



# Linking ecosystem research and earth observation

## LTER-Europe and EUBON as test bed for global cooperation's

**EUBON annual meeting**  
**1<sup>st</sup> – 4<sup>th</sup> June 2015**  
**Cambridge, UK**

**Johannes Peterseil, Michael Mirtl**  
**(Environment Agency Austria, EAA)**



# Overview

- ... the social infrastructure
- ... the physical infrastructure
- ... the data infrastructure
- ... the links



... the social infrastructure

# LTER Europe in a nutshell ...

A Network of

- ~ 420 LTER Sites
- ~ 35 LTSER Platforms
- metadata and data
- 21 national networks
- around 100 institutions
- more than 1000 scientists (community)
- Part of a Network of European Networks (ALTER-Net, EXPEER, LifeWatch)... and part of a global network

[www.lter-europe.net](http://www.lter-europe.net)

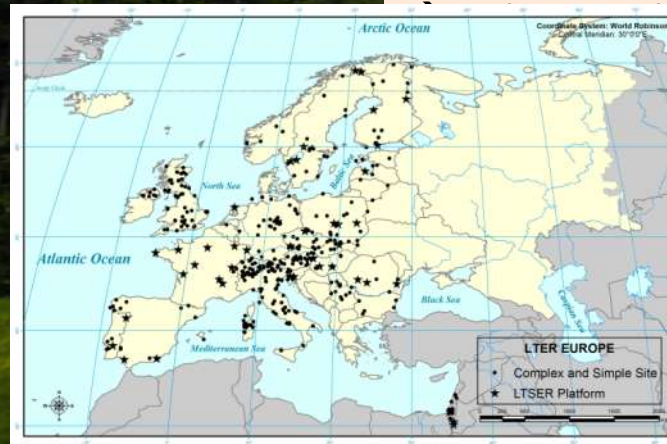
## Key questions addressed by the European Long-term Ecosystem Research Network ...

→ What are the drivers of change for the major European ecosystems and socio-ecological systems?

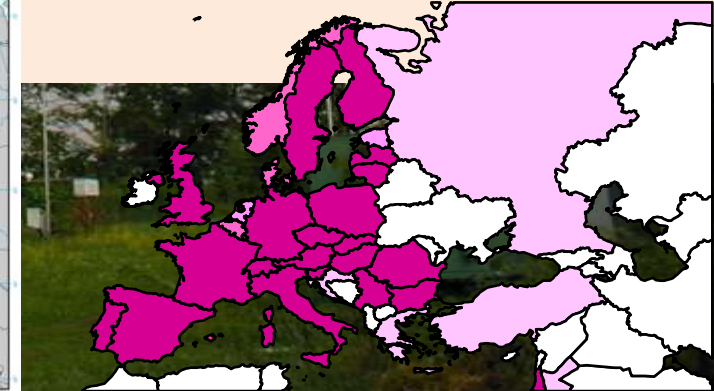
→ How do these changes affect ecosystem functions, biodiversity and ecosystem services?

**... in order to provide information to policy processes and management ...**

→ How can Ecosystem Services be sustainably secured?



Best options for mitigation and





# Governance structure ...

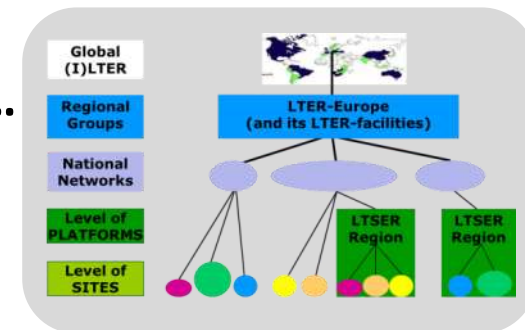
## LTER Europe a regional group of ILTER ...

The global ILTER network is a legal entity (association, registered in Costa Rica)

The European national networks are formally adopted members of the global network (quality criteria such as data policies, site network...)

## National LTER Networks as the building stones ...

Several national networks are legal entities, in most cases associations

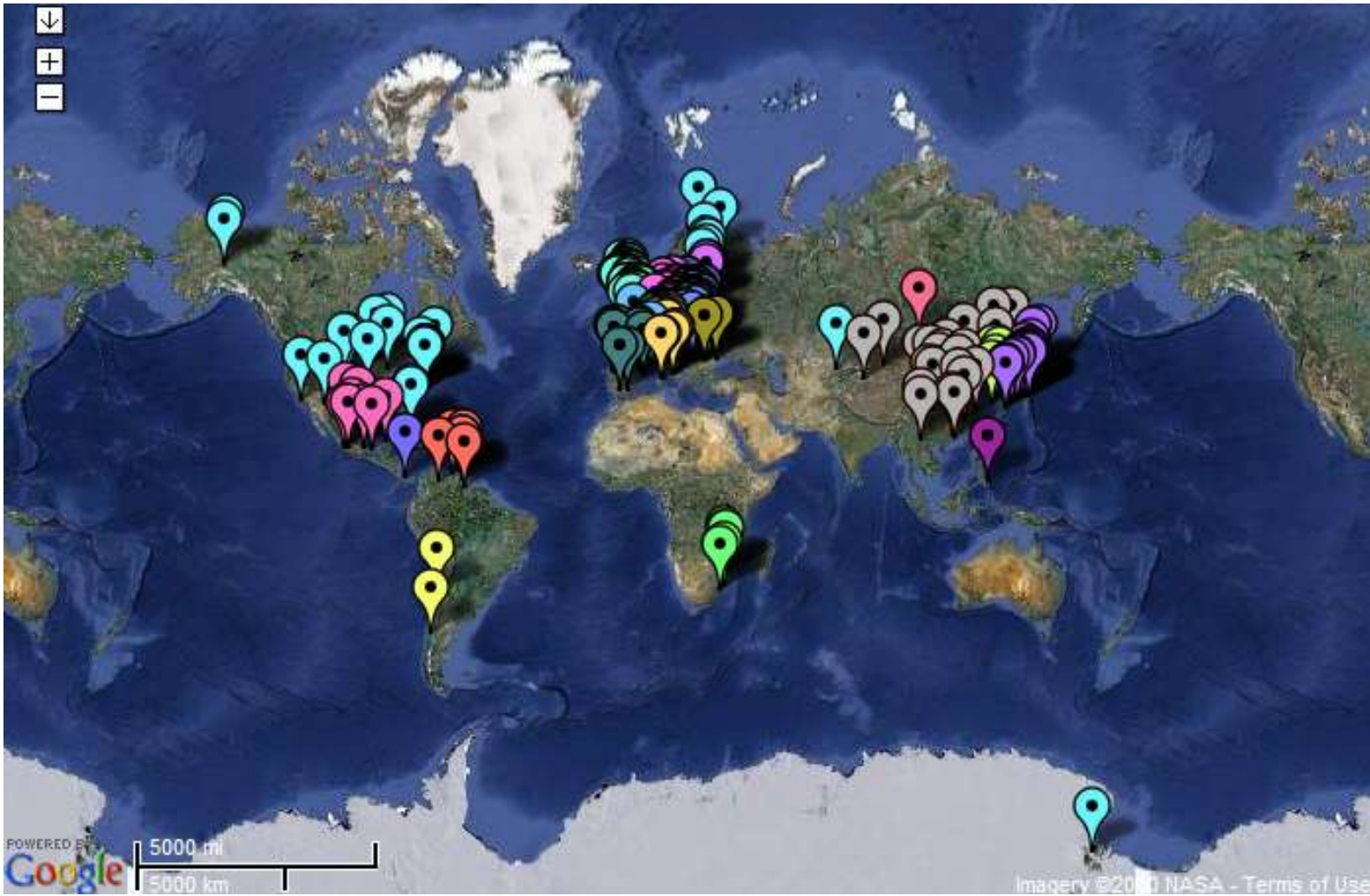


## LTER Europe as European scale research infrastructure ...

Submission for the ESFRI roadmap with the aim to create an ERIC (through ESFRI) or become a European scale association



