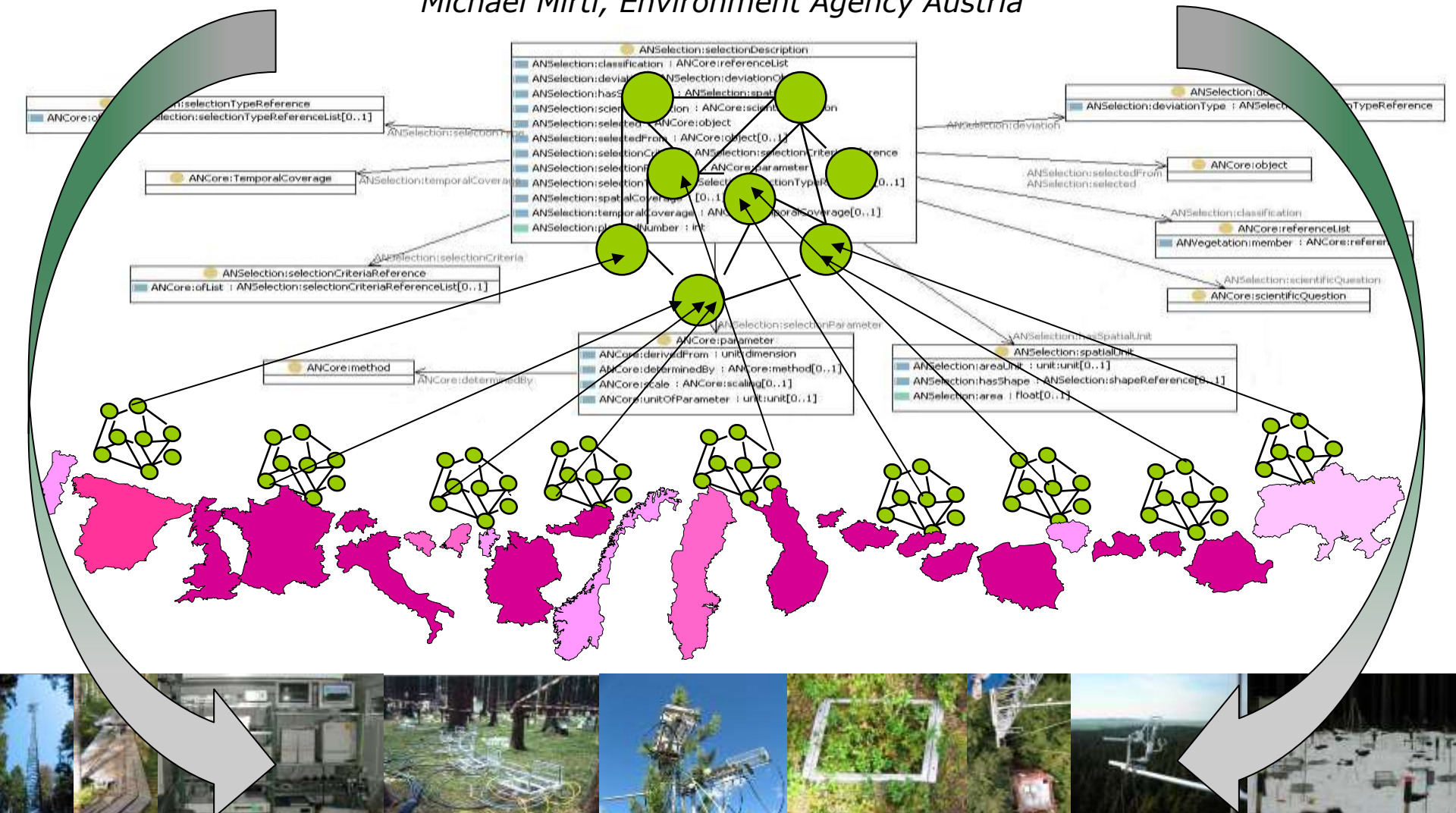
Integrated European Long-term Ecosystem, critical zone and socio-ecological system Research infrastructure

connectinGEO/ ENEON WS, Paris, 21st/22nd September 2015

Michael Mirtl, Environment Agency Austria



The conceptual pillars of LTER

- **Long-term**: dedicated to the long-term AND continuous collection, documentation, provisioning and use of long-term data on ecosystems with a time horizon of decades to centuries (covering the aspect of natural capital for sustainable development)
- **In-situ**: data generation at different spatial scales across ecosystem compartments of individual in-natura sites, European environmental zones and socio-ecological regions
- **Process orientation**: aims at identifying, quantifying and studying the interactions (→ patterns) of ecosystem processes affected by internal and external drivers. As for socio-ecological systems the process orientation implies processes related to ecosystem services and their use.
- **System approach:** interactions of abiotic and biotic components at different scales in a given system
- **Wide-scale ?systematic? coverage** of major terrestrial and aquatic environments

