Monitoring Non-native and Invasive Alien Species in the Czech Republic

Karel Chobot, Jan Pergl & Tomáš Görner

Invasive alien species (IAS), together with natural ecosystem fragmentation, degradation, destruction and loss, growing natural-resource consumption, environmental pollution and climate change, are among the main negative factors threatening native species and the biodiversity of native ecosystems. In addition, they can cause high economic damage/financial costs or adversely affect human health. Due to the ability of IAS to spread, an isolated approach to their management at the level of individual regions or countries is usually not effective; we need a targeted and tailored strategy that transcends national borders. Therefore, Regulation (EU) No 1143/2014 of the European Parliament and of the Council on the prevention and management of the introduction and spread of invasive alien species was adopted in the European Union, which was transposed into the Czech Republic's legal order by amending Act No. 114/1992 Gazette on Nature Conservation and Landscape Protection, and other laws related to the issue, entering into force January 1, 2022.

The Box tree moth (*Cydalima perspectalis*).   © Karel Chobot

Looking for invasive alien species

Following the adoption of the Regulation, a list of IAS of EU concern (the Union list) has been created; it currently includes 66 species and is gradually being updated. Pursuant to the Regulation, invasive species are considered to be non-native species whose introduction and spread threatens biodiversity and related ecosystem services, or has a negative impact on them. It is therefore a sub-group of introduced non-native species in the Czech Republic. The Regulation and the Amendment to the Nature Conservation and Landscape Protection Act speak mainly of IAS. A very important component of prevention and regulation, which are the main topics of the Regulation, is IAS monitoring. However, for nature conservation purposes, it is advisable to monitor a wider group of species, *i.e.* non-native, already established and potentially invasive in the future, or those that have been only just settling in the Czech Republic or are newly introduced there. It is therefore advisable for the monitoring scheme to give priority to monitoring those species that are defined by legislation, but also to be prepared for monitoring other ones. In the Amendment to the Act, Article 13f is devoted to monitoring. In its two paragraphs, it describes the two necessary points of the information base on IAS control.

Two paragraphs, two topics

The first paragraph of the Article entrusts the Nature Conservation Agency of the Czech Republic (NCA CR) with monitoring the IAS occurrence and distribution across the country. It should also be informed about found occurrences by Public/State Administration bodies or an authorized person, in accordance with the Forest Act, and then publish all the collected data on its website. The NCA CR also gathers information from public institutions and the public. The second paragraph mentions the analysis of how IAS listed on the Union list spread, which, according to the law, is provided by the Ministry of the Environment of the Czech Republic Based on the analyses, the Ministry updates the action plans (practical measures aimed at regulating and controlling unintentional introductions). Both topics are interrelated; spread analysis must be based on knowledge of distribution, and, retrospectively, it can influence monitoring methods and the selection of priority areas. It is also important whether the target is an invasive species in the Czech Republic, invasive species from the Union list, or a wider group of non-native species. According to the law and Regulation, these analyses and action plans only apply to species on the Union list. That is, the list which includes only species originating outside the EU, and which

reflects the history of political negotiations at the EU level (due to which knotweeds *Reynoutria* spp. and the American mink *Neovison vison* have not been included in the Union list). Therefore, in the case of the Czech Republic, it does not include a number of species that are considered significant in terms of negative impacts. So, let us summarize the current situation of monitoring IAS in the Czech Republic.

Mapping + monitoring = surveillance

In the established interpretation of terms, "surveillance" can be understood as combinations (or spectrum) of mapping and monitoring activities. The aim of mapping is to find out the current distribution of the phenomenon in a specified level of detail, monitoring aims to repeatedly observe trends (population, qualitative), or other detailed parameters on permanent plots. Repeated mapping is actually monitoring; monitoring the species at its all known sites also fulfils the function of mapping. Both basic principles of surveillance are necessary for correct analyses, or for fulfilling obligations, *e.g.* from the EU Habitats Directive, which also introduced the obligation to monitor the species and habitats listed in the annexes. Based on the latter example, the formulation of obligations in relation to IAS can be expected in the future. To begin with, we should remember that a specialized and unified scheme of detailed and comprehensive IAS monitoring in the Czech Republic has not yet been established. So have we been mapping and monitoring IAS today?

