

DELIVERABLE 3.3 - BEST PRACTICES FOR USING THE GGBN DATA STANDARD TO PROVIDE RESTRICTION AND LOAN INFORMATION HANDBOOK

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Grant Agreement Number | 823827

Acronym | SYNTHESYS PLUS

Call | H2020-INFRAIA-2018-2020

Start date | 01/02/2019

Duration | 48 months

Work Package | 3 Molecular Collections in the age of genomics - Standards & Processes

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Task | 3.3 Create a data standard for enabling traceability of restrictions for molecular samples

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Delivery date | [27.02.2023]



SYNTHESYS⁺ was funded by the Horizon 2020 Framework of the European Union under the H2020 Open Innovation and Open Science Research Infrastructure call.

Deliverable status:

Version	Status	Date	Author(s)
1.0	Draft	14.11.2022	Edmund Schiller, Karin Wiltzsche
2.0	Review chapter 3.4	28.11.2022	Edmund Schiller, Karin Wiltzsche, Frederik Leliaert, Breda Zimkus, Jutta Buschbom, John Dickie, Suzete Gomes, Eva Häffner, Chris Lyal, Daniel Mulcahy, Alan Paton
2.1	Review chapter 3.5	02.12.2022	Edmund Schiller, Karin Wiltzsche, Frederik Leliaert, Breda Zimkus, Jutta Buschbom, John Dickie, Suzete Gomes, Eva Häffner, Chris Lyal, Daniel Mulcahy, Alan Paton
3.0	extended draft	22.12.2022	Edmund Schiller, Karin Wiltzsche, Eva Häffner, Jutta Buschbom
3.1	extended draft	30.12.2022	Edmund Schiller, Karin Wiltzsche
3.2	extended draft	04.01.2023	Jutta Buschbom, Edmund Schiller, Karin Wiltzsche
4.0	Review	09.01.2023	Edmund Schiller, Karin Wiltzsche, Frederik Leliaert, Breda Zimkus, Jutta Buschbom, Alan Paton, John Dickie, Eva Häffner, Anton Güntsch, Daniel Mulcahy
5.0	Review comments implemented	24.02.2023	Edmund Schiller, Karin Wiltzsche, Jutta Buschbom, Eva Häffner, Anton Güntsch



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1 Acronyms

Acronyms for participating institutions are listed at the end

ABS - [Access & Benefit-Sharing](#)

ALA – Atlas of Living Australia

APHIS – the USDA’s Animal and Plant Health Inspection Service

BBNJ - [Biodiversity Beyond National Jurisdiction](#)

BCoN - Biodiversity Collections Network (USA)

CARE - Collective benefit, Authority to control, Responsibility and Ethics (www.gida-global.org/care)

CBD - UN [Convention on Biological Diversity](#)

CD - the lawful source of a use-term is a contract or deed (hence CD) under civil law

CETAF - Consortium of European Taxonomic Facilities

CITES - [Convention on International Trade in Endangered Species of Wild Fauna and Flora](#)

D - the lawful source of a use-term is an individual document issued to a specific person or legal entity, based on a public administration's decision (often after examination of a specific project)

DES - Digital Extended Specimen (concept), see Hardisty et al. 2022

DiSSCo - the Distributed System of Scientific Collections (www.dissco.eu) – a long-term initiative and research infrastructure in preparation

“DSI” - “Digital Sequence Information” as recently discussed in the CBD context

DOA - Digital Object Architecture

DUA - Data Use Agreement

EDP - electronic data processing

ELViS - European Loans and Visits System in the framework of DiSSCo

FAIR - Findable, Accessible, Interoperable and Reusable (www.go-fair.org/fair-principles/)

GBF - The Kunming-Montreal Global Biodiversity Framework

GBiOS - Global Biodiversity Observation System



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GeoBon - Group on Earth Observations Biodiversity Observation Network

GGBN - Global Genome Biodiversity Network (www.ggbn.org/)

GMO - Genetically Modified Organisms

GR - [Genetic Resources](#)

iDigBio - Integrated Digitized Biocollections

INSDC - International Nucleotide Sequence Database Collaboration (www.insdc.org)

IPBES - Intergovernmental Platform on Biodiversity and Ecosystem Services

IPLC - Indigenous Peoples and Local Communities

IPR - Intellectual Property Rights

IRCC - Internationally Recognised Certificate of Compliance

IRI - Internationalised Resource Identifiers

ITPGRFA - International Treaty on Plant Genetic Resources for Food and Agriculture

JSON - JavaScript Object Notation

JSON-LD - JavaScript Object Notation for Linked Data

L - the lawful source of a use-term is a law without individualised document, the law however can be referenced

LN - the lawful source of a use-term is a written evidence that no individual document is necessary for a permission, but the evidence may lack information whether this is based on written law or missing legal provisions

MAT - Mutually Agreed Terms

MBTA - United States of America Migratory Bird Treaty Act

MIDS - Minimum Information about a Digital Specimen in the framework of DiSSCo

MoC - Memorandum of Cooperation

MoU - Memorandum of Understanding

MTA - Material Transfer Agreement

N - the lawful source of a use-term is the fact that no legal provisions exist (hence N) nationally or on the level of applicable supranational (e.g. EU) legislation



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NP - Nagoya Protocol

OA - W3C-recommended Web Annotation Ontology (<https://www.w3.org/ns/oa>)

ODRL - W3C-recommended ontology of the Open Digital Rights Language

openFDO - open FAIR Digital Objects

openDS - the “open Digital Specimen” specification

PIC - Prior Informed Consent

PID - persistent, globally unique and resolvable identifier

PIP - [Pandemic Influenza Preparedness Framework](#)

PROV - W3C-recommended Provenance ontology (<https://www.w3.org/TR/prov-o/>)

REL - Rights Expression Language

ROR - Research Organization Registry

SMTA - Standard Material Transfer Agreement

SPNHC - Society for the Preservation of Natural History Collections (<https://spnhc.org/>)

SDR - Specimen Data Refinery in the framework of DiSSCo

TDWG - Biodiversity Information Standards (originally called the Taxonomic Databases Working Group) (www.tdwg.org)

TK - Traditional Knowledge in the meaning of the [Nagoya Protocol](#)

UID - unique Identifier

UN - United Nations

UNDP - United Nations Development Program

URL - Uniform Resource Locator

USDA - United States of America Department of Agriculture

W3C - World Wide Web Consortium



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Institution acronyms used in this text:

BGM - Agentschap Plantentuin Meise

BGBM - Botanischer Garten und Botanisches Museum, Freie Universität Berlin

CSIC - Agencia Estatal Consejo Superior de Investigaciones Cientificas, Madrid

GBIF - Global Biodiversity Information Facility

HNHM - Hungarian Natural History Museum (Hungarian: Magyar Természettudományi Múzeum), Budapest

HUJI - The Hebrew University of Jerusalem

LUOMUS - Finnish Museum of Natural History (Finnish: Luonnontieteellinen keskusmuseo), University of Helsinki (Helsingin Yliopisto), Helsinki

MfN - Museum für Naturkunde - Leibniz-Institut für Evolutions- und Biodiversitätsforschung

MNHN - Muséum national d'Histoire naturelle, Paris

Naturalis - Stichting Naturalis Biodiversity Center, Leiden

NHM - Natural History Museum London

NHMW - Naturhistorisches Museum Wien

NRM - Naturhistoriska Riksmuseet Stockholm

RBGE - Royal Botanic Garden Edinburgh

RBGK - Royal Botanic Gardens Kew

SGN - Senckenberg Gesellschaft für Naturforschung, Frankfurt

SMNS - Staatliches Museum für Naturkunde Stuttgart

UCPH - Københavns Universitet

UGOT-GGBC - Goteborgs Universitet, Gothenburg Global Biodiversity Centre

ZFMK - Zoologisches Forschungsmuseum Alexander Koenig, Bonn



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2 Abstract

This deliverable presents two different typologies of legal/contractual information in the context of natural history objects: The Biodiversity **Permit/Contract** Typology and the Typology of Legal/Contractual **Terms** for Biodiversity Specimens. They have been developed under SYNTHESYS+ with the participation of experts from outside the consortium. The document further addresses a possible technical integration of these typologies into the Distributed System of Scientific Collections (DiSSCo). The implementation into the DiSSCo data model is described and a concrete use case is presented to show how conditions, e.g. the Typology of Legal/Contractual Terms, can be introduced into the DiSSCo Electronic Loans and Visits System (ElViS). Finally, the deliverable gives an outlook on the next steps to develop the typologies into a standard that supports compliance with legal and contractual obligations within the wider community of natural science collections.



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3 Executive Summary

In SYNTHESYS+ Task 3.3, “Create a data standard for enabling traceability of restrictions for molecular samples”, we address effects resulting from events in the years 2009/10: Between October 2007 and October 2009 the costs of DNA sequencing dropped from approximately 400 USD below 1 USD per raw megabase (Wetterstrand 2021) and on 29 October 2010 the *Nagoya Protocol* (NP) on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization (ABS) to the Convention on Biological Diversity (CBD) was adopted (it entered into force on 12 October 2014).

The effects were on one hand a massive increase of genetic sequencing in biodiversity research. On the other hand, more and more countries devised their specific national set of regulations for researchers’ access to their biodiversity, which several equalise with “genetic resources”. [Genetic resources](#) are a key concept in the framework for [Access and Benefit Sharing](#) provided by the CBD and NP. This situation poses considerable challenges for genetic studies in biodiversity research that typically include specimens from different countries. The administrative burden increased enormously.

Our work intends to support an efficient and systematic way of dealing with the multitude of ABS regulations that may be attached to specimens in biodiversity collections (tangible specimens or their electronic representations). Furthermore, the presented resources extend the range beyond ABS regulations and include a wide variety of permits and contracts typically associated with biodiversity collection specimens.

Our work provides the possibility of updating electronic data processing systems with data standards for delivering information not only on permits and contracts, but also on typical terms they include. In this way it becomes possible to flag all specimens in biodiversity collections with their respective legal and contractual information, to automatically display these flags and to search for specimens by selecting legal/contractual terms.

The present document starts with depicting the scientific, infrastructural and policy background of the current work (chapter [4.1-4.2](#)), then describes the methodological approach to the problem (chapter [4.3](#)) and the results of the analysis of the community practices and needs regarding the management of legal information in filing and data processing systems (chapter [4.4](#)). The analysis includes a) the results of a survey and detailed interviews with SYNTHESYS+ partners exploring their practices regarding the management of loans and associated documents, and b) a workshop that went beyond the scope of biological collections to get a broader view of policies and regulations present in different communities holding natural science collections and the challenges they pose to documentation and data management. From the analysis, typical categories of use cases were derived that come with different levels of complexity and risk.



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In chapter [4.5](#) we present the Biodiversity Permit/Contract Typology which can be used for establishing a comprehensive filing system (physical and/or electronic) for documents on important events in the life-cycle of a collection object. Additionally, it can serve as a revised version of the GGBN data standard's Permit Vocabulary, now also including different contracts, among them, loan contracts.

The Typology consists of seven Document Categories (1-[Access & Benefit-Sharing](#) (ABS) Documents, 2-High Level Arrangements, 3-Permits for Collecting & Related/Taking/Possessing, 4-Permits for Research, 5-Permits for Special Purposes (excluding ABS), 6-Material Transfer Agreements, Stewardships & Ownership-related Information, and 7-Transport Documents) with altogether 38 Document Types ([Annex 1](#)), enabling flexible use by natural history collections. Each Category and Type respectively is supported by a description of its meaning and scope.

However, the Typology does not include permits/contracts for research with human tissue, human pathogens or genetically modified organisms. Documents focusing on intellectual property rights such as patents are also out of scope of this study.

The two-tiered approach of Document Categories and Document Types provides thematic clusters, graded specificity and the opportunity to flexibly apply these two levels of granularity. It is up to the institutions to use Document Categories and Types according to the needs of their implemented collection or content management systems or document filing system. Aggregating platforms like GGBN might consider implementing the full set of suggested Categories and Types to be prepared for varying contributions from different institutions.

Chapter [4.6](#) presents the Typology of Legal/Contractual **Terms** for Biodiversity Specimens, which complements the Biodiversity Permit/Contract Typology that classifies complete documents, but cannot provide reliable information on permitted actions, due to the lack of international standardisation of document contents. The Typology of Legal/Contractual **Terms** for Biodiversity Specimens showcases terms for specific actions performed on and with biodiversity specimens that otherwise would be hidden in multiple hard-to-read documents. It creates a basis for easily and swiftly exchanging information on what can be done with biodiversity specimens, and under which conditions.

For the Typology of Legal/Contractual Terms we identified five types of lawful sources, i.e. **individualised documents issued by authorities, laws, missing legal provisions for certain actions, contracts/deeds, and written evidence that no individualised documents are necessary**. We further identified four characteristics that may be contained in these lawful sources, i.e. **permissions, prohibitions, duties, and restrictions**. Additionally, we identified **expert opinions** as a separate element that is often necessary for fulfilling legal terms and therefore must be included in the Typology (e.g. expert opinions stating that a specimen is free of familiar pests).

Resulting from this SYNTHESYS+ project 87 different terms have been included in the Typology of Legal/Contractual Terms for Biodiversity Specimens: 50 terms on a general level, 26 specific



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terms for complementing - or at will replacing - them, and 11 specific terms typically used in loan contracts issued by biodiversity collections ([Annex 2](#)). Future work may add more terms to the Typology. Since science is highly integrated on an international level, modifying single definitions for the standardised Document Categories, Document Types and legal/contractual terms should involve as many partners from other countries as possible, to maintain consistent understanding.

The next two chapters of our work contain information to support the implementation of the data standards for both our Typologies in electronic data processing systems. Thereby, the proposed implementation approach is independent of the scope of the data infrastructure system into which the typologies and associated functionality will be integrated. It can be applied to infrastructures that support information needs and applications at the international, (supra)national, or institutional level. To be able to show the transition from abstract conceptual work to the integration of programming code into a concrete, existing infrastructure environment, we are building the two chapters on implementation on the European Distributed System of Scientific Collections (DiSSCo) research infrastructure and its ELViS loans and visits module (European Loans and Visits System). The developed use case is the evaluation of a loan transaction for a physical specimen between the staff of the collection institution holding the specimen and of an institution requesting the specimen on loan.

Chapter [4.7](#) introduces the technical architecture of DiSSCo, its building blocks of open digital objects that are specified as open Digital Specimens (openDS) for the biodiversity domain and the events model that forms the foundation of this highly cooperative and dynamic infrastructure.

In the following Chapter [4.8](#), the functionality of the basic transactional model is expanded by integrating functionality for conditions and their machine-actionable assessment as the basis for a final step of human decision-making. Example code for the loan transaction use case is based on vocabularies and information models provided by the Provenance ontology (PROV), the Web Annotation ontology (OA) and the ontology of the Open Digital Rights Language (ODRL).



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4 Description of Deliverable 3.3

The subject of this SYNTHESYS+ task and Deliverable 3.3 was to “Create a data standard for enabling traceability of restrictions for molecular samples”. The motivation for setting this specific SYNTHESYS+ task was to enable ease of and transparency in lawfully handling biodiversity specimens from various jurisdictions, as they are usually included in taxonomic or phylogenetic research, or in biodiversity collections. To this end, we have expanded the objective of the work beyond the original scope to cover other characteristics of documents than restrictions, i.e. permissions, prohibitions and duties as well as expert opinions. Similarly, we extended our focus from molecular biology samples to all tangible biodiversity specimens usually housed in natural history museums and botanical gardens, which form the professional background of the authors. The multinational composition of the institutions involved in this task enables a result and a Deliverable that addresses not only decision makers in these institutions, but also a wide range of other entities’ decision makers with a biodiversity background from all over the world.

Although the title of this deliverable was specified to be “Best Practice for Using the GGBN Data Standard to Provide Restriction and Loan Information Handbook” our work focused on fulfilling the subject of the task “Create a data standard for enabling traceability of restrictions for molecular biology samples”. At present, no standards exist for “traceability of restrictions”. While the results presented in this Deliverable are the best imaginable practice the authors could think of when debating the different needs of the institutions they work for, it is no “best practice” in the meaning of “a method or technique that has been generally accepted as superior to other known alternatives” (Wikipedia 2022). However, the authors believe that this Deliverable lays the foundation for such a standard and expedites the selection of a generally accepted standard. Additionally, the work on the subject of the task confirmed that the present GGBN data standard’s sections on permits and loans needed an update. This deliverable suggests standardised vocabularies to facilitate such an update, and ways of using it.

Data standards are needed to communicate unambiguously about permits, contracts, agreements or terms relevant to biodiversity collections so that commitments described in such documents can be implemented. We present a standardised system of naming and semantically defining not only such documents, but also and terms within them, and suggestions for extending the scope of the current GGBN standard. The goal of this work is to create transparency and understanding of the legal terms and conditions attached to a specimen from the point of collection throughout all uses of the specimen, its derivatives, and related collection data.



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4.1 Using biodiversity objects and data for science and societal applications

Scientific collections are profoundly service oriented in their mission for preserving and facilitating research and education on tangible material, i.e. of bacteria, archaea, unicellular eukaryotes, fungi, plants, animals, and human tissue samples (the latter are out of scope of this study). Naturally, this also applies to data and information derived from and associated with this material. This endeavour of scientific collections is embedded in the highly social and dynamic context of science and requires the cooperative contributions of many, who are continuously maintaining, updating, annotating, extending and further developing scientific collections.

This highly cooperative context of scientific collections will need to be reflected and accommodated in present and upcoming biodiversity data infrastructures, intended not only to showcase biodiversity, but also to enable research and education on its components and associated electronic records. These biodiversity data infrastructures excel in fulfilling their purposes when interlinked by a globally shared, harmonised, and interactive infrastructure. Extensive discussion and development for such a global infrastructure are underway (see Chapter 4.7.1). The purpose is to create an extended and powerful, since information-rich, global data network, which requires transparent data governance. Our work contributes to transparency by empowering data providers and users through integrating conditions into data models, in support of rights-based approaches and participatory decision-making.

Natural history museums, botanic gardens, zoos and aquaria serve a societal purpose beyond entertainment. The services that arise from managing, preserving and sharing physical objects and digital data maintained in scientific collections form the foundation for sophisticated research. It has the unique feature of relying on biodiversity specimens collected over a long period of time, constituting unique evidence for evolutionary history and the changes in environment over time.

Present biological research relies - at least in part - on analysing the genetic and/or biochemical characteristics of specimens and/or species. This molecular biological research often gains relevance by including samples from many different countries. The resulting large, information-rich data sets can provide the foundation for powerful, parameter-rich analytical approaches, which can produce well-resolved and reliable results, answering pressing societal questions. Currently, such transnational sampling designs require, e.g., researchers, businesses or public planners, to follow a multitude of different legal or contractual permissions, obligations or prohibitions on collecting, taking, possessing and using biodiversity, adapted to each country's individual needs and legal framework.



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The knowledge of especially “foreign” countries’ modalities governing accessibility, handling and use of biodiversity is limited not only among biologists, but also among many other professions involved in this topic.

Information on - and traceability of - legal and contractual permissions, prohibitions, duties and restrictions for the use of biodiversity, including for the use of molecular biology samples, is a vital requirement. This applies not only to any kind of biorepository, including natural history collections, living collections and biobanks, but also to scientific research and to international governmental and institutional cooperation for protecting biodiversity. Biodiversity data infrastructures with the ability to inform users of such legal issues can contribute to filling this knowledge gap.

The outcomes of the SYNTHESYS+ Task 3.3 working group reported here in this deliverable, listing and describing the most common permit and contract information related to biodiversity specimens in collections, may also contribute to the development of governance structures and functions for such biodiversity data infrastructures.

Accessibility and the use of physical objects via loan transactions and the investigation of individual collection objects by visitors are of equal importance to the sharing of data. Data include e.g. digital representations of the physical objects and born-digital field observations (directly typed into or saved by a mobile digital device), as well as information derived from and associated with biodiversity specimens and observations (such as taxon identifications, locality information, legal and contractual information, DNA-sequences, 3D-scans, multimedia recordings, metabolomics, traditional knowledge, taxonomic literature, and much more).

The technical functionality that we outline in this report for integrating conditions into the next generation of biodiversity data infrastructures is forward-looking and generally applicable. We focused our work on legal conditions, including contractual documents. The specifics of categorising and comprehensively representing other conditions, for example arising from social and ethical considerations, intellectual property rights (IPR) and further categories of conditions, will need to be considered and developed in future work.

Our initial motive for working on standardised names and semantic definitions was to alleviate the administrative burden of a special type of regulations, i.e. the huge variety of national “[Access and Benefit Sharing](#)” regulations, based on the [Convention on Biological Diversity](#) with Annexes (1992) and subsequent international treaties, especially the [Nagoya Protocol](#) on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization (2010) that entered into force in 2014. This variety has been a major issue for collection management and basic scientific research in the last approximately 5–10 years (e.g. Zimkus & Ford 2014, Watanabe 2015).



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The extent of our work then expanded to comprise other permit and contract documents related to biological collection objects (including natural history collections, living collections and - in part¹ - biobanks) and researching them based on attached permissions, duties, restrictions and prohibitions.

¹ With the limits described in chapter 3.2 - no human tissue, human pathogens, GMO



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4.2 Landscape overview: institutional to global infrastructures

Getting information on permits, contracts, and their respective terms governing physical collection objects from biodiversity is easiest with electronic data processing systems (EDP). Only small biodiversity collections can provide it comparably easy with manual filing systems.

Information on the ways of using EDPs, or more precisely, on the software used for managing biodiversity collections on the institutional, European and international level, helps to understand how best to deliver legal/contractual information.

4.2.1. Institutional Collection Management Systems

Natural History Museums use various software for managing their collections, and to manage information about their collection objects. A workshop organised in the framework of SYNTHESYS+ task 3.3 (see chapter 4.4.2) showed that open source software, proprietary software and individually designed databases are used. Participants listed the proprietary software: Adlib (<https://www.adlibsoftware.com/>), Axiell (<https://www.axiell.com/>) and Filemaker (<https://www.claris.com/filemaker/>). Open source software are Specify (<https://www.specifysoftware.org/> Biological and Earth Sciences), DINA (<https://www.dina-project.net/>), Diversity Workbench (<https://diversityworkbench.net/Portal/Software>), JACQ (<http://www.jacq.org/> herbaria), Arctos (<https://arctosdb.org/>) and Symbiota (<https://symbiota.org/>).

Several of these programs provide the feature of attaching or linking documents to records of biodiversity specimens. These documents include permits and contracts, e.g. loan contracts. However, to our knowledge no standardised tags are used for such attached or linked documents. As a result, information from different collections cannot simply be compared and is usually only easily understood by staff if properly trained, but not by other users. By simply comparing permit/contract information from different collections, we mean general information such as the purpose of a document or the total number of a particular type of permit, not the full contents of a permit, which may include confidential information.

Another issue is the terms themselves contained in permits and contracts applicable to biodiversity specimens in a collection. As far as we could determine, there are no workflows in institutions to systematically extract terms from documents that are relevant for the future, e.g., a term such as the duty to provide a copy of every publication on a specimen. Certainly, this would bind considerable resources if done retroactively, but it could be feasible for new material added to a collection. A reason for the lack of such workflows may be that no standard terms exist that can be used for tagging. It is important to note that such tagging of terms for a certain biodiversity specimen must not replace necessary legal counsel prior to initiating actions with it, but the tagging could save time when preparing such actions. In this respect, tagging and compiling terms give a quick overview but do not replace the obligation to read the permits and contracts.



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4.2.2. An upcoming European research infrastructure: DiSSCo

The mission of the Distributed System of Scientific Collections (DiSSCo; <https://www.dissco.eu/>) is to develop a next-generation research infrastructure for biodiversity data. It is a long-term initiative and infrastructure development process that originated with the Consortium of European Taxonomic Facilities (CETAF; <https://cetaf.org/>).

DiSSCo is to provide the services required for large-scale and transdisciplinary research. Research that in turn is expected to support the continuing development of a wide range of operational applications that address today's societal challenges. Up-to-date information-intensive basic research into biodiversity and its transition into operational infrastructure tools are needed to effectively and reliably inform and support, e.g., biodiversity conservation, evolutionary stable and ecologically sound nature-based solutions and ecosystem-based services, agri- and aquaculture breeding programs, sustainable management of natural populations in fisheries and forestry, One Health approaches, and much more.

A comprehensive approach to protect and conserve the planet's biodiversity is the **Kunming-Montreal Global Biodiversity Framework** adopted on December 19th 2022 (GBF; Conference of the Parties to the Convention on Biological Diversity 2022, <https://www.cbd.int/doc/decisions/cop-15/cop-15-dec-04-en.pdf>) at the 15th conference of the parties of the UN **Convention on Biological Diversity** (CBD; <https://www.cbd.int/doc/legal/cbd-en.pdf>). The vision of the GBF is for humans to live in harmony with nature (section F of the GBF). It also contributes to the UN Sustainable Development Goals (SDGs; <https://sdgs.un.org/goals>). In support of the monitoring strategy for tracking the GBF's progress and achievements, powerful information- and communication-technical (ICT) data infrastructures are needed, such as DiSSCo that is further expanded in its applicability to the cross-continental level by its alignment with the **Digital Extended Specimen concept** (DES; Hardisty et al. 2022).

4.2.3 GGBN and other international infrastructures

At least 6 international data infrastructures provide contents related to biodiversity specimens (compare chapter 4.4.2). They may be interested in providing information on associated permits, contracts and their terms, and hence in the work presented here. These 6 infrastructures are the Global Genome Biodiversity Network (GGBN, https://wiki.ggbn.org/ggbn/Main_Page), the International Nucleotide Sequence Database Collaboration (INSDC; <https://www.insdc.org>), JACQ (herbaria; <https://www.jacq.org/>), the Integrated Digitized Biocollections (iDigBio; <https://www.idigbio.org/>), the Atlas of Living Australia (ALA, <https://www.ala.org.au/>), and the Global Biodiversity Information Facility (GBIF, <https://www.gbif.org>).

The Global Genome Biodiversity Network (GGBN) is the only international data infrastructure that already displays some information on permits. The GGBN website includes a catalogue of genomic samples (https://www.ggbn.org/ggbn_portal/search/index) which not only displays



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species identification, collection/taking event, extraction and available sequences. It also displays loan information and permit information (Fig. 1), based on the GGBN Permit Vocabulary and GGBN Loan Vocabulary.

Permit(s)

Permit Type:
 Permit Status: Permit not required
 Permit Status Remarks: no national requirement for a permit at date of access
 Permit Remarks:

○

Loan information

DNA available ✓

Interested in this sample?
 Request Account/Log in to request samples

○

Figure 1: Sections from the GGBN webpage on a seashell sample, showing how the GGBN Permit Vocabulary and GGBN Loan Vocabulary (from the “GGBN data standard v1”) is used by the GGBN data portal (https://www.ggbn.org/ggbn_portal/search/record?unitID=ABMBS172-10&collectioncode=BIOUG-DNA&institutioncode=University+of+Guelph%2C+Centre+for+Biodiversity+Genomics&guid=DNA-10BPBS-0172)



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4.3 Material & Methods

The scope of documents considered was based on the experience of members of Task 3.3 in managing biological collections, and encompassed the documents that the group had encountered. We also considered previous relevant work such as that of GGBN and SPNHC and views of other collection managers via a survey and workshop as outlined below.

We did not systematically research specific jurisdictions for possible permits and contracts, although we regarded a set of permit templates from the US and the EU (Annex 7). We also did not speculate on documents that might be implemented in the (near) future.

4.3.1 Starting point: GGBN data standard v1 & SPNHC permitting webpage

We considered a wide range of official notifications and private contracts, and already existing compilations of such documents.

The **Global Genome Biodiversity Network (GGBN)** released the first version of its “GGBN data standard” at the end of 2016 (Droege et al. 2016). This standard comprises 9 different vocabularies:

- for amplification,
- DNA cloning,
- gel imaging,
- loans,
- material samples,
- permits,
- preparation,
- preservation
- and for single reads.

The vocabularies for permits (Annex 4 and https://wiki.ggbn.org/ggbn/GGBN_Data_Standard_v1#GGBN_Permit_Vocabulary), but also the vocabulary for loans (Annex 5 and https://wiki.ggbn.org/ggbn/GGBN_Data_Standard_v1#GGBN_Loan_Vocabulary) served as cornerstones of our work.

For permits the “GGBN data standard” version 1 provides a vocabulary with 30 terms that do not only describe different permit purposes, e.g., Collecting Permit, or Memorandum of Understanding (the GGBN Data Standard uses the word “label” for these terms), but also terms that refer to administrative aspects of the permit, e.g., whether the permit is (publicly) available or not. The data standard then supplements each term (“label”) with a normative URI (uniform resource identifier), a definition, information whether it is “required” and/or “repeatable”, and in the case of administrative aspects with examples for possible options. We considered only 20 terms and definitions that describe the purpose of the permit as a basis for our work (Table 1) and



because of limited resources we discarded five of them (human pathogens, genetically modified organisms, intellectual property rights, patents, copyright).

Table 1: The first version of the GGBN data standard's Permit Vocabulary contains these terms for describing permit contents (the data standard uses the expression "label").

GGBN Permit Vocabulary: "labels" for permit contents	
Collecting Permit	Material Transfer Agreement
Contract	Memorandum of Cooperation
Copyright	Memorandum of Understanding
Data use	Other
Exemption Permit	Patent
Export Permit	Phytosanitary
Genetically Modified Organism	Salvage
Human Pathogens	Unknown
Import Permit	Veterinary Certificate
Internationally Recognized Certificate of Compliance	Intellectual Property Rights

We did not include the "GGBN data standard v1" Loan Vocabulary in our Biodiversity Permit/Loan Typology, as it only describes administrative elements of loans (date, loan identifier, availability of specimen...). In this way it differs from the GGBN Permit Vocabulary, which contains primarily different types of documents (but only a few of their administrative elements). Anyway, loans are covered within the "MTA" Documents Types in this deliverable.

The **Society for the Preservation of Natural History Collections (SPNHC)** runs the website "SPNHC wiki" (SPNHC Wiki contributors 2022a), including topics on legislation and regulation, among them a webpage on "permitting" that started in 2016 (SPNHC Wiki contributors 2022b, main editor Breda Zimkus). The document categories from the SPNHC permitting webpage formed another cornerstone of our work (Annex 6). These document categories are listed in the webpages' section "Categories of Legal/Compliance Documentation" and were first generated by GGBN with a number of additions made by participants of a BCoN-funded workshop "[Addressing Legal Issues Involved in Digitized Collections: The Nagoya Protocol as a Test Case](#)" (NSF grant DBI #1441785) held at Harvard University in March 2018." (SPNHC Wiki contributors 2022b)

Participants of this workshop used compliance with the [Nagoya Protocol](#) to investigate how US institutions must respond to the need for increased transparency of their biodiversity collections and the required digital tracking. The group recognized the need for standardised definitions across the entire community, nationally and internationally, and they identified a number of permits not included in the GGBN list during working group discussions. Harvard's Museum of



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Comparative Zoology applied the discussion generated from the workshop and created a controlled vocabulary of Document Categories and specific Document Types (Zimkus, Ford & Morris 2021).

4.3.2. Creating Document Categories & Document Types, describing Terms

From the sources mentioned in chapter 4.3.1 we compiled an initial list of 16 Document Categories, intuitively named according to keywords of documents or with seemingly fitting short names (Tab. 3 in chapter 4.5.3). In an iterative process of 22 biweekly to monthly discussions, we changed their names, devised definitions for them, reviewed them several times, and in this process reduced their number to a final set of 7 (Tab. 4). In parallel we did the same for the subordinate Document Types (chapter 4.5.4 and [Annex 1](#)). In the 9th meeting participants decided to disconnect the description of documents and the description of terms applying to work with biodiversity specimens. A second and different set of names and descriptions was started, specifically applying on one hand to general terms and on the other hand to very common specific terms extracted from documents.

For the specific terms for collection objects (No. 51-76 in [Annex 2](#)) we additionally included publicly available permits associated to Internationally Recognised Certificates of Compliance from Kenya, Peru and India ([ABS Clearing House](#) Unique Identifiers/reference numbers of the national permit: [ABSCH-IRCC-KE-253235-1/NEMA/AGR/104/2018](#), [ABSCH-IRCC-KE-253313-1/NEMA/AGR/135/2019](#), [ABSCH-IRCC-KE-242932-1/NEMA/AGR/68/2017](#), [ABSCH-IRCC-PE-249103-1/0013PER/SERFOR-2020](#), [ABSCH-IRCC-PE-249106-1/0016PER/SERFOR-2020](#), [ABSCH-IRCC-PE-254865-1/00026PER/SERFOR-2021](#), [ABSCH-IRCC-IN-255561-1/India/NBA/Apl/9/4124](#)).