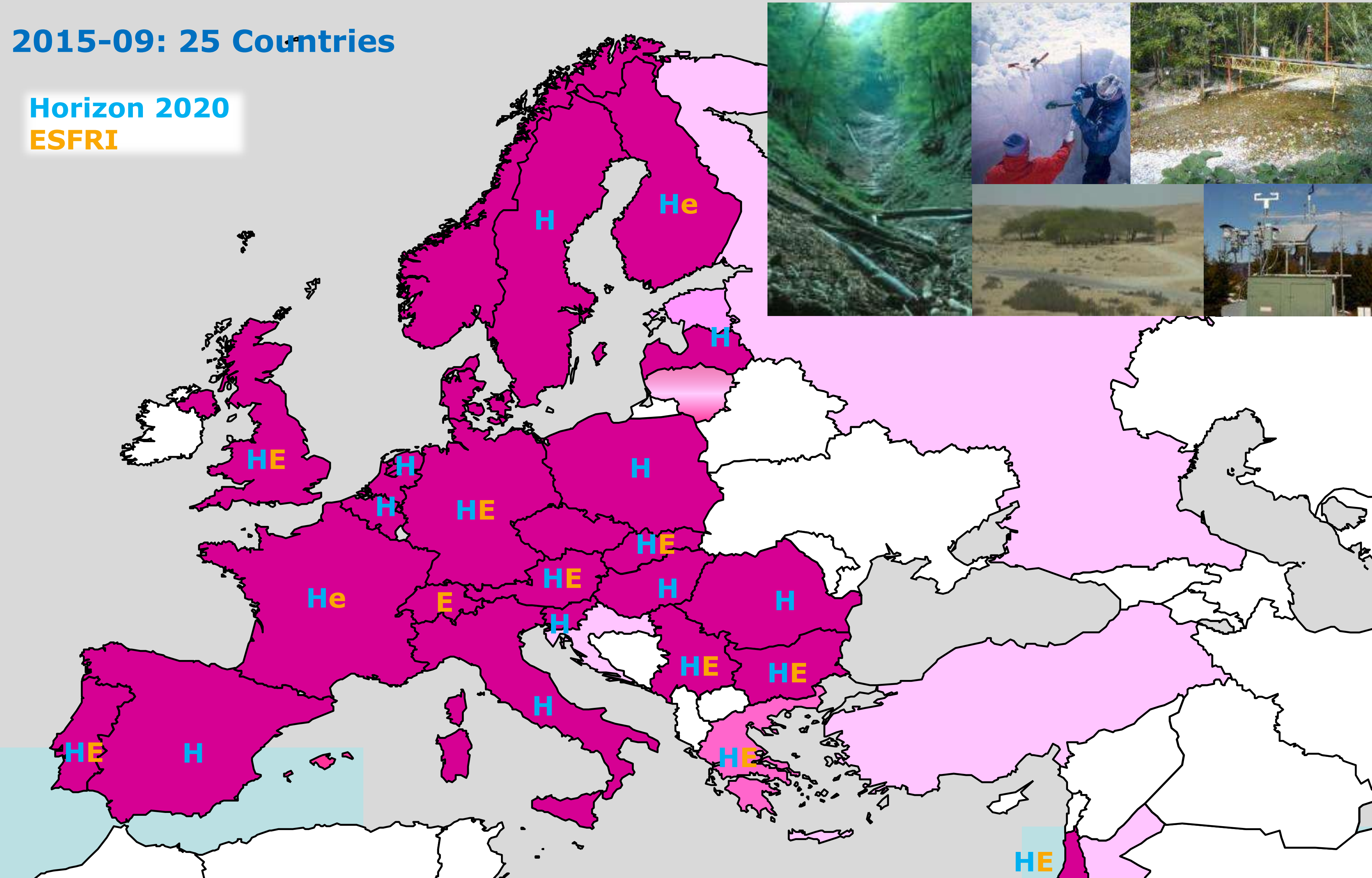
eLTER ESFRI

LTER europe

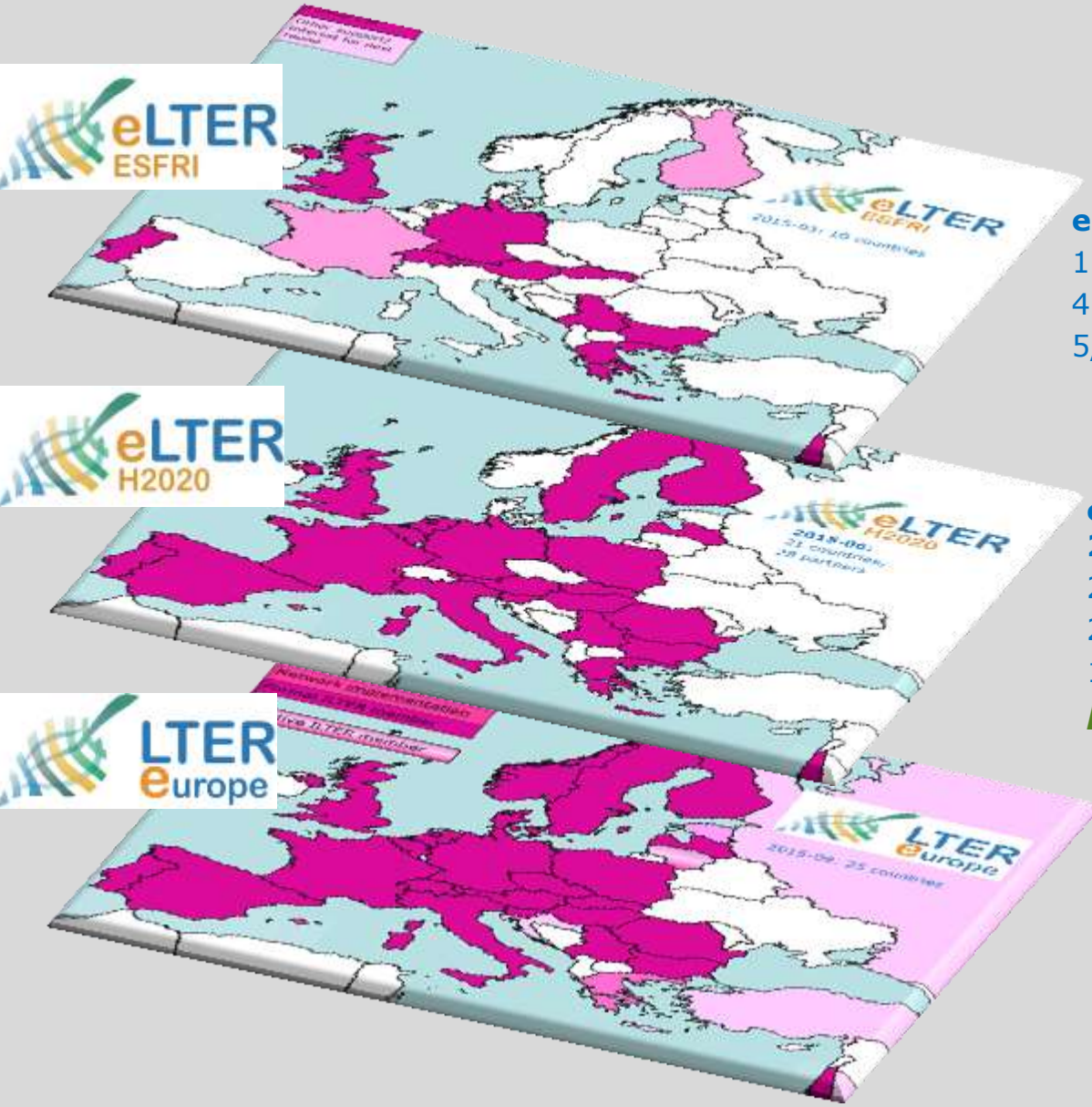
Geopolitical coverage of LTER in Europe

2015-09: 25 Countries

Horizon 2020
ESFRI



Recruiting eLTER ESFRI from well organized national RI networks



eLTER ESFRI initiative
11 initiating countries
45/80/**130** eLTER **Sites** (MS, RS)
5/10/**30** eLTSER **Platforms**

eLTER H2020 Project 2015-2019
21 LTER countries,
28 partners
162 data providing sites
[Q 2.4]

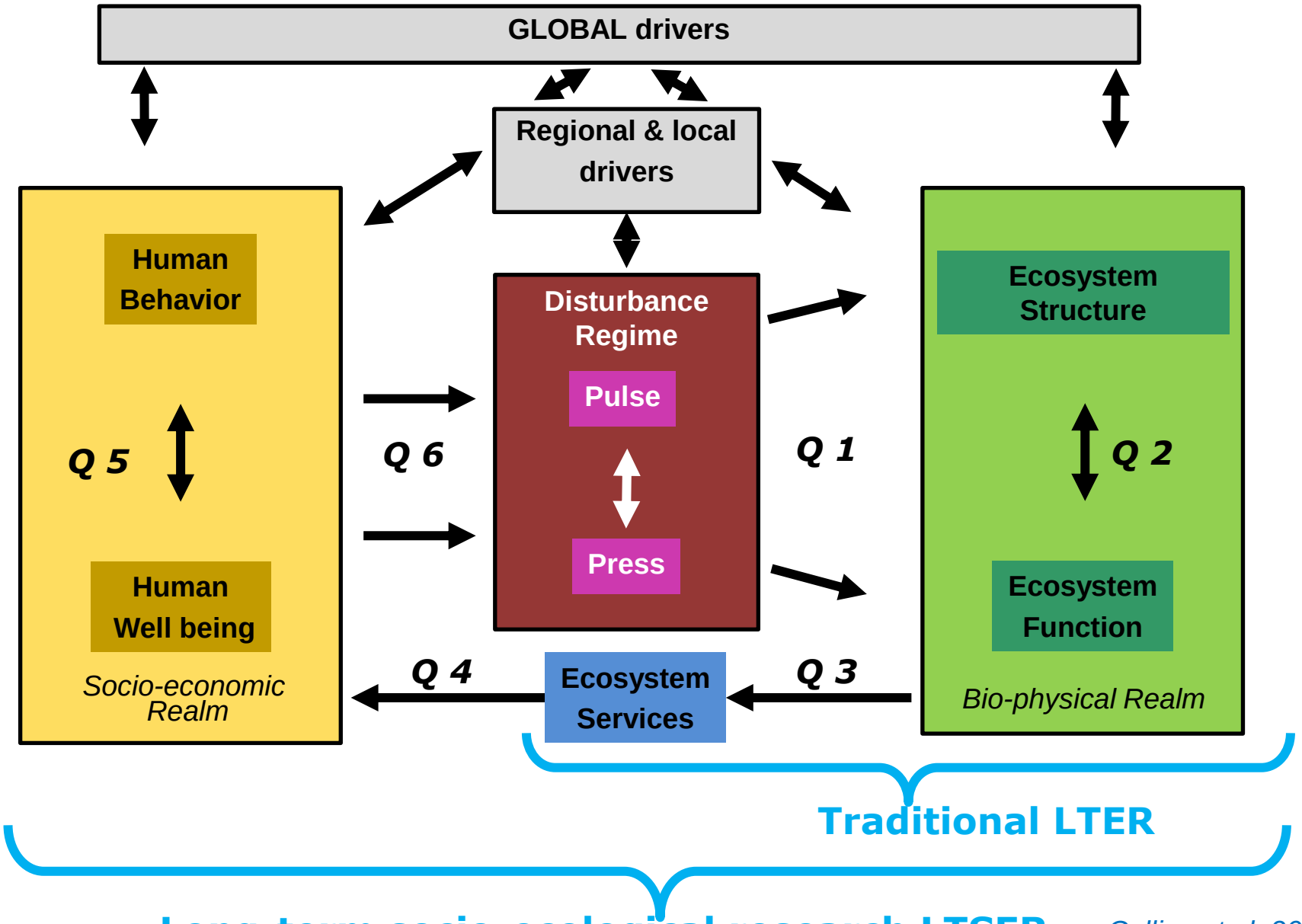
Network of formal national networks
25 countries
400 LTER Sites
35 LTSER Platforms
[Q 6.1]

Recruiting

Standards, Formalisation

Conceptual Framework:

Integrated Science for Society and the Environment



Collins et al. 2011

A European fleet for terrestrial long-term ecosystem and biodiversity research *[→„eLTER Eurofleet"]*

- Generic research infrastructure offering basic services and baseline activities
- Harmonized action of formerly less coordinated elements, enabling new research qualities
- Central steering PLUS adaptive manouvers of individual elements
- Mid- and long-term planning in close interactions with strategic processes & other RIs

Ships/ Fleet:

- Fuel containers, engines
- Access to open sea points of interest
- Space for instruments/sensors
- Computers & signal transmission for general use
- Space for staff
- Long-term planning and operation
- Can host many specific questions, but there are overarching ones
  - Contributions of open sea to C-balance and interactions with climate
  - Ocean current research
  - Sustainable fishery

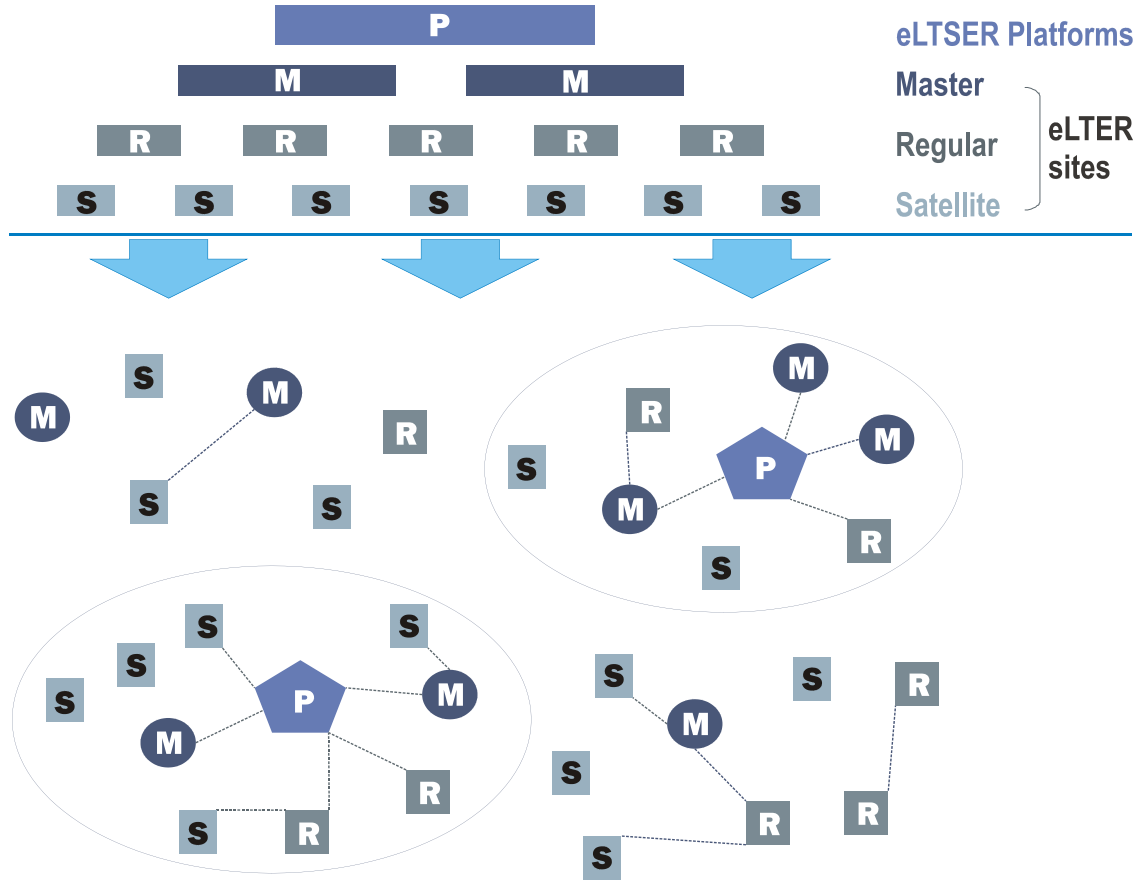
eLTER Sites

- Power supply
- Access all year under all weather conditions

...and other analogies

eLTER ESFRI

Cross Cutting Issue 3 (CCI 3): Site categories, Coverage, representativity, iterative growth and envisaged topology



Spatial construction

Assembles elements

- eLTSER Platforms,
- eLTER Sites (Satellite, Regular, Master)

according to

(1) research needs and

(2) national possibilities.

