Biodiversity information systems in Japan and Asia: Current status and perspective

Motomi Ito, The University of Tokyo

Three layers of Biodiversity Information usages

Creating

- Creating and Collecting biodiversity data
- Capacity building

Sharing

- Networking biodiversity resources
- Sharing and integrating biodiversity data

Utilizing

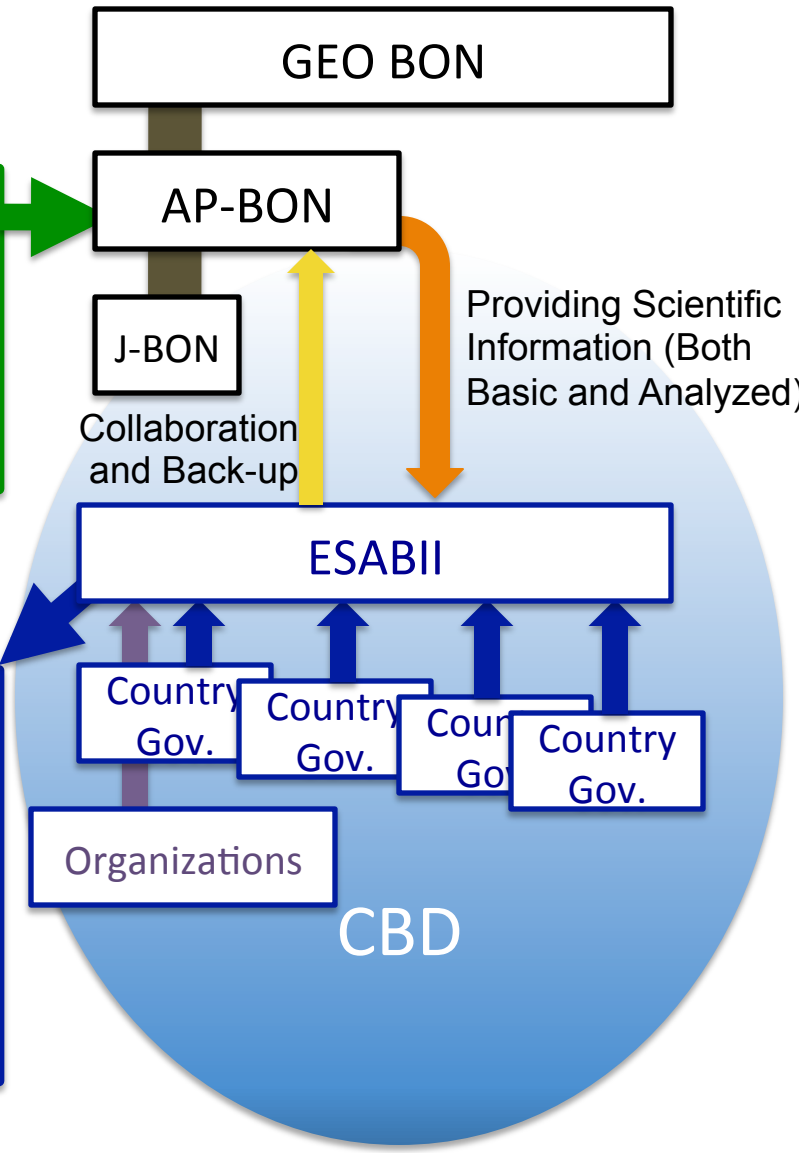
- Aggregating and summarizing the integrated biodiversity data

Policies and Actions

AP-BON and ESABII

Research Institutes and/or
Researchers Driven Network

- **AP-BON** (Asia and Pacific) and **J-BON** (Japan) will:
  - **Connect existing networks** on biodiversity projects
  - **Establish a database network** on biodiversity data
- **ESABII** (East and Southeast Asia Biodiversity Information Initiative) will:
  - **Provide a decision making supporting system** by aggregating and summarizing biodiversity data
  - **Establish a capacity building** with the aim of evaluation of biodiversity based on the information

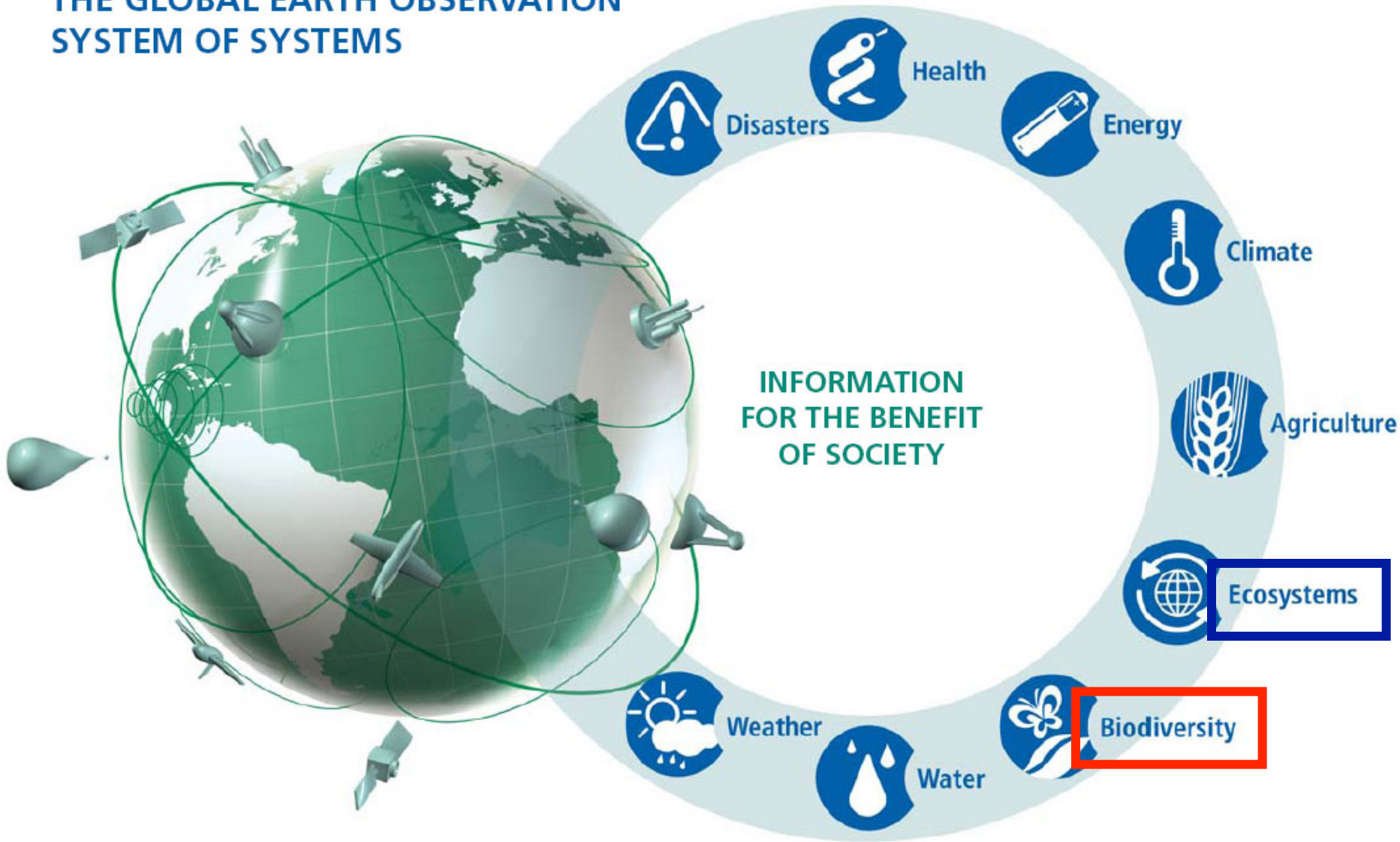


Quick View of Biodiversity information Activities

- Species Occurrence Data
  - GBIF
- Ecological Data
  - Introduction of our activities in GRENE Environment Information

GEOSS

THE GLOBAL EARTH OBSERVATION SYSTEM OF SYSTEMS

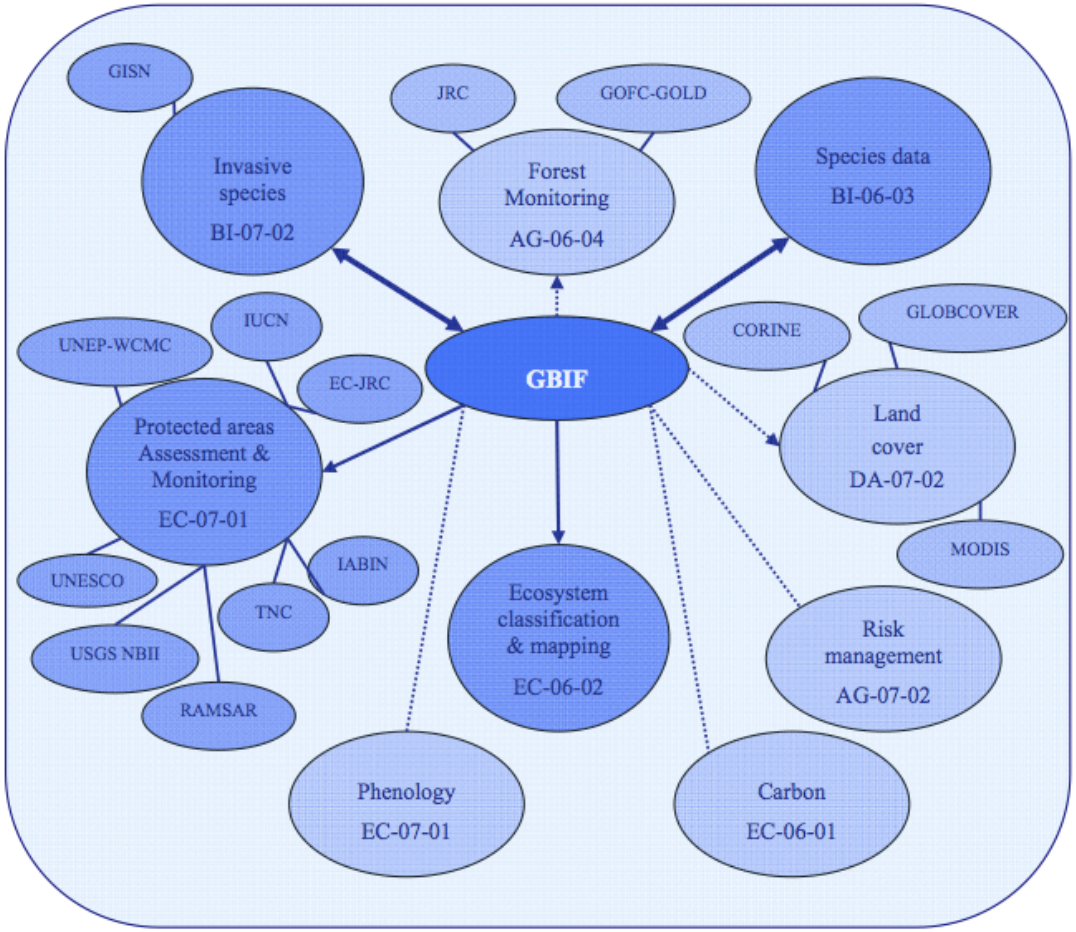


GEO BON

GEO Biodiveristy Observation Network

GROUP ON EARTH OBSERVATIONS

GEO-V – 19-20 November 2008 **Document 20**



GBIF

Global Biodiversity Information Facility

http://www.gbif.org

GBIF

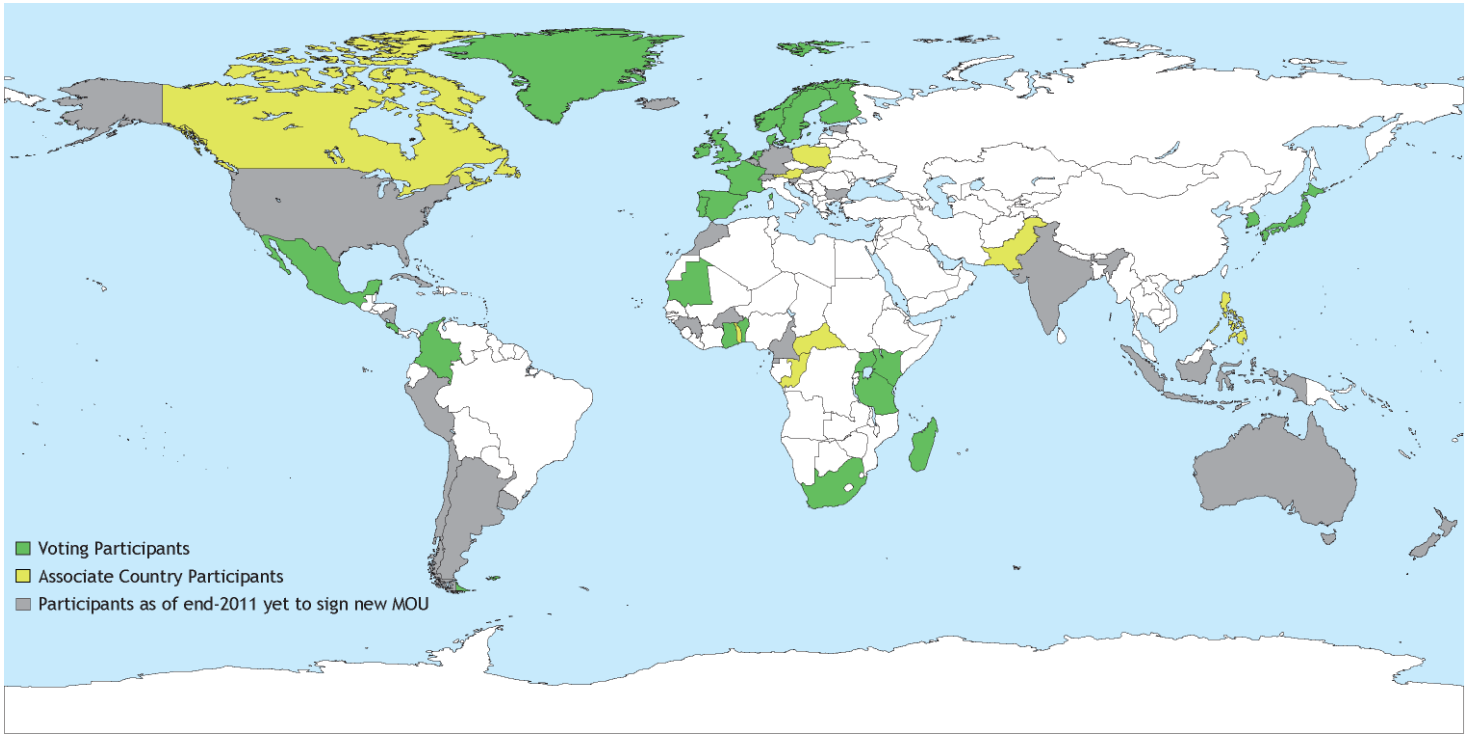
- 1st period 2002-2006

  Prototyping
- 2nd period 2007-2011

  From prototype towards full operation
- 3rd period 2012-2016

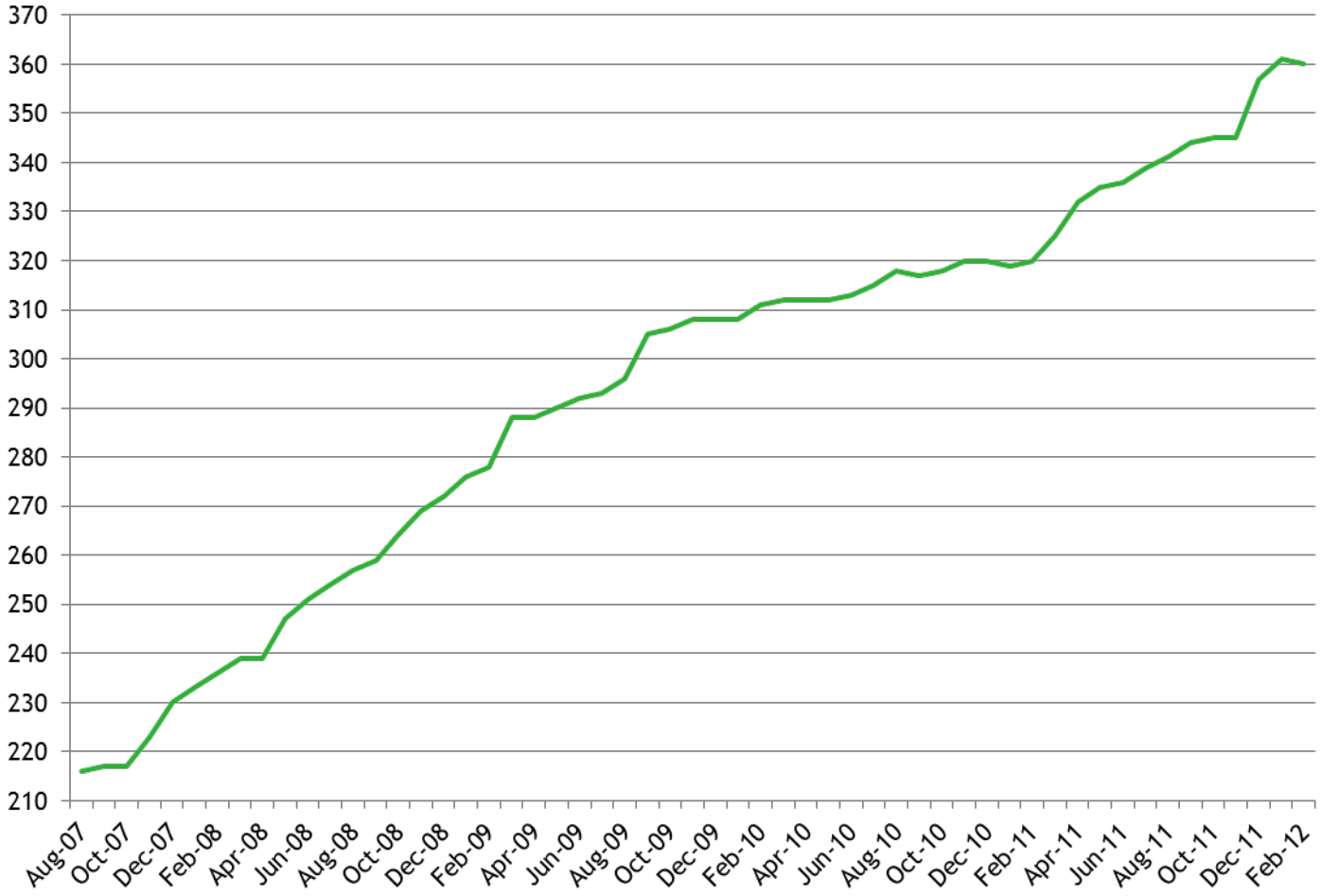
  Seizing the Future

GBIF participants (end 2011)