4.3.3 Questionnaire on using molecular biological collections

To find out critical points in workflow and [Nagoya Protocol](#) compliance with outgoing material requests for DNA studies, and to find out how to overcome insufficient documentation of third party material and ensure good scientific practice with incoming loans, a joint (with T 3.2) questionnaire with 32 questions was sent out to all institutions involved in both tasks on September 4th, 2020. The goal for this survey was to get a first overview on how molecular biological lab data, permit documents, and sampling requests are logged. A distinction between the usage of institutions' own molecular biological collections by internal and external scientists versus using third party molecular biological collections (and receiving third party material for own research) was made. The questions in the questionnaire concerned the handling of these collections of sampled tissue, and the handling of the corresponding permits. This was followed by personal interviews at some institutions. 18 SYNTHESYS+ partners of NA3 participated and 17 completed this survey: BGM, BGBM, CSIC, HNHM, HUJI, LUOMUS, MfN, MNHN, NHM, NHMW, NRM, SGN, SMNS, UGOT, RBGE, RBGK, UCPH, and ZFMK (see acronym list at the beginning). From the 17 institutions who filled the questionnaire, 8 institutions had a follow up interview.



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4.3.4 Joint MOBILISE-SYNTHESYS+ workshop

A joint virtual MOBILISE WG3 and SYNTHESYS+ NA3 workshop on "A Loans and Permits Data Standard for Scientific Collections" was organised by Gabi Droege and Eva Häffner on September 29th and 30th 2021. In total 105 people from 27 countries attended the workshop.

In this workshop, input was sought from various collection communities regarding their expertise, experiences, needs and challenges in connection with a data standard for loans and permits, with the long-term goal to develop a data standard that can be jointly used by different communities. In the workshop, the implementation of the standard in infrastructures and portals was discussed from a general point of view of what shall be achieved and how.

The workshop contributed to an ongoing cross-community discussion on how to support the adequate handling of legal and ethical requirements in natural history collections and related digital data infrastructures. In this context, the community consultation on converging Digital Specimens and Extended Specimens

(<https://www.gbif.org/news/x7u6tmOhyfTE6rM3FQglK/community-consultation-converging-digital-specimens-and-extended-specimens>), especially part 8 on meeting legal/regulatory, ethical and sensitive data obligations (<https://discourse.gbif.org/t/8-meeting-legal-regulatory-ethical-and-sensitive-data-obligations/2665>) provided an excellent approach to the topic.

Digital Specimens and Extended Specimens (Webster 2017, Schindel & Cook 2018, Lendemer et al. 2020a, Lendemer et al. 2020b) have slightly different definitions: The DS “represents the sum of information on the Internet about a natural specimen object. The Digital Specimen acts as a processable digital twin on the Internet for the physical specimen in a natural sciences collection” (<https://github.com/DiSSCo/openDS/blob/master/faqs/faqds.md> of Nov. 17th 2020, see a slightly different definition in Hardisty et al. 2020 of May 18th). It serves as a fundamental element of the European research infrastructure DiSSCo (<https://dissco.tech/2020/03/31/what-is-a-digital-specimen/>). The “extended specimen” is “a constellation of specimen preparations and data types that, together, capture the broader multidimensional phenotype of an individual, as well as the underlying genotype and biological community context from which they were sampled.” (Webster 2017). Combined into a “Digital Extended Specimen” its definition is “the collective representation on the Internet of all digital assets referring to a physical specimen (which can include physical evidence of related observations), that meets the FAIR principles and that is distinguished and linked using globally unique persistent and resolvable identifiers to create an extensive online network of knowledge regarding life and related natural science objects.” (Hardisty et al. 2022).

As a starting point, four different communities were invited, representing the main collections of natural history collections: biological collections, palaeontological collections, geological collections, and anthropological collections. DiSSCo and GGBN as data providing infrastructures were also present. Breakout sessions corresponding to the different disciplines were led by Gabi Droege (biological collections), Rachel Walcott and Steffen Kiel (Earth Sciences and



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palaeontological collections), Karin Wiltshke-Schrotta and Eva Häffner (Anthropological collections), as well as Jutta Buschbom and Breda Zimkus (Implementation/Infrastructures).



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4.4 Analysis of community needs and use cases

The ultimate goal of this work and the revision of the GGBN data standard is to create transparency and foster continuity of legal terms and conditions associated with specimens and their linked collection data throughout workflows and different use scenarios. This general goal can be broken down into a number of well-defined use cases, i.e. typical activities associated with the use of the specimens or data, which may come with different levels of complexity and quality requirements regarding e.g. the parties involved, the visibility of the activity, and the risks that non-compliance could entail. Use cases help with defining the scope of a task. In SYNTHESYS+ Task 3.3 the partners have looked into the use cases “outgoing and incoming loans”, and assessed the current status and future requirements. In the joint MOBILISE-SYNTHESYS+ workshop on a loans and permits data standard for scientific collections the topic was presented to and discussed with over 100 participants representing the wider community of natural science collections. In this workshop, we looked into the use cases, policies and requirements of different disciplines.

Although the SYNTHESYS+ work package NA3 deals with molecular biological collections predominantly, the standardisation of legal information, which is the objective of the subordinate task 3.3, cannot be restricted to this subgroup of collections - the idea is to foster continuity of associated legal information, and this extends to all materials associated with a molecular biological sample, such as a voucher specimen.

Depending on the scientific discipline there may be very different prerequisites and requirements for the respective collections regarding e.g. the type of material, the legal requirements and other potential restrictions regarding their use, and different best practices followed in the community. This interdisciplinary scope was explored jointly by the MOBILISE and SYNTHESYS+ working groups. In the long run, an updated GGBN data standard should be powerful enough to serve all scientific communities using natural history collections. Starting out, the project focused on non-human biological specimens and samples, with the option to extend the standard in the future. The present section 4.4 describes the results of the community consultations and derives typical situations in need of the standard.

4.4.1 Using molecular biological collections: Survey results

Questions from the joint questionnaire developed in collaboration with SYNTHESYS+ task 3.2 on MTAs (see [Annex 9](#)) was one source of information used to get insight in common practice on the use of molecular collections. Outgoing loans for DNA investigations by external and internal researchers are already documented well across the partners, but associated lab data are mostly not linked properly. Associated MTAs, permits and other legal documents are stored centrally in 11 partner institutions, in six institutions they are stored by individual researchers or staff and one



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organisation doesn't store them at all. 10 partners store the documents in both printed and digital form, seven store them digitally only.

For the question what kind of MTA the institutions employ for sending out samples to be used for molecular biological analysis four partners use the CETAF MTAs, seven partners use individual MTAs based on CETAF or GGBN, four partners use individual MTAs, and two partners have either no MTA in place or gave no clear answer.

When requesting material from third party institutions - incoming loans - eight partners store associated MTAs, permits and other legal documents centrally, at seven partners individual researchers or staff are responsible for their storage, five partners store them both in printed and digital form, while seven partners keep them only in digital format. Some organisations mentioned that many documents are not reported at all.

The question if good policies are in place for documenting incoming loan requests for genetic analysis was answered positively by 12 partners, five partners said no without specifying reasons. The majority of respondents agreed that it would be useful to establish organisation-wide policies for incoming loans, though stated that it often would be very difficult to implement these due to a lack of resources.

As a general result of this questionnaire, workflows for handling voucher specimens and extracted DNA, as well as for maintaining related documentation vary widely and are often not institutionalised. The need for standardisation in the handling of documentation is evident for DNA tissue material transferred both by out- and ingoing loans.

4.4.2 Use cases in the wider community of natural science collections

This chapter is a summary of the still unpublished internal report of the joint MOBILISE WG3 and SYNTHESYS+ NA3 -Workshop on a loans and permits data standard for scientific collections (see [4.3.4](#)).

The workshop explored differences and similarities between the different disciplines of a natural history museum: biology, mineralogy and palaeontology as well as anthropology. The workshop went beyond the scope of SYNTHESYS+ NA3.3 (with a focus on biological collections) to introduce the concept of a loans and permits data standard to the wider community of scientific collections. The main conclusion was that a standardised vocabulary for permits and regulations, in biology for example implementing national ABS legislation arising from the [Nagoya Protocol](#), is relevant for all these disciplines and that this cross-disciplinary approach should be continued in the future. We decided to summarise the comprehensive results of the workshop here, but emphasise that non-biological collections are out of the scope of the current deliverable. The plan for a next step is to widen the scope again by setting up a TDWG Task Group for continuing the present work and transforming it into a TDWG standard for "Permits & Transactions" (working title).



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The goals set out for the joint MOBILISE-SYNTHESYS+ workshop were:

- bringing together different collection communities
- discussing the need and possibilities for a data standard to share permit and loan information in different disciplines
- working on a set of minimum information required to provide permit/loan data
- coming to a decision that it makes sense to include all the invited disciplines
- (finding volunteers to form a working group for the data standard and agreeing on next steps, not relevant for this Deliverable)

Within the scope of this workshop were Natural History Museums, Botanic Gardens, incl. seed banks, Culture Collections, Technical Infrastructures and associated networks like GBIF, GGBN etc.

Libraries, medical collections, related biological collections (agriculture and forestry collections, veterinary collections, zoos/aquaria, virus collections) were out of scope for this workshop, but could be added at a later point.

Regarding permit management, linking permits to samples or specimen data is straightforward in most cases. although there is no controlled vocabulary for permits. Post-hoc searching for applicable legal, ethical, and confidentiality restrictions for specimens is a time-consuming task that is currently done manually.

To explore the requirements of the different disciplines that are holding natural science collections, typical use cases and policies of each discipline were collated to form a starting point for a controlled vocabulary for the contents of legal documents. Typical use cases and policies of each discipline were collated. In four breakout sessions characteristics and legal issues of different collection types were addressed and discussed.

4.4.2.1 Framework for use cases from biological collections

Typical objects are

- preserved specimens, living specimens in botanic gardens or culture collections, DNA and tissue banks, seed banks
- often these collection objects are closely related to each other (e.g. seeds collected from one or more plants growing in a botanic garden, DNA sampled from a preserved specimen, preserved specimens as vouchers of living collections), resulting in complex data relations
- observation records, collected by professionals or citizen scientists, play an important role



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Use cases that are regulated by permits and policies:

- ❖ As a researcher I want to know who is managing specimens in a collection and which associated documents exist.
- ❖ As a curator/collection manager, I would like to know which collection items are subject to ABS regulation.
- ❖ As a researcher I want to know which analyses are possible and under which conditions or with which obligations, and whether subsampling or destructive sampling is allowed.
- ❖ As a researcher or exhibition manager I want to know if the loan of a specimen is possible.
- ❖ As a curator I want to know if the exchange of a specific object is possible.
- ❖ As a researcher I want to know how I have to reference the collection objects in publications.
- ❖ As a researcher or an enterprise, I want to know if specific objects are available for bioprospecting & commercialization.

Regulatory Frameworks:

- [Convention on Biological Diversity](#) and its [Nagoya Protocol](#) (CBD and NP - apply to countries only, national laws oblige their residents)
- [Convention on International Trade in Endangered Species of Wild Fauna and Flora](#) (CITES - applies to countries only, national laws oblige their residents)
- Protected areas (laws on different levels of legislation - e.g. national, regional)
- Protected species (laws on different levels of legislation - e.g. national, regional)
- Laws to prevent the spread of pests and diseases (supranational/EU, national)
- Protection of cultural heritage

Handling **sensitive data** applies to:

- Occurrences of endangered species subject to illegal hunting/collecting
- Data indicating commercial potential (e.g. ethnobotany, traditional knowledge)

Handling **sensitive specimens** applies to:

- Type specimens
- Very old, rare, or susceptible specimens

Tips on **best practices for publishing** information on biological specimens:



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- Collaborate and publish together with scientists from provider countries
- Use stable specimen identifiers (such as CETAF stable identifiers) for citation
- Deposit voucher specimens in official and accessible collection-holding institutions
- Cite specimens and samples both in publications and in INSDC databases

Existing **international data infrastructures** (selection, with a focus on specimens):

- ✓ Global Biodiversity Information Facility (GBIF)
- ✓ International Nucleotide Sequence Database Collaboration (INSDC)
- ✓ Global Genome Biodiversity Network (GGBN)
- ✓ Distributed System of Scientific Collections (DiSSCo; under development)
- ✓ Integrated Digitized Biocollections (iDigBio)
- ✓ Atlas of Living Australia (ALA)
- ✓ JACQ (herbaria)

Open Source **Collection Management Systems** (selection):

- Specify (Biological and Earth Sciences)
- DINA
- Diversity Workbench
- JACQ (herbaria)
- Arctos
- Symbiota

4.4.2.2 Framework for use cases from the Earth Sciences

Typical objects are:

- Fossils, rocks, minerals, meteorites, hydrocarbons, gems, models (e.g. physical copies, digital tomography data), moulds (natural casts & embedding made of e.g. wax, gypsum, latex, silicone rubber, gutta percha, epoxy resin), analytical samples (e.g. thin sections, polished sections, SEM stubs, acetate peels)
- observation records are very rare



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- Some features must be considered as they add value and may affect associated insurance and transport costs:
 - large and heavy
 - hazardous (radioactive or asbestiform)
 - liquid
 - need to be pure (chemically uncontaminated)
 - delicate
 - brittle
 - valuable
 - rare (type specimens, from sites that are now depleted or inaccessible)

Use cases that are regulated by permits and policies:

- ❖ As a curator I want to know how a specific hazardous specimen has to be handled and stored.
- ❖ As a researcher/curator/collection manager I want to know under which conditions a specimen becomes toxic (soluble in acid, soluble in water, poisonous to ingest, sensitive to temperature and humidity changes -e.g. pyrite decay, sulphur-sensitive to light e.g. amber, fluorite).

Regulatory Frameworks:

- no international framework exists (to the breakout group's knowledge)
- varies by country, state, county, national park as well as time of collection, size and value
- National or local legislations can vary a lot e.g.
 - Specimens from “sites of special interest (SSSI)” – UK
 - Mines Royal – Scotland & UK (Queen claims ownership of certain metals, fish and birds)
 - Danekræ – fossils are of national importance in Denmark
 - Meteorite – treated differently in every country, land where it falls has ownership
- Museum policies and curators in charge can add additional rules
- Protection of cultural goods

Handling **sensitive data/sensitive specimens** applies to:



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- Some locality information may potentially be targeted by (commercial) hunters

Best Practices for publishing:

- Some journals ask for permit descriptions, or a disclaimer that no permits were required
- Types and figured specimens typically require registration numbers
- Stable specimen identifiers (such as CETAF stable identifiers) are not yet established well enough, but should be used in the future

Existing international data infrastructures (selection, with a focus on specimens):

- ✓ Palaeontology
 - Global Biodiversity Information Facility (GBIF)
 - Integrated Digitized Biocollections (iDigBio)
 - Atlas of Living Australia (ALA)
 - Palaeobiology Database (PBDB, focus on publications)
 - Geobiodiversity Database & Neptune (focus on publications)
- ✓ All earth sciences
 - GeoCAsE
- ✓ Various national portals are in the pipeline, e.g.
 - SwissCollNet
 - DiSSCo UK
 - Swedish Biodiversity Data Infrastructure (SBDI)

Open Source Collection Management Systems (selection):

- Specify (Biological and Earth Sciences)
- Diversity Workbench
- Mostly employed CMS' are not open source (Adlib, Axiell, Filemaker etc.)



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4.4.2.3 Framework for use cases from anthropology

Typical objects are:

- Ethnographic Artefacts – Cultural objects (including those made e.g. from biological or mineralogical specimens)
- Prehistoric Artefacts – Cultural objects
- Human remains – no cultural objects (with exceptions)

Only human remains as collection items were addressed in the following discussion on use cases, regulatory frameworks, sensitive objects, best practices, data infrastructures and open source collection management systems.

Use cases that are regulated by permits and policies:

Different approaches and regulations are in place in different institutions; no standard exists.

- ❖ As an exhibition manager I want to know if a specific object is available for loan to be exhibited.
- ❖ As a researcher I want to know if a scientific investigation is allowed.
- ❖ As a researcher I want to know if destructive sampling is possible.
- ❖ As a curator/researcher/collection manager I want to know which specimens are tagged as sensitive or/and have sensitive data (human remains).

Regulatory Frameworks:

- ICOM <https://icom.museum/wp-content/uploads/2018/07/ICOM-code-En-web.pdf>
- Museumsbund Germany <https://www.museumsbund.de/publikationen/care-of-human-remains-in-museums-and-collections>
- Austria - Bundesdenkmalamt <https://www.bda.gv.at/service/publikationen/standards-leitfaeden-richtlinien/richtlinien-archaeologie-massnahmen.html>
- UK-British Museum <https://www.britishmuseum.org/sites/default/files/2019-11/DCMS-Guidance-for-the-care-of-human-remains-in-museum.pdf>

Many objects from anthropological collections are declared as **sensitive objects** after evaluation of different aspects:

- fossils
- unknown provenance
- sensitive context (colonial context, NS-context, illegal collection, tribal concerns)

Best Practices for publishing:

- Some journals ask for permit descriptions, and/or a disclaimer that no ethical issues are present.



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- Pictured objects usually require identifiers in the caption. (Stable specimen identifiers, such as CETAF stable identifiers, should be used in the future).

At present many **internationally available data repositories** are used for storing public shareable anthropological data like GitHub (Wikipedia contributors 2023), MorphoSource (Duke University Library Digital Repository Software Development and Integration Service 2023), Zenodo (European Organization for Nuclear Research & OpenAIRE 2013), tDAR (Center for Digital Antiquity 2023), etc., <http://anthropologicaldata.free.fr/>; <https://www.kiglobalhealth.org/>; <https://primatelocomotion.org/>; <https://www.ahobproject.org/>; (Mulligan et al. 2022, 36).

Further many Institutional portals may be in place (<https://thanados.net/>), At present no Open Source **Collection Management Systems** for Anthropological Collections are in place.

4.4.3 Synthesis of use cases

Taking together the results of the surveys about managing and using molecular biological collections and of the consultation in the wider community of natural science collections, we derived four levels of activities (transactions) with increasing complexity: 1. Accessioning and (in-house) documentation, 2. Loans and exchange, 3. Use and 4. Submission and publication. With these four levels, the degree of interconnection and visibility of objects and data increases. Accordingly, there is an increasing need to provide standardised information on legal obligations that is transmitted with each step.

4.4.3.1 Accessioning and in-house documentation

The management of objects and information in collection-holding institutions is the first level of complexity when it comes to documenting and managing legal information. All the collection-holding institutions participating in our endeavour have policies in place for accessioning material, and workflows for managing associated information. The SYNTHESYS+ NA3.2 Policies Handbook on Using Molecular Collections lists best practices for accessioning samples and for managing legal documents related to specimens and samples. The handbook points out the challenge to “record rights, restrictions and obligations related information in a standardised way and unambiguously attribute it to the collection items it refers to” (de Mestier et al. 2022). The Biodiversity Permit/Contract Typology, together with the Typology of Legal/Contractual Terms for Biodiversity Specimens presented here, addresses this challenge by providing the possibility to update the GGBN data standard to form a tool to link legal information to specimens and their derivatives in collection management systems. Such a stable link is a prerequisite for keeping the information through all subsequent transaction levels. Full implementation of the vocabulary is in most cases not a requirement at this first, in-house level in order to achieve coverage of the legal information applying to the objects within an institutional collection.



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4.4.3.2 Loans and exchange

From the perspective of an institution, sharing its resources with other parties constitutes the next level of complexity and responsibility. Each institution that was involved in the current project has a loan policy in place that governs the terms and conditions under which a specimen or sample is available for loan. That loan policy forms the basis for the material transfer agreement. It is in the vital interest of the institution to include and transfer all relevant legal information that is attached to a specimen sent out for loan. The standardised vocabulary makes it easier for the providing party to apply due diligence and to define the terms and conditions under which the specimen is offered for loan. The receiving party is supported in ensuring compliance and in establishing its own management plan of the received specimen/sample and the related legal information.

4.4.3.3 Use

A number of activities may be performed on specimens/samples apart from simply holding them in the collection, leading to e.g. identification, exhibition, research, development or commercialisation and may include subsampling and different methods of analysis. Use of the material usually leads to the generation of benefits and is thus the main subject of ABS ([Access and Benefit Sharing](#)) regulations. Independently of whether the material falls under the [Nagoya Protocol](#) or not, collections and users have a vital interest to ensure that the terms for using the material are transparent and complied with. The Biodiversity Permit/Contract Typology and the Typology of Legal/Contractual Terms for Biodiversity Specimens help to flag possible use rules, that is, permissions, prohibitions, restrictions and duties in databases and repositories. In that way, they facilitate locating the sources for these regulations, which may otherwise be hidden in multiple, hard-to-read documents.

4.4.3.4 Publication and submission to public repositories, databases and infrastructures

The last level of complexity the management of legal information must master is the publication, display or offer of the material and associated data in publicly accessible resources. This may be a public database for specimen information (including institutional collection databases and portals, and data aggregators such as GBIF, GGBN or DiSSCo), a database for research results (as for example the INSDC sequence databases or trait databases), a public repository for reference material, or a scientific journal. This step of opening up data and information about material objects and associated knowledge is essential for openly providing biodiversity knowledge for science and societal applications (see chapter 4.1). At the same time this step can be considered to be most sensitive, specifically for highly interlinked data and digital objects, if legal and ethical requirements have to be fulfilled. The Biodiversity Permit/Contract Typology and the Typology of Legal/Contractual Terms for Biodiversity Specimens help to create transparency on information related to rights, restrictions and obligations, fosters trust on the side of the providing parties and can contribute to legal certainty of users. Infrastructures become increasingly aware of the responsibility that arises when unprecedented use can be made of their assets with the emergence of semantic technologies, artificial intelligence and advanced data analysis tools. By implementing



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the data standard, infrastructures take care that legal information is visible to users and providers. Implementing the standard is no guarantee that information on rights, restrictions and obligations is correct or complete. It is still the responsibility of the user to apply due diligence and to take every measure to make sure that all legal requirements are complied with. Yet, it is an important step towards more transparency and good scientific practice, and can establish increased levels of awareness and public control. The latter are connected with the hope that more biodiversity data are made openly available when there are better and more effective measures in place to respect and comply with legal obligations.

4.4.4 Needs for implementation and infrastructure development

The following aspects were highlighted during the fourth breakout session of the MOBILISE-SYNTHESYS+ workshop with members of the biodiversity informatics community engaged in developing, implementing and maintaining biodiversity data infrastructures:

- The standardisation and harmonisation of legal and contractual information associated with physical specimens, their digital representations, as well as derived and associated data is considered to be much needed and to provide important advantages for future collections-based work.
- Accessibility of legal information is of importance for assessing compliance with, e.g., the [Nagoya Protocol](#).
- Legal conditions apply to a wide range of different transactions, both analogue and digital, including e.g. loans, gifts, accessions.
- Digital specimens have an entirely different legal background as the physical museums' objects. Connecting both has more dimensions than just "linking permits". The relation between legal conditions associated with a specimen and its legal twin needs to be explored and clarified.
- The meaning of "open data" can be very differently understood, and thus be prone to misunderstanding and contention among different sectors and among different rights- and stakeholders.
- Liability issues may arise from transcripts of "closed" contractual agreements to a standardised set of terms (cp. the Typology of Legal/Contractual Terms).
- There are often legal and linguistic difficulties in transcribing and translating legal documents
- Time stamps are needed since the legal landscape is dynamic and laws change.
- Quality flags are required, e.g. in the form of "no permit present" in the absence of permit information.
- Persistent linkage to data derived from a specimen, e.g. during a loan event, is needed to ensure that legal information is appropriately propagated.
- Infrastructure providers need to solve long-term archiving.



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- The different types and levels of legal structures need to be represented. For example, the [Nagoya Protocol](#) applies to countries, which then mint national laws, which form the basis for contracts between e.g. providers and users.

The information and experiences provided by infrastructure providers and users in this breakout group became part of the foundation of the work of the SYNTHESYS+ working group and directly influenced the development of the typologies as well as the implementation model.



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4.5 The Biodiversity Permit/Contract Typology

The Biodiversity Permit/Contract Typology provides a common standard terminology with names and semantic definitions for biodiversity-related permits, as well as contracts. It helps to overcome one of the first obstacles for dealing with these documents: unfamiliar permit/contract titles from foreign jurisdictions have the effect that their significance cannot be easily understood, and familiar permit/contract titles potentially mislead the reader to expect content that is not included in reality.

Further an automatised, swift exchange of information on permits/contracts will be a valuable service that such a standardised typology of permits/contracts potentially facilitates. Likewise, a typology makes sorting and filing documents much easier, be it in physical filing cabinets or in databases.

Only for some purposes a common rulebook already exists at international level for configuring biodiversity-related permits and contracts, e.g. for the [Convention on International Trade in Endangered Species of Wild Fauna and Flora \(1973\)](#) that defined a standard for permits in Article VI. The Conference of the Parties to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (2002) explicated this standard.

4.5.1 Not covered: human tissue & pathogens, GMO, IPR, high granularity

Limited resources triggered our decision to exclude certain topics from developing these biodiversity permit/contract typologies: Human tissue & pathogens, genetically modified organisms (GMO), biosafety and biosecurity issues (e.g. <https://bccm.belspo.be/legal/biosafety-biosecurity>) and intellectual property rights (IPR). These are extensively regulated topics requiring considerable engagement of legal counsel, at the same time they are not core objectives of biological collections participating in our European Union funded SYNTHESYS+ project.

We also decided to drop attempts to cover at least certain topics in a high granularity, e.g. country-specific permits and legislation, such as Australian permits. No member of our group had the necessary comprehensive knowledge of Australian biodiversity legislation (compare Table 2). Another example for our decision to dismiss high granularity in featuring permit types is the available information on [phytosanitary](#) requirements: FAO lists approximately 700 different documents on that topic under <https://www.ippc.int/en/countries/all/legislation/>. Or else: the USDA APHIS (United States of America Department of Agriculture Animal and Plant Health Inspection Service) lists approximately 80 different commodity import and export manuals, plus many other manuals on different related topics (<https://www.aphis.usda.gov/aphis/ourfocus/planthealth/complete-list-of-electronic-manuals>).



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Table 2: Not covered in this task are some Australian legislation related to biodiversity, showcasing the need of specialist (legal) knowledge to inform on topics that might be relevant for natural history collections

title of legal topic	related internet resources
Australian biosecurity legislation (including links to approx. 40 more documents)	https://www.agriculture.gov.au/biosecurity/legislation#biosecurity-legislation
Australian Biosecurity Act	https://www.legislation.gov.au/Details/C2021C00265
Australian Biosecurity Regulation	https://www.legislation.gov.au/Details/F2021C00745
Australian Imported Food Control Act	https://www.legislation.gov.au/Series/C2004A04512
Australian Imported Food Control Order	https://www.legislation.gov.au/Series/F2019L01233
Australian Imported Food Control Regulations	https://www.legislation.gov.au/Series/F2019L01006
Australian Export Control Act	https://www.legislation.gov.au/Details/C2020C00192
Australian Interstate Quarantine Zones	https://www.interstatequarantine.org.au/travellers/quarantine-zones/
Australian Emergency Quarantine Measures for <i>Xylella fastidiosa</i> (Pierce's disease)	https://www.agriculture.gov.au/import/goods/plant-products/how-to-import-plants/xylella/notification-amended-emergency-quarantine-measures
Australian Sea Container Cleaning Standards	https://www.agriculture.gov.au/import/before/prepare/sea-container-cleaning-standards
Australian requirements for importing solid wood packaging material (ISPM15)	https://www.agriculture.gov.au/import/goods/timber-packaging/ispm-15
Permits for pest animals in Victoria	https://agriculture.vic.gov.au/biosecurity/protecting-victoria/legislation-policy-and-permits/permits-for-pest-animals-in-victoria
Revised guidelines for the introduction of exotic biological control agents for the control of weeds and plant pests	https://www.agriculture.gov.au/sites/default/files/documents/guidelines-introduction-exotic-bcas_0.pdf



4.5.2 A two-tiered system of Document Categories and Document Types for permits and contracts

We collected more than 40 different permit and contract document types for expanding the GGBN permit/loan vocabulary into this Biodiversity Permit/Contract Typology. We selected a two-tiered system where we grouped similar documents (e.g. collecting permits from different countries) in one Document Type (e.g. the Document Type “Collecting Permit”). Then, similar Document Types (e.g. “Collecting Permit”, “Salvage permit”, “Incidental Take Permit”) are pooled to form one Document Category (e.g. the Document Category “Permits for Collecting & related/Taking/Possessing”).

Apart from higher clarity, our two-tiered approach offers additional advantages:

- thematic clusters – Document Categories are grouping permit/contract documents corresponding to the main processes related to biodiversity collection objects, all but one of these processes (and document categories respectively) are repeatable, only “Collecting & Related/ Taking/ Possessing“ represents the first phase of a collection object’s life-cycle and is not repeatable for this specific collection object. At the same time most Document Categories contain either only permits or only contracts, while two categories comprise both (permits and contracts are mixed in the document categories ABS and Transport Documents).
- flexible granularity – For filing permits and contracts, institutions can choose whether they only use the less granular Document Categories and skip the more granular Document Types classification (e.g. for subject matters where they have few and very different documents), or they use both Document Categories and Types (e.g. for subject matters with a large number of different documents), or whether they use only a specific Document Type without associated Document Category (e.g. for subject matters where they have few very similar documents).
- graded specificity – the two-tiered approach of Document Categories and Document Types constitutes two levels of specificity that may help with filing documents. Sometimes it is too time-consuming to determine the correct Document Type for a given document at once, then it may be a quick solution to allocate the document preliminarily to the less specific document category.

4.5.3 A set of 7 Document Categories

In one form or another, almost all initial Document Categories remained at the Document Category level. However, seven were combined into two Document Categories (i.e. "Permits to Collect and Take/Possess" and "Transportation Documents"). These seven may be an indication of how numerous related documents are in our natural history collections, and how highly their importance is estimated. Furthermore, we adjusted the names for three Document Categories: "Agreement Document" became "High-Level Arrangements", "Use permission" changed to “Permits for special purposes”, and “Transfer of ownership” to “material transfer agreements,



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stewardships & ownership-related information". Two initial Document Categories were transferred to the more granular Document Types. These are on the one hand "Exemption Permit," which we renamed to "Exemption Certificate" and added to all Document Categories for which it was an option based on our experience. On the other hand, we relocated the "Ethical oversight Document" into the "Permits for research" Category. Moreover, the initial Document Category "Institutional Permit" was dissolved and the contents (CITES Certificate for Scientific Exchange, US Endangered Species Act Museum permit, Memorandum of Understanding) were moved to the Document Categories "Transportation Documents" and "High Level Arrangements".

We realised that our initial drafts for the Biodiversity Permit/Contract Typology were biased by the high number of documents stored in our biodiversity collections for taking objects from nature and transporting them. In the end we needed only two Document Categories for them.

Table 3: Development of the 16 initially used Document Categories (numbers in brackets refer to the final Document Categories-DC) and where applicable the type of change: merged, modified, dissolved, excluded - or downgraded to a Document Type - DT.

Initial Document Categories and their development			
Access and Benefit-Sharing Document	(DC1)	Institutional Permission	dissolved
Agreement Document	modified (DC2)	Export Permission	merged (DC7)
Authorization to Possess	merged (DC3)	Import Permission	merged (DC7)
Collecting/Take Permission	merged (DC3)	Ownership Document	excluded
Use Permission	modified (DC4)	Receiving Permission	merged (DC3)
Research Permission	(DC5)	Salvage Permission	merged (DC3)
Ethical Oversight Document	downgraded (DT)	Transfer of Ownership	modified (DC6)
Exemption Permission	downgraded (DT)	Transport Document	merged (DC7)

Finally, the initial Document Category "Ownership Document" was excluded for this task because it contained intellectual property rights, and we did not have the resources and expertise to address this topic.



Table 4: The final seven Document Categories and their 38 associated Document Types

Document Categories	Corresponding Document Types
1) Access and Benefit-Sharing Document (ABS)	1-1 Mutually Agreed Terms (MAT) 1-2 Internationally Recognized Certificate of Compliance (IRCC) 1-3 Prior Informed Consent (PIC) 1-4 Specialised standard ABS terms - SMTA 1-5 Other ABS document (e.g. biomedical, BBNJ) 1-6 Exemption evidence
2) High level arrangements	2-1 Contract (legally binding) 2-2 Memorandum of Cooperation (MoC) 2-3 Memorandum of Understanding (MoU)
3) Permits for collecting & related/taking/possessing	3-1 Authorisation to enter site 3-2 Collecting permit 3-3 Taking: “incidental take” permit 3-4 Taking: Migratory Bird Treaty Act (MBTA) Special Purpose, Salvage Permit 3-5 Taking: Salvage Permit (e.g., Non-US, US federal, state, local) 3-6 Possessing: Receiving permit 3-7 Exemption evidence
4) Permits for special purposes (excluding ABS)	4-1 Permit to reintroduce/translocate organism into the wild 4-2 Data use agreement 4-3 Bioprospecting permit
5) Permits for Research	5-1 Research Permit 5-2 Ethical oversight document 5-3 Exemption evidence



6) Material Transfer Agreements, stewardships & ownership-related information (excluding ABS)	6-1 Public law MTA (e.g. acquiring customs' seizures, stewardship agreement) 6-2 Institutional MTA (e.g. loans) 6-3 Individual deeds of transfer (e.g. private gifts) 6-4 Provenance evidence
7) Transport Documents	7-1 (Phyto-)Sanitary/Veterinary Certificate 7-2 Permit to move across boundaries 7-3 CITES export permits & re-export certificates 7-4 CITES import permits 7-5 CITES certificates of scientific exchange (COSE) 7-6 other CITES documents 7-7 Original Export Permit 7-8 Export Permit 7-9 Original Import Permit 7-10 Import Permit 7-11 Exemption evidence 7-12 Other transport documents

The Document Category definitions describe the scope of each Category and which Document Types it includes.

