



# Digitised historical press data as research material for interdisciplinary biodiversity research

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## Abstract

This article explores the use of digitised historical press data as a valuable resource for biodiversity research, especially in understanding long-term changes in species distribution. Researchers can supplement current biodiversity databases, which often lack historical data before the mid-20th century, by analysing press records of species observations. The study draws on findings from the *Fauna et Flora Fennica* project that reveals many previously undocumented observations of different species in Finland. The authors highlight the interdisciplinary collaboration required – between historians, biologists, and linguists – to navigate challenges such as old species names, Optical Character Recognition (OCR) errors, and varied cultural contexts. This approach shows how historical press archives can enrich biodiversity databases and provide insights into the historical patterns of biodiversity change. Leveraging digitised press data enables researchers to enhance our understanding of global biodiversity trends, which is crucial for addressing current and future ecological challenges.

**Keywords** Interdisciplinarity · Press data · Biodiversity data · Digital history

## Introduction

The global loss of biodiversity, which refers to life in all its manifestations, currently shapes our future. Up to an estimated million species will face the risk of extinction within the next few decades (IPBES 2019). It has become evident that the intertwined combination of

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human-induced biodiversity loss and climate change is not only an ecological crisis, but it is also a human crisis at heart (WEF 2024). This “pervasive human-driven decline of life on Earth” has been caused by, e.g., massive changes in land and sea use, direct exploitation of species, human-induced climate change, pollution and invasive alien species (Díaz et al. 2019). To put it simply, our current way of life is destroying the natural ecosystems on which the wellbeing and mutual survival of all species depend.

Our knowledge of the world’s biodiversity is still limited despite the rapid development in research, and conservation decisions often need to be based on insufficient data (Johnson et al. 2024). Long-term research on biodiversity and changes in species occurrence is extremely important, and large quantities of different data on species sightings are readily available in different digitised databases regarding the recent past. These databases provide not only locational data on species observations but also, for example, images on different species. However, the further back in time we look, the more fragmented our knowledge becomes on the distribution of species. Species sighting records from the 19th and early 20th centuries in the Global Biodiversity Information Facility database (<https://www.gbif.org/>) are significantly lower than in the more recent past. The same applies to other biodiversity databases such as iDigBio (<https://www.idigbio.org/>). We give concrete examples of this in the “Examples of results” chapter of the article.

Several reasons exist for the scarcity of long-term historical data in biodiversity databases. One obvious reason is that the kind of extensive species-change monitoring conducted today was not performed in the past, nor were the tools and methods available to perform such monitoring. Another reason is that databases mainly accumulate data from the present and recent past, collected by natural scientists and via citizen science, which are used to monitor the situation for the future. We would like to stress that, in addition to the present day and the recent past, older information on the long-term historical changes in biodiversity is essential for various reasons. For example, it is difficult to understand the current biodiversity environment and its dynamics without looking at the long-term human relationship with nature (Latva et al. 2024). Biodiversity loss is a processual concept and unfolds in time, so understanding it in-depth requires a historical perspective. The diversity of the living world can only be understood through the context of its changing status in time. Furthermore, historical sources also reveal a great amount of surprising information about the past of different species, challenging the current understandings of species distributions (Meine 1999; Willis et al. 2007; McClenachan et al. 2015; Estes & Vermeij 2022; Thurstan 2022). Therefore, it is important that the historical observations of different species remain available in biodiversity databases to both researchers and the wider public.

Where else, besides natural history collections, can we find data on species sightings dating back several decades, sometimes even more than a hundred or two hundred years? A vast amount of information on the sightings and distribution of different species is available in various historical documents that address this question. Many naturalists in Finland attempted to collect comprehensive records of the region’s species during the 19th and early 20th centuries, using not only the concrete samples of animals, plants and other organisms as sources but also the species sightings from surveys and newspapers. Additionally, they likely had their own network of natural history enthusiasts who reported new observations.

