International
Long-Term Ecological Research
Network

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

Interplay of the European LTER (eLTER) & global LTER (ILTER) in response to biodiversity & ecosystem services research requirements

DG Research / EKLIPSE
Brussels, 1 June 2018

Michael Mirtl
Chair man of ILTER, eLTER ESFRI coordinator
(UFZ/DE & EAA/AT)

Reference to the meeting background

Item 3 of the background document:

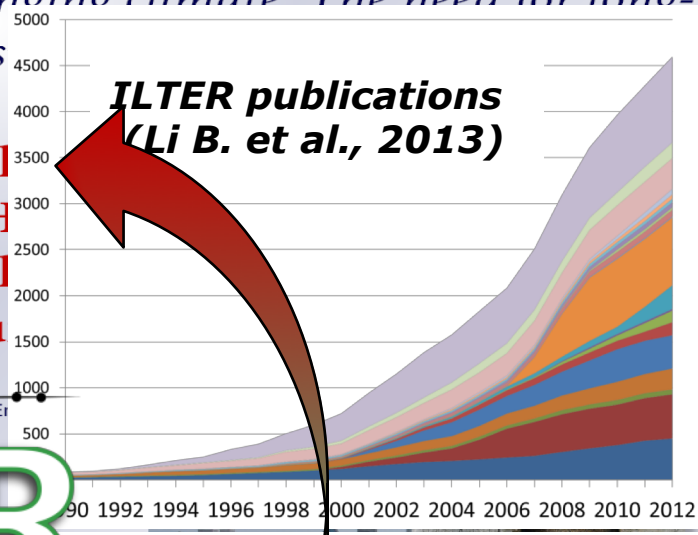
...how these **global processes** and results could concretely be **translated into European priorities**, capturing EU-**added value for** European research and innovation policy, and conversely, how best **European research and innovation policy** and results (priorities, projects, **knowledge, scientific capacity & research infrastructure**) could **strategically feed into** these **global** processes.

ILTER: Integrating and coordinating key elements of environmental systems research

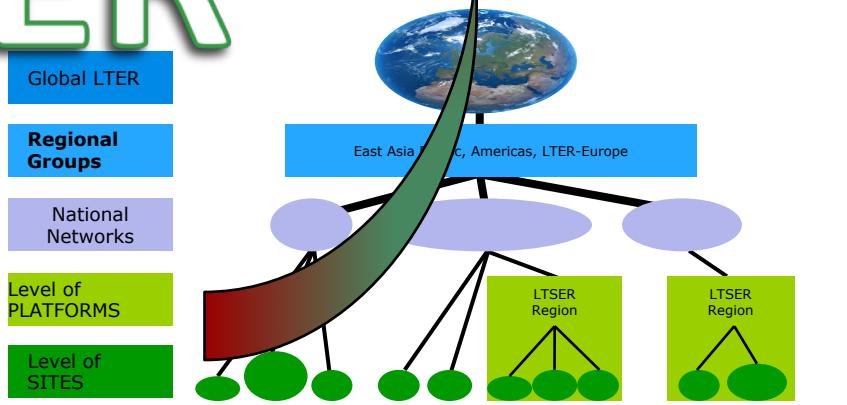
Consequence of altered nitrogen cycles in the coupled human and ecological system under changing climate: The need for long-term and s

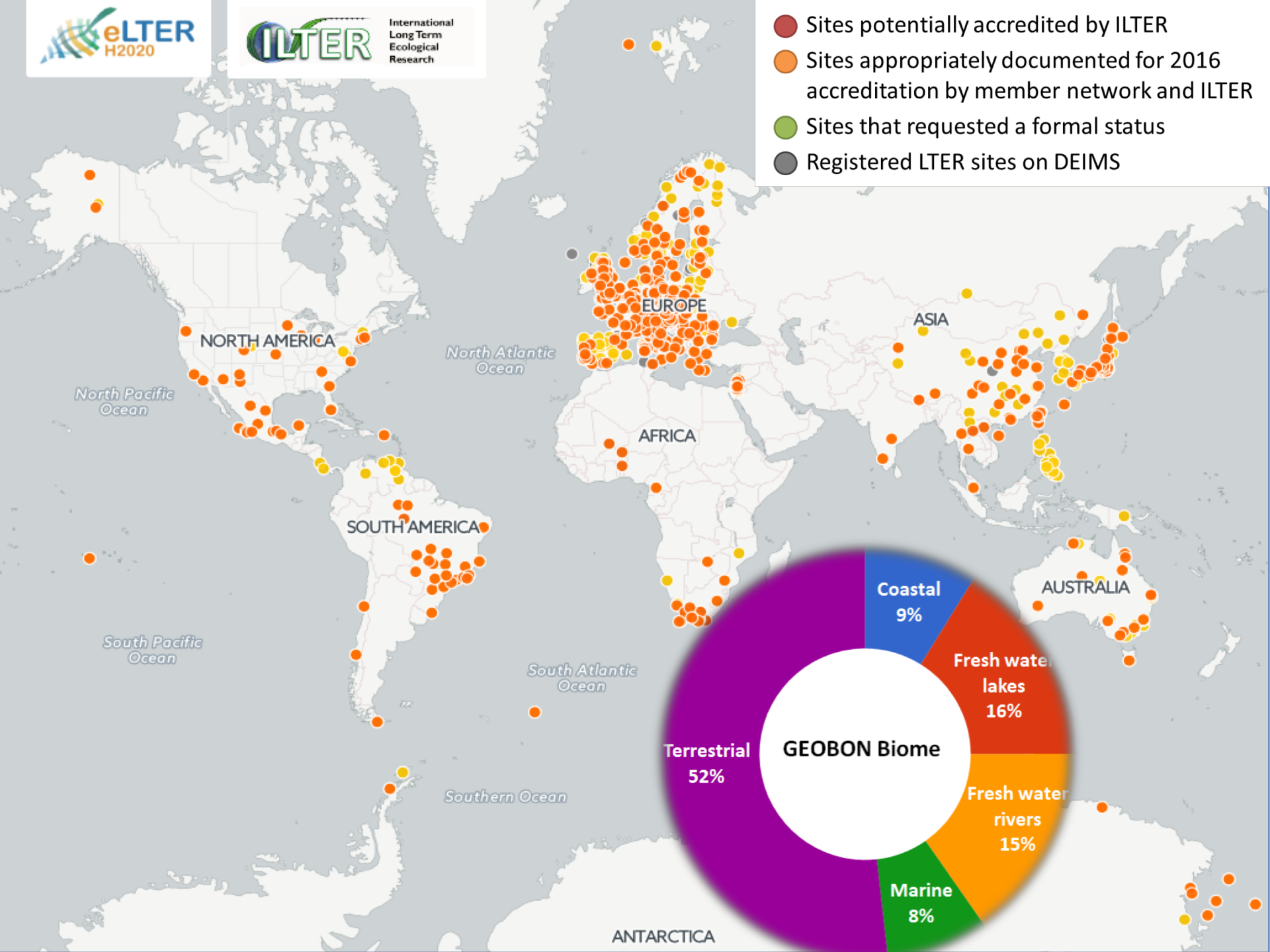
Hideaki Sh
William H
J. Mitchell
Tang, Lau

AMBIO
A ...al of the Human E...

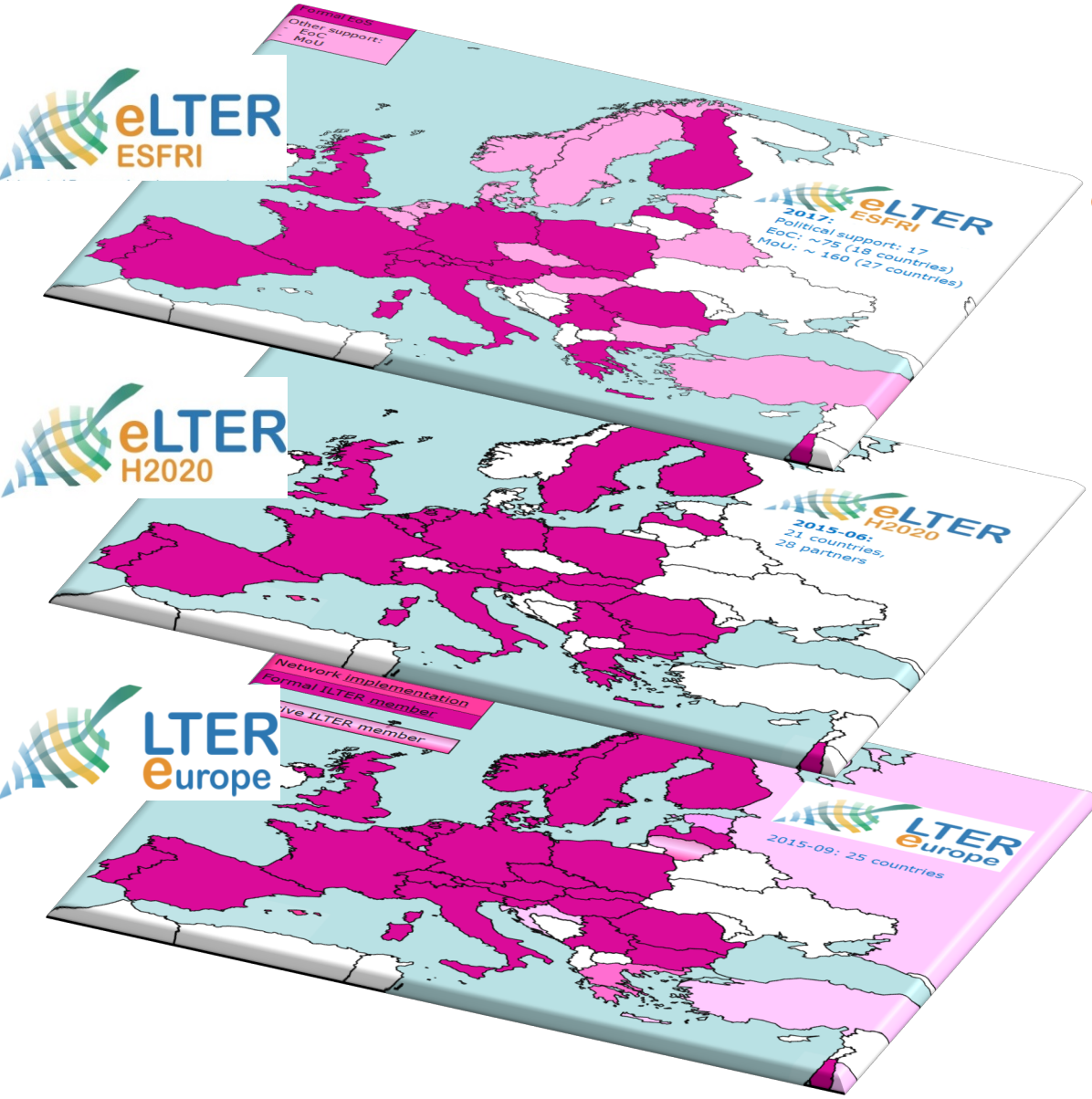


ILTER




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 wate lakes 16%
Fresh wate rivers 15%
Marine 8%
Terrestrial 52%

