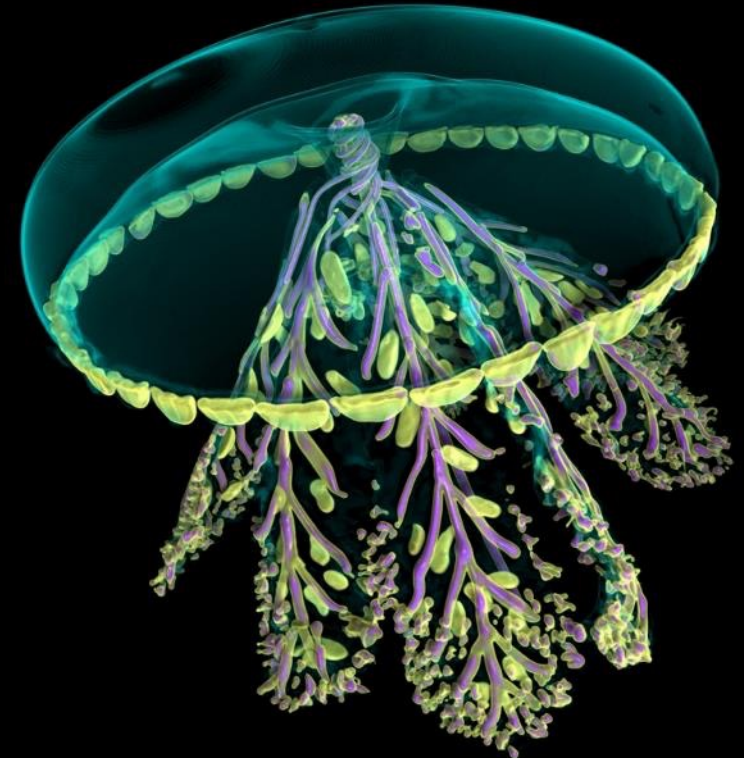


## SYNTHESYS+

**Kristina Gorman, SYNTHESYS project manager**

Distributed infrastructure: provision and use in practice

NHSF, London, 25<sup>th</sup> January 2023

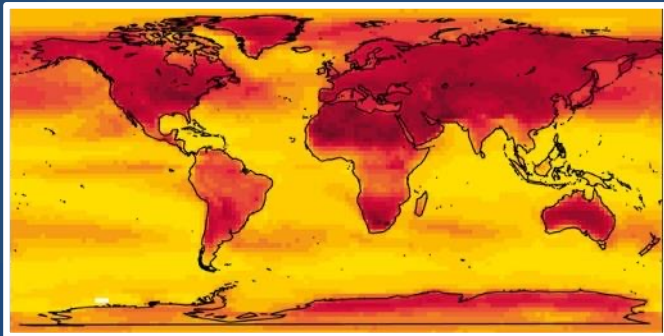


- *Background*
- *What is SYNTHESYS+*
- *Managing the consortium*
- *Transnational + Virtual Access*
- *How did we get here?*
- *Next steps: DiSSCo and ESFRI*



- Bio/geodiversity are central to humanity's sustainability
- Natural history collections are a unique tool to understand biological, geological and cultural diversity through time, and how they interact to shape a changing planet
- a vital resource to answer the big questions of today including maintaining food security, solutions for healthcare, palaeontological research, biodiversity and climate change

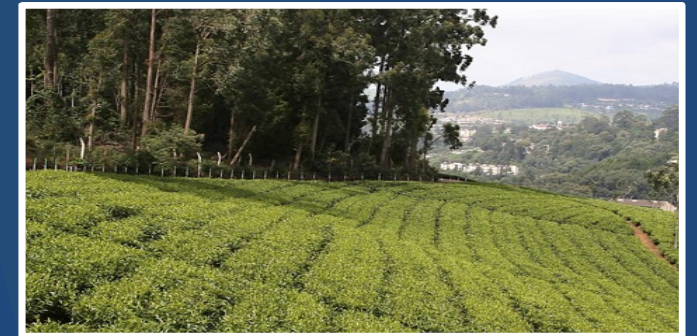
Climate change



Emerging diseases



Biodiversity loss



Food security



Human migration



Mineral supply



# Background

- EC promoting “integrated research infrastructures”
- NH consortia developed “SYNTHESYS” led by NHM
- Four iterations, €38.2m funding since FP6 in 2004
- Common themes
  - Access (mechanism to access participating collections & facilities)
  - Networking (unifying best practice, policy & collections assessment)
  - Research (ancient DNA, virtual collections)
- Aligned with DiSSCo ESFRI initiative



# SYNTHEsys 1 - 4

- SYNTHEsys (FP6): 2004 – 2009  
Networking and Access 13M€, 20 Partners (66 months)
- SYNTHEsys2 (FP7): 2009 – 2013  
JRA, Networking and Access 7.2M€, 20 Partners (48 months)
- SYNTHEsys3 (FP7): 2013 – 2017  
JRA, Networking and Access 8M€, 21 Partners (48 months)
- SYNTHEsys+ (H2020): 2019 – 2023  
JRA, Networking and Access 10M€, 32 Partners (54 months)

# SYNTHESYS+

- 1) Developing infrastructure coupled with comprehensive access programme;
- 2) Develop & deliver support, training & dissemination activities;
- 3) JRA innovating digital/molecular workflows & prioritising collections to digitise;
- 4) Developing common policies, harmonise processes & link out internationally.