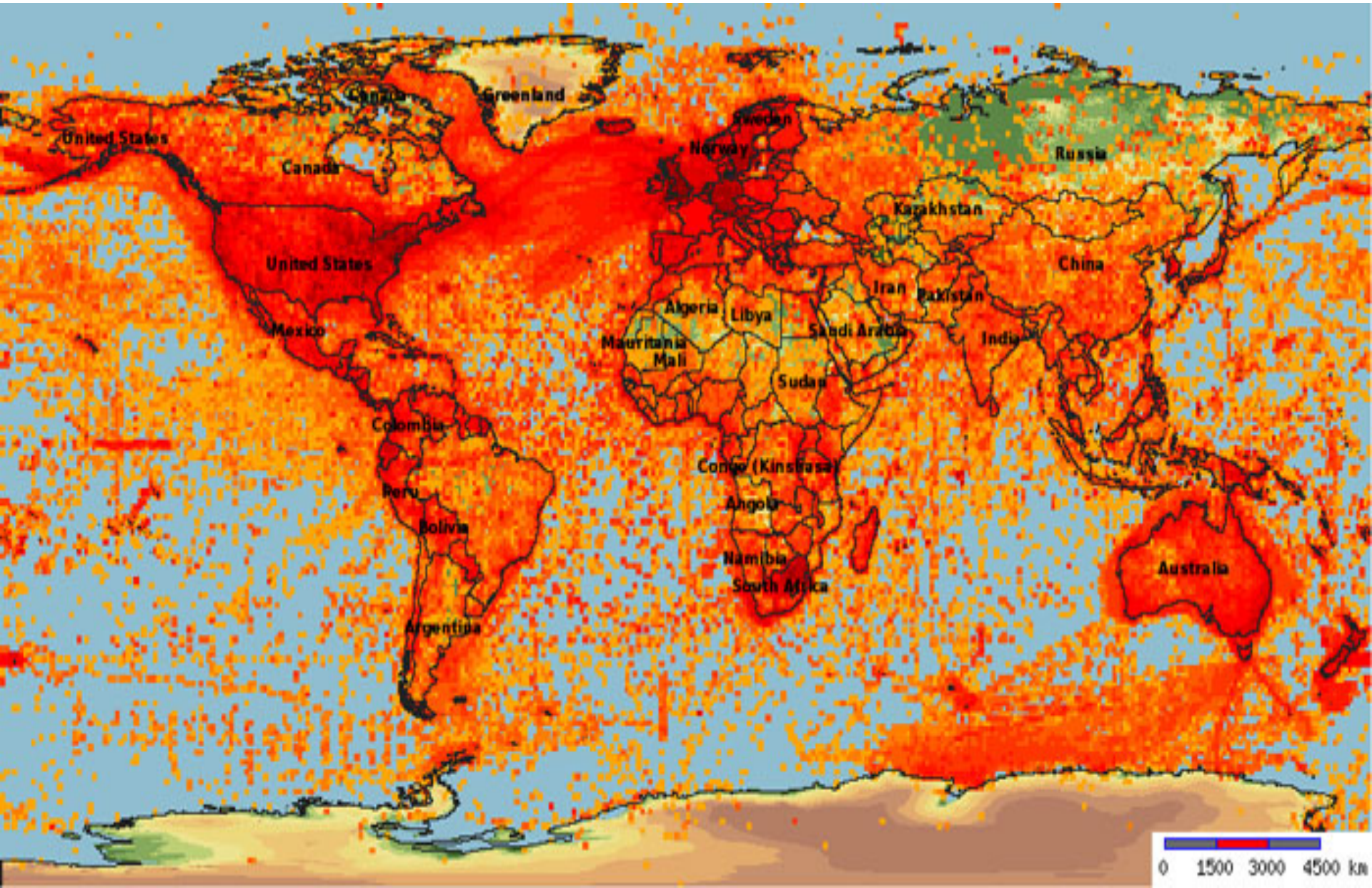


GBIF Country Participants – 57
GBIF Participant organizations and economies – 47

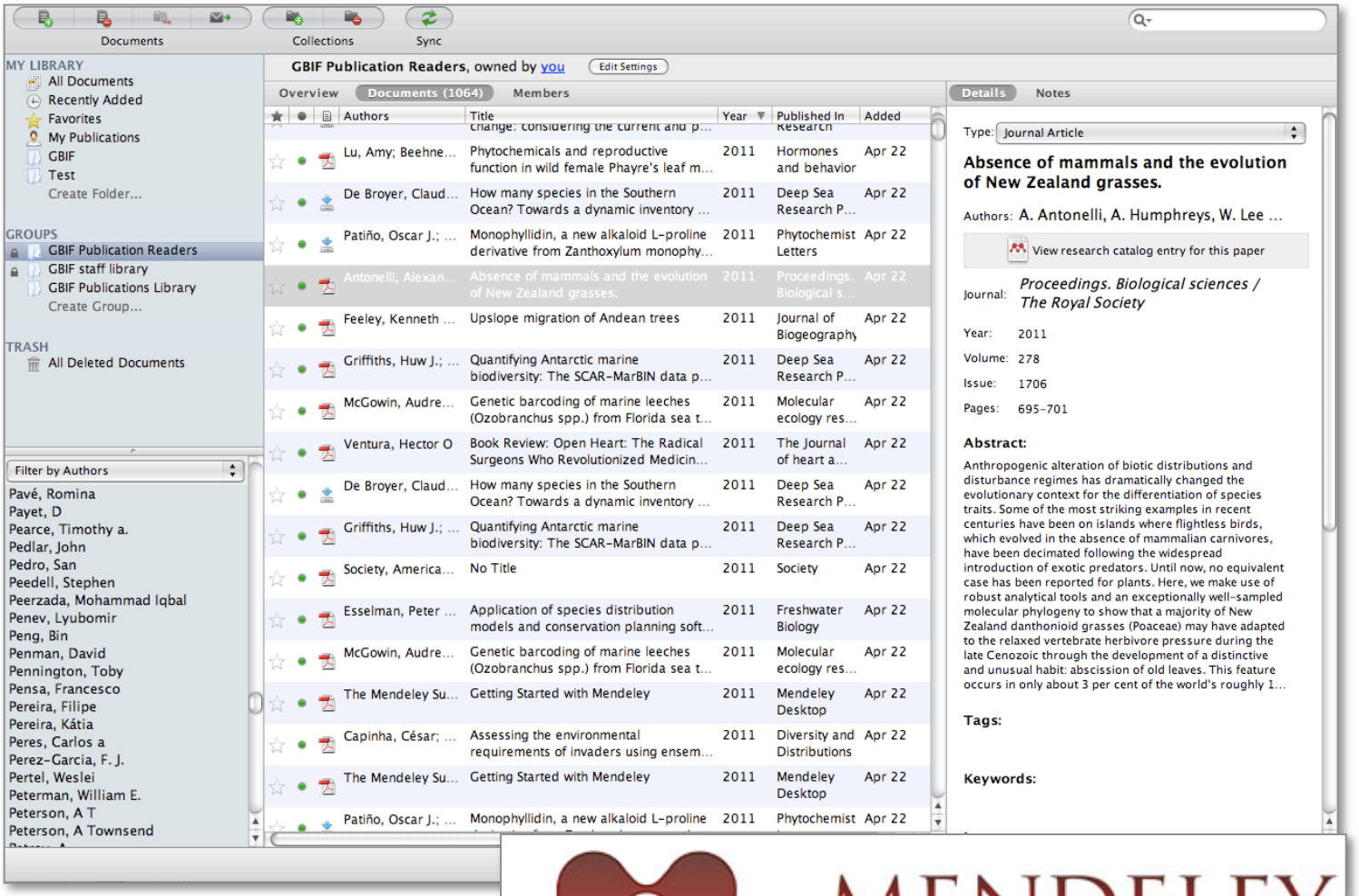
GBIF-mediated data



Data coverage

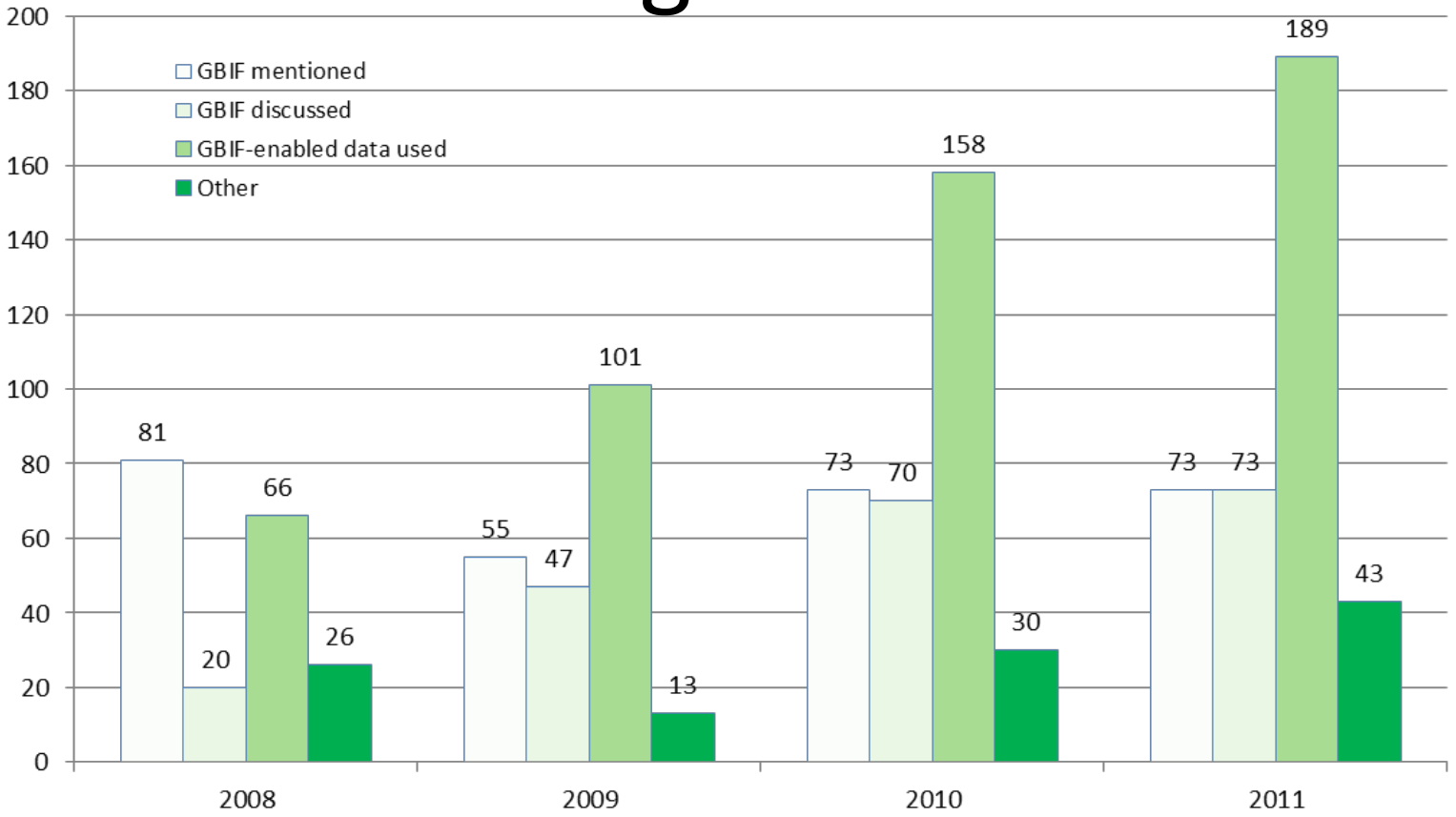


Monitoring data usage



MENDELEY
RESEARCH NETWORKS

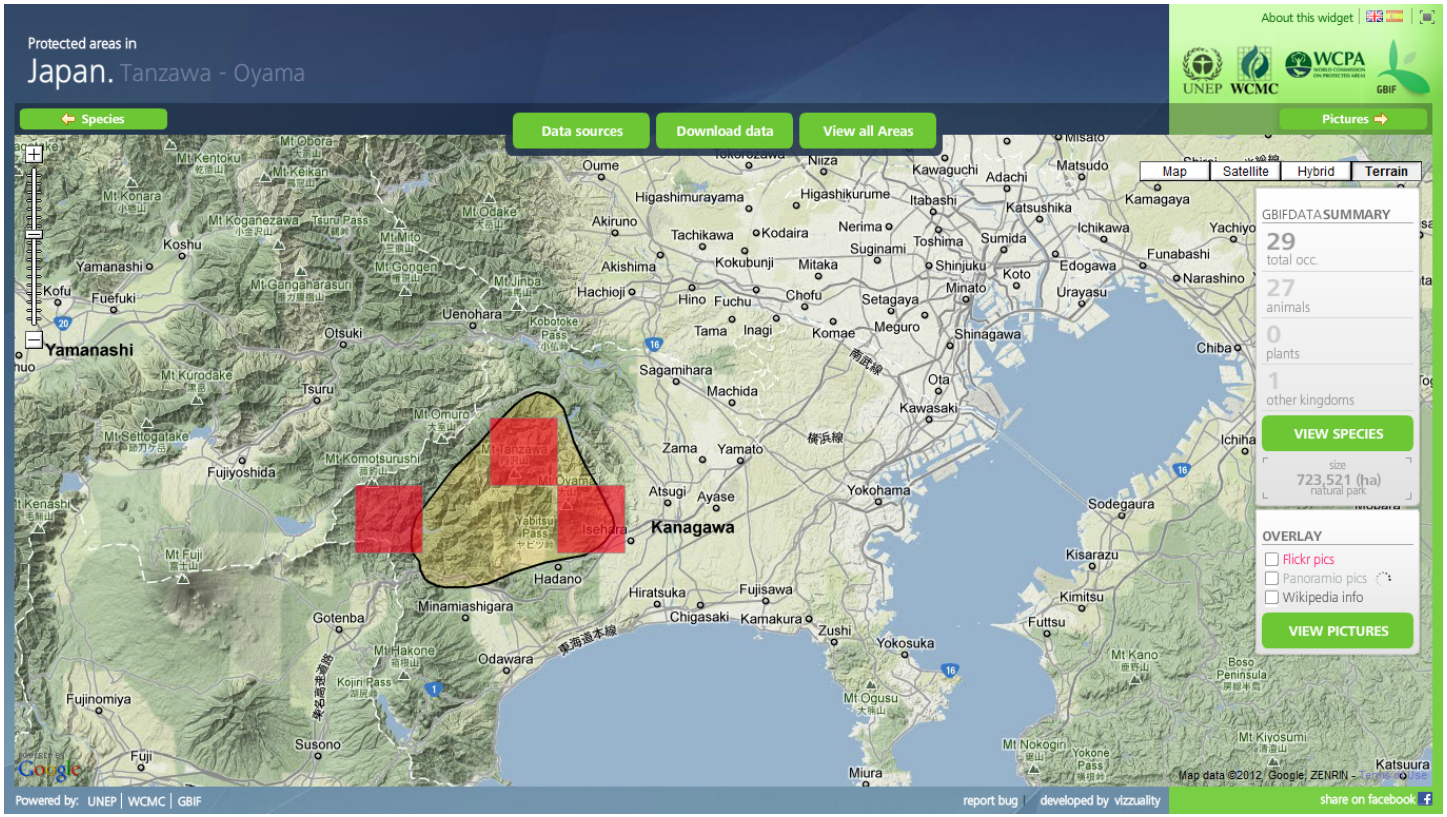
Increasing use of data



Scientific papers referencing GBIF and using GBIF data:

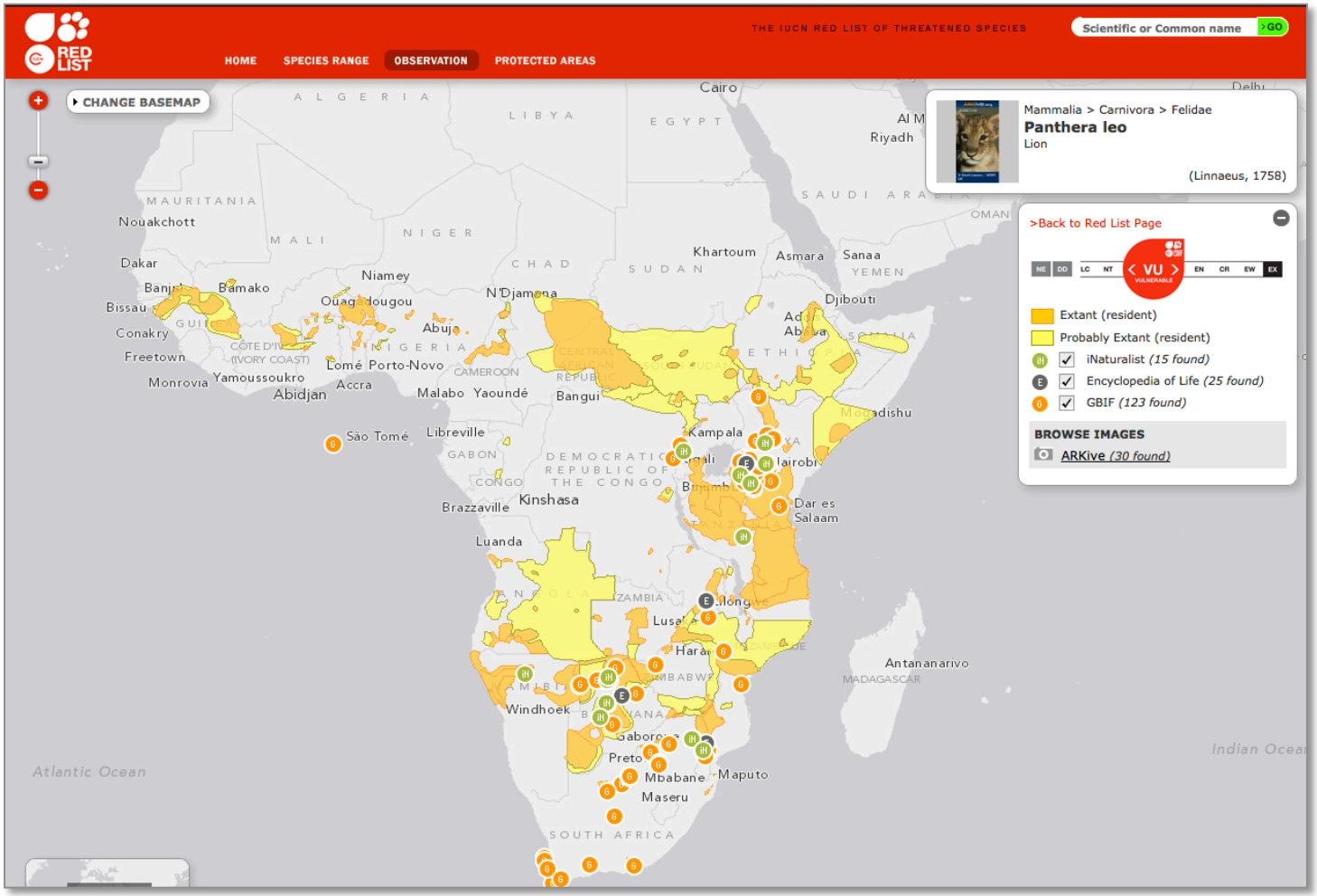
- **Ecological Niche Modeling** (e.g. climate change, invasive species)
- **Agriculture**
- **Taxonomy** (and identification of species)
- **Conservation actions**
- **Biodiversity inventory** (survey, species distribution)
- **Intra-specific variation** (genomics, molecular biology)
- **Human health**

Uses: WDPA



Integration of GBIF data with World Database of Protected Areas

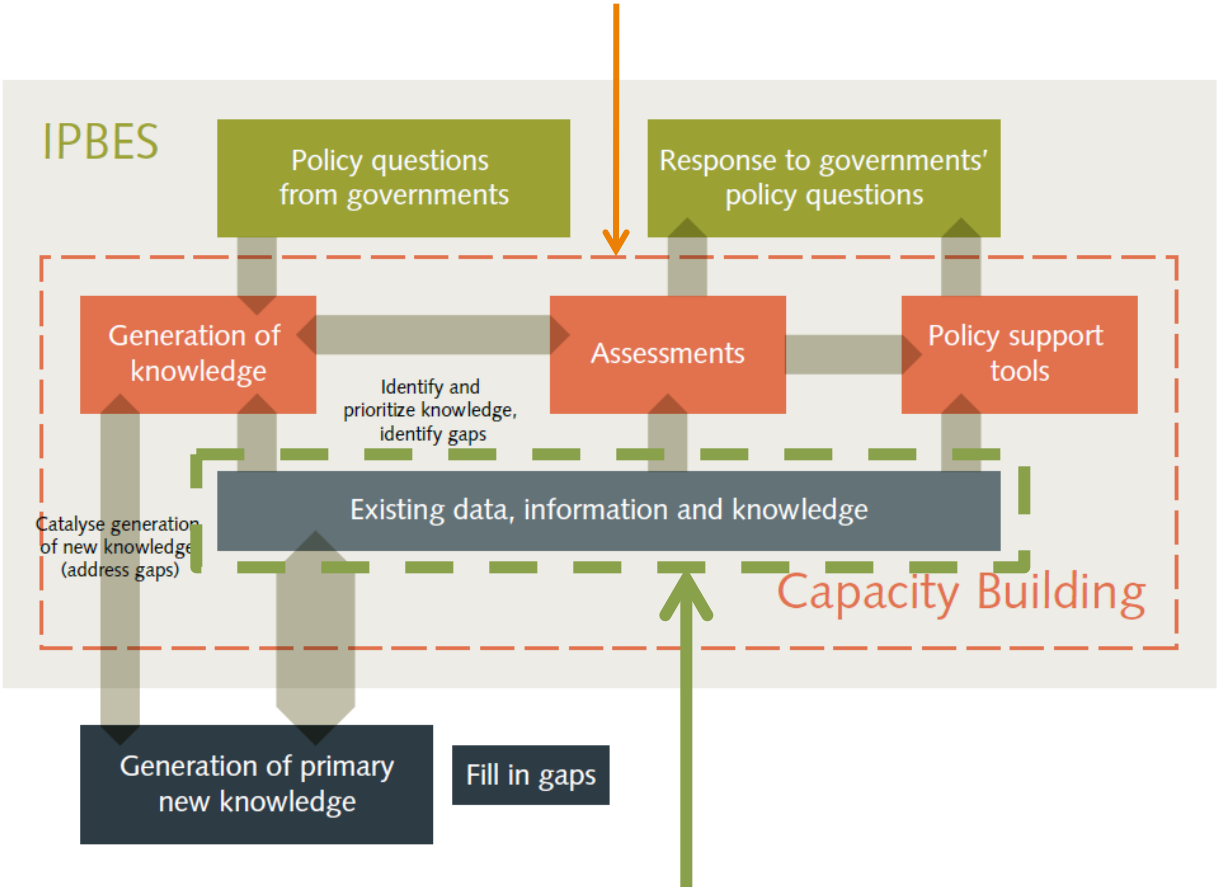
Uses: Red List



Integration of GBIF data with IUCN Red List

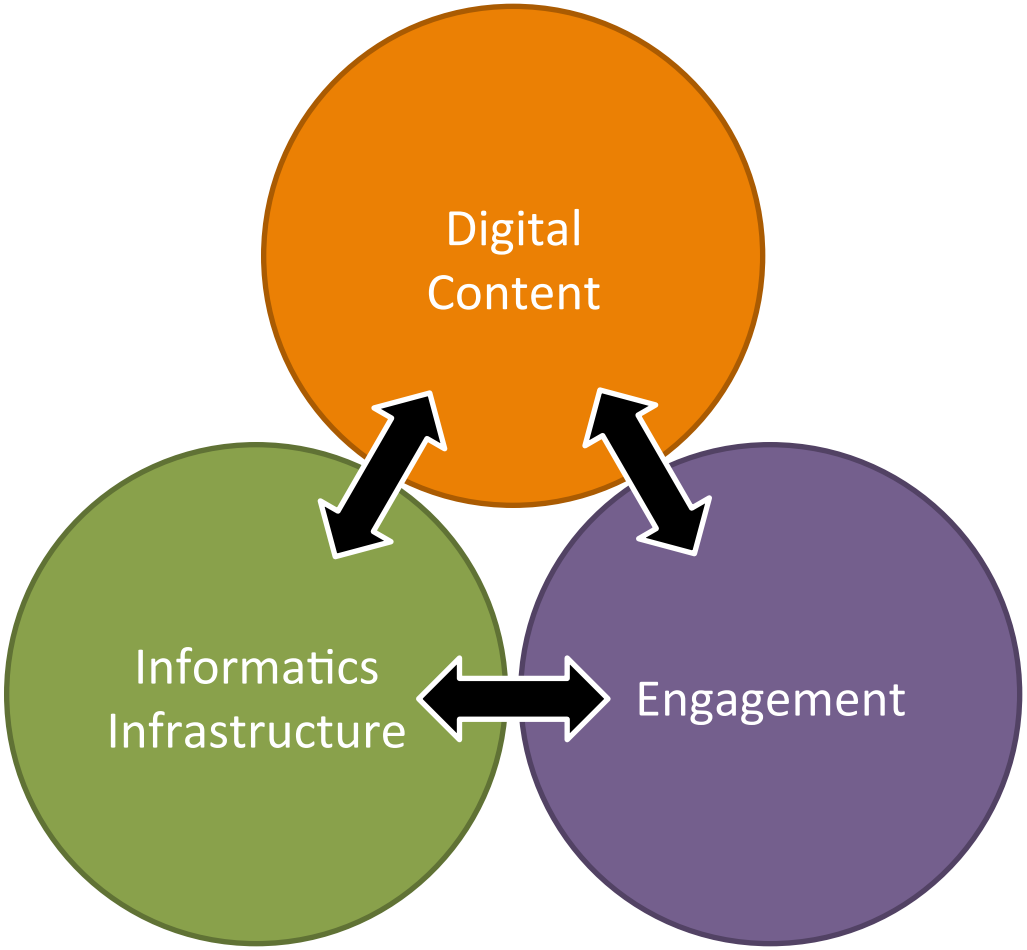
GBIF and IPBES

Intergovernmental Science-Policy Platform on Biodiversity & Ecosystem Services (**IPBES**): **Science to support policy**



Global Biodiversity Information Facility (**GBIF**):
Data to support science

GBIF Strategic Imperatives

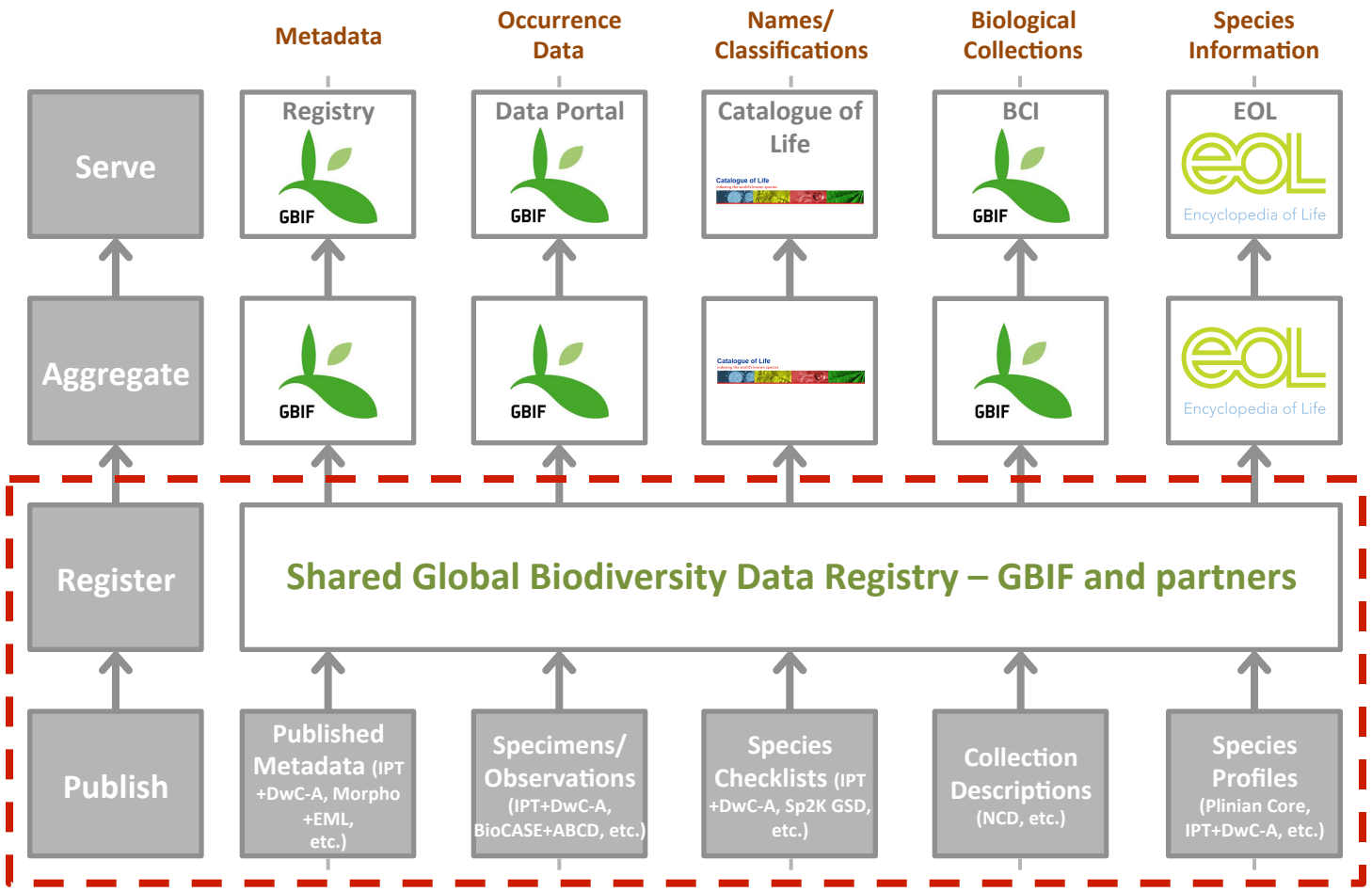


Advance three integrated strategic imperatives

GBIF's unique role

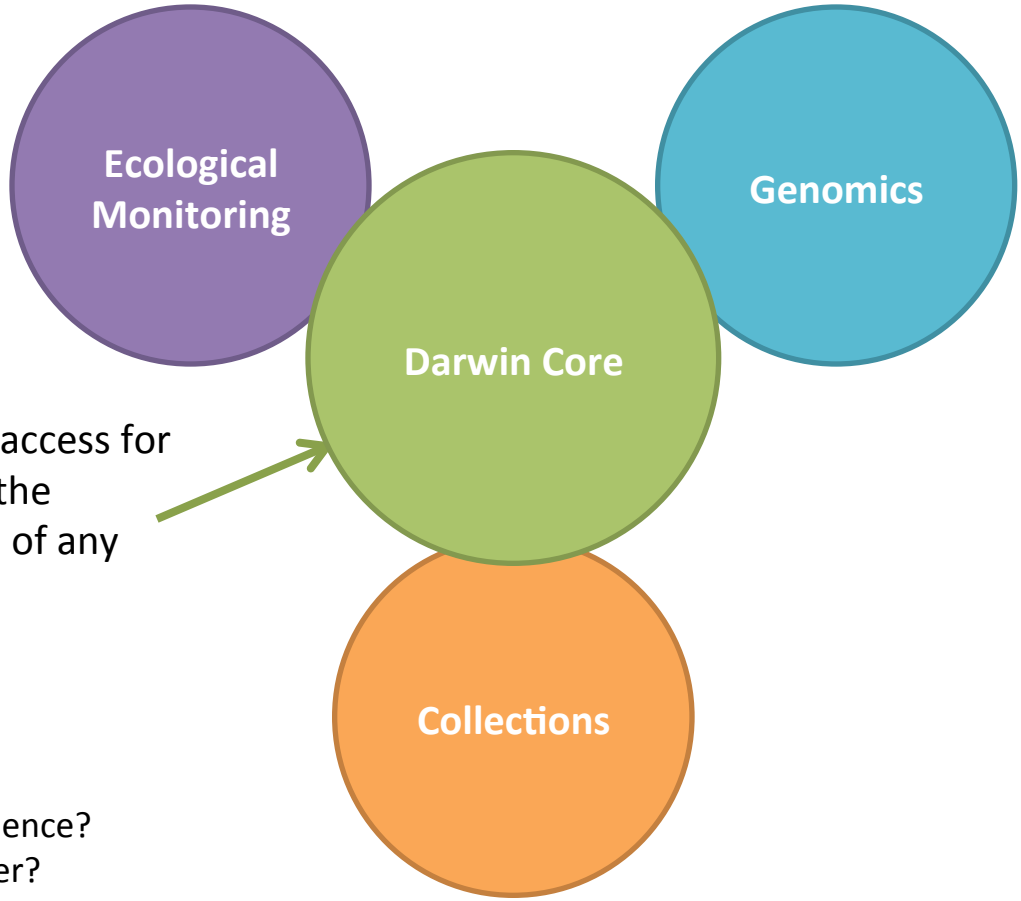
- Registry of biodiversity data resources
- Global virtual natural history collection
- Link data from collections, ecology and genomics
- Biodiversity data for GIS analysis and environmental monitoring
- Tools and support for biodiversity data publication
- Network development at national, regional and global levels

