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Baseline distribution of invasive alien species added to the Union list in 2019

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Table of contents

Abstract	2
Acknowledgements / Contributors	3
Executive summary	5
1. Introduction	7
1.1 Background	7
1.2 Purpose of the report	8
2. Methodology	8
2.1 Background	8
2.2 The use of the European Alien Species Information Network as a data source	8
2.3 Methodology for Member States contributions	10
2.4 Member States feedback	11
2.5 Scientific and technical issues	12
2.6 Building the distribution baseline	12
2.7 Traits of Invasive Alien Species of Union concern	13
3. Results	14
3.1 Baseline distribution at country level	14
3.2 Baseline distribution at grid level	18
3.3 Traits of Invasive Alien Species of Union concern	34
4. Discussion & Conclusions	44
References	48
List of abbreviations and definitions	50
List of figures	52
List of tables	54
List of annexes	55

Abstract

The EU Regulation 1143/2014/EC (IAS Regulation) recognizes the need for a coordinated set of actions to prevent, control and mitigate Invasive Alien Species (IAS) in Europe. The IAS Regulation gives priority to a list of species, named as IAS of Union concern. The current report defines an EU baseline of spatial distribution for the 18 species added to the Union list in 2019, based on the assessment of data aggregated through the European Alien Species Information Network (EASIN) in collaboration with the Competent Authorities of 16 EU Member States. The report also provides species traits, which have a key role in biological invasions management. For each IAS, the year and country of first introduction in the EU, the main pathway of introduction, the taxonomic group, the habitat, the origin, and the impact are given. The distribution baseline has revealed that most IAS have been introduced and spread across western EU countries, while their presence is more limited in eastern MS. Several species are already quite widespread across the EU (e.g. *Lepomis gibbosus*, *Ailanthus altissima*), other are still rare (e.g. *Andropogon virginicus*, *Arthurdendyus triangulatus*) or are completely absent from the EU (*Lespedeza cuneata*, *Lygodium japonicum*, *Plotosus lineatus*, *Cortaderia jubata*). Most IAS were primarily introduced in the EU through escapes linked with introduction for ornamental purposes, and aquarium trade before the 1950's. Most of them originate from East Asia. This baseline constitutes an important tool supporting the implementation of the IAS Regulation.

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BE: We note that baseline data of Union concern IAS for BE are based on:

Adriaens, Tim, Barbier, Yvan, Branquart, Etienne, Coupremagne, Maxime, Desmet, Peter, Devisscher, Sander, ... Prevot, Céline. (2020). Belgian baseline distribution of invasive alien species of Union concern (Regulation 1143/2014/EC) [Data set]. Zenodo. <http://doi.org/10.5281/zenodo.3835756>

HR: Data on *Acacia saligna* (Labill.) H.L.Wendl., *Humulus scandens* (Lour.) Merr., *Nyctereutes procyonoides* (Gray, 1834) and *Lepomis gibbosus* (Linnaeus, 1758) were retrieved from the Ministry of Economy and Sustainable Development (2020), Nature Protection Information System (NPIS), and spatial data on *Ailanthus altissima* (Mill.) Swingle were retrieved from Nikolić, T. (ed.) (2020): Flora Croatica Database. University of Zagreb, Faculty of Science, Department of Botany and Botanical Garden, Zagreb. <http://hirc.botanic.hr/fcd> (accessed May 27, 2020).

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CZ: Data was provided from Dr. Jan Pergl from Institute of Botany CAS (www.pladias.cz; more information here: Wild J., Kaplan Z., Danihelka J., Petřík P., Chytrý M., Novotný P., Rohn M., Šulc V., Brůna J., Chobot K., Ekrt L., Holubová D., Knollová I., Kocián P., Štech M., Štěpánek J. & Zouhar V. (2019) Plant distribution data for the Czech Republic integrated in the Pladias database. – *Preslia* 91: 1–24) and Dr. Tomáš Görner from Nature Conservation Agency (NCA CR: Species Occurrence Database, more information here: <https://www.casopis.ochranaprirody.cz/en/research-surveys-and-data-management/chobot-k-zarybnicky-j-kucera-z-nature-conservancy-species-occurrence-finding-data-database-serving-the-public/>).

DK: Data Contributors: Atlas Flora Danica, Natural History Museum of Denmark, Danish Ornithological Society and The Danish Environmental Protection Agency.

EE: The distribution of *Nyctereutes procyonoides* is based on the Estonian mammal atlas and data from the Estonian Environmental Agency.

FI: Natural Resources Institute Finland (Luke) and the Finnish Wildlife Agency.

FR: Fauna data is based on the National Inventory of Natural Heritage database. For *Nyctereutes procyonoides*, data for the period 1975-2005 come from a first national survey carried out by the PMC team (OFB); the contributors to this survey are: ONCFS, FDC, FNC, UNAPAF, APA, Associations de Protection de la Nature (APN), agents of ONEMA, ONF,

national parks and regional natural parks, volunteer naturalists. A second national survey was carried out in the period 2001-2013 by: agents of the ONCFS, FDC, FNC, UNAPAF, APA, Associations of Protection of Nature (APN), agents of ONEMA, ONF, national parks and regional natural parks, volunteer naturalists. Since then, the data has been supplemented by observation data from OFB agents recorded in the "logbooks" or via the BDBiodiv application (since 2014). The people involved were Jean-François Maillard (OFB - DRAS), Frédéric Vest, Blandine Decherf and Jessica Thévenot of UMS PatriNat (OFB - CNRS - MNHN).

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HU: Contributors: Gergő Nagy (Ministry of Agriculture, Department for Nature Conservation); Bianka Jónás (Ministry of Agriculture, Department for Nature Conservation); Péter Sulyán (Ministry of Agriculture, Department for Nature Conservation).

IE: Spatial data have been retrieved from the National Biodiversity Data Centre and the Botanical Society of the British Isles (Irish branch). With thanks to the National Parks and Wildlife Service, Waterways Ireland, Aubrey Fennell, Archie Murchie, Roy Anderson and many citizen science contributors.

LU: Musée national de l'histoire naturelle du Luxembourg (MNHNL)

NL: The comparison between national data and EASIN data was performed by the Dutch organisation Floron (Plant Conservation Netherlands).

PL: General Directorate for Environmental Protection.

SI: Data on species distribution were prepared and gathered by the Institute of the Republic of Slovenia for Nature Conservation (Sonja Rozman) with the cooperation of the Fisheries Research Institute of Slovenia. Database www.invazivke.si was used for *Ailanthus altissima*.

SE: Data contribution: Swedish Species Information Centre. Acknowledgments to: The Swedish Agency for Marine and Water Management (SwAM) and the Swedish EPA.

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Executive summary

Policy context

The EU Regulation 1143/2014/EC on Invasive Alien Species (IAS), known also as IAS Regulation, recognizes the need for a coordinated set of actions to prevent, minimise and mitigate the adverse impact of the introduction and spread of IAS in Europe. The IAS Regulation gives priority to a list of species, named as IAS of Union concern. The first list of IAS of Union concern included 37 species (2016) by effect of the Commission Implementing Regulation 1141/2016/EC. Following the dynamic character of the Union list, 12 species were added in 2017 by Commission Implementing Regulation 1263/2017/EC. However, *Nyctereutes procyonoides* inclusion on the Union list applied as of 2 February 2019. In 2019, 17 species were added to the Union list by the Commission Implementing Regulation 1262/2019/EC.

The current report aims at defining an EU baseline of spatial distribution for the 18 species added to the Union list in 2019 (including *Nyctereutes procyonoides*).

Key conclusions

The baseline distribution of the 18 IAS added to the list of Union concern in 2019 constitutes an important reference dataset in support to the implementation of the IAS Regulation.

A commonly acknowledged baseline is fundamental for supporting the implementation of the IAS Regulation, with particular reference to Articles 16 ("Early detection Notifications"), 24 ("Reporting and review"), and 14 ("surveillance system"). The baseline will help EU Member States (MS) in the establishment of a surveillance system for the targeted species, can foster MS cooperation and coordination across borders or within shared biogeographical regions, and inform the discussion amongst MS on the spatial planning of the appropriate management measures to be implemented (Art. 19).

The collaborative baseline will also help MS and the European Commission (EC) in monitoring the evolution of the IAS distribution in Europe and the effectiveness of the actions undertaken by MS Competent Authorities implementing the IAS Regulation, as well as the review of the IAS Regulation.

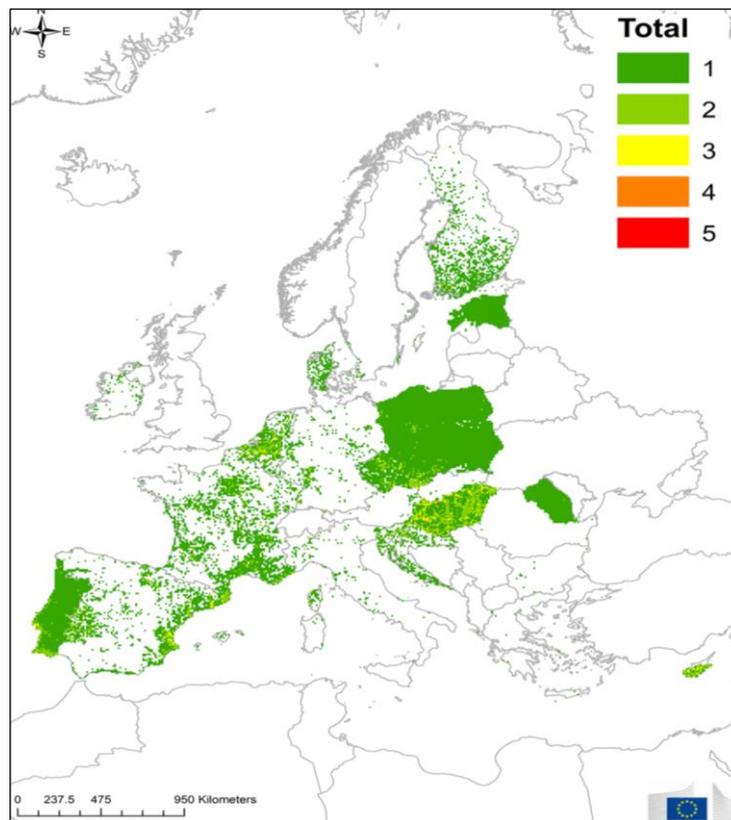
The European Alien Species Information Network (EASIN) proved to be a reliable information source of IAS distribution records within the EU, attesting its role as the official information system supporting MS in the implementation of the IAS Regulation (Art. 25).

Main findings

Spatial information is provided for each targeted species, per MS, at country and grid 10x10 km level, based on the assessment of data aggregated through EASIN in collaboration with the Competent Authorities of MS. The report also provides species traits, which have a key role in biological invasions management. For each species, the year and country of first introduction in the EU, the main pathway of introduction, the taxonomic group, the habitat, the origin, and the impact are given.

The distribution baseline has revealed that most of the species have been introduced and spread across western EU countries (e.g. IT, FR, PT, ES), while their presence is more limited in eastern MS (e.g. EE, LV, LT). Lack of data, identification and monitoring difficulties could partly explain for some MS a limited reported presence and spread of the listed species. Several species are already quite widespread across the EU (e.g. *Lepomis gibbosus*, *Ailanthus altissima*), other are still rare (e.g. *Andropogon virginicus*, *Arthurdendyus triangulatus*) or are completely absent from the EU (*Lespedeza cuneata*, *Lygodium japonicum*, *Plotosus lineatus*, *Cortaderia jubata*). Most of the regulated species

were primarily introduced in the EU through escapes linked with introduction for ornamental purposes, and aquarium trade before the 1950's. Most of them originate from East Asia.



Cumulative number of Invasive Alien Species added to the list of Union concern in 2019 at grid level (10x10 km pixel grid) in the EU Member States.

Related and future JRC work

The current work is linked with the official information system of the IAS Regulation, namely the European Alien Species Information Network (EASIN). The data provided by this report aim to assist MS and the EC in the implementation of the IAS Regulation. The work by Commission services towards a new update of the Union list in 2021 is ongoing. EASIN will prioritize the update of information of the relevant species, based on data from its data partners, and on the protocol for development of the related baseline.

Quick guide

Invasive Alien Species (IAS) are animals and plants introduced accidentally or deliberately into a natural environment where they are not normally found, with serious negative consequences for their new environment. They constitute one of the most important threats to biodiversity, causing severe ecological and socio-economic impacts. Under the EU Invasive Alien Species Regulation 1143/2014/EC, EU Member States must prevent the introduction and spread of regulated IAS (IAS of Union concern), enforce effective early detection and rapid eradication mechanisms for new introductions, and adopt management measures for species already widely spread. The geographical baseline described in this report constitutes an important reference dataset in support to the implementation of the IAS Regulation.

1. Introduction

1.1 Background

Invasive Alien Species (IAS) are defined by the EU Regulation 1143/2014/EC (EU 2014; hereinafter referred to as the IAS Regulation) on the prevention and management of the introduction and spread of IAS, as “alien species whose introduction or spread has been found to threaten or adversely impact upon biodiversity and related ecosystem services”. They constitute one of the most important threats to biodiversity, causing severe ecological and socio-economic impacts (Ricciardi et al. 2013; Jeschke et al. 2014). To this end, economic resources invested by the EU in research and management of IAS have grown steadily over the years (Scalera 2010; Silva et al. 2014).

The IAS Regulation gives priority at European level to a subset of IAS, named as IAS of Union concern (Article 4 “the Union list”, hereinafter IAS of Union concern). Species are included in this list *inter alia* because they can cause such a significant damage in Member States (MS) justifying the adoption of dedicated measures at Union level. The list of IAS of Union concern has a dynamic character, focusing on species whose inclusion in the list would effectively prevent, minimize or mitigate their adverse impact in a cost efficient manner (EU 2014).

The listing of species as of Union concern follows an evaluation process on priority species, based on specific criteria and requirements laid down in Article 4.3 of the IAS Regulation, and on Risk Assessments matching the requirements of Article 5.1. This led to the adoption of a first list of IAS of Union concern, published through the Commission Implementing Regulation (EU) 1141/2016/EC of 13.07.2016 (which entered into force on 03.08.2016). The first list contained 37 taxa, including both animals and plants. 12 species were added to the list by the Commission Implementing Regulation 1263/2017/EC of 12.07.2017 (for 11 species the inclusion on the Union list applied as from 02.08.2017, while for *Nyctereutes procyonoides* the inclusion applied as from 2 February 2019). Finally, 17 species were added to the Union concern list by Commission Implementing Regulation 1262/2019/EC of 25.07.2019 (which entered into force on 15.08.2019). Under the IAS Regulation, MS must prevent the introduction and spread of the listed species, enforce effective early detection and rapid eradication mechanisms for new introductions, and adopt management measures for species already widely spread.

The effective implementation of the IAS Regulation can benefit from a detailed and up to date spatial reference dataset of the IAS of Union concern in the MS territories. To this end, the European Alien Species Information Network (EASIN; <https://easin.jrc.ec.europa.eu/easin/>) constitutes a primary source of data. EASIN is the core of the information system supporting MS in the implementation of the IAS Regulation (EU 2014, Art. 25), facilitates access to data on alien species (AS) in Europe, and provide a single repository for accessing all the information necessary to underpin AS related policy and management decisions (Katsanevakis et al. 2013).

The EASIN datasets have been used for pan-European or regional assessments of alien species invasions (e.g. Katsanevakis et al. 2013; Nunes et al. 2014; Tsiamis et al. 2018; Magliozzi et al. 2020) towards the fulfilment of the related targets of the Convention on Biological Diversity and of European policies. In the context of the IAS Regulation, the EASIN datasets have proven useful for setting up EU baselines of spatial distribution for the IAS on the Union list implemented by the Commission Implementing Regulations 1141/2016/EC and 1263/2017/EC (Tsiamis et al. 2017a; Tsiamis et al. 2019a, b). The baseline reports were resulted from an assessment of data aggregated through EASIN in collaboration with the Competent Authorities of EU MS.