4.5.3.1 [Access and Benefit-Sharing](#) Document (ABS)

Document Category definition: *documents permitting the [access to genetic resources](#) for their utilisation and/or covering the terms of benefit-sharing*

4.5.3.2. High level arrangements

Document Category definition: *documents that require signature(s) by (a) member(s) of the highest management level of an institution. There may be country-specific arrangements at even higher levels, or higher-level arrangements applicable only to institutions being a government department*



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4.5.3.3. Permits for collecting & related/taking/possessing

Document Category definition: *documents by authorities or private entities allowing collecting live specimens from nature (and entering certain areas) or taking e.g. roadkill, as well as possessing restricted material - this does not include ABS-permits, research permits and permits related to the transport of specimens (see the relevant other document categories)*

4.5.3.4. Permits for special purposes (excluding ABS)

Document Category definition: *documents by authorities or private entities allowing use of the collection (objects) for specific, limited purposes (future perspective) - this does not include ABS-permits*

4.5.3.5. Permits for Research

Document Category definition: *document by an authority allowing basic and/or applied research within its jurisdiction, and legally required committee decisions on research*

4.5.3.6. Material transfer agreements, stewardships & ownership-related information (excluding ABS)

Document Category definition: *documents demonstrating the will of two parties regarding the transfer of tangible material between them (e.g., an agreement between two institutions that outlines the terms and conditions for transferring specimens or samples; for stewardships the conceding party is a public authority) or which include information on such transfers in the past. This does not include shipping documents, contracts with a carrier (both: see transport documents) or transfer documents under ABS-legislation.*

4.5.3.7. Transport Documents

Document Category definition: *permits, certificates and other documents necessary for the act of sending specimens from one place to another*



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4.5.4 A set of 38 Document Types

The purpose of creating Document Types ([Annex 1](#)) was twofold. The main purpose was to identify and group documents relevant for future use of collection objects. For example, documents related to [access to genetic resources & benefit-sharing](#) based on their utilisation. The second was to create a comprehensive system for filing all documents in the life-cycle of a collection object, e.g. a permission to enter a collecting site by car.

Creating our collection of Document Types started in June 2021 with an existing list of documents, and Document Types from the database “MCZbase” of the Museum of Comparative Zoology (Harvard University, Cambridge, MA, USA) provided by Breda Zimkus. On the one hand, the documents on this list were compared to similar documents from different jurisdictions stored in the other institutions participating in SYNTHESYS+ task 3.3. On the other hand, participants added new documents to the list. In cases where no similar documents were available in our institutions, participants consulted other colleagues or checked either European or USA legal information to see if similar documents exist. In the process of researching and comparing documents, new Document Types were created, the names of existing Document Types were changed, a definition was added to each Document Type, and Document Types were assigned to the superior Document Categories. In addition, the definitions were supplemented with “additional information” about what a Document Type could include. In “Examples” e.g. links to publicly available blank forms are listed. The 38 Document Types with their definitions, additional information and examples are listed in [Annex 1](#).

The search for European documents similar to those from the USA quickly became time-consuming, as few are standardised at the European level. The multitude results from national or even local legislation. As a by-product we compiled a list of permits issued by US or European authorities (completeness was not pursued, Appendix 4).

Creating definitions for each Document Type was very labour-intensive because they had to fit all documents we knew that belonged to that Document Type. We intended for them to be short and concise, but at the same time contain enough information so that even non-experts could correctly assign the documents.



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4.6 Typology of Legal/Contractual Terms for Biodiversity Specimens

For the purpose of capturing (not only, but also) “restriction information” attached to biodiversity objects we initially planned to create a list of various biodiversity-related documents including their descriptions; and we wanted to do that by updating the GGBN data standards for the GGBN Permit Vocabulary and the GGBN Loan Vocabulary (Droege et al. 2016) (https://wiki.ggbn.org/ggbn/GGBN_Data_Standard_v1).

4.6.1 Addressing a problem: uniform use-terms are missing in permit vocabulary

Once we began updating core elements of the GGBN Permit Vocabulary and Loan Vocabulary, i.e. names and definitions for a list of different permits and contracts, it soon became clear that uniform names/definitions for similar documents from different jurisdictions do not automatically provide uniform “restriction information” or, at large, uniform use-terms. Simply because we often could not infer accurate “restriction information” from the name of the permit/contract (“contract” also includes loans of biodiversity collection objects). For instance, two “Prior Informed Consent-PIC” documents for [utilising genetic resources](#) issued by different jurisdictions contained different restrictions, and also different duties. Both are the same type of permit, but containing different types of use-terms. It became clear that the lack of a comprehensive international standard for configuring biodiversity-related permits requires a twofold approach in addressing restrictions attached to biodiversity specimens. We had to create not only a Biodiversity Permit/Contract Typology for sorting the multitude of national permits/contracts, but we also had to complement it with another typology, the Typology of Legal/Contractual Terms for Biodiversity Specimens if we want to arrive at harmonised concepts for “restriction information”.

4.6.2 Identifying a backbone: five types of lawful sources, their characteristics, plus expert opinions

Lawfully handling and using biodiversity collection objects, as well as creating harmonised concepts for “restriction information”, rests not only on permits and contracts, there are additional lawful sources that must be considered. A recent example is related to “[utilisation of genetic resources](#)”, first defined in the international [Nagoya Protocol](#) and subsequently incorporated in several countries’ national legal systems. These countries often issue individual permits for “[utilisation of genetic resources](#)” (provided the [genetic resource](#) was taken from that country). But other countries do not regulate their genetic resources, they do not issue such permits and any “[utilisation of their genetic resources](#)” is permitted on the principle that anything is allowed unless it is explicitly forbidden.



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Documents related to objects in our collections do not only represent different types of lawful sources for restrictions on having and using these objects, they may also contain other characteristics than “restriction information”, e.g. a permission. These characteristics are compiled further below. And some documents related to collection objects are no judicial texts at all, but opinions of experts in natural sciences.

4.6.2.1 Lawful sources

The question “How do you know?” that certain “restriction information” exists led us to five types of lawful sources setting conditions for handling biodiversity specimens:

1. an individual **document** issued to a specific person or legal entity, based on a public administration's decision (often after examination of a specific project; abbreviated “D”)
2. a written **law** without individualised document, the law however can be referenced (abbreviated “L”)
3. **no legal provisions** exist nationally or on the level of applicable supranational (e.g. EU) legislation (abbreviated “N”)
4. **a contract/deed** (civil law; abbreviated “CD”)
5. evidence that no individual document (see No. 1.) is necessary for a permission, but without information whether this is based on written law or missing legal provisions (abbreviated “LN”)

These five types of lawful sources D, L, N, LN and CD also provide their specific degree of legal certainty. For example, any permission derived from an individually assigned document (or contract) pertaining to a specific collection object provides less room for interpretation than a permission derived from written law - because you need to be certain that the law really applies to the collection object in question. And finally, a permission inferred from the absence of specific legal provisions requires even more research or legal expertise if you want to have legal certainty.



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4.6.2.2 Characteristics of lawful sources

“Restriction information”, our starting point, is but one of four characteristics potentially contained in the lawful sources we identified. The lawful sources 1, 2 and 4 may contain all four legal characteristics listed below. We have taken the definitions for two of them, “prohibition” and “duty”, from the Open Digital Rights Language ODRL (<https://www.w3.org/TR/odrl-vocab/>), and slightly adapted ODRL’s wording for “permission”. We have also added the new legal characteristic „restriction“:

- Permission: The CONSENT to perform an action over an asset (we exchanged “ability” for “consent” to emphasise that a person gets the opportunity to perform an action, without testifying that the person is able to do so). *Our example: collecting specimens from nature.*
- Prohibition: The inability to perform an Action over an Asset. *Our example: Do not damage the specimen’s integrity.*
- Duty: The obligation to perform an Action. *Our example: Deliver a copy of the publication.*
- Restriction: The obligation to refrain from an action for the time being. A restriction can be modified or lifted by subsequent negotiations. *Our example: Only for taxonomic purposes.*

Furthermore, we use “obligation” as an umbrella term for both “restriction” and “duty” (but not necessarily in the meaning it has in ODRL, where it is used in relation to “policies”).

Depending on the jurisdiction or special legal context the lawful sources 3 and 5 express either “not prohibited”, or “permitted”, for the lawful source 5 the permission may also be based on a law.

4.6.2.3 Expert opinions

In the context of documents related to collection objects expert opinions that confirm a certain quality, such as “free of known pests”, “free of biosecurity risks” or “ethical statement for a research project”, also became part of our Typology of Legal/Contractual Terms for Biodiversity Specimens. The source of their content is expert knowledge only, therefore we do not classify them according to our lawful sources or legal characteristics (although we recognize that lawful sources may have initiated writing these expert opinions). For our purpose we distinguish whether a document is an expert opinion (Y) or not (n).



4.6.3 Describing terms for biodiversity specimens

Users need a specific set of information to work efficiently with terms attached to biodiversity specimens.

1. First of all, they need to know the contents of a term, or in the event of a standardised vocabulary for terms, the definition/description for every item in the vocabulary.
2. Then, most users want to get information on the legal certainty that comes with a specific term, in line with the lawful sources mentioned above.
3. Third, users want to know whether a term potentially applies to them, or has already been fulfilled in the past.

Our Typology of Legal/Contractual Terms for Biodiversity Specimens includes these three elements - definition, lawful source, past/future. Users wanting to implement this Typology in EDP systems (Electronic Data Processing) might also be interested in a classification that specifies whether an item of the Typology is a permission, prohibition, duty or restriction (or a combination of them) - for this purpose we provide a pre-processed version of our Typology.

4.6.3.1 Indicating the lawful source for each legal/contractual term

The information on lawful sources that we provide for every term, implying a certain degree of legal certainty, is a judgement call by the authors based on the limited selection of available permits/contracts. The same applies for the information whether a term is only used by public authorities through administrative decisions or laws (e.g. import permission) or also in contracts under civil law (e.g. transfer to 3rd parties).

For implementing the Typology of Legal/Contractual Terms for Biodiversity Specimens in collections or with international data providers we used the relevant capital letter CD (contract/deed), D (individual document), L (law), N (no legal provision), or LN (exemption evidence) or “not specified”, added to the catchphrase for the legal/contractual term. In any case, where no resources are available for examining the content of permits or contracts, the tag “not specified” can be applied.

For example: For a given biodiversity specimen the legal term “YES: genetic and biochemical” may come from one of the following lawful sources: D, L, N, LN or “not specified”. Depending on the contents of the permit at hand, a collection holding institution may flag their data record or label of a given biodiversity specimen with “YES: genetic and biochemical (not specified)”, or “YES: genetic and biochemical (D)”, or “YES: genetic and biochemical (L)” etc. Very common will be “YES: genetic and biochemical (N)” for biodiversity specimens from countries that do not regulate their [genetic resources](#), which means that no legal restrictions are in place.

International platforms such as GGBN or the upcoming DiSSCo might want to implement all possible options in their systems to be ready for whichever information the participating institutions deliver.



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4.6.3.2 Legal/contractual terms for actions in the past and/or future

Some of these legal/contractual terms refer to future use (e.g. “YES: genetic and biochemical”), some only to actions in the past (e.g. “collecting from nature”) and some to both (e.g. “under CITES”). When talking about “future use” and “actions in the past” we need a key for a consistent understanding of these attributes, and for drawing a line between a legal/contractual term that applies only to the past, only to future use or to both. For this purpose, we suggest to select alternately one of two definitions to delimit actions in the past. First, the end of the project/endeavour bringing a biodiversity object into the collection for the first time. For example, if the biodiversity object is collected for a specific research project and then kept in a biodiversity collection, every legal/contractual term applying only to this research project is rated “applies to actions in the past”. Any term applicable beyond this first research project gets the attribute “future use”. Specifically, the legal/contractual term demanding to send a taxon list with counts of all collected specimens gets the attribute “past”, because taxa are at least roughly determined before specimens are added to a collection (although, if the legal/contractual terms are categorised at a very early stage of the research project, e.g. during digitising the documents upon their arrival, the taxon list usually has not been sent). As a second definition for delimiting actions in the past we suggest that terms always apply to “actions in the past” if they target a single specific point of time, e.g. the time of import into the country where the specimen is added to a collection.

The attributes “past” and “future use” provide choices for institutions implementing the Typology. Some may choose to implement only those terms (e.g. in their collection management routines/systems) that are relevant for “future use”, while they evaluate terms relevant to the “past” only once, e.g. at the time when a biodiversity object is about to be added to the collection at the end of a research project or a collecting trip. Other institutions additionally may want to set up management systems for contracts they enter into, starting the monitoring of all terms right after signing a contract, or management systems for projects they conduct, monitoring (among other project elements) the contractual terms they have to fulfil. Then they may implement terms related to the past to have the ability to check off all items that have already happened.



4.6.3.3 The legal characteristics of every term

For the implementation of the Typology of Legal/Contractual Terms for Biodiversity Specimens in EDP-systems we provide a table allocating every legal/contractual term we describe to the characteristics described in 4.6.2.2, differentiated by the lawful source from which it originates ([Annex 3](#)).

The structure of the large table in [Annex 3](#) is explained in Table 5 showing the heading, and as an example row 12 with the catchphrase “obligations: genetic & biochemical” in the first column. The definition for this catchphrase is provided in [Annex 2](#), it also states that additional “institutional loan conditions may apply”- we provide typical examples for institutional loan conditions in rows 77-87 of the table in [Annex 3](#). The second column of Table 5 shows that the catchphrase in row 12 refers to future actions with the biodiversity specimen in question, the third column shows that it is no mere expert opinion on the quality of a collection object (such as e.g. “free of familiar pests”). Columns 4-9 show that it is based on public law, and the lawful source may be either an individually assigned document (D) or a law (L) or, indicated by “possible” in the respective columns, a mixture of both. Additionally, they show the characteristics of the lawful source for the specific catchphrase, i.e. permission(s), duty(-ies) and/or restriction(s). The “n/a-not applicable” in the last column “required by contracts/deeds under civil law” indicates that this catchphrase refers only to public law. Loan conditions (e.g. from museums) or other contractual obligations, are covered with other catchphrases.



Table 5: Explanation how to read [Annex 3](#): Legal characteristics of every term

The “catchphrases” are defined in [Annex 2](#); details on “action in the past/ future” see [4.6.3.2](#); information on “expert opinion” see [4.6.2.3](#); types of lawful sources are explained in [4.6.2.1](#): D=individual document, L=law, N=“not subject to national/ supranat. public law”, CD= “required by contracts/ deeds under civil law”; characteristics of lawful sources see [4.6.2.2](#); n/a=not applicable; possible=the relevant lawful source differs among countries.

Catchphrase ↓	action in the past/ future	expert opinion Y/n	under national (or supranational, e.g. EU) public law						(N) not subject to national/ supranat. public law	(CD) required by contracts/ deeds under civil law
			(D) refers to individually -			(L) refers to written law providing -				
			granted permission	assigned obligation (duty or restriction)	assigned prohibition	permission	obligation (duty or restriction)	prohibi- tion		
12 obligations: genetic & biochemical	future	n	possible	possible	n/a	possible	possible	n/a	n/a	n/a



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4.6.4 A set of 87 legal/contractual terms for biodiversity specimens

We identified 87 different legal/contractual terms and characterised each of them, based on documents that we used for setting up the Biodiversity Permit/Contract Typology.

In [Annex 2](#) we list these terms, along with their individual characterisation and possible lawful source (see [4.6.2.1](#) - or where applicable an expert opinion, [4.6.2.3](#)) and whether they are relevant for future use, for actions in the past or for both (see [4.6.3.2](#)). The terms 1-50 are general terms, followed by optional specific terms 51-76, which are starting with the word “required”, for adding more detail to the general terms. Term No. 77-87 are loan terms.

The table “Legal characteristics of every use-term” [Annex 3](#) provides an overview of the 87 terms and focuses on the “legal background” of each term, i.e. the potential variety of lawful sources and their possible characteristics (see [4.6.2.2](#)). The table complements Annex 2, but adding “legal background” information to biodiversity specimens is optional, institutions may choose to work with legal/contractual terms alone. However, the table can also be used to facilitate implementation in EDP systems, an example of how to read the table is provided in [4.6.3.3](#). In general, institutions have to spend significant resources if they want to provide information on lawful sources and their characteristics defining what can be done with a collection object. On the other hand, the benefits of an implementation appear just as great: First, staff and users quickly receive information on the legal background. For example, a document individually addressing a collection specimen has a higher clarity than the more general statements in a law. Second, differentiating the four characteristics - permission, prohibition, duty, restriction - makes it possible to search all specimens according to these characteristics. For example, specimens with no restrictions can easily be compiled. Further the implementation of the four characteristics is also a basis for machine-actionability and the automated exchange of information across different databases all over the world.

Flexibility is a main advantage of the Typology of Legal/Contractual Terms for Biodiversity Specimens. If only a selection of terms is applicable to specimens of an institution, only this selection can be implemented, not the entire Typology. Likewise, institutions can choose to add information on the terms’ lawful sources and their characteristics according to their needs and resources: such information may be implemented only for selected terms, only for selected lawful sources (e.g. all documents individually issued by a public authority), only for selected characteristics (e.g. all duties), only for selected collection items (e.g. newly collected specimens), only for internal use (to avoid liability disputes), or for any mixture of these options.

Terms in the Typology may overlap content-wise, not only with respect to general terms (No. 1-50) versus specific terms (No. 51-76), but also within the group of general terms. This is an inevitable feature of terms originating from different jurisdictions.

It is inevitable that additional legal/contractual terms will be defined and added in the future, given the limited resources that have been available to us.



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4.7 The DiSSCo openDS specification and event-based data model

4.7.1 The open Digital Specimen specification

DiSSCo is currently developing a specification, i.e. a technical standard, for digital representations of curated collection specimens, called open Digital Specimen (**openDS**; <https://github.com/DiSSCo/openDS>). Digital representations are the sum of information on the Internet about a natural specimen.

The following description of openDS is based on communication with Wouter Addink, Work package lead SYNTHESYS+ WP6 and DiSSCo CSO Deputy Director in charge of Data and Technology, to closely align it with the most up-to-date understanding of both groups: “openDS is a specification for open Digital Specimens, which includes three components: a data model, ontology and an API. The openDS data model and ontology aim to describe specimens and their related objects, such as the organisation holding it, a contract or permit dealing with it, images of a preserved specimen, field observation media files, notes in field notebooks, in such a way that they can be related and also interlinked with additional data and information derived from and associated with the specimen, such as traits, taxonomic treatments and genetic sequence data. The different groups of objects within the specification are defined by classes with properties, which can be properties pointing to other classes to relate them, or properties with actual content (data or metadata). The first version of openDS contains the classes which are mandatory for basic interoperability with the DiSSCo Technical Framework and cover use cases such as Minimum Information about a Digital Specimen (MIDS) and the Specimen Data Refinery (SDR). These core groups are: Digital Specimen, Multimedia, Agent, Provenance and Other, where Other is used for concepts that don't properly fit in the other core groups, but are not extensive enough to warrant the creation of another group.”

The openDS specification will standardise data and metadata entries for natural specimens and related objects and, thus, provide a foundation for global data harmonisation and aggregation. Enabling the merging of (meta)data of different types and from many different sources for their combined reuse, it will facilitate joint analyses of large datasets and transdisciplinary information. Community agreement on and acceptance of the specification will form the foundation for an integrated and extensible global data infrastructure providing (meta)data on biodiversity entities preserved and managed by scientific collections.

With this specification, the Distributed System of Scientific Collections (DiSSCo) can be one of the starting points for a globally connected, though distributed and federally governed infrastructure for biodiversity data. It can contribute to the integration of collection- and event-based data from species- to population-level into, for example, the Global Biodiversity Observation System (**GBIOS**) conceptualised by bioDISCOVERY/Future Earth and GeoBon (Krug et al. 2022), or the Knowledge Centre for Biodiversity of the European Commission



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(https://knowledge4policy.ec.europa.eu/biodiversity_en). Taking advantage of the FAIRness (Wilkinson et al. 2016) of openDS objects and linking out from discipline-specific platforms beyond the realm of biodiversity and its associated sectors, enables event-based data describing and recording collection objects and field observations to become part of a wide-ranging open and interoperable global data system and network bringing together all kinds of data, information and knowledge.

The foundational architecture for such versatile and highly transdisciplinary next-generation data infrastructures has been laid out in the Digital Object Architecture (DOA; Sharp 2016). The DOA aims to enable “an internet of FAIR data and services” (Wittenburg et al. 2019) and conceptualises a system, which will enable the wide-ranging, dense and flexible interlinking of data entities, based on open FAIR Digital Objects (**openFDOs**; Schultes & Wittenburg 2019) as its individual data elements. openFDOs are data packets in which “payload” data are wrapped by several layers of operational metadata that transform data of any type into Findable, Accessible, Interoperable and Reusable (**FAIR**; Wilkinson et al. 2016) entities that can be effectively shared online. Furthermore, as openFDOs data become machine-actionable enabling the automatic updating and extended interlinking of the objects as the basis for building a provenance record and increasing transparency.

When openFDOs and the DOA in addition follow and intrinsically implement within their metadata layers and infrastructure functionality the rights and guidelines associated with Collective benefit, Authority to control, Responsibility and Ethics, together forming the **CARE** principles (Carroll et al. 2021) of data governance, they will empower data providers and promote data and metadata sharing and reuse in a wide range of contexts.

The metadata layers that are wrapping an openFDO and form the foundation of the power and versatility of the digital objects combine both generally applicable operational information common to all openFDOs, as well as discipline- and data type-specific metadata profiles. The openDS specification provides such a discipline-specific metadata profile for the biodiversity sciences and data of the applied biodiversity sector. It includes, for example, several data type-specific sub-schemata to represent metadata specific to physical objects of different biological, anthropological and geological subdisciplines. Among others, sub-schemata are present for specimens from anthropology, botany, mycology, zoology, palaeontology, geology, human medicine and genetic resource collections.

In conjunction with the DiSSCo technical infrastructure and its openDS specification, which are focused on providing general functionality for work with the digital representations of collection specimens, a module is under development specifically for the management of loans and visits to collections of physical objects, the **European Loans and Visits System (ELViS)**; <https://github.com/DiSSCo/ELViS>). Supporting the functional focus of this DiSSCo module, here as well (meta)data standardisation and harmonisation will enable the inclusion and handling of all



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kinds of digital biodiversity records. For example, Digital Specimens can be included that represent physical specimens whose information have been digitised to different extents (cp. MIDS levels, <https://github.com/tdwg/mids>). The ability to include objects is independent of their disciplines of origin (e.g. bio-, geo-, anthropological or ethnocultural diversity), object types (e.g. microscope slides, DNA extracts, mounted vertebrates, artist models of organisms), material (e.g. frozen tissue samples, bones, mineral objects, dried organisms or clay cultural artefacts), as well as their location in the world and their holding organisation.

4.7.2 Transactional model

Building on the openFDO and biodiversity-focused openDS data specifications, event-based transactional models consider that (meta)data are not static, but are constantly created, accessed (retrieved and read), updated and deleted. That is, they are always changing due to the activities of humans and machines that are interacting with them. Event-based transactional models are able to support and incorporate these interactions and their arising information. They do so by digitally representing and implementing the functionality contained in interactions, thereby building capacity for processes. Hence, they digitally represent the dynamic nature of (meta)data.

Forming the core part of the backbone in the next generation of biodiversity data infrastructures, event-based transactional models enable the **bidirectional sharing** and **reuse** of physical objects and digital data. For example, in event-focused infrastructures not only collection-holding institutions provide data to users, but annotations and extensions with new insights from users flow back to the data providers. From the recording of individual transaction events as well as their persistent linking to the data object arises an object's **provenance** record. This record is created automatically with the help of transactional models. A complete time series of transactional records results in a full chain of custody for the physical object or data entity.

A chain of custody arising from a time series of provenance records that has been accumulating along, e.g., a research workflow can be transformed into an **operation-grade chain of custody**. This requires extensive resources and efforts to be allocated for development and continued maintenance. Furthermore, if required such an operational chain-of-custody can be further developed into supporting **tracking** and **tracing** if the provenance information is associated with sufficient, reliable and information-rich metadata, including metadata that might be legally required for the specific use case at hand, and complemented by the implementation and maintenance of software application to operating system and hardware auditing as well as security measures. The implementation of tracking and tracing applications might be considered, for example, for the purpose of international benefit sharing, supply chain certification, or verification of geographic origin.



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Overall, transactional models with the capabilities of announcing and transmitting events and their results across interlinked infrastructure landscapes form the basis for transparency, attribution and accountability.

The event-based transactional model used in DiSSCo, which therefore can also be used in upcoming versions of its ELViS module, is based on the W3C-recommended **Provenance Ontology** (PROV; <https://www.w3.org/TR/prov-o/>). The functionality of the PROV standard is extended by the W3C-recommended **Web Annotation Ontology** (OA; <https://www.w3.org/ns/oa>), which allows an infrastructure to capture and record more detailed information about transactions. The OA standard thus fosters the linking of several transactional events, potentially involving different parts of a physical or digital object, into a series. In this way, a sufficiently information-rich provenance record can be accumulated.

The core elements (fig. 4.7.2-1) of an event in the PROV standard are a **prov:Activity**, associated with or performed by a **prov:Agent**, potentially acting as part of a specific **prov:Role**, on a **prov:Entity**, which can be physical or digital. In a series of activity events on one and the same object or entity, the OA standard provides more specificity by adding functionality for identifying which specific part of the object (the **oa:Target**) was modified in which way (the **oa:Body** of the annotation).

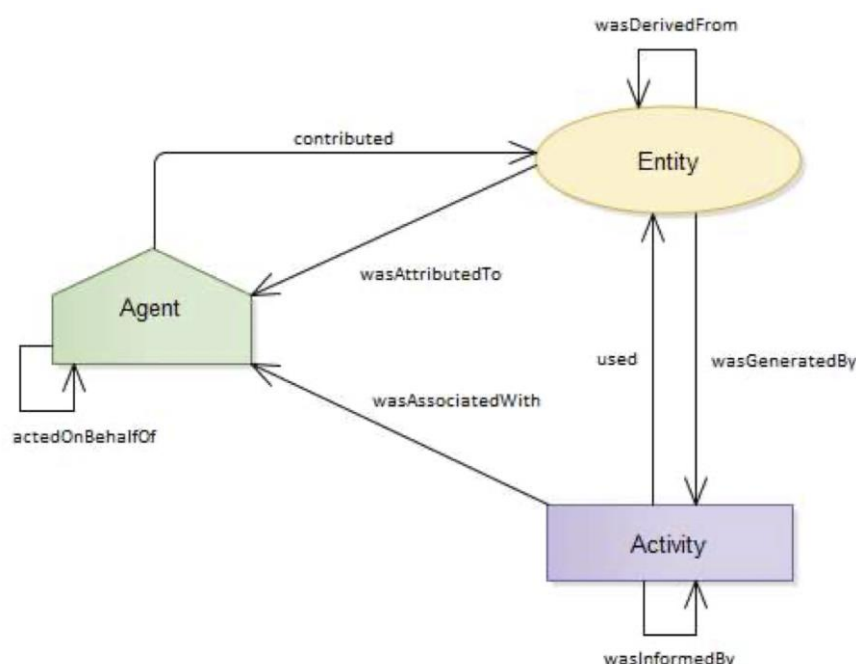


Figure 4.7.2-1: The core elements of the PROV standard and their structure (Copied from Thessen et al. (2019) Appendix A, fig. S1, CC-BY 4.0; based on PROV Model Primer, <http://www.w3.org/TR/2013/NOTE-prov-primer-20130430/>, Copyright © 2013 W3C® (MIT, ERCIM, Keio, Beihang), All Rights Reserved. W3C liability, trademark and document use rules apply.)



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4.8 Extending DiSSCo's basic model by proposed components for conditions

DiSSCo's basic model (Islam et al., 2020), which is built based on the PROV ontology and extended by OA functionality as mentioned above, is fully adequate for describing events and transactions, as well as for building a provenance record. This is sufficient for the open and free sharing of digitised representations of physical objects and digital (meta)data that have no conditions associated. Originating in the basic biodiversity sciences, the open and free sharing of (meta)data that do not need special protection and do not come with specific considerations or concerns currently is DiSSCo's starting point.

Nevertheless, looking to the future, DiSSCo has the goal to develop and implement additional capacity. On one hand, DiSSCo's basic model's functionality needs to be expanded for the implementation of its ELViS module. The module will enable the DiSSCo technical infrastructure to act as an agent that mediates the lending of unique physical objects. These are susceptible to damage and decay, at the same time there are no identical backup copies, in contrast to the digital world, in which such copies are possible. On the other hand, in the future DiSSCo plans to be able to support the sharing of data that have conditions attached. Such data can include, for example, sensitive (meta)data (cp. the exploitation of endangered natural populations), or information derived from physical specimens, as well as (meta)data that are governed by decisions of different rights holders and stakeholders. Science-informed policy processes give rise to conditions, for example Access and Benefit Sharing (ABS) regulations implementing the [Nagoya Protocol](#), the [International Treaty on Plant Genetic Resources for Food and Agriculture \(2001; ITPGRFA\)](#) and - in the future - the results of the present negotiations on marine [Biodiversity Beyond National Jurisdiction \(BBNJ\)](#) in the UN. However, none of these conditions are considered by the basic PROV and OA ontologies.

A wide range of conditions must be considered that are associated with biodiversity data. Within the current SYNTHESYS+ project the focus of the working group for Task 3.3 was on conditions recorded in legal, including contractual, documents and policies that are associated with physical objects preserved in natural science collections. More generally, conditions may, for example,

1. concern the protection of sensitive (meta)data (e.g. informing on endangered populations or vulnerable data providers; also, GDPR-relevant information),
2. arise from specific considerations regarding data's social contexts and ethical uses, e.g. data and knowledge (including traditional knowledge) from indigenous peoples and local communities (IPLCs) flagged by Local Contexts labels <https://localcontexts.org/>,
3. govern the subsequent sharing of arising benefits with the original provider in return (cp. ABS regulations), and/or
4. have specific contractual conditions attached (cp. MTAs, collection policies, licence information).



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While the technical functionality that we propose in this report for extending the basic model should be forward-looking and generally applicable to any conditions, the specifics of categorising and representing social and ethical considerations, intellectual property rights (IPR) and further categories of conditions will need to be considered and developed in future work.

Even in the context of DiSSCo's current implementation focus on data without conditions, as already mentioned, procedures are slightly different for physical objects and the data representing them, even if the underlying physical object in general can be openly shared and exchanged. Practical management tasks associated with physical objects, e.g. loan transactions and visits to collections, most often involve a cautious consideration of appropriate conditions. These considerations include, for example, a review of available information that is attached to each object and informs on e.g. concrete access to, required handling and packaging, and the use of the object. Who can receive the object? Which ethical and legal, as well as collection policy information needs to be made available with the object? What actions and investigations are allowed on and with the object by the receiving party?

Hence, concerns for the preservation of the physical object and the need to consider its manifold contexts lead to concrete conditions that need to be considered during both “events”, that is, loan transactions and on-site visits. For the purpose of an integrated comprehensive, efficient and effective digital loans and visits system, the events, the involved physical specimens and agents, as well as the associated conditions must be digitally represented within DiSSCo's technical infrastructure. This digital representation has the effect that any information, including about conditions, is available and can be shared with both the holding organisation's staff preparing the loan or visit, as well as the receiver of the physical object. Hence, easily accessible information on conditions associated with each physical and digital object enables informed decisions by providers, mediators and users as the cornerstones of potential transactions.

4.8.1 Outline of a technical integration of conditions into the transactional model

Certain functionality needs to be implemented for conditions to take the step from an attached information resource to being functionally incorporated and forming an integral part of (automated) online transactions. All information, first, needs to be reliably and persistently **linked** to the digital representation of the physical object or digital data. Second, information needs to be made **machine-actionable** as a prerequisite for implementation and, third, all information will need to be embedded in an information model or architecture that provides the structure and semantics supporting **automated functionality**, specifically **reasoning**. These prerequisites are essential, for example, for empowering complex online tools such as DiSSCo and its ELViS module.



