further contain the invasion by prohibiting its sale, phasing out its keeping and requiring a rapid eradication of any newly observed populations. The eradication of the ruddy duck in the Western Palaearctic by 2020 was recommended within the framework of the Convention on the Conservation of European Wildlife and Habitats.

Pacifastacus leniusculus (Signal crayfish)

Originating from North-Western US and Canada, the signal crayfish was first introduced into Europe over 100 years ago to revive the dwindling crayfish industry. It is now one of the most widespread non-native crayfish species in Europe present in 22 Member States (Austria, Belgium, Croatia, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Latvia, Lithuania, Luxemburg, the Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, and Sweden), as well as in the United Kingdom.

As with other invasive alien crayfish, the signal crayfish outcompetes native species and alters the habitat structure. It is also a vector of the crayfish plague, which has led to large-scale mortalities amongst European crayfish populations.

Today, the signal crayfish supports a large, commercially and recreationally important fishery sector, especially in Sweden, Finland and the Netherlands. Placing the species on the Union list does not need to undermine its current socio-economic value, but a ban on releasing or restocking the species, pathway management and the rapid eradication of new invasions should help contain its further spread. Continued fishing will therefore be part of the management solution, provided that this is integrated in the management measures of the Member State.

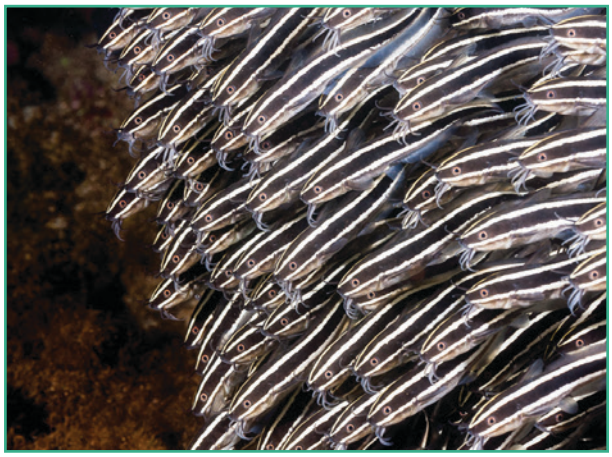
Perccottus glenii (Amur sleeper)

The Amur sleeper is a small, streamlined fish, native to North Korea and far eastern Russia. It is now one of the most widespread and successful invasive fish species in European inland waters, especially in ponds in Eastern Europe and in large parts of the Danube, the Vistula and other river basins. The species is currently present in nine Member States (Bulgaria, Croatia, Estonia, Germany, Hungary, Lithuania, Poland, Romania and Slovakia).

The Amur sleeper is a voracious predator. It can have a significant negative impact on native aquatic species, especially amphibians and other freshwater fish, not only through competition for food and predation but also possibly through the transmission of diseases and the disruption of the food chain.

Given the difficulties and the costs associated with eradicating or controlling this species, management of potential pathways and the rapid eradication of any newly emerging populations should prevent the species from spreading into yet unaffected water bodies. Stowaway individuals in consignments of other fish species is probably the most important pathway of introduction and spread.

Plotosus lineatus (Striped eel catfish)



The striped eel catfish is a marine catfish species native to most of the Indo-Pacific region, from the Red Sea and East Africa to Samoa, Japan, Korea, Australia and Micronesia. In this range, it inhabits a variety of coastal benthic habitats, coral reefs, seagrass beds, estuaries and tide pools. The species is present in the Mediterranean but has not yet been recorded in the EU. However, it has established populations in some EU neighbouring countries, such as Tunisia, Turkey and the Middle East. For this reason it is considered likely to enter the EU (including through natural dispersal) in the near future. One of the most distinctive features of this species is the fact that their first dorsal and each of the pectoral fins conceal spines that deliver a highly toxic venom when touched, one that could be fatal even to humans.

With population explosions often following establishment, the striped eel catfish has the potential to outcompete similar native species for prey. Furthermore, juvenile feeding swarms can increase turbidity and alter properties of the sediment with consequences for nutrient cycling, and mobilization of demersal eggs or dormant cysts. Invasions of the species also negatively impact the fishing industry, as much time is needed to remove them from the catch to avoid injuries to fishermen as a result of its venomous spines.

There are currently no management practices that could affect the species capability to establish in the EU via natural dispersal. However, targeted intensive fishing could help to provide local control of its impact on native biodiversity, especially during the reproductive period.

