

# Observing and monitoring *biodiversity* - new horizons and persistent challenges

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# Global challenges

The **big** issues:

- **Biodiversity loss**
- **Climate change**
- **Water & Food scarcity**
- **Energy**
- **Poverty reduction**

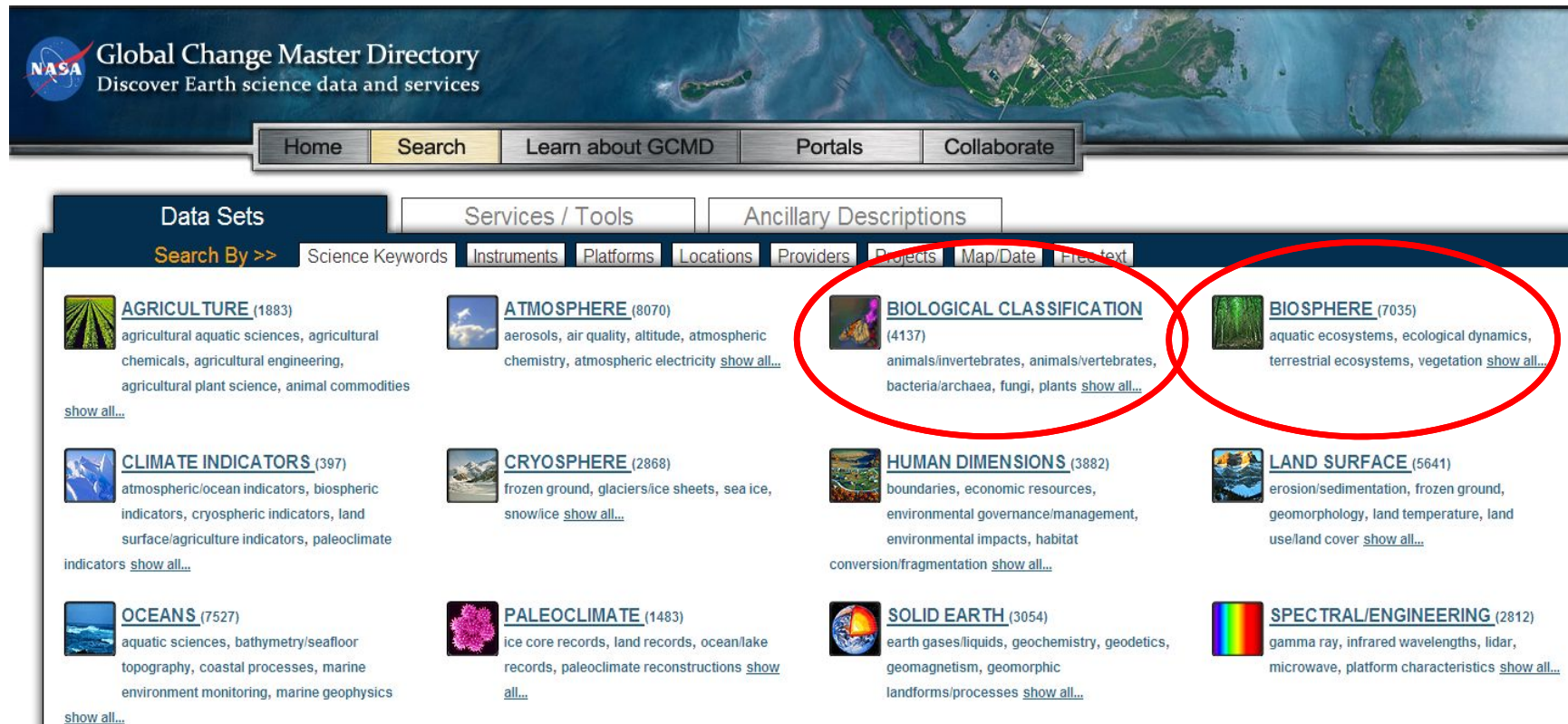
**Our *Knowledge Society* is based on science and technology, i.e., the availability of sound & reliable scientific data, analysis, and interpretation**



# Biodiversity – challenges:

- ongoing **biodiversity loss** – continued / increased extinction rates / habitat loss !!
- missing **baseline data** – lack of basic knowledge
- ***fragmentation*** of available information  
– problems accessing/using existing data/knowledge
- targeted and effective information **delivery**  
– limited impact of scientific data (& publications) on policy and individual behaviour

# Biodiversity data sources: NASA GC master directory : <http://gcmd.nasa.gov>



Global Change Master Directory  
Discover Earth science data and services

Home Search Learn about GCMD Portals Collaborate

Data Sets Services / Tools Ancillary Descriptions

Search By >> Science Keywords Instruments Platforms Locations Providers Projects Map/Date Free text

**AGRICULTURE** (1883)  
agricultural aquatic sciences, agricultural chemicals, agricultural engineering, agricultural plant science, animal commodities [show all...](#)

**ATMOSPHERE** (8070)  
aerosols, air quality, altitude, atmospheric chemistry, atmospheric electricity [show all...](#)

**BIOLOGICAL CLASSIFICATION** (4137)  
animals/invertebrates, animals/vertebrates, bacteria/archaea, fungi, plants [show all...](#)

**BIOSPHERE** (7035)  
aquatic ecosystems, ecological dynamics, terrestrial ecosystems, vegetation [show all...](#)

**CLIMATE INDICATORS** (397)  
atmospheric/ocean indicators, biospheric indicators, cryospheric indicators, land surface/agriculture indicators, paleoclimate indicators [show all...](#)

**CRYOSPHERE** (2868)  
frozen ground, glaciers/ice sheets, sea ice, snow/ice [show all...](#)

**HUMAN DIMENSIONS** (3882)  
boundaries, economic resources, environmental governance/management, environmental impacts, habitat conversion/fragmentation [show all...](#)

**LAND SURFACE** (5641)  
erosion/sedimentation, frozen ground, geomorphology, land temperature, land use/land cover [show all...](#)

**OCEANS** (7527)  
aquatic sciences, bathymetry/seafloor topography, coastal processes, marine environment monitoring, marine geophysics [show all...](#)

**PALEOCLIMATE** (1483)  
ice core records, land records, ocean/lake records, paleoclimate reconstructions [show all...](#)