Related main questions:
Q 1.6: Scientific upgrade plan;
Q 4.2, Q 4.3, Q 5.2: Implementation phases and costs

Exemplary design of a regular LTER Site
(site type = complex; catchment design scale)

Input

Ecosystem Change

Output

- primary production
- population ecology
- organic matter

- inorganic inputs
- disturbances
- biodiversity (implicitly)

PLUS: main drivers

LTER Master sites (nodes for multiple programs and equipment)

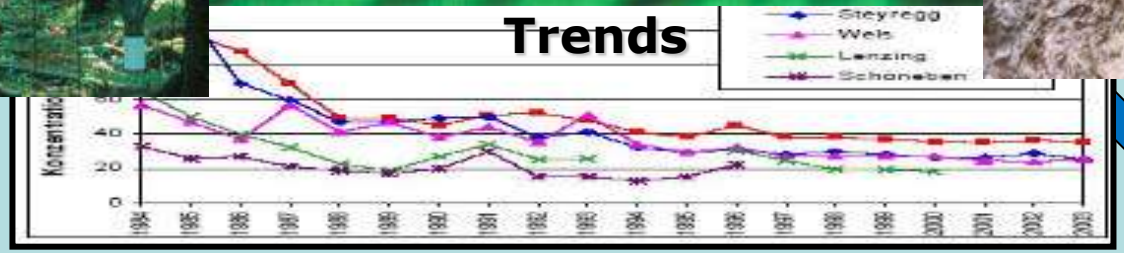
Environmental monitoring schemes

Input

Ecosystem Change
e.g. BioDiv, CZ research

Output

Trends

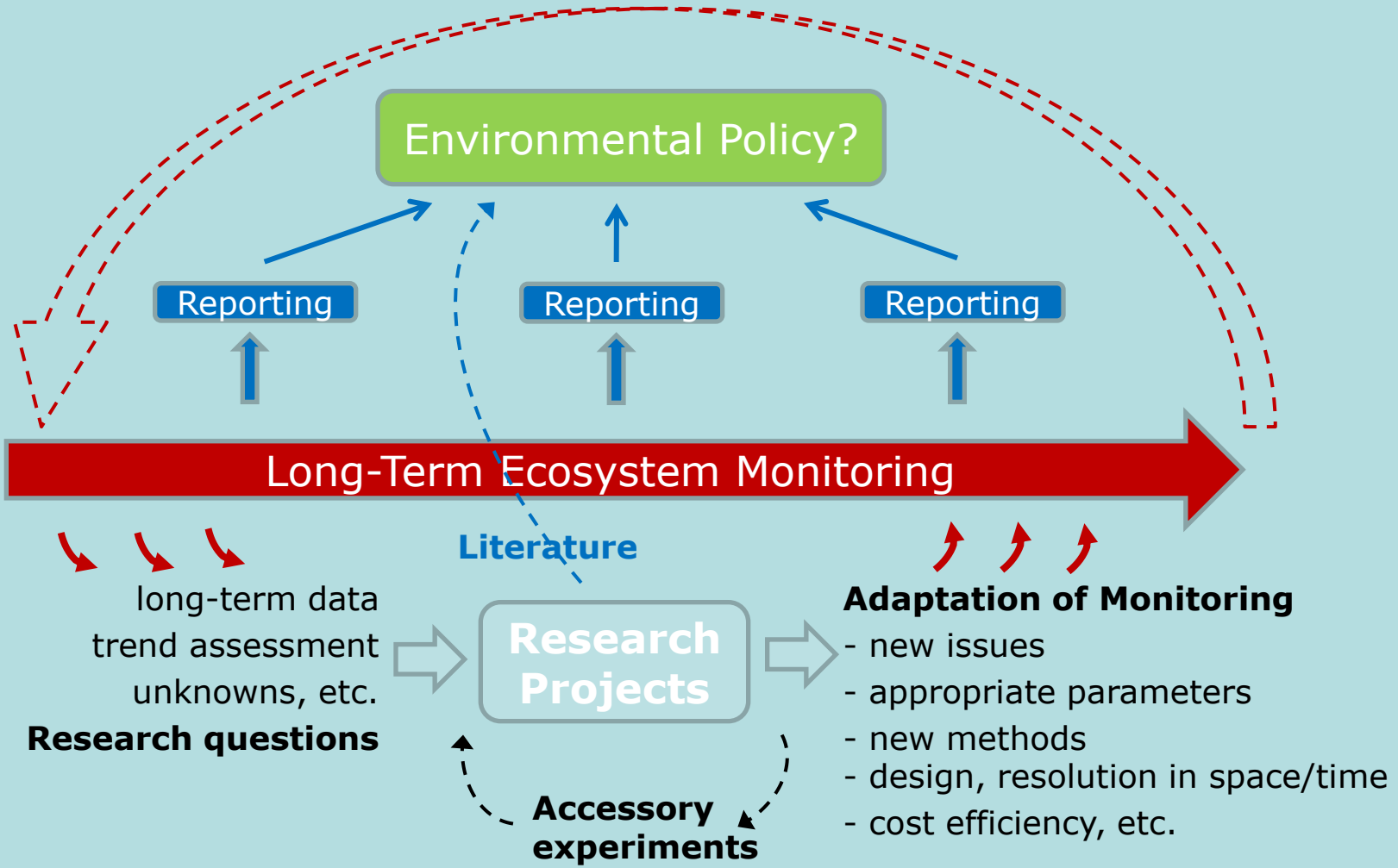


Experiments
e.g. AnaEE,
INCREASE

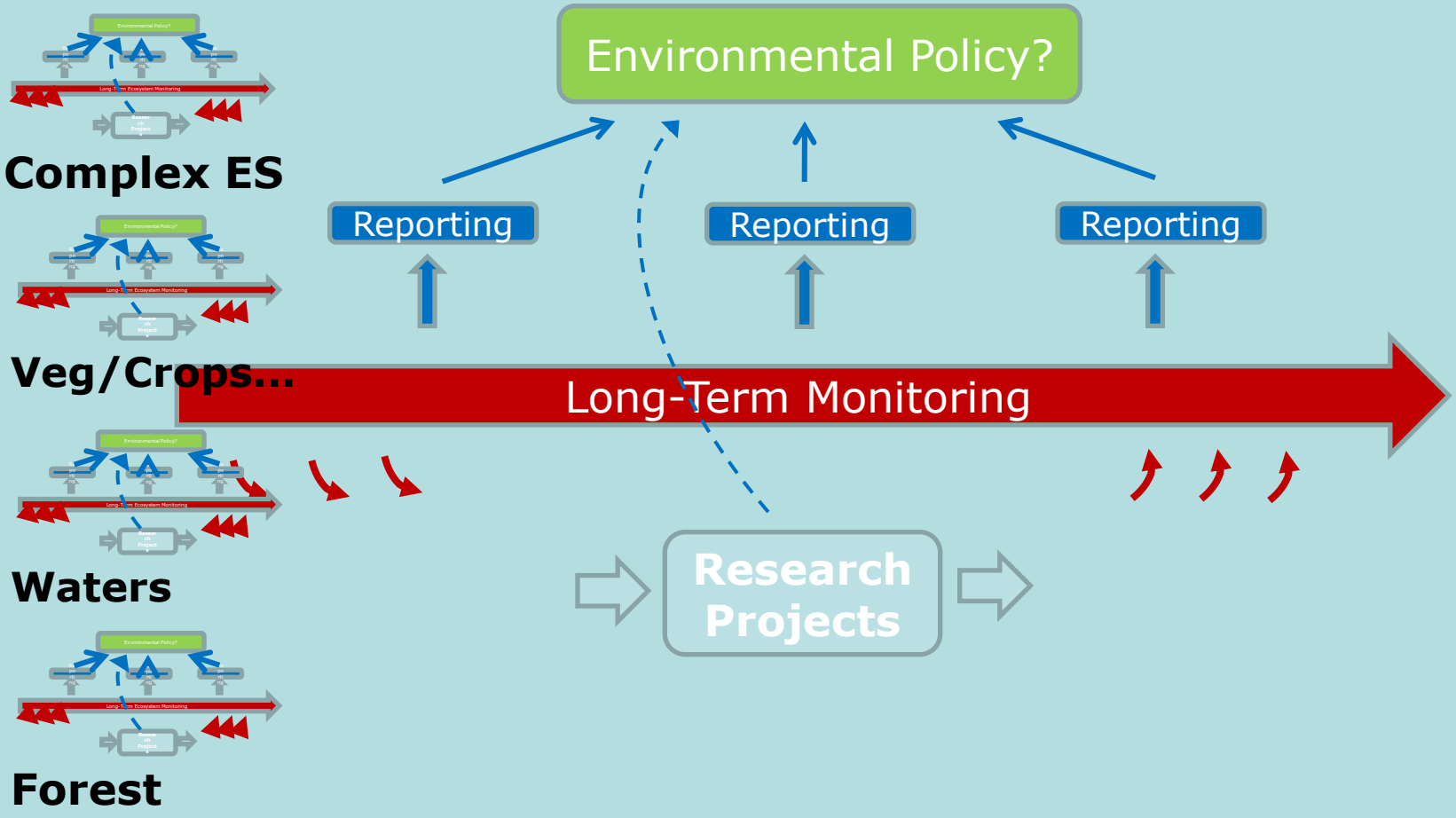
Hydrology,
e.g. NOAH

Atmosphere,
e.g. ICOS

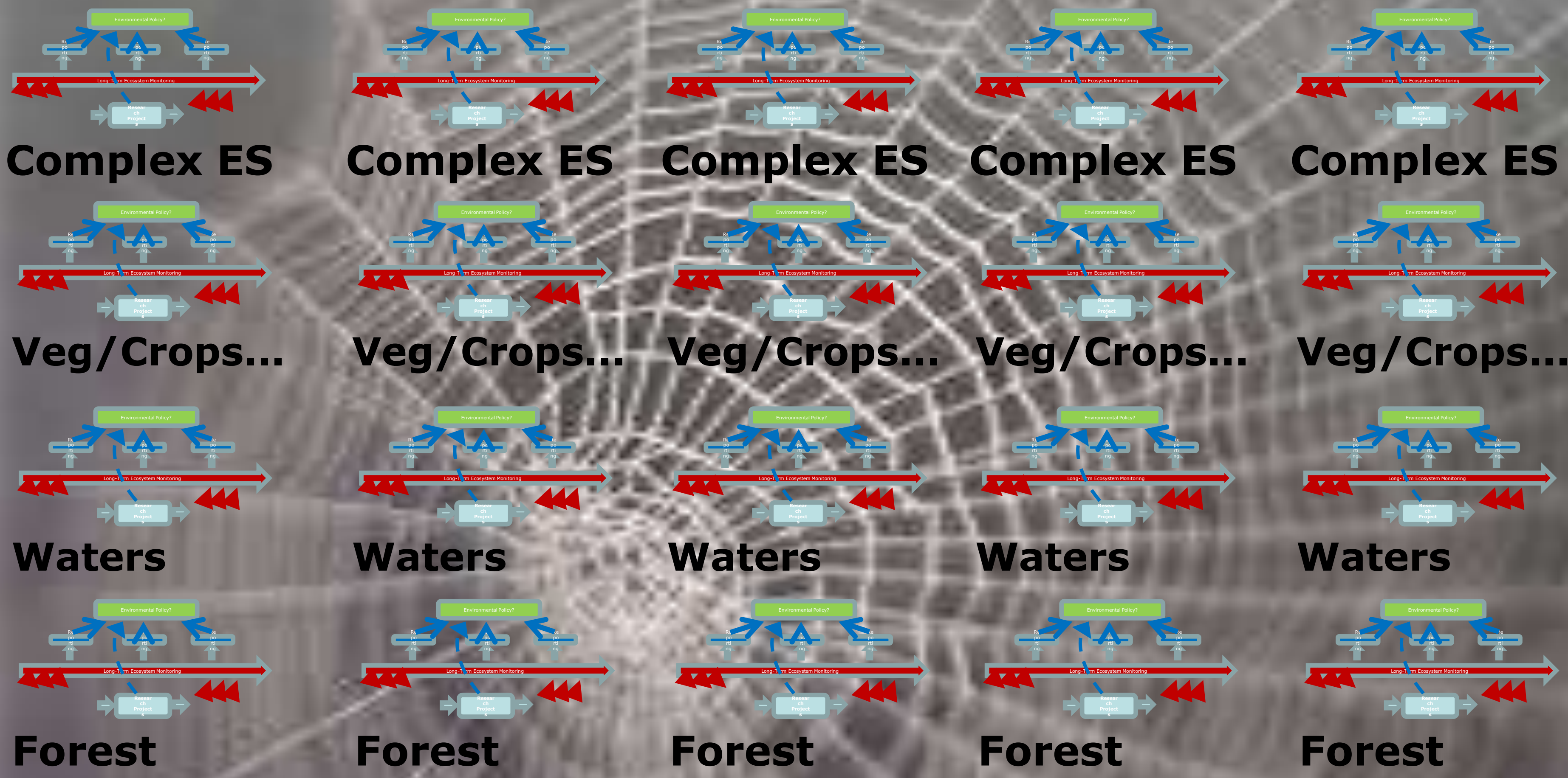
Iterative scientific workflow and the continuous improvement of monitoring



Distributed teams across ecosystem types ….



Coverage of environmental gradients at the continental scale



