European Union Network for the Implementation and Enforcement of Environmental Law

JoNeF Survey Report

Survey on macrofungi conservation and data collection in Europe.

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JoNeF Joint Network for wild Fungi

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Introduction to IMPEL

The European Union Network for the Implementation and Enforcement of Environmental Law (IMPEL) is an international non-profit association of the environmental authorities of the EU Member States, acceding and candidate countries of the European Union and EEA countries. The association is registered in Belgium and its legal seat is in Brussels, Belgium.

IMPEL was set up in 1992 as an informal Network of European regulators and authorities concerned with the implementation and enforcement of environmental law. The Network's objective is to create the necessary impetus in the European Community to make progress on ensuring a more effective application of environmental legislation. The core of the IMPEL activities concerns awareness raising, capacity building and exchange of information and experiences on implementation, enforcement and international enforcement collaboration as well as promoting and supporting the practicability and enforceability of European environmental legislation.

During the previous years IMPEL has developed into a considerable, widely known organisation, being mentioned in a number of EU legislative and policy documents, e.g. the 7th Environment Action Programme and the Recommendation on Minimum Criteria for Environmental Inspections.

The expertise and experience of the participants within IMPEL make the network uniquely qualified to work on both technical and regulatory aspects of EU environmental legislation.

Information on the IMPEL Network is also available through its website at: www.impel.eu

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Executive Summary

A questionnaire-based survey was developed by the JoNeF (Joint Network for wild Fungi) project team and distributed from October to December 2023 to IMPEL and non-IMPEL member organizations, contacting experts and institutions that were interested in fungal conservation and data collection. Respondents from thirty-two European countries replied to the questionnaire. The responses showed the interest for the subject as well as differences between countries. Some European countries have developed laws, policies, and plans for the study of fungal diversity and its protection while others do not have any specific law on fungal conservation. This variability highlights the absence of a common European operational framework (or a common European directive), and therefore the lack of common environmental policies and scientific initiatives at European level. This lack affects the possibility of obtaining a homogeneous framework of knowledge on fungal diversity in European countries, since different data acquisition systems cannot be interoperable in absence of common rules.

It is our recommendation that the European Commission listen to the need to include fungi in environmental legislation and policies, following the requests that have been made over the years by the scientific community and considering the more recent knowledge acquired on fungi.

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Recently, there has been an increased awareness about the need to include the Kingdom of Fungi in European environmental legislations and policies, just like animals and plants, to protect these organisms in their habitats.

> "We call upon state leaders, civil society, scientists, and citizens of the world to seize this moment and create legal protections for fungi under international, regional, and domestic laws and policies."
>
> (Furci G. et al., 2023)

The conservation of fungal diversity is crucial to preserve global ecological cycles. The main reason we know so little about fungi is because they lead very cryptic lifestyles (Antonelli A. et al., 2020).

Currently, Kingdom Fungi is not represented in the Bern Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention, 1982)[1] and in the Council Directive on the conservation of natural habitats and wild fauna and flora (Habitats Directive, 1992)[2]. The interest in fungal diversity and its conservation has continuously increased, and it is currently the founding element of several European institutions.

In this context, in 2022 the Italian Institute for the Environmental Protection and Research (ISPRA)[3] proposed to the European Union Network for the Implementation and Enforcement of Environmental Law (IMPEL)[4] the project "Joint Network for wild Fungi – JoNeF"[5].

The IMPEL General Assembly approved the JoNeF project in June 2023 under the Nature Protection Expert Team. The main goal of JoNeF is to discuss and propose to the European Commission a way to integrate fungi conservation into European legislation on nature conservation and in decision-making processes, in order to implement a comprehensive conservation strategy (Dahlberg A. et al., 2010).

JoNeF's objective is to enhance the actions that have already been taken, considering the outcomes of numerous previous initiatives (Senn-Irlet et al., 2007; Fraiture & Otto, 2015).

The JoNeF project's first objective has been collecting and curating the information of current national legislation on fungal protection, conservation and data collection and the existing procedures for the census and monitoring of macromycetes (i.e. macrofungi) in Europe.

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[1] https://www.coe.int/en/web/bern-convention

[2] https://environment.ec.europa.eu/topics/nature-and-biodiversity/habitats-directive_en

[3] https://www.isprambiente.gov.it/en?set_language=en

[4] https://www.impel.eu/en

[5] https://www.impel.eu/en/projects/joint-network-for-wild-fungi-jonef

The Questionnaire results, presented in this report, will be the basis for the development of the practical Guidance for census and monitoring of wild macrofungi in Europe.

The belief is that National Environmental Institutions and Ministries can coordinate data collection activities, involving the knowledge and expertise of mycological associations, professional and amateur mycologists, and academia.

The JoNeF project started on July 2023, and it will end in December 2024.

Currently, the project team is composed by **30 active members** on behalf of **17 European countries.** Moreover, there are 4 members from a follower country (Lithuania), two members belong to global non-profit associations and one member freelance. The 18 European countries are depicted in Figure 1 with active member countries shown in green and follower member country shown in yellow.

The IMPEL Network has allowed to get in touch not only with national bodies and agencies that deal with environmental policies, but also with scientific institutions, universities and mycological associations, all stakeholders interested in the topic of mycology, working for the protection of the Fungi Kingdom, so little considered at present. The common goal of the team members was the demand for attention for fungi towards both the legislator and those who deal with policies.

The JoNeF project is composed by members with different training, skills, and experience, and this has been a strength to be able to ask again to consider Kingdom of Fungi in terms of legal protection like Animals and Plants.

Albania
France
Greece
Hungary
Iceland
Ireland
Italy
Kosovo
Latvia
Malta
Montenegro
North Macedonia
Portugal
Sweden
Switzerland
The Netherlands
UK
Lithuania (follower)

Figure 1. Map of European countries of the JoNeF team members.

Box – Kingdom Fungi

Author: Corrado Nai

Fungi are a kingdom of life, systematically equal to plants, animals and to the microscopic groups composed of protists, bacteria, and archaea. Until less than six decades ago (Whittaker, R.H., 1969), however, fungi were considered plants.

The attention of naturalists, environmentalists, researchers as well as funders, legislators, and decision-makers towards the kingdom Fungi has thus lagged when compared with other kingdoms.

Fungi are a very diverse group of eukaryotes (that is, cells with a nucleus, as opposed to other organisms like bacteria and archaea) and include mushrooms, moulds, yeasts, and lichens. Fungi often live in subvisible forms escaping sight, like mycelia, hyphae, and spores, and can have a sexual or an asexual reproductive cycle. Fungi which form macroscopic structures like mushrooms or truffles are called macrofungi (as opposed to microfungi).

Macrofungi provide a broad spectrum of ecosystem services. Primary ecosystem services include nutrient cycling, carbon stocking, soil formation, mycoremediation, food source (Niego A.G.T. et al., 2023).

Moreover, fungi have a paramount importance for industry and economy and are investigated for innovative approaches in the production of biological materials and the circular economy (Niego A.G.T. et al., 2023).

About 150’000 species of fungi are currently known, which according to estimates represent a mere 5% of all fungal biodiversity of about 2.5 million species (in comparison, about 400’000 plants from a total of about 450’000 existing species are known, and about 74’000 vertebrate animals from a total of about 81’000 existing species are known). This lack in knowledge about fungi is also reflected in the legislative and regulatory frameworks involving conservation of fungi: while most fungi (and plants) are at severe risk of extinction, only 0.4% of currently known fungi have been assessed for their conservation status (vs. about 18% of plants and about 80% of animals) (Antonelli et al., 2023).

2. The Questionnaire-based Survey

A questionnaire developed by the team was the basis of the Survey.

The objective of the questionnaire was to gather information on conservation and data collection of macrofungi in Europe.

The questionnaire was shared with JoNeF members and National Coordinators of IMPEL countries. JoNeF members and IMPEL National Coordinators disseminated the questionnaire both in their own country and in other countries not involved with JoNeF.

An online form was used to disseminate the questionnaire, starting on 16th October 2023. The form was linked to the following webpages:

- the JoNeF webpage on IMPEL website: https://www.impel.eu/en/projects/joint-network-for-wild-fungi-jonef
- the JoNeF webpage on the Italian NMD Network website: https://ndm.isprambiente.it/en/activities/projects-and-initiatives/project-jonef/

The deadline to reply was originally November 26th, but it was extended to December 11th.

The questionnaire included **82 questions** divided in two parts.

Part 1 included the following **five sections**:

- Information on the respondent
- National legislative context
- Sub-national legislative context
- Regulatory context
- Institutions dealing with conservation and data collection of fungi.

Part 2 included the following **six sections**:

- Information on the respondent
- Data collection initiatives and projects
- Conservation plans and projects
- Species lists
- Data collection, databases and fungaria
- Ask the European Commission.

2.1 Terminological and procedural specifications

For the purposes of the Questionnaire, the term “fungi” means macrofungi, i.e. fungi visible to the naked eye, or macromycetes, or mushrooms (edible and not edible ones) excluding cultivated ones.

The term “conservation” is used in a broad sense including *in situ* and *ex situ* conservation practices, protection, preservation, management and restoration activities and measures.

With the term “sub-national” is intended any administrative subdivision under the national level, e.g. a region within a nation; and the term “official” is used with the meaning of “produced by a Ministry or a public agency or a public research institute”.

This report is based on responses received from both JoNeF and non-JoNeF members (including non-IMPEL members and organizations) who contributed to the questionnaire between October 16 and December 11, 2023.

All the responses were collected and grouped by country. In cases where countries had more than one response, these were integrated into a single response, and this activity was conducted by JoNeF members. In these cases, team reported countries as “combined”. This does not apply to section 11 for which the answers have not been aggregated.

In some cases, an appropriate answer could not be determined, so it has been marked with “NA”, which means both “Not Applicable” and “Not Available”. NA answers include different types of unhelpful responses, like blank answers, “I do not know”, free text that is not coherent with the question, unclear free text instead of a yes/no answer. NA answers are omitted from the tables.

Whenever possible, in case of free text inserted in the yes/no field, answers were assigned to ‘yes’ or ‘no’ based on their contents.

The survey results cannot be considered exhaustive or complete. The objective of this exploratory survey is to provide a current glimpse into the state of fungi conservation in Europe.

When there were contradictory responses in the same country regarding data processing, the JoNeF members’ response was given precedence.

All maps are made using MapChart.

The texts of the replies received were not reworked but were left in the original form, except for fixing spelling errors and clarity.

The original answers, when written in a language other than English, were translated into English using the Reverso app.

The raw data is available from ISPRA for anyone wishing to view them.

Since JoNeF wanted to provide a picture of the European situation, the answers to the questionnaire provided by non-European countries (Canada and USA) were not counted for charts and maps. For answers of USA see Box - Data collection and conservation of fungi in the USA. It was decided not to include a box for Canada due to the incompleteness of the answers provided.

2.2 Synthesis of the Survey responses

The responses received were as follows:

- Sixty-nine answers for the part 1 of the questionnaire
- Sixty-three answers for the part 2 of the questionnaire.

Eleven countries sent multiple answers.

A total of thirty-four countries (32 European countries plus USA and Canada) participated in the questionnaire, as follows:

- Respondents from thirty-one countries filled out both part 1 and part 2
- Respondents from two countries (Canada and Czech Republic) filled out only part 1
- Respondents from one country (Turkey) filled out only part 2.

Countries that participated in the survey are reported in Figure 2, except Canada and USA.

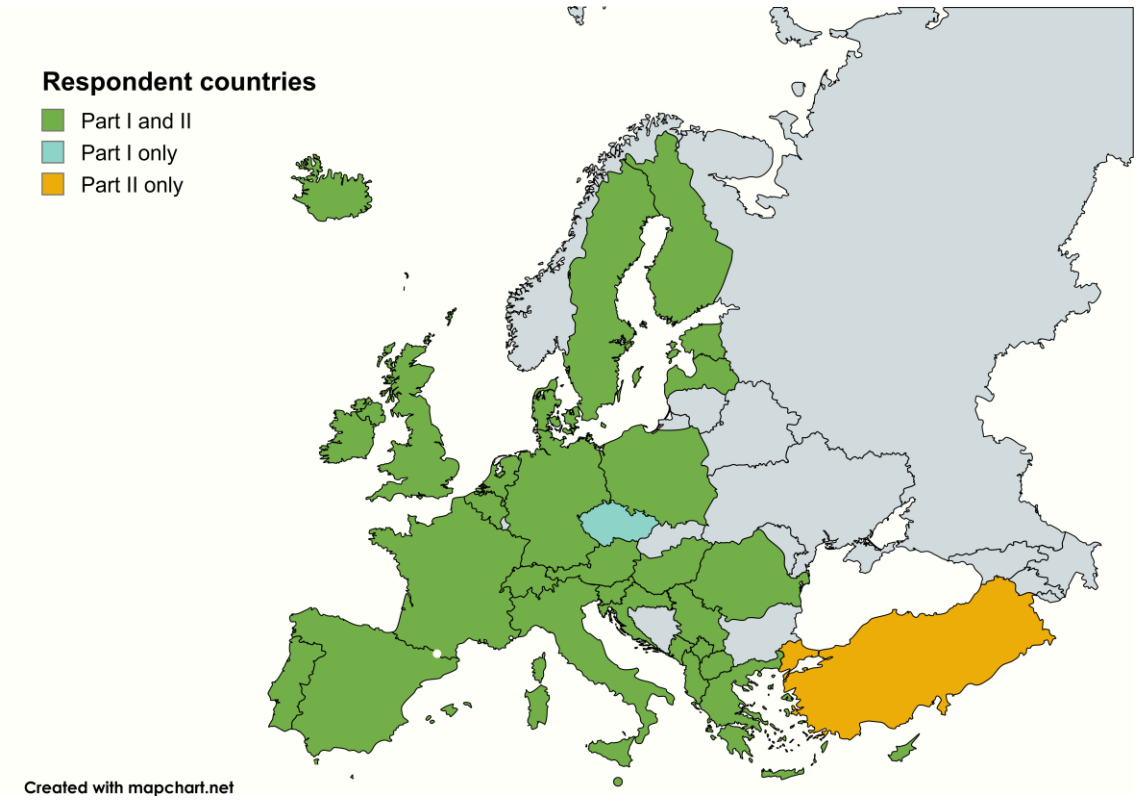


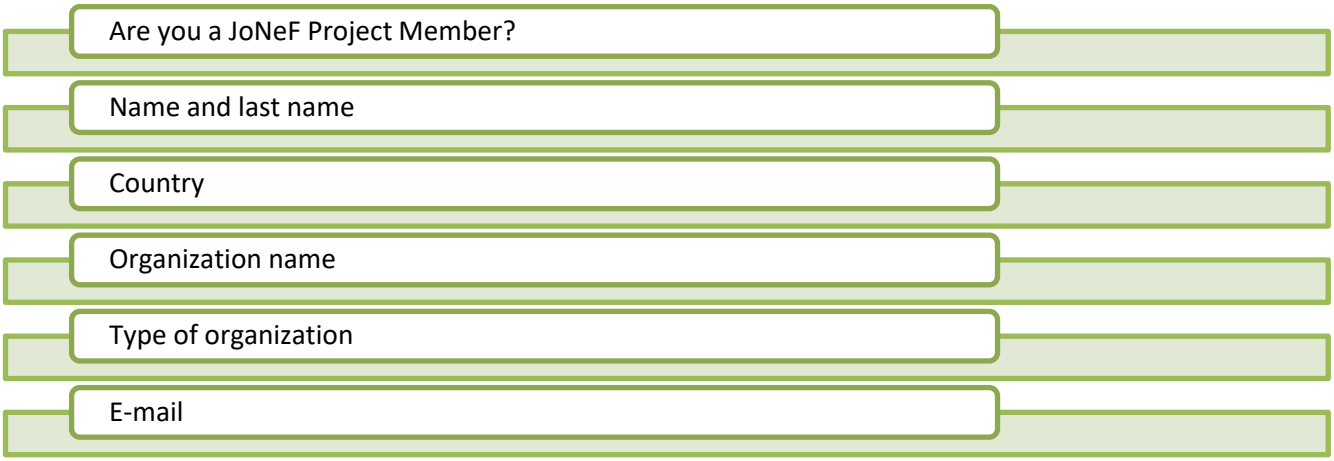
Figure 2. Map of the European countries that filled out part 1 and part 2 of the questionnaire.

3. Survey results on part 1

3.1 Information on the respondents of part 1

Author: Francesca Floccia

The information about the respondents in part 1 of the questionnaire is reported in this section. The following are the six reported questions.



People who filled out part 1 of the questionnaire were in total 69 among which **23** were JoNeF members and **46** were non-JoNeF members.

A total of 33 countries (of which 31 European countries) participated in part 1 of the questionnaire: 17 were countries of JoNeF members and 16 were countries of non-JoNeF members (see Figure 3). Canada and USA are not reported in the map.

Regarding the type of organizations that participated in the survey, the most common are National public authorities (25%), followed by Academic institutions (20%) and Sub-national public authorities (16%; see Figure 4).

Organization names, types of organizations, and countries are reported in Box - Data collection and conservation of fungi in the USA.

Names and emails of respondents are not reported for privacy reasons.

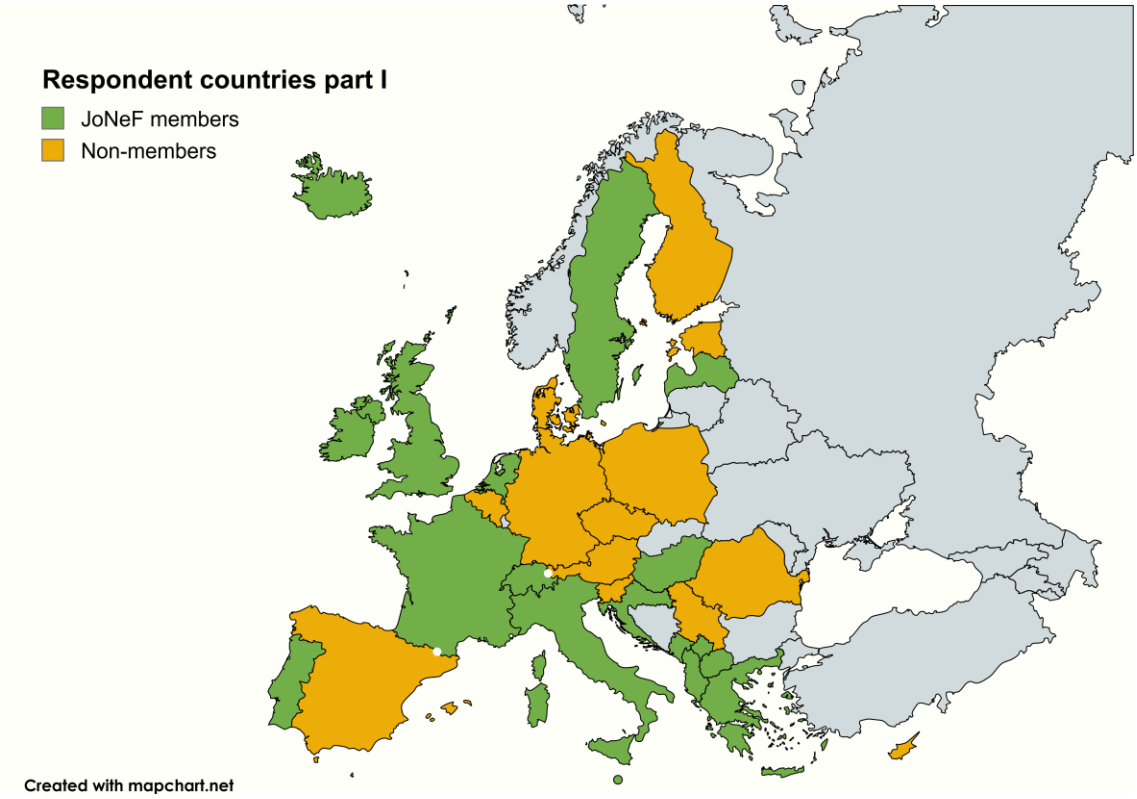


Figure 3. Map of countries of JoNeF and non-JoNeF members that answered to part 1 of the questionnaire.

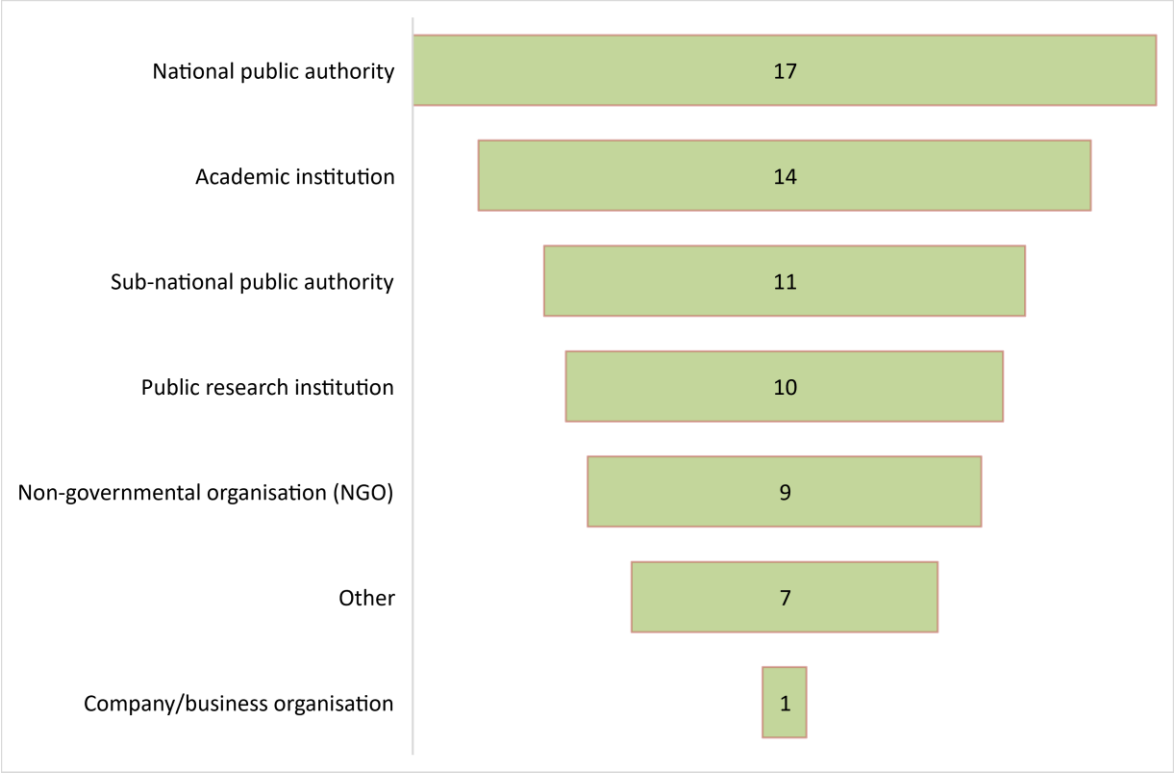


Figure 4. Number of respondents in part 1 of the questionnaire by type of organisation.

3.2 National Legislative Context

Author: Stefania Ercole

This section concerned the legislative context at national level, particularly the national environmental legislation related to the conservation of fungi. Also, the existence of lists of protected species of fungi in the legislation was investigated as well as the existence of national laws that guarantee the public access to environmental information.

It included three main questions, as follows.

Are there national laws specifically dedicated to conservation of Fungi (including species and habitat for the species)?

- If yes, please enter the law title and a short synthesis of the law content.
- If yes, please specify if there is a list of protected species and how many species are included

Are there national laws dedicated to gathering of Fungi?

- If yes, please enter the law title and a short synthesis of the law content.

Are there national laws dedicated to the public access to environmental information (Aarhus Convention)?

- If yes, please enter the law title and a short synthesis of the content.

The following **31 European countries** answered to the questions: Albania, Austria, Belgium, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Kosovo, Latvia, North Macedonia, Malta, Montenegro, Poland, Portugal, Romania, Serbia, Slovenia, Spain, Sweden, Switzerland, The Netherlands, UK.

National laws specifically dedicated to conservation of fungi (first question): 15 countries answered "no", 14 answered "yes" and 2 answers are NA (Figure 5). Among the 15 countries that have a national law, 13 have provided information about law title, and a short synthesis of the law content, if there is a list of protected species and how many species are included (Figure 6[6] and Table 1).

[6] Only countries that provided the number of protected species are represented.

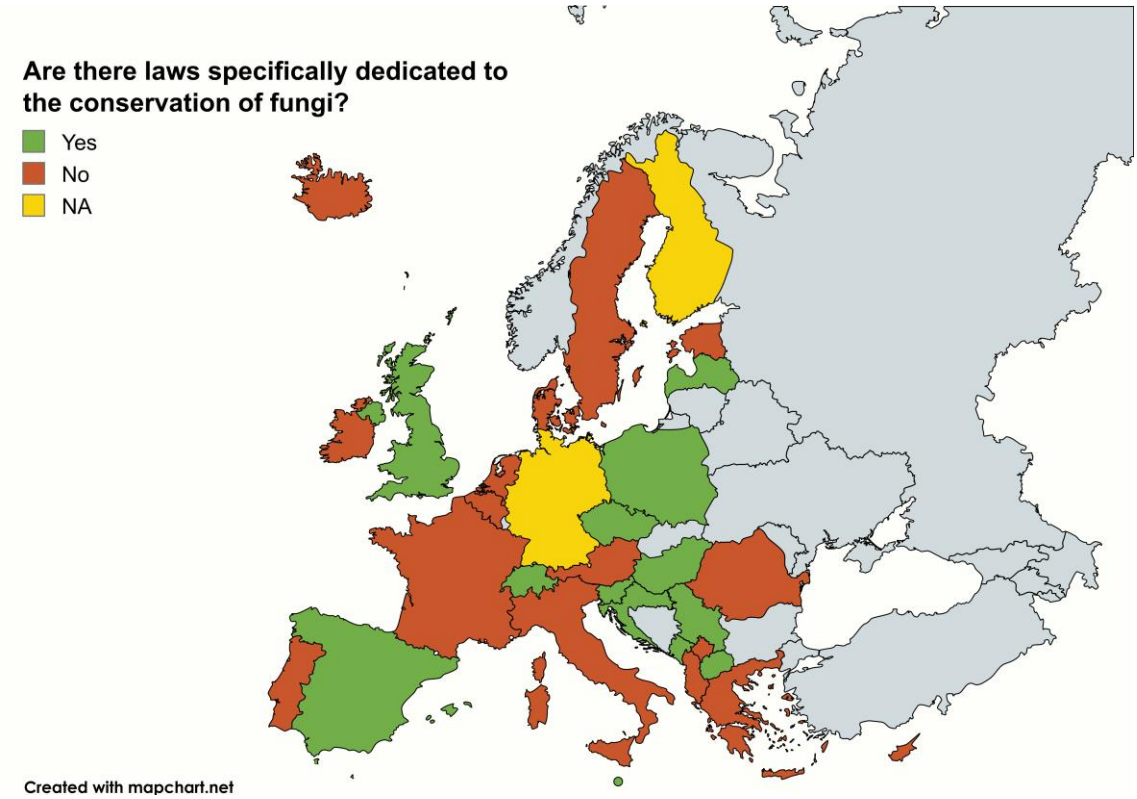


Figure 5. Map of countries that reported having national laws dedicated to conservation of fungi.

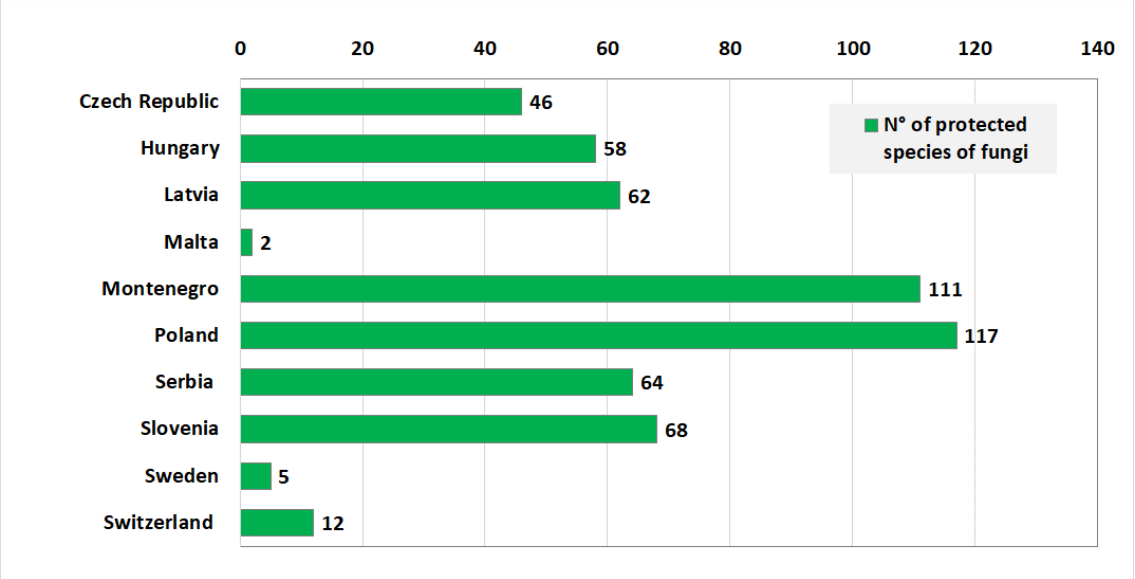


Figure 6. Number of fungal species protected by national laws.

Only 15 countries have National laws dedicated to gathering of fungi (Figure 7) with different kinds of rules (Table 2), 16 countries have not national laws dedicated to gathering.

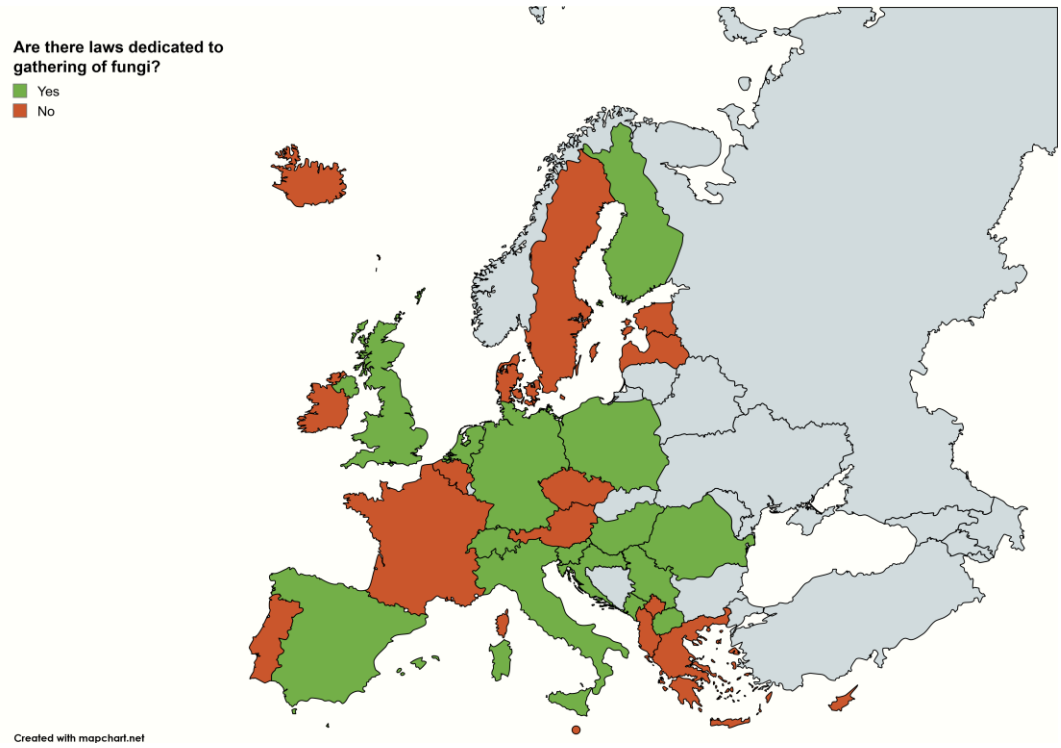


Figure 7. Map of countries that reported having national laws dedicated to gathering of fungi.