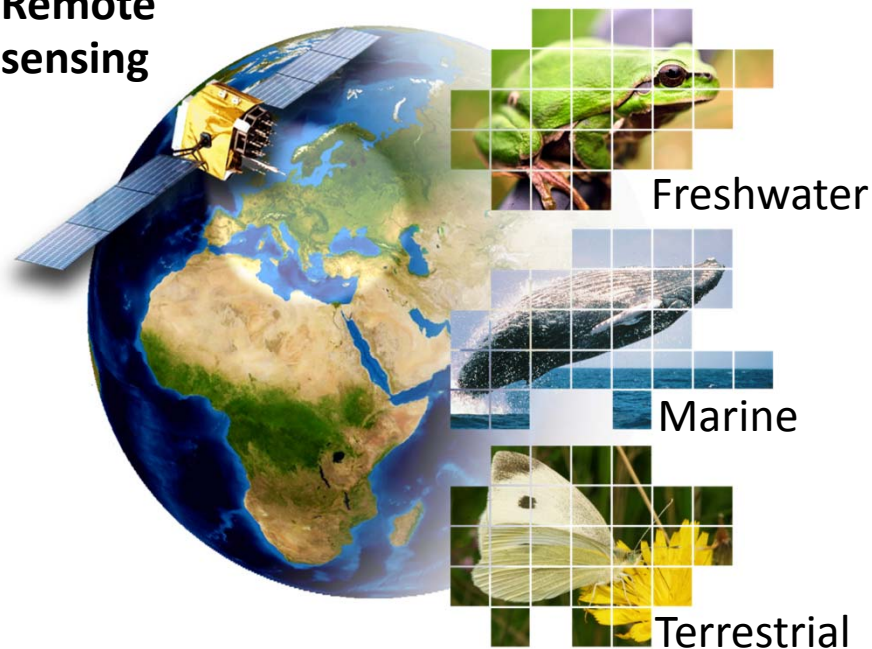
**SOLID EARTH** (3054)  
earth gases/liquids, geochemistry, geodetics, geomagnetism, geomorphic landforms/processes [show all...](#)

**SPECTRAL/ENGINEERING** (2812)  
gamma ray, infrared wavelengths, lidar, microwave, platform characteristics [show all...](#)

For „biosphere“ + „biological classifications“  
**>11.000** online data sources / information systems  
listed in this registry !!

# The Challenge: Integration of *Biodiversity* Information

Remote  
sensing



## Specific Challenges:

- + data standards, interoperability
- + common recording & monitoring schemes
- + analysis, interpretation, tools [patterns and trends]
- + information dissemination
- + science policy interface(s)

Two large realms: **field** („in situ“) + **remote sensing data**

# Field / on ground („in situ“) biodiversity data: challenges + opportunities

- high fragmentation: large number of data sources, little coordination of effort(s)
- much legacy data/information [non digital]
- ✓ (some) universal data standards available (Darwin Core, ABCD, )
- ✓ (some) long term data sets / time series available (>150 ys)
- ✓ cover **all** aspects of biodiversity (small + mobile organisms, genetic information, etc)





EuMon portal - <http://eumon.ckff.si/monitoring/>

EU-wide monitoring methods and systems of surveillance for species and habitats of Community interest

2021 15 00 03

Halt the loss of  
biodiversity  
by 2020

## Welcome to the EuMon portal

### Biodiversity monitoring in Europe

An information and support platform for biodiversity monitoring in Europe

Developed and maintained by EuMon, EBONE, and SCALES  
for the European biodiversity monitoring community

- Motivation
- Information available
- Support tools available



### Navigation

#### About EuMon

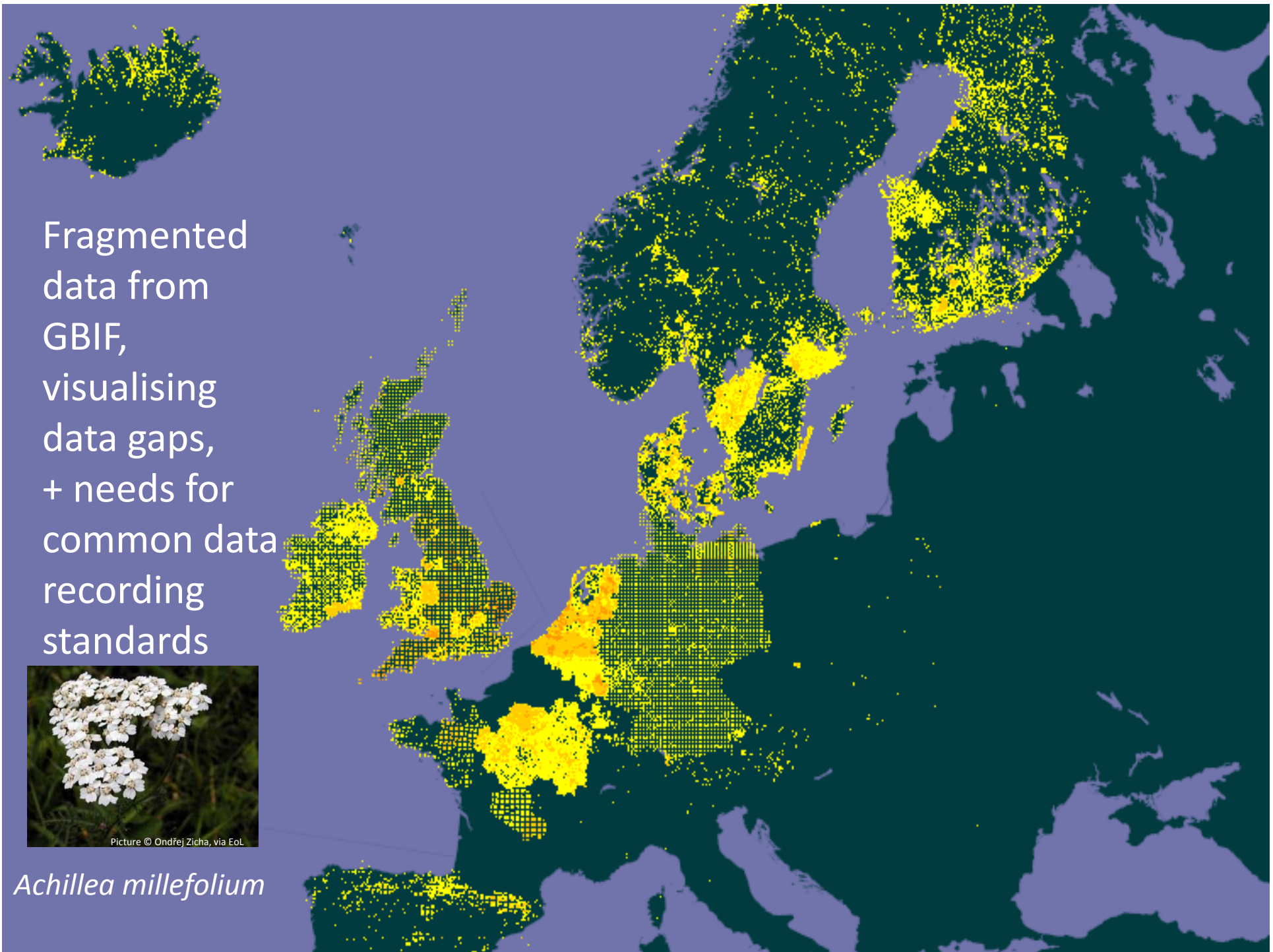
- Summary
- News
- Partners
- Job opportunities
- Presentations of EuMon