Professor J. A. Palmén has, in fact, administered such an archive in Finland since 1901 (Lehikoinen et al. 2020). These zoologists collected information on their findings in archives and published them in books (Mela 1882; Kivirikko 1926; Kivirikko 1940). Scholars have

used these sources in later studies on the historical record of the species in Finland, along with more recent newspaper and magazine material (Vuorisalo et al. 2001). They have conducted similar global studies on past biodiversity by using data from the collections of natural history museums (Gomez & Freire 2023), biological records compiled by early naturalists (Zettler & Daunys 2007; Stöckli et al. 2011), newspapers and magazines (Knott et al. 1998). However, prior to the digitalisation of such records, researchers have examined the biodiversity data and conducted much of the research by reading the sources manually, a very laborious and time-consuming process.

Digitalisation has greatly changed the accessibility of historical biodiversity data. For instance, Nelson and Ellis (2018) have highlighted the importance of digital collections of natural history museums for biodiversity research. The research infrastructure FinBIF (Finnish Biodiversity Information Facility; <https://laji.fi/en>) in Finland enables researchers to identify the rapidly evolving patterns of biodiversity and facilitates their analysis against explanatory variables (Lahti et al. 2021). However, most of the data deposited in FinBIF and other research infrastructures compiling biodiversity data is based only on the collected natural history museum specimens and/or field observations. The situation changed for the FinBIF in the summer of 2025, when our research group uploaded data on nearly 12,000 historical sightings of species to the FinBIF system in collaboration with their staff. The data was collected by our *Fauna et Flora Fennica* research project, examining the distribution of animal and plant species in Finland from the 19th century to the 1970s based on press material (<https://sites.utu.fi/faffe/en/>). FinBIF collections before this included hardly any of the countless records of many species that have been published in newspapers and magazines over the past centuries.

For our part, we thus emphasise the importance of historical press data because the digitisation of such data has given us unprecedented opportunities to study the long-term changes in biodiversity. Historical press data in this article means newspapers and magazines. Researchers have actively collected Finnish species sightings in newspapers and magazines since the 19th century, as we have mentioned, but all this work was done before the time of computer-assisted methods and tools. It was still possible to collect records of different species from the press from perhaps the early 19th century. The number of periodicals published, as well as their format and overall volume, has grown to such an enormous extent since then that it has been impossible to find species sightings comprehensively covering the whole country. Nevertheless, it is no longer necessary to read newspapers or magazines page by page, from cover to cover. Instead, it is possible to conduct detailed searches of such material in various databases. For example, the National Library of Finland has already digitised over 30 million pages of documents published in the country (<https://digi.kansalliskirjasto.fi/stats>). This opens up, in practice, a new and far-reaching way of looking at species sightings made in the past, particularly when the collection covers all published pages since the inauguration of newspaper publishing until the late 1940s, which makes the collection particularly fruitful for research.

Given the potential of digitised press data, it is interesting to note that such data have been sparsely used in biodiversity research. We are aware of only a few studies, in addition to our *Fauna et Flora Fennica* research project, in which scholars used digitised press data to examine the long-term changes in biodiversity (Turvey et al. 2015; Herbst et al. 2023). A notable detail of these earlier studies is that they were conducted solely by biologists. However, we have recognised in our *Fauna et Flora Fennica* project that achieving more

comprehensive results when studying the species distribution from historical press material requires at least the cooperation of historians, linguists and biologists. We are aware that other disciplines, such as palaeontology and anthropology, also offer useful perspectives on the past, complementing the timelines of historical archives and extending even further back into the past to provide a more comprehensive view of changes in species occurrence over time. We particularly focus in this paper, however, on our experience of historians, linguists and biologists working together on digital press material.

We will discuss in more detail in this article's different sections how to search for species sightings in digitised press databases, how to analyse sighting data from several decades, and why such research should be conducted in interdisciplinary collaboration. This article aims overall to demonstrate how historical press data can be used for research on biodiversity and its changes and why such research should be conducted collaboratively between historians, linguists and biologists.

### Issues to be aware of when using digitised press data for biodiversity research

Digitised newspapers and periodicals expand the sources for biodiversity history by providing a wide range of material across geographical and linguistic boundaries that can, at best, significantly add to or change our previous understanding of species distribution. There are, of course, a number of issues related to the use of such data that are worth highlighting here.

Firstly, OCR technology is what makes digitised press material useful for research on the historical occurrence of different species. An abbreviation of "optical character recognition", OCR refers to the process of converting the text in a scanned document into machine-encoded text (Mori et al. 1992; Chaudhuri et al. 2017). Once the press material is OCR-identified, keyword searches can be carried out on it. However, the quality of OCR varies between different databases, which means that it may not be possible to find all the relevant results for a given search term (Kettunen et al. 2023). However, this does not mean that digitised press material would be unusable. Despite the OCR errors, the data may still contain a number of previously unknown and important sightings of different species. Nevertheless, it is important to be aware that digitised material does not guarantee 100% valid results.