Regarding the last question, it emerged that 21 countries have a National law dedicated to the public access to environmental information (Law title and a short synthesis of the content reported in Table 3), only 4 countries do not have it and 6 countries could not answer or did not provide valid answer (Figure 8).

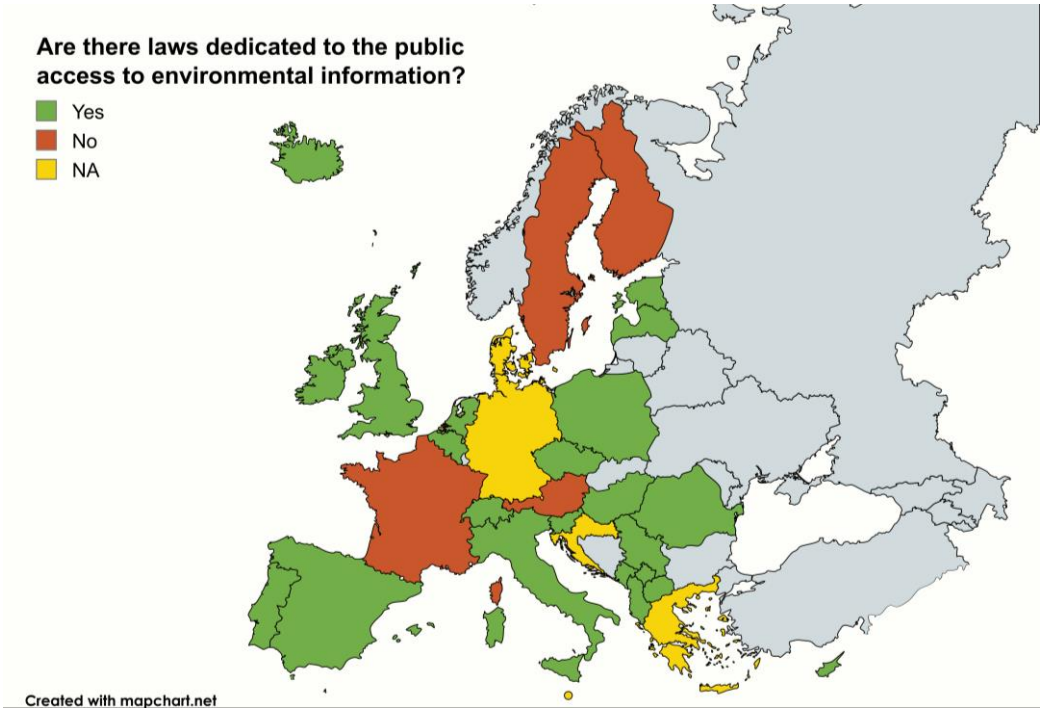


Figure 8. Map of countries that reported having national laws dedicated to the public access to environmental information.

Table 1. National laws dedicated to conservation of fungi and related lists of protected species by countries.

Country	Law title and a short synthesis of the law content	List of protected species (n. of species)
Czech Republic	**Act no. 114/1992 Coll., on Nature and landscape protection** as amended, nature and landscape protection, divided into general site and species protection and special site and species protection. General nature and landscape protection comprises protection of landscape, species diversity, natural values and aesthetic values of nature, as well as conservation and considerate use of natural resources. Special species protection protects species diversity through selected species of plants, fungi, invertebrates, and vertebrates, listed in the relevant list of implementing regulations. Special Nature and Landscape Protection is one of the most important instruments for nature and landscape protection. They comprise national parks (NP), protected landscape areas (PLA), national nature reserves (NNR), nature reserves (NR), national nature monuments (NNM), and nature monuments (NM).	The currently valid implementing regulation distinguishes 3 levels of protection: endangered, highly endangered and critically endangered. Populations, inhabited habitats, and natural development are protected, especially in the case of more strictly protected categories, as well as individuals. Specifically, 487 (92 E, 149 HE and 246 CE) vascular plant species, **46 (6, 13, 27) fungal species (macromycetes)**, 116 (36, 42, 38) invertebrate species and 200 (45, 90, 65) vertebrate species are protected.
Hungary	National nature conservation laws are not dedicated only to Fungi but include them among other organisms. **Act LIII of 1996 on the Protection of Nature Conservation**. The law is a general nature conservation law, the paragraphs concerning protected organisms must also be interpreted in the case of mushrooms. Paragraph 42 (1) Endangering, destroying or damaging individuals of protected plant species without permission, endangering or damaging their habitats is prohibited. The linked ministerial decree (13/2001. (V. 9.) KöM rendelet) specifies the list of protected species including 58 fungi.	13/2001. (V. 9.) KöM rendelet (ministerial decree) Appendix 9. contain **58 species of protected fungi** and further 17 species lichens (lichenized fungi).
Latvia	In Latvia national legislation, requirements of protection of species and habitats are defined by the **Law of Protection of Species and Habitats**, ratified by the Parliament on 16.03.2000 (62 fungi species). An updated version of the Law is being prepared right now.	In old version **62 fungi species** are included. The new version of the law could include around 90 species.
North Macedonia	There is a law for protection of nature with a list of species (plants, fungi, animals). Lists of affected and protected wild species of plants, fungi, animals and their parts. **Official V. of R.M. no: 15/2012** from 31.01.2012. GOVERNMENT OF THE REPUBLIC OF NORTH MACEDONIA: https://dejure.mk/zakon/listi-na-zasegnati-i-zashtiteni-divi-vidovi-rastenija-gabi-zhivotni-i-nivni-delovi	There is a list of species (plants, fungi, animals)
Malta	Threatened species and habitats	Only **two species of fungi**: *Boletopsis grisea* and *Sarcosphaera coronaria*
Montenegro	We have the **Law of the Nature Protection** ("Official Gazette of Montenegro", No. 054/16 of 15.08.2016) which regulates the conditions and manner of protection and conservation of nature. When it comes to fungi, they're treated on an equal footing with plants and animals.	Yes, we have a list of protected species at the national level that contains **111 species of fungi**, dating back to 2006. A new conservation proposal is now in the process and there will be more

	The law defines measures for the conservation and sustainable use of fungi – mushrooms. It defines the obligation to adopt red lists of fungi in accordance with international standards, the placing of rare and endangered species under national protection, the inclusion of mushrooms in the management plans of protected natural areas, the obligation to monitoring rare fungal species and to draw up action plans for endangered species, the rules for the sustainable use of edible commercial species, etc.	species on this list. A Red List of Fungi in accordance with the IUCN methodology is also in preparation.
Poland	**Regulation of the Minister of the Environment of October 9, 2014**, on the species protection of fungi: Set of regulations (prohibitions, orders, and derogations) and measures, with four annexes containing lists of protected species of fungi (including lichens). First regulation on the species protection of fungi (21 species) – 1983	All together – **117 species of macrofungi protected** by law: Annex 1 – strictly protected species – 54 species of macrofungi (plus lichens) Annex 2 – partly protected species – 63 species of macrofungi (plus lichens) Annex 3 – partly protected species which can be collected for medical/culinary purposes if a special certificate is issued by the Ministry – nine species of macrofungi (plus one lichen) Annex 4 – species for which a protection zone (50 m radius) around the occurrence locality is required – 10 lichen species
Serbia (combined)	**Nature Conservation Law (2009) and Regulation on the proclamation and protection of strictly protected and protected wild species of plants, animals and fungi (2010)** – list of strictly protected and protected fungal species (RULEBOOK on the declaration and protection of strictly protected and protected wild species of plants, animals and fungi "Official Gazette of RS", no. 5 of February 5, 2010, 47 of June 29, 2011, 32 of March 30, 2016, 98 of December 8 in 2016). In accordance with the law of the Republic of Serbia on the Proclamation and Protection of Protected Species, mushrooms are divided into strictly protected and protected species. Strictly protected wild species of plants, animals and mushrooms are wild species that have disappeared from the territory of the Republic of Serbia or its parts, returned by reintroduction programs, extremely endangered, threatened, relict, locally endemic, strong endemic, internationally important and protected wild species, of special importance for preservation of the biological diversity of the Republic of Serbia. (Regulation on the declaration and protection of protected species – Article 3). Protected wild species of plants, animals and fungi are wild species that are not currently endangered in nature to the extent that they are in danger of disappearing or becoming critically endangered, and these are vulnerable, endemic,	**64 species (38 strictly protected, 24 protected)** see attached decree

	indicator, key and umbrella species, relict, internationally significant and protected wild species, as well as species that are not endangered but due to their appearance can be easily confused with strictly protected species. (Regulation on the declaration and protection of protected species – Article 5)	
Slovenia	Regulation on the protection of autotrophic fungi. The deliberate destruction of mushrooms and mushroom spawn and the collection of mushrooms and mushroom spawn of all types of autotrophic fungi is prohibited in the territory of the Republic of Slovenia.	68 species
Spain	Real Decreto 1057/2022, de 27 de diciembre, por el que se aprueba el Plan estratégico estatal del patrimonio natural y de la biodiversidad a 2030, en aplicación de la Ley 42/2007, de 13 de diciembre, del Patrimonio Natural y de la Biodiversidad. Translated: **Royal Decree 1057/2022 of 27 December approving the State Strategic Plan for Natural Heritage and Biodiversity to 2030, pursuant to Law 42/2007** of 13 December on Natural Heritage and Biodiversity.	Apparently no
Sweden	Species and habitats directive where the specimens of five fungi are protected; *Sarcosoma globosum*, *Aurantiporus croceus*, *Hericium erinaceus*, *Pycnoporellus alboluteus*, *Haploporus odorus*.	Five species: *Sarcosoma globosum*, *Aurantiporus croceus*, *Hericium erinaceus*, *Pycnoporellus alboluteus*, *Haploporus odorus*.
Switzerland (combined)	Bundesgesetz über den Natur- und Heimatschutz 1966 (NHG, SR 451), Stand 1. Januar 2012, Abschnitt 3: Schutz der einheimischen Tier- und Pflanzenwelt – Verordnung über den Natur- und Heimatschutz 1991 (NHV, SR 451.1), Abschnitt 3: Schutz der einheimischen Tier- und Pflanzenwelt. Translated: Federal Act on the Protection of Natural and Cultural Heritage 1966 (NHG, SR 451), as of 1 January 2012, Section 3: Protection of Native Flora and Fauna. Ordinance on the Protection of Nature and Homeland 1991 (NHV, SR 451.1), Section 3: Protection of Native Flora and Fauna. “The extinction of native animal and plant species [fungi are still counted as plants here] must be counteracted by maintaining sufficiently large habitats (biotopes) and other suitable measures.”	Twelve species protected at a national level
UK	Wildlife and Countryside Act, 1981	A list of fungi that should not be picked

Table 2. National laws dedicated to gathering of fungi by countries.

Country	Law title and a short synthesis of the law content
Germany	Bundesartenschutzverordnung, Sammelverbot für besonders geschützte Arten Translated: Federal Ordinance on the Protection of Species, Prohibition of Collection for Protected Species
Hungary	1. The gathering of protected fungi is prohibited. (Act LIII of 1996 on the Protection of Nature Conservation) 2. The Act. XXXVII of 2009 about "the forest, forest protection and forest management" in the par. 68.§. classifies the collection of mushrooms as forest benefits. And in the linked ministerial decree (61/2017. (XII. 21.) FM decree) contain the detailed rules concerning gathering of fungi. The Act "about the forest, forest protection and forest management": 42. § (1) Collecting mushrooms, wild fruit, medicinal herbs and carrying spring water a) in a forest owned 100% by the state, with the prior written consent of the forest manager in an amount exceeding individual needs b) in a forest not 100% owned by the state, it can be exercised with the prior written consent of the usufructuary. (2) If the legislation does not provide otherwise, it is considered an individual need per person, no more than per day a) 2 kg of mushrooms b) 2 kg of wild fruit or c) 2 kg of herbs collection. (3) Mushrooms, wild fruits, herbs and spring water collected for individual needs may not be sold commercially. 3.A separate law about the gathering of subterranean fungi (24/2012. (III. 19.) VM ministerial decree) include the detailed rules: - who can gather truffles (training course + exams) - permissions needed (The owner of a privately-owned forest in his own forest, and the forest manager in the privately-owned forest where he is the forest manager registered by the forestry authority, in the case of collection not exceeding 20 dkg/day or 3 trifla/day, if he does not sell it commercially, is exempted from the obligations prescribed in Section 1, Section 4, and Sections 7 and 8) - gathering time intervals - how the habitat should protect.
Italy (combined)	Law 23 August 1993, no. 352. Framework rules on the collection and marketing of fresh and preserved epigeal mushrooms. The law establishes that the Administrative Regions regulate with their own laws the collection and marketing of wild epigeal mushrooms; the law establishes the fundamental principles of harvesting and marketing.
Montenegro	Law of Nature Protection (Official Gazette No 54/16) and the Regulations on the closer method and conditions of collection, use and movement of non-protected wild species of animals, plants and fungi used for commercial purposes (Official Gazette No 54/16. 62/10)
North Macedonia	Regulation for issuing a permit for the collecting of the concerned and protected wild species of plants, fungi and animals and their parts. The Regulation is delivered based on the low of Nature protection. https://www.moepp.gov.mk/wp-content/uploads/2014/09/Pravilnik%20za%20izdavanje%20dozvola%20za%20sobiranje%20na%20zasegnati%20zastiteni%20divi%20vidovi%20rastenija,%20gabi%20i%20zivotni%20i%20nivnite%20delovi.pdf
Poland	Regulation of the Minister of Health on mushrooms permitted for trading or the production of mushroom products, foodstuffs containing mushrooms and the qualifications of a mushroom classifier and mushroom expert. The regulation contains the list of fungal species allowed for trading and food production (as annex).

	Mushroom classifier and mushroom expert are qualified people who has to be employed by mushroom companies and traders
Romania (combined)	ORDER no. 768 of June 10, 2019, regarding the amendment of the annex to the Order of the Minister of Agriculture, Forestry and Rural Development no. 246/2006. The order includes the List of 43 species of edible mushrooms from the spontaneous flora whose collection or purchase and sale are permitted. Unfortunately, the list mentions for harvesting species of mushrooms for which regulations regarding their harvesting are necessary or species with low food value. Scientific names need updating.
Serbia (combined)	Decree on putting under control the use and trade of wild flora and fauna, Official gazette of the Republic of Serbia 31/05, 45/05, 22/07, 38/08, 9/10 Article 3 – The collection, use and circulation of protected species is put under control in order to ensure their sustainable use by preventing the collection of those species from natural habitats in quantities and in a way that would threaten their survival in the future, the structure and stability of living communities.
Slovenia	Anyone picking mushrooms must observe the following rules: 1. the mushroom must have obvious morphological characteristics from which the species can be reliably identified 2. the use of mushroom picking implements which may damage the growing medium or the undergrowth is prohibited 3. the mushrooms must be roughly cleaned at the growing site 4. mushrooms may only be transported in rigid and airtight packaging.
Spain	Royal Decree 30/2009, of 16 January, establishing the sanitary conditions for the marketing of mushrooms for food use.
Switzerland (combined	Mushrooms may not be collected in nature and plant conservation areas.
UK	Wildlife and Countryside Act, 1981

Table 3. National laws dedicated to the public access to environmental information by countries.

Country	Law title and a short synthesis of the law content
Albania	DECISION No. 16, dated 4.1.2012 ON THE PUBLIC'S RIGHT TO HAVE ENVIRONMENTAL INFORMATION This decision is aimed to ensure the continuous and systematic distribution of information to the public environmental and making this information available to him and to determine the appropriate conditions and ways for exercising the right to have environmental information, for the exchange of public opinion, as well as for participation its effectiveness in environmental decision-making
Belgium	MINISTRY OF THE FLEMISH COMMUNITY 6 DECEMBER 2002 – Decree approving the Convention on access to information, public participation in decision-making and access to justice in environmental matters, and Annexes I and II, signed at Aarhus on 25 June 1998 (1) https://www.ejustice.just.fgov.be/cgi/article_body.pl?language=nl&caller=summary&pub_date=2003-01-07&numac=2002036577
Cyprus	Law 119(I)/2004 Law on Public Access to Environmental Information
Czech Republic	Act No. 123/1998 Coll., on the Right to Information on the Environment, Act No. 106/1999 Coll., on Free Access to Information.
Estonia	General Part of the Environmental Code Act. The Act aims to minimize environmental nuisances to safeguard the environment, human health, property, and cultural heritage. It also promotes sustainable development to meet the needs of current and future generations, preserves natural diversity, maintains a healthy environment, and prevents and rectifies environmental damage.

Hungary	Act LXXXI of 2001 on the promulgation of the Convention on access to information, public participation in decision-making and access to justice in environmental matters, adopted in Aarhus on 25 June 1998
Iceland	The Aarhus Convention/Árósasamningurinn was ratified in 2011 after review and necessary changes of Icelandic laws. 2012/nr. 140. Information laws/ Upplýsingalög. 2011/nr. 130. Review committee for environmental issues/ Úrskurðarnefnd umhverfis- og auðlindamála 2010/nr. 123. The planning act/ Skipulagslög 2021/nr. 111. The act on environmental impact/ Lög um umhverfismat framkvæmda og áætlana. 1998/nr. 7. Sanitation and protection against pollution/ Lög um hollustuhætti og mengunarvarnir. 2013/nr. 60. Nature protection act. / Lög um náttúruvernd Source: Collection of Icelandic laws https://www.althingi.is/lagasafn/
Ireland (combined)	Ireland is a party to the Aarhus Convention, and it has implemented measures to ensure public access to environmental information. The Aarhus Convention is an international treaty that grants the public rights regarding access to information, public participation, and access to justice in environmental matters. In Ireland, the Aarhus Convention is implemented through the Access to Information on the Environment (AIE) Regulations. These regulations provide the public with the right to access environmental information held by public authorities. The AIE Regulations transpose the requirements of the Aarhus Convention into Irish law.
Italy (combined)	LEGISLATIVE DECREE no. 195 of 19 August 2005. Implementation of Directive 2003/4/EC on public access to environmental information. The decree aims to: a) guarantee the right of access to environmental information held by public authorities and establish the terms, basic conditions and modalities for its exercise; b) ensure that environmental information is systematically and progressively made available to the public and disseminated, including by means of telecommunications and computer tools, in easily accessible forms or formats, promoting the use of information and communication technologies.
Kosovo	Law no. 03/L-233 of nature protection, Article 151-Public participation in decision making. 1. In course of drafting the legislation or acts on designating the protected natural assets, administration plans for protected areas and plans of using natural resources as well as the generally applicable and legally binding regulations and documents in the field of nature protection, participation of the public shall be provided for. 2. The public should be informed about the procedure from paragraph 1. Of this Article via public announcement.
Latvia	Latvia signed the Aarhus Convention in 2002. Amendment to the convention on access to information, public participation in decision-making and access to justice in environmental matters. https://likumi.lv/doc.php?id=61586
North Macedonia	The Centre contributes to the implementation of environmental legislation and Aarhus Convention in practice in North Macedonia and participates in: - meeting with Aarhus network members, Ministry of Environment and Physical Planning and local authorities for implementation of the convention as well as other environmental legislation - meeting and networking with Regional Aarhus Centers (Montenegro, Serbia, Albania) - preparing a Guidance on the obligations for involving CSOs in decision making processes for the national and local authorities - supporting the organization of National Strategy Meetings (NSM): every year NSM, has thematic issue in the field of environment protection and climate change. Presenting the establishment of the Aarhus Center and its strategy is great opportunity for discussions to further plans and activities between the network and the Aarhus Centre. Link: https://aarhus.osce.org/north-macedonia/aarhus-centre-skopje

Montenegro	Law on free access to information ("Official Gazette of Montenegro", no. 44/2012 and 30/2017). This Law enables every domestic and foreign natural and legal person to have the right to access information, without obligation to state the reasons and explain the interest in seeking information.
Poland	Act Providing information on the environment and its protection, public participation in environmental protection and environmental impact assessment
Portugal (combined)	Portugal signed the Aarhus Convention in 1998 and then ratified it in 2003 by Decree of the President of the Republic no. 9/2003, of 25 February, and by Resolution of the Assembly of the Republic no. 11/2003, of 25 February.
Romania (combined)	Law No. 86 of May 10, 2000, for the ratification of the Convention on access to information, public participation in the taking decision and access to justice in environmental matters, signed in Aarhus on June 25, 1998.
Serbia (combined)	Law on the Ratification of the Convention on Availability of Information, Public Participation in Decision-Making and the Right to Legal Protection in Environmental Matters (ratified Aarhus Convention) The Law on the confirmation of the Convention on the accessibility of the information, public participation in the decision-making and the right of access to justice in the questions concerning the environment, Republic of Serbia Official Gazette-International Treaties, number 38/09.
Slovenia	Act on the Ratification of the Convention on Access to Information, Public Participation in Decision-Making and Access to Legal Protection in Environmental Matters (MKDIOZ)
Spain	https://www.boe.es/diario_boe/txt.php?id=BOE-A-2005-2528
Switzerland (combined)	Aarhus Convention see here: https://www.bafu.admin.ch/bafu/de/home/themen/recht/fachinformationen/aarhus-konvention.html
The Netherlands (combined)	The Netherlands ratified the Aarhus Convention in 2004, and since 2005 we have a Law implementing the Aarhus Convention (Wet Uitvoer Verdrag van Aarhus)

3.3 Sub-National Legislative Context

Author: Stefania Ercole

This section regarded the legislation at sub-national level dedicated to conservation and gathering of fungi. It included four main questions, as follows.

Are there sub-national laws specifically dedicated to conservation of Fungi?

- If yes, please enter the law titles and indicate in brackets the number of protected fungal species.

Are there sub-national conservation laws which, while not dedicated only to Fungi, also include them among other organisms?

- If yes, please enter the law titles and indicate in brackets the number of protected fungal species.

Are there sub-national laws dedicated to gathering of Fungi for personal and/or commercial use (excluding scientific purposes)?

- If yes, please enter the law titles.

Are there sub-national laws dedicated to gathering of Fungi for scientific purposes?

- If yes, please enter the law titles.

The following **31 European countries** answered to the questions about the Sub-national legislation: Albania, Austria, Belgium, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Kosovo, Latvia, North Macedonia, Malta, Montenegro, Poland, Portugal, Romania, Serbia, Slovenia, Spain, Sweden, Switzerland, The Netherlands, UK.

The answers to the first question show that most of the 31 European countries that responded to the JoNeF survey do not have sub-national legislation dedicated to fungi conservation (22 “no” answer) (Figure 9). Only 4 countries declared to have subnational laws: Estonia, Serbia, UK, and Austria, which have some legislation in some of the federal states. The details provided by these 4 countries are reported in Tabel 4 and only Estonia reported the number of protected fungal species (15).

The second question showed that 20 of the European countries that responded to the JoNeF survey do not have sub-national conservation laws which, while not dedicated only to fungi, also include them among other organisms (Figure 9). Only 7 countries indicated to have sub-national laws, providing the details reported in Table 5.

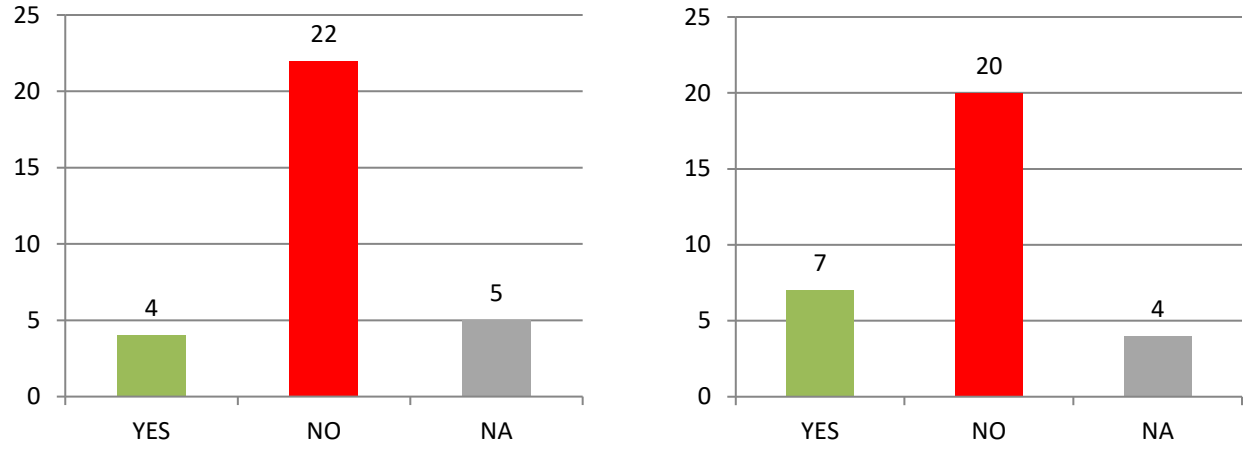


Figure 9. Number of countries that reported having sub-national laws specifically dedicated to conservation of fungi (left) and sub-national laws including fungi (right).

The answers to the last two questions show that most of the countries that responded to the survey indicated not having have sub-national laws dedicated to gathering of fungi in their territory (15 and 20 "no" answers), while eight countries indicated having laws dedicated to gathering for personal and/or commercial use (Figure 10) and five countries indicated having laws dedicated to gathering for scientific purposes (Figure 10). The detail provided for the "yes" answers are reported in Table 6.

Several answers were placed into NA category, mainly because some respondents did not provide an answer, or they wrote "I don't know". We conclude that, while we cannot exclude availability of further sub-national laws not listed in this report, information available on this topic is scarce.

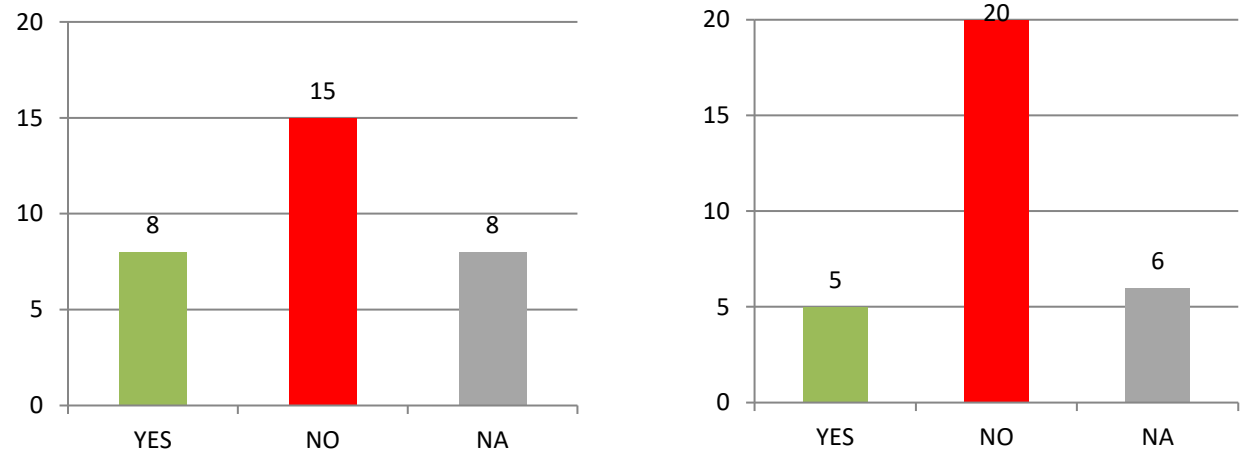


Figure 10. Number of countries that reported having sub-national laws dedicated to gathering of fungi for personal and/or commercial use (left) and for scientific purposes (right).

Table 4. Sub-national laws specifically dedicated to conservation of fungi by countries.

Country	Law title and number of protected fungal species
Austria	There is some legislation in some of the federal states. You can read about this legislation in our FAQs on the homepage of the Austrian Mycological Society: https://myk.univie.ac.at/pilzschutzbestimmungen-in-oesterreich/
Estonia	"Protection and regulation of the habitats of protected fungal species" (Regulation falling under the auspices of the Nature Conservation Law). Regulates habitat protection of legally protected fungal species in specific localities outside the designated protected zones that serve as habitats for these species and need protection to ensure their favourable condition. Number of fungal species: 15.
Serbia (combined)	Rulebook on the transboundary movement and trade in protected species, Official gazette of the Republic of Serbia 99/2009 This rulebook declares wild species of plants, animals, and fungi for the purpose of preserving biological diversity, natural gene pool, i.e. species that have special importance from an ecological, ecosystem, scientific, economic and economic aspect for others, from a scientific, economic and economic aspect., as strictly protected wild species or protected wild species and the protection measures of protected species and their stations are established.
UK	The NERC Act has an associated list of priority fungi tailored to the countries England, Scotland, and Wales.

Table 5. Sub-national conservation laws which, while not dedicated only to fungi, also include them among other organisms.

Country	Law titles and number of protected fungal species
Albania	Council Directive 92/43/EEC dated 21 May 1992, "On the conservation of natural habitats and of wild flora and fauna", as amended", Number CELEX 31992L0043, Official Journal of the European Union, Series L, no. 206, dated 22.7.1992. Forest. Sub-natural woodland vegetation comprising native species forming forests of tall trees, with typical undergrowth, and meeting the following criteria: rare or residual, and/or hosting species of Community interest
Czech Republic	There are 3 specially protected areas in the Czech Republic, which have been declared, among other things, for the purpose of protecting fungal species of conservation importance: National Nature Reserve Rendez-vous (near Valtice, Decree č. 204/2013 Coll., 2 species), National Nature Monument Luční (near Turovce, Decree č. 149/2014 Coll., Boletales and Russulales) and National Nature Monument Velký vrch (near Vršovice, Decree č. 19/2016 Coll., Boletales, Agaricales and Pezizales). Each of the specially protected areas is established by a separate decree of the regional authority.
Estonia	Both national, not sub-national actually. On a national level Nature Conservation Law also regulates the protection of fungi (among other organisms). Altogether there are 46 legally protected fungal species, divided between three different protection categories. On sub-national level fungi (among other organisms) are mentioned in several acts regulating the conservation regime in different protected areas (46 abovementioned species). Among these is a specific protected area designated mainly for certain fungal species (Liiva-Putla, ca 10 fungal species)

Portugal (combined)	1. Council of Ministers Resolution no. 179/2008, of November 24th Approves the Management Plan for the Montesinho Natural Park (*Amanita caesarea*, *Boletus* sp., *Cantharellus* sp.) 2. Council of Ministers Resolution no. 11-A/2011, of February 4 Approves the Management Plan for the Peneda-Gerês National Park (*Amanita caesarea*, *Boletus* sp., *Cantharellus* sp.)
Spain	DECRET 172/2008, of August 26, creating the Catalog of Endangered Flora of Catalonia. Link: https://portaljuridic.gencat.cat/ca/document-del-pjur/?documentId=509129
Switzerland (combined)	Conservation areas at the cantonal levels, collection of plants/ animals/ fungi is restricted.

Table 6. Sub-national laws dedicated to gathering of fungi for personal and/or commercial use by countries.