#### EuMon Database on Monitoring Schemes

- About the database
- Login / Registration
- Browse the schemes

The **EuMon database** lists 649 monitoring programmes for Europe  
– *the actual number is about 3-fold!*

Example: Finland has 60 monitoring programmes (250 person years annually spent in their implementation, 70% is voluntary work) - only 15 of them listed in the EuMon database. Each of the monitoring programmes has their own database management system, and no particular data access policy. Less than 10% of them share their data (e.g., through GBIF).



Fragmented  
data from  
GBIF,  
visualising  
data gaps,  
+ needs for  
common data  
recording  
standards



Picture © Ondřej Zicha, via EoL

*Achillea millefolium*



# Biodiversity data – (new) opportunities

- Information infrastructures (+ standards)
- New technologies
- Big data
- Political considerations/pressures

# GBIF: a global biodiversity data portal

<http://data.gbif.org>

GBIF data portal links to:

- > 640 data provider
- > 13.000 data sets
- > 500 mio data records (individual organisms from practically all countries and regions)

GBIF

Data ▾ News ▾ Community ▾ About ▾

## Global Biodiversity Information Facility

Free and Open Access to Biodiversity Data

515,281,786 OCCURRENCES | 1,454,694 SPECIES | 13,766 DATASETS | 634 DATA PUBLISHERS

Sharing biodiversity data for re-use  
Learn about GBIF  
Publish your data through GBIF  
Technical infrastructure

Providing evidence for research and decisions  
Using data through GBIF  
Enabling biodiversity science  
Supporting global targets

Collaborating as a global community  
Current Participants  
How GBIF is funded  
Enhancing capacity

Search 🔍

### Explore Species

Find data for a species or other group of organisms.

**Species**  
Information on species and other groups of plants, animals, fungi and micro-organisms, including species occurrence records, as well as classifications and scientific and common names.

**Example species:**  
*Puma concolor* (Linnaeus, 1771)

### Explore Countries

Find data on the species recorded in a particular country.

**Countries**  
Information on the species recorded in each country, including records shared by providers from throughout the GBIF network.

**See data for:**  
Germany

### Explore Datasets

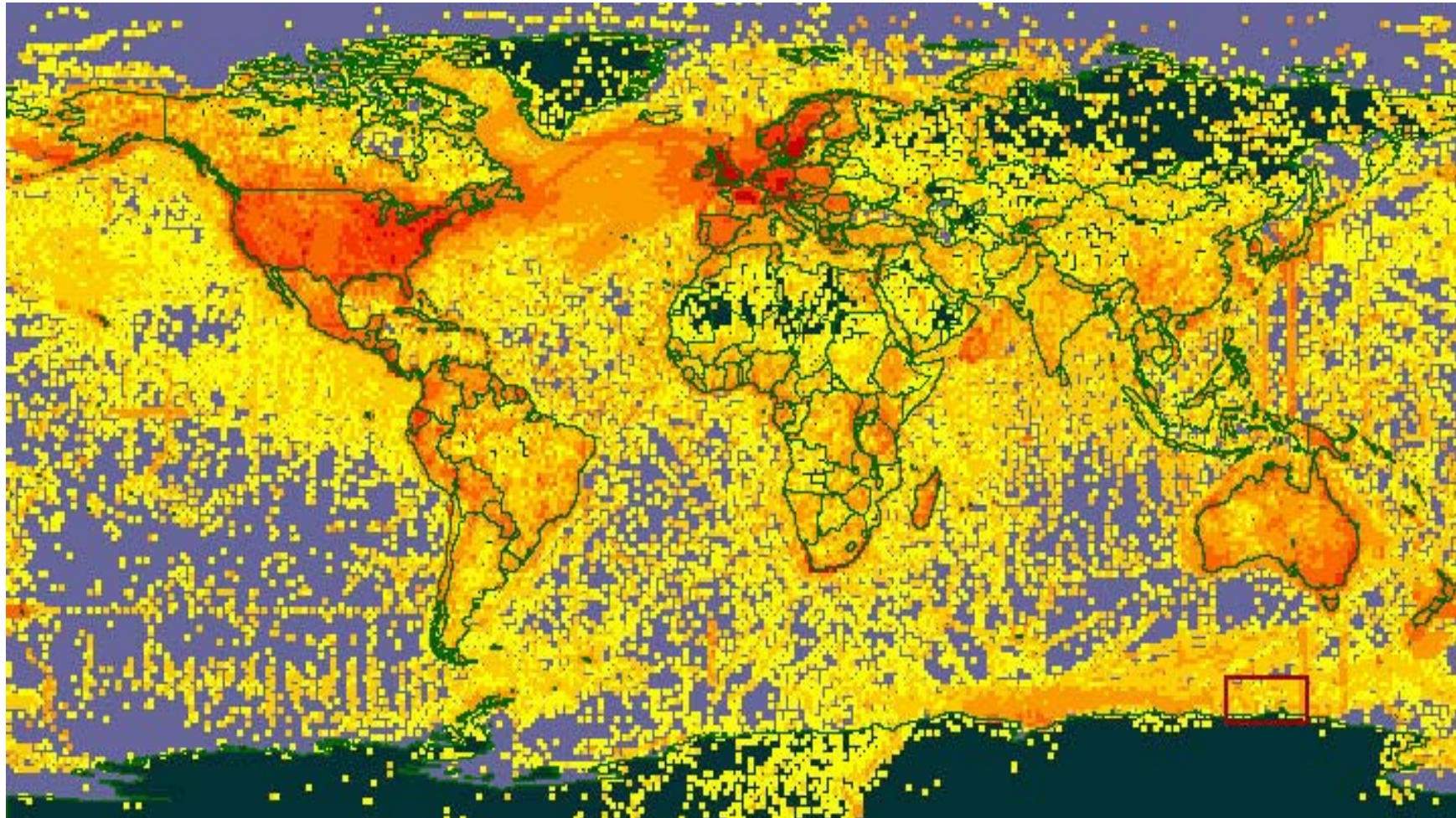
Find data from a data provider, dataset or data network

**Datasets**  
Information on the data providers, datasets and data networks that share data through GBIF, including summary information on 1693 datasets from 235 data providers.