We have lists

The basic element of monitoring is the knowledge of the occurrence in the area, and so for IAS, the existence of lists of these species. At the European level, the DAISIE Database of Non-Native Species in Europe, covering more than 11,000 items, has played this role. Today, the EASIN platform can be used at a European scale, bringing together almost all European databases of non-native species, including those focused only on certain regions (NOBANIS, ESENIAS). There are over 2,000 non-native species in the Czech Republic, and the proportion of IAS among them is up to 15%, such as at the EU level. We have these data from two basic lists of non-native species in the Czech Republic. The first is the *Catalogue of alien plants of the Czech Republic* (Pyšek *et al.* 2012) and the other is the *Catalogue of alien animal species in the Czech Republic* (Šefrová & Laštůvka 2005), both of which are scheduled to be updated in 2022. Other lists are based on these studies – Black, Grey, and Watch Lists of non-native species

(Pergl *et al.* 2016), which used and summarized the relatively long tradition of studying non-native species in the Czech Republic; it includes not only a simple list of species but also the information on their distribution, spreading and pathways, and environmental and socio-economic impact. We can say that we know what species we should monitor in an ideal situation. These are not just species from the Union list, but also those important for our Central Europe and those have been occurring in neighbouring countries and could be potentially introduced to the Czech Republic.

We know quite a lot

However, interest in non-native and invasive alien species does not come with the EU regulation or the amendment to the act. The above-mentioned tradition of research on non-native species in our country (internationally important and recognized) together with the long-term interest in IAS from the ranks of conservationists and phytosanitary experts are behind the fact that we have already had good knowledge of many species. The current overall state of knowledge of the IAS occurrence is essentially fragmentary, both at the species level and at the spatial and temporal ones. IAS and their mapping are a topic of projects and partial activities limited by time, capacity or area. This should change with the implementation of Article 13f of the amended Nature Conservation and Landscape Protection Act, and it should therefore be comprehensive and systematic for at least some IAS.

Non-native species in the Species Occurrence Database

The long-term effort of the NCA CR to centralize all available data on species diversity within the Nature Conservancy Species Occurrence Finding Data Database, shortly known as the Species Occurrence Database (SOD; https://portal.nature.cz) has, in fact, gradually been summarizing these data in the database. At the same time, data have already been published in the SOD applications (SOD Filter, Species Cards).

Due to distributing access rights/permissions for access and data entry into the SOD to the relevant State Nature conservancy authorities, the structure pursuant to Article 13f has been prepared and functional. Simply said, the most comprehensive dataset on IAS distribution and numbers in the Czech Republic has regularly been published, updated and enhanced.

These data are based on several extensive sources. Of the total number (as of 19 November

Table 1 Summary of sources processed in the SOD (excluding habitat mapping data) with more than 1,000 records on the occurrence of non-native species in the Czech Republic.