# ILTER International Long term ecological research sites



Sites: 571 sites (34 out of 40 networks only)

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





# The conceptual pillars of LTER in Europe

**Long-term:** dedicated to the 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 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 European terrestrial and aquatic environments





... the physical infrastructure





# Physical infrastructure of distributed in-natura research sites (in-situ component)



• Sorø  
photo Søren W. Lund



SMEAR II, Hyytiälä, Finland



Högwald  
Pictures from Rainer Gasche



## Exemplary design of a complex single LTER Sites

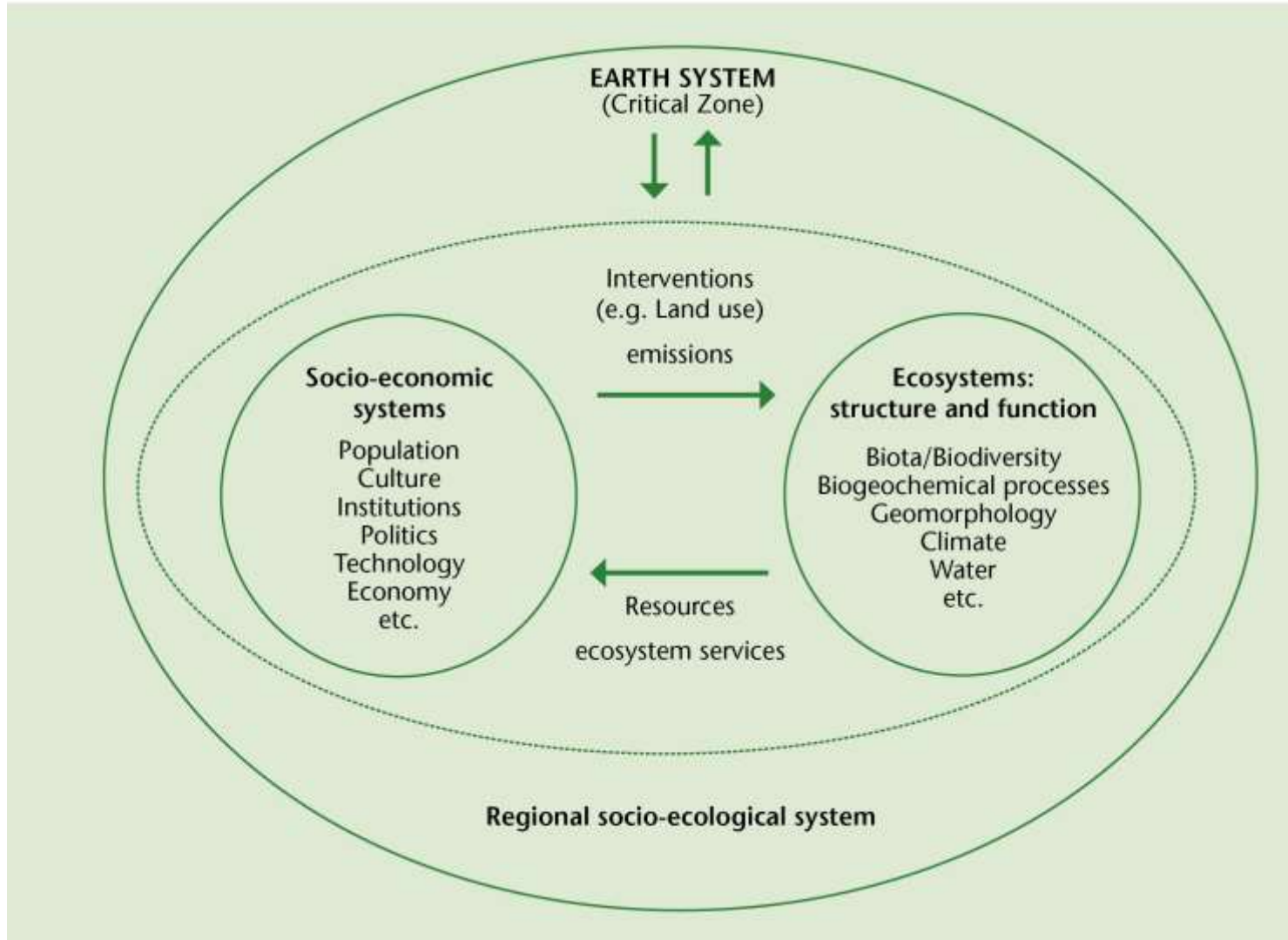


- primary production
- population ecology
- organic matter



**PLUS: main drivers**

- inorganic inputs
- disturbances
- biodiversity (implicitly)



Socio-ecological research: LTSER

Simron Jit Singh · Helmut Haberl  
Marian Chertow · Michael Mirtl  
Martin Schmid *Editors*

# Long Term Socio-Ecological Research

Studies in Society-Nature Interactions  
Across Spatial and Temporal Scales

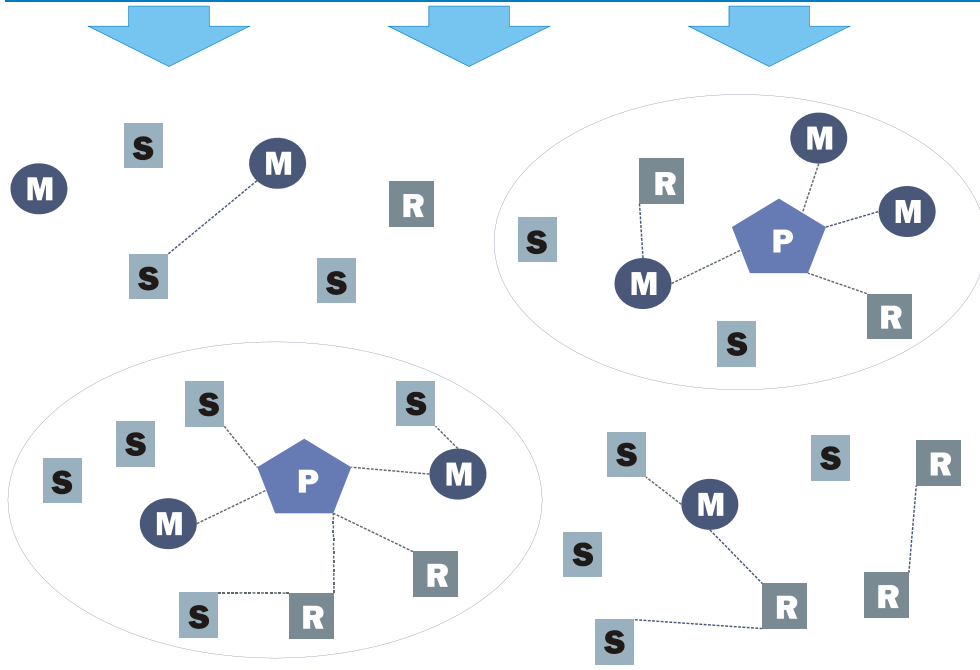
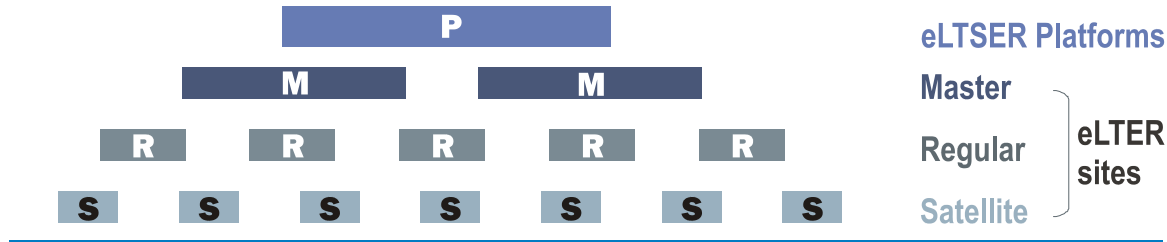
## Contents