LTER-Europe strategy towards consistent earth observation at the network level and high level contributions

BOTTOM UP: What is out there?

Site documentation & classification

- site metadata system (DEIMS)
- classification of sites

Data documentation & mapping

- documentation of data sets and data including design and methodologies (EML...)
- semantic annotation/mapping - scientific context of data for natural, sociological and economic data
  → SERONTO
  → EnvThes

TOP DOWN: Adapt, construct

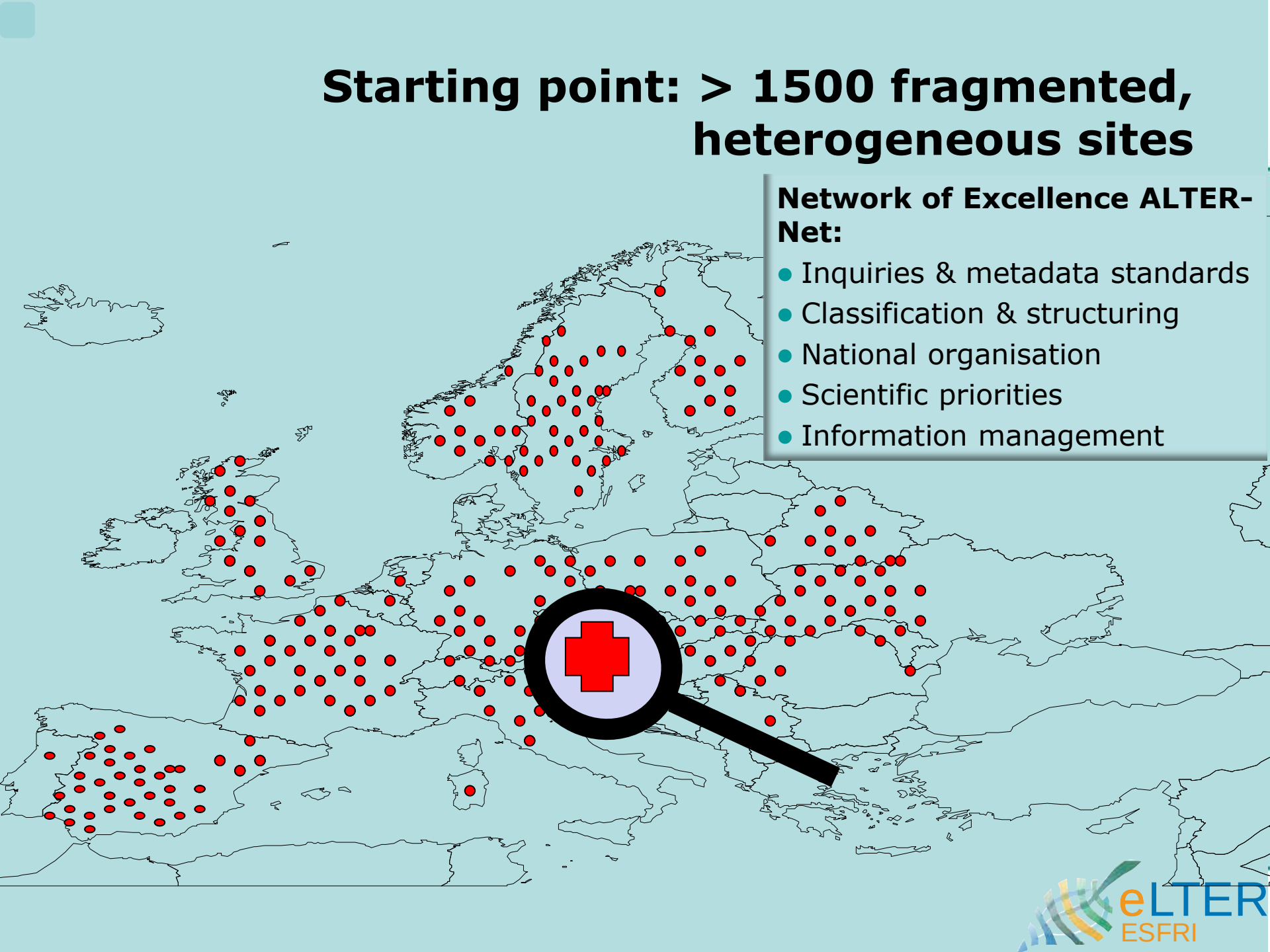
Increasing pressure towards standardization and harmonization

- joint development of standard parameters and methods across habitat types and domains
  → **RECOMMENDATIONS**
- multiple use of data and sites (EnvEurope projects, multi-site experiments)
- co-operations at the network level; network integration: EUBON, ALTER-Net, Copernicus, UNECE ICPs, ESFRI RIs, ENVRI+

Infrastructure development

- eLTER ESFRI
- nationally

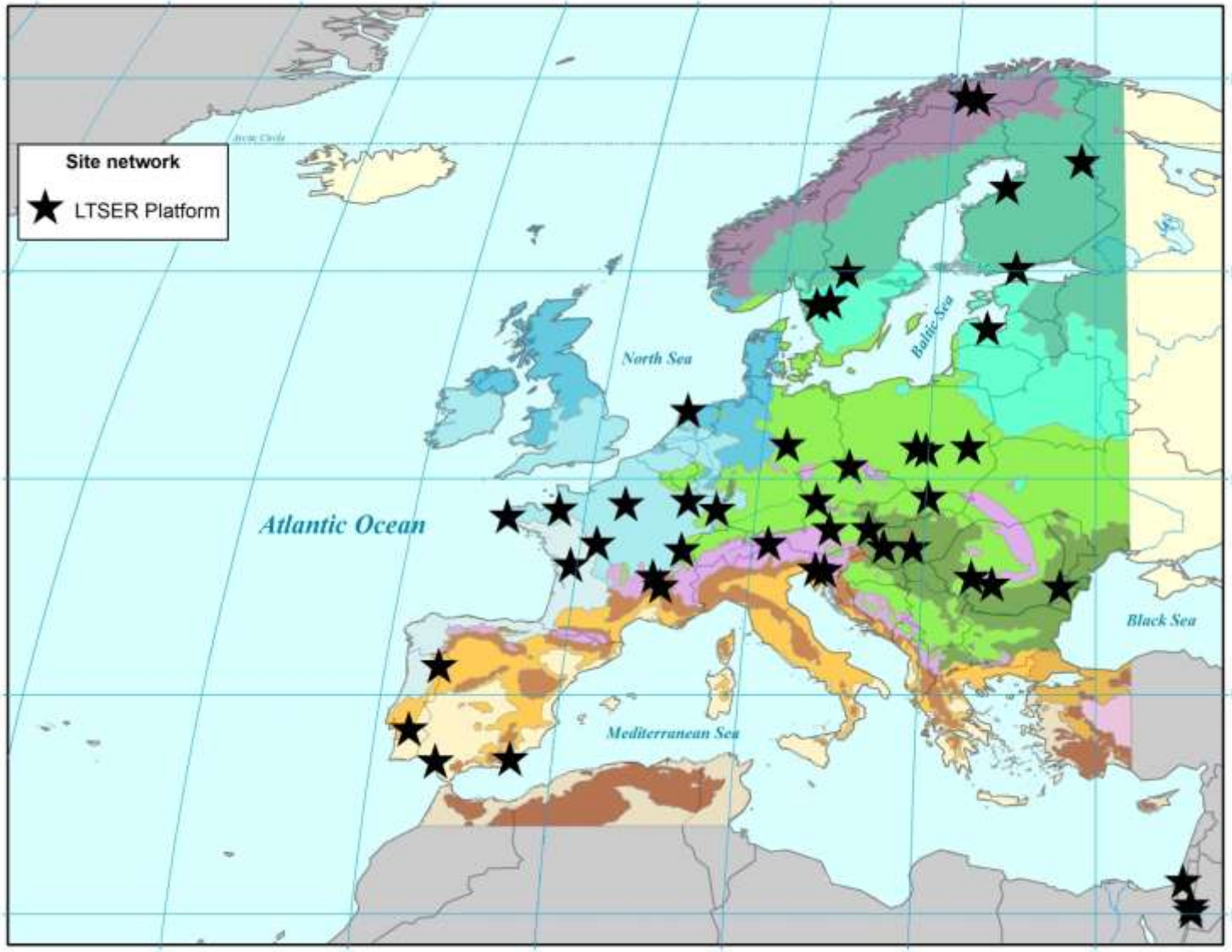
Starting point: > 1500 fragmented, heterogeneous sites