**SYNTHESYS+**  
Synthesis of Systematic Resources a DiSSCo project

DiSSCo EC-funded project (*Synthesys.info*)  
(scored: 14.5/15)

## Access (€4.8m)

TA1: Physical Access

VA1: Virtual Access

## Joint Research Activities (€2.3m)

JRA1: European Loans +  
Visits System (ELViS)

JRA2: Collections on  
Demand

JRA3: Specimen Data  
Refinery

## Networking Activities (€2.9m)

NA1: Management

NA2: Training, Support &  
Policy dissemination

NA3: Molecular standards  
& processes

NA4: Digital standards &  
processes

NA5: Internationalisation



Co-funded by the Horizon 2020  
Framework Programme of the European Union

4.5 years  
(starting  
01/02/2019)

Linked with DiSSCo goals & supported by CETAF, GGBN, TDWG & GBIF

# Consortium

32 partner consortium: 17 NH museums, 4 botanic gardens, 4 international networks, 3 commercial, 2 research centres, 1 university, 1 not-for-profit. (21 Access providers)



# SYNTHESYS+ Networking work packages

## NA1: Management (NHM)

- Integrated governance model
- Risk management strategy

## NA2: Training, Support & Policy dissemination (CETAF)

- Develop training modules
- Run helpdesk for online services
- Integrate & expand institutional collections assessments
- Facilitate implementation of policy mandates

## NA3: Molecular Standards & Processes (GGBN)

- Landscape analysis of biobanking standards
- Development & endorsement of missing standards & best practices on biobanking
- Best practice for Collection on Demand requests





# SYNTHESYS+ Networking work packages

## NA4: Digital Standards and Processes (TDWG)

- Landscape (gap) analysis of biodiversity data standards & dashboard
- Metadata standard implementation
- Attribution & data tracking standards
- Networking to support standards adoption & community engagement

## NA5: Internationalisation and New User Communities (GBIF)

- International roadmap
- International stakeholders & new user communities
- European Biodiversity infrastructures stakeholder forum



# SYNTHESYS+ Joint Research Activity

## work packages

### **JRA1: European Loans + Visits System (ELViS) (Naturalis)**

A platform replacing previous SYNTHESYS Access system, supporting access requests, tracking access outputs and ultimately integrating with CMSs to support loans. Includes dashboard reporting functionality.

### **JRA2: Collections on Demand (HCMR)**

Supporting and enhancing the technical infrastructure and institutional capacity to undertake “collection on demand” requests. This includes prioritisation of digitisation-on-demand requests as well as enhancing workflows for molecular sequencing and 3D digitisation.

### **JRA3: Specimen Data Refinery (NHM)**

A platform that integrates machine learning, computer vision and human-in-the loop approaches to extract, enhance and annotate data from digital images and records at scale.

# SYNTHESYS+ Access work packages

## TA1: Transnational (physical) access (NHM)

- 13 national TAFs (Taxonomic Access Facilities), 21 institutions
- 4 annual competitive funding calls in Feb 2019-2022

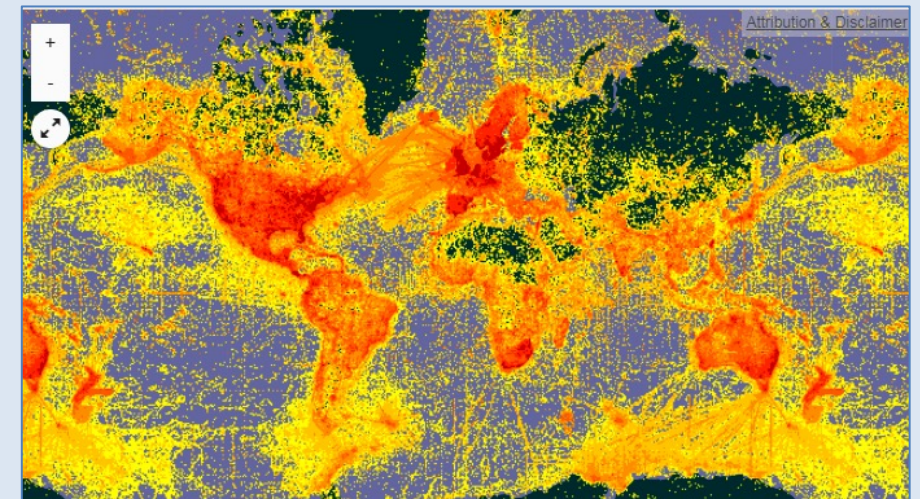
## VA1: Virtual (digital) access (NHM)

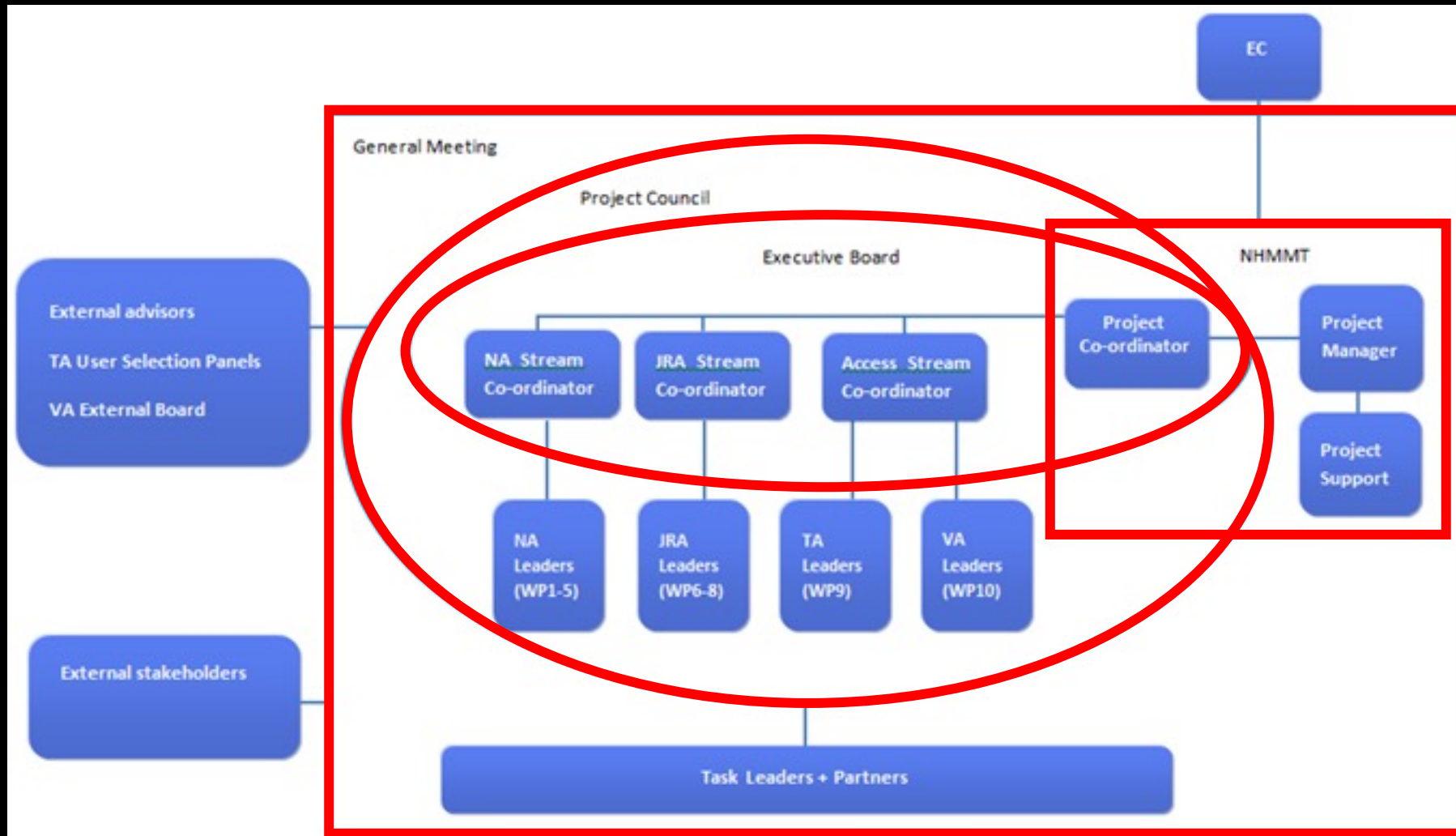
- Digitisation on Demand (DoD) service
- 2 open Calls (years 2 + 3) for collections at 19 institutions
- Open access to data & no embargos