1. Concepts, Methods and Linkages
  - LTSER, SES, ISSE/PPD, SEM
  - environmental history
  - critical scales
2. Applications Across Ecosystems, Time and Space
  - remote, urban, islands
  - agricultural systems
3. Formations and the Transdisciplinary Challenge
  - Europe, US, France, Finland, Austria



# LTER site categories in Europe

The hierarchy of eLTER facilities



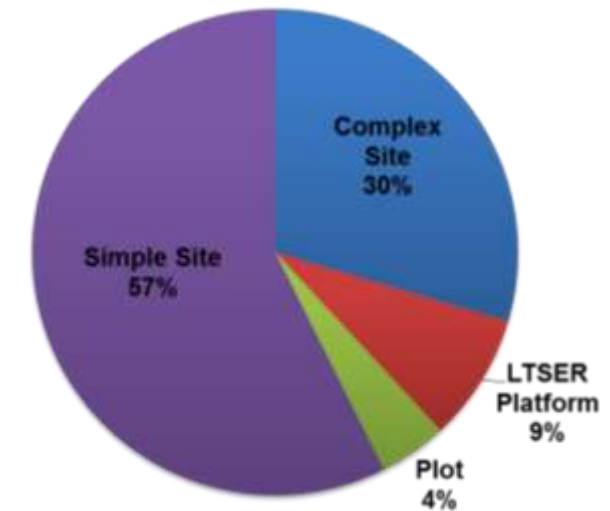
Assembling eLTER facilities according to regional conditions across Europe

## Hierarchy

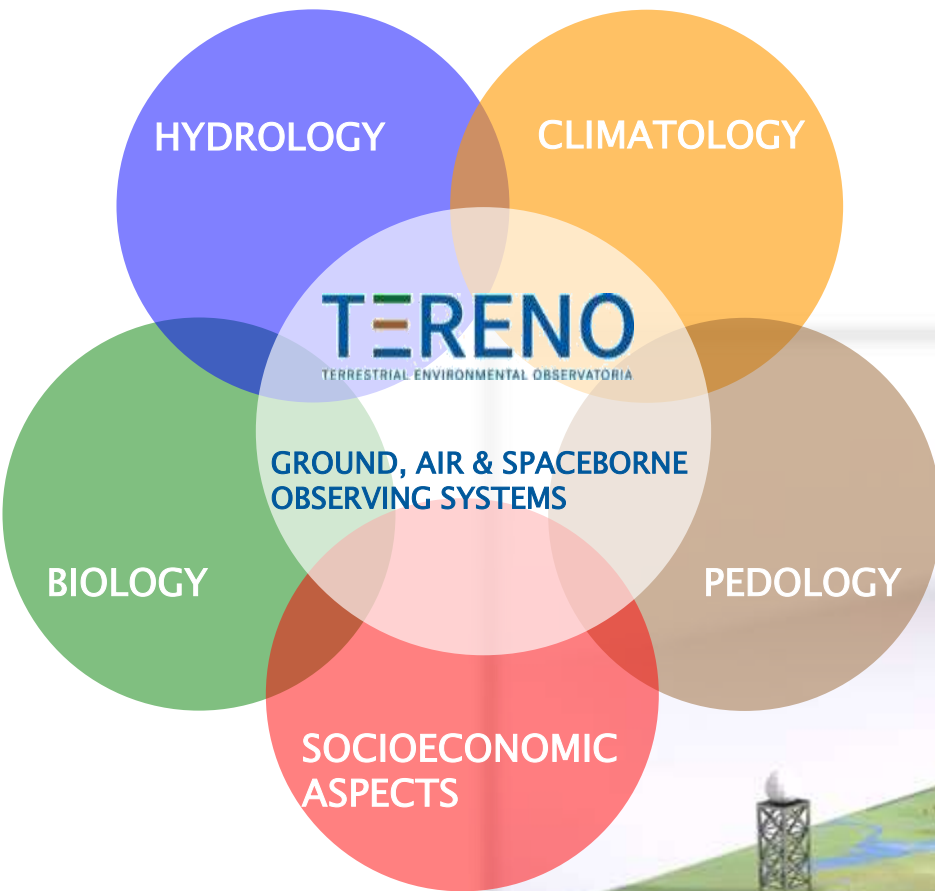
- spatial scale
- complexity
- instrumentation

## Integration

- hot spot areas for ecological and socio-ecological research
- nested designs



# Nested design: example „TERENO“



## Multiple use:

- ICOS
- LTER
- LTSER
- Critical Zone



Geophysics



Groundwater  
monitoring



Remote Sensing



Wireless soil  
moisture sensor  
network



Lysimeters



Biodiversity  
monitoring



Mobile  
Mesocosms



Water quality  
monitoring



Eddy-Flux-Tower



Rainscanner



Modelling  
Platform



... the data infrastructure



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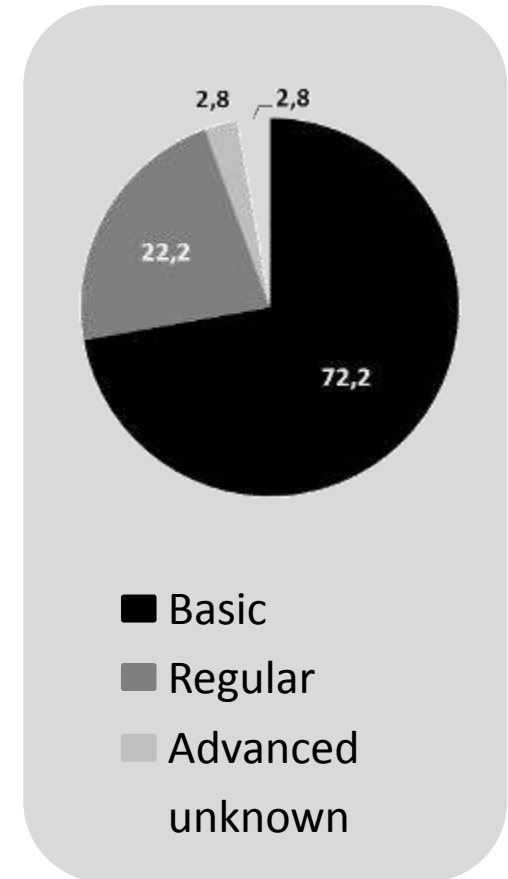
umweltbundesamt<sup>U</sup>



# LTER Europe RI – data management

LTER is a network of research institutes and sites with extremely heterogeneous data management capabilities and IT capacities

