EnvEurope
Bulletin issue n.4

Contents

Introduction

The long-term research and monitoring of ecological systems need a shared scientifically-sound basis and a methodological harmonization at European scale, to improve the environmental management and to support the development of environmental policies through integrated approaches of objectives, resources and disciplines. The link between long-term ecological research (LTER) and a complementary monitoring component (LTEM, Long-term ecosystem monitoring) is an indispensable prerequisite for the LTER-Europe network, which aim is to support research projects on the site and multi-site level with both a clear scientific focus and trend information.

The Action 4 ("Network Design") is involved in the EnvEurope project for all those aspects concerning an improved LTER network design. Action 4 considers and elaborates all the relevant EnvEurope outcomes (from all the other Actions) in order to produce a know-how on the organization (or restructuring, if necessary) of the network to improve the information flow and high value research and monitoring. Besides, the permanent trans-domain, ecological, long-term site network should represent a valuable system for in situ validation of satellite data, thus helping also the implementation of the COPERNICUS program (Regulation EU n. 911/2010) and the Inspire Directive through the creation of a updated and accessible metadatabase and database of the LTER sites.

Main objectives of

The harmonized network designed by the A4 should:

- Reflect the environmental and economic stratification of Europe and key ecosystem types
- Be connected to other site-based environmental networks
- Interact with the European initiative COPERNICUS and its specific projects
- Contribute to the implementation of SEIS and the Inspire Directive in LTER

In a first phase, the network design mainly deals with the issue of "site gaps filling" in order to provide solutions to ensure the best site coverage for long-term ecological research and monitoring in Europe.
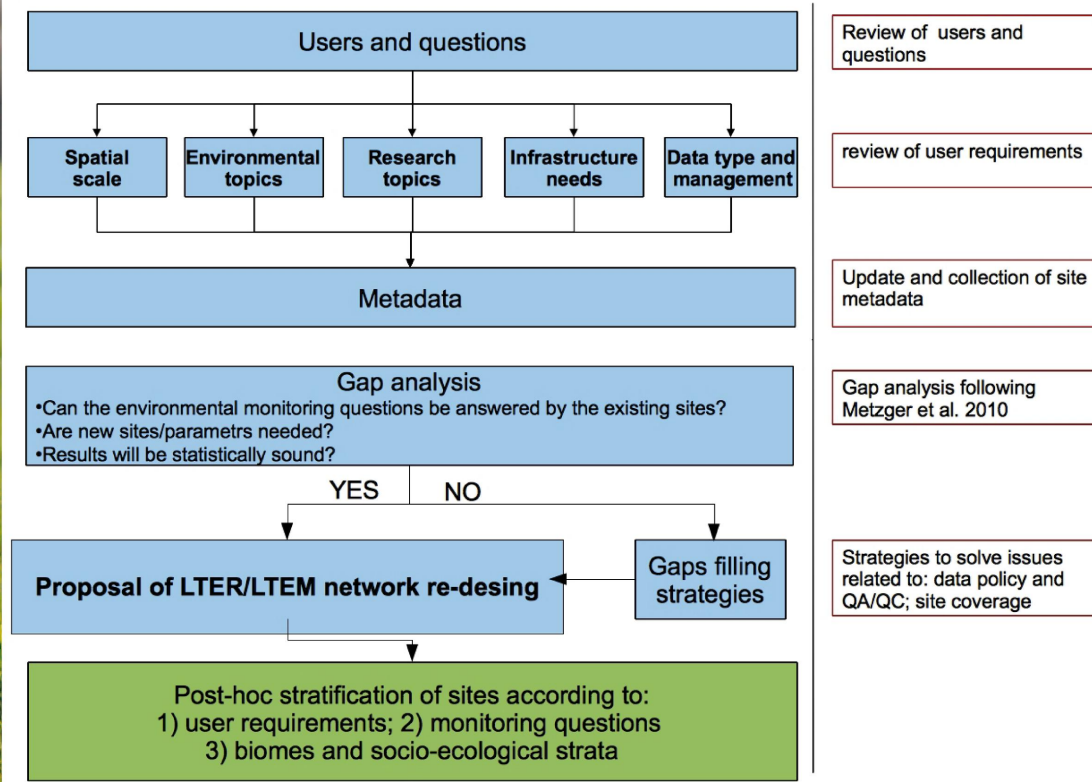
Successively, through an evaluation of the weaknesses and strengths of the present LTER-Europe network, based on the analysis of an updated set of site metadata, it contributes to organize the monitoring component at different scales of observation, with respect to standardized baseline monitoring for multiple use.