The possible deficiencies of OCR are not the only factor to consider when searching for material on biodiversity change in historical newspapers. In fact, a much greater challenge arises with species whose names have many different meanings or species observations that are based on misidentifications. For example, the names of animals and plants can have many different meanings and can appear as part of metaphors and idioms (Jarić et al. 2016). The word "duck" in English, can refer to a type of waterfowl; it can also function as a verb meaning to dodge. Many animal species, such as a fox or bear, are also used as adjectives to describe people's appearance or character. The names of many plants are used in human names, such as rose, daisy or violet. This also applies to other languages. For example, "susi", the Finnish word for wolf, not only means a concrete actual animal but is also a word for failure. The names of many species are also used in products and marketing. Another challenge is that animals, for example, may be referred to by generic descriptions such as "yellow bird". It is impossible in such cases to say which species of bird has been sighted.

Thus, when searching for information hidden in historical press material about various animal and plant species sightings, one of the most laborious and difficult steps in such a

project is to filter out the relevant from the irrelevant hits. This is particularly acute in the case of species that hold cultural importance to humans, which often have significantly more mentions in the press material than many other species. For example, we noticed in the *Fauna et Flora Fennica* project that mammals and birds received the most hits in the Finnish press for a range of species, while many insect and mollusc species or specifically named plants received only a few hits. This is due to the fact that the co-existence of mammals and birds in particular is emphasised in many cultures, while, e.g., numerous insect or mollusc species or lesser-known plants are not well known. This is also why the names of such species do not have as many different meanings in the language. Of course, there are exceptions. For example, the search term “puutiainen”, the Finnish word for tick, gives several hits in the press database digitised by the National Library of Finland, because these arachnids spread diseases to humans and other vertebrates and have therefore been the subject of public discussion (Latva 2024).

Filtering out sources on a specific species from all the hits found in the press data is a crucial step in the study of biodiversity change using historical press databases. The second step is to identify which of the texts refer to a concrete sighting. This is where the skills of both historians and biologists are needed.

Firstly, the press itself and the way we write for the press have changed a lot over the decades and centuries. Moreover, people have by no means written completely objective accounts in newspapers; instead, they have always written texts from different perspectives at different times. It is noteworthy that newspapers have always covered many genres of writing, from news items to travelogues, from poems to readers' columns. Thus, when studying press material, one needs to know the social context of each newspaper, i.e. who owned the newspaper or magazine and to whom it was addressed. It is also useful to know who wrote the text on the species sighting, what the authors based their sightings on, and why they chose to write their sighting in the periodical. The historical context from the time of writing the sighting must also be known, because the motives for writing observations on nature have varied greatly from time to time. It is important when obtaining all this information to rely on the of historians' expertise to interpret the species sightings that emerge from the press data.