European LTER components



eLTER ESFRI Process

- EoS: 17 Countries
- ~ 80 EoC: 18 countries
- ~ 160 MoU: 27 countries

eLTER H2 StartComm 2015-2019

21 LTER countries,
28 partners
162 data providing sites

Network of formal national networks

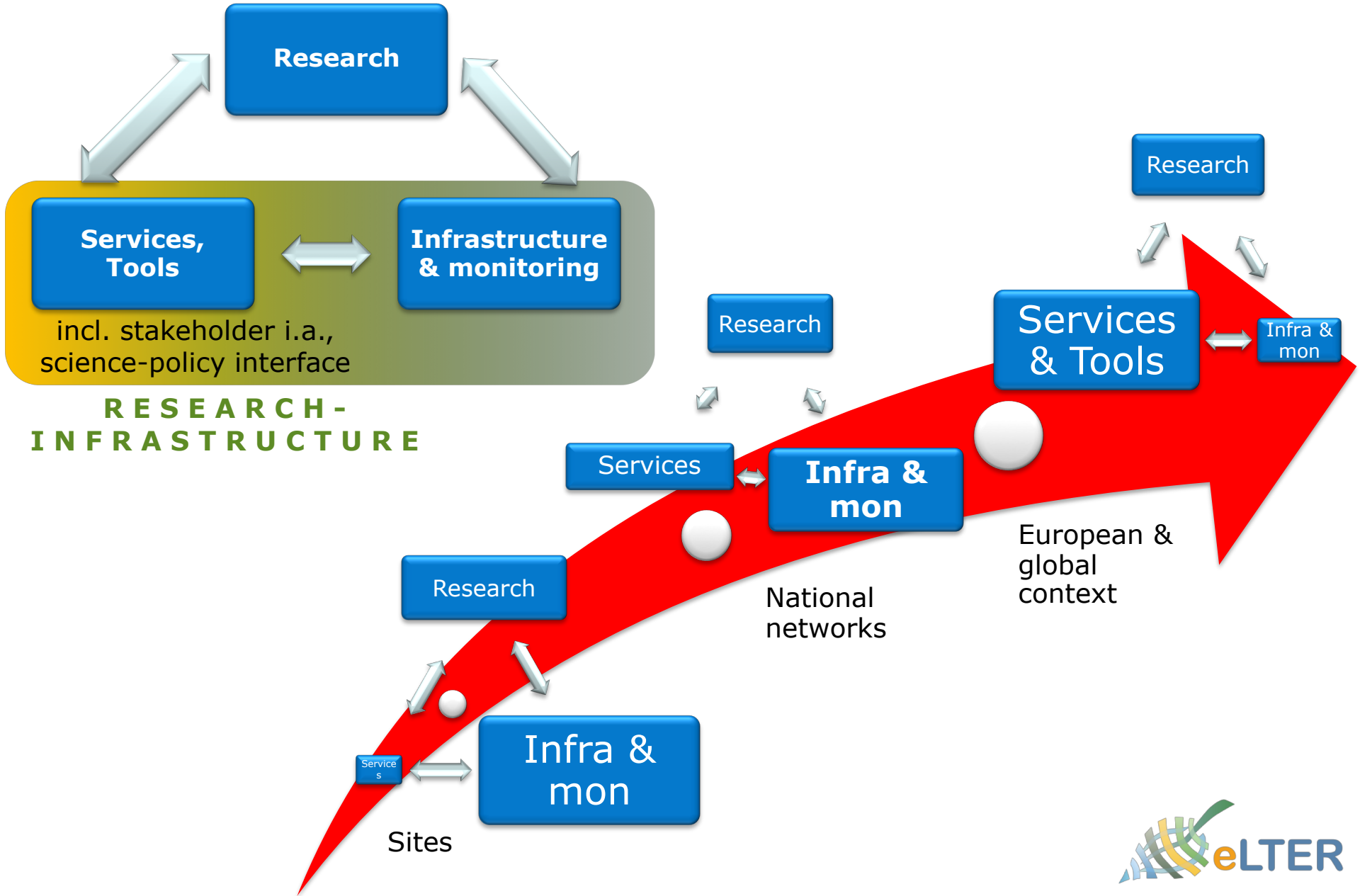
26 countries
450 LTER Sites
35 LTSER Platforms
European contribution to the global LTER network

Standards, Formalisation

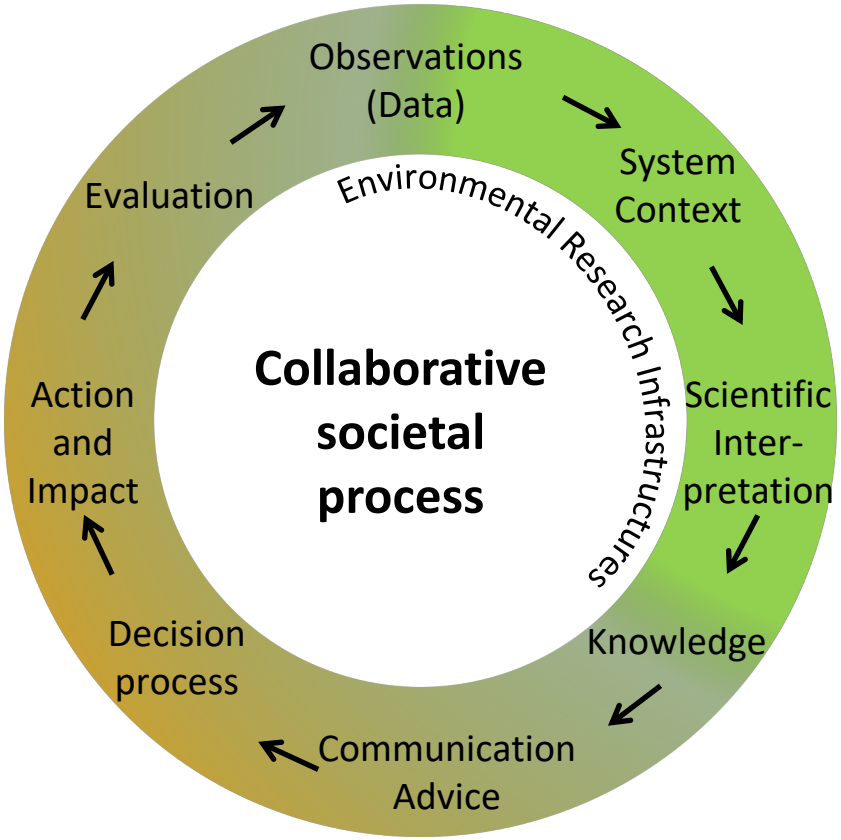
Recruiting

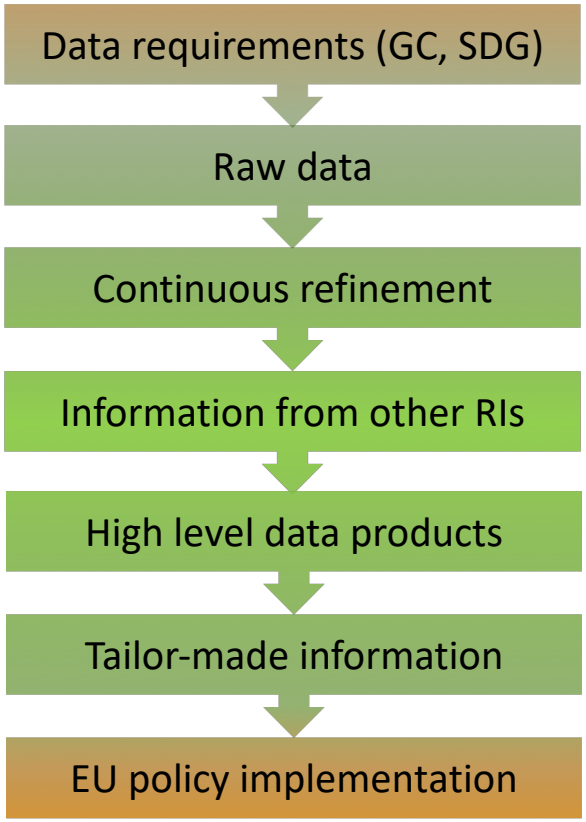
eLTER

Effects of strategic planning across organizational levels



Societal and economic Impact as a collaborative societal process





Exemplary frameworks for environmental policies:

- Strategy on adaptation to Climate Change
- Biodiversity Strategy
- Habitats Directive
- Birds Directive
- Regulation on Invasive Alien Species
- Common agricultural policy (CAP)
- Nitrates Directive
- Soils thematic strategy
- Drinking Water Directive
- Water Framework Directive
- NEC Directive

Major inputs from Europe to the global scale

Special focus on societal Grand Challenges, Biodiversity and Ecosystem Services concerning

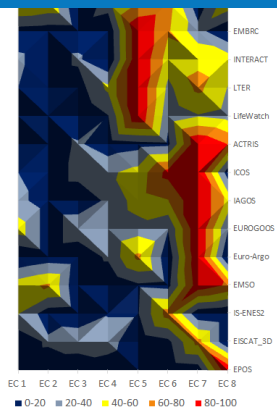
- scientific concepts
- in-situ design
- standards
- tools & services

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"**

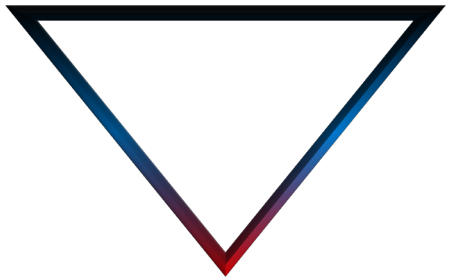
Anchoring in 3 Grand Challenge classifications

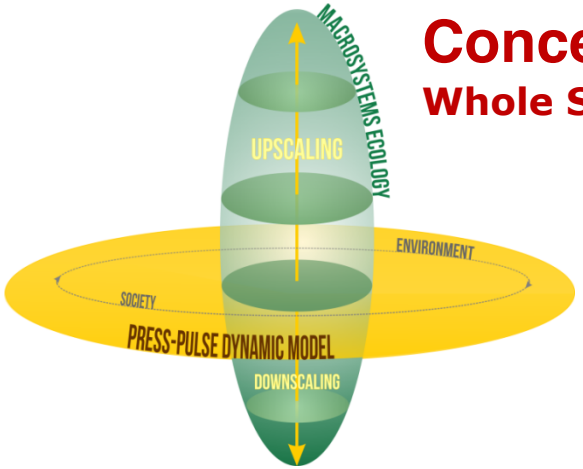
- Research: US NRC
- Societal: EC
- Workflow: ICSU