Global data products



Common open-access foundations from which others can also aggregate and serve data

Unifying species data

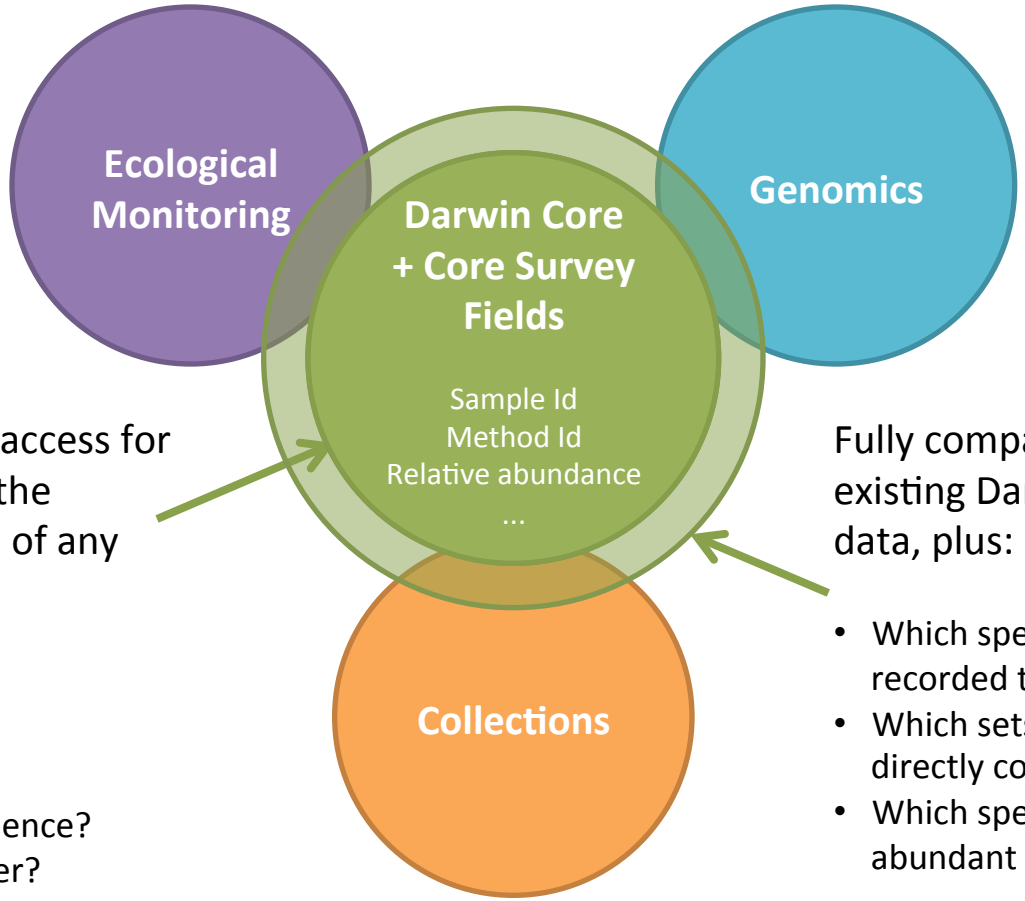


Integrated access for records of the occurrence of any species:

- What?
- When?
- Where?
- What evidence?
- Data owner?
- Link to full record

<u>Presence only</u>

Unifying species data



Integrated access for records of the occurrence of any species:

- What?
- When?
- Where?
- What evidence?
- Data owner?
- Link to full record

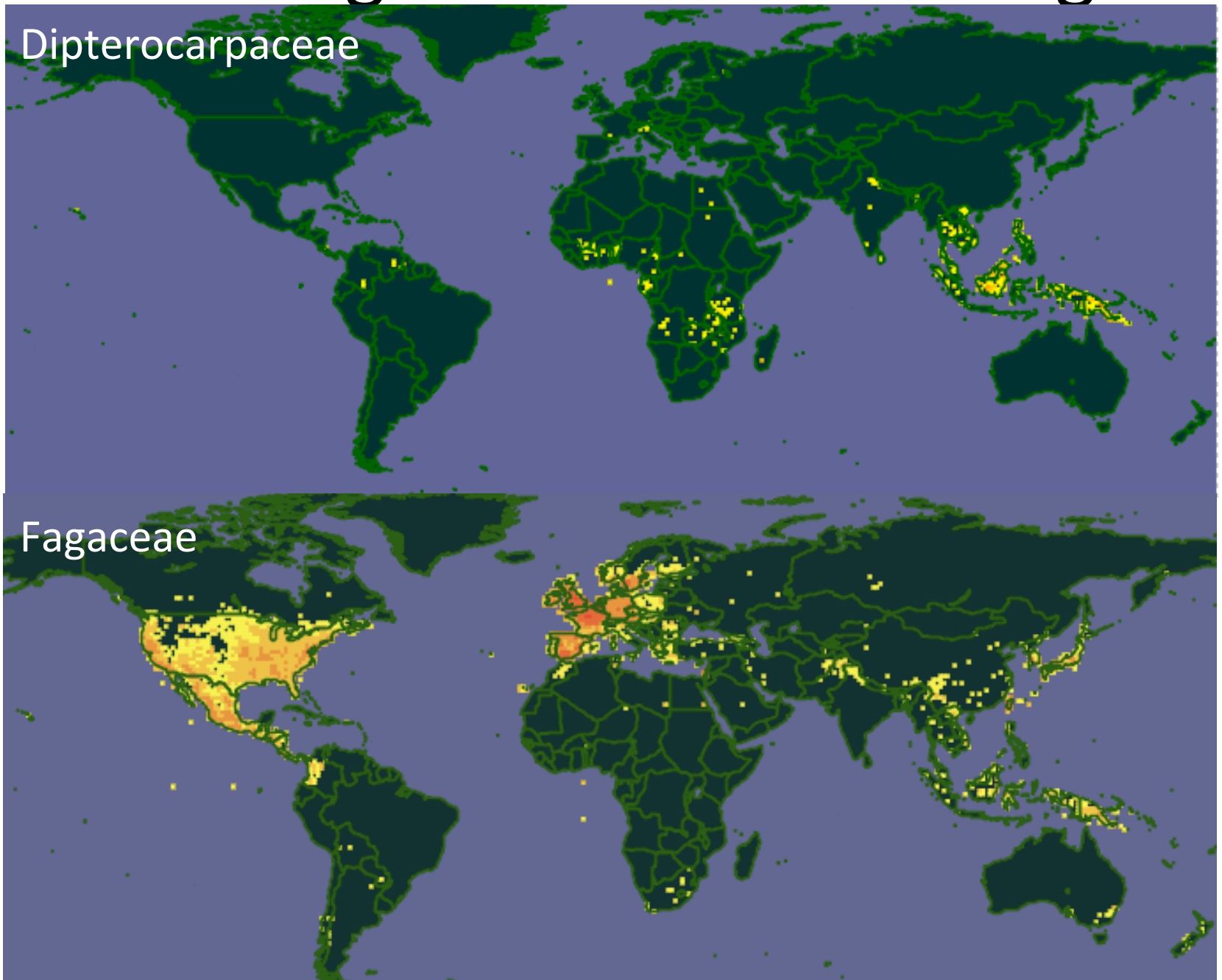
<u>Presence only</u>

Fully compatible with existing Darwin Core data, plus:

- Which species were recorded together?
- Which sets of data are directly comparable?
- Which species were most abundant in each sample?

<u>Presence/absence</u>

Increasing data from Asian region



Join to GBIF Global Network and Share Biodiversity Data

- Participant Countries
- Regional Initiative
  - ASEAN countries: ASEAN Center for Biodiversity (ACB)
  - Himalayan Region: International Centre for Integrated Mountain Development (ICIMOD)
  - Pacifics: Pacific Biodiversity Information Forum (PBIF)

Ecological Data

GEO BON – GBIF working group for standardizing Ecological Data

- Use of EML in GBIF Metadata
- DarwinCore 2.0 Extension for Ecological Data

ILTER working group

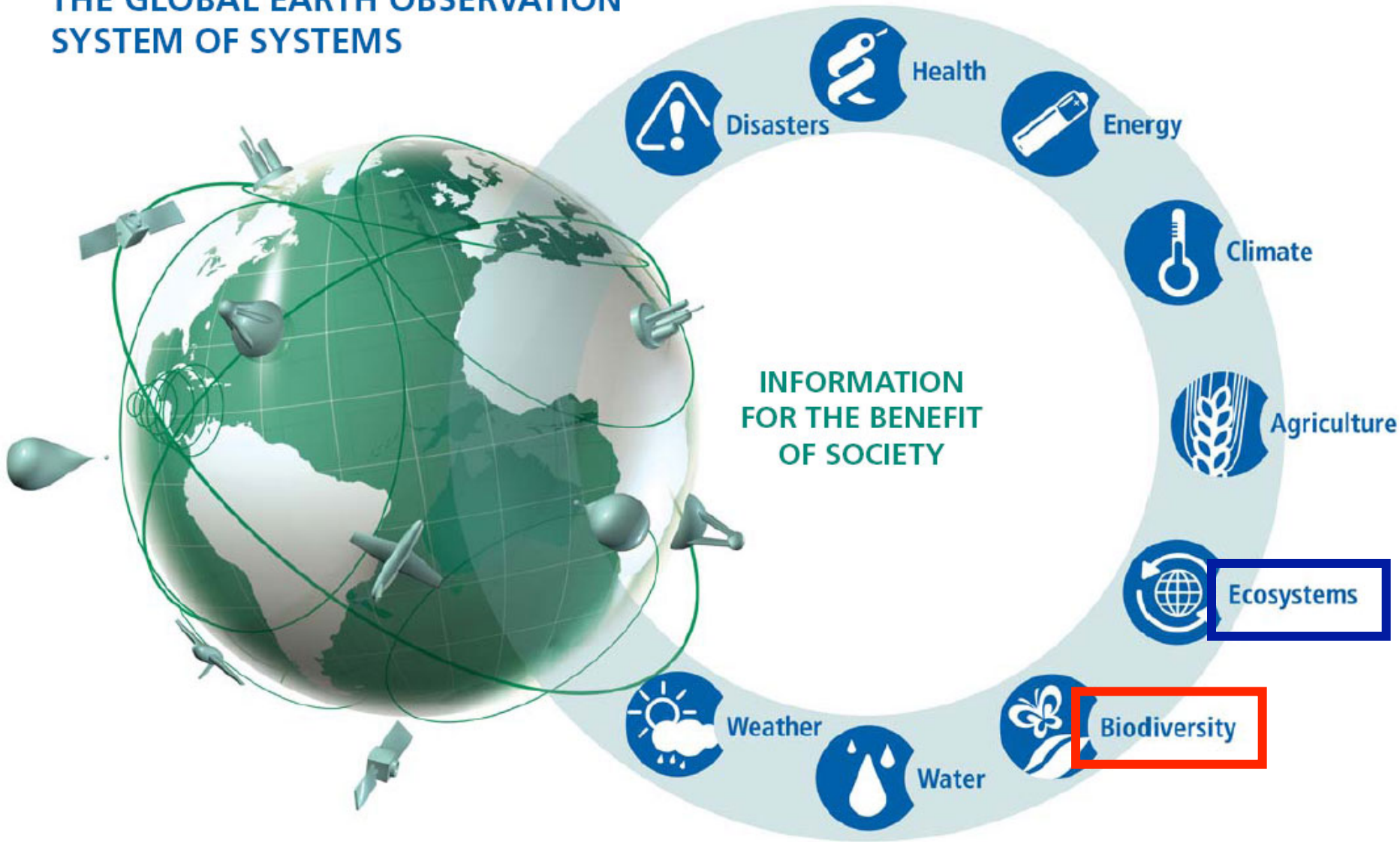
GRENE (Green Network of Excellence) Biodiversty,Ecosystem

2011-2015 fys project MEXT, PI: Motomi Ito

Purpose:

GEOSS

THE GLOBAL EARTH OBSERVATION SYSTEM OF SYSTEMS



DIAS Data Integration & Analysis System

Data Opening

Click Here !!

Contact・Access | Site Map | Member Limitation | 日本語

News | About DIAS | Projects | Member | Symposium | Link | Publication

TOP > English

DIAS, creating global knowledge and awareness to support better management of one precious Earth

What is DIAS?

Human activities have large impacts on the environment and are responsible for global warming, ecosystem degradations, increased threats to industrial activities, and increased losses from natural hazards such as floods and droughts that arise from large fluctuations in the climate To address these problems, society needs access to usable information on the environment to deepen our understanding of the earth environment, to improve our predictive ability, and to make sound decisions on risk and resources management through the best possible use of earth observation data.

Data Integration and Analysis System (DIAS) was launched in 2006 as part of the Earth Observation and Ocean Exploration System, which is one of five National Key Technologies defined by the 3rd Basic Program for Science and Technology of Japan. The mission of DIAS is:

-to coordinate the cutting-edge information science and technology and the various research fields addressing the earth environment;
-to construct data infrastructure that can integrate earth observation data, numerical model outputs, and socio-economic data effectively;
-to create knowledge enabling us to solve the earth environment problems; and
-to generate socio-economic benefits.

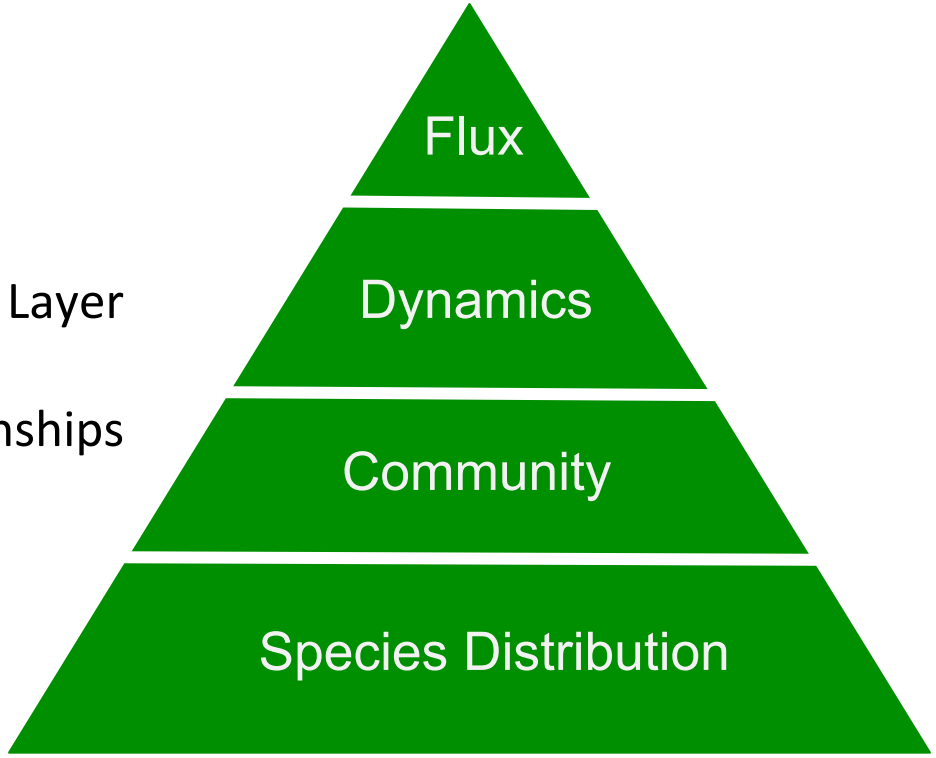
http://www.editoria.u-tokyo.ac.jp/dias/english/index.html

