eLTER

Integrated European
Long-Term Ecosystem
Critical Zone &
Socio-ecological Research
Research Infrastructure

Filling a critical gap for top-class science at the continental scale

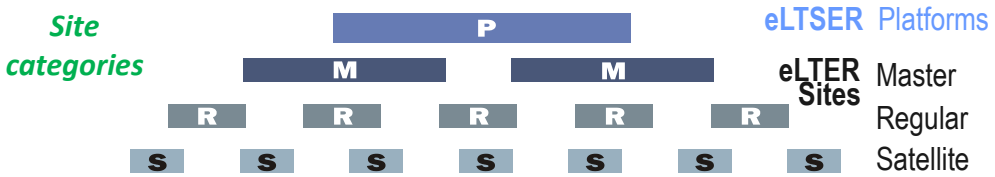
The eLTER Research Infrastructure perspective & link with Protected Areas

Michael Mirtl
Helmholtz Center for Environmental Research (UFZ)
& Environment Agency Austria (EAA)

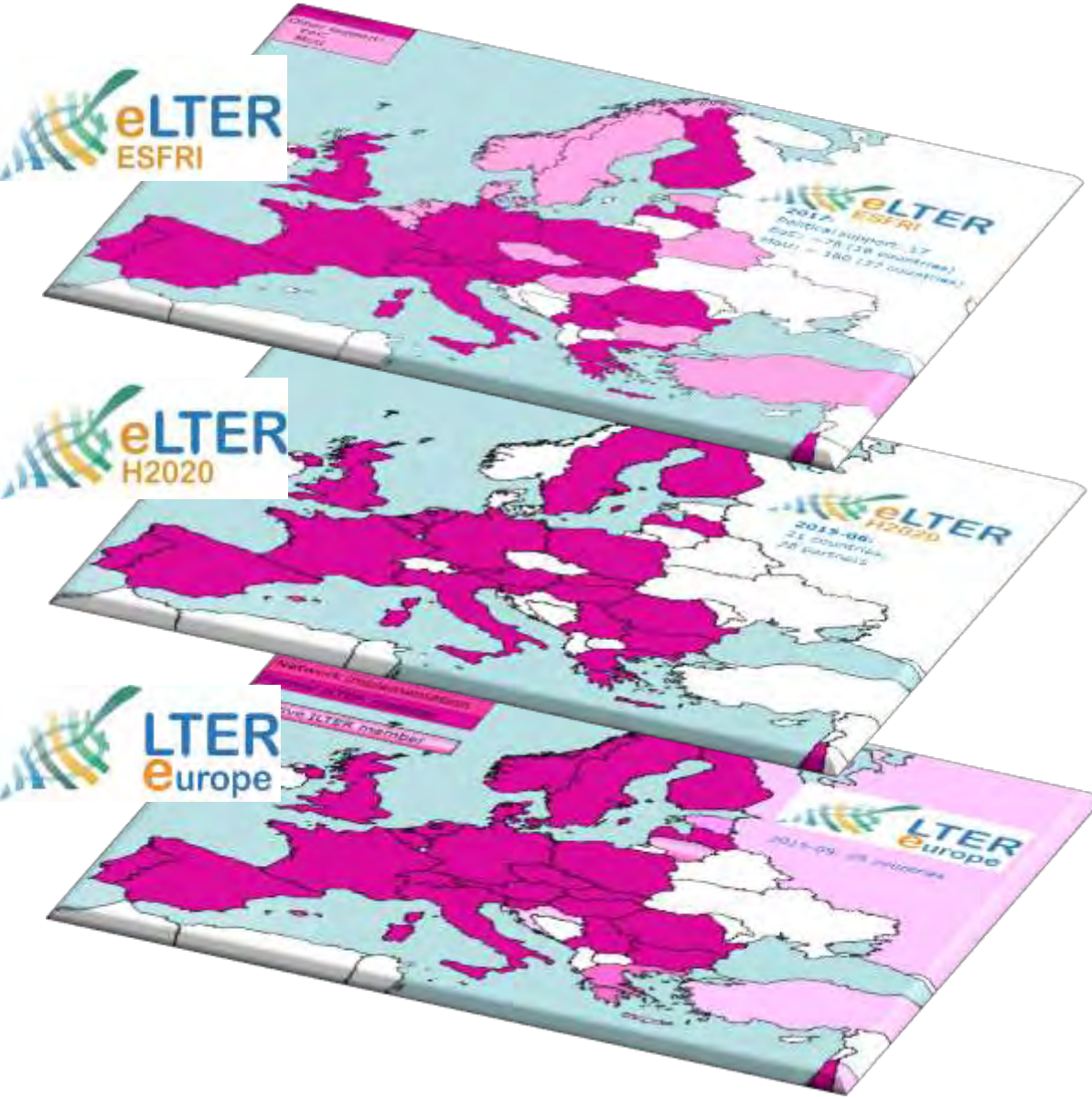
Advance eLTER

A „fleet“ for long-term ecosystem, critical zone and socio-ecological research

1. Distributed & generic **in-situ RI** for investigating long-term change across **major environmental zones**
2. **Whole-system approach** to observe and analyse the entire environmental system
3. Baseline **long-term operation** & observation, basic **data products & services**
4. Design & service development in **collaboration with related research & observation systems**
5. **Continental contributions to a GRI** (ILTER) and other Global networks/initiatives (GEOSS/ GEOeco)



European LTER components



eLTER ESFRI Process

EoS: 17 Countries

~ 80 EoC: 18 countries

~ 160 MoU: 27 countries

eLTER H2020 Project 2015-2019

21 LTER countries,

28 partners

162 data providing sites

Network of formal national networks

26 countries

450 LTER Sites

35 LTSER Platforms

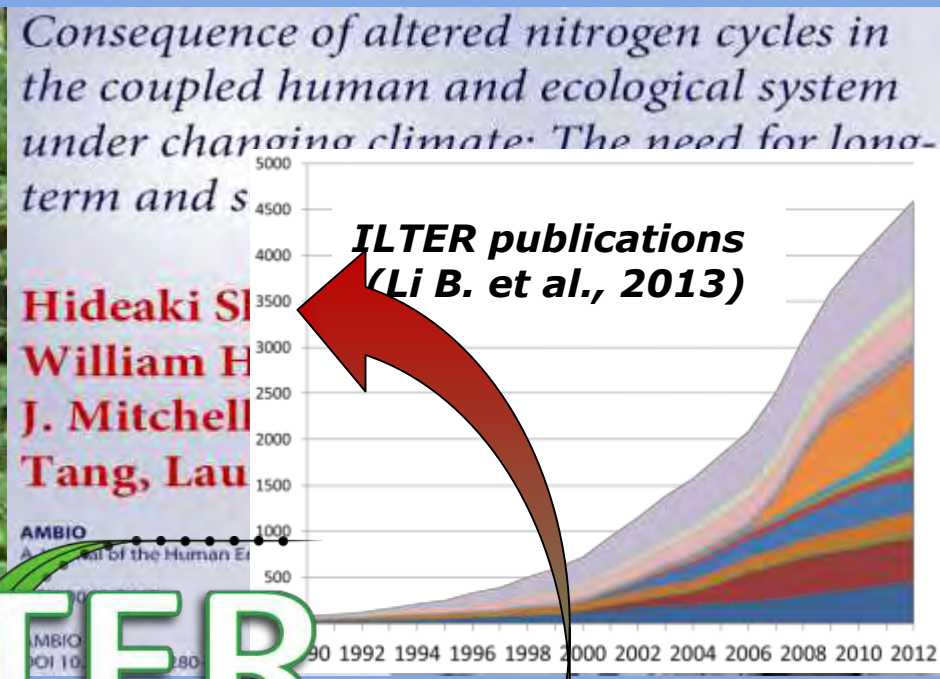
European contribution to the global LTER network