Country	Law title
Belgium	https://codex.vlaanderen.be/Portals/Codex/documenten/1003183.html Article 97. (29/06/2019) § 1. Without prejudice to the prohibitions in laws, decrees and regulations, it is without the permission of the owner and authorization of the Agency or without its provisions in the approved management plan, prohibited in all public forests: 1. remove the litter 2. remove the dead wood, lying on the ground or still attached to the trunk, unless it belongs to a batch of trees sold 3. collect and remove buds, shoots, twigs, inflorescences, cones, fruits, seeds 4. prune trees, except when this measure has been included in the approved management plan 5. to set up and maintain a chain, sheds and all other structures and places of residence, and to install tents and trailers, whether or not on wheels, with the exception of those required for the management and monitoring of forests and for the safety and well-being of persons lawfully present in the forest 6. attach advertising to the trees, place billboards and use any other commercial advertising means 7. to disturb the peace in the forest and of the visitors in any way 8. to leave residues, waste and waste of any kind outside the collection points made available for that purpose, with the exception of wood waste and bark left behind after an authorized operation 9. keep animals within fences 10. damage trees, take plants away, tear them out or cut them off 11. any object that is part of the equipment of the forest to destroy, damage, move and abuse 12. to install and / or maintain barbed wire in and around the forests, unless otherwise provided in the management plan. (Answer translated)
France	No law, but national or regional regulations educated by the National Forest Service limiting the collection of edible mushrooms to 5 liters per family. Gathering truffles in public and private lands is forbidden.
Italy (combined)	There are sub-national laws dedicated to the gathering of fungi slightly different for different Regions. Abruzzo Region, LR 34/2006 – Discipline of the collection and marketing of wild epigei mushrooms in Abruzzo Basilicata Region, LR 48/1998 – Regulation on the collection, increase and marketing of fresh and preserved wild epigei mushrooms Autonomous Province of Bolzano, L 18/1991 – Regulation of mushroom harvesting to protect plant ecosystems Calabria Region, LR 30/2001 – Regulation for the collection and marketing of fresh and preserved epigeal and hypogeal mushrooms Campania Region, LR 8/2007 – Discipline of the collection and marketing of fresh and preserved mushrooms Emilia Romagna Region, LR 6/1996 – Regulation of the collection and marketing of wild epigei mushrooms in the regional territory, application of Law No. 352 of 23 August 1993

	Friuli Venezia Giulia Region, LR 25/2017 – Rules for the collection and marketing of wild epigei mushrooms in the regional territory Lazio Region, LR 32/1998 – Regulation of the harvesting and marketing of wild epigei mushrooms and other undergrowth products Liguria Region, LR 17/2014 – Discipline of the collection and marketing of wild epigei mushrooms Lombardia Region, LR 31/2008 – Consolidated text of regional laws on agriculture, forestry, fisheries and rural development Marche Region, LR 17/2001 – Rules for the collection and marketing of wild and preserved epigei mushrooms Molise Region, LR 11/2000 – Rules on the harvesting and marketing of epigei mushrooms, according to the principles established by Law No. 352/1993 Piemonte Region, LR 24/2007 – Protection of wild epigei mushrooms Puglia Region, LR 12/2003 – Regulation of the harvesting and marketing of fresh and preserved epigei mushrooms in the regional territory Sicilia Region, LR 3/2006 – Discipline of the collection, commercialization and valorisation of spontaneous epigei mushrooms Toscana Region, LR 16/1999 – Collection and trade of wild epigei mushrooms Autonomous Province of Trento, L 11/2007 – Provincial Law on Forests and Nature Protection Umbria Region, LR 17 December 2002, n.34. Amendments and additions to the regional law of 21 February 2000, n. 12 – Regulation of the collection, marketing and enhancement of fresh and preserved epigei mushrooms. Valle d'Aosta Region, LR 16/1977 – Rules governing the harvesting of mushrooms and the protection of certain species of inferior fauna. Veneto Region, LR 23/1996 – Discipline of harvesting and marketing of fresh and preserved epigei mushrooms
North Macedonia	Regulation for issuing a permit for the collecting of the concerned and protected wild species of plants, fungi and animals and their parts. The Regulation is delivered based on the low of Nature protection. https://www.moepp.gov.mk/wp-content/uploads/2014/09/Pravilnik%20za%20izdavanje%20dozvola%20za%20sobiranje%20na%20zasegnati%20zastiteni%20divi%20vidovi%20rastenija,%20gabi%20i%20zivotni%20i%20nivnite%20delovi.pdf
Portugal (combined)	For example, the Management Plan for the Peneda-Gerês National Park (see previous replies) regulates the picking of wild mushrooms and prohibits picking except by residents and landowners.
Slovenia	Regulation on the protection of wild fungi.
Switzerland (combined)	Various cantons have collection restrictions (closed days, quantity restrictions) for wild mushrooms. Technically all species but only really relevant for species collected for culinary purposes; https://www.vapko.ch/de/oekologie/kantonale-und-kommunale-pilzsammelbestimmungen Also, mushroom reserves with a general ban on picking exist in Graubünden (e.g. in the municipality of Bonaduz). More here: https://swissfungi.wsl.ch/de/pilze-und-pilzschutz/pilzschutz-schweiz.html

Table 7. Sub-national laws dedicated to gathering of fungi for scientific purposes by country.

Country	Law title
Estonia	National, actually. On a national level Nature Conservation Law (the abovementioned law that regulates the protection of fungi among other organisms), also states that collecting protected species can be allowed for scientific purposes (special permission needed).
Italy (combined)	The same laws dedicated to gathering of fungi for personal and/or commercial use regulate the gathering for scientific purposes too (see Table 6).
North Macedonia	Regulation for issuing a permit for the collecting of the concerned and protected wild species of plants, fungi and animals and their parts. The Regulation is delivered based on the low of Nature protection: https://www.moepp.gov.mk/wp-content/uploads/2014/09/Pravilnik%20za%20izdavanej%20dozvola%20za%20sproveduvanje%20na%20naucno%20istrazuvanje%20vo%20prirodata.pdf
Portugal (combined)	For example, the Management Plan for the Peneda-Gerês National Park (see previous replies) allows collecting wild mushrooms for scientific purposes, subject to prior request.

3.4 Regulatory Context

Authors: Eleni Topalidou, Panagiotis Madesis

This section concerned the existing – if any – regulatory context of fungal collection among different countries. Fungi-gathering has expanded in Europe during the last decades and has gained prominent economic, gastronomic and ecotourist importance. This expansion in fungi-gathering has resulted in the introduction of national or regional regulatory context in several European countries. However, existing legislation for their sustainable management, collection, certification, and trade differs widely between countries and regions. Review and evaluation of European and national legislation by investigating possible similarities, differences and gaps is necessary to ensure sustainable harvesting of macromycetes and development of a European conservation guidance.

It included seven main questions, as follows.

- Is there any national regulation on the gathering of Fungi?
  - If yes, please enter the title and some information about.
- Is there a specific training and a license to gather Fungi for personal/commercial use?
- Is there the professional figure "mycologist" who gathers Fungi for scientific purposes?
- Are there maximum national and/or sub-national amounts of Fungi you can gather every day for personal and/or commercial use (excluding scientific purposes)?
- Are there maximum national and/or sub-national amounts of Fungi you can gather every day for scientific purposes?
- Is there any sub-national regulation regarding the gathering of Fungi?
  - If yes, please specify.
- Are there organizations involved in laws and regulations enforcement?

Regarding the existence of **national regulation** on gathering fungi, the answers received among the 31 countries that answered the questionnaire were as follows.

- In 12 countries there is no national regulation on gathering fungi
- In 15 countries there is national regulation
- In 4 countries the answer is NA.

Among the 15 countries that answered that there is national regulation on gathering fungi, most of the answers report that gathering of protected species is prohibited and/or gathering in protected areas is prohibited. In France there is a clear regulation, which limits the gathering of edible fungi to specific quantity per family, whereas in Italy there is a specific regulation on the collection and marketing of fresh and preserved epigeal mushrooms. Moreover, in some countries (including NA answers) regulations on gathering fungi exist only by extension through the regulations for the conservation of animals and plants (see Figure 11 and Tabel 8).

Regarding the requirements for specific training and licence to gather fungi for personal of commercial use, the answers received were as follows.

- In 24 countries there is no specific training or license
- In 5 countries a specific training and a licence are required
- In 2 countries, the answer is NA.

Two countries did not reply to the question (see Figure 12).

Regarding questions related to the existence of the professional figure “mycologist”, who gathers fungi for scientific purposes, the answers were as follows.

- In 4 countries, there is not the professional figure “mycologist”
- In 19 countries, there is a professional figure “mycologist”, which mainly refers to scientists/researchers that work at universities and/or Research Institutions. In Italy, there is a specific professional course for mycologist based on Decree 29 November 1996 No. 686. Regulation on criteria and modalities for the issue of mycologist attestation
- In 8 countries, the answer to this question was NA (see also Figure 13).

Regarding the existence of regulations on the maximum national and/or sub-national amounts of fungi that can be gathered daily, the answers were as follows.

- In 18 countries, there is no restriction on the quantity of fungi gathering per day
- In 10 countries there are restrictions on the daily quantities of fungi gathering
- In 3 countries, the answer is NA (see Figure 14).

Regarding regulations for the maximum national and/or sub-national amounts of fungi that can be gathered daily for scientific purposes, the received answers were as follows.

- In 23 countries, there is no restriction on gathering fungi for scientific purposes
- In 2 countries there are restrictions applied to gathering fungi for scientific purposes
- In 6 countries, the answer is NA (see Figure 15).

Regarding the existence of sub-national regulations on gathering fungi, the received answers were as follows.

- In 17 countries, there are no sub-national regulations on gathering fungi
- In 8 countries, there are sub-national regulations on gathering fungi
- In 6 countries, the answer is NA.

In countries where sub-national regulations are applied to gathering fungi, the regulations mainly apply to the gathering of particular species (e.g. protected), or certain practices (e.g. restriction on gathering species at a specific stage), or allowance for gathered only by residents and landowners of a certain area, or quantity restrictions (see Figure 16 and Table 9).

Regarding the involvement of organisations in the enforcement of laws and regulations, the answers received were as follows.

- In 7 countries, there is no organisation involved in the enforcement of laws and regulations
- In 17 countries, there is organisation involved in the enforcement of laws and regulations
- In 7 countries, the answer is NA (see Figure 17).

In yes answers it is included an answer that reports that there is involvement of organisations in the enforcement of laws and regulations but not specifically to fungi. In “no” answers, it is included an answer that reports that enforcement takes place only on national level by ERA (Environment and Resources Authority).

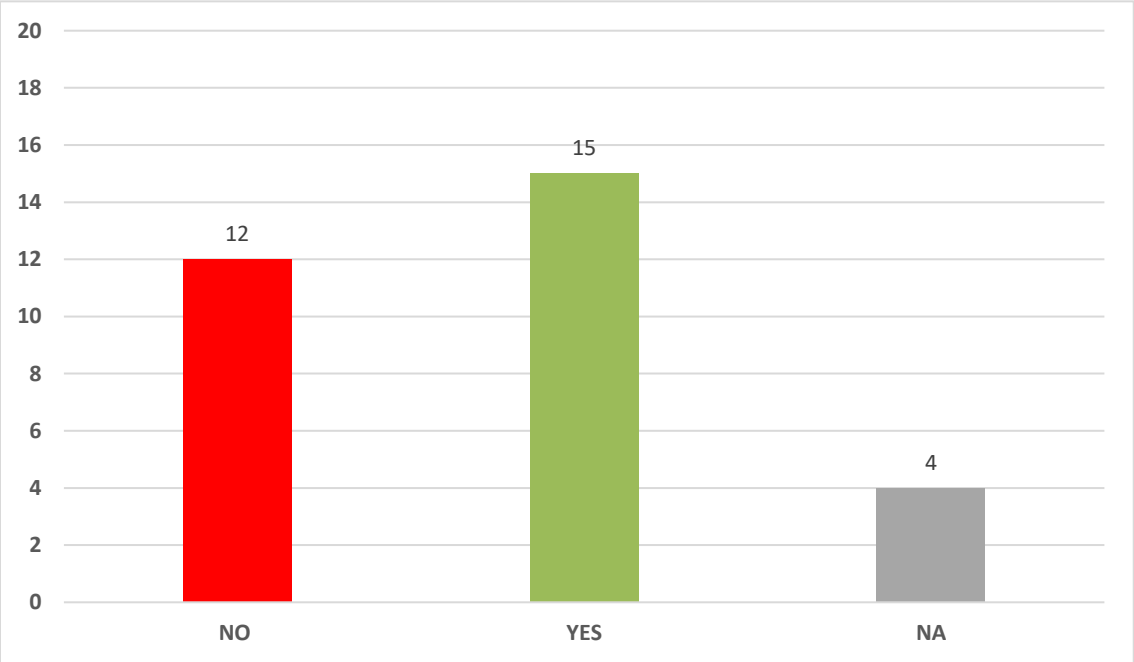


Figure 11. Number of countries that reported having a national regulation on the gathering of fungi.

Table 8. National regulations on the gathering of fungi by countries

Country	National regulation
Austria	It does not have a separate title, it is included in the BGBl. Nr. 440/1975, Forstgesetz 1975
Estonia	On a national level, Nature Conservation Law (the abovementioned law that regulates the protection of fungi among other organisms) also states that collecting protected species is prohibited. General Part of the Environmental Code Act General Part of the Environmental Code Act: regulates collecting fungi (and other forest goods) in the private lands.
Finland	Only on some protected areas, where you have to get a permit to collect. Usually gathering is not forbidden.
France	As mentioned above, there is a national regulation limiting the gathering of edible mushrooms to 5 liters per family per day.
Germany	Bundesnaturschutzgesetz, Allgemeiner Schutz wildlebender Pflanzen (und Pilze)
Hungary	1. The gathering of protected fungi is prohibited. (Act LIII of 1996 on the Protection of Nature Conservation) 2. The Act. XXXVII of 2009 about “the forest, forest protection and forest management” in the par. 68.§. classifies the collection of mushrooms as forest benefits. And in the linked ministerial decree (61/2017. (XII. 21.) FM decree) contain the detailed rules concerning gathering of fungi. The Act “about the forest, forest protection and forest management”: 42.§ (1) Collecting mushrooms, wild fruit, medicinal herbs and carrying spring water a) in a forest owned 100% by the state, with the prior written consent of the forest manager in an amount exceeding individual needs b) in a forest not 100% owned by the state, it can be exercised with the prior written consent of the usufructuary. (2) If the legislation does not provide otherwise, it is considered an individual need per person, no more than per day a) 2 kg of mushrooms, b) 2 kg of wild fruit or c) 2 kg of herbs collection. (3) Mushrooms, wild fruits, herbs and spring water collected for individual needs may not be sold commercially. 3. A separate law about the gathering of subterranean fungi (24/2012. (III. 19.) VM ministerial decree) include the detailed rules: - who can gather truffles (training course + exams) - permissions needed (The owner of a privately-owned forest in his own forest, and the forest manager in the privately-owned forest where he is the forest manager registered by the forestry authority, in the case of collection not exceeding 20 dkg/day or 3 trifla/day, if he does not sell it commercially, is exempted from the obligations prescribed in Section 1, Section 4, and Sections 7 and 8.) - gathering time intervals - how the habitat should be protected.
Ireland	Wildlife Acts primarily focus on the protection of animal species, they also encompass the conservation of plant species and, by extension, fungi.
Italy (combined)	Decree of the President of the Republic 14 July 1995, no. 376. Regulation of the collection and marketing of fresh and preserved epigeal mushrooms.
Kosovo	Administrative Instruction (MAFRD) – no. 11/2023 on the use of non – timber forest products 25. 09. 2023

Montenegro	Rulebook on the detailed manner and conditions of collection, use and circulation of unprotected wild species of animals, plants and mushrooms that are used for commercial purposes ("Official Gazette of the Republic of Montenegro", no. 62/10)
North Macedonia	Regulation for issuing a permit for the collecting of the concerned and protected wild species of plants, fungi and animals and their parts. The Regulation is delivered based on the low of Nature protection. https://www.moepp.gov.mk/wp-content/uploads/2014/09/Pravilnik%20za%20izdavanje%20dozvola%20za%20sobiranje%20na%20zasegnati%20zastiteni%20divi%20vidovi%20rastenija,%20gabi%20i%20zivotni%20i%20nivnite%20delovi.pdf
Romania	ORDER no. 768 of June 10, 2019 regarding the amendment of the annex to the Order of the Minister of Agriculture, Forestry and Rural Development no. 246/2006 for the establishment of the List of edible mushrooms from spontaneous flora whose harvesting and marketing are allowed.
Serbia	Collection of protected species for the purpose of use and marketing may be carried out under the conditions and in the manner prescribed by this regulation and in the quantity that has been approved. It is forbidden to collect protected species outside the period prescribed by this regulation and to use technical means that can damage or destroy specimens of the species, or its habitat.
Slovenia	Regulation on the protection of autotrophic fungi, In the central areas of national and regional parks and in nature and forest reserves, the collection or deliberate destruction of mushrooms of all types of autotrophic fungi is prohibited.
Spain	Real Decreto 30/2009, de 16 de enero, por el que se establecen las condiciones sanitarias para la comercialización de setas para uso alimentario. https://www.boe.es/buscar/doc.php?id=BOE-A-2009-1110
Sweden	Only in some protected areas, and the five protected species. Gathering of some truffles is not included in the every man´s right, as it includes digging.
Switzerland	There are 12 species that are under strict national protection from picking. maquette 5 (wsl.ch)

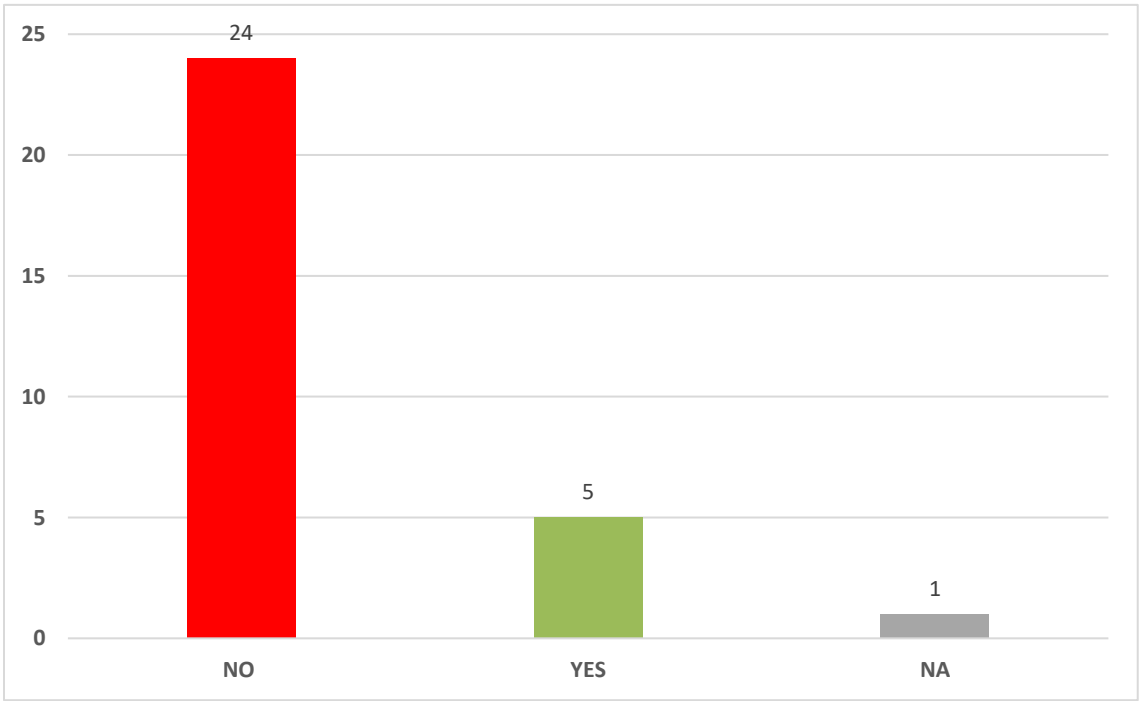


Figure 12. Number of countries that reported having specific training and a license to gather fungi for personal/commercial use.

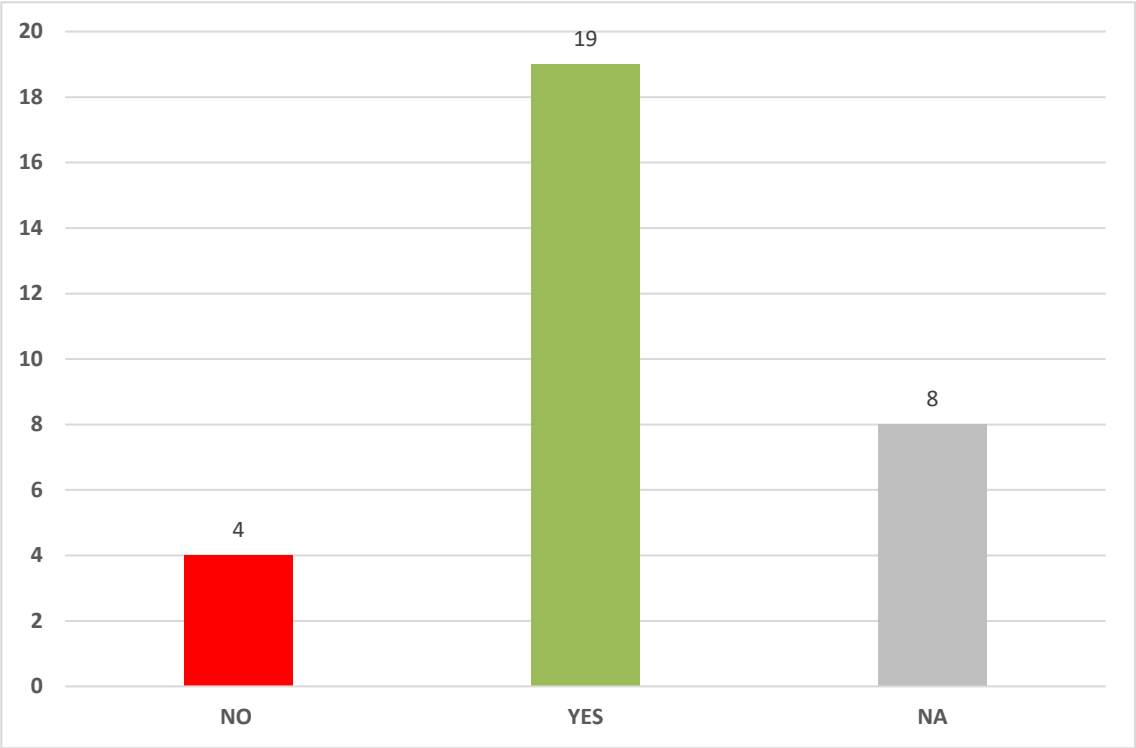


Figure 13. Number of countries that reported having the professional figure "mycologist".

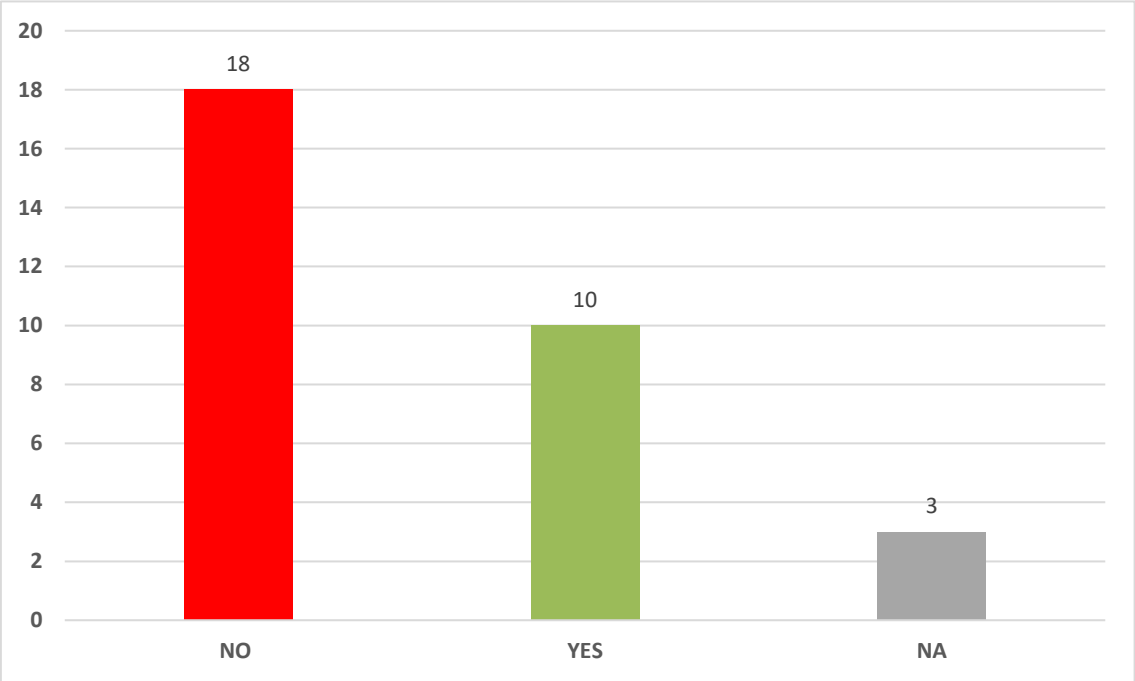


Figure 14. Number of countries that reported having maximum national and/or sub-national amounts of fungi that can be gathered every day for personal and/or commercial use (excluding scientific purposes)

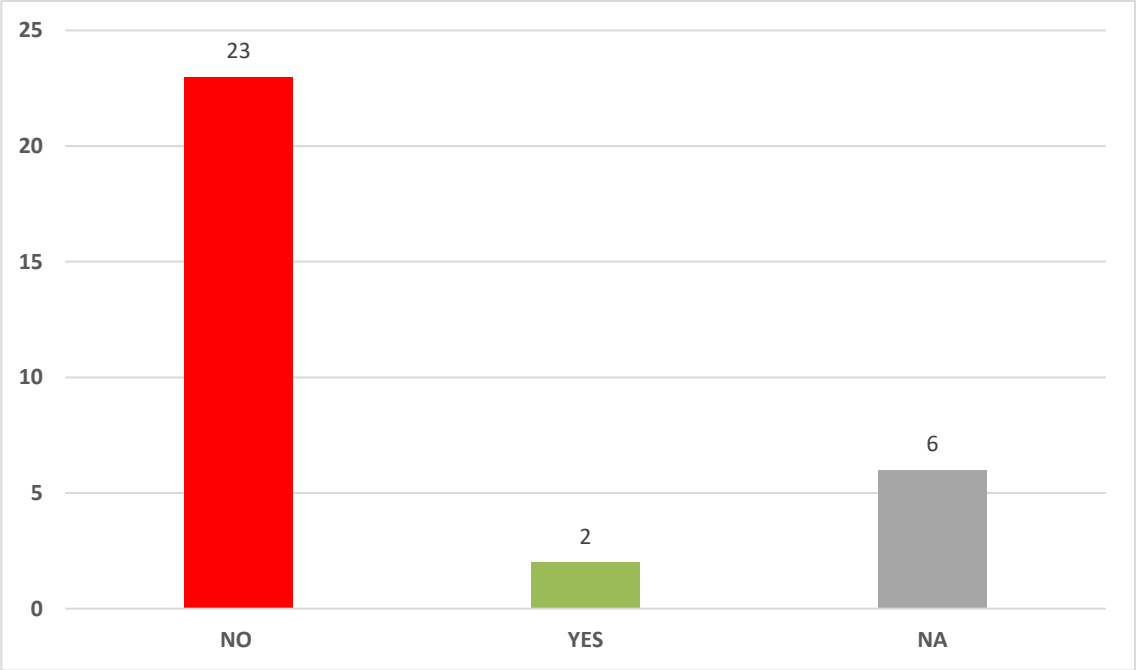


Figure 15. Number of countries that reported having maximum national and/or sub-national amounts of fungi that can be gathered every day for scientific purposes.

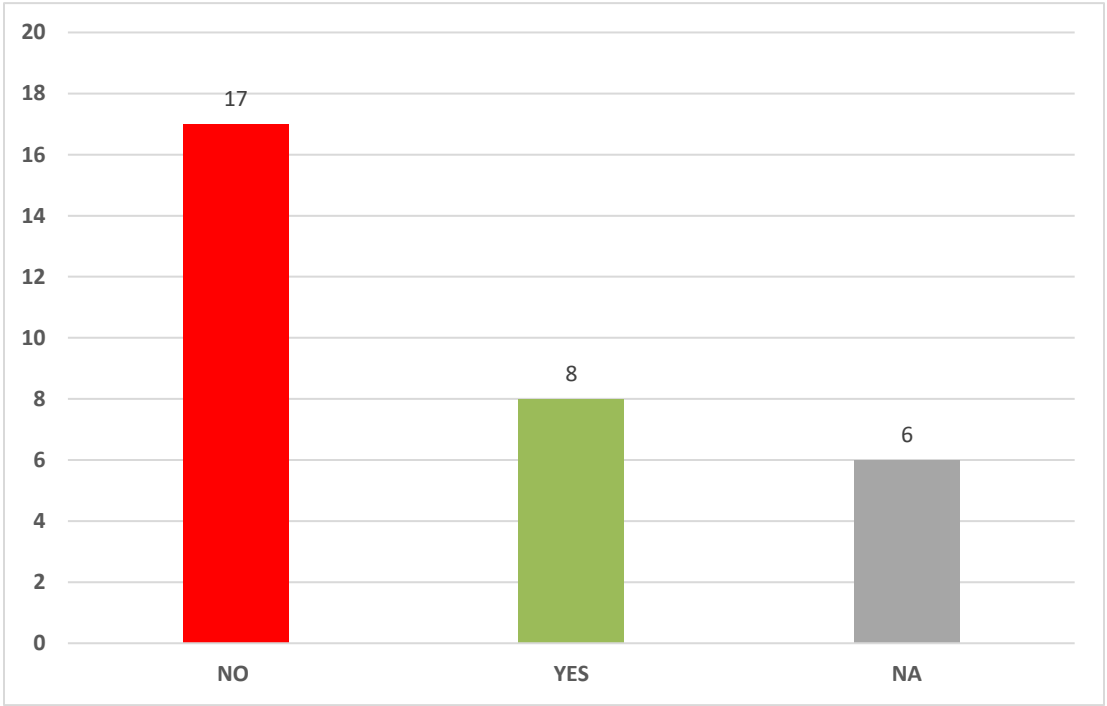


Figure 16. Number of countries that reported having sub-national regulation regarding the gathering of fungi.

Table 9. Sub-national regulations regarding the gathering of fungi.

Country	Sub-national regulation
Austria	It does not have a separate title, it is included in the BGBl. Nr. 440/1975, Forstgesetz 1975. It is restricted to 2 kg per person and day for personal use, there are exceptions for commercial gathering.
France	Regulation may vary from between regions and even between cities.
Germany	You are allowed to gather fungi only 1-2 kilo/day
Malta	ERA (Environment and Resources Authority) is the national authority dealing with the environment, natural habitats and biodiversity in general, but there are not regulations specific to the collection of fungi.
North Macedonia	There are some cases, for particular species, which are protected by the municipality, or protected in the frames of the particular documents concerning some protected area
Portugal	Only the regional management regulations of certain protected areas as mentioned before— For example, the Management Plan for the Peneda-Gerês National Park regulates the picking of wild mushrooms and prohibits picking except by residents and landowners. It also prohibits certain practices, such as, for instance the removal of soil or the picking of *Amanita caesarea* in "egg" stage.
Switzerland	Various cantons have collection restrictions (closed days, quantity restrictions) for wild mushrooms.