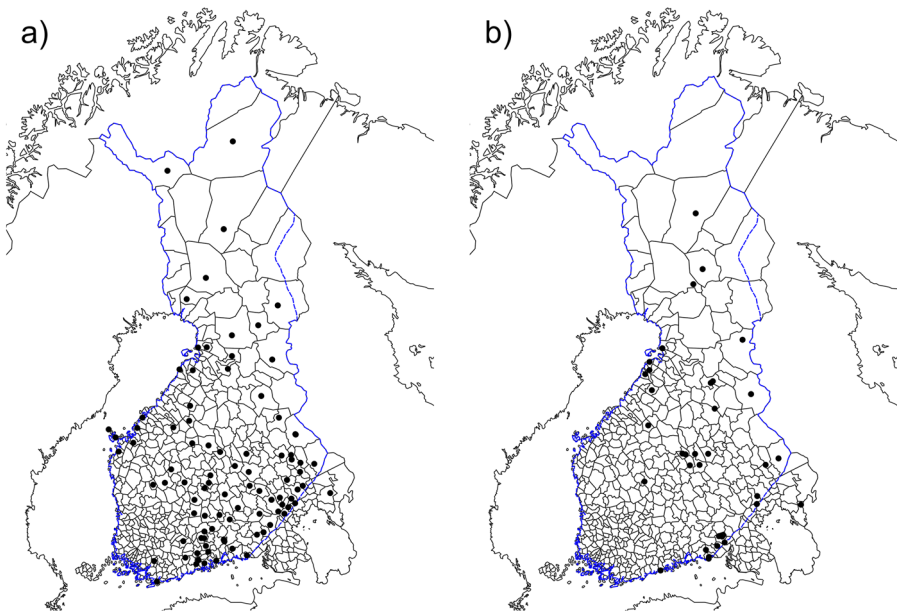
Secondly, many of the observations recorded in the press have been made by someone other than a professional with a background in zoology or botany. Therefore, some species sightings may have been misrepresented in the historical press material. For example, in the context of the *Fauna et Flora Fennica* project, we have found a sighting of a moose recorded in Finland in the 19th century that described the animal similarly to a reindeer (Rovaniemestä 1853). The moose was an extremely rare species in Finland at the time, and people no longer had any knowledge of it. The raccoon dog, which had arrived in Finland as a new species in the mid-20th century, was similarly mentioned as different kinds of canine animals in press reports at the time because the contemporaries were unaware of the new species (Eräpalsta 1965). Knowing and identifying the biological characteristics of different species is extremely important for such sightings, which is why biodiversity research using historical press material should also rely on the biologists' expertise.

It is advantageous to include linguistic expertise in these types of projects in addition to historians and biologists. The understanding of dialectology and historical lexicology are especially very beneficial, because linguists know the tools, methods and sources for seeking the changes in species names, which can be complicated. Modern scientific naming

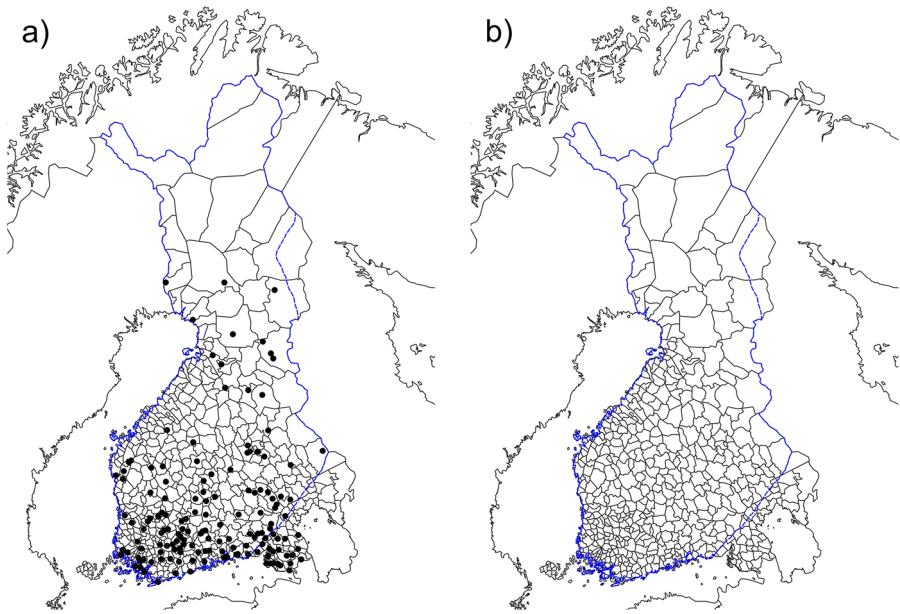
patterns differ from the older ethnolinguistic naming patterns (Brown 1986; Uusitalo 2022). We have noticed in the *Fauna et Flora Fennica* project that local dialect names exist for many animal and plant species and that many species have also been referred to by names that are quite different from those used today. It is very crucial to take these points into account when searching for information on different species in historical press databases. Scientific Latin names of species also appear in historical texts, and the interpretation of obsolete forms of names particularly requires biological and taxonomical expertise.

Historical press material, in addition to revealing concrete species observations, almost always provides location data for the observations. However, the location data mentioned in connection with the observation are not always expressed in the most easily understandable form. We noticed while working on the *Fauna et Flora Fennica* project that some species observations mentioned in newspapers or magazines were accompanied by very precise location data, while others were mentioned in much broader terms. For example, some species were said to occur in a province or even a wider area. Such sources do provide information on the historical distribution of species, but they do not allow us to map the spatial coordinates of species sightings, which we were able to use, for example, to create maps for Figs. 1a, 2a and 3a.