**Latest dataset added:**  
Lichenes North-Eastern Poland

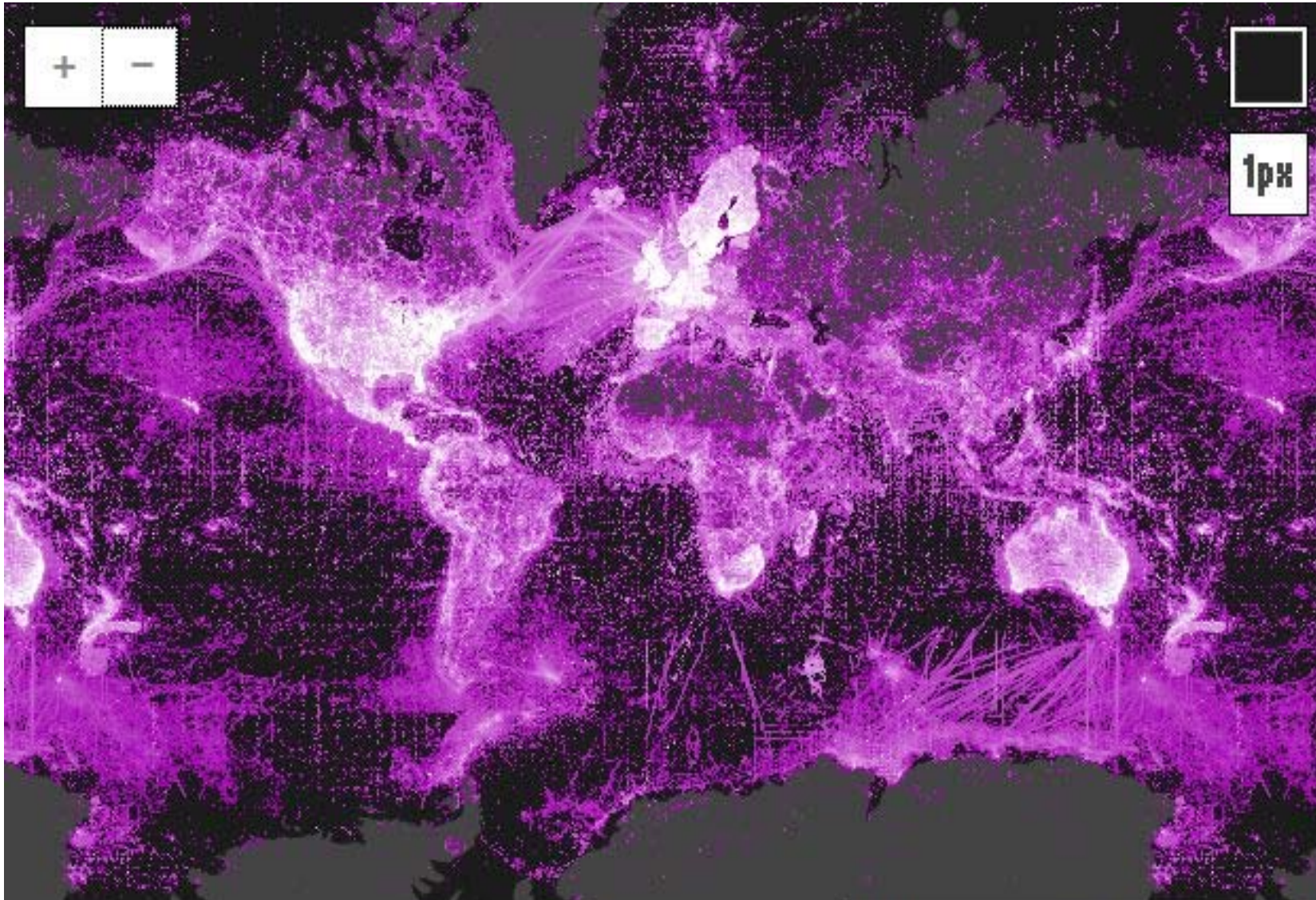


# GBIF: >500 mio occurrence data available



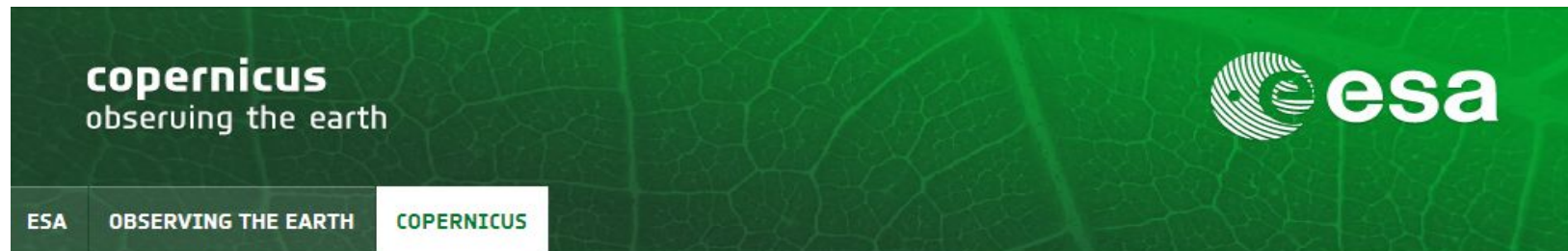


# GBIF: >500 mio occurrence data available





# Big data for biodiversity : new opportunities



+ About Copernicus

- ESA's Sentinel satellites

- Overview
- Sentinel-1
- Sentinel-2
- Sentinel-3
- Sentinels -4/-5 and -5P

+ Contributing Missions

+ Ground Segment infrastructure

+ Services through Copernicus

+ Multimedia

- FAQs
- Contact us

ESA > Our Activities > Observing the Earth > Copernicus



Search here

## OVERVIEW

ESA is developing a new family of missions called Sentinels specifically for the operational needs of the Copernicus programme.

Each Sentinel mission is based on a constellation of two satellites to fulfil revisit and coverage requirements, providing robust datasets for Copernicus Services.