Recruiting

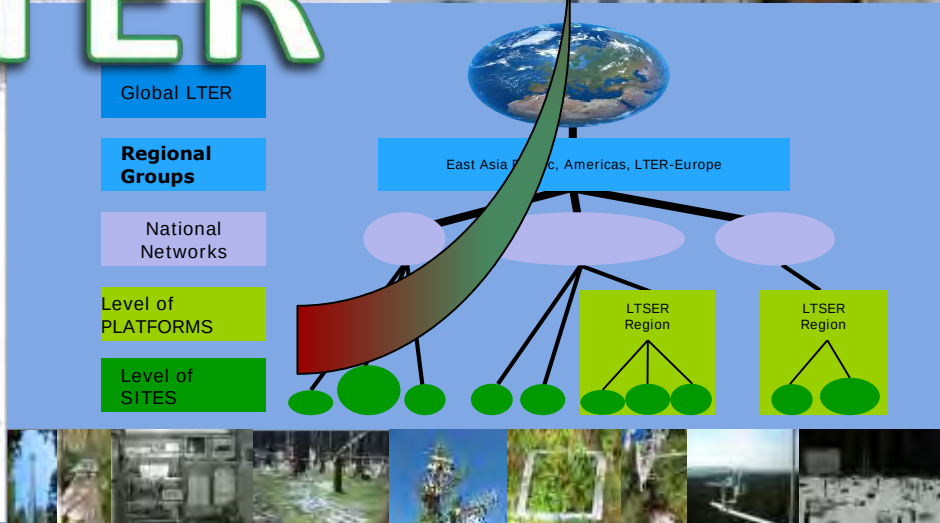
Standards, Formalisation

Advance eLTER

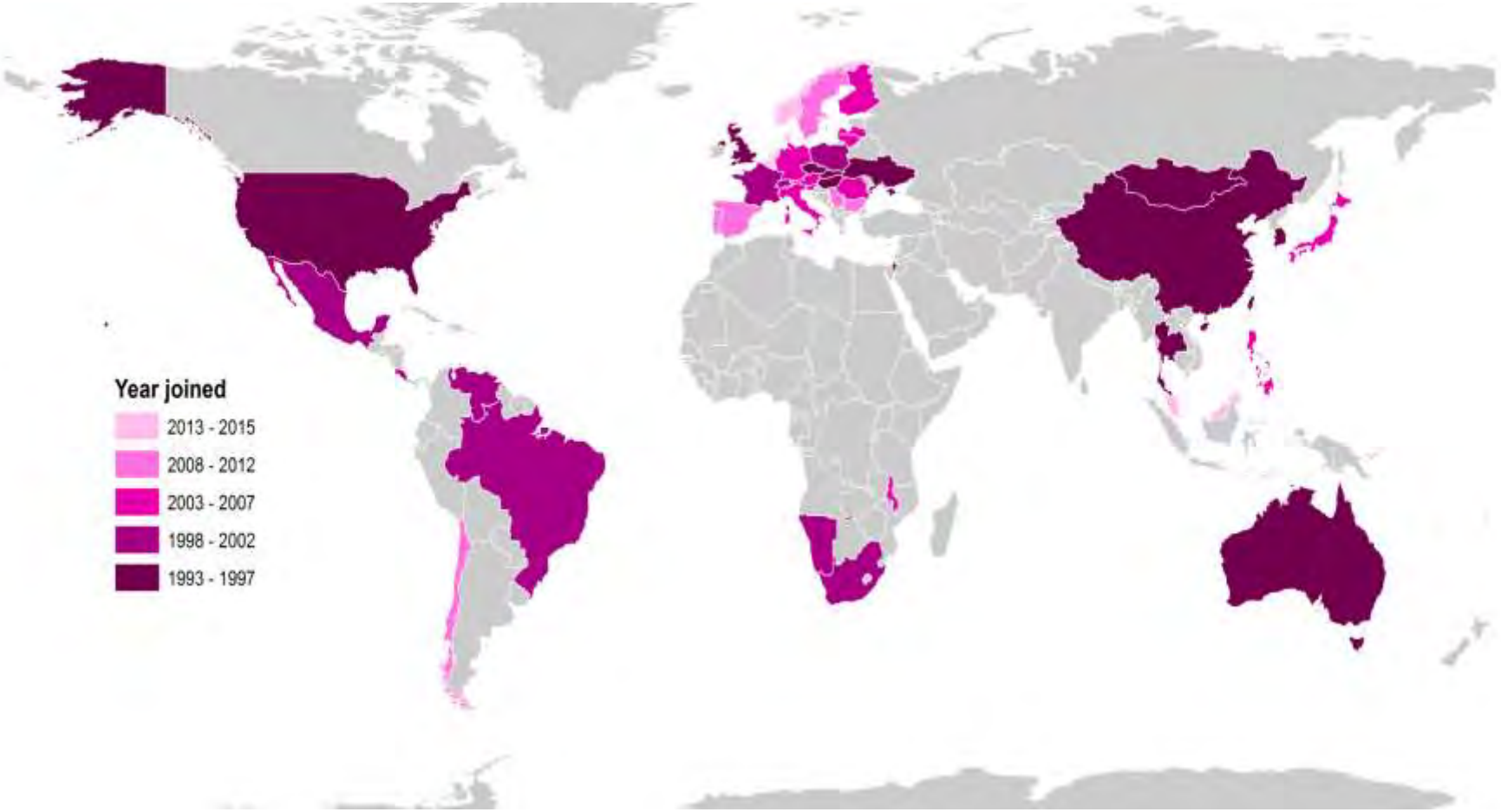
INTEGRATING & COORDINATING
KEY ELEMENTS OF ENVIRONMENTAL SYSTEMS RESARCH

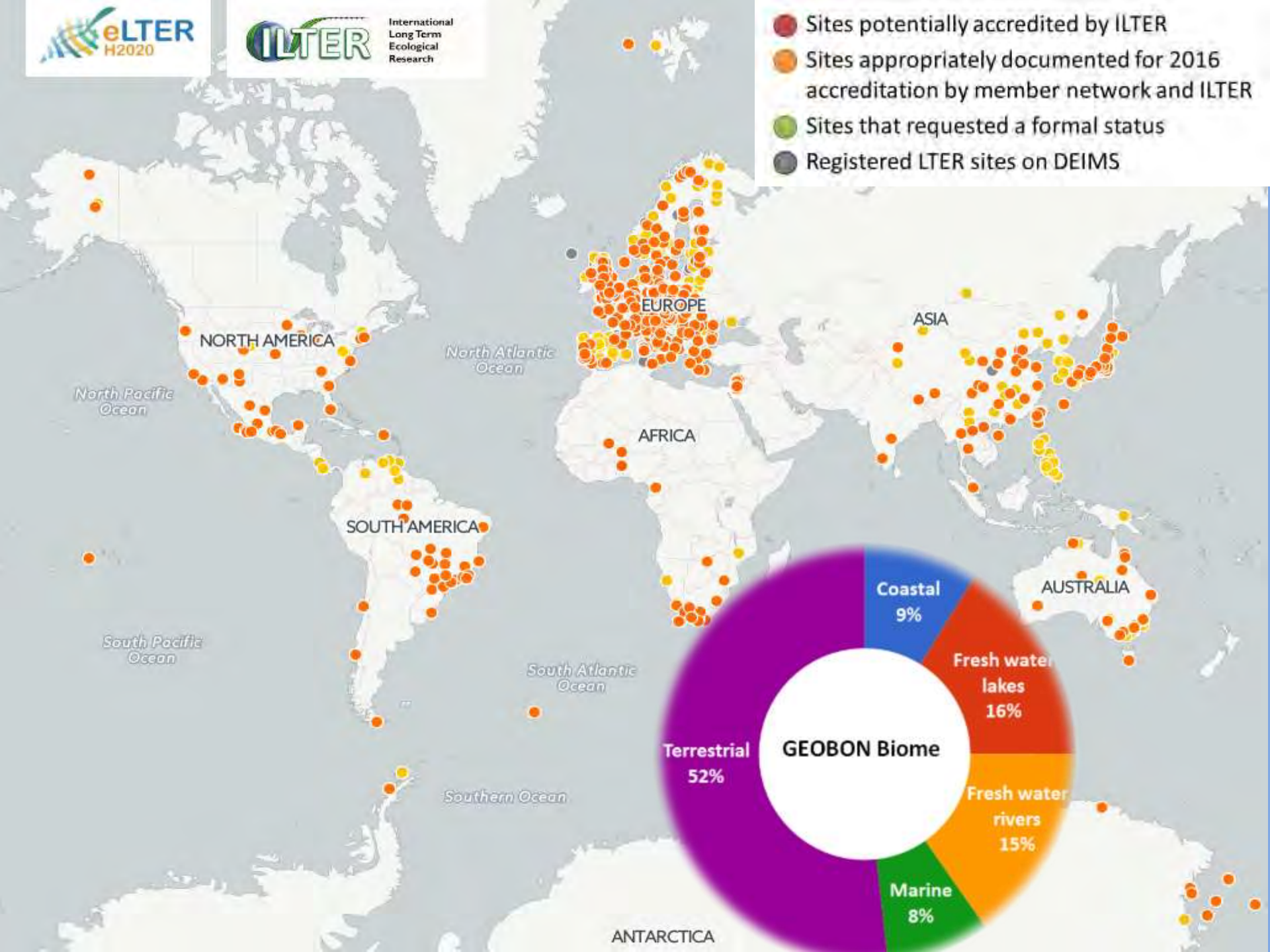


ILTER

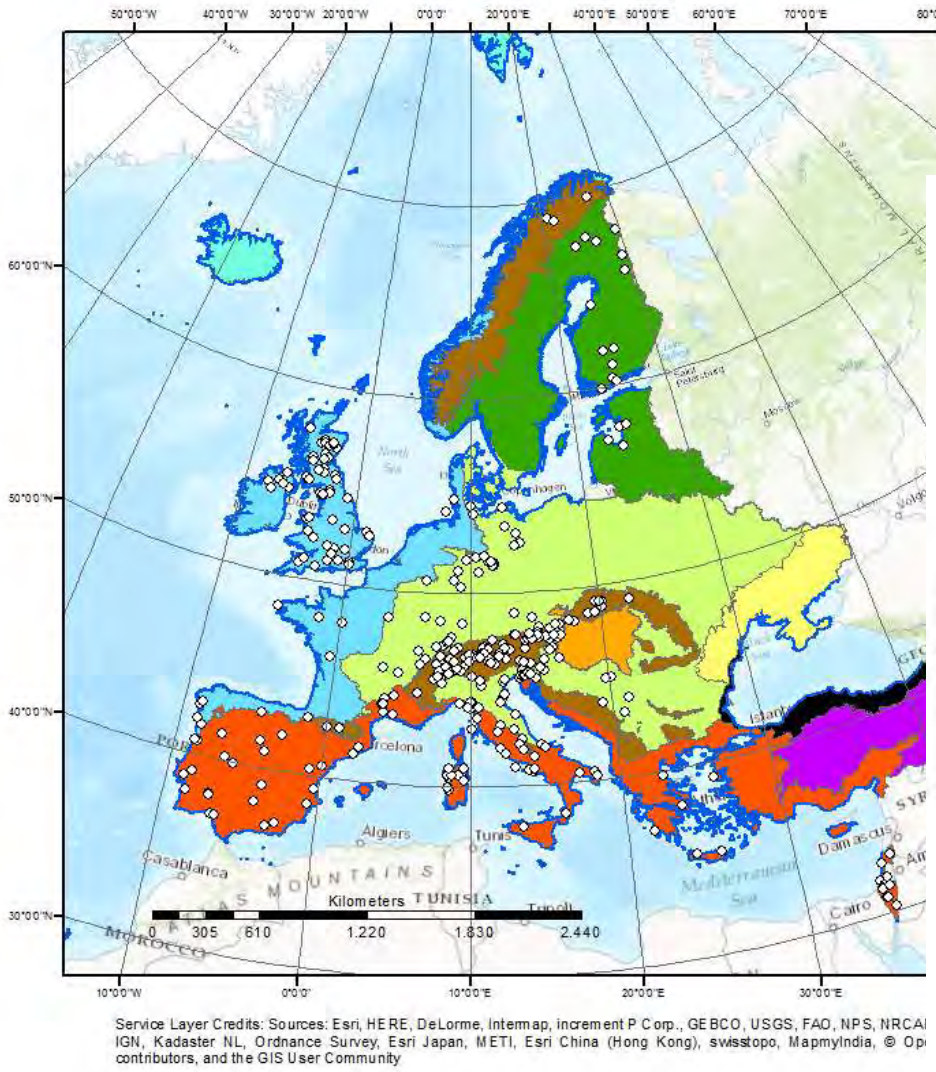


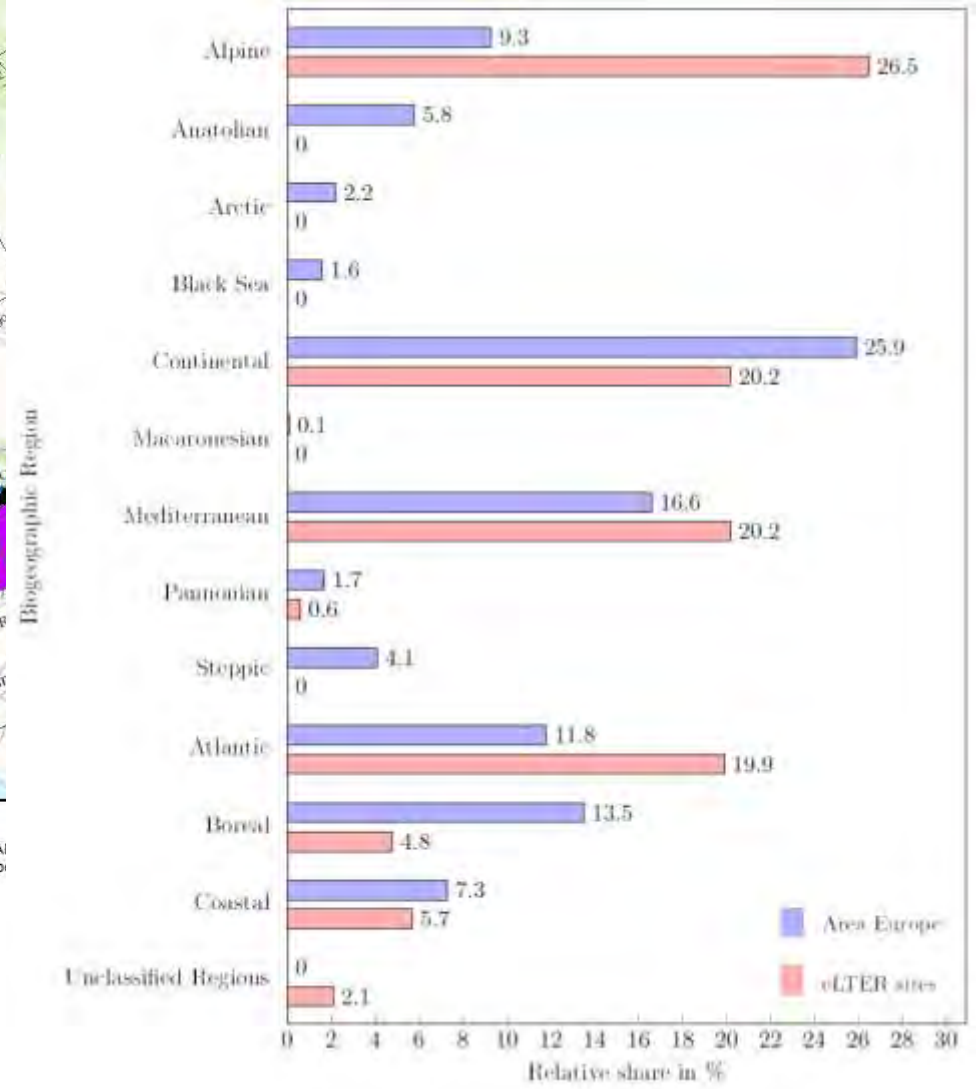
Development of member networks since 1993




eLTER H2020
ILTER International Long Term Ecological Research
Sites potentially accredited by ILTER
Sites appropriately documented for 2016 accreditation by member network and ILTER
Sites that requested a formal status
Registered LTER sites on DEIMS
EUROPE
NORTH AMERICA
ASIA
AFRICA
SOUTH AMERICA
AUSTRALIA
ANTARCTICA
North Atlantic Ocean
North Pacific Ocean
South Pacific Ocean
South Atlantic Ocean
Southern Ocean
GEOBON Biome
Coastal 9%
Fresh water lakes 16%
Fresh water rivers 15%
Marine 8%
Terrestrial 52%

