Schuttelaar & Partners

Early detection and monitoring of invasive alien species in neighbouring countries

Final report

Brussels, 7 februari 2022

The Agency for a Healthy World

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Brussels, 7 februari 2022
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Introduction

Dutch biodiversity is in a continuous exchange with that of other countries. After all, nature does not stop at borders. Animals and plants can spread through the air, water and on the ground and end up in the Netherlands. In addition, the movement of people, goods and animals across countries causes the unintentional movement of, for example, seeds and insects. For the protection of Dutch biodiversity, it is important to have an early picture of invasive alien species (IAS) that are progressing towards the Netherlands. In this study we have made an inventory of the organisations dealing with the early detection and monitoring of invasive species in countries close to the Netherlands, that are Germany, Belgium, Luxembourg and Northern France. Their systems and data as well as the persons in charge have been identified. This will allow the Netherlands Food and Consumer Product Safety Authority (NVWA) to come a step closer to answer the question which species are approaching the Netherlands and which species potentially pose a risk to biodiversity in the country.

This study has been performed in between mid-October 2021 and mid-January 2022. Its final report is based on the data publicly available online, experts which have been identified and interviewed in the neighbouring countries and the guidance provided by NVWA during that timeframe.

In his report, we aim at responding to the following two main questions:

1. For queries on specific species, whom shall the NVWA contact, or which source of information is useful?

2. For trends regarding species that are approaching the Netherlands, whom shall the NVWA contact, or which source of information is useful?

To this end, this study provides an inventory with respect to IAS in the neighbouring countries. It describes

- The systems that are in place,
- What is measured and how,
- Which data is recorded and how this is done,
- The experts who are in charge,
- In which way the data are accessible, and
- The potential for collaboration across countries.

The approach and the methodology of data collection are outlined in the following chapter.

Approach

In agreement with NVWA, the present study was conducted in three phases, that were:

1. An **online desk research** to get an overview and make a first inventory of the organisations, databases and experts per neighbouring region/country

2. In-depth **interviews** with experts identified in neighbouring countries and in charge of European initiatives

3. A synthesis of all collected data in a **draft report** including a review of the regional/country chapters by the national/regional experts and final recommendations to NVWA.

Online desk research

The desk research was performed online via Google. The terms “alien species”, “invasive species” and “biodiversity” were translated into German, French (and Flemish) and combined with the term of the region/country. A “snowball effect” led from one website to the next one, allowed making connections and finding new sources. 53 google hits in German were verified, 44 in French and 20 in Flemish.

To structure the output from the desk research we designed and used a study template in the format of an Excel file. In this template we collected the following information:

Information	***Explanation of information searched***
Region/country	*Region/country in close neighbourship to the Netherlands*
Who	*Original name of organisation (including abbreviation)*
Website	*Website of organisation*
General	*What was the general objective of the data collection?*
What (content)	*Whata data are collected*
Species group	*For which alien species groups are data available?*
Quantity of	*Do the data indicate the quantity of species observed?*
Number of	*Do the data indicate the number of locations observed?*
Localisation	*Do the data specify the closer geographic location of the invasive species within the country/region?*
Trend	*Do the data indicate a trend per species over time in terms of quantity and/or spread?*
How (method)	*How are the data collected? (Empirical research, expert group, citizens science, …)*

Format	*In which format are the data presented? (Report in pdf format, list, SQL/Excel database, …)*
Language	*In which language are the data presented?*
Data verification	*Have the data been verified? How?*
Data access	*How can the data be accessed? (Public and online or restricted access)*
Title	*Title of report/tool*
Link	*Hyperlink*
Last	*Last updated*
Contact	*Person in charge*
Details	*Contact details*
Comments	*Additional comments*
Recommendation	*Recommendation for follow-up with interview*

The online desk research resulted in 40 distinct entry lines in the study template. The study template is annexed to this report.

Interviews of experts

Organisations and experts who were identified either through the online desk research or previously known by NVWA were contacted for in-depth interviews. The purpose of these interviews was

- to obtain more detailed information about the initiatives found,
- to get insight into further systems that collect data on IAS, and
- to learn about further organisations or experts that are relevant in the neighbouring regions and countries.

All interviews except one were conducted via video call. As for France and Germany, the native language of the experts was used, whereas the interviews with Luxembourgish, Belgian and European experts were in English. All interviews were recorded.

Interviewees

The following experts were interviewed:

Country	Expert	Organisation
Germany	Stefan Nehring	Bundesamt für Naturschutz (BfN, Federal Agency for the Protection of the Environment)
	Carla Michels	Landesamt für Natur, Umwelt und Verbraucherschutz Nordrhein Westphalen (LANUV NRW, North Rhine-Westphalia State Office for Nature, Environment and Consumer Protection)
	Christian Boestfleisch	Niedersächsischer Landesbetrieb für Wasserwirtschaft, Küsten- und Naturschutz (NLWKN, Lower Saxony State Office for Water Management, Coastal and Nature Conservation)
	Linus Günther	Niedersächsischer Landesbetrieb für Wasserwirtschaft, Küsten- und Naturschutz (NLWKN, Lower Saxony State Office for Water Management, Coastal and Nature Conservation)
Belgium	Etienne Branquart	Belgian Forum on Invasive Species (BFIS)
	Tim Adriaens	Institute of Nature and Forest Research (INBO)
	Nicolas Pardon	Agentschap voor Natuur en Bos (ANB)
	Jane Reniers	Royal Belgian Institute of Natural Sciences
	Arnaud Jacobs	Royal Belgian Institute of Natural Sciences
Luxembourg*	Paul Braun	iNaturalist
	Carrie Seltzer	iNaturalist
	Nora Elvinger	Ministry of the Environment, Climate and Sustainable Development
	Tiago de Sousa	Ministry of the Environment, Climate and Sustainable Development > Service de la nature > Espèces invasives, infrastructure verte (Nature department, invasive species, green infrastructure)
Northern France **	Emmanuelle Sarat	Centre de ressources espèces exotiques envahissantes (EEE, Resource centre of invasive alien species)
	Madeleine Freudenreich	Centre de ressources espèces exotiques envahissantes (EEE, Resource centre of invasive alien species)
	Arnaud Albert	Office français de la biodiversité (French Biodiversity Office)
	Benoit Delangue***	Conservatoire botanique national de Bailleul (CBNBL, National Botanic Conservatory Bailleul)
Europe	Ana Cristina Cardoso	EASIN - European Alien Species Information Network

* In addition, Sandra Cellina from the Luxembourgish Ministry of the Environment, Climate and Sustainable Development, Christian Ries from the National Science

Museum Luxembourg and Xavier Mestdagh from the Luxembourg Institute of Science and Technology (LIST) were recommended for an interview.
** Thomas Hermant from Picardie Nature and Francois Delaquaize from the sustainability department of the French government were unable to respond to our requests for interviews within the scope of this study.
*** Benoit Delangue responded to the interview questions in writing.

Interview protocol

During the interviews we mainly followed the questions as outlined in the following interview protocol. This protocol was sent ahead of the interviews to the experts in the agreed interview language.

1. Introduction to the study
2. In which function do you deal with invasive alien species (IAS)?
3. Do you know which IAS are in your country/region? Do you/does your organization collect information on the spread of IAS in your country/region (e.g., for reporting to the EU)?
4. Data collection/database: Can you make use of a database that contains information about the spread of IAS? Either within or outside of your organisation.

   If so, can you give a general description of the database (e.g., number of species, kind of species, method of data collection, validation of data, updates)
5. Which species are spreading fast? Do you monitor the trends over time? Since when? For how many species?
6. According to you, which IAS pose the biggest threat to biodiversity?
7. Do you know where the IAS are located geographically?
8. Is there an alert system for first sightings or rapid spread of species?
9. Are you making policy recommendations? If yes, which ones?
10. What is important to know for the Netherlands (concerning the use of information as well as the spread of species towards the Netherlands)?
11. Do you have documentation that you can share with us (concerning the use of information as well as the spread of species towards the Netherlands)?
12. Should we consult other experts in the matter? Are you aware of other systems that report alien species in your country or in Germany, France, Belgium and Luxembourg?
13. Are you working together with colleagues/institutions in neighbouring countries?