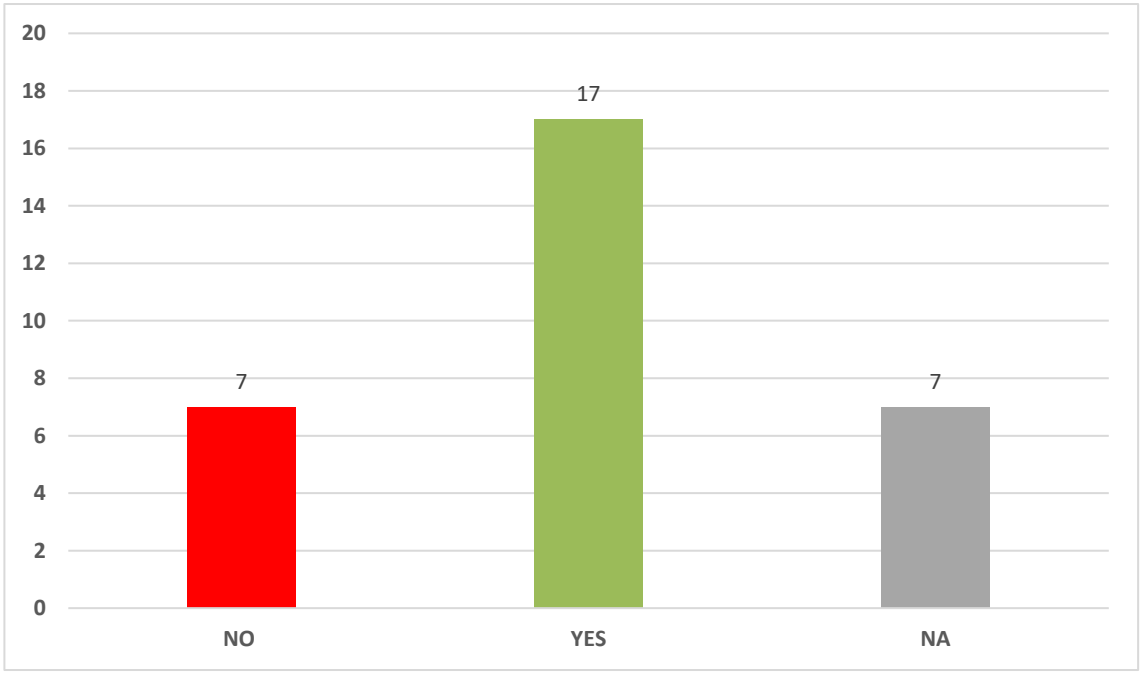


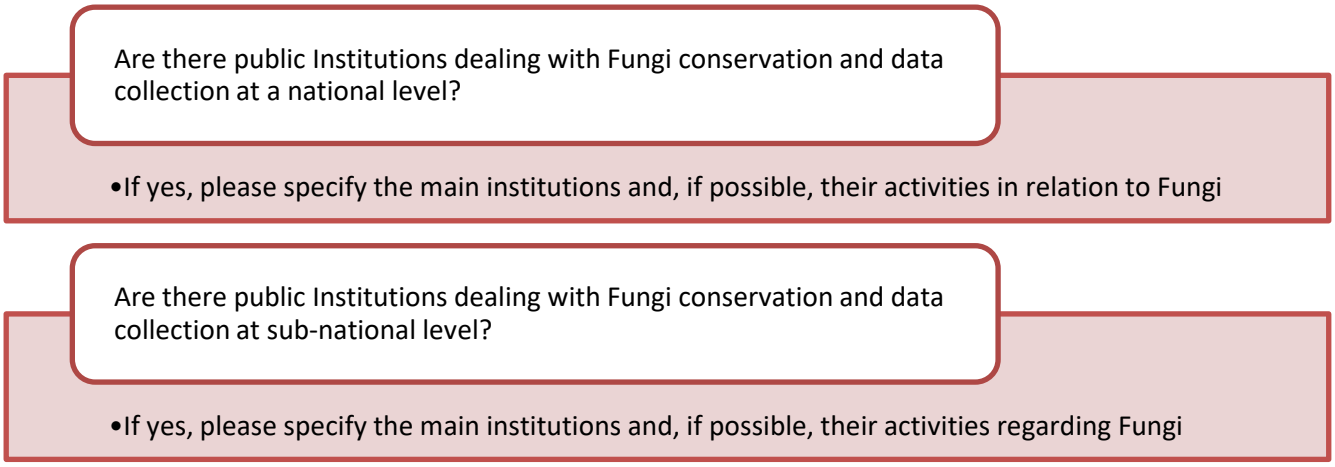
Figure 17. Number of countries that reported the presence of organizations involved in laws and regulations enforcement.

3.5 Institutions dealing with Conservation and Data Collection of Fungi

Authors: Enxhi Oga, Guðríður Gyða Eyjólfsdóttir

Institutions dedicated to the conservation and data collection of fungi play a crucial role in advancing our understanding of fungal diversity, ecology, and their importance in various ecosystems. Fungi, as a diverse group of organisms, contribute significantly to ecological processes, human health, and industry. To preserve this biodiversity and harness its potential, institutions worldwide are actively engaged in conservation efforts and systematic data collection related to fungi.

This section included two main questions, as follows.



Institutions specialized in the conservation and data collection of fungi focus on preserving fungal species, studying their ecological roles, and documenting their genetic information. These organizations often maintain fungal collections, such as herbaria and culture libraries, where specimens are stored for research and reference purposes. Additionally, they contribute to the development of databases that catalogue fungal species, facilitating research, identification, and conservation initiatives. By combining expertise in mycology, ecology, and molecular biology, these institutions play a vital role in advancing our knowledge of fungi and promoting their sustainable coexistence with other organisms and environments.

In the analysis of the survey results based on the countries that participated, a total of 32 countries were included, as indicated in Figure 18. Particularly, nine of these countries did not give responses, reported as “NA” in the findings. This absence is visually emphasized in the accompanying graphic, where the category of “NA” represents a significant portion, comprising 28% of the entire dataset.

The entities actively engaged in fungi conservation at the national level were further classified in distinct categories. Topping the list are associations, encompassing state bodies, local authorities, and non-governmental organizations (NGOs) collaborating to safeguard and collect fungi. These associations constitute the second-largest segment in the graphic, underscoring their substantial role in this conservation effort.

Following associations, government institutions contribute significantly, comprising 19% of the overall distribution. This highlights the active involvement of official governmental bodies in various countries in the conservation and collection of fungi on a national scale.

Universities, institutes, and societies collectively form another integral sector in this conservation landscape, trailing behind government institutions. The data indicates their noteworthy contribution, emphasizing the diverse range of entities engaged in fungi-related initiatives.

In summary, the survey shed light on the varied landscape of fungi conservation at the national level across the 32 participating countries. The absence of dedicated institutions in some nations underscores potential gaps in conservation efforts, while the active involvement of associations, government bodies, and educational institutions reflects a collaborative and multifaceted approach to address this ecological concern (see Table 10).

Of the 31 countries in the list 13 reported some sub-national activity on conservation or data collection of fungi. For some countries this data appears to be presented in a rather wide sense while a few are more specific. For some countries a more detailed information could clarify the current status where there is more information on fungi in some regions of a country than in other regions (see Figure 19 and Table 11).

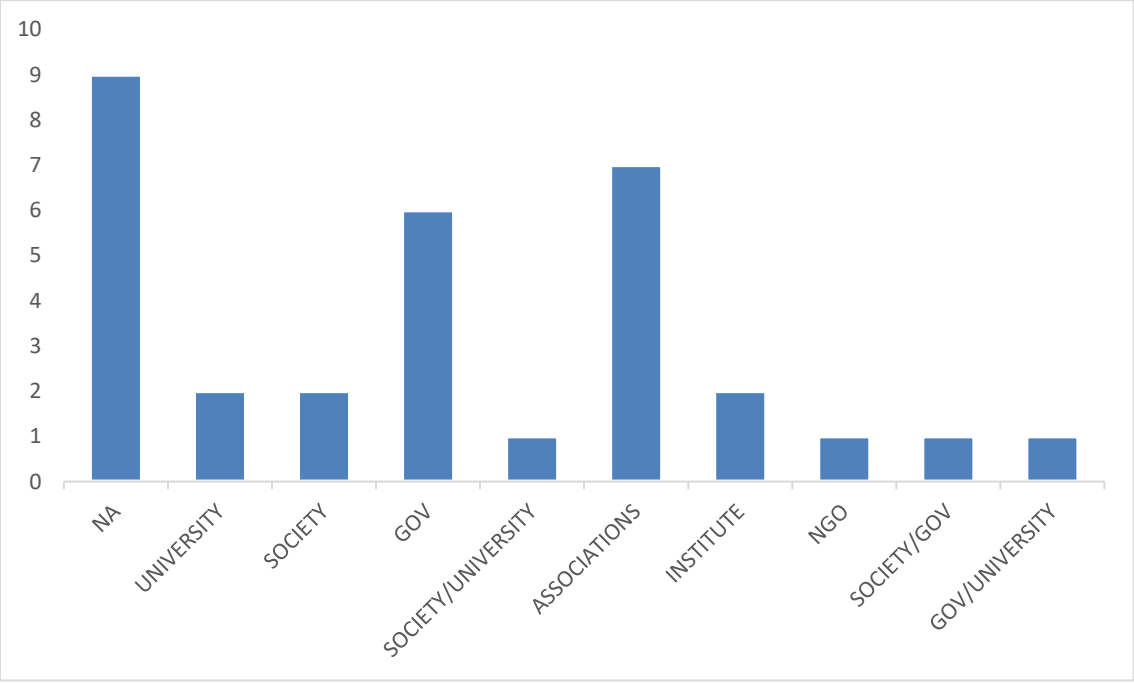


Figure 18. Public Institutions dealing with fungi conservation and data collection at a national level.

Table 10. Main institutions and activities specifically dealing with fungi at national level.

Country	Institution names and activities regarding fungi
Cyprus	To a limited extend by the Cyprus University of Technology
Denmark	The Danish Mycological Society is to some extend involved in fungal conservation work, and is partner in the Danish Fungal Atlas (www.svampe.databasen.org) run jointly with University of Copenhagen to collect fungal observation data
Estonia	Estonian Environmental Board. Keeps a database with information on localities where the legally protected species have been found. Has a power to e.g. decline forest management plans in such localities. Estonian Environment Agency. Monitors the localities for certain legally protected species. (Not yearly, though...)
Finland	Finnish mycological society – mainly data collecting. Open data is available for everyone at FinBIF. Link: https://laji.fi/enspecies.fi
France	- FONGIBASE by ADONIF (mapping, collecting data, Red List); Nature and landscape information system (SINP) by Museum National d'Histoire Naturelle Paris - Conservatoire Botanique National.
Germany	Deutsche Mykologische Gesellschaft, Pilzkartierung in Germany, Forum
Greece (combined)	1. Forest Research Institute – ELGO DIMITRA (biodiversity, properties-applications, ex-situ conservation – mycetotheca of dried specimen collection), 6. University of Patras, Biology Department 2. Agricultural University of Athens (biodiversity, properties-applications, ex-situ conservation – mycetotheca of culture collection a dried specimen collection) 3. National & Kapodistrian University of Athens (biodiversity, properties-applications, ex-situ conservation – mycetotheca of culture collection a dried specimen collection) 4. University of Patras 5. University of Ioannina (Department of Biological Applications and Technology).
Hungary	Ministry of Agriculture – Department of Nature Conservation responsible for the topic of fungi conservation Data, which are collected in the frame of National Biodiversity Monitoring System, are integrate to the Nature Conservation Information System There are several museums and NGOs collect further data regarding fungi.
Iceland	Náttúrufræðistofnun Íslands/ Icelandic Institute of Natural History maintains a national fungarium and records distribution of fungal species mostly based on specimens that have been collected. The institute will publish a checklist of Icelandic fungi in 2025 and subsequently rank fungi based on IUCN criteria.
Italy (combined)	Universities (data collection, conservation, research), ISPRA, Ministry of the Health, Regions and autonomous Provinces, local health authorities.
Kosovo	Ministry Environment Spatial Planning and Infrastructrure/ Ministry of Agriculture Forestry and Rural Development/Faculty of biology.
Latvia	Nature Conservation Agency Republic of Latvia. The most ambitious project in the field of nature protection in Latvia to ensure long-term preservation of protected species and habitats (including fungi). LIFE project "Threatened species in Latvia: improved knowledge, capacity, data and awareness".

North Macedonia	Mycological Laboratory, Institute of Biology, Faculty of Natural Science and Mathematics, Ss. Cyril and Methodius University in Skopje Link to the official Red List of fungi: https://redlist.moepp.gov.mk/
Montenegro	The Agency for Environmental Protection conducts research of fungi, prepares proposals for fungal species for protection, creates Red Lists of fungi, and creates Action Plans for endangered species. The Agency also issues permit for the collection of commercial species and permits for scientific and research work. The Agency also has a scientific collection of fungi.
Poland	General Directorate of Environment Protection No special part or activities concerning fungi.
Portugal (combined)	No. But it there were it would be ICNF (www.icnf.pt)
Serbia (combined)	Ministry of Environmental Protection Mycological-Fungal Association of Serbia
Sweden	SLU Artdatabanken - collects and analyse data. County boards - protect areas, initiate species inventories, carries out species action plans. Swedish Environmental Agency - Initiate species action plans, protected areas, legislation. Swedish Forest Agency - Conservation activities, species inventories, information landowners. Swedish universities - expert advice, research.
Switzerland (combined)	SwissFungi at Swiss Federal Institute for Forest, Snow and Landscape Research WSL Monitoring of Fungi, evaluation of fungal diversity and endangerment status (Red List), defining priority lists at a national level, target species for forests or agriculture etc. Swissfungi is part of the Swiss information centre for species (InfoSpecies).
The Netherlands (combined)	Dutch Mycological Society NMV, Naturalis Biodiversitiy Center, and National Database Flora & Fauna NDFF
UK	No, there are societies/charities such as British Mycol Soc who maintain fungal recording databases (fungal distribution). Fungal conservation dealt with by public bodies such as Natural England in England and NGOs such as Plantlife, and to some extent large landowners such as the National Trust

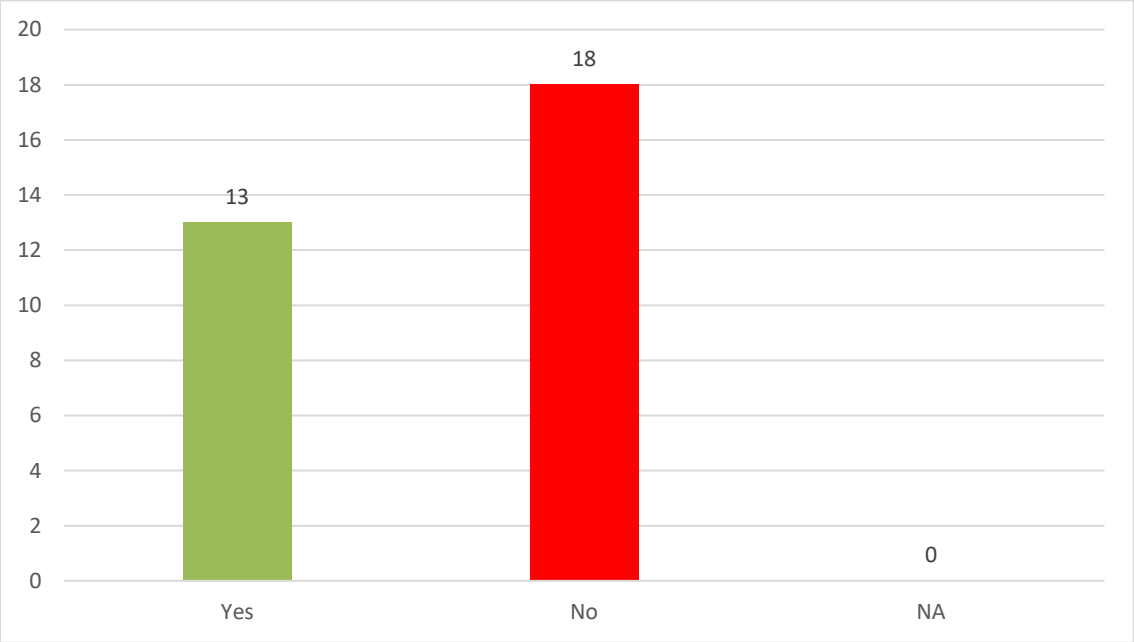


Figure 19. Number of countries that reported having public Institutions dealing with fungi conservation and data collection at sub-national level.

Table 11. Main institutions and activities specifically dealing with fungi at sub-national level.

Country	Institution name
Austria	In Vorarlberg the INATURA Dornbirn produces an official sub-national Red List for this federal state.
Belgium	Koninklkjke Vlaamse Mycologische Vereniging in Flanders, Natuurpunt Studie.
Czech Republic	There are several scientific institutions where mycologists are present, such as some regional museums, research institutes with various focuses, administrations of large-scale protected areas, etc.
Estonia	University of Tartu, PlutoF database. Collects both scientist and citizen scientist data.
France	Local agencies of the Conservatoire Botanique National
Germany	Bayerische Mykologische Gesellschaft, Pilzkartierung in Bavaria, Forum
Italy (combined)	The situation is very diversified, respondents reported some examples: Natural history museum (data collection, specimen collection) Mountain communities and managing body of the regional state property Museo Botanico-Erbario, Università degli Studi di Padova Fondazione Musei Civici di Venezia – Museo di Storia Naturale Giancarlo Ligabue Università degli Studi di Firenze – Sistema Museale di Ateneo – Museo di Storia Naturale – Collezioni botaniche “Filippo Parlatore” Museo di Storia Naturale di Verona MUSE – Museo delle Scienze Università di Torino Museo Botanico del Sistema Museale d’Ateneo dell’Università di Pisa Museo di Storia Naturale di Verona

	Museo Herbarium – Università degli Studi di Cagliari The regional observatory of biodiversity Academic Institutions for mycological research University of Siena, involved since many years through the European Mycological Association EMA, the European council for conservation of fungi ECCF, the international society for conservation of fungi ISCF, the IUCN, in activities for their conservation, and in European and global red-listing of fungi
Kosovo	Ministry Environment Spatial Planning and Infrastructure
Montenegro	The Agency for Environmental Protection, research of fungi, proposes fungi which need protection, creates Red Lists and Action Plans for endangered species. The Natural History Museum of Montenegro and the Bio-technical Institute of Montenegro, studies of the diversity of fungi, phytopathology of fungi, mycorrhizal fungi etc.
Poland	Regional Directorates of Environment Protection No special part or activities concerning fungi
Portugal (combined)	In the University of Coimbra, a research group explicitly includes fungal conservation in its mission.
Spain	Different universities and research centres have their own fungal collections.
Sweden	Regional county boards. Protect areas, initiate species inventories, carry out species action plans.

Box - Fungi Foundation

Author: Marios Levi, Program development at the FF

Launched in 2012, the Fungi Foundation is a global organization that explores Fungi in the remaining pristine areas of the world to increase knowledge of its diversity, document ancestral relations with fungi, promote innovative solutions to contingent problems, educate about its existence and responsible applications, as well as recommending public policy for their conservation. Through its global network, the Fungi Foundation leads efforts in fungal acknowledgement, and shares the common mission with JoNeF to integrate Fungi into biodiversity monitoring plans, including in the European legislation on nature protection and in conservation strategy.

The Fungi Foundation is composed of four distinct programs: Education (including fungi in K-12 school curriculums worldwide), Conservation (recommending into public policy, 3F campaign, and promotion of Rights of Nature), Elders (documenting ancestral relations with fungi), and Expeditions (exploratory fungal expeditions in the remaining pristine areas of the world).

Fungi
FOUNDATION
WWW.FFUNGI.ORG

Box - SPUN

Author: Kelcie Walther, Communication Lead from SPUN

SPUN (Society for the Protection of Underground Networks) is a science-based initiative that aims to map and protect the underground fungal networks that regulate Earth's climate and ecosystems. In collaboration with researchers and local communities, SPUN leads efforts to explore mycorrhizal biodiversity and advocates for the inclusion of fungi in conservation and climate agendas.

Mycorrhizal fungi are a group of network-forming soil fungi that form symbiotic associations with plants. Nearly all plants form symbiotic associations with mycorrhizal fungi. Plants and fungi exchange resources with one another, trading carbon compounds for essential nutrients such as nitrogen and phosphorus. Without their fungal partners, few plants would be able to thrive on Earth.

In order to protect underground networks, we need to know which fungi are there. A recent analysis found that more than 70% of Earth's known soil biodiversity hotspots remain unprotected by current conservation priorities (Guerra et al., 2022). SPUN creates high-resolution mycorrhizal biodiversity maps, identifies under-sampled areas, and advocates for better protection of these communities.

We achieve this by combining large geo-located databases of fungal sequencing data with ecological variables in a machine learning model, generating spatial predictions of mycorrhizal diversity based on relationships learned by the model.

SPUN works with local researchers to develop sampling campaigns that help characterize mycorrhizal biodiversity in diverse underground ecosystems. We aim to generate data that is useful to governments, policymakers, NGOs, and others to help shape conservation agendas for these critical, under-protected organisms.

SPUN
SOCIETY FOR THE PROTECTION
OF UNDERGROUND NETWORKS

4. Survey results on part 2

4.1 Information on the respondents of part 2

Author: Francesca Floccia

This section reports the details of the respondents to the part 2 of the questionnaire. It included six questions, as follows.

- **Are you a JoNeF Project Member?**
- **Name and last name**
- **Country**
- **Organization name**
- **Type of organization**
- **E-mail**

People who filled out the part 2 of the questionnaire were in total 63 among which **21** were JoNeF members and **42** were non-JoNeF members.

In total **32** countries (of which 31 European countries) responded to the part 2 of the questionnaire: 17 were countries of JoNeF members and 15 were countries of non-JoNeF members (see Figure 20). USA is not reported in the map.

Regarding the type of organization, the most common were academic institutions and national public authorities, both with 22%, followed by sub-national public authorities and non-governmental organisation (NGO), both with 16% (see Figure 21).

Organization names, types of organization and countries are reported in Errore. L'origine riferimento n on è stata trovata..

Names and e-mails of respondents are not reported for privacy reasons.

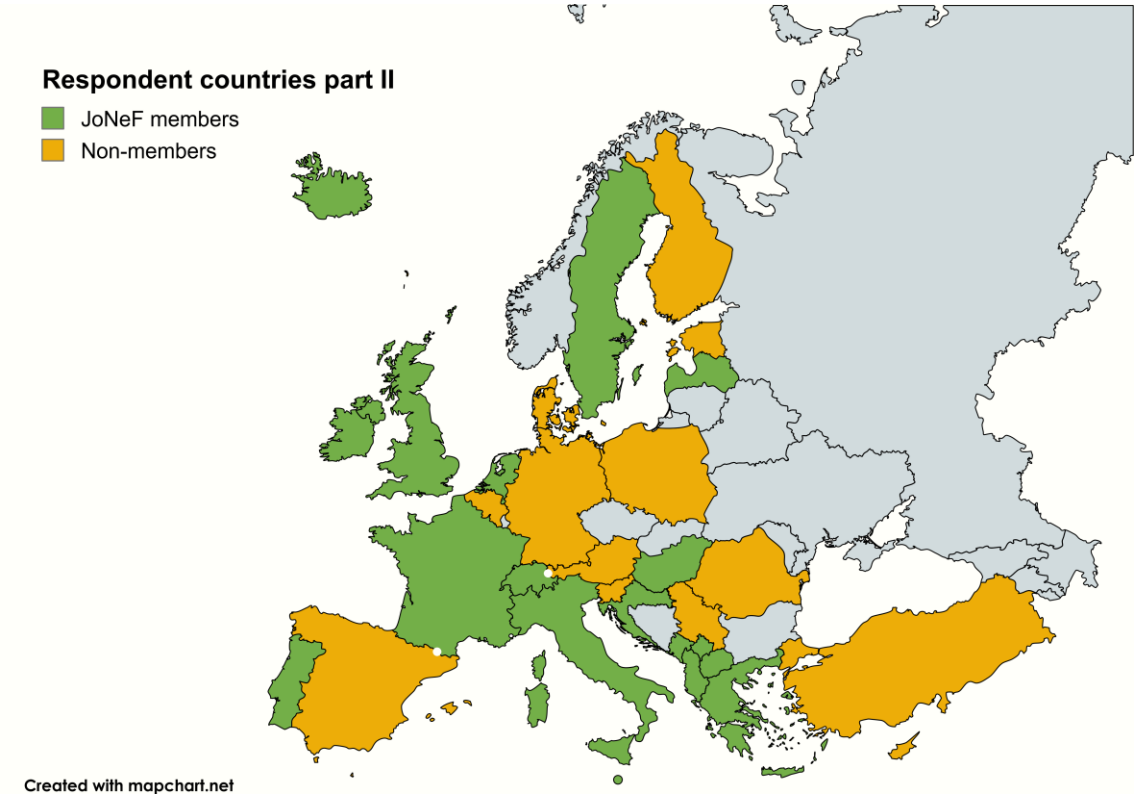


Figure 20. Map of countries of JoNeF and non-JoNeF team members that answered to part 2 of the questionnaire.

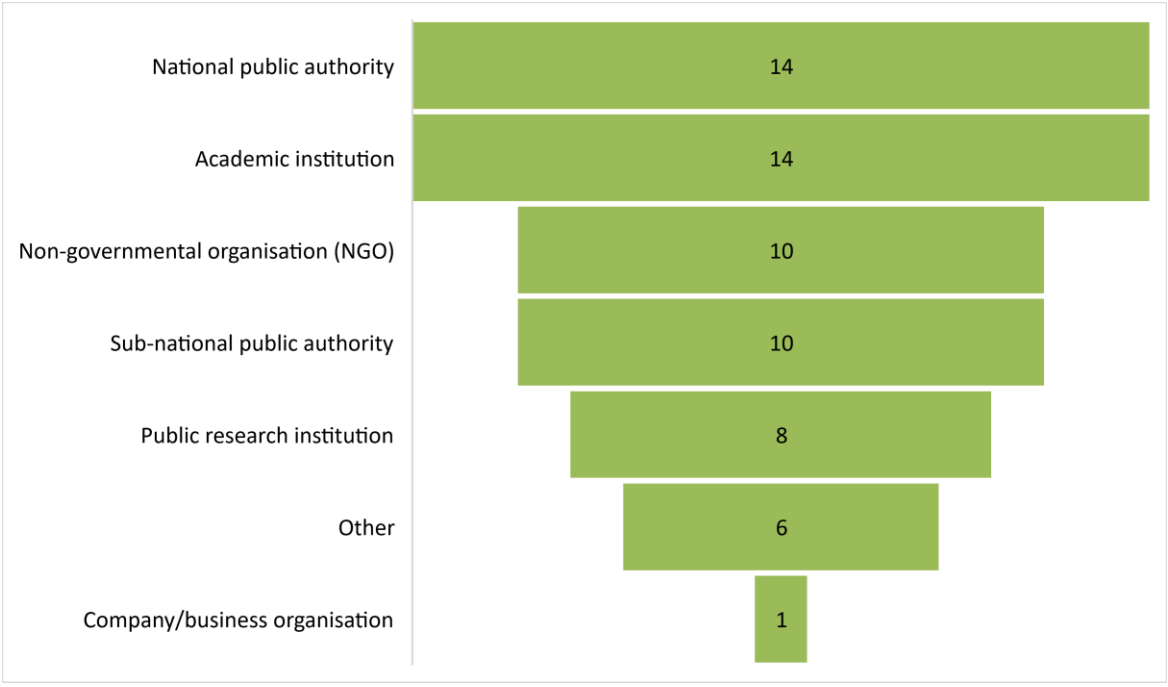


Figure 21. Number of respondents in part 2 of the questionnaire by type of organisation.

4.2 Data Collection Initiatives and Projects

Authors: Lívia Fodor Kisné, Katerina Rusevska, Susana C. Gonçalves

The demand for evidence-based decision support is increasing. Large-scale databases are necessary to map species distribution, to identify threatened species or habitats, to monitor the state and changes of nature over time. The datasets and assessments establish the basis of nature conservation measures, including the protection of fungi.

This section focused on data collection initiatives and their operating conditions.

It included five main questions, as follows.

- Are there data collection initiatives and/or projects regarding Fungi on a national scale?
  - If yes, please enter the initiative's names and the main activities (census, monitoring, mapping, collecting data on toxic fungi, etc.).
- Are there national guidelines for Fungi data collection (both governmental and not governmental)?
  - If yes, please indicate the bibliographic references.
- Are there data collection initiatives and/or projects regarding Fungi on a sub-national scale?
  - If yes, please enter the initiative's names and the main activities (census, monitoring, mapping, collecting data on toxic fungi, etc.).
- Are there data collection initiatives and/or projects regarding Fungi carried out by Associations and Groups?
- Are there citizen science activities on Fungi?

Two-thirds of the responding countries have data collection initiatives on a national level. Among these are programs focused on one task, and others are multi-task initiatives, i.e. the data are also used for mapping and monitoring purposes.

Some programs collect data on all mushroom species, but other focus on selected species (e.g. edible species, protected species, endangered species).

Some programs specifically focus on threatened species and create the Red Lists based on the evaluation of the collected data.

There are some initiatives focusing only on fungi, but in other cases the subsystem that collects mushroom data is part of an information system that handles other biotic data together (see Figure 22 and Table 12). Some of the databases are available online.

Even though 68% of the responding countries indicated the existence of a data collection system on a national scale (see above), only 29% provided a reference to a guideline related to data collection. This may result from the fact that few programs require the survey of designated areas according to specified methodology. For example, systems operating primarily for mapping ask the data to be recorded and its required format is determined by the information system and its application service, but there are no other requirements (see Figure 23 and Table 13).

Less than half of the responding countries indicated that they are aware of sub-national data collection initiatives (regarding fungi), and the details are less known than in the case of national programs. The answers were formulated in a more general way, and only few specific programs were named. This may be also because nowadays the data of georeferenced databases developed at their national level, according to uniform protocols, can be evaluated also at a sub-national level (regionally). Besides, this data collection can be initiated and coordinated regionally. Among the built-in queries of the national level database, you can usually solve the regional evaluation as well (see Figure 24 and Table 14).

Data collection programs initiated by various associations are known in most of the responding countries (71%). It shows the importance of doing so (see Figure 25).

Volunteer-based citizen science data collection is gaining more and more space in the construction of large databases. The answers to the questionnaire also reflect this, since 26 of the 31 answers, i.e. 84% of the answering countries, refer to the fact that citizen science-based data collection on mushrooms is taking place in the given country (see Figure 26).