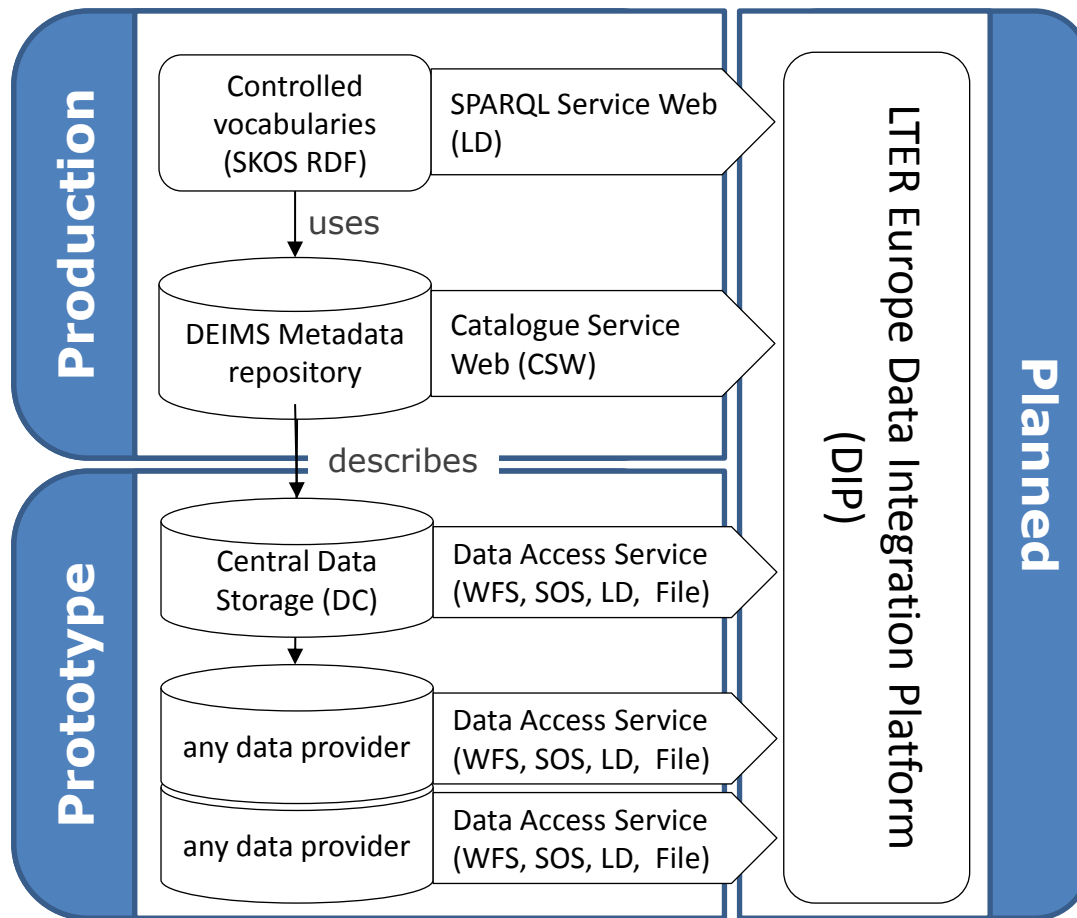
- **Basic capabilities** - doing very basic data management (e.g. based on EXCEL spreadsheets), with no major IT support and infrastructure.
- **Regular capabilities** - providing well structured data storages, (e.g. Databases) and related metadata. Ready to setup data services, but need support (e.g. tools and IT infrastructure)
- **Advanced capabilities** - already implemented a comprehensive data management system with services installed (e.g. WFS, WMS, SOS, linkedData)







# LTER Europe RI – data infrastructure



## DEIMS **Drupal Ecological Information Management System** -

Management of Metadata on Research site, Dataset, Person, and Network (ISO 19115 and EML compliant)

Data upload system

EnvThes **Thesaurus for LTER** (interlinked with GEMET, EUROVOC, AGROVOC and others)

Data access services, Linked-Data (D2RQ, SPARQL) and SOS

Network Name

- Australia (TERN)
- Austria (LTER-Austria)
- Belgium (LTER-Belgium)
- Brazil (LTER Program)
- Bulgaria (LTER-Bulgaria)
- Canada (EMAN)
- Chile (LTER Chile)
- China (CERN)

Networks in Addition toILTER

- ABC - UNEP atmospheric brown Cloud project
- ACAP Agreement on the conservation of albatrosses and petrels
- Biodiversity AQ. (Antarctif)
- Census of Antarctic marine life
- Expert group on birds and marine mammals (SCAR)
- ALTER-Net
- RESEAU LORLUX
- AMAP

Site Type

- LTSER Platform
- Complex Site
- Simple Site
- Plot
- Sub Site

Ecosystem Type

- Tropical and subtropical moist broadleaf forests
- Tropical and subtropical dry broadleaf forests
- Tropical and subtropical coniferous forests
- Temperate broadleaf and mixed forests
- Temperate coniferous forests
- Boreal forests/taiga
- Tropical and subtropical grasslands, savannas, and shrublan
- Temperate grasslands, savannas, and shrublands

ILTER Biome

- Agricultural
- Alpine
- Chaparral
- Coastal
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Desert

Declaration Status requested by Site

- Formal LTER/LTSER
- Potential LTER/LTSER
- Candidate LTER/LTSER

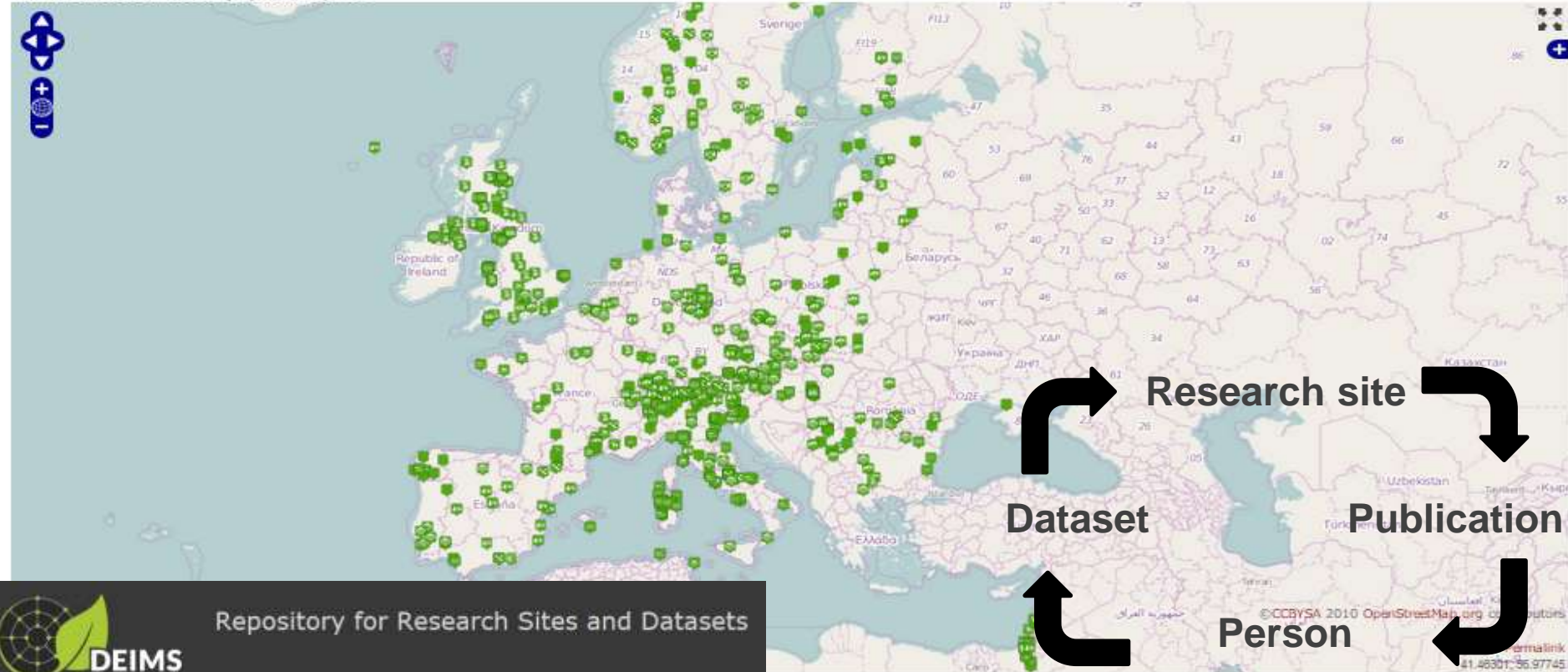
Declaration status accredited by LTER-Europe

- Accredited formal LTER Site/ LTSER Platform
- Accredited potential LTER Site/ LTSER Platfor