Particularly A4 takes into account a cost-effective network design and the potential connections with other site-based environmental networks.

Finally, it combines updated metadata at the site level from the whole LTER network with information provided by the actions 1, 2, 3 and 5 of the project.

A special attention is also directed to the cooperation with other intensive monitoring and conservation networks (e.g. UNECE, ICPs, Natura 2000) in order to provide a proposal for the increasing efficiency of ecological monitoring in Europe.

Action 4

Network design

The existing LTER-Europe presents four core characteristics differentiating it from other networks and forming part of its uniqueness (Mirtl 2009):

• In situ: LTER-Europe generates field data at different scales (up to the regional scale) and across ecosystem compartments.
• Long-term: LTER-Europe dedicates itself to the provisioning, documentation and continuous use of long-term information and consistent data on ecosystems with the time horizon of decades to centuries.
• System: LTER-Europe contributes to better understanding the complexity of natural ecosystems and coupled socio-ecological systems.
• Process: LTER-Europe´s research aims at the identification, quantification and interaction of processes of ecosystems driven by internal and external drivers.

The selection of sites in LTER Europe was not decided with a top-down approach and, therefore, it did not follow an a priori "design". The proposal of a network "design" would necessarily result in a post-hoc stratification of sites, taking into account the core characteristics of LTER network and according mainly to user requirements, focal ecosystems and biome or socio-ecological strata of Europe. To achieve this goal we adopted a step-wise process to produce a proposal of a LTER network re-design.

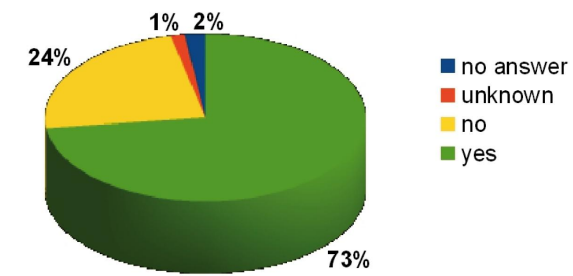| Flowchart	Side notes
Users and questions	Review of users and questions
Spatial scale / Environmental topics / Research topics / Infrastructure needs / Data type and management	review of user requirements
Metadata	Update and collection of site metadata
Gap analysis • Can the environmental monitoring questions be answered by the existing sites? • Are new sites/parametrs needed? • Results will be statistically sound?	Gap analysis following Metzger et al. 2010
YES / NO	
Proposal of LTER/LTEM network re-desing — Gaps filling strategies	Strategies to solve issues related to: data policy and QA/QC; site coverage
Post-hoc stratification of sites according to: 1) user requirements; 2) monitoring questions 3) biomes and socio-ecological strata	

The gap analysis by A4 started in July 2010 and followed a step-by-step procedure. The main reference tool for this activity was the LTER-Europe site meta-database (LTER Infobase).
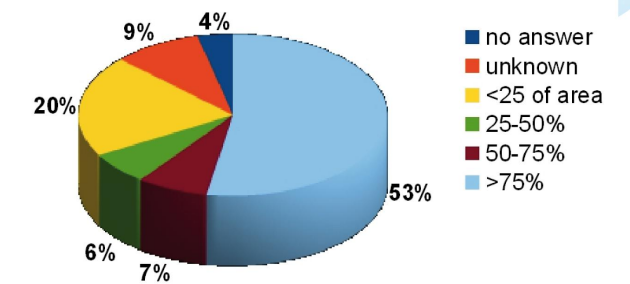
The first step was the analysis of the site list and of metadata available on the Infobase and that were updated to early 2009. Then, this information were integrated with the results of a questionnaire, specifically produced for the EnvEurope Beneficiaries, on the overlapping of the LTER sites with other networks, and, in particular, with COPERNICUS.