14. Would you be willing to cooperate with the Dutch authorities on the matter? For instance, by exchanging information on first sighting and rapid spread? How would you prefer to cooperate in this matter?
15. Would you be interested in critically reading our report (in English)?
16. Have you got any further questions?

All information obtained during the interviews was compiled, where necessary translated into English and synthesized into the relevant section of this report.

Drafting the report

This final report which provides NVWA with an overview of the current organisations, systems and experts in the neighbouring regions/countries is intended to help NVWA in improving the early detection and monitoring of IAS in the Netherlands. Hence, the report was drafted as hands-on as possible while being based on our collection of publicly available online data and our interviews of experts in the field.
All data collected were synthesized and the experts interviewed were asked to review the sections of the report relevant to their region/country. In addition, NVWA reviewed the entire draft report. The concluding recommendations are derived from the findings per region/country.

Main findings

In this section, the outcomes of the interviews and the online desk research are described per region/country, namely

- Germany (including the Länder North Rhine-Westphalia and Lower Saxony),
- Belgium (including Flanders, Wallonia and the Brussels region),
- Luxembourg,
- Northern France, and
- Europe (restricted to EASIN).

The findings were compiled into 4 main topics per region/country which covered all interview questions:

1. Available knowledge about IAS and organisations monitoring them,
2. Available databases and documentation,
3. Trends, threats to biodiversity and alert systems, and
4. Interregional and cross-border cooperation.

Germany

Knowledge about IAS and organisations

The Federal Agency for Nature Conservation (Bundesamt für Naturschutz, BfN) is the Federal Government's scientific authority in the context of nature conservation. Before the EU's IAS Regulation No. 1143/2014[1] entered into force, BfN was mainly concerned with the collection of distribution data of vascular plants[2]. To date, this is the only database that BfN has for a specific group of organisms as it does not collect any other data on invasive alien species. BfN's mandate is to advise the Federal Ministry for the Environment on specific issues brought to BfN's attention. As of 2021, there are three national report booklets about the species of the EU Union list (including its updates)[3]. The information from these booklets will then eventually be included in the mandatory report to the EU every 6 years.

Providing the input data on IAS is the responsibility of Germany's 16 federal states. BfN collects the data and integrates it in regular intervals of six years into a national report for Germany[4]. Every six years, all EU Member States are required to report on the implementation of the EU Invasive alien species regulation under Article 24 of Regulation 1143/2014. The federal states follow similar approaches in their IAS monitoring. A system of existing, partly specially modified, survey programmes and other data sources are supplemented by additional targeted surveys. The implementation varies greatly in some cases, with the two biggest differences being the number of collection programmes or data sources used and the degree of systematic digitisation of the collection, storage, and provision of data.

According to the EU Regulation (No. 1143/2014), Germany must define appropriate management measures for widespread invasive species on the Union list. For the species concerned, corresponding measurement sheets are being jointly drawn up by the federal states to serve as a uniform guideline and basis for the management of these species. The measures are developed by a working group, consisting of 25 – 30 experts from BfN and the specialised authorities of each federal state which deal with the enforcement and legal obligation resulting from the EU Regulation through periodical meetings. The authorities in each federal state focus on the technical issues such as internet trade of invasive alien species, consultations concerning specific requests and targeted enforcement measures. The political representation of these authorities is carried out by the federal states' Ministries of Environment together with the Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection.

Under the EU Regulation (No. 1143/2014) for Article 16 species there is a reporting requirement for new discoveries so that a rapid modification can take place. For Article

[1] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R1143&from=EN
[2] floraweb.de
[3] first version 2016, second version 2017, third version 2019
[4] https://www.bfn.de/sites/default/files/BfN/service/Dokumente/skripten/skript567.pdf

19 species, the EU expects new data from Member States every 6 years. In these regards, the Ministry for the Environment together with BfN acts as a mediator between the federal states and the EU. This is the distribution of responsibilities in Germany.

Available databases and documentation

In Germany various private organisations and environmental associations have developed internet-based recording portals as part of species conservation projects, where interested citizens and volunteer watchers can report their observations. In some cases, there are mobile applications for these recording portals, facilitating the contribution with GPS-based functions. The recording portals are specialised to varying degrees, ranging from specific groups of species or organisms to portals for almost all organisms.

Due to the lack of a centralised database in Germany, the data are currently collected manually from these collection platforms by the responsible authorities like the State Agency for Nature, Environment and Consumer Protection (LANUV NRW) in North Rhine-Westphalia or the State Agency for Water Management, Coastal Protection and Nature Conservation (NLWKN) in Lower Saxony. These databases are heterogeneous and partly incomplete because several ones exist for different species. Hence, the federal state authorities are responsible for assessing the plausibility of the observations based on factors such as localisation which is included in the data collection and distribution data. Once the observations have been validated, the federal state authorities publish them in their own databases and information portals to monitor and manage IAS. The plausibility assessment can be done more accurately for plants than for animals.

Species from the EU Union list existing in Lower Saxony[5] and in North Rhine-Westphalia[6] can be found on the federal state platform which were already established before the EU Regulation No. 1143/2014 came into force. In North Rhine-Westphalia the information portal has existed since 2008. On this portal, 60-70 species that are partly not on the EU Union list but particularly important or problematic in North Rhine-Westphalia are presented to inform about measures. In Lower Saxony, the internal databases are:

- Lower Saxony's web-based species recording portal (NIWAP)[7],
- Biotope mapping application (FABio),
- Biology of surface waters (BOG),
- Breeding bird and guest bird database (Brutvogel- & Gastvogeldatenbank).

Currently, the NIWAP is integrated automatically in the Lower Saxony Environmental Information System Nature Conservation (UIS-NLWKN) while the other three are checked manually to close information gaps for certain species and will be integrated

[5] https://www.nlwkn.niedersachsen.de/cites/invasive_arten/invasive-arten-164705.html
[6] https://neobiota.naturschutzinformationen-nrw.de/site/Default.aspx
[7] https://services-nlwkn.hannit.de/NIWAP/Anmelden.aspx?ReturnUrl=%2fNIWAP%2f

automatically in the future (UIS-NLWKN). Alongside these internal recording portals for Lower Saxony, the following additional as well as external databases are of importance for the invasive alien species data collection of the federal authority:

- LAVES (Lower Saxony State Office for Consumer Protection & Food Safety) for fish monitoring[8],
- State Hunters' Association (Landesjägerschaft) for wildlife registration[9],
- Chamber of Agriculture for muskrat management[10],
- Observation information and monitoring portals for volunteers:

    - Deutschlandflora-Portal for flora in Germany[11],
    - Flora Incognita for flora in Germany[12],
    - Ornitho for breeding and guest birds in Germany[13],
    - Tierfund-Kataster for mammals, birds and reptiles in Germany[14],
    - iMammalia application for mammal monitoring in Europe[15],
    - Fischartenatlas for fish fauna in Germany and Austria[16],
    - Invasive Alien Species in Europe application[17],
    - Naturgucker.de[18], iNaturalist[19], and Observation.org[20] for all organisms worldwide.

Trends, threats to biodiversity and alert system

The analysis of existing data is mandatory by Article 14 of the EU Regulation (No. 1143/2014). At present, however, there is no centralized warning system to track trends in place because many different sources are used for the data collection by the federal authorities. The central coordination required for this is time-consuming and personnel-intensive and oftentimes the federal state authorities lack the capacity to actively create an early warning system. Their focus is on the 66 animal and plant species on the latest EU Union list. In the future, this could be bundled within the framework of technical possibilities, but it will certainly remain with a multitude of information paths. No trend can be derived from the current monitoring systems in place in Germany as the existing data is too heterogenous and the collection intervals are too short. Hence, neither BfN nor the federal state authorities make any statements about probable trends for the

[8] https://www.laves.niedersachsen.de/startseite/tiere/tiere-73341.html
[9] https://www.ljn.de/wild-und-jagd/wildtiererfassung-wte
[10] https://www.lwk-niedersachsen.de/lwk/news/5612_Der_Bisam_-_eine_W%C3%BChlmaus_die_viel_Schaden_anrichtet
[11] https://deutschlandflora.de/dflor/de
[12] https://floraincognita.com/de/
[13] https://www.ornitho.de/
[14] https://tierfund-kataster.de/tfk/tfk_beschreibung.php
[15] https://play.google.com/store/apps/details?id=uk.ac.ceh.imammalia&hl=gsw
[16] https://biodiv-atlas.de/fish/#!/home
[17] https://digitalearthlab.jrc.ec.europa.eu/app/invasive-alien-species-europe
[18] https://naturgucker.de/
[19] https://www.inaturalist.org/
[20] https://observation.org/

majority of invasive alien species. When asked about a specific species, however, the BfN cooperates with the federal states in developing appropriate measures.