Apply

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

Number of Research Sites displayed on Map: 761



Repository for Research Sites and Datasets



©CCBYSA 2010 OpenStreetMap.org contributors

armalink 41.48301; 36.97745



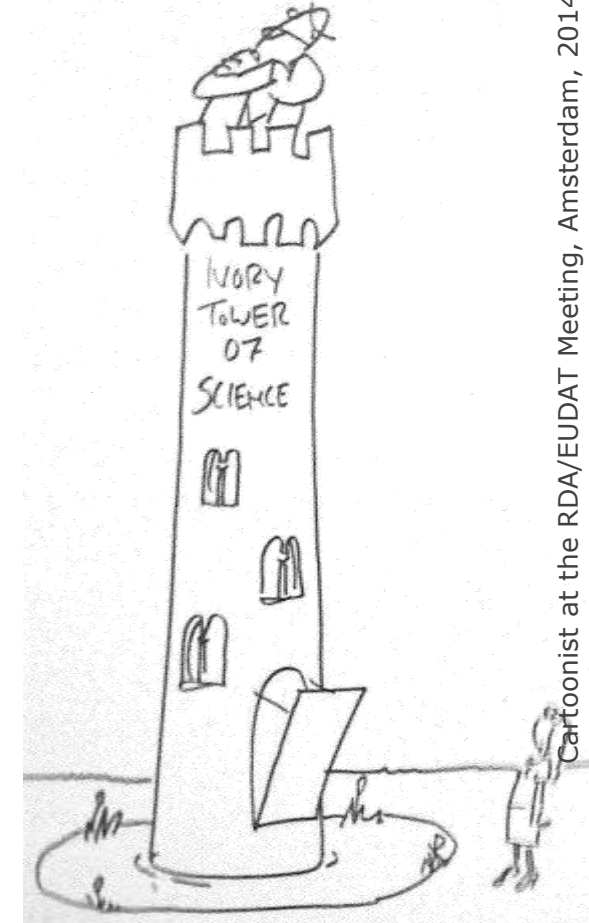
# Data access policy

## Network level data:

- In principle open access
- Consistent site metadata across all sites (web-based service DEIMS)
- Increasing number of data sets also available

## Site level data:

- Varying policies
- BUT: policies and technical format known as part of the mentioned site metadata
- Increasing number of cross-site data use and access



Cartoonist at the RDA/EUDAT Meeting, Amsterdam, 2014/09

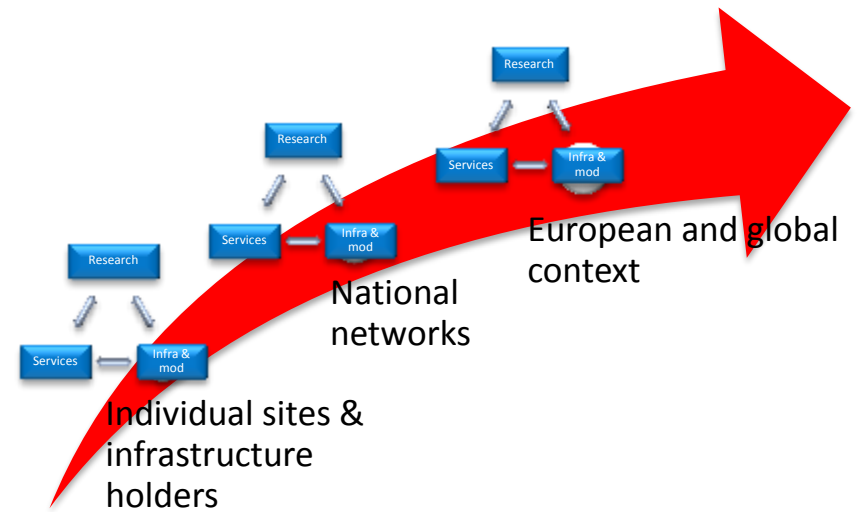
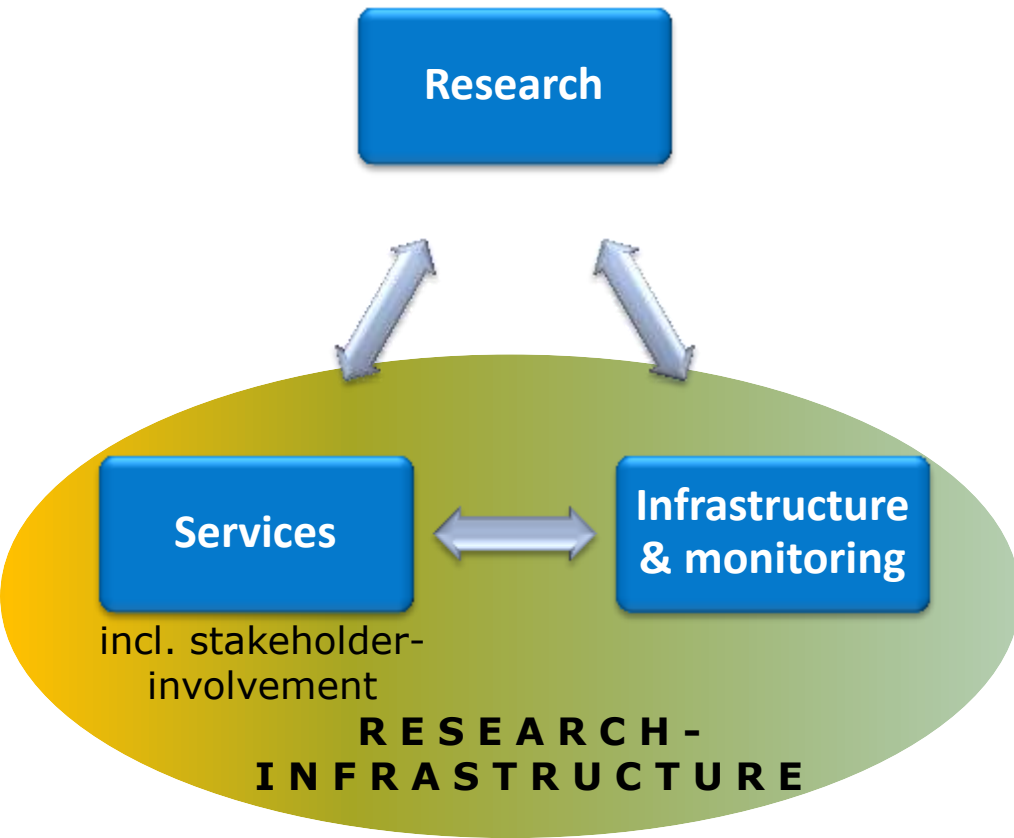


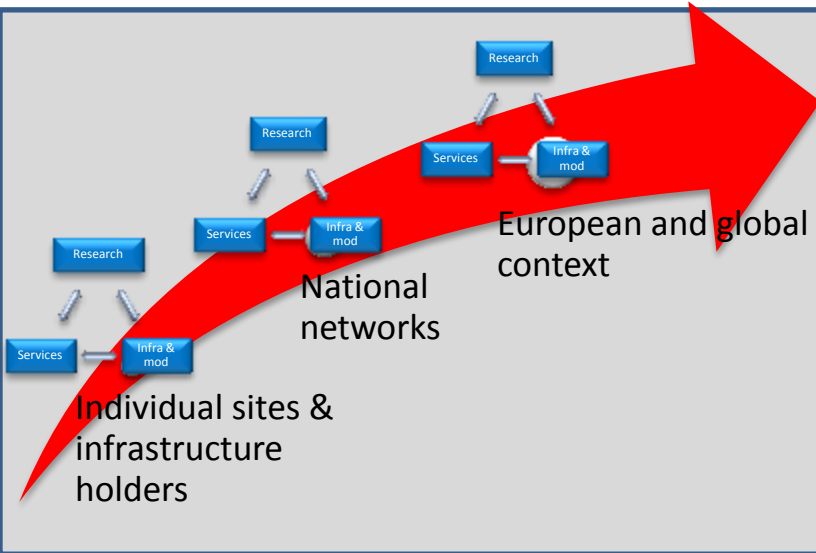
... from sites to infrastructure  
... from local to global scale