Source	Number of records
CHYTRÝ M. *et al.* (2013) Česká národní fytocenologická databáze/ Czech National Phytosociological Database.	17,964
FALTYS Vladimír (2015) Personal findings.	14,864
ANDĚRA M. *et al.* (1995 – 2009) Atlas rozšíření savců v České republice/Atlas of the distribution of mammals in the Czech Republic. National Museum, Prague.	9,280
DANIHELKA J. (2005) Kompletní inventarizace flóry území rozšíření CHKO Pálava/Comprehensive survey on flora within the enlargement of the Pálava/Pavlov Hills Protected Landscape Area (today's Dolní Morava/ Lower Moravia Biosphere Reserve).	6,930
Various authors (2017) Botanický inventarizační průzkum KRNAP a jeho OP z let 2006–2014/Survey on flora of the Krkonoše/Giant Mts. National Park and its buffer zone in 2006–2014.	6,442
JONGEPIER J. W. (2011) Biodiversity. Project of the Council of the Government of the Czech Republic for Research & Development.	5,158
iNaturalist (2021) Data Czech Republic 2020 (iNaturalist.com).	4,120
Forest Management Institute (2016) Databáze lesnické typologie/ Database of Czech Forest Classification System (as of 2016).	3,986
Czech Anglers Union (2004) Czech Anglers Union. Questionnaires in 2004.	3,873
BERCHOVÁ K. (2016) Ohrožení biotopů soustavy Natura 2000 invazními druhy/Threatening habitats of EU Natura 2000 network by invasive alien species (Mon EVD v Natura 2000, EEA-CZ02-OV-1-024-2015 Project).	2,759
POPELÁŘOVÁ M., WOLFOVÁ J. & WOLF P. (2009) Mapování flóry v CHKO Beskydy v letech 2006–2009 (síťové mapování)/Flora mapping in the Beskydy/Moravian-Silesian Beskids Mts. Protected Landscape Area in 2006–2009 (grid mapping).	2,684
NĚMEC R. *et al.* (2020) Mapování cévnatých rostlin Podyjí/Vascular plant mapping in the Podyjí/Thaya River Basin.	2,630
iNaturalist (2020) Data Czech Republic August 1, 2018 – December 31, 2019 (iNaturalist.com).	2,407
Central Institute for Supervising and Testing in Agriculture (2015) Monitoring zaplevelení. Metodika a vyhodnocení: Průzkum výskytu a rozšíření plevelů v ČR v roce 2014/Monitoring weed distribution and infestation. Methods and assessment: Survey on weed occurrence and distribution in the Czech Republic in 2014.	1,857
Koniklec/Pasqueflower Ecocentre, charitable trust. (2015) Monitoring vybraných invazních rostlin Prahy a blízkého okolí/Monitoring the selected invasive alien plants in Prague and its vicinity.	1,398
MAREK M. (2013) Terénní šetření 2005–2013 – Květena hradů, zámků a zřícenin, včetně okolí do cca 100 m/Field survey 2005–2013. Flora of castles and ruins including their vicinity up to approx. 100 meters	1,257
ŠPRYŇAR P. & MAREK M. (2001) Květena pražských chráněných území/Flora in Prague Specially Protected Areas.	1,192
GRULICH V. (1997) Atlas rozšíření cévnatých rostlin Národního parku Podyjí/Thayatal/Atlas of vascular plant distribution in the Podyjí/Thaya River Basin National Park. 297 pp.	1,074
Czech Society for Ornithology (2014) Bird Fauna Database – AVIF.	1,054
GREMLICA T. *et al.* (2011) VaV SP/2d1/141/07 Rekultivace a management nepřírodních biotopů v České republice/Non-natural habitat restoration and management. Project of the Council of the Government of the Czech Republic for Research & Development.	1,033

specific non-natural habitats; these activities are always limited in area or species.

If we limit ourselves to the species of the Union list, *i.e.* a *de facto* arbitrary subset of the data, the numbers are logically lower and the share of data is also different. Thanks to habitat mapping, 22,856 data were gathered (these are only plant species). Among other activities, the SOD include 23,347 data on Union list species (both plants and animals). In terms of time, there is an increase in the number of data collected. Up to 1999 the SOD included 72,158 data, 222,257 data from 2000–2009, and 313,187 findings since 2010. Although biological invasions are a dynamic phenomenon, the increase in the number of data is mainly due to the combination of higher efficiency of data collection and processing and also its targeting; after all, it concerns data in general, not just data on non-native species. On the other hand, for nature conservation, new or newly verified data are needed, or even negative findings (there are very few of them in the SOD) reflecting, *e.g.* successful interventions and measures.

However, some data have still been missing in the SOD file. The outputs of the monitoring economically important non-native species carried out by the Central Institute for Supervising and Testing in Agriculture were only imported partially and once; in the future, the data exchange should be more intensive. The data still lack exports of the occurrence of invasive tree species captured by forest management plans collected by the Forest Management Institute (FMI). It is the actual authorized person according to the Forest Act and the import of the data into the SOD will be carried out in the near future. The SOD has also not yet received data from an interesting citizen science project of the Research Institute of Plant Production aimed at general public – Najdi.je. A number of other scattered data published and hidden in grey literature have been waiting to be included into the SOD, which is, *inter alia*, one of the aims of the DivLand project consortium, in which the NCA CR participates.