Core research challenges

Tackled Grand Challenges

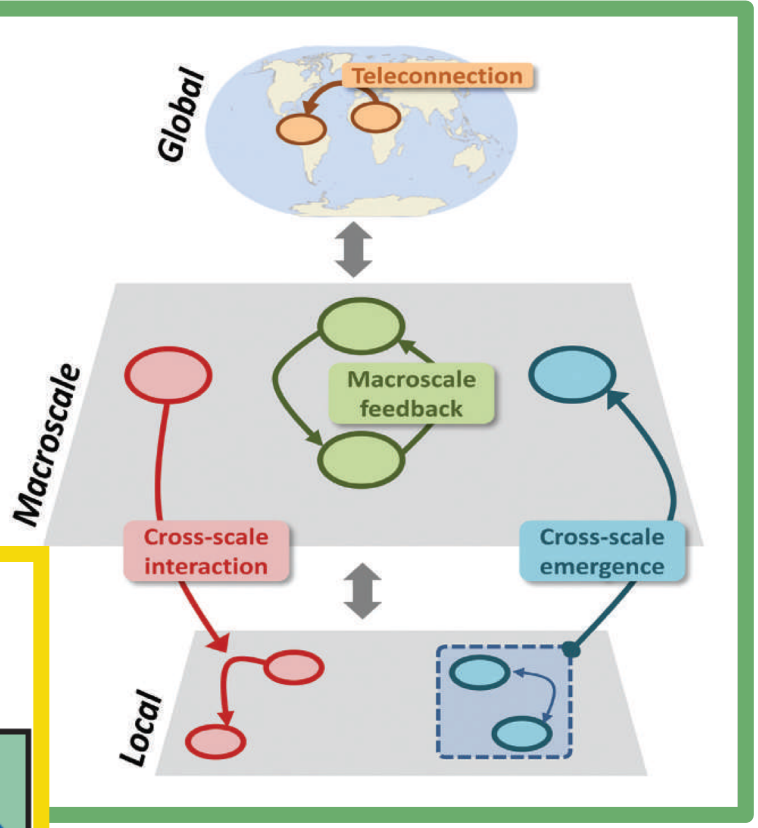




Conceptual model
Whole System Approach
WAILS

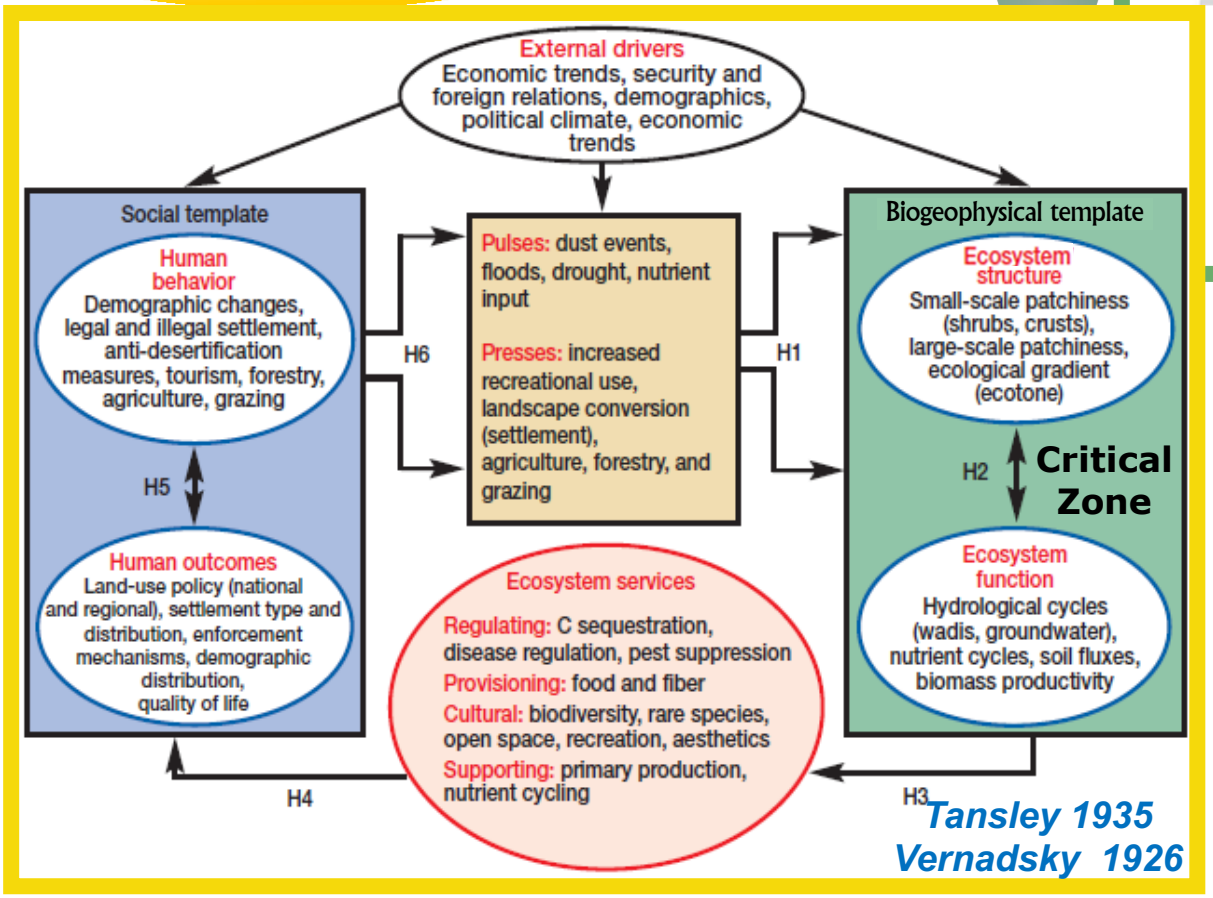
Whole-systyem approach for in-situ research: Elements

Hefferman et al. 2014



Heffernan et al. 2014

Collins et al. 2011



Tansley 1935
Vernadsky 1926

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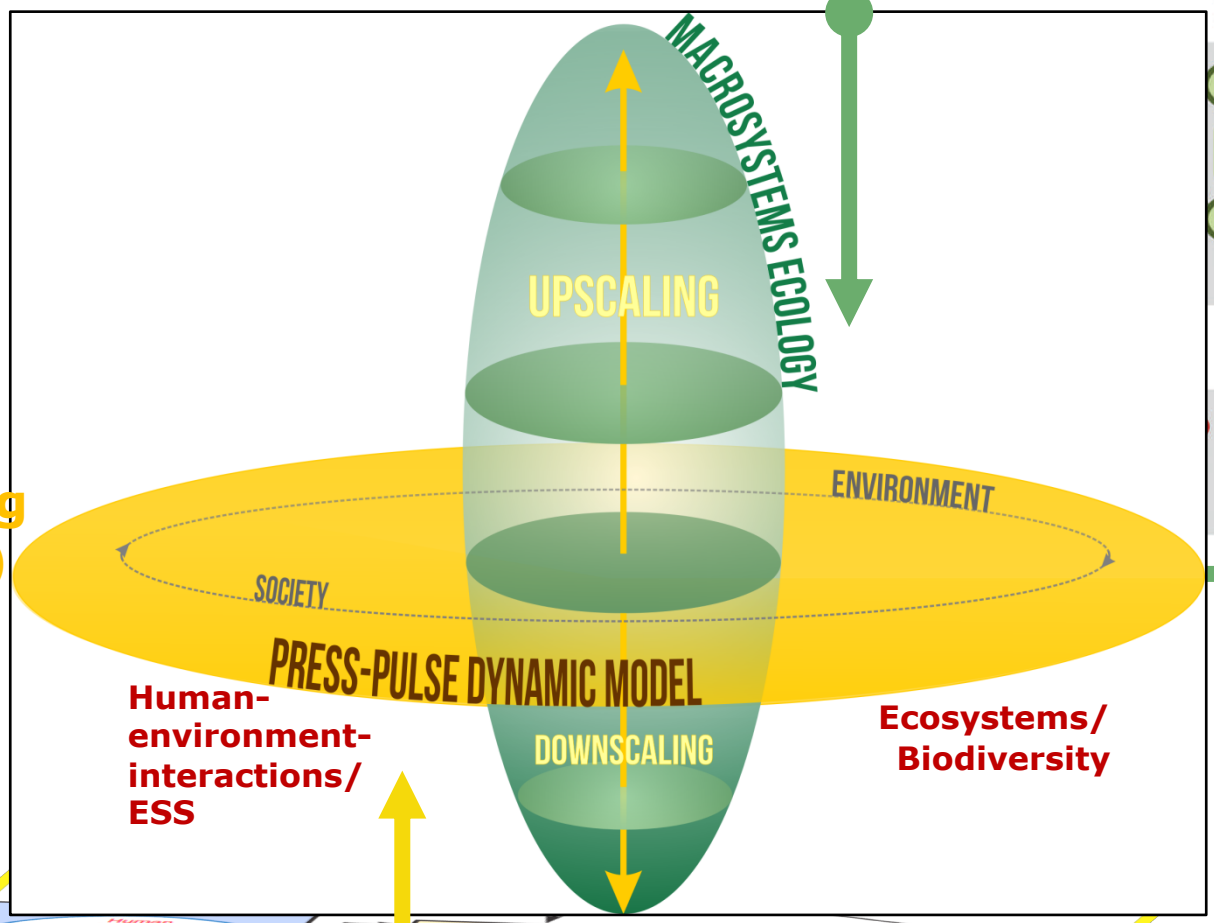
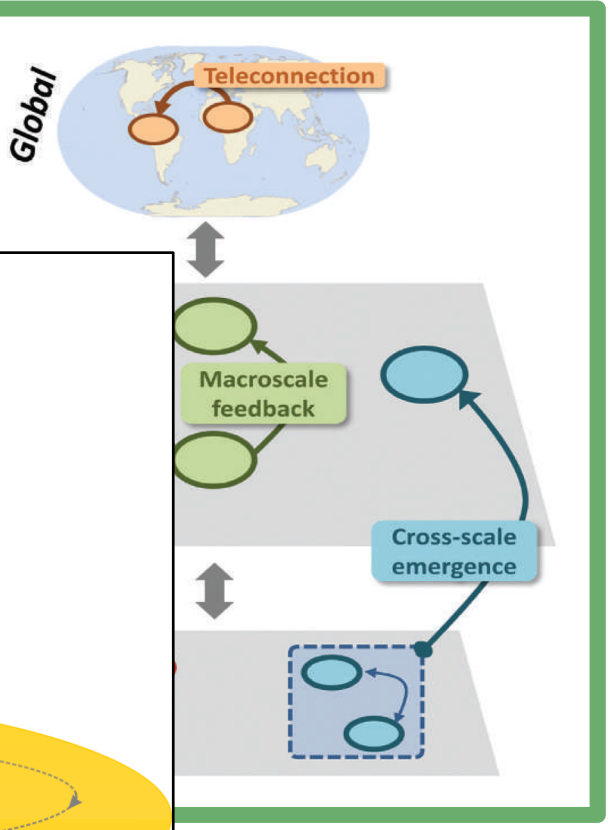
Combined: WAILS

Life Supporting System(s) across scales



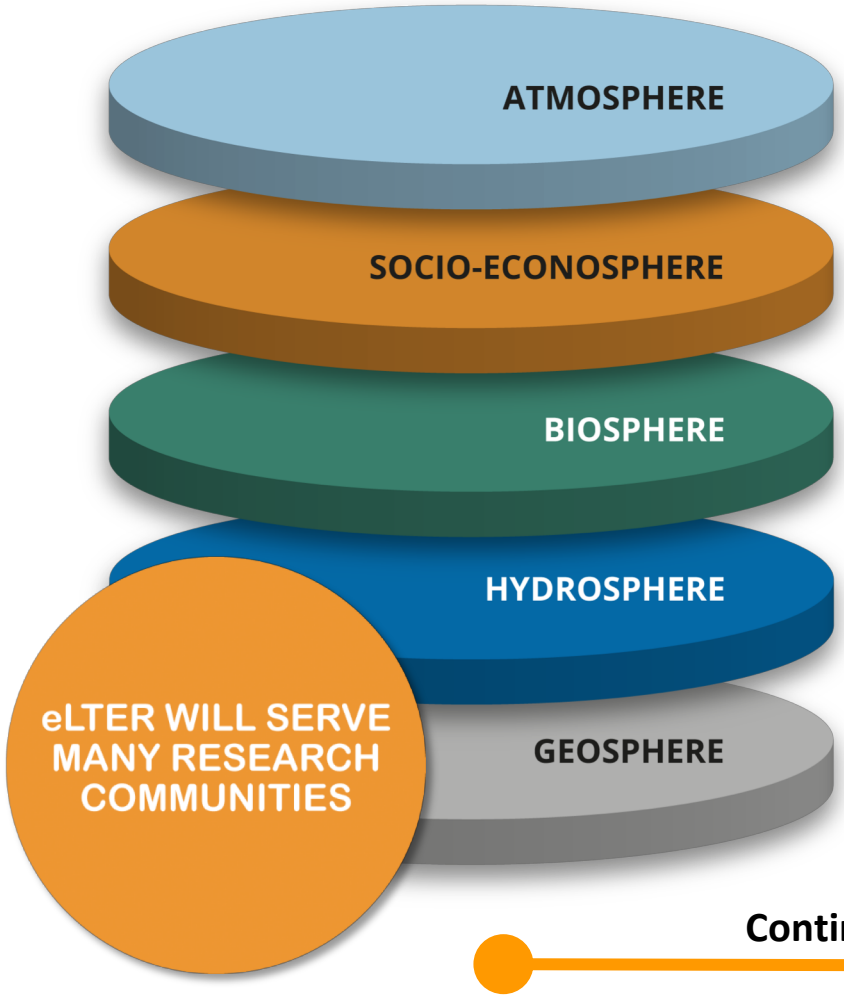
Human-environment-interactions/ ESS

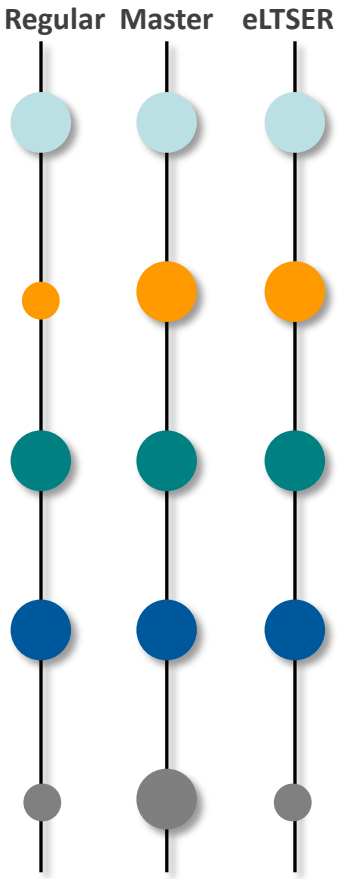
Ecosystems/ Biodiversity



eLTER

Design based on „Whole System“-Approach & cross-disciplinarity





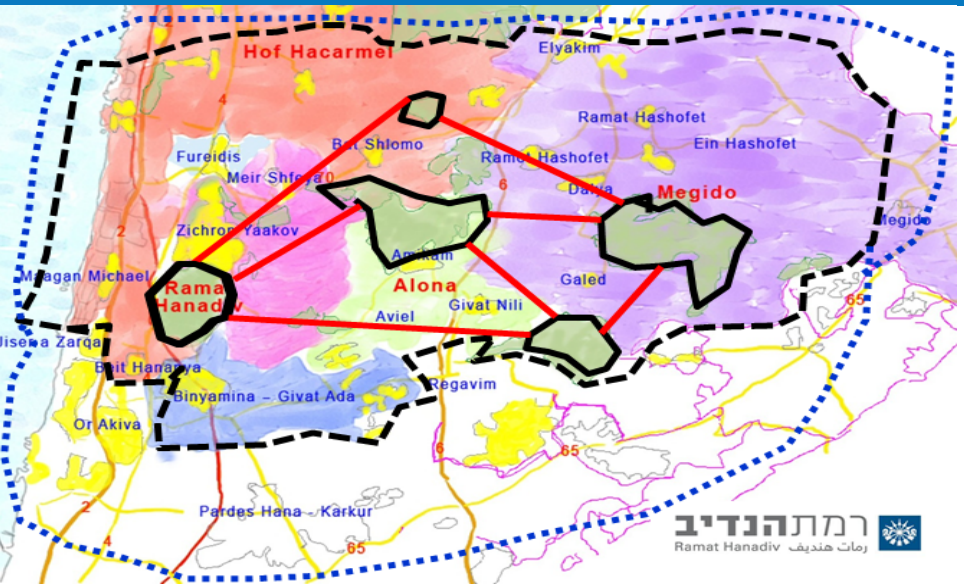
Site categories
differ in their focus on different system layers

eLTER provides

- basic infrastructure
- integrated baseline observation
- User access to
  - in-situ sites
  - data