The screenshot shows the SYNTHESYS+ web application interface. The header includes the logo and navigation links. The main content area is titled "List Of Applications for GB-TAF" and displays a table of applications. The table has columns for Applicant Name, Project Acronym, Project Title, Application State, Administration State, and Support. The table lists several applications, including "specimens from the north-eastern tributaries of the Congo River (Zaire)", "The FRODOX Group: neuroanatomy as a tool to insect paleontology", "Mineral chemistry of corrosion of the strobilum: Zinkgruvan Zn Pb Ag (Cu) deposit, Bergslagen, Sweden", "Revision of the Tristan da Cunha freshwater diatom flora based on the collections of John R. Gardner", "Systematics of Helosporal Heliosporium and Lounetaria (Heliosporaceae, Sordariales)", and "Skull and osteology of Antarctic leynceines as an emerging tool for predicting effects of the ocean acidification".

Applicant Name	Project Acronym	Project Title	Application State	Administration State	Support
		specimens from the north-eastern tributaries of the Congo River (Zaire), Auvergne	in processing	Scored	received
		The FRODOX Group: neuroanatomy as a tool to insect paleontology	in processing	Scored	received
		Mineral chemistry of corrosion of the strobilum: Zinkgruvan Zn Pb Ag (Cu) deposit, Bergslagen, Sweden	in processing	Scored	received
		Revision of the Tristan da Cunha freshwater diatom flora based on the collections of John R. Gardner	in processing	Scored	received
		Systematics of Helosporal Heliosporium and Lounetaria (Heliosporaceae, Sordariales)	in processing	Scored	received
		Skull and osteology of Antarctic leynceines as an emerging tool for predicting effects of the ocean acidification	Complete	Complete	received





Stream Co-ordinator  
Team

Project co-ordinators, Stream coordinators, WP Leaders & TA/VA meetings project manager & 3 monthly support  
 Ensures that teleconferencing is used to coordinate project activities across all WPs integration of 3 streams (JRA, NA & Access)  
 Monitoring, events & dissemination  
 Decides on changes to GA

- Project management tool
- Notebooks
- File repository
- Mailing lists
- Members management
- Task lists
- Milestones
- Risks summary

- Clear Consortium Agreement: incl. roles & decision-making processes
- Project management tools
- Named leaders & *deputies* for each WP, milestone & deliverable
- Robust risk & financial management
- Dissemination, communication & exploitation plans – frequent communication!
- Advance planning for reporting
- Organisation of AGMs & other project meetings
- Preparation for inclusion of new partners

- Checklist for accepting new (Access-providing) partners to the consortium: agreed with project committees and written in to our Grant Agreement
  - What can your institution bring to the table?
  - Show evidence of demand from user community
  - Show evidence of collection being a **key** research infrastructure
  - Become member of specified international networks
  - Can your institution legally commit to the consortium T+Cs?
  - Self-assessment + audit of collections: evidence of high quality care, management & access
  - Commitment to in-kind contributions

- EDI: Gender & diversity action plan to monitor equal opportunities
  - monitoring Access requests
  - gender balance on selection panels
- Research ethics based on CETAF Framework for Responsible Research & Innovation
  - e.g. biodiversity resources held within collection-holding partner institutions to be utilised following ethical codes
  - report on activities relating to ABS & best practice of usage of molecular collections
- Collection of personal data
- Ethical use of materials of historical value, tissue samples, genetic material, endangered flora/fauna samples





# Transnational Access: 19 years, 57,000+ User Days

## SYNTHESYS (FP6): 2004 - 2009

- 11 countries, 19 institutions
- 2,056 projects & 29,636 User Days funded over 9 calls

## SYNTHESYS2 (FP7): 2009 - 2013

- 10 countries, 16 institutions
- 1,002 projects & 10,464 User Days funded over 4 calls