In 2009, the Federal Nature Conservation Act stipulated how IAS should be classified and managed. Therefore, BfN has developed a methodology to assess the invasiveness through a scientific risk analysis, in cooperation with the Austrian Agency for the Environment. Through the EU Regulation (No. 1143/2014) there is now a standardized assessment system in place. If a native species in Germany is endangered at population level, then the alien species is classified as invasive, requiring monitoring alongside containment measures. Therefore, BfN does not perform any further classifications concerning the potential threat of a species. Species of particular concern are either already on the EU Union list or added to an extended list of invasive species for Germany[21] through nature conservation invasiveness assessments. Since nature conservation and data collection are the responsibility of the federal states, they are required to act based on the national list to control the spread of certain species.

Threats to biodiversity depend on many situational factors such as the location of the IAS and which threatened native species are present there. In terms of biodiversity, invasive aquatic plants cause significant problems because of a lack of management experience in intervening in water bodies. In North Rhine-Westphalia a rapid spread of the Canada goose or Egyptian goose could recently be observed alongside the raccoon, however, with no observable negative impacts yet. So far, no extinction of native species has been caused by IAS in Germany. Nevertheless, species that are supposedly unproblematic at present can have serious consequences for biodiversity in the long run. For some IAS, the exact impacts are largely not yet known and based on assumptions or conjectures as the federal authorities are not able to determine their exact distribution. Because of the precautionary principle, it is however important to address these species as well.

The biggest threat of extinction for the native noble crayfish and stone crayfish comes from the American crayfish which is spreading rapidly in almost all waters in North Rhine-Westphalia. In the Rhine, the fauna already consists of 90% of alien species as the native species have been displaced by water pollution. Aquatic IAS have generally a more serious impact than species spreading on land. The threat to biodiversity increases with all animal and plant species that can potentially spread very quickly. This includes in principle all vertebrates and the Asian hornet.

Interregional and cross-border cooperation

According to BfN, there is a regular exchange with the Federal Environmental Agency in Austria regarding IAS. A cooperation between the BfN and other countries usually only takes place with regard to specific issues like the early detection of a certain species.

[21] https://www.bfn.de/sites/default/files/BfN/service/Dokumente/skripten/skript567.pdf

The BfN as well as the federal state authorities have interregional cooperation in terms of technical support. For instance, the information portal of North-Rhine Westphalia[22] has received praise by the colleagues from IUCN who evaluated the EU report of Germany. This is in particular because of the data entry module with GPS localization, facilitating the observations for volunteers.

The State Agency for Nature, Environment and Consumer Protection in North Rhine-Westphalia and the State Agency for Water Management, Coastal Protection and Nature Conservation in Lower Saxony mainly cooperate with colleagues from other German federal states. Cooperation with local authorities in the Netherlands already exists and the publications and literature of the NVWA are actively used. They also participate in workshops such as the IUCN - Workshop "Identification, assessment, exchange and dissemination of effective measures (good practices) for humane management of invasive alien species" together with Denmark and Luxembourg. In addition, the federal state authorities invite experts to learn from their experience with flood control as a containment measure for muskrat or nutria (Life MICA[23]). Furthermore, there is a cross-country cooperation to discuss containment measures and management approaches for specific species spreading through waterways or the Asian hornet. The common goal is the conservation of natural habitats and of wild fauna and flora stipulated in the Council Directive 92/43/EEC[24].

In conclusion, the federal state authorities of North Rhine-Westphalia and Lower Saxony emphasize that the conservation of natural habitats is an interregional effort, benefitting from knowledge exchange and cooperation. To address this challenge more efficiently in the future, the responsible authorities require additional resources to foster this cooperation. For further information, the following experts in Germany can be contacted:

- **Stefan Nehring** (Federal Agency for the Protection of the Environment)
- **Carla Michels** (North Rhine-Westphalia State Office for Nature, Environment and Consumer Protection)
- **Christian Boestfleisch** (Lower Saxony State Office for Water Management, Coastal and Nature Conservation)
- **Linus Günther** (Lower Saxony State Office for Water Management, Coastal and Nature Conservation).

Belgium

Knowledge about IAS and organisations

In Belgium, competences related to the implementation of EU Regulation on IAS are divided between the federal level and the regions (Brussels Capital region, Flanders

[22] https://neobiota.naturschutzinformationen-nrw.de/site/
[23] https://lifemica.eu/
[24] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31992L0043&from=DE

and Wallonia). Import and official controls at the borders are a federal competence, while monitoring and observation efforts are regional competences, each region being competent in its own territory. Spanning from local to national and from passive to active[25], surveillance initiatives in place aim to gather information on species' occurrence and distribution, later used to conduct risk assessments and eventually launch alerts used for developing response actions.

Today, species surveillance efforts range from species-specific monitoring projects (e.g. *Vespa Velutina)*[26], general surveillance initiatives for different taxonomic groups (e.g. birds, plants, crayfish), surveillance initiatives conducted by experts (e.g. Natura 2000)[27] to volunteer citizens' science observation schemes (mostly through waarnemingen.be).

Data collected is aggregated through two different projects, one of which is still under development, whose aim it is to ensure that information concerning alien species is equally accessible to all three regions.

Tracking Invasive Alien Species, also known as TrIAS, is one of them. The project, launched between 2017 and 2021 and funded by Belspo (Belgian Science Policy office)[28], aimed to track alien species development, identify emerging alien species, model their potential distribution and assess their current and future risk. This was done by drafting a standard checklist of alien species for Belgium, later published to GBIF (Global Biodiversity Information Facility)[29], containing information (e.g. introduction pathway, degree of establishment, date of introduction) provided by online recording platform observations.be (also known as waarnemingen.be) and specialists on all taxonomic groups, where possible. While the percentage of IAS species included in the list might only amount to 50-60% of those expected to be present in the country, the formulation of a list containing information on 3500 different species and branded as the Global Register of Introduced and Invasive Species in Belgium (curated by Invasive Species Specialist Group of IUCN)[30] made for a good starting point in anticipating new species and linking real world data to scientific databases.
Despite it being important for the feeding of policy indicators as well as for prioritisation and risk assessment, there are currently no plans to further update the GRISS checklist or to conduct quality checks of the baseline information included there.

[25] https://cdr.eionet.europa.eu/be/eu/ias/envxifnpg/Description_of_the_surveillance_system.pdf
[26] https://www.vespawatch.be/
[27] https://natura2000.vlaanderen.be/
[28] https://www.belspo.be/
[29] https://www.gbif.org/dataset/6d9e952f-948c-4483-9807-575348147c7e
[30] https://www.nature.com/articles/sdata2017202

A second project, LIFE RIPARIAS[31] (2021-2026), has recently kicked off in Belgium. The project brings together partners from the 3 Belgian regional authorities, thereby allowing them to pool resources to optimise the management of IAS. The preparatory phase of this project, which is currently ongoing, includes a business analysis for the development of an early warning system for IAS. In terms of the dataflow, the system heavily relies on harvesting data from GBIF, including datasets from NGOs and governmental institutions. These data, whose publication rate to GBIF is expected to increase in the future, are then visualised on a portal which makes use of alerts. This system will be complemented by a mapping tool (available after 2026) which will make it possible to select a polygon in order to get reports for selected alien species. Focused initially on providing information concerning crayfish and aquatic plants (along river basins), it is expected that the project will cover the entire Belgian territory, thereby becoming the overarching Belgian Early Warning System for Union List species and IAS in general.