Continuous long-term operation of ~200 innovative hubs

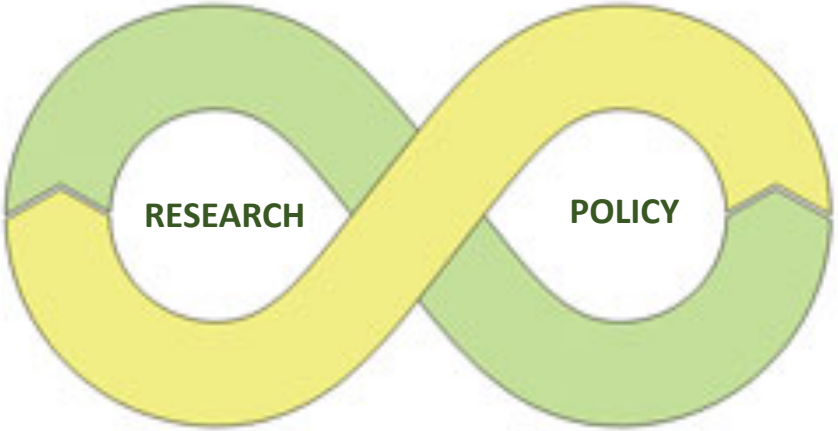
LTSER Platforms



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

Iterative:
Continue the research

Responsive:
Addressing societal needs



Reflexive:
Did it work?

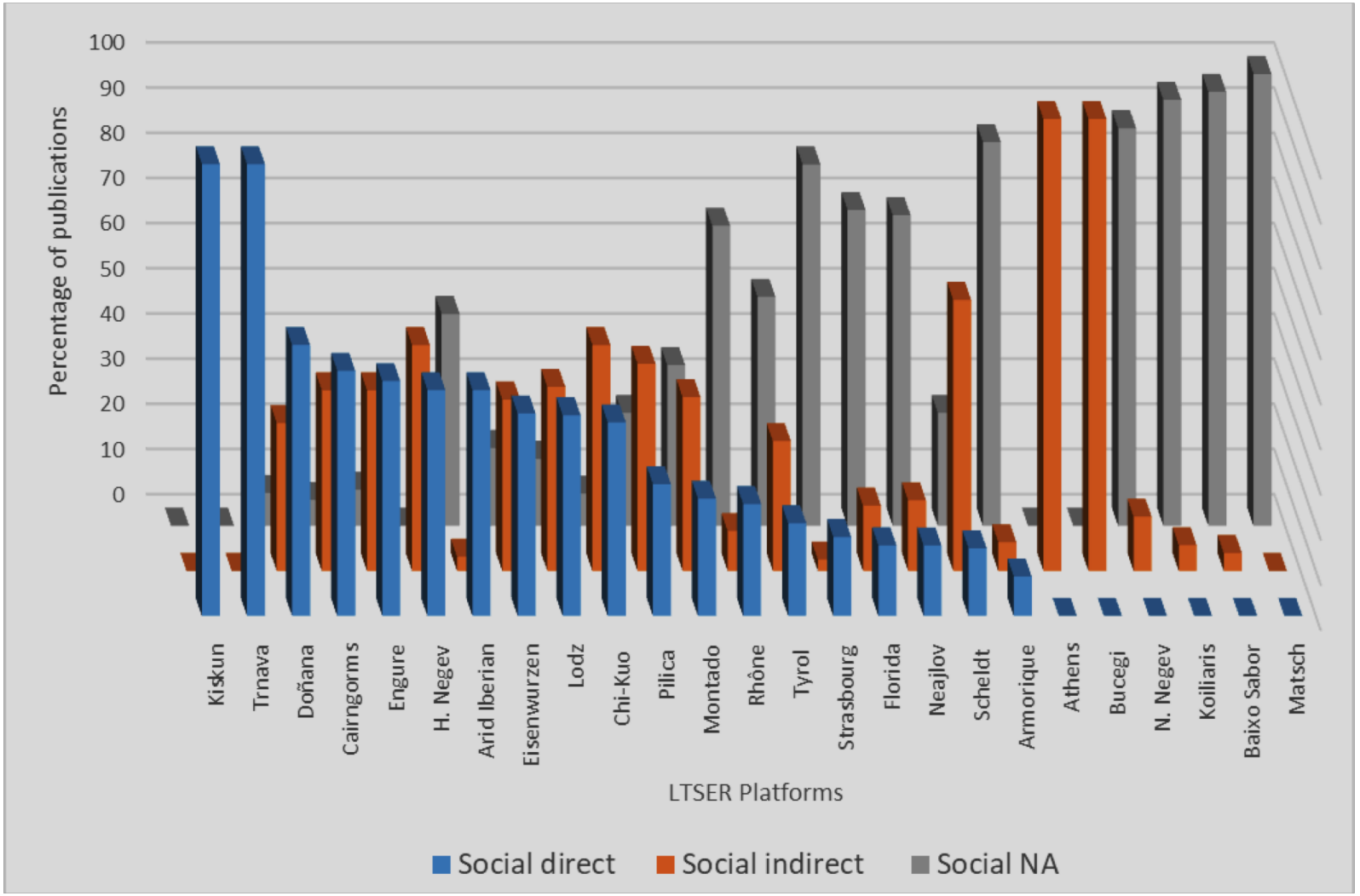
Relevant:
Designed for direct policy uptake

- **Interdisciplinary**: Promote integration of natural and social science
- **Cross-sector** stakeholder collaboration
- **Relevant knowledge** for decision-making

Courtesy D: Orenstein , 2017

eLTER

What is LTSER producing?
(Do LTSER papers report on social data)



From Dick, Jan, et al. 2017. What is socio-ecological research delivering? A literature survey across 25 international LTSER platforms. Science ot the Total Environment.

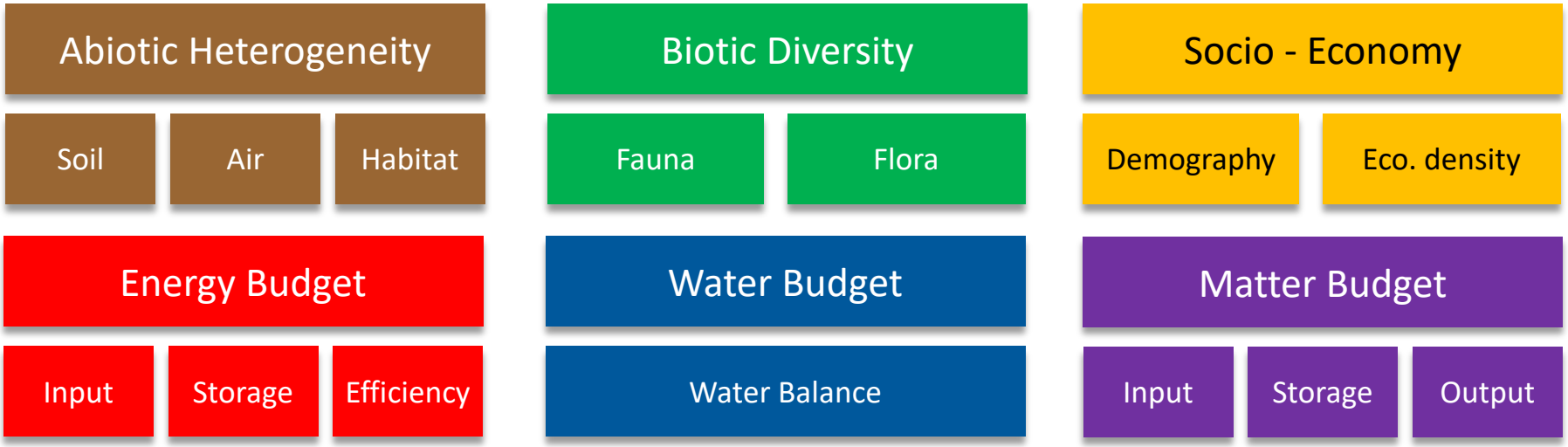
Towards an integrated conceptual framework for the LTER standard ecosystem observations: Ecosystem Integrity & Essential Biodiversity Variables

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, Tonkin, Stoll, Burkhard, Frenzel, Geijzendorffer, Häuser, Klotz, Kühn, Mirtl, Müller, Musche, Penner, Schmeller (in review): The next generation of site-based long-term ecological monitoring

eLTER Standard Observation Variables

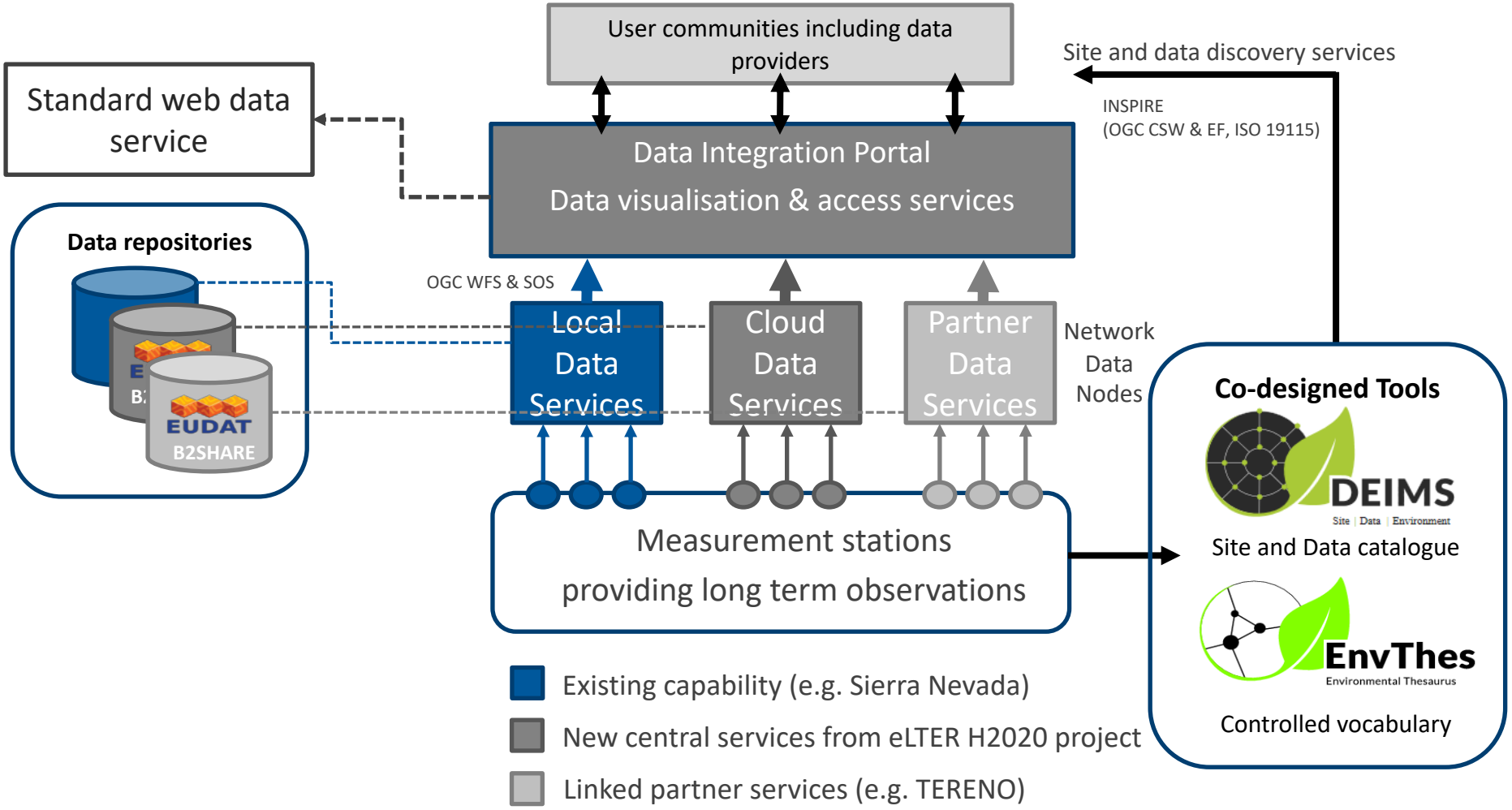


Simplicity (Parsimony)