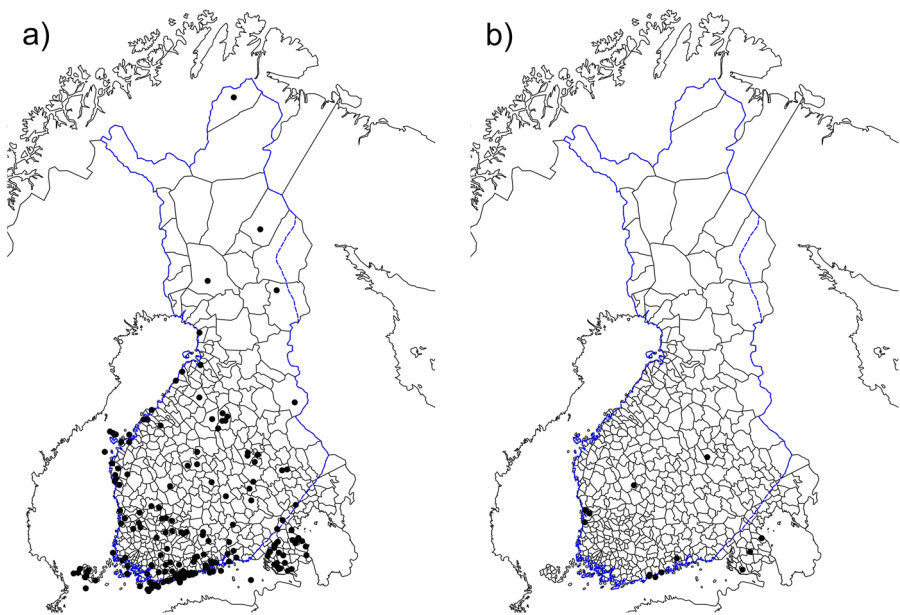
We also examined individual species sightings, so we had to carefully read through each source to discover, for example, the movements of the same animal as it moved through different areas. However, in order to achieve a broader picture of the historical distribution of species, the definition of precise sighting data for species individuals is not of such importance, because sightings of the same or different individuals will nevertheless indicate the possible presence of the species in the area of observation. Press data are, however,



**Fig. 1** The map on the left (a) shows the observations of raccoon dogs (*Nyctereutes procyonoides*) collected by the *Fauna et Flora Fennica* project from the press between 1930 and 1969. The map on the right (b) shows the raccoon sightings in the territory of Finland at the time recorded in the database of the Finnish Biodiversity Information Facility (FinBIF) for the same period



**Fig. 2** The map on the left (a) shows the sightings of moose (*Alces alces*) collected by the *Fauna et Flora Fennica* project from the press between 1800 and 1899. The map on the right (b) shows the moose sighting of the FinBIF database for the same period, of which there are none



**Fig. 3** The map on the left (a) shows the sightings of grey herons (*Ardea cinerea*) collected by the *Fauna et Flora Fennica* project from the press between 1820 and 1969. The map on the right (b) shows the grey heron sightings recorded in the database of the Finnish Biodiversity Information Facility (FinBIF) for the same period

inherently qualitative data and cannot be used, for example, to make accurate interpretations of species populations. Therefore, in our research project, for example, we did not attempt to make any interpretations of species abundance but mainly analysed the changing occurrence of species in Finland over a long period of time.

It must be remembered, in addition to the various problems and limitations of historical press material previously mentioned, that this kind of source material from the distant past is unavailable. The first printed newspapers were published as early as the 16th century, and the term “newspaper” was coined in the 17th century (Weber 2006). The first newspapers began to appear in Finland only at the end of the 18th century (Salokangas & Tommila 1982). The newspaper expansions began at the European level in the 1820s and 1830s, when their size, volume and circulation grew rapidly. Newspapers needed texts to fill their columns, and people increasingly reported environmental observations, not only rarities and anomalies but also the details of everyday life. Local letters were widely published in Finland from the mid-19th century onwards, and the press highlighted observations from around the country (Kokko 2022). This means that newspapers can also be better interpreted as observational material on nature and its continuous changes, especially from the late 19th century onwards.

