

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

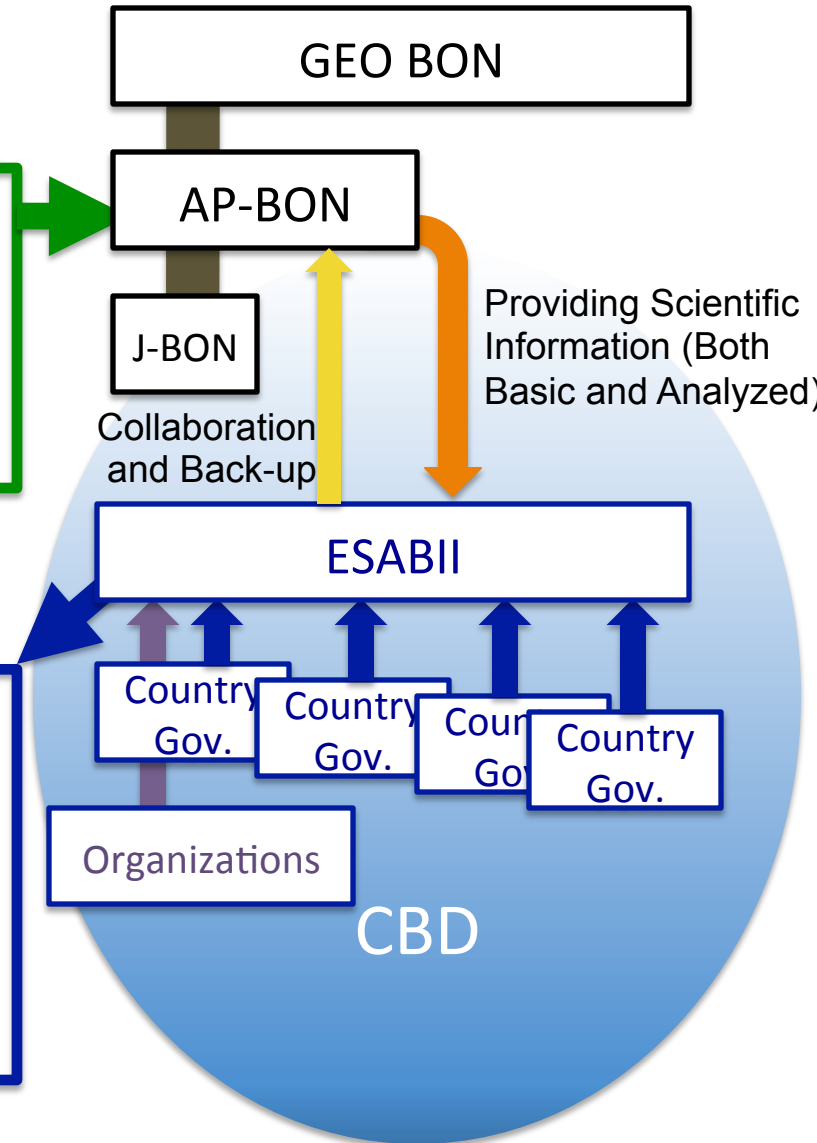
Research Institutes and/or
Researchers Driven Network

- **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

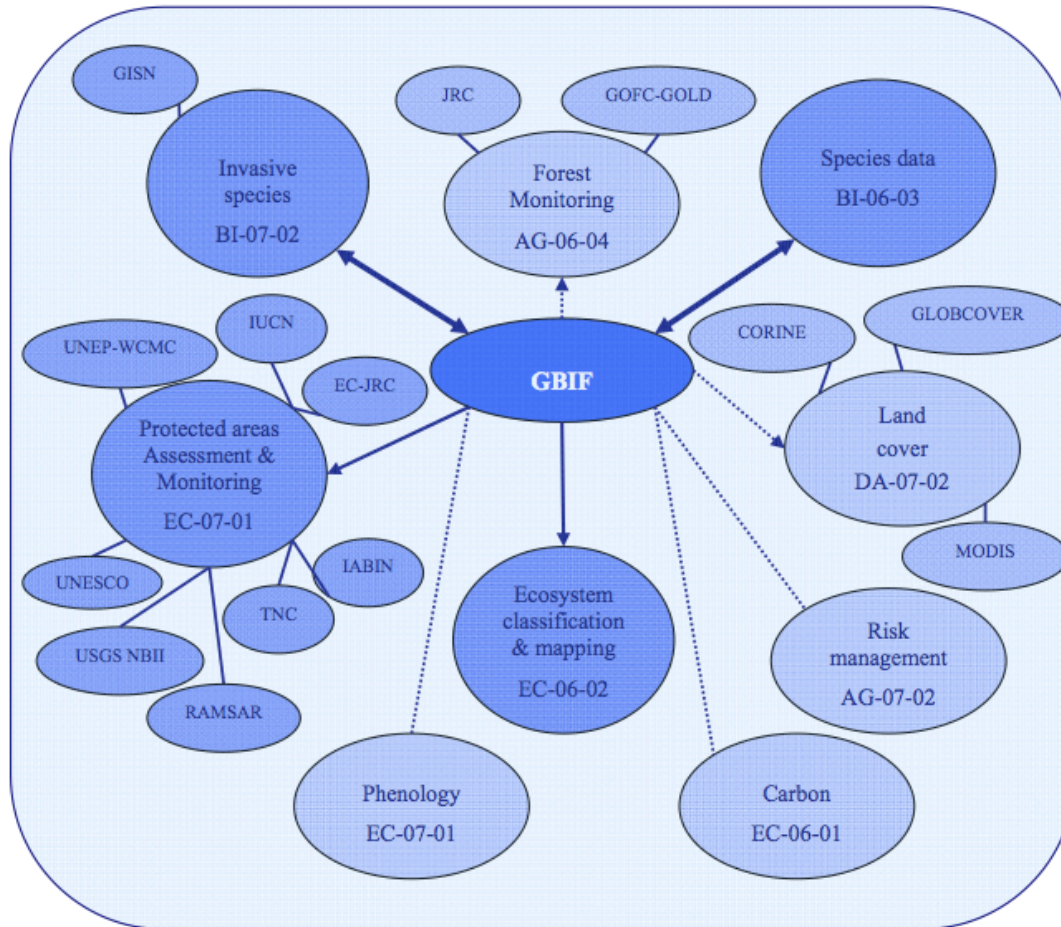
GEOSS

THE GLOBAL EARTH OBSERVATION
SYSTEM OF SYSTEMS



GEO BON

GEO Biodiversity Observation Network



GBIF

Global Biodiversity Information Facility



The image is a screenshot of the GBIF Data Portal homepage. It features a green header with the GBIF logo and navigation links. Below the header is a blue section with a grid pattern and a row of four images: an orangutan, a butterfly, a dolphin, and a flower. A banner below the images reads "... free and open access to biodiversity data". The bottom section is white and contains a search bar, a welcome message, and a small image of a data card.

GLOBAL BIODIVERSITY INFORMATION FACILITY

SPECIES COUNTRIES DATASETS OCCURRENCES SETTINGS

ABOUT

```
<?xml version="1.0" encoding="UTF-8
<response xmlns="http://rs.tdwg.org/t
<header>
<source accesspoint="http://145.18.162
<software name="TapirLink" version="0.2(re
```

... free and open access to biodiversity data

Search
species/country/dataset
 Search

Welcome to the GBIF Data Portal

Access 321,064,406 data records (277,629,428 with coordinates) shared via the GBIF network.
To learn how to use this site, please see *About*.
To tune this site for smaller displays, see *Settings*.
Version 1.3.2 - click here to see what is new!

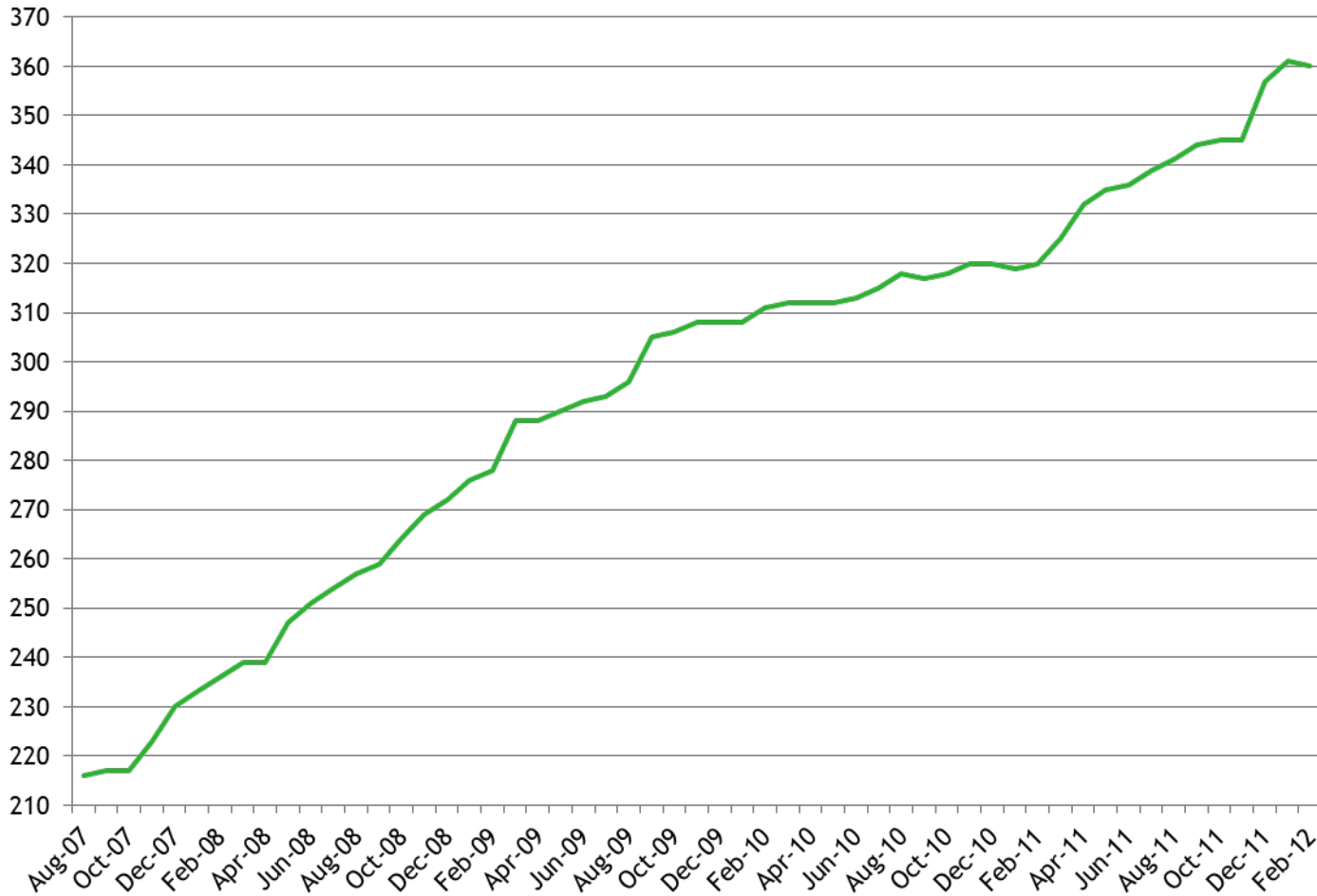


<http://www.gbif.org>

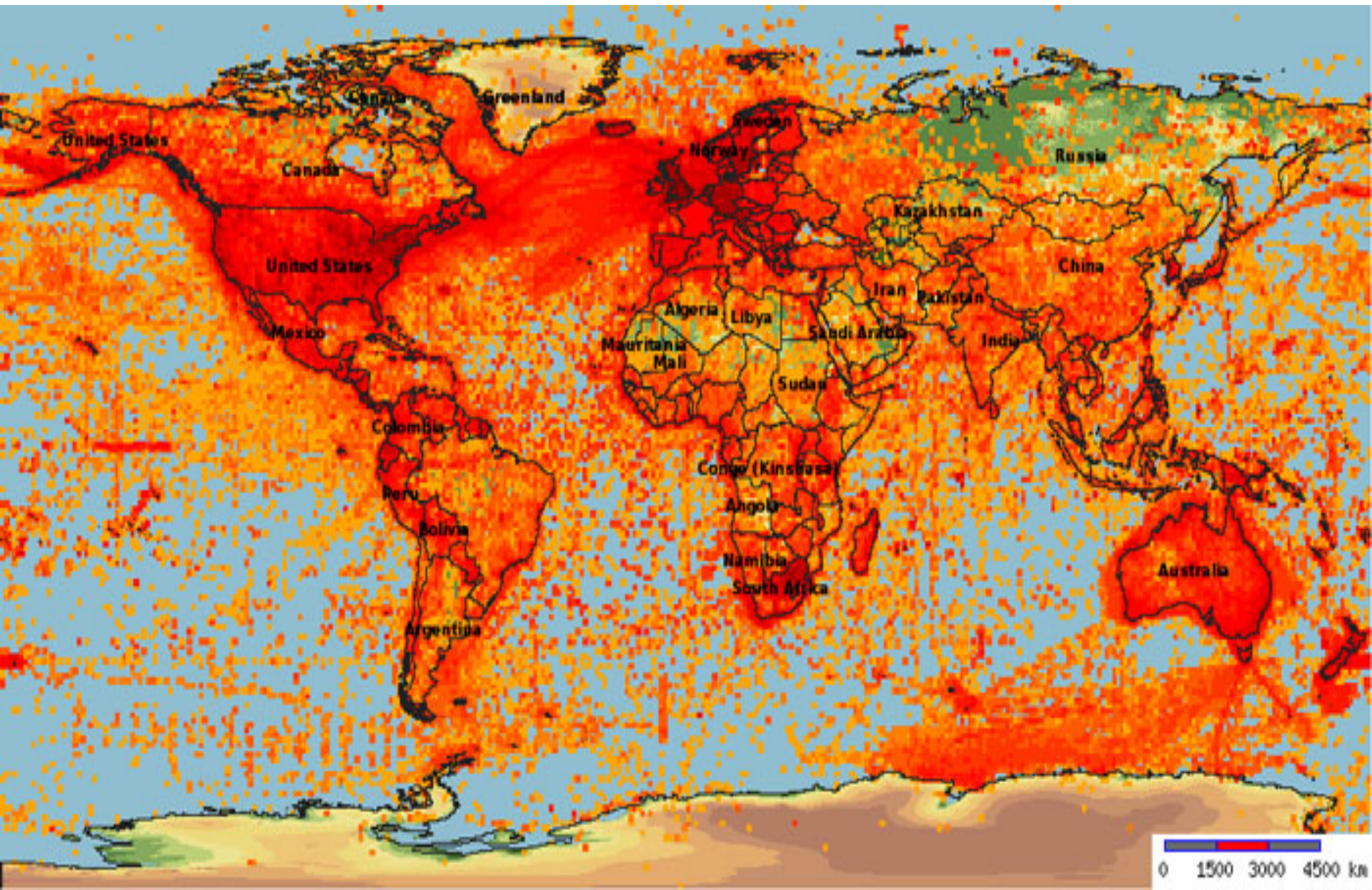
GBIF

- 1st period 2002-2006
Prototyping
- 2nd period 2007-2011
From prototype towards full operation
- 3rd period 2012-2016
Seizing the Future

GBIF-mediated data



Data coverage



Monitoring data usage

The screenshot displays the Mendeley Desktop application interface. On the left, there is a sidebar with sections for 'MY LIBRARY' (All Documents, Recently Added, Favorites, My Publications, GBIF, Test, Create Folder...), 'GROUPS' (GBIF Publication Readers, GBIF staff library, GBIF Publications Library, Create Group...), and 'TRASH' (All Deleted Documents). Below the sidebar is a 'Filter by Authors' list containing names like Pavé, Romina; Payet, D; Pearce, Timothy a.; Pedlar, John; Pedro, San; Peedell, Stephen; Peerzada, Mohammad Iqbal; Penev, Lyubomir; Peng, Bin; Penman, David; Pennington, Toby; Pensa, Francesco; Pereira, Filipe; Pereira, Kátia; Peres, Carlos a.; Perez-Garcia, F. J.; Pertel, Weslei; Peterman, William E.; Peterson, A T; and Peterson, A Townsend.