Coverage and Representativity





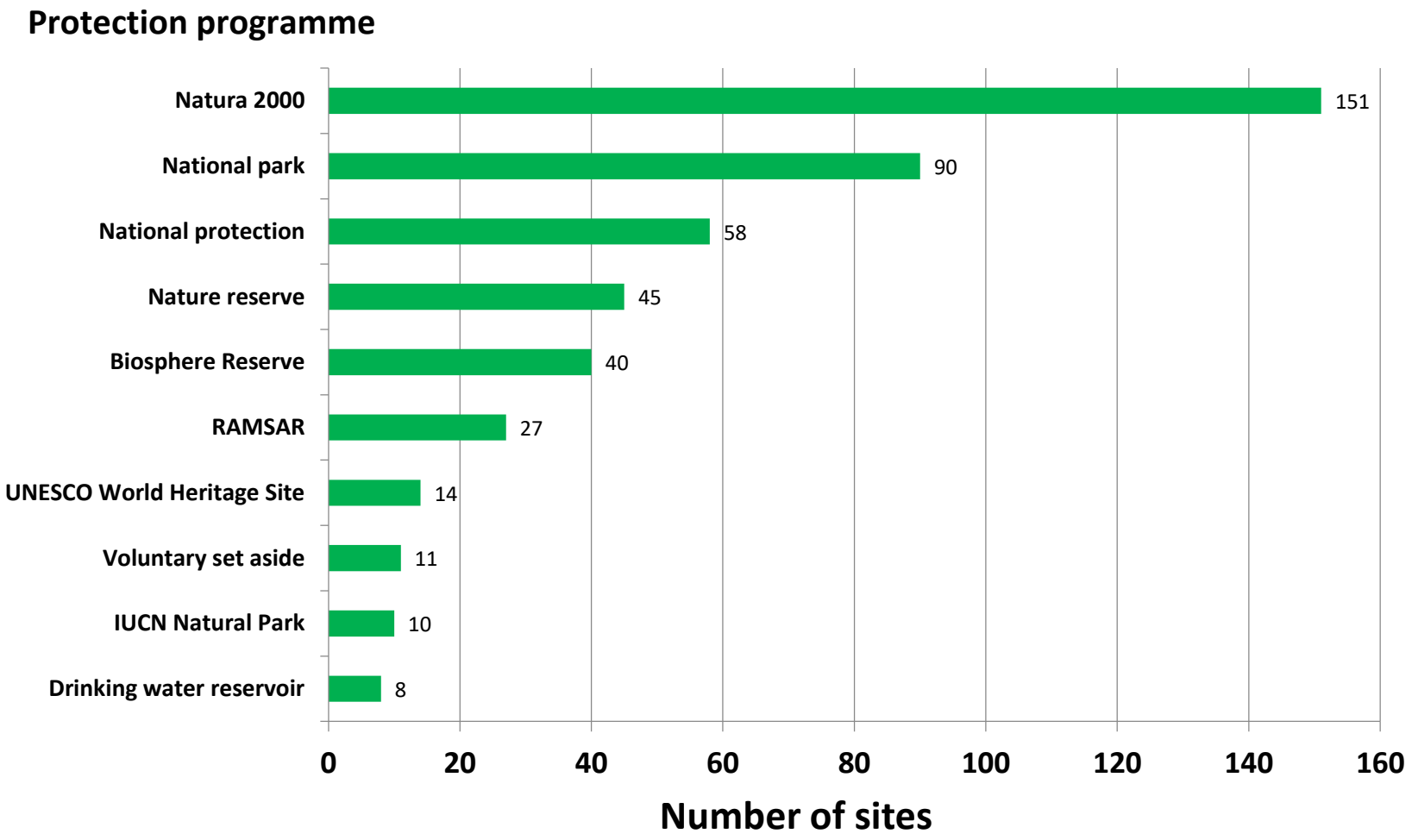
LTER sites with any protection status

Statistics

- 526 accredited LTER Europe sites
- 329 with protection status
- Multiple protection programmes possible for a site
- 479 protection programme involvements at 329 sites