"A design too complex increases the risk of premature demise."
(Henry Janzen, 2014)

1. Representation of key elements of the Ecosystem Integrity Concept & EBVs
2. High sensitivity to environmental changes
3. Critical Relevance for environmental modelling

Technical tools: eLTER Information Management architecture



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DEIMS-SDR - Dynamic Environmental Information Management System

Home | Discovery | Documentation | Network | About | Login

Quick Search

Latest Updates

- Viesturs 2017-05-
- Viktor O 2017-05-
- Climate-Observat 2017-05-
- Åshild Ø 2017-05-
- Negev hi 2017-05-
- LTER Zöb Through 2017-05-
- LTER Zöb Through 2017-05-

LTER Zöbelboden - Austria

Basic Informa

LTER

Site Name:
Site Code:
Web Addre

Country (S
LTER Mem
Parent Site
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Keywords
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General Sit

General Characteristics, Purpose, History

Metadata pr

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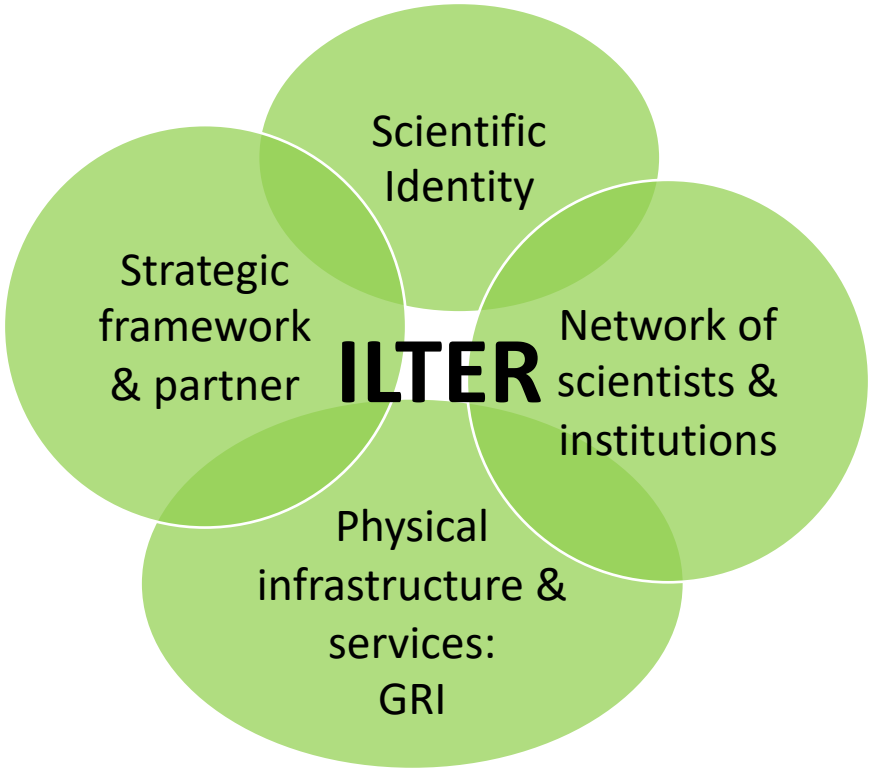
Latitude: 47.842246069311
Longitude: 14.444136161386

http

Europe´s current role in the global LTER context

Europe leading ILTER in close collaboration **with pace setting LTER networks** in China (CERN), South Africa (SAEON), Australia (TERN), US-LTER etc.



ILTER as platform for high-level global partnerships (e.g. UNESCO WNBR, GSO, ICSU/PECS, FutureEarth/BELMONT, IPBES)

Prominent example GEO:

- ILTER as in-situ data provider for GEO
- DEIMS SDR as agreed pilot for a global site registry

eLTER

ILTER ties to GEO (Group on Earth Observation)

- GEO
  - 100 national governments
  - 100 Participating Organizations
- ILTER =Participating Organisation
  - Observations contributing to several SDGs
    (e.g. 6/water; 15/biodiversity)

ILTER as **in-situ data provider**

User of RS products to better fulfil its own mission *(scale?)*

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**/consolidation of terrestrial in-situ observation networks

Contribution to the development of a **Global Terrestrial Observation System** successor

Outlook

Europe:

- ESFRI Roadmap 2018 (official communication June 2018)
- Prepratory Phase Project
- eLTER H2020 Advanced Communities project (forthcoming INFRAIA call)
- New overall governance structure

Globally:

- Zhaoqing Think Tank on integrated ecosystem research infrastructures
- G8 Group of Senior Officers (GSO): LTER as case study Global Research Infrastructure
- LTER element of network nucles for re-establishing GTOS
- 2nd ILTER Open Science Meeting (OSM): 2-8 September 2019, Leipzig


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/

Q 2.1: Please elaborate how eLTER will fit in the landscape of RIs

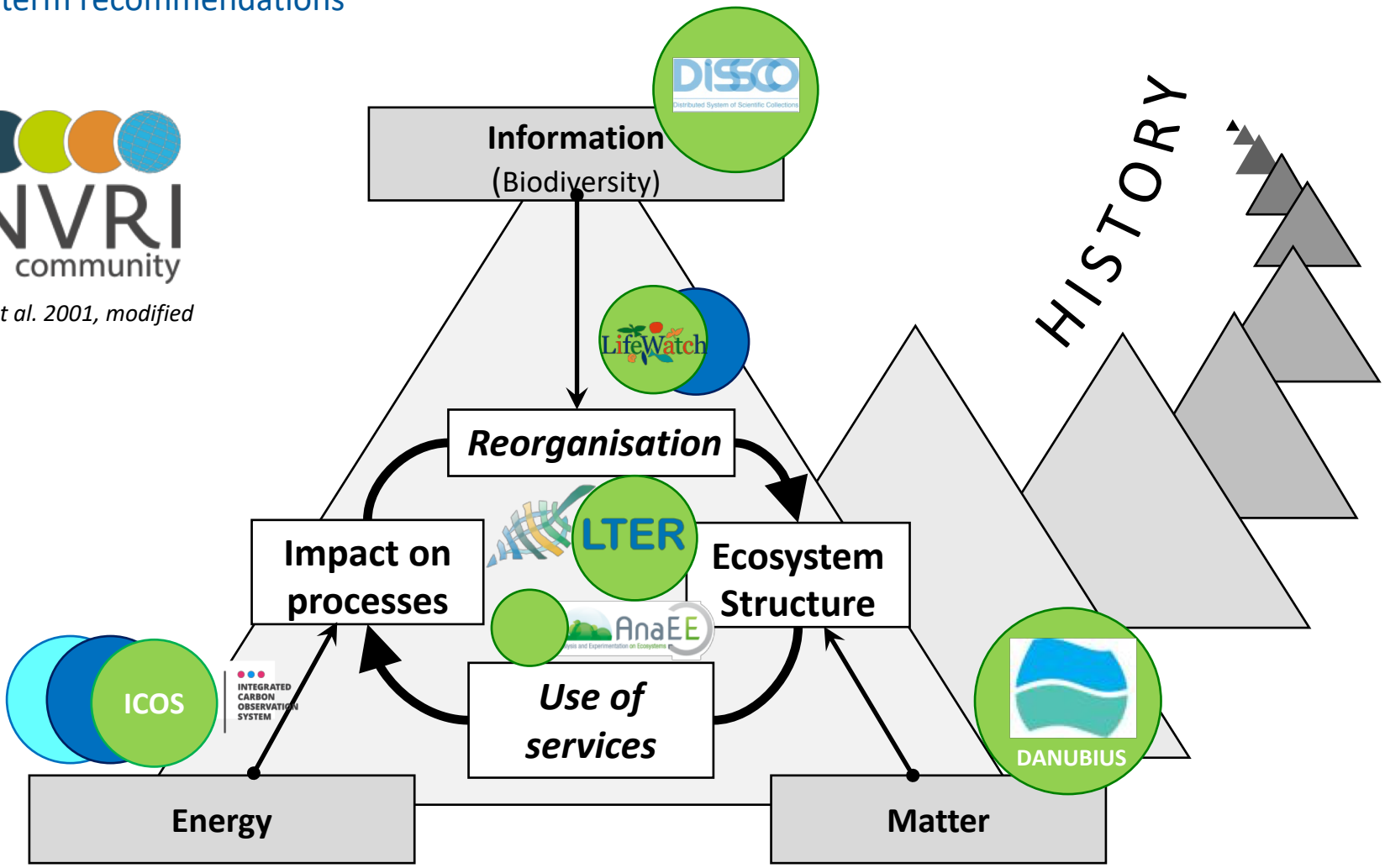
- Two "outside views"

ESFRI ROADMAP 2016/2018

- emerging eLTER RI
- mid-term recommendations

ENVRI community

Kutsch et al. 2001, modified



Option: s.th. on coverage...

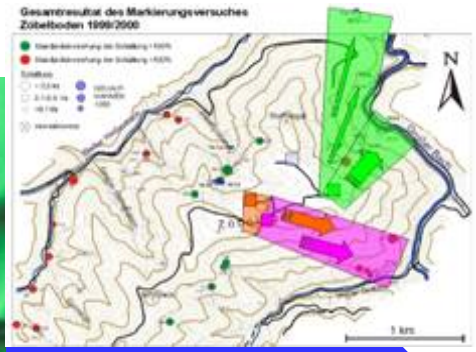
s.th. on coverage...

- to stress socio-ecological regions

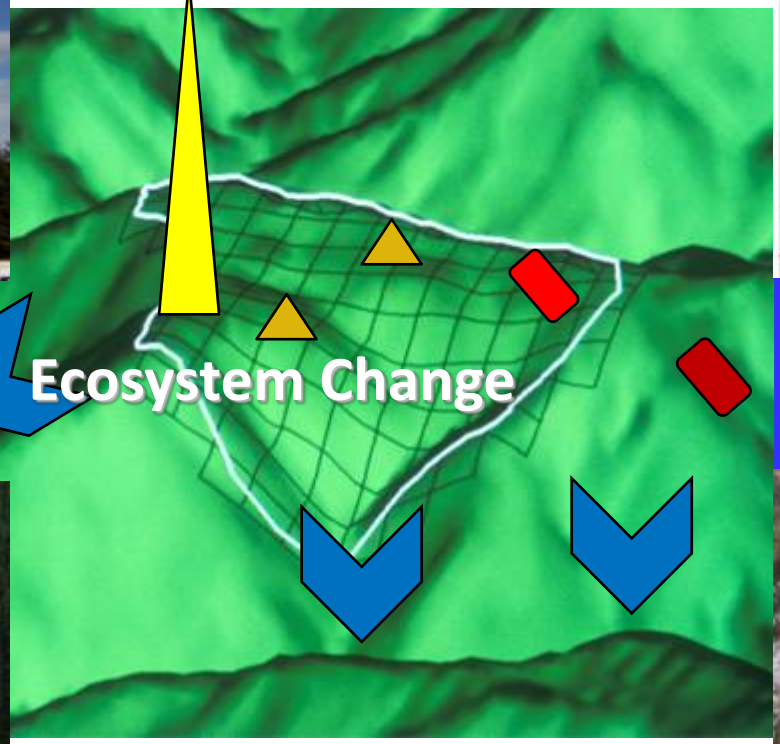
basic natur of what we are doing:

- the „layers“ model
- OR: the RIs – political process interactions slide from the hearing

Example for LTER site setup, activities and co-location



Input



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

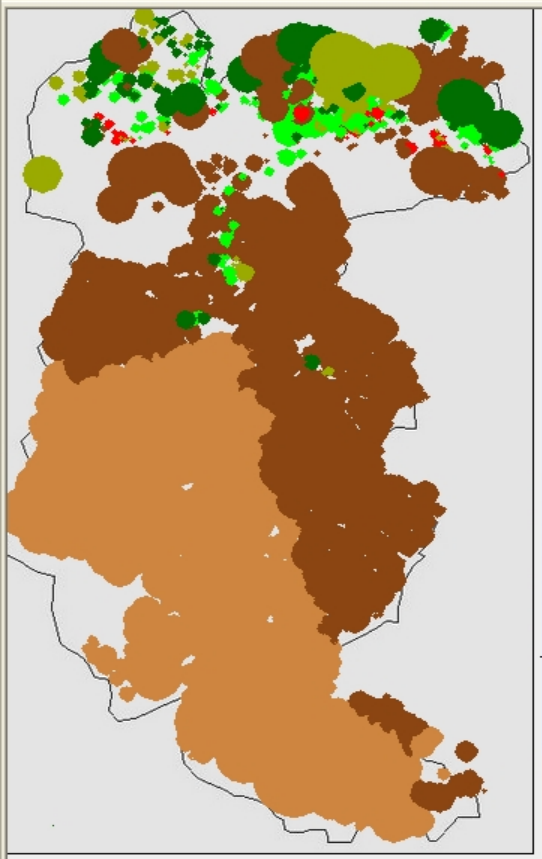
Contents

eLTER

Reichraming19.02.08_modMartin_1.alp - AnyLogic - [Animation: Reiraming]