1.2 Purpose of the report

Despite the availability of several distribution maps at different scales, there are not yet accurate distribution maps at EU level concerning the 18 IAS added to the Union list in 2019. The current report aims to provide a consolidated EU distribution baseline for 17 species added to the Union list by the Commission Implementing Regulation 1262/2019/EC, and *Nyctereutes procyonoides* (species regulated in 2017, which inclusion in the list applied as of 2 February 2019)

The proposed baseline includes available knowledge on the regulated species within the EU territory based on EASIN spatial data. These data are aggregated from various data sources (scientific literature, databases), harmonized and integrated through EASIN, at country and 10x10 km grid level. MS Competent Authorities had an active role in this process by contributing substantially with national data, validating and endorsing the updated information.

The report also provides information on the traits of the targeted species, which have a key role in biological invasions management. For each species the year and country of first introduction in the EU, the main pathway of introduction, the taxonomic group, the habitat, the origin, and the impact (environmental, economic, social) are given.

2. Methodology

2.1 Background

Spatial information on IAS of Union concern is scattered across various sources, including the scientific literature, online and offline databases, reports, institute collections, web sources, etc. In addition, the type and format of geographical data vary substantially. Addressing these challenges, EASIN offers a single aggregation point for AS spatial data, which are standardized, harmonized and integrated (Katsanevakis et al. 2012). EASIN, the official information system supporting the IAS Regulation, was chosen as the primary source of data for compiling the distribution baseline in EU countries for the IAS of Union concern targeted in this report.

In a second phase, MS Competent Authorities for implementing the IAS Regulation were invited to check and validate the EASIN baseline data of the targeted species, at country and grid level, supplementing the spatial data with national data. By this way, any error and omission of spatial data could be addressed for each country. The final aim was to promote collaboration and coordination with MS and ensure data sharing and exchange of information, leading to a consolidated baseline

2.2 The use of the European Alien Species Information Network as a data source

EASIN aggregates scientific information and spatial data on AS from several sources, and offers flexible web services for searching and mapping AS in Europe.

A key component of the EASIN system is the "**EASIN Catalogue**": a comprehensive list of AS in Europe, currently including information on about 14,000 taxa in a wide range of environments. For each taxon, information is available on the year and country of the first observation in Europe, alien status (alien, cryptogenic, questionable), native range, taxonomy, synonyms, common names, environment, pathways, vectors and impact. Links to factsheets are also provided for selected taxa (Katsanevakis et al. 2015). The initial EASIN Catalogue was compiled collating information from 43 databases (Katsanevakis et al. 2012). All data collected was harmonised, standardized and integrated. Since the initial

compilation, the EASIN Catalogue has been continuously updated, revised and validated through an established protocol. The process includes several steps to pursue high quality standards, with the engagement of external experts. All taxonomic groups have been updated and validated by the end of 2018 including virus taxa.

EASIN offers flexible and efficient online mapping tools for the retrieval of spatial data through the **EASIN Geodatabase** (see also Deriu et al. 2017). All species occurrence records mapped in the EASIN Geodatabase result from the crawling of data from a network of **Data Partners**, on the basis of the species contained in the EASIN Catalogue. The process of retrieving the data from the Data Partners is done through the EASIN Data Broker system, which is able to retrieve the species occurrences and related information (date, source) from different kind of data sources and store them in a normalized database structure. Data are transformed by converting the harvested data to the EASIN Data Model through the following steps: Validation, Cleansing and Standardization, Geocoding, Mapping, Application of Quality rules and finally loaded on the Geodatabase (Data warehouse). Data collected is shown in occurrences maps through the new generation of EASIN search and mapping tools at country, grid 10x10 km, river basin district, marine ecoregion, MSFD marine areas and outermost regions level. Data and the list of mapped species can be downloaded and exported. EASIN adopts the reference grid 10x10 km of the European Environmental Agency (EEA). This grid is also compatible with the data format coming from EASIN Data Partners. However, a higher resolution for EASIN grid maps is planned for the future.

The EASIN Data Partners are global, regional and national databases that provide EASIN with spatial information on AS in Europe. Ownership of the data remains with its source, which is properly cited and linked in the EASIN Geodatabase. The EASIN Data Partners gain increased visibility and networking possibilities through EASIN, and can also benefit from mutual data exchange. EASIN follows international standards and protocols for distribution spatial data (INSPIRE Framework Directive 2007/2/EC – EU 2007; INSPIRE 2013). Given the vast amount of information recorded in EASIN and the need for constant updates and revision, an **Editorial Board** has been established to ensure the quality of the data in the EASIN system (Tsiamis et al. 2016).

The EASIN network is composed of 24 Data Partners, both global and European (reference date 2 March 2020), and includes:

1. The Global Biodiversity Information Facility (GBIF)
2. The Global Invasive Species Information Network (GISIN)
3. The Regional Euro-Asian Biological Invasions Centre (REABIC)
4. The Hellenic Network on Aquatic Invasive Species (ELNAIS)
5. The International Commission for Scientific Exploration of the Mediterranean Sea (CIESM)
6. The European Environmental Agency (EEA) / Hellenic Centre for Marine Research (HCMR)
7. The International Union for Conservation of Nature (IUCN) online information system for monitoring invasive non-native species in marine protected areas (IUCN-MedMIS)
8. The Marine Mediterranean Invasive Alien Species (MAMIAS)
9. The Norwegian Biodiversity Information Centre (NBIC) Norway
10. The European and Mediterranean Plant Protection Organization (EPPO)
11. The Stop Vespa Asiatica LIFE project (STOPVESPA)
12. The EEIKO multi-platform application for control of invasive alien flora species (EEIKO)
13. The Centre for Agriculture and Bioscience International (CABI)
14. The Research Institute for Nature and Forest - T0 Belgium
15. The National Biodiversity Network (NBN) UK
16. The Information and citizen science platform on invasive plants in Portugal (Invasoras)

17. The Ministry for the Ecological Transition and the Demographic Challenge (MITECO), Spain
18. The Institute of Zoology of the Academy of Moldova (IZASM)
19. The National Biodiversity Data Centre (NBDC) of Ireland
20. The University Ovidius of Constanza (OUC)
21. The East and South European Network for Invasive Alien Species (ESENIA)
22. The iSEA
23. The Icelandic Institute of Natural History (IINH)
24. The Invasive web portal of Life-ARTEMIS project (INVAZIVKE)

Additional and updated spatial data has been gathered through EASIN-Lit, an internal EASIN activity (Trombetti et al. 2013), that contributes to enriching the Geodatabase through screening the scientific literature and retrieving geo-referenced data.

In the context of EASIN-Lit, part of the literature review for the species considered in this report was outsourced to a fee paid expert, and supplemented by in-house work carried out by the EASIN team. Finally, a data quality check took place on all spatial data of IAS of Union concern of the EASIN Geodatabase, especially at grid 10x10 km level data, thus ensuring the accuracy of the related information.

2.3 Methodology for Member States contributions

MS Competent Authorities were invited to review and supplement the baseline distribution provided by EASIN of the 18 IAS added to the Union list in 2019. In addition, MS were invited to provide information on whether the species present in their country were “established” (reproducing in the wild and forming self-sustaining populations) or “casual” (few sporadic records and/or not reproducing in the wild).

A two-steps process was followed:

1. Country-level check: MS were invited to check EASIN occurrences of each species on their territory, and to provide revisions and/or updates of spatial data by using the protocol in Annex I.

2. Grid-level check (GIS data 10x10 km): Shapefiles including all EASIN data concerning the occurrences of the species per MS and per species were delivered to relevant MS Competent Authority. The grid 10x10 km level corresponds to the 10 km resolution level of the EEA reference grid, which is recognised by the INSPIRE Framework Directive 2007/2/EC – EU 2007 (INSPIRE 2013). The coordinate reference system and projection of the spatial information were the European Terrestrial Reference System 1989 and Lambert azimuthal equal-area projection (ETRS89/ETRS-LAEA, EPSG: 3035, <http://spatialreference.org/ref/epsg/etrs89-etrs-laea>). Shapefiles could be opened and managed with GIS software such as ArcGIS, QGIS, GRASS. MS were invited to compare the EASIN shapefile data with their national data at grid level 10x10 km. The shapefiles provided to each MS by EASIN contained the following information (GIS Attribute Table):

- Identifier of the record (FID: a code for each EASIN record).
- Spatial information (Shape: polygon, line or dot).
- Scientific name of the species (Species_NA).
- Name of the entity providing the original observation (EASIN Data Partner: <https://easin.jrc.ec.europa.eu/easin/Partners/Partners>).
- Identifier of the reference (e.g. scientific publication) (code of reference). Full citation references were provided in a separate excel file by EASIN.
- The column “Accepted”; to be filled-in by the MS (Y/N).
- The column “Notes”; to be filled-in by the MS in case “N” has been indicated; appropriate reference(s) when applicable were provided.

In addition, an Excel file containing the related full references mentioned in the shape files (reference code and associated citation) was provided. References were the sources (e.g. scientific publications, datasets) from which the information about the species occurrences had been extracted and processed by EASIN.

New spatial data entries were provided by the MS using the same shape file received from EASIN (adding new features to the Attribute Table in the GIS environment) or by creating a new shape file following the same structure. New spatial data entries contained all the relevant information included in the Attribute Table:

- Record identifier (FID).
- Spatial information (polygon, line or dot).
- Scientific name (Species_NA).
- Name of the entity providing the record (the official name of the MS national authority organization).
- Reference identifier (providing a code of reference). The national code and the full citation reference were added by the MS in the excel file provided by EASIN.

More technical details on the process can be found in the baseline protocol (Annex I).

2.4 Member States feedback

By September 2020, 16 MS submitted feedback concerning the distribution at country and grid level of the IAS included in the current report. All details concerning the MS feedback on the EASIN data are illustrated in Table 1.

Table 1. MS feedback on EASIN occurrences data of the 18 IAS added in the Union list in 2019, at country and grid level.		
Member States	Feedback on country level provided	Feedback on grid level provided
AUSTRIA (AT)		
BELGIUM (BE)	YES	YES
BULGARIA (BG)		
CROATIA (HR)	YES	YES
CYPRUS (CY)	YES	YES
CZECH REPUBLIC (CZ)	YES	YES
DENMARK (DK)	YES	YES
ESTONIA (EE)	YES	YES
FINLAND (FI)	YES	YES
FRANCE (FR)	YES	YES
GERMANY (DE)		
GREECE (EL)		
HUNGARY (HU)	YES	YES
IRELAND (IE)	YES	YES
ITALY (IT)		
LATVIA (LV)		
LITHUANIA (LT)		
LUXEMBOURG (LU)	YES	YES
MALTA (MT)		

NETHERLANDS (NL)	YES	YES
POLAND (PL)	YES	YES
PORTUGAL (PT)		
ROMANIA (RO)		
SLOVAKIA (SK)		
SLOVENIA (SI)	YES	YES
SPAIN (ES)	YES	YES
SWEDEN (SE)	YES	YES
TOTAL	16	16

2.5 Scientific and technical issues

The check of spatial data by MS required close collaboration with the EASIN team, through the exchange of e-mails. During this process, several technical problems regarding the data format and other specifications were addressed. At the same time, a number of issues were highlighted by MS, summarized as follows:

Time and sources limitation: DE pointed that checking the requested information would be extensively time-consuming and it would need personnel-intensive checks of quality by the federal states.

Casual records: Several MS included IAS which have a "casual" status within their territory; these species correspond to "occasional" (e.g. *Acridotheres tristis*, *Nyctereutes procyonoides*, *Salvinia molesta* in BE), species not reproducing in the wild (e.g. *Gymnocoronis spilanthoides* in SE) or not overwintering (*Salvinia molesta* in NL). Such species were finally included in the country-level baseline distribution, but with an indication of "casual status".

Historical records: The baseline should reflect the current distribution of the IAS of Union concern in each MS. Therefore, it was agreed to exclude "historical records" from the baseline, i.e. species that are not currently present in the MS territory (e.g. *Cardiospermum grandiflorum* and *Humulus scandens* in BE, *Acridotheres tristis* in Canary Islands).

Records not in the wild: Several species are not found in the wild, but in controlled environment, such as gardens and greenhouses (e.g. *Cortaderia jubata* in FR, *Cardiospermum grandiflorum*, *Humulus scandens* and *Triadica sebifera* in NL, *Triadica sebifera* in ES). These records were excluded from the baseline.

2.6 Building the distribution baseline

The final distribution baseline of the 18 IAS added to the Union concern list in 2019, at country and grid level, was built based on:

- EASIN data endorsed by the MS Competent Authorities
- additions/exclusions/revisions proposed by MS Competent Authorities

Important Note: At the time of finalisation of this report (January 2021) 11 MS have not provided feedback on EASIN distribution data at country and grid level concerning the IAS addressed in the current report (Table 1). As a result, the baseline data presented in the current report for these MS are those corresponding to the original EASIN dataset (see chapter 2.2).

2.7 Traits of Invasive Alien Species of Union concern

A detailed information search was performed for each IAS of Union concern in EASIN Catalogue, Risk Assessments of the IAS Regulation and web sources (CABI, NOBANIS, GISD, DAISIE, WORMS, ITIS), about:

- Common name: in English.
- Taxonomic position: Kingdom, Phylum/Division, Class; following the ITIS (<https://www.itis.gov/>) and WORMS (<http://www.marinespecies.org/>).
- Habitat: terrestrial / freshwater / oligohaline / marine.
- Origin: the native distribution range of each species, provided at sub-continent level.
- Pathways of introduction in Europe: the CBD categorization of pathways (CBD 2014) was adopted for the current study (Table 2). One or more CBD pathways were attributed to each IAS of Union concern, based on updated literature.
- Year of first observation in the EU: year of the first detection or report of the species within the EU.
- Country of first observation in the EU: the country of first detection or report of the species within the EU.
- Impact: environmental / economic / social; referring to impacts reported globally, but focusing on European studies.

Table 2. CBD main (in capital letters) and sub-category pathways (CBD 2014).	
1	RELEASE IN NATURE: Biological control
2	RELEASE IN NATURE: Erosion control/ dune stabilization (windbreaks, hedges, ...)
3	RELEASE IN NATURE: Landscape/flora/fauna "improvement" in the wild
4	RELEASE IN NATURE: Fishery in the wild (including game fishing)
5	RELEASE IN NATURE: Hunting
6	RELEASE IN NATURE: Introduction for conservation purposes or wildlife management
7	RELEASE IN NATURE: Release in nature for use (other than above, e.g., fur, transport, medical use)
8	RELEASE IN NATURE: Other intentional release
9	ESCAPE FROM CONFINEMENT: Agriculture (including Biofuel feedstocks)
10	ESCAPE FROM CONFINEMENT: Farmed animals (including animals left under limited control)
11	ESCAPE FROM CONFINEMENT: Forestry (including afforestation or reforestation)
12	ESCAPE FROM CONFINEMENT: Fur farms
13	ESCAPE FROM CONFINEMENT: Aquaculture / mariculture
14	ESCAPE FROM CONFINEMENT: Botanical garden/zoo/aquaria (excluding domestic aquaria)
15	ESCAPE FROM CONFINEMENT: Pet/aquarium/terrarium species (including live food for such species)
16	ESCAPE FROM CONFINEMENT: Horticulture
17	ESCAPE FROM CONFINEMENT: Ornamental purpose other than horticulture
18	ESCAPE FROM CONFINEMENT: Research and ex-situ breeding (in facilities)
19	ESCAPE FROM CONFINEMENT: Live food and live bait
20	ESCAPE FROM CONFINEMENT: Other escape from confinement
21	TRANSPORT – CONTAMINANT: Contaminant nursery material
22	TRANSPORT – CONTAMINANT: Contaminated bait
23	TRANSPORT – CONTAMINANT: Food contaminant (including of live food)
24	TRANSPORT – CONTAMINANT: Contaminant on animals (except parasites, species transported by host/vector)

25	TRANSPORT – CONTAMINANT: Parasites on animals (including species transported by host and vector)
26	TRANSPORT – CONTAMINANT: Contaminant on plants (except parasites, species transported by host/vector)
27	TRANSPORT – CONTAMINANT: Parasites on plants (including species transported by host and vector)
28	TRANSPORT – CONTAMINANT: Seed contaminant
29	TRANSPORT – CONTAMINANT: Timber trade
30	TRANSPORT – CONTAMINANT: Transportation of habitat material (soil, vegetation,...)
31	TRANSPORT - STOWAWAY: Angling/fishing equipment
32	TRANSPORT - STOWAWAY: Container/bulk
33	TRANSPORT - STOWAWAY: Hitchhikers in or on airplane
34	TRANSPORT - STOWAWAY: Hitchhikers on ship/boat (excluding ballast water and hull fouling)
35	TRANSPORT - STOWAWAY: Ship/boat ballast water
36	TRANSPORT - STOWAWAY: Ship/boat hull fouling
37	TRANSPORT - STOWAWAY: Hitchhikers on ship/boat (excluding ballast water and hull fouling)
38	TRANSPORT - STOWAWAY: Machinery/equipment
39	TRANSPORT - STOWAWAY: People and their luggage/equipment (in particular tourism)
40	TRANSPORT - STOWAWAY: Organic packing material, in particular wood packaging
41	TRANSPORT - STOWAWAY: Vehicles (car, train, ...)
42	TRANSPORT - STOWAWAY: Other means of transport
43	CORRIDOR: Interconnected waterways/basins/seas
44	CORRIDOR: Tunnels and land bridges
45	UNAIDED: Natural dispersal across borders of invasive alien species that have been introduced through pathways 1 to 5
46	UNKNOWN

3. Results

3.1 Baseline distribution at country level

The overall country-level baseline of the IAS added to the Union concern list in 2019 by the Commission Implementing Regulation 1262/2019/EC is presented in Table 3. *Nyctereutes procyonoides* is also included (added to the Union list in 2017 by the Commission Implementing Regulation 1263/2017/EC). The higher number of species have been found in IT (10), FR (9), PT (8), and ES (8), while EE (1) has the lowest number (Figure 1). The fish *Lepomis gibbosus* is the most common species within EU, since it has been found in 24 MS (Figure 2). The terrestrial plant *Ailanthus altissima* and the mammal *Nyctereutes procyonoides* are also very common, and reported in 23 and 20 MS respectively (Figure 2). Other species have been rarely found across EU (e.g. *Andropogon virginicus*, *Arthurdendyus triangulatus*) or are not present (*Cortaderia jubata*, *Lespedeza cuneata*, *Lygodium japonicum*, *Plotosus lineatus*) (Figure 2).

