

Letter of intent: Digitization of museum collections Rhineland-Palatinate and Saarland

1 Binding letter of intent as advance notification or non-binding letter of intent

<input checked="" type="checkbox"/>	Binding letter of intent (required as advance notification for proposals in 2020)
<input type="checkbox"/>	Non-binding letter of intent (anticipated submission in 2021)

2 Formal details

- Planned name of the consortium

Digitization of museum collections Rhineland-Palatinate and Saarland

- Acronym of the planned consortium

Collection Digitization Rhineland-Palatinate and Saarland: CoDiRPS

- Applicant institution

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3 Objectives, work programme and research environment

- Research area of the proposed consortium (according to the DFG classification system):

202-01 Evolution and Systematics of Plants and Fungi

202-02 Plant Ecology and Ecosystem Analysis

203-01 Special Zoology and Morphology

203-02 Evolution, Anthropology

203-03 Animal Ecology, Biodiversity and Ecosystem Research

- Concise summary of the planned consortium's main objectives and task areas

All members of the consortium are designated facilities for the preservation of scientific or environmental significant collections and reference materials of regional to national level. Data sets gained from museum collections have been accumulated throughout decades and even centuries. Each year significant numbers of objects are donated or otherwise acquired, while the backlog to properly archive and document these important historic materials is often substantial. Evaluating the gathered data sets provides an insight into the characteristic biological communities of the past and the present (McCarthy 1998; Schaffer et al. 1998). Therefore, both historical and recent collection material is an important factor for the study of biodiversity or biogeography (Elith & Leathwick 2007; Enting et al. 2007; Enting et al. 2012; Wang et al. 2018).

Availability of data on the occurrence of specific organism groups or their population development over several decades remains limited, while present in the extensive collections of natural history museums. This data remains on physical labels only available through direct visit of the archiving institution, while the modern national and international scientific community as well as the growing community of citizen science uses digital data as primary source of information. To provide better knowledge and visibility of these vast collections in Rhineland-Palatinate and the Saarland housed primarily by the members of the consortium, it is our main objective to digitalize and publish all available collections which could not be processed due to insufficient personal capacities. Furthermore the permanent storage is to be ensured by providing modern storage containers and furniture to historic collections.

Linking scientific literature to pre-existing collections does allow for reevaluation of its scientific value and does add further information previously overlooked. Digitization of accompanying institutional libraries does not only help this process, it does allow researchers, institutional and visiting, to find and access needed literature more efficiently.

As first step the visibility of collections will be increased by providing a short summary of each thematic or individual collection (compilation of metadata) either on the homepage of the respective institution or via a sample dataset submitted to an open source database, e. g. the Global Biodiversity Information Facility (GBIF). This will allow taxonomic specialist and researchers interested in specific data to locate and subsequently request data of this collection.

In case of funding the next step is to input all available label data accompanying already taxonomically addressed objects. This should include determination down to family- and genus-level, to allow researchers to determine if specimens are available and of potential interest for their studies. If possible, unidentified material with sufficient collecting information should be predetermined and included in this process. This step is accompanied with most of the work for archiving specimens, e. g. assigning, primary labeling, and preparing, which can be done by

trained assistants. In cases of historic collections identification of old handwritten labels (e. g. Sütterlin) may require a professional with appropriate language skills. To have records available for further data mining, reconstruction of geographic coordinates is also necessary.

With the extent of the collections and the taxonomic status known, taxonomic specialists can be employed to assign the predetermined material and revisit critical taxa as well as doubtful records. At this step online tools for taxonomy reevaluation will be used to update all records. While this process is fast and automated, it largely depends on corrected and curated databases, which are not necessarily available for all groups of interest. A close collaboration with globally operating platforms such as GBIF on updating lists with known taxonomic issues may result in alpha-taxonomic publications as well as increase the usability of the online-platforms themselves and be in the interest of the taxonomic specialist already assigned to review the collection. At this stage the long term storage system of the collections should be evaluated and optimized to ensure physical availability.

Updating all published records, as well as uploading all processed collection records to an online depository of national and global recognition is planned for all data. In case of scientifically most valuable records and collections further digitalization such as photographing or scanning of specimens may be necessary to have data readily available and allowing faster access to information. Historical collections have often been split between facilities, depending on personal preferences of the collector or group of expertise of curators or researching scientists in charge. For research purposes it is often advisable to look at the unified dataset to gain additional information. While summarizing is finally possible via online analysis of the uploaded data, thorough study and publications on the whereabouts of these collections, together with a brief summary or even a catalogue of its entire content to be freely available to the scientific community is the most desired goal. This will be also important as a means of further strengthen and enhance the collaboration of the member of the consortium and enhance their capacity on taxonomy, biodiversity and ecosystem research.

- Brief description of the proposed use of existing infrastructures, tools and services that are essential in order to fulfill the planned consortium's objectives
Guidelines and standards for the work of digitization should also be made very clear to ensure consistency throughout the project.

All collaborating facilities are equipped with storage rooms designated and equipped for their collections, using individual and often paper-based organization systems. Standard equipment for taxonomic work and digitization, such as workspace, microscopes and computers are available at all facilities. In addition extensive libraries for research and taxonomic identification work, DIN A3-sized scanners for herbarium sheets and standard photographic devices are present at several of the collaborating institutions. The consortium offers an extensive and long-

standing network of taxonomic specialists from regional to international expertise to tackle most of the necessary taxonomic groups.

In the course of ecological research, several thousand individuals of invertebrates are sampled and identified per year e. g. in the Ecosystem Analysis lab at iES Landau, and similar amounts of data are collected at other University institutes in Southwest-Germany. They are valuable for further faunistic publications and population studies, while long-term storage of the samples is rarely provided. The consortium is going to provide the infrastructure for researchers in Rhineland-Palatinate and Saarland to process raw data files and to archive corresponding samples for future research that is based on the species records.