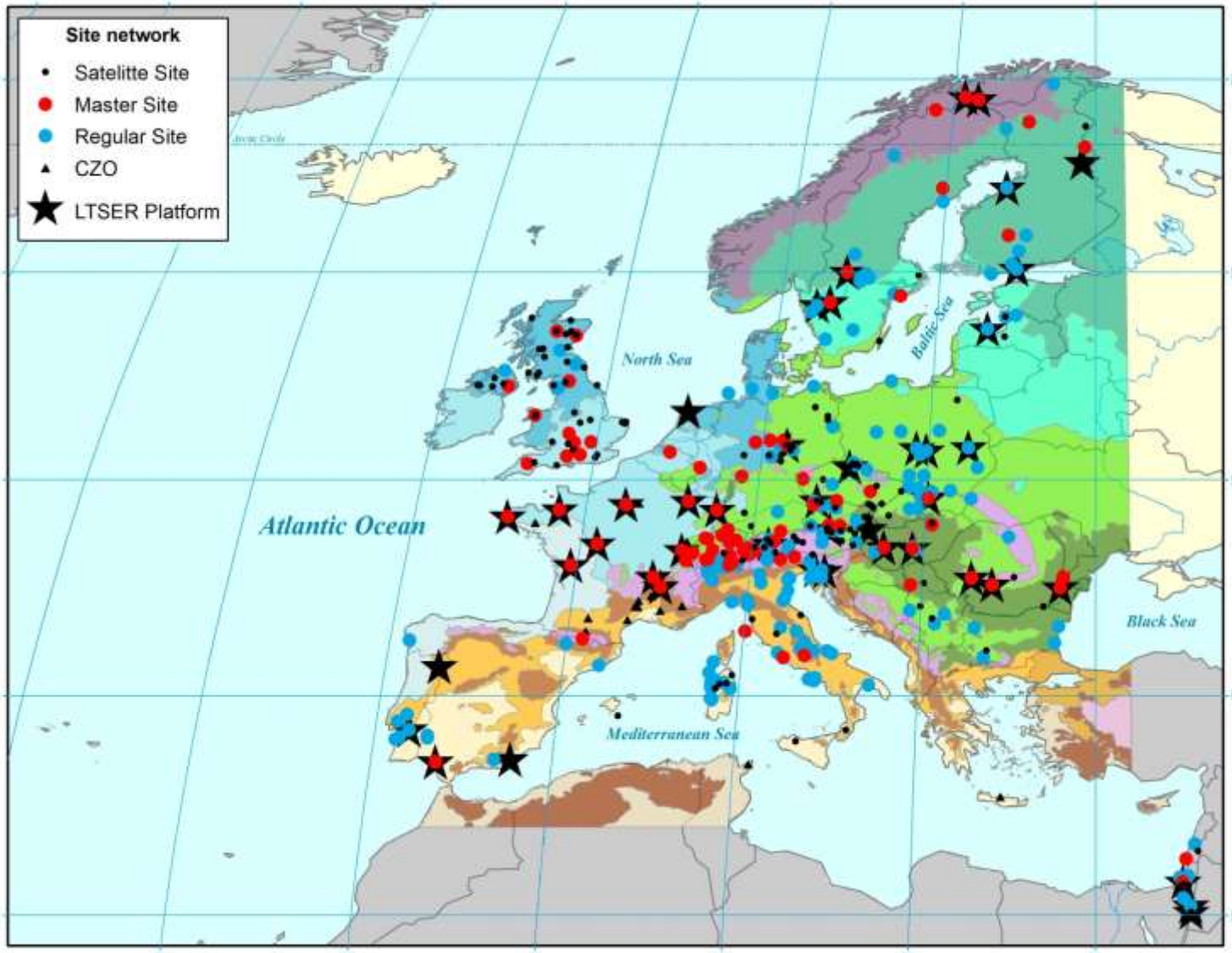
Network of Excellence ALTER-Net:

- Inquiries & metadata standards
- Classification & structuring
- National organisation
- Scientific priorities
- Information management

Pool of LTER facilites to recruit the eLTER ESFRI RI



Pool of LTER facilites to recruit the eLTER ESFRI RI



Repository for Research Sites and Datasets

DEIMS
Site | Data | Environment

http://data.lter-europe.net/deims/

Home | Discovery | Map | Documentation | Network | Help & Training

AVAILABLE RESOURCES

RESEARCH SITE

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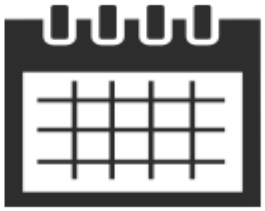
Find out about the European and global network of ecosystem research, monitoring and experimentation sites.

read more ...
discover ...

DATASET



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Find out about the available datasets from the European and global ecosystem research, monitoring and experimentation site network.

read more ...
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PERSON

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Find out about the network of European and global researchers dealing with ecosystem research, monitoring and experimentation.

read more ...
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PUBLICATION

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Find out about publication and reports published or contributed by the European and global network of ecosystem research, monitoring and experimentation site network.

read more ...
discover ...

Intended and increalsingly used as European and global sites documentation

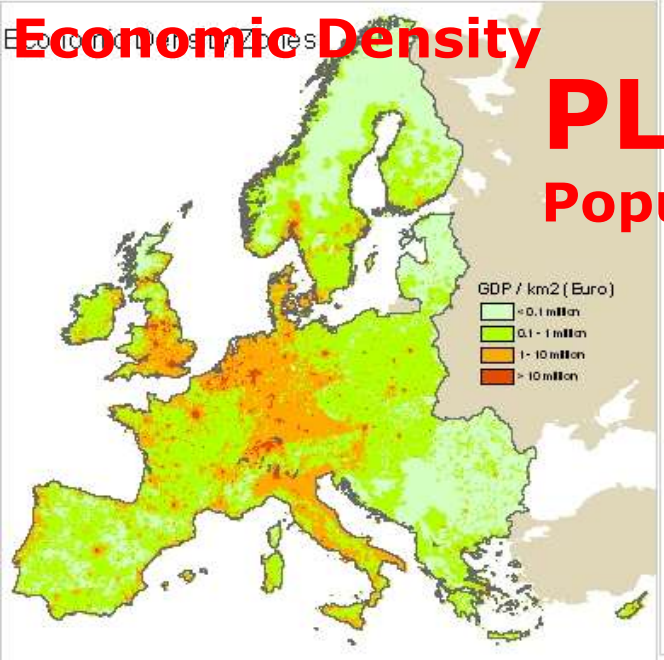
Full documentation
- ILTER
- ExpeER
- LTER-Europe

Sites lists
- ICP IM
- INCREAS
- ICOS/ecosys
- ...

eLTER ESFRI

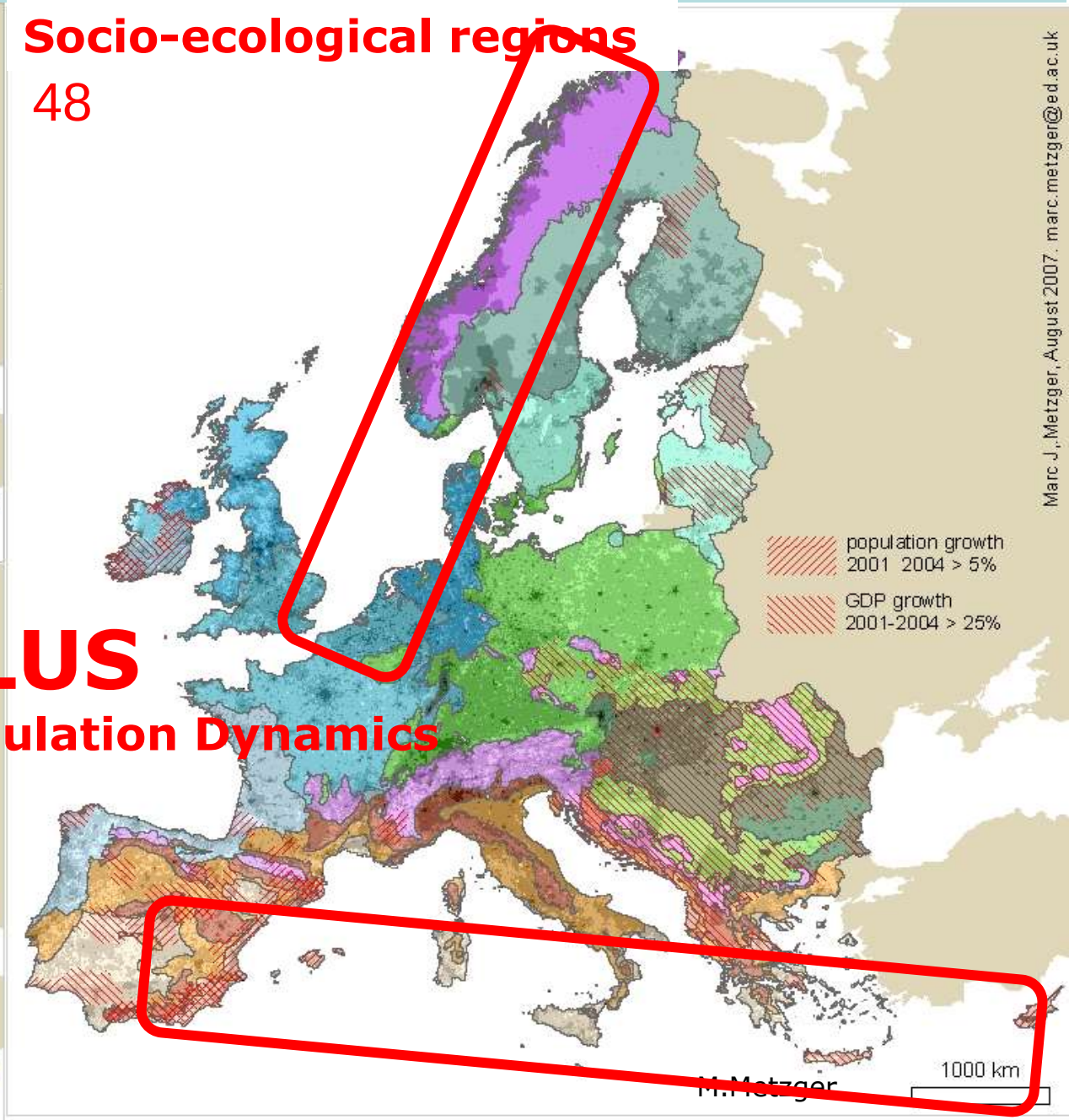
Representativity check: LTER Socio-Ecological Regions (LTER-SER)

