eLTER

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

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

eLTER - Standard Observations – Process and current status

LTER-D 2022

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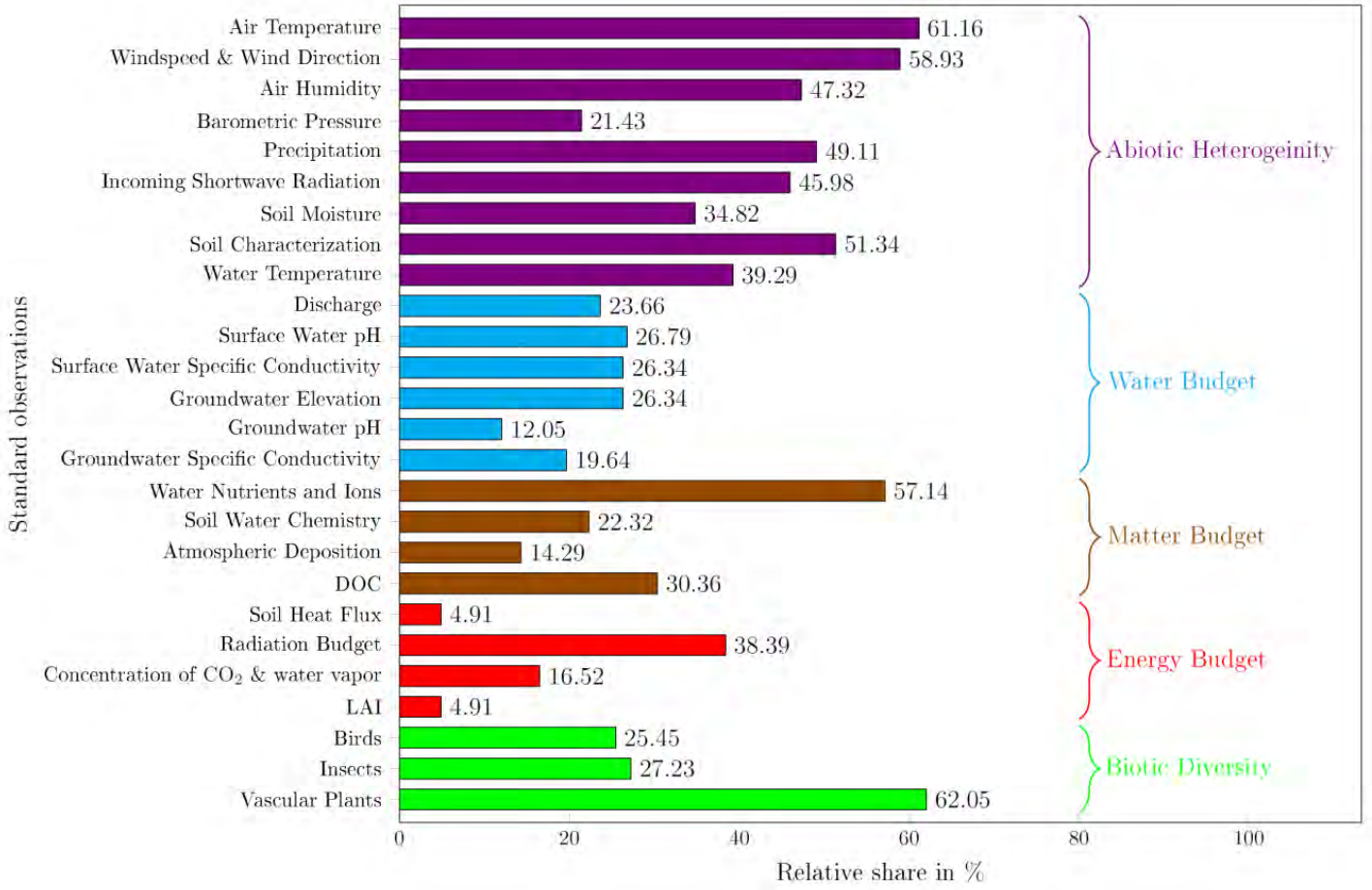
UFZ, Germany