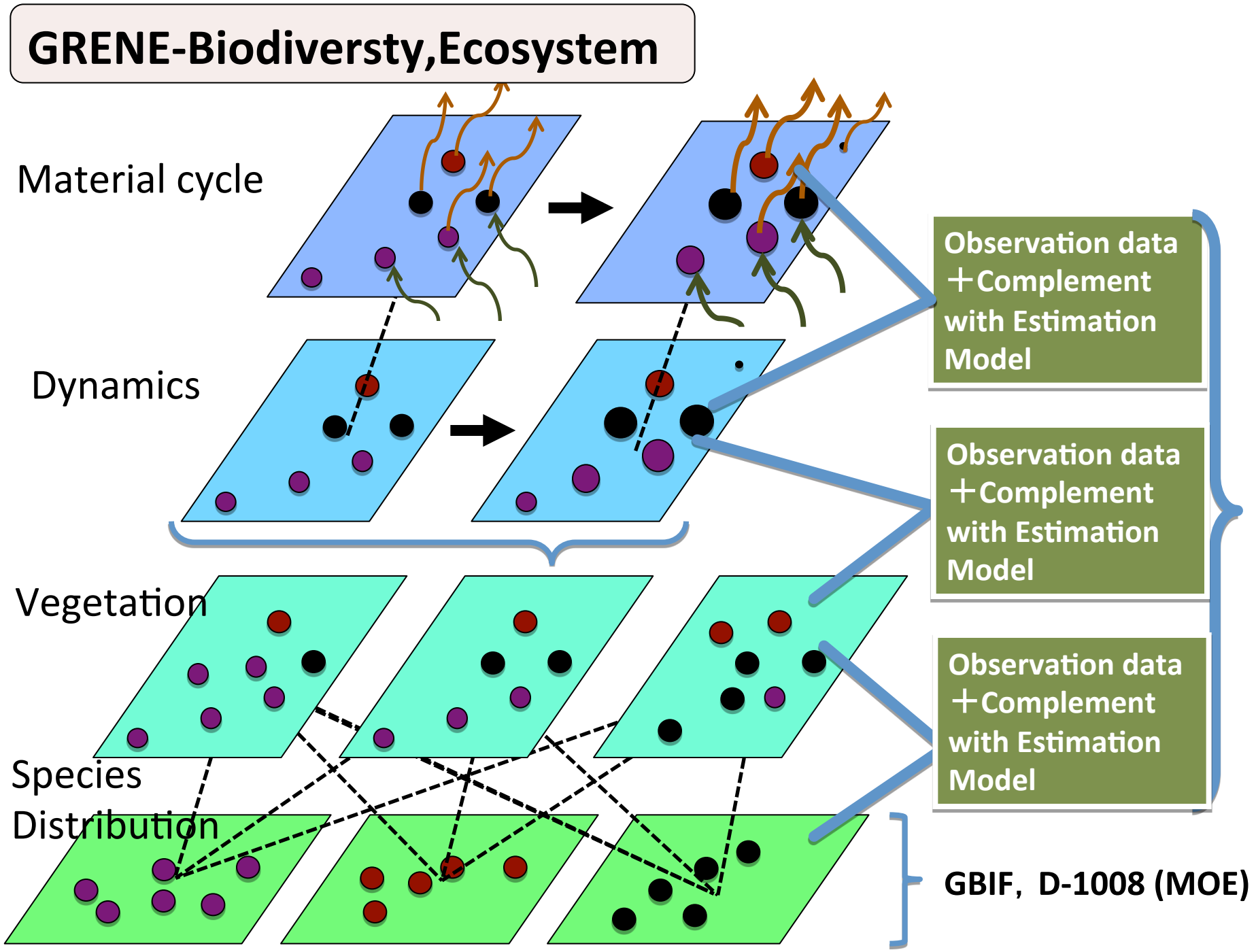
Strategy for Dealing Ecological Data

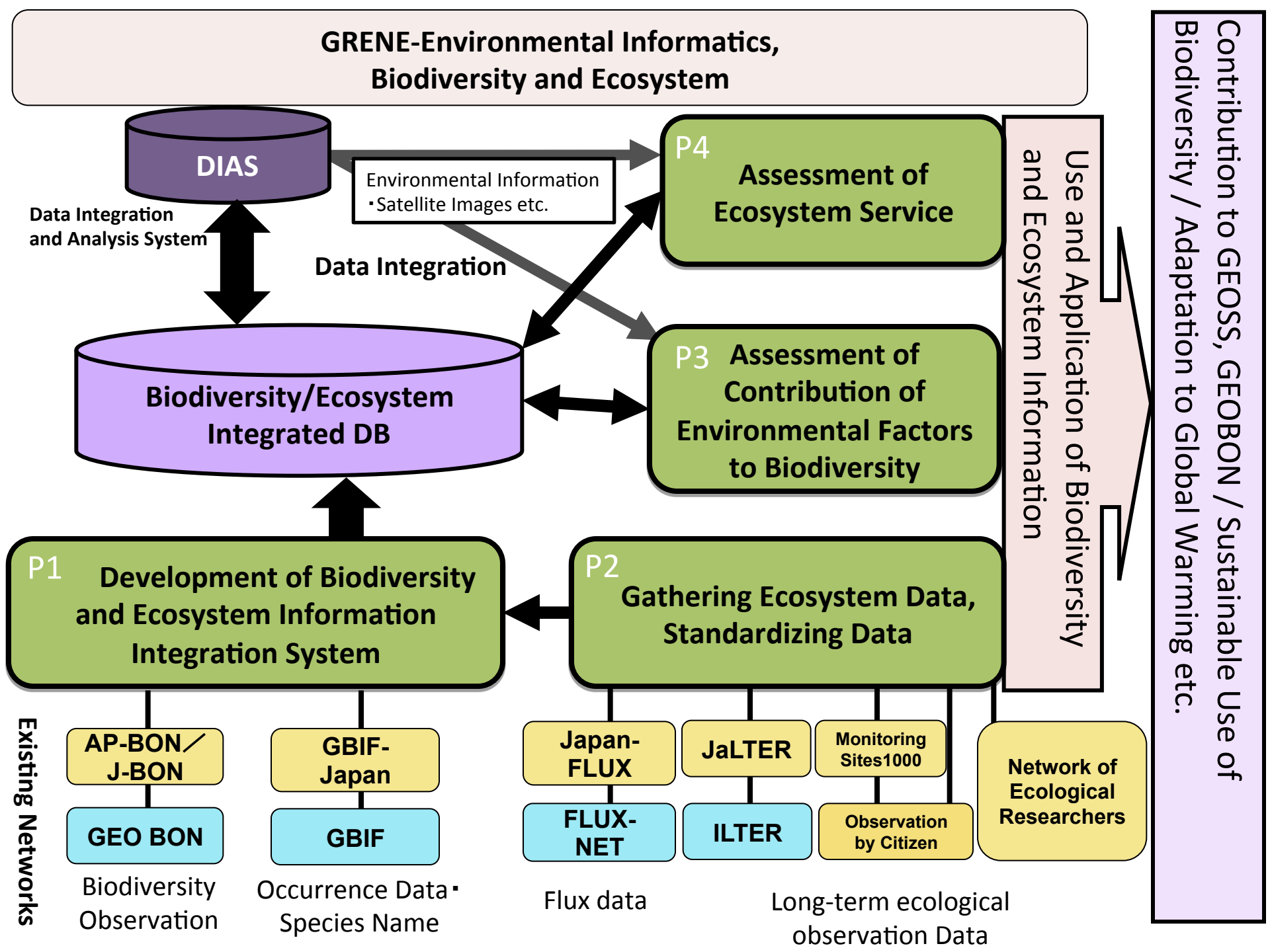
How can we treat Ecological Information?

Connecting Layers

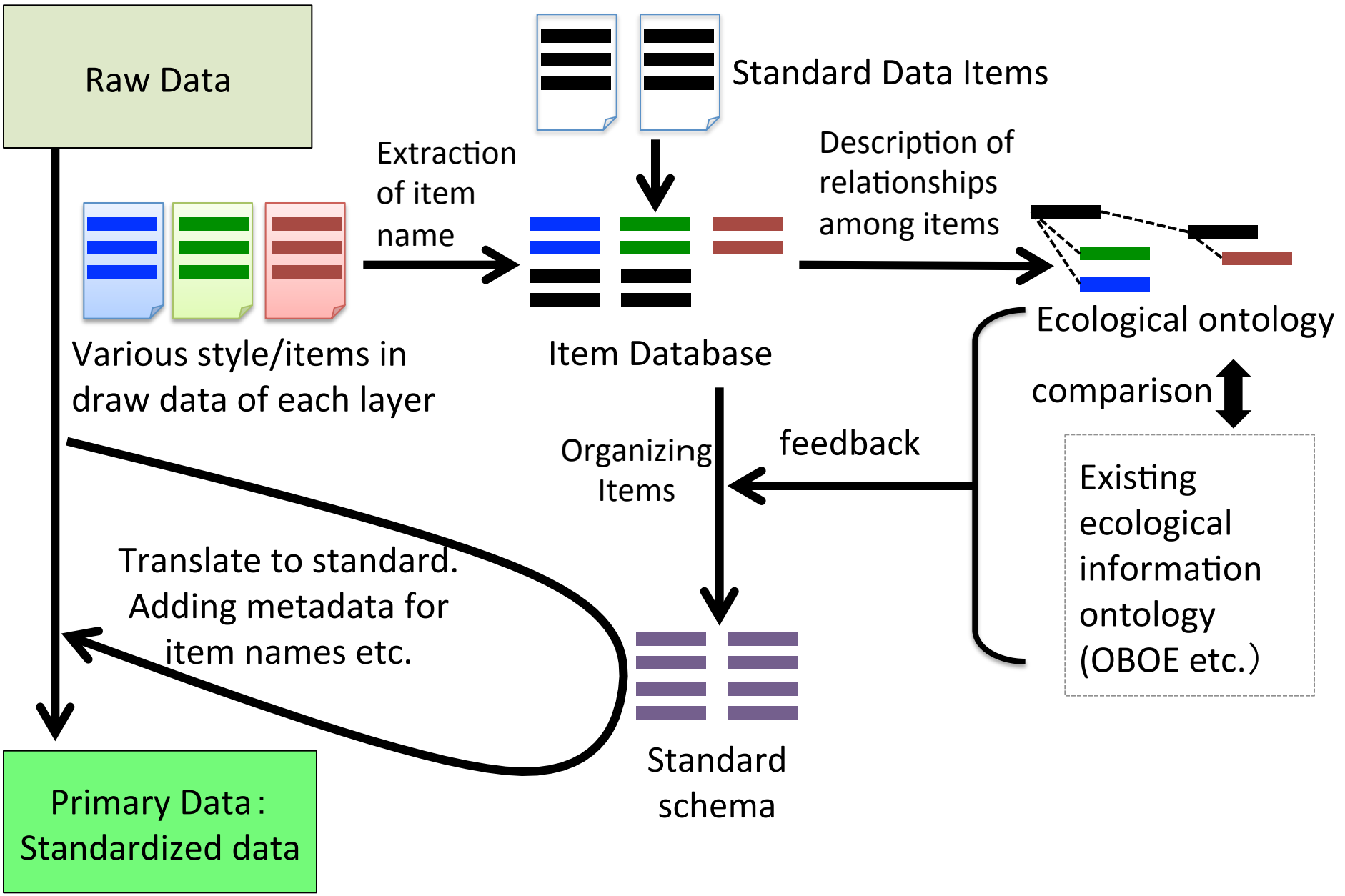
- Define Standard Scheme for each Layer
- Use Same Ontology (e.g. EML)
- Create Models describing Relationships between Layers



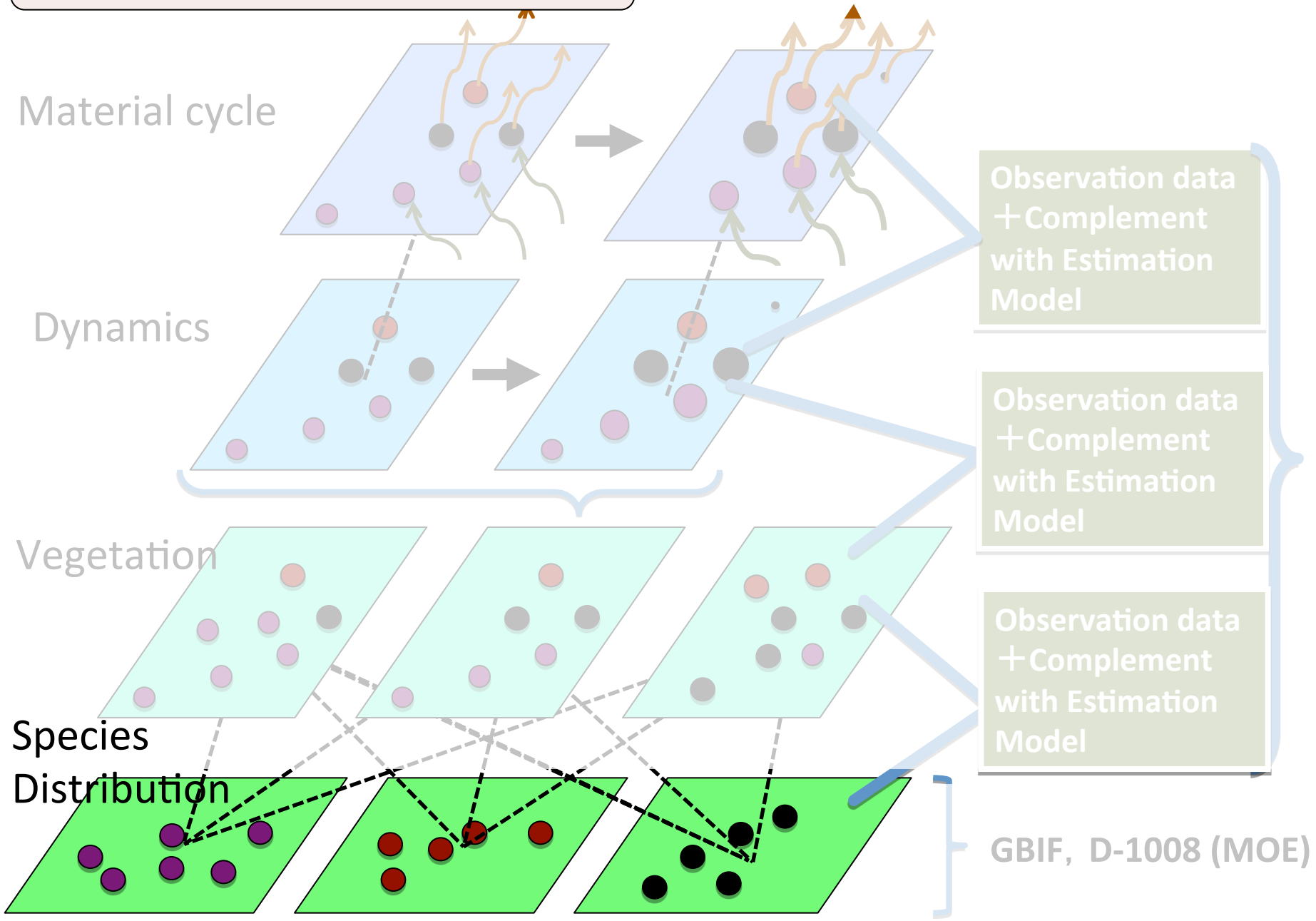

GRENE-Biodiversty,Ecosystem
Material cycle
Dynamics
Vegetation
Species Distribution
Observation data ＋Complement with Estimation Model
Observation data ＋Complement with Estimation Model
Observation data ＋Complement with Estimation Model
GBIF, D-1008 (MOE)


GRENE-Environmental Informatics, Biodiversity and Ecosystem
DIAS
Data Integration and Analysis System
Environmental Information ・Satellite Images etc.
Data Integration
P4 Assessment of Ecosystem Service
P3 Assessment of Contribution of Environmental Factors to Biodiversity
Biodiversity/Ecosystem Integrated DB
P1 Development of Biodiversity and Ecosystem Information Integration System
P2 Gathering Ecosystem Data, Standardizing Data
Use and Application of Biodiversity and Ecosystem Information
Contribution to GEOSS, GEOBON / Sustainable Use of Biodiversity / Adaptation to Global Warming etc.
Existing Networks
AP-BON／J-BON
GEO BON
Biodiversity Observation
GBIF-Japan
GBIF
Occurrence Data・Species Name
Japan-FLUX
FLUX-NET
Flux data
JaLTER
ILTER
Monitoring Sites1000
Observation by Citizen
Network of Ecological Researchers
Long-term ecological observation Data

Standardization



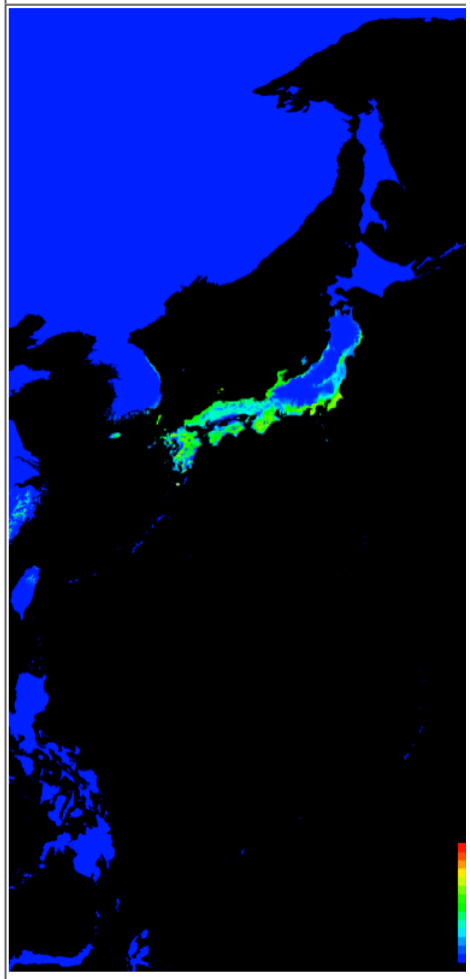
Species Distribution Layer



Predicted Natural Distribution of Plants based on Climate Data (Ecological Niche Modeling using Maxent)