These missions carry a range of technologies, such as radar and multi-spectral imaging instruments for land, ocean and atmospheric monitoring:

- **Sentinel-1** is a polar-orbiting, all-weather, day-and-night radar imaging mission for land and ocean services. The first Sentinel-1 satellite was launched on a Soyuz rocket from Europe's Spaceport in French Guiana on 3 April 2014.
- **Sentinel-2** is a polar-orbiting, multispectral high-resolution imaging mission for land monitoring to provide, for example, imagery of vegetation, soil and water cover, inland waterways and coastal areas. Sentinel-2 will also deliver information for emergency services.



Sentinel family

Data access

Space Component Data Access

More information

Sentinels technical site

Sentinels facts & figures (.pdf)

Related links

European Commission Copernicus site

Eumetsat



# Future integrated data recording / handling

## Fieldwork



© M. Bos, A. Turpaud, A. Schäfer-Verwimp

## Data collection

## Facilitated field data entry



- Automated recording of GPS coordinates, date & time
- Standardized protocols
- Taxonomic authority files
- Habitat data, etc
- Photos



## Testing of digital recording tools

Export in *standardised* formats (shape-files, dbf-files, etc.)

## Output



GBIF species maps distribution maps

Bryales
Aulacomniaceae
Bartramiaceae
Bryophyta
Anomobryum conditatum (Spruce) Lindb.
Anomobryum julaceum (Schrad. ex K. Goertn. et al.)
Bryum alpinum Sordb. ex M. J. Heil.
Bryum alpinum Huds. ex With.
Bryum archangelicum Bruch & Schimp.
Bryum argenteum Hedw.
Bryum argenteum lanatum (P. Beauv.) Hampe
Bryum bicolor Griseb.
Bryum blanda Bruch & Schimp.
Bryum caespitosum Hedw.
Bryum caespitosum caespitosum
Bryum capillare Hedw.
Bryum capillare capillare
Bryum crabbenium Taylor
Bryum zyllophyllum Miettinen
Bryum elegantis Nees
Bryum funckii Schwägr.
Bryum gemmiparum De Not.
Bryum kunzei Hornsch.

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# Rangefinder-System

Precise recording of moving objects / animals

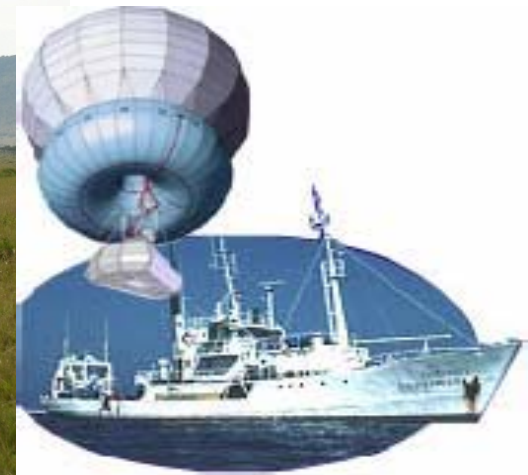


Vector 1500

- Distance measurement (up to 2 km)
- Direction and slope are recorded
- Supplementary to standard GPS
- Battery capacity up to several days



>1.000.000 new field generated data records every day !?!



# Mobile Interface for Citizen Science - [www.anymals.org](http://www.anymals.org)



The anyimals + plants smartphone application, supported by the German Federal Ministry of Education and Research, enables users to upload geo-referenced wildlife observations via their Android device.



TERENO Int. Conference 2014, Bonn



GEFÖRDERT VOM

Bundesministerium  
für Bildung  
und Forschung

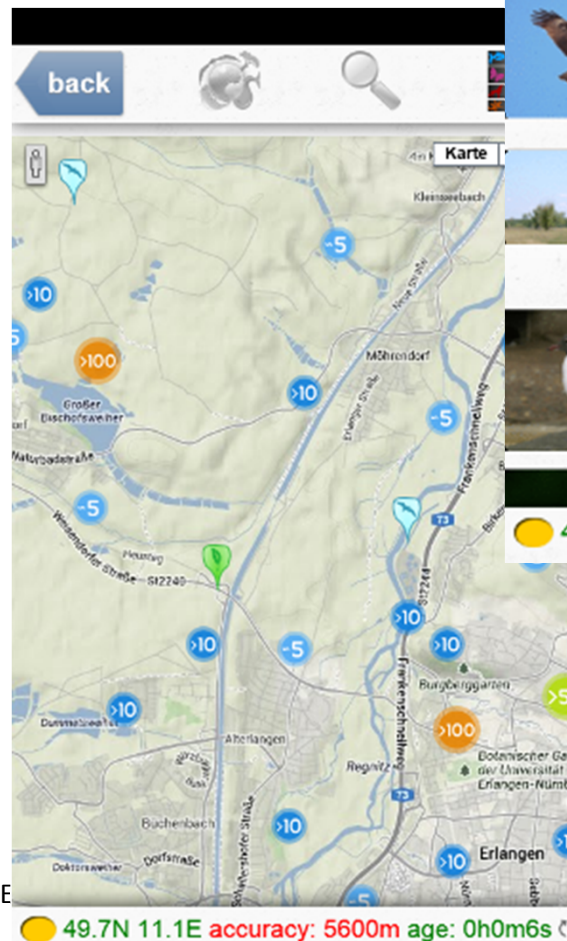
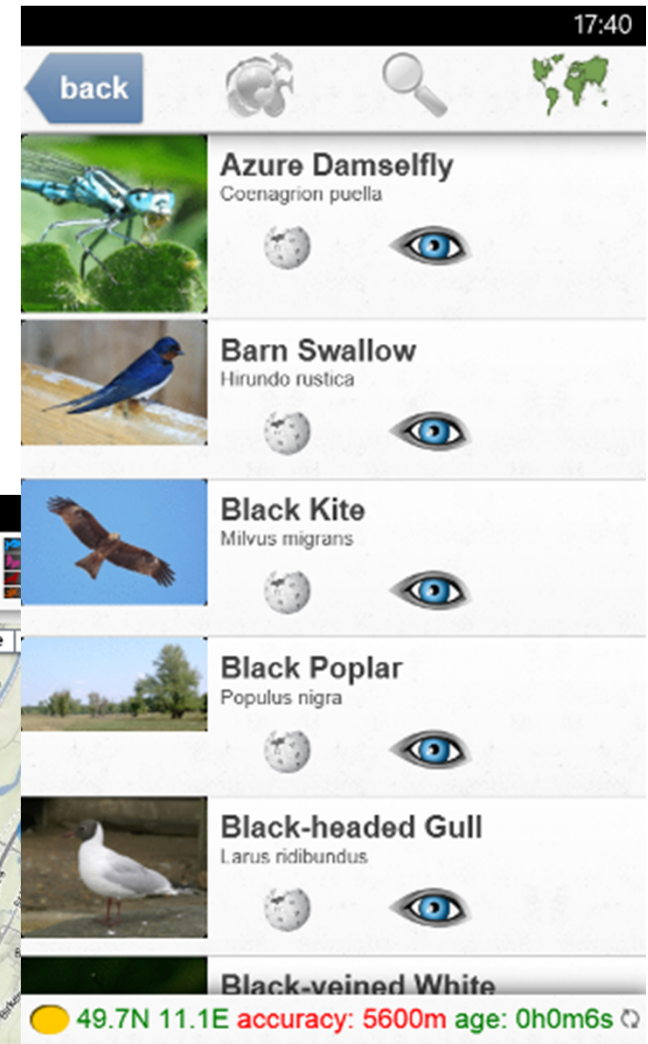
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naturkunde  
berlin