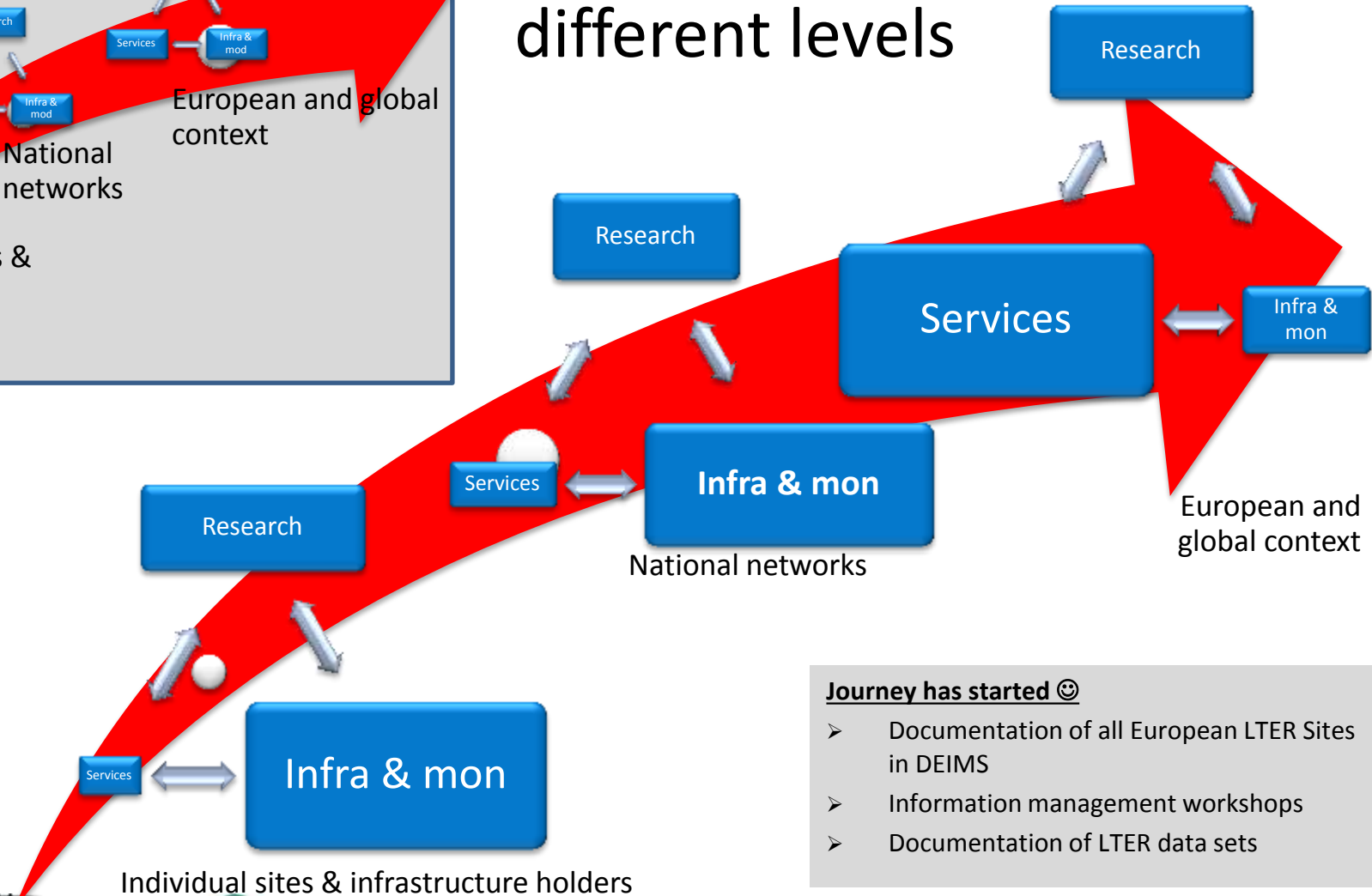


# „Infrastructure“ and the added value of distributed RIs with central components



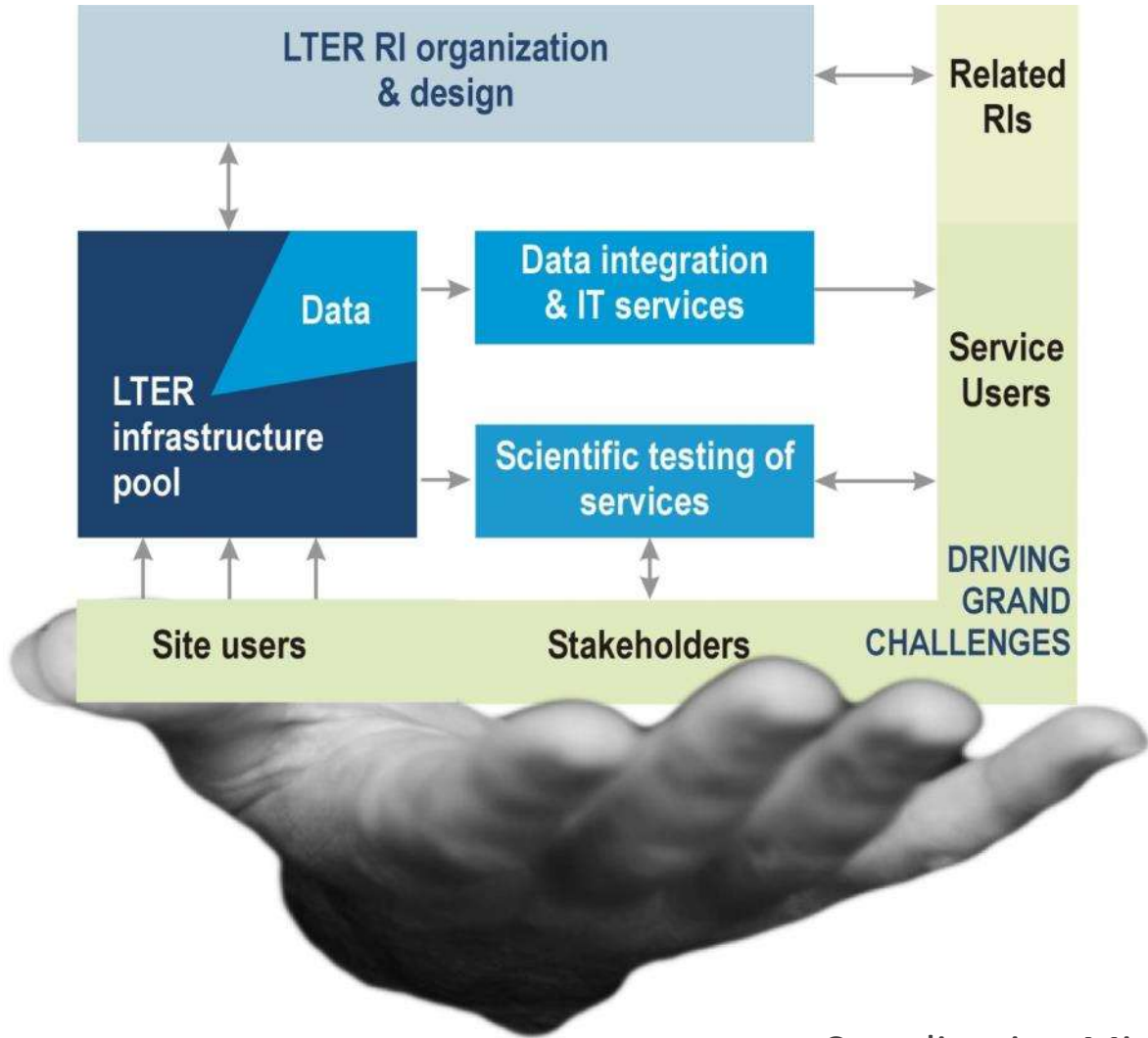


# Division of tasks between different levels



## Journey has started ☺

- Documentation of all European LTER Sites in DEIMS
- Information management workshops
- Documentation of LTER data sets