学名	Quercus acuta（亜種を含む）
和名	アカガシ

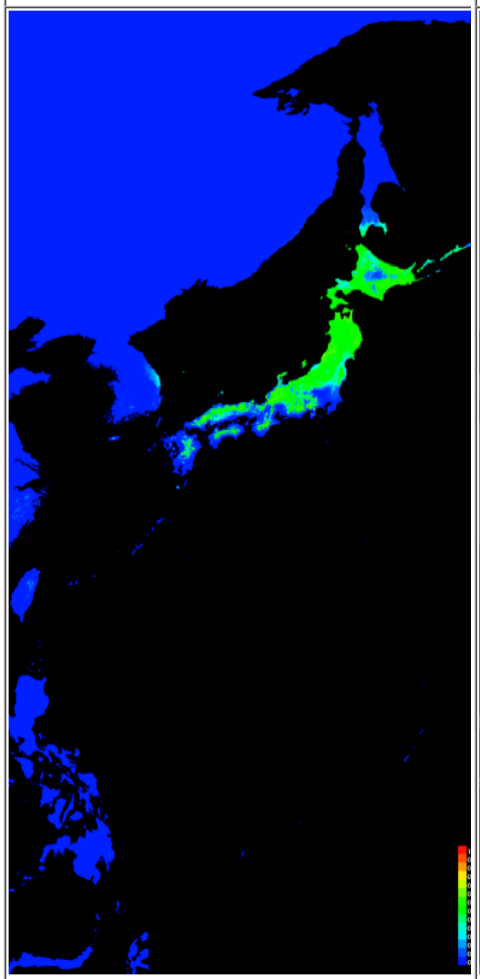
気象データに基



クリックで拡大

学名	Quercus crispula（亜種を含む）
和名	ミズナラ，ミヤマナラ

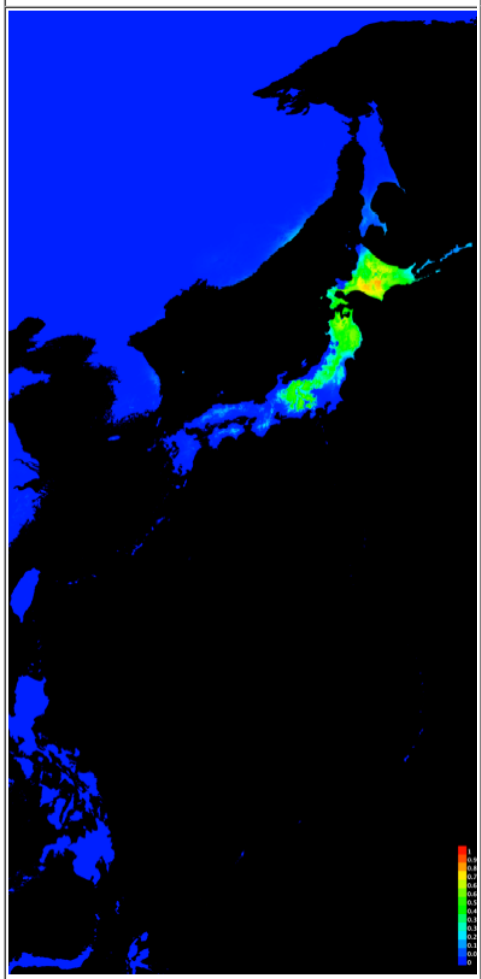
気象データに基



クリックで拡大

学名	Acer miyabei（亜種を含む）
和名	クロビイタヤ

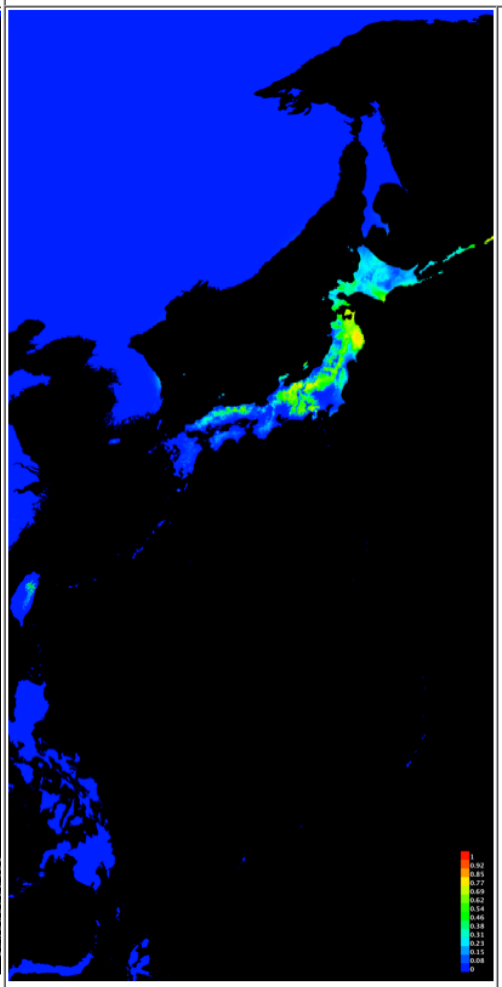
気象データに基



クリックで拡大

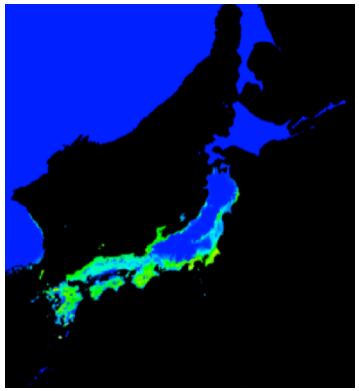
学名	Trillium apetalon（亜種を含む）
和名	エンレイソウ

気象データに基づく



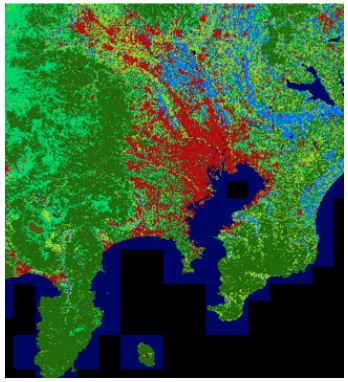
クリックで拡大

Estimating Actual Distribution



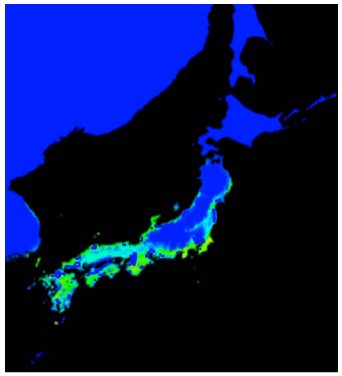
Predicted Natural Distribution

+



Land Cover Map

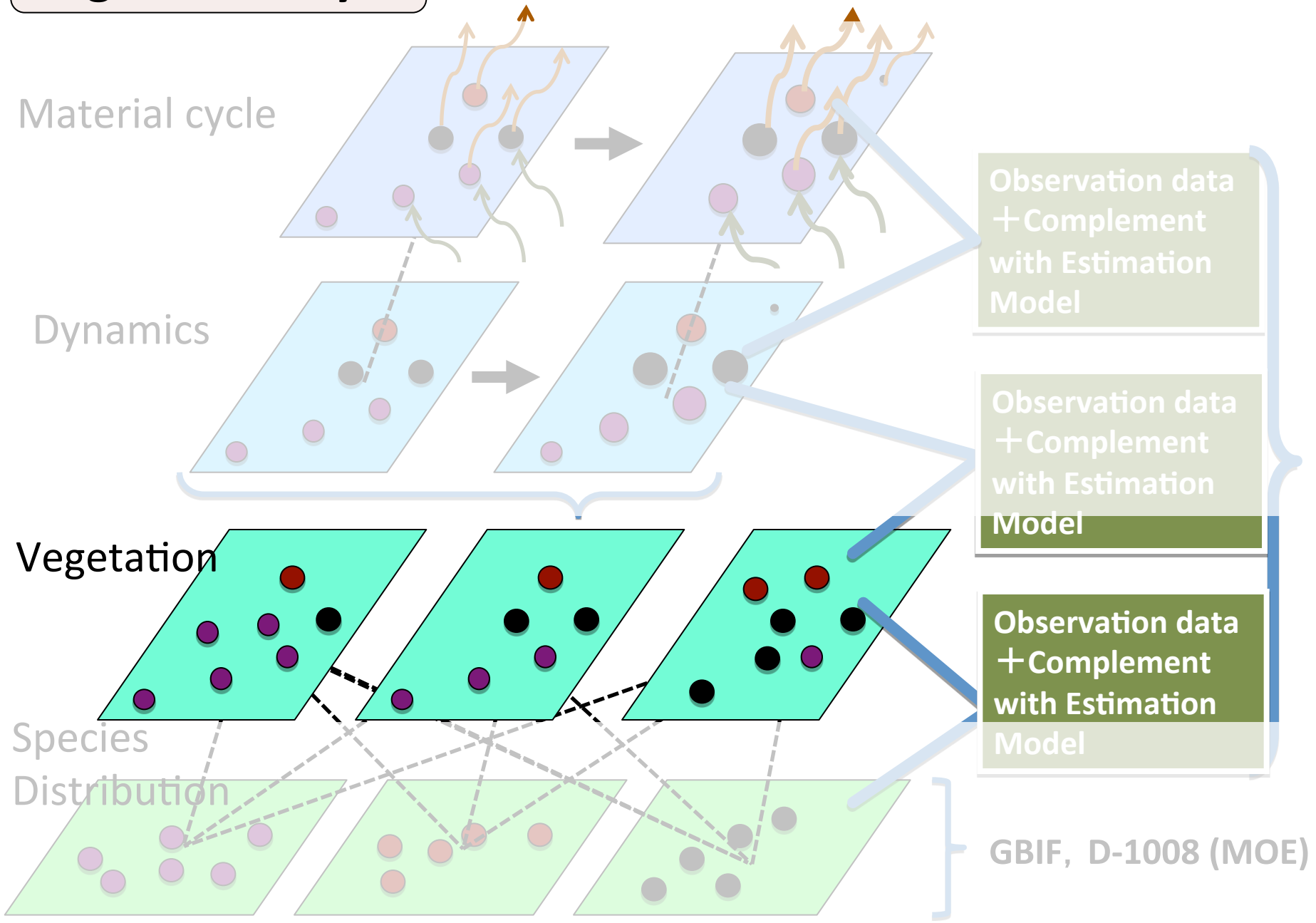
=



Predicted Actual Distribution

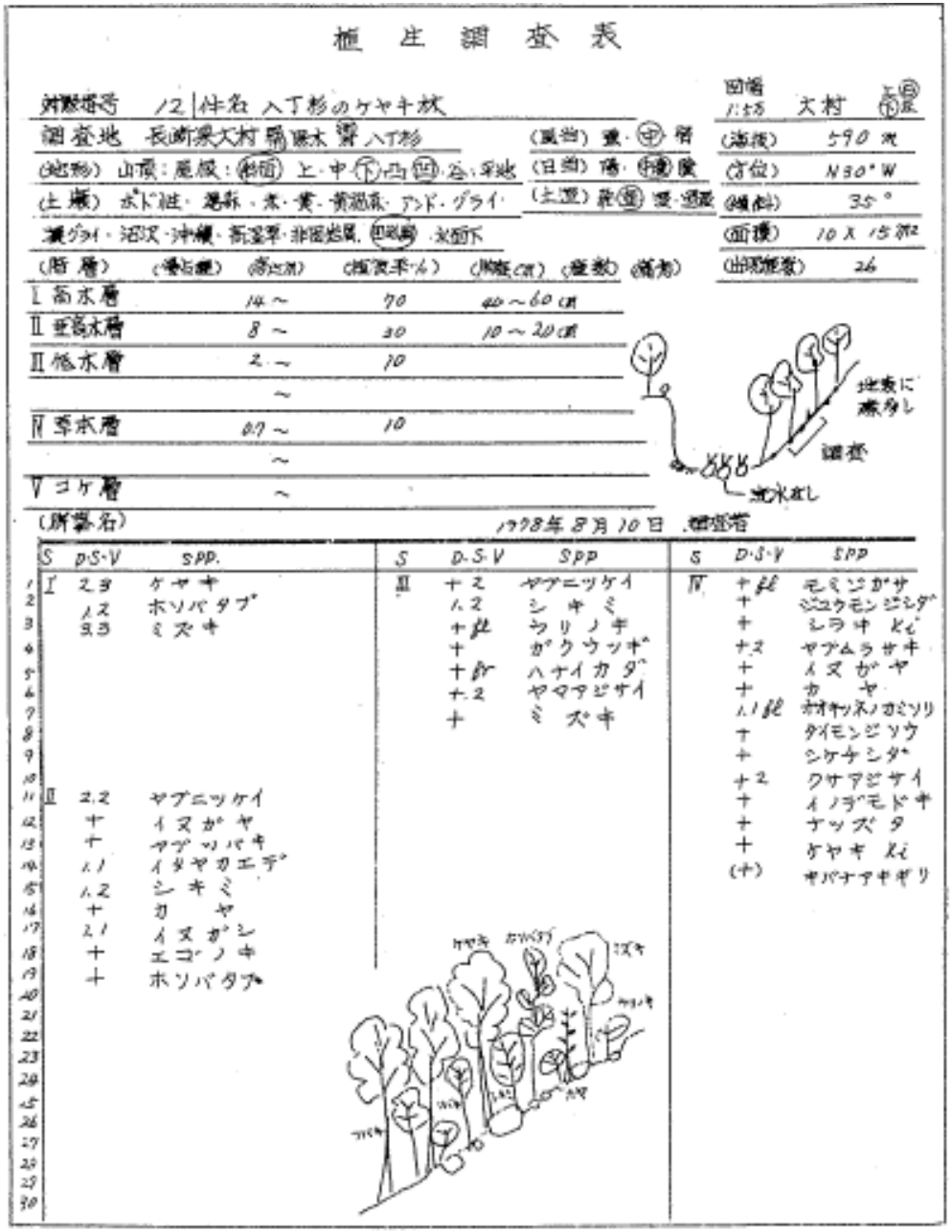
We had made a database of predicted natural distribution maps for more than 2,000 Japanes plant species

Vegetation Layer



Digitalization and Standarization of Plant Community Information

Table for vegetation survey



Sources

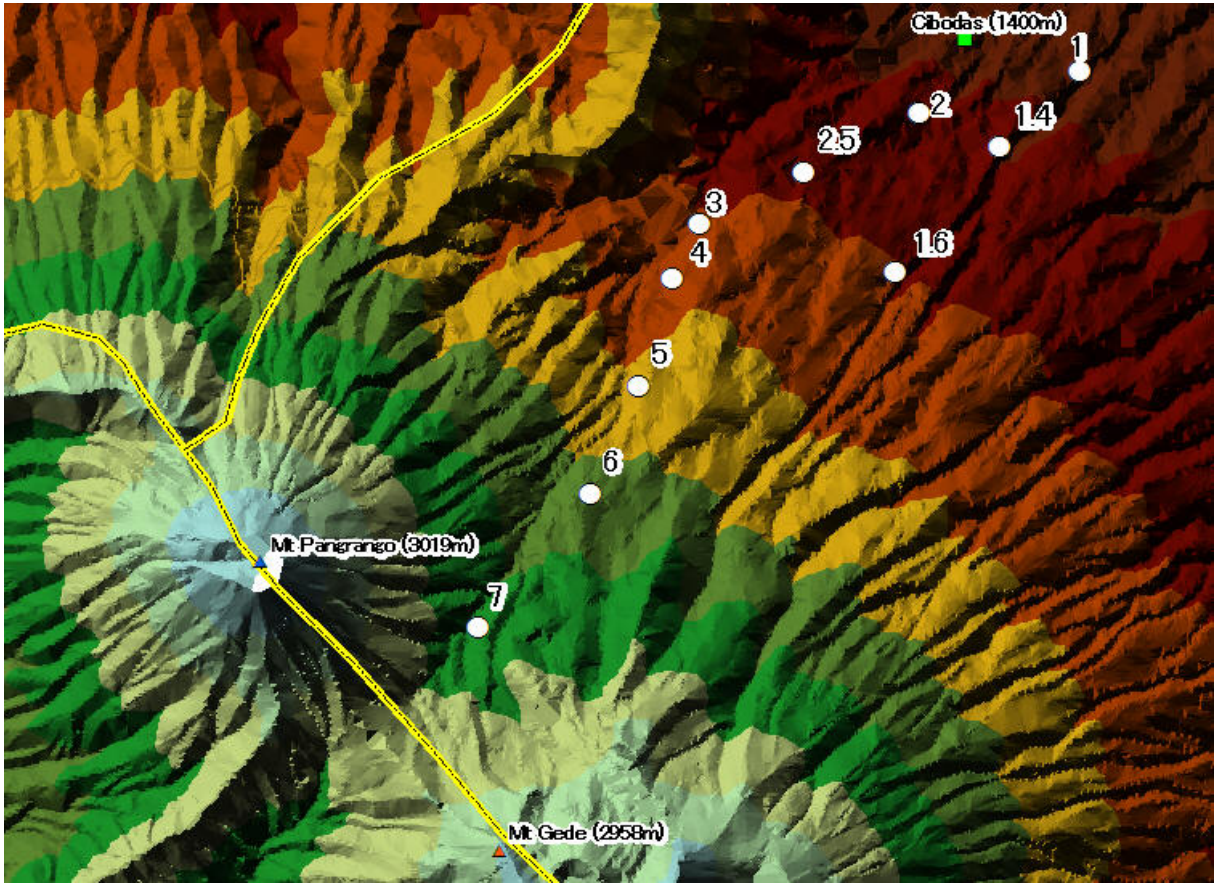
- National Survey on the Natural Environment by MOE
- Other Reports for Environmental Assessment