Advance eLTER

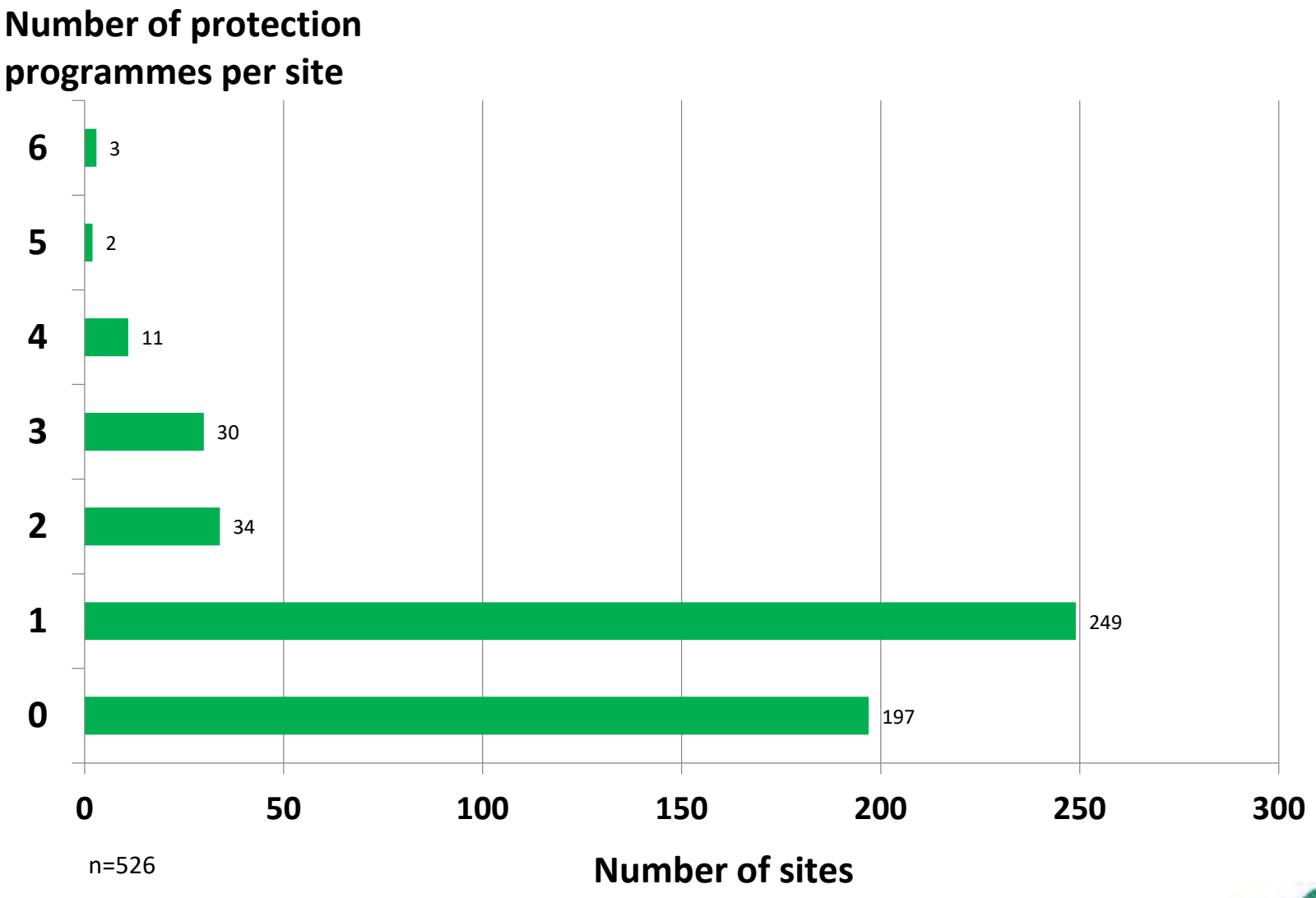
Frequency of protection programmes



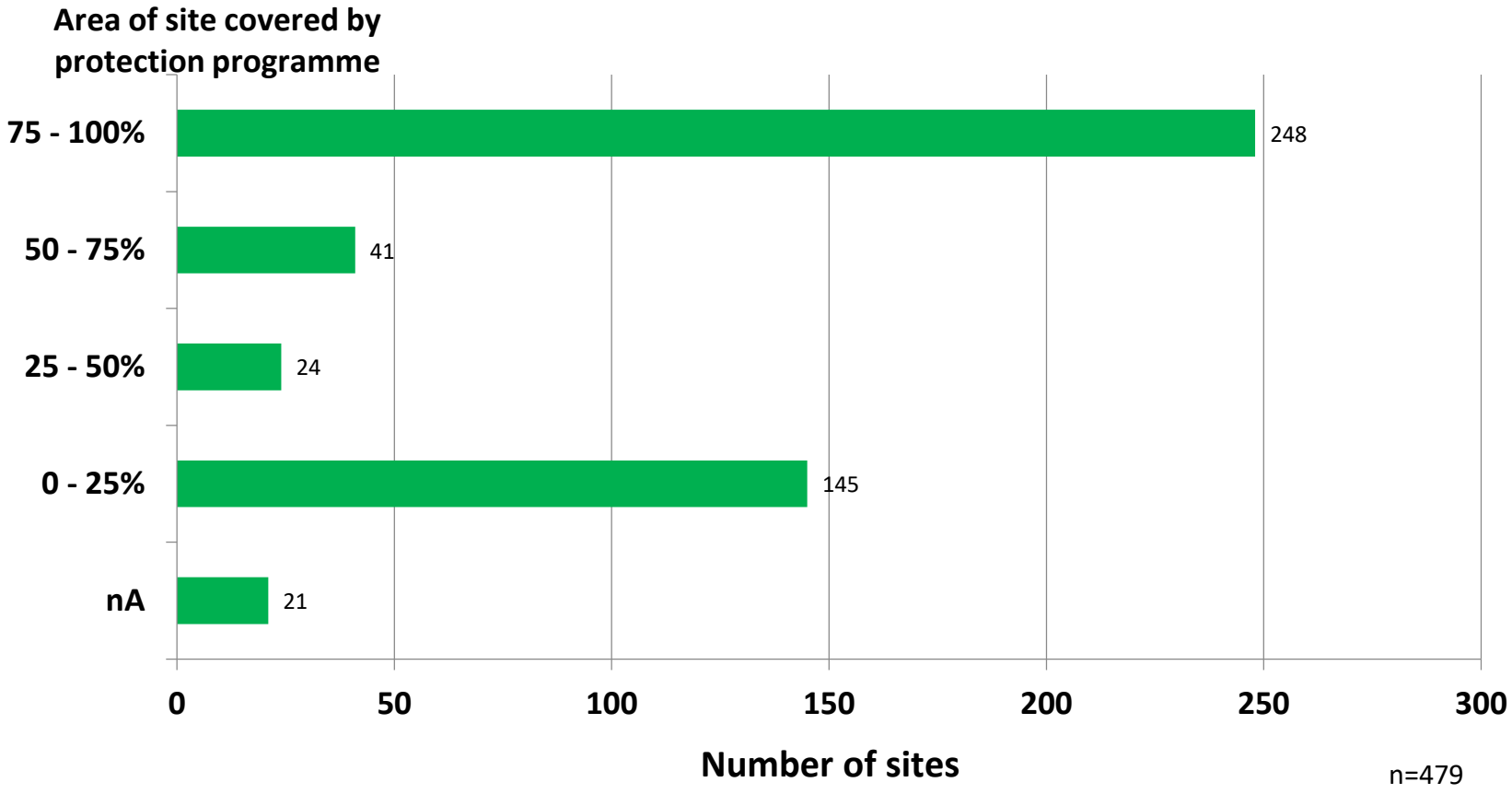
n=454

*18 protection programmes listed by <3 sites (a total of 25 sites) were excluded from this chart

Distribution of protection programmes



Percentage of protected areas within sites



Example for LTER site setup, activities and co-location

Input

Ecosystem Change

Output

- Climate change
- Biodiversity and land use
- Eutrophication and pollutants
- Sustainable socio-ecological systems (resource use)

- Main drivers
- Ecosystem structure & functions
- Disturbances (presses, pulses)

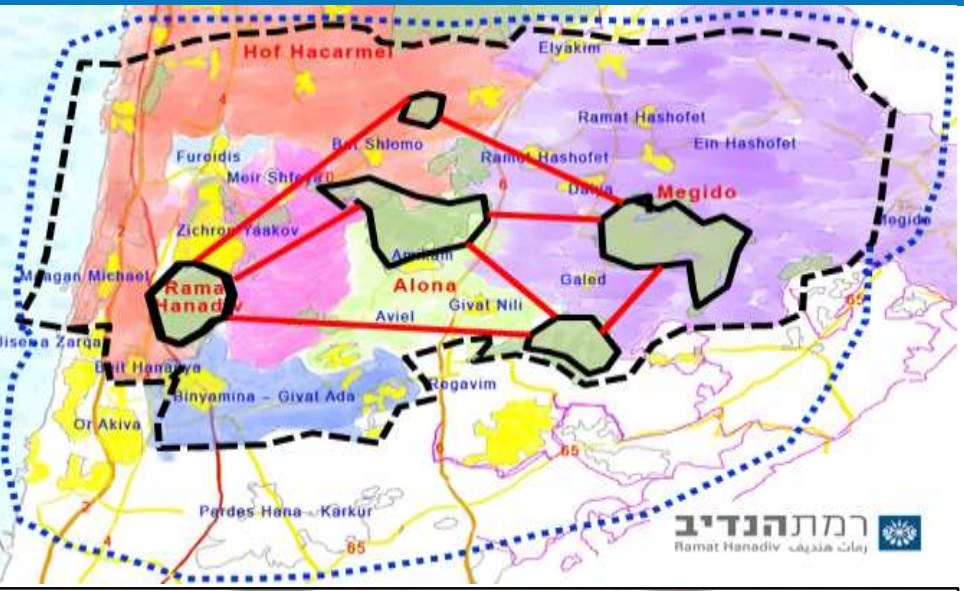
Hydrology,

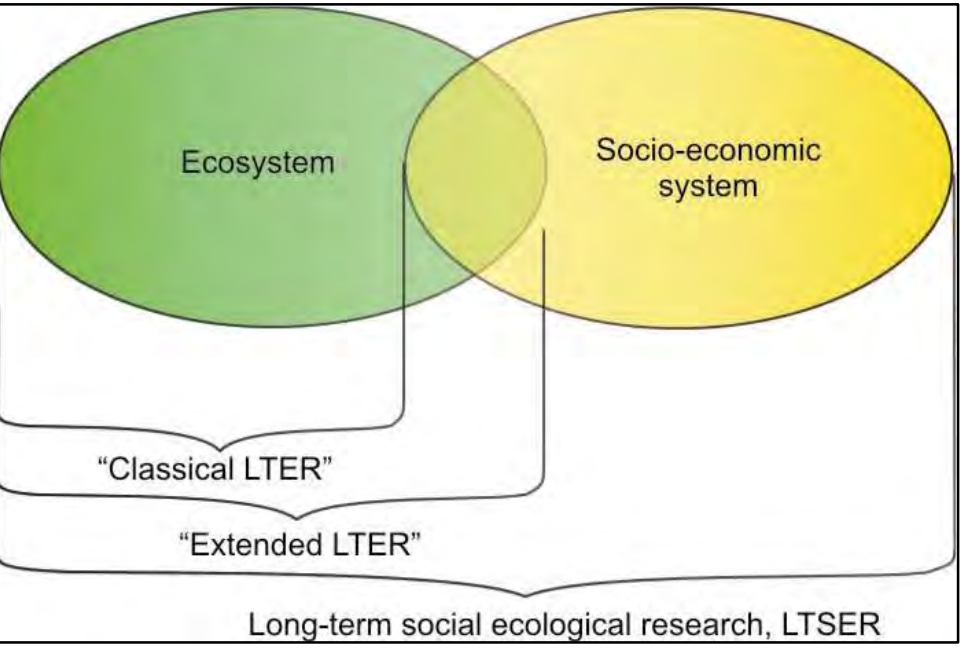
Atmosphere,
e.g. ICOS, FluxNet

Experiments

eLTER H2020

LTSER Platforms





- Regional scope, **including** multiple land use types

- Promotes integration of natural and social science (interdisciplinary)
- Cross-sector stakeholder collaboration
- Focus on knowledge for decision-making