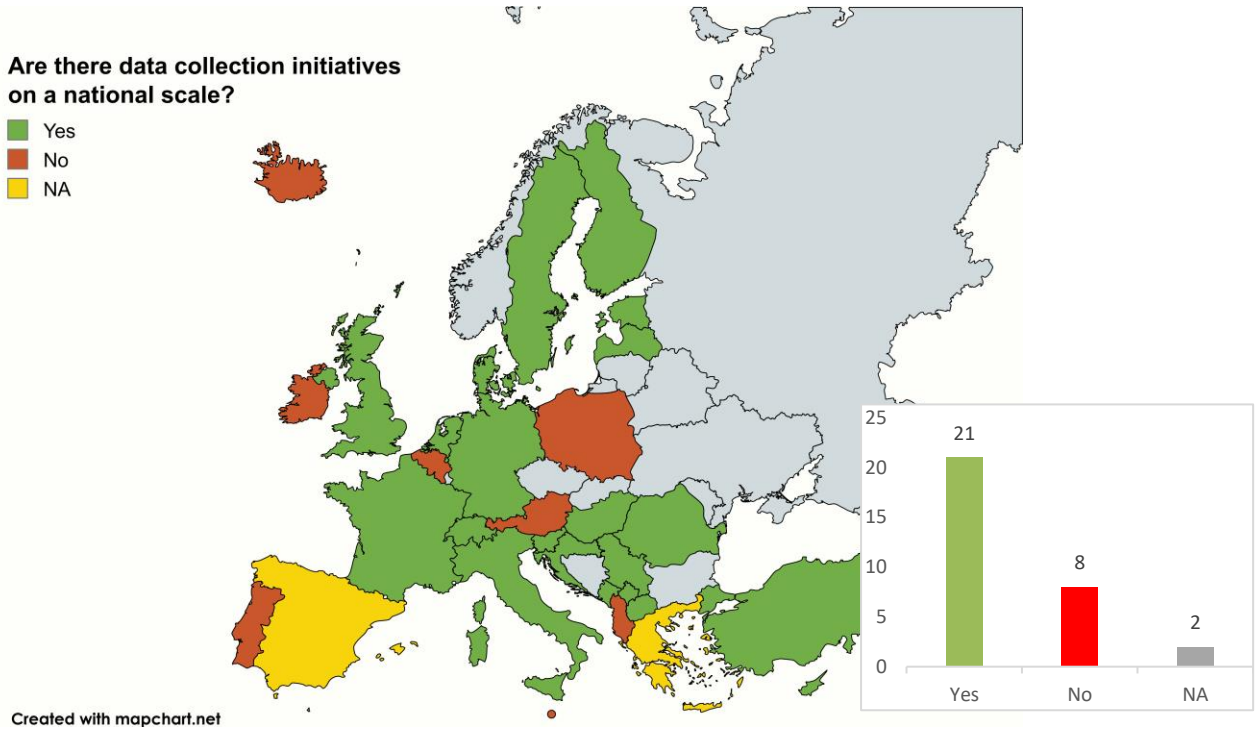


Figure 22. Map of countries that reported having data collection initiatives and/or projects regarding fungi on a national scale.

Table 12. Data collection initiatives and/or projects regarding fungi on a national scale.

Country	Initiative's names	Main activities (census, monitoring, mapping, collecting data on toxic fungi, etc.)
Croatia	Project of Croatian Mycological Society "Biodiversity of fungi in Croatia".	Mapping and inventory of fungi in Croatia.
Cyprus	Cyprus Mycological Association Link: https://www.facebook.com/cyprusfungi/	
Denmark	Danish Fungal Atlas	Mapping, providing information and resources for fungal identification
Estonia	Plutof Database Estonian Nature Observations Database	Plutof Database: Collects scientist and citizen scientist observations on fungi. (Has a phone application: PlutofGo). Estonian Nature Observations Database: collects citizen scientist observations on fungi.
Finland	1. Atlas of Finnish fungi 2. Biomon	1. Atlas of Finnish fungi (teaching, mapping, data collection, taxonomy, barcoding) 2. Biomon (monitoring about 250 most toxic and also most fungi used for foods)
France	FONGIBASE by ADONIF Nature and landscape information system (SINP) by MNHN Paris	FONGIBASE by ADONIF (mapping, collecting data, Red List)
Germany	Mykologische Informationssystem MykIS	Deutsche Mykologische Gesellschaft, mapping, collecting data on all fungi
Hungary	1. Hungarian Biodiversity Monitoring System – monitoring of fungi 2. National Data Collecting Network of Protected Fungi Species 3. Natural History Museums	1. monitoring (assigned localities in connection with Forest Reserves, standard methods on basis of detectation of fruit bodies) – Hungarian Biodiversity Monitoring System – Nature Conservation (Ministry of Agriculture) 2. Collecting data of protected fungi (Hungarian Mycological Society and linked volunteers) 3. Fungaria data
Italy	Network for the study of mycological diversity of ISPRA	The main activities are census of fungal species, mapping and species-habitat association
Kosovo	Kosovo Association of the Processors and Exports of the Non-Wood Forest Products and Medical Aromatic Plants "ORGANIKA"/ Ministry of Agriculture Forestry and Rural Development	
Latvia	1. Natural data management system OZOLS (Oak) 2. The State Register 3. Portal www.dabasdati.lv 4. Fungi collection of Latvian Museum of Natural History	Natural data management system OZOLS (Oak) accumulated information on specially protected nature territories, micro-reserves, specially protected species and habitats management activities, tourism infrastructure in protected nature areas, rewards restrictions on economic activities in specially

		protected nature territories and micro reserves, the State Register of cartographic data, biodiversity monitoring data and other data that are actual in nature protection. In nature observations portal dabasdati.lv everyone is welcome to share their observations in nature – report on fungi, plants and animals. Fungi collection of Latvian Museum of Natural History (10.000 specimens)
North Macedonia	Red List approach	Preparation of Macedonian Red List of Fungi. Project is financed by European Bank for Reconstruction and Development (EBRD), implemented by Hardner & Gullison Associates, USA (January 2020 – March 2021).
Montenegro	1. Red List approach 2. Data on macro fungi are also collected as part of the preparation of the Protection Study or audit of a certain area, and in accordance with the Law on Nature Protection ("Official Gazette of Montenegro", No. 054/16 of 15 August 2016	There is an initiative in the Environmental Protection Agency to draw up the Red List of endangered macro fungi of Montenegro in accordance with the IUCN methodology, and then to draw up a plan for future research on the inventory of species and the collection of data on the state of populations of selected taxa. Data on macro fungi are also collected as part of the preparation of the Protection Study or audit of a certain area, and in accordance with the Law on Nature Protection ("Official Gazette of Montenegro", No. 054/16 of 15 August 2016), which is also implemented by the Agency. As part of these research, an inventory of registered species is made, material is collected that needs to be processed in the laboratory, and data on rare and endangered species on national and international level (species protected by national law, species candidate for the Appendix II of Bern Convection....) is collected and the coordinates of the findings of these species are taken.
Romania		Census and collecting data on diversity of fungi
Serbia	Biologer tools for collecting data on biological diversity https://biologer.org/	
Slovenia		Collecting data on student biological camps
Sweden	Artportalen / Swedish Species Observation System	Artportalen / Swedish Species Observation System which is not a coordinated project per se, but has a national coverage where a lot of data on fungal species is reported and stored. Open access for all.

Switzerland	- Red List Revision - Forest Reserve monitoring - Monitoring Neomycetes - National collection calls - Spore monitoring	- Field campaign for Red List Revision - Monitoring of dead wood fungi in unmanaged forest reserves compared to managed forest - Monitoring Neomycete diversity and distribution - Collection calls for selected species of research interest - Metabarcoding of air samples from different habitats to analyse species communities
The Netherlands	Mapping project NEM monitoring projects	Mapping project (all species of macrofungi and myxomycetes), and 3 NEM monitoring projects (1. Outer dune area (shifting dunes and fixed dunes in part), 2. Woodland on sandy soils, and 3. Sphagnum vegetations)
Turkey	Fungal Biodiversity, Fungal systematic	Collecting of the macrofungi, mapping them, fungal biodiversity studies.
UK	FRDBI a national recording database, CATE2 recording database, each county has an Environmental Records Centre	The BMS runs the FRDBI a national recording database, the FCT runs the CATE2 recording database, each county has an Environmental Records Centre which compiles all biodiversity records for a local area

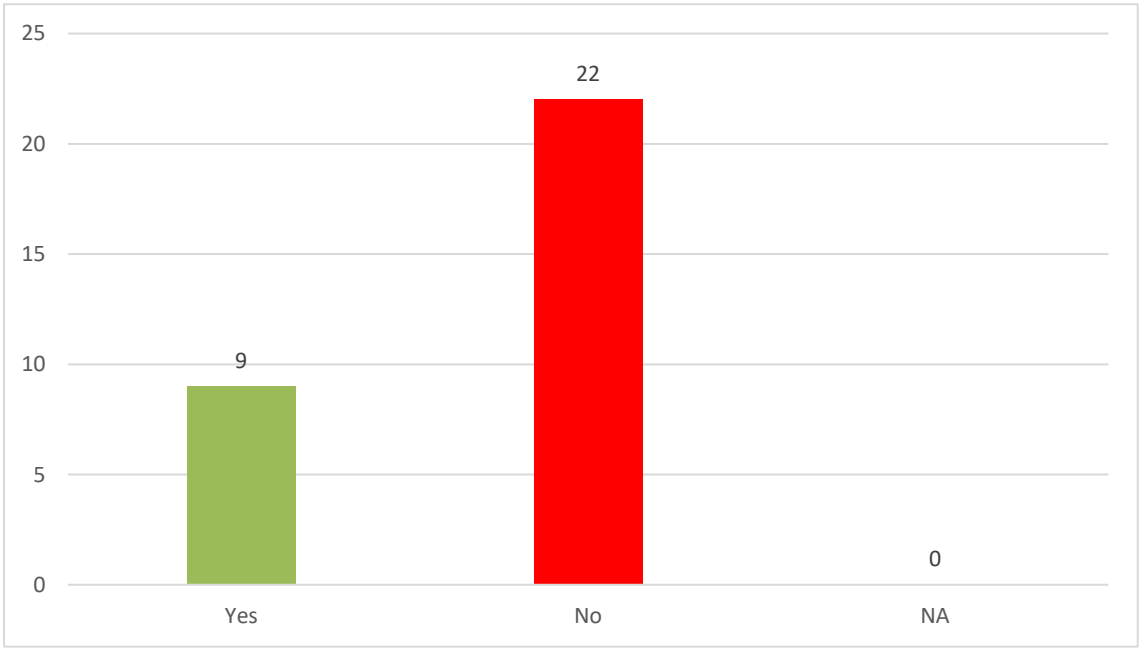


Figure 23. Number of countries that reported having national guidelines for fungi data collection (both governmental and not governmental).

Table 13. National guidelines for fungi data collection (both governmental and not governmental).

Country	National guidelines references
Finland	Atlas of Finnish fungi website Link: https://sieniatlas.fi/
France	National inventory: https://fongibase.fongifrance.fr Consideration of fungus in natural areas: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwi-_Pbf2d-BAxXYUaQEHXa1BwAQFnoECBUQAQ&url=http%3A%2F%2Fwww.mycofrance.fr%2Fwp-content%2Fuploads%2F2021%2F04%2Fcahier-technique-RNF-champignons-2021-Bdef-A4.pdf&usg=AovVaw075EaDr5DeuMAlw2zLtzIm&opi=89978449
Germany	German Mycological Society Link: https://www.pilze-deutschland.de/
Hungary	Protocol of fungi monitoring in the frame of Hungarian Biodiversity Monitoring System: https://termeszetvedelem.hu/_user/downloads/mintavetel/gomba5_2008_0609.pdf Török K., Fodor L. (ed): Nemzeti Biodiverzitás-monitorozó Rendszer Eredményei I.: Élőhelyek, mohák és gombák, KvVM-TVH, 2006 Budapest (First results of Hungarian Biodiversity Monitoring System I.: Habitats, mosses and fungi) https://termeszetvedelem.hu/_user/browser/File/NBmR/Kiadv%C3%A1nyok/NBmR_elso_kotet.pdf
Italy	Guidelines for the census and monitoring of macromycetes in Italy. Girometta C.E., Floccia F., Leonardi M., Bianco P.M., 2023. ISPRA Manuali e Linee Guida 03/2023. Link: https://ndm.isprambiente.it/en/go-to-the-field/guidelines-for-the-census-and-monitoring-of-macromycetes-in-italy/
North Macedonia	Manual for the collecting of mushrooms and lichens. Publisher: Ministry of Agriculture, forestry and water management. Link: http://www.mkdsumi.com.mk/upload/files/Priracnik_i_monografija_za_sobiranje_pecurki_i_lisai.pdf
Slovenia	Boletus information system
Sweden	https://www.svampar.se/att-samla-svamp-for-artbestamning/
The Netherlands	https://www.mycologen.nl/onderzoek/kartering/ https://www.mycologen.nl/onderzoek/meetnet/

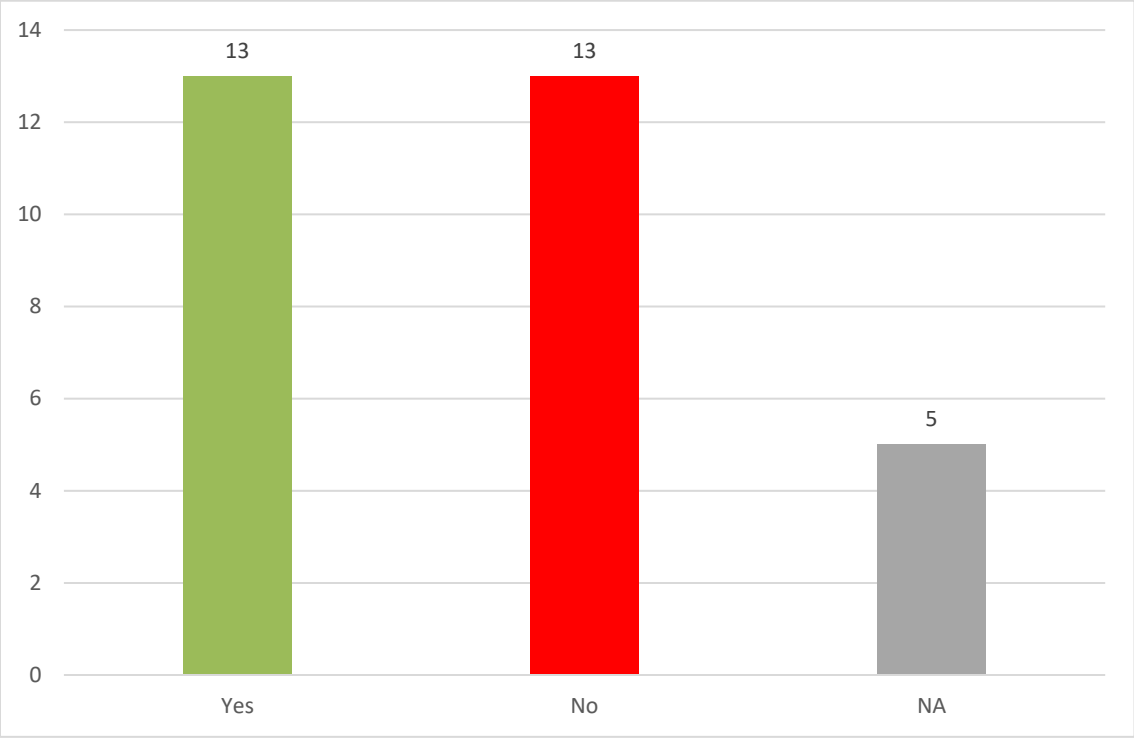


Figure 24. Number of countries that reported having data collection initiatives and/or projects regarding fungi on a sub-national scale.

Table 14. Data collection initiatives and/or projects regarding fungi on a sub-national scale.

Country	Initiative's names	Main activities (census, monitoring, mapping, collecting data on toxic fungi, etc.)
Belgium	Funbel-databank Www.waarnemingen.be	
Finland	Atlas of Finnish fungi website https://sieniatlas.fi/	Still Atlas collects data, does taxonomy about many groups of fungi for biodiversity aims and for e.g. FinBOl for BOLD
Germany	Bayerische Mykologische Gesellschaft	Mapping and collecting data
Greece		- There is an ongoing project by the Natural Environment & Climate Change Agency of Greece for the "Compilation of Red Lists of Threatened Species of Plants, Animals and Fungi of Greece". (https://necca.gov.gr/en/erga/nature-biodiversity/compilation-of-red-lists-of-threatened-species-of-plants-animals-and-fungi-of-greece/) - Mapping and collecting data on fungi in general including toxic fungi carried out by amateur societies, Hellenic, Mushroom society, scientists/researchers etc

		- Study of diversity of macromycetes from different ecosystems and substrates in Greece. - Collecting data for a check list of Greek macromycetes incorporating data from scientific mycologists and citizen scientists.
Italy		There are several regional/local data collection initiatives carried out by local Mycological Association and Groups.
Kosovo	Kosovo Association of the Processors and Exports of the Non-Wood Forest Products and Medical Aromatic Plants	
North Macedonia		There are some cases, for particular species, which are protected by the municipality, or protecter in the frames of the particular documents concerning some protected area
Romania		Kálmán László Mycological Society publishes (in the review: Moeszia.Erdélyi Gombász) and continue to collect such data, I know about essays in this domain of the Mycological Society of Romania
Sweden		There are a few regional initiatives (census, mapping, specimen collections for reference).
Switzerland		- Monitoring of fungi on dead wood (canton Aargau) - Action plan Hygrocybe calyptriformis (Bern) - Forest reserve monitoring for mushrooms in the canton of Ticino
The Netherlands	Local monitoring programs, for instance Waxcap grasslands in Amsterdamse Waterleidingduinen; data are included in the national database NDFF	
Turkey		Identification to regional fungal biodiversity, identification to edible or inedible fungal species
UK		Surveys run by charities (e.g. Plantlife) and UK govt agencies (Natural England, NatureScot etc)

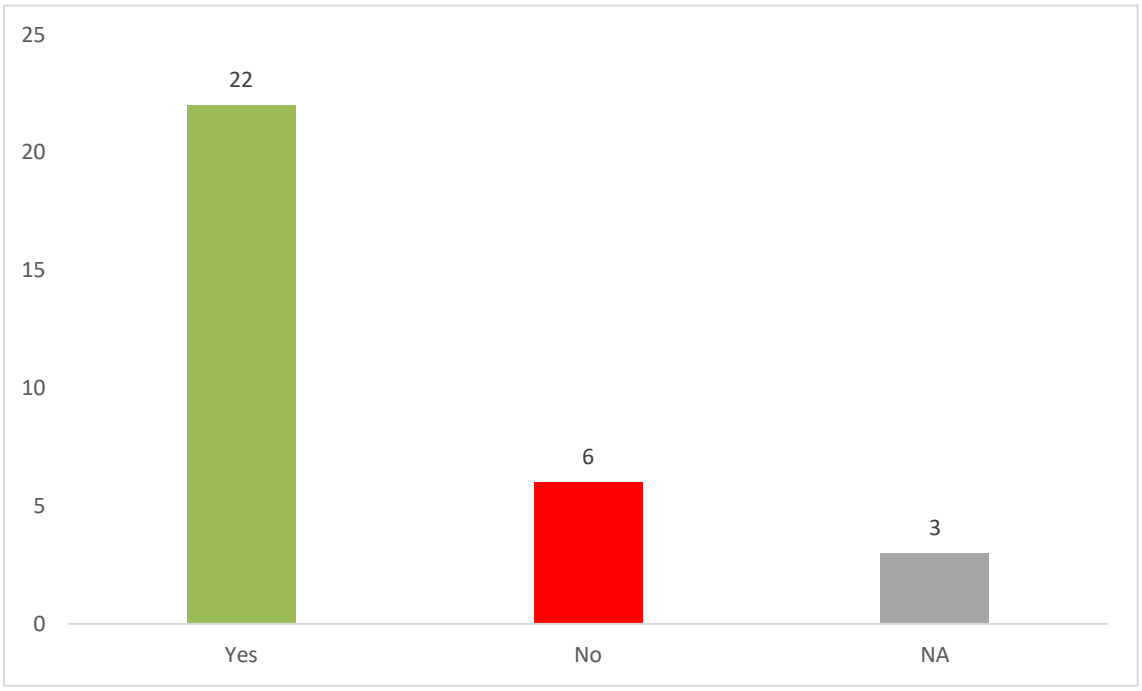


Figure 25. Number of countries that reported having data collection initiatives and/or projects regarding fungi carried out by Associations and Groups.

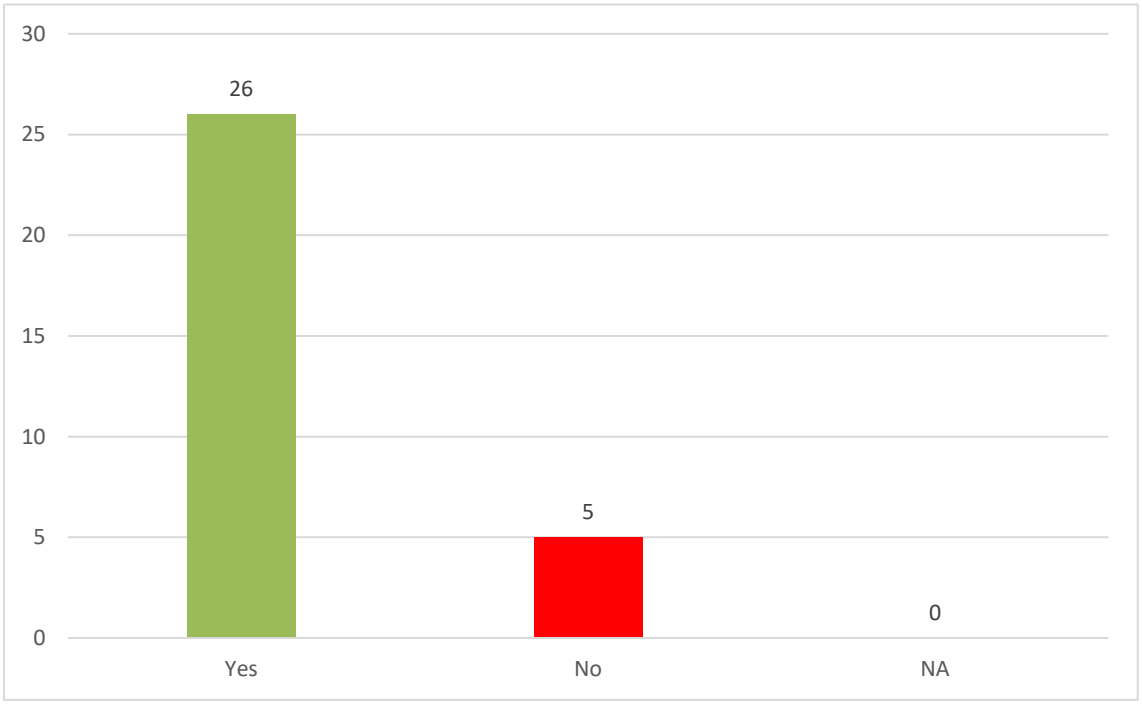


Figure 26. Number of countries that reported having citizen science activities on fungi.

4.3 Conservation Plans and Projects

Authors: Valeria Giacanelli, Corrado Nai

This section concerns the existence of **(sub-)national plans and projects for the conservation of wild fungi**, both oriented to single species and/or to the habitat for the species.

The section aimed at assessing if countries are engaged in the conservation of wild fungi by implementing measures to preserve, reinforce or reintroduce fungi populations and/or to improve their natural habitats.

This section included two main questions:

Are there national plans and/or projects specifically oriented to the conservation of Fungi (including species and habitat for the species)?

- If yes, please provide a brief description.

Are there sub-national plans and/or projects specifically oriented to the conservation of Fungi or including Fungi among other organisms?

- If yes, please provide a brief description.

Representatives from the following **31 countries** provided an answer: Albania, Austria, Belgium, Croatia, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Kosovo, Latvia, North Macedonia, Malta, Montenegro, Poland, Portugal, Romania, Serbia, Slovenia, Spain, Sweden, Switzerland, The Netherlands, Turkey, UK.

National scale (first question)

Eleven countries answered “yes”, but only 5 reported information coherent with the question. One specific project mentioned is LIFE FOR SPECIES (Latvia), and other projects are mentioned without specific names (see Table 15). The remaining 6 positive answers were moved to “NA” category (see Figure 27).

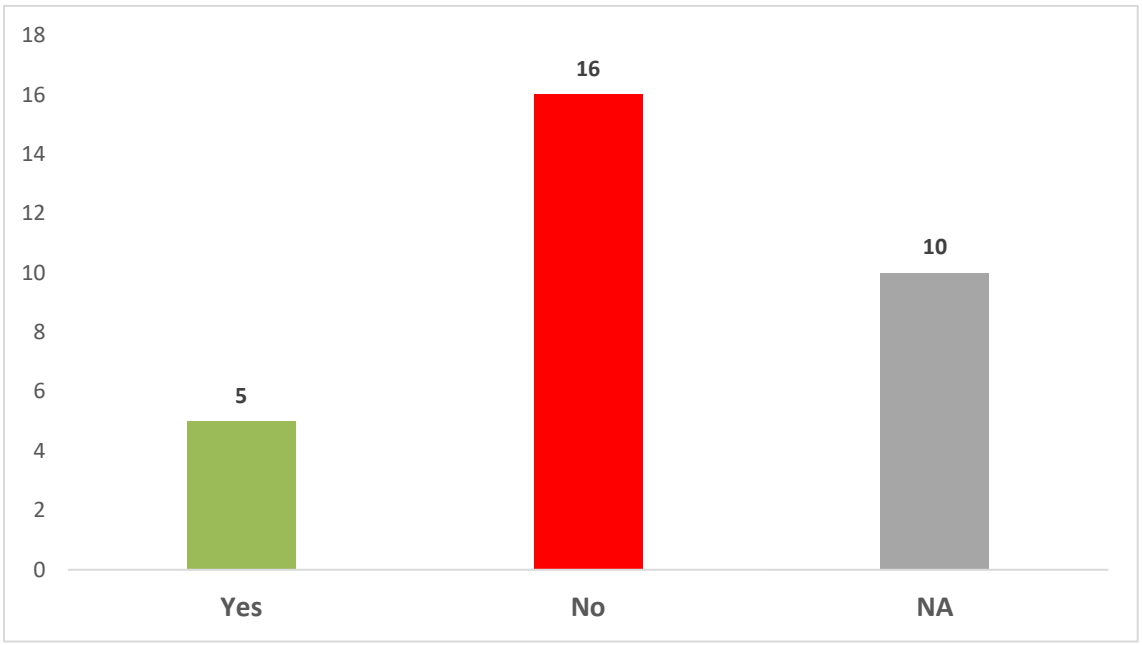


Figure 27. Number of responses regarding national plans and/or projects specifically oriented towards the conservation of fungi (including species and their habitat).

Table 15. National plans and/or projects specifically oriented to the conservation of fungi (including species and habitat for the species).

Country	Plans/projects description
Estonia	The legally protected species and their habitats are protected on a national level. A specific “Conservation Management Plan” is made for the fungal species that are protected with highest grade.
France	The Muséum national d’histoire naturelle de Paris (MNHN) is leading several projects on the conservation of fungi.
Latvia	LIFE FOR SPECIES. The project will improve the cornerstone of conservation of natural diversity, a system for protecting species, by assessing the vulnerability of wild species and the need for their legal protection (including fungi).
North Macedonia	Species conservation and habitat protection are included in the national plans and strategies. Link to the pdf document “National strategy for nature conservation (2017-2027) https://www.moepp.gov.mk/wp-content/uploads/2014/12/National-Strategy-for-Nature-Protection-2017-2027.pdf
Sweden	For several species there are species action plans for mapping distributions and preserving / restore habitat.

Sub-national scale (second question)

Seven countries answered "yes", but only 4 reported information coherent with the question. The remaining 3 positive answers were moved to the "NA" category (see Figure 28 and Table 16).

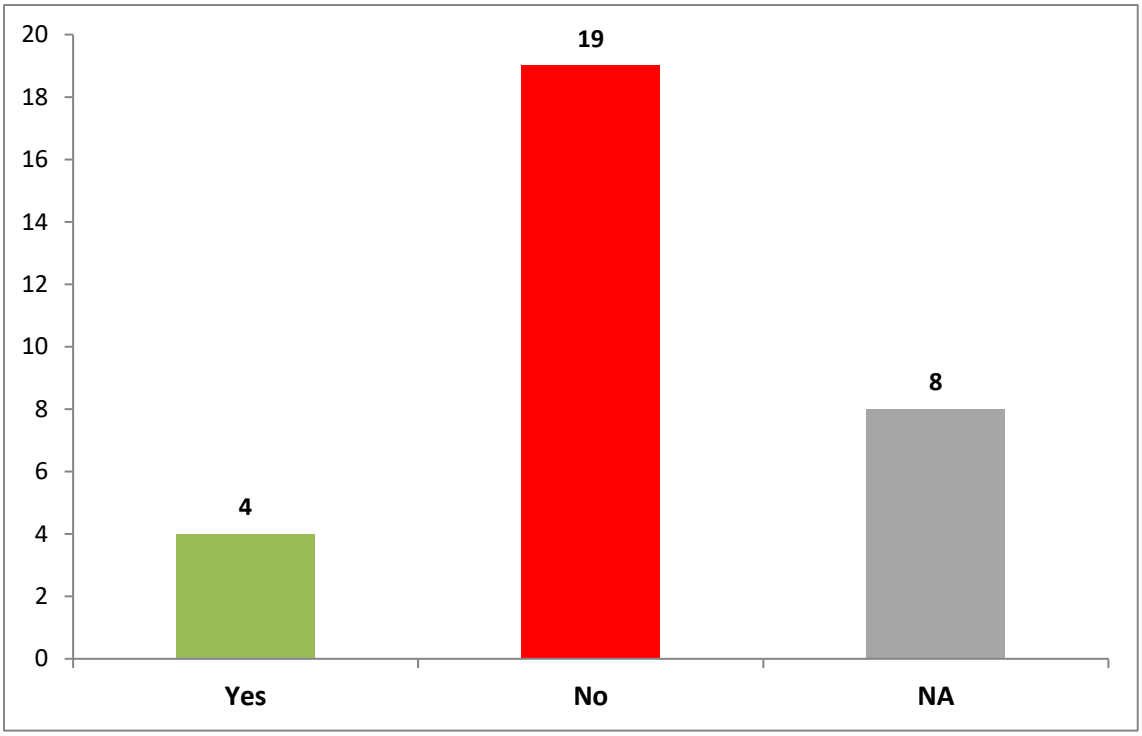


Figure 28. Number of countries that reported having sub-national plans and/or projects specifically oriented to the conservation of fungi or including fungi among other organisms.

Table 16. Sub-national plans and/or projects specifically oriented to the conservation of fungi or including fungi among other organisms. Information reported for each country with a yes-answer.

Country	Plans/projects description
France	Projects led by the network of regional agencies of the Conservatoire Botanique National (https://www.fcbn.fr/le-reseau-des-cbn)
North Macedonia	There are some cases, for particular species, which are protected by the municipality, or protected in the frames of the particular documents concerning some protected area.
Sweden	The species action plans mentioned above are carried out on the regional level but initiated on the national level.
The Netherlands (combined)	Some (about four or five) small reserves where management is aimed at preserving certain groups of fungi.

Outcomes

In the section, we aimed at drawing attention to conservation plans and projects specifically oriented to wild fungi, like protected areas management plans, conservation measures applied in Natura 2000 sites, LIFE projects dedicated to fungal species, etc.

The number of positive answers with precise indication of plans/projects is very low, and there is a clear majority of “no” answers, both at national and sub-national level, which highlights a widespread lack of projects and action plans dedicated to conservation of fungi in Europe.

While it is also important to stress that members of JoNeF, as well as many respondents not belonging to the JoNeF team, are well knowledgeable about fungal conservation, we cannot exclude that a negative or “NA” answer is due to a lack of knowledge on this topic due to the difficulty of finding information, or to the limited number of respondents we could reach. In many European countries there are no databases on conservation projects, protected areas management plans, active conservation measures implemented on a national or local scale.

4.4 Species Lists

Authors: Artemis Diana Treindl, Stephen Mifsud

Compiling comprehensive species lists for macrofungi is a challenging task due to a couple of factors.