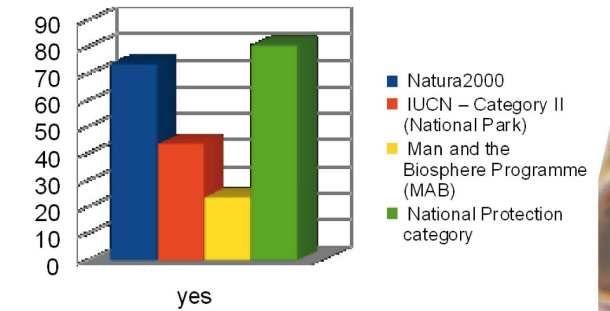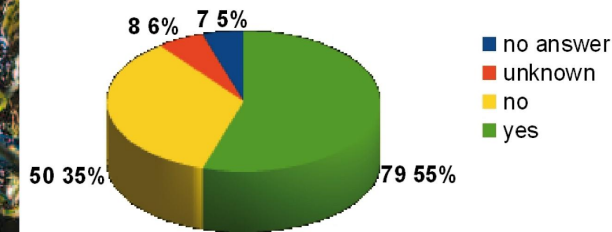# Exploratory site metadata analysis of LTER-Europe sites

Map of LTER-Europe sites structure according to site metadata. Different colours cluster sites according to the research topics carried out in each site

LTER-Europe and environmental protection

Protection (% of sites)

- no answer
- unknown
- no
- yes

1% 2%
24%
73%

Protection coverage %

- no answer
- unknown
- <25 of area
- 25-50%
- 50-75%
- >75%

4%
9%
20%
53%
6%
7%

Site is used or managed to extract natural resources

- no answer
- unknown
- no
- yes

8 6% 7 5%
50 35%
79 55%

- Natura2000
- IUCN – Category II (National Park)
- Man and the Biosphere Programme (MAB)
- National Protection category

yes

First results of metadata analysis...

Most common research topic

Habitat structure
Biodiversity driven by landuse
Ecosystem structure
Forest ecology
Management changes
Arthropods
Primary production
Protected areas (national parks etc.)
Mammals
Grassland ecology
Landscape ecology
Drivers of ecosystem services
Fish
Habitat management
Zooplancton
Production
Wetland ecology
Amphibians
River ecology
Population management
Bioenergy
Fire
Other heterotrophic
Urban ecology