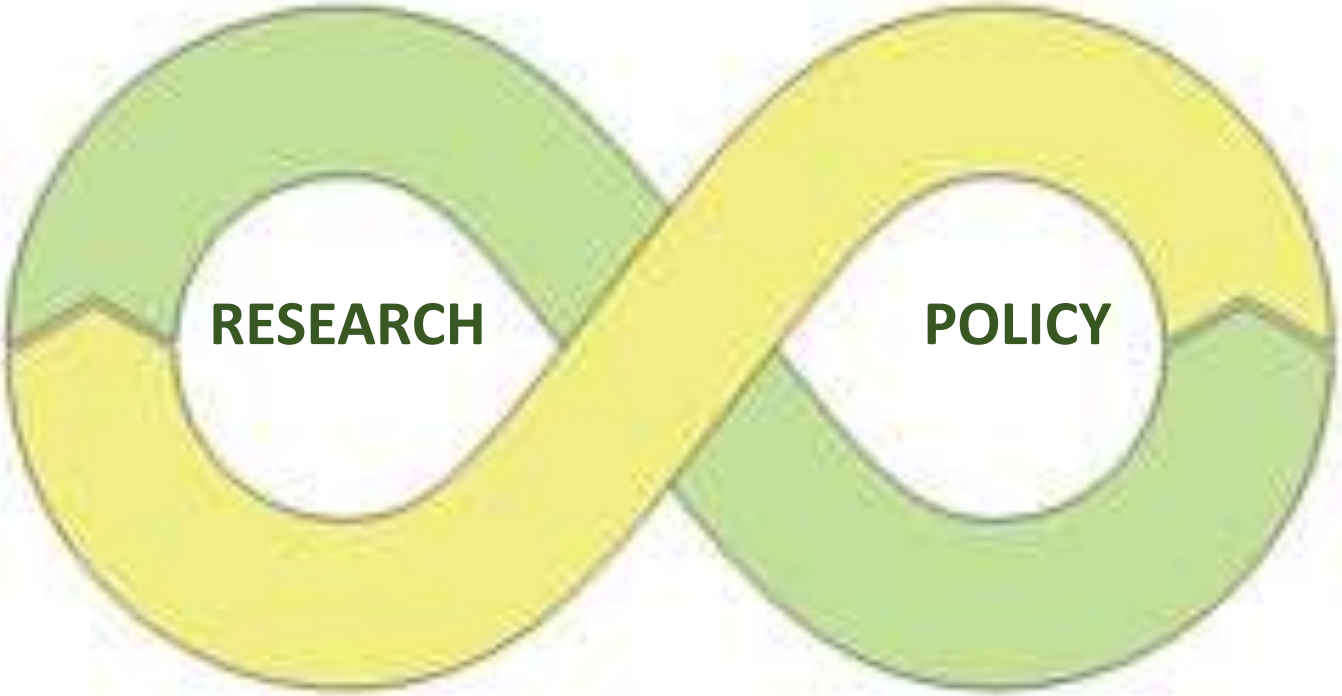
Haberl, Helmut, et al. (2006)

Advance eLTER

LTSER: Transdisciplinary research process

Iterative:
Continue the research

Relevant:
Designed for direct policy uptake



Responsive:
Addressing societal needs

Reflexive:
Did it work?

Transdisciplinary: Engagement of multiple disciplines and local knowledge

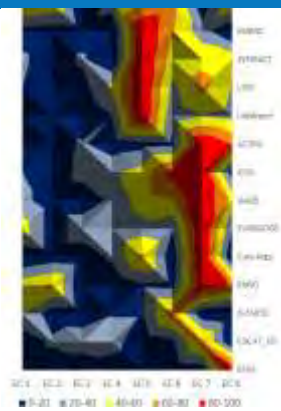
eLTER H2020

Scientific identity: role, scope, basic concept

- **Climate** change and greenhouse gases
- **Biodiversity** loss and land use change
- **Eutrophication** and pollution
- Environmental protection & **sustainable** management of **nat. resources**
  → **"socio-ecology"**

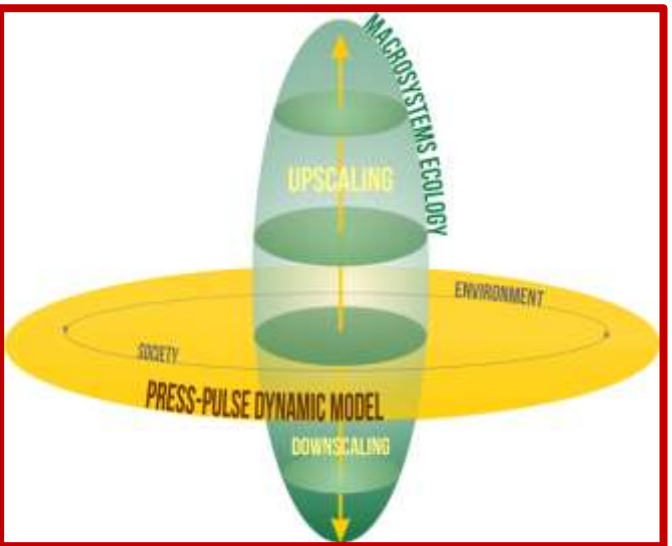
Anchoring in 3 Grand Challenge classifications