The main window is titled 'GBIF Publication Readers, owned by you' and has tabs for 'Overview', 'Documents (1064)', and 'Members'. The 'Overview' tab is active, showing a table of publications. The table has columns for 'Authors', 'Title', 'Year', 'Published in', and 'Added'. The selected row is:

Authors	Title	Year	Published in	Added
Antonelli, Alexan...	Absence of mammals and the evolution of New Zealand grasses.	2011	Proceedings. Biological s...	Apr 22

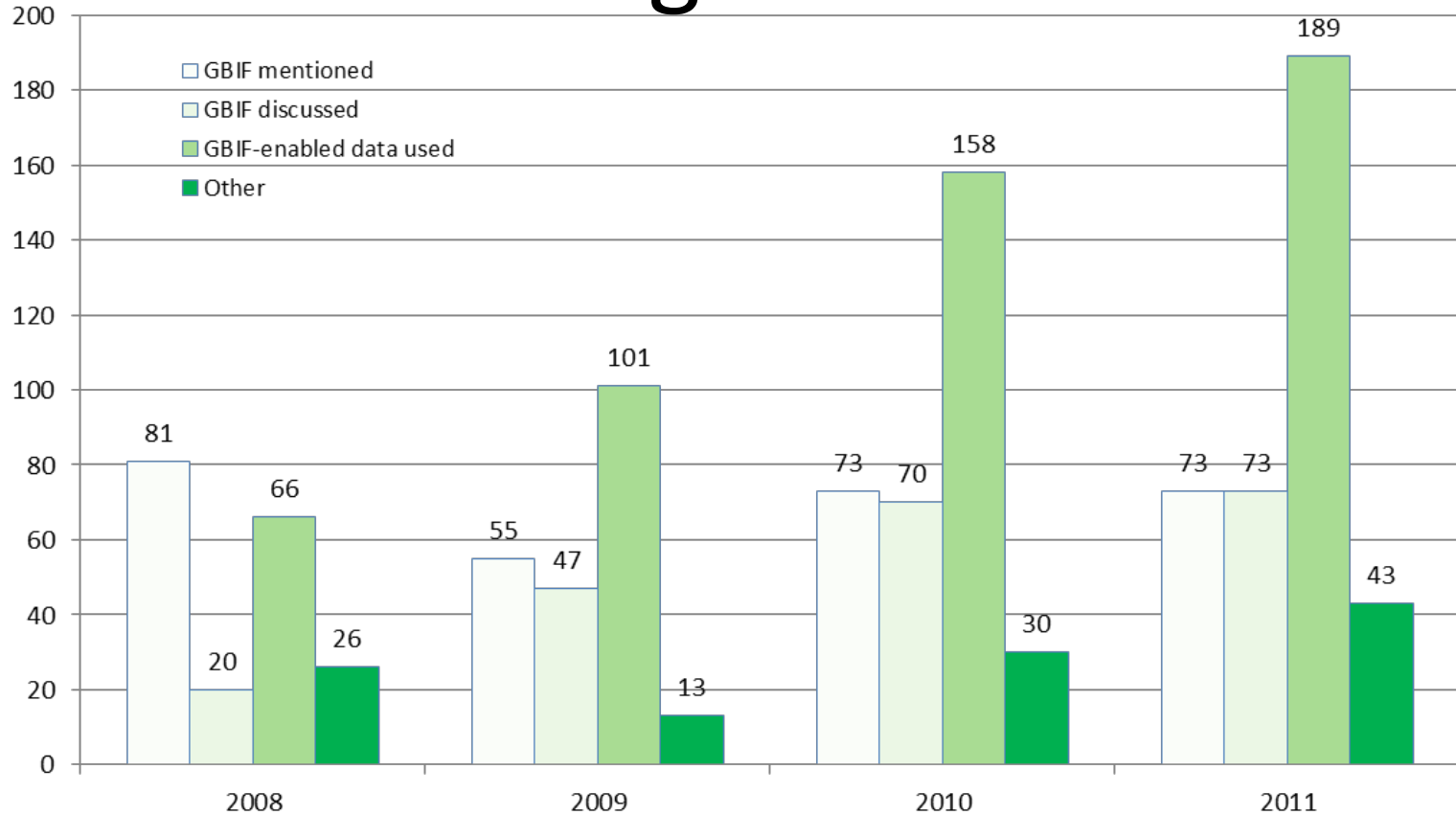
The 'Details' pane on the right shows the following information for the selected article:

- Type: Journal Article
- Absence of mammals and the evolution of New Zealand grasses.**
- Authors: A. Antonelli, A. Humphreys, W. Lee ...
- Journal: *Proceedings. Biological sciences / The Royal Society*
- Year: 2011
- Volume: 278
- Issue: 1706
- Pages: 695-701
- Abstract:** Anthropogenic alteration of biotic distributions and disturbance regimes has dramatically changed the evolutionary context for the differentiation of species traits. Some of the most striking examples in recent centuries have been on islands where flightless birds, which evolved in the absence of mammalian carnivores, have been decimated following the widespread introduction of exotic predators. Until now, no equivalent case has been reported for plants. Here, we make use of robust analytical tools and an exceptionally well-sampled molecular phylogeny to show that a majority of New Zealand danthonioid grasses (Poaceae) may have adapted to the relaxed vertebrate herbivore pressure during the late Cenozoic through the development of a distinctive and unusual habit: abscission of old leaves. This feature occurs in only about 3 per cent of the world's roughly 1...
- Tags:
- Keywords:



MENDELEY
RESEARCH NETWORKS

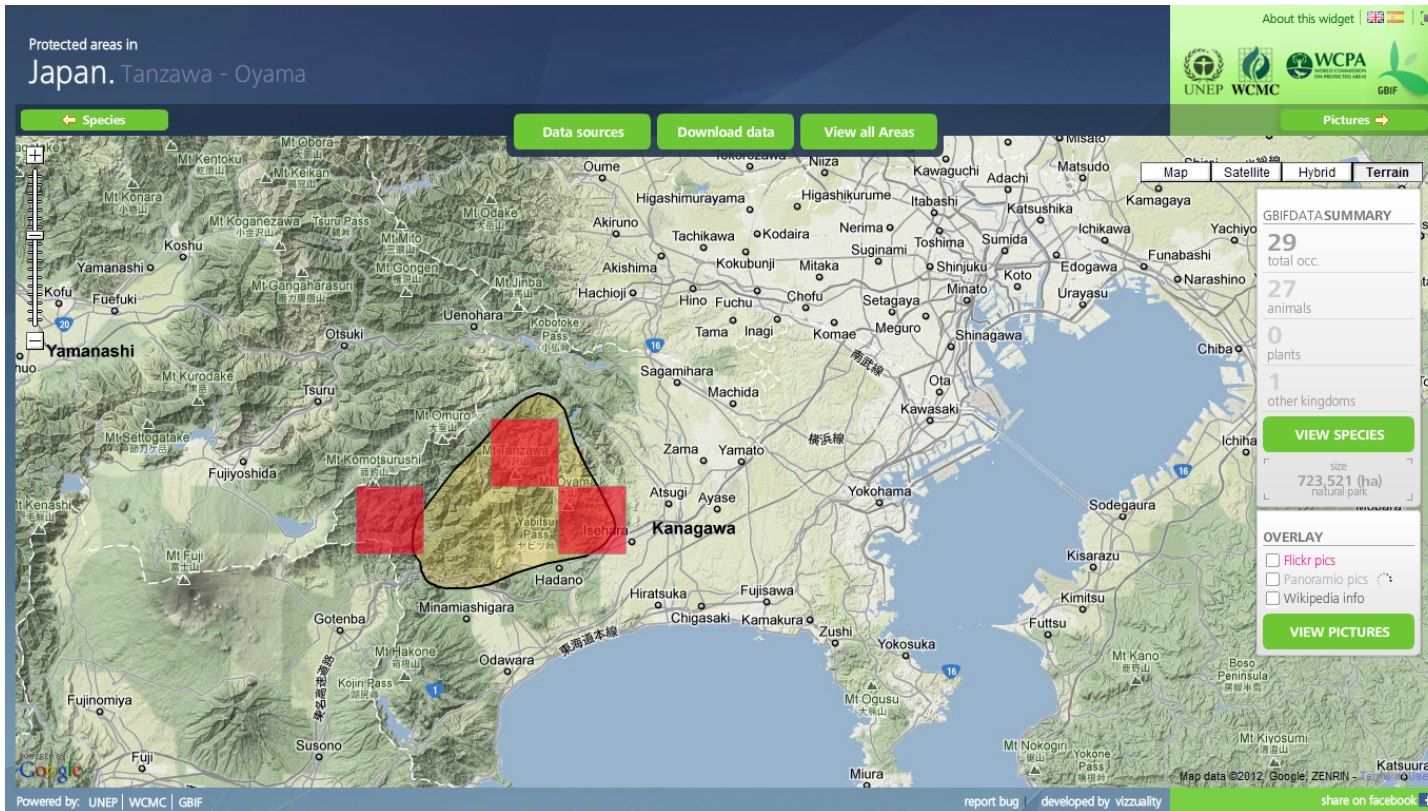
Increasing use of data



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

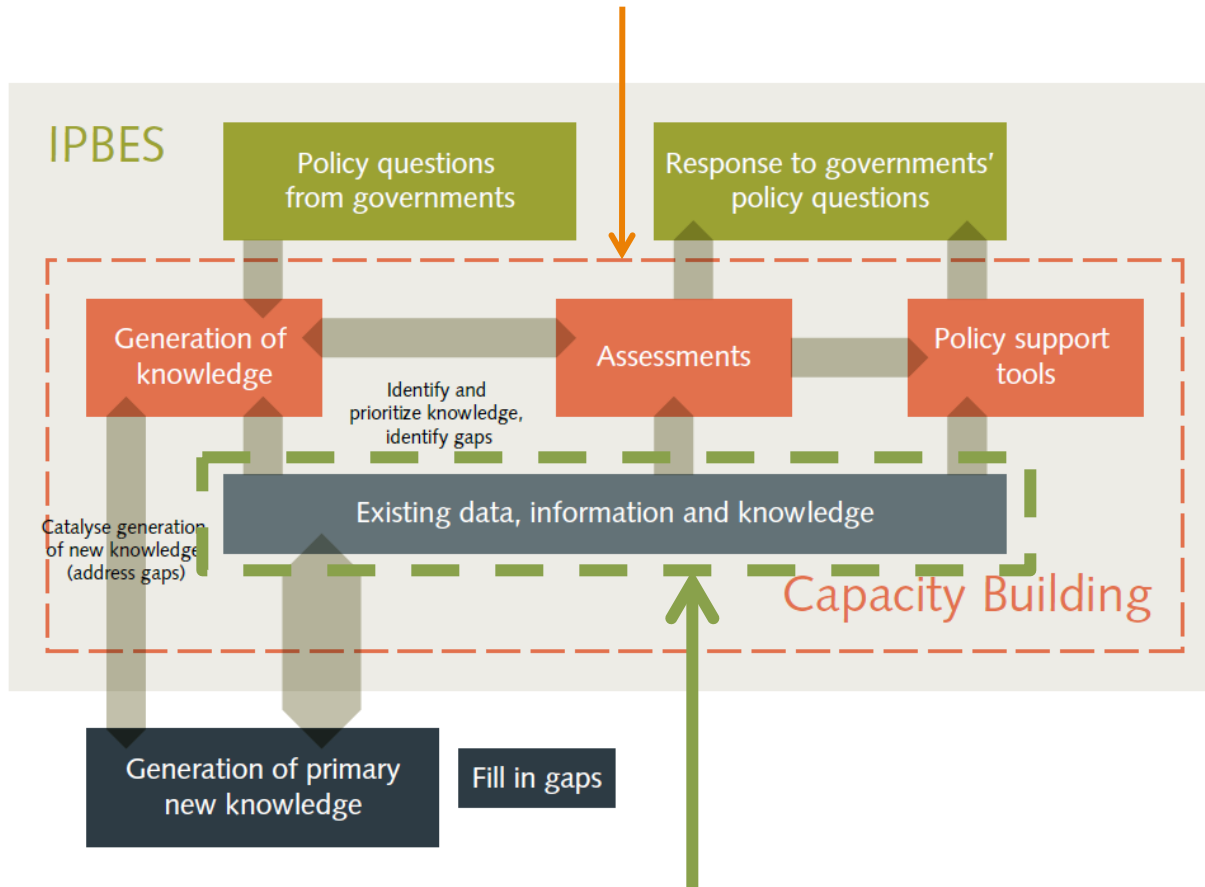
The screenshot displays the IUCN Red List website interface. At the top, there is a navigation bar with the IUCN Red List logo and a search bar containing the text "Scientific or Common name" and a "GO" button. Below the navigation bar, there are tabs for "HOME", "SPECIES RANGE", "OBSERVATION", and "PROTECTED AREAS". The main content area features a map of Africa with various countries labeled, such as Algeria, Libya, Egypt, Sudan, Ethiopia, and South Africa. The map is overlaid with colored regions representing the distribution and status of the species. A detailed information panel on the right side of the map provides the following information:

- Species Information:** Mammalia > Carnivora > Felidae
Panthera leo
Lion
(Linnaeus, 1758)
- Conservation Status:** VU (Vulnerable)
- Legend:**
 - Extant (resident) (Orange)
 - Probably Extant (resident) (Yellow)
- Data Sources:**
 - iNaturalist (15 found)
 - Encyclopedia of Life (25 found)
 - GBIF (123 found)
- Image Sources:**
 - ARKive (30 found)