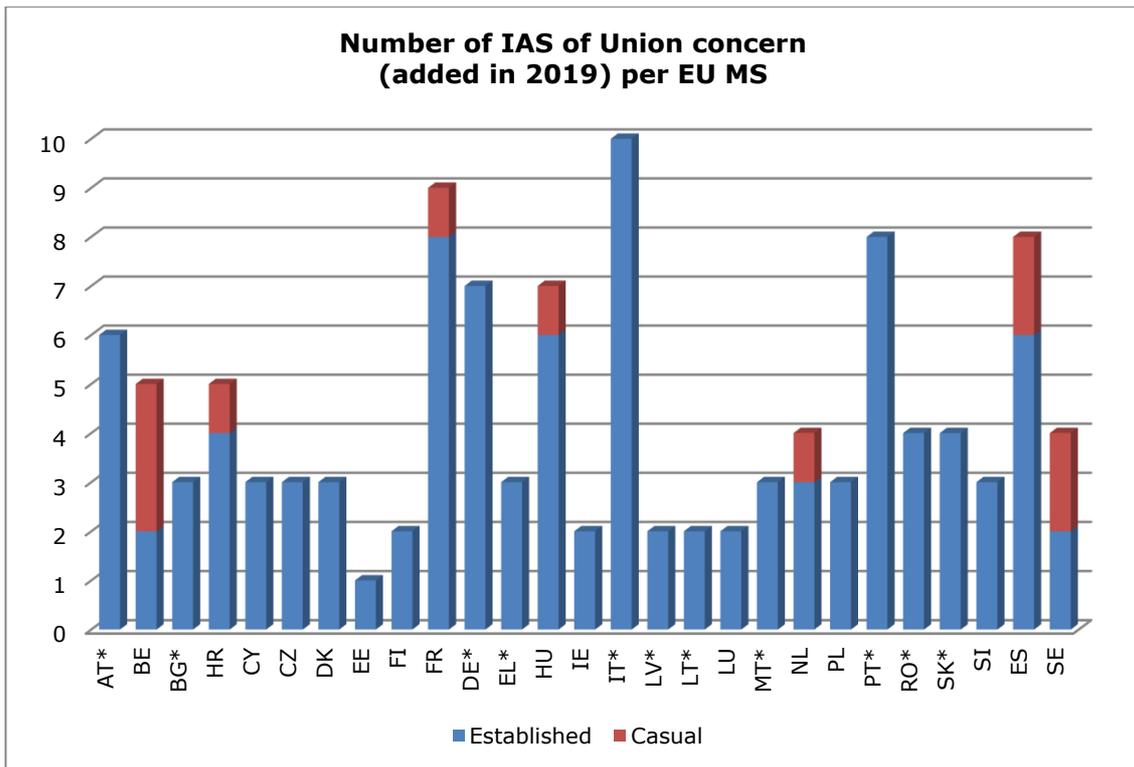


Figure 1. Number of IAS added to the Union list in 2019 per EU MS. Both established and casual country-level records are depicted. Information corresponding to MS marked with * comes only from EASIN datasets. In these cases there is no distinction between established and casual records.

Table 3. IAS added to the Union list in 2019. Their presence is given per EU MS. E=established populations, C=casual occurrences. Information corresponding to MS marked with * comes only from EASIN datasets. In these cases there is no distinction between established or casual records (all marked as Present = "P"). Information corresponding to grey-shaded indicates grid level data is coming only from EASIN datasets.

SPECIES NAME	AT*	BE	BG*	HR	CY	CZ	DK	EE	FI	FR	DE*	EL*	HU	IE	IT*	LV*	LT*	LU	MT*	NL	PL	PT*	RO*	SK*	SI	ES	SE
<i>Acacia saligna</i>				E	E					E		P			P				P			P				E	
<i>Acridotheres tristis</i>	P	C								C	P				P							P				C	
<i>Ailanthus altissima</i>	P	E	P	E	E	E	E			E	P	P	E	E	P			E	P	E	E	P	P	P	E	E	E
<i>Andropogon virginicus</i>										E																	
<i>Arthurdendyus triangulatus</i>														E													
<i>Cardiospermum grandiflorum</i>										E					P				P			P				E	
<i>Cortaderia jubata</i>																											
<i>Ehrharta calycina</i>																						P				E	
<i>Gymnocoronis spilanthoides</i>													E		P												C
<i>Humulus scandens</i>	P			E						E	P		E		P									P	P		
<i>Lepomis gibbosus</i>	P	E	P	E	E	E	E		E	E	P	P	E		P	P	P	E		E	E	P	P	P	E	E	C

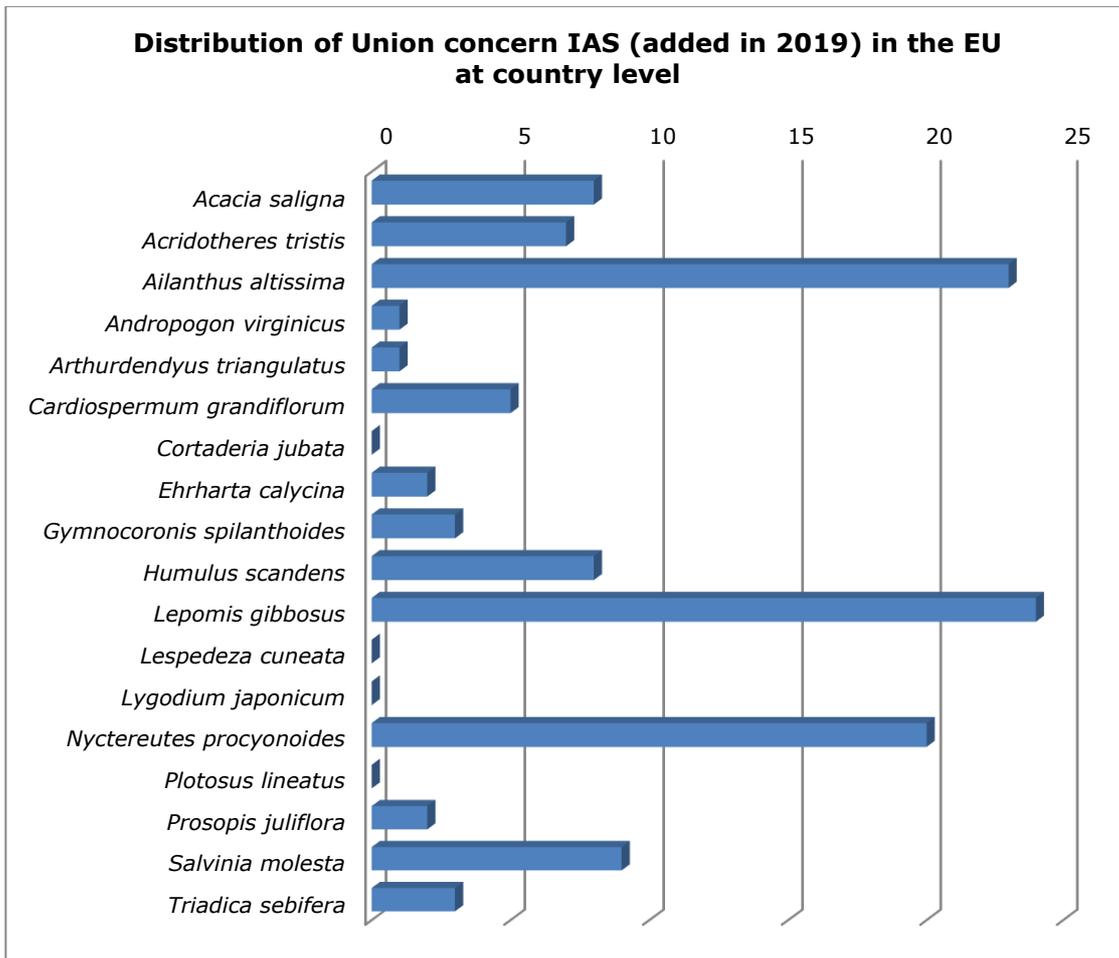


Figure 2. Number of MS where each species added in 2019 to the Union concern list has been reported. Both established and casual country-level records per country are included in the analysis.

3.2 Baseline distribution at grid level

The grid-level baseline (10x10 km) of the IAS added to the Union list in 2019 is presented in Figure 3. Dense occurrences at grid level have been reported mostly from PL, EE, PT, CZ, HU. The species *Ailanthus altissima*, *Nyctereutes procyonoides* and *Lepomis gibbosus* show the highest spread in Europe (Figure 4). On the other hand, limited spread characterises the species *Acridotheres tristis*, *Andropogon virginicus*, *Cardiospermum grandiflorum*, *Ehrharta calycina*, *Gymnocoronis spilanthoides*, *Prosopis juliflora*, and *Salvinia molesta* (Figure 4). The overall grid-level baseline distributions across EU for each of the IAS added to the list of Union concern in 2019 are depicted in Figures 5-18, with the exception of *Cortaderia jubata*, *Lespedeza cuneata*, *Lygodium japonicum*, and *Plotosus lineatus* which have not been found in the EU by 2020.

Important Note: Detailed spatial information and original sources are provided for each species and for each EU MS in Annex II.

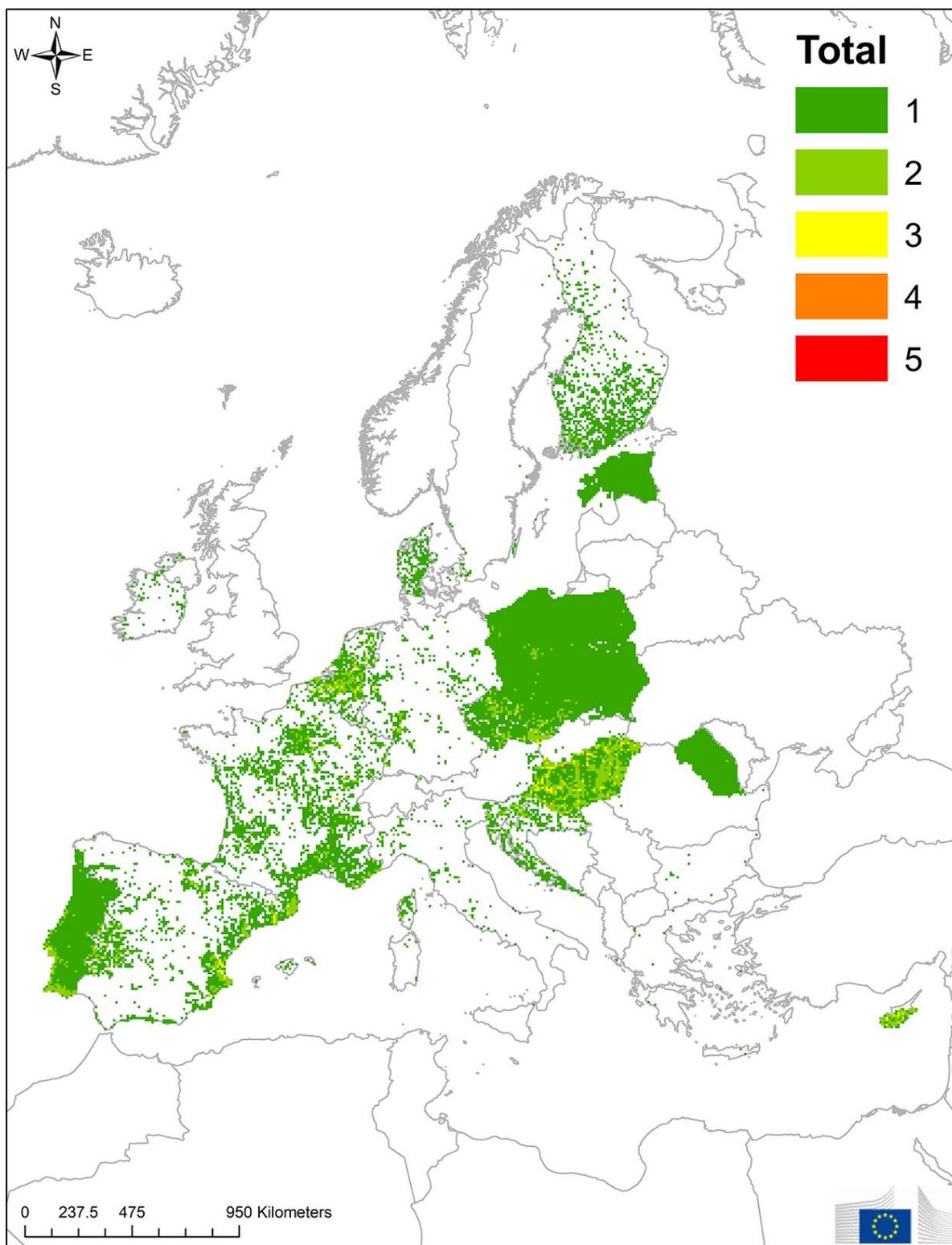


Figure 3. Cumulative number of the IAS added to the list of Union concern in 2019 given at grid level (10x10 km pixel grid) in the EU Member States, based on the available georeferenced information.