Monitoring systems, as well as databases are complemented by the work of the Belgian National Scientific Secretariat on IAS, hosted at the Royal Belgian Institute of Natural Sciences, who is responsible for preparing scientific advice and recommendations for parties of the agreement throughout all of Belgium. Topics on the table include, but are not limited to, pathway action plans, recommendations concerning management, manageability analyses and pathway prioritisation. Taken together they serve draft recommendations and suggestions to be made in relation to the implementation of EU regulations on IAS.

Available databases and documentation

Thanks to the data provided through the TRIAS project, experts are able to run models and to aggregate data spatially in what they call a cube, which provides information on the degree to which a species is present on the territory - occupancy - as well as of the spread. By relying on so-called cube and gridded data, experts can determine occupancy with a degree of precision from 2 to 100 square metres, thereby allowing for the detection of emerging alien species. While this process can account for species new on the territory or which show a signal in their observation/occupancy (i.e. something is happening in relation to their spread), it might encounter difficulties where the species is spread over different clusters across the Belgian territory, as there are no existing models accounting for this particular case. It is for this reason that experts call for real monitoring data and on-the-ground monitoring networks (such as those accounting for protected species of fish, plants or birds). By setting up such a system, the expectations are that they would be able to provide more accuracy in the detection, thereby filling the

[31] https://www.riparias.be/

possible gaps encountered by existing digital early warning procedures. Nonetheless, further attempts to collect information on the spread of different invasive species across all of Belgium would be needed in order to assess the evolving of the situation over the upcoming years.

For more information visit:

- The community page of TrIAS on gbif, which has all the published checklists and occurrences in the framework of that project: https://www.gbif.org/network/b153643d-735a-440f-a0e9-428b4f9d1cd2
- The Belgian GRIIS checklist: https://www.gbif.org/dataset/6d9e952f-948c-4483-9807-575348147c7e
- http://ias.biodiversity.be/species/risk
- http://observatoire.biodiversite.wallonie.be/

Trends, threats to biodiversity and alert systems

As explained in the sections before, monitoring systems in Belgium take on a regional approach. This means that trends will be monitored differently in Flanders vs. Wallonia or Brussels, resulting in more data for certain taxonomic groups vs. others according to the region in question. Flanders proves, for example, to be well informed about data concerning plants. Nonetheless, while it suffices for the region, it does not speak for all the plants in Belgium, thereby rendering it difficult to make a sufficiently generic statement about IAS belonging to this taxonomic group within the country. A similar situation concerns Florabank[32], the database which accounts for distribution data and species-specific characteristics on flora in Flanders. As a matter of fact, while the work done at the regional level is sufficient in measuring occupancy and providing information on alien species within this specific region (using gridded data), it is not a proper monitoring system to describe IAS trends. In other words, while both examples can be deemed successful in their efforts to monitor IAS in their respective regions, unless they will be complemented by dedicated surveys accounting for species recurrence in specific areas at specific times, efforts might prove to be somewhat limited, especially in relation to species on the Union list which require a lot more data to match the expectations set out in the EU regulations. To make up for this gap, experts have suggested to improve existing monitoring efforts by setting up permanent and recurrent plots observations where the same area is covered over a lengthier time span and to come up with a national list in which the scope of detrimental species covered is widened. These solutions, complemented by the coordination carried out by experts of the Belgian National Scientific Secretariat on IAS, hosted at the Royal Belgian Institute of Natural Sciences who are responsible for keeping an overview of surveillance

[32] https://flora.inbo.be/Pages/Common/Default.aspx

actions, would be able to provide a good description of the species which are currently on the Belgian territory as a whole and allow experts to update the EU list more consistently in order to produce adequate risk assessments.

Interregional and cross-border cooperation

With a view to interregional and cross-border cooperation, Belgium appears to be on good terms with Luxembourg as well as France. With regards to the former, it seems as if both countries are relying on the same network, iNaturalist[33] to map and share observations of biodiversity, data which is then used by the Belgian experts to update GBIF on a weekly basis. Similarly, Belgium is in touch with France for what concerns management practice. Together they are working on developing a website to improve the management of taxonomic groups. With regard to a possible partnership between Belgium and the Netherlands, Belgian experts see an alignment between both countries' systems and are positive about the benefits that a possible sharing of data between the two could contribute to, especially in relation to scientific citizen databases. Today, collaborations are already in place for what concerns certain taxonomic groups, as the app MijnVISmaat[34], developed to record information from anglers, is an example of. Nonetheless, further initiatives to exchange data and align surveillance and monitoring systems would enable both countries to facilitate the flow of information across borders, for the benefit of both.

Northern France

Knowledge about IAS and organisations

Following the adoption of the EU Regulation 1143/2014[35] in 2014, France developed its own national IAS strategy in 2017. The strategic document is composed of 12 objectives regrouped in 5 axes: 1) preventing the introduction and propagation of IAS; 2) managing IAS and restoring ecosystems; 3) improving and sharing knowledge on IAS; 4) raising awareness, communication, and training; 5) implementation of the legislation[36]. The Ministry of the Ecological Transition involved many stakeholders in the development of the strategy and collaborates with them for its implementation.

At the national level, the French Ministry of the Ecological Transition (MTE)[37] works with a focused team composed of the French Biodiversity Agency (Office Français de la Biodiversité, OFB), the French Committee of the International Union for Conservation of Nature (IUCN) who are co-leading the Resources Centre on Invasive Alien Species

[33] https://www.inaturalist.org/
[34] https://www.mijnvismaat.nl/
[35] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R1143&from=EN
[36] https://inpn.mnhn.fr/docs/EspecesExotiqueEnvahissanteEEE/Strategie_nationale_EEE_17_3_17.pdf
[37] https://www.ecologie.gouv.fr/direction-generale-lamenagement-du-logement-et-nature-dgaln

(Centre De Ressources Espèces Exotiques Envahissantes, CDR EEE), the National Museum of Natural History (Museum National d'Histoire Naturelle, MNHN), the French Federation of Nature Conservancies (FCEN) and the network of National Botanical Conservatories (Conservatoires Botaniques Nationaux, CBN).

The OFB[38] is a public state institution from the MTE and the Ministry of Agriculture. Its objectives are the protection and restoration of biodiversity in France. Therefore, part of the OFB participates in the detection, monitoring and management of the IAS. It also supports the MTE with the implementation of various legislations and policies (i.e., IAS National Strategy, EU Regulation on IAS), with research and studies on biodiversity and the management of the environmental police corps (enforcing laws on IAS, on pollution or wildlife protection). The OFB produces policy and scientific recommendations for the government and is in direct contact with the MTE.

The French Committee of the IUCN[39] is a non-governmental organisation affiliated with the International Union for Conservation of Nature. IUCN's objectives are to raise awareness, advise and support public policy in order to protect biodiversity. It produces policy recommendations and had previously played an active role in animating the public dialogue on the subject of IAS in continental and overseas France.

The OFB and IUCN are co-directing the CDR EEE[40]. The CDR EEE supports the French IAS National Strategy with Axes 3 & 4: Improving and sharing knowledge, raising awareness, communicating, and training. The CDR EEE is not involved in the detection or monitoring of IAS as such in France but supports it by sharing tools and information with its network (i.e., sharing alert on early detection of IAS, sharing best practises and lessons learnt in preventing and managing IAS, offering training, etc.). The CDR EEE compiles the lists of IAS available for France and its territories, but these lists are not exhaustive and rely on the capacity of regional and local IAS experts to produce the information.

The National Museum of Natural History (MNHN) supports the MTE with data management on biodiversity and IAS. In this regard, the MNHN developed and manages the National Inventory of the Natural Heritage (Inventaire National du Patrimoine Naturelle, INPN)[41]. The MNHN is involved in the collection of data, but this process is mainly delegated to a series of local and regional organisations. However, the INPN launched a mobile application to collect observations from citizens in 2020[42].