Integration of GBIF data with IUCN Red List

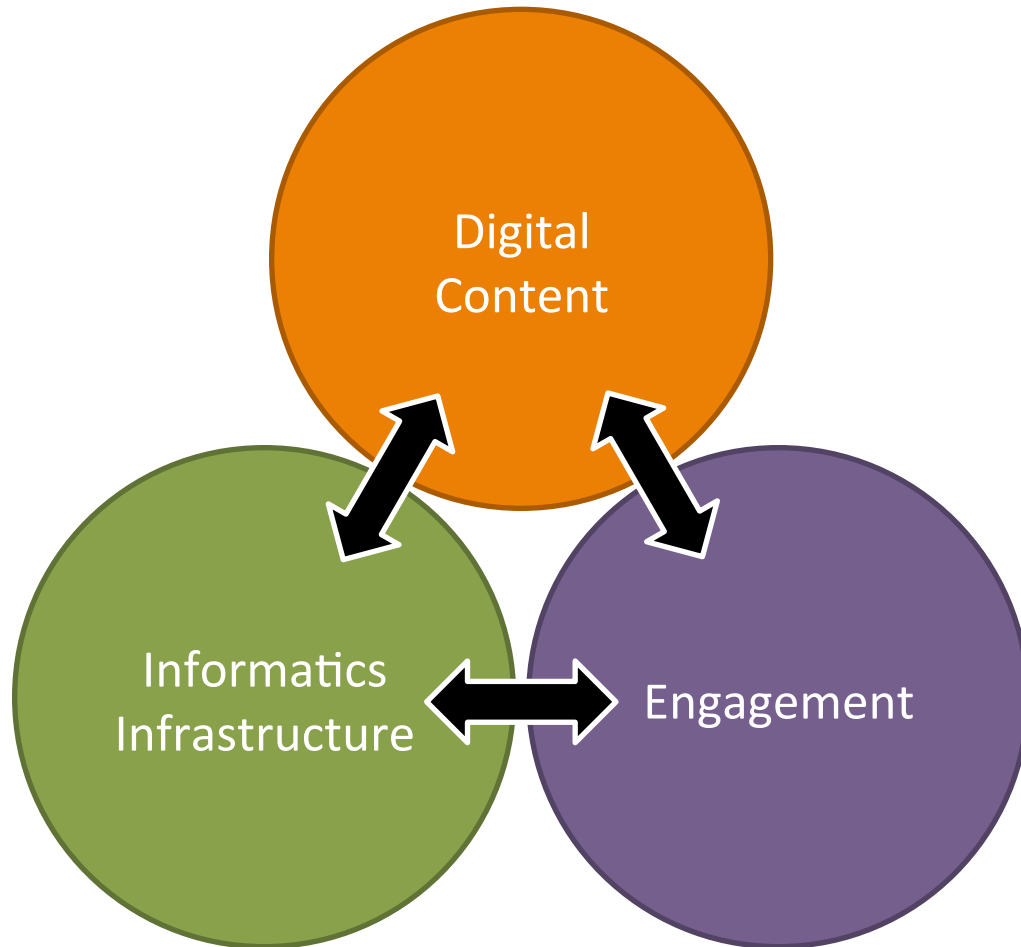
GBIF and IPBES

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

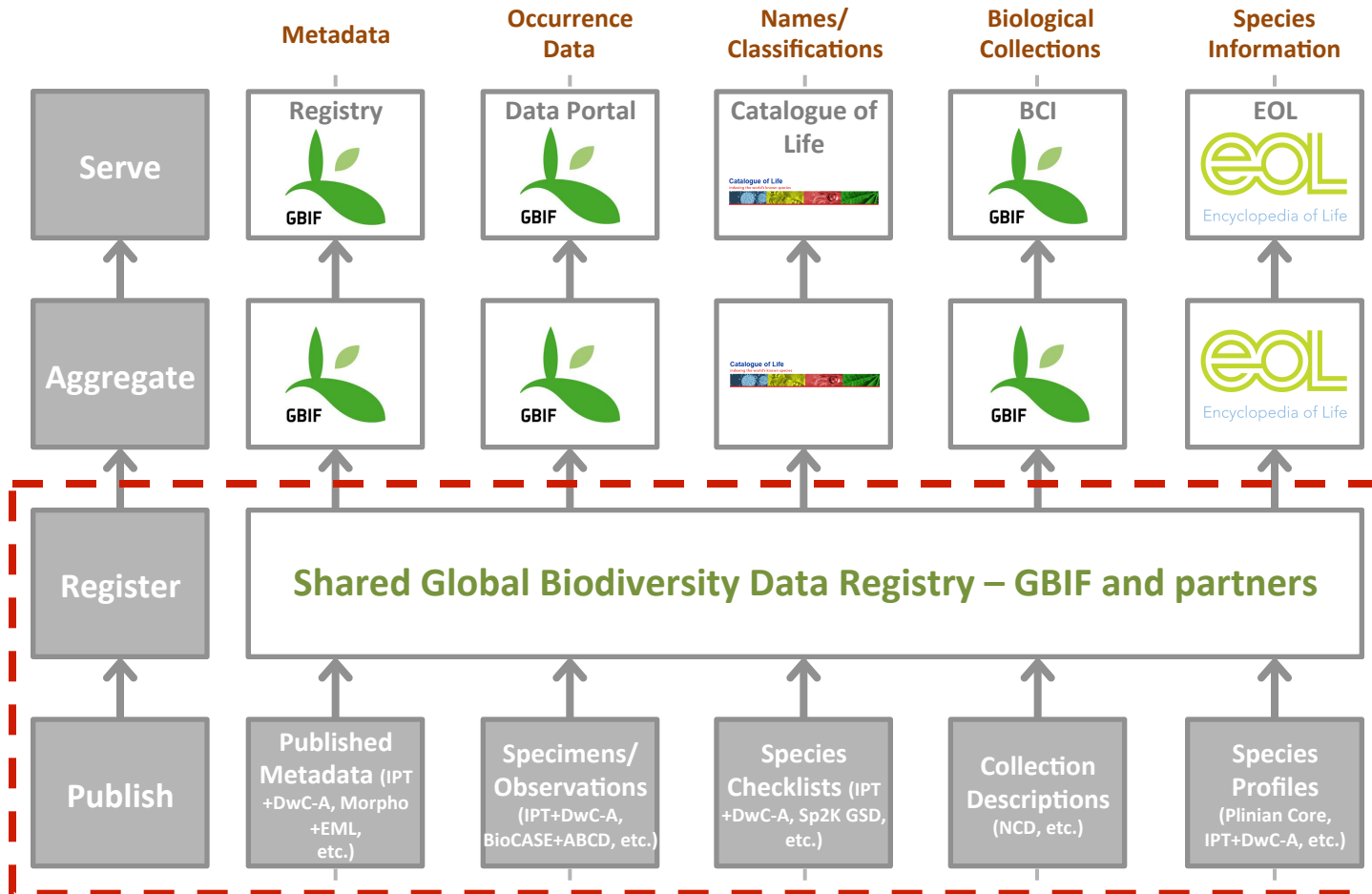


Advance three integrated strategic imperatives

GBIF's unique role

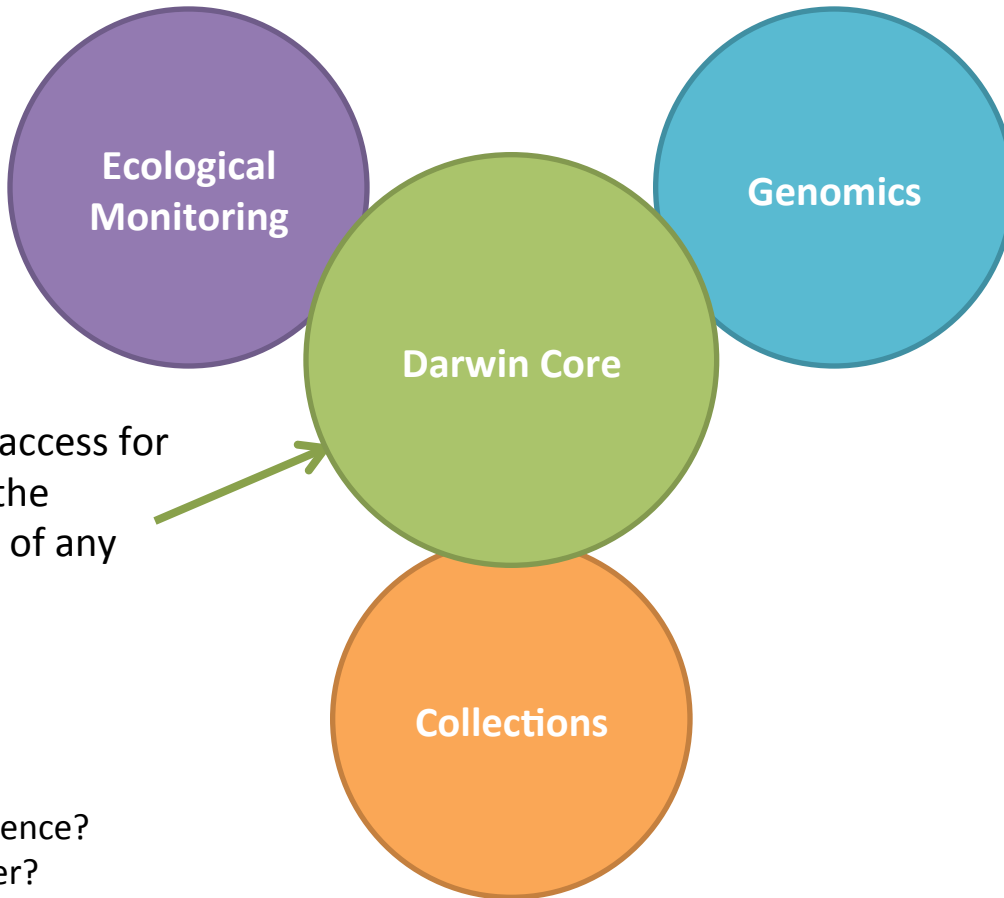
- Registry of biodiversity data resources
- Global virtual natural history collection
- Link data from collections, ecology and genomics
- Biodiversity data for GIS analysis and environmental monitoring
- Tools and support for biodiversity data publication
- Network development at national, regional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

Global data products



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

Unifying species data

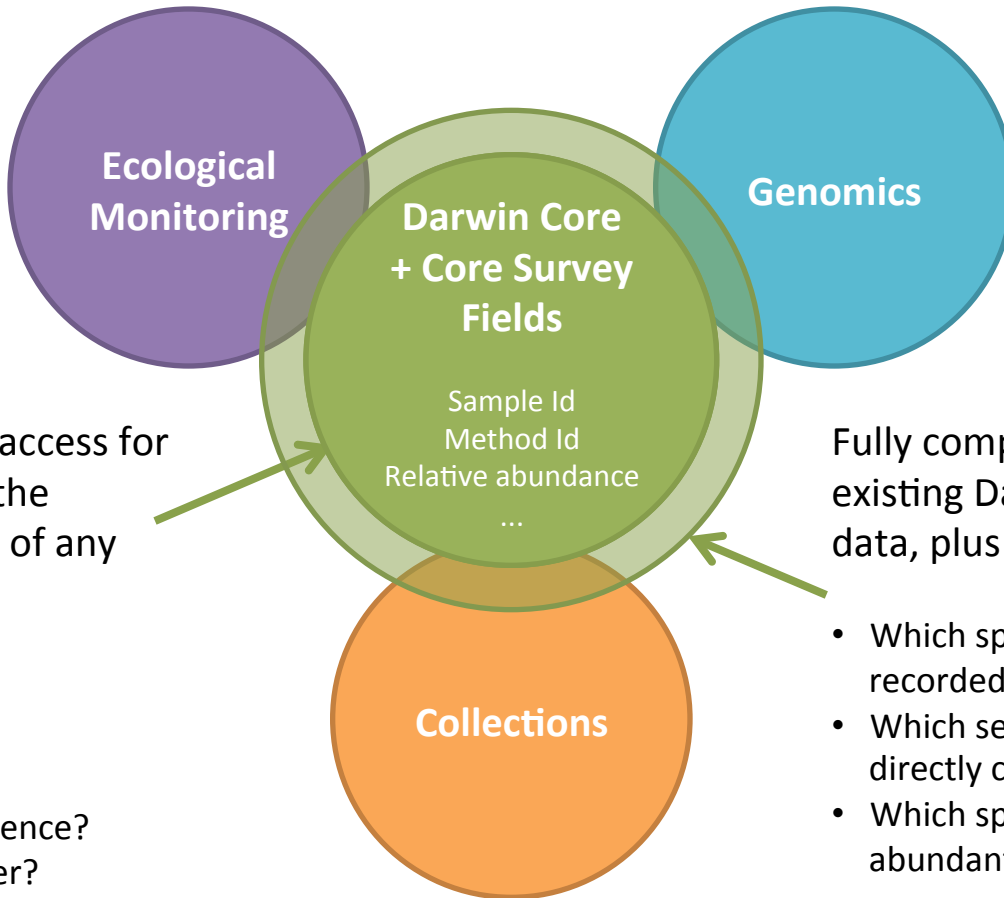


Integrated access for records of the occurrence of any species:

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

Presence only

Unifying species data



Integrated access for records of the occurrence of any species:

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

Presence only

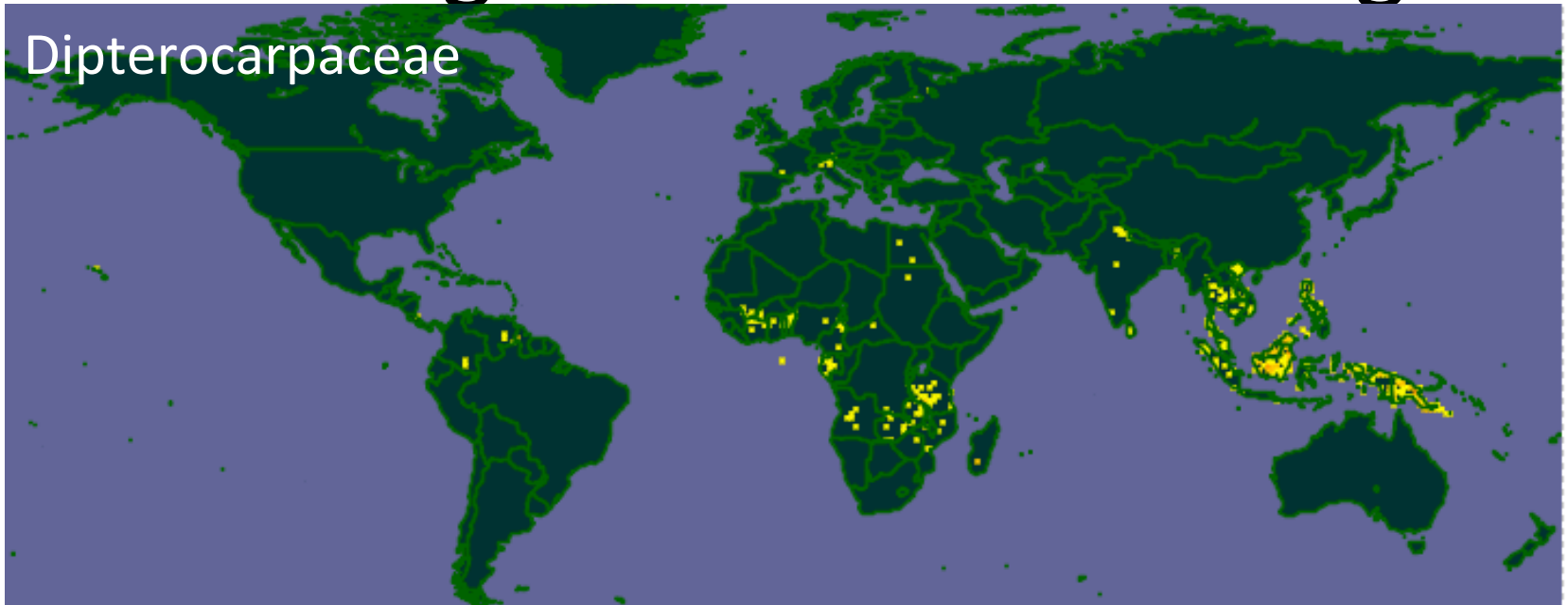
Fully compatible with existing Darwin Core data, plus:

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

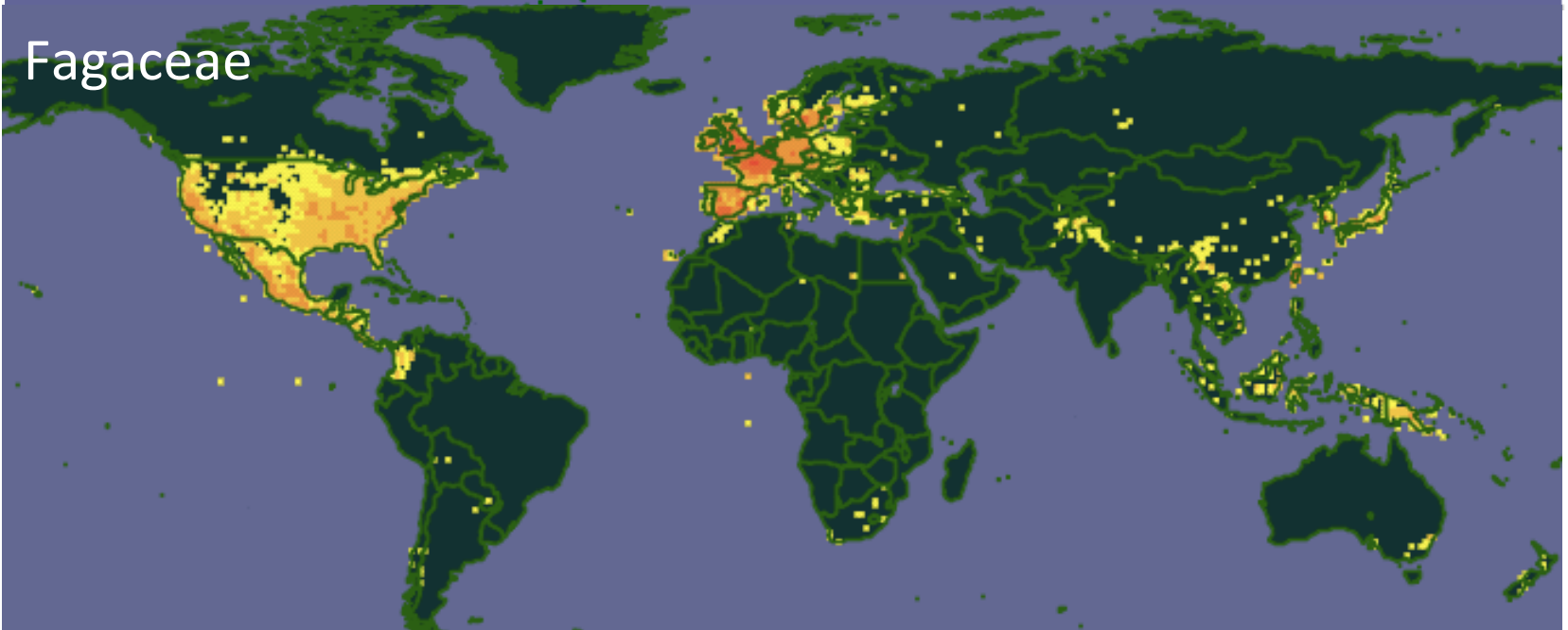
Presence/absence

Increasing data from Asian region

Dipterocarpaceae



Fagaceae



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

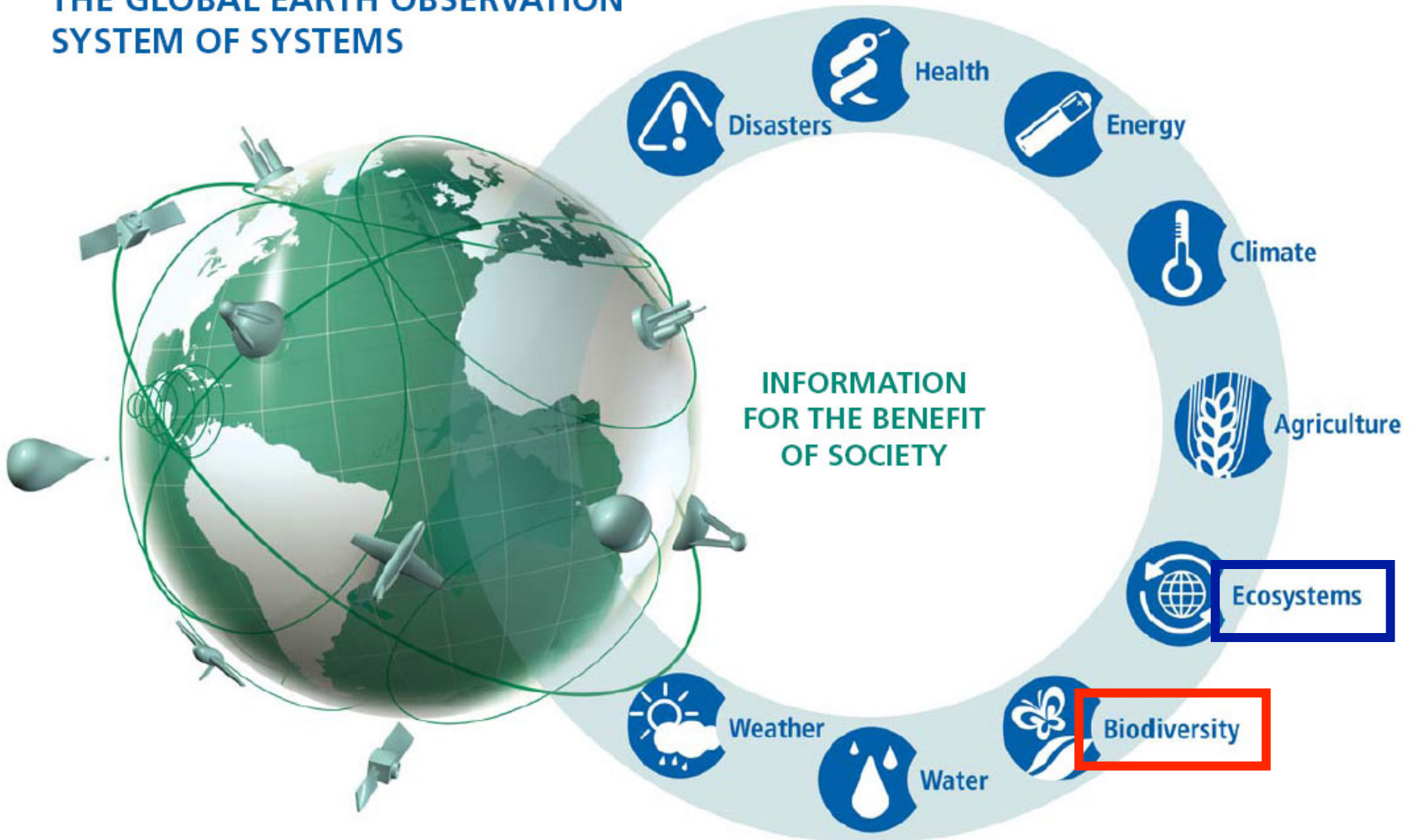


2011-2015 fys project MEXT, PI: Motomi Ito

Purpose:

GEOSS

THE GLOBAL EARTH OBSERVATION
SYSTEM OF SYSTEMS



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

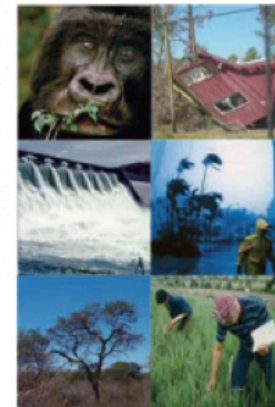


What is DIAS?

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.

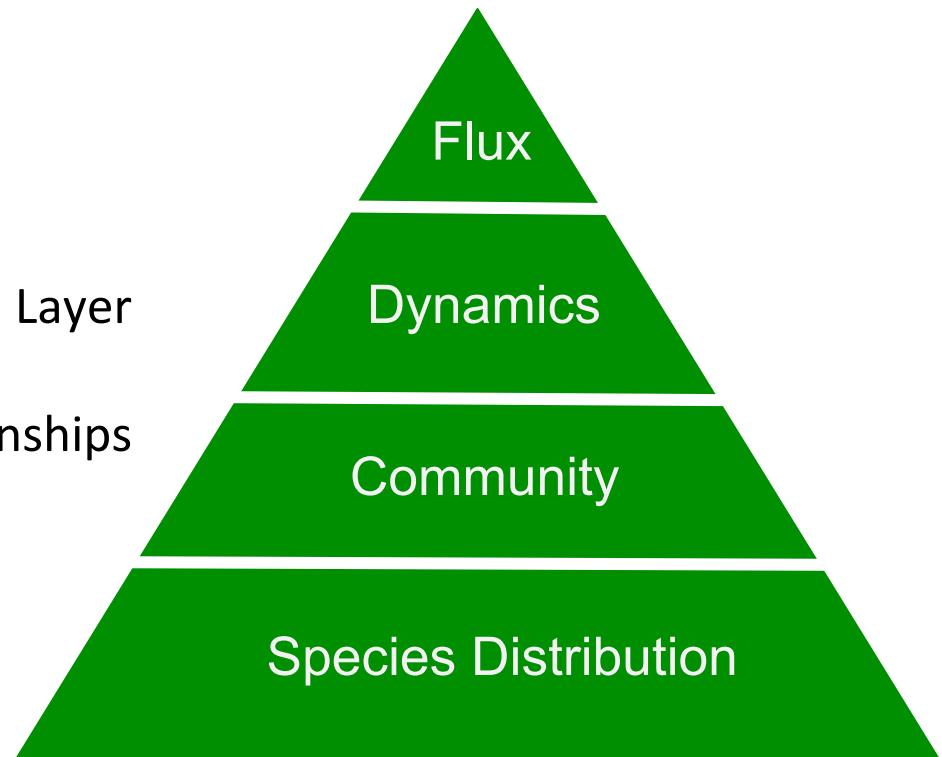


Strategy for Dealing Ecological Data

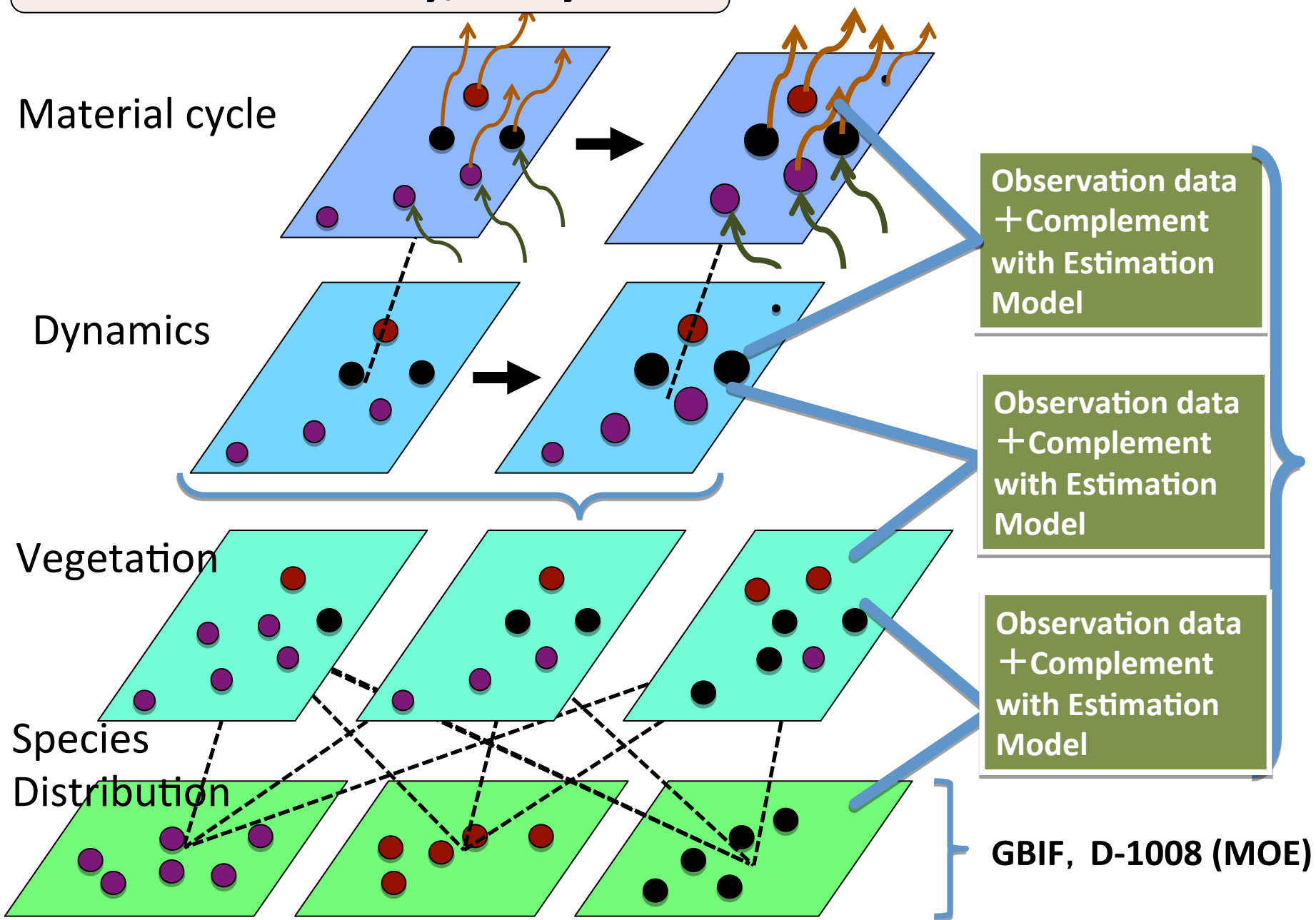
How can we treat Ecological Information?