## SYNTHESYS3 (FP7): 2013 - 2017

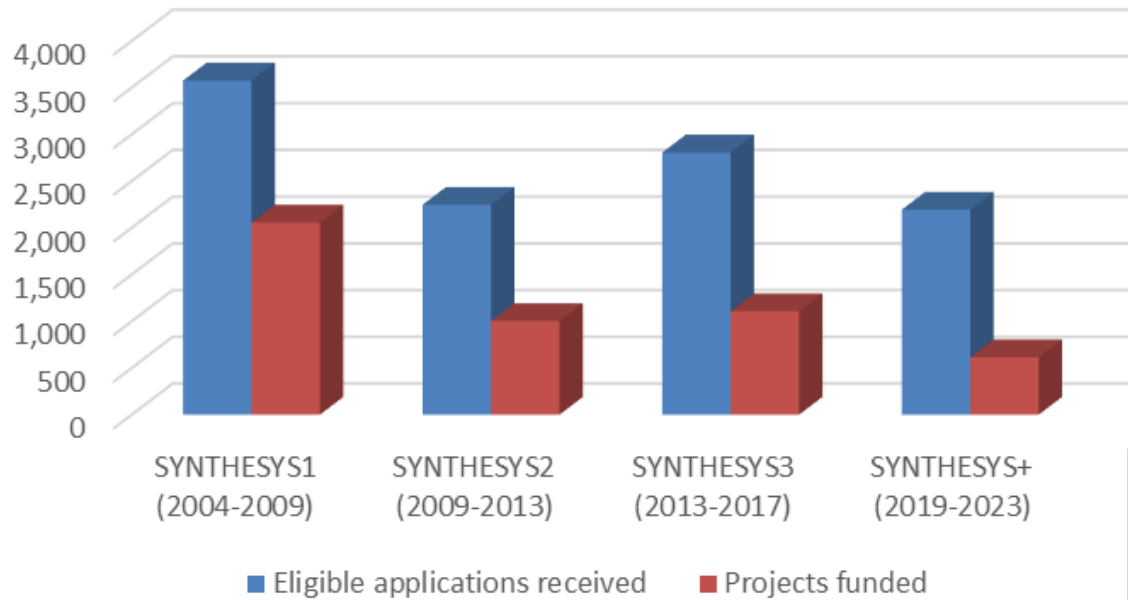
- 11 countries, 18 institutions
- 1,106 projects & 11,053 User Days funded over 4 calls

## SYNTHESYS+ (H2020): 2019 – 2023

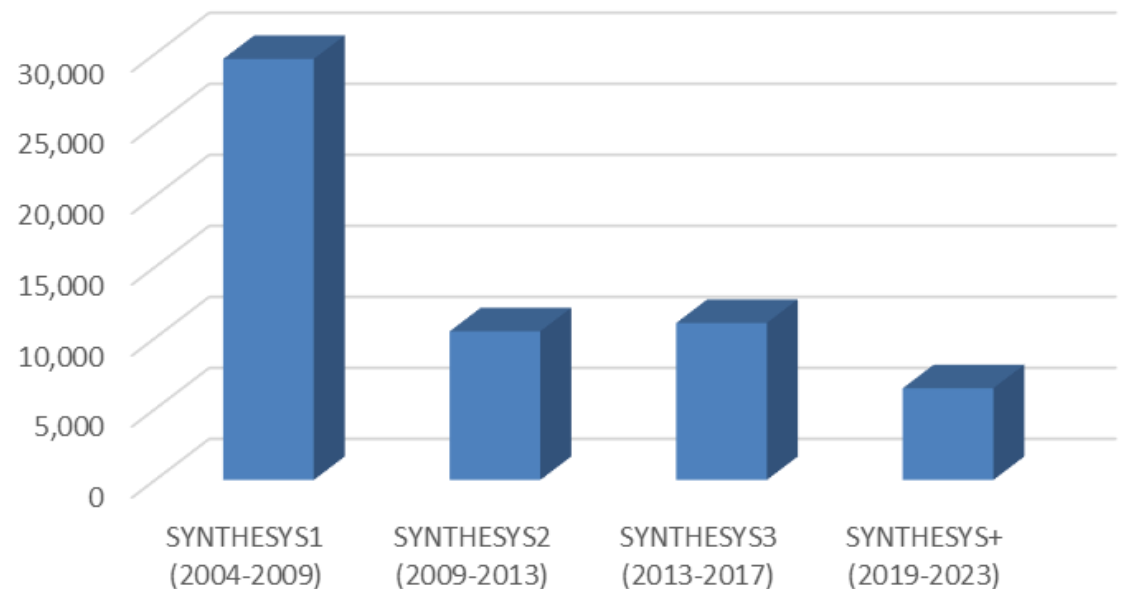
- 13 countries, 21 institutions
- 613 projects & 6,457 User Days funded over 4 calls