To collect data and knowledge on biodiversity and IAS, France relies on a network of regional and local structures which are either specialised in plants, animals, or specific species. For the flora, the network of Conservatoires Botaniques Nationaux (CBN) received governmental accreditation to collect data and improve knowledge on

[38] https://www.ofb.gouv.fr/en
[39] https://uicn.fr/
[40] http://especes-exotiques-envahissantes.fr/?lang=en
[41] https://inpn.mnhn.fr/partenaires/organisme-gestionnaire
[42] https://inpn.mnhn.fr/informations/inpn-especes

biodiversity and monitor IAS. The CBNs prepare policy and scientific recommendations for the regional administration on their IAS strategy. The Conservatoire Botanique National de Bailleul (CBNBL) covers the Region Hauts-de-France[43] and a part of the Region Normandie, and the CBN Alsace-Lorraine, which is under development, will cover partially the Region Grand Est with the CBN Bassin Parisien[44]. For the fauna, the data collection is less systematic, and depending on the region, it can be under the responsibility of several organisations[45]. In the region Hauts-de-France[46], two entities have been designated as fauna data centre by the regional information system (SINP): Picardie Nature and Groupe Ornithologique et Naturaliste du Nord Pas-de-Calais (GON). It is important to highlight the disparity among the regions in France. For example, the Hauts-de-France region is still developing its regional management strategy on the IAS. However, the region has been faster at establishing its network and making it visible, notably because several actors, such as the CBNBL, have been working on building knowledge on the invasive alien plants for many years. It also benefited from the reflections and their outcomes of the neighbouring Regions Normandie and Grand Est. While the Region Grand Est has been conducting reflections on networking and management strategies of IAS for a longer time than Hauts de France, it has been a bit slower at establishing its network.

Besides the governmental initiatives, a series of citizen science-based projects have been launched to collect data on biodiversity and IAS in France. Most of the citizen science- based initiative are listed on the websites “OPEN sciences”[47] and INPN[48].

Available databases and documentation

At international level, the Global Biodiversity Information Facility (GBIF)[49] is used to centralise all data related to biodiversity and IAS. The data provides information on the species, the geo-localisation, its occurrences and to a certain extent on its spread. The platform also ensures that the data are available for international partners.

At national level, two main databases exist, the National Inventory of the Natural Heritage (INPN) and the Taxonomic Reference System (Référentiel taxonomique, TAXREF)[50]. Both are managed by the MNHN. The INPN is updated following a specific procedure that guarantees the uniformity of the data for the whole territory and regroups all the data collected by the partners of the MNHN. Although the INPN does not focus on IAS, it can be used to map the observations of presence of a species at a specific moment in time[51]. The INPN provides for all IAS a technical sheet with information on

[43] https://www.cbnbl.org/
[44] https://cblorraine.fr/
[45] Structure at the national level: https://inpn.mnhn.fr/programme/donnees-observations-especes/contribuer
[46] Organisation in the Hauts-de-France: http://www.hauts-de-france.developpement-durable.gouv.fr/?Le-systeme-d-information-sur-la-nature-et-les-paysages-SINP-17249
[47] https://www.open-sciences-participatives.org/home/
[48] https://inpn.mnhn.fr/accueil/participer/tout-public
[49] https://www.gbif.org/dataset/search?publishing_country=FR
[50] https://inpn.mnhn.fr/telechargement/referentielEspece/referentielTaxo
[51] https://inpn.mnhn.fr/espece/listeEspeces/statut/metropole/J

the taxonomy, localisation, occurrence and date of introduction. The TAXREF is an index of all the species present in France, it is updated annually, and the latest version was released in January 2022[52]. Both databases allow the OFB to precisely know which IAS are present in France. The data are publicly accessible, the data of the INPN can be consulted online[53]. INPN currently estimates with regard to IAS that in Metropolitan France 1.379 species of alien plants et 708 species of alien animals exist. However, France makes a distinction between alien species and invasive alien species depending on the threat of the species for biodiversity. Therefore only 65 animal species and 53 plant species were considered alien invasive species in Metropolitan France in 2019, according to the TAXREF index. This estimation is preliminary and is considered as incomplete by the IAS community[54].

The CDR EEE website also provides valuable information on IAS (a database with more than 450 species recorded, management feedbacks, documentation, etc.). At the regional level, the CBNBL is currently updating the list of IAS for the Region Hauts-de-France for 2022.

The data are centralised at the regional level by local partners (i.e. in the region Hauts-de-France, the CBNBL for flora[55] and GON and Picardie Nature for fauna) which form parts of the regional Natural Heritage Inventory Information System (Système d'information de l'inventaire du patrimoine naturel, SINP)[56], and are sent to SINP's national office. The SINP is a partnership of several organisations (MNHN, OFB, etc.) that supports the production, formatting, exchange and storage of data on biodiversity for the INPN[57]. The validation of the data collected is done by the regional partners (i.e., CBNBL for plants in Hauts-de-France). In the region Hauts-de-France, a list of invasive alien plants based on scientific criteria is made by the CBNBL.

Trends, threats to biodiversity and alert systems

Due to the relative geographical distance, only a few IAS present in France pose a threat to the Netherlands. The experts interviewed mainly highlighted the risk from aquatic plants and their spread along with freshwater bodies. In France, some of the species under surveillance are the Asian hornet, the tiger mosquito or in Region Hauts-de-France, the plants Crassula Helmsii and Myriophyllum heterophyllum. Experts agree to say that the most harmful species are the ones settling in fragile ecosystems, the impact assessments preferred in France are the EPPO protocol and the Weber & Gut method.

[52] https://inpn.mnhn.fr/telechargement/referentielEspece/referentielTaxo
[53] https://openobs.mnhn.fr/
[54] https://inpn.mnhn.fr/espece/indicateur
[55] https://digitale.cbnbl.org/digitale-rft/site/Authentification.do;jsessionid=409CB54A36EECD8E26E74FA090552C3A
[56] https://sinp.naturefrance.fr/
[57] More on the exchange flux of information in France: https://inpn.mnhn.fr/images/content/archi_francais.jpg

Currently in France there is no alert system in place, besides the CDR EEE website where some alerts can be found. When a new species is discovered in France, an alert is written by the CDR EEE with national and local experts and sent to a list of 2.000 stakeholders. The CDR EEE also regularly publishes articles on emerging species on its website in a section called "A surveiller de près" (To keep an eye on)[58]. The OFB is currently working on improving the early detection of exotic plants by creating a monitoring network and systemizing the report of new exotic plants in France. The OFB will create alert lists to facilitate the identification of high-risk IAS in France. With this information, the OFB hopes to boost the CDR EEE alert system with frequent and up-to-date mentions of emerging IAS.

The OFB and IUCN mentioned that they will attend the 22nd International Conference on Aquatic Invasive Species organised by NVWA, Belgium's Research Institute for Nature and Forest (INBO) and Canada's Invasive Species Centre.

The CDR EEE shared the following resources:

- Biosecurity: the key to preventing biological invasions in freshwater and marine environments (July 2020)[59].
- Making use of invasive alien species settled in natural environments: an effective approach to management? (2019)[60].
- Les espèces végétales invasives des milieux aquatiques et humides du bassin Artois-Picardie (2005)[61].
- Manual of the Alien Plants of Belgium[62].

Interregional and cross-border cooperation

France participates in a series of European initiatives either through the Interreg programme or the Life Programme. The OFB will be leading several tasks in the EU programme BiodivERSa+ about the management of IAS on the field, the programme will also support the harmonisation of protocols of detection, monitoring, etc[63]. In general, French organisations collaborate sporadically with their Belgian counterparts, but this is not formalised.