Fungi are among the most species rich and diverse branches of life but compared to plants and animals, the biodiversity of fungi is understudied. They are elusive in nature, often hidden underground and their study is time and resource intensive.

Furthermore, many fungal species are difficult to identify even by experts and their identification is becoming more and more dependent on molecular techniques. Another significant factor is the comparatively low number of mycologists: the ratio of mycologists to the number of described macrofungi is the lowest compared to experts studying the plant and animal kingdoms and hence, the available data is less abundant or not fully verified.

This section regards the availability and status of species lists (checklists and Red Lists) for macrofungi in Europe.

It includes 3 main questions, as follows.

Is there a national check-list of Fungi?

- If yes, please indicate the bibliographic reference
- If yes, how many species on the list?
- If yes, are data accessible on line?
- If yes, are data available to citizens?
- If yes, please share the link
- If yes, are data geolocated?

Are there sub-national lists of Fungi?

- If yes, please indicate the bibliographic reference
- If yes, are data accessible on line?
- If yes, are data available to citizens?
- If yes, please share the link
- If yes, are data geolocated?

Is there a national officially approved Red List of Fungi?

- If yes, is it created using current IUCN criteria?
- If yes, please indicate the bibliographic reference
- If yes, how many species on the list?
- If yes, are data accessible on line?
- If yes, are data available to citizens?
- If yes, please share the link
- If yes, are data geolocated?

Species checklists are intended to identify a set of taxa belonging to a particular taxonomic group, occurring in a geographic region, or grouped by a thematic context (e.g. invasive species), or some combination of all three. Checklists may range from simple lists of species names to annotated checklists with metadata on taxonomy, threat status, distribution, and basic descriptive information etc.

National and sub-national species lists

The results of the survey show that most European countries has produced checklists of at least some fungal groups or geographic regions or are in the process of preparing them.

Of the 31 European countries who participated in the survey, 18 countries have published checklists for macrofungi. However, the quality and scope of these checklists is variable, with some focusing on specific groups of fungi such as polypores[7], boletes, or single genera of basidiomycetes. Some other checklists, such as those from Latvia and Hungary, are outdated and now considered as unreliable. There are 12 countries with published national checklists, and in two additional countries (Iceland and Latvia) they are in preparation and planned to be published soon (Figure 29). Some countries such as Finland, France, Sweden, and Switzerland provide their checklists on online database platforms.

The countries which have a national checklist or databases are: **Austria**, ca. 4500 species (Dämon & Krisai-Greilhuber, 2017); **Denmark**, ca. 9200 species (Danish Mycological Society, 2016-2024); **Finland**, ca. 8000 species (FinBIF, 2023); **France**, ca. 5000 species (est.) (MNHN & OFB, 2003–2024); **Ireland**, ca. 3800 spp. (Legon et al., 2005); **Italy**, ca. 4200 sp. (Onofri et al., 2005); **Montenegro** ca. 1000 sp. (Perić & Perić, 1997; Kasom, 2013); **Poland**, ca. 3500 sp. (Wojewoda, 2003; Chmiel, 2006); **Romania**, ca. 8000 sp. (Bontea 1985-1986; Sălăgeanu & Sălăgeanu, 1984; Tănase et al., 2009); **Sweden** (not numerated), (SLU, 2024); **Switzerland**, ca. 10,000 species (SwissFungi, 2024); **The Netherlands**, ca. 6000 sp. (Arnolds & van den Berg, 2013); **Turkey** ca. 5000 sp. (Sesli et al., 2020) and the **United Kingdom**, ca. 3800 spp. (Legon et al., 2005). Of these, the checklists for Austria, Montenegro, Poland, Romania, and Turkey are not available online and are not free to the public as they are hardcopy publications (books). Hence only Denmark, Finland, France, Italy (partially), and the Netherlands have a national checklist which is freely accessible to the public online (see respective references below).

Five European countries which do not have a national checklist, offer checklists for smaller regions or municipalities (Figure 30). These are **Belgium** (e.g. Walleyn & Vandeven, 2006; Declercq & Leysen, 2017); **Estonia** (e.g. Saar et al., 2007), **Germany** (e.g. Besl & Bresinsky, 2009; Lohmeyer & Karasch, 2009-2024), **Malta** (e.g. Mifsud & Mifsud, 2023), **Portugal** (e.g. Natário et al., 2019) and **Romania** (e.g. Pál-Fám et al., 2023). Most of these publications are available online and reference is given to their location either through the toponyms of the areas found or by direct geolocations.

Red Lists

Official national Red Lists for macrofungi are available from 19 out of the 31 European countries that responded to the survey (Figure 31).

Some of these Red Lists are outdated (i.e. Belgium, Latvia, Malta, Hungary) as before the year 2000, evaluations were not based on current IUCN criteria. A new updated Red List of Latvia is in its final

[7] Polypores are a group of fungi that form large fruiting bodies with pores or tubes on the underside.

preparation and planned to be published in 2024. Some of the more recent Red Lists did also not employ the current IUCN Criteria (i.e. Poland, Serbia, Slovenia, and the Netherlands).

Countries with official Red List following IUCN criteria are Austria (Dämon & Krisai-Greilhuber, 2017), Croatia (Tkalčec et al., 2008), Denmark (Læssøe et al., 2019), Estonia (Saar et al., 2019; Jüriado et al., 2022), Germany (FANC, 2017), Italy (Rossi et al., 2013), Macedonia (Karaldev et al, 2021), Romania (Tănase & Pop, 2005), Sweden (SLU, 2020) and Switzerland (Senn-Irlet et al., 2007). Nine of these Red Lists or Red Data books are available to the public online (Croatia, Denmark, Estonia, Germany, Italy, Macedonia, Sweden, and Switzerland (Table 17). There is significant variability in the number of evaluated species in each country's Red Lists and often, only a subset of all macrofungal species present were included. Fewer countries aimed to evaluate as many species as possible (e.g. Denmark, Finland, France, Sweden, Switzerland). The number of evaluated species ranges from 13 (Italy) to 4'450 (Austria). Out of these, the proportion of species categorized as some level of threatened (VU, EN or CR) varies from 6% (Finland) to 77% (Italy).

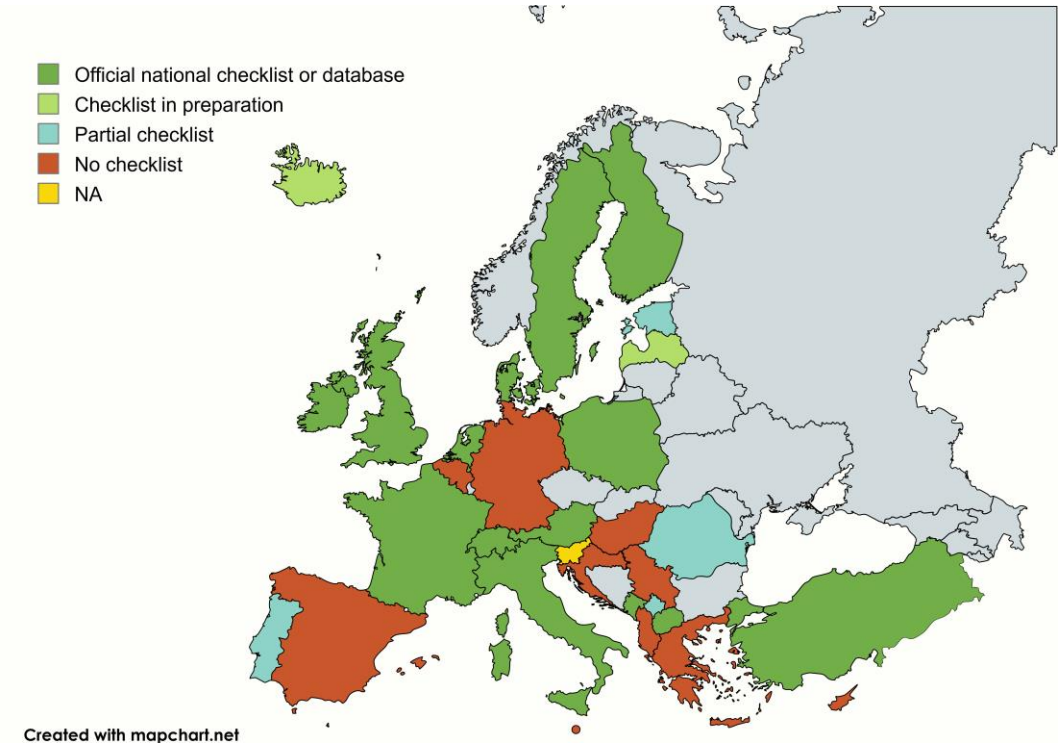


Figure 29. Availability and status of national fungal checklists in Europe.

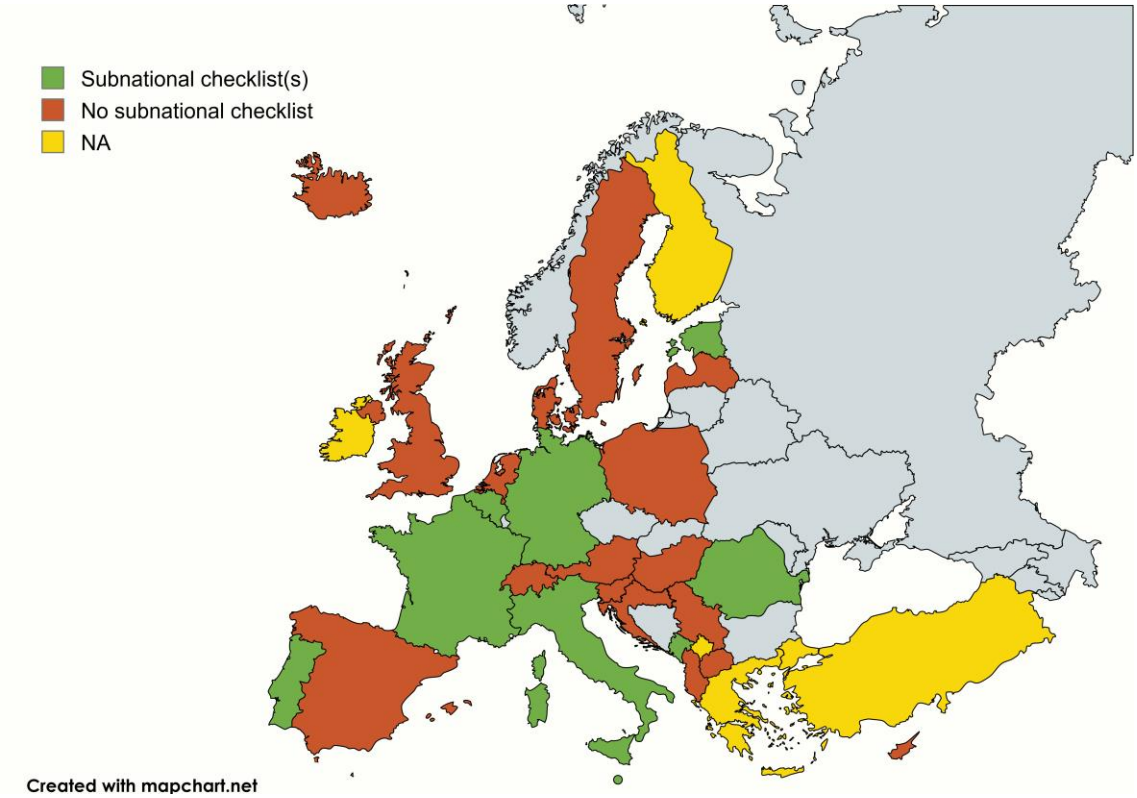


Figure 30. Availability and status of subnational fungal checklists in Europe.

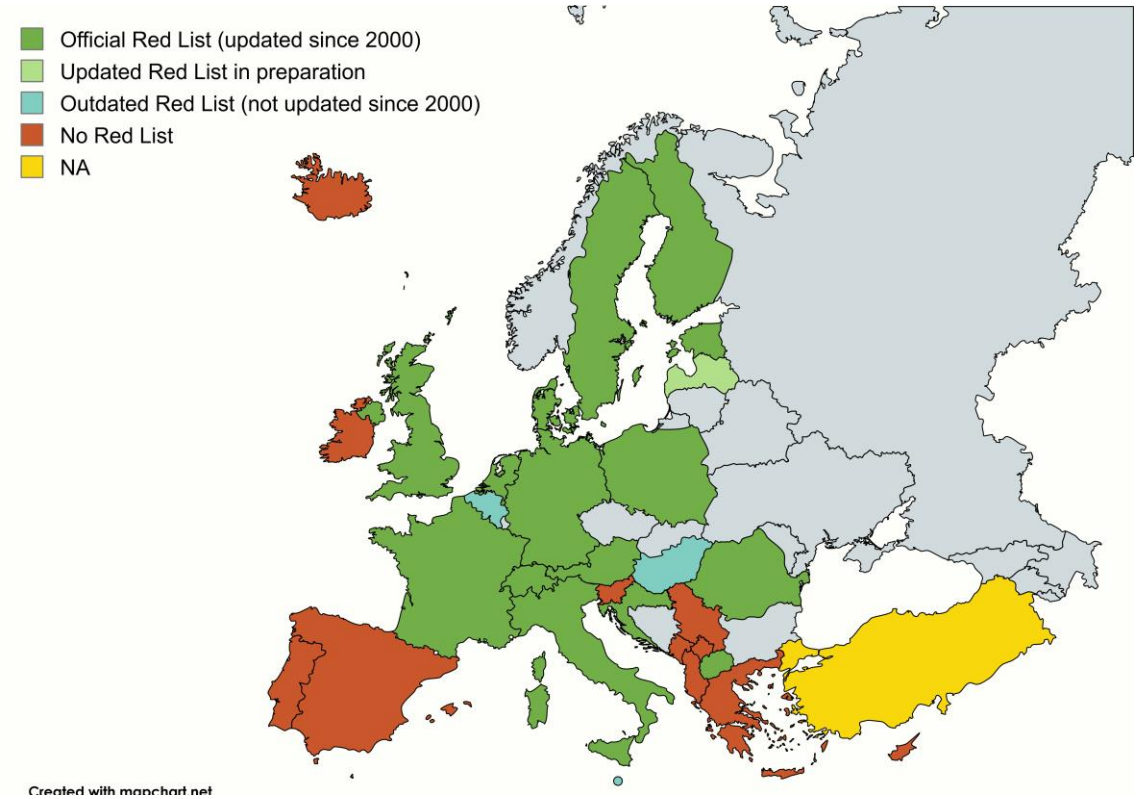


Figure 31. Red Lists of macrofungi in Europe.

Table 17. National Red List of fungi employing IUCN criteria.

Country	No. of species evaluated	No. of species threatened (VU, EN, CR) 8	Data accessible online	Data available to citizens
Austria	4’450	1’300		
Croatia	349	251	x	x
Denmark	3’092	572	x	x
Estonia	214	94	x	x
Finland	3’973	250	x	x
Germany	ca. 3’000	ca. 900	x	x
Italy	13	10	x	x
North Macedonia	213	122	64[9]	64
Romania	179	72		
Sweden	3’628	263	x	x
Switzerland	2’956	937	x	x

[8] Numbers do not include species categorized NT or DD

[9] https://redlist.moepp.gov.mk/species-summary-page/#fungi

https://manu.edu.mk/contributions/NMBSci/Papers/2023_42_43_3.%20Karadelev.pdf

4.5 Data collection, Databases and Fungaria

Authors: Katerina Rusevska, Inge Somhorst, Livia Fodor Kisné

This section regards to the representation of the national and local data collections, databases and fungaria, as well as existence of national monitoring plans, protocols and indicators used regarding fungi in 32 countries which answered the questions of this part of the survey.

It included seven main questions, as follows.

- Are there official and/or national monitoring plans for Fungi?
  - If yes, please provide details and purposes.
  - If no, would you recommend it and why?
- Are there official and/or national protocols/methods for data collection in fields?
  - If yes, please provide the details.
- Is there any central database and/or information system for organizing the data concerning Fungi?
  - If yes, how many records are in the database/information system?
- Are there indicators used to show the results of Fungi monitoring and to evaluate fungal species/communities' trends?
  - If yes, please describe them.
- Are there indicators used to analyse the quality and/or conservation status of an habitat/area?
  - If yes, please provide more details.
- Is there a national fungarium?
  - If yes, please provide more details.
- Are there local fungaria?
  - If yes, please provide more details.

One third of the countries have monitoring plans and protocols for data collection in fields; part of these plans and protocols are in the frame of the national biodiversity strategies or other similar relevant documents which are concerning rare and/or protected species. The other countries recommend their needs. Based on the answers, there are very different approaches to the concept of monitoring, and because of the short answers, it is not possible to analyse the details. For most respondents monitoring means mainly to collect the data of selected fungi species, and in 1-2 cases about regularly survey the fungal diversity (fungi/habitat association) of a given area.

Half of the countries have central database and/or information system for organizing the data concerning fungi. In the other half there are attempts to introduce them or to find other ways (such as usage of data from GBIF[10] or iNaturalist[11]).

Similarly, half of the countries reported developing macrofungal indicators for monitoring and analysing the quality and conservation status of a habitat/area. In the future, it is expected that the assessment of the state of nature, vulnerability and linked measures are based on databases. There are several well-established databases with online access, including a lot of data. Elsewhere, work is beginning or planned.

Fungaria (national and local) are present in half of the countries. Most of them are located in the appropriate nationals' museums (usually natural museums), botanical gardens, universities or in some cases there are private collections. In some countries there are several national or private fungaria.

In nine countries there are official and/or national monitoring plans for fungi, in three it is "NA", and 19 countries are without official and/or national monitoring plans for fungi, but most of them underlined that are willing to have them. In some countries there are current projects concerning monitoring of selected fungi (Figure 32 and Table 18Table 18).

[10] GBIF is the Global Biodiversity Information Facility: https://www.gbif.org/

[11] iNaturalist is a Community for Naturalists: https://www.inaturalist.org/

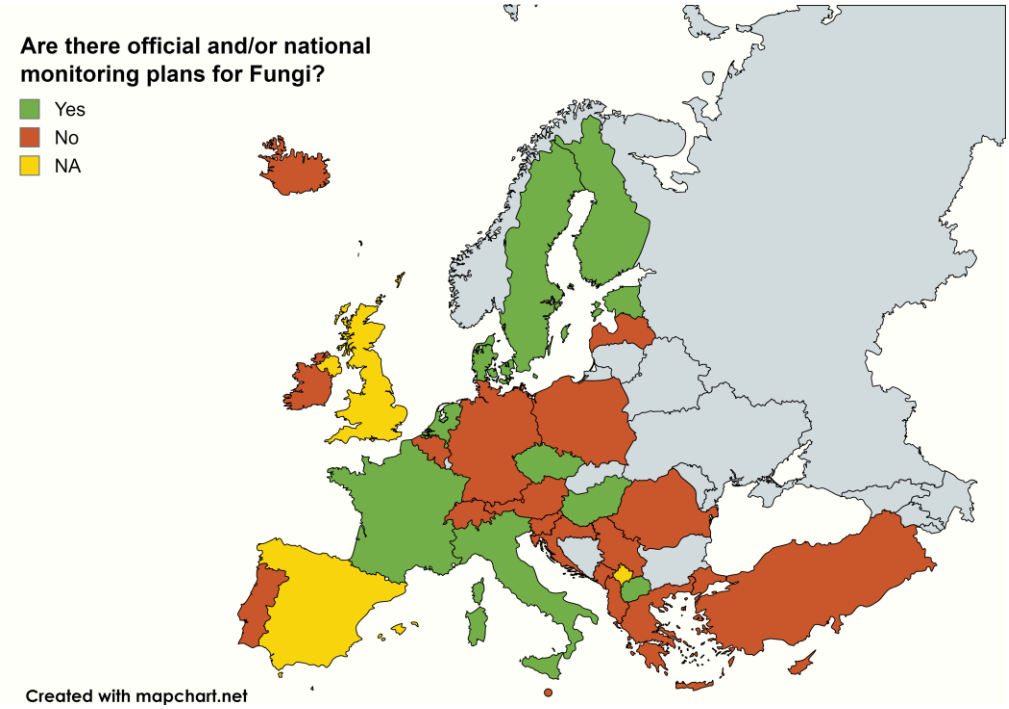


Figure 32. Map of countries that reported having official and/or national monitoring plans for fungi.

Table 18. Official and/or national monitoring plans for fungi.

Country	Details and purposes of existing plans	Desirability of the existence of plans and reasons
Denmark	For the Natura2000 network 13 wood-inhabiting fungi are regularly monitored. Besides fungi are included in the national monitoring of unmanaged forest reserves (polypores + all fungi via eDNA)	
Estonia	Only for the few species protected under the highest grade (I).	
Finland (combined)	Biomonitoring. Monitoring common fungi, 100 species and monitoring indicator fungi (for valuable forests) Mobile app for monitoring fungi: Mobiilivihko (for free, for android)	Need also for semi-natural habitats, and in nutrient poor boreal forest fungi
France	Inventaire National du Patrimoine Naturel Citizen science project: observation (of fungi) Biomon-project: monitoring and “complete lists”, starting 2024 with fungi: 1) monitoring about 290 most toxic and commonly used species (and other taxa) for food & lookalikes–- so called “practical fungi list”) 2)“bracked fungi list” (polypores & corticioid fungi) 225 species/taxa 3) 150 species/taxa of fungus and 50 lichen”" is to be created during spring 2024 and probably also“indicator fungus (of valuable forests of Finland) list is also coming.	

	Biodiversa + FunDive-project, which has Citizen science (WP3) and monitoring plans.	
Hungary	In the frame of HBMS (Hungarian Biodiversity Monitoring System). Objective 1: Investigating the effect of silviculture on the species richness of deciduous forests (linked to forest reserves). Different forestry activities modify the deciduous forests species richness. Goal 2: Trend monitoring of forest associations. 500 m^2 standard sampling sites, species and number of fruit bodies are recorded. One sampling period is 3 years (6-8 occasion/year). Derived parameters: trends in species number/ fruit bodies number (abundance) / diversity indexes/ functional spectrum (myc/sap/par)/ proportion of protected species/ proportion of red-listed species	
Italy (combined)	The Network for the study of mycological diversity (NMD) of ISPRA will start a national monitoring initiative with experimental protocols	Yes
North Macedonia	In the frame of national strategy for biodiversity; link to the national strategy (2017-2027) https://www.moepp.gov.mk/wpnag	
Sweden	One project on monitoring habitats and species in natural grassland. Purpose is to map these but also raise awareness to the public authorities.	
The Netherlands (combined)	NEM monitoring programs. Network Ecological Monitoring: collection of nature data for policy purposes and international obligations (European habitats directive) https://www.netwerkecologischemonitoring.nl/ 3 NEM monitoring projects (1. outer dune area (shifting dunes and fixed dunes in part; 2. woodland on sandy soils; 3. sphagnum vegetations)	

In nine countries there are official and/or national protocols/methods for data collection in fields (in part of these countries, data are concerning protected/rare species), in two it is “NA”, and 20 countries have no official and/or national protocols/methods for data collection in fields (Figure 33 and Table 19).

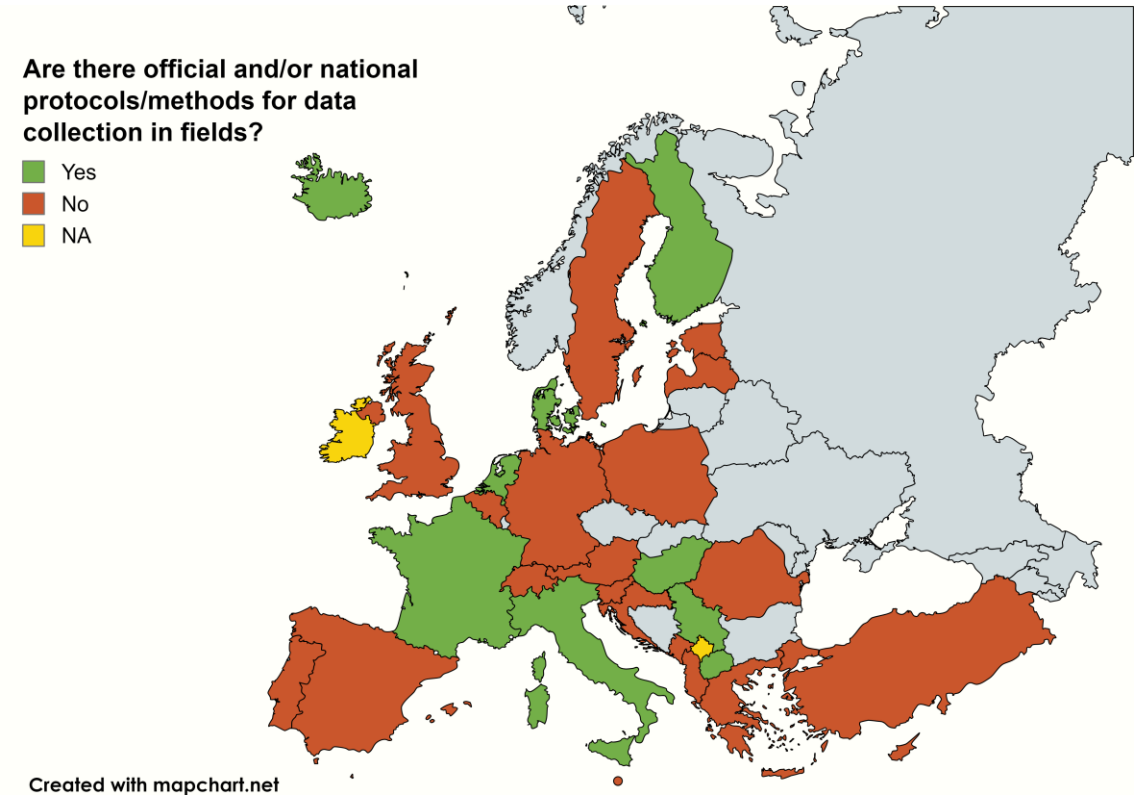


Figure 33. Map of countries that reported having official and/or national protocols/methods for data collection in fields.

Table 19. Official and/or national protocols/methods for data collection in fields.

Country	Details on existing data collection protocols/methods[12]
Denmark	For details, see: https://ecos.au.dk/fileadmin/ecos/Fagdatacentre/Biodiversitet/TAN01TerrestriskeNaturtyperV4_1.pdf , https://ecos.au.dk/fileadmin/ecos/Temasider/UroerteSkove/20220427_TA_Uroertskov_Niveau2.pdf and https://ecos.au.dk/fileadmin/ecos/Temasider/UroerteSkove/20230309_TA_Uroertskov_Niveau3.pdf
Finland (combined)	E.g. Made for mobile app monitoring
France	The prescribed protocol for methods and data collection in the field is described in FONGIBASE by ADONIF (for mapping, data collection, and red-listing) based on the Nature and Landscape Information System (SINP) edited by the Muséum National d'Histoire Naturelle de Paris (MNHN)

[12] Information reported for each country in case of yes-answer.

Hungary	There is a protocol in the frame of HBMS (Hungarian Biodiversity Monitoring System) for sampling biodiversity of fungi in standard sampling plots. On the other hand, there are protocols for collecting biotic data (including fungi), the requirements are for a biotic data: taxa/date/geo-coordinates/name of collector and who identified/amount of each observed taxa. Protocol for fungi monitoring: https://termeszetvedelem.hu/_user/downloads/mintavetel/gomba5_2008_0609.pdf
Iceland	Name of the fungus, name of the site and GPS coordinates, region (sýsla), biogeographic divisions used for distribution of species, habitat and substrate, date of collection, collector and who identified the specimen.
Italy (combined)	The Network NMD of ISPRA published Guidelines for the census and monitoring of macromycetes in Italy with the aim to establish national common rules and standard to be used by mycologists who participate at the national fungal census activity. Girometta C.E., Floccia F., Leonardi M., Bianco P.M., 2023. Link: https://ndm.isprambiente.it/en/go-to-the-field/guidelines-for-the-census-and-monitoring-of-macromycetes-in-italy/
North Macedonia	Law for Nature protection, link https://ener.gov.mk/files/propisi_files/doc1/86_139848121%D0%9F%D1%80%D0%BE%D0%BF%D0%B8%D1%81_%D0%97%D0%B0%D0%BA%D0%BE%D0%BD%20%D0%B7%D0%B0%20%D0%B7%D0%B0%D1%88%D1%82%D0%B8%D1%82%D0%B0%20%D0%BD%D0%B0%20%D0%BF%D1%80%D0%B8%D1%80%D0%BE%D0%B4%D0%B0%D1%82%D0%B0%20(%D0%BF%D1%80%D0%B5%D1%87%D0%B8%D1%81%D1%82%D0%B5%D0%BD%20%D1%82%D0%B5.pdf
Serbia (combined)	Only for the protected species. It is forbidden to: damage the mushroom mycelium during collection; collect fruiting bodies of porcini mushrooms, *Lactarius* mushrooms, with a diameter of less than 4 cm; collect fruiting bodies of chanterelles and black trumpets with a diameter of less than 2 cm; when collecting mushrooms, use rakes and similar tools, destroy and damage the habitat; collect mushrooms near traffic roads and at waste disposal sites; old specimens with signs of rotting; collect more than two-thirds of the individuals at the collection point; when collecting underground mushrooms, damage the roots of forest trees. It is forbidden to use or put into circulation: 1) protected types of *Boletus* and *Lactarius* mushroom, diameter below 4 cm; 2) protected species of chanterelles and brown trumpets with a diameter of less than 2 cm; 3) old specimens of protected mushroom species with signs of rotting.
The Netherlands (combined)	Protocols from the NEM monitoring program https://www.mycologen.nl/downloads/handleiding_paddenstoelmeetnetten_2023.pdf

Half of the total number of countries that answered the survey (15) have as central database and/or information system for organizing the data concerning fungi, and part of them wrote the name of the collection and/or the total number of data they have. From the other half of the countries which are without database systems (15) or answered NA (1), in some of them there is an effort to make it or use some other options, like using of data form GBIF (see Figure 34 and Table 20).

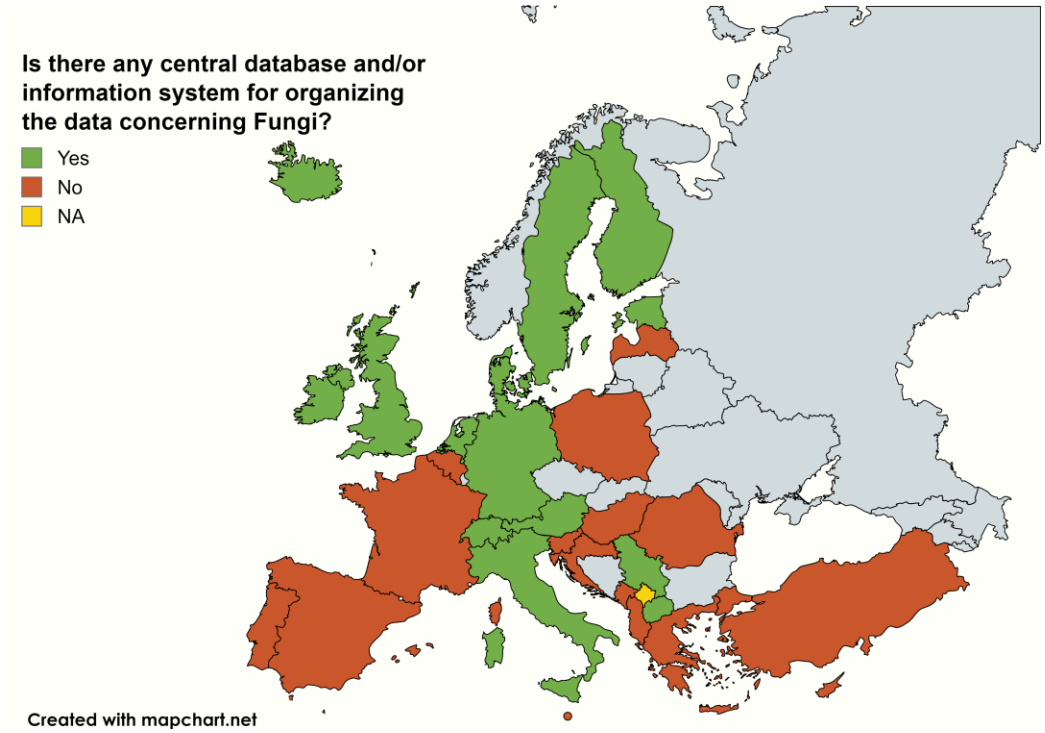


Figure 34. Map of countries that reported having central database and/or information system for organizing the data concerning fungi.