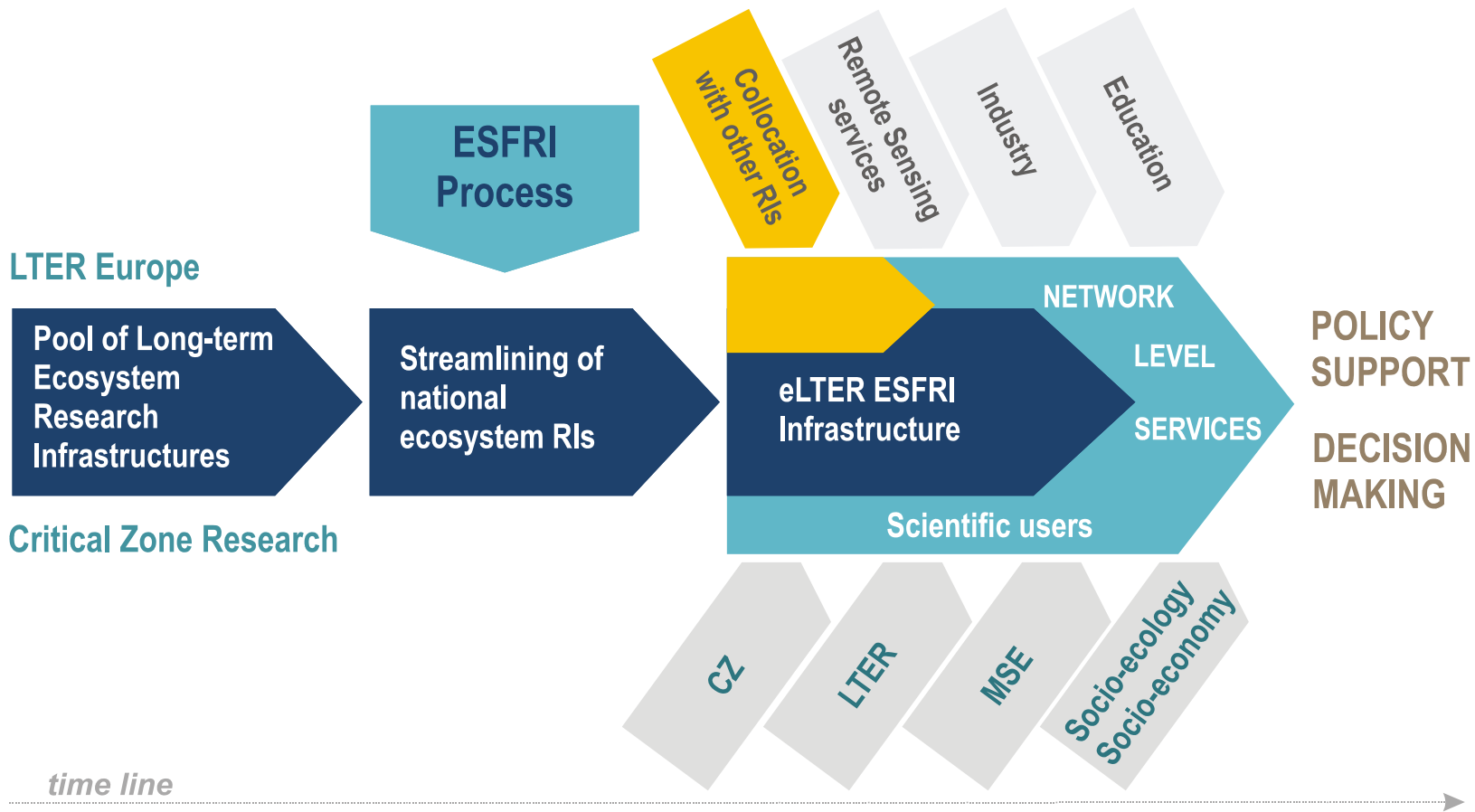


Horizon2020 „eLTER“:  
Building blocks

Coordination Michael Mirtl (EAA)



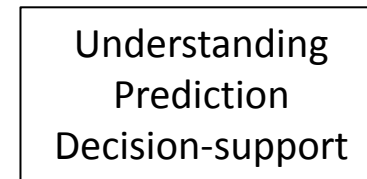
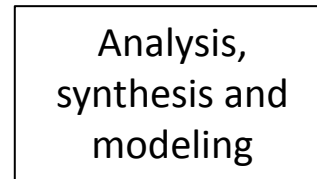
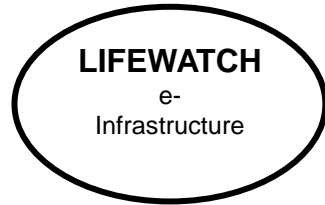
# ESFRI „eLTER“ process and impact





# Well concerted interactions with other RIs

Scientific and other user Communities, e.g. ALTER-Net , BioDiversa, GEOSS, COPERNICUS



Data input



Required  
parameters

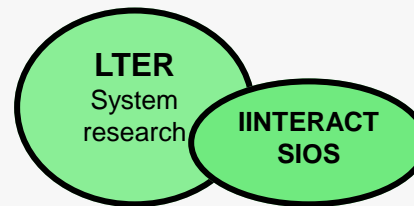
Large scale  
monitoring



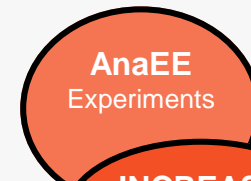
In-situ  
Ecosystem  
Research Infrastructures



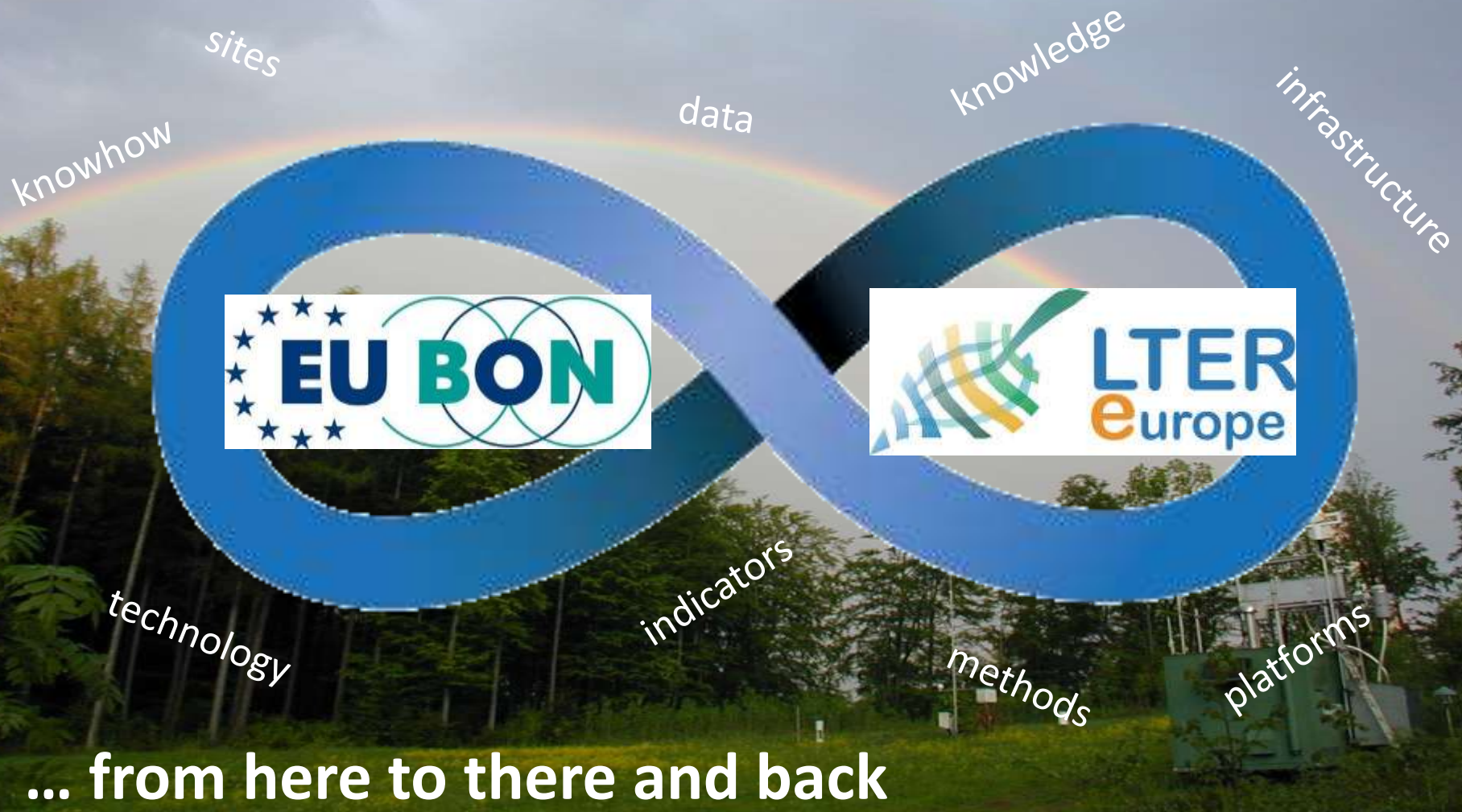
Natural and socio-ecological systems  
research (trends & interactions)