0   20   40   60   80   100 120
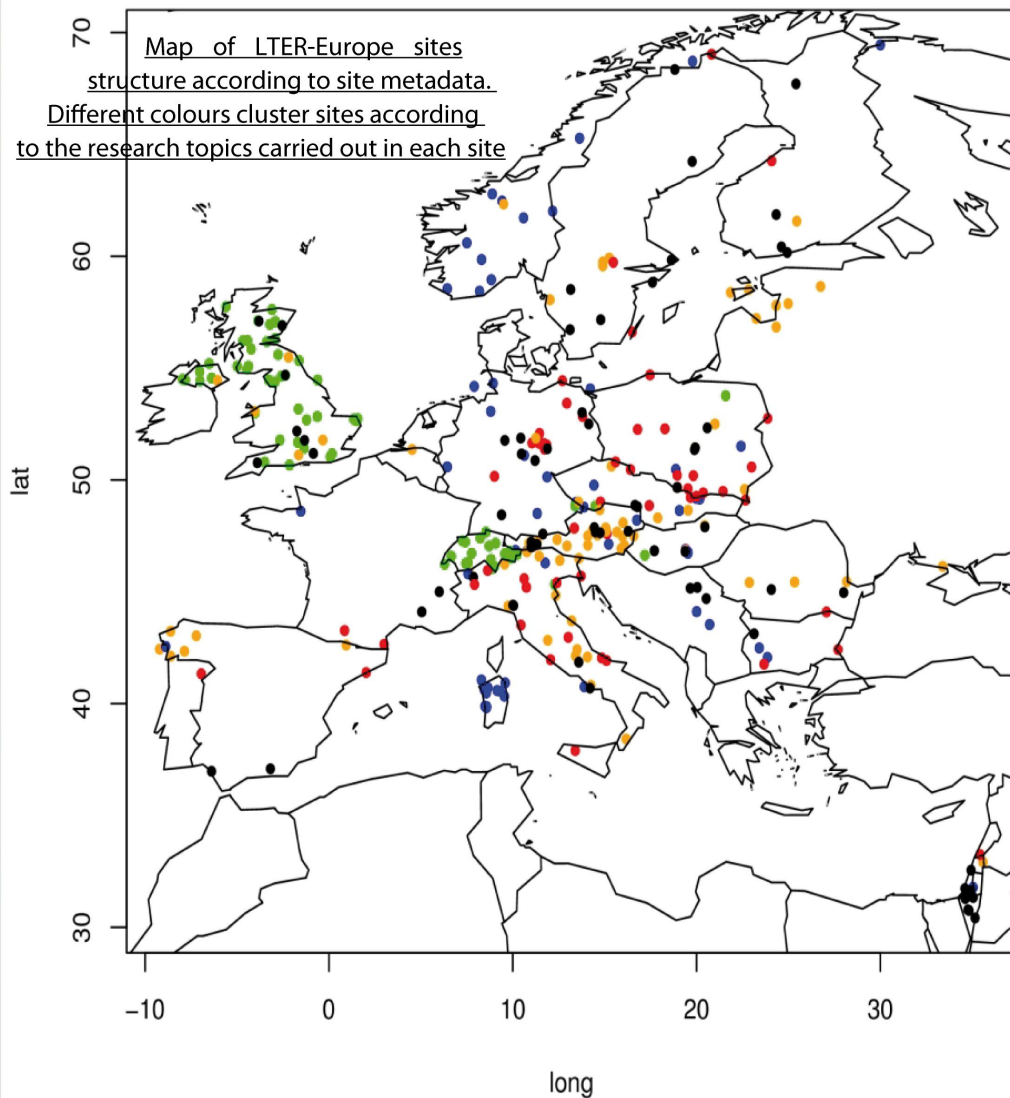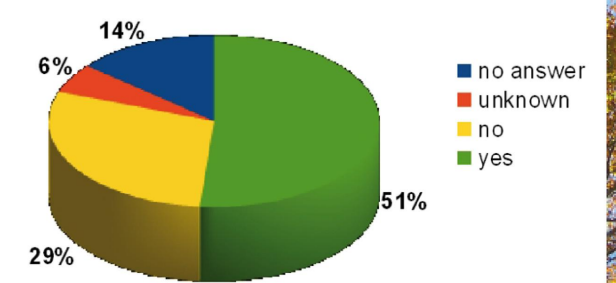