## Examples of results

We present some of the results we obtained in the *Fauna et Flora Fennica* project in this section to provide a more complete picture of the use of historical press data and its interdisciplinary analysis as part of biodiversity research. We chose the raccoon dog (*Nyctereutes procyonoides*) and the moose (*Alces alces*) as examples of mammals and the grey heron (*Ardea cinerea*) for birds. Next we compare the data found in the *Fauna et Flora Fennica* project with the Finnish Biodiversity Information Facility (FinBIF) database before we uploaded our data into their system in the summer of 2025.

Figure 1a presents 128 reported sightings of raccoon dogs in the Finnish (Finnish and Swedish language) press from the 1930s until the end of 1960s. The first reports on raccoon dogs in Finland were published at the turn of the 1930s and 1940s. However, the contemporaries had difficulties recognising the species and there were many uncertain reports on possible raccoon dogs. These cases are not included in the map.

The number of raccoon dog sightings we found in the press data is more than three times higher than the number of sightings in the Finnish Biodiversity Information Facility (FinBIF) database for the same period, even after removing uncertain sightings from the data we collected. Figure 1b presents the data from the FinBIF in which there are only 41 different observations of raccoon dogs from the 1930s to the end of the 1960s. We are therefore able to use historical press material to show that the sightings of raccoon dogs in the region of Finland was probably much larger than thought already in the mid-20th century.

This example of raccoon dog sightings is a good demonstration of the importance of historical press material for biodiversity research. For instance, Kauhala and Helle (1995) attempted to examine the number and distribution of raccoon dogs in Finland by analysing a survey targeted at hunters between 1950 and 1992, although their estimate of the distribution of the species is much lower than the distribution indicated by the sighting data in the press. Many studies on the distribution of raccoon dogs have also suggested that the number of these canine animals in Finland did not increase significantly until the 1970s (Nummi

1995). However, we are able to show, on the basis of the data we have collected from the historical press data, that the number of raccoon dogs in Finland in the 1950s was already higher than previously thought.

We wanted to take the moose sightings, in addition to the raccoon dog sightings, as an example of the species sightings discovered from the historical press, because there are no sightings of these animals recorded in the FinBIF database from the 19th century. Figure 2b illustrates this. There is also no precise information on the distribution of moose in Finland before 1895 when contemporary zoologists published a map of the distribution of these animals in Finland, based on information from the hunting magazines published in the late 19th century (Kujala 1931). The Finnish naturalist Aukusti Mela did collect sightings of moose in the 19th century, and they are briefly mentioned in his book on the Finnish vertebrata (Mela 1882). His archives may have more information on moose sightings in Finland in the 19th century, but they were unavailable for this research.

Figure 2a presents the reported observations of moose in the Finnish-language press from 1800 until the end of 1890s. During this period, there were 198 different sightings of moose mentioned in the digitised Finnish-language press. This example shows that we can use historical press material to find sighting data with concrete spatial information on species whose sightings are not recorded as concrete specimen samples in the collections of natural history museums, for example.

We wanted to include one example of bird observations in our article, in addition to the previously-mentioned observations of mammals, because we wanted to demonstrate that the Finnish (Finnish and Swedish language) historical press data can also be used to study sightings of species other than mammals. Figure 3a presents the places where the grey heron was observed in the Finnish region from 1820 to 1969. The map shows a total of 274 sightings reported in the press material at the time. The Finnish ornithologist Kaarlo Kivirikko also collected 19th-century sightings of grey herons in the early 20th century, and they are mentioned in his book on Finnish vertebrates published in the 1940s (Kivirikko 1940). The grey heron sightings we found in the digitised press data include the sightings listed in Kivirikko's book, although it also includes many that Kivirikko did not mention. Again, the sightings found in the historical press data enormously add to the FinBIF data repository presented in Fig. 3b, which mentions only 16 sightings of grey herons for this period, mainly based on specimens collected in natural history museums.

## Summary and future directions

The results indicate that analysing the digitised press material provides a rich source of new information on the historical records of different species. The *Fauna et Flora Fennica* project examined sighting data for eighty different species in total from the Finnish press. These findings have been published in an open access book in Finnish, *The Historical Atlas of Finnish Species* (Latva et al. 2025a). We were able to compile, in addition to the book, a dataset containing geospatial data for a total of 72 different species examined in the project (Latva et al. 2025b).