PLUS

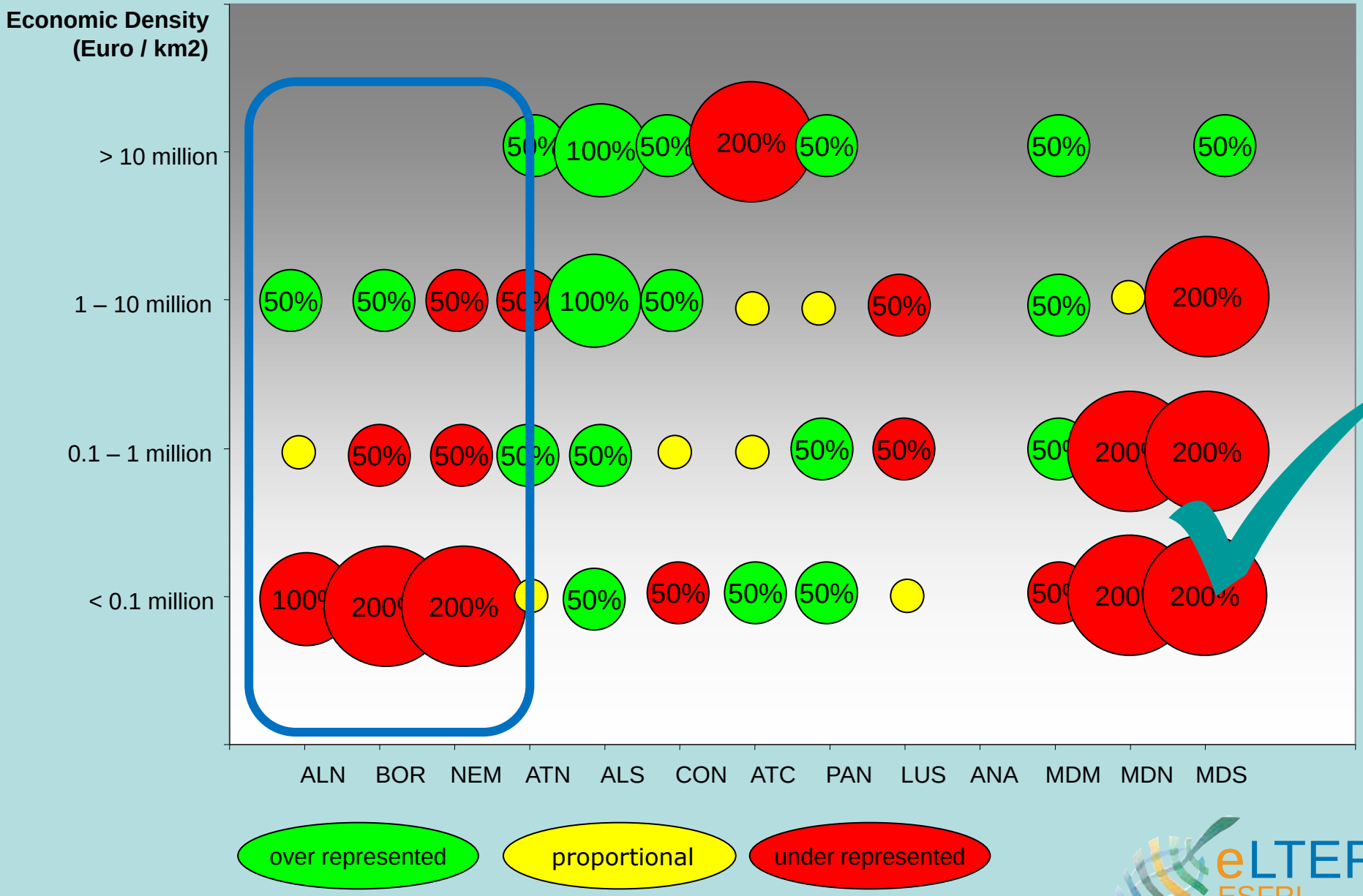


PLUS

Population Dynamics



Representation based on coverage of strata



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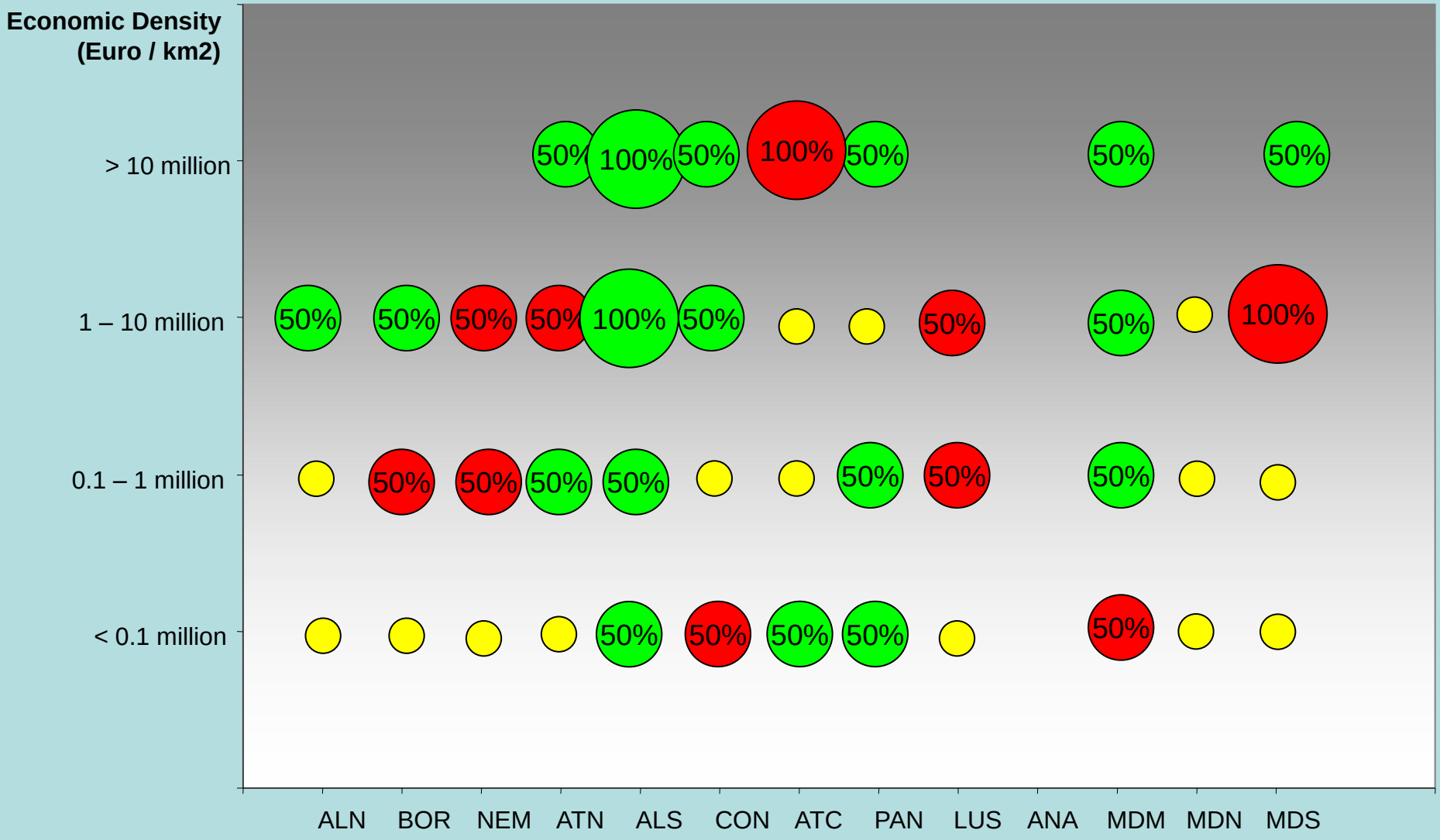


Towards standard parameters

Indicandum				LTER ecosystem type		
				terrestrial ecosystems	freshwater ecosystems	marine ecosystems
ecosystem structures	biotic diversity		flora diversity	Indicator	indicator	indicator
			fauna diversity	Indicator	indicator	indicator
			habitat structure	Indicator	indicator	indicator
			additional variables	Indicator	indicator	indicator
	abiotic heterogeneity		soil heterogeneity	Indicator	indicator	indicator
			water heterogeneity	Indicator	indicator	indicator
			air heterogeneity	Indicator	indicator	indicator
			habitat heterogeneity	Indicator	indicator	indicator
			additional variables	Indicator	indicator	indicator
ecosystem process	energy budget	*input*	exergy capture	Indicator	indicator	indicator
		storage	exergy storage	Indicator	indicator	indicator
		output	entropy production	Indicator	indicator	indicator
		Addit. state variables	meteorology	Indicator	indicator	indicator
		efficiency measures	metabolic efficiency	Indicator	indicator	indicator
	matter budget	*input*	matter input	Indicator	indicator	indicator
		storage	matter storage	Indicator	indicator	indicator
		output	matter loss	Indicator	indicator	indicator
		Addit. state variables	element concentrations	Indicator	indicator	indicator
		efficiency measures	nutrient cycling	Indicator	indicator	indicator
	water budget	*input*	water input	Indicator	indicator	indicator
		Storage	water storage	Indicator	indicator	indicator
		Output	water output	Indicator	indicator	indicator