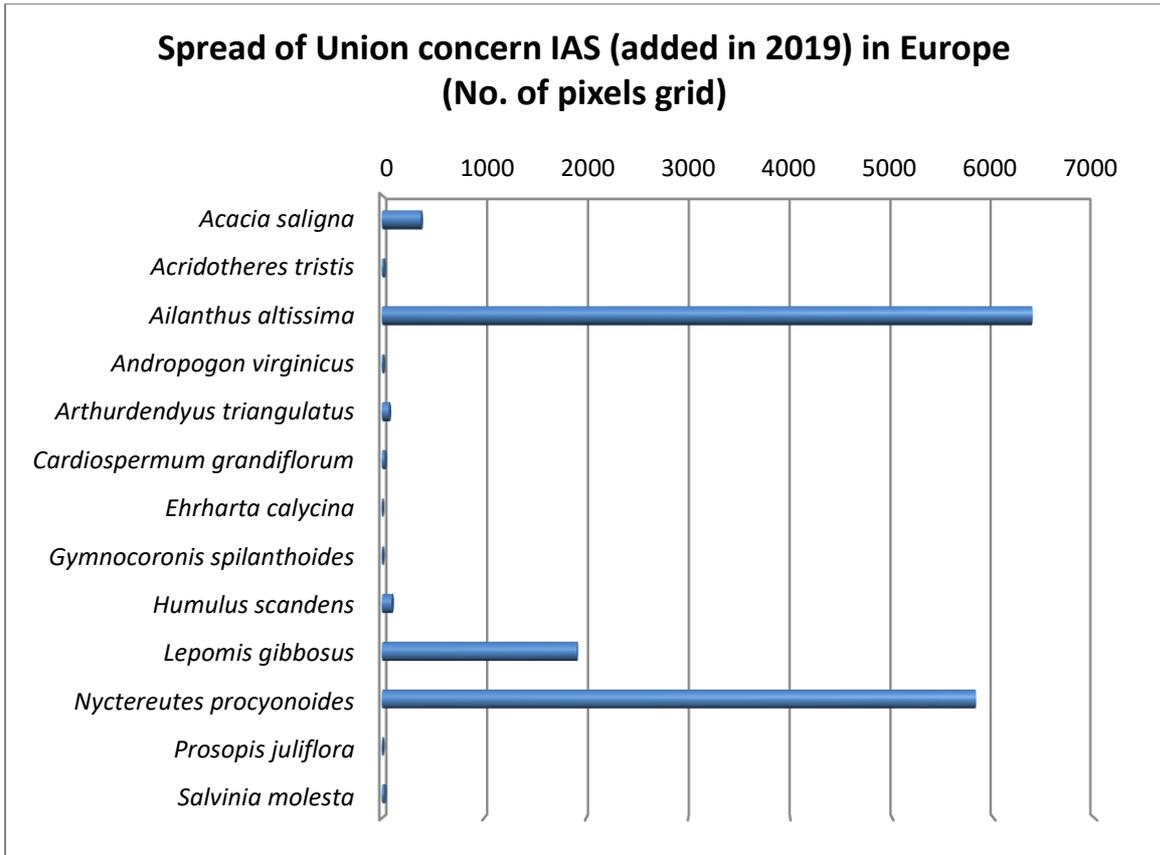


Figure 4. Number of grid cells (10x10 km) where each of the IAS added to the list of Union concern in 2019 has been reported in the EU MS, based on the available georeferenced information.



Figure 5. Grid-level (10x10 km) baseline distribution of *Acacia saligna* in EU MS. The species is also present in MT but no georeferenced data are available.



Figure 6. Grid-level (10x10 km) baseline distribution of *Acridotheres tristis* in EU MS. The species is also present in DE but no georeferenced data are available.

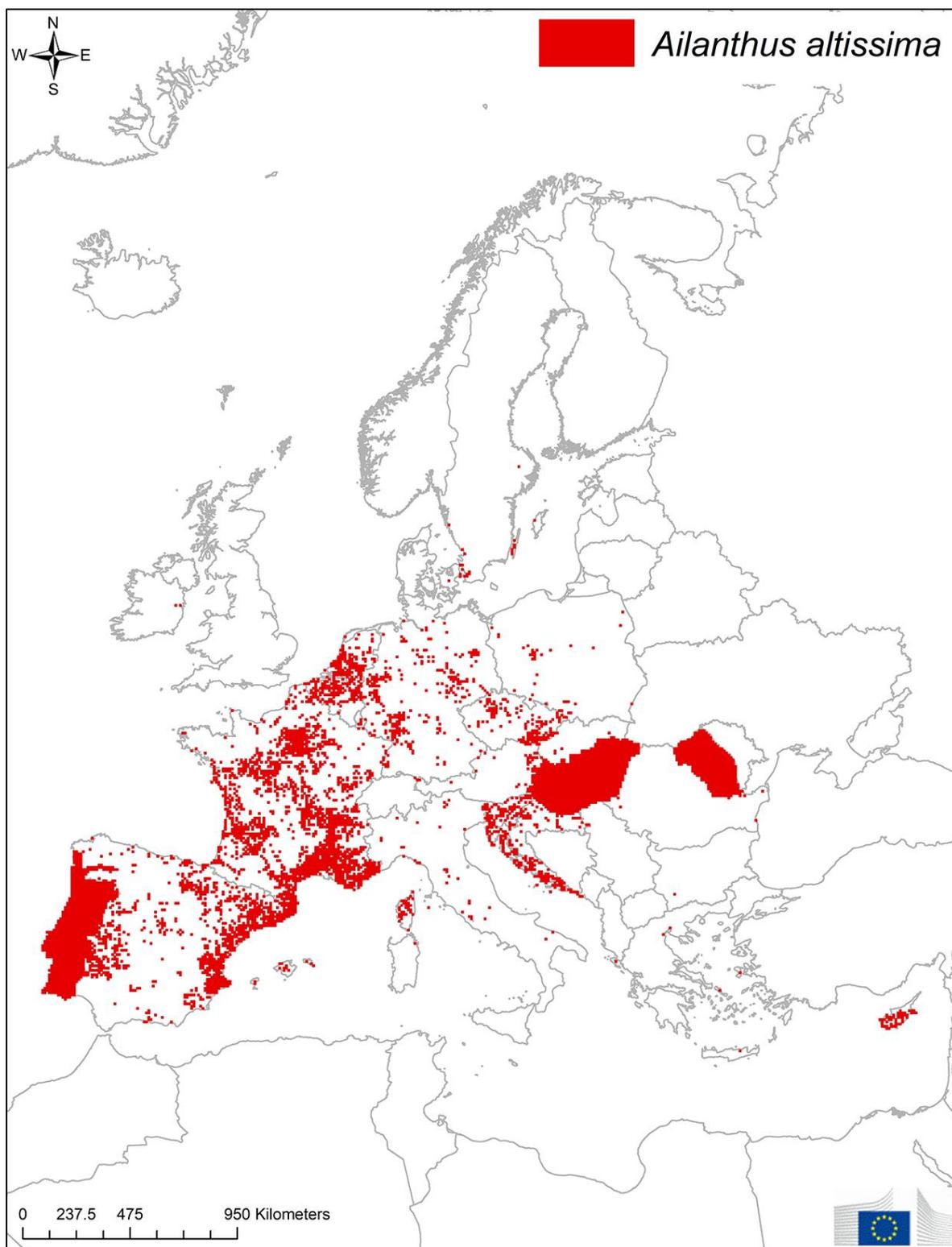


Figure 7. Grid-level (10x10 km) baseline distribution of *Ailanthus altissima* in EU MS. The species is also present in MT but no georeferenced data are available.



Figure 8. Grid-level (10x10 km) baseline distribution of *Andropogon virginicus* in EU MS.



Figure 9. Grid-level (10x10 km) baseline distribution of *Arthurdendyus triangulatus* in EU MS.



Figure 10. Grid-level (10x10 km) baseline distribution of *Cardiospermum grandiflorum* in EU MS. The species is also present in MT, PT but no georeferenced data are available.



Figure 11. Grid-level (10x10 km) baseline distribution of *Ehrharta calycina* in EU MS. The species is also present in PT but no georeferenced data are available.



Figure 12. Grid-level (10x10 km) baseline distribution of *Gymnocoronis spilanthoides* in EU MS.



Figure 13. Grid-level (10x10 km) baseline distribution of *Humulus scandens* in EU MS. The species is also present in RO but no georeferenced data are available.

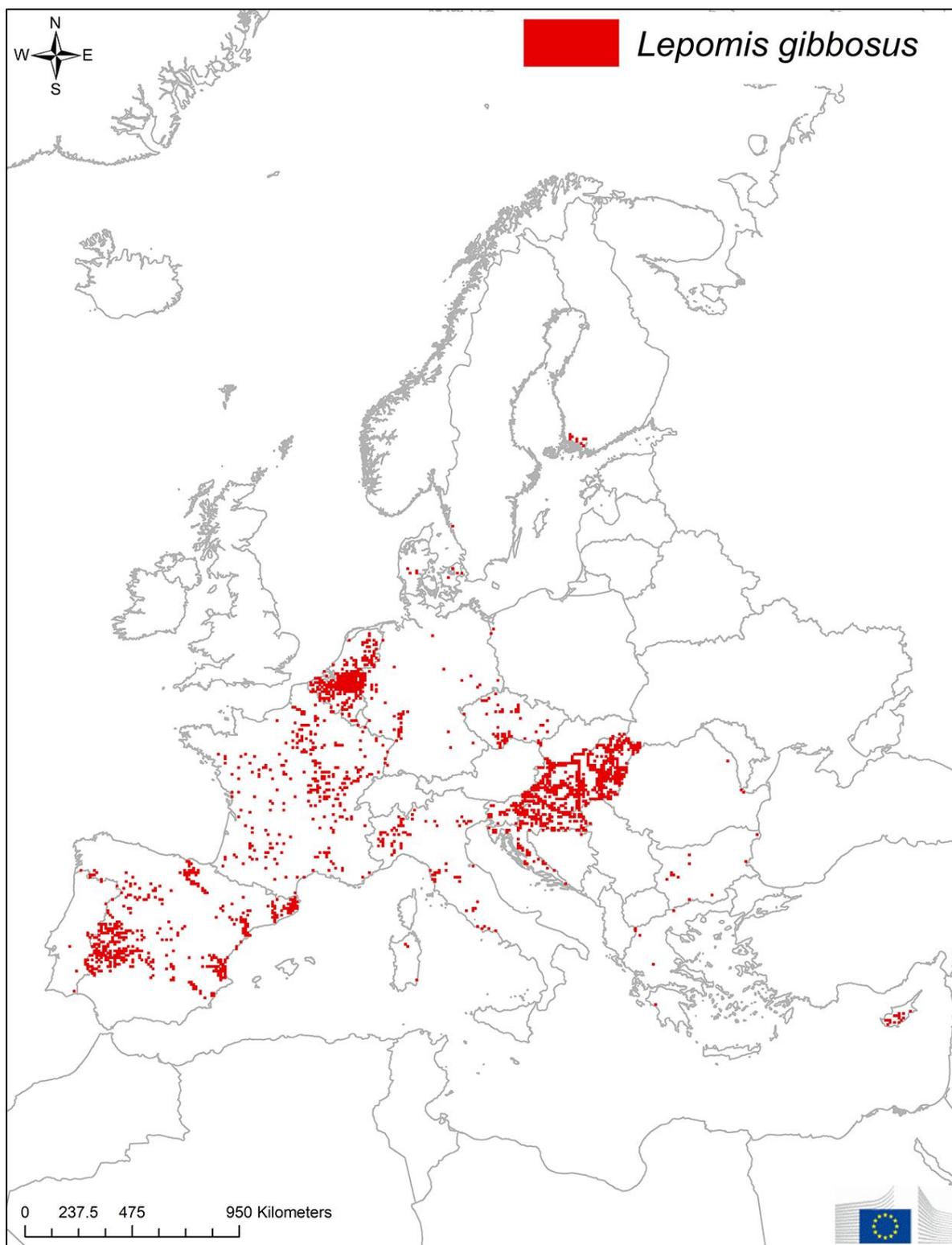


Figure 14. Grid-level (10x10 km) baseline distribution of *Lepomis gibbosus* in EU MS. The species is also present in AT, LV, LT but no georeferenced data are available.

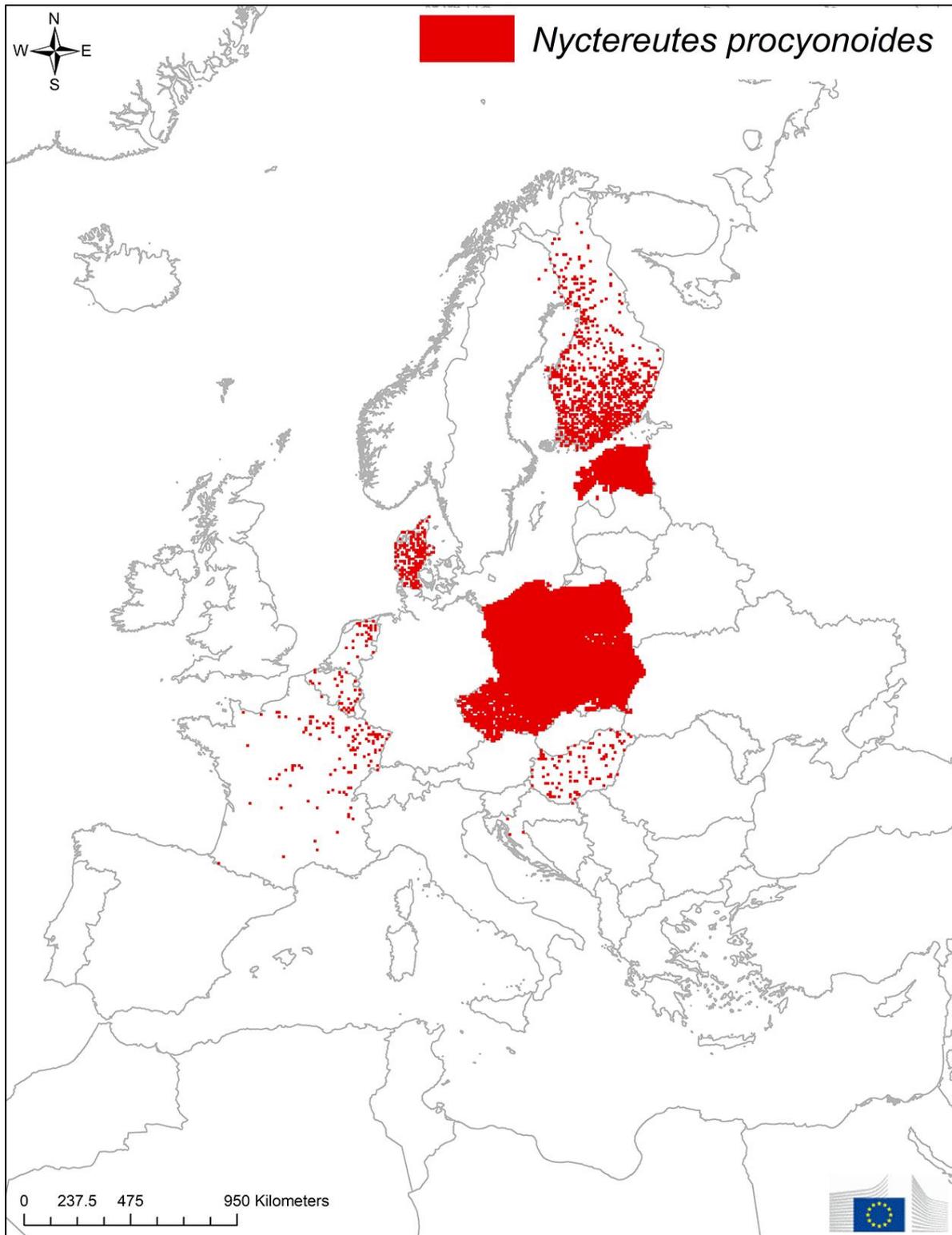


Figure 15. Grid-level (10x10 km) baseline distribution of *Nyctereutes procyonoides* in EU MS. The species is also present in AT, BG, DE, IT, LV, LT, RO, SK, SI but no georeferenced data are available.



Figure 16. Grid-level (10x10 km) baseline distribution of *Prosopis juliflora* in EU MS. The species is also present in HU (casual) but no georeferenced data are available.



Figure 17. Grid-level (10x10 km) baseline distribution of *Salvinia molesta* in EU MS. The species is also present in AT, IT but no georeferenced data are available.



Figure 18. Grid-level (10x10 km) baseline distribution of *Triadica sebifera* in EU MS. The species is present in DE, IT, PT but no georeferenced data are available.

3.3 Traits of Invasive Alien Species of Union concern

In Table 4, all traits of the IAS added to the Union list in 2019 are reported. Related information has been extracted from EASIN, Risk Assessments of the IAS Regulation and web sources (CABI, GISID, NOBANIS, DAISIE, ITIS, WORMS). For more details see sub-chapter 2.7.

Table 4. Traits of species added to the Union concern list in 2019. Related information has been extracted from EASIN, Risk Assessments of the IAS Regulation and web sources (CABI, GISID, NOBANIS, DAISIE, ITIS, WORMS). For more details see sub-chapter 2.7.