Table 20. Central databases and/or information systems for organizing the data concerning fungi.

Country	Number of records of the central database/information system
Austria	715.221
Estonia	Plutof database contains 1,538,076 fungal records from Estonia
Finland (combined)	Species.fi, Taxon Editor
Iceland	14300 records
Ireland	National Biodiversity Data Centre
Italy (combined)	The fungi Information System (SIF) of ISPRA contains 1500 concerning more than 500 fungal
North Macedonia	~37000, the data base is not public
Serbia (combined)	Inside the Mycological society of Novi Sad
Slovenia	13.121 in 2022
Sweden	3.916.497 records (including lichens) between 1/1/1900 and 21/11/2023

Switzerland	72.326
The Netherlands (combined)	2.000.000 –- 3.000.000 observation-data
UK	Recording databases

Ten countries reported using fungal indicators to analyse the quality and conservation status of a habitat or area. Some indicators are not official or are included in other documents (such as the National Biodiversity Strategy or the Natura 2000 system) or have been developed for selected habitats or are represented by the number of fungal species from the national Red List. Also, there are some other indicators that can contribute to the conservation status of a habitat/area. For example, the proportion of protected species/ proportion of red-listed species can help supporting the expert judgement regarding the conservation status. These indicators are in the protocol of monitoring system regarding fungi, in the section of data assessment. In the rest of the countries, for 15 there aren't these types of indicators and for 6 no information was given (see Figure 35, Figure 36 and Table 21).

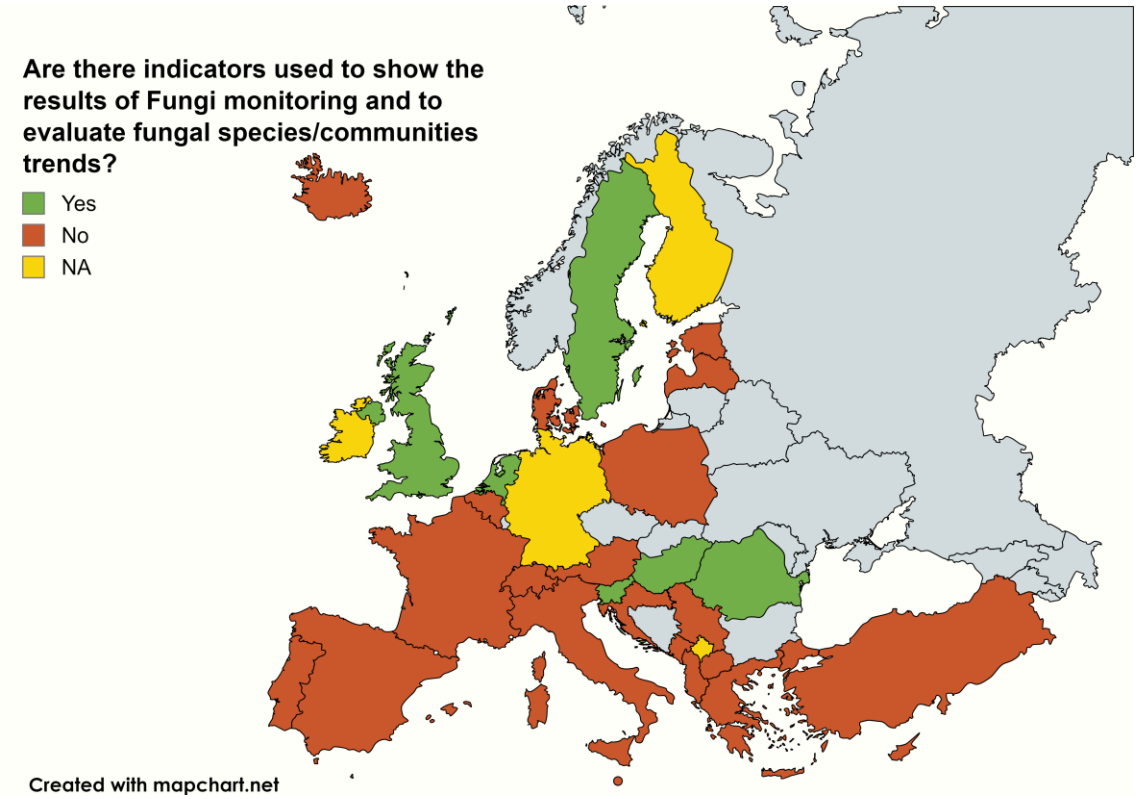


Figure 35. Map of countries that reported indicators used to show the results of fungi monitoring and to evaluate fungal species/communities' trends.

Table 21. Indicators used to show the results of fungi monitoring and to evaluate fungal species/communities' trends.

Country	Details on existing indicators
Hungary	In the monitoring protocols there are guidance how the data should assess. These are: trends in species number/ fruit bodies number (abundance) / diversity indexes/ functional spectrum (myc/sap/par)/ proportion of protected species/ proportion of red-listed species
Romania (combined)	Kálmán László Mycological Society has some indicators
Slovenia	https://boletusinformaticus.si/stat_vnos.aspx - upward trend
Sweden	Trends of areas and numbers of substrates (i.e. dead wood) are used as indicators.
The Netherlands (combined)	Selected species that are monitored in the NEM monitoring program (for instance N-sensitive ECM species) are used in trends
UK	Indicators are used to designate sites for legal protection

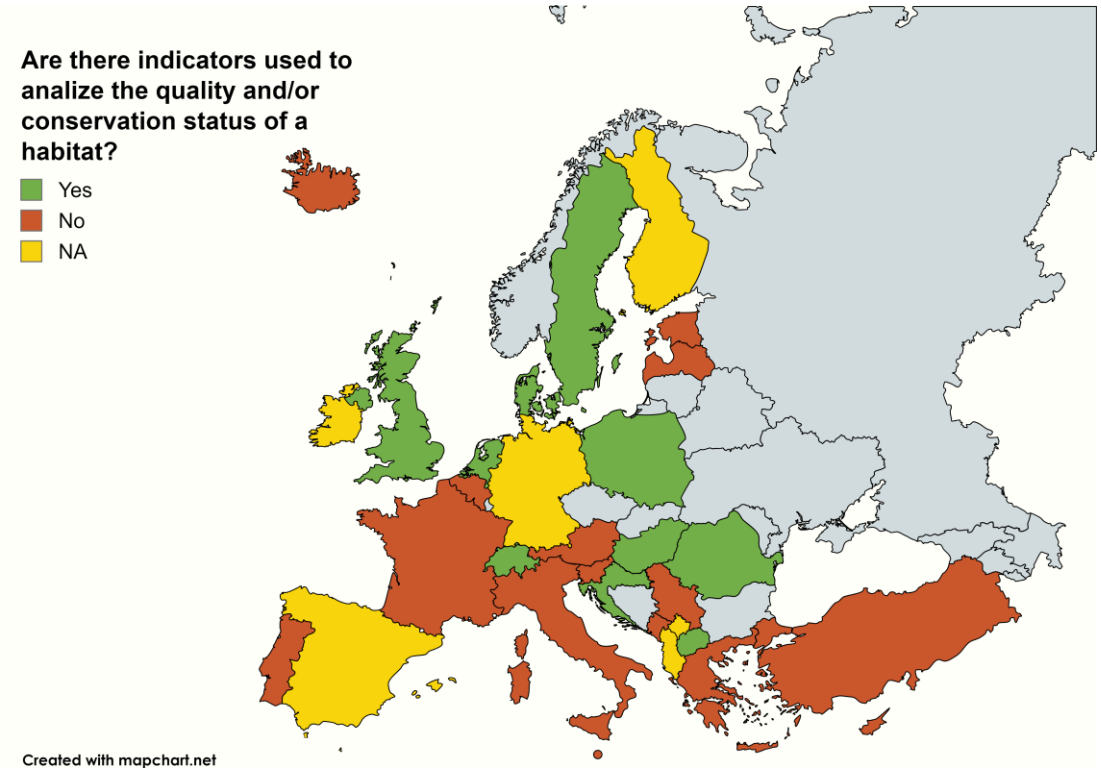


Figure 36. Map of countries that reported indicators used to analyse the quality and/or conservation status of a habitat/area.

Table 22. Indicators used to analyse the quality and/or conservation status of a habitat/area.

Country	Details on existing indicators
Croatia	Indicators: number of fungal species in Red List of Croatian Fungi and their status of threat
Denmark	Not officially, but various indicator lists are sometimes used
Hungary	Proportion of protected species/ proportion of red-listed species can help the support the expert judgement regarding the conservation status. These indicators are in the protocol of monitoring system regarding fungi, in the section of data assessment.
North Macedonia	National strategy for biodiversity; link to the national strategy (2017-2027) https://www.moepp.gov.mk/wp-
Poland	As for Natura 2000 system
Sweden	Trends of areas and numbers of substrates (i.e. dead wood) are used as indicators.
Switzerland	Indicator species for biodiversity assessment in forest; indicator species for agriculture (which ones should be promoted)
The Netherlands (combined)	incidental, not structured; in habitats that are monitored for fungi in the Network Ecological Monitoring
UK	See use of assemblages in https://hub.jncc.gov.uk/assets/d1fcb171-8086-4f5b-ade5-a34c5edc78c5

In 17 countries there is at least one national fungarium, most of them located in the national museums, botanical gardens, or universities, as well as in centres for biodiversity or some other nature centres. In some countries, such as Estonia, Italy, Montenegro, and Switzerland there are two, in UK and Montenegro (one is private) three and in Sweden five. Eight countries do not have a national fungarium and for six countries this question is “NA”. See Figure 37 and Table 23.

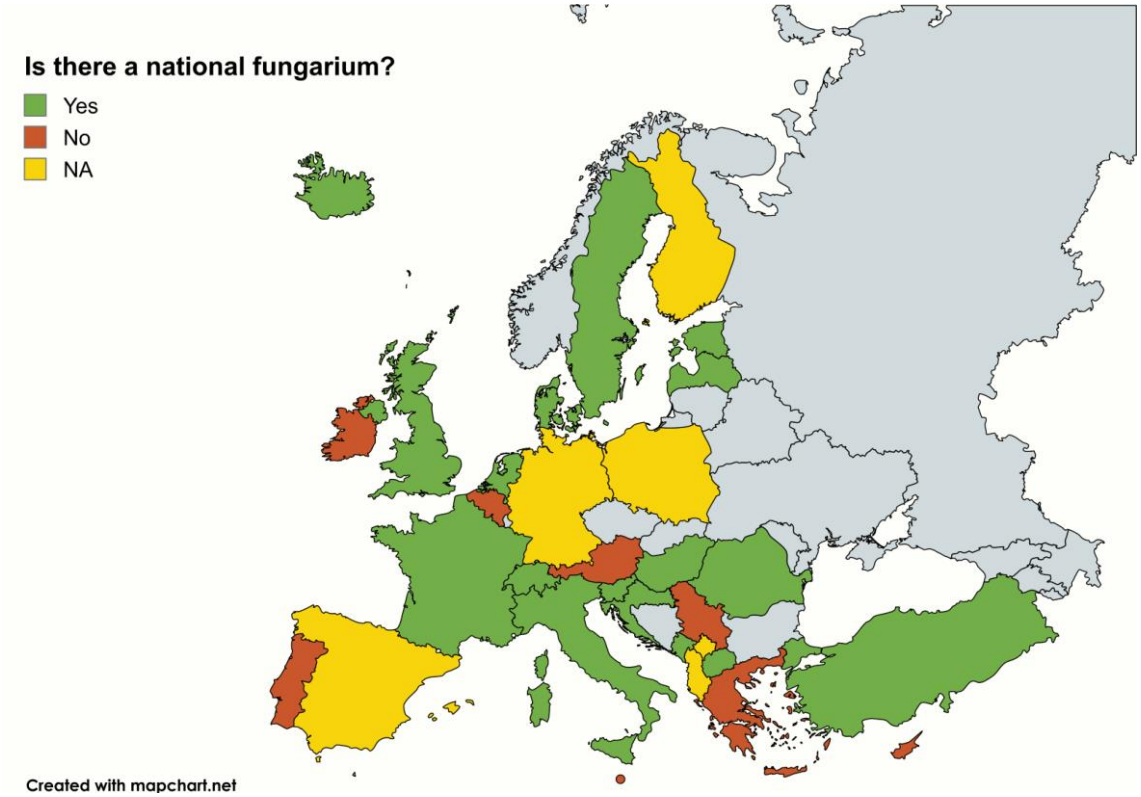


Figure 37. Map of countries that have national fungaria.

Table 23. Information reported by countries that have national fungaria.

Country	Details on national fungaria
Croatia	Croatian National Fungarium (CNF), more than 30.000 specimens.
Denmark	Please see https://samlinger.snm.ku.dk/en/dry-and-wet-collections/botany/fungal-herbarium/
Estonia	There are two: TUF and TAAM
France	Muséum National d'Histoire Naturelle de Paris
Hungary	Fungaria of the Natural History Museum http://www.nhmus.hu/en/collections/department_of_botany/macrofungi_collection
Iceland	Náttúrufræðistofnun Íslands in Akureyri, a division of the herbarium AMNH.
Italy (combined)	There are two national fungaria: 1. the national Italian fungarium of ISPRA has been operating since 2022 at the ISPRA headquarters of Ozzano dell'Emilia (Bologna) both for conservation of samples and genetic analysis. It is registered in the Index Herbariorum with the Code: IFI 2. The Erbario Micologico of the Mycological Association Bresadola (AMB).
Latvia	Fungarium of Latvian Museum of Natural history (10 000 specimens).
North Macedonia	The National fungarium is Macedonian Collection of Fungi (MCF) and is located in the Mycological Laboratory, Institute of Biology, Faculty of Natural Science and Mathematics, Ss.

	Cyril and Methodius University in Skopje; there are more than 20.000 samples from different countries.
Montenegro	There is a fungarium in the Environmental Protection Agency of Montenegro and in the Natural History Museum of Montenegro. There is also a private collection – the fungarium of mycologist Branislav Perić, and the new species for science described by Perić and foreign colleagues are located in registered fungarium outside Montenegro.
Romania (combined)	The Mycological Herbarium of the Institute of Biology Bucharest (BUCM) http://sciweb.nybg.org/science2/IndexHerbariorum.asp and http://sweetgum.nybg.org/ih/
Slovenia	In Forestry Institute Slovenia.
Sweden	There are in Lund, Göteborg, Stockholm, Uppsala and Umeå.
Switzerland	There are two, one in Zurich and one in Geneva.
The Netherlands (combined)	Naturalis Biodiversity Centre; national collection of all groups of macro-organisms.
Turkey (combined)	There is a fungarium at Selcuk University.
UK	National Fungaria at Kew and Edinburgh, lichens in Natural History Museum, London

The presence of local fungaria is quite common in most of the countries (14). As national fungaria, most of them are in national museums, botanical gardens, or universities. In a few cases there are also private local fungaria, which are not considered either a national or a local fungarium. In eight countries there aren't local fungaria and in nine there is no information. See Figure 38 and Table 24.

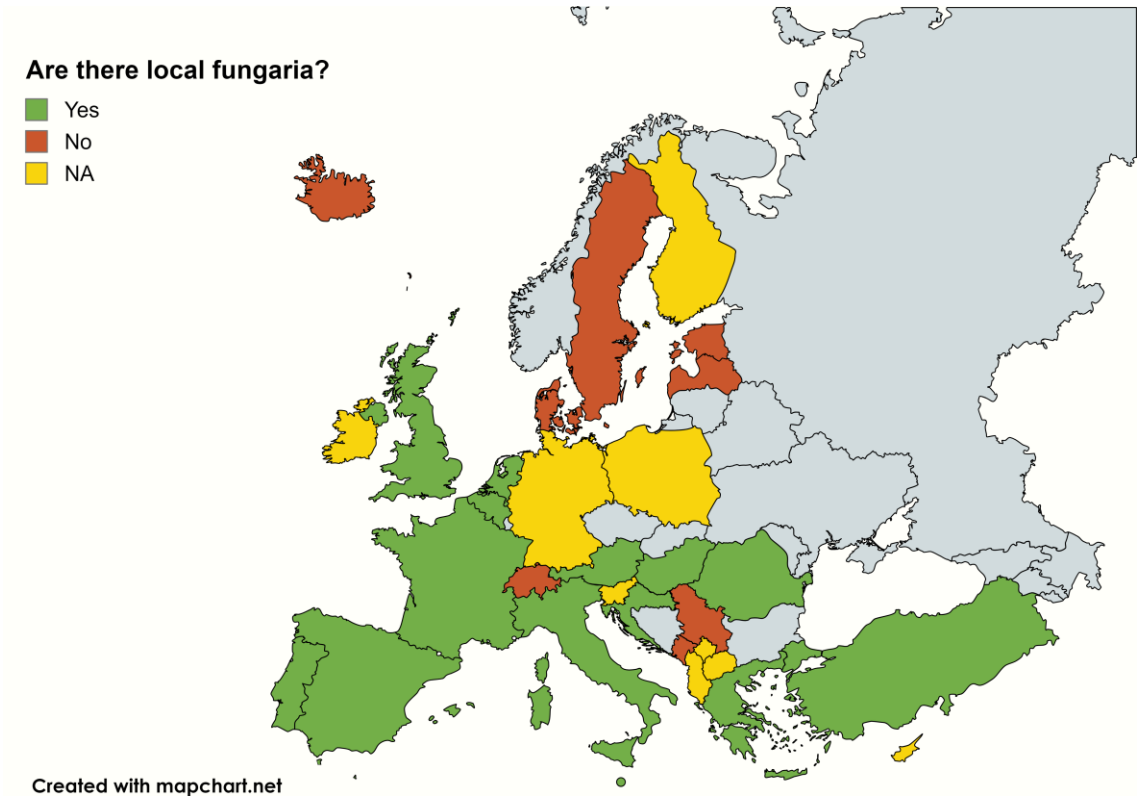


Figure 38. Map of countries that have local fungaria.

Table 24. Information reported for countries that have local fungaria.

Country	Details on local fungaria
Austria	There are several mycological collections within public herbaria, e.g. W, WU-MYC, IB, SZU, GZU, GJO, KL, LI
Belgium	https://www.plantentuinmeise.be/nl/pQzmWIx/fungi
Croatia	DA, Natural History Museum Split, unknown number of specimens.
France	The fungaria of the different universities are not connected
Greece (combined)	There are fungaria at public research institutes and universities. There are also personal fungaria (individual or of groups of citizen scientists)
Hungary	Universities: ELTE, SzTE, MATE Budai Campus Museums: Szombathely, Zirc, Sárospatak, Pécs Debrecen Personal fungaria (not opened)
Italy (combined)	There are several local fungaria both in Museums and among local Mycological Associations. For example: • the Herbarium Universitatis Senensis (SIENA), fungarium section • the data of exsiccata are accessible on-line (www.anarchive.it) • the fungarium of the Mycological Association Bresadola (AMB) in Vicenza • the fungarium of the Association of Tuscan Mycological Groups (AGMT) in Tuscany • the fungarium of the Venetian Society of Mycology in Venice • the Science Musuem of Trento.
Malta	Biology department at the University of Malta holds a collection of some 300 specimens of fungi collected by Michael Briffa, amongst other specimens of fauna, hence not a dedicated fungarium. I was dealing with the transfer of his fungarium between his family members and the UoM.
Portugal	All the major academic institutions have herbaria with fungal collections.
Romania (combined)	Alexandru Borza Botanical Garden of Cluj-Napoca https://grbot.ubbcluj.ro/herbarul-universitatii-babes-bolyai/ and Alexandru Ioan Cuza University of Iasi, Faculty of Biology http://www.bio.uaic.ro/?page_id=9295
Spain	http://museudelbolet.cat/
The Netherlands (combined)	Natuurmuseum Fryslan (Leeuwarden), Herbarium frisicum Wolvega (both part of herbaria), private fungaria
Turkey (combined)	It is situated in Selcuk University, Konya/Turkiye. There are 25000 fungal collections from different places in Türkiye
UK	Museums

4.6 Ask the European Commission

Authors: Corrado Nai, Livia Fodor Kisné, Stefania Ercole

This section concerns what respondents think about existing national, sub-national, and European legislations and regulations concerning conservation of fungi. The respondents were asked to express possible suggestions to the European Commission for future actions related to the conservation of fungi.

It included three main questions, as follows.

- What do you think about the conservation of Fungi in your country provided through national/sub-national legislation and regulation?
- Do you think that European conservation directives and policies should explicitly include Fungi?
  - If you agree/strongly agree, what do you think would be the most effective European legislation for Fungi conservation?
  - If you disagree/strongly disagree, please explain why.
- Would you like to make proposals or suggestions to the European Commission about the conservation of Fungi?
  - If yes, please specify.

In total, we received 62 answers from respondents from the following 28 countries: Albania, Austria, Belgium, Croatia, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Kosovo, Latvia, Macedonia, Malta, Montenegro, Poland, Portugal, Romania, Serbia, Slovenia, Spain, Sweden, Switzerland, The Netherlands, Turkey, UK, USA.

Please note that in this section, due to the peculiarity of the topic, the answers were not grouped for each country and therefore the graphs show the overall number of answers provided by the respondents.

Most respondents believe that national or subnational legislations and regulations are inadequate for the conservation of fungi (Figure 39).

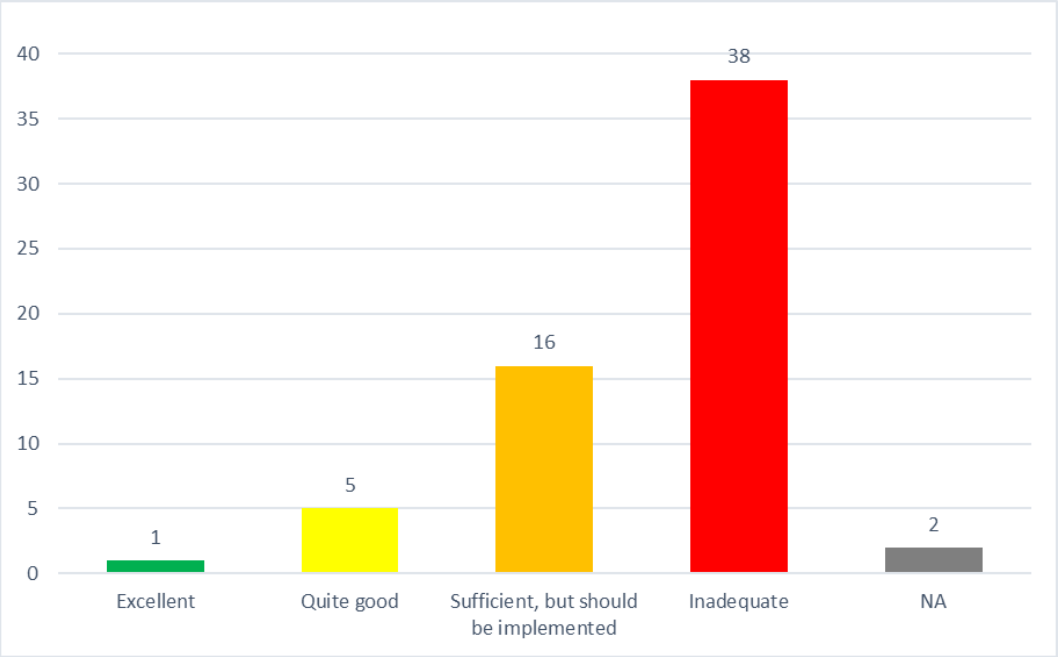


Figure 39. Number of responses to the question "What do you think about the conservation of fungi in your country provided through national/sub-national legislation and regulation?"

All the respondents strongly agree or agree that European conservation directives and policies should explicitly include fungi. No respondent disagreed and four answers are blank (classified as "NA") (Figure 40). The answers on why the respondent strongly agree or agree this statement to be true, are provided in Table 25.

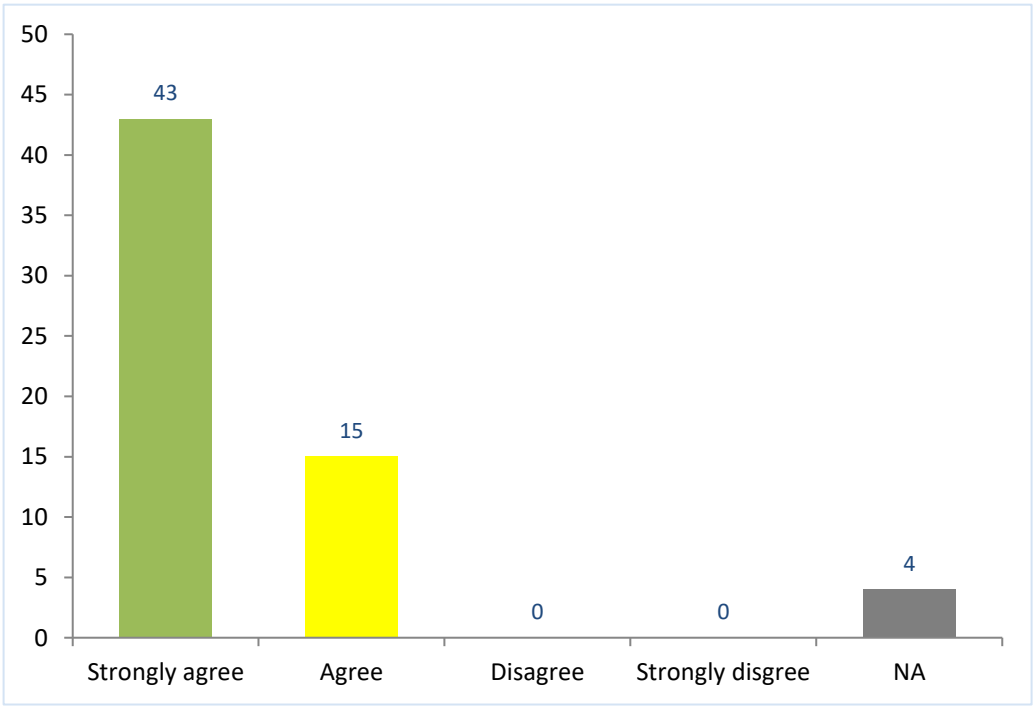


Figure 40. Number of responses to the question "Do you think that European conservation directives and policies should explicitly include fungi? "

Table 25. Responses given on the inclusion of fungi in European conservation directives and policies[13]

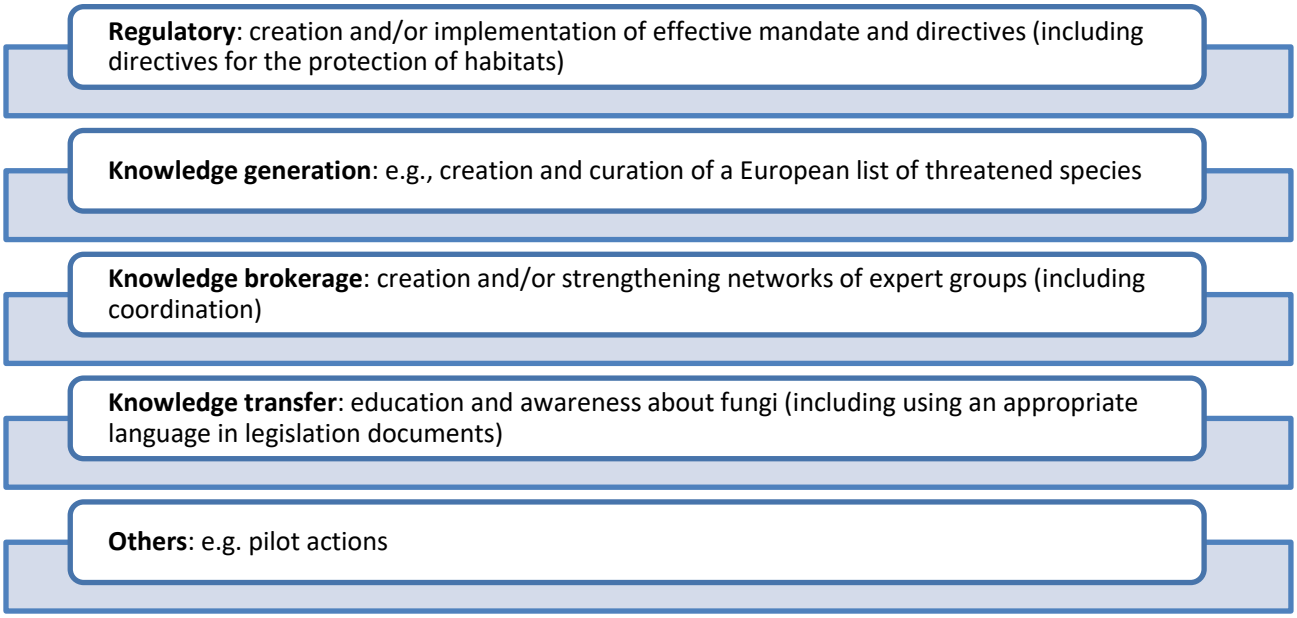
Respondent from (country)	Response on what would be the most effective European legislation for fungi conservation
Albania	Creating legislation that mandates the protection of key habitats crucial for fungal biodiversity could be effective. This could involve designating certain areas as protected zones where fungi thrive, similar to protected areas for animals and plants. Additionally, including fungi explicitly in conservation laws and policies alongside other biodiversity could enhance their protection
Austria	Habitat directive, fungi protection law, maybe within another nature protection law
Belgium	Making up a European conservation list of fungi for the Habitats directive
Denmark	Inclusion in the EU Habitat directive
Estonia	Include fungal species into Habitat Directive / Bern Convention!
Finland	Do not know what legislation but red-listed fungi and strictly protected species should be involved and recognized when the question whether the habitat is to be protected (or treated for fungi of semi-natural habitats) and how largely. European expert group for fungi should be established, where representatives of every county that has knowledge and red-listing
France	Coordinating the various national legislations
Germany	Strengthen the mycological associations
Greece	Each country should have an official list of rare and threatened species. Based on the country lists there should also be a European list. The legislation should be similar to that of IUCN
Greece	Pilot actions (in different countries) in proposed by the expert's management, collection, transportations, identification, education, certification and marking of macromycetes should be tested in practice. In this way it is possible to identify potential problems or failures and reduce potential bureaucratic procedures that, without slowing down control procedures will allow the development of European legislation according to the different needs of each country
Greece	There should be legislation that will prohibit the collection of wild fungi for specific periods and specific species. It should be allowed only for certain species and for a limited quantity and only after a relative permit. If someone fails to provide the permit should be fined and serve for a certain time in fungi conservation actions
Hungary	One of the most important the public awareness and education. I believe that role of fungi is very important in ecosystems. For this reason, I think the legislation should include fungi. On the other hand, the legal enforcement should be feasible. But the people have not enough knowledge about mushrooms for this. The most important to find the best way. What is the most efficient way to achieve enhanced conservation of fungi
Iceland	To protect habitat of fungi that need protection
Ireland	Linking fungi populations' health to habitat resilience in particular forests. Fungi conservation = habitat preservation with all their functions, including production
Italy	Implement monitoring of fungal species in nature at national level and increase gathering controls

[13] Answers providing general comments without concrete suggestions are removed.