Connecting Layers

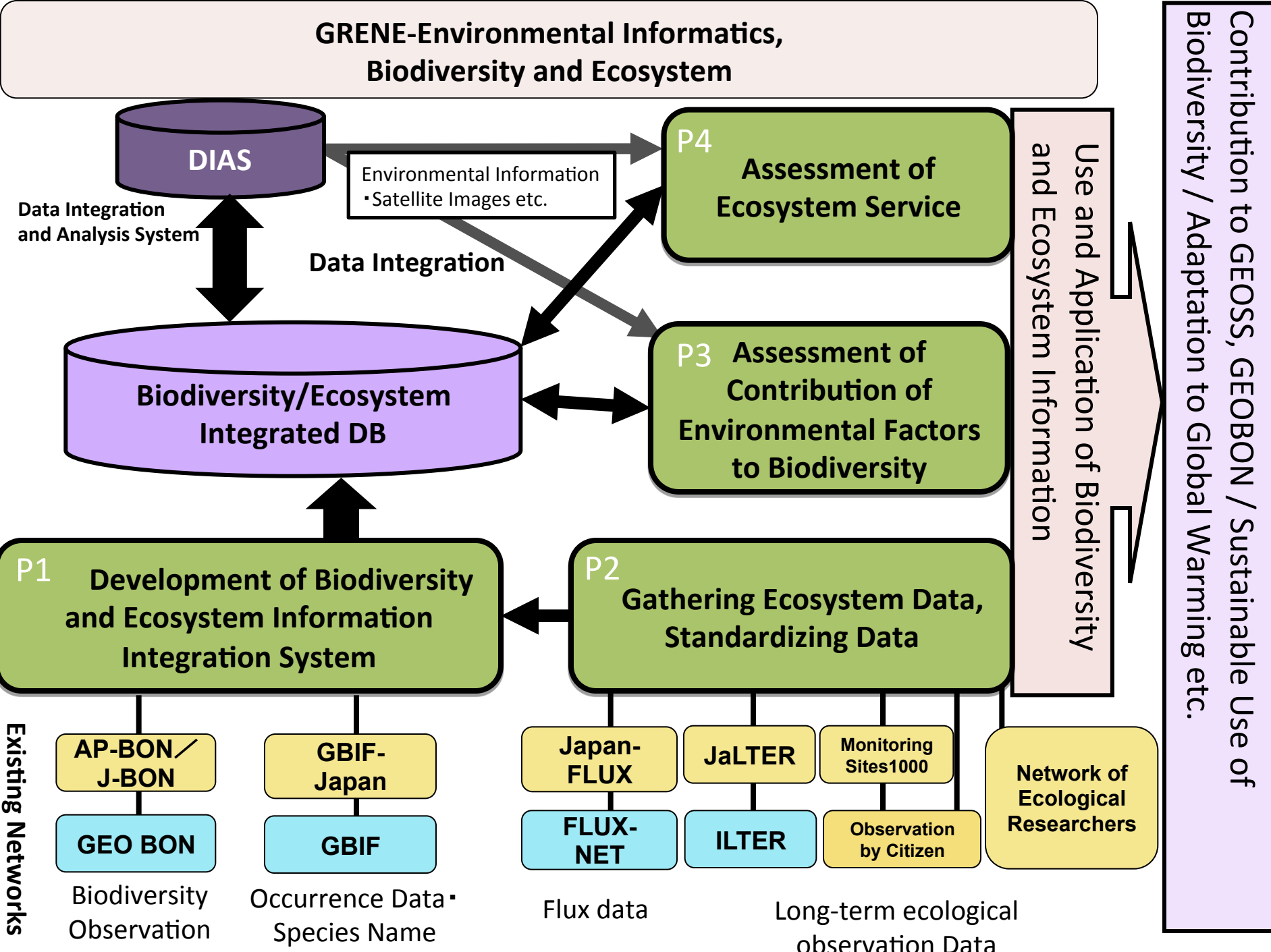
- Define Standard Scheme for each Layer
- Use Same Ontology (e.g. EML)
- Create Models describing Relationships between Layers



GRENE-Biodiversity, Ecosystem



GRENE-Environmental Informatics, Biodiversity and Ecosystem



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

Long-term ecological observation Data

Monitoring Sites1000

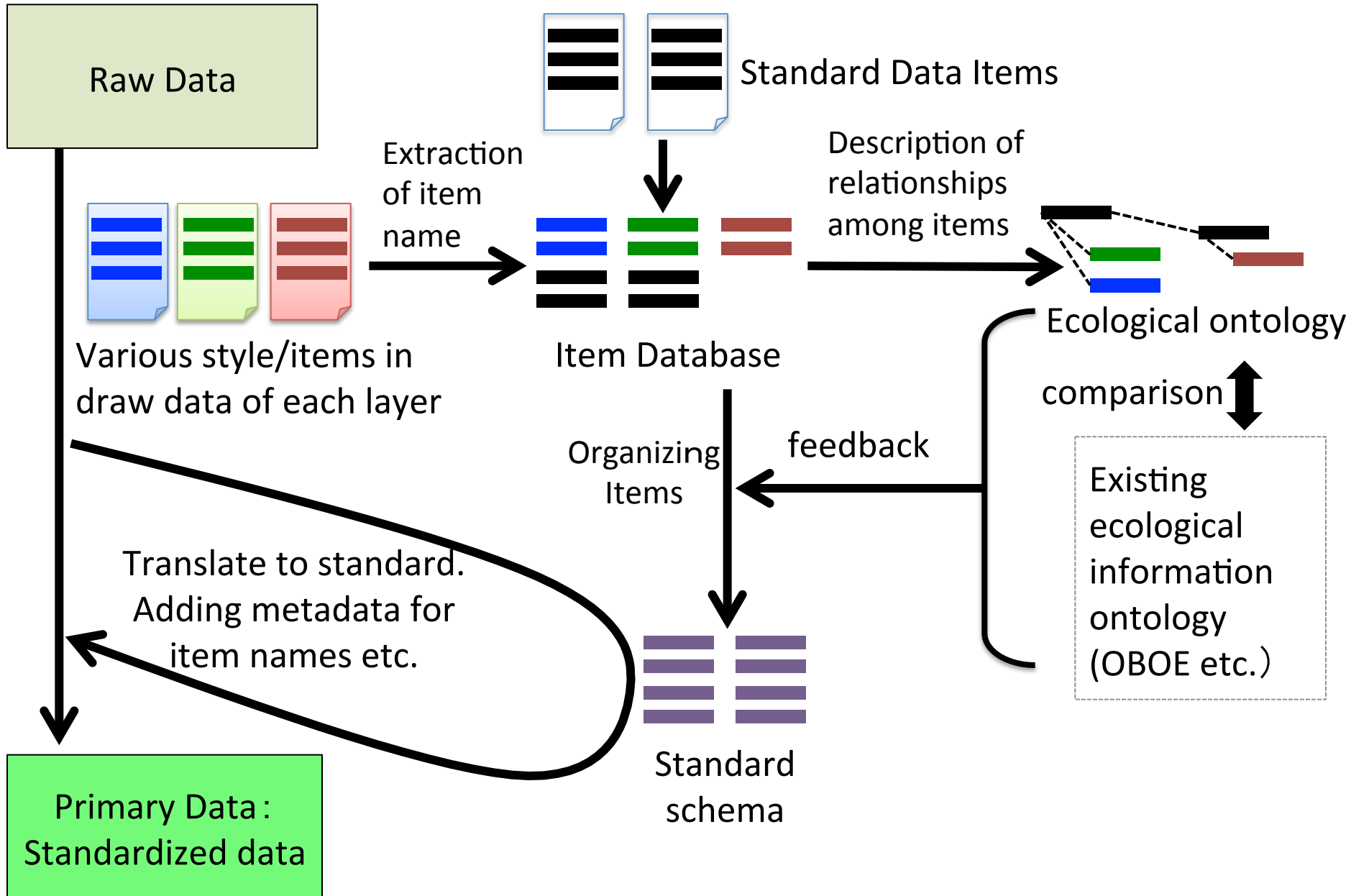
Observation by Citizen

Network of Ecological Researchers

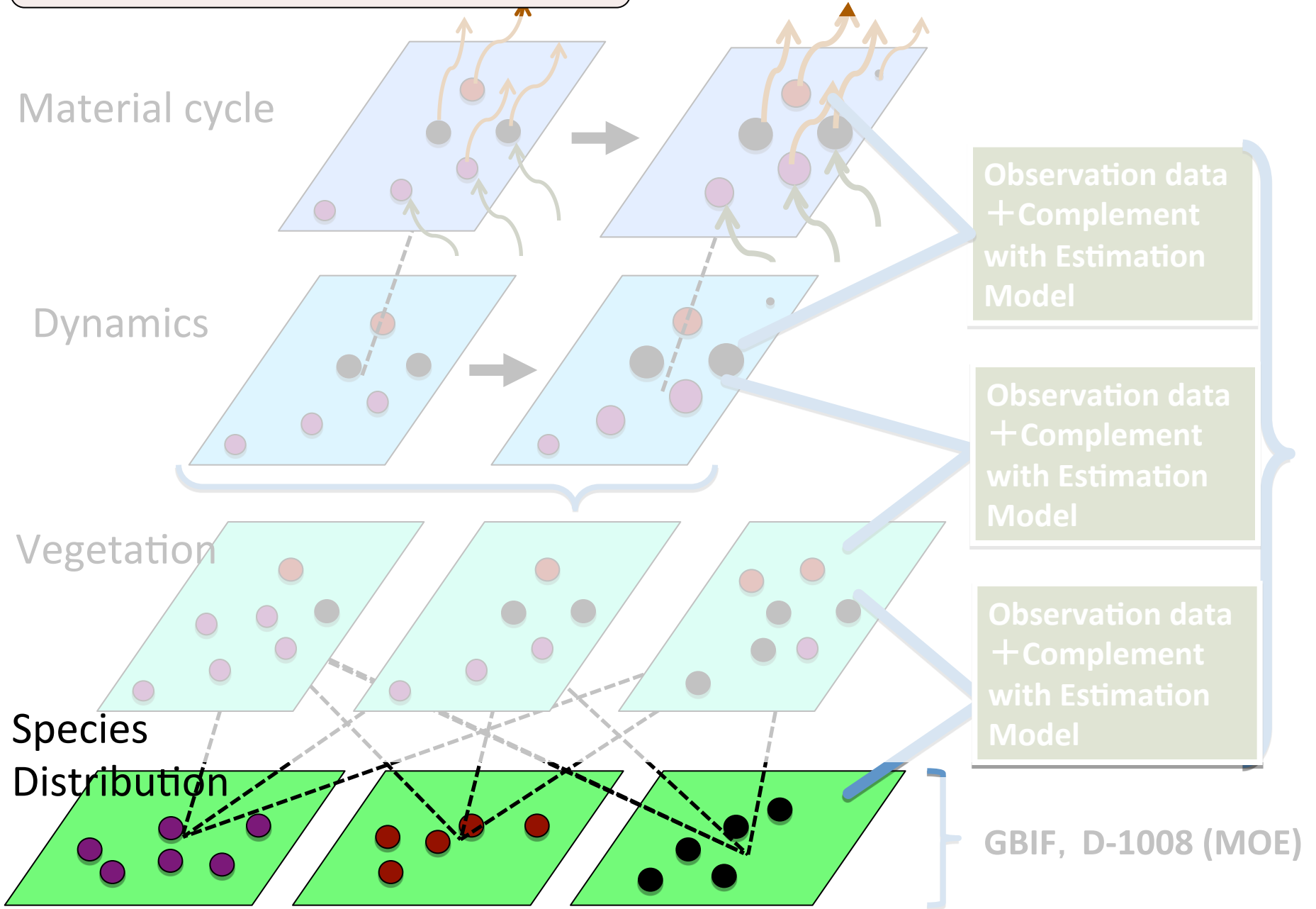
Use and Application of Biodiversity and Ecosystem Information

Contribution to GEOSS, GEOBON / Sustainable Use of Biodiversity / Adaptation to Global Warming etc.

Standardization

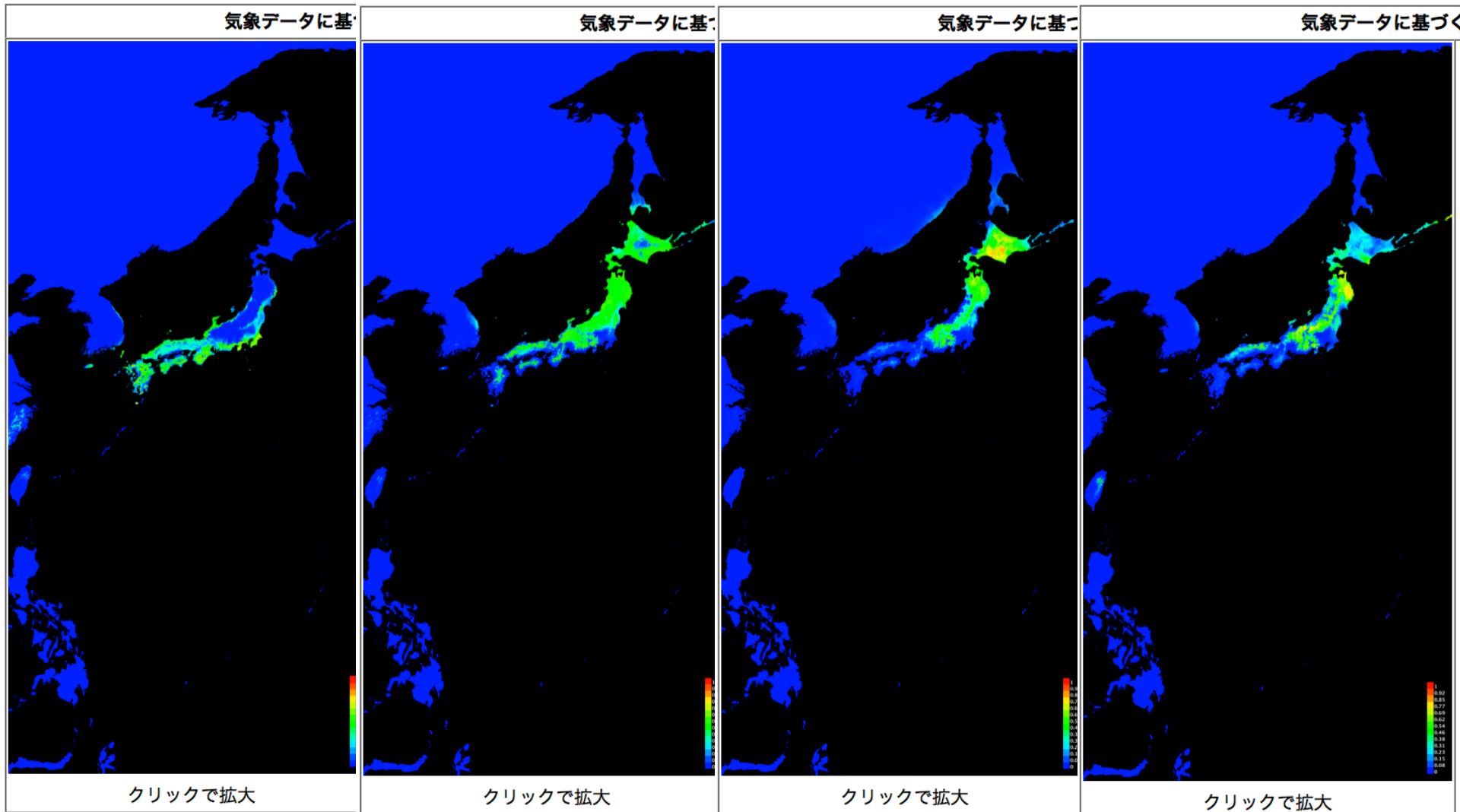


Species Distribution Layer

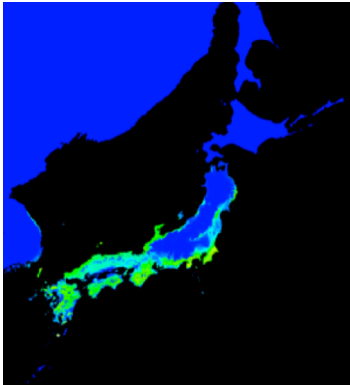


Predicted Natural Distribution of Plants based on Climate Data (Ecological Niche Modeling using Maxent)