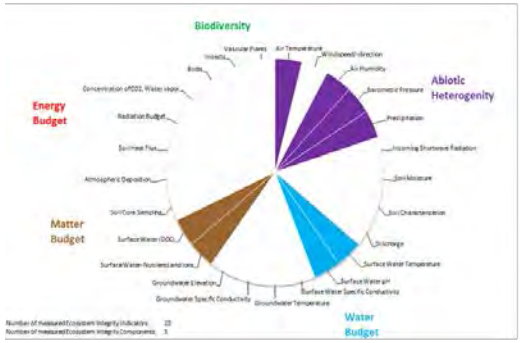
Many others in eLTER PLUS/PPP

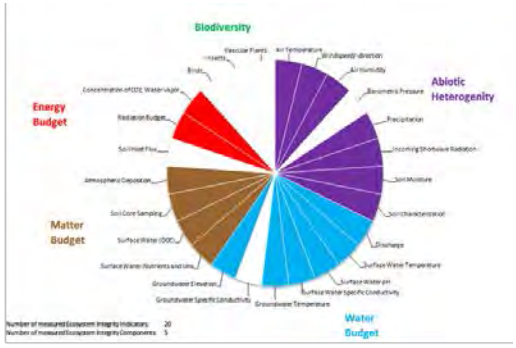
Relative frequency of eLTER standard observations – “status quo”

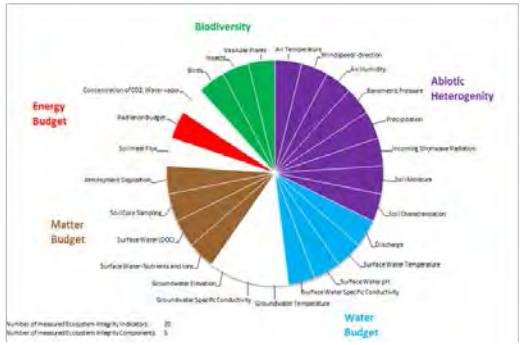


Mollenhauer et al. 2018. Long-term environmental monitoring infrastructures in Europe: observations, measurements, scales, and socio-ecological representativeness. Science Total Environ. 624: 968-978

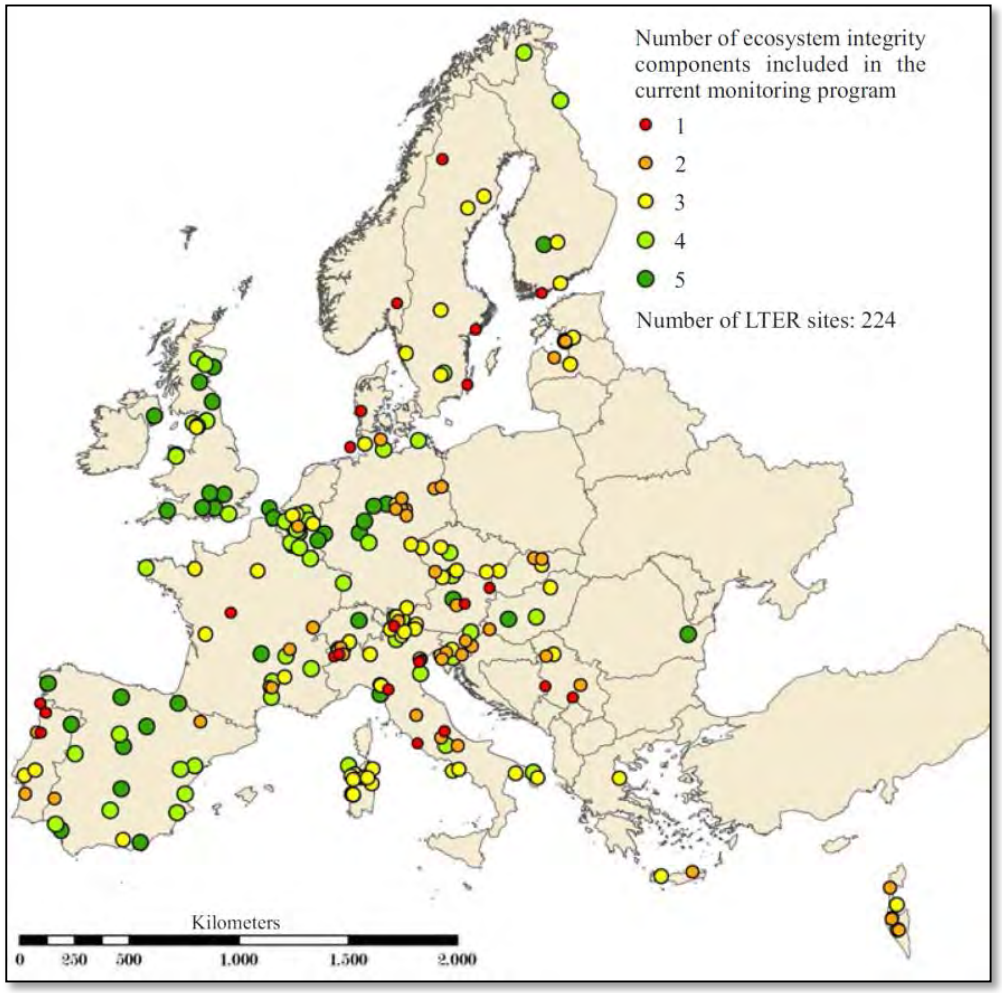
Geographical distribution of eLTER sites
Level of development