Experimentation



Generic supporting e-Infrastructures (e.g. EUDAT) and reference data (e.g. Species2000)



... from here to there and back





# Key products of LTER-Europe

- **Metadata portal** on long term ecological / environmental information (datasets and research sites), including defined (open) access for research and modeling (indicators, trends in populations /ecosystem services, etc).
- LTER is a **site based infrastructure/network** which could contribute to the implementation of monitoring protocols or the development of methods and testing of indicators
- LTER as an **data provider**, especially for long term datasets (LTER/ILTER sites), also as a European network for early warning function (by first/early detecting / signaling new and important trends or changes in biodiversity)

Open question? How is data integration within LTER achieved?  
How could LTER data be more effectively linked to larger / international scale biodiversity information schemes (GBIF, GEOSS)?





## ... from here to there and back again

- **Cooperation with the EU BON testing sites** – data sharing, common technical solutions (data upload, storage and dissemination, e.g. EU BON testing sites already using LTER tools to upload metadata), using and improving common monitoring standards.
- A permanent relation would need to be established that allows **easy transfer or exchange of ideas during the EU BON and eLTER project**. The exchange may allow LTER to develop towards a scientifically oriented global network, with strong data connections of biotic and abiotic data sets, something which is missing in most biodiversity monitoring programs.



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# Challenges to be addressed ...

## Harmonisation of data resulting from the different domains ...

- Using standard data models for sensor based observations (e.g. soil temperature, etc.) based on OGC SOS and OGC O&M
- Not all data can use the same type of service because of its inherent complexity (e.g. species observation data) → SERONTO
- Semantic harmonisation of data (reference lists, data structure, etc.)

## Harmonisation of methods and indicators ...

- provide experience and recommendations on how (long term) standardized biodiversity monitoring could take place in Europe for the biodiversity 2020 targets

## Harmonise the level of knowledge and expertise ...

- How could knowledge exchange be organised across the network (in terms of technology, data management, etc.)





# Contributions to GEO: LTER-Europe strategy towards consistent earth observation at the network level

## BOTTOM UP: What is out there?



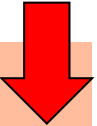
### Site documentation & classification

- site metadata system
- 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)

## 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 (GEOBON, EU-BON, ALTER-Net, NoK EnvEurope, Copernicus)

### Infrastructure lobbying

- EU/ ESFRI → „EON component of eLTER “
- nationally

**ILTER**

**LTER**  
Europe

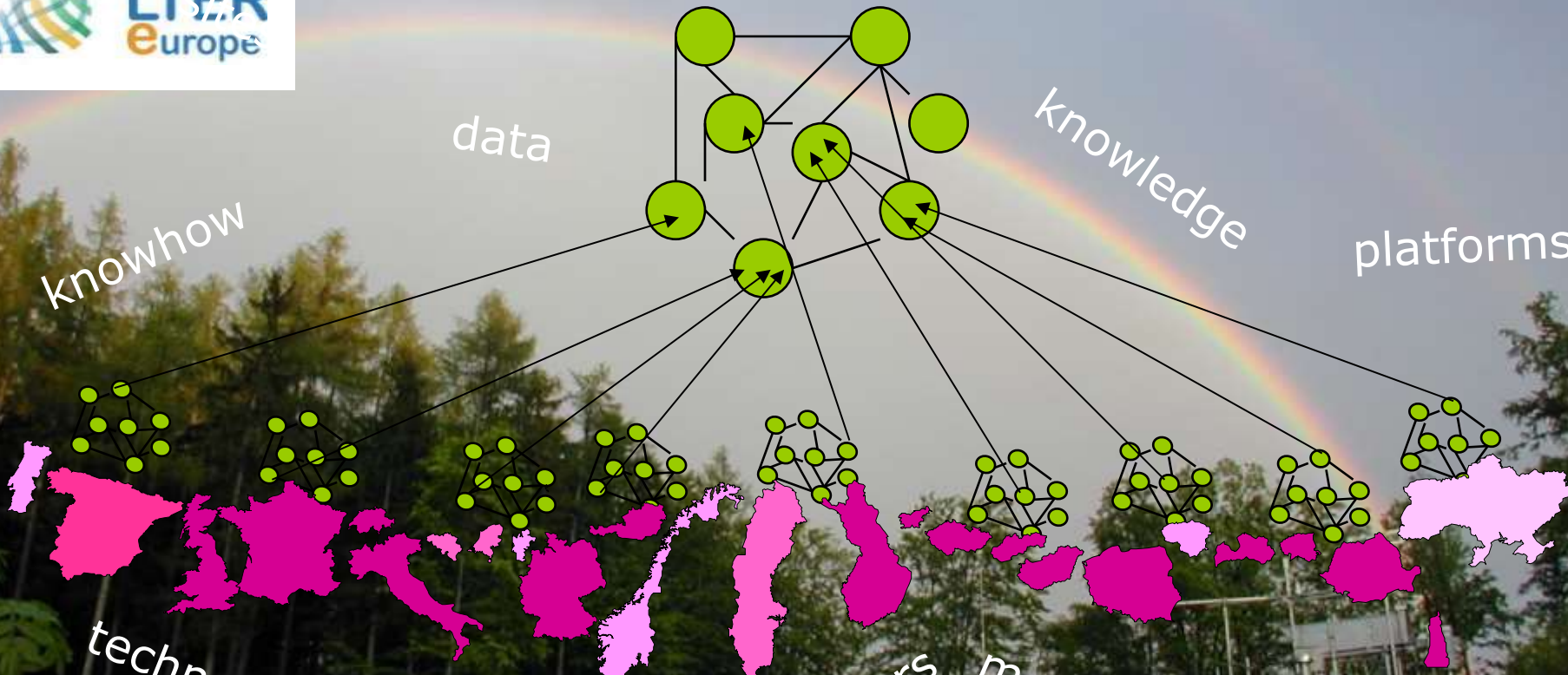


data

knowledge

platforms

knowhow



technology

indicators


methods

infrastructure

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[Johannes.Peterseil@Umweltbundesamt.at](mailto:Johannes.Peterseil@Umweltbundesamt.at)



**If you want to go fast go  
alone,  
if you want to go far go  
together.**

An old African proverb