Current digitization is feeding all label information of individual specimens into standard spreadsheets (e.g. Microsoft Excel), allowing subsequent transfer to most database systems.

Digitization already been achieved for approximately 10 % of the zoological collection and 20 % of the herbarium of the Palatinate Museum of Natural History, 50 % of the entomological collections of the Zentrum für Biodokumentation, 10 % of the zoological collection and 20 % of the herbarium of the Mainz Natural History Museum. Current work on digitization has been conducted by the curators of the collections and by professionals employed by means of contracts for work and labor.

We plan for permanent availability of our provided data in correspondence to the FAIR data principles (Wilkinson et al. 2016). Meeting these criteria, all data will be finally included into the online database Global Biodiversity Information Facility (www.gbif.org/). This database has been growing and shown to be well curated for almost two decades, demonstrating reliability for storage of biodiversity information of all formats and as such improving the visibility of scientific collections and allowing for individual research as well as international cooperation.

In addition several public national databases are used for frequent integration to other open databases like ArtenFinder (<https://artenfinder.rlp.de/>), Schmetterlinge Deutschlands (<https://www.schmetterlinge-d.de/Lepi/Default.aspx?id=2202>), Schmetterlinge Rheinland-Pfalz (<http://rlp.schmetterlinge-bw.de/>), Aculeata (<http://www.aculeata.eu/>) and Deutschlandflora (<https://deutschlandflora.de/dflor/>).

In many cases these repositories automatically link to GBIF and all present and future data will be revisited or curated to be available on platforms freely accessible and interconnected. Important historical collections should be further digitalized through means of digital imaging. Another additional step is the reconstruction of geo-data of written localities. Lastly, all storage possibilities need to be evaluated to optimize long term storage of the respective collections.

In the library, all books have been equipped with a unique signature. The digitized literature will be included in the Hessische BibliotheksInformationsSystem HeBIS (e. g. <https://opac.ub.uni-mainz.de/IMPLAND=Y/SRT=YOP/LNG=DU////DB=7/>) to allow for an optimized public access for all members of the consortium.

- Interfaces to other proposed NFDI consortia: brief description of existing agreements for collaboration and/or plans for future collaboration

An international project documenting the cooperation between the participating and other institutions in the Saar-Lor-Lux-Euroregion is the first bilingual faunal atlas on the distribution of damselfly and dragonflies (Trockur et al. 2010). On a national scale large amount of data available in the aforementioned online databases (Schmetterlinge Deutschlands & Schmetterlinge Rheinland-Pfalz) resulted in the "Verbreitungsatlas der Tagfalter und Widderchen Deutschlands" (Reinhardt et al. 2020) to which this consortium contributed a large dataset allowing Rhineland-Palatinate and Saarland to represent one of the leading regions in this project. Another national project demonstrating the cooperation of the consortium, was the "Verbreitungsatlas der Farn- und Blütenpflanzen Deutschlands" (Netzwerk Phytodiversität Deutschlands e.V. & Bundesamt für Naturschutz 2013). The huge amount of data from this project was the cornerstone used to assemble the Red Data Book of German plants (Metzing et al. 2018), resulting in updating an array of federal lists.

Further regional, national and international projects will follow which can only be implemented if the respective datasets can be made available within a reasonable time frame. The proposed consortium is intended to interconnect and strengthen the collaboration between the participating institutions for the benefit of the research community. Institutions are located at or in direct connection and collaborations with universities and other research facilities with local to international publication records. As federal and public institutions we are generally open to all requests from the scientific community.

4 Cross-cutting topics

- Please identify cross-cutting topics that are relevant for your consortium and that need to be designed and developed by several or all NFDI consortia.

The topic of our applied consortium corresponds with the topics of the nfdi4biodiversity consortia. We want to promote collection data as an integral part of biodiversity research.

- Please indicate which of these cross-cutting topics your consortium could contribute to and how.

Provision of data for critical taxa for environmental projects, loan of specimen for research, provision of curated datasets on individual scientific collections and groups, as well as direct participation in research projects is integral part of service for all members of the consortium. However, most fundamental modern approaches to biodiversity or climate change represent metastudies requiring large consistent and therefore curated datasets. To further facilitate the use of our data we are aiming to unite formerly split collections and information on many groups

in different time frames within a geographical restricted area. Comprising different ecological distinct areas, e. g. the Rhine River Valley, also known corridor as well as border zone of organismic migration, several biological hotspots are documented for Germany. Thus organismic diversity is highest outside the Alps, while experiencing fast changes due to habitat transition caused mostly by increasing human activity. The long term monitoring of small localized areas such as nature refuges, outlines them as reference areas for changes in organismic composition possibly linked to climate change, biogeographic and adaptation processes. All compiled data is likely to contribute to information on species diversity over many decades and even centuries. The historic collections comprise a wealth of species nowadays hardly accessible due to species decline, collecting regulations or even extinction. These are still available for Systematic research due to the advent of new genetic methods for extracting and analyzing even fragmented DNA.

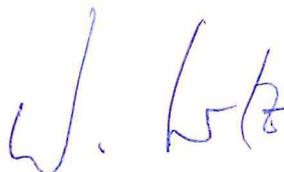
Biodiversity includes the diversity of living specimens and also the genetic, phenotypic and functional diversity. It also includes the diversity of populations and ecosystems. All these data are important to study biodiversity as a whole. In our planned project we compile data for species diversity over many decades and even centuries. So our project provides a part of data for biodiversity research as a whole.

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