# Interactive functionalities



- Data gathering:
  - who, when, where, what
  - project-specific information with customizable forms
  - image handling
- Identification keys
- Offline availability
- Illustration on maps
- Multilingual apps





# Providing Data from Anymals to GBIF

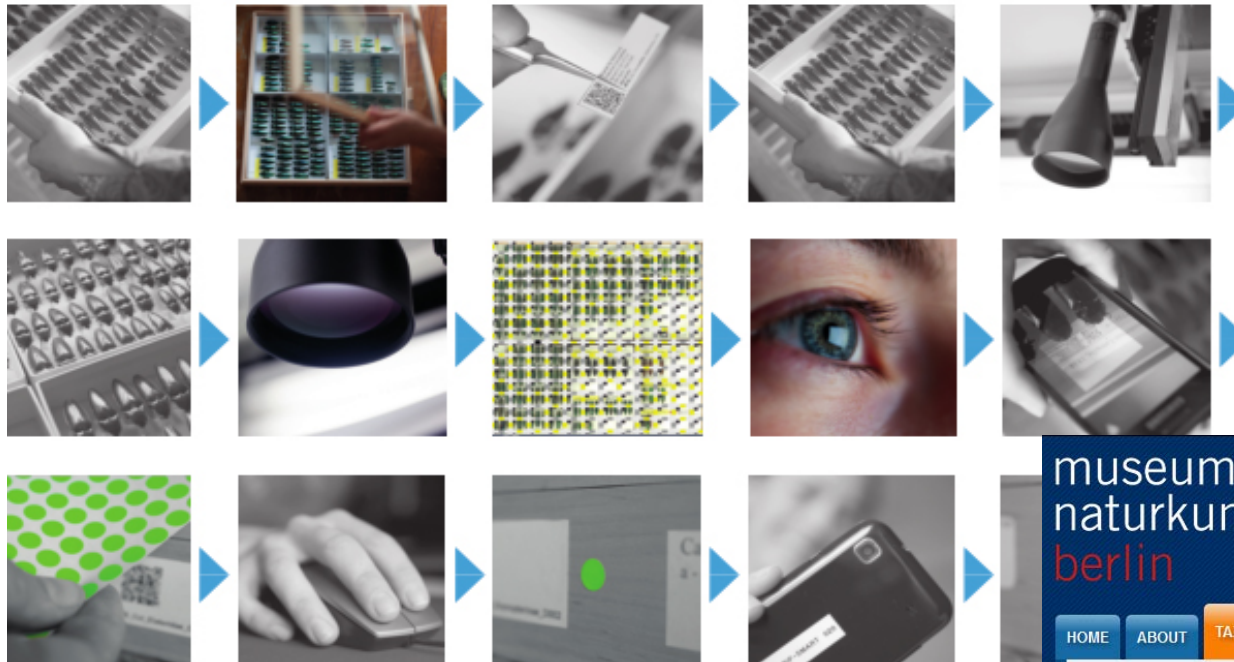


# Biodiversity legacy data - collections: large scale facilities





# Mass digitization approaches at MfN



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Open Drawer Project

HOME ABOUT TAXON SEARCH DRAWER SEARCH INSTITUTIONS CONTACT FAQ DISCLAIMER



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1 2 3 Next >

Drawer URI: [http://coll.mfn-berlin.de/u/ZMB\\_Phasm\\_D014](http://coll.mfn-berlin.de/u/ZMB_Phasm_D014)



## EU BON - key information



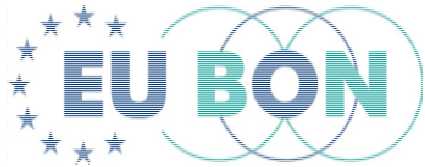
[www.eubon.eu](http://www.eubon.eu)

**EC FP7 - Cooperation Theme 6 “Environment (incl. climate change)”.**

- Call ENV.2012.6.2-2: Assessing global biological resources: the European contribution to the Global Earth Observation Biodiversity Observation Network (GEO BON)



- **Project start:** 1st December, 2012
- **Duration:** 54 months (until May 2017)
- **Project Coordination:** MfN, Berlin
- **Consortium:** 30 partners (18 countries)
- **Budget:** 11,6 mio Euro, <9 mio Euro EC contribution



## Main objective of EU BON



=> building a *European* contribution to **GEO BON (GEOSS)**

The main objective of EU BON is to build a substantial part of the Group on Earth Observation's Biodiversity Observation Network (**GEO BON**), ...

also in light of the new Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services (**IPBES**).