This article uses the examples of raccoon dog, moose and grey heron, all of which have undergone significant changes in their populations and all of which have also attracted wide public interest. We discovered many previously unknown sightings for each of these spe-

cies, which provide new and more detailed information on their long-term distribution in Finland. This kind of information can be used, for example, in research on biodiversity loss or on invasive species. Adding historical observations of different species to existing biodiversity databases can, for example, significantly deepen our understanding of biodiversity, species dynamics, and ecological change. Observations found in digitised press material can help refine our knowledge of long-term shifts in species distribution and occurrence, making it easier, for instance, to identify which changes are and are not driven by human activity. Historical data may also reveal previously unnoticed aspects of species distribution. New interpretations of ecosystem development and species interactions can emerge when historical occurrences of different species are examined in relation to environmental changes such as land use or climate change. These are examples of how digitised historical press data may lead to a reassessment of how biodiversity change has been described so far and, consequently, may influence conservation strategies and research priorities.

Digitised press material has already been used to some extent in research on biodiversity change, although in this article we have wanted to highlight its potential and possibilities and its limitations. After all, the research presented in this article has only been made possible in practice by digitisation technology and search applications built into digital data systems. In other words, it was not possible to conduct this kind of research before the 2000s (Rosenzweig 2003).

We have particularly wanted to emphasise that digital press material is best used as a source for research on long-term changes in biodiversity, provided that the research is conducted by an interdisciplinary research team. It has been essential, from our perspective, for the implementation of our research that historians, biologists and linguists have been involved in the team. This has allowed us to look at the data from a much broader perspective than would have been the case if the data had been analysed solely by biologists, for instance.

The interdisciplinary approach has allowed for a multifaceted analysis of the data and avoided possible misunderstandings. For example, historians can distinguish between different discourses of press articles, linguists know the dialects associated with species names, and biologists can tell if a species described in a press article is misrepresented as the wrong species. Despite this, however, the press material itself imposes various limitations on research as we have demonstrated in this article.

One possible direction for future research is, for example, the development of AI to identify different text types in press data in such a way that hits that do not deal with specific species observations can be easily filtered out of large numbers of hits. These include, for example, fictional stories or fairy tales dealing with species. Another direction for future research is to apply our research to press data from other countries than Finland and also to apply it to transnational press data.

It will be particularly important in the future to expand the interdisciplinary group of researchers working on digital press data to include not only historians, biologists and linguists but also anthropologists, palaeologists, palaeoecologists and other researchers with expertise in sedimentary ancient DNA (sedaDNA) analysis. This will allow them to compare the observational data found in press material with local historical data and data hidden in natural archives. For example, we have already conducted research on Finnish plant species by combining palaeoecology with historical, cultural and linguistic approaches, using newspaper data as one of the sources (Uusitalo et al. 2025).

To conclude, we have demonstrated how digitised press material plays an important role for research on biodiversity. Press data can expand the observational data available for the research on long-term changes in nature. It provides new opportunities to draw well-considered conclusions on how to address biodiversity loss. At the same time, however, we have also pointed out the challenges associated with the use of historical press material and stressed that an interdisciplinary collaboration between historians, biologists and linguists can overcome those challenges. Our examples are based on the work conducted in our *Fauna et Flora Fennica* project and the material collected from the digitised press database of the National Library of Finland, although the proposed research agenda is replicable in a broader geographical setting. There is already a huge number of digitised press databases, which means that the research mentioned in the article can be conducted in almost any geographical area. A particularly interesting challenge would be to combine digitised press material from different countries and continents into a multicultural and multilingual dataset and to analyse what the history of biodiversity change would look like on a global scale and what answers it would offer to our future challenges.

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**Author contributions** O.L conceived and planned the article, made the figures, and took the lead in writing the manuscript. A.J aided in the analysis, provided feedback and collected the data. I.S and T.V aided in the analysis and helped shape the research. H.R collected the data. H.U and H.S provided feedback and helped shape the research.

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**Data availability** The dataset used and analysed during the current study is available from the Zenodo research repository: <https://zenodo.org/records/17192105>.

## Declarations

**Competing interests** The authors declare no competing interests.

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