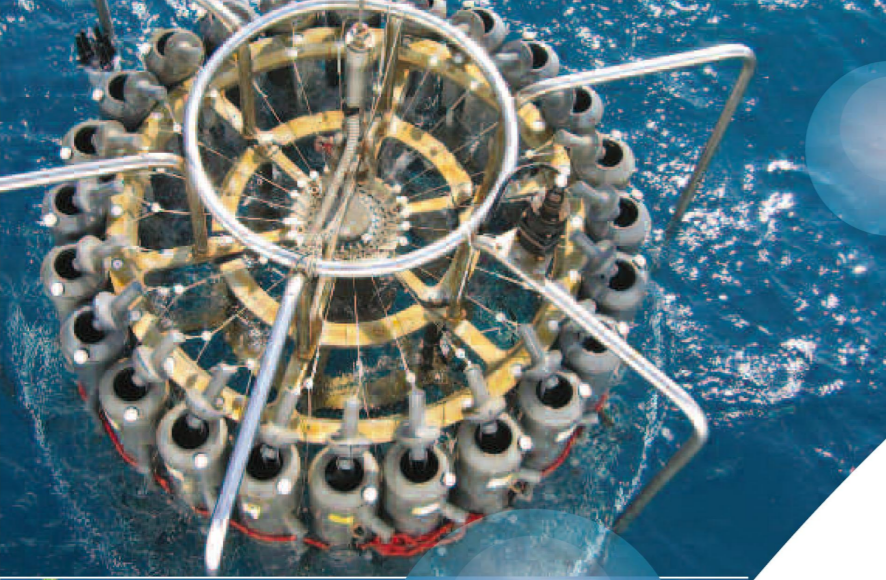
Most common research topics in the EnvEurope/LTER sites