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Therefore, information on conditions that are specific to certain events, agents, objects and data (e.g. contracts) or inherited from contexts (e.g. national laws and regulations, or collection policies) will need to be stored with or linked to the digital objects as part of their metadata. For this purpose, the openDS specification will need to be extended. A general “slot” for conditions will allow the integration of information about conditions into the openDS specification. To design the data structure for this slot and for identifying the metadata details in this slot, the working group developed a two-level classification for this deliverable. The first level, **Document Categories and Types** (see [Chapter 4.5](#)) provides an initial, high-level orientation to users, as well as a scaffolding for the structuring of the second level, the **Typology of Legal/Contractual Terms for Biodiversity Specimens** (see [Chapter 4.6](#)). The Typology of Legal/Contractual Terms directly contributes to the foundation for machine-actionability.

Once information on conditions associated with a collection specimen, e.g. in the form of governmental or contractual documents, has been digitised and integrated into the metadata of the openDS object, the contents of such information and documents, which describe concrete rules for behaviours and activities, need to be identified (Document Categories and Types), extracted and represented as machine-actionable commands (see the Typology of Legal/Contractual Terms for Biodiversity Specimens as a development step towards this goal).

Finally, the basic event-based transactional model built using the PROV and Annotation ontologies will need to be extended to allow the incorporation of functionality that transforms such document-derived, machine-actionable information on conditions into corresponding, appropriate and well-designed computational commands, steps and routines.

4.8.2 Transforming linked legal documents into machine-actionable information

The Typology of Legal/Contractual Terms for Biodiversity Specimens ([Chapter 4.6](#)) has been developed primarily with the goal to document, standardise and harmonise the action-oriented contents stated within and between Document Types, as well as found associated with the diverse contexts in which physical and digital objects are embedded.

At the same time, the standardised Typology with its “catchphrases” and their definitions takes an important step towards a “vocabulary”. A vocabulary provides human-readable labels that can act as codified condition statements (see e.g. the labels of boxes and connections in fig. 4.8.2-1). These labels are associated with corresponding machine-readable terms, which can act as commands in algorithms and computational routines (see e.g. the code examples below) that underlie and give rise to automated conditional actions.



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Such condition statements specific to the bio-, geo- and anthropodiversity sector, and the computational workflows that implement arising domain-specific computational decisions and consequences, can be integrated into an existing **Rights Expression Language** (REL) and, thus, take advantage of its already developed functions (i.e. expressions). The vocabulary and functionality of a REL expanded for the natural sciences domain will complement the PROV and OA ontologies that are currently forming the basis of DiSSCo's technical architecture. In the following, we are exploring the W3C-recommended **Open Digital Rights Language** (ODRL) ontology (<https://www.w3.org/ns/odrl/2/>) for use within the biodiversity sector and more specifically for an ELViS use case.

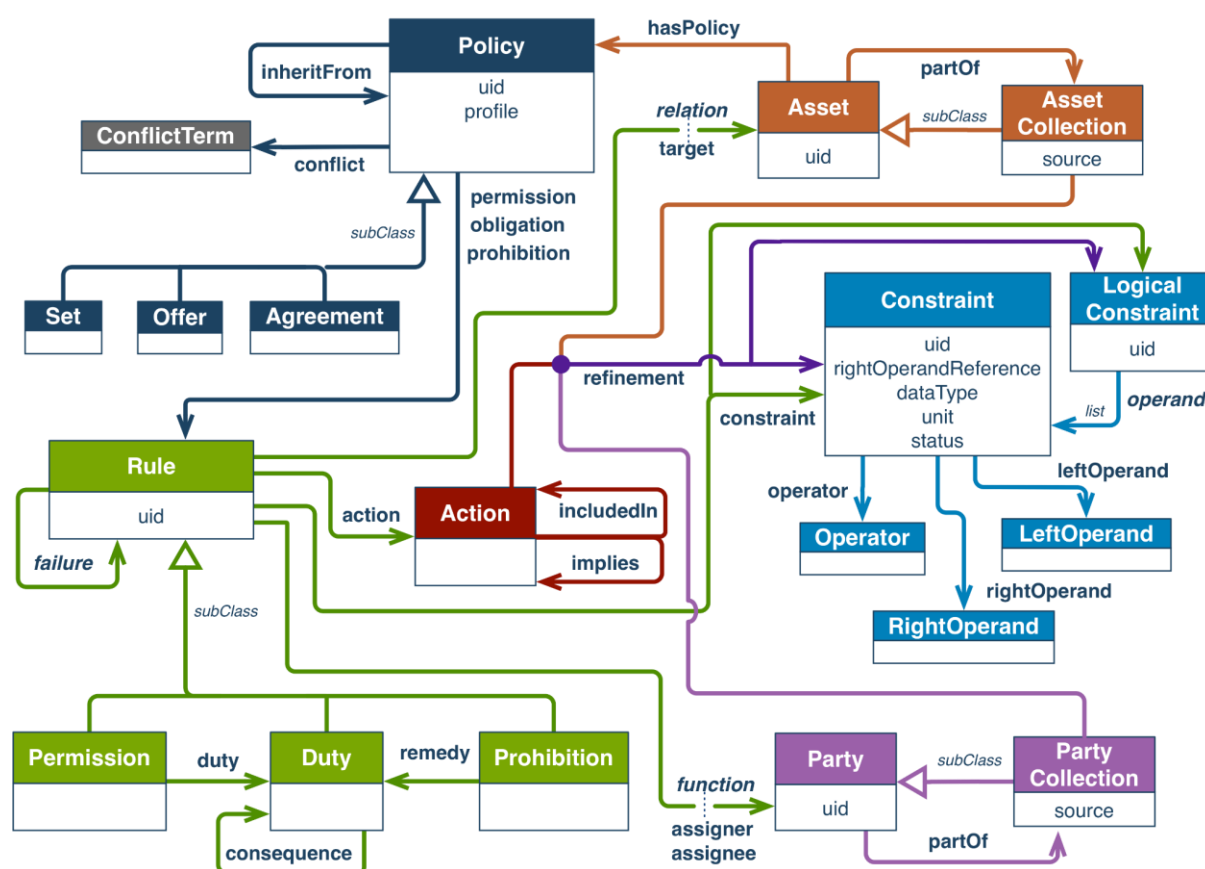


Figure 4.8.2-1: ODRL information model (Diagram copied from "ODRL Information Model 2.2", Figure 1, <https://www.w3.org/TR/odrl-model/>; Copyright © 2018 W3C® (MIT, ERCIM, Keio, Beihang). W3C liability, trademark and permissive document licence rules apply, see <https://www.w3.org/Consortium/Legal/2015/copyright-software-and-document>).

The ODRL ontology provides a general structure, as well as functions and workflows for transforming predefined condition statements into actions, which can be machine- and human-mediated, as appropriate (fig. 4.8.2-1). In future work, the integration of biodiversity-relevant condition statements ("contents") and actions into the already existing information model of the



ODRL ontology can be further explored, necessary extensions developed and their limits identified. In this way, conditions can be made functional, resulting in automated events and transactions. In addition, biodiversity-specific condition statements can form the basis for developing, implementing and populating informative user interfaces. These enable human decisions and subsequent manual input. The incorporation of human decisions into workflows might be implemented as, e.g., a click on a “yes” or “no” button by a user after they made a decision that was informed by a machine-generated assessment provided by the user interface, as well as, if available and disclosable, attached documentation materials.

When developing and implementing machine-actionable and automated assessments of legal, including contractual, and other conditions, the following statement from "ODRL Implementation Best Practices - Draft Community Group Report 10 January 2023" needs to be kept in mind and considered:

"While ODRL can represent elements of a license or regulation for machine consumption, it cannot replace them in court! It is best practice to explicitly point to the license or regulation that a policy models using the `dc:terms` property provided by the Dublin Core Metadata Initiative."

(Cited from <https://w3c.github.io/odrl/bp/#example-3-representation-of-rights-in-rules> (Section 2.3). [Copyright](#) © 2023 the Contributors to the ODRL Implementation Best Practices Specification, published by the [ODRL Community Group](#) under the [W3C Community Contributor License Agreement \(CLA\)](#). A human-readable [summary](#) is available.)

Therefore, the final decision on an assessment of conditions associated with a physical specimen, openDS object or dataset always remains with the human user and requires in a final manual step the input of the human agent.



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General decision model for a single indivisible functional event

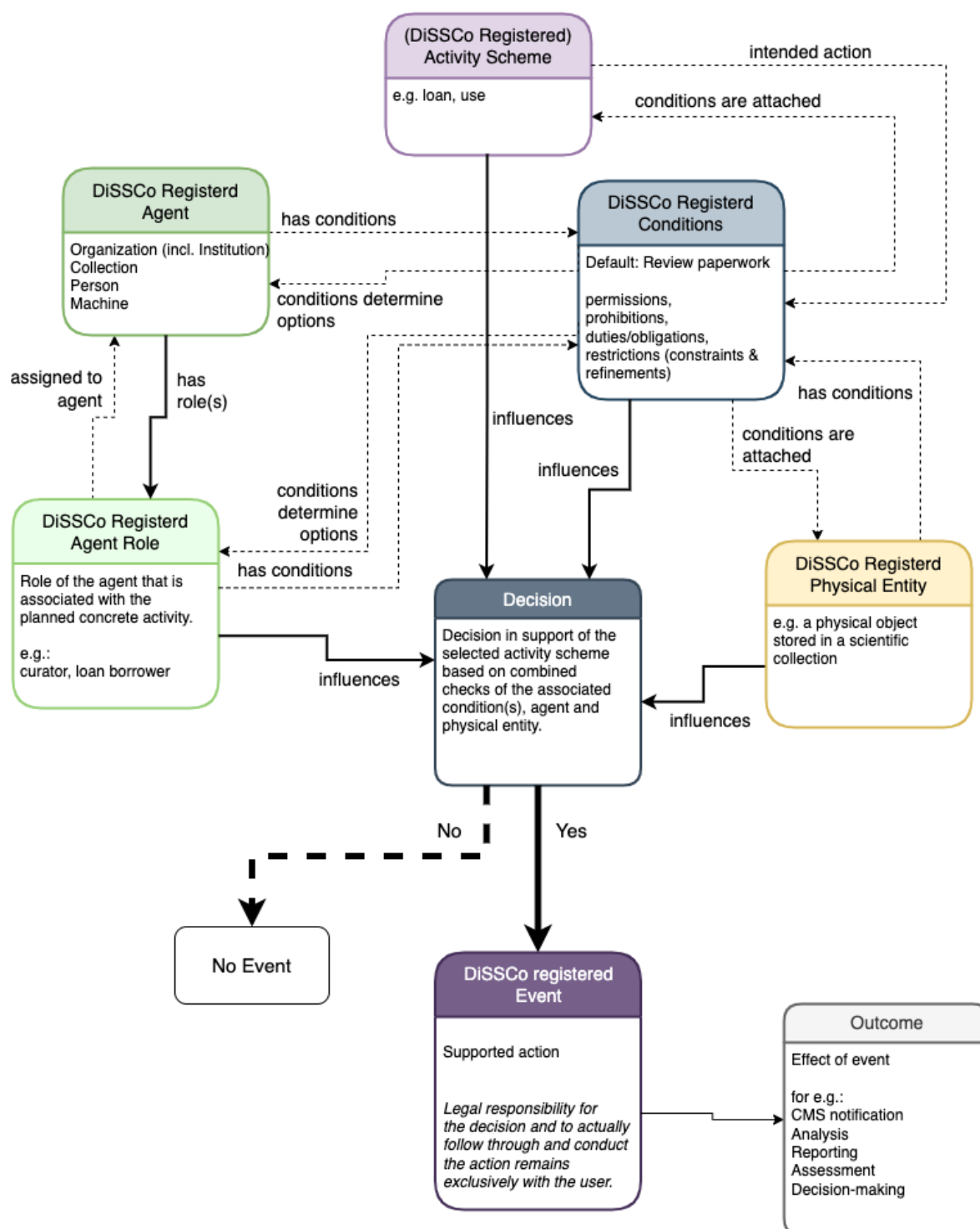


Figure 4.8.2-2: Generalised decision model for a single atomized step, that is, a functional event that cannot be further divided. The decision model arises by integrating conditions (e.g. the terms from the typology) into the basic transactional model. The model can be set into the background



of a physical or digital infrastructure (e.g. a collection institution or digital platform) that publicly presents open data to the world.

Figure 4.8.2-2 provides a high-level, abstract view of the integration of ODRL functionality into the PROV-based transactional model employed by DiSSCo. The integration of an element representing “**Conditions**” (e.g. the terms from the typology) into the basic event-based transactional model (fig. 4.7.2-1) fundamentally changes the structure of the data model. The model transitions from a two-dimensional triangular structure with bilateral links between all elements into a three-dimensional tetrahedron, in which for each node several bilateral links might be activated in parallel, the information of each of them being required for the event to be performed appropriately and as expected. Represented as a two-dimensional structure, a central junction arises (cp. the centroid of a tetrahedron) with connections to all of the four primary elements of the model, i.e. entity, agent, activity and condition. In this “**Decision**” hub simultaneous input from all four model elements is needed for the formulation of a valid outcome.

For example, a decision about a loan will only be possible if a user (manually) and/or the model (automatically) considers at the same time the involved elements: the **prov:Agents** (**odrl:Parties**; Who are the holding institution and the loaner? Where are they located, also relative to each other?), the **prov:Entity** (**odrl:Asset**), that is the physical object that is requested for loan (e.g. is it currently available and can it be sent out by mail or is it too fragile?), the **prov:Activity** (**odrl:Action**; here: a loan event, including an access event, which in addition might be associated with further requested use activities, e.g. a scan by computer tomography/magnetic resonance tomography, removal of tissue for DNA extraction, etc.) and specific **Conditions** (cp. **odrl:Policy**) arising from the contexts associated with the object, including its geographic origin and history (e.g. is it a biological type specimen and is there an institutional or collection policy for sending out types?; Where does the object come from and does it thus have legal documents attached, e.g. a MAT, governing access, use and subsequent duties of benefit sharing?).

In the ODRL ontology three categories of concrete conditions are defined, called **odrl:Rules** that can modify and thus have an impact on a decision, these are **odrl:Permission**, **odrl:Prohibition**, and **odrl:Duty** (for rules) or **odrl:Obligation** (for policies). **Restrictions** can be applied to these conditions in the form of **odrl:Constraints** modifying rules in general and/or **odrl:Refinements** of agents, activities and entities that enter the joint evaluation and decision process.

The overall structural system for conditions in ODRL is that all conditions are placed in the context of **odrl:Policies** at the highest level. Thereby, policies present the envelopes for sets of **odrl:Rules**, which are of the three types mentioned before and in turn can be modified by restrictions (i.e. constraints and refinements).



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More fine-grained detail for an exploration of and insights into the applicability of the ODRL standard and its functionality to common tasks and use cases within biodiversity contexts is provided by considering the three types of policies defined within ODRL. These three policy categories are namely `odrl:Agreement`, `odrl:Offer` and `odrl:Set`. In a biodiversity context these can correspond to and be used for, for example, contracts between two parties, a licence attached to an `odrl:Asset` or `prov:Entity` by a rights-holder, and a governmental law or regulation, respectively.

Within `odrl:Actions` (cp. `prov:Activities`), the classes `odrl:Use` and `odrl:Transfer` of ownership form the two highest level subclasses. “Use” and “transfer” in general seem to be both pivotal to events and transactions, as well as to the conditions themselves that are associated with activities performed on and with (meta)data and digital representations of physical objects in the biodiversity sector. However, they are not only of interest in connection with ownership, but can interact with a wide range of conditions. Of interest are within the context of biodiversity data infrastructures, for example, the delegation of actions and their associated rules to third parties, or actions that involve multiple, that is more than two, parties each with different rights. This is an area that will need to be explored further, see [Chapter 4.8.4](#) on next steps and open tasks.

4.8.3 Transforming concepts into code: an ELViS use case

In the previous sections a conceptual approach to the integration of conditions into the next-generation of biodiversity data infrastructures, based e.g. on the Digital Extended Specimen concept (DES; Hardisty et al. 2022) and as e.g. implemented in DiSSCo’s event-based transactional data model has been explored and outlined. In this section we provide an example of how these abstract considerations can be transformed into a concrete, code-based implementation. The chosen use case for the example is a loan transaction represented in, mediated by and made machine-actionable by the planned ELViS module of the DiSSCo technical infrastructure.

The **use case** expressed in human-readable prose can be described as follows: Curator Hortensia (names were chosen in honour of the taxon group) of Institution 2 requests the loan of a specific physical specimen identified as common earthworm from Institution 1 holding the specimen. Curator Annelie at collection institution 1 prepares the loan and assesses if the specimen can be sent out to curator Hortensia. Once curator Annelie decides that the loan can move forward, she links associated legal documents with the loan transaction for online access by curator Hortensia. Finally, after the specimen has been sent out, the collection management record of the specimen gets updated with the new location information during the loan period.



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Starting out with a minimal loan scenario the code base of the example is introduced and subsequently expanded by stepwise integrating additional information and functionality, so that an increasingly complex and thus more realistic and common loan scenario will be represented by machine-actionable code. The following **outline** provides an overview over the main stages of developing the loan transaction used in the example:

1. Introduction to the JSON-LD serialisation.
2. Digital representation of the elements involved in and necessary for the loan transaction using PROV.
3. A simple loan transaction without associated conditions, represented by PROV functionality.
 - a. Including the delegation of the activity from the responsible institution to a curator.
 - b. Communicating legal documents that are associated with and inform the loan transaction.
4. Updating the CMS or DiSSCo record to reflect the new locality of the physical specimen during the loan period using OA functionality.
 - a. Attaching information about rights to the annotation of the digital record.
5. Integrating conditions governing the loan transaction using ODRL.
 - a. Adding global YES/NO conditions governing shipping and handling of the physical specimen.
 - b. Setting loan decisions that are context-dependent: To which countries and partners can the specimen be shipped?
6. Moving towards an operational framework: exploring the policy life-cycle with inheritance between policies

A compilation of the example code provided for the loan use case can be found in [Annex 8](#).

JSON (JavaScript Object Notation; <https://en.wikipedia.org/wiki/JSON>) is a widely used, human-readable data exchange format that enables interoperability between independent infrastructure platforms. Its extension for linked data, JSON-LD (JavaScript Object Notation for Linked Data; <https://en.wikipedia.org/wiki/JSON-LD>) opens up the opportunity of integrating efficiently the latest versions of distributed, independently maintained, often powerful and standardised information resources, as for example ontologies, data files, database records or open FAIR Digital Objects (openFDOs), into data transactions between federated digital infrastructure systems by linking to these resources. The links are based on persistent, globally unique and resolvable identifiers (PIDs), or more generally on Internationalised Resource Identifiers (IRIs; https://en.wikipedia.org/wiki/Internationalized_Resource_Identifier). In the following example Uniform Resource Locators (URLs; <https://en.wikipedia.org/wiki/URL>) are used, colloquially known as “web addresses” for locating and retrieving information on networks.



The following JSON-LD implementation of the ELViS loan use case was inspired by the examples and JSON-LD serialisations that have been developed and published for PROV (Provenance ontology), OA (Web Annotation ontology) and JSON-LD itself, which are provided by the World Wide Web Consortium (W3C) at <https://www.w3.org/>. More information, examples, explanations and background can be found at these links for

- PROV: <https://openprovenance.org/prov-jsonld/>
- OA: <https://www.w3.org/TR/annotation-model/#complete-example>
- JSON-LD: <https://www.w3.org/TR/json-ld11/#data-model>

This online validator can provide support for writing JSON-LD serialisation:

- JSON-LD Playground: <https://json-ld.org/playground/>

Step 1: Introduction to the structure of a JSON-LD serialisation

In the example code developed for the loan use case, the top-level is structured into two parts or entries:

EXAMPLE CODE 1: Top-level framework of the example JSON-LD serialisation

```
{
  "@context" : [ { } ],
  "@graph" : [ { } ]
}
```

In **@context** a shared overall context is defined for the overall JSON-LD object, in which terms are mapped to full IRIs. This mapping enables the use of a short-hand notation throughout the object that is better human-readable. Thus, the term "<http://example.com/physicalSpecimen1>" in the following code can be written as "ex:physicalSpecimen1" and the full namespace address for the PROV term "Entity", that is, "<https://www.w3.org/ns/prov#Entity>" can be shortened and unambiguously identified by using the short-hand "prov:Entity".



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EXAMPLE CODE 2: Top-level framework: @context

```

{
  "@context" : [ {
    "xsd" : "http://www.w3.org/2001/XMLSchema#", // date & time
    "dcterms" : "http://purl.org/dc/terms/", // titles
    "ex" : "http://example/", // example prefix
    "foaf" : "http://xmlns.com/foaf/0.1/", // names
    "prov" : "http://www.w3.org/ns/prov#", // provenance
    "oa": "http://www.w3.org/ns/anno.jsonld", // annotations
    "odrl": "http://www.w3.org/ns/odrl.jsonld", // conditions
  }, "https://openprovenance.org/prov-jsonld/context.json"
  ],
  "@graph" : [ { } ]
}

```

In **@graph** the data structure and data of the actual transaction are described as entries in an array, or more specifically a map of key : value pairs (<https://infra.spec.whatwg.org/#data-structures>). These entries are each independent, but interlinked and interacting JSON objects themselves that might be, e.g., openFDOs'. The objects require at least an **@type** property describing them. They describe an expression (i.e. a snippet of code) as a resource, which can be explicitly named by the use of an identifier (**@id**) or remain anonymous, in which case no identifier is associated with the resource or expression. The following graph in EXAMPLE CODE 3 includes two anonymous objects, one a `prov:Entity`, the other a `prov:Agent`.

EXAMPLE CODE 3: Top-level framework: @graph

```

{
  "@context" : [ {
    "xsd" : "http://www.w3.org/2001/XMLSchema#", // date & time
    "dcterms" : "http://purl.org/dc/terms/", // titles
    "ex" : "http://example/", // example prefix
    "foaf" : "http://xmlns.com/foaf/0.1/", // names
    "prov" : "http://www.w3.org/ns/prov#", // provenance
    "oa": "http://www.w3.org/ns/anno.jsonld" // annotations
    "odrl": "http://www.w3.org/ns/odrl.jsonld", // conditions
  }, "https://openprovenance.org/prov-jsonld/context.json"
  ],
  "@graph" : [ {
    "@type": "prov:Entity",
  }, {
    "@type" : "prov:Agent",
  } ]
}

```



In the following, the context defined in `@context` remains the same, so that the subsequent example code snippets focus only on the development of the expressions in the data structure part under `@graph`, and the `@context` part will be omitted.

Step 2: Digital representation of involved objects

At the core of a loan transaction lies a collection specimen that is sent to a different locality for a certain time. To represent this loan transaction, the digital representation of the specimen, its openDS twin, needs to be identified.

In the PROV ontology, the specimen's representation as/in the form of an openDS instance takes the role of a `prov:Entity`, thus, the JSON object is of `"@type": "prov:Entity"`. The expression `"@id" : "ex:physicalSpecimen1"` links the JSON object to the openDS resource (that is, the digital twin of the physical specimen stored in the DiSSCo technical infrastructure) and, thus, uniquely identifies it.

To improve human readability, a `prov:label` is set for the `prov:Entity`, informing us that the physical specimen in the focus of the loan transaction of this use case had been identified as a common earthworm (*Lumbricus terrestris* Linnaeus, 1758).

EXAMPLE CODE 4: Digital representation of the collection specimen

```
{
  "@graph" : [ {
    "@type": "prov:Entity",
    "@id" : "ex:physicalSpecimen1",          // the openDS PID
    "prov:label" : "Common earthworm"
  } ]
}
```

A loan transaction has two agents, first, the institution holding the physical specimen, which is preparing the loan. Second, the institution that requested the loan and will receive it once the loan has been approved and sent out.

Both institutions are digitally represented as agents using `"@type": "prov:Agent"`. The PROV standard allows a classification of agents into agent subcategories, we choose the subcategory `prov:Organization` for the description of the institutional agents and set it using



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the expression "prov:type" : ["prov:Organization"]. The institutions are uniquely identified by their Research Organization Registry (ROR) identifiers (<https://ror.org/>), which are incorporated into the script as the values of @id.

EXAMPLE CODE 5: Adding the legal agents of a loan transaction

```
{
  "@graph" : [ {
    "@type": "prov:Entity",
    "@id" : "ex:physicalSpecimen1",
    "prov:label" : "Common earthworm"
  }, {
    "@type" : "prov:Agent",
    "prov:type" : [ "prov:Organization" ], // agent subcategory
    "@id" : "ex:institution1_holding", // ROR PID
    "prov:location" : "http://www.wikidata.org/entity/Q40", \\
AT    "prov:label" : "NHMW, Vienna, Austria"
  }, {
    "@type" : "prov:Agent",
    "prov:type" : [ "prov:Organization" ], // agent subcategory
    "@id" : "ex:institution2_requesting", // ROR PID
    "prov:location" : "http://www.wikidata.org/entity/Q27", \\
IE    "prov:label" : "National Museum of Ireland, Dublin, Ireland"
  } ]
}
```

We know based on the given human-readable ID to which of the two institutions the specimen belongs. However, this information is not machine-readable and -actionable. Therefore, it is necessary to explicitly link the specimen and Institution 1 holding it by employing an object of "@type": "prov:Attribution". The prov:Attribution-object links an prov:Entity to its associated prov:Agent.



EXAMPLE CODE 6: Linking the specimen to its holding institution

```

{
  "@graph" : [ {
    "@type": "prov:Entity",
    "@id" : "ex:physicalSpecimen1",
    "prov:label" : "Common earthworm"
  }, {
    "@type" : "prov:Agent",
    "prov:type" : [ "prov:Organization" ],
    "@id" : "ex:institution1_holding",
    "prov:location" : "http://www.wikidata.org/entity/Q40",
    "prov:label" : "NHMW, Vienna, Austria"
  }, {
    "@type" : "prov:Agent",
    "prov:type" : [ "prov:Organization" ],
    "@id" : "ex:institution2_requesting",
    "prov:location" : "http://www.wikidata.org/entity/Q27",
    "prov:label" : "National Museum of Ireland, Dublin, Ireland"
  }, {
    "@type" : "prov:Attribution",
    "@id" : "ex:institution1_accession",    \\ (P) ID
    "entity" : "ex:physicalSpecimen1",    \\ specimen
    "agent" : "ex:institution1_holding"    \\ holding institution
  } ]
}

```

Step 3: A simple loan transaction without associated conditions

Now the loan event itself needs to be defined and represented as JSON objects. Two objects are defined to capture the fundamental information of the loan process. These objects are the complementary entities of "@type" : "prov:Activity" and "@type": "prov:Usage".

The object of type `prov:Activity` defines the outline of the activity, that is, it sets the stage by defining its `@type` as an activity and minting an `@id` that uniquely identifies this concrete activity, this loan transaction. Furthermore, this object represents the (planned) duration of the loan (given by start and end time).

Due to the structure of the standard and its JSON-LD implementation, a second object is needed that “qualifies” the activity as being of type `prov:Usage`. Usage describes an interaction between two resources that are in this case the interaction of a `prov:Activity` with a



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`prov:Entity`, in which the `prov:Activity` `prov:used` the `prov:Entity` (see diagram and examples at <https://openprovenance.org/prov-jsonld/#introduction-qualification-pattern> as well as <https://www.w3.org/TR/2013/REC-prov-o-20130430/#description-qualified-terms>). The activity and the entity of `prov:Usage` are unambiguously identified by the (P)ID of this specific loan transaction defined in the object of type `prov:Activity` and the (P)ID of the specimen that is requested and prepared for loan, defined in the object of type `prov:Entity`, respectively. Both involved objects were defined earlier in the script.

Finally, after the loan transaction has been recorded and the physical specimen has been sent out to Institution 2, the specimen needs to be associated with the loaning institution for the duration of the loan. Thus, the attribution of the specimen needs to be updated, using again `prov:Attribution` for this purpose.

Obviously, this is a very rudimentary way of recording the change in association for the specimen during the loan that doesn't differentiate between properties that change (e.g. locality and associated curator) and those properties that remain associated with the original holding institution (e.g. ownership and accession information). Here, expressions need to be found or developed in future work that enable the system (e.g. the DiSSCo technical infrastructure) to update and record only those properties that require updating.



EXAMPLE CODE 7: Defining the loan activity of the transaction

```

{
  "@graph" : [ {
    "@type" : "prov:Entity",
    "@id" : "ex:physicalSpecimen1",
    "prov:label" : "Common earthworm"
  }, {
    "@type" : "prov:Agent",
    "prov:type" : [ "prov:Organization" ],
    "@id" : "ex:institution1_holding",
    "prov:location" : "http://www.wikidata.org/entity/Q40",
    "prov:label" : "NHMW, Vienna, Austria"
  }, {
    "@type" : "prov:Agent",
    "prov:type" : [ "prov:Organization" ],
    "@id" : "ex:institution2_requesting",
    "prov:location" : "http://www.wikidata.org/entity/Q27",
    "prov:label" : "National Museum of Ireland, Dublin, Ireland"
  }, {
    "@type" : "prov:Attribution",
    "@id" : "ex:institution1_accession",
    "entity" : "ex:physicalSpecimen1",
    "agent" : "ex:institution1_holding"
  }, {
    "@type" : "prov:Activity",           // loan activity
    "@id" : "ex:loan2023_1",           // unique loan identifier
    "startTime": "2023-03-31T09:21:00.000+01:00", // start
    "endTime": "2025-04-01T15:21:00.000+01:00"   // end
  }, {
    "@type" : "prov:Usage",           // loan details
    "activity" : "ex:loan2023_1",     // id of involved activity
    "entity" : "ex:physicalSpecimen1", // id of involved entity
  }, {
    "@type" : "prov:Attribution",     // Updating of new status
    "@id" : "ex:institution2_loanReceived",
    "entity" : "ex:physicalSpecimen1",
    "agent" : "ex:institution2_requesting" //current association
  } ]
}

```



Step 3a: Delegation of the activity from the responsible institution to a curator

While loan transactions officially (legally) often are transactions between institutions, in reality, it is collection staff and scientists who act on behalf of institutions. Organisations' concrete activities are delegated to individual persons. The PROV ontology can represent patterns of delegation.

To represent a delegation, two additional entities are defined for each delegation relationship. First, a `prov:Person` is defined as `prov:Agent` in addition to the already defined `prov:Organization-agent` object. This `prov:Person` object is uniquely identified by the `@id` of the involved person (here referred to as `ex:curator1` or `ex:curator2`), which might be, for example, an ORCID. For improved human readability, the name of the person (here Annelie or Hortensia) is added to the JSON object representing the involved person.

The second object defines the delegation itself (`"@type": "prov:Delegation"`) and its unique `@id` (`"@id" : "ex:toCurator1"` or `"@id" : "ex:toCurator2"`). The following line `"responsible" : "ex:institution1_holding"` (or `"responsible" : "ex:institution2_loaning"`) identifies the delegating organisation, while the next line `"delegate" : "ex:curator1"` (or `"delegate" : "ex:curator2"`) identifies the person that performs the activity in delegation for the organisation. The last line `"activity" : "ex:loan2023_1"` identifies the activity that gets delegated, that is, to which the delegation refers. A more realistic implementation might divide this activity further into institution-specific sub-activities, that is, e.g. the sub-activities `"ex:preparingLoan"` and `"ex:receivingLoan"` that can inherit the delegation.

EXAMPLE CODE 8: Delegation of the activity

```
{
  "@graph" : [ {
    "@type" : "prov:Entity",
    "@id" : "ex:physicalSpecimen1",
    "prov:label" : "Common earthworm"
  }, {
    "@type" : "prov:Agent",
    "prov:type" : [ "prov:Organization" ],
    "@id" : "ex:institution1_holding",
    "prov:location" : "http://www.wikidata.org/entity/Q40",
    "prov:label" : "NHMW, Vienna, Austria"
  }, {
    "@type" : "prov:Agent",
    "prov:type" : [ "prov:Person" ], // curator handling loan
    "@id" : "ex:curator1", // e.g. ORCID
    "foaf:givenName" : [ { "@value" : "Annelie" } ]
  }, {
```



```

    "@type": "prov:Delegation",           // delegation
    "@id" : "ex:toCurator1",             // PID
    "responsible" : "ex:institution1_holding", // defined above
    "delegate" : "ex:curator1",           // defined above
    "activity" : "ex:loan2023_1"          // defined below
  },{
    "@type" : "prov:Agent",
    "prov:type" : [ "prov:Organization" ],
    "@id" : "ex:institution2_requesting",
    "prov:location" : "http://www.wikidata.org/entity/Q27",
    "prov:label" : "National Museum of Ireland, Dublin, Ireland"
  },{
    "@type" : "prov:Agent",
    "prov:type" : [ "prov:Person" ], // curator receiving loan
    "@id" : "ex:curator2",           // e.g. ORCID
    "foaf : givenName" : [ { "@value" : "Hortensia" } ]
  },{
    "@type": "prov:Delegation",           // delegation
    "@id" : "ex:toCurator2",             // PID
    "responsible" : "ex:institution2_requesting", // s. above
    "delegate" : "ex:curator2",           // defined above
    "activity" : "ex:loan2023_1"          // defined below
  },{
    "@type" : "prov:Attribution",
    "@id" : "ex:institution1_accession",
    "entity" : "ex:physicalSpecimen1",
    "agent" : "ex:institution1_holding"
  },{
    "@type" : "prov:Activity",
    "@id" : "ex:loan2023_1",
    "startTime": "2023-03-31T09:21:00.000+01:00",
    "endTime": "2025-04-01T15:21:00.000+01:00"
  },{
    "@type" : "prov:Usage",
    "activity" : "ex:loan2023_1",
    "entity" : "ex:physicalSpecimen1"
  },{
    "@type" : "prov:Attribution",
    "@id" : "ex:institution2_loanReceived",
    "entity" : "ex:physicalSpecimen1",
    "agent" : "ex:institution2_requesting"
  } ]
}

```



Step 3b: Communicating legal documents that are associated with and inform the loan transaction

In the ELViS use case it is important that documents associated with and governing the loan transaction are transferred from the holding institution to the institution that receives the physical specimen as loan.