Lower level indicators – an example

		Ecological integrity indicators	Examples	More detailed indicators for terrestrial systems
ecosystem structures	biotic diversity	flora diversity		**species numbers / abundance / identity**, functional groups, coverage, dominance, traits
		fauna diversity		**species numbers / abundance / identity**, functional groups, taxonomic groups, dominance, traits
		habitat diversity	habitat structure	**layers,** fragmentation, coverage, number / proportion of habitat types
		additional variables		**phenology, deadwood, alien species, protected / threatened species**
	abiotic hetero-geneity	soil heterogeneity		soil types, **soil characteristics** (depth, texture,…)
		water heterogeneity		ground water (availability, level), chemistry
		air heterogeneity		meteorology, air quality (heterogeneity in time)
		habitat heterogeneity		**habitat types**, site quality-aspects, **landscape measures** (connectivity, fragmentation), successional stage, disturbances
		additional variables		**management** (land use intensity), land use change

http://www.ufz.de/lter-d/index.php?en=32141&contentonly=1

I. Selection of Ecosystems and Ecological Integrity components

II. Selection of table columns

III. Search for terms and phrases

Show 5 rows on each page

Submit query

Table size

smaller small normal

page 1 of 61 > >|

Ecosystem	Structures and Processes	Diversity and Budget	Basic Indicators	Definition	Parameter
Terrestrial	Ecosystem Structures	Biotic Diversity	comment **Flora Diversity**	comment The presence and absence of selected species, (functional) groups of species, biotic habitat components or species composition.	comment **tracheophyta - species list**

Towards eLTER ESFRI: Interoperability checklist

→ Widely used interoperability checklist (COOPEUS/FP7, NEON, US-LTER…)

Aligning Science Questions and Hypotheses → concrete Requirements

- Define interfaces among respective Infrastructures
- Defining Joint Science Scope
- Mapping Questions to 'what must be done concretely'

[CCI 2, Q 2.3]

Traceability of Measurements

- Use of Recognized Standards
- Traceability to Recognized Standards, or First Principles
- Known and managed signal: noise
- Managing QA/QC
- Uncertainty budgets

[Q 2.4]

Algorithms/Procedures

- What is the algorithm or procedural process to create a data product?
- Provides "consistent and compatible" data
- Managed through intercomparisons
- What are their relative uncertainties?

Informatics

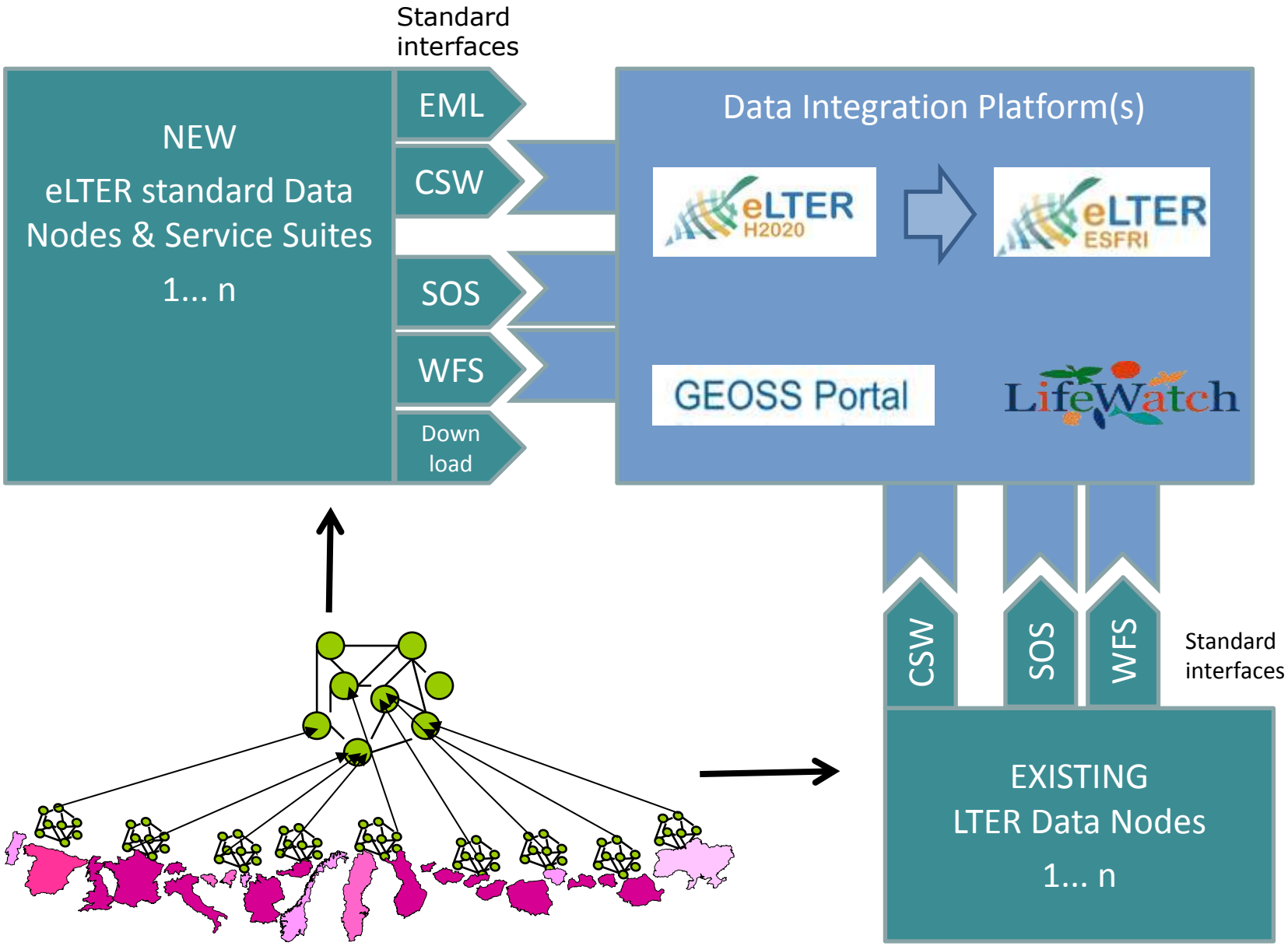
- Standards – Data / Metadata formats
- Persistent Identifiers / Open-source
- Discovery tools / Portals
- Ontologies, semantics and controlled vocabularies

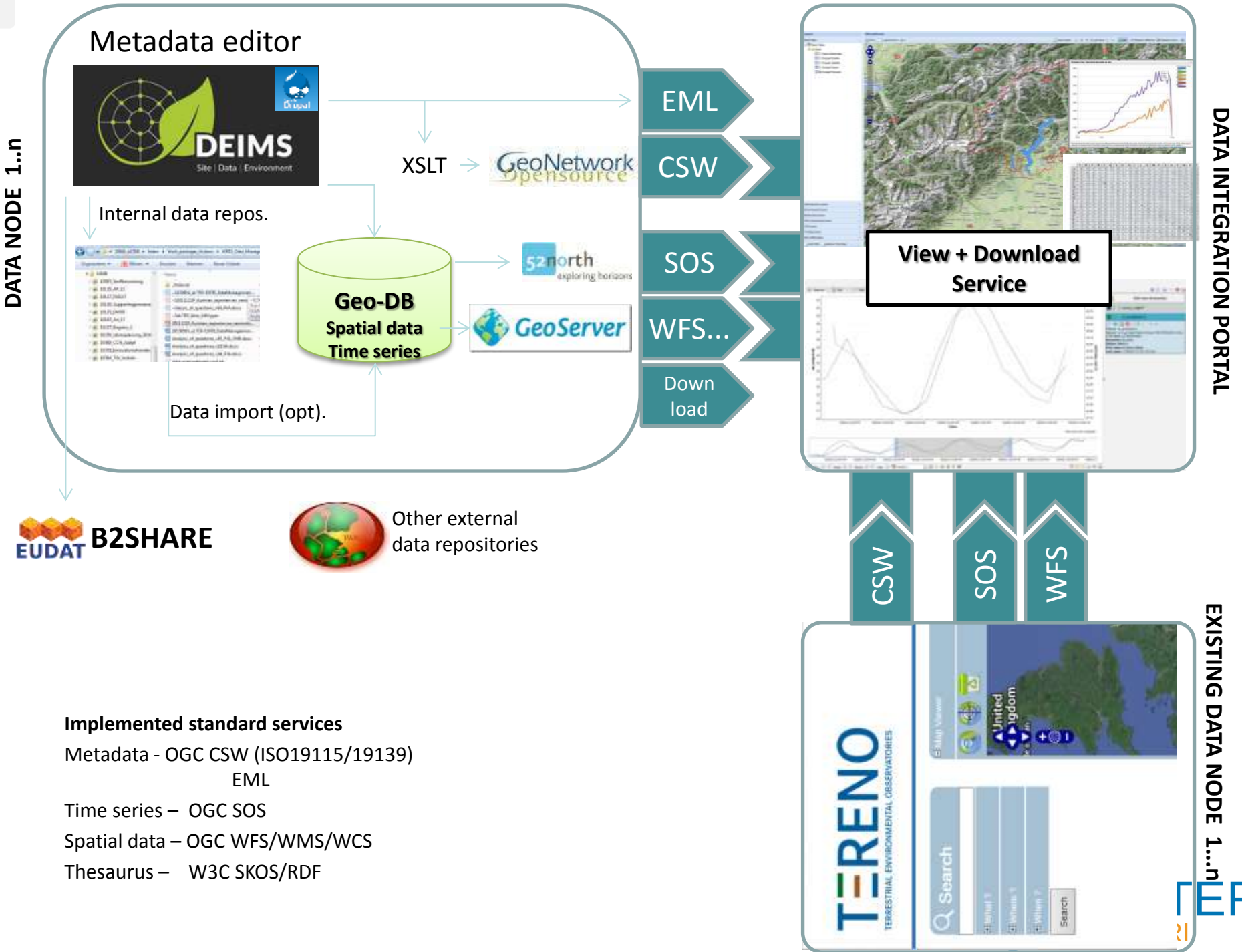
[CCI 5]