Italy	Including fungi in the directives
Italy	Habitat directive
Italy	In no one protections measure related to Special Areas of Conservation (SAC calls ZSC, Zona Speciale di Conservation in Italy) is reported fungi conservation. Due to primary importance of mushroom in environment, European institution should introduce rules about identification of specific protection measure in SAC.
Italy	Directive, or integration of Habitat Directive
Italy	A new regulation or a modification of Habitat directive 92/43/CEE
Italy	Conservation of specific areas / environments selected on the basis of fungal inventories and Red Lists
Italy	European legislation should have a greater knowledge of the Fungi kingdom and the important relationships it has with the ecosystem. European policies should ensure that fungi is known better from school education and after, creating greater awareness and knowledge (answer translated from Italian).
Italy	Bern Convention, Habitat Directive, and other at global level
Latvia	Legislation based on habitat protection. Include fungal species into Habitat Directive / Bern Convention!
Malta	Education, Monitoring & Enforcement of a selected list of threatened fungi and selected zones that are considered as biodiversity hotspots of fungi.
Montenegro	I think that macro fungi should be included in the Annexes of the EU Habitats Directive. Also, I think that special controls and protocols for the collection of edible and medicinal species should be defined at the European level. Let's say it would be useful if every collector should get a permit for collection and that the method of collection and the amount collected can be controlled in the field. And that it is necessary to define monitoring programs and protocols and obligations to make the national Red Lists and books of endangered species, and to define criteria for the establishment of Important Fungus Areas and habitats.
Poland	Including fungi in Bern Convention and including fungi in Natura 2000 system
Portugal	Explicitly include fungi in all European biodiversity legislation
Romania	For example, that which is functioning in Hungary
Romania	EUROPEAN CHARTER ON FUNGI-GATHERING AND BIODIVERSITY, 33-rd meeting, Strasbourg, 3-6 December 2013
Serbia	Better implementation of laws, better monitoring and more effective penalty policy regarding environmental protection
Serbia	Special law for truffles in the form of preservation and protection of these species
Spain	Informative on good practices, regulation of land uses, access, mushroom picking, etc. and, if necessary, implementation of a sanctioning regime
Sweden	Red-listing on a European level, species action plans on European level, include fungal species in the species and Habitats directive
Resp. from The Netherlands	Habitat conservation with special attention on macrofungi

The questions generated answers with different focus. A need for supporting research and generation of knowledge on fungi emerged stronger in the second question. In both questions, many respondents indicated protection of habitats and creation of Red Lists as important factors for the protection of fungi.

From the answers above, it emerged that respondents believe that effective legislations for fungi protection fall within one or more of the following areas.



A summary of the areas mentioned is reported in the table below (Table 26).

Table 26. Grouping of answers in table 25 into major areas of activity (more than one area per respondent is possible).

Area for effective legislation for fungi protection	Number of answers
Regulatory (e.g., mandates and directives, including habitat protection)	23
Knowledge generation (e.g., curation of a European list of threatened species)	7
Knowledge brokerage (e.g., expert network creation, strengthening, and coordination)	3
Knowledge transfer (e.g., communication and awareness, use of inclusive language)	4
Others (e.g., pilot studies monitoring)	4

Close to 50% of respondents would like to make proposals or suggestions to the European Commission about the conservation of fungi (Figure 41). Suggestions are reported in Table 27.

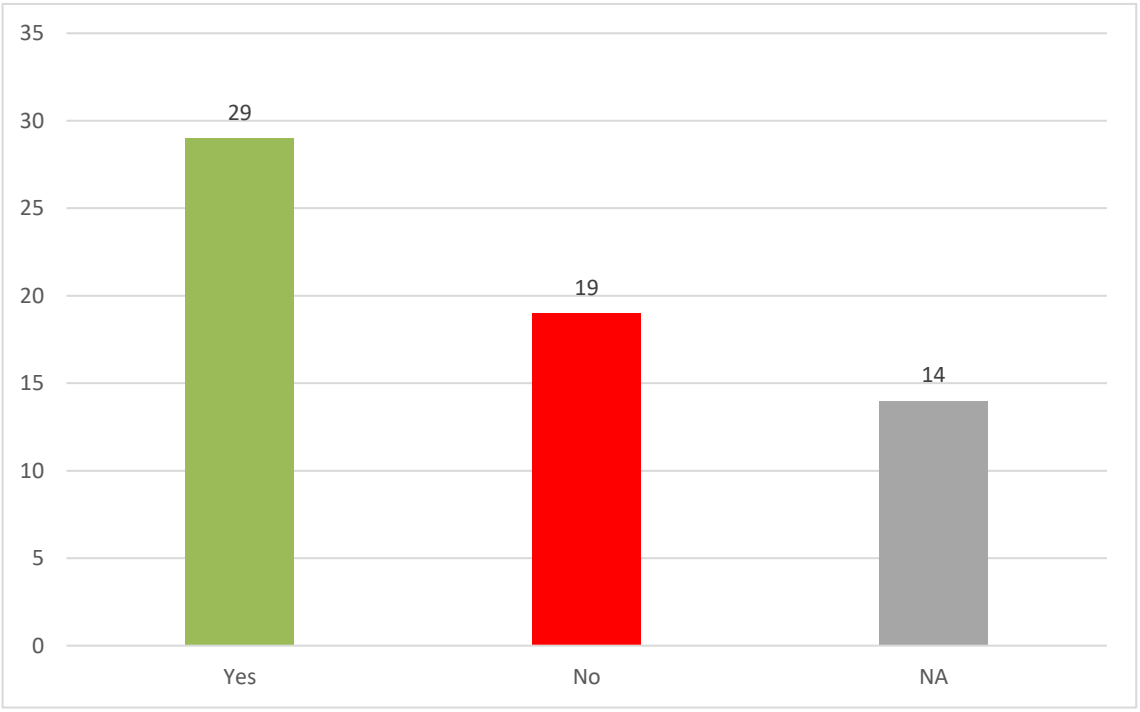


Figure 41. Number of responses to the question "Would you like to make proposals or suggestions to the European Commission about the conservation of fungi?"

Table 27. Proposals or suggestions to the European Commission about the conservation of fungi[14].

Respondent from (country)	Proposal
Albania	Research and Education: Encourage funding and support for research initiatives focused on fungi. Promote educational programs to increase public awareness about the importance of fungi in ecosystems, human health, and various industries
Austria	Habitat protection is the most important point when talking about fungal conservation, so nature protected areas should be implemented specially because of fungi. We need many more nature protected areas! Laws on landscape use/management should include fungal aspects e.g. on quality and amount of dead wood, diversity of trees planted, direction for fungal positive management of extensive grasslands, etc.
Denmark	I lead a Biodiversa project starting up next year (FunDive - no homepage yet) where fungal conservation is a key issue. In that context we plan to produce a policy brief with recommendations on fungal conservation and monitoring

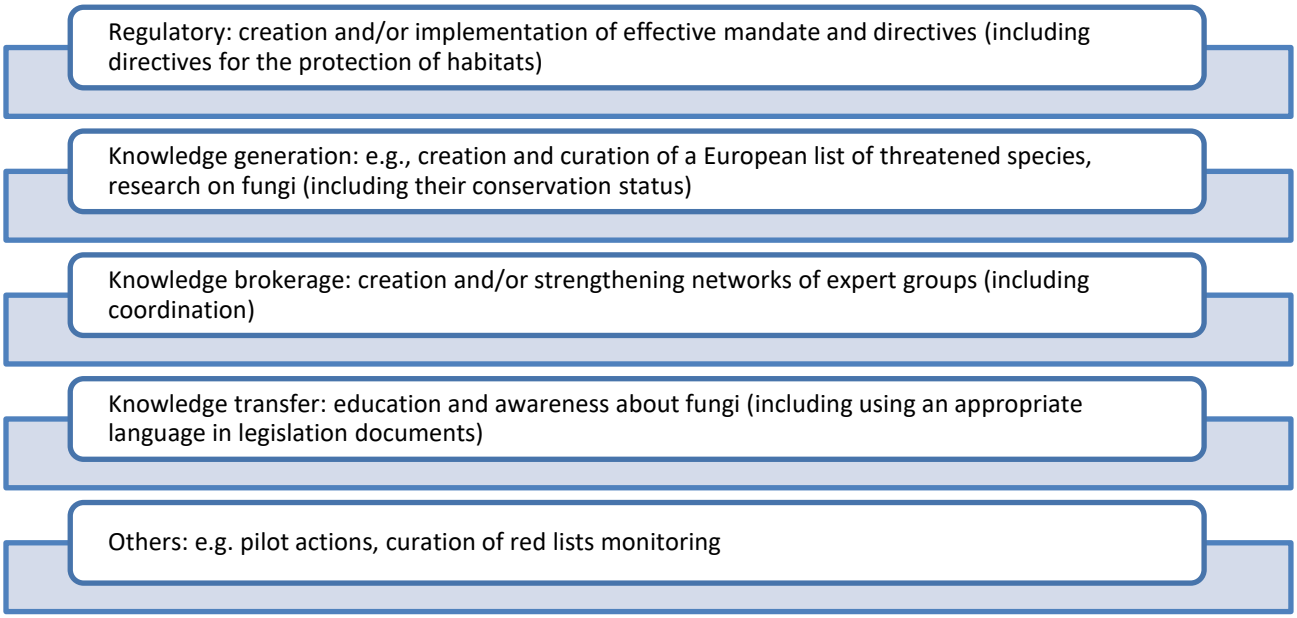
[14] Answers providing general comments without concrete suggestions are removed.

Estonia	I would start by updating Dahlberg ans Croneborg list from 2006 https://book.coe.int/en/nature-and-environment-series/3436-the-33-threatened-fungi-in-europe-nature-and-environment-no-136.html
Greece	The European Mycological Association and the European Council for the Conservation of Fungi are working towards a European list of threatened species (Prof. Dalberg in Sweden)
Greece	I believe that proposals should be made after a wide discussion with various interest/stakeholder groups (traders and those involved in marketing of agricultural/forest products, mushroom associations and societies, forest cooperatives, municipalities and relevant ministries, Academia, and government officials, especially the decentralized Forestry Services of the country
Greece	There should be European funding for studies on the status of fungi species in European countries and for identifying endangered species and developing plans for conservation. Also, Europe should provide funding for conservation (in situ and ex situ) actions
Greece	Incorporate fungi into national Red Lists and integrate them into environmental impact assessments. Develop a comprehensive mushroom atlas and disseminate informative posters and print media to forest rangers and other enthusiasts interested in the fungi of the Greek region, emphasizing sustainable and ethical collection practices. Advocate for the mandatory inclusion of fungi education in public school curricula
Greece	Establishment of legislative framework about fungi for all European Countries
Hungary	It is necessary to think about the feasible way to integrate mushrooms into HD.
Ireland	A special focus on forest fungi is now needed in relation to understanding their critical role in helping forest withstand the serious challenges already posed by climatic changes to many forests' regions across our continent (droughts, pest explosions, windstorms)
Italy	We would suggest defining a legislation dedicated to fungal species conservation, to select target species and habitats at European scale and define common reporting standard
Italy	In no one protections measure related to Special Areas of Conservation (SAC calls ZSC, Zona Speciale di Conservazione in Italy) is reported fungi conservation. Due to primary importance of mushroom in environment, European institution should introduce rules about identification of specific protection measure in SAC
Montenegro	1. Macro fungi should be included in the Annexes of the EU Habitat Directive 2. Special controls and protocols for the collection of edible and medicinal species should be defined at the European level 3. Define monitoring programs and protocols for macro fungi 4. Define obligations to make the national Red Lists and books of endangered species of macro fungi 5. Define criteria for the establishment of Important Fungus Areas and habitats
Poland	I could take part as a member of a broader sort of a working group for elaboration of recommendations
Romania	Promoting principles and guidelines intended to ensure that the gathering of fungi in Europe is practiced in a sustainable manner, with a positive contribution to the conservation of biodiversity and the needs of society, including life quality

Sweden	Red-listing on a European level, species action plans on European level, include fungal species in the species and Habitats directive

The answers from the question above can be summarized into categories like those in Table 26; additionally, some respondents would like to suggest to the European Commission to support research on fungi (including on their conservation status).

It emerged that respondents believe that effective legislations for fungi protection fall within one or more of the following areas.



A summary of the areas mentioned is reported in the table below (Table 28).

Table 28. Grouping of answers reported in table 27 into major areas of activity (more than one area per respondent is possible).

Area for effective legislation for fungi conservation	Number of answers
Regulatory (e.g., mandates and directives, including habitat protection)	5
Knowledge generation (e.g., curation of a European list of threatened species, research on fungi and their conservation status)	8
Knowledge brokerage (expert network creation, strengthening, and coordination)	1
Knowledge transfer (communication and awareness, use of inclusive language)	2
Others (e.g., pilot studies, monitoring)	1

Four significant quotes were selected from all the answers as they reflect the most cited and relevant items (see Figure 42).

"There should be European funding for studies on the status of fungi species in European countries."	
"Proposals should be made after a wide discussion with various interest and stakeholder groups."	
"A special focus on forest fungi is now needed in relation to understanding their critical role in helping forest withstand the serious challenges already posed by climatic changes."	
"Habitat protection is the most important point when talking about fungal conservation […]. We need many more nature protected areas!"	

Figure 42. Four quotes from respondents with emerging items.

Box - Data collection and conservation of fungi in the USA.

Authors: Gabriela D'Elia, Britt Bunyard

JoNeF members decided to distribute the questionnaire to non-European countries with the aim to connect, learn, and collaborate with organisations sharing similar goals and scopes, that are data collection and conservation of fungi.

We received responses by two experts in the USA. An overview and summary are below.

As emerging from part 1, in the USA there are no national law related to conservation and (data) collection of fungi; instead, the legal framework is fragmented by state and county laws.

"The Survey and Manage Standards and Guidelines of the Northwest Forest Plan (SMNFP; 1994)" provides a framework under which hundreds of fungi were once actively managed.

In the USA, some states require a certification (or a specific training, a license) to sell, rather than to gather, wild mushrooms for consumption (for example, the "Wild Mushroom Food Safety and Certification Course" [15]).

A specialized Forest Products Permit must be obtained to harvest and/or transport more than three (5) gallons of a single species of wild edible mushrooms[16].

From the results of part 2, it emerged how there are various sub-national plans and/or projects aimed at the conservation of fungi. Many academics, mycological societies, or individuals keep regional lists. Some states have a working beginning - through the Natural Heritage programs (e.g. NatureServe Networks). States interested in working towards this goal are Montana, Alaska, Pennsylvania, Washington, Oregon, and California.

There is a national, officially approved, Red List of Fungi, created using current IUCN criteria that can be found online[17]. The Red List for USA is initiated by Greg Mueller.

Fungal data is being collected through iNaturalist[18] and the state of California is preparing a database to collect own fungi data. So far, they have collected 5,000 collections and have IDd over 1,100 unique species. FUNDIS[19] uses normal public repositories for the work, in addition to iNaturalist, like GenBank and MycoPortal.

The national fungarium is U.S. National Fungus Collections (BPI) [20].

There is usually at least one fungarium in many states, or 'herbaria' with fungal curators. Some states have over four fungaria, like California.

There are many large academic fungaria (for example at the Field Museum in Chicago, at New York Botanical Garden, and at Denver Botanical Garden) as well as many smaller ones at universities.

In the U.S. we need to open up/find lots of funding for prolonged longitudinal work to understand the mycodiversity across the country as our first step.

Box - FUNDIS for JoNeF, 2024

Fungal Diversity Survey ("FUNDIS") is the only nonprofit organization 501(c)(3) that focuses on the conservation and biodiversity of North American fungi. Since 2017, we have worked to better understand the fungi in North America with the founding intention to create a complete "funga" for North America – a comprehensive list of the continent's fungi, supplemented by maps, images, voucher specimens, and sequences for every single species. FUNDIS's longterm goals are (1) Improve protection of fungi and their habitats; (2) Create pathways for people to participate; and (3) Increase public appreciation of fungi.

FUNDIS supports the documentation of fungi through core community science programs and one statewide documentation model. FUNDIS community science programs include (1) The Fungal Diversity Database: a vetted database of high quality community science observations hosted on iNaturalist, that helps increase the quality of community science mycological data; (2) Rare Fungi Challenges in which FUNDIS coordinates the creation of regional challenges that promote the finding and documentation of 20 selected rare, threatened, or under-documented fungal species; and (3) FUNDIS Local Projects: a resourced network of fungal field workers across North America, many of the projects are led by community scientists, but others by academics or conservationists.

In addition to community science programs, in November 2022 FUNDIS began an unprecedented project across the state of California: the California Fungal Diversity Survey ("CA FUNDIS"). The goals of this project are to provide a baseline of California's fungal biodiversity and create a successful model for fungal documentation and conservation that can be replicated across the continent. FUNDIS aims to meet those goals with carefully collected open-source field data, preserved specimens accessioned in local herbaria, a DNA barcode library of the collections, integration of the data into databases where it will be directly used to guide conservation planning and effective land management in CA. Thanks to support from the State of California and the California Institute for Biodiversity, this program has built a dedicated workforce from the ground up and became the first state-level fungal conservation initiative by a North American nonprofit.

Together by supporting community scientists and revitalizing professional mycology, FUNDIS is working towards protecting fungi for future generations.

5. Conclusions

An online questionnaire was distributed by the JoNeF project team between October and December 2023 to gather an overview of the legislation and environmental policies regarding fungi conservation and data collection activities in European countries.

> Fungi make up one of life's kingdoms – as broad a category as "animals" or "plants" – and provide a key to understanding our planet.
>
> Yet fungi have received only a small fraction of the attention they deserve.
>
> (Furci G. et al, 2023)

As this was a voluntary questionnaire, the results of the survey cannot be considered exhaustive or complete but provide a snapshot of the subject based on respondents from 32 European countries. The sample of respondents included mainly experts in mycology who were contacted to gather information within their own countries. The state of knowledge on fungi is not yet sufficient, as emerging from the results shown in this report.

The questionnaire was sent to JoNeF and non-JoNeF members and IMPEL and non-IMPEL member organizations. The survey aroused some interest: almost 70 answers were received (some from different experts from the same country), showing a great attention to fungi conservation.

The results of part 1 of the questionnaire showed a rather varied situation of the legislation both at national and sub-national level.

Almost half of the 32 respondent countries have a national law dedicated to fungal conservation and gathering, but with different rules. Similar results were obtained for the regulatory situation.

Almost half of the countries have national regulations on fungi picking. Only a few provide specific training and licenses to collect fungi for personal or commercial use. Almost 10 countries have national restrictions on the permitted daily amount that can be collected for personal use, while more than half have no restrictions if harvesting is for scientific purposes.

In 19 countries, there is a professional figure called "mycologist", which mainly refers to scientists/researchers that work at universities and/or Research Institutions.

At sub-national level some kind of regulation is active in almost half of the respondent countries (17), concerning mostly the collection of specific fungal taxa, or specific practices, or to allow only residents and landowners to collect.

Regarding institutions dealing with conservation and data collection of fungi, the questionnaire results showed that associations, encompassing state bodies, local authorities, and non-governmental organizations (NGOs) have a substantial role, followed by government institutions, actively involved in different countries in the conservation and collection of fungi on a national scale.

The survey shed light on the varied landscape of fungi conservation at the national level across the 32 participating countries. The absence of dedicated institutions in some countries underscores potential gaps in conservation efforts, while the active involvement of associations, government bodies, and

educational institutions reflects a collaborative and multifaceted approach to address this ecological concern.

At the sub-national level only 13 countries reported having public Institutions that deal with fungi conservation and data collection but in many cases a more detailed information would be needed to better understand the sub-national situations.

The results of part 2 of the questionnaire showed that two-thirds of the 32 respondent countries have national data collection initiatives. Some programs collect data on all species of fungi, while others collect data on selected fungal species. Furthermore, some projects are dedicated to endangered species and are aimed at the realization of Red Lists.

Even though 68% of the responding countries indicated the existence of a national data collection system, only 29% provided a reference to a guideline related to data collection.

Thirteen countries indicated that they are aware of sub-national data collection initiatives regarding fungi, but the details are less known than in the case of national programs.

Citizen science data collection based on volunteers seems to be gaining more and more space in building large databases, since the 84% of the answering countries refer to the existence of these kind of data collection programs.

On the contrary, the number of countries reporting on conservation plans and projects specifically dedicated to wild fungi is very low, showing a widespread lack of projects and action plans dedicated to fungal conservation in Europe.

Over half of the respondent countries have published checklists for macrofungi, although very varied in quality and scope, and more than 60% of the countries have an official national Red List for, though some of them are outdated or not based on current IUCN criteria.

A few numbers of countries reported having monitoring plans and protocols for data collection in the fields, while other countries recommend the need to have it.

Fifteen countries reported having a central database and/or information system for organizing the data concerning fungi.

Similar results concern countries that reported having macrofungal indicators used to show the results of monitoring and used to analyse the quality and/or conservation status of a habitat or area.

In 17 countries there is at least one national fungarium, most of them located in the national museums, botanical gardens, or universities, as well as in centres for biodiversity or some other nature centres.

Fungaria, like herbaria, are fundamental for knowledge, taxonomy, and for in situ and ex situ conservation.

The last section of the questionnaire asked what people think about existing legislations on fungal conservation and to express possible suggestions to the European Commission for future actions related to this topic. These opinion questions received 62 answers from 28 countries. Most respondents believe that national or subnational legislations and regulations are inadequate for the conservation of fungi. All respondents agreed that European conservation directives and policies should explicitly include fungi. The need to support research and the production of knowledge of fungi has emerged

stronger. Many respondents indicated also that the protection of habitats and the creation of Red Lists are very important.

It is interesting that 29 respondents would like to submit proposals or suggestions to the European Commission on fungal conservation, and 17 of these respondents wrote their proposals for the EC in the questionnaire. These proposals are reported in this report in Table 27.

The answers and suggestions given in this last section of the questionnaire fall within one or more of the following areas: regulatory (e.g., mandates and directives, including habitat protection), knowledge generation (e.g., curation of a European list of threatened species, research on fungi and their conservation status), knowledge brokerage (expert network creation, strengthening, and coordination), knowledge transfer (communication and awareness, use of inclusive language) and others items (e.g., pilot studies, monitoring).

The questionnaire results showed the interest for the topic of fungal conservation, as well as differences between European countries. Some countries have developed over the years national laws and regulatory acts for fungal protection and even some plans and projects, while others did not. The heterogeneity that emerged from the results highlights the lack of common environmental policies and scientific initiatives at European level for fungi. This lack affects the possibility to obtain a homogeneous framework of knowledge on fungal diversity and conservation needs.

The most significant findings are reported in Figure 43.

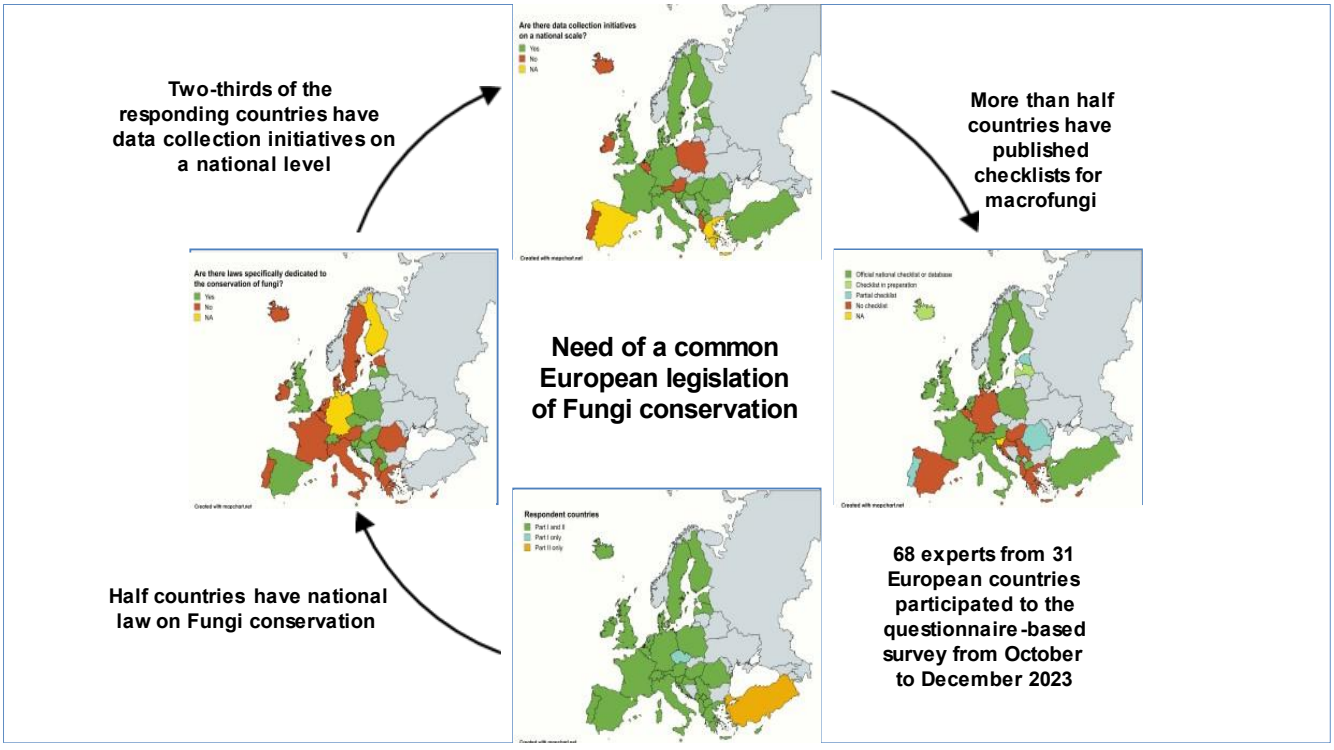


Figure 43. Significant findings from the questionnaire.

A CALL TO ACTION

It is important and necessary to continue to request a common directive from the European Commission so that European countries interested in the conservation of fungi receive guidelines for a uniform data collection and a common conservation strategy for all living organisms in habitats, including fungi.

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Annex I. List of organizations.

Table 29. List of organizations that participated in the questionnaire (alphabetical order by country).

COUNTRY	ORGANIZATION NAME	TYPE OF ORGANIZATION
Albania	National Environment Agency	National public authority
Austria	Austrian Mycological Society	Non-governmental organisation (NGO)
Belgium	Natuurpunt Studie vzw	Non-governmental organisation (NGO)
Canada	Centre for Biodiversity Genomics, University of Guelph	Academic institution
Croatia	Rudjer Boskovic Institute	Academic institution
Cyprus	Cyprus University of Technology	Academic institution
Czech Republic	Czech environmental inspectorate	National public authority
Denmark	University of Copenhagen	Academic institution
Estonia	University of Tartu	Academic institution
Finland	Finnish Museum of Natural History LUOMUS, University of Helsinki	Public research institution
France	INRAE	Public research institution
Germany	Bayerische Mykologische Gesellschaft	Non-governmental organisation (NGO)
Greece	DI.FO.P	Non-governmental organisation (NGO)
Greece	Forest Research Institute-ELGO DIMITRA	Public research institution
Greece	Fungi Foundation	Non-governmental organisation (NGO)
Greece	Kilkis Biodiversity	Other: Biodiversity group
Greece	Management Unit of Nestos-Vistonida and Rhodope National Parks	National public authority
Greece	National & Kapodistrian University of Athens	Academic institution
Greece	Natural Environment and Climate Change Agency	National public authority
Greece	Forest Research Institute	Public research institution
Greece	University of Ioannina	Academic institution
Greece	University of Thessaly	Academic institution
Hungary	Ministry of Agriculture	National public authority
Iceland	Icelandic Institute of Natural History	Public research institution
Ireland	Teagasc	Public research institution
Italy	Agenzia Regionale Protezione Ambiente Emilia-Romagna	Sub-national public authority
Italy	Agenzia Regionale Protezione Ambiente Lazio	Sub-national public authority
Italy	Agenzia regionale Protezione Ambiente Liguria	Sub-national public authority

Italy	Agenzia Regionale Protezione Ambiente Lombardia	Sub-national public authority
Italy	Agenzia Regionale Protezione Ambiente Umbria	Sub-national public authority
Italy	Agenzia Regionale Protezione Ambiente Veneto	Sub-national public authority
Italy	AsFo Azienda Sanitaria Friuli Occidentale	Sub-national public authority
Italy	Azienda Sanitaria Universitaria Friuli Centrale	Sub-national public authority
Italy	Gruppo Micologico G. Bresadola di Trento	Non-governmental organisation (NGO)
Italy	Italian Institute for the Environmental Protection and Research - ISPRA	National public authority
Italy	MUSE - Museo delle Scienze, Trento	Other: Public natural history museum
Italy	Mycology working Group of Italian Botanical Society	Other: Scientific Association
Italy	Regione Autonoma Friuli Venezia Giulia	Sub-national public authority
Italy	Regione Lombardia	Sub-national public authority
Italy	University of Siena	Academic institution
Kosovo	Ministry Environment Spatial Planning and Infrastructure	National public authority
Kosovo	Ministry of Environment Spatial Planning and Infrastructure	National public authority
Latvia	Latvian Museum of Natural History	National public authority
Malta	EcoGozo Directorate (Ministry for Gozo)	National public authority
Malta	Environment Resources Authority	National public authority
Malta	EcoGozo Directorate	National public authority
Montenegro	Environmental Protection Agency of Montenegro	National public authority
North Macedonia	Ss. Cyril and Methodius University in Skopje, Faculty of Natural Science and Mathematics, Institute of Biology, Mycological Laboratory	Academic institution
Poland	University of Lodz	Academic institution
Portugal	Centre for Functional Ecology, University of Coimbra	Academic institution
Portugal	Universidade de Évora	Academic institution
Romania	Alexandru Ioan Cuza University of Iasi	Academic institution
Romania	Kálmán László Mycological Society	Non-governmental organisation (NGO)
Serbia	Biologer	Non-governmental organisation (NGO)
Serbia		Other: Not part of any organisation
Slovenia	Biotehnical faculty - Ljubljana and Forestry Institute Slovenia	Public research institution
Spain	Institute of Agrifood Research and Technology (IRTA)	Public research institution
Sweden	Swedish Species Information Centre	Public research institution
Switzerland	Fungi Foundation	Non-governmental organisation (NGO)

Switzerland	Swiss Federal Institute for Forest, Snow and Landscape Research WSL	Public research institution
The Netherlands	Committee for the Reservation of Fungi of the Dutch Mycological Society (NMV)	Other: Society with 1200 members, including professionals
The Netherlands	Dutch Mycological Society	Non-governmental organisation (NGO)
The Netherlands	Omgevingsdienst Noord-Holland Noord	National public authority
the Netherlands	PWN	Other: Semi-governmental company - drinking water and natural area mgmt
Turkey	Selcuk University	Academic institution
UK	Royal Botanic Gardens, Kew	Other: Non-departmental public body
USA	Fungal Diversity Survey	Non-governmental organisation (NGO)
USA	Fungi Magazine	Company/business organisation

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