Even so, the amount of SOD data makes it possible to present a very good overview of the current distribution in the resolution of the basic grid mapping for a number of non-native species (Central European mapping network KFME, 10' × 6', approximately 11 × 12 km). Thus, the Species Cards (https://portal.nature.cz/karty-druhu) captures the spread of important invasive plant species well, thanks to habitat mapping and other sources; thanks to the systematic mapping of vertebrates, it captures the spread of invasive species of mammals and reptiles, and thanks to the combination of conspicuousness and belonging to a group with a higher

2021) of 603,540 data on non-native species in the SOD (which is 2% of the total number of data), two thirds (399,390) are based on data gathered during habitat mapping (3% of the number of species records gathered by habitat mapping). Habitat mapping is, to a large extent, also a systematic mapping of IAS occurrence. On each mapped segment of a semi-natural habitat, the occurrence of vascular plant non-native species is also recorded. From a strictly objective point of view, this extensive data set is fragmentary: it does not consider animals or fungi, it is limited to preserved segments within the landscape, *i.e.* often ignoring the centres of occurrence of
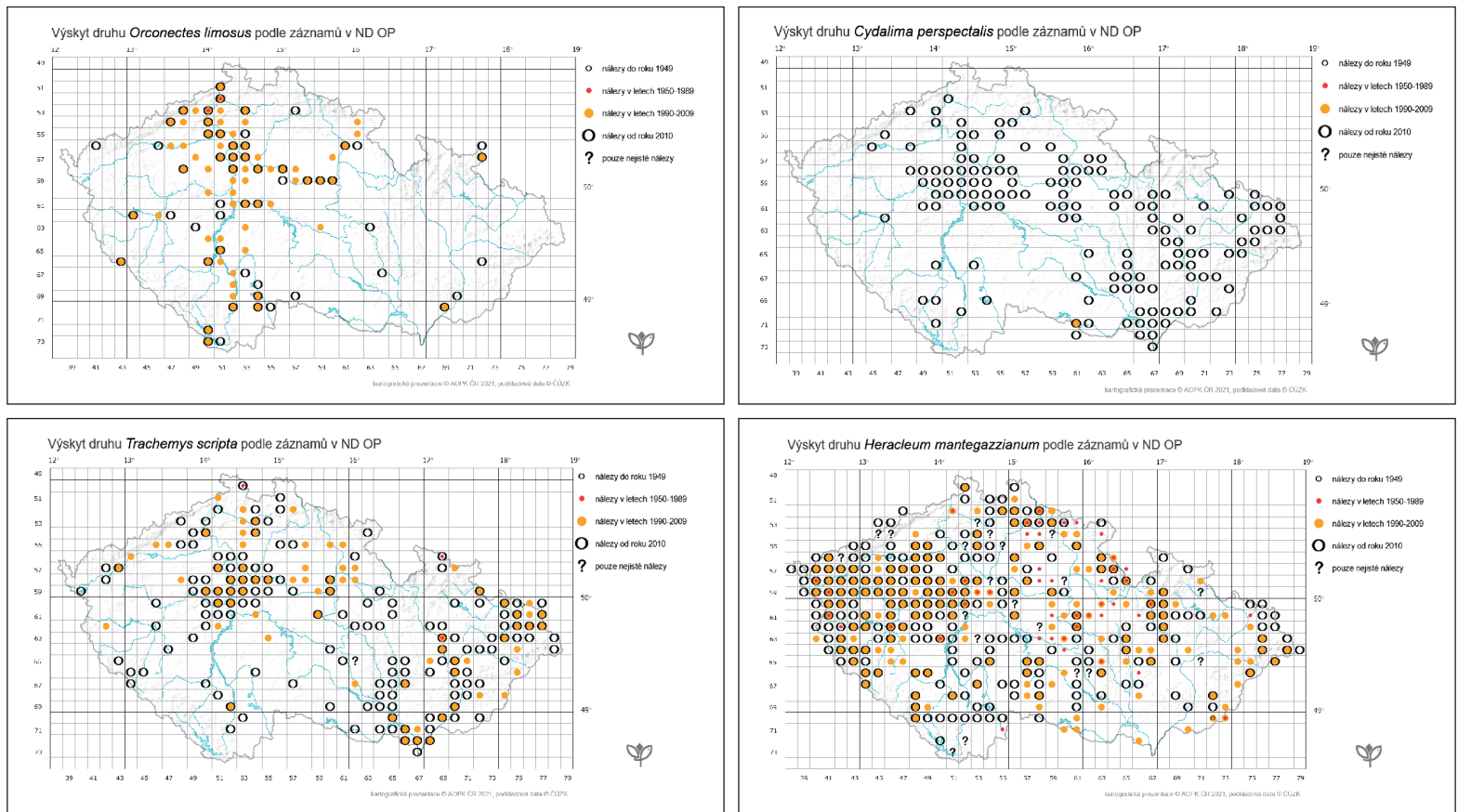
non-native species in disturbed habitats. The remaining data largely compensate for these shortcomings (see Table 1 for a list of the biggest sources). But again, strictly objectively, these are not systematic activities. Although data sources include subnational grid mappings of the large-size Specially Protected Areas (*i.e.* National Parks and Protected Landscape Areas, PLAs), imports from large databases (Czech National Phytosociological Database; FMI Database of Czech Forest Classification System; Avif Ornithological Database; CISTA Weed Database), data from the public from iNaturalist and BioLog apps, and the results of projects aimed at IAS or