Such legal and ethical documents and information can be directly associated with the physical specimen (the `prov:Entity`, in that case likely as part of a `prov:Collection`). In addition, certain documents, e.g. defining institutional and collection policies, might be associated with and govern the loan event itself (not the specimen directly). In that case, a set of documents will be assembled in preparation of the loan that is loan-specific.

In general, documents that will be attached to and transferred with the loan will be focused on the physical specimen and the tangible, offline loan process, in accordance with the main perspective of the SYNTHESYS+ process. They might include selected and/or abridged versions of documents or their extracted information contents, whereby all three will be associated with the physical specimen.

Information that governs the loan transaction can be incorporated into the digital representation of the loan event itself, using entities of "@type" : "`prov:Communication`". The functionality of `prov:Communication` makes it possible to represent that one activity informs another activity. In the example, the `prov:Communication` object has the (P)ID `ex:transferLegalInfo`.

The activity that is informed by the `prov:Communication` is the earlier defined loan activity (`ex:loan2023_1`). The activity that informs the loan event is the informant. To define the informant activity, again a `prov:Activity` entity is generated (with the (P)ID `ex:createdLegalInfoCollection`) and further qualified by a `prov:Usage` object. The `prov:Usage` expression associates a collection of legal documents and information (a `prov:Entity`) with the `ex:createdLegalInfoCollection` activity. The entity representing the collection remains anonymous in the example, that is, without (P)ID. It is defined by an array of two elements that have the IDs `ex:assocLegalDoc1` and `ex:assocLegalDoc2`.



EXAMPLE CODE 9: Communicating legal information associated with the loan transaction

```

{
  "@graph" : [ {
    "@type" : "prov:Activity",          // providing legal info
    "@id" : "ex:createdLegalInfoCollection" //PID collection
  }, {
    "@type" : "prov:Usage",            // compilation of infos
    "activity" : "ex:createdLegalInfoCollection", // see above
    "entity" : [ {
      "@type" : "prov:Entity", "@id" : "ex:assocLegalDoc1"
    }, {
      "@type" : "prov:Entity", "@id" : "ex:assocLegalDoc2"
    } ]
  }, {
    "@type" : "prov:Communication",    // information transfer
    "@id" : "ex:transferLegalInfo",    // PID of the transfer
    "informant" : "ex:createdLegalInfoCollection", // ID info
    "informed" : "ex:loan2023_1"      // ID of the loan event
  } ]
}

```

The information encoded by using PROV, so far represents some basic building blocks of a loan transaction. This digital representation of the loan transaction in the ELViS module of the DiSSCo technical infrastructure can be made accessible to both (or all) partners of the loan transaction. Shared online via the ELViS system, digital representations of loan transactions enhance communication between the involved partners and in this way can support and mediate interactions associated with loans of physical specimens.

Step 4: Updating of the CMS or DiSSCo record to reflect the new locality of the physical specimen during the loan period

Supported by the digitised information available in the online ELViS system, once the decision has been made to send out a physical specimen, it can be of interest to collection managers to update the record of the physical specimen with some or all of the information associated with the loan. Such an update can make sense for the record of the physical specimen in an institution's local collection management system (CMS) or in the globally accessible openDS twin of the physical specimen stored in the DiSSCo technical infrastructure. We will use the example



of updating the locality information associated with the physical specimen to introduce functionality provided by the Web Annotation Ontology (OA).

In the following code examples the `@context` entity will be added with one line defining the specific namespace that is the focus of this part of the example code. This is to highlight that the examples are now using expressions of different, more specialised ontologies.

EXAMPLE CODE 10 shows an encoding of an annotation event that modifies the local CMS record or a globally shared openDS twin of the physical specimens with information taken from the loan transaction. In this case, the locality information is updated to reflect the location of the physical specimen during the loan period. If set up in advance by the holding institution, it is assumed that such an annotation event is automatically triggered by the ELViS system at the time the loan is sent out, as well as when it is returned and the physical specimen is reinserted into the collection of its steward institution. In this case, no human involvement is needed, since the transactional model of ELViS supports machine-actionability.

The JSON object of `"@type" : "oa:Annotation"` is identified by a (P)ID, here represented by `ex:update_spec1_location`. The keywords `"body"` and `"target"` are functionality provided by the OA ontology. `"body"` identifies the information (e.g. provided by a standardised locality string) that will be inserted into the CMS record or openDS metadata, and thus update the locality information there. The `target` identifies and links to the CMS record or openDS object that represents the physical specimen and needs updating.

EXAMPLE CODE 10: Annotation of a corresponding CMS record (or openDS twin)

```
{
  "@context" : [{ "oa": "http://www.w3.org/ns/anno.jsonld" }],
  "@graph" : [ {
    "@type" : "oa:Annotation",          // of digital representation
    "@id" : "ex:update_spec1_location", // PID of annotation
    "body": "http://www.wikidata.org/entity/Q27",
                                         // new location info
    "target" : "ex:CmsRecordSpec1"      // PID CMS record
  } ]
}
```



Step 4a: Attaching information about rights to the annotation of the digital record

The OA ontology defines a key - value pair (`rights`) to capture and store rights information that is associated with an annotation event itself, as well as the information given in the body and/or the target object (here: the CMS record or openDS). EXAMPLE CODE 11 shows how rights information can be integrated at the level of the annotation event as a whole ("`ex:AnnotationRightsInfo`") and at the level of the target object. The expression "`rights`": "`ex:RecordRightsInfo`" is only changing and setting the rights for the target context.

EXAMPLE CODE 11: Adding information on rights associated with the CMS record and annotation itself

```
{
  "@graph" : [ {
    "@type" : "oa:Annotation",
    "@id" : "ex:update_spec1_location",
    "rights": "ex:AnnotationRightsInfo",      // assoc. w/ annot.
    "body": "ex:loanLocation",
    "target": [ {
      "@id" : "ex:CmsRecordSpec1",
      "rights": "ex:RecordRightsInfo"        // assoc. w/ record
    } ]
  } ]
}
```

Step 5: Integrating conditions governing the loan transaction

The digital representation of the loan transaction at this point provides a sufficiently developed context for introducing conditions into the code of the example. Functionality provided by the ODRL ontology is used as an example of how legal information provided by documents can be transformed into and implemented as machine-actionable commands.



Step 5a: Adding global YES/NO conditions governing shipping and handling of the physical specimen

In preparation of a loan transaction the conditions attached to the physical specimen need to be clarified. This involves an assessment if the specimen can be shipped to a different collection or research institution, and which actions on and with the specimen are allowed by the receiving partner.

[Chapter 4.6](#) provides proposals for standardised legal/contractual terms that can be used to set conditions that might apply in the context of a loan transaction. In future work, these terms can be integrated into the functionality of the ODRL ontology (using e.g. the "profile" functionality, see <https://www.w3.org/TR/odrl-model/#profile>) or other rights expression languages. The W3C recommendation webpage for the "ODRL Information Model 2.2" (<https://www.w3.org/TR/2018/REC-odrl-model-20180215/>) and the "ODRL Implementation Best Practices" webpage (<https://w3c.github.io/odrl/bp/>) provide an introduction to and guidelines for implementing the ODRL ontology in JSON-LD.

In the following code examples, a globally applicable (that is, no constraints or refinements apply) permission is encoded that allows unconditional shipping to 3rd parties. A second global permission subsequently is added that provides explicit consent to physical analyses of the material specimen.

In EXAMPLE CODE 12 a contractual agreement is digitally represented by using the ODRL policy type `odrl:Agreement`. This loan contract is unambiguously identified by and has the address of `ex:inst1_inst2_loan_contract`. The next line of code links to a (future) ODRL profile (`"profile": "ex:biodivDomain_profile"`) that defines legal/contractual (cp. [Chapter 4.6.4](#)) - and at that point potentially also social and ethical (see CARE principles) - terms that are specific to the biodiversity domain.

The agreement explicitly provides a permission that allows the shipping of the physical specimen to third parties (`"action" : "ex:shipping_to_3rdParty"`), for example implementing term "23_YES_3rd party" of the Typology of Legal/Contractual Terms. This `odrl:Rule` has been set by the institution holding the physical specimen (the `"assigner" : "institution1_holding"`). It governs the rights and conditions associated with the physical specimen (`"target" : "ex:physicalSpecimen1"`), for which conditions are evaluated for the concrete loan transaction in question. The loan requesting institution is identified by `"assignee" : "ex:institution2_requesting"`.

As before, the informative elements of this policy are defined by links to PID/ID-identified information (which might be formatted and deposited as openDS and/or openFDOs objects) that



is stored independently within the Distributed System of Scientific Collections (DiSSCo) or the wider network of a decentral, federated digital object architecture.

EXAMPLE CODE 12: Applying a permission to the loan transaction

```
{
  "@context" : [{ "odrl": "http://www.w3.org/ns/odrl.jsonld" }],
  "@graph" : [ {
    "@type" : "odrl:Agreement",
    "@id" : "ex:inst1_inst2_loan_contract",
    "profile" : "ex:biodivDomain_profile",
    "permission" : [{
      "target" : "ex:physicalSpecimen1",
      "assigner" : "ex:institution1_holding",
      "assignee" : "ex:institution2_requesting",
      "action" : "ex:shipping_to_3rdParty"
    }]
  } ]
}
```

The same contractual agreement might further set a second permission and allow anatomical-morphological analyses on the physical specimen, compare

"ex:10_YES_physical_analysis" of the Typology of Legal/Contractual Terms ([Annex 2](#)).

EXAMPLE CODE 13: Adding a second permission to the loan transaction

```
{
  "@context" : [{ "odrl": "http://www.w3.org/ns/odrl.jsonld" }],
  "@graph" : [ {
    "@type" : "odrl:Agreement",
    "@id" : "ex:inst1_inst2_loan_contract",
    "profile" : "ex:biodivDomain_profile",
    "permission" : [{
      "target" : "ex:physicalSpecimen1",
      "assigner" : "ex:institution1_holding",
      "assignee" : "ex:institution2_requesting",
      "action" : "ex:shipping_to_3rdParty"
    }],
    "permission" : [{
      "target" : "ex:physicalSpecimen1",
      "assigner" : "ex:institution1_holding",
      "assignee" : "ex:institution2_requesting",
      "action" : "ex:physical_analysis"
    }]
  } ]
}
```



EXAMPLE CODE 14 alternatively implements a globally valid prohibition that applies to the physical specimen and prohibits all shipping of the specimen ("action" : "ex:8noShipping") implementing "ex:80_NO_shipping" of the Typology.

EXAMPLE CODE 14: Applying a globally applicable prohibition to the loan transaction

```
{
  "@context" : [{ "odrl": "http://www.w3.org/ns/odrl.jsonld" }],
  "@graph" : [ {
    "@type" : "odrl:Agreement",
    "@id" : "ex:inst1_inst2_loan_contract",
    "profile" : "ex:biodivDomain_profile",
    "permission" : [{
      "target" : "ex:physicalSpecimen1",
      "assigner" : "ex:institution1_holding",
      "assignee" : "ex:institution2_requesting",
      "action" : "ex:noShipping"
    }]
  } ]
}
```

Step 5b: Representing information for loan decisions that is context-dependent

Often decisions associated with loan transactions are context-dependent. In the following we provide example code for implementing rules representing answers to the question to which countries and partners a physical specimen can be sent out.

The basis again is an explicit permission with its associated information on the target, the assigner and the assignee. The action now implements a different predefined legal/contractual term, that is `ex:24_obligations_3rd_party`, with the outcome after a successful evaluation however remaining the same `ex:shipping_to_3rdParty`.

The permission is modified by a constraint expression that limits the permission for shipping of the physical specimen to third parties located in countries within the European Union. If that constraint is evaluated and the country, in which the receiving institution is located, satisfies the constraint (i.e. it is a member of the EU for this example), then an action appropriate to fulfilling the term `ex:24_obligations_3rd_party` from [Annex 2](#) can be conducted, i.e. the loan transaction can go through and the physical specimen can be prepared for shipping to this institution.



The second global permission (allowing anatomical-morphological analyses) is not impacted by the constraint to the first permission and remains as before.

EXAMPLE CODE 15: Defining a context-dependent decision - based on country

```
{
  "@context" : [{ "odrl": "http://www.w3.org/ns/odrl.jsonld" }],
  "@graph" : [ {
    "@type" : "odrl:Agreement",
    "@id" : "ex:inst1_inst2_loan_contract",
    "profile" : "ex:biodivDomain_profile",
    "permission" : [{
      "target" : "ex:physicalSpecimen1",
      "assigner" : "ex:institution1_holding",
      "assignee" : "ex:institution2_requesting",
      "constraint" : [{ // define allowed countries
        "leftOperand" : "spatial",
        "operator" : "isPartOf",
        "rightOperand":
http://www.wikidata.org/entity/Q458,
        "comment" : "European Union"
      }],
      "action" : "ex:shipping_to_3rdParty"
    }],
    "permission" : [{
      "target" : "ex:physicalSpecimen1",
      "assigner" : "ex:institution1_holding",
      "assignee" : "ex:institution2_requesting",
      "action" : "ex:physical_analysis"
    }],
  } ]
}
```

constraint properties modify specifically `prov:Rules`, which include `prov:Permissions`, `prov:Prohibitions` and `prov:Duty's`. The "refinement" property is used to modify (restrict) the scope of `prov:Actions`, `prov:Assets` and `prov:Party's`.

In the following EXAMPLE CODE 16 a refinement is introduced to the first permission, which requires loan recipients to be of age (i.e. 18 years or older). To be able to do so, the assignee is defined as `"@type": "foaf:Person"`. In the following line the person is identified with `"source" : "ex:curator2"` to be curator Hortensia at Institution 2. The refinement



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checks the age of Hortensia by defining an operation that states that a `foaf:Person`'s age (`foaf:age`) is required to be greater than the integer number "17", that is, it needs to be "18" or higher. If that equation is true, then the geographic constraint will be evaluated. If both restrictions are positively evaluated, then the action of `ex:shipping_to_3rdParty` corresponding to the linked resource `ex:24_obligations_3rd_party` can be performed.

EXAMPLE CODE 16: Defining a context-dependent decision - adding an age restriction

```
{
  "@context" : [{ "odrl": "http://www.w3.org/ns/odrl.jsonld" }],
  "@graph" : [ {
    "@type" : "odrl:Agreement",
    "@id" : "ex:inst1_inst2_loan_contract",
    "profile" : "ex:biodivDomain_profile",
    "permission" : [{
      "target" : "ex:physicalSpecimen1",
      "assigner" : "ex:institution1_holding",
      "assignee" : { // specifying the delegate
        "@type" : "foaf:Person",
        "source" : "ex:curator2",
        "refinement" : [{ // restricting age to 18+
          "leftOperand" : "foaf:age",
          "operator" : "gt", // greater than
          "rightOperand" : {
            "@value" : "17", "@type" : "xsd:integer"
          }
        }]
      }
    }],
    "constraint" : [{
      "leftOperand" : "spatial",
      "operator" : "isPartOf",
      "rightOperand": "http://www.wikidata.org/entity/Q458",
      "comment" : "European Union"
    }],
    "action" : "ex:shipping_to_3rdParty"
  }],
  "permission" : [{
    "target" : "ex:physicalSpecimen1",
    "assigner" : "ex:institution1_holding",
    "assignee" : "ex:institution2_requesting",
    "action" : "ex:physical_analysis"
  }]
} ]
}
```



Step 6: Moving towards an operational framework: exploring the policy life-cycle with inheritance between policies

In an operational setting, as for example ELViS and the DiSSCo technical infrastructure, policies and event set-ups do not exist in isolation. Hence, their machine-actionable representation as program code will not be called and run in isolation, too.

In the here explored use case of an ELViS loan transaction, the code describing `odrl:Policyes` is populated with links to information that has been captured by PROV-constructs, which in their first function are used to record all activities and lay down a provenance trail over time. At the same time, due to this function they therefore are the go-to resources for linking to the most up-to-date versions of digital objects and (meta)data. These up-to-date versions can then be used to construct conditions in the form of `odrl:Policyes`.

Furthermore, `odrl:Policyes` complement each other, exchange information and function in interaction. Already within the considered loan use case they evolve and introduce a life-cycle perspective. A loan environment can be considered to start with a `prov:Agent` to design a loan policy in the form of an `odrl:Offer` and offer `prov:Entities` (physical collection specimens) on the ELViS platform. Another `prov:Agent` interested in receiving a specimen on loan, can design an `odrl:Request` (a subtype of `odrl:Policy`). Generally, this will mean that they fill out a standard request form on the ELViS system with the specifics of their loan request. The loan system will then bring together both the `odrl:Offer` and the `odrl:Request` policies and create from them a concrete loan contract, an `odrl:Agreement`. This newly minted `odrl:Agreement` policy will inherit its information from the two parental policies (`odrl:Offer` and `odrl:Request`). Based on the information and conditions inherited, the ELViS loan system will evaluate if the loan request fulfils the requirements associated with the requested specimen(s). If it does, the contract can be manually accepted by the involved `prov:Agents` and the loan be realised. In this way, `odrl:Offer` and `odrl:Request` policies evolved into an `odrl:Agreement` contract.

The following code example (EXAMPLE CODE 17) provides an overview over the elements of the policy life-cycle. Several open questions currently remain regarding the details of inheritance, for example when information and conditions overlap and need to be merged, as well as concerning approaches for identifying and accessing specific properties within the policy objects. Thus, the example code exemplifies a general framework that can be further developed.

EXAMPLE CODE 17: The policy life-cycle: an **offer** (with links to PROV objects) and **request** (with links to PROV objects) evolve into a contractual **agreement** as the basis for a machine-actionable assessment, including a final **human decision** step, in preparation of and leading up to a loan event.



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```

{
  "@context" : [{ "odrl": "http://www.w3.org/ns/odrl.jsonld" }],
  "@graph" : [ {

\\ 1st parent offer: Availability of loans to 3rd parties

    "@type" : "odrl:Offer",
    "@id" : "ex:24_obligations_3rd party",
    "profile" : "ex:biodivDomain_profile",
    "permission" : [{
      "target" : [{
        "@type" : "odrl:AssetCollection",
        "source" : "ex:institution1_inVertCollection"
      }],
      "assigner" : "ex:institution1_holding",
      "assignee" : {
        "@type": "odrl:PartyCollection",
        "refinement": [{
          "leftOperand": "foaf:age",
          "operator": "gt",
          "rightOperand": {
            "@value": "17", "@type": "xsd:integer"
          }
        }]
      },
      "constraint" : [{
        "leftOperand": "spatial",
        "operator": "isPartOF",
        "rightOperand":
http://www.wikidata.org/entity/Q458,
        "comment": "European Union"
      }],
      "action" : "ex:shipping_to_3rdParty"
    }],
  }, {

\\ 2nd parent offer:
\\ Are requests that include physical analyses acceptable?

    "@type" : "odrl:Offer",
    "@id" : "ex:10_YES_physical_analysis",
    "profile" : "ex:biodivDomain_profile",
    "permission" : [{
      "target" : [{
        "@type" : "odrl:AssetCollection",
        "source" : "ex:institution1_inVertCollection"
      }],
      "assigner" : "ex:institution1_holding",

```



```

        "action" : "ex:physical_analysis"
      }
    ],{

\\ Parent request:
\\ Definition of loan request and intended uses

      "@type" : "odrl:Request",
      "@id" : "ex:institution2_standardLoanRequest",
      "profile" : "ex:biodivDomain_profile",
      "permission" : [{
        "target" : "ex:physicalSpecimen1",
        "assignee" : "ex:institution2_loaning",
        "action" : [
          "ex:shipping_to_3rdParty", "ex:physical_analysis"
        ]
      }]
    },{

\\ Contractual agreement with inheritance from parent policies
\\ Assessment if joint agreement can be found

      "@type" : "odrl:Agreement",
      "@id" : "ex:inst1_inst2_loanContract",
      "profile" : "ex:biodivDomain_profile",
      "inheritFrom" : [{
        "@id" : "ex:24_obligations_3rd party"
      }],{
        "@id" : "ex:10_YES_physical_analysis"
      },{
        "@id" : "ex:institution2_standardLoanRequest"
      }],
      "permission" : [{
        "target" : [{
          "@type" : "odrl:Asset",
          "source" : "ex:institution2_standardLoanRequest",
          "refinement" : [{
            "leftOperand" : "ex:institution2_standardLoanRequest",
            "operator" : "isPartOf",
            "rightOperand" : [{
              "@id" : "ex:24_obligations_3rd party"
            }],{
              "@id" : "ex:10_YES_physical_analysis"
            }
          ]
        }]
      }]
    },{
      "assigner" : "ex:institution1_holding",
      "assignee" : [{

```



```

      "@type": "odrl:PartyCollection",
      "source" : [{
        "@type" : "foaf:Organization",
        "source" : "ex:institution2_standardLoanRequest"
      }, {
        "@type" : "foaf:Person",
        "source" : "ex:institution2_standardLoanRequest",
        "odrl:assigneeOf" :
"ex:institution2_standardLoanRequest",
        "refinement": [{
          "leftOperand": "foaf:age",
          "operator": "gt",
          "rightOperand": {
            "@value": "17", "@type": "xsd:integer"
          }
        }]
      }]
    },
    "constraint" : [{
      "leftOperand": "spatial",
      "operator": "isPartOf",
      "rightOperand": "http://www.wikidata.org/entity/Q458",
      "comment": "European Union"
    }],
    "action" : [{
      "@id" : "ex:loan2023_1",
      "refinement" : [{
        "leftOperand" : "ex:institution2_standardLoanRequest",
        "operator" : "includedIn",
        "rightOperand" : [{
          "@id" : "ex:24_obligations_3rd party"
        }, {
          "@id" : "ex:10_YES_physical_analysis"
        }]
      }]
    }]
  }],
}]]

```

\\ final human intervention required

```

"obligation" : [{
  "assigner" : "ex:dissco_ri_elvis",
  "assignee" : [{
    "@type": "odrl:PartyCollection",
    "source" : [{
      "@id": "ex:institution1_holding"
    }, {
      "@id": "ex:institution2_standardLoanRequest"
    }
  ]
}

```