- Research: US NRC
- Societal: EC
- Workflow: ICSU



Core research challenges

Tackled Grand Challenges



Conceptual model

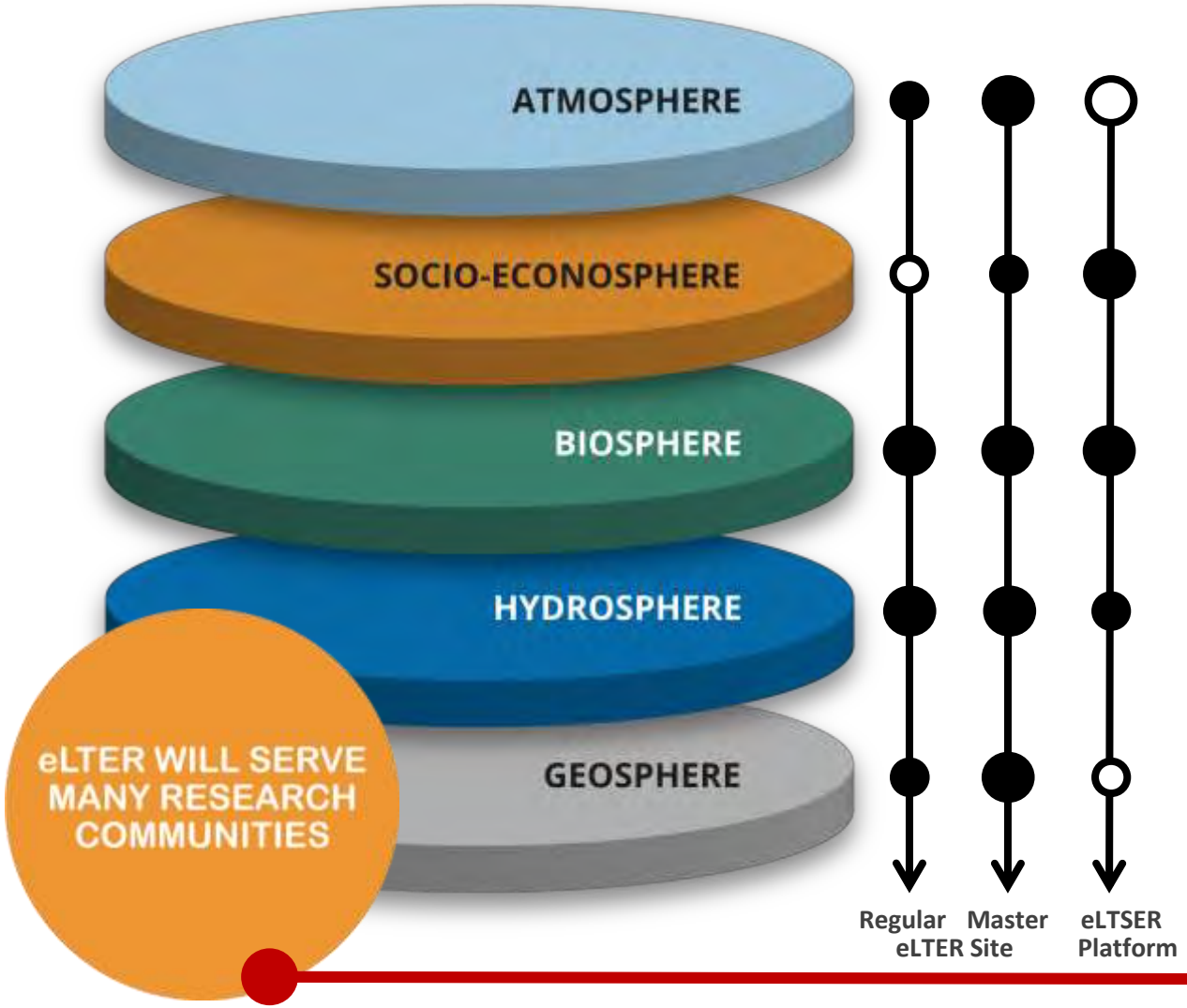
Whole System Approach

Pulse-Pressure-Dynamics model: Socio-system & Biophysical system incl. Critical Zone

+

Macrosystem Ecology (MSE): cross-scale interactions

„Whole system approach“:
→ Serving various user communities



eLTER provides

- basic infrastructure
- integrated baseline observation

Users access to

- in-situ sites
- data

Site categories differ in their focus on different system layers

LTER and protected areas I

1. Many LTER sites are or contain protected areas belonging to **major protection programs**
2. According to habitat type and other site characteristics they cover a **wide range of protected goods** with biodiversity prevailing
3. LTER´s Whole System Approach and **long-term research** in ecsystem structures, functions and processes **informs the knowledge base required for effective and efficient management and protection measures** in Protected Areas (PA) and their surroundings (landscape context, specifically covered by LTSER)
4. Pristine habitats are **benchmark ecosystems where direct human interventions were/are minimal so that effects of other drivers of global change can be detected and studied** (climate, air pollution, etc.: see Allen et al. 2016)

LTER and protected areas II

5. **Long-term environmental observation forms a core element in operating PAs and LTER** sites. Both require reliable long-term trend information on changing states plus possible drivers of change. Both strive for cost efficient measurements
6. Relevance of **harmonized/nested observation designs** (physical, observational) to support upscaling
7. The **combined usage of in-situ data and remotely sensed information represents a common interest of PAs and LTER** and are jointly dealt with in flagship projects such as EcoPotential
   - Stats. of LTER site uasage in EcoPotential
8. **Crucial importance of site registries and documentation**, incl. protections status and categories

Towards an integrated conceptual framework for the LTER standard ecosystem observations: Ecosystem Integrity & Essential Biodiversity Variables

Ecosystem Integrity

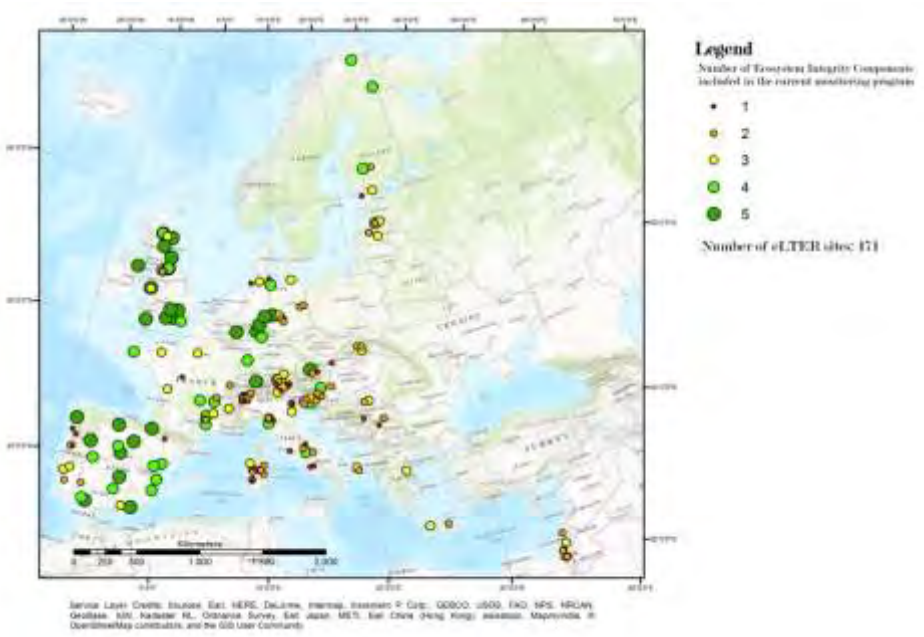
Components I	Components II	Basic Ecological Integrity Indicators III
Ecosystem structure	Biotic diversity	Flora diversity
		Fauna diversity
		Within habitat structure
	Abiotic heterogeneity	Soil
		Water
		Air
		Habitat
		Additional variables when indicated
Ecosystem processes	Energy budget	Input
		Storage
		Output
		Other state variables when indicated
		Efficiency measures
	Matter budget	Input
		Storage
		Output
		Other state variables when indicated
		Efficiency measures
	Water budget	Input
		Storage
		Output
		Other state variables when indicated
		Efficiency measures