■ n sites

Link between EnvEurope/ LTER sites and Natura2000

EnvEurope/Natura2000 sites

- No answer
- Unknown
- No
- Yes

2% 11%
30%
58%

LTER Europe/Natura2000 sites

- no answer
- unknown
- no
- yes

6% 14%
29%
51%
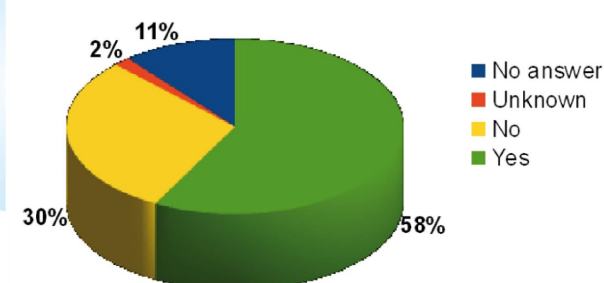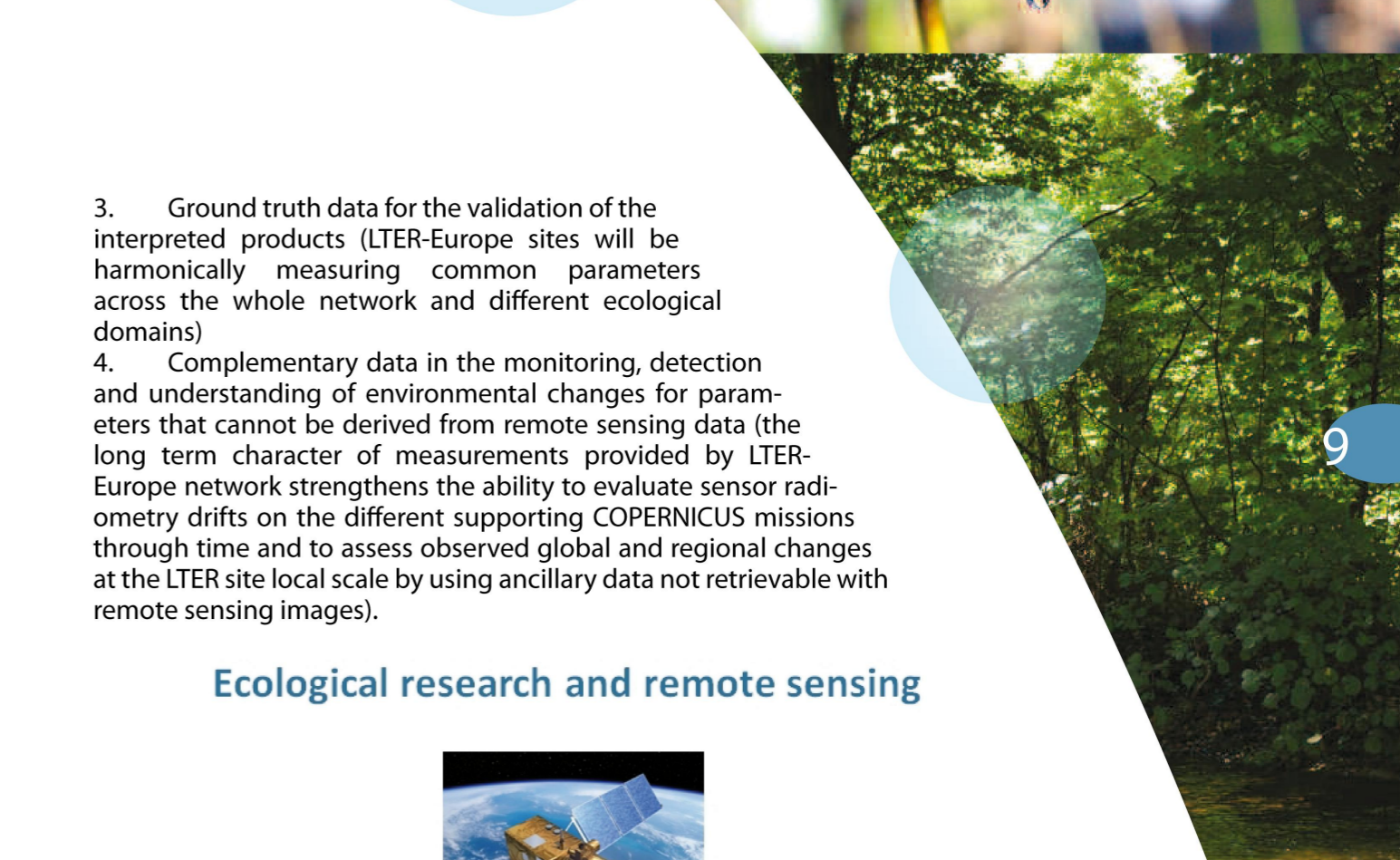
Connection