```

    }],
    "refinement" : [{
      "and" : {
        "@list": [{
          "@id": "ex:institution1_holding"
        }, {
          "@id": "ex:institution2_standardLoanRequest"
        }]
      }
    }]
  }],
  "action" : [{
    "@id" : "ex>manual_input",
    "refinement" : [{
      "leftOperand" : "ex:humanDecision",
      "operator" : "eq",
      "rightOperand" : "YES",
      "comment" : "Final human decision step"
    }]
  }]
}]
}

```

4.8.4 Next steps: Further development of the openDS specification and adopting ODRL for the biodiversity domain

The Kunming-Montreal Global Biodiversity Framework (GBF; Conference of the Parties to the Convention on Biological Diversity 2022) adopted in December 2022 by the parties to the UN [Convention on Biological Diversity](#) (CBD) sets global biodiversity conservation into an overarching context of ethical and socio-political principles that provide conditions for human actions and interactions (CBD 2022, Section C). Most of these principles are of direct application and impact to biodiversity data, data infrastructure design and maintenance, as well as knowledge management. For example, biodiversity data and knowledge services are called to consider different value systems (IPBES et al. 2019), be founded on a human rights-based approach (UNSDG-HRWG 2003), enable free, prior and informed consent and the right to participative decision-making by indigenous peoples and local communities (IPLCs; United Nations General Assembly 2007), as well as support collaboration of all, providing implementation for a whole-of-government and whole-of-society approach.



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IPLCs have already been working for some time on transforming such principles into operational implementations. Members of the communities developed the CARE principles (Carroll et al. 2021) and have started to build systems of concrete flags that can be associated with physical objects, e.g. collection specimens, and data, e.g. genomic data. One such system are the Local Contexts labels, including Traditional Knowledge and Biocultural labels (<https://localcontexts.org/>).

The approaches that have been developed by and for IPLCs can provide inspiration, since biodiversity data infrastructures and natural science collections are embedded in highly cooperative social contexts that involve a wide range of stakeholders and rights holders, which at least in part have distinct and sometimes divergent interests.

These social structures are characterised by dynamically changing and sometimes complex conditions arising from multi-layered legal, ethical and social contexts, multiple interacting agents in a variety of roles and sets of situation-specific restrictions and decision processes. Examples are annotations of taxon identifications, and updates to a physical object's associated collection management information by members of the biodiversity sciences and collections communities. In addition, the same physical object might be subject to contracts, policies, regulations and laws at all legislative levels, from civil contracts between two parties to local, national and international legislation, including bilateral and multilateral treaties.

Thus, information on conditions associated with physical specimens and biodiversity data is and increasingly will be multi-faceted, structured and interlinked, dynamic and context-dependent. The modular structure of the openDS specification will enable the integration of one or more classes that store such information. In next steps, the overall structure as well as internal details of these classes will need to be clarified and developed. Together the Biodiversity Permit/Contract Typology and the Typology of Legal/Contractual Terms for Biodiversity Specimens provide a comprehensive and information-rich starting point for structuring data and information on conditions within the openDS specification.

One higher-level split that suggested itself already during this work cycle differentiates between, on one hand, `odrl:Set` and `odrl:Offer` policies spanning open a context of "lawful handling" and, on the other hand, `odrl:Agreement` policies determining concrete "contract conditions" between uniquely identified parties for specific assets (specimens). The first category provides information on conditions derived from applicable laws and regulations. Entering information to elements in this category might not be made mandatory. For example, many common species might not have any legislation associated with them. In addition, for a large part of old collection objects, legal conditions are not readily available and cannot be reliably inferred automatically. Entries to the second category storing contractual information might be made mandatory, at least for contracts covering future activities and transactions, as e.g. loan transactions. Most transactions are associated with contracts that are concrete, well-delimited and state condition



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explicitly. Here, the decision is whether all available contractual information should be reflected in the DiSSCo technical infrastructure and e.g. its ELViS module.

Some challenges that the working group encountered and discussed during the development of the Typology of Legal/Contractual Terms for Biodiversity Specimens were associated with use cases in which conditions are linked to past (e.g. collecting from nature) versus future (e.g. loan, use) events, as well as use cases that require the identification of implicit permissions. Implicit conditions can be associated with specimens and/or situations, which are characterised by an absence of existing policies or regulations.

The SYNTHESYS+ working group focused exclusively on legal and contractual conditions associated with physical specimens to build a starting point for continuing development. Participants of the MOBILISE-SYNTHESYS+ workshop in the fall of 2021 pointed out that legal conditions apply to a wide range of both analogue and digital transactions. It is clear that, compared to physical specimens, digital objects, (meta)data and processes exist in entirely different legal backgrounds, which currently are very dynamic and rapidly evolving, cp. the ongoing discussions and negotiation process on “Digital Sequence Information” within the CBD, and the latest UNCTAD report on transnational data flows (UNCTAD 2021). Understanding, differentiating and connecting the interrelated realms of physical and digital objects is an important objective of upcoming work. It will increasingly require transdisciplinary collaboration with legal experts.

Further work is also needed to investigate the capabilities and limitations of applying ODRL and its extensions for the design and construction of normative statements for data and services required by and commonly occurring within the biodiversity sector. Very likely existing rights expression languages (REs), with ODRL being one implementation system, will need to be modified, expanded and adapted to the specifics of the biodiversity sector with its own set of widely varied legal, ethical and social contexts.

Kebede et al. (2021) pointed out and discussed several challenges that they encountered while exploring ODRL for use cases arising in connection with data sharing infrastructures in the health and logistics sector. The limitations considered by them concern, e.g., the delegation of compound rights, in which some rights are passed on, while others are restricted or revoked, specifically in situations of unequal power; the handling of newly created entities from existing assets; normative statements pertaining to outcomes (e.g. of "use") versus the process-based approach taken by ODRL; agent granularity and the diversity of their roles; a dynamic user-driven consent management; and transitions within the policy- and rule-lifecycles.

Kebede et al. (2021) suggest eFlint (van Binsbergen et al. 2020) as an alternative or complementary approach to ODRL. They describe and highlight eFlint as an action-based policy language. In addition, they point to several more REs and suggest a review of Hohfeld's



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“Fundamental legal conceptions” (Hohfeld 1917), which introduces and informs about the fundamentals of legal decision processes. This provides essential background for investigations and work towards a decision for a fully applicable and functional REL for defining and implementing normative statements and their conditions for data and services.

In conclusion, the investigation of the ODRL ontology, its applicability and limits, as well as explorations of additional existing REL standards and ontologies will need to be continued. Furthermore, a comprehensive structural framework for integrating information about conditions into the openDS specification will need to be developed, considering (known) challenges and a wider range of use cases. For this, the interconnections between and potential inheritance of conditions associated with physical and digital entities will need to be developed.

The goal of all these developments is the integration of conditions into events and transactions that are representing the dynamic and evolving nature of physical and digital biodiversity records as captured in and by biodiversity data infrastructures.



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5 Future development

Two lines of action seem to be obvious for future development. First, a process among a group of like-minded institutions to decide, on one hand the extent to which they want to implement the Typology of Legal/Contractual Terms for Biodiversity Specimens and, on the other hand, to decide what kind of updates and amendments it might need. Updates and amendments could be based on the needs of their own staff or typical stakeholders respectively. Amendments could include fossil, geological and mineralogical objects. A pilot implementation carried out for a number of different CMS and different collection types could provide additional insight in the applicability of the proposed terminology and potential gaps. In order to have the possibility to further develop the vocabulary in the future, the version published here has been transferred to the GGBN Wiki platform

([https://wiki.ggbn.org/ggbn/Permits and Contracts and Terms for Biological Specimens](https://wiki.ggbn.org/ggbn/Permits_and_Contracts_and_Terms_for_Biological_Specimens)). The wiki system allows future collaborative curation and transparent versioning as well as the documentation of discussions on specific topics. In this way we can ensure that current findings and developments can be documented dynamically.

The second line of action would be at the level of international platforms such as GGBN or the upcoming DiSSCo. Based on the institutional processes, both the Biodiversity Permit/Contract Typology and the Typology of Legal/Contractual Terms for Biodiversity Specimens could be implemented in GGBN, and DiSSCo could extend its basic model and make the latter Typology machine-actionable. These steps facilitate the management of terms by worldwide access to the information in the Typology. It should also be considered to transfer the standardisation process to the TDWG Biodiversity Information Standards organisation, either in the form of a task group or a more general working group.



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6 Acknowledgements

Our gratitude goes to Ole Seberg, our former Workpackage lead.

We want to thank the following colleagues for feedback on elements of our work which helped us to considerably improve our results:

Wouter Addink, Sharif Islam, Sam Leeftang and Claus Weiland and other members of the DiSSCo technical team. Marc Reynders, Filip Vandeloos, Ann Bogaerts and Sofie De Smedt (Meise Botanic Garden) for feedback on permits and other documents related to living plant collections, seed banks and herbaria. Anita Eschner, Christoph Hörweg, Maria Marschler, Andrea Stadlmayr and Elke Lhotak from Naturhistorisches Museum Wien.

We further want to thank

- Andreas Planck for creating dedicated pages on the GGBN Wiki platform and importing the Permit/Contract Typology and the Typology of Legal/Contractual Terms for Biodiversity Specimens, the Glossary, and our examples for EU and US permits from this deliverable.
- Alex Hardisty as a moderator and the contributors to the discussion topic "Meeting legal/regulatory, ethical and sensitive data obligations" of the community consultation towards the Digital Extended Specimen by the alliance for biodiversity knowledge for sharing their knowledge, expertise and insights.
- The presenters, session moderators and participants at the Mobilise and SYNTHESYS+ workshop as well as the many colleagues who responded to our survey and questionnaire.
- COST Action CA 17106 supported the joint MOBILISE-SYNTHESYS+ workshop on loans and permits data standard for scientific collections.



SYNTHESYS+ was funded by the Horizon 2020 Framework of the European Union under the H2020 Open Innovation and Open Science Research Infrastructure call.

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8 Glossary of terms used in the Typologies

ABS Clearing House

Global information portal (<https://absch.cbd.int>) developed under the [Convention on Biological Diversity \(CBD\)](#) and further elaborated in the [Nagoya Protocol \(NP\)](#) to make information available on national contacts (especially National Focal Points and Competent National Authorities), national legislation and other matters relevant to [Access and Benefit Sharing](#) and the [Nagoya Protocol](#)

Access and Benefit-Sharing (ABS)

A system based on public international law that outlines the way in which [genetic resources](#) or (where applicable) traditional knowledge associated with such resources is [accessed](#) and how the benefits that result from the [utilisation of such resources](#) and associated traditional knowledge are shared with the countries and/or indigenous peoples and local communities providing them.

Access to genetic resources or associated traditional knowledge

The acquisition of [genetic resources](#) or associated traditional knowledge from the country that has sovereign right over those resources (providing country). Note that this term may be used differently by some countries or organisations. The EU Regulation defines access as ‘the acquisition of genetic resources or of traditional knowledge associated with genetic resources in a Party to the Nagoya Protocol’. Both the [Convention on Biological Diversity \(CBD\)](#) and - in more detail - the [Nagoya Protocol \(NP\)](#) contain provisions for granting access to genetic resources.

Biodiversity Beyond National Jurisdiction (BBNJ)

An international agreement, currently at the time of writing this glossary in 2022 under negotiation at the United Nations, on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction.

Bioprospecting

The search for potentially valuable genetic data and biochemical compounds in biodiversity for the purpose of developing economically valuable products for different applications (e.g. pharmaceutical, cosmetic, agricultural).

The UNDP defined bioprospection "Biodiversity prospecting or bioprospecting is the systematic search for biochemical and genetic information in nature in order to develop commercially-valuable products for pharmaceutical, agricultural, cosmetic and other applications.

Bioprospecting activities must comply with the definition of [utilisation of genetic resources](#) of the [Nagoya Protocol](#) or as stated in the national law or policy. The [Nagoya Protocol](#) applies to the [utilisation of genetic resources](#) and their derivatives"



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([https://www1.undp.org/content/dam/sdfinance/doc/Bioprospecting%20 %20UNDP.pdf](https://www1.undp.org/content/dam/sdfinance/doc/Bioprospecting%20%20UNDP.pdf)
<https://de.scribd.com/document/505930765/Bioprospecting-UNDP>)

Convention on Biological Diversity (CBD)

International agreement designed to promote three goals, the "conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources" (<https://www.cbd.int/convention/text/>). The agreement was adopted by the states that participated in the 1992 UN Conference on Environment and Development in Rio de Janeiro; it entered into force on 29 December 1993.

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

International agreement designed to ensure that international trade in wild fauna and flora does not deteriorate the situation of endangered or strongly exploited species. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973) resulted from a resolution by the World Conservation Union (IUCN) in 1963; it entered into force on 01 July 1975.

Environmental sample

A collected volume of water, soil, sediment, or any other material containing living or dead organisms, or genetic material such as DNA.

Genetic resources (GR)

Term identified in the [Convention on Biological Diversity \(CBD\)](#) and refers to all "genetic material of actual or potential value", thus encompasses "any material of plant, animal, microbial or other origin containing functional units of heredity" that is potentially valuable to humans. Genetic resources can be taken from the wild, domesticated or cultivated. They may be sourced from natural environments (in situ) or human-made collections (ex situ) (e.g. botanical gardens, gene banks, seed banks and microbial culture collections).

International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA)

Also referred to as the Plant Treaty or Seed Treaty. International agreement designed to promote the "conservation and sustainable use of plant genetic resources for food and agriculture and the fair and equitable sharing of the benefits arising out of their use, in harmony with the Convention on Biological Diversity, for sustainable agriculture and food security" (<https://www.fao.org/3/i0510e/i0510e.pdf>). It entered into force on 29 June 2004.



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Nagoya Protocol (NP)

Short for “The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization”. An international agreement related to the [Convention on Biological Diversity \(CBD\)](#), which primarily aims at sharing the benefits arising from the [utilisation of genetic resources](#) in a fair and equitable way (<https://www.cbd.int/abs/text/>). It entered into force on 12 October 2014.

Pandemic Influenza Preparedness framework (PIP)

International instrument that aims to "improve pandemic influenza preparedness and response" by improving and strengthening a system for the global sharing "of H5N1 and other influenza viruses with human pandemic potential and access to vaccines and sharing of other benefits" (<https://apps.who.int/iris/rest/bitstreams/1351857/retrieve>). It was negotiated by Member States of the World Health Organization (WHO) and entered into force on 24 May 2011.

Phytosanitary

Scientific and regulatory frameworks relating to plant health, including the control of plant pests or pathogens.

Reintroduction

The intentional release of a species from captivity (e.g. zoo, botanical garden, seed bank) in an area inside its indigenous range from which it has disappeared.

Translocation

The intentional movement of a species within its indigenous range to an area where it has disappeared.

Utilisation of genetic resources

To "conduct research and development on the genetic and/or biochemical composition of genetic resources, including through the application of biotechnology" ("biotechnology means any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use") as defined in the --> Nagoya Protocol (NP).



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9 Annexes

Annex 1 - A set of 38 Document Types

For additional information on Document Types see chapter [4.5.4](#).

1-1 Mutually Agreed Terms-MAT

from Category: [Access and Benefit-Sharing](#) Document (ABS)

Document Type definition: Mutually Agreed Terms-MAT is a contract on benefit-sharing from the [utilisation of genetic resources](#) that has been mutually agreed between providers and users of [genetic resources](#) in the context of the [Convention on Biological Diversity \(CBD\)](#) including [Nagoya Protocol \(NP\)](#). It may be named Mutually Agreed Terms (MAT) or have another title.

Please note: Collecting permits from countries without national requirements for [Access & Benefit-Sharing](#) to/from their own [genetic resources](#) should be filed under "permits for collecting & related/taking/possessing".

Additional information: According to the Nagoya Protocol MAT is not focussed on [access to genetic resources](#), [access](#) is subject to PIC (see 1-3) only. In the Nagoya Protocol the term MAT rather seems to describe the process of negotiations between equal partners than a formally required title of the contract. Therefore, the contract on benefit-sharing may have a title other than "MAT".

1-2 Internationally Recognised Certificate of Compliance (IRCC)

from Category: [Access and Benefit-Sharing](#) Document (ABS)

Document Type definition: A record generated on the [ABS Clearing House](#) when the Competent National Authority of a Providing Country publishes a permit or equivalent (e.g. PIC, MAT) there. This record is given a unique identifier by the [ABS Clearing House](#) and provides legal certainty on [utilising the genetic resources](#) covered.

1-3 Prior Informed Consent (PIC)

from Category: [Access and Benefit-Sharing](#) Document (ABS)

Document Type definition:

1) *for [genetic resources](#):* A written permission given by a government authority of a provider country to a user prior to and allowing [access](#) to genetic resources for their [utilisation](#), most often based on the national legal implementation of Convention on Biological Diversity (CBD) including Nagoya Protocol (NP).



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2) *for traditional knowledge*: the prior and informed consent by, or approval and involvement of indigenous peoples or local communities on [access](#) to their traditional knowledge associated with [genetic resources](#) for [utilisation](#).

3) A PIC can also be the leading part of a combined document covering the contents of MAT as well. If this combined document is filed as PIC a note and reference should be filed in the Document Type MAT.

1-4 Specialised Standard ABS Terms (SMTA)

from Category: [Access and Benefit-Sharing](#) Document (ABS)

Document Type definition: An internationally agreed "Standard Material Transfer Agreement-SMTA" like it is used for the [International Treaty on Plant Genetic Resources for Food and Agriculture \(ITPGRFA\)](#) and the [Pandemic Influenza Preparedness framework \(PIP\)](#).

Example: <https://www.fao.org/3/a-bc083e.pdf>

1-5 Exemption evidence

from Category: [Access and Benefit-Sharing](#) Document (ABS)

Document Type definition: Certificates and other documents demonstrating that ABS documents are not necessary.

1-6 Other ABS documents (e.g. biomedical, BBNJ)

from Category: [Access and Benefit-Sharing](#) Document (ABS)

Document Type definition: This refers to documents outside the CBD - a formal agreement with an individual, a legal person or government containing terms and conditions related to [access](#) to, use of, and benefits arising from, genetic resources originating either outside national jurisdiction or from humans.

Additional information: This refers to documents outside the CBD. These are documents (i) under the Antarctic treaty or the upcoming BBNJ instrument (when agreed - [Biodiversity Beyond National Jurisdiction](#)); (ii) covering biomedical samples, where ABS applies to the individual donor.



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2-1 Contracts (legally binding)

from Category: High level arrangements

Document Type definition: A formal and legally binding agreement signed between parties.

Please note: for contracts on "benefit-sharing" use the ABS-document "Mutually Agreed Terms"; for contracts on transferring (collection) objects select a suitable Document Type from the Category "Material Transfer Agreements, stewardships & ownership-related information".

2-2 Memorandum of Cooperation (MoC, not legally binding)

from Category: High level arrangements

Document Type definition: A document that outlines - without binding effect - the terms and details of cooperation between parties.

Additional information: The terms MoC and MoU seem to be understood differently by different organisations and definition providers. The MoC may be understood as a document in which two or more parties agreed upon to work together for a common objective, whereas the Memorandum of Understanding (MoU) may be understood as a written document which describes the terms of an agreement.

2-3 Memorandum of Understanding (MoU, not legally binding)

from Category: High level arrangements

Document Type definition: A document that outlines - without binding effect - the terms and details of an understanding between parties; "a memorandum of understanding is a type of agreement between two or more parties. It expresses a convergence of will between the parties, indicating an intended common line of action."

(https://en.wikipedia.org/wiki/Memorandum_of_understanding#cite_note-1)

Additional information: The terms MoU and MoC seem to be understood differently by different organisations and definition providers. The MoU may be understood as a written document which describes the terms of an agreement, whereas the Memorandum of Cooperation (MoC) may be understood as a document in which two or more parties agreed upon to work together for a common objective.

3-1 Collecting Permit

from Category: Permits for collecting & related/taking/possessing

Document Type definition: Authorises the collection of specimens, DNA, tissue or [environmental samples](#) in the wild that are subject to legal restrictions (e.g. protected species/areas, special techniques) AND where this is not covered by a legal requirement to obtain an ABS-permit/PIC.



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Please note: this Document Category includes Hunt/Fish/Trap licences, salvage may be included unless special legislation calls for a separate type of permit (e.g. for migratory birds).

Example: Permits from the Brazilian Biodiversity Authorisation and Information System SISBIO <https://www.gov.br/icmbio/pt-br/servicos/sistemas/sisbio-sistema-de-autorizacao-e-informacao-em-biodiversidade/ManualdoUsurio.pdf>

3-2 Authorisation to enter site

from Category: Permits for collecting & related/taking/possessing

Document Type definition: A signed document that indicates that a person has authorization to enter private/public property; for purposes that sometimes may require additional documents, e.g. for conducting research and/or removing specimens from the property.

3-3 Taking: "incidental take" permit

from Category: Permits for collecting & related/taking/possessing

Document Type definition: A permit required when a protected species is unintentionally harassed, harmed, pursued, hunted, shot, wounded, killed, trapped, captured, or collected as a consequence of an approved or lawful activity.

Example: USA Endangered Species Act (ESA) incidental take permit; a migratory bird, their nests and/or eggs can be inadvertently harmed or disturbed as a result of an approved activity (e.g., clearing trees and other vegetation, draining or flooding land, or using fishing gear).

3-4 Taking: Migratory Bird Treaty Act (MBTA) Special Purpose-Salvage Permit

from Category: Permits for collecting & related/taking/possessing

Document Type definition: A permit required to salvage migratory birds regulated under the US Migratory Bird Treaty Act found dead; authorises temporary possession of the dead specimens for transport to a designated public, scientific, or educational institution. Applies to the US only.

3-5 Taking: Salvage Permit (e.g., Non-US, US federal, state, local)

from Category: Permits for collecting & related/taking/possessing

Document Type definition: Authorises the collection of dead animals or animal parts from the wild.



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3-6 Possessing: Receiving Permit

from Category: Permits for collecting & related/taking/possessing

Document Type definition: Authorises the acceptance - and holding - of specimens that are subject to special national regulations making possession legally restricted (or illegal) because of their properties. This is different from ABS-documents, where restrictions are based on the specimen's origin/providing country, not on the properties. A receiving permit may also impose certain conditions. ***Please note:*** In contrast, a certificate of health or (phyto)sanitary certificate rules that a specimen, being legally unrestricted in general, is safe to import with regard to certain pathogen risks.

Additional information: One difference between this Document Type and ABS documents is that ABS operates bilaterally between countries (though in an international framework), but e.g. drugs and plant(/soil) health are national instruments prohibiting material being held and/or studied/utilised within or entering the country.

Examples: 1) "Permit to Receive Soil" issued by the USDA APHIS may authorise the importation of soil from foreign sources (except countries with sanctions or embargoes by U.S. State Department), and interstate/ domestic movement of soil for chemical/ physical analysis in a controlled laboratory environment at the named facility on the permit. 2) UK Scheduled Drug licence allows an institution to possess scheduled drugs (e.g. cannabis herbarium specimens). This licensing system can also allow an institution to supply scheduled drugs for a given purpose under a separate licence e.g. for display in another institution providing the recipient has a licence to possess.

3-7 Exemption evidence

from Category: Permits for collecting & related/taking/possessing

Document Type definition: Documents demonstrating that permits for collecting & related/taking/possessing are not necessary.

Example: A letter that confirms that documentation establishes that the marine mammal parts were taken prior to the effective date of the US Marine Mammal Protection Act or US Endangered Species Act and as such, the prohibitions to sell, import, or export these objects under the MMPA and ESA do not apply.

4-1 Permit to [reintroduce/translocate](#) organism into the wild

from Category: Permits for special purposes (excluding ABS)



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Document Type definition: A permit following national or supranational (EU) law to release one or several specimens of a species in a place where they are not yet present.

Examples: EU regulation concerning the placing of plant protection products on the market (Regulation (EU) 1107/2009), EFSA Panel on Plant Health 2015; EU regulation on the prevention and management of the introduction and spread of invasive alien species (Regulation (EU) 1143/2014).

4-2 Data Use Agreement (DUA)

from Category: Permits for special purposes (excluding ABS)

Document Type definition: Terms and conditions that govern the transfer and use of data that are "confidential, proprietary, or otherwise considered sensitive"

(<https://researchdatamanagement.harvard.edu/data-use-agreements>). DUAs state the legal framework for data access, what the requestor may do with the data (e.g., scope of the study, restrictions on redistribution), security controls (i.e., obligations to safeguard the data), privacy rights, constraints on publishing and liability for harm arising from the use of the data. They might be accompanied by non-disclosure agreements to guarantee confidentiality over sensitive discussions, information, and data (cp. <https://admindatahandbook.mit.edu/book/v1.0-rc4/dua.html> , https://research.unc.edu/wp-content/uploads/sites/61/2013/04/CCM3_039360.pdf).

Additional information: "Data use agreements (DUA)—also referred to as data sharing agreements or data use licences—are documents that describe what data are being shared, for what purpose, for how long, and any access restrictions or security protocols that must be followed by the recipient of the data." (<https://admindatahandbook.mit.edu/book/v1.0-rc4/dua.html>). In the context of natural science collections data use agreements sometimes are called “data management plan” (DMP), see e.g. the DMP of Brazil’s Virtual Herbarium

<https://riojournal.com/articles.php?id=14675>. While data licences are often applicable to openly accessible data, data use agreements are often applicable to data to which access is restricted. A Data Use Agreement (DUA) can be used to set conditions for sharing one's data (see <https://www.ru.nl/rdm/vm/licenses-data-use-agreements/>). These conditions do not only apply to data publishing, but also can set rules for how data needs to be handled, e.g. some data should not be transferred to a different server, discussed with/made available to other members of a working group, or what type of analyses can be performed (e.g. any method resulting in de-anonymization might not be allowed). "Depending on the data provider, other forms of documentation can be used. Examples include memoranda of understanding (MOU), data use agreements, and data exchange letters. These have different structures and levels of detail, but all of these instruments will state the legal framework for data access, what the requestor may do with the data (e.g., scope of the study, restrictions on redistribution), security controls, and constraints on publishing. The data requestor should always prepare some form of documentation for data access, even if the data provider does not require it" (<https://admindatahandbook.mit.edu/book/v1.0-rc4/dua.html>).



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Examples: Data Use Agreement Guidance with lists of topics to consider and flow diagrams for decision processes: <https://research.unc.edu/wp-content/uploads/sites/61/2020/06/osr-ic-Data-Use-Agreement-Guidance.pdf>.

With a focus on data protection:

<https://www.eui.eu/documents/servicesadmin/deanofstudies/researchethics/guide-data-protection-research.pdf>.

Data Use Ontology (DUO) with standardised terms for different uses of genomic data:

<https://github.com/EBISPOT/DUO>

A list of aspects to be considered: <https://www.ru.nl/rdm/vm/licenses-data-use-agreements/>

4-3 Bioprospecting permit

from Category: Permits for collecting & related/taking/possessing

Document Type definition: A document authorising [bioprospecting](#) activities. We follow the UNDP definition of bioprospecting, i.e.: "Biodiversity prospecting or bioprospecting is the systematic search for biochemical and genetic information in nature in order to develop commercially-valuable products for pharmaceutical, agricultural, cosmetic and other applications. Bioprospecting activities must comply with the definition of utilization of genetic resources of the Nagoya Protocol or as stated in the national law or policy. The Nagoya Protocol applies to the utilization of genetic resources and their derivatives"

([https://www1.undp.org/content/dam/sdfinance/doc/Bioprospecting%20 %20UNDP.pdf](https://www1.undp.org/content/dam/sdfinance/doc/Bioprospecting%20%20UNDP.pdf)

<https://de.scribd.com/document/505930765/Bioprospecting-UNDP>). Existing bioprospecting permits may go beyond the scope of the UNDP description.

Examples: [Bioprospecting](#) permits may comprise very different elements, e.g.

1) in South Africa a bioprospecting permit allows to export indigenous biological resources for the purpose of research, and/or allows within South Africa commercialisation of research on indigenous biological resources

(https://www.dffe.gov.za/sites/default/files/legislations/guide_complete_permitapplication.pdf);

2) in Vanuatu a bioprospecting permit allows collecting, and/or export, and/or import of genetic resources, derivatives and associated traditional knowledge

([https://tradeportal.gov.vu/media/EPC_Act_2002_\(consolidated_version_incl_2011_amends\).pdf](https://tradeportal.gov.vu/media/EPC_Act_2002_(consolidated_version_incl_2011_amends).pdf));

3) in Australia/Northern Terr. "collecting any kind of biological resource for scientific research or commercial use is called bioprospecting" (<https://nt.gov.au/environment/animals/collecting-animal-materials-for-scientific-research>).

5-1 Research permit

from Category: Permits for Research



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Document Type definition: Authorises researchers to engage in a scientific activity; may or may not specify type of activity (sometimes specifying the research, sometimes including activities for which other countries require permits of their own such as collecting) may also indicate where research will occur, and a certain time period. Additional permits may be necessary, e.g. for collecting. ***Please note:*** If research permits are directed to show compliance with national [Access & Benefit-Sharing](#) legislation, they belong to the Document Type "Prior Informed Consent", within the Document Category "[Access and Benefit-Sharing](#) document".

Examples: Indonesian Foreign Research Permit (<https://frp.brin.go.id/>), Botswana Research Permit (<http://www.botswanaembassy.org/page/guidelines-for-completing-research-permit-application>), Tanzania Research Permit (<https://tawiri.or.tz/>), Victoria (Australia) Research Permit (<https://www.vic.gov.au/research-permits>), Brazilian SISGEN system to issue research permits for Brazilians (at the moment foreigners need to be associated with Brazilians researchers) (<https://www.gov.br/mma/pt-br/assuntos/biodiversidade/patrimonio-genetico/sisgen> <https://sisgen.gov.br>).

5-2 Ethical oversight document

from Category: Permits for Research

Document Type definition: Research review and approval documentation generated by a group formally designated to review and monitor research involving e.g. animals (animal welfare).

Additional information: For both wildlife and lab animals, similar to institutional review board (IRB) and also known as an independent ethics committee (IEC) for humans.

5-3 Exemption evidence

from Category: Permits for Research

Document Type definition: Certificates and other documents demonstrating that permits for research are not necessary.

6-1 Public law MTA (e.g. acquiring customs' seizures/confiscated material, stewardship agreements)

from Category: material transfer agreements, stewardships & ownership-related information

Document Type definition: A (often standardised) contract on transferring tangible materials (e.g. specimens or samples) from a public authority to an institution (rarely an individual), in which the public authority rules on all (major) terms and conditions.



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Examples: Stewardship agreement, acquiring customs' seizures.

6-2 Institutional MTA (e.g. loans)

from Category: material transfer agreements, stewardships & ownership-related information

Document Type definition: Terms and conditions for transferring tangible materials (e.g. specimens or samples) between two legal entities, including permanent/indefinite loans and material to be consumed (e.g. in DNA analysis).

Additional information: Institutional MTA may be complemented by documents from the document category "Transport Documents".

6-3 Individual deeds of transfer (e.g. private gifts)

from Category: material transfer agreements, stewardships & ownership-related information

Document Type definition: Terms and conditions for transferring tangible materials (e.g. specimens or samples) between two individuals or from an individual to an institution, including private permanent/indefinite loans.

Additional information: Deeds of transfer may be complemented by documents from the document category "Transport Documents".

Examples: Private gifts, private permanent loans.

6-4 Provenance Evidence

from Category: material transfer agreements, stewardships & ownership-related information

Document Type definition: Documentation that establishes from where, how and/or when a specimen has been transferred to the museum, thus indicating provenance but in itself not transferring ownership; not a legal document.

7-1 (Phyto-)Sanitary/Veterinary Certificate

from Category: Transport Documents

Document Type definition: Certificate that confirms that an inspection and/or test has been performed and that the plant/animal specimens or products are free from regulated diseases or pests.



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Examples: e.g. certificate of health, veterinary permit to transport.

7-2 Permit to move across boundaries

from Category: Transport Documents

Document Type definition: Document that allows the movement of regulated species across boundaries within countries.

Examples: injurious wildlife, biological control organisms, invasive and/or pest species.

7-3 CITES export permits & re-export certificates

from Category: Transport Documents

Document Type definition: CITES export permits allow the export of specimens of a species included in CITES-Appendices I, II, or III; re-export certificates apply to corresponding specimens that have previously been imported.

7-4 CITES import permits

from Category: Transport Documents

Document Type definition: CITES import permits allow importing specimens of a species included in CITES-Appendix I.

7-5 CITES certificates of scientific exchange (COSE)

from Category: Transport Documents

Document Type definition: A certificate for institutions registered by a Management Authority of their state, and therefore entitled to the CITES-exemption (article VII, para 6) for non-commercial loans, donations or exchanges between scientists or scientific institutions. (non-registered institutions need permits for export, import, re-export and certificates of origin).

7-6 other CITES documents

from Category: Transport Documents

Document Type definition: This refers to CITES documents different from: export/re-export/import/COSE. Among "other CITES documents" are 1) "Certificates of Origin" for specimens of species included in CITES Appendix III, 2) certificates for the "Introduction from the sea" of specimens of a species included in Appendices I or II, 3) "Pre-Convention certificates"



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for acquisitions before CITES applied, 4) "Travelling exhibition certificates", or 5) certificates for specimen of an animal species bred in captivity / specimen of a plant species artificially propagated. A full range of CITES permits and certificates can be found here: [SUMMARY-OF-USE-OF-PERMITS-CERTIFICATES-IN-CITES-2018.pdf](#)

7-7 Original Export Permit

from Category: Transport Documents

Document Type definition: Authorises exporting specimens abroad from provider country.

Example: Trophy Export Certificate

7-8 Export Permit

from Category: Transport Documents

Document Type definition: An export permit for material already belonging to natural history museums or botanic gardens, e.g. institutional exchange, loans etc.

Additional information: An export permit is an additional document (may be required by national legislation), complementing the institutional material transfer agreement.

Example: US Fish & Wildlife Form 3-177 based on the Endangered Species Act (ESA)

7-9 Original Import Permit

from Category: Transport Documents

Document Type definition: For initial import to the institution at time of collection. ***Please note:*** (Phyto-)Sanitary/Veterinary Certificates are a Document Type of its own.

Examples: Centers for Disease Control (CDC) Import Permit; US Fish & Wildlife Form 3-177.

7-10 Import Permit

from Category: Transport Documents

Document Type definition: An import permit for material already belonging to natural history museums or botanic gardens, e.g. institutional exchange, loans etc.; special types of import



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permits may be needed in particular cases (e.g. illegal products such as herbarium specimens of drug plants, human remains).

Additional information: An import permit is an additional document (may be required by national legislation), complementing the institutional material transfer agreement.

Example: US Fish & Wildlife Form 3-177 based on the Endangered Species Act (ESA)

7-11 exemption evidence

from Category: Transport Documents

Document Type definition: certificates and other documents demonstrating that transport documents are not necessary.

7-12 other transport documents

from Category: Transport Documents

Document Type definition: any transport document not belonging to other transport Document Types (e.g. carrier contracts)



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Annex 2 - A set of 87 legal/contractual terms for collection objects

For additional information on these terms see chapter [4.6.4](#).

1 Info not processed

possible lawful sources: *unknown*

Information on official permissions, obligations or prohibitions for this specimen is available, but has not yet been digitally processed.

2 no ties

possible lawful sources: *N*

refers to: *actions in the past AND future use*

Neither for collecting this specimen in the past, nor for future working/using/exhibiting (with) this specimen any official permission was/is necessary, nor do official obligations or prohibitions exist regarding working/using/exhibiting. Institutional loan conditions may apply.

3 permission & free further use

possible lawful sources: *not specified, D, L, N, LN*

refers to: *actions in the past AND future use*

Already existing permissions refer to the past only (e.g. collecting), no permissions are necessary for further use, no official obligations or prohibitions apply. Institutional loan conditions may apply.

4 free further use + reporting

possible lawful sources: *not specified, D, L, CD*

refers to: *actions in the past AND future use*

Already existing official permissions refer to the past only (e.g. collecting) and no official permissions are necessary for further use, but reporting obligations apply. No prohibitions. Institutional loan conditions may apply.

5 YES: exhibition

possible lawful sources: *not specified, D, L, N, LN*

refers to: *future use*

Exhibiting this specimen and use for educational purposes is officially permitted without obligations. Institutional loan conditions may apply.

6 obligations: exhibition



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possible lawful sources: *not specified, D, L, CD*

refers to: *future use*

Exhibiting this specimen and use for educational purposes is permitted but specific obligations apply. Institutional loan conditions may apply.

7 NO exhibition

possible lawful sources: *D, L, CD*

refers to: *future use*

Exhibiting this specimen is officially prohibited

8 YES: taxonomy

possible lawful sources: *not specified, D, L, N, LN*

refers to: *future use*

Taxonomic work with this specimen is permitted without further legal obligations (non-taxonomic work may not be covered, e.g. genetic analysis beyond taxonomy, and institutional obligations e.g. on destructive sampling may apply)

9 obligations: taxonomy

possible lawful sources: *not specified, D, L*

refers to: *future use*

Using this specimen for taxonomy is permitted, but specific legal obligations apply. Institutional loan conditions may apply.

10 YES: physical analysis

possible lawful sources: *not specified, D, L, N, LN*

refers to: *future use*

Using this specimen for physical analysis, such as morphology or anatomy, is legally permitted. Institutional loan conditions, e.g. on dissecting the specimen, may be present.

11 YES: genetic and biochemical

possible lawful sources: *not specified, D, L, N, LN*

refers to: *future use*



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Utilising this specimen for any kind of research and development on its genetic and/or biochemical composition is officially permitted without further obligations. Institutional loan conditions, e.g. on destructive sampling, may be present.

12 obligations: genetic & biochemical

possible lawful sources: *not specified, D, L*

refers to: *future use*

Utilising this specimen for research and development on its genetic and/or biochemical composition is officially permitted with specific obligations (e.g. new PIC/MAT in certain situations). Institutional loan conditions may apply.

13 reporting: genetic & biochemical

possible lawful sources: *not specified, D, L*

refers to: *future use*

Utilising this specimen for research and development on its genetic and/or biochemical composition is officially permitted with reporting duties. Institutional loan conditions may apply.

14 NO genetic & biochemical

possible lawful sources: *D, L*

refers to: *future use*

Utilising this specimen for research and development on its genetic and/or biochemical composition is prohibited

15 benefit-sharing-NP

possible lawful sources: *not specified, D, L*

refers to: *future use*

Utilising this specimen for research and development on its genetic and/or biochemical composition is officially permitted with benefit-sharing duties from countries that are Party to the Nagoya Protocol (NP). Institutional loan conditions may apply.

16 benefit-sharing-CBD

possible lawful sources: *not specified, D, L*

refers to: *future use*



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Utilising this specimen/genetic resource is officially permitted with benefit-sharing duties from countries that are Party to the [Convention on Biological Diversity \(CBD\)](#), but not to the Nagoya Protocol. Institutional loan conditions may apply.

17 benefit-sharing-ITPGRFA

possible lawful sources: *not specified, D, L*

refers to: *future use*

Using this specimen for research, breeding and training for food and agriculture is permitted with duties and restrictions from the [ITPGRFA \(International Treaty for Plant Genetic Resources for Food and Agriculture\)](#). Institutional loan conditions may apply.

18 YES: TK-utilisation

possible lawful sources: *not specified, D, L, N, LN*

refers to: *future use*

Utilising traditional knowledge (sensu Nagoya Protocol) associated with genetic resources is officially permitted without further legal obligations in research and development on the genetic and/or biochemical properties. Additionally, institutional obligations may apply.

19 obligations: TK utilisation

possible lawful sources: *not specified, D, L*

refers to: *future use*

Utilising this specimen's associated traditional knowledge (sensu Nagoya Protocol) in research and development on the genetic and/or biochemical composition is permitted, but specific legal obligations apply. Institutional loan conditions may apply.

20 YES: living organism research

possible lawful sources: *not specified, D, L, N, LN*

refers to: *future use*

Living organism research such as germination trials or experiments, moisture relationship testing and diagnostic characterization is officially permitted without further obligations on research and development on the genetic and/or biochemical properties. Additionally, institutional obligations may apply.

21 obligations: living organism research

possible lawful sources: *not specified, D, L*

refers to: *future use*



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Living organism research such as germination trials or experiments, moisture relationship testing and diagnostic characterization (everything about living organisms) is officially permitted with specific obligations. Additionally, institutional obligations may apply.

22 NO living organism research

possible lawful sources: *D, L*

refers to: *future use*

Living organism research such as germination trials or experiments, moisture relationship testing and diagnostic characterization (everything about living organisms) is prohibited

23 YES: 3rd party

possible lawful sources: *not specified, D, L, N, LN*

refers to: *future use*

Official permission to transfer the object to third parties. Institutional loan obligations may apply.

24 obligations: 3rd party

possible lawful sources: *not specified, D, L, CD*

refers to: *future use*

legal or contractual duties and/or restrictions on third party transfer apply.

25 NO 3rd party

possible lawful sources: *not specified, D, L, CD*

refers to: *future use*

Transfer to 3rd parties is prohibited

26 any quality

possible lawful sources: *not specified, D, L, N, LN*

refers to: *actions in the past AND future use*

No expert opinion on the quality (e.g. health certificates, ethical statement) is necessary for this specimen.

27 ethical research

possible lawful sources: *n/a*

refers to: *actions in the past AND future use*



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Ethical statement for a particular research project.

28 PIC-exempt

possible lawful sources: *not specified, L, N, LN*

refers to: *future use*

A certificate or other document issued by an authority confirms that no PIC (=Prior Informed Consent issued by e.g. a Competent National Authority) is necessary. Not always the document specifies whether the legal background for the exemption is a specific law or the fact that no legal regulation is present. This exemption may imply other elements of permits/contracts, such as "YES: genetic and biochemical".

29 MAT-exempt

possible lawful sources: *not specified, L, N, LN*

refers to: *future use*

A certificate or other document issued by an authority confirms that no MAT (=Mutually Agreed Terms on Benefit-sharing) is necessary. Not always the document specifies whether the legal background for the exemption is a specific law or the fact that no legal regulation is present. The exemption may imply other elements of permits/contracts, such as "YES: genetic and biochemical".

30 pre-Act exemption

possible lawful sources: *not specified, L, N, LN*

refers to: *future use*

A certificate or other document issued by an authority confirms that the material originates from a time prior to enacting a certain law, and therefore is exempt from that law's requirements. Not always the document specifies whether the legal background is a clause of that specific law or the fact that such old material is not legally regulated.

31 pre-listed exemption

possible lawful sources: *not specified, L, N, LN*

refers to: *future use*

A certificate or other document issued by an authority confirms that the material originates from a time prior to its listing in a certain law, and therefore is exempt from this law's requirements. Not always the document specifies whether the legal background is a clause of that specific law or the fact that such old material is not legally regulated.

32 not-protected exemption



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possible lawful sources: *not specified, L, N, LN*

refers to: *actions in the past*

A certificate or other document issued by an authority confirms that an official collection permit is not required because no protected species are concerned. Not always the document specifies whether the legal background for the exemption is a specific law or the fact that no legal regulation is present.

33 free of familiar pests

possible lawful sources: n/a

refers to: *actions in the past*

Confirmation of non-hazardous health, phytosanitary, etc. status at a certain point of time. As such, this content has no legal background, it is solely based on an expert's technical knowledge. (nevertheless, conducting this quality assessment may be legally required).

34 free of biosecurity risks

possible lawful sources: n/a

refers to: *actions in the past*

Confirmation that the material is free of biosecurity risks, such as viruses, bacteria, spores, invertebrate eggs, living stowaways at a certain point of time. As such, this content has no legal background, it is solely based on an expert's technical knowledge. (nevertheless, conducting such a quality assessment may be legally required).

35 import approved

possible lawful sources: *not specified, D*

refers to: *actions in the past*

Permission to bring physical material into a country, based on a public administration's decision in a document addressed to a specific person or legal entity.

36 YES: collect material

possible lawful sources: *not specified, D, L, N, LN*

refers to: *actions in the past*

Permission to collect physical material.

37 obligations: collect material

possible lawful sources: *not specified, D, L, CD*



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refers to: *actions in the past AND obligations may apply to future use*

Collecting physical material is permitted, but specific obligations apply.

38 YES: sensitive information

possible lawful sources: *not specified, D, CD*

refers to: *actions in the past AND future use*