Estimated more than 10K data in Japan

Make a standard schema for this kind of ecological data

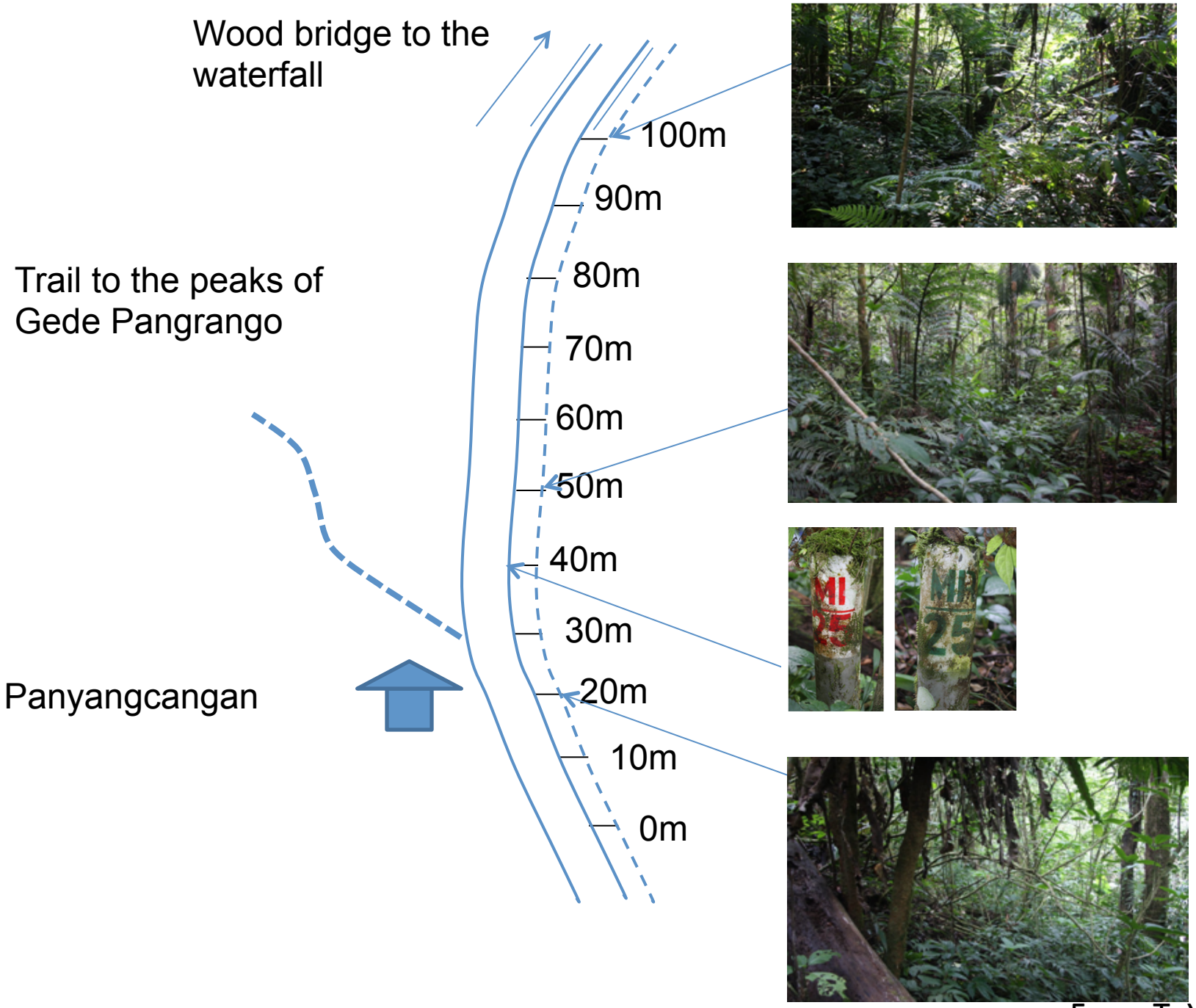
PLANT DISTRIBUTION IN GEDE/PANGRANGO

Transect-based approach along altitudinal gradients



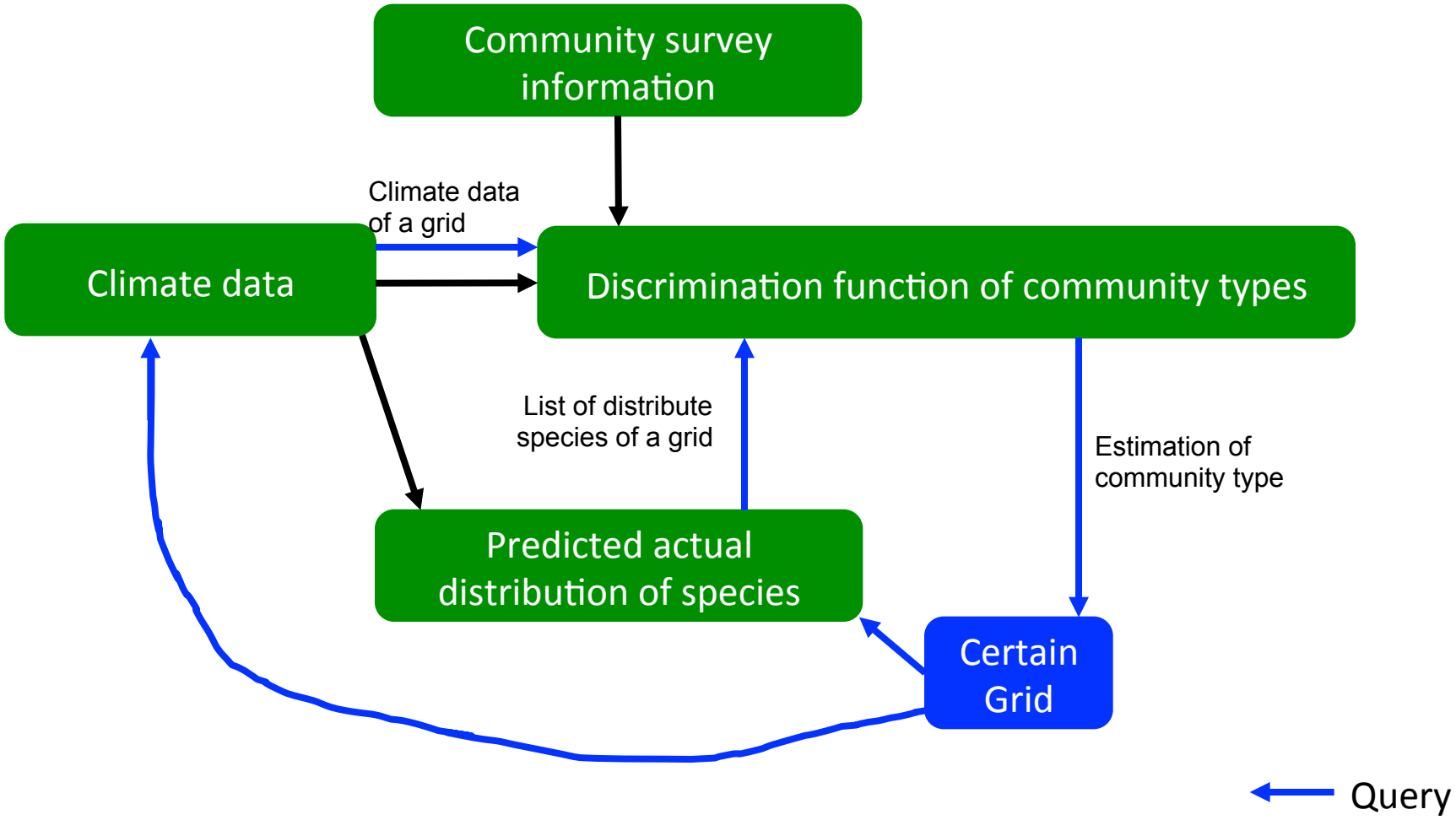
In collaboration with Dedy Darnaedi, Arief Hidayat, Asep Sadili, Marlina Ardiyani (Cibinong), Dwi-san, Zaenal-san (Chibodas BG), Taman National Gede Pangrango

From T. Yahara

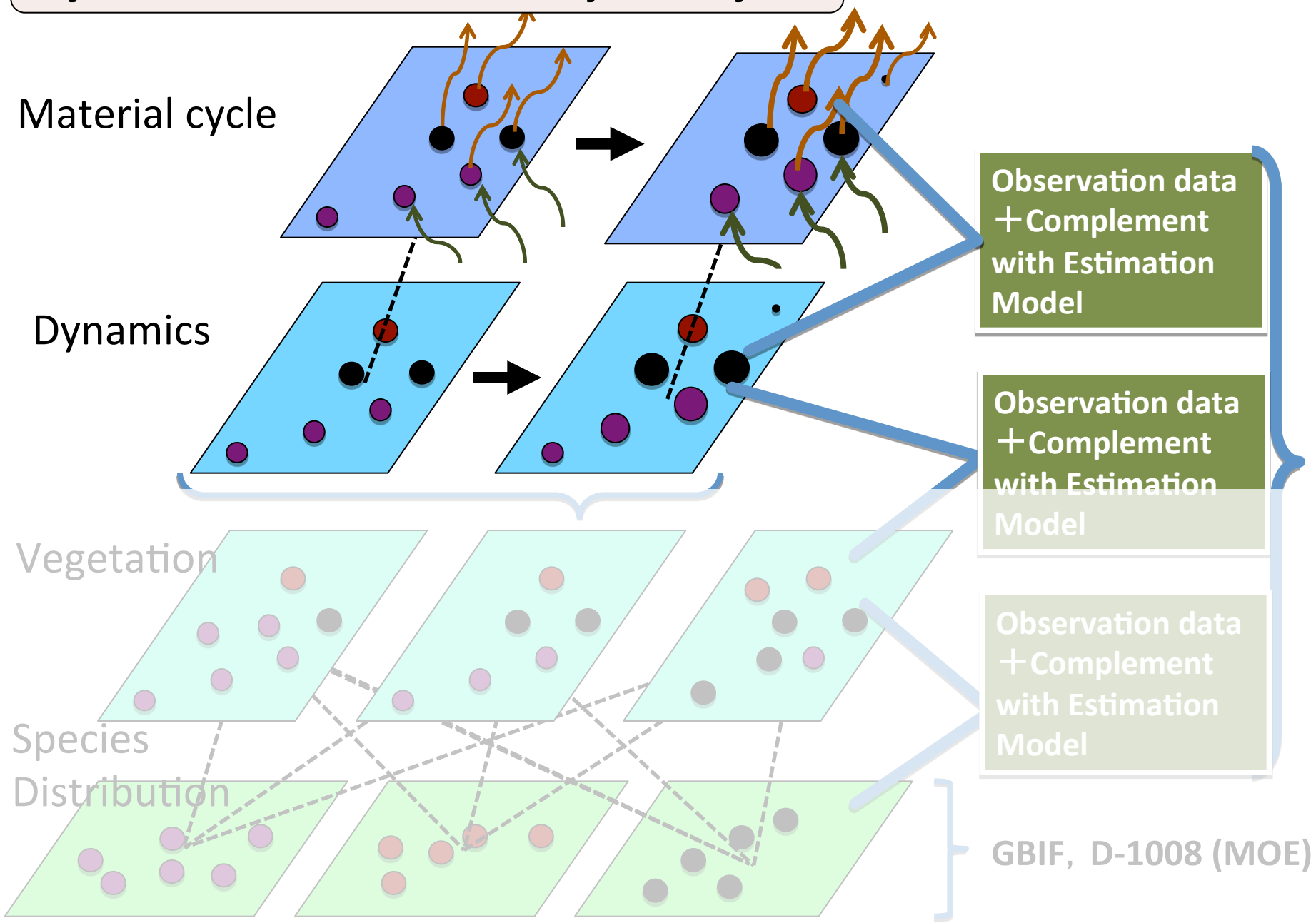


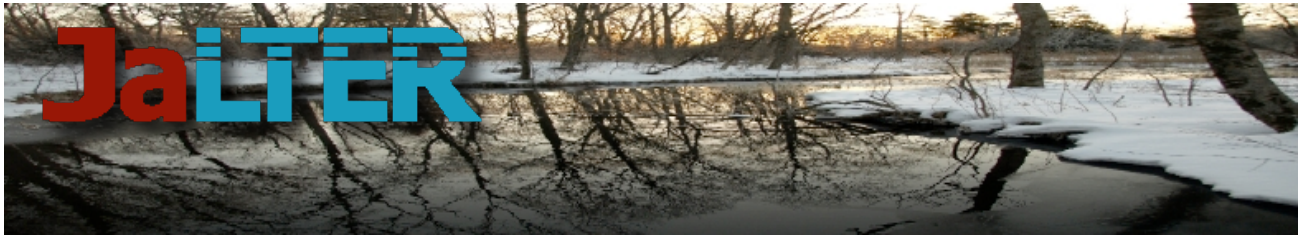
From T. Yahara

Estimation of Community Type

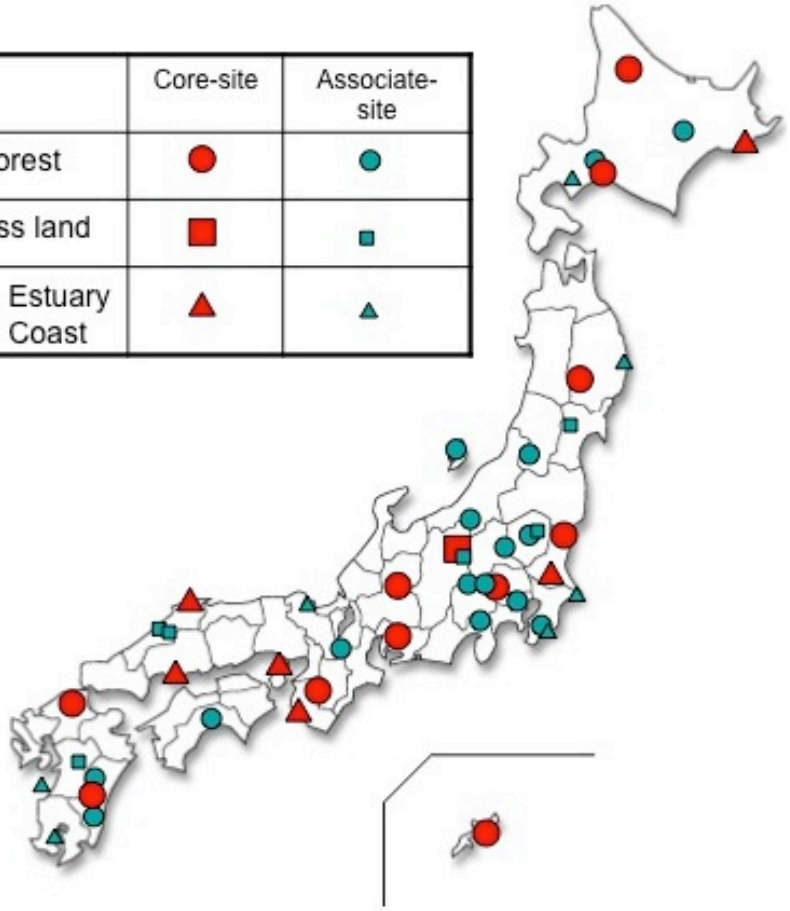


Dynamics and Material Cycle Layers





	Core-site	Associate-site
Forest	●	●
Grass land	■	■
Lake, Estuary and Coast	▲	▲



19 Core sites,

30 Associate sites

- Dynamics of Plant Vegetation
- Dynamics of Animals
- Materials Recycling
- Water
- Flux

AsiaFlux/FLUXNET

FLUXNET: International Network of Flux in Land Ecosystem
AsiaFlux: Asian Regional Network of FLUXNET（http://www.asiaflux.net/）

Sites in Japan (31)

Sites in SE Asia (18)