Figure 1 Grid maps of distribution of the selected non-native species, well represented in SOD: the Spinycheek crayfish (*Orconectes limosus*), an invasive species of crayfish, a major vector of crayfish plague pathogen, therefore also relatively intensively monitored. The Box tree moth (*Cydalima perspectalis*), a visually striking pest of box stands, an example of high spreading dynamics. The Pond slider (*Trachemys scripta*), today the most common representative of turtles in Czech Republic's nature, with an increasing number of sites inhabited. The Giant hogweed (*Heracleum mantegazzianum*), a symbol of biological invasions in the Czech Republic, with an expanding distribution range within the country.

number of specialists, it captures *e.g.* some species of butterflies and crayfish (*cf.* Fig. 1).

We want to know more

Everything can be improved. Gaps and shortcomings in the data have already been indicated; overall and more frequently updated data on a wider range of species have been still missing. Due to the fact that no funds were found in the State Budget for monitoring IAS, *i.e.* a new legal obligation of the state, based on its experience in systematic mapping, the NCA CR prepared a proposal for an extensive project Mapping and monitoring IAS within the Operational Programme Environment, *i.e.* from the EU funds.

The aim of the project is to establish a long-term functional system for collecting current and detailed data on the occurrence of the selected IAS and the topical data collection during the project implementation. The system aims to provide up-to-date information on the state of invasive alien species in the Czech Republic on a much more detailed scale than before and across the whole country's territory. This would

not only meet the legislative requirements, but would also provide detailed and up-to-date data that can be used for practical management. The project should focus on mapping species from the Union list, as well as on other non-native species important for nature conservation. The current set of practical methodologies for a wide range of species (PERGL *et al*. 2016a) will be used as a basic background for methodological settings in the context of area-wide mapping.

Due to the relatively high costs and complexity of the project for field work, area-wide mapping will be based on the following basic principles. In the open landscape (excluding PLAs and small-size Specially Protected Areas), IAS will be mapped in units of 1st order mapping grid (approx. 5.5 × 6 km) and on the basis of a survey of potentially affected areas (*e.g.* brownfields, linear green belts along roads, or watercourses); within large-size Specially Protected Areas (PLAs), in units of 2nd order grid (3 × 3 km, or finer), and within small-size Specially Protected Areas by regular monitoring of the entire site. The whole Czech Republic (with the exception of Prague, National Parks, and military domains/

areas) will be mapped by new NCA CR employees; in addition, the project will fund a number of studies contributing to greater efficiency and detail of mapping (*e.g.* prediction models of spread, satellite data analysis, eDNA analyses, genetic analyses of pathogens) and trying to actively involve the general public through citizen science and other projects aimed at non-native species.

If the project succeeds and is supported, a significant increase in data in the SOD can be expected – even up to a ten per cent share. The data will be available for further research. For example, lists of non-native species tend to be updated, just as Red Lists of Threatened Species are updated, so it will be possible to respond to new knowledge gained, *inter alia*, by mapping IAS. However, this is not the main outcome; thanks to mapping, data will be obtained for more effective nature conservation field measures, especially if its objective is to eradicate or prevent the spread of invasive alien species at the specific sites. ∎

The list of references is attached to the online version of the article at www.casopis.ochranaprirody.cz.