Procambarus clarkii (Red swamp crayfish)

The red swamp crayfish is a highly adaptable freshwater crayfish, native to South-Eastern USA. It is commonly found in slow-flowing rivers, marshes, canals and rice paddies. Originally introduced into Europe for aquaculture, it has since escaped into the wild and is now present in 9 Member States (Austria, Belgium, Cyprus, France, Germany, Italy, the Netherlands, Portugal, and Spain), as well as in the United Kingdom.

Along with other invasive alien crayfish, the red swamp crayfish is responsible for the dramatic decline of the native crayfish Austropotamobius pallipes to which it transmits a lethal fungal disease. In addition, it is known to change the structure of entire wetland habitats by disrupting the native species composition and it causes significant damage to drainage and irrigation systems, especially in rice-growing areas.

A ban on releasing or restocking the species, pathway management and rapid eradication of any newly emerging populations will prevent invasion into new areas and other Member States. Part of the management solution will be to continue fisheries, provided that this is integrated in the management measures of the Member State.

Procambarus fallax f. virginalis (Marbled crayfish)

The marbled crayfish is a medium-sized crayfish with a distinct marbled pattern. It is the only crayfish with the capacity to clone itself. All individuals are female which means the offspring are genetically identical to the parent. A popular species for the aquarium trade, it has since escaped or been released into the wild in six Member States (Croatia, the Czech Republic, Germany, Italy, the Netherlands, and Slovakia). Its origin is unknown.

Although the species is still quite limited in distribution and there is little evidence of it having a major impact so far, it could potentially become a major threat to native European crayfish species through competition and the spread of the crayfish plague. As other introduced crayfish, it is also likely to disrupt natural wetlands through its extensive burrowing activities.

A ban on keeping, including in aquaria, or releasing the species, pathway management and the rapid eradication of any newly emerging populations will prevent the species from being introduced into other parts of the EU.

Procyon lotor (Raccoon)

The raccoon is a medium-sized carnivore originating from North America with a distinctive black eye mask and a ringed bushy tail. It was brought into Europe in the mid-20th century for the fur trade and has since escaped into the wild. It is a cute-looking animal that became popular in zoos and as a pet. It is now present in 16 Member States (Austria, Belgium, Croatia, the Czech Republic, Denmark, France, Germany, Hungary, Ireland, Italy, Luxemburg, Poland, Romania, Slovakia, Slovenia and Spain).

Raccoons can survive in a wide range of habitats. They are omnivorous and opportunistic, eating eggs, chicks and adult birds, especially waterfowl. Their impact on biodiversity can be severe, especially in Natura 2000 wetlands. They are also known to damage fruit trees, vineyards and chicken farms and they carry important diseases and parasites, such as rabies, roundworms and toxoplasmosis.

A sales ban, the phasing out from zoos, collections or any other ownership, a rapid eradication of any newly emerging populations, and the management of established populations should prevent the species from invading the rest of the EU.

Pseudorasbora parva (Stone moroko)

The stone moroko is a small fish native to Eastern Asia. It typically inhabits small ponds and ditches, but also sometimes larger lakes and streams. It is now present in 18 Member States (Austria, Belgium, Bulgaria, Croatia, the Czech Republic, Denmark, France, Germany, Greece, Hungary, Italy, Luxemburg, the Netherlands, Poland, Romania, Slovakia, Slovenia, and Spain), as well as in the United Kingdom.

It was first introduced to the EU either by accident as a hitch-hiker on carp species imported for aquaculture, or intentionally for recreational fishing or the ornamental fish trade. Because the species is tolerant of a wide range of environmental conditions and occasionally predates on the eggs of other fish species, such as the indigenous gudgeon, it can quickly dominate new water bodies, causing the loss of native species.

An EU-level ban on keeping, including in aquaria, or releasing the species, action on pathways of introduction and spread, and rapid eradication of any newly emerging population will prevent its further invasion into other Member States. Where the species has become widely spread, appropriate management measures have to be taken.

Sciurus carolinensis (Grey squirrel)

The grey squirrel is a medium-sized tree squirrel native to the forests of North America. It was introduced in Italy, Ireland and the United Kingdom where it is now expanding in range.

The grey squirrel can be found in natural forests, as well as in planted forests, scrublands, urban parks and gardens. Due to its competitive nature and propensity to carry diseases, it is now one of the main threats to the survival of the native red squirrel. It can also cause significant economic and ecological damage through its habit of bark stripping, which increases the risk of fungal infections and insect damage to trees.