Abiotic Heterogeneity
Energy Budget
Water Budget
Biotic Diversity
Matter Budget



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The different perspectives of research on standardization

Predictive research
- Modelling
- Systems analysis

Process research
- Experiments
- Mechanisms

Descriptive research
- Observations
- Monitoring

Operational (predictive) Monitoring
- Systems behaviour
- Amalgamating Monitoring & Models
- Key system properties

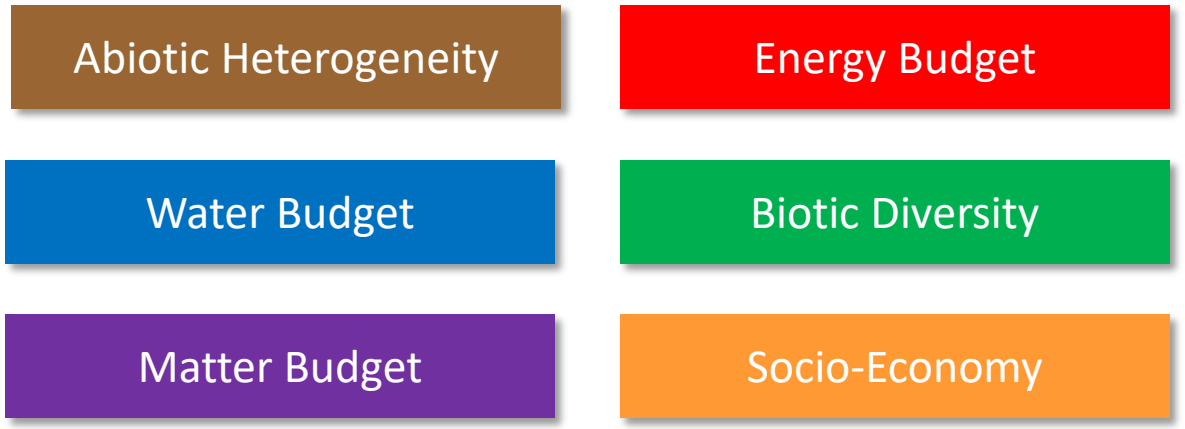
Functional Monitoring
- Functions & process rates
- System dynamics = higher sampling frequencies
- Ecosystem services

Status Monitoring
- State variables
- Value = state
- Bioindication
- Low sampling frequencies
- e.g. EU-WFD