学名	<i>Quercus acuta</i> (亜種を含む)	学名	<i>Quercus crispula</i> (亜種を含む)	学名	<i>Acer miyabei</i> (亜種を含む)	学名	<i>Trillium apetalon</i> (亜種を含む)
和名	アカガシ	和名	ミズナラ, ミヤマナラ	和名	クロビイタヤ	和名	エンレイソウ

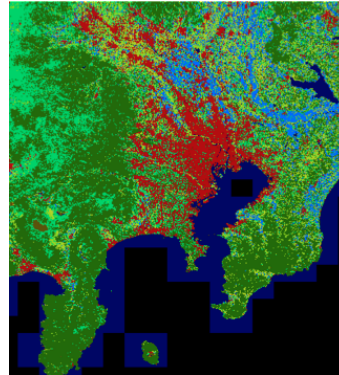


Estimating Actual Distribution



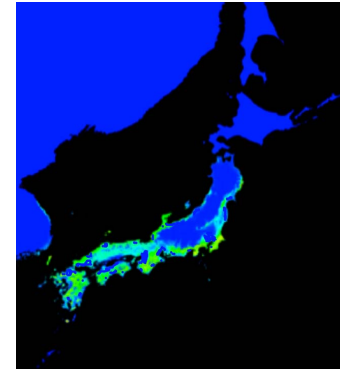
Predicted Natural
Distribution

+



Land Cover Map

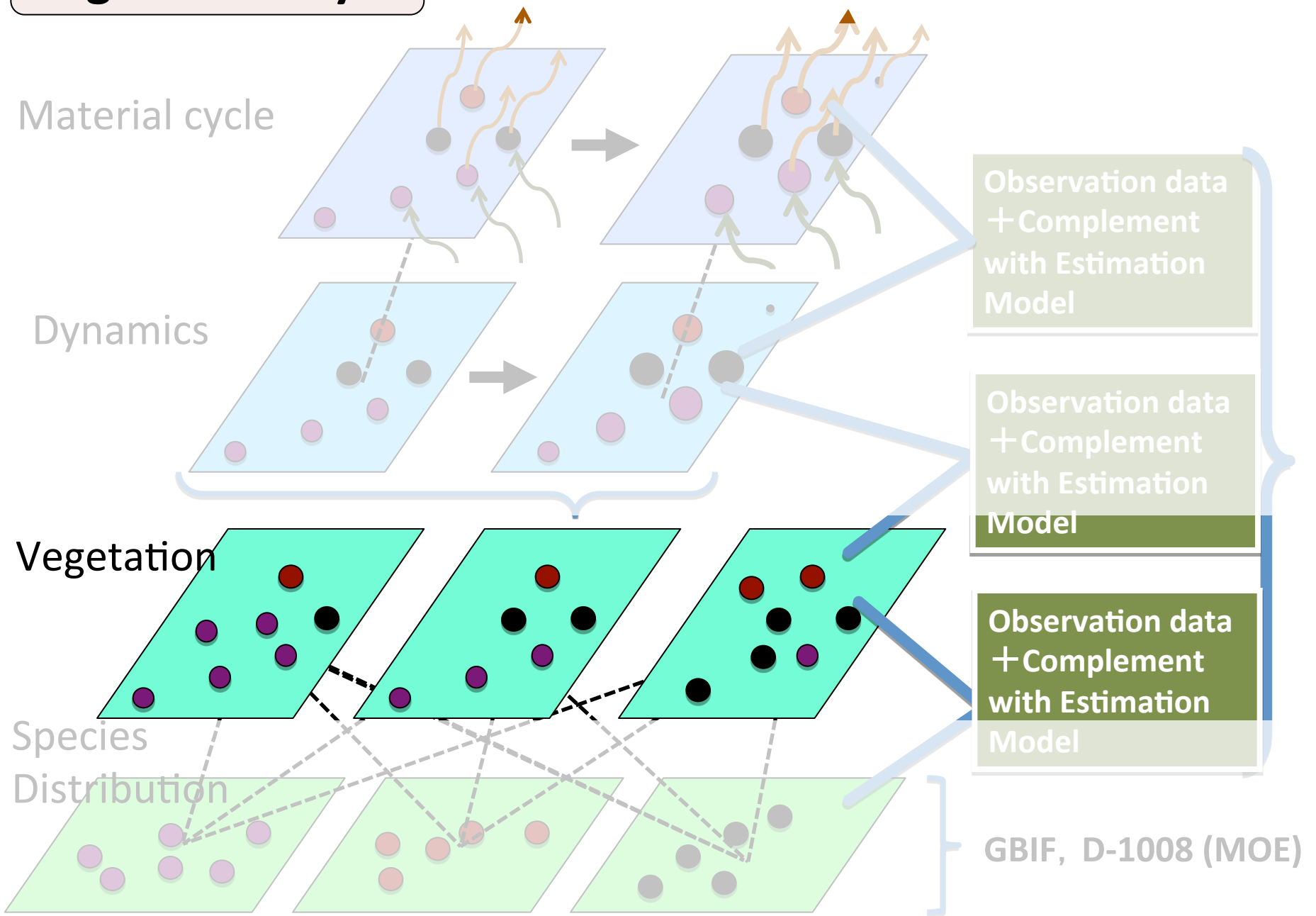
=



Predicted Actual
Distribution

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

Vegetation Layer



Digitalization and Standardization 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

植生調査表

対象地号 12 | 件名 八丁杉のケヤキ林 田舎 大村 50
 調査地 長崎県大村市馬場木戸八丁杉 (風向) 東 (⊙) 傾 (海拔) 590 m
 (地形) 山頂: 麓: (形) 上: 中: (凸) (凹) 谷: 平地 (日当) 陽: (方位) 東 (方位) N30°W
 (土壌) 赤土: 凝灰: 赤: 黄: 黄褐色: ア>D: グライ (土質) 粘 (土質) 粘 (傾斜) 35°
 調査日: 1978年 沖積: 高草: 非固結土: (固結) 水田下 (面積) 10 x 15 m²
 (階層) (優占種) (高さ) (樹高率%) (胸径cm) (密度) (備考) (出現種数) 26

I 高木層	14 ~	70	40 ~ 60 cm
II 亜高木層	8 ~	30	10 ~ 20 cm
III 低木層	2 ~	10	
IV 草本層	0.7 ~	10	
V コケ層	~		

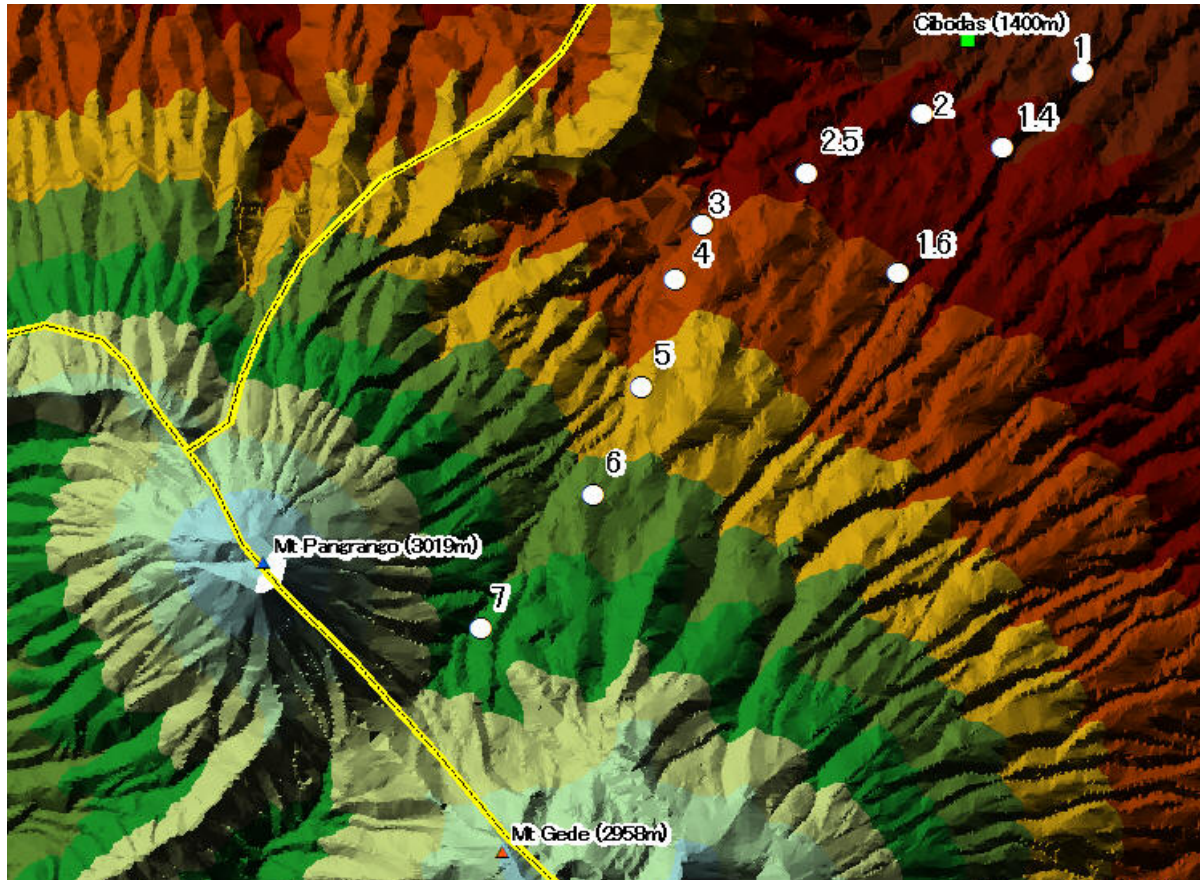
調査
地表に
露出し
て
枯木
立

1978年 8月 10日 調査者

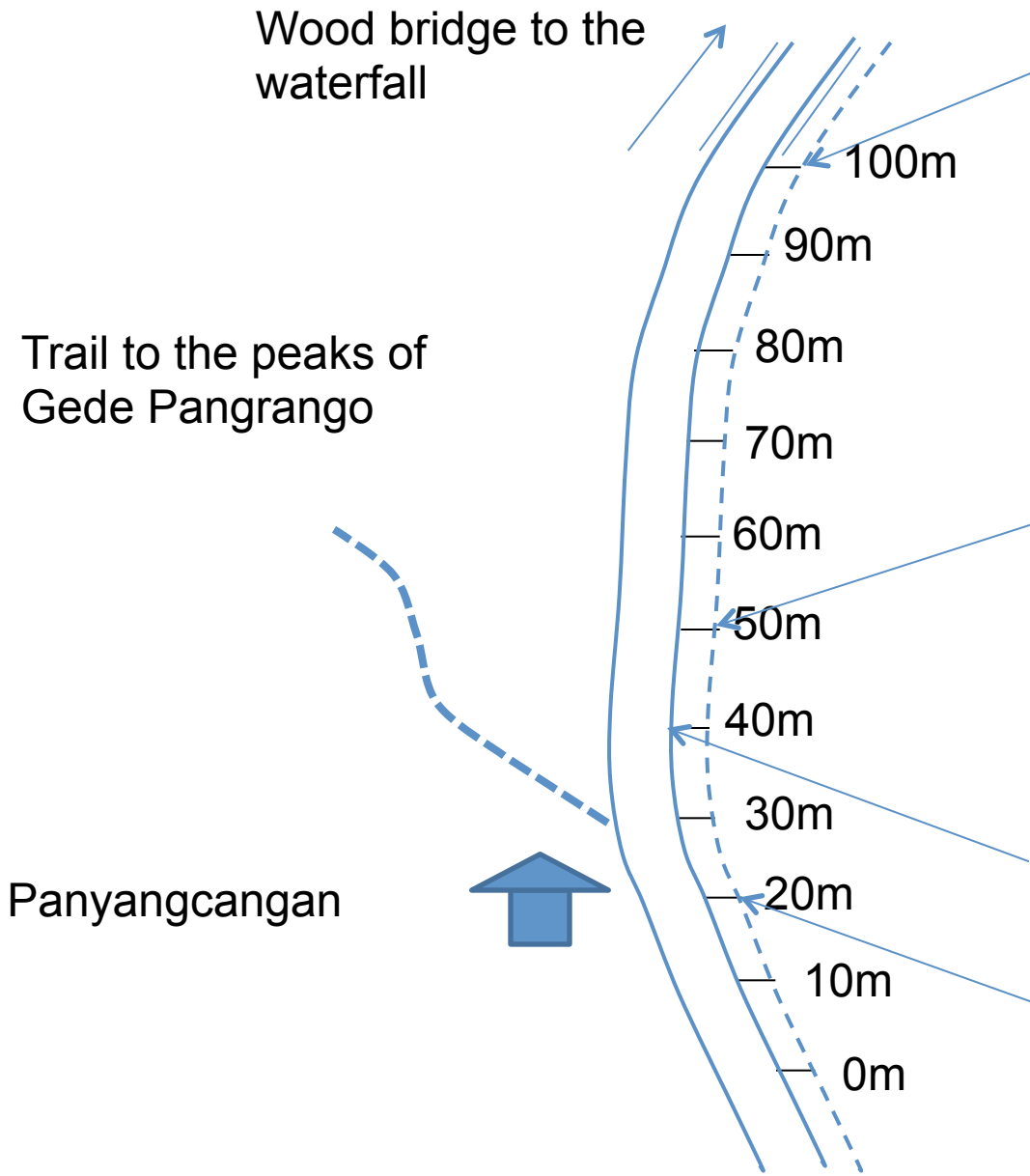
S	D-S-V	SPP.	S	D-S-V	SPP.	S	D-S-V	SPP.
1	2.3	ケヤキ	II	+2	ヤブニツケイ	IV	+1.1	モミジガサ
2	1.2	ホソバタマ		1.2	シキミ		+	ジコウモンゴシダ
3	3.3	ミズキ		+1.1	フリノキ		+	シラヤシ
4				+	カクウツキ		+2	ヤブムラサキ
5				+1.1	ハナイカダ		+	イヌガヤ
6				+2	ヤマアジサイ		+	カヤ
7				+	ミズキ		1.1	ホオノキ
8							+	クサアジサイ
9							+	シケキシダ
10							+2	クサアジサイ
11	2.2	ヤブニツケイ					+	イノチモドキ
12	+	イヌガヤ					+	ナツズタ
13	+	マブツバキ					+	ケヤキ
14	1.1	イタヤカエデ					(+)	ヤバチアキギリ
15	1.2	シキミ						
16	+	カヤ						
17	2.1	イヌガヤ						
18	+	エゴノキ						
19	+	ホソバタマ						
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PLANT DISTRIBUTION IN GEDE/PANGRANGO