with COPERNICUS

COPERNICUS is a EU-user-driven programme with support of ESA (European Space Agency).

The COPERNICUS programme comprises a service component, ensuring access to information to any organization or citizen, of different areas and compartments (such as: the monitoring of atmosphere, climate change, land and marine environment, emergency management and security); a space component, ensuring sustainable space borne observations for the services; and an in-situ component ensuring observations through airborne, seaborne and ground-based installations for the services.

The COPERNICUS in-situ stakeholders are International, European, regional (public or private) and national organizations that collect, hold, coordinate and provide the required in-situ data needed for the COPERNICUS services to deliver their products.

The LTER-Europe network is interested to be one of such stakeholders as it can play an important role as an official validation network and in-situ data provider for the COPERNICUS products.
Furthermore, COPERNICUS explicitly look for harmonized in-situ network and, actually, one of the main goals of EnvEuropeis to attain the harmonization of LTER-Europe.
From the analysis of the available information it clearly comes out that some peculiar LTER features (e.g. the long-term perspective, the ecologically meaningful of the in-situ measured parameters, the quality of data and the availability of biodiversity data), well define that the important role of LTER could be to provide:
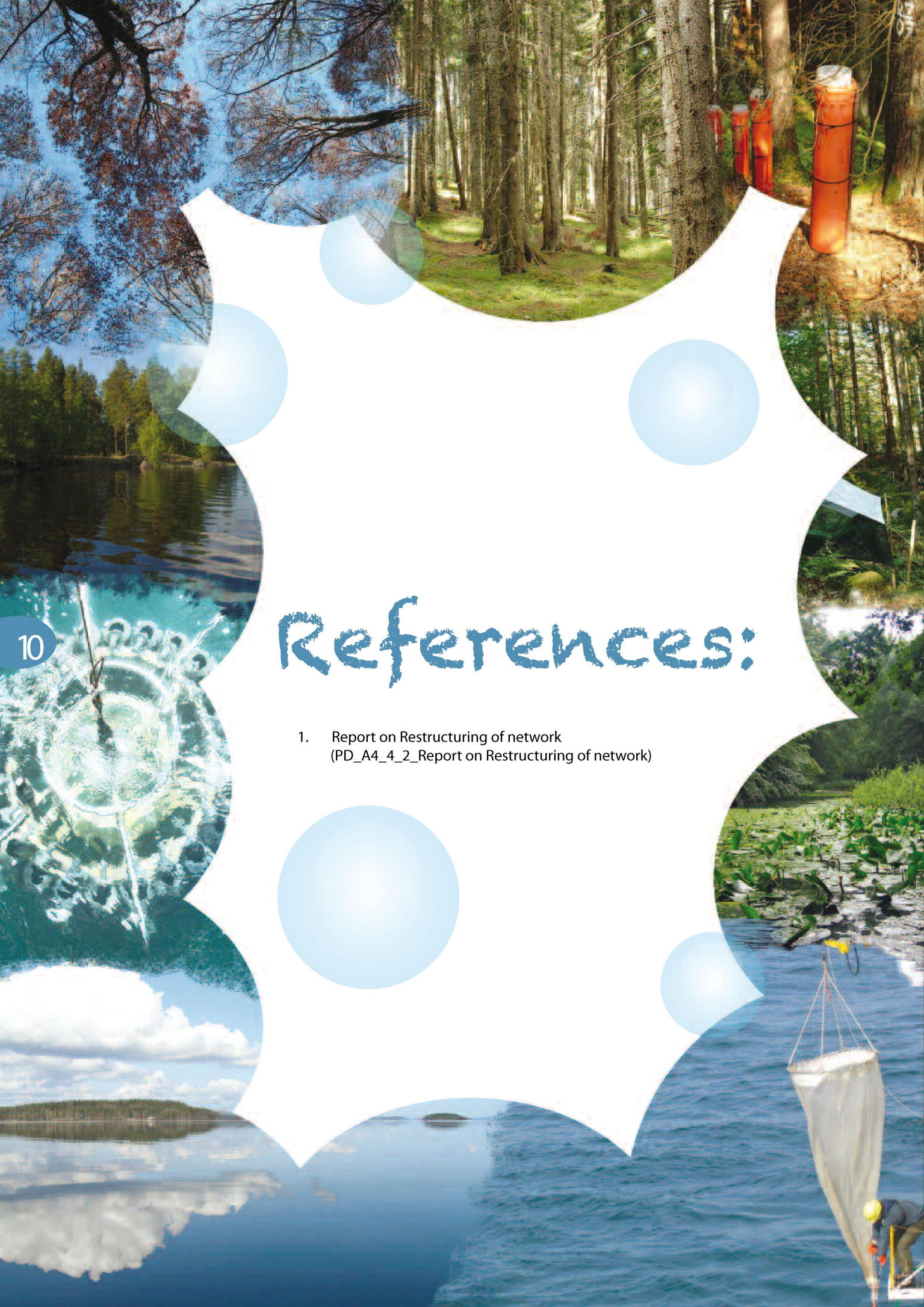1. Control points for calibration (many LTER-Europe sites measure important atmospheric parameters for image calibration)
2. Training Information for supervised image classification (most of LTER-Europe sites have updated fine-scale land cover maps)

3. Ground truth data for the validation of the interpreted products (LTER-Europe sites will be harmonically measuring common parameters across the whole network and different ecological domains)
4. Complementary data in the monitoring, detection and understanding of environmental changes for parameters that cannot be derived from remote sensing data (the long term character of measurements provided by LTER-Europe network strengthens the ability to evaluate sensor radiometry drifts on the different supporting COPERNICUS missions through time and to assess observed global and regional changes at the LTER site local scale by using ancillary data not retrievable with remote sensing images).