Species name	Common name	Taxonomic group	Habitat	Origin	Pathway (CBD)	Year of first introduction in EU	Country of first introduction in EU	Environmental impact	Economic impact	Social impact
<i>Acacia saligna</i>	Golden wreath wattle	Plant	Terrestrial	Western Australia	ESCAPE FROM CONFINEMENT: Ornamental purpose other than horticulture - Forestry (including afforestation or reforestation) RELEASE IN NATURE: Erosion control/ dune stabilization (windbreaks, hedges, ...)	1800	ES	(-) excludes most native plant species and changes community composition (-) modifies ecosystems hydrology, fire and nutrient regime and successional patterns	(-) loss of water provision for crops (+) used in honey production	(-) reduction of aesthetic and recreational landscape quality
<i>Acridotheres tristis</i>	Common myna	Bird	Terrestrial	central and southern Asia	ESCAPE FROM CONFINEMENT: Botanical garden/zoo/aquaria (excluding domestic aquaria) RELEASE IN NATURE: Biological Control TRANSPORT-STOWAWAY : Hitchhikers on ship/boat (excluding ballast water and hull fouling)	1906	DE	(-) threat to the indigenous biota, especially on islands, competing with small mammals and birds for nesting hollows (-) can spread invasive plants		(-) poses a human health risk carrying mite, and droppings can spread ornithosis and salmonellosis
<i>Ailanthus altissima</i>	Tree of heaven	Plant	Terrestrial	Central Asia	RELEASE IN NATURE: Erosion control / dune stabilization - Landscape/flora/fauna "improvement" in the wild ESCAPE FROM CONFINEMENT: Ornamental purpose other than horticulture - Forestry (including afforestation or reforestation) TRANSPORT-CONTAMINANT: Seed contaminant	1749	FR	(-) reduces native biodiversity especially of plants and invertebrates (-) produces toxins that inhibit the growth of other plants	(-) causes damages on infrastructure (damaging pavements, archaeological remains, walls, etc. by root system)	(-) causes allergic reactions, respiratory problems, and skin rashes
<i>Andropogon virginicus</i>	Broomsedge	Plant	Terrestrial	North and Central America	TRANSPORT-CONTAMINANT: Seed contaminant TRANSPORT-STOWAWAY: Machinery/equipment - People	2006	FR	(-) threat to endangered plant species	(-) increases the risk or intensity of fire	

					and their luggage/equipment (in particular tourism)			(-) causes erosion and alters hydrology		
<i>Arthurdendyu s triangulatus</i>	New Zealand flatworm	Arthropoda	Terrestrial	New Zealand	TRANSPORT - CONTAMINANT: Contaminant on plants (except parasites, species transported by host/vector)	1984	IE	(-) reduces earthworm populations and associated biodiversity (-) effects on grassland productivity and indigenous wildlife	(-) could have an economic impact on soil fertility and grasslands productivity	
<i>Cardiospermum grandiflorum</i>	Balloon vine	Plant	Terrestrial	Africa and South America	ESCAPE FROM CONFINEMENT: Ornamental purpose other than horticulture	1959	BE	(-) can smother indigenous vegetation		
<i>Cortaderia jubata</i>	Pampa grass	Plant	Terrestrial	South America	ESCAPE FROM CONFINEMENT: Ornamental purpose other than horticulture	1898	FR	(-) can displace native vegetation	(-) negatively affecting forestry operations	(-) exacerbating asthma in humans (from its many wind-dispersed seeds) and harbouring vermin
<i>Ehrharta calycina</i>	Perennial veldtgrass	Plant	Terrestrial	Southern Africa	RELEASE IN NATURE: Erosion control / dune stabilization TRANSPORT-CONTAMINANT: Seed contaminant	1982	ES	(-) reduces local plants and invertebrate diversity (-) negatively impacts on ecosystem services by being a habitat transformer, changes nutrient cycling	(-) increases fire risk (+) valuable forage grass	(-) degrades the aesthetical value of habitats
<i>Gymnocoronis spilanthoides</i>	Senegal tea plant	Plant	Terrestrial / Freshwater	America : from Mexico to Argentina	ESCAPE FROM CONFINEMENT: Pet/aquarium/terrarium species (including live food for such species)	1988	HU	(-) displaces native vegetation and associated fauna	(-) obstructs water bodies by increasing flooding, impedes navigation and other water uses	(-) water quality may deteriorate as a result of its dense mats

									(+) widely sold as an ornamental species	
<i>Humulus scandens</i>	Japanese hop	Plant	Terrestrial	Russia	ESCAPE FROM CONFINEMENT: Ornamental purpose other than horticulture RELEASE IN NATURE: Other intentional release	1893	FR	(-) displaces native vegetation by out-competing for resources		(-) allergic pollen (-) skin irritation
<i>Lepomis gibbosus</i>	Pumpkins eed	Fish	Freshwater	North America	ESCAPE FROM CONFINEMENT: Pet/aquarium/terrarium species (including live food for such species) RELEASE IN NATURE: Fishery in the wild (including game fishing)	1877	FR	(-) severe threat to native fish, molluscs, amphibians and dragonflies	(+) recreational sportfish (+) baitfish production (+) aquarium trade	
<i>Lespedeza cuneata</i>	Perennial lespedeza	Plant	Terrestrial	central-south Asia and Australia	RELEASE IN NATURE: Landscape/flora/fauna "improvement" in the wild TRANSPORT-CONTAMINANT: Transportation of habitat material (soil, vegetation, ...)	N/A	N/A	(-) reduces native plants in natural areas (-) pure stands that can take over entire fields	(-) can replace more palatable forage species (-) high tannin levels can also have negative impact on cattle and horses	
<i>Lygodium japonicum</i>	Japanese climbing fern	Plant	Terrestrial	Asia	ESCAPE FROM CONFINEMENT: Ornamental purpose other than horticulture TRANSPORT - CONTAMINANT: Contaminant on plants (except parasites, species transported by host/vector)	N/A	N/A	(-) competes with native species	(-) alters fire behavior, easily spreading into canopy trees and wetland (-) economic damage to forestry	(+) medicinal value in its native range
<i>Nyctereutes procyonoides</i>	Raccoon dog	Mammalia	Terrestrial / Freshwater	SE Siberia	ESCAPE FROM CONFINEMENT: Fur farms RELEASE IN NATURE: Hunting	1954	EE	(-) predation of native birds and frogs	(-) important vector of rabies and parasites (+) fur farming	

<i>Plotosus lineatus</i>	Striped eel catfish	Fish	Marine	Red Sea	CORRIDOR: Interconnected waterways/basins/seas	N/A	N/A	(-) predation pressure on native species (-) competes for resources with similar predators and effect changes in native community structure	(-) presence in trawl catches as discards (-) loss of working hours due to injuries in fishermen	(-) can sting fishermen and beachgoers
<i>Prosopis juliflora</i>	Mesquite	Plant	Terrestrial	Central and South America	ESCAPE FROM CONFINEMENT: Ornamental purpose other than horticulture	1988	ES	(-) outcompetes native vegetation	(-) its profuse thorns can pierce tyres (-) blocks paths and make whole areas impenetrable (+) used for fuel, posts, poles and sawn timber, and pods for fodder and human food sources	(-) important source of respiratory allergens
<i>Salvinia molesta</i>	Kariba weed, water fern	Plant	Freshwater	South America	ESCAPE FROM CONFINEMENT: Ornamental purpose other than horticulture - Pet/aquarium/terrarium species (including live food for such species) TRANSPORT - CONTAMINANT: Contaminant on plants (except parasites, species transported by host/vector)	2000	IT	(-) forms mats with high ecological impact	(-) impedes transport and affects recreation, irrigation and drainage	(-) can cause human health problems as host of mosquitoes
<i>Triadica sebifera</i>	Chinese tallow tree	Plant	Terrestrial	East Asia	ESCAPE FROM CONFINEMENT: Ornamental purpose other than horticulture - Agriculture (including Biofuel feedstocks)	19 th century	FR	(-) forms homogeneous stands displacing native plants (-) alters nutrient cycles (encourages eutrophication) from the rapid decay of its leaves	(-) toxic to livestock (+) ornamental qualities and productive capability in agricultural and industrial sectors	(-) human contact with the sap can cause irritation and ingesting any part of this plant can cause gastrointestinal upset, nausea, and vomiting

								(-) favours non-native arthropods		
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Taxonomy

The IAS added to the Union list in 2019 correspond to 6 animals and 13 plants. The overall taxonomic proportion of all 66 IAS of Union concern is depicted in Figure 19.

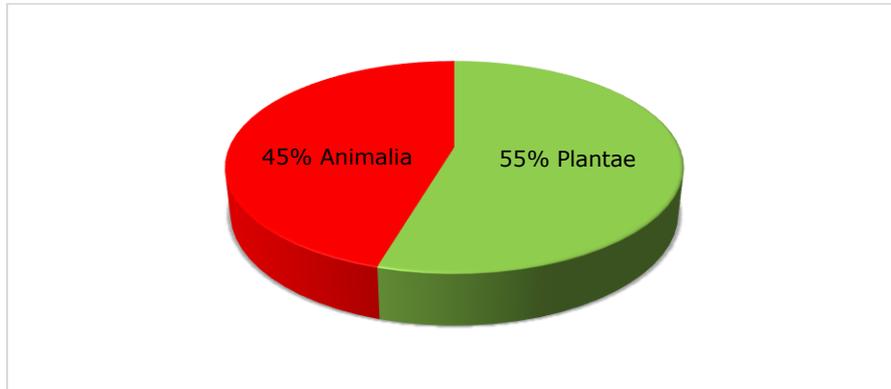


Figure 19. Proportion of animal and plant species of all 66 IAS of Union concern.

Habitat

Species added to the Union list in 2019 include mostly terrestrial species, a few freshwater, and one marine species, *Plotosus lineatus*, the first marine species added to the Union list. The overall environment proportion of the 66 IAS of Union concern listed by 2019 is depicted in Figure 20.

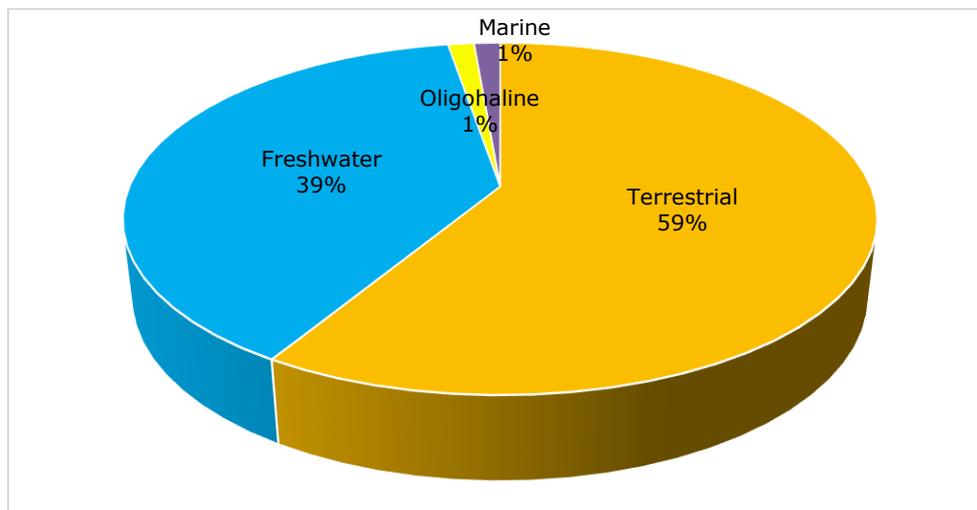


Figure 20. Environment clustering of all 66 IAS of Union concern.

Origin

Most of the species added to the Union list in 2019 originate from East Asia (Figure 21). Species with African and Oceania origin are low represented.

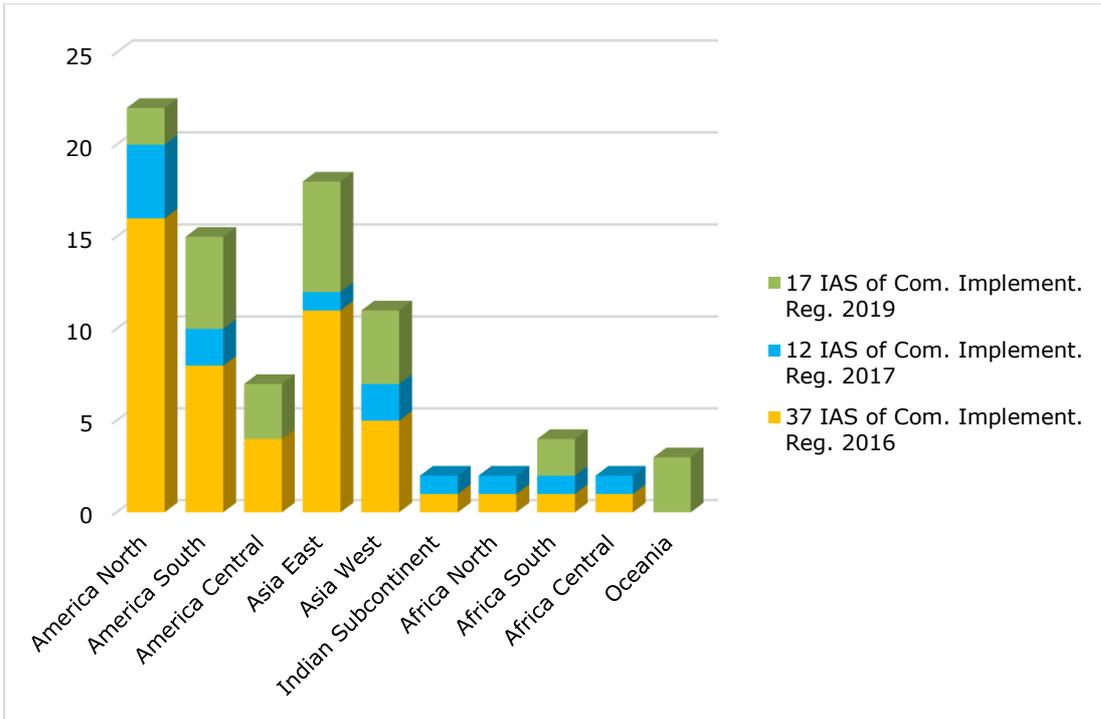


Figure 21. Origin of all 66 IAS of Union concern.

Pathways of introduction

Species added to the Union list in 2019 were introduced in Europe mainly through the pathway "Escape from confinement". This pathway is mostly related to the sub-categories "Ornamental purpose other than horticulture", and "Pet/aquarium/terrarium species (including live food for such species)", following the same traits of the species listed in the first Union list (Tsiamis et al. 2017a) and those added in 2017 (Tsiamis et al. 2019a, b). The overall pathways patterns of the 66 IAS of Union concern listed by 2019 are depicted in Figures 22 and 23.

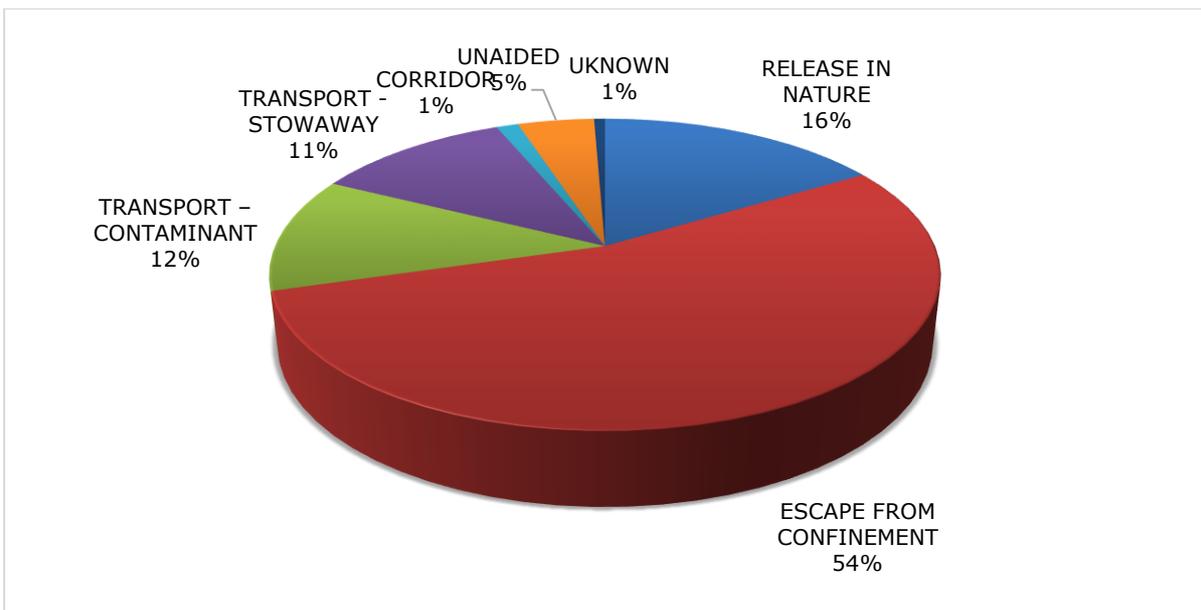


Figure 22. Main pathways of introduction of the 66 IAS of Union concern, based on CBD pathways categorization.