## TA applications received & funded

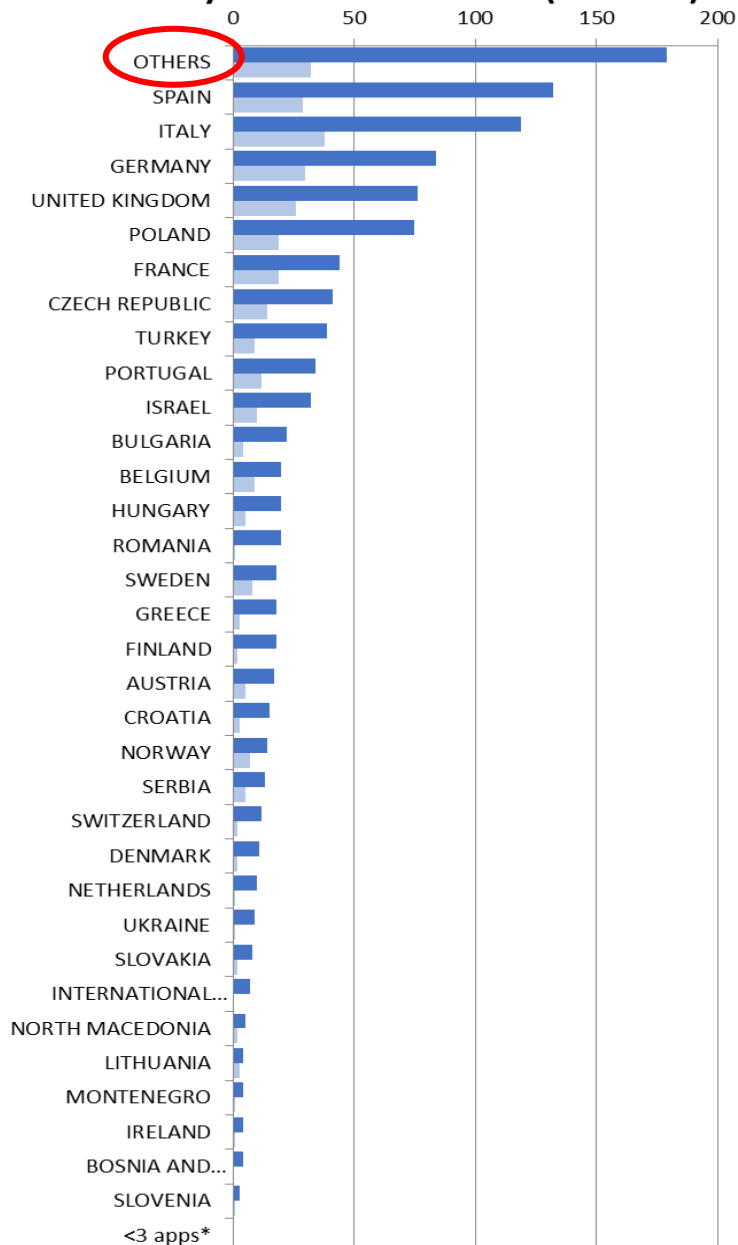


## Researcher days funded



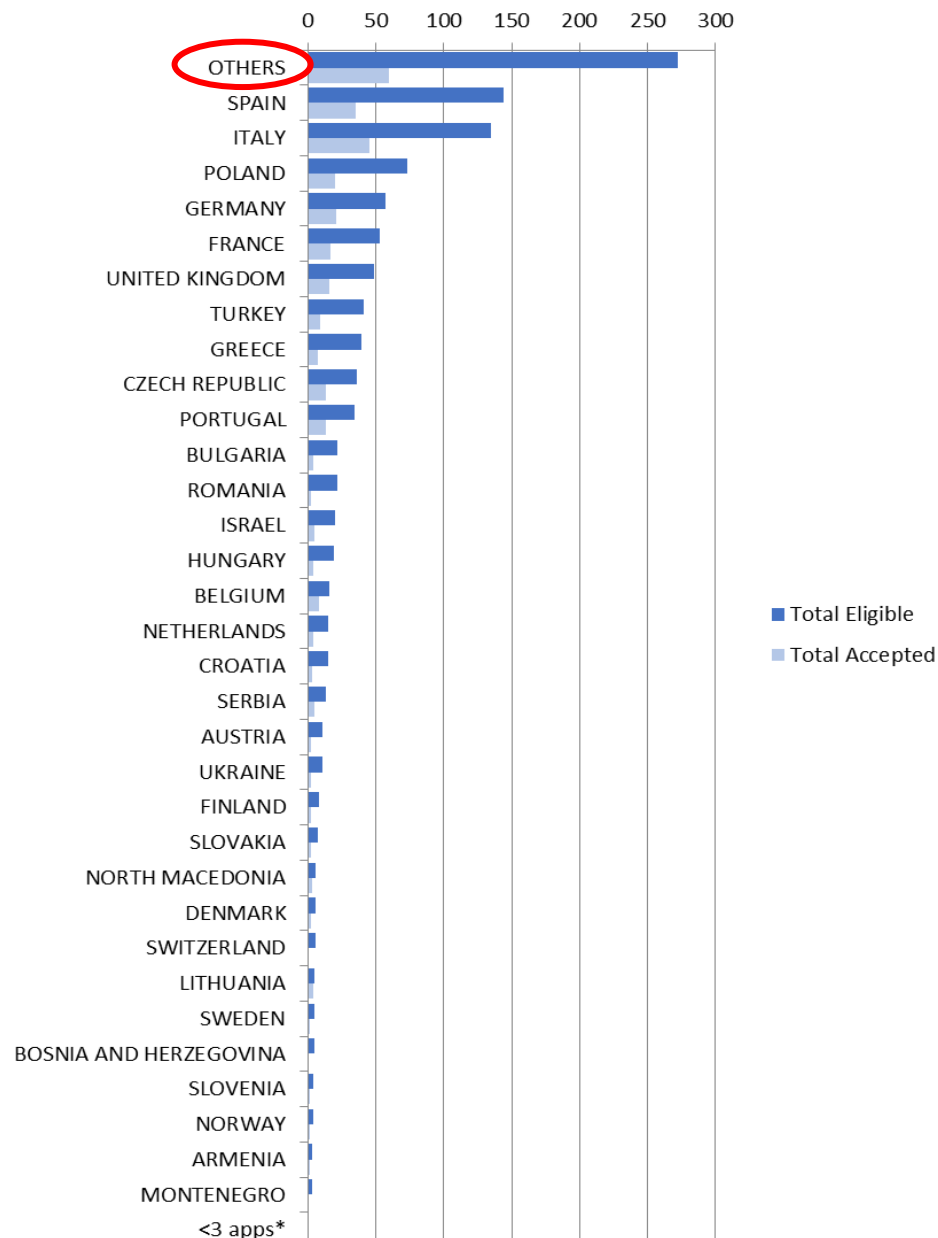
To date, 4,777 projects have been funded (across SYNTHESYS 1-4) resulting in 57,610 User Days, the equivalent of c.260 years!).

### Country of home institution (Calls 1-2)



\*<3 apps: Estonia (2 apps, 2 accepted), Moldova (2,0), Tunisia (2,0), Latvia (1,1), Albania (1,0), Armenia (1,1), Georgia (2,0).

### Nationality of applicant (Calls 1-2)



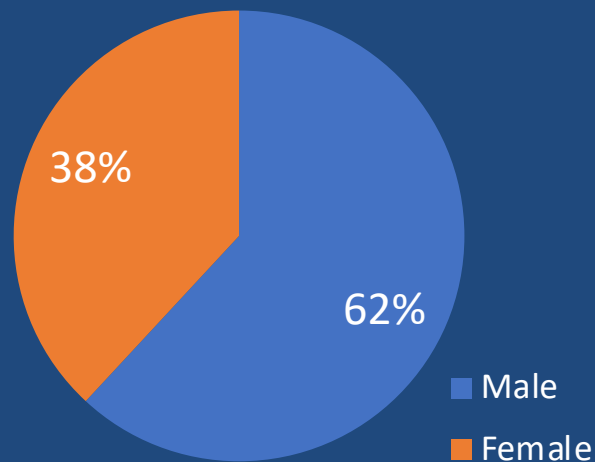
\*<3 apps: Estonia (2 apps, 2 accepted), Ireland (2,2), Moldova (2,0), Latvia (1,1), Cyprus (1,1), Albania (1,0), Georgia (2,0).