On collaborating with NVWA, the OFB, IUCN and CBNBL welcomed the opportunity to improve the collaboration with the Dutch authorities and the other countries involved in the study. The main priorities would be to facilitate the discussion and exchange of

[58] http://especes-exotiques-envahissantes.fr/actualites-a-surveiller-de-pres/
[59] http://especes-exotiques-envahissantes.fr/wp-content/uploads/2019/05/32486_ofb_rencontres-vf-vang-biosecu-et-prevention-invasion_en_bd-1.pdf
[60] http://especes-exotiques-envahissantes.fr/wp-content/uploads/2019/07/uicn-guide-eee-ang-m3.pdf
[61] https://www.hauts-de-france.developpement-durable.gouv.fr/IMG/pdf/especes_vegetales_invasives_des_milieux_aquatiques_et_humides.pdf
[62] https://alienplantsbelgium.myspecies.info/
[63] https://www.biodiversa.org/1772

information among the EU Member States, to better share resources to avoid spending time on the creation of similar tools, to share experiences and best practises on IAS management.

The OFB and IUCN suggest following up beyond this study with:

- **François Delaquaize**: Invasive Alien Species Officer, Ministry of the Ecological Transition, Directorate-General for Development, Housing and Nature Directorate for Water and Biodiversity, Sub-directorate for the protection and enhancement of species and their environments (not reachable within the scope of this study),
- **Jean-François Maillard**: Team leader on vertebrates' invasive species, French Biodiversity Agency (no contact established yet within the scope of this study),
- **Nicolas Poulet**: Continental Aquatic Biodiversity Officer, French Biodiversity Agency and Coordinator CDR EEE (no contact established yet within the scope of this study),
- **Thomas Hermant**: fauna study officer, Picardie Nature (not reachable within the scope of this study).

Luxembourg

Knowledge about IAS and organisations

In Luxembourg, to manage all aspects related to IAS, a working group was set up in 2016: the IAS Coordination Group Luxembourg[64]. The group is composed of 10 members (researchers, government and local civil servants) and supports the development of national strategies for the prevention and management of invasive alien species.

The IAS Coordination Group Luxembourg plays a central role in guiding the detection, monitoring and management of IAS and coordinates various stakeholders in this framework (i.e., collaboration with local groups of birdwatchers or fishermen, independent experts, etc.). It also provides policy and scientific recommendations to the government and decides on national strategies to deal with IAS. In addition, it suggests and follows awareness and action campaigns targeting specific types of professionals (i.e., gardeners or builders) and citizens to decrease the spread of IAS.

The presidency of the group is under the responsibility of Nora Elvinger from the Directorate of Natural Resources, Water and Forestry.[65] In her role at the Ministry of Environment, Climate and Sustainable Development, Nora is responsible for the

[64] https://neobiota.lu/wp/wp-content/uploads/Arrete_ministeriel_Memorial_B121_20161128.pdf
[65] Direction des Ressources Naturelles, de l'Eau et des Forêts, Ministère de l'Environnement, du Climat et du Développement Durable.

implementation of the EU regulation 1143/2014[66], the cooperation with the EU institutions, the developments of national policy and scientific recommendations, the participation in cross border initiatives.

Tiago De Sousa from the Nature Department of the Nature and Forestry Administration[67]has similar functions to Nora Elvinger but with a stronger focus on the local level, like e.g. the implementation of action plans. The Nature Department is the central hub of a network of local branches of the Nature and Forestry Administration.

The Luxembourg Institute of Science and Technology (LIST) has been appointed by the Ministry to coordinate the national systematic IAS monitoring and develops and provides new technologies, such as photo traps, to detect and monitor biodiversity and IAS in Luxembourg.

The National Museum of Natural History of Luxembourg (MNHN) is in charge of gathering and publishing the data on biodiversity from Luxembourg. The MNHN oversees the development and usability of databases related to biodiversity and IAS. It ensures the maintenance of the information system, the update of the online database and the digitalization of the material which allows a better understanding of the occupancy and/or impact of some IAS on the territory. The MNHN does not provide policy recommendations but supports the IAS Group Luxembourg with its scientific expertise.

In terms of knowledge of IAS, Luxembourg has a good overview of the species present on its territory. Luxembourg uses three databases on biodiversity for detection, monitoring and management of IAS. The data are collected through different means: 1) Through scientific studies: the Ministry of Environment, Climate and Sustainable Development has deployed long term monitoring studies for either species on the EU list or of concern for Luxembourg; 2) With the support of naturalists: there are several programmes for monitoring biodiversity and/or specific species; 3) With the support of citizens: the MNHN uses the iNaturalist platform to collect data from citizens on biodiversity and IAS. The data collected through scientists and naturalists are uploaded to the national database Recorder-Lux[68] after being reviewed by national validators. The data are also available on the MNHN's website[69]. The data collected by citizens, through iNaturalist, are not validated by then validators but are nevertheless imported on MNHN's website.

[66] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R1143&from=EN
[67] Service de la Nature, Administration de la nature et des forêts, ministère de l'Environnement, du Climat et du Développement Durable.
[68] https://www.mnhn.lu/science/data-portal/recorder-software-2/?lang=en
[69] http://data.mnhn.lu

With this system, the Ministry of Environment, Climate and Sustainable Development can monitor the location and the spread of IAS in Luxembourg. It also works at producing risk assessment and impact assessment based on the ISEIA and Harmonia+ protocols. Moreover, the MNHN created an online list, Neobiota.lu[70] which is an email-based alert system to inform persons of interest of new observations of IAS in Luxembourg based on iNaturalist records. A second alert system exists and is based on the Recorder-Lux database, it triggers an alert message as soon as an observation is entered into the data.mnhn.lu website or uploaded to the Recorder-Lux database. More information is available on the existing alert system are available on Neobiota.lu website[71].

Available databases and documentation

The National Museum of Natural History of Luxembourg works with 3 online databases and disposes of a large collection of data on biodiversity for Luxembourg structured as follows: the GBIF platform (Global Biodiversity Information Facility)[72] is used to centralise all data available; Recorder-Lux is the national database of the MNHN regrouping the data from the scientific studies – including digitalized collections – and naturalists; iNaturalist Luxembourg is the network partner of the global iNaturalist network and allow naturalists and citizens to record their observations via a mobile application.

At the international level, the main database used is GBIF (Global Biodiversity Information Facility)[73]. All data available are centralised there by various partners, the main contributor being the MNHN with more than 2,350,520 occurrences.[74] The data gathered through the platform iNaturalist are also accessible on GBIF. GBIF is accessible to the public, however, the frequency of updates of datasets may vary strongly from the MNHN or other partners. This implies that the platform is not fit for the early detection of IAS.

At the national level, the most complete database is from the MNHN[75] which, as stated above, also gathers observation data from the platform iNaturalist. Recorder-Lux has been used in Luxembourg since 2000. The MNHN contracted a licence of the software Recorder to collect and format the data[76]. The data set is accessible on an online platform[77] after registration. The platform http://data.mnhn.lu which feeds data into

[70] https://neobiota.lu/luxembourg-ias-list/
[71] https://neobiota.lu/
[72] https://www.gbif.org/country/LU/summary
[73] https://www.gbif.org/country/LU/summary
[74] https://www.gbif.org/occurrence/charts?country=LU&dataset_key=962f59bc-f762-11e1-a439-00145eb45e9a
[75] http://mdata.mnhn.lu
[76] https://www.mnhn.lu/science/data-portal/recorder-software-2/?lang=en
[77] https://mdata.mnhn.lu/

Recorder-Lux allows the contribution of citizens and naturalists. However, this function will be transferred to the iNaturalist platform which provides a mobile app to facilitate the recording of new occurrences with more advanced data (i.e., geo-localisation). The database is updated frequently – daily for the plant group, in a bundle for the animal group. The data from Recorder-Lux are uploaded on the GBIF platform at various frequency.

The third major database used by the MNHN is iNaturalist. The MNHN started working with iNaturalist 2 years ago, while it was looking for a flexible solution to collect observations. iNaturalist is an American online platform created by the University of Los Angeles. The platform uses citizen observations to collect data on biodiversity, thus including invasive alien species. It relies on its community to review and validate observations and in the case of IAS, national validators. The platform is very useful for the early detection and monitoring of the spread of IAS. The database is updated in real time with the observations, depending on the activity of the naturalists and citizens. The set of data is uploaded on GBIF frequently, and on the http://mdata.mnhn.lu website several times a week.