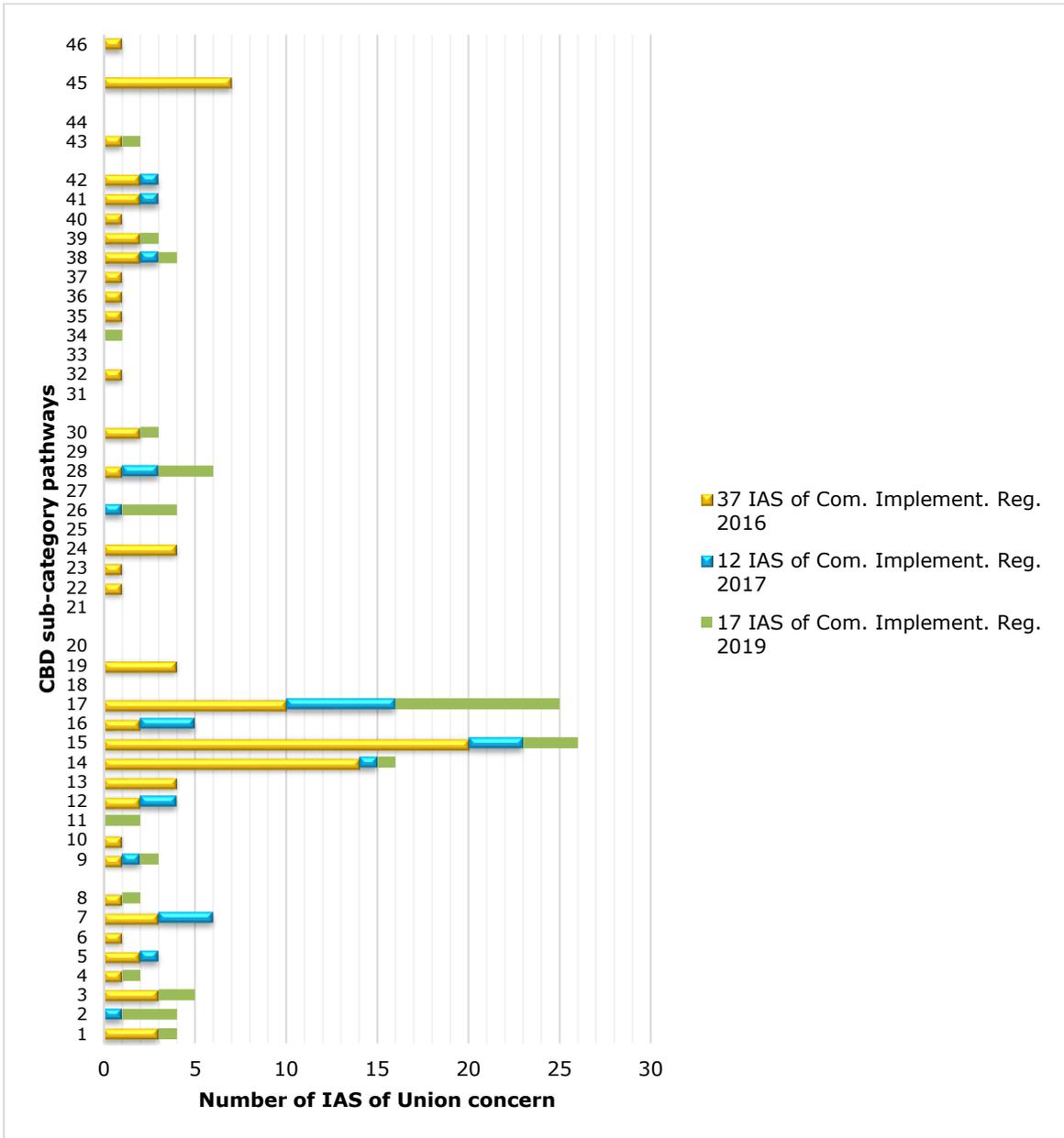


Figure 23. Sub-category pathways of introduction of all 66 IAS of Union concern in Europe, based on CBD categorization. Multiple pathways for each species have been considered. CBD pathways' codes are based on Table 2 (see sub-chapter 2.7).

Year of first introduction in the EU

Many of the species added to the Union list in 2019 were introduced in the EU before 1950 (Figure 24). Only one was introduced after the year 2000 (*Andropogon virginicus*), while the species *Lespedeza cuneata*, *Lygodium japonicum*, and *Plotosus lineatus* have not been introduced in the EU yet.

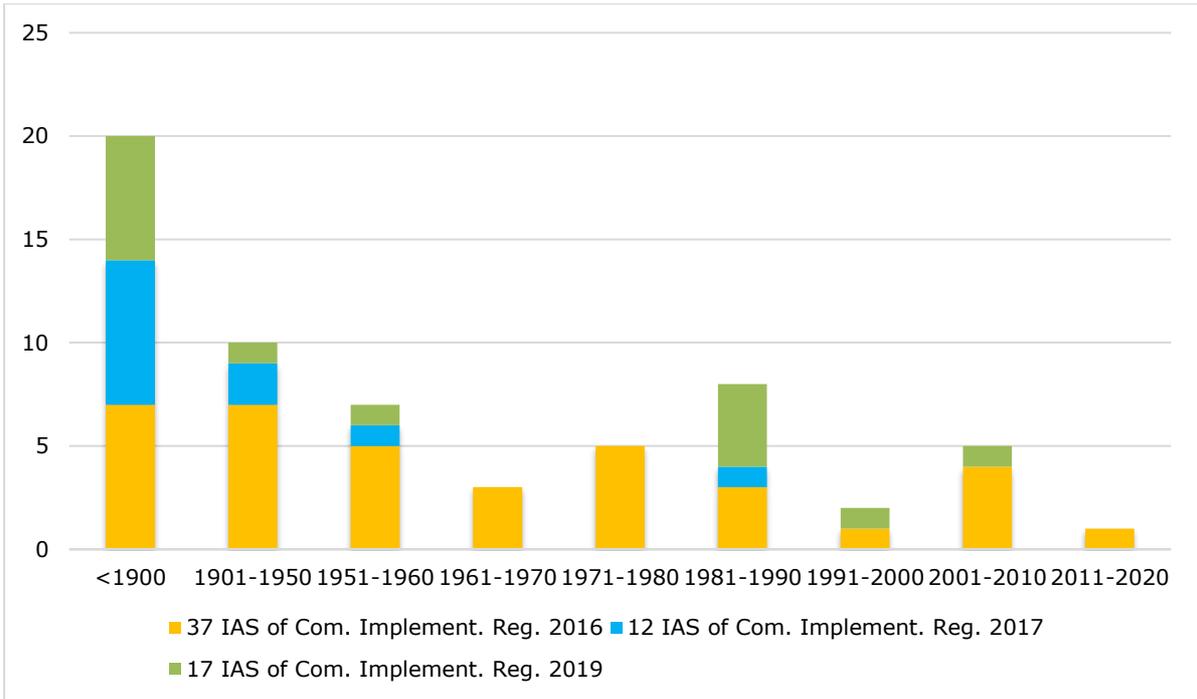


Figure 24. Timeline of first introduction events of all 66 IAS of Union concern in the EU.

Country of first introduction in the EU

Most of the first introduction events of the species added to the Union list in 2019 occurred in FR (Figure 25). No first introduction events were reported for 10 EU MS. The overview of first introductions per country for all IAS of Union concern is depicted in Figure 29.

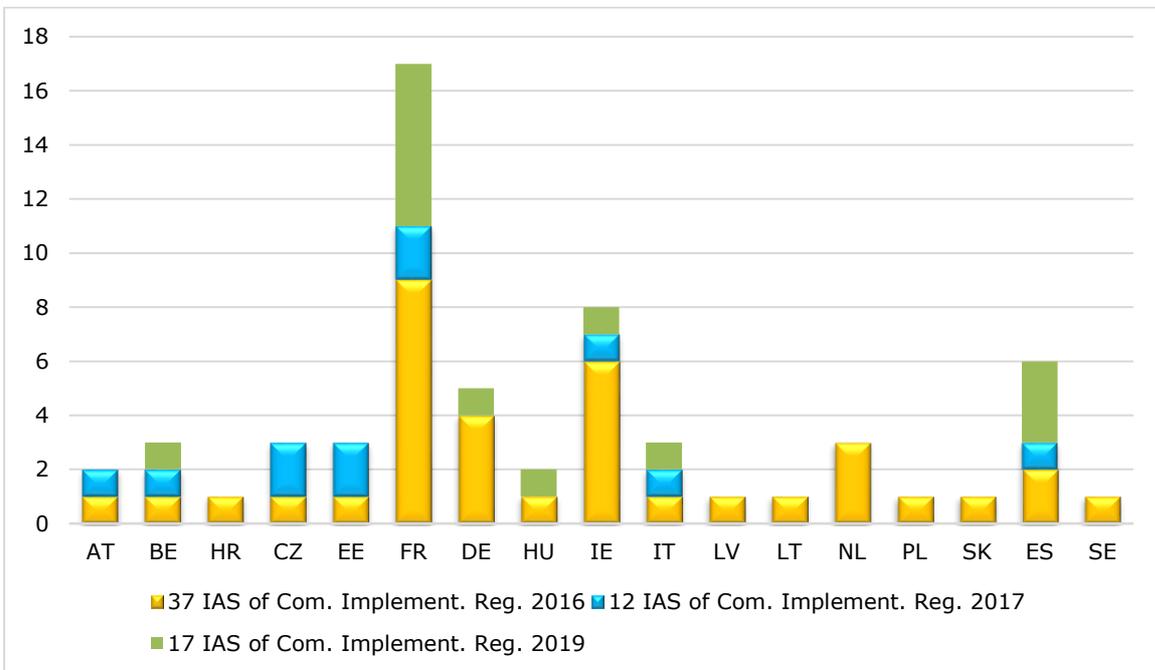


Figure 25. Countries of first introduction of all 66 IAS of Union concern at EU scale. No first introduction events were reported for 10 EU MS (not depicted).

4. Discussion & Conclusions

The EU distribution baseline of the species added to the Union concern list in 2019 (Commission Implementing Regulation 1262/2019/EC and *Nyctereutes procyonoides* - Commission Implementing Regulation 1263/2017/EC - the inclusion of which applied as of 2 February 2019) together with the baseline distributions of the species listed in the Union lists in 2016 and 2017 (Tsiamis et al. 2017a; 2019 a, b), constitute an important tool supporting the implementation of the IAS Regulation. These baselines data is crucial to track new detections of IAS of Union concern in unaffected areas of the EU territory, in relation to Art. 16, which dictates the mandatory notification of early detections of listed species to the European Commission (EC) and to the other MS. In addition, the baseline data is made available through the EASIN platform, which obeys to the format required by the Commission Implementing Regulation 145/2017/EC, and can be reused by MS to comply with their obligations under the IAS Regulation, by scientists and the public. However, it should be noted that the present baseline has not been fully checked by all MS (11 countries did not provide any feedback). For these countries the baseline information provided in the current report, coming from EASIN geodatabase, should be considered as the best available knowledge, in the absence of information and checking by the relevant MS Competent Authorities.

The current baseline can help MS in the establishment of a surveillance system for the targeted species under Art. 14 of the IAS Regulation, and can foster MS cooperation and coordination across borders or within shared biogeographical regions, as recalled by Art. 22. The distribution of the targeted species will also help the discussion amongst MS about the appropriate management measures to be implemented (Art. 19). In addition, the data provided can assist MS and the EC in monitoring the evolution of the IAS distribution across Europe and evaluating the effectiveness of the actions undertaken by MS Competent Authorities while implementing the IAS Regulation. The evaluation of this data can eventually lead to reconsider or modify implementation activities and give an input when updating the list of IAS of Union concern.

Thirteen of the IAS added to the Union list in 2019 are plants, while only 4 are animals. They are mainly terrestrial species, a few are freshwater, while *Plotosus lineatus* is the first marine species included in the Union list. The vast majority of the added species are already present in EU. Only the species *Lespedeza cuneata*, *Lygodium japonicum*, and *Plotosus lineatus* have not been introduced in EU yet. The plant *Cortaderia jubata* was introduced in the EU in 1898 (FR) but based on the current information the species is no longer present in the EU. Several species are already widespread across EU (e.g. *Lepomis gibbosus*, *Ailanthus altissima*), while others are still rare (e.g. *Andropogon virginicus*, *Arthurdendyus triangulatus*).

Distribution data has revealed that most of the species were introduced and have spread across western EU countries (e.g. IT, FR, PT, ES), while their presence is more limited in eastern EU MS (e.g. EE, LV, LT). A similar pattern was observed for the species already in the Union list in 2016 and 2017 (Tsiamis et al. 2017a; 2019a, b), and it should be attributed to historical reasons, since most of the first introduction events across EU took place in FR, IE and ES. In addition, lack of data, identification and monitoring difficulties could explain for some MS a limited reported presence and spread of the listed species. The cumulative numbers of all 66 IAS of Union concern per EU MS at country and grid 10x10 km level are shown in Figures 26 and 27 respectively.

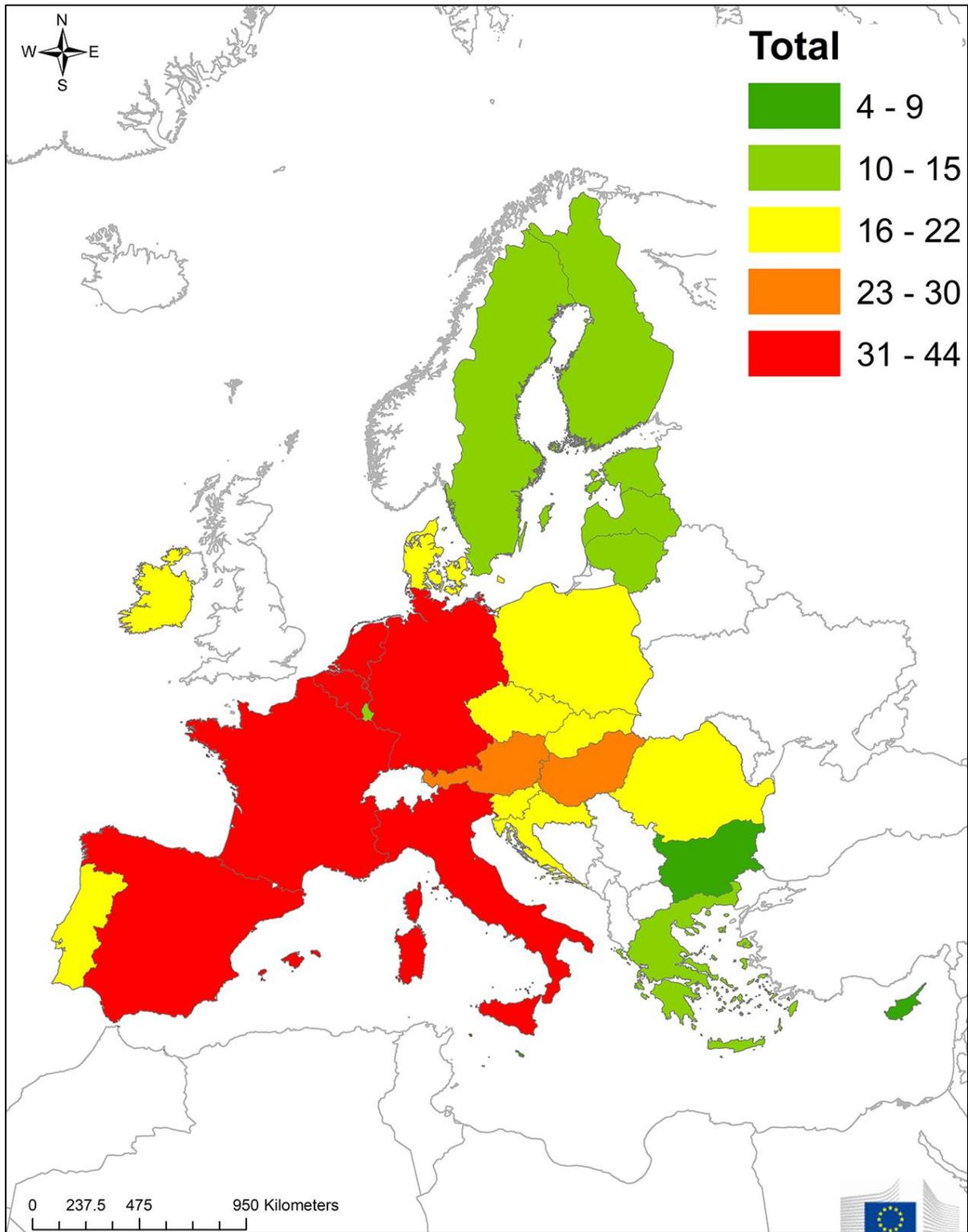


Figure 26. Cumulative number of all 66 IAS of Union concern per EU MS. Both established and casual country level records per country are included in the analysis.