Number of Sites

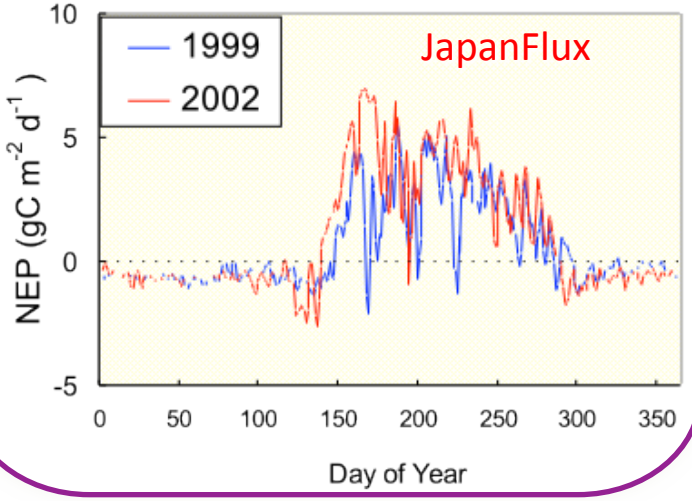
- AsiaFlux: 82 sites
- National Subnetworks:
  ChinaFlux, JapanFlux, KoFlux,
  TaiwanFlux, ThaiFlux, (India),…

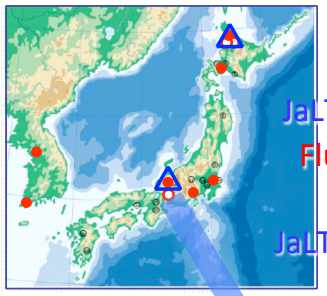
Ecosystem Net Production(ENP) Comparison between JapanFlux data and JaLTER data

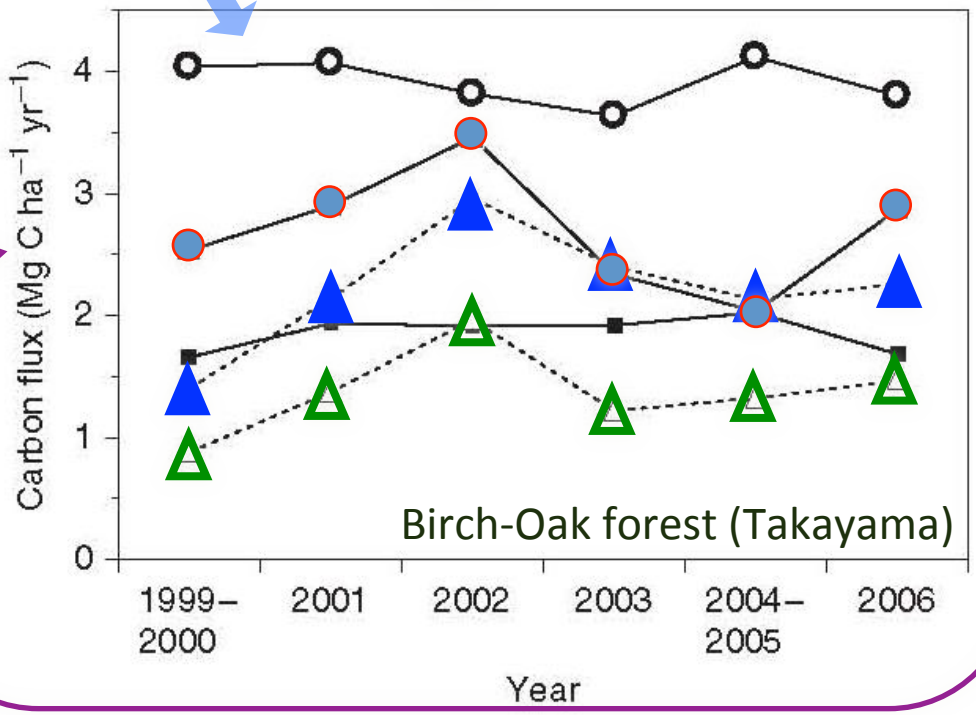
JapanFlux

JaLTER

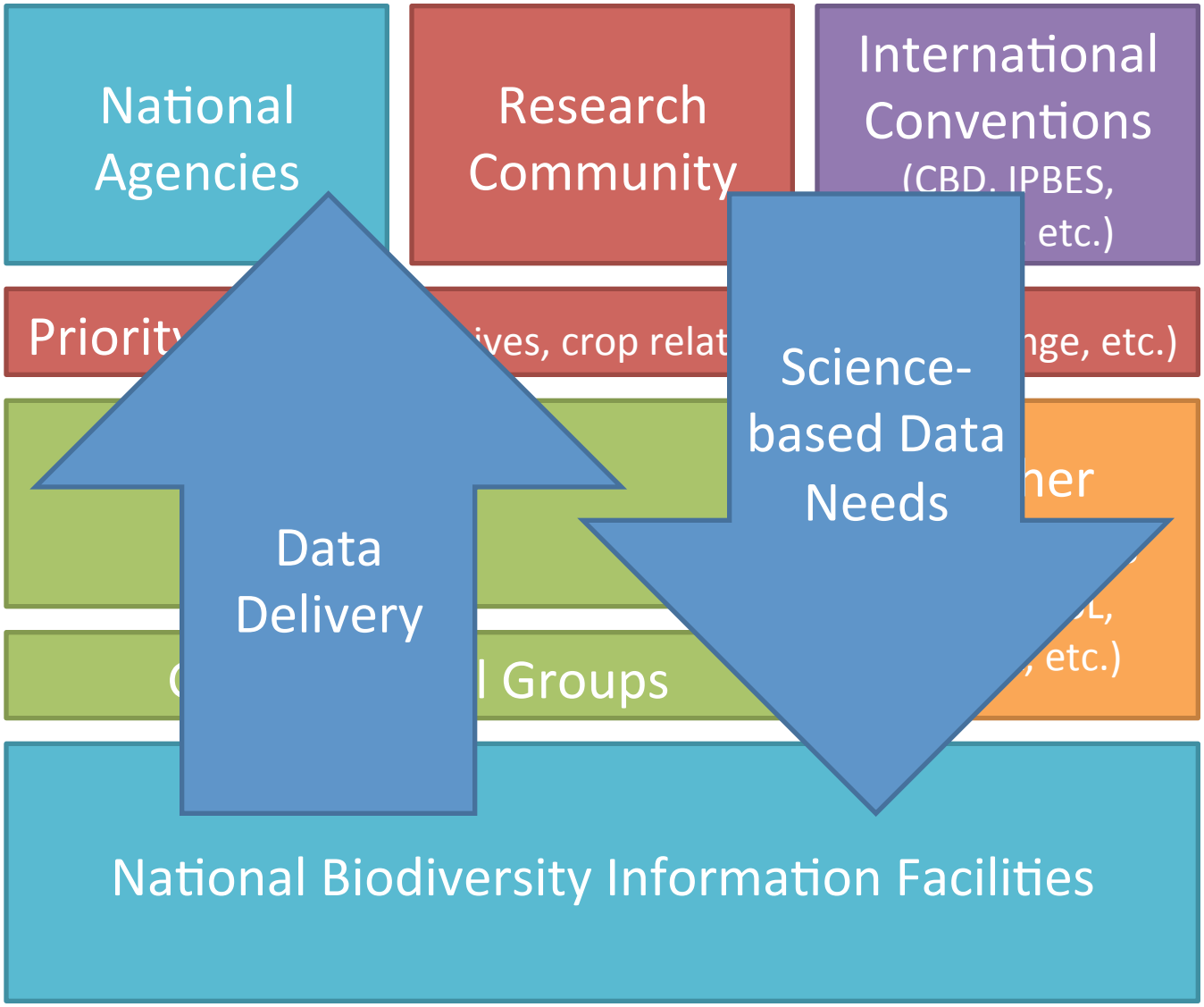
Seasonal pattern of NEP







Supporting science needs



National information delivery

Uses (biosecurity, land-use, climate change, crop development, resource management, forensics, taxonomy, etc.)

International

GBIF

eol Encyclopedia of Life

Catalogue of Life

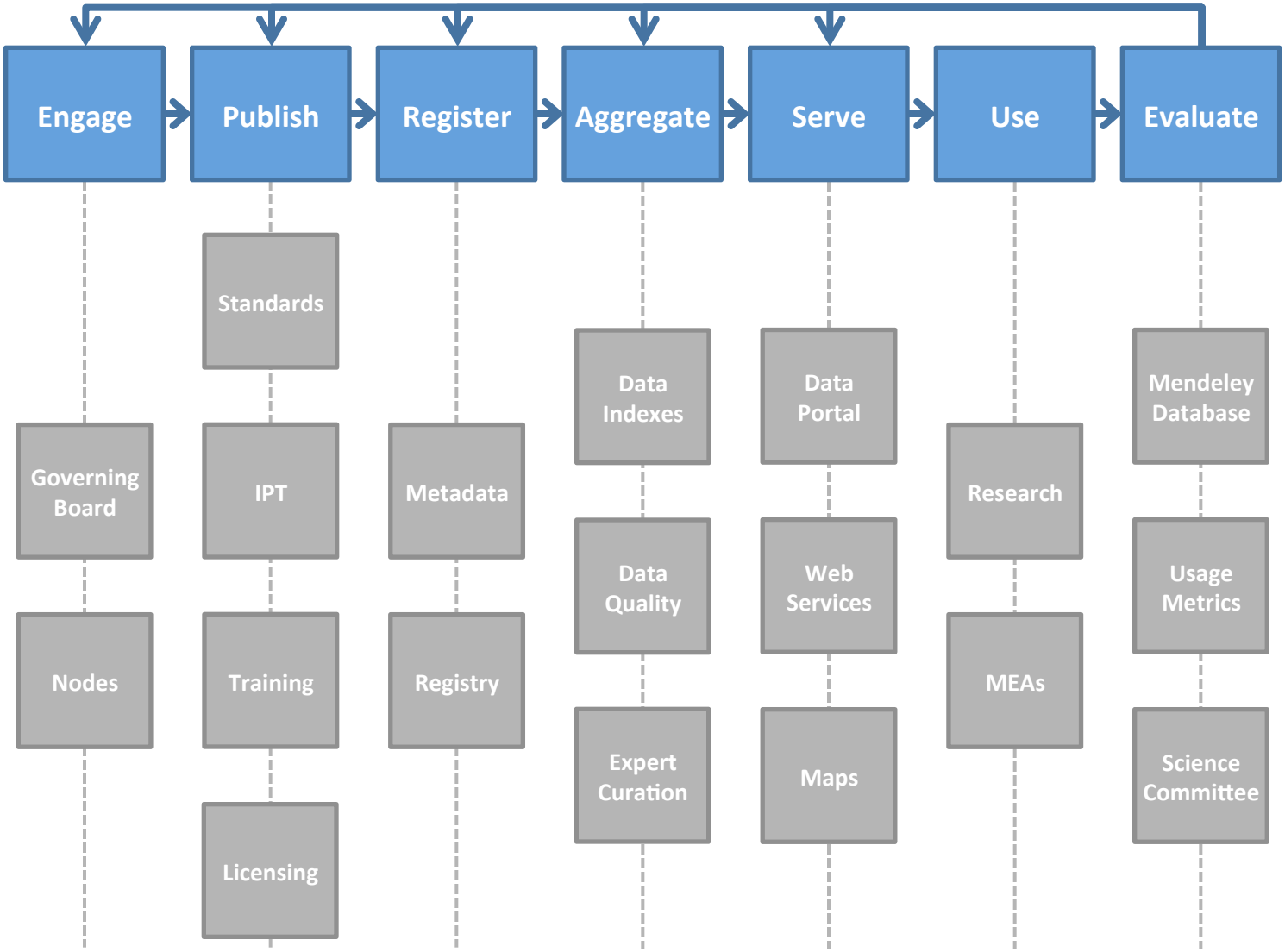
Consortium for the Barcode of Life

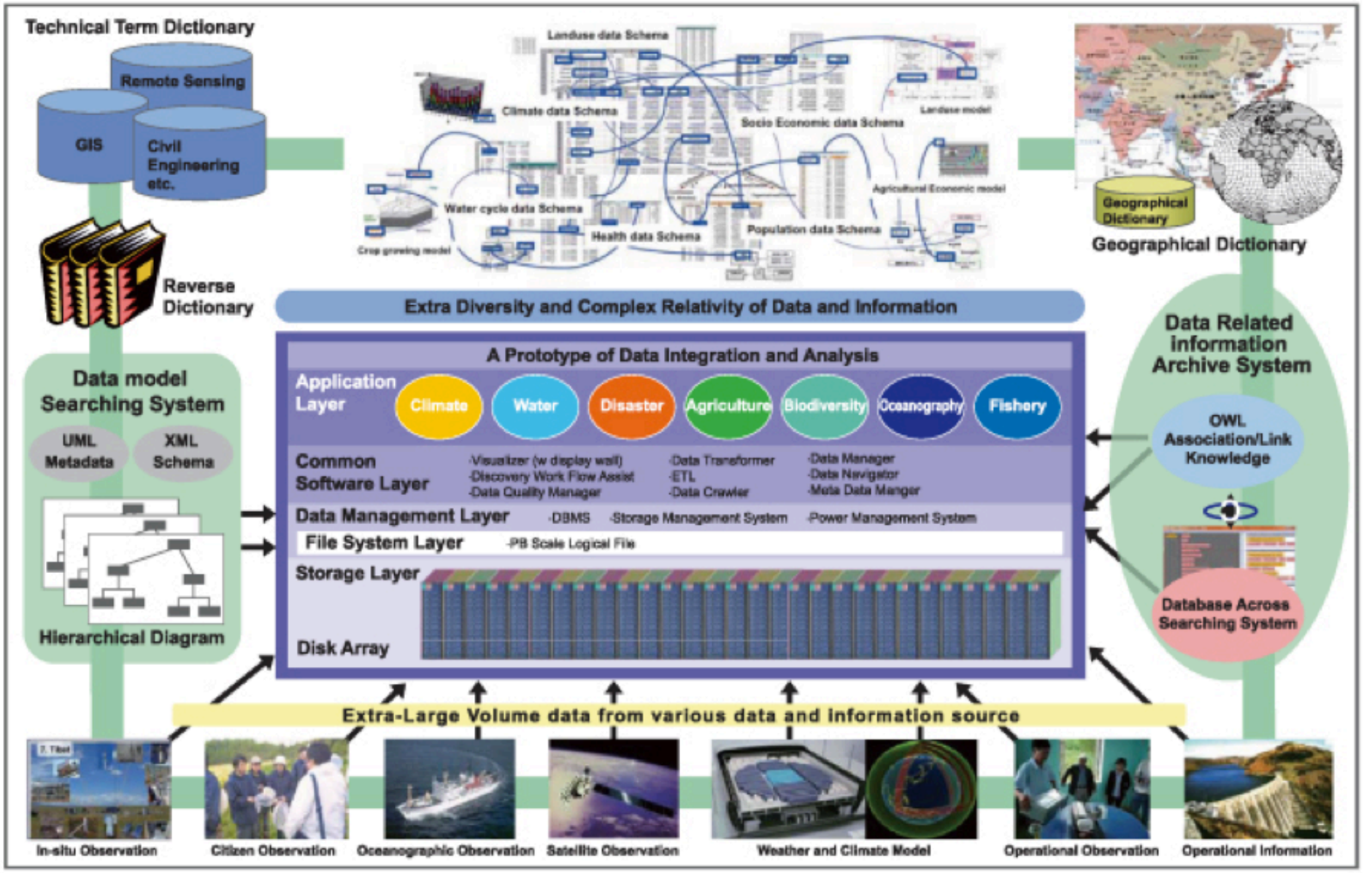
National Biodiversity Information Facility

Metadata (source, methods, ownership, access, etc.)

Data (collections, field observations, literature, molecular, images, expert knowledge, etc.)

Data pathway




Technical Term Dictionary
Remote Sensing
GIS
Civil Engineering etc.
Reverse Dictionary
Landuse data Schema
Climate data Schema
Socio Economic data Schema
Landuse model
Water cycle data Schema
Agricultural Economic model
Health data Schema
Population data Schema
Crop growing model
Geographical Dictionary
Geographical Dictionary
Extra Diversity and Complex Relativity of Data and Information
Data model Searching System
UML Metadata
XML Schema
Hierarchical Diagram
A Prototype of Data Integration and Analysis
Application Layer
Climate
Water
Disaster
Agriculture
Biodiversity
Oceanography
Fishery
Common Software Layer
·Visualizer (w display wall)
·Discovery Work Flow Assist
·Data Quality Manager
·Data Transformer
·ETL
·Data Crawler
·Data Manager
·Data Navigator
·Meta Data Manger
Data Management Layer
·DBMS
·Storage Management System
·Power Management System
File System Layer
·PB Scale Logical File
Storage Layer
Disk Array
Data Related Information Archive System
OWL Association/Link Knowledge
Database Across Searching System
Extra-Large Volume data from various data and information source
In-situ Observation
Citizen Observation
Oceanographic Observation
Satellite Observation
Weather and Climate Model
Operational Observation
Operational Information