Karsten Rinke, UFZ

eLTER Framework of Standard Observations

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



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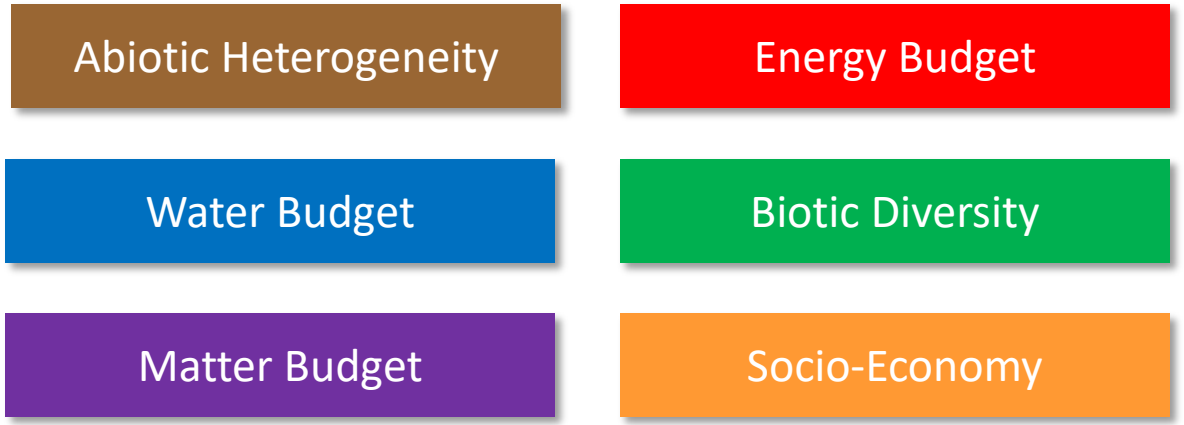
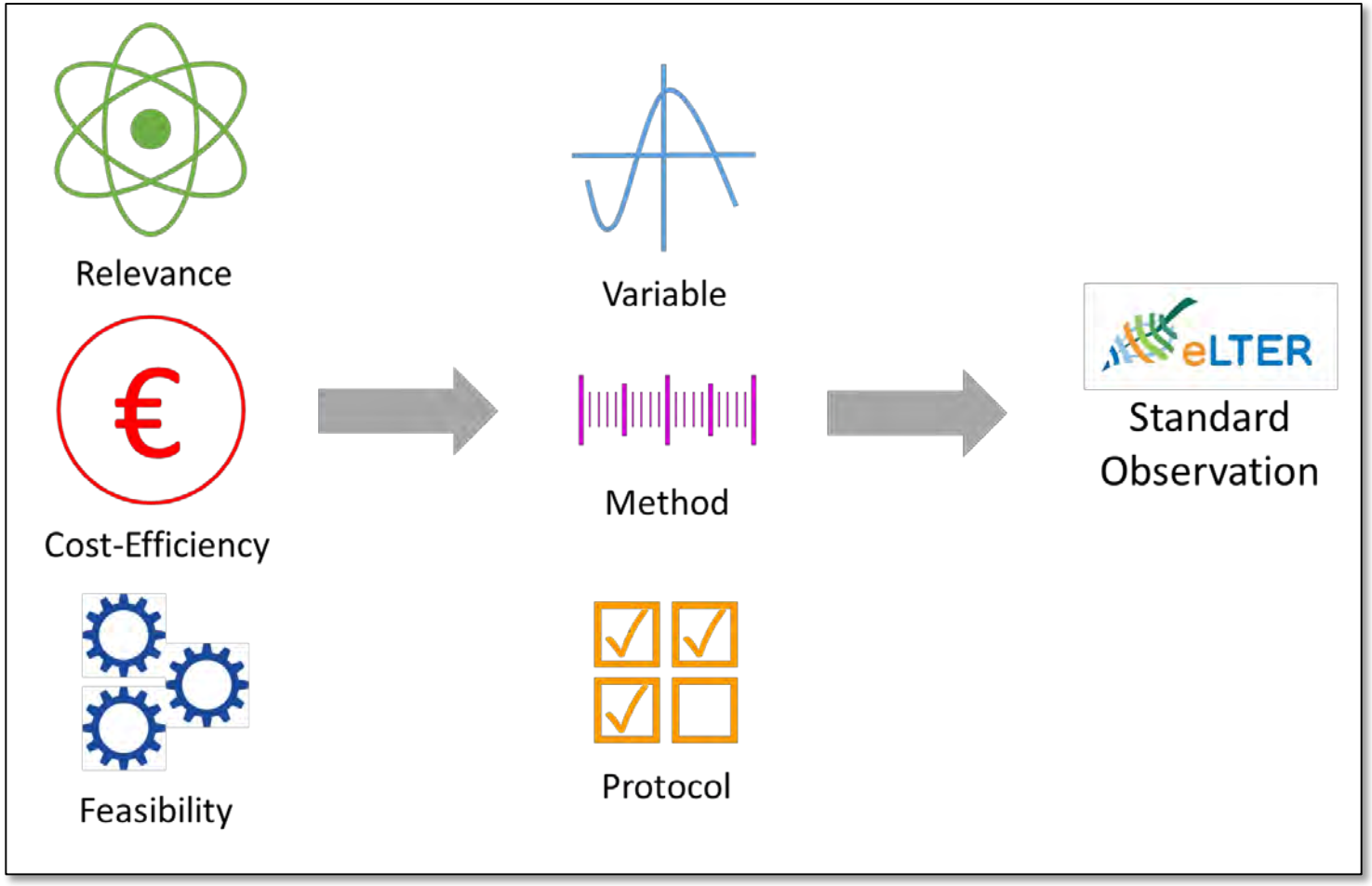