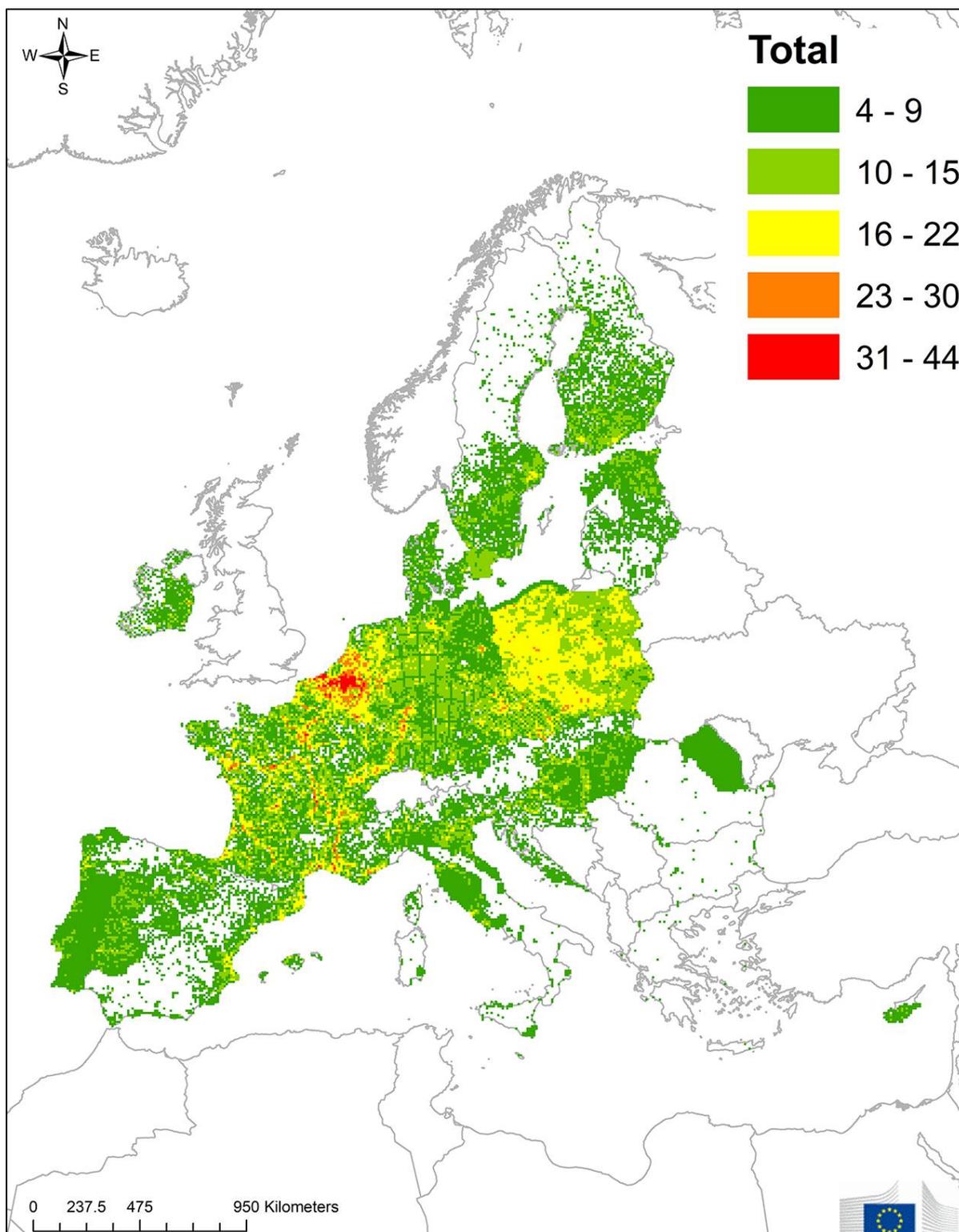


Figure 27. Cumulative number of all 66 IAS of Union concern per EU MS at grid 10x10 km level in EU, based on the available georeferenced information for each MS.

When it comes to primary introduction pathways, most of the 18 species added to the Union list in 2019 spread in the EU through escapes linked with introduction for ornamental purposes and aquarium trade. It should be noted that most primary introductions events took place during the 19th century, while only one species was introduced after the year 2000 (*Andropogon virginicus* in 2006). Most species originate from South America and East Asia, and not from North America as it was the case for the Union species listed in

2016 and 2017 (Tsiamis et al. 2017a; 2019a, b). Moreover, species originating from Oceania are listed for the first time in the Union list (*Acacia saligna*, *Arthurdendyus triangulatus*, *Lespedeza cuneata*).

EASIN proved to be an excellent source of information on AS spatial data for compiling the distribution baseline of the IAS of Union concern, and a reliable source of IAS distribution records, attesting its role as official information system supporting MS in the implementation of the IAS Regulation (Art. 25). The mismatches observed between EASIN and MS Competent Authorities data concerned mostly species records corresponding to historical records and specimens from gardens and greenhouses, which were excluded from the baseline.

MS Competent Authorities in charge of implementing the IAS Regulation were invited to check and validate the EASIN baseline data of the targeted species, at country and grid level, supplementing it with national data. The feedback received was satisfactory, since 16 MS provided relevant data. Still, 11 MS were unable to provide feedback, some of them highlighting problems such as time limitations and organizational issues.

The 18 IAS added to the Union list in 2019 have been already included in the dedicated smartphone application (app) on IAS of Union concern, called "Invasive Alien Species Europe", developed by JRC (Tsiamis et al. 2017b). This application can act as a supplementary tool for monitoring IAS of Union concern and a way to increase public awareness and citizens' engagement. Finally, in the context of a 'Proof of Concept Project', the Joint Research Centre has been promoting the uptake of the "Invasive Alien Species Europe" app as a tool to support the national official surveillance activities in Europe. Validated data will inform MS authorities and feed the EC official information system on IAS (EASIN), allowing its reuse at European level.

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List of abbreviations and definitions

AS	Alien species as defined in Art. 3 of EU Regulation 1143/2014/EC
CABI	Centre for Agriculture and Biosciences International
CBD	Convention on Biological Diversity
CIESM	International Commission for Scientific Exploration of the Mediterranean Sea
DAISIE	Delivering Alien Invasive Species Inventories for Europe
DG ENV	European Commission Directorate General for Environment
EASIN	European Alien System Information Network
EC	European Commission
EEA	European Environmental Agency
EEIKO	EEIKO multi-platform application for control of invasive alien flora species
ELNAIS	Hellenic Network on Aquatic Invasive Species
EPPO	European and Mediterranean Plant Protection Organization
ESENIAS	East and South European Network for Invasive Alien Species
EU	European Union
GBIF	Global Biodiversity Information Facility
GISID	Global Invasive Species Database
GISIN	Global Invasive Species Information Network
HCMR	Hellenic Centre for Marine Research
IAS	Invasive Alien Species as defined in Art. 3 of EU Regulation 1143/2014/EC
IAS of Union concern	Species identified according to Art. 4 of the EU Regulation 1143/2014/EC, requiring EU concerted action, published in the EU Commission Implementing Regulation 1141/2016/EC of 13 July 2016
IAS Regulation	Regulation No 1143/2014/EC 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
IINH	Icelandic Institute of Natural History
INVASORAS	Information and citizen science platform on invasive plants in Portugal
INVAZIVKE	Invasive web portal of Life-ARTEMIS project
ITIS	Integrated Taxonomic Information System
IUCN	International Union for Conservation of Nature

IZASM	Institute of Zoology of the Academy of Moldova
JRC	Joint Research Centre Directorate of the European Commission
MAMIAS	Marine Mediterranean Invasive Alien Species
MITECO	Ministry for the Ecological Transition and the Demographic Challenge (Spain)
MS	Member States
NBDC	National Biodiversity Data Centre (Ireland)
NBIC	Norwegian Biodiversity Information Centre
NBN	National Biodiversity Network (UK)
NOBANIS	European Network on Invasive Alien Species
NOTSYS	Official notification system for detection of IAS of Union concern
OUC	University Ovidius of Constanza
REABIC	Regional Euro-Asian Biological Invasions Centre
STOPVESPA	Stop Vespa Asiatica LIFE project
WoRMS	World Register of Marine Species

List of figures

Figure 1. Number of IAS listed in the Union list in 2019 per EU MS. Both established and casual country-level records are depicted. Information corresponding to MS marked with * comes only from EASIN datasets. In these cases there is no distinction between established and casual records.

Figure 2. Number of MS where each species listed in 2019 in the Union concern list has been reported. Both established and casual country-level records per country are included in the analysis.

Figure 3. Cumulative number of the IAS added to the list of Union concern in 2019 given at grid level (10x10 km pixel grid) in the EU MS, based on the available georeferenced information for each MS.

Figure 4. Number of grid cells (10x10 km) where each of the IAS added to the list of Union concern in 2019 has been reported in the EU MS, based on the available georeferenced information.

Figure 5. Grid-level (10x10 km) baseline distribution of *Acacia saligna* in EU MS. The species is also present in MT but no georeferenced data are available.

Figure 6. Grid-level (10x10 km) baseline distribution of *Acridotheres tristis* in EU MS. The species is also present in DE but no georeferenced data are available.

Figure 7. Grid-level (10x10 km) baseline distribution of *Ailanthus altissima* in EU MS. The species is also present in MT but no georeferenced data are available.

Figure 8. Grid-level (10x10 km) baseline distribution of *Andropogon virginicus* in EU MS.

Figure 9. Grid-level (10x10 km) baseline distribution of *Arthurdendyus triangulatus* in EU MS.

Figure 10. Grid-level (10x10 km) baseline distribution of *Cardiospermum grandiflorum* in EU MS. The species is also present in MT, PT but no georeferenced data are available.

Figure 11. Grid-level (10x10 km) baseline distribution of *Ehrharta calycina* in EU MS. The species is also present in PT but no georeferenced data are available.

Figure 12. Grid-level (10x10 km) baseline distribution of *Gymnocoronis spilanthoides* in EU MS.

Figure 13. Grid-level (10x10 km) baseline distribution of *Humulus scandens* in EU MS. The species is also present in RO but no georeferenced data are available.

Figure 14. Grid-level (10x10 km) baseline distribution of *Lepomis gibbosus* in EU MS. The species is also present in AT, LV, LT but no georeferenced data are available.

Figure 15. Grid-level (10x10 km) baseline distribution of *Nyctereutes procyonoides* in EU MS. The species is also present in AT, BG, DE, IT, LV, LT, RO, SK, SI but no georeferenced data are available.

Figure 16. Grid-level (10x10 km) baseline distribution of *Prosopis juliflora* in EU MS. The species is also present in HU (casual) but no georeferenced data are available.

Figure 17. Grid-level (10x10 km) baseline distribution of *Salvinia molesta* in EU MS. The species is also present in AT, IT but no georeferenced data are available.

Figure 19. Proportion of animal and plant species of all 66 IAS of Union concern.

Figure 20. Environment of all 66 IAS of Union concern.

Figure 21. Origin of all 66 IAS of Union concern.

Figure 22. Main pathways of introduction of all 66 IAS of Union concern, based on CBD pathways categorization.

Figure 23. Sub-category pathways of introduction of all 66 IAS of Union concern in Europe, based on CBD categorization. Multiple pathways for each species have been taken into consideration. CBD pathways' codes are based on Table 2 (see sub-chapter 2.7).

Figure 24. Timeline of first introduction events of all 66 IAS of Union concern in EU.

Figure 25. Countries of first introduction of all 66 IAS of Union concern at EU scale. No first introduction events have been observed for 10 EU MS (not depicted).

Figure 26. Cumulative number of all 66 IAS of Union concern per EU MS. Both established and casual country level records per country are included in the analysis.

Figure 27. Cumulative number of all 66 IAS of Union concern per EU MS at grid 10x10 km level in EU, based on the available georeferenced information for each MS.

List of tables

Table 1. MS feedback on EASIN occurrences data of the 18 IAS added in the Union list in 2019, at country and grid level.

Table 2. CBD main (in capital letters) and sub-category pathways (CBD 2014).

Table 3. IAS added in the Union list in 2019. Their presence is given per EU MS. E=established populations, C=casual occurrences. Information corresponding to MS marked with * comes only from EASIN datasets. In these cases there is no distinction between established or casual records (all marked as Present = "P"). Information corresponding to grey-shaded indicates grid level data coming only from EASIN datasets.

Table 4. Traits of species added in the Union concern list in 2019. Related information has been extracted from EASIN, Risk Assessments of the IAS Regulation and web sources (CABI, GISID, NOBANIS, DAISIE, ITIS, WORMS). For more details see sub-chapter 2.7.

List of annexes

Annex I. Protocol for checking the EU baseline distribution of IAS of Union concern through EASIN (Regulation 1143/2014/EC - Implementing Regulation 1262/2019/EC)

1) Introduction

The implementation of the IAS Regulation (1143/2014/EC) can be greatly supported by a detailed and updated spatial baseline distribution of the Invasive Alien Species (IAS) of Union concern in the Member States (MS) territories.

The first EU baseline, developed in collaboration with MS Competent Authorities, contained 37 species and was published as a JRC science-for-policy report in 2017 (<http://publications.jrc.ec.europa.eu/repository/bitstream/JRC104969/kj-na-28596-en-n.pdf>).

The Commission Implementing Regulation 1263/2017/EC of 12.07.2017 (which entered into force on 02.08.2017), added 12 species. The relevant EU baseline was published in 2019

(https://publications.jrc.ec.europa.eu/repository/bitstream/JRC114406/jrc114406_final.pdf).

The last legislation update, provided by the Commission Implementing regulation 1262/2019/EC of 25.07.2019 (entered in force on 15.08.2019), added 17 species to the Union list. Thus, there is a need to update the EU distribution baseline to include these species.

This protocol provides guidance to MS on how to check the EASIN (European Alien Species Information Network - <https://easin.jrc.ec.europa.eu>) records on occurrences and spatial data of each species listed in the Commission Implementing Regulation 1262/2019/EC in their territory, aiming to set a geographic baseline. The current exercise includes also *Nyctereutes procyonoides*, which listing took effect on 02.02.2019 (Commission Implementing Regulation 1263/2017/EC) and thus was not considered in the previous checking exercise.

The JRC has conducted a thorough review of the spatial occurrence in Europe of the 18 species considered in this exercise based on existing scientific literature, supplemented with spatial data from the EASIN network of data partners, which has been integrated in the EASIN geodatabase. The datasets submitted to each MS represent therefore the best available knowledge on the spatial occurrence of the 18 species considered.

MS are invited to contribute to the compilation of the baseline distribution of the species added to the list of Union concern, by evaluating and amending the data received from EASIN.

2) Baseline check

MS are invited to check the EASIN records of the 17 species last added to the list of IAS of Union concern (plus *Nyctereutes procyonoides*) in their territory, and to provide revisions and/or updates. For each MS the EASIN Team has prepared an **Excel file** (including the distribution of each IAS at Country level and at Grid10x10 km level) and a **shapefile** (including the distribution of each IAS at Grid10x10 km level). MS can decide to check and revise the data at Grid10x10 km level using either Excel tables or GIS files.

EASIN records refer to occurrences, which means that a species is either:

- a) established (reproducing in the wild and forming self-sustaining populations) or
- b) casual (few sporadic records and/or not reproducing in the wild and/or not overwintering).