# Home institution & nationality data Calls 1-2

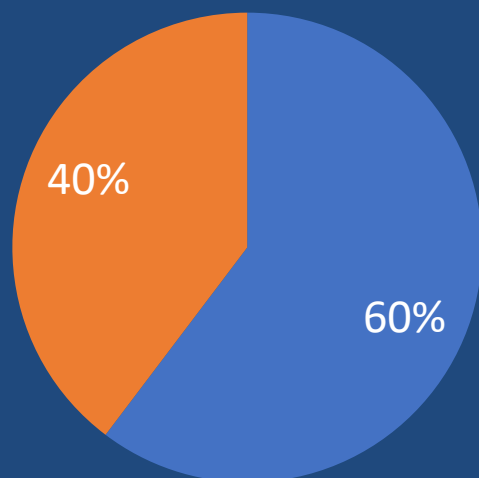
‘Others’ (in the database = non-Europe) a positive sign that TA is now being engaged with globally.

# Gender balance & researcher status

## Gender Call 1-2 all applicants



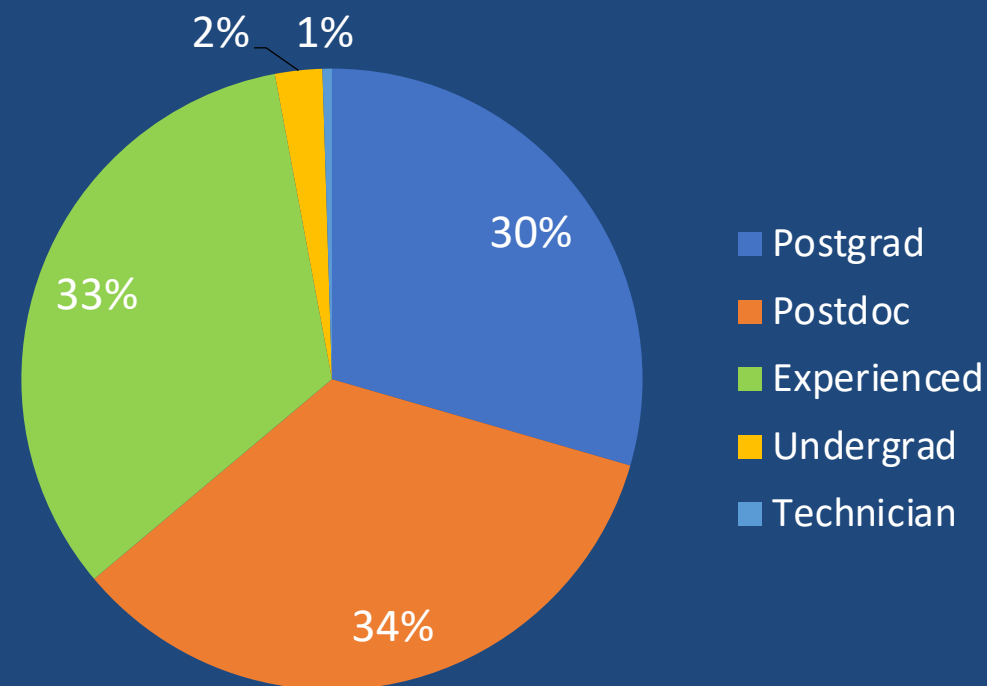
## Call 1 and 2 Successful applicants



Gender balance of accepted applications similar to that of all applicants, similar to SYNTHESYS3, and matches industry average\*

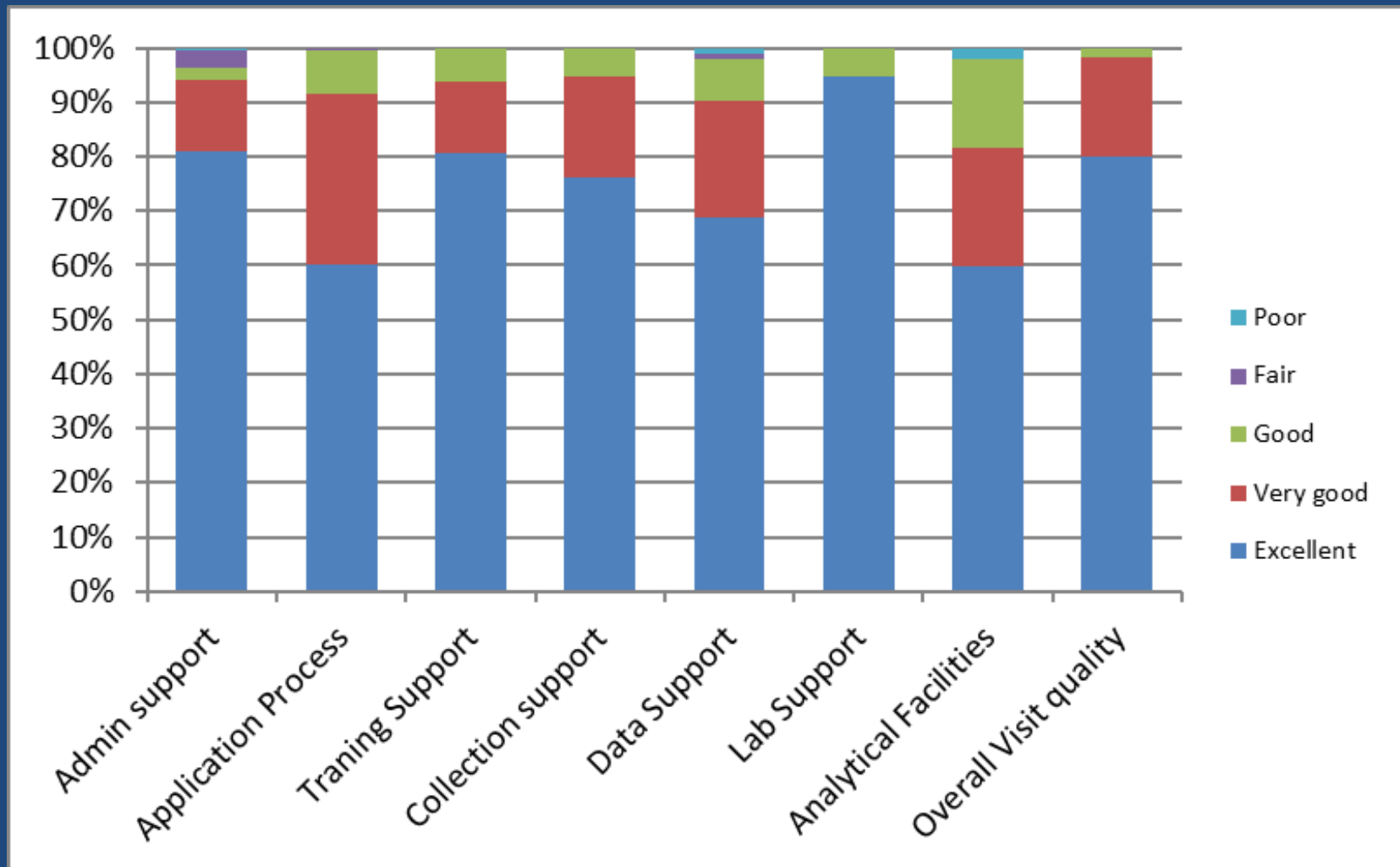
\*'She Figures 2018' indicating that females account for 40.8% of scientific and engineering researchers in the EU.