The import of this species has already been banned through the EU Wildlife Trade Regulation, but placing it on the Union list will further contain the invasion by prohibiting its sales, phasing out its keeping and requiring a rapid eradication of any newly observed population and management of the established populations.

Sciurus niger (Fox squirrel)

The fox squirrel is a relatively large squirrel with a long, bushy tail native to North America. Until recently, it was imported to Europe for the pet trade. It has not yet established itself in the wild.

There is a strong likelihood that the species will become invasive if it were to escape into the wild, as the conditions in many European countries are similar to those in its native home range. As other invasive squirrels, it could outcompete the native red squirrel and pass on diseases and parasites to which the native fauna is not resistant.

The import of this species has already been banned through the EU Wildlife Trade Regulation, but placing it on the Union list will further prevent the invasion by prohibiting its sales, phasing out its keeping and requiring a rapid eradication of any newly observed population.

Tamias sibiricus (Siberian chipmunk)

The Siberian chipmunk is a small squirrel native to the Siberian taiga. It was introduced into Europe as a pet in the 1960s. Since then, individuals have most probably escaped or been deliberately released from captivity. So far, isolated wild populations have been recorded in woodlands, suburban forests and urban parks in Belgium, France, Germany, Ireland, Italy and the Netherlands.

It is suspected to compete with native rodents and may have a local impact on ground-nesting birds, although the numbers of studies investigating its potential impact on biodiversity are currently limited. It can also cause significant damage to crops, gardens and orchards and it is a potential host for various infectious diseases, such as Lyme disease or rabies, and parasites.

A sales ban, the phasing out from zoos, collections and any other ownership, a rapid eradication of any newly emerging populations and the management of established populations should prevent the species from becoming a wider problem.

Threskiornis aethiopicus (Sacred ibis)

The sacred ibis is an easily recognisable large bird with a bald, black head and neck, a thick curved bill and black legs. A native to sub-Saharan Africa, it was first brought into France and Italy as a zoological specimen in the 19th century but has since escaped into the wild. It is currently present in eight Member States (Belgium, France, Greece, Italy, Latvia, Lithuania, Portugal and Spain).

Sacred ibises are highly mobile and adaptable. They feed in a variety of man-made habitats including rubbish tips, farmyards and ploughed fields but are mostly found in wetlands, often in large colonies. Through its feeding habits, it can outcompete and even predate on native water birds, thus causing severe biodiversity losses locally. Colonial-nesting species such as terns and seabirds are particularly vulnerable.

A sales ban, the phasing out from zoos, collections and any other ownership, a rapid eradication of any newly emerging populations and the management of established populations should prevent the species from becoming a wider problem in other areas and Member States.

Trachemys scripta (Red-eared, yellow-bellied and Cumberland sliders)

The slider is a large freshwater turtle, native to Eastern and Central US. There are three sub-species: red-eared, yellow-bellied and Cumberland sliders. In the past, over 50 million individuals have been imported into Europe for the pet trade. Many have since escaped or been deliberately released into the wild. The species is now present in 22 Member States (Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Luxembourg, Poland, Portugal, Romania, Slovakia, Slovenia and Spain).

The slider is a serious threat to endangered populations of indigenous turtle species, such as the European pond turtle *Emys orbicularis* or the Mediterranean turtle, *Mauremys leprosa* because it competes for basking and nesting sites. With its voracious appetite, it disturbs aquatic habitats and poses a human health risk, being a possible reservoir for salmonella.

The import of the red-eared, yellow-bellied and Cumberland sliders has already been banned through the EU Wildlife Trade Regulation, but placing all three sub-species on the Union list will further contain the invasion.

Vespa velutina nigrithorax (Asian hornet)

The Asian hornet is native to South-East Asia and was probably introduced by accident through imported goods from China. Since its first recording in France in 2005, it has spread rapidly into Germany, Italy, Portugal, and Spain.

The Asian hornet is a highly effective predator of honeybees, wasps and other important pollinators, such as hoverflies. The huge size of its colonies (consisting of up to 10,000 individuals per season) means that they can rapidly decimate entire beehives. Observations in France noted losses of 14,000 honeybees per hive per month. Due to its aggressive nature and feeding habits, it could have a serious impact on native insect biodiversity and on pollination services in general.

Given that queen hornets are highly mobile and very adaptable, there is a strong risk that the species will be able to spread rapidly across the landscape, causing significant economic and ecological damage. EU-level action seeks to prevent this spread by inter alia rapidly destroying its nests. In addition, where the species has become widely spread, appropriate management measures have to be taken.

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KH-04-20-414-EN-N