Ecological research and remote sensing

In situ observations for ground truth validation

Remote sensing products

LTER sites

8

9
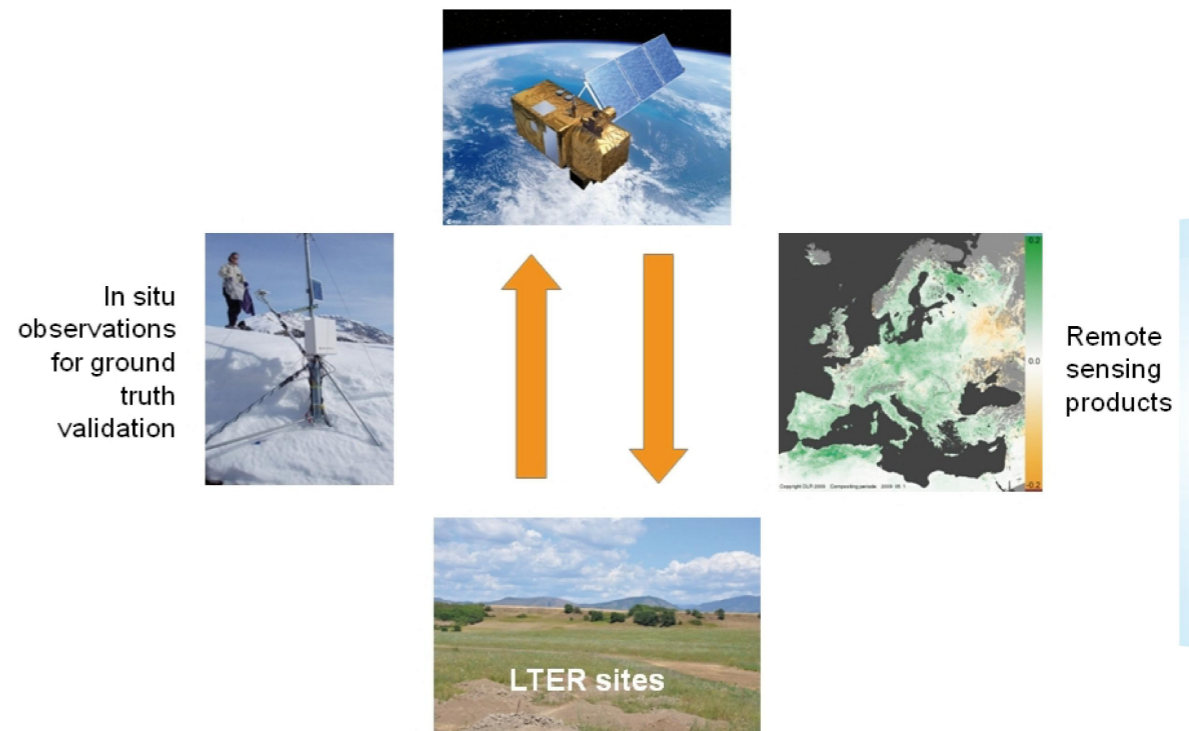
References:

1. Report on Restructuring of network
   (PD_A4_4_2_Report on Restructuring of network)

Authors:

Claudia Cindolo [1], Cristiana Cociuffa [1], Paolo Colangelo [2],
Alessandro Campanaro [2], Enrico Pompei [1]

with the contributions of

Alessandra Pugnetti [3], Paola Focaccia [3]

1 National Forest Service, Italy

2 National Forest Service-National Centre Forest Biodiversity "Bosco Fontana"
   of Verona and University of Rome "La Sapienza"- Dept. Biology and
   Biotechnology, Italy

3 National Research Council - Institute of Marine Sciences, Italy