## Researcher Status of Applicants (Calls 1-2)



# User evaluations from Call 1-3 (to date)

Exit survey for all users: used to help improve user experience with each Call.

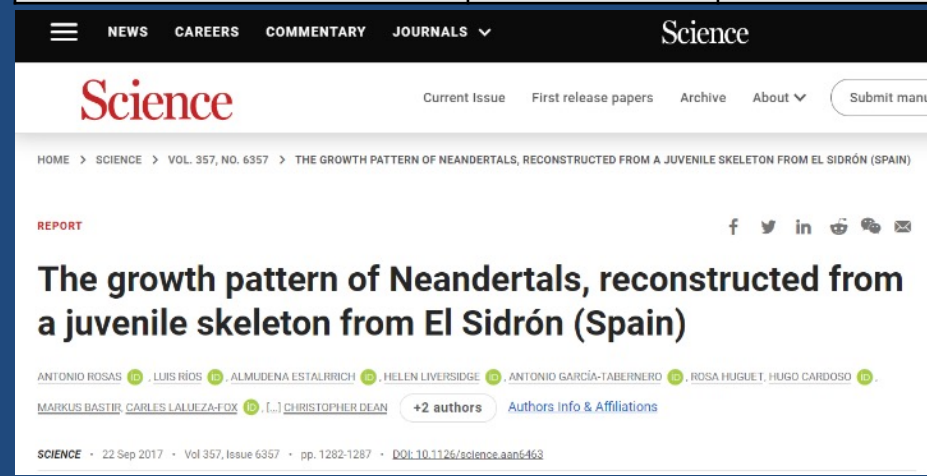


- 169 responses to date
- 98% of Users regarded their overall visit quality as “excellent” or “very good”
- Only 7 “Fairs” and 4 “Poors”

# Outputs

- SYNTHESYS 1-4: >5,000 research outputs.
- 323 outputs from SYNTHESYS+ Call 1 visits, 109 of which Accepted, In Press or Published.

SYNTHESYS+:	Accepted	In press	Published	Total
Book/Monograph	1	3	4	8
Database, CD or DVD		1		1
Non Peer Reviewed	2	2	6	10
Peer Reviewed	10	12	67	89
Thesis			1	1
Training				
<b>Total</b>	<b>13</b>	<b>18</b>	<b>78</b>	<b>109</b>



- Robust method of managing applications (e.g. online portal)
- Clear listings to users of what is available for access
- Consortium-agreed rules and FAQs
- Management team representation at User Selection Panel meetings to ensure consistent practice
- Gather, monitor & act upon feedback from users
- Good hosts are key
- Outreach to new users: mailing lists, international networks, previous users, social media
- Acknowledgement of SYNTHESYS in outputs

# Benefits of Transnational Access

## User

- Increased collaborations with Hosts + multiple TAFs
- Users learn new skills - transferred to home institution

## Host institution

- Increased quality of collections: identifying specimens, updating nomenclature
- Users create new metadata
- Enhanced electronic data capture + processing
- Increased use of collections leads to enhanced value in the collections

## Wider community

- High-quantity, high-quality research outputs
- Increased collaborations between international experts
- Fast-tracked progress in global research issues including environmental + climate change + climate modelling, soil biodiversity, marine, freshwater + terrestrial ecosystem functioning, mineral deposit distribution + food security.

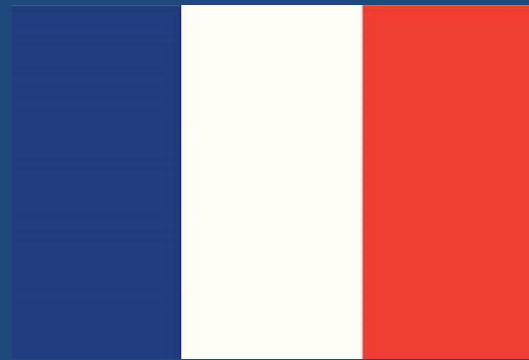


# How did we get here? FP4 + 5

- It all started during the European Commission's FP4 TMR Programme when natural history collections were recognised as "*Infrastructures*"
- Launch of FP5 featuring a 'Human Potential' Programme (1999-2004) included calls for more access grants
- Our collections-holding community seized these opportunities and applied successfully for funding
- Six countries won contracts during 2000 – 2004, total value over €5m to provide transnational access