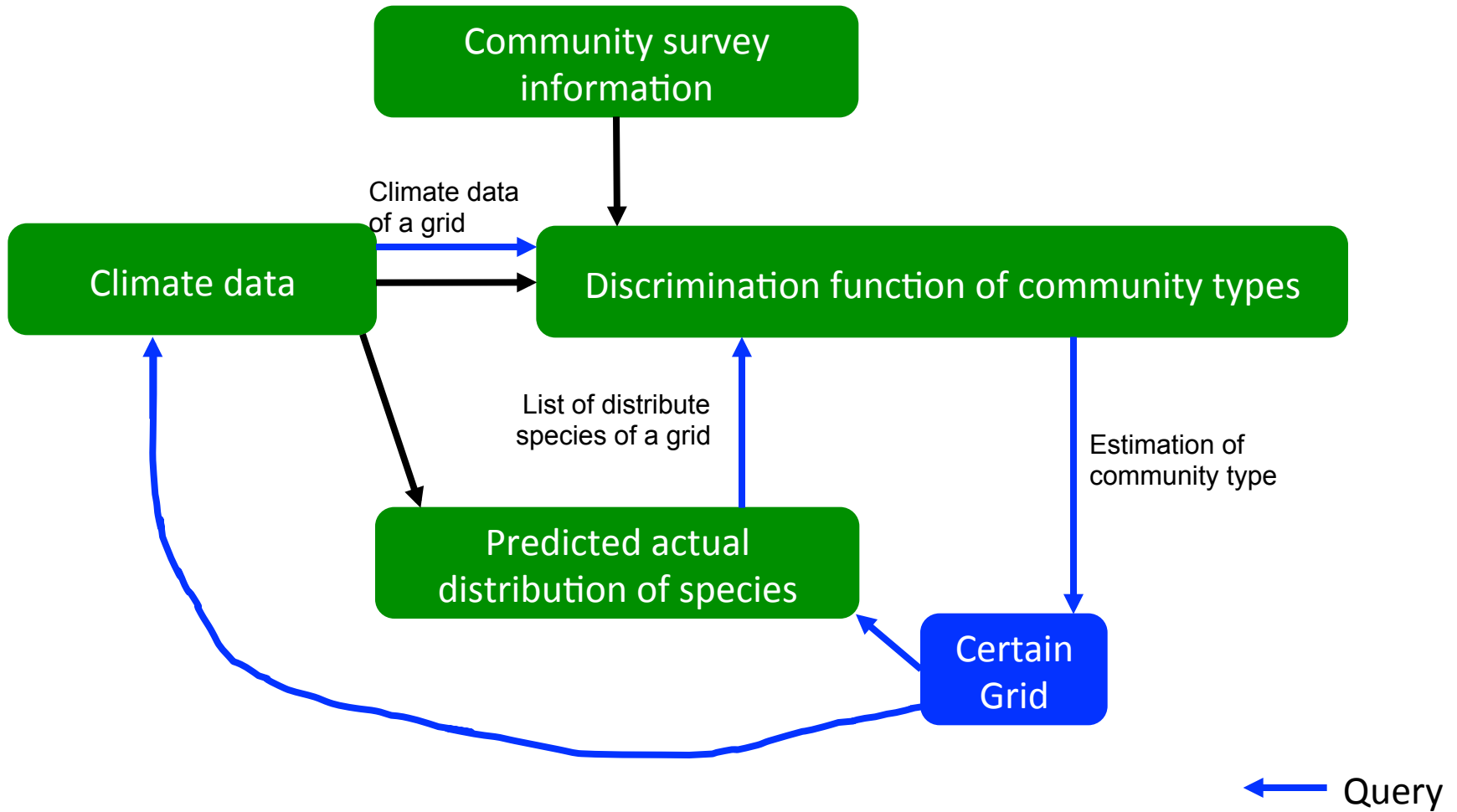
Transect-based approach along altitudinal gradients



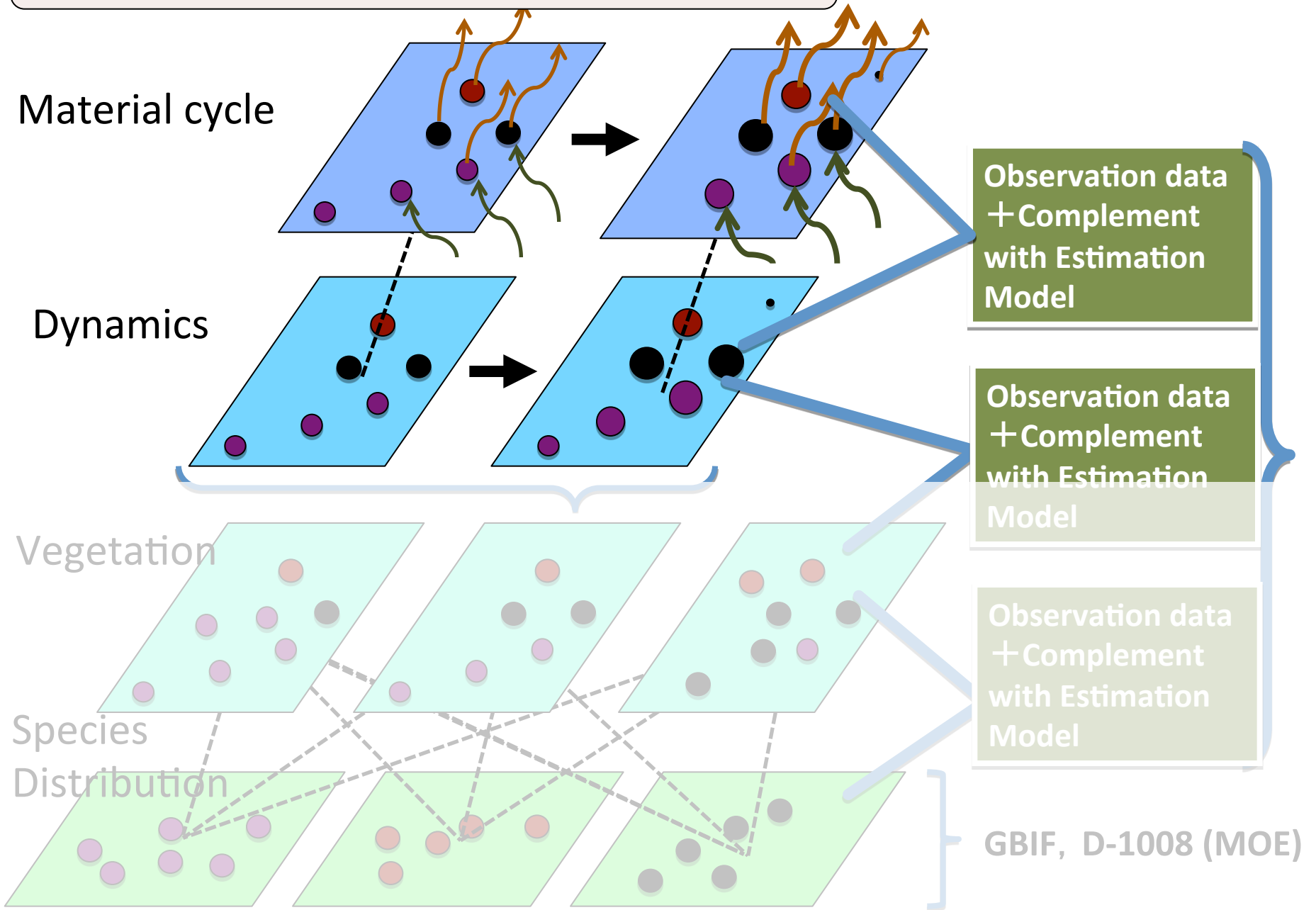
In collaboration with Dedy Darnaedi, Arief Hidayat, Asep Sadili, Marlina Ardiyani (Cibinong), Dwi-san, Zaenal-san (Chibodas BG), Taman Nasional Gede Pangrango



Estimation of Community Type

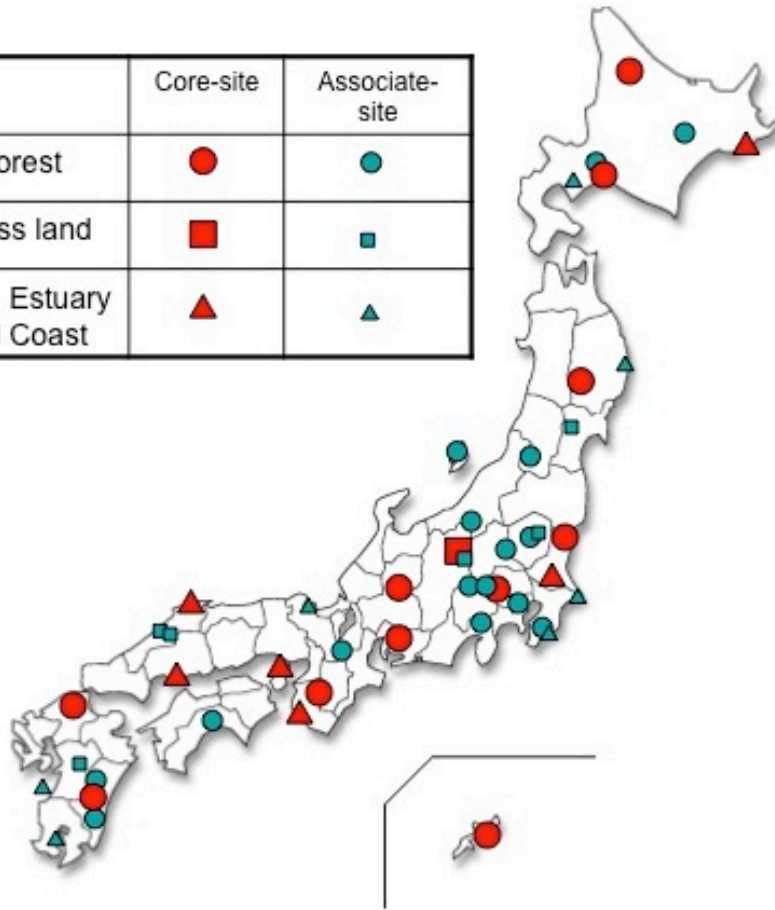


Dynamics and Material Cycle Layers





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



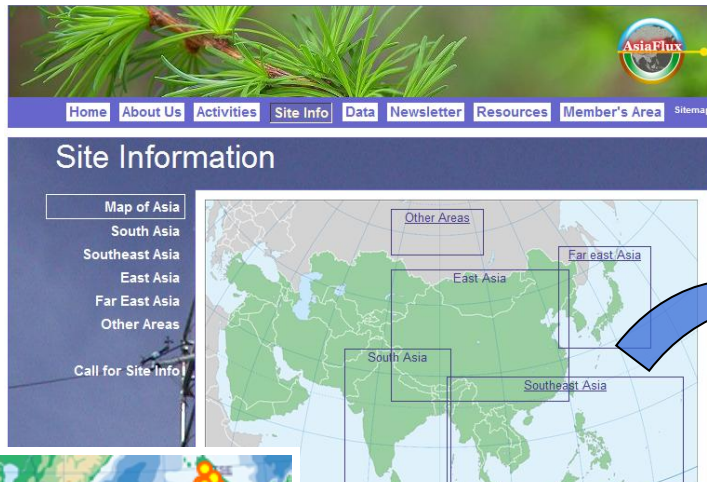
19 Core sites,
30 Associate sites

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/>)

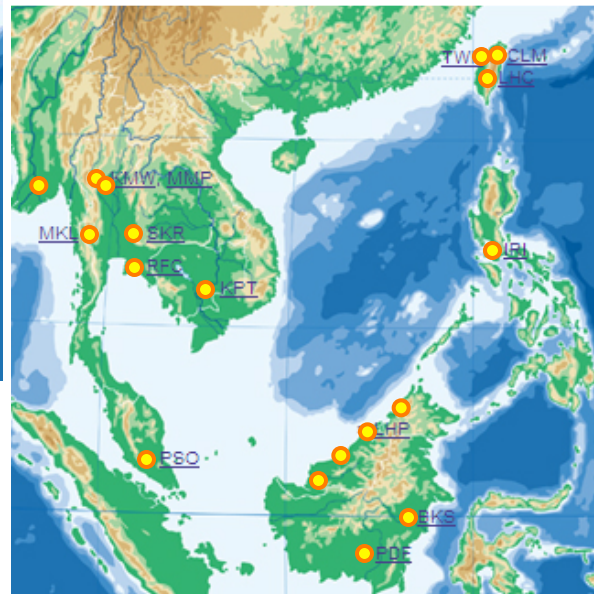


Number of Sites

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



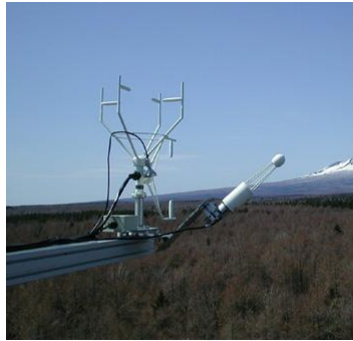
Sites in Japan (31)



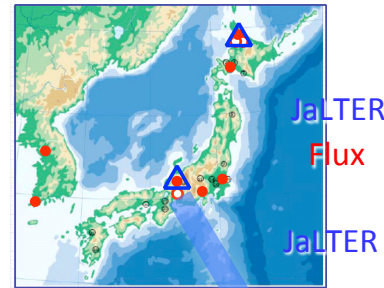
Sites in SE Asia (18)