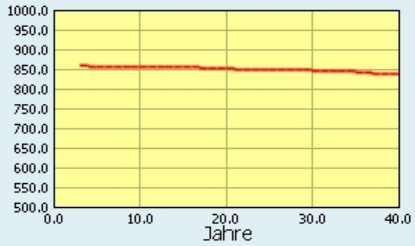
File Edit View Insert Draw Model Tools Window Help

root.labourBilanz | root.labourBilanz | root.agriLabourTimePerWorker | root.labourBilanz | root.labourTimePerWorker | root.householdNr | root.municipalityBudget_mioEuro | Global Log | root | Animation: Reiraming

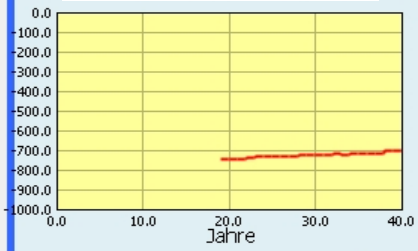


Municipaltiy

Number of households



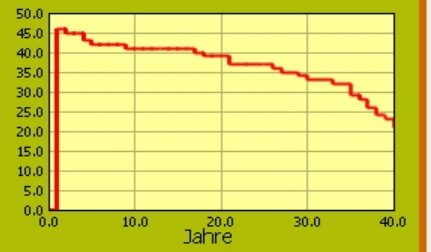
Number of commuters



Details Gemeinde

Agriculture

Number of farms



Area of pastures

Details Landwirtschaft

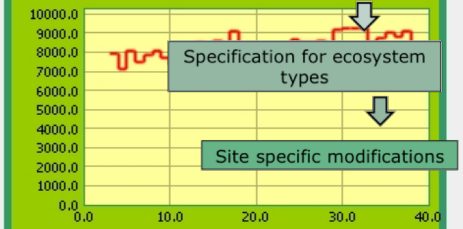
Biogeochemistry

Conceptual gaps

Overarching research questions

Greenhou

Specification for specific processes & controls



Specification for ecosystem types

Site specific modifications

C-balance

Details Stoffluss & Ökologie

External Drivers

Prices for agro-products

Conditions for organic farming

Agricultural subsidies

Bedingungen für Bioenergie

Internal Drivers

Cooperation of municipalities

Readiness to co-operate

Minimum income of farms

Investments in nat. park infrastr.

Direkt marketing of agro products

Desired spare time of farmers

Legende

Bundesforste | Bauern Wald | Siedlungs Flächen

Nationalpark | Grünflächen | Wald Gemeinschaft

Vorher - Nachher Referenzwerte

Roter Rahmen = Wert unter dem Refrenzwert (schlechter)

Grüner Rahmen = Wert über dem Referenzwert (besser)

Ready | DIS | Time: 40.000000 | Step: 10659 | Replication: 1

Start | Novell GroupWise... | 3 Firefox | 3 Windows Expl... | AnyLogic [EDUCA... | 4 Microsoft Offi... | Reichraming19.02... | DE | Desktop | 16:23

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

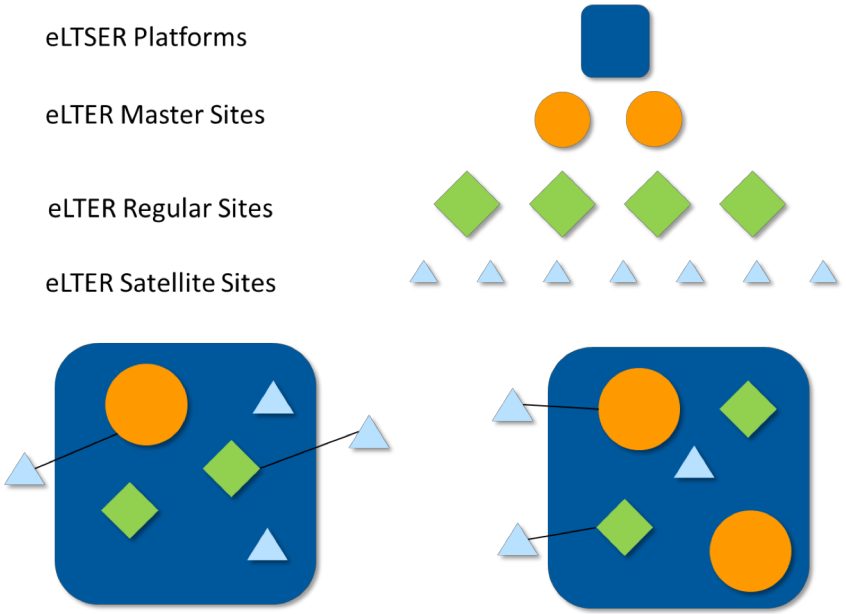
Filling a **critical gap**

Fostering **cross-disciplinary** research in **LTSER Platforms**

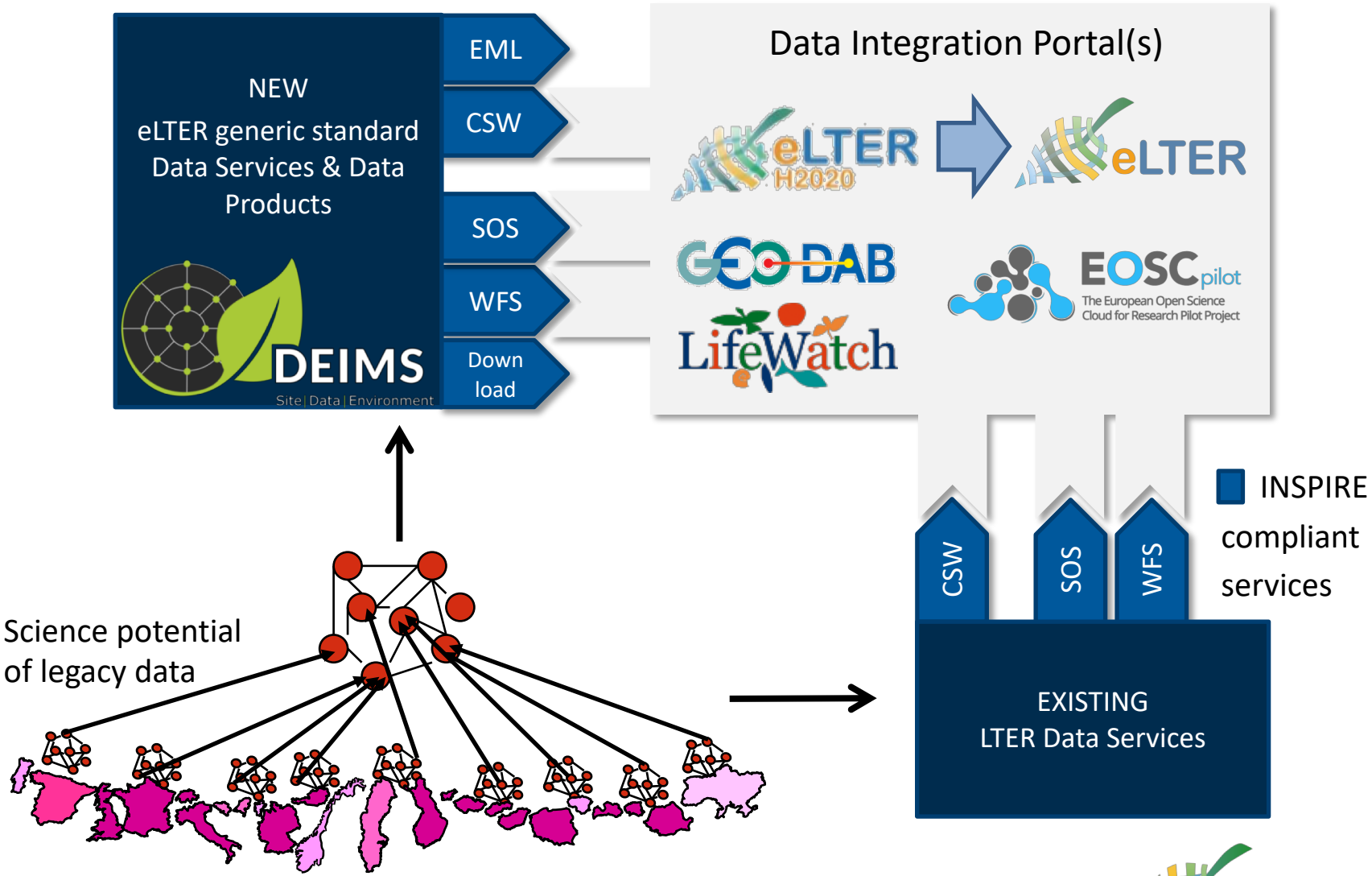
Aligning investments

Collaboration with related RIs

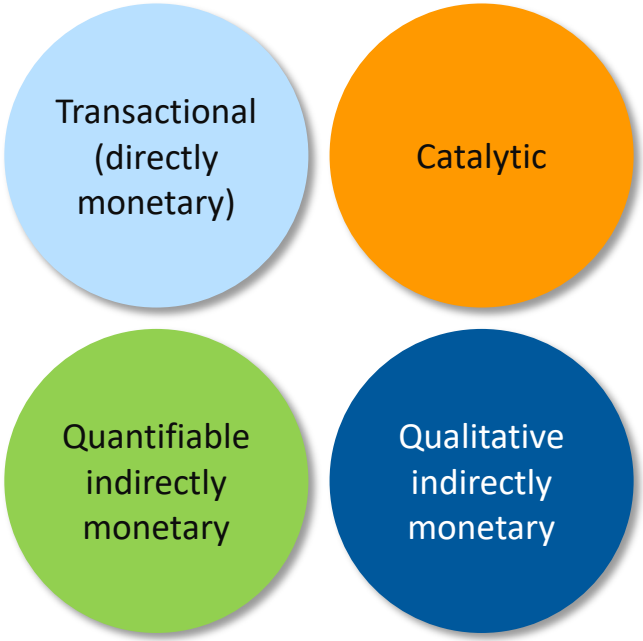
European leadership and contributions to Global Research Infrastructures



Q1.4: Harmonisation activities & the scale of ambition for harmonisation and accessibility of legacy data from the various sites



Q4: Define and quantify societal and economic impact and your plans to monitor it especially with respect to the GCs mentioned