## EU BON proposes two related networking levels:

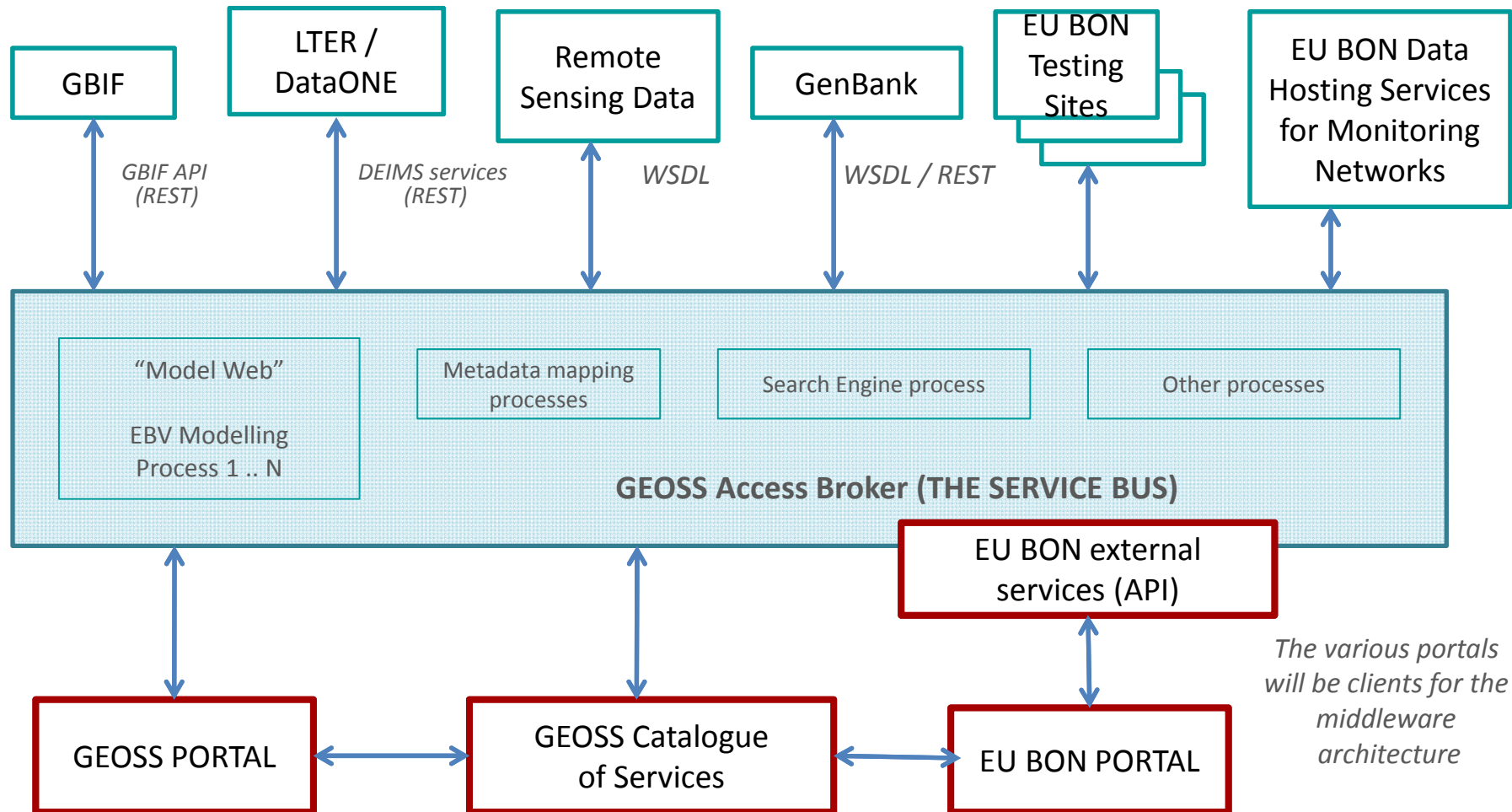
(1) a science-based ***social network***, comprising and connecting the *communities of practice* engaged in collecting, managing, analyzing, and utilizing biodiversity observations and data, and

(2) a **technological network** of interoperating IT infrastructures and systems that store and distribute information of all kinds held by multiple organisations and partners, and to provide a user-friendly platform for data analysis and interpretation.

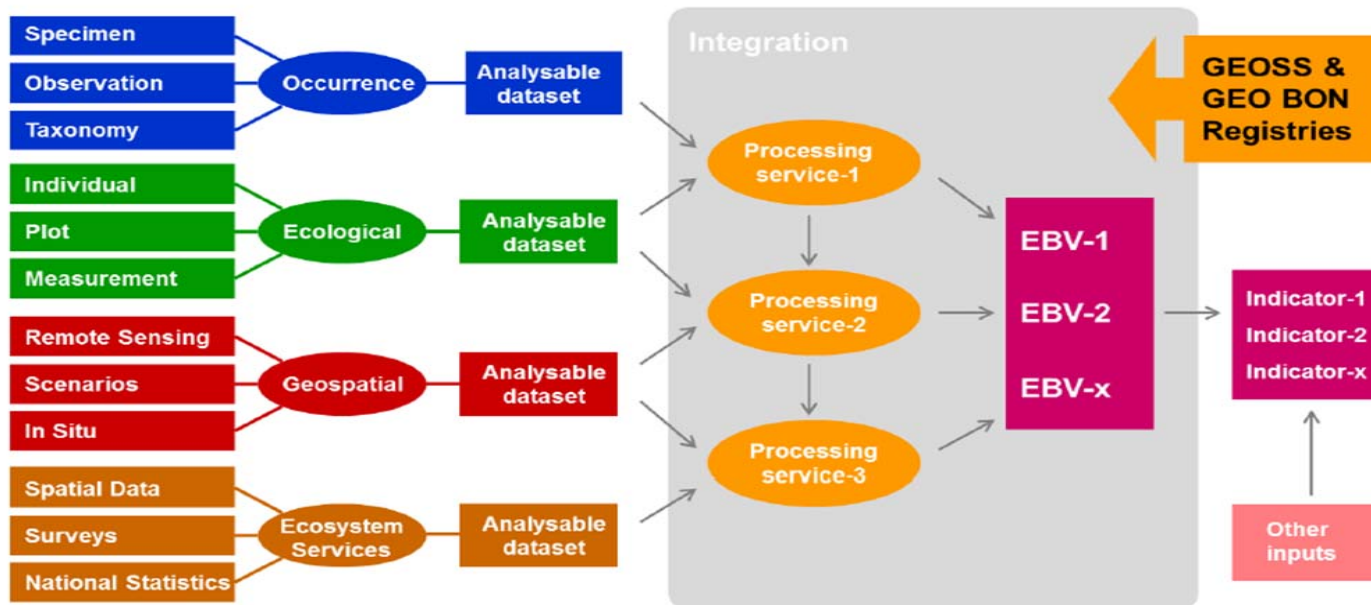
➤ For **resource efficiency**, the **EU (GEO) biodiversity information network (BON)** will build on **existing / emerging biodiversity recording schemes** and **information infrastructures** across Europe, and internationally, in particular:

**GEOSS, GBIF, LifeWatch, DataONE, LTER, TERENO**

# Information architecture



# EU BON –Data Flow + Integration



EU BON will be implementing the GEO BON vision:

- automated, streamlined data flow, from observations to Essential Biodiversity Variables (**EBVs**),
- using a plug-and-play service-oriented approach,
- coordinated through the GEO BON registry system
- linked to the [GEOSS Common Infrastructure \(GCI\)](#), and transparent to users through portals

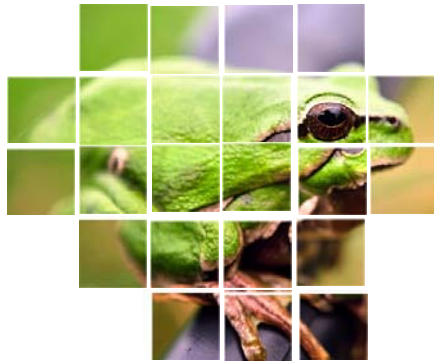


# New horizons – for biodiversity (monitoring) data!

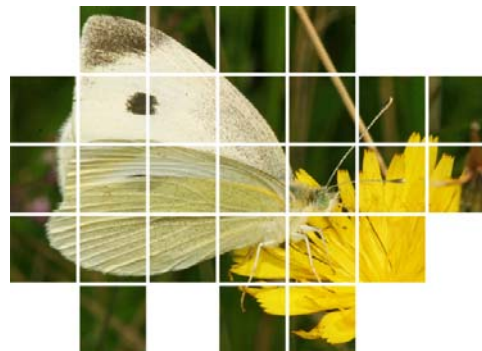
- Encourage/request free & open sharing of digital data / information – across institutions / communities / domains: adopt and implement **data policies**
- Implementation of international (meta-) **data standards** – by institutions, projects, + donors/funders!
- Coordinate/network **site-based long-term monitoring** efforts/programs – for Europe + globally
- Enlarge/Sustain international/global **information infrastructures** – big data for biodiversity!

# The Solution: Integration of Biodiversity Information

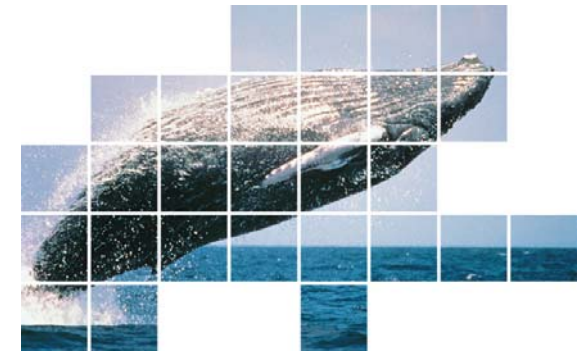
Freshwater



Terrestrial



Marine



## through:

- international data standards – for interoperability
- coordinated in situ monitoring schemes + sites
- international/global information infrastructures  
+ political harmonization!

# Acknowledgements

## Many thanks to:

- funding organizations: **BMBF**; BMUB; DFG; **EC** (DG R&I)
- all partners + colleagues in **EU BON**, **EDIT**, GBIF-D, NeFo, OpenUp!, ViBRANT, GFBio, in particular:
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  - Olaf Banki, *Samy Gajji*, Donald Hobern, *David Remsen*, Tim Robertson: GBIF Secretariat, Copenhagen





# Additional slides

# The biodiversity knowledge base – some shortcomings

**Scientific biodiversity inventory ongoing since > 250 years (1753 / 1758) :**

- no global checklist yet available!
- most countries without accurate / up-to-date national faunas / floras (inventories, checklists)!
- no complete species inventory for any Protected Area in the World!!
- majority of described organisms (species) are known from <10 specimens / records / publications!!!

**➔ Biodiversity crisis = information crisis !?!**

# Overall goals of EU BON

- Enabling greater **interoperability of data layers & systems**
- Advancing **data integration**
- Increasing **data mobilization** (from science and society)
- Harmonizing and mainstreaming **biodiversity recording and monitoring schemes**
- Improving **analytical tools and services**
- Linking **integrated information to relevant stakeholders**
- Strengthening **European capacities and infrastructures for environmental information management**

***„The new, integrative EU BON approach will facilitate (political) decisions in different sectors concerned with biodiversity for human well-being at different levels, ranging from local park management to national governments, and IPBES.“***



# EU BON consortium partners (30)



www.gbif.org  
GLOBAL BIODIVERSITY INFORMATION FACILITY



NORWEGIAN BIODIVERSITY INFORMATION CENTRE



SENCKENBERG  
world of biodiversity



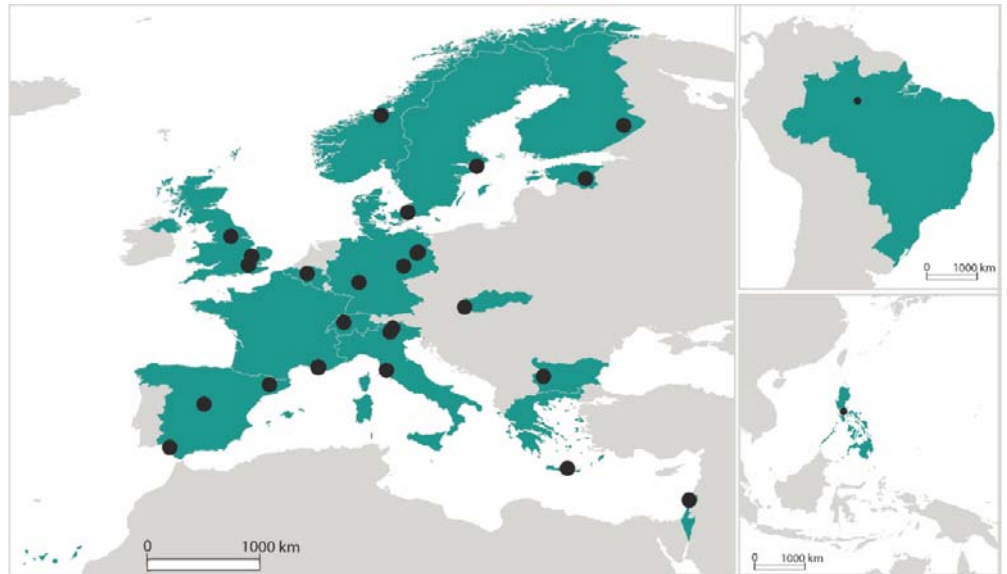
NATURAL HISTORY MUSEUM



WCMC



GlueCAD  
Engineering IT Portal



Map: Johannes Penner