For early detection and monitoring of IAS, the MNHN created a list online, Neobiota.lu, which currently contains 144 species – animal, plant, and fungi. These species are divided into four categories: Black List, Alert List, To Watch List and Not Listed. Moreover, Neobiota provides a webpage with further information for each species, as well as its occupancy, an impact assessment (ISEIA and/or Harmonia+ protocol) when available and a short scientific bibliography. An email-based alert system is available for the members of the IAS Group Luxembourg. The alert system provides daily updates on the observations of new species and species already listed.
The IAS Group Luxembourg is also working on identifying pathways – entry points of IAS and developing a strategy to manage those at the national level. The documentation can be found on the website Neobiota under the section *Pathway Action plans.*[78]

Trends, threats to biodiversity and alert systems

As mentioned in the previous section, there is an alert system based on the Neobionata.lu platform.[79] This alert system sends a daily email to the members of the IAS Group Luxembourg. The MNHN proposes to share the program's code they developed with other EU Member States to help them create a similar alert system based on the iNaturalist platform.[80]

[78] https://neobiota.lu/info/
[79] For further information on the alert system, please consult: http://neobiota.lu/
[80] "If interested, other Member States of the European Union are welcome to obtain the code in order to set up a similar alert system for their country. The contact email address is inaturalist@mnhn.lu.", https://neobiota.lu/.

Although Luxembourg has a good overview of the IAS on its territory, the IAS Group Luxembourg cannot provide a scientific opinion on which species are spreading the fastest or pose the biggest threat to biodiversity. There are some trends visible but there is a lack of scientific evidence to confirm them. To progress further in this matter, it will be important to conduct more long-term monitoring and more ambitious impact assessment studies for each species emerging or established.

Interregional and cross-border cooperation

Luxembourg is part of several international or regional organisations and has good bilateral relationships with its neighbours.

Luxembourg cooperates bilaterally with its neighbours for the monitoring and management of specific species (i.e., raccoons with Germany, Egyptian and Canadian geese with France and Belgium).
Luxembourg is collaborating with the Netherlands and Belgium in the framework of the Benelux working group dedicated to IAS. The Benelux IAS working group belongs to the Biodiversity Committee and met last in summer 2021. This working group was set up to enhance collaboration on early detection and monitoring of invasive alien species.

Luxembourg also collaborates at the regional level with the members of the Grande Region, which are the region of Grand-Est (France), Wallonia (Belgium), Luxembourg, Saarland (Germany) and Rhineland-Palatinate (Germany)[81]. This initiative aims at building a database of occurrences of IAS for the territory of the Grande Region and it is based on data collected through Natura2000. There is no further information on the timeline for the creation of this database.

The need for further collaboration among the Member States was seen as crucial by Nora Elvinger and Tiago De Sousa. They welcomed the initiative of the NVWA including the present study and expressed their willingness to further increase the collaboration with their Dutch counterparts.

They suggested to contact the following further experts on the topic:

- **Dr Christian Ries:** curator, leading research fellow; Department of Ecology at the National Museum of Natural History,

[81] https://www.granderegion.net/

- **Dr Sandra CELLINA:** Department Manager; Nature Department, Nature and Forestry Administration at the Ministry of Environment, Climate and Sustainable Development, and
- **Xavier Mestdagh:** Senior Engineer; Environmental Research & Innovation (ERIN) at the Luxembourg Institute of Science and Technology (LIST).

A more extensive list of contacts is available on the website Neobiota[82].

Europe

Knowledge about IAS and organisations

The European Alien Species Information Network (EASIN) was set up by the European Commission's Joint Research Center (JRC) with the objective of enabling easy access to data and information on Alien Species (AI) from existing databases, in support of policy and research.[83] The initiative, launched in 2012, follows data needs identified in the implementation of EU policy, in particular the EU Water Framework Directive, which sets out to ensure the protection of all water bodies. Having EU countries identified certain species as a threat to freshwater, under the Directive, a need emerged to further assess their estimated damage as well as their status. This resulted in the first inventory of AI species to be launched in Europe. Today, EASIN counts with 31 data partners, both from EU Member States as well as from candidate countries and neighbouring ones. This extended network ensures the collection of data spanning large geographical areas, all natural environments, and the coverage of all types of species, which amount today to a total of 13,964[84] species, ranging from bacteria and viruses to mammals. Data released by Member States authorities, scientific international organisations, and citizen science initiatives feeds into the European database where it is indexed and aggregated according to certain factors, such as countries, river basin districts, marine ecoregions as well as 10x10Km grids. Taken together, these efforts assist the work of scientists, as they tackle biological invasions, allow for an improved communication between stakeholders, promote the reuse of existing information, and facilitate information and data sharing for actions taken in the policy context, for the sake of alignment.

Available databases and documentation

Originally, the EASIN catalogue was compiled using information reported by 43 online information systems (7 with global coverage, 2 with European coverage, 5 with

[82] https://neobiota.lu/contacts/
[83] https://easin.jrc.ec.europa.eu/easin
[84] As of 20-12-2022. https://easin.jrc.ec.europa.eu/easin

supranational coverage, 26 with national coverage and 3 with sub-national coverage).[85] The information collected (e.g. names, data regarding occurrence) was then submitted to a comprehensive revision and quality check before proceeding with the elimination or modification of erroneous or duplicate pieces of information. Today, these verification procedures are complemented by the publication of assessment reports, citizen science, peer reviewing as well as by the work carried out by the Editorial Board. Responsible for ensuring high quality standards for the data uploaded to the inventory, the Editorial Board is in charge of proposing the necessary changes to the catalogue in case it receives updates on specific species it is tracking. This is then uploaded to the two databases that the catalogue relies on: one, reporting information specific to the inventory (i.e. scientific name, environment, information regarding impact, pathways, year of first introduction, native range synonyms, taxonomy) and the other, holding information accounting for species' occurrences (e.g. country of presence). Together, they provide the user all types of information about species of concern.

Trends, threats to biodiversity and alert systems

Unlike most EU Member States, which carry out species-specific monitoring exercises, efforts made to monitor trends at the wider EU level by the JRC have adopted a less specific and more general approach. Nonetheless, on some occasions and when the species in questions have raised specific concerns among the expert community, exceptions have been made (e.g., to compare Invasive species of Union concern distributions with their baseline). Overall, it currently seems that encountered differences are to be explained in relation to the quality of the data provided and not so much to other factors. For this reason, recommendations have been provided to partner institutions and entities on how to enhance the quality of submitted data by, for example, streamlining the data availability and improving reporting efforts on species.

To help the surveillance and management of species, for a few years EASIN has launched a new tool called NOTSYS.[86] The platform allows EU Member States to notify the Commission and thereby inform other Member States of early detections of IAS of Union concern and related eradication measures. The data, collected and verified for privacy requirements, is then used to update the EASIN Catalogue and spatial database, resulting in updates to the data and information of the Union list.

In addition, the JRC has developed a mobile application called Invasive “Alien Species in Europe app” with the purpose of facilitating reporting occurrences of IAS of Union concern by citizen, fostering citizens’ awareness about the problems caused by IAS in Europe, and actively getting the public involved in the management of IAS to the benefit of European environment.

[85] https://easin.jrc.ec.europa.eu/easin/Catalogue
[86] https://easin.jrc.ec.europa.eu/notsys

Today, one of the fastest-spreading invasive species to have been included in the list of Union concern is the *Vespa Velutina nigrithorax*, also known as Asian hornet. The species, which raised a lot of concerns among different stakeholders for threatening honey production and native pollinating insects, has spread into other countries where it had not yet appeared, showing an increase in overall range and distribution. While this is just one example of species which the Union list should be on the lookout for, other pathways of introduction, such as ports and airports, have also been marked as "of concern". Within this framework, the sharing of data from border controls can further support and increase the efficacy of surveillance and management programmes.

The spatial data collected through EASIN, together with that concerning new species detection can serve the European institutions more in general to communicate with Member States' authorities about possible risks surrounding new detections as well as to provide them with early warnings. To this day, the procedure followed for Europe has served to understand the importance of working with higher resolution data as it could help monitor the (potential) spread for new invasive alien species.