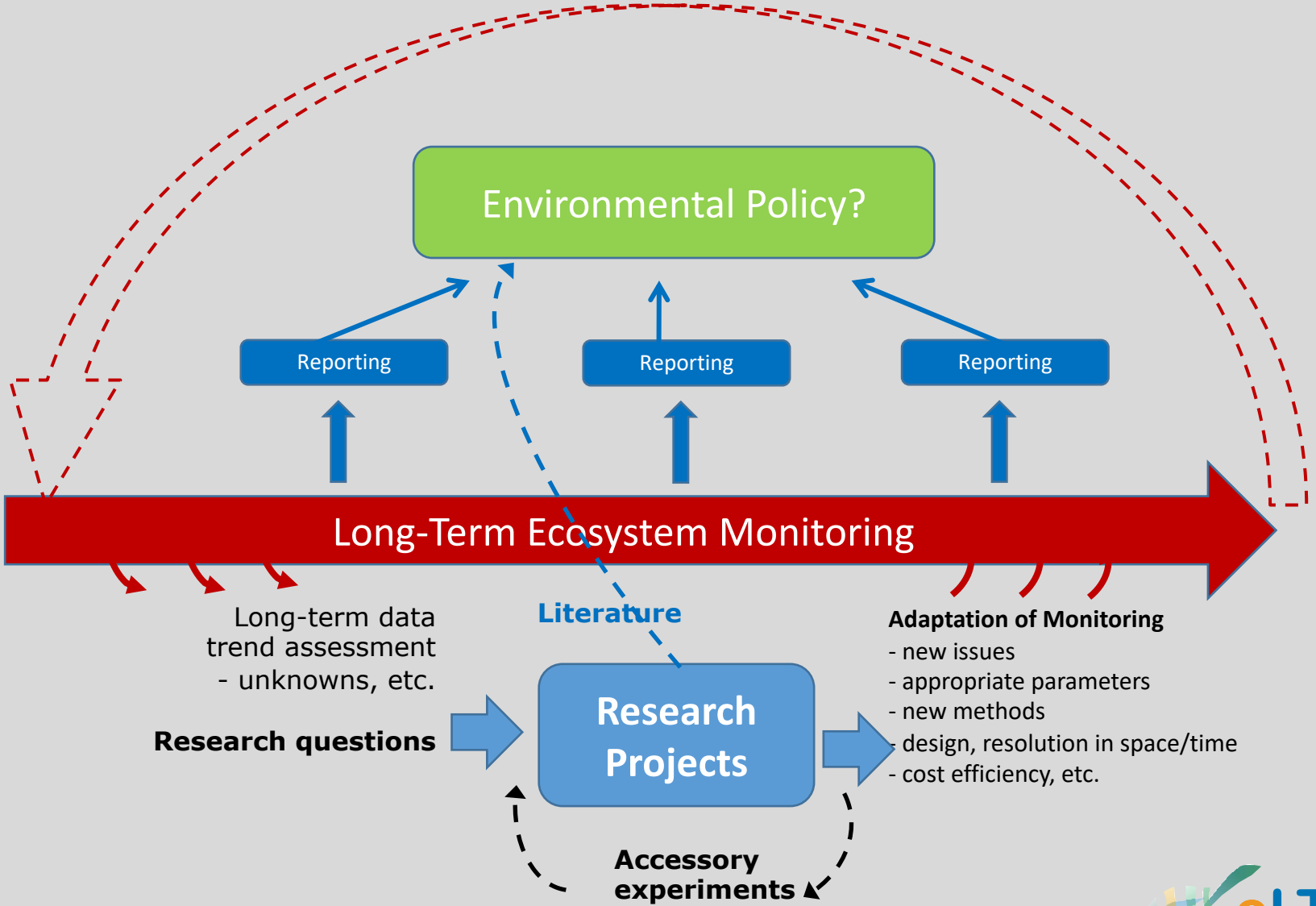
Huge external long-term impact for society

- **SBAs:** Genetic diversity, water quality, natural resources, environmentally related health issues and risks
- **Grand Challenges**: Biogeochemical, Biodiversity and Ecosystem, Climate change, Land-use Dynamics

Policy support

Economic Value of Ecosystem Services in Europe *(Constanza et al. 2014)*	If eLTER RI helps saving **only 0.01%** of total European ES	Operational costs of eLTER RI	Cost/Benefits Ratio
12,5 Trillion €/a	1,25 Billion €/a	30 Million €/a	1:42

Iterative scientific workflow and the continuous improvement of monitoring



Issues of relevance & next steps for the ALTER-Net infrastructures activity

Decisions

- ALTER-Net position paper on RI requirements for biodiversity research: Adoption of final draft
- Reconfirm Letter of Support for the LTER ESFRI initiative: Via support letter for the Science Case MoU
- Continue co-development of DEIMS: No additional funds requested, but move existing item to next phase (12 kEUR)

Milestones

- Combined LTER 2017 annual meeting (possibly with stakeholders slot) (Vienna): 7-9 June 2017
- Almost final draft: End June 2017

Candidate Grand Challenges classifications

- European Commission's Societal Challenges for Europe 2020
  - http://ec.europa.eu/programmes/horizon2020/en/h2020-section/societal-challenges
- US Nat. Research Council Grand Challenges in Environmental Sciences
  - http://www.nap.edu/catalog/9975/grand-challenges-in-environmental-sciences
- ICSU Earth System Science for Global Sustainability: The Grand Challenges
  (Observing – forecasting – confining – responding – innovating)
  - http://www.icsu.org/news-centre/press-releases/2010/scientific-grand-challenges-identified-to-address-global-sustainability
- ESFRI Grand Research Challenges used for the 2014 ESFRI environmental RI interoperability and landscape analysis
  - Asmi et al. 2014

ENVRIplus GC-matrix

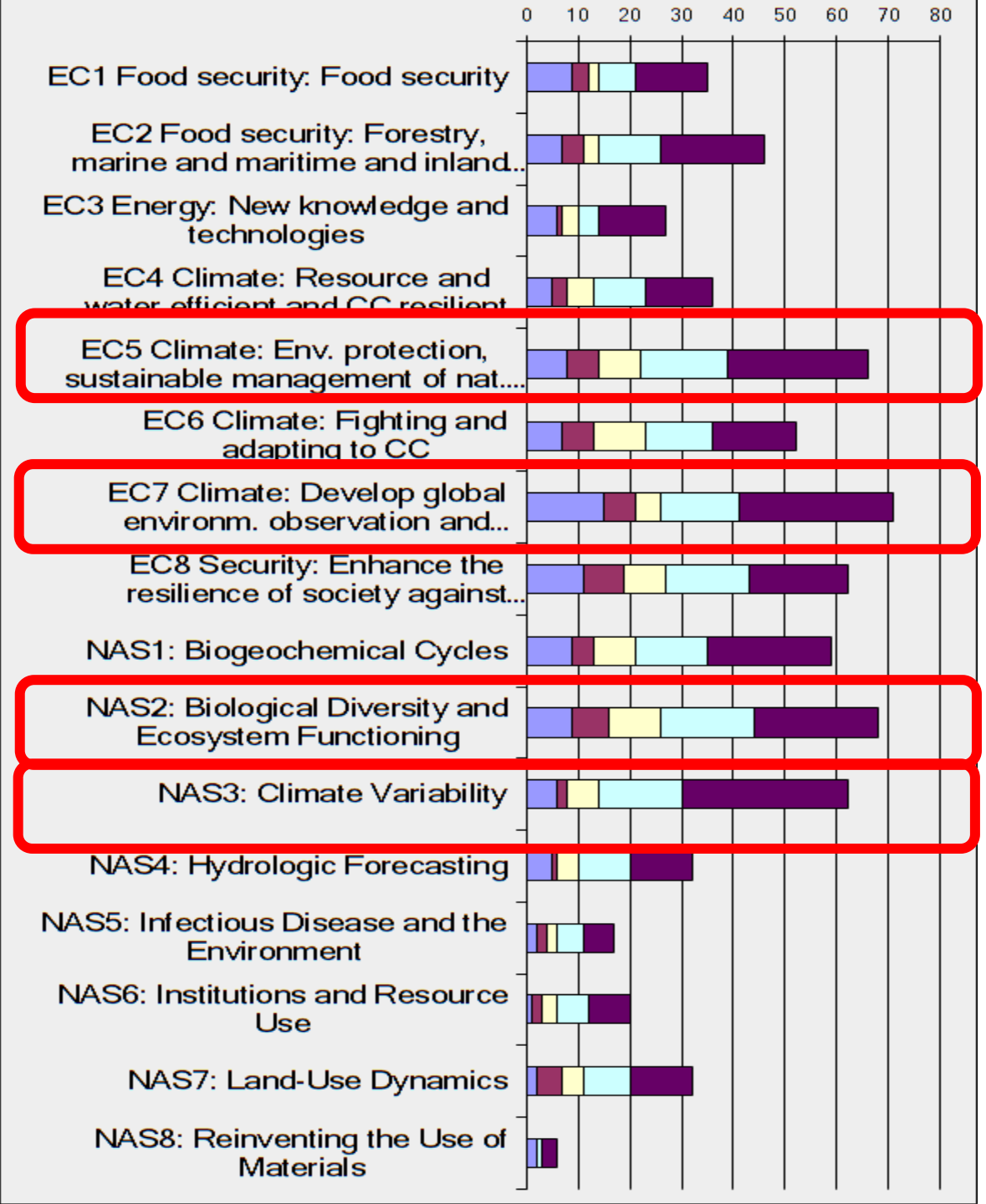
ENVRIplus Matrix for defining Research Infrastructure response to selected Grand Challenge classifications		SOCIETAL AND POLITICAL ASPECTS								RESEARCH AND DEVELOPMENT MOTIVATED ASPECTS							
		European Commission´s Grand Challenges								US NRC/NAS - Grand Challenges in Environm: Sciences							
		Food security	Food security	Energy	Climate & res.effic.	Climate & res.effic.	Climate & res.effic.	Climate & res.effic.	Security	1	2	3	4	5	6	7	8
	GC	Food security	Forestry, marine and maritime and inland water research	New knowledge and technologies	Achieve a resource – and water - efficient and CC resilient econ. & societ.	Environment protection, sustainably manag. nat. resources, water, biodiv. &	Fighting and adapting to climate change	Develop global environm. observation and information systems	Enhance the resilience of society against natural and man-made disasters	Biogeochemical Cycles	Biological Diversity and Ecosystem Functioning	Climate Variability	Hydrologic Forecasting	Infectious Disease and the Environment	Institutions and Resource Use	Land-Use Dynamics	Reinventing the Use of Materials
WORKFLOW & ECONOMIC ASPECT	ICSU Scientific Grand Challenges identified to address global sustainability																
	Observing—Develop, enhance and integrate the observation systems needed to manage global and regional environmental change.																
	Forecasting—Improve the usefulness of forecasts of future environmental conditions and their consequences for people.																
	Confining—Determine how to anticipate, recognize, avoid and manage disruptive global environmental change.																
	Responding—Determine what institutional, economic and behavioural changes can enable effective steps toward global sustainability.																
	Innovating—Encourage innovation (coupled with sound mechanisms for evaluation) in developing technological, policy and social responses to achieve global sustainability.																

FOR EACH CROSS-SECTION THE SCOPE OF

RESEARCH INFRASTRUCTURES CAN BE CHECKED

Overall response to EC and US NRC Grand Challenges & share of ICSU workflow elements

(based on yes/no)



plus ENVRI

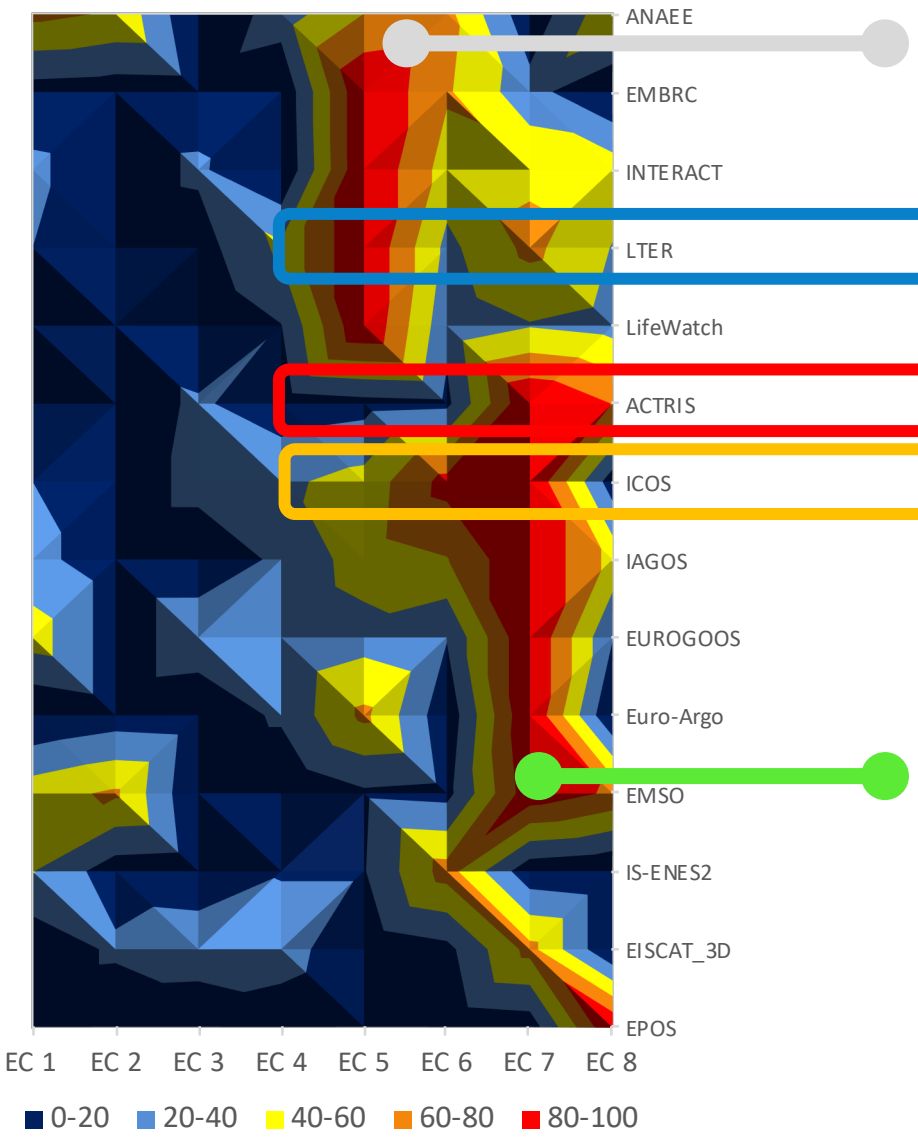
Example for usage in anchoring individual RIs in GC matrix: LTER