# FP5 Successes: predecessor projects



**ABC** *Access to Belgian Collections of interest for biodiversity research (RBINS)*

HPRI-CT-2001-00159 Nov 2001 - Feb 2004 € 325 000

**COBICE** *Copenhagen biosystematics centre (University of Copenhagen)*

HPRI-CT-1999-00021 Jan 2000 - Dec 2002 € 1 050 000

HPRI-CT-2001-00129 Jan 2003 - Feb 2004 € 408 333

**BIOD-IBERIA** *Iberian collections of fauna and flora (CSIC)*

HPRI-CT-2001-00165 Nov 2001 - Feb 2004 € 466 613

**COLPARSYST** *Paris: access to collections and resources (MNHN)*

HPRI-CT-2001-00151 Nov 2001 - April 2004 € 583 333

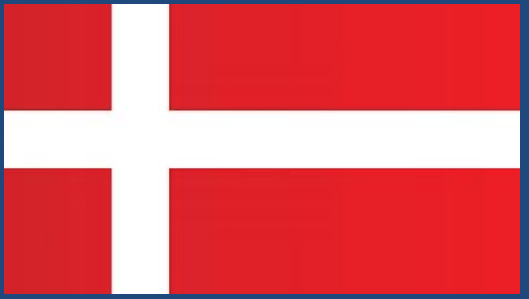
**SYS-RESOURCE** *Increasing access for European researchers to systematics resources and analytical facilities (NHM, Linnaean Society and RBG, Kew)*

HPRI-CT-1999-00062 May 2000 - Apr 2002 € 1 050 000

HPRI-CT-2001-00130 May 2002 - Jan 2004 € 366 667

**HIGH LAT** *Access to naturhistoriska riksmuseet: high latitude*

HPRI-CT-2001-00125 Nov 2001 - Jun 2004 € 895 022



## How did we get here? FP5

- FP5 also offered 'Thematic network' grants
- Our community saw the merit in working together on access problems, not least data sharing issues

**ENHSIN** *European natural history specimen information network*

HPRI-CT-1999-40010 Jan 2000 - Mar 2003

€ 200 000

## FP6 & 7: Step change

- Commission changed its approach, partly through the work of ESRFI (European Strategy Forum on Research Infrastructures, set up in 2002), the case for funding delivery a programme '*Integrated Research Infrastructures*' across Europe was made
- Provided a golden opportunity to increase the collections access offer and fund further work on common issues through 'Networking' and 'Research'

## What comes next?

- Commission is limiting the funding for the advance infrastructure communities in favour of supporting newly formed communities
- ESFRI roadmap is now providing our community with an opportunity to build a more sustainable virtual collection
- Through DiSSCo: commitment to digitising their collections now have a game plan to deliver a global distributed infrastructure of scientific collections
- Use of knowledge/experience in future collaborative endeavours: e.g. AHRC RICHeS & CapCo, NERC environmental infrastructure



**120** National Facilities  
**21** Countries



## a new business model: ONE EUROPEAN COLLECTION

- One European Collection of scientific assets
- Common Collections development strategy
- Economies of scope and scale
- Monitoring impact of collections (documenting ROI)
- Specialisation strategies  
(e.g. in alignment with national priorities, e.g. Smart Specialisation Strategies)
- Joint Research Agendas

- Largest ever formal agreement between natural science collection facilities
- A system of distributed facilities
- Centralised shared governance model

<https://dissco.eu>

# Financial Resourcing: Aligned Projects

# SAP

Strategic  
Alignment  
of Projects

ICEDIG



Funded by the Horizon 2020  
Framework Programme of the  
European Union

€3M | 2018-2020

CoL+



€0.5M | 2017 - 2020

**DiSSCo Design Study**

€10M | 2014 - 2017

**DiSSCo Deploy**

€2M | 2024 - 2025

**DiSSCo Construct**

€53M | 2021 - 2024

**DiSSCo Prepare**

€20M | 2019 - 2023

**SYNTHESYS+**

€10M | 2019 - 2023

**MOBILISE**

€0.5M | 2018 - 2022



# ICEDIG: Future-proofing digitisation

- Innovation and consolidation for large scale digitisation of natural heritage
- Quality assurance, applying common digitisation standards, procedures & policy
- Stable & robust metadata schemes including adoption of persistent identifiers on our data
- New digitisation techniques, driven by research requirements



DiSSCo EC-funded project (ICEDIG.eu)  
(scored: 14.5/15)



Co-funded by the Horizon 2020  
Framework Programme of the European Union



## Established technology

### 2D image

1 picture with sub-micron resolution  
= 20 MB / specimen

## Emerging Technology

### 3D model

raw data and reconstructed images  
= 200 GB / specimen



# The UK Distributed System of Scientific Collections

- A partnership of institutions, working together to harness the digital potential of their collections
- Enabling natural science collections to be physically and digitally accessible and usable for research and innovation
- A business case for digitising collections
- A plan (blueprint) on how to make this happen
- Evidence on the size, breadth and use of these collections and associated expertise
- Aligned with European DiSSCo activities



**EMPOWER THE UK NETWORK OF COLLECTIONS THROUGH DIGITISATION**

**ENHANCE UK BIODIVERSITY AND HUMANITIES INFORMATION INFRASTRUCTURE**



**IMPROVE DATA QUALITY**  
**IMPROVE DATA QUALITY**

origin, relevance and usefulness for any application.

**DELIVER RELEVANT DATA**

**DELIVER RELEVANT DATA**



# UK Blueprint

*Towards a business case for digitising UK Natural Science Collections*

- Part plan, part promotion
- Meeting the needs of a diverse range of stakeholders & institutions
- Emphasising science & infrastructure needs (reflecting funding)
- Inclusive of all UK natural science collections (life & earth, large & small)
- Recognises that our plans are in development
- 28 pages with 5 key sections
- 4 case studies from partners



<https://doi.org/10.5281/zenodo.6472238>

# DiSSCo UK Website (dissco-uk.org)

- Gateway to DiSSCo UK resources
  - Blueprint
  - News and case studies
  - UK collections dashboard
  - DiSSCo UK Brand guidelines
  - Training resources
  - Pilot UK portal
- More dynamic content
- Routes for more institutions to get involved

## DISSCO UK

The Distributed System of Scientific Collections



### Harnessing the power of Natural Science Collections

DiSSCo UK is a partnership of institutions who are digitising their collections to make reliable knowledge and evidence about the natural world available to all.

**Any questions?**