Haase et al. 2018

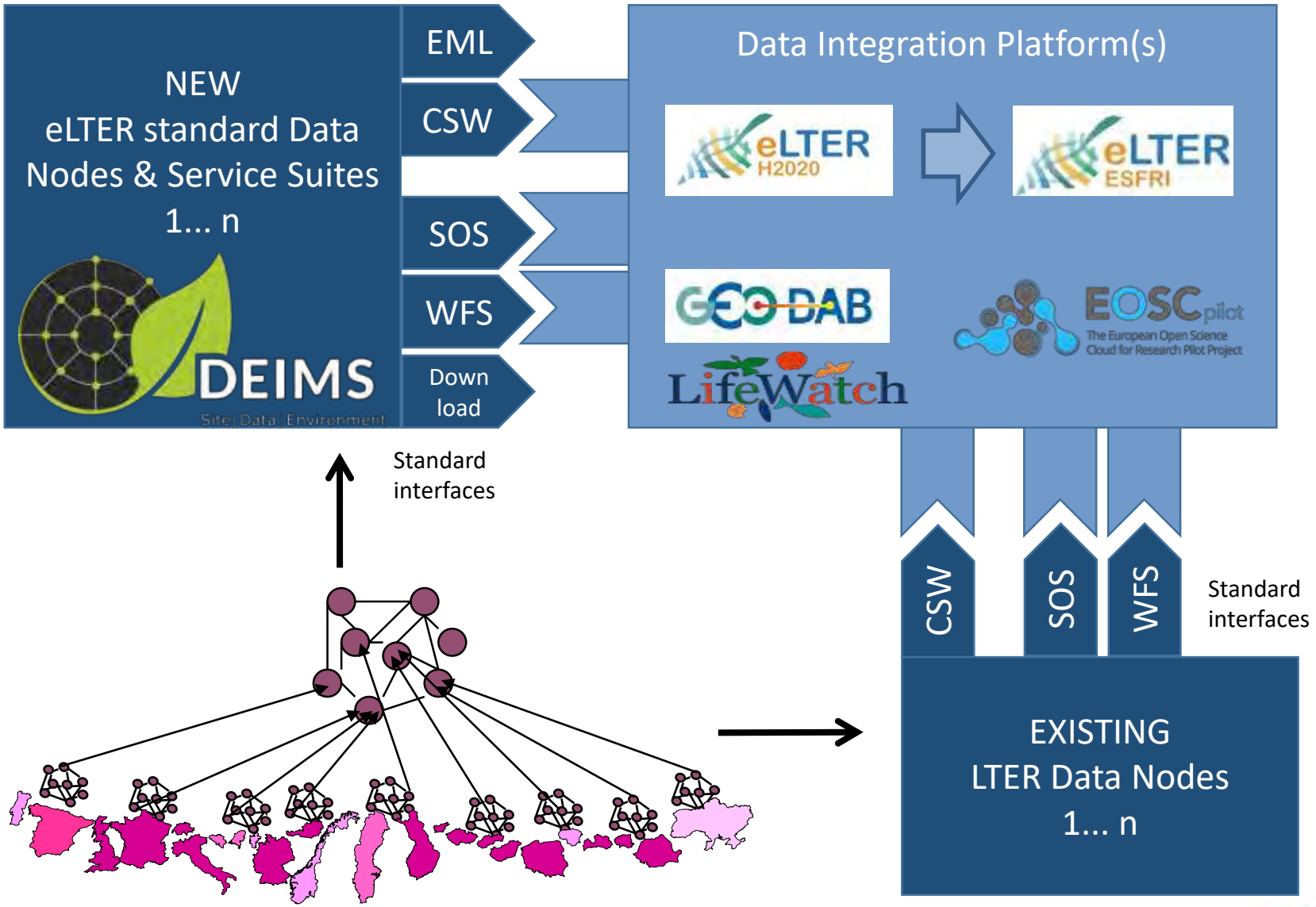
Advance eLTER

LTER Standard Observation Variables

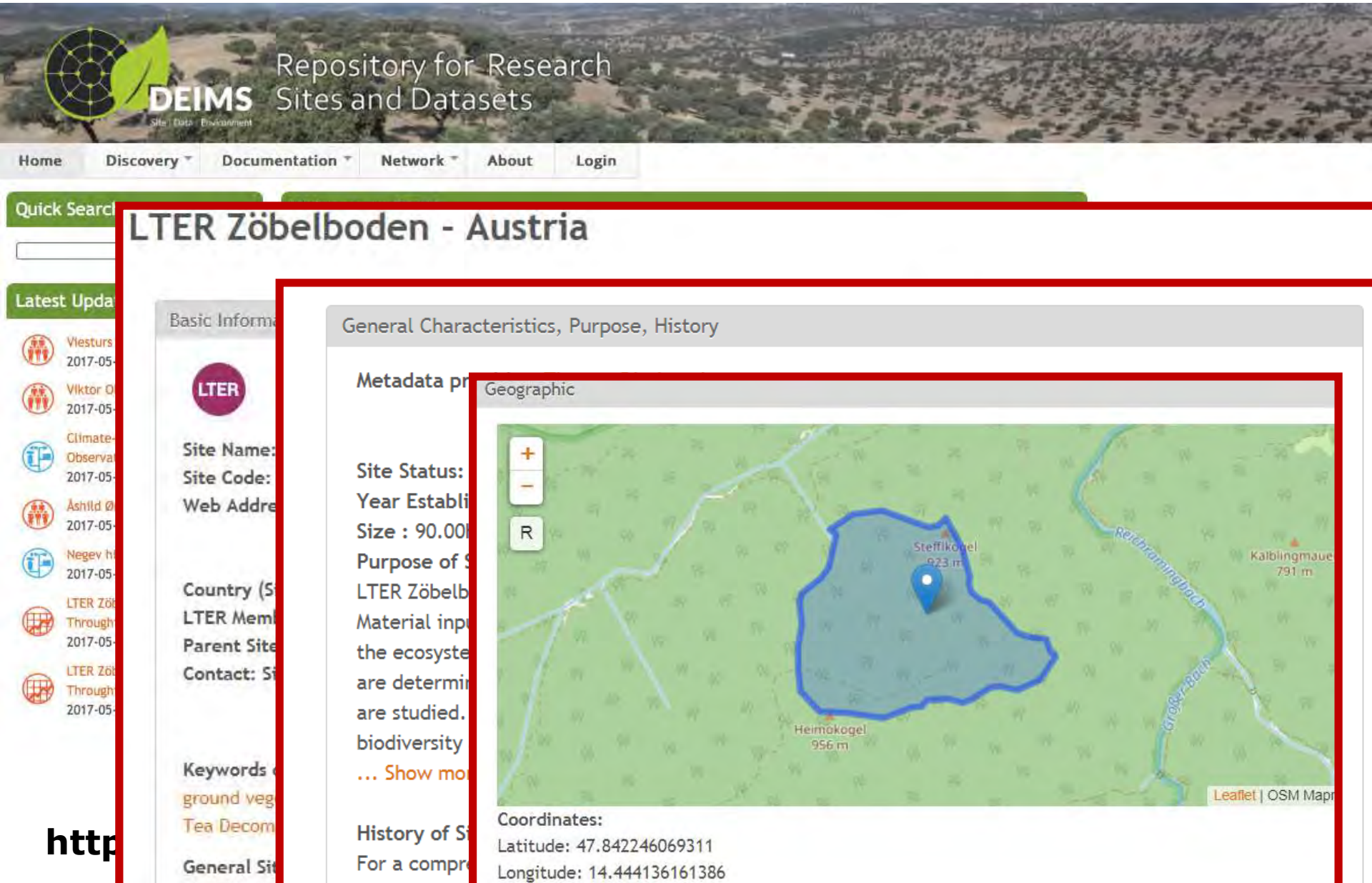
- **Abiotic Heterogeneity**
  - Soil
  - Air
  - Habitat
- **Biotic Diversity**
  - Fauna
  - Flora
- **Energy Budget**
  - Input
  - Storage
  - Efficiency
- **Water Budget**
  - Water Balance
- **Matter Budget**
  - Input
  - Storage
  - Output
- **Socio - Economy**
  - Demography
  - Eco. density



LTER Data & Service Architecture



DEIMS-SDR - Dynamic Environmental Information Management System



http

ILTER in the Framework of GEO/GEOSS/GEOeco

ILTER as **in-situ data provider**

ILTER as **user of RS products** to better fulfil its own mission *(scale?)*

ILTER as a **calibration, verification and validation** facility for RS service providers

DEIMS SDR as agreed pilot for a **global site registry** across networks (incl. accreditation)

ILTER fosters **bottom-up integration**/consoli-dation of terrestrial in-situ observation networks

Contribution to the development of a **GTOS** successor

ILTER

eLTER H2020

EuroGEOSS pilot show case myECOSYSTEM

- Expand the EcoPotential model of collating and providing relevant RS-based **standard sets of information and services** for all eLTER RI sites (in combination with standard in-situ observation data)
- Citizen science and **crowd sourcing** component
- Implementation of **EBVs** as component of standard eLTER in-situ observation program and instrumentation
- Creating **about 200 long-term hot spots of combined terrestrial and RS environmental data** ready for barrier-free scientific & other use
- Make all information **freely available** (DEIMS, „myECOSYSTEMs data cube“?)
- Long-term **show case for service uptake & highly visible impact** (multiple publications, reports etc., also used by the private & industry sector)
- **Sustainable** beyond the runtime of the next EuroGEOSS project

Advance eLTER


If you want to go fast go alone,
if you want to go far go together.
An old African proverb
European LTER: www.lter-europe.net
ILTER: www.ilternet.edu/