RI	EC1 Food security agro MV	EC2 Food security - non-agro habitats & water MV	EC3 Energy: New knowledge and technologies MV	EC4 Climate: Resource and water efficient and CC resilient economy and society MV	EC5 Climate: Env. protection, sustainable management of nat. resources, water, biodiv & ecosystems MV	EC6 Climate: Fighting and adapting to CC MV	EC7 Climate: Develop global environm. observation and information systems MV	EC8 Security: Enhance the resilience of society against natural and man-made disasters MV	NRC1: Biogeochemical Cycles MV	NRC2: Biological Diversity and Ecosystem Functioning MV	NRC 3: Climate Variability MV	NRC4: Hydrologic Forecasting MV	NRC5: Infectious Disease and the Environment MV	NRC6: Institutions and Resource Use MV	NRC7: Land-Use Dynamics MV	*Mean over all*
LTER	**20**	**44**	**11**	**44**	**100**	**35**	**65**	**39**	**59**	**87**	**70**	**23**	**3**	**14**	**57**	***44***
LTER above mean		1		1	1		1	1	1	1	1			1	1	*1*
ACTRIS	3	10	23	8	13	15	100	79	3	3	87	23	5	0	5	*24*
ICOS	20	18	25	36	47	87	100	9	76	55	45	16	7	2	13	*35*
ANAEE	66	58	0	30	60	66	6	56	100	90	24	18	0	58	54	*43*
EISCAT_3D	5	24	33	29	5	14	67	0	57	24	57	100	19	14	19	*31*
EMBRC	11	11	10	3	100	63	28	0	100	100	15	0	40	0	0	*30*
EMSO	52	63	0	0	17	13	93	77	50	30	100	0	0	17	0	*32*
EPOS	5	3	1	9	0	4	8	100	0	0	0	0	0	5	0	*8*
Euro-Argo	0	9	6	24	65	6	100	0	35	24	94	18	0	0	0	*24*
EUROGOOS	50	58	32	21	32	21	100	21	53	26	84	32	3	0	0	*33*
IAGOS	26	27	9	23	50	59	100	54	30	30	71	30	25	25	25	*41*
INTERACT	23	18	23	0	100	51	56	51	92	92	38	31	0	49	28	*41*
IS-ENES2	41	50	6	19	19	69	6	0	69	19	100	38	6	0	0	*28*
LifeWatch	10	23	0	19	100	26	39	32	0	90	3	0	32	10	6	*24*
Other (please	27	57	43	35	63	45	100	46	31	55	51	37	62	15	40	*50*
Mean	*24*	*31*	*15*	*18*	*48*	*39*	*65*	*38*	*50*	*46*	*55*	*24*	*14*	*14*	*14*	*32*

GCs, where LTER ranks specifically high

- EC5 Climate: Environmental protection, sustainable management of nat. resources, water, biodiversity & ecosystems
- EC7 Climate: Develop global environmental observation and information systems
- NRC1 Biogeochemical Cycles
- NRC2 Biological Diversity and Ecosystem Functioning
- NRC3 Climate Variability
- NRC7 Land-Use Dynamics.

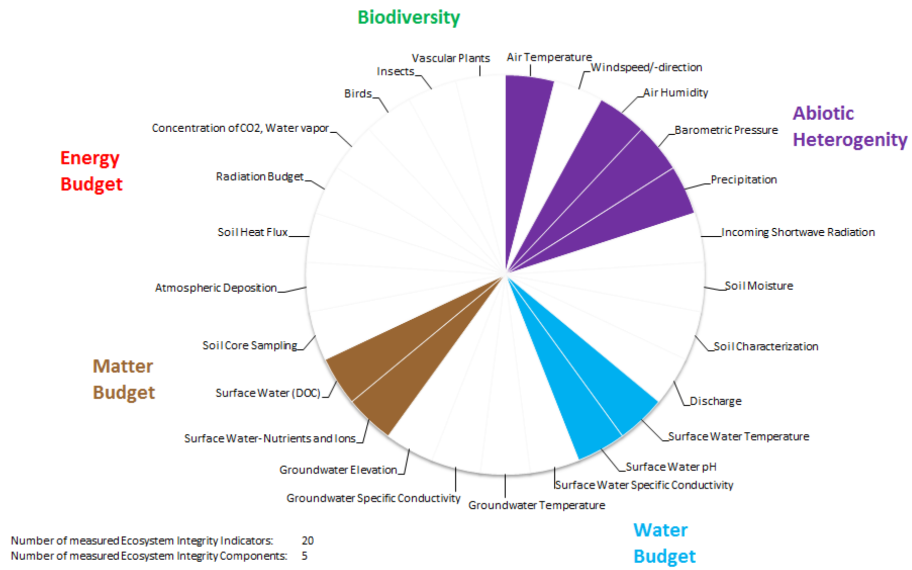
Example: Visibility of special niche of eLTER, ACTRIS & ICOS in response to EC Societal GCs

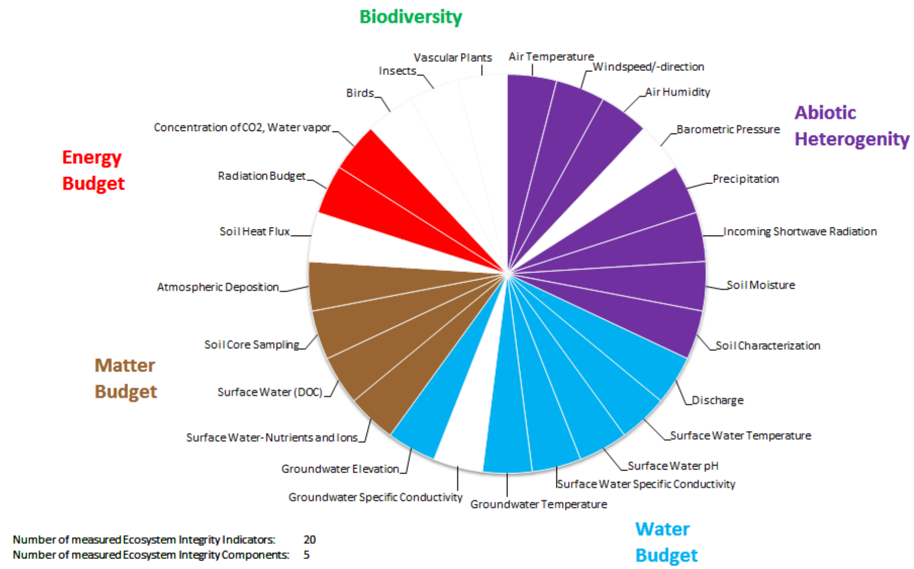


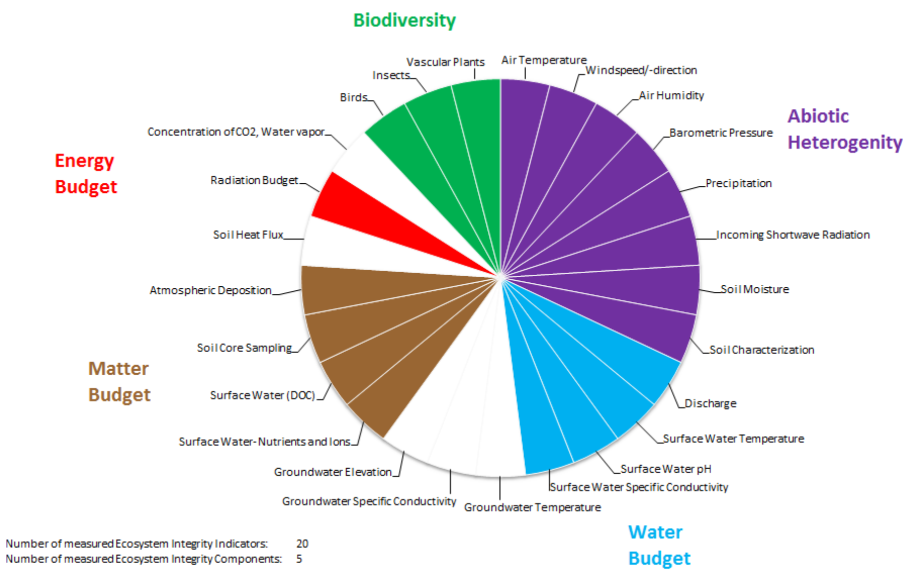
EC5 Climate: Env. protection, sustainable management of natural resources, water, biodiversity & ecosystems

EC7 Climate: Develop global environmental observation and information systems

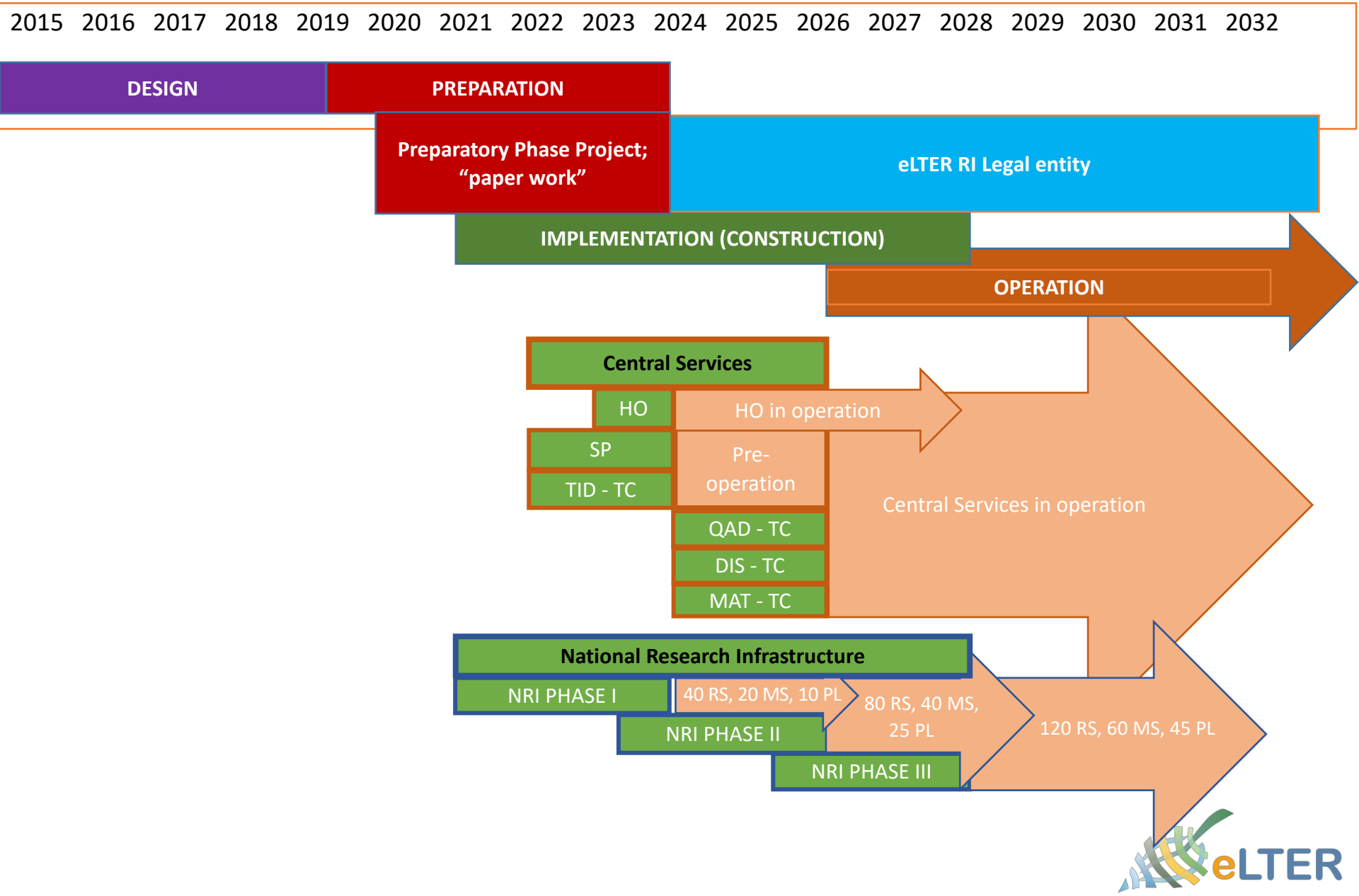
Compliance check of indiv. sites







Time plan overview



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