Courtesy of Henry Loescher, NEON

eLTER ESFRI

„HOMEWORK“: Intrinsic eLTER data management tasks towards data integration and interoperability





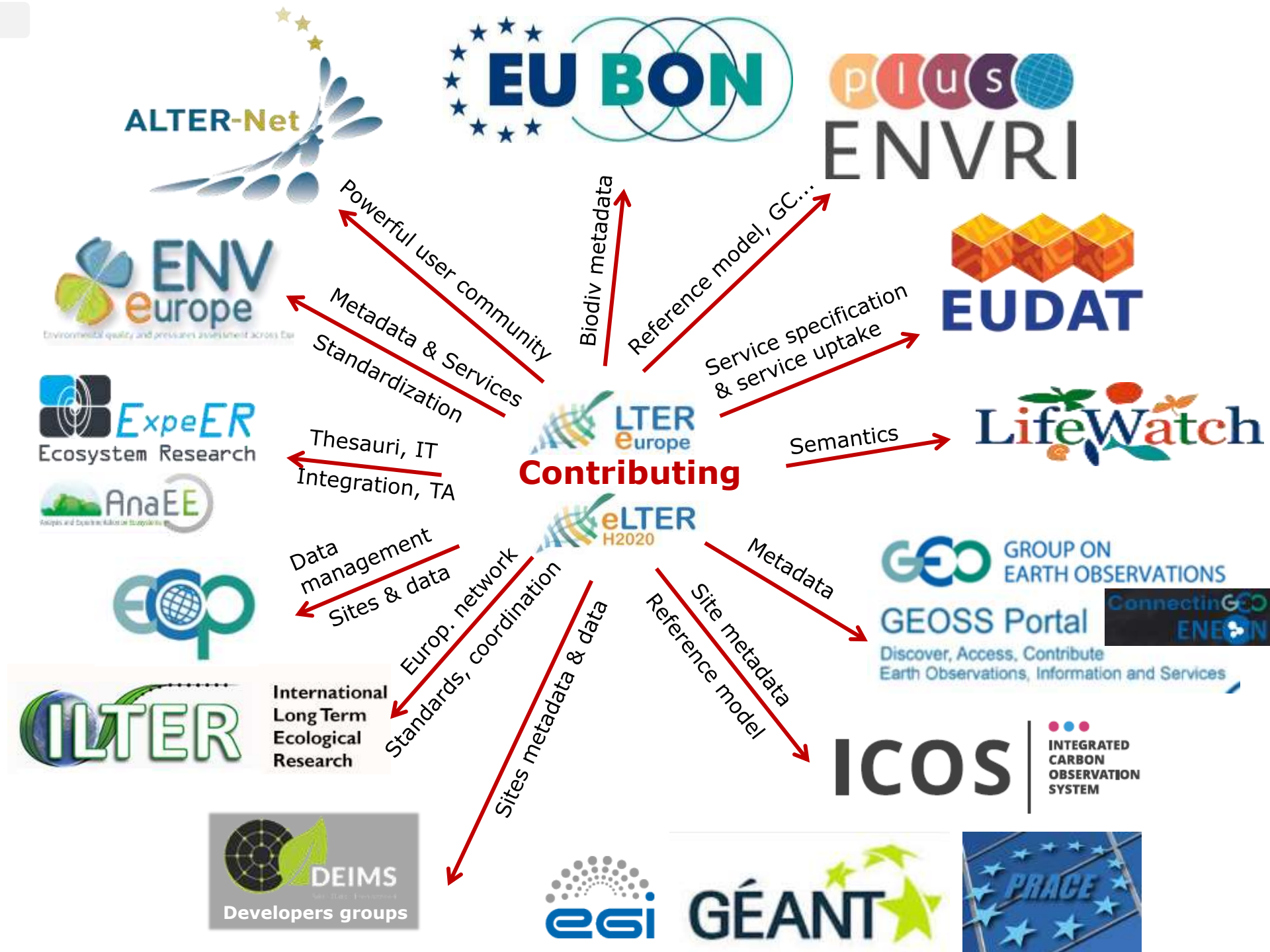
Implemented standard services

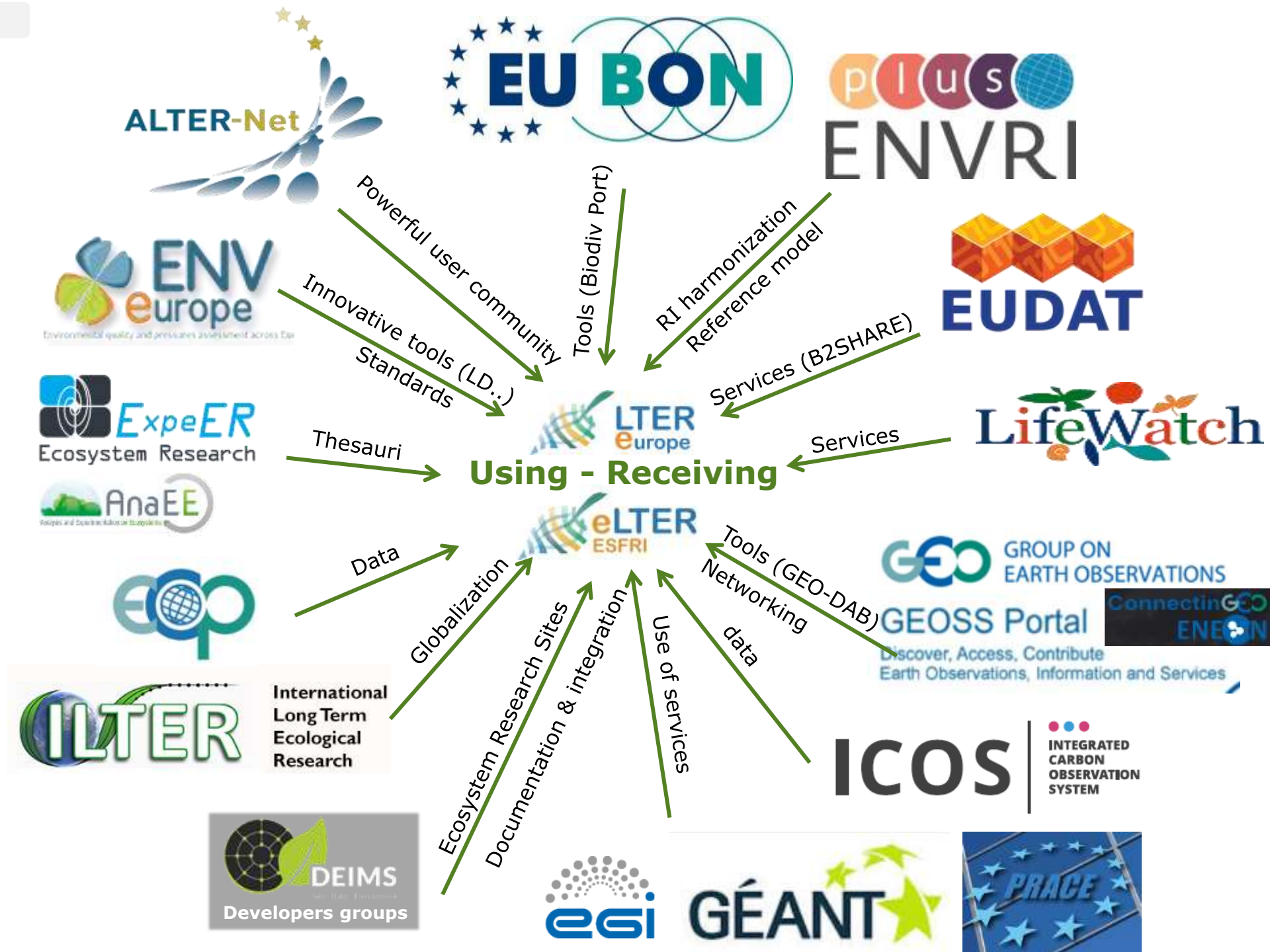
Metadata - OGC CSW (ISO19115/19139)
EML

Time series – OGC SOS

Spatial data – OGC WFS/WMS/WCS

Thesaurus – W3C SKOS/RDF


ALTER-Net
EU BON
plus
ENVRI
ENV europe
EUDAT
ExpeER
Ecosystem Research
AnaEE
LTER europe
Contributing
LifeWatch
eLTER H2020
GROUP ON EARTH OBSERVATIONS
GEOSS Portal
Discover, Access, Contribute
Earth Observations, Information and Services
ILTER
International Long Term Ecological Research
ICOS
INTEGRATED CARBON OBSERVATION SYSTEM
DEIMS
Developers groups
egi
GÉANT
PRACE
Powerful user community
Biodiv metadata
Reference model, GC...
Metadata & Services Standardization
Service specification & service uptake
Thesauri, IT Integration, TA
Semantics
Data management
Sites & data
Europ. network
Standards, coordination
Sites metadata & data
Site metadata
Reference model
Metadata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ICOS
INTEGRATED CARBON OBSERVATION SYSTEM
DEIMS
Developers groups
egi
GÉANT
PRACE
Powerful user community
Tools (Biodiv Port)
RI harmonization
Reference model
Innovative tools (LD..)
Standards
Services (B2SHARE)
Thesauri
Services
Using - Receiving
Data
Globalization
Ecosystem Research Sites
Documentation & integration
Use of services
data
Networking
Tools (GEO-DAB)

Cooperations of LTER in Europe, the global ILTER and EUDAT

As contributions to global activities

- Manual for in-situ biodiversity monitoring
- Advancing GEOBON: The GSEO concept (Global System of Biodiversity and Ecosystem Observatories)
  - Frist draft by ex-chair of ILTER (T.W. Parr)
  - In principle accepted at the last GEOBON meeting

eLTER ESFRI

Cooperations of LTER in Europe, the global ILTER and EUDAT

- Inter-/transdisciplinary: yes
- Networked: yes, s. previous slides
- Benefits from ENEON
  - yes
  - lobbying for common requirements
  - platform for joint service development and exchange on existing standards
  - another path for supporting multiple data usage
- How to organize ENEON?
  - key question: if a 4 years project achievable targets should be identified (many of the relevant networks are much more long-term or „permanent)
    - Transdisciplinary reference services
    - Ontologies: → SERONTO

eLTER ESFRI


If you want to go fast go alone,
if you want to go far go together.
An old African proverb