Interregional and cross-border cooperation

As the European Alien Species Information Network, EASIN brings together partners of different nature: local and regional authorities, stakeholders as well as citizens, facilitating cross-border cooperation, among others. Examples are, the list of competent authorities[87], which could serve member countries in finding and establishing possible partnerships for cooperation, and the inventory of citizen science projects[88], of which several are transnational in nature.

Other useful websites and links:

- The European Group on Biological Invasions[89]
- The Group of experts on Invasive Alien Species of the Standing Committee of the Bern Convention[90]
- Baseline Distribution of IAS of Union concern[91]
- Factsheet about IAS of Union Concern[92]
- Assessment of IAS of Union concern distribution[93]
- Publication "Handling Big Data of Alien Species in Europe: The European Alien Species Information Network Geodatabase"[94].

[87] https://easin.jrc.ec.europa.eu/easin/MSCAuthorities
[88] https://easin.jrc.ec.europa.eu/easin/CitizenScience/Projects
[89] https://www.neobiota.eu/
[90] https://www.coe.int/en/web/bern-convention/on-invasive-alien-species
[91] https://easin.jrc.ec.europa.eu/easin/Documentation/Baseline
[92] https://easin.jrc.ec.europa.eu/easin/Documentation/Factsheet
[93] https://easin.jrc.ec.europa.eu/easin/Documentation/AssessmentIAS
[94] https://www.frontiersin.org/articles/10.3389/fict.2017.00020/ful

Recommendations to NVWA

In Belgium, Northern France, Luxembourg and the German Länder neighbouring the Netherlands, many different IAS monitoring and surveillance systems exist. In addition, new initiatives and projects which aim to harmonise and improve the data collection are being set up. Some of these initiatives are international or cross-border such as EASIN, GBIF or the IAS database of the Grande Region.
At the same time, the number of experts in these regions/countries is limited which will make it easy to establish closer cooperation with peers. Based on the findings of this study, we recommend

1. To intensify the **communication and build a network with peers in the neighbouring countries** for regular knowledge exchange and further collaboration. Beside opportunities to meet peers at international conferences and meetings, disseminating this report to the experts identified in the neighbouring countries could serve as an excellent means to launch more intensive one-to-one exchanges and informal collaboration.

2. To make an **in-depth evaluation of the main international or cross-border databases** described in this study and their usefulness for the early IAS detection and monitoring (EASIN, GBIF, IAS database of Grande Region, iNaturalist).

3. To **start with a specific IAS group of concern** to the Netherlands to test the different data repositories and possible communication channels in order to find out what works best.

4. To register for national and regional newsletters and follow up online via online websites on current **national and regional projects** such as LIFE RIPARIAS and TrIAS in Belgium and see if they can increase NVWA's knowledge beyond the Dutch borders.

5. To define a **tailor-made approach per neighbouring country**. To this end, we recommend:

With regard to Germany:

- To monitor the publication page of the Federal Agency for Nature Conservation (BfN)[95] for their national report booklets which include a detailed analysis of the species of the EU Union list and their spread over Germany reported to the BfN by each of the federal states which collect these data from various sources.
- To regularly visit the central federal state platform dedicated to the spread of species from the EU Union list existing in Lower Saxony[96] and in North Rhine-

[95] https://www.bfn.de/publikationen
[96] https://www.nlwkn.niedersachsen.de/cites/invasive_arten/invasive-arten-164705.html

Westphalia[97]. The website for North Rhine-Westphalia offers a detailed description for each species and provides the exact date of the last update.

- To exchange knowledge and lessons-learned in terms of containment measures aimed at invasive alien species to develop best practices together in an efficient way. Event participation or invitations of guest speakers could facilitate the interregional transfer of knowledge.
- To consult observation databases that are aimed at a cross-border registration of invasive alien species in Europe[98] and on a bigger scale for all organisms worldwide[99] to help identify trends and threats to biodiversity at an early stage.

With regard to Belgium:

- To have a look at the TrIAS project and the TrIAS community page on GBIF to gather more information about alien species' occurrences and their development in Belgium.
- To monitor the LIFE RIPARIAS project to receive a better insight into the management of invasive alien species across regional borders as well as concerning the emergence of new IAS in Belgium.
- To use the GBIF database to access the Global Register of Introduced and Invasive Species and thereby be informed on over 3,500 (about 50-60% of the total) different species present in Belgium.
- To monitor the LIFE RIPARIAS project closely as they are working on a mapping tool (available after 2026) allowing users to select a polygon in order to get reports for selected alien species spread over the whole Belgian territory.
- To expand on existing collaborations between the two countries by coming up with new initiatives that allow the exchange of data and the alliance of surveillance and monitoring systems further in order to facilitate the flow of information across both borders. Possible partners are: Agency for Nature and Forests of the Flemish Government, Royal Belgian Institute of Natural Sciences, Belgian Forum on Invasive Species, and Institute of Nature and Forest Research.

With regard to Luxembourg:

- To use the database GBIF Luxembourg to deepen the knowledge on IAS established in Luxembourg and their spreading patterns.
- To frequently monitor Neobiota for the early detection of emerging IAS in Luxembourg.
- To contact Dr Christian Ries and Paul Braun to seek whether NVWA experts could be added to the mailing list of the Neobiota Alert System.
- To invest in the Benelux IAS Committee to further improve the collaboration with Luxembourg.

[97] https://neobiota.naturschutzinformationen-nrw.de/site/Default.aspx
[98] https://digitalearthlab.jrc.ec.europa.eu/app/invasive-alien-species-europe
[99] https://observation.org/

- To contact the IAS Group Luxembourg, through Dr Nora Elvinger and Tiago De Sousa, to improve bilateral collaboration between the two countries.
- To closely monitor the creation of the new IAS database for the Grande Region and support the initiative if possible. Such a database would help NVWA to better anticipate the emergence of IAS on the Southern Dutch border.

With regard to France:

- To use the database GBIF France to deepen the knowledge on IAS established in Northern France and their spreading patterns.
- To monitor the national webpage of the Resource Centre on IAS[100] (CDR EEE) as well as the regional webpage of the Hauts-de-France[101] and Grand Est[102] Regions to stay informed on the discovery of new IAS in Metropolitan France.
- To discuss with the CDR EEE and the French Office of Biodiversity (OFB) about future collaborations, mutualisation of resources and exchange of information.
- To develop and sustain relationships with the OFB and to develop bilateral initiatives between the Netherlands and France (i.e., monitoring of freshwater aquatic plants pathways).
- To actively participate in the European programme BiodivERSa+, and to use it as an opportunity to further collaborate with France and to possibly support France's initiatives in the framework of BiodivERSa+.

With regard to Europe:

- To rely on the EASIN catalogue to access information on taxonomy, pathways of introduction, native range, and impact of alien species in Europe. The catalogue allows to make a tailored search and selection of species based on various criteria (e.g. environment, taxonomy, pathways).
- To access NOTSYS, the early warning system set up under EASIN, to receive notifications of new detections of IAS of Union concern and information on eradication measures in place. This should allow member states' authorities to communicate possible new detections to each other more promptly.
- To check out the various publications and reports made available by the EASIN platform to further deepen the knowledge on IAS in Europe (i.e. the websites listed in the Europe chapter).
- To use the NOTSYS tab (Member States Competent Authorities[103]) to reach out to other specialists or editorial board members.

[100] Resource Centre on IAS
[101] Hauts-de-France
[102] Grand Est
[103] https://easin.jrc.ec.europa.eu/easin/MSCAuthorities

Next steps

Based on our discussions of the above recommendations with NVWA, the study team concluded that currently the most effective way to deepen NVWA's insights on IAS approaching the Netherlands from neighbouring countries would be to favour people over systems. This would mean for the IAS experts at NVWA

1. To build up a network with key colleagues in the regions in order to foster regular exchange of data

2. To meet regularly (e.g. twice per year) with these key colleagues to exchange face-to-face on latest developments

3. To ensure to continuously get notified about new trends and new species being spotted in the neighbouring regions (via informal email notifications, email alerts, newsletters, feeds, etc.).


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