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

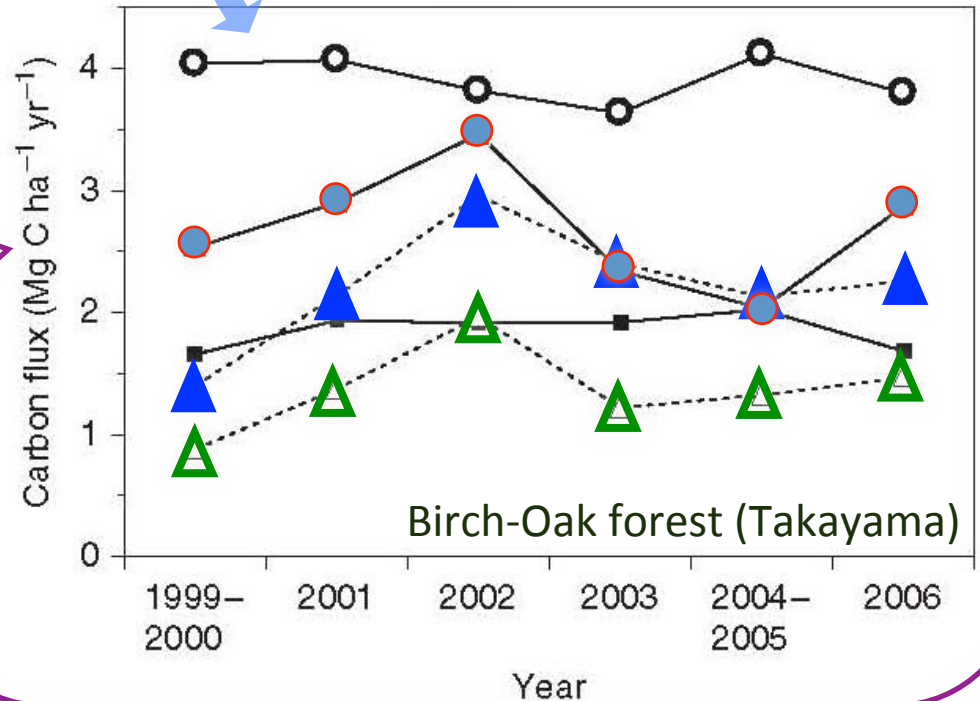
JapanFlux



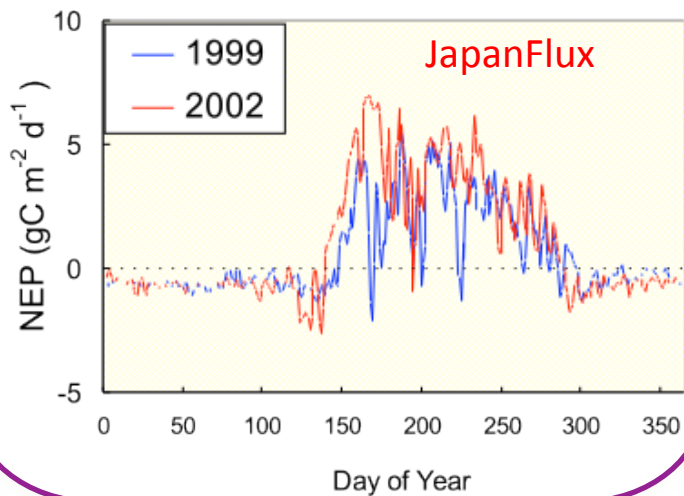
JaLTER



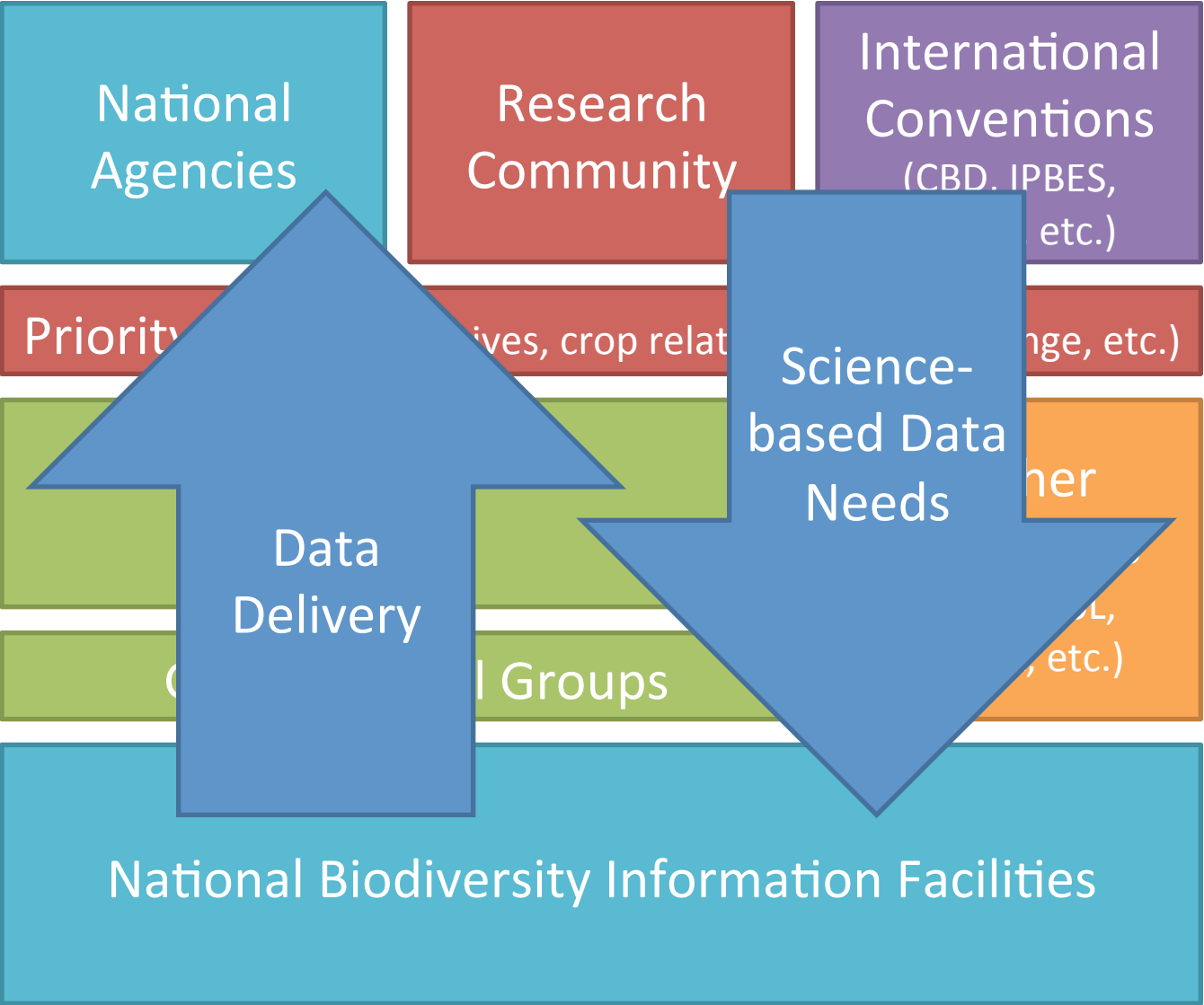
- Heterotrophic respiration
- Eddy covariance-based NEP
- ▲ Biometric-based NEP*
- Foliage NPP
- △ Woody tissue NPP



Seasonal pattern of NEP



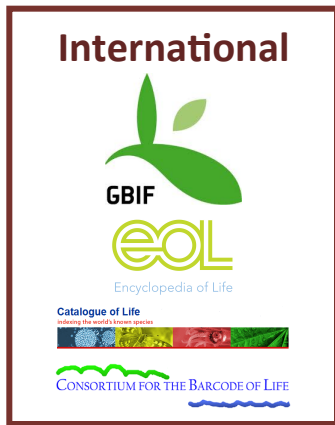
Supporting science needs



National information delivery



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



National Biodiversity Information Facility

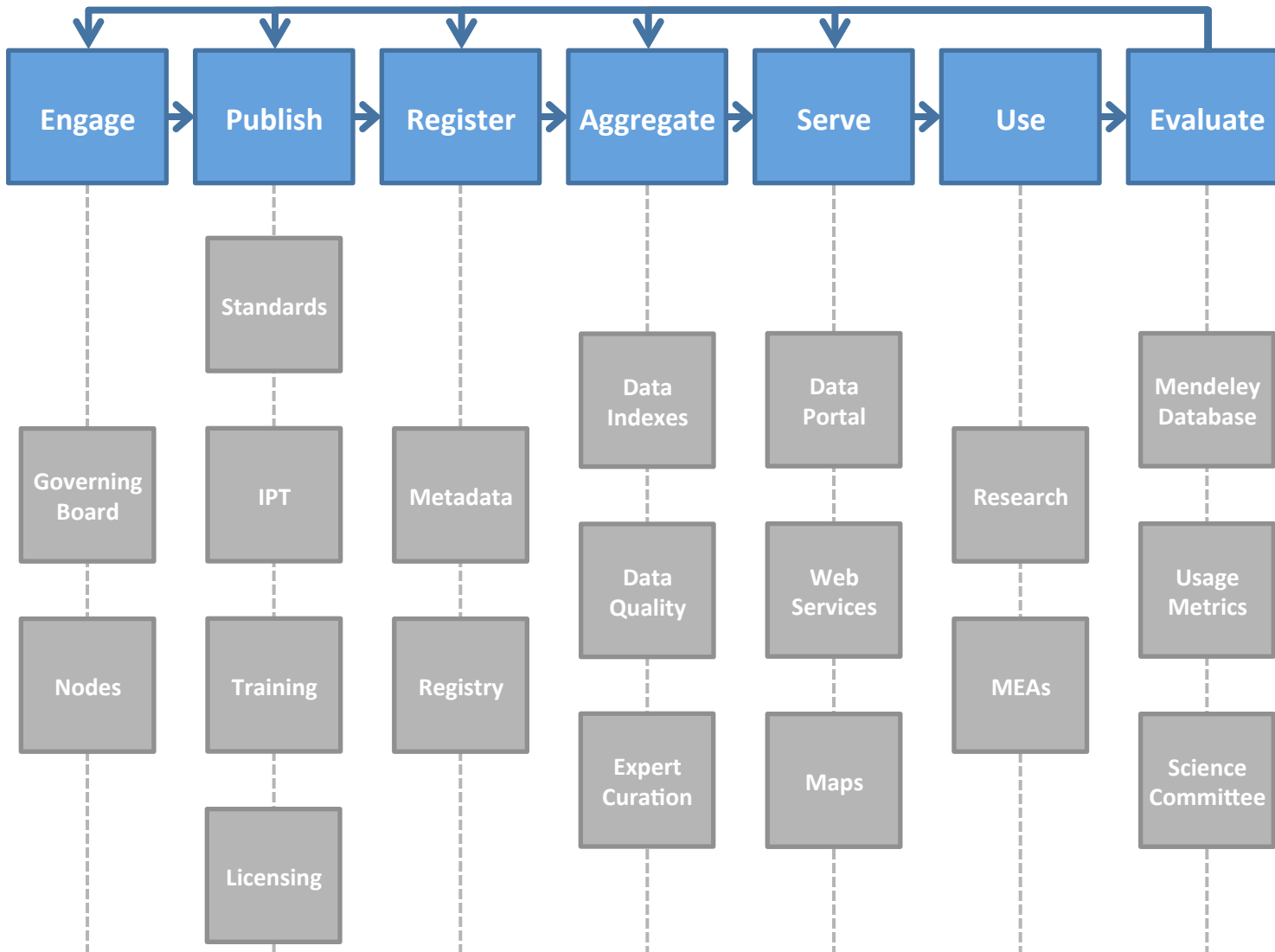


Metadata (source, methods, ownership, access, etc.)

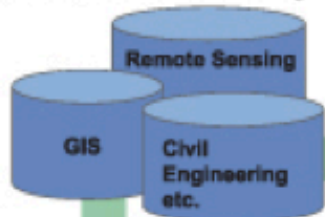
Data (collections, field observations, literature, molecular, images, expert knowledge, etc.)



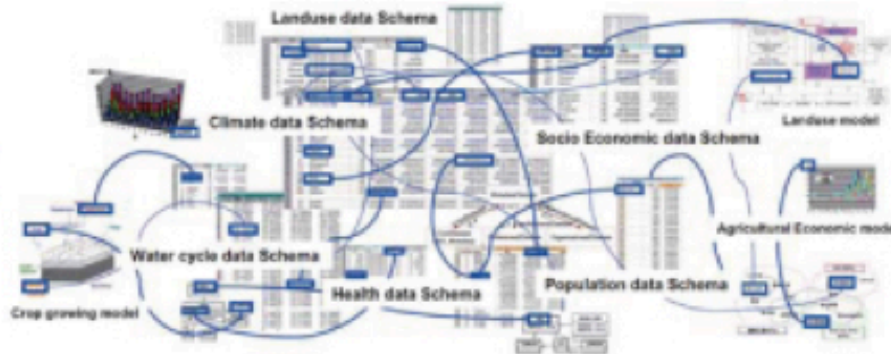
Data pathway



Technical Term Dictionary



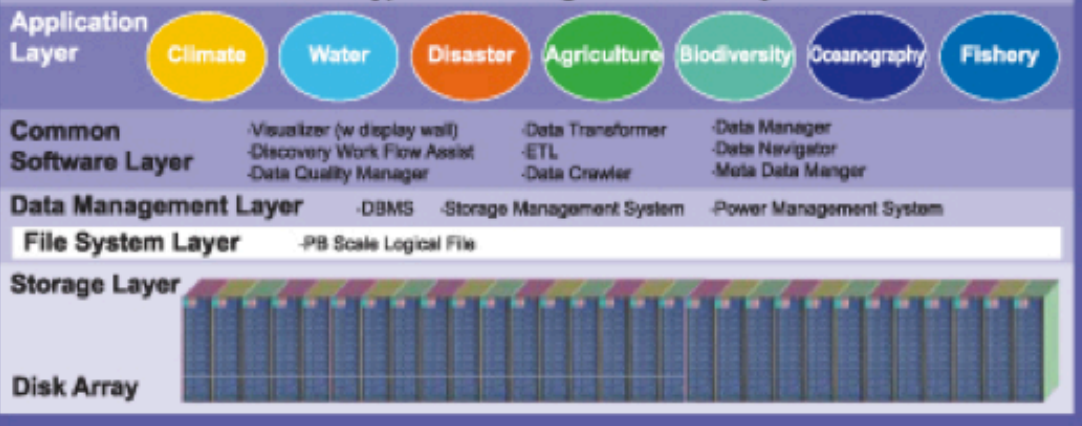
Reverse Dictionary



Geographical Dictionary

Extra Diversity and Complex Relativity of Data and Information

A Prototype of Data Integration and Analysis



Data model Searching System

UML Metadata
XML Schema



Hierarchical Diagram

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



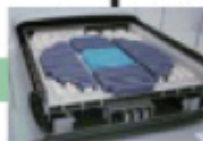
Citizen Observation



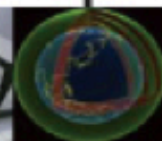
Oceanographic Observation



Satellite Observation



Weather and Climate Model



Operational Observation



Operational Information