Permission to get and use sensitive information.

39 export approved

possible lawful sources: *not specified, D*

refers to: *actions in the past*

Official permission to export physical material from a country, based on a public administration's decision in a document addressed to a specific person or legal entity.

40 holding approved

possible lawful sources: *not specified, D, L*

refers to: *future use*

Official permission to hold physical material that is subject to special national regulations because a government considered the specimen to be legally restricted (or even illegal) in one way or the other because of their properties.

41 under CITES

possible lawful sources: *not specified, D, L*

refers to: *actions in the past AND future use*

This specimen is subject to CITES regulations.

42 YES: move countrywide

possible lawful sources: *not specified, D*

refers to: *actions in the past*

Permission to move physical material within a country (e.g. to another administrative division), based on a public administration's decision in a document addressed to a specific person or legal entity.

43 YES: setting free

possible lawful sources: *not specified, D*



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refers to: *actions in the past*

Permission to release living organisms into the wild, based on a public administration's decision in a document addressed to a specific person or legal entity.

44 YES: get ownership

possible lawful sources: *not specified, D, CD*

refers to: *actions in the past*

Transfer of ownership title to physical material.

45 obligations: get ownership

possible lawful sources: *not specified, D, CD*

refers to: *actions in the past AND obligations may apply to future use*

Transfer of ownership title to physical material with specific obligations.

46 stewardship

possible lawful sources: *not specified, D, CD*

refers to: *actions in the past AND obligations may apply to future use*

The object is transferred under terms of stewardship, the owner retains the title and obligations for including the object in the collection have been set.

47 entering permitted

possible lawful sources: *not specified, D, CD*

refers to: *actions in the past*

Permission to enter a certain location/area, based on a written decision addressed to a specific person or legal entity, or a verbal decision directed to a specific person who created a written record.

48 equipment permitted

possible lawful sources: *not specified, D, CD*

refers to: *actions in the past*

Permission to use certain equipment for collecting specimens, based on a written decision addressed to a specific person or legal entity, or a verbal decision directed to a specific person who created a written record.

49 tagging permitted



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possible lawful sources: *not specified, D, CD*

refers to: *actions in the past*

Permission to tag animals, based on a written decision addressed to a specific person or legal entity, or a verbal decision directed to a specific person who created a written record.

50 mode(s) permitted

possible lawful sources: *not specified, D*

refers to: *actions in the past*

Specific methods or modes for collecting, hunting, fishing or otherwise taking objects from a place where objects occur in nature were permitted.

51 required: for residents

possible lawful sources: *not specified, D*

refers to: *actions in the past*

It is required to have temporary resident status.

52 required: visa

possible lawful sources: *not specified, D*

refers to: *actions in the past*

It is required to have a temporary stay visa for researchers.

53 required: exit permit

possible lawful sources: *not specified, D*

refers to: *actions in the past*

It is required to obtain an "exit permit" at the end of research.

54 required: teaching

possible lawful sources: *not specified, D*

refers to: *both*

It is required to provide training for local staff or students.

55 required: report progress

possible lawful sources: *not specified, D*

refers to: *both*



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It is required to send regular progress reports.

56 required: exit report

possible lawful sources: *not specified, D*

refers to: *actions in the past*

It is required to deliver an interim report upon leaving the country.

57 required: cash

possible lawful sources: *not specified, D*

refers to: *actions in the past*

It is required to deliver a security cash deposit.

58 required: payment

possible lawful sources: *not specified, D*

refers to: *actions in the past*

Upfront payment required for e.g. collecting.

59 required: send publication

possible lawful sources: *not specified, D*

refers to: *actions in the past AND to future use*

Copies of publication must be sent.

60 required: inform public legal entity

possible lawful sources: *not specified, D*

refers to: *actions in the past AND to future use*

An authorised public legal entity must be informed about data that have been obtained from the specimen.

61 required: send taxa names

possible lawful sources: *not specified, D*

refers to: *both*

Provide a sample list with taxa names to the providing country.

62 required: provider uID



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possible lawful sources: *not specified, D*

refers to: *actions in the past AND to future use*

Use the provider country's unique identifier.

63 required: holding location

possible lawful sources: *not specified, D*

refers to: *actions in the past AND to future use*

Hold the genetic resource in a defined location only.

64 required: negotiate 3rd party

possible lawful sources: *not specified, D; CD*

refers to: *future use*

Transferring the specimen to a third party requires additional negotiations.

65 required: work abroad

possible lawful sources: *not specified, D*

refers to: *actions in the past AND to future use*

Conduct work in the provider country.

66 required: negotiate commercial

possible lawful sources: *not specified, D, CD*

refers to: *actions in the past AND to future use*

Using the specimen for commercial purposes requires additional negotiations.

67 required: non-commercial

possible lawful sources: *not specified, D*

refers to: *actions in the past AND to future use*

The present permit requires uses to be non-commercial

68 required: no economic benefit

possible lawful sources: *not specified, D*

refers to: *actions in the past AND to future use*

Only for research and development lacking economic benefits.



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69 required: IPR notification

possible lawful sources: *not specified, D*

refers to: *actions in the past AND to future use*

Notify the provider country once intellectual property rights are granted based on research and development with this specimen, or when such rights are commercialised.

70 required: share sales

possible lawful sources: *not specified, D*

refers to: *actions in the past AND to future use*

A certain amount of the sales from a product based on research and development on this specimen must be shared.

71 required: method

possible lawful sources: *not specified, D*

refers to: *both*

A certain methodology is required

72 required: single research

possible lawful sources: *not specified, D*

refers to: *actions in the past*

Only a specific research plan is allowed

73 required: handle duplicates

possible lawful sources: *not specified, D*

refers to: *actions in the past*

Provisions for sample duplicates apply.

74 required: handle left-over

possible lawful sources: *not specified, D, CD*

refers to: *actions in the past AND to future use*

provisions for left-over material apply.

75 required: return left-over

possible lawful sources: *not specified, D, CD*



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refers to: *actions in the past AND to future use*

At the end of the project all remaining genetic resources must be returned to the provider.

76 required: handle "DSI"

possible lawful sources: *not specified, D*

refers to: *actions in the past AND to future use*

Provisions apply to "Digital Sequence Information" originating from this specimen.

77 NO destructive sampling

possible lawful sources: *CD*

refers to: *future use*

A loan is possible, but destructive sampling is by no means acceptable.

78 destructive sampling restricted

possible lawful sources: *CD*

refers to: *future use*

Destructive sampling requires prior consultation with the lending institution and a separate permission.

79 dissecting restricted

possible lawful sources: *CD*

refers to: *future use*

Dissecting the specimen/material requires prior consultation with the lending institution.

80 NO shipping

possible lawful sources: *CD*

refers to: *future use*

Cannot be shipped (transport outside the holding institution).

81 preparation restricted

possible lawful sources: *CD*

refers to: *future use*

Transforming the (microscopic) specimen into a preparation requires prior consultation with the lending institution.



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82 share images

possible lawful sources: *CD*

refers to: *future use*

Images that have been produced from the specimen must be shared with the lending institution.

83 NO microwave

possible lawful sources: *CD*

refers to: *future use*

Microwave treatment of the specimen is prohibited.

84 storage parameters

possible lawful sources: *CD*

refers to: *future use*

The specimen must be stored under defined parameters and/or following specific procedures.

85 NO sampling

possible lawful sources: *CD*

refers to: *future use*

Borrowers must not take samples from the specimen on their own, they may ask the lending institution for providing a sample.

86 negotiate commercial use

possible lawful sources: *CD*

refers to: *future use*

Any commercial use of the specimen, of photographs of the specimen or of other elements created with the help of the specimen requires additional negotiations.

87 not available

possible lawful sources: *n/a*

refers to: *future use*

This specimen is temporarily not available, e.g. because it is on loan or must be restored



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Annex 3 - Legal characteristics of every term (definitions in [Annex 2](#))

(D)=individual document, (L)=law, (N)=no legal provisions, n=no, Y=yes, n/a= not applicable; see also chapter [4.6.3.3](#)

Catchphrase ↓	action in the past/ future	expert opinion Y/n	under national (or supranational, e.g. EU) public law						(N) not subject to national/ supranat. public law	(CD) required by contracts/ deeds under civil law
			(D) refers to individually -			(L) refers to written law providing -				
			granted permission	assigned obligation (duty or restriction)	assigned prohibition	permission	obligation (duty or restriction)	prohibition		
1 info not processed	neither	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	n/a
2 no ties	both	n	n/a	n/a	n/a	n/a	n/a	n/a	Y	n/a
3 permission & free further use	both	n	possible	n/a	n/a	possible	n/a	n/a	possible	n/a
4 free further use w. reporting	both	n	possible	possible	n/a	possible	possible	n/a	n/a	possible
5 YES: exhibition	future	n	possible	n/a	n/a	possible	n/a	n/a	possible	n/a
6 obligations: exhibition	future	n	possible	possible	n/a	possible	possible	n/a	n/a	possible
7 NO exhibition	future	n	n/a	n/a	possible	n/a	n/a	possible	n/a	possible



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8 YES: taxonomy	future	n	possible	n/a	n/a	possible	n/a	n/a	possible	n/a
9 obligations: taxonomy	future	n	possible	possible	n/a	possible	possible	n/a	n/a	n/a
10 YES: physical analysis	future	n	possible	n/a	n/a	possible	n/a	n/a	possible	n/a
11 YES: genetic & biochemical	future	n	possible	n/a	n/a	possible	n/a	n/a	possible	n/a
12 obligations: genetic & biochemical	future	n	possible	possible	n/a	possible	possible	n/a	n/a	n/a
13 reporting: genetic & biochemical	future	n	possible	possible	n/a	possible	possible	n/a	n/a	n/a
14 NO genetic & biochemical	future	n	n/a	n/a	possible	n/a	n/a	possible	n/a	n/a
15 benefit- sharing-NP	future	n	possible	possible	n/a	possible	possible	n/a	n/a	n/a
16 benefit- sharing-CBD	future	n	possible	possible	n/a	possible	possible	n/a	n/a	n/a
17 benefit-sharing-ITPGRFA	future	n	possible	possible	n/a	possible	possible	n/a	n/a	n/a
18 YES: TK-utilisation	future	n	possible	n/a	n/a	possible	n/a	n/a	n/a	n/a
19 obligations: TK utilisation	future	n	possible	possible	n/a	possible	possible	n/a	n/a	n/a
20 YES: living organism research	future	n	possible	n/a	n/a	possible	n/a	n/a	n/a	n/a



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21 obligations: living organism research	future	n	possible	possible	n/a	possible	possible	n/a	n/a	n/a
22 NO living organism research	future	n	n/a	n/a	possible	n/a	n/a	possible	n/a	n/a
23 YES: 3rd party	future	n	possible	n/a	n/a	possible	n/a	n/a	possible	possible
24 obligations: 3rd party	future	n	possible	possible	n/a	possible	possible	n/a	n/a	possible
25 NO 3rd party	future	n	n/a	n/a	possible	n/a	n/a	possible	n/a	possible
26 any quality	past	n	possible	n/a	n/a	possible	n/a	n/a	possible	n/a
27 ethical research	both	Y	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
28 PIC-exempt	future	n	n/a	n/a	n/a	possible	n/a	n/a	possible	n/a
29 MAT-exempt	future	n	n/a	n/a	n/a	possible	n/a	n/a	possible	n/a
30 pre-Act exemption	future	n	n/a	n/a	n/a	possible	n/a	n/a	possible	n/a
31 pre-listed exemption	future	n	n/a	n/a	n/a	possible	n/a	n/a	possible	n/a
32 not-protected exemption	past	n	n/a	n/a	n/a	possible	n/a	n/a	possible	n/a
33 free of familiar pests	past	Y	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
34 free of biosecurity risks	past	y	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
35 import approved	past	n	possible	n/a	n/a	n/a	n/a	n/a	n/a	n/a



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36 YES: collect material	past	n	possible	n/a	n/a	possible	n/a	n/a	possible	possible
37 obligations: collect material	both (obligations)	n	possible	possible	n/a	possible	possible	n/a	n/a	possible
38 YES: sensitive information	both	n	possible	n/a	n/a	n/a	n/a	n/a	n/a	possible
39 export approved	past	n	possible	n/a	n/a	n/a	n/a	n/a	n/a	n/a
40 holding approved	future	n	possible	n/a	n/a	possible	n/a	n/a	n/a	n/a
41 under CITES	both	n	possible	possible	n/a	possible	possible	n/a	n/a	n/a
42 YES: move countrywide	past	n	possible	n/a	n/a	n/a	n/a	n/a	n/a	n/a
43 YES: setting free	past	n	possible	n/a	n/a	n/a	n/a	n/a	n/a	n/a
44 YES: get ownership	past	n	possible	n/a	n/a	n/a	n/a	n/a	n/a	n/a
45 obligations: get ownership	both (obligations)	n	possible	possible	n/a	n/a	n/a	n/a	n/a	n/a
46 stewardship	both (obligations)	n	possible	possible	n/a	n/a	n/a	n/a	n/a	n/a
47 entering permitted	past	n	possible	n/a	n/a	n/a	n/a	n/a	n/a	n/a
48 equipment permitted	past	n	possible	n/a	n/a	n/a	n/a	n/a	n/a	n/a



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49 tagging permitted	past	n	possible	n/a	n/a	n/a	n/a	n/a	n/a	n/a
50 mode(s) permittd	past	n	possible	n/a	n/a	n/a	n/a	n/a	n/a	n/a
BELOW WE LIST INDIVIDUAL OBLIGATIONS THAT MAY BE ADDED TO A MORE GENERAL ELEMENT FROM ABOVE SUCH AS "obligations: genetic & biochemical"										
51 required: for residents	past	n	n/a	possible	n/a	n/a	n/a	n/a	n/a	n/a
52 required: visa	past	n	n/a	possible	n/a	n/a	n/a	n/a	n/a	n/a
53 required: exit permit	past	n	n/a	possible	n/a	n/a	n/a	n/a	n/a	n/a
54 required: teaching	past	n	n/a	possible	n/a	n/a	n/a	n/a	n/a	n/a
55 required: report progress	both	n	n/a	possible	n/a	n/a	n/a	n/a	n/a	n/a
56 required: exit report	past	n	n/a	possible	n/a	n/a	n/a	n/a	n/a	n/a
57 required: cash	past	n	n/a	possible	n/a	n/a	n/a	n/a	n/a	n/a
58 required: payment	past	n	n/a	possible	n/a	n/a	n/a	n/a	n/a	n/a
59 required: send publication	both	n	n/a	possible	n/a	n/a	n/a	n/a	n/a	possible
60 required: inform public legal entity	future	n	n/a	possible	n/a	n/a	n/a	n/a	n/a	n/a
61 required: send taxa names	past	n	n/a	possible	n/a	n/a	n/a	n/a	n/a	n/a
62 requi'd: provider uID	both	n	n/a	possible	n/a	n/a	n/a	n/a	n/a	n/a



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63 required: holding location	both	n	n/a	possible	n/a	n/a	n/a	n/a	n/a	n/a
64 required: negotiate 3rd party	future	n	n/a	possible	n/a	n/a	n/a	n/a	n/a	possible
65 required: work abroad	both	n	n/a	possible	n/a	n/a	n/a	n/a	n/a	n/a
66 required: negotiate commercial	future	n	n/a	possible	n/a	n/a	n/a	n/a	n/a	possible
67 required: non-commercial	future	n	n/a	possible	n/a	n/a	n/a	n/a	n/a	n/a
68 required: no economic benefit	future	n	n/a	possible	n/a	n/a	n/a	n/a	n/a	n/a
69 required: IPR notification	future	n	n/a	possible	n/a	n/a	n/a	n/a	n/a	n/a
70 required: share sales	future	n	n/a	possible	n/a	n/a	n/a	n/a	n/a	n/a
71 required: method	future	n	n/a	possible	n/a	n/a	n/a	n/a	n/a	n/a
72 required: single research	past	n	n/a	possible	n/a	n/a	n/a	n/a	n/a	n/a
73 required: handle duplicates	past	n	n/a	possible	n/a	n/a	n/a	n/a	n/a	n/a
74 required: handle left-over	both	n	n/a	possible	n/a	n/a	n/a	n/a	n/a	n/a



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75 required: return left-over	future	n	n/a	possible	n/a	n/a	n/a	n/a	n/a	possible
76 required: handle DSI"	future	n	n/a	possible	n/a	n/a	n/a	n/a	n/a	n/a
BELOW WE LIST TYPICAL ELEMENTS OF LOAN AGREEMENTS										
77 NO destructive sampling	future	n	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Y
78 destructive sampling restricted	future	n	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Y
79 dissecting restricted	future	n	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Y
80 NO shipping	future	n	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Y
81 preparation restricted	future	n	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Y
82 share images	future	n	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Y
83 NO microwave	future	n	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Y
84 storage parameters	future	n	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Y
85 NO sampling	future	n	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Y
86 negotiate commercial use	future	n	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Y
87 not available	future	n	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Y



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Annex 4 - GGBN vocabulary for permits, version 1

This copy of the GGBN vocabulary for permits was downloaded on October 18th, 2022 from [https://wiki.ggbn.org/ggbn/GGBN_Data_Standard_v1#GGBN Permits Vocabulary](https://wiki.ggbn.org/ggbn/GGBN_Data_Standard_v1#GGBN_Permits_Vocabulary).

Concept Name: ggbn:permitStatus	
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/permitStatus
Label	Permit Status
Definition	Information about the presence, absence or other basic status of permits associated with the sample(s).
	Required: Yes — Repeatable: Yes
Examples	Permit available , Permit not required , Permit not available , Unknown Material collected after 2014-10-12 cannot be in "Unknown" permit status!
Notes:	Predefined vocabulary, See permitStatus vocabulary ; entry of data is mandatory
Concept Name: ggbn:permitStatusQualifier	
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/permitStatusQualifier
Label	Permit Status Qualifier
Definition	Description of why a certain permit was not required or why Permit Status is unknown



	Required: No — Repeatable: Yes
Examples	"no national requirement for a permit at date of access", "officially authorized illegal holder", "collected on private land", "pre-Nagoya"
Concept Name:	ggbn:permitText
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/permitText
Label	Permit Text
Definition	The text of a permit related to the gathering/shipping or further details
	Required: No — Repeatable: Yes
Concept Name:	ggbn:permitType
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/permitType
Label	Permit Type
Definition	A permit is a document that allows someone to take an action that otherwise would not be allowed.
	Required: Yes — Repeatable: Yes
Examples	Collecting Permit , Import Permit , Export Permit , Intellectual Property Rights , Copyright , Patent , Data use , Phytosanitary , Salvage , Exemption Permit , Material Transfer Agreement , Internationally Recognized Certificate of Compliance , Contract , Memorandum of Understanding , Memorandum of Cooperation , Veterinary Certificate , Human Pathogens , Genetically Modified Organism , Other



Notes:	Predefined vocabulary! See permitType vocabulary
Concept Name:	ggbn:permitURI
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/permitURI
Label	Permit URI
Definition	A reference to the permit related to the gathering or shipping event
	Required: No — Repeatable: Yes
Notes:	One will eventually need a direct link to ggbn:IRCC in the future.
Concept Name:	ggbnvoc:Collecting Permit
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/permitURI
Label	Collecting Permit
Definition	A value of the ggbnvoc:permitType vocabulary
	Required: No — Repeatable: Yes
Concept Name:	ggbnvoc:Contract
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/permitURI
Label	Contract



Definition	A value of the ggbnvoc:permitType vocabulary
	Required: No — Repeatable: Yes
Concept Name:	ggbnvoc:Copyright
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/permitURI
Label	Copyright
Definition	A value of the ggbnvoc:permitType vocabulary
	Required: No — Repeatable: Yes
Concept Name:	ggbnvoc:Data use
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/permitURI
Label	Data use
Definition	A value of the ggbnvoc:permitType vocabulary
	Required: No — Repeatable: Yes
Concept Name:	ggbnvoc:Exemption Permit
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/permitURI
Label	Expemtion Permit



Definition	A value of the ggbnvoc:permitType vocabulary
	Required: No — Repeatable: Yes
Concept Name:	ggbnvoc:Export Permit
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/permitURI
Label	Export Permit
Definition	A value of the ggbnvoc:permitType vocabulary
	Required: No — Repeatable: Yes
Concept Name:	ggbnvoc:Genetically Modified Organism
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/permitURI
Label	Genetically Modified Organism
Definition	A value for the ggbnvoc:permitType vocabulary
	Required: No — Repeatable: Yes
Notes:	Currently a placeholder only, might be renamed in the future
Concept Name:	ggbnvoc:Human Pathogens
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/permitURI



Label	Human Pathogens
Definition	A value of the ggbnvoc:permitType vocabulary
	Required: No — Repeatable: Yes
Concept Name: ggbnvoc:Import Permit	
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/permitURI
Label	Import Permit
Definition	A value of the ggbnvoc:permitType vocabulary
	Required: No — Repeatable: Yes
Concept Name: ggbnvoc:Intellectual Property Rights	
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/permitURI
Label	Intellectual Property Rights (IPR)
Definition	A value of the ggbnvoc:permitType vocabulary
	Required: No — Repeatable: Yes
Concept Name: ggbnvoc:Internationally Recognized Certificate of Compliance	
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/permitURI



Label	Internationally Recognized Certificate of Compliance (IRCC)
Definition	A value of the ggbnvoc:permitType vocabulary
	Required: No — Repeatable: Yes
Concept Name: ggbnvoc:Material Transfer Agreement	
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/permitURI
Label	Material Transfer Agreement (MTA)
Definition	A value of the ggbnvoc:permitType vocabulary
	Required: No — Repeatable: Yes
Concept Name: ggbnvoc:Memorandum of Cooperation	
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/permitURI
Label	Memorandum of Cooperation (MoC)
Definition	A value of the ggbnvoc:permitType vocabulary
	Required: No — Repeatable: Yes
Concept Name: ggbnvoc:Memorandum of Understanding	
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/permitURI



Label	Memorandum of Understanding (MoU)
Definition	A value of the ggbnvoc:permitType vocabulary
	Required: No — Repeatable: Yes
Concept Name: ggbnvoc:Other	
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/permitURI
Label	Other
Definition	A value of the ggbnvoc:permitType vocabulary
	Required: No — Repeatable: Yes
Concept Name: ggbnvoc:Patent	
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/permitURI
Label	Patent
Definition	A value of the ggbnvoc:permitType vocabulary
	Required: No — Repeatable: Yes
Concept Name: ggbnvoc:Permit available	
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/permitURI



Label	Permit available
Definition	A value of ggbnvoc:permitStatus_vocabulary
	Required: No — Repeatable: Yes
Concept Name: ggbnvoc:Permit not available	
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/permitURI
Label	Permit not available
Definition	A value for the ggbnvoc:permitStatus_vocabulary
	Required: No — Repeatable: Yes
Concept Name: ggbnvoc:Permit not required	
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/permitURI
Label	Permit not required
Definition	A value for the ggbnvoc:permitStatus_vocabulary
	Required: No — Repeatable: Yes
Concept Name: ggbnvoc:permitStatus_vocabulary	
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/permitURI



Label	permitStatus Vocabulary
Definition	Vocabulary of ggbnvoc:permitStatus term
	Required: No — Repeatable: No
Examples	Permit available , Permit not required , Permit not available , Unknown
Concept Name: ggbnvoc:permitType vocabulary	
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/permitURI
Label	permitType vocabulary
Definition	Vocabulary of ggbn:permitType term
	Required: No — Repeatable: Yes
Examples	Collecting Permit , Import Permit , Export Permit , Intellectual Property Rights , Copyright , Patent , Data use , Phytosanitary , Salvage , Exemption Permit , Material Transfer Agreement , Internationally Recognized Certificate of Compliance , contract , Memorandum of Understanding , Memorandum of Cooperation , Veterinary Certificate , Human Pathogens , Genetically Modified Organism , Other
Concept Name: ggbnvoc:Phytosanitary	
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/permitURI
Label	Phytosanitary
Definition	A value of the ggbnvoc:permitType vocabulary



	Required: No — Repeatable: Yes
Concept Name:	ggbnvoc:Salvage
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/permitURI
Label	Salvage
Definition	A value of the ggbnvoc:permitType vocabulary
	Required: No — Repeatable: Yes
Concept Name:	ggbnvoc:Unknown
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/permitURI
Label	Unknown
Definition	A value for the ggbnvoc:permitStatus vocabulary
	Required: No — Repeatable: Yes
Concept Name:	ggbnvoc:Veterinary Certificate
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/permitURI
Label	Veterinary Certificate
Definition	A value of the ggbnvoc:permitType vocabulary



Required: No — **Repeatable:** Yes



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Annex 5 - GGBN vocabulary for loans, version 1

This copy of the GGBN vocabulary for loans was downloaded on October 18th, 2022 from https://wiki.ggbn.org/ggbn/GGBN_Data_Standard_v1#GGBN_Loan_Vocabulary.

Concept Name: dwc:disposition	
Normative URI	http://rs.tdwg.org/dwc/terms/disposition
Label	Disposition
Definition	The current state of a specimen with respect to the collection identified in collectionCode or collectionID. Recommended best practice is to use a controlled vocabulary.
	Required: No — Repeatable: Yes
Examples	"in collection", "missing", "voucher elsewhere", "duplicates elsewhere"
Notes:	For discussion see http://code.google.com/p/darwincore/wiki/Occurrence Remark by GGBN: "consumed" as another example
Concept Name: ggbn:blocked	
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/blocked
Label	Blocked
Definition	Sample or specimen data can not be ordered/loaned in general, but are visible via portals.



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	Required: No — Repeatable: Yes
Examples	yes, no
Notes:	Records/samples/specimens not to be published should be blocked on database level. If they are available via Darwin Core or ABCD, they are visible for everyone. This element is to be used for samples/specimens that cannot be loaned.
Concept Name: ggbn:blockedUntil	
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/blockedUntil
Label	Blocked Until
Definition	Sample or specimen data can not be ordered/loaned until the given date, but are visible via portals
	Required: No — Repeatable: Yes
Examples	2016-03-31, format YYYY-MM-DD
Notes:	in GGBN context the record is visible at the portal but blocked for ordering until the given date
Concept Name: ggbn:loanConditions	
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/loanConditions
Label	Loan Conditions
Definition	Sample can be ordered under certain conditions, that are described here



	Required: No — Repeatable: Yes
Examples	for non-commercial institutions only; only with permission of material supplier
Concept Name: ggbn:loanDate	
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/loanDate
Label	Loan Date
Definition	Date when loan has been sent by the lender.
	Required: No — Repeatable: Yes
Notes:	based on HISPID extension for ABCD
Concept Name: ggbn:loanDestination	
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/loanDestination
Label	Loan Destination, Loaned To
Definition	Name of person and/or organization the unit was sent to. Person/Institution who received the material.
	Required: No — Repeatable: Yes
Examples	Jane Doe, NMNH



Notes:	based on HISPID extension for ABCD; in this instance, “sent” is not equivalent to “shipped”. A shipment can be directed to a recipient who is not the actual intended responsible party; many organizations have shipping offices to handle packages.
Concept Name:	ggbn:loanIdentifier
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/loanIdentifier
Label	Loan Identifier, Loan Number
Definition	The unique institutional loan number to uniquely identify a specimen on loan
	Required: No — Repeatable: Yes
Examples	2014/123
Notes:	based on HISPID extension for ABCD
Concept Name:	ggbn:receivedFrom
Normative URI	http://data.ggbn.org/schemas/ggbn/terms/receivedFrom
Label	Received From
Definition	Name of person and/or organization the unit was received from. Person/Institution who authorized the loan of the material. From the perspective of the owner of the material, this type of loan is incoming.
	Required: No — Repeatable: Yes



Examples	e.g. lender or recipient of a strain, sample, specimen etc.
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Annex 6 - SPNHC Categories of Legal/Compliance Documentation

This copy of the SPNHC Categories of Legal/Compliance Documentation was downloaded on October 18th, 2022 from

https://spnhc.biowikifarm.net/wiki/Permitting#Categories_of_Legal.2FCompliance_Documentation

“The Categories of Legal/Compliance Documentation was first generated by GGBN with definitions and additions made by participants of a BCoN-funded workshop "Addressing Legal Issues Involved in Digitized Collections: The Nagoya Protocol as a Test Case" (NSF grant DBI #1441785) held at Harvard University in March 2018. Click on individual categories to obtain more information.

- [Access and Benefit-Sharing Agreement](#): serves as evidence that a genetic resource has been accessed in accordance with Prior Informed Consent and that Mutually Agreed Terms have been established
- [Authorization to Possess](#): authorization to possess specimens under certain conditions
- [Collecting Permit](#): authorizes the collection of specimens; note: salvage may be included or may require a specialized permit
- [Contract](#): formal and legally binding agreement between parties
- [CITES](#): allows for the handling of specimens that are included on the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) list
- [Copyright](#): provides the creator of an original work exclusive rights, usually for a limited time
- [Data Use](#): used for the transfer of non-public data that is subject to some restrictions on its use
- [Exemption Permit](#): authorizes that an action does not require specific permits or documentation
- [Export Permit](#): authorizes exporting specimens abroad
- [Ethical Collection](#): approved protocols associated with the research that includes vertebrate animals (e.g., IACUC) and human subjects (e.g., IRB)
- [Genetically Modified Organism](#): indicates that specimens are (or are not) genetically engineered; may include specific indication and/or authorization to release
- [Hunt/Fish/Trap License](#): license to hunt, fish, or trap animals, usually recreational but can be required for collecting
- [Human Pathogens](#): indicates that specimens are in accordance with any domestic regulations regarding human pathogens
- [Import Permit](#): authorizes importing specimens into a country from abroad
- [Intellectual Property Rights](#): rights given to persons over the creations of their minds
- [Material Transfer Agreement](#): governs the transfer of tangible materials between two organizations



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- [Memorandum of Cooperation](#): outlines the terms and details of cooperation between parties
- [Memorandum of Understanding](#): outlines the terms and details of an understanding between parties
- [Patent](#): right granted to an inventor
- [Phytosanitary](#): indicates that plant and plant products are free from regulated pests
- [Quarantine Agreement](#): agreement that establishes quarantine requirements
- [Receiving Permit](#): authorization to receive specimen under certain conditions
- [Research Permit](#): authorizes researcher to engage in scientific activity; may specify type of activity or place that it will occur
- [Salvage Permit](#): authorizes the collection of dead animals or animal parts from the wild
- [Transport Permit](#): authorizes the transfer of specimens within a given country
- [Veterinary Certificate](#): indicates that specimens are in accordance with any domestic regulations regarding animal health

Access and Benefit-Sharing Agreement

Under the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization, Parties are to issue a permit or its equivalent at the time of access as evidence that access to genetic resources was based on **Prior Informed Consent (PIC)** and that **Mutually Agreed Terms (MAT)** were established. Parties are required by the Nagoya Protocol to make information on the permit or its equivalent, available to the ABS Clearing-House for the constitution of an **Internationally Recognized Certificate of Compliance (IRCC)**. For more detailed information, see [Access and Benefit-Sharing \(Nagoya Protocol and the CBD\)](#).

Authorization to Possess

In some cases, specific documentation may be needed to certify that permission has been given to possess specimens under certain conditions. For example, museums may receive permission to accession material that has been confiscated from wildlife agencies.

Collecting Permit

Various types permits legally allow a researcher to collect possess specimens from the wild. Most institutions require copies of collection permits as evidence that all specimens were obtained legally. Permits may be issued at the federal, state, or local level (e.g., indigenous lands and peoples); depending on the country and region, multiple permits may be needed. Most permits specify the taxon/taxa and number that may be collected. Specific activities may be stipulated via the permit type (e.g., collection, capture, salvage, incidental take). Similar permits may also be needed to handle animals, even if the specimens are not collected. See also, [Scientific Collecting Licenses](#). Note: a specific permit may be needed to salvage specimen (see also [Salvage Permits \(US\)](#)), or collecting permits may not be issued, and rather a Hunt/Fish/Trap License obtained (see below).



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Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

International agreements may regulate the transport of particular specimens, and specific permits may be required to collect, import, or export specimens. [The Convention on International Trade in Endangered Species of Wild Fauna and Flora \(CITES\)](#) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival. CITES works by subjecting international trade in specimens of selected species to certain controls. All import, export, re-export and introduction from the sea of species covered by the Convention has to be authorized through a licensing system. Each Party to the Convention must designate one or more Management Authorities in charge of administering that licensing system and one or more Scientific Authorities to advise them on the effects of trade on the status of the species. The species covered by CITES are listed in three Appendices, according to the degree of protection they need. (For additional information on the number and type of species covered by the Convention, see [\[How CITES Works\]](#).)

Certificate of Scientific Exchange (COSE)

A Certificate of Scientific Exchange (COSE) authorizes the non-commercial loan, donation or exchange of CITES-listed specimens (i.e., preserved, dried or embedded specimens, herbarium specimens, live plant material) between scientists or scientific institutions. Registered scientific institutions can be found on the [CITES website](#). If specimens are protected by other [U.S. laws and/or treaties](#), you are required to obtain additional authorizations prior to any export or re-import of those specimens. Note: a COSE cannot be used with specimens collected by field researchers unless such specimens are first accessioned into the collection of a registered facility in the state of origin. For the import or export of specimens that are not part of your museum collection, have not yet been collected, or accessioned into your collect, a separate CITES collection permit is likely needed.

Contract

Museum acquisitions can occur through collection, purchases, donations, and bequests, as well as transfer or exchange of objects from individuals, private companies, other museums, or research institutions outside the Museum. Museums should track any contracts associated with the collection or transfer of ownership of specimens.



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PRIVATE LANDOWNER PERMISSION LETTER

This letter indicates that _____ (the landowner) permits
 _____ (the researcher) and colleague(s), _____ to access the
 landowner's property at _____, in order to
 conduct research and collection activities as described below:

The researcher affirms that permission for these activities has already been
 obtained from the relevant state authorities.

In addition, the landowner permits the researcher and colleagues to remove from
 their property the following animal(s) or part(s):

The landowner hereby irrevocably transfers ownership of the
 specimen(s)/object(s) described above to the Museum of Comparative Zoology
 (MCZ), by gift, free of restrictions or conditions, in perpetuity.

Landowner _____ Name _____
 _____ Telephone number _____
 _____ Email address _____
 _____ Signature _____

Researcher _____ Name _____
 _____ Signature _____

Landowner's Permission to Collect

It is best practice to obtain a signed document that indicates that a researcher has authorization to enter the property and remove specimens. This contract should include:

- Name of researcher with full contact information
- Name of landowner with full contact information
- Property address
- Activities to be conducted
- Transfer of ownership of material collected
- Signature of researcher with date signed
- Signature of landowner with date signed

Transfer of Ownership

Museums should document the transfer of ownership of specimens using either a Deed of Gift or Deed of Transfer form. Details regarding the type of information that should be included in each form can be found below.

Deed of Gift

- Name of donor with full contact information
- Name of museum with full contact information
- Description of materials offered



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- Statement that the donor owns the objects and has the authority to gift
- Statement that the gift is without restrictions, or specific restrictions
- Statement that the donor relinquishes all rights he/she may have had
- Signature of donor with date signed
- Signature of museum representative with date signed

Deed of Transfer

- Name of originating museum with contact information
- Name of accessioning museum with contact information; if printed on the museum's letterhead, this information will already be on the form and doesn't need to be duplicated
- Description of materials offered
- Statement that donor institution owns the object and has authority to transfer
- Statement that the gift is without restrictions (or exactly what the restrictions are) and that donor institution relinquishes all rights it may have had
- Signature of donor institution representative with date signed
- Signature of receiving museum representative with date signed

Data Use

A Data Use Agreement (DUA) is a contractual document used for the transfer of data that has been developed by nonprofit, government or private industry, where the data is nonpublic or is otherwise subject to some restrictions on its use. A DUA is similar to a confidentiality agreement in that it restricts the use and disclosure of the data set. Institutions will want to ensure that DUA terms protect confidentiality when necessary, but permit appropriate publication and sharing of research results in accordance with institutional policies, applicable laws and regulations, and federal requirements.

Exemption Permit

An exemption permit or certificate authorizes documents that specimens, products, or derivatives, or the particular actions taken to acquire the specimens are exempt from the normal procedures (e.g., do not require legal documentation normally required). For example, permitting exemptions may be made if specimens are:

- In transit
- Collected prior to a specific date associated with the ratification or implementation of a law or regulation
- Captive-bred or artificially propagated

Export Permit



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Permission to remove specimens from their country of origin is generally obtained with an export permit. Most export documentation requires a list of the species (scientific and possibly common names) and the total number of specimens per species. For details about exports from the U.S., see [U.S. Fish & Wildlife Service \(USFWS\)](#). Note: some protected or regulated species may require additional export permits; consult [U.S. Agencies Regulating Import, Export, and Transport](#) and [U.S. Conservation Laws and Protected Species](#) for more information.

Ethical Collection

Studies involving animals or human subjects should be conducted according to internationally-accepted standards. Prior approval or research protocols must be obtained if research involves vertebrate animals (e.g., IACUC) or human subjects (e.g., IRB). Note: journals are increasingly requiring that the name of the relevant ethics committees, as well as relevant permit numbers, must be provided at submission; therefore, this information has become important for museums to track.

Institutional Animal Care and Use Committee (IACUC)

Scientific procedures carried out on animals should minimize adverse effects and maximize the scientific benefit gained. These legal and ethical requirements are included under the laws and regulations of numerous countries worldwide, including the [U.S. Animal Welfare Act](#) (United States Code, Title 7, Chapter 54, Sections 2131-2159), the [U.K. Animals \(Scientific Procedures\) Act 1986](#), the [U.K. Animal Welfare Act 2006](#), the [Animal Health and Welfare Strategy for Great Britain](#), [Animal Welfare Strategy](#), Canadian Council on Animal Care in Science, among others. Researchers should be aware of laws and regulations associated with their home country and possibly the country of origin of the specimens collected.

Within the U.S., Institutional Animal Care and Use Committees (IACUCs) ensure that all projects involving the use of live vertebrate animals comply with federal regulations and guidelines. An institutional animal care and use committee (IACUC) is required by federal regulations for most institutions that use animals in research, teaching, and testing. The IACUC has a key oversight role, including the review and approval of animal use activities, and inspection of animal facilities. Federal regulations and guidelines dealing with animal welfare focus mainly on biomedical and behavioral research, teaching, and testing that takes place in the laboratory. The U.S. Department of Agriculture (USDA) Animal Welfare Act (AWA) regulations exempt field study ("any study done on free-living wild animals in their natural habitat, which does not involve an invasive procedure, and which does not harm or materially alter the behavior of the animals") from IACUC review. However, if the animals are confined, an invasive procedure is involved, or the behavior of the animal is harmed or materially altered, then the study must comply with federal regulations and standards. Since field studies often cannot satisfy the USDA definition, and the IACUC is also answerable to Public Health Service (PHS) Guidelines, researchers should have



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protocols reviewed by Institutional Animal Care and Use Committees (IACUCs) before specimens are collected. In addition, some funding agencies may require proposed projects involving use of any vertebrate animal for research or education be approved by the submitting organization's Institutional Animal Care and Use Committee (IACUC) before an award can be made.

IACUC review of such studies would be necessary and would focus on, but not necessarily be restricted to, such issues as:

1. Number of animals to be used in the study, and the stability of the population from which the animals are to be taken
2. Appropriateness of the methods used for capturing, immobilizing, and euthanizing animals
3. Training and supervision of the personnel involved with the study

Institutional Review Board (IRB)

An institutional review board (IRB), also known as an independent ethics committee (IEC), ethical review board (ERB), or research ethics board (REB), is a type of committee that applies research ethics by reviewing the methods proposed for research to ensure that they are ethical. Such boards are formally designated to approve (or reject), monitor, and review biomedical and behavioral research involving humans. The purpose of the IRB is to assure that appropriate steps are taken to protect the rights and welfare of humans participating as subjects in a research study. Along with developed countries, many developing countries have established National, regional or local Institutional Review Boards in order to safeguard ethical conduct of research concerning both national and international norms, regulations or codes.

Genetically Modified Organism

Import, export, or transport of Genetically Modified Organisms is often highly regulated and may require specialized permits, documentation or package labeling.

Human Pathogens

Documentation may be required to certify that specimens are in accordance with any domestic regulations regarding human pathogens.

Hunt/Fish/Trap License

In lieu of a [Collecting Permit](#), a license to hunt, fish, or trap animals may be issued for the collection of specimens if a permit to collect scientific specimens is not needed or available. Consult the regional or local authorities to determine whether this type of license or a permit that authorize species-specific or research-related activities is needed.



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Import Permit

Permission to import specimens into a country from abroad is generally required. Most import documentation requires a list of the species (scientific and possibly common names) and the total number of specimens per species. For details about imports into the U.S., see [U.S. Fish & Wildlife Service \(USFWS\)](#). Note: some protected or regulated species may require additional import permits; consult [U.S. Agencies Regulating Import, Export, and Transport](#) and [U.S. Conservation Laws and Protected Species](#) for more information.

Intellectual Property Rights

Intellectual property (IP) is a category of property that includes intangible creations of the human intellect, and primarily encompasses copyrights, patents, and trademarks. It also includes other types of rights, such as trade secrets, publicity rights, moral rights, and rights against unfair competition. Artistic works like music and literature, as well as some discoveries, inventions, words, phrases, symbols, and designs, can all be protected as intellectual property. In addition, plant variety rights are the rights to commercially use a new variety of a plant. The variety must amongst others be novel and distinct and for registration the evaluation of propagating material of the variety is considered.

Copyright

A number of documents associated with copyright may be tracked by museums, including:

- Copyright License: allows creators to designate whether the copy, distribution, and editing of their work is allowed; see [Creative Commons copyright licenses](#) for more information
- Transfer of Copyright: a legal document containing provisions for the conveyance of full or partial copyright from the rights owner to another party.
- Public Domain Dedication: allows for unrestricted use of a work that is in the public domain; Creative Commons public domain tools allows copyright holders to place works in the public domain using CC0 (occasionally written as CC Zero).

Patent

A patent is a form of right granted by the government to an inventor, giving the owner the right to exclude others from making, using, selling, offering to sell, and importing an invention for a limited period of time, in exchange for the public disclosure of the invention. An invention is a solution to a specific technological problem, which may be a product or a process and generally has to fulfill three main requirements: it has to be new, not obvious and there needs to be an industrial applicability.

Material Transfer Agreement



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A Material Transfer Agreement (MTA) is a contract that governs the transfer of research materials between two institutions. Some countries may require that researcher's enter into cooperation with a local institution and sign an MTA to specify the rights, obligations, and restrictions of both the providing and receiving parties with respect to issues such as ownership, publication, intellectual property and permitted use and liability. To encourage the process of sharing research tools between scientists, the National Institutes of Health and the Association of University Technology Managers developed standard language to simplify material transfers, issued as the [Uniform Biological Material Transfer Agreement \(UBMTA\)](#).

Memorandum of Cooperation/Understanding

When two or more parties wish to engage in a collaborative effort in research, education or other activities, a Memoranda of Understanding (MOU) or Memoranda of Cooperation (MOC) may be needed. MOUs are legal agreements defining the roles and responsibilities. MoUs generally do not include terms and conditions for funding, exchange of materials, non-disclosure of proprietary information, licensing or future licensing of intellectual property, or specific research activities. MoUs may, however, describe how agreements for such activities will be negotiated and establish a timeline for doing so. Some countries may require collaboration with a local institution or the inclusion of a local researcher on the project or collection team. Specific agreements between institutions may be required before collection permits are issued. Note: institutions may have a designated representative to sign such agreements.

Phytosanitary

Phytosanitary certificates are issued to indicate that consignments of plants, plant products or other regulated articles meet specified phytosanitary import requirements, and most often indicate that plant and/or plant products are free from regulated pests.

Quarantine Agreement

The main purpose of animal quarantine inspection certificate is to prevent the ingress of dangerous exotic diseases into the country through imported animals and animal products.

Receiving Permit

A receiving permit authorizes the acceptance of specimens under certain conditions. For example, a "Permit to Receive Soil" issued by the [USDA APHIS](#) may authorize the importation of soil from foreign sources (except countries with sanctions or embargoes by U.S. State Department), and interstate/ domestic movement of soil for chemical/ physical analysis in a controlled laboratory environment at the named facility on the permit.

Research Permit



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Research permits may be required to engage in scientific activity; permits may specify the type of activity or place that it will occur. Permits may be required to conduct research in specific areas (e.g., protected lands). Privately owned land trusts and preserves (e.g., The Nature Conservancy, Audubon Society) also act as independent preserves and may have an independent process for obtaining permits.

- Federally Protected Lands

- National Forests
- National Monuments and Recreation Areas
- National Parks
- National Wildlife Refuge

- State Protected Lands

- Nature Preserves
- State Parks

Salvage Permit

A salvage permit may be needed specifically for the possession, transport, or receipt of dead animals or animal parts from the wild. Note: a specialized salvage permit may also be needed to possess wildlife killed in a vehicular collision. See also, [Salvage Permits \(US\)](#).

Transport Permit

Permits may be required to transport specimens across state boundaries within a given country. Note: some protected or regulated species may require specific transport permits; consult [U.S. Agencies Regulating Import, Export, and Transport](#) and [U.S. Conservation Laws and Protected Species](#) for more information.

Veterinary Certificate

Certificates of Veterinary Inspection (also referred to as Official Health Certificates or Health Certificates) may be required before import or transport to certify that specimens are in accordance with any domestic regulations regarding animal health.”



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Annex 7 - Names of some permits issued by US or European authorities

United States:

- US Fish and Wildlife Service declaration for importation or exportation of Fish or Wildlife

Form name: USFWS Form 3-177 (Rev. 10/2017)

URL: <https://www.fws.gov/le/pdf/3177.pdf>

- Native Endangered and Threatened Species -Scientific Purposes, Enhancement of Propagation or Survival Permits (i.e., Recovery Permits) and Interstate Commerce Permits

Form name: USFWS Form 3-200-55

URL: <https://www.fws.gov/forms/3-200-55.pdf>

- IMPORT/TRANSPORT OF INJURIOUS WILDLIFE
- INTERSTATE OR FOREIGN COMMERCE OF LIVE ANIMALS/SAMPLES/OR PRODUCTS
- TAKE/IMPORT/EXPORT OF MARINE MAMMALS FOR PUBLIC DISPLAY, SCIENTIFIC
- RESEARCH, ENHANCEMENT, OR RESCUE/REHABILITATION/RELEASE ACTIVITIES OR
- RENEWAL/AMENDMENT OF EXISTING PERMIT (MMPA and/or ESA)
- Migratory Bird Special Purpose-Salvage
- Migratory Bird Import / Export
- Migratory Bird and Eagle Scientific Collecting
- Import/Export/Re-Export of Biological Specimens (CITES/ESA) for Scientific Research

European Union:

- Phytosanitary certificate for import into EU (issued by the country from which the plant, plant product or other object originates)
- Phytosanitary certificate for import into EU (issued by a country from which the plant, plant product or other object DOES NOT originate)
- Phytosanitary certificate for export from the EU
- Phytosanitary certificate for re-export from the EU
- Plant passports for movement within the Union territory as referred to in the first subparagraph of Article 83(2) of Regulation (EU) 2016/2031



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- Plant passports for movement into and within protected zones as referred to in the second subparagraph of Article 83(2) of Regulation (EU) 2016/2031
- EU Member State's import permit for European Union quarantine pests as referred to in Art. 8 of Regulation (EU) 2016/2031



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Annex 8 - Summary of JSON-LD code for the loan use case

The following box provides a summary of the example code written for the use case to represent an ELViS loan transaction.

An interactive visualisation can be generated at <https://json-ld.org/playground/> by first removing all comments and then copy-pasting the below example code into the "JSON-LD Input" field of the website. Once validated, the tab "Visualized" below the input area produces a visual representation that can be explored by clicking on the graphical elements.

Summary of EXAMPLE CODE