3) Scientific and technical issues

For the purpose of the current exercise the following criteria apply:

- **Casual records** (occasional, rare records, species not reproducing in the wild and/or not overwintering), **should be included in the baseline distribution** (country level check), but with an indication of "casual status" (using the “*”).
- **Historical records should be excluded from the baseline.** The baseline should reflect the current distribution of the species in each MS. Therefore, excluding “historical records”, i.e. species that are not currently present within their territory.
- **Eradicated species**, i.e. species which have been recently eradicated from a country territory **should be excluded from the baseline.**

The baseline check considers 2 distinct phases:

- Country level check
- Grid 10x10 km level check.

4) Country level check

MS are invited to check the “**EASIN Country level**” sheet in the **Excel file** (Fig. 1), which contains the information regarding the presence of each species in the MS territory at Country level.

MS are invited to provide revisions and/or updates of the data accepting or not the information provided by EASIN, and in the latter case providing further explanations supported by appropriate references.

NB. Species considered as “casual” at Country level should be marked with an *.

A	B	C	D (if remote box)	E	F
Union Concern IAS	Present in the EASIN Country-level map	EASIN reference(s)	EASIN reference(s) URL	Accept EASIN country-level map for your Country. (Choose YES/NO)	Remarks. In case you choose "NO" please explain, citing appropriate reference(s).
<i>Alopecurus egyptiacus</i>	YES	Gyimesi & Lensink, 2010	http://www.burwa.nl/fileadmin/burwa_upload/Bureau_Waardenburg_rappo.../ten/09-617_Egyptian_Goose_final_draft_30-09-2010_web.pdf		
<i>Albionothra phaeoeroides</i>	NO				
<i>Asclepias syriaca</i>	YES	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/1.c66940-80ea-11d6-a9d0-f1785f9f18b		
<i>Elaeoa nuttallii</i>	YES	BioFresh	http://www.gbif.org/publisher/8872b075-9a35-4e77-b6c6-5ad0b890279		
		Naturalis Biodiversity Center	http://www.gbif.org/publisher/296d5f30-d6a9-11d6-8a84-b8a03c50a862		
		Thiebaut and Di Nino, 2009	http://www.aquationvasions.net/2009/AI_2009_4_2_Thiebaut_DiNino.pdf		
		Dutch Foundation for Applied Water Research	http://www.gbif.org/publisher/68a216ee-f721-40cd-932c-84153af09451		
		BeBIF Provider	http://www.gbif.org/publisher/27e82b90-1e21-11d6-a9d0-f72009d2669b		
		Alterra, Wageningen UR	http://www.gbif.org/publisher/2498d55c-dc02-4caf-ab67-14f2ffe05c37		
		Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/1.c66940-80ea-11d6-a9d0-f1785f9f18b		
		Segers and Brantgart, 2010	https://ico.gi/gTcVQy		
<i>Gunnera tinctoria</i>	NO				
<i>Heracleum montegazzianum</i>	YES	BeBIF Provider	http://www.gbif.org/publisher/27e82b90-1e21-11d6-a9d0-f72009d2669b		
		Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/1.c66940-80ea-11d6-a9d0-f1785f9f18b		
		Halford et al., 2011	https://pco.gi/PEApN		
		Musée national d'histoire naturelle Luxembourg	http://www.gbif.org/publisher/25642970-8655-11d6-8235-b8a03c50a862		
<i>Impatiens glandulifera</i>	YES	Dutch Foundation for Applied Water Research	http://www.gbif.org/publisher/68a216ee-f721-40cd-932c-84153af09451		
		Hagenblad et al., 2015	http://bmgenet.biomedcentral.com/articles/10.1186/s12863-015-0242-8		
		Council of Heads of Australasian Herbaria (CHAH)	http://www.gbif.org/publisher/47e00926-5a2f-44e8-8509-139a89c8b4d		
		Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/1.c66940-80ea-11d6-a9d0-f1785f9f18b		
		Alterra, Wageningen UR	http://www.gbif.org/publisher/2498d55c-dc02-4caf-ab67-14f2ffe05c37		
		Cawoy et al., 2012	http://www.palnationecology.org/index.php?journal=ips&page=article&article=6&path=58%5D=203		
		Naturalist.org	http://www.gbif.org/publisher/28e1a31c-1c15-4a95-931a-4af90ec3574f		

Figure 1. Example of an Excel sheet for the Country level check. MS are invited to check the information and fill-in the columns “E” and “F”.

5) Grid 10x10 km level check

MS are invited to check the “**EASIN Grid10Km level**” sheet of the **Excel file** (Fig. 2) or the **shapefile**.

The Excel file and the shape file contain the information regarding the presence of each species in the MS territory at Grid10x10 km level.

The Grid10x10km level corresponds to the **10km resolution level of the EEA reference grid** (See Annex1). Each cell of the EEA reference grid has a unique identifier, recorded in the column as “Cell Code”.

MS can alternatively use the Excel file or the shapefile for checking and providing revisions and/or updates of the EASIN data, including the addition of new occurrences.

MS are invited to provide revisions and/or updates of the data accepting or not the information provided by EASIN, and in the latter case providing further explanations supported by appropriate references.

A	B	C	D	E	F	G
Union Concern IAS	Cell Code (EEA Reference Grid 10km)	EASIN Data Partner	EASIN Reference Name	EASIN Reference Url	Accept EASIN record for your Country. Choose YES/NO	Remarks. In case you choose "NO" please explain, citing appropriate reference(s).
Alopecurus aegyptiacus	10kmE403N301	EASIN-Lit	Konter and Lorge, 2009	http://goo.gl/Ux4ia0		
Asclepias syriaca	10kmE388N312	GBIF	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/1cd669d0-80ea-11de-a900-1f765f95f18b		
Asclepias syriaca	10kmE398N314	GBIF	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/1cd669d0-80ea-11de-a900-1f765f95f18b		
Asclepias syriaca	10kmE355N311	GBIF	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/1cd669d0-80ea-11de-a900-1f765f95f18b		
Asclepias syriaca	10kmE396N313	GBIF	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/1cd669d0-80ea-11de-a900-1f765f95f18b		
Elodea nuttallii	10kmE380N313	GBIF	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/1cd669d0-80ea-11de-a900-1f765f95f18b		
Elodea nuttallii	10kmE381N309	GBIF	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/1cd669d0-80ea-11de-a900-1f765f95f18b		
Elodea nuttallii	10kmE381N311	GBIF	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/1cd669d0-80ea-11de-a900-1f765f95f18b		
Elodea nuttallii	10kmE381N312	GBIF	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/1cd669d0-80ea-11de-a900-1f765f95f18b		
Elodea nuttallii	10kmE382N310	GBIF	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/1cd669d0-80ea-11de-a900-1f765f95f18b		
Elodea nuttallii	10kmE382N312	GBIF	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/1cd669d0-80ea-11de-a900-1f765f95f18b		
Elodea nuttallii	10kmE382N314	GBIF	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/1cd669d0-80ea-11de-a900-1f765f95f18b		
Elodea nuttallii	10kmE383N313	GBIF	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/1cd669d0-80ea-11de-a900-1f765f95f18b		
Elodea nuttallii	10kmE383N314	GBIF	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/1cd669d0-80ea-11de-a900-1f765f95f18b		
Elodea nuttallii	10kmE383N315	GBIF	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/1cd669d0-80ea-11de-a900-1f765f95f18b		
Elodea nuttallii	10kmE384N308	GBIF	SPN - Service du Patrimoine naturel, Museum national d'Histoire naturelle, Paris	http://www.gbif.org/publisher/1928bd0f-f5d2-11dc-8c12-b8a03c50a882		
Elodea nuttallii	10kmE384N310	GBIF	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/1cd669d0-80ea-11de-a900-1f765f95f18b		
Elodea nuttallii	10kmE384N311	GBIF	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/1cd669d0-80ea-11de-a900-1f765f95f18b		
Elodea nuttallii	10kmE384N314	GBIF	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/1cd669d0-80ea-11de-a900-1f765f95f18b		
Elodea nuttallii	10kmE384N315	GBIF	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/1cd669d0-80ea-11de-a900-1f765f95f18b		

Figure 2. Example of an Excel information for the grid 10x10 km level check. MS need to check the information and fill-in the columns “F” and “G”.

New records on occurrences shall be provided using the same reference grid and resolution.

When using the **Excel file** new occurrence records should be provided by inserting them in the sheet “**MS NEW Data – Grid10Km level**” (Fig. 3), linking them to the related grid identifier.

FID	Shape	CellCode	Species	DataPartner	ReferenceName	ReferenceURL	Accept	Remarks
0	Polygon	10kmE4020301	Asclepias syriaca	EASN-Lt	Kotter and Lörge, 2009	http://gec.gfx496		
1	Polygon	10kmE388132	Asclepias syriaca	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
2	Polygon	10kmE393014	Asclepias syriaca	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
3	Polygon	10kmE395011	Asclepias syriaca	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
4	Polygon	10kmE396013	Asclepias syriaca	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
5	Polygon	10kmE389013	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
6	Polygon	10kmE3810369	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
7	Polygon	10kmE3810311	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
8	Polygon	10kmE3810192	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
9	Polygon	10kmE382010	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
10	Polygon	10kmE382012	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
11	Polygon	10kmE382014	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
12	Polygon	10kmE383013	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
13	Polygon	10kmE383014	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
14	Polygon	10kmE383015	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
15	Polygon	10kmE3840168	Elaeagnus nuttallii	GFZ	SPN - Service du Patrimoine naturel, Muséum national d'Histoire naturelle, Paris	http://www.gbif.org/publisher/1923045-95d1-11de-af12-1a28b42c5848d2		
16	Polygon	10kmE384010	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
17	Polygon	10kmE384011	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
18	Polygon	10kmE384014	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
19	Polygon	10kmE384015	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
20	Polygon	10kmE3850169	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
21	Polygon	10kmE385010	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
22	Polygon	10kmE385011	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
23	Polygon	10kmE385013	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
24	Polygon	10kmE385014	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
25	Polygon	10kmE3860192	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
26	Polygon	10kmE386010	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
27	Polygon	10kmE386012	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
28	Polygon	10kmE386014	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
29	Polygon	10kmE387010	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
30	Polygon	10kmE387011	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
31	Polygon	10kmE387012	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
32	Polygon	10kmE387013	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
33	Polygon	10kmE388011	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
34	Polygon	10kmE388012	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
35	Polygon	10kmE388013	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
36	Polygon	10kmE388015	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
37	Polygon	10kmE388014	Elaeagnus nuttallii	GFZ	Dutch Foundation for Applied Water Research	http://www.gbif.org/publisher/88a216e-721-40cc-932c-84153a194511		
38	Polygon	10kmE388010	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
39	Polygon	10kmE3890164	Elaeagnus nuttallii	GFZ	SPN - Service du Patrimoine naturel, Muséum national d'Histoire naturelle, Paris	http://www.gbif.org/publisher/1923045-95d1-11de-af12-1a28b42c5848d2		
40	Polygon	10kmE3890169	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
41	Polygon	10kmE389010	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
42	Polygon	10kmE389011	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
43	Polygon	10kmE389012	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
44	Polygon	10kmE389013	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
45	Polygon	10kmE3890169	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
46	Polygon	10kmE390010	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
47	Polygon	10kmE390011	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
48	Polygon	10kmE390012	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
49	Polygon	10kmE390013	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
50	Polygon	10kmE390013	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
51	Polygon	10kmE3910168	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
52	Polygon	10kmE3910169	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
53	Polygon	10kmE391012	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
54	Polygon	10kmE391014	Elaeagnus nuttallii	GFZ	Altarra, Wageningen UR	http://www.gbif.org/publisher/248045c-dcd2-4caf-abb7-14d276e5c37		
55	Polygon	10kmE391014	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
56	Polygon	10kmE3920168	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
57	Polygon	10kmE3920169	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
58	Polygon	10kmE392010	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
59	Polygon	10kmE392012	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
60	Polygon	10kmE392013	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
61	Polygon	10kmE392014	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
62	Polygon	10kmE392015	Elaeagnus nuttallii	GFZ	Dutch Foundation for Applied Water Research	http://www.gbif.org/publisher/88a216e-721-40cc-932c-84153a194511		
63	Polygon	10kmE392015	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
64	Polygon	10kmE3930168	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		
65	Polygon	10kmE3930169	Elaeagnus nuttallii	GFZ	Research Institute for Nature and Forest (INBO)	http://www.gbif.org/publisher/c066940-30ea-11de-a950-17185f9511b8		

Figure 4. Attribute table of the shapefile. MS are invited to check the information and fill-in the columns.

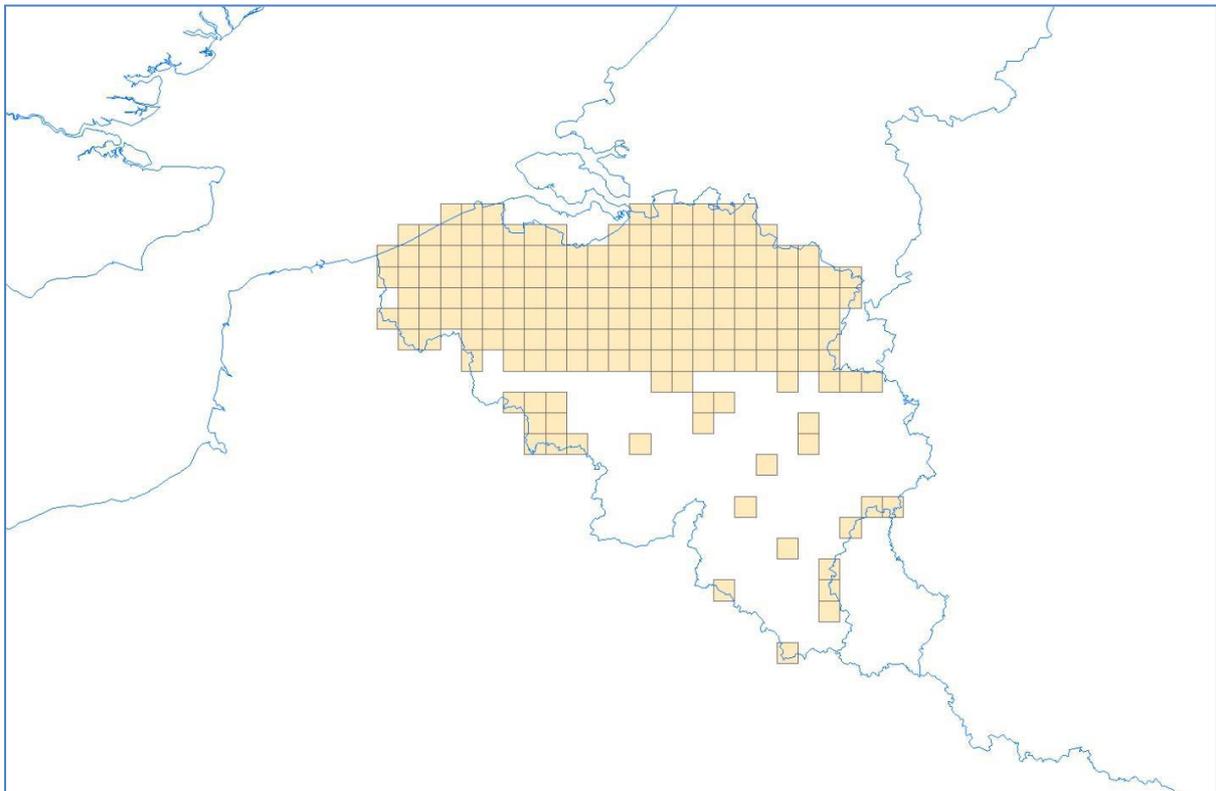


Figure 4. Map of spatial data based on a shapefile.

Annex II. Detailed spatial information at grid level 10x10 km as well as original sources are provided for each of the IAS added in 2019 in the Union list (Commission Implementing Regulation 1262/2019/EC), and for each EU country through ARC GIS digital files. *Nyctereutes procyonoides* is also included (added in the Union list in 2017 by the Commission Implementing Regulation 1263/2017/EC).

Important Note: Due to the huge number of ARC GIS files, the information is directly provided through a web-link in the EASIN website (<https://easin.jrc.ec.europa.eu/easin/>). The related information is also available on request by the EASIN team (JRC-EASIN@ec.europa.eu).

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