```
{
  "@context" : [ {
    "xsd" : "http://www.w3.org/2001/XMLSchema#",
    "dcterms" : "http://purl.org/dc/terms/",
    "ex" : "http://example/",
    "foaf" : "http://xmlns.com/foaf/0.1/",
    "prov" : "http://www.w3.org/ns/prov#",
    "oa": "http://www.w3.org/ns/anno.jsonld",
    "odrl": "http://www.w3.org/ns/odrl.jsonld"
  }, "https://openprovenance.org/prov-jsonld/context.json"
  ],
  "@graph" : [ {

\\ PROV: Digitally representing involved (physical) resources

    "@type" : "prov:Entity",
    "@id" : "ex:physicalSpecimen1",
    "prov:label" : "Common earthworm"
  }, {
    "@type" : "prov:Agent",
    "prov:type" : [ "prov:Organization" ],
    "@id" : "ex:institution1_holding",
    "prov:location" : "http://www.wikidata.org/entity/Q40",
    "prov:label" : "NHMW, Vienna, Austria"
  }, {
    "@type" : "prov:Agent",
    "prov:type" : [ "prov:Person" ],
    "@id" : "ex:curator1",
    "foaf : givenName" : [{ "@value" : "Annelie" }]
  }, {
    "@type": "prov:Delegation",
    "@id" : "ex:toCurator1",
```



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```

"responsible" : "ex:institution1_holding",
"delegate" : "ex:curator1",
"activity" : "ex:loan2023_1"
},{
"@type" : "prov:Agent",
"prov:type" : [ "prov:Organization" ],
"@id" : "ex:institution2_requesting",
"prov:location" : "http://www.wikidata.org/entity/Q27",
"prov:label" : "National Museum of Ireland, Dublin, Ireland"
},{
"@type" : "prov:Agent",
"prov:type" : [ "prov:Person" ],
"@id" : "ex:curator2",
"foaf : givenName" : [{ "@value" : "Hortensia" }]
},{
"@type": "prov:Delegation",
"@id" : "ex:toCurator2",
"responsible" : "ex:institution2_requesting",
"delegate" : "ex:curator2",
"activity" : "ex:loan2023_1"
},{

```

\\ PROV: Qualified relationships between resources

```

"@type" : "prov:Attribution",
"@id" : "ex:institution1_accession",
"entity" : "ex:physicalSpecimen1",
"agent" : "ex:institution1_holding"
},{
"@type" : "prov:Activity",
"@id" : "ex:createdLegalInfoCollection"
},{
"@type" : "prov:Usage",
"activity" : "ex:createdLegalInfoCollection",
"entity" : [{
  "@type" : "prov:Entity", "@id" : "ex:assocLegalDoc1"
},{
  "@type" : "prov:Entity", "@id" : "ex:assocLegalDoc2"
}]
},{

```

\\ ODRL: Representing conditions

\\ ODRL: Contractual agreement with constraints

```

"@type" : "odrl:Agreement",
"@id" : "ex:inst1_inst2_loan_contract",
"profile" : "ex:biodivDomain_profile",

```



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```

"permission" : [{
  "target" : "ex:physicalSpecimen1",
  "assigner" : "ex:institution1_holding",
  "assignee" : [{
    "@type" : "foaf:Person",
    "source" : "ex:curator2",
    "refinement" : [{
      "leftOperand" : "foaf:age",
      "operator" : "gt",
      "rightOperand" : {
        "@value" : "17", "@type" : "xsd:integer"
      }
    }]
  }]
}],
"constraint" : [{
  "leftOperand" : "spatial",
  "operator" : "isPartOf",
  "rightOperand": "http://www.wikidata.org/entity/Q458",
  "comment" : "European Union"
}],
"action" : "ex:shipping_to_3rdParty"
}],
"permission" : [{
  "target" : "ex:physicalSpecimen1",
  "assigner" : "ex:institution1_holding",
  "assignee" : "ex:institution2_requesting",
  "action" : "ex:physical_analysis"
}]
},{

```

\ \ ODRL: Policy life-cycle

\ \ ODRL: 1st parent offer: Availability of loans to 3rd parties

```

"@type" : "odrl:Offer",
"@id" : "ex:24_obligations_3rd party",
"profile" : "ex:biodivDomain_profile",
"permission" : [{
  "target" : [{
    "@type" : "odrl:AssetCollection",
    "source" : "ex:institution1_inVertCollection"
  }],
  "assigner" : "ex:institution1_holding",
  "assignee" : [{
    "@type": "odrl:PartyCollection",
    "refinement": [{
      "leftOperand": "foaf:age",
      "operator": "gt",

```



```

        "rightOperand": {
          "@value": "17", "@type": "xsd:integer"
        }
      }
    ]],
    "constraint" : [{
      "leftOperand": "spatial",
      "operator": "isPartOF",
      "rightOperand": "http://www.wikidata.org/entity/Q458",
      "comment": "European Union"
    }],
    "action" : "ex:shipping_to_3rdParty"
  ]
}, {

```

\\ ODRL: 2nd parent offer:

\\ Are requests that include physical analyses acceptable?

```

"@type" : "odrl:Offer",
"@id" : "ex:10_YES_physical_analysis",
"profile" : "ex:biodivDomain_profile",
"permission" : [{
  "target" : [{
    "@type" : "odrl:AssetCollection",
    "source" : "ex:institution1_inVertCollection"
  }],
  "assigner" : "ex:institution1_holding",
  "action" : "ex:physical_analysis"
}]
}, {

```

\\ ODRL: Parent request:

\\ Definition of loan request and intended uses

```

"@type" : "odrl:Request",
"@id" : "ex:institution2_standardLoanRequest",
"profile" : "ex:biodivDomain_profile",
"permission" : [{
  "target" : "ex:physicalSpecimen1",
  "assignee" : "ex:institution2_loaning",
  "action" : [
    "ex:shipping_to_3rdParty", "ex:physical_analysis"
  ]
}]
}, {

```

\\ ODRL: Arising agreement with inheritance from parent policies

\\ Assessment if joint agreement can be found



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```

"@type" : "odrl:Agreement",
"@id" : "ex:inst1_inst2_loanContract",
"profile" : "ex:biodivDomain_profile",
"inheritFrom" : [{
  "@id" : "ex:24_obligations_3rd party"
},{
  "@id" : "ex:10_YES_physical_analysis"
},{
  "@id" : "ex:institution2_standardLoanRequest"
}],
"permission" : [{
  "target" : [{
    "@type" : "odrl:Asset",
    "source" : "ex:institution2_standardLoanRequest",
    "refinement" : [{
      "leftOperand" : "ex:institution2_standardLoanRequest",
      "operator" : "isPartOf",
      "rightOperand" : [{
        "@id" : "ex:24_obligations_3rd party"
      },{
        "@id" : "ex:10_YES_physical_analysis"
      }]
    }]
  }],
  "assigner" : "ex:institution1_holding",
  "assignee" : [{
    "@type": "odrl:PartyCollection",
    "source" : [{
      "@type" : "foaf:Organization",
      "source" : "ex:institution2_standardLoanRequest"
    },{
      "@type" : "foaf:Person",
      "source" : "ex:institution2_standardLoanRequest",
      "odrl:assigneeOf" :
"ex:institution2_standardLoanRequest",
      "refinement": [{
        "leftOperand": "foaf:age",
        "operator": "gt",
        "rightOperand": {
          "@value": "17", "@type": "xsd:integer"
        }
      }]
    }]
  }],
  "constraint" : [{
    "leftOperand": "spatial",
    "operator": "isPartOf",

```



```

        "rightOperand": "http://www.wikidata.org/entity/Q458",
        "comment": "European Union"
    }],
    "action" : [{
        "@id" : "ex:loan2023_1",
        "refinement" : [{
            "leftOperand" : "ex:institution2_standardLoanRequest",
            "operator" : "includedIn",
            "rightOperand" : [{
                "@id" : "ex:24_obligations_3rd party"
            }, {
                "@id" : "ex:10_YES_physical_analysis"
            }]
        }]
    }]
}],
"obligation" : [{
    "assigner" : "ex:dissco_ri_elvis",
    "assignee" : [{
        "@type": "odrl:PartyCollection",
        "source" : [{
            "@id": "ex:institution1_holding"
        }, {
            "@id": "ex:institution2_standardLoanRequest"
        }],
        "refinement" : [{
            "and" : {
                "@list": [{
                    "@id": "ex:institution1_holding"
                }, {
                    "@id": "ex:institution2_standardLoanRequest"
                }]
            }
        }]
    }]
}],
"action" : [{
    "@id" : "ex>manual_input",
    "refinement" : [{
        "leftOperand" : "ex:humanDecision",
        "operator" : "eq",
        "rightOperand" : "YES",
        "comment" : "Final human decision step"
    }]
}]
}],
}, {

```



***\\ PROV: Logging of accepted loan transaction
\\ into the provenance record***

```
"@type" : "prov:Activity",
"@id" : "ex:loan2023_1",
"startTime": "2023-03-31T09:21:00.000+01:00",
"endTime": "2025-04-01T15:21:00.000+01:00"
},{
"@type" : "prov:Usage",
"activity" : "ex:loan2023_1",
"entity" : "ex:physicalSpecimen1"
},{
"@type" : "prov:Communication",
"@id" : "ex:transferLegalInfo",
"informant" : "ex:createdLegalInfoCollection",
"informed" : "ex:loan2023_1"
},{
"@type" : "prov:Attribution",
"@id" : "ex:institution2_loanReceived",
"entity" : "ex:physicalSpecimen1",
"agent" : "ex:institution2_requesting"
},{
```

\\ OA: Updating of CMS record and/or DiSSCo openDS object

```
"@type" : "oa:Annotation",
"@id" : "ex:update_spec1_location",
"rights": "ex:AnnotationRightsInfo",
"body": "ex:loanLocation",
"target": [ {
  "@id" : "ex:CmsRecordSpec1",
  "rights": "ex:RecordRightsInfo"
} ]
}]
}
```



Annex 9 - Questionnaire on using molecular biological collections

Synthesys+ NA3.2/3.3 survey template (copied from <https://www.surveymonkey.com/r/HQDGLN> on Sept. 6th, 2022, field functions removed, initially stacked answering options are here displayed in a row to save space). Compare chapter 4.4.1.

SYNTHESYS+ Partner Survey

Storage of DNA, tissues and other

* 1. What kind of material do you store in your biobank?

☐ Tissue ☐ Whole specimens ☐ Genomic DNA ☐ Cultures ☐ Environmental DNA ☐ Environmental samples ☐ Other (please specify):

2. How do you manage your genetic sample data (e.g. collection data, relation to voucher, preservation)?

☐ Enterprise database ☐ Excel sheet ☐ Other (please specify):

3. How do you manage laboratory data generated from extraction (e.g. date, method of extraction)?

☐ Enterprise database ☐ Excel sheet ☐ We do not store this information ☐ Other (please specify):

4. How do you manage laboratory data generated from sequencing (e.g. date, method of sequencing)?

☐ Enterprise database ☐ Excel sheet ☐ We do not store this information ☐ Other (please specify):

5. How do you store the associated MTA, permit and other legal documents?

Please select the appropriate location and format.

Location:

☐ Central storage ☐ Individual storage (researcher/personal) ☐ Other (please specify in remarks)

☐ Not stored (please indicate why in remarks); Remarks:

Format:

☐ Printed format ☐ Digital format ☐ Both printed and digital ☐ Other (please specify in remarks)

☐ Not stored (please indicate why in remarks); Remarks:

* 6. What kind of MTA do you use for sending out samples to be used for molecular analysis?

☐ CETAF MTA with change in ownership ☐ CETAF MTA without change in ownership

☐ GGBN MTA with change in ownership ☐ GGBN MTA without change in ownership



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☐ Other (please also specify with/without change in ownership):

7. After the completion of a project, what should happen to any remaining material not used by the recipient (usually part of the MTA)?

☐ It should be returned to the loaning institution ☐ It should be destroyed by the researcher

☐ We do not have such a statement in our MTA ☐ Other (please specify):

8. Do you have established workflows within your institution for DNA/tissue sample requests?

☐ Yes ☐ No Remarks:

9. If yes, do you have one workflow across all departments/organism groups or individual workflows?

☐ One workflow across all departments ☐ Different workflows ☐ We do not have an established workflow for DNA/tissue sample requests; Remarks:

*** 10. How do you receive sample requests?**

☐ Our own online catalogue ☐ GGBN portal ☐ Email to DNA Bank curator ☐ Email to other collection curators ☐ Other (please specify):

*** 11. Who logs/manages your DNA/Tissue requests? (Note: We know that approval is usually given by the individual curators/managers, here we want to know who logs the request.)**

☐ Curators/managers of individual collections ☐ DNA Bank curator/manager ☐ we do not log the requests ☐ Other (please specify):

*** 12. If DNA/Tissue requests are logged, do you also log internal requests in a similar way?**

☐ Yes ☐ No ☐ Sometimes ☐ We do not log these requests Remarks

*** 13. If DNA/tissue requests are logged, how are they managed?**

☐ Enterprise database ☐ Excel sheet ☐ On specimen (e.g. extra label) ☐ We do not log these requests ☐ Other (please specify):

*** 14. If DNA/tissue requests are logged, do you also log the shipped/remaining volume?**

☐ Yes ☐ No ☐ We do not log DNA/tissue requests ☐ Other (please specify):

*** 15. Do you have citation policies in place for your samples?**

☐ Yes ☐ No Remarks:

*** 16. If yes, how do you inform the requesting researcher about this policy?**

☐ email text ☐ link to website ☐ part of our MTA ☐ We do not have citation policies in place for our samples ☐ Other (please specify):

17. Who in your institution is in charge of requesting material from other institutions?

☐ Individual researcher ☐ Curators ☐ Other (please specify):



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*** 18. How do you store the associated MTA, permit and other legal documents?**

Please select the appropriate location and format. Format menu

Location:

☐ Central storage ☐ Individual storage (researcher/personal) ☐ Other (please specify in remarks)

☐ Not stored (please indicate why in remarks)

Format:

☐ Printed format ☐ Digital format ☐ Both printed and digital ☐ Other (please specify in remarks)

☐ Not stored (please indicate why in remarks)

Remarks:

*** 19. How are those incoming samples logged?**

☐ Enterprise database ☐ Excel sheets ☐ We do not log them ☐ Other (please specify)

*** 20. Is your DNA bank informed about incoming loaned material?**

☐ Yes ☐ No

Remarks:

*** 21. Who takes care of fulfilling the third-party MTA (e.g. sending back/destroying remaining material)?**

☐ individual researcher ☐ DNA Bank curator ☐ Collection curators ☐ Project leads ☐ Nobody

☐ Remarks:

*** 22. In sum, would you say you have good policies in place to track incoming loan requests for genetic analysis?**

☐ Yes ☐ No

Remarks:

*** 23. If no, do you think establishing policies for incoming loans would be useful?**

☐ Yes ☐ No ☐ We have good policies in place to track incoming loan requests

Remarks:

24. What kind of samples do you prefer to send to researchers? (Note: we know that all kinds of material are shipped depending on the request, but want to know what your preferred/standard sample type is to ship out.)

☐ DNA ☐ Tissue ☐ Whole specimens ☐ Other (please specify):

*** 25. Do you provide extraction services (for third-party requests)?**

☐ Yes ☐ No (please indicate why not):

*** 26. If yes, do you take fees for the extraction service?**

Yes (please indicate how much):

No (please indicate why not):

We do not provide sequencing services (please type N/A):

*** 27. Which groups of organisms do you offer extraction services for? (check all that apply)**

☐ Preserved specimens ☐ Living specimens ☐ Cultures ☐ Environmental samples ☐ Higher plants

☐ Ferns ☐ Fungi ☐ Lichens ☐ Mosses ☐ Algae ☐ Vertebrates ☐ Insects ☐ Molluscs ☐ Protozoa

☐ Ancient humans ☐ We do not offer extraction services to third parties ☐ Other (please specify):



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*** 28. Based on your lab experience, which group or organisms (or age/preservation) from your collections are you unable to offer extraction services for? (Note: please mention only those that you have in your collections!)**

*** 29. Do you provide sequencing services (for third-party requests)?**

☐ Yes ☐ No (please indicate why not):

*** 30. If yes, do you take fees for the sequencing service?**

Yes (please indicate how much): No (please indicate why not):

We do not provide sequencing services (please type N/A):

31. What is the name of your institution?

*** 32. As appropriate, we plan to schedule follow-up interviews to gather additional information on workflows used across SYNTHESYS+ partner institutions. Would your institution be willing to participate in a follow-up interview?**

☐ Yes (unless otherwise specified, we will contact the SYNTHESYS+ primary contact for your institution)

☐ No

Remarks:

Thank you!

Thank you for your time in filling out this survey. Your responses will enable us to evaluate existing best practices for the use of molecular collections and to develop shared best practice recommendations among the SYNTHESYS+ partners



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