Simplicity (Parsimony)

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

eLTER Standard Observations



Discussion Paper on eLTER Standard Observations

1. eLTER and the process for defining Standard Observations
2. eLTER Standard Observations
3. eLTER Standard Observations for Earth Observation Cal/Val activities

- 173 variable have been proposed and evaluated regarding (i) scientific impact, (ii) cost-efficiency, and (iii) feasibility

Classification of priority:

A = „goes without saying“: 73 variables
B = „important, but needs further discussion“: 100 variables

eLTER PLUS

European long-term ecosystem, critical zone and socio-ecological systems research infrastructure PLUS

Discussion paper on eLTER Standard Observations (eLTER SOs)

Deliverable D3.1

8th March 2021

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Table 2: Proposed variables for the description of the abiotic site characteristics

Compartment Component	Variable	Relevance 1 = low 3 = medium 5 = high	Costs 1 = high 3 = medium 5 = low	Feasibility 1 = low 3 = medium 5 = high	Priority A = very high B = further discussion
Climate	Relative air humidity	5	3	5	A
Climate	Precipitation	5	3	5	A
Climate	Air temperature	5	3	5	A

Table 3: Information on methods and protocols for variables on abiotic site characteristics

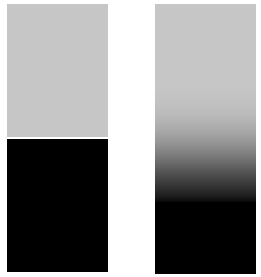
Variable	Optimal frequency of measurement	Field Laboratory Model	Remarks on method	Available protocols (examples)
Relative air humidity	30 min	Field	Standard climate station	WMO, ICPF, ICOS,
Precipitation	30 min	Field	Standard climate station	WMO, ICPF, ICOS,
Air temperature	30 min	Field	Standard climate station	WMO, ICPF, ICOS,
Wind speed / Wind	30 min	Field	Standard climate station	WMO, ICPF, ICOS,

eLTER Standard Observations – Where do we go from here and how can we get involved?

- The Discussion paper on eLTER Standard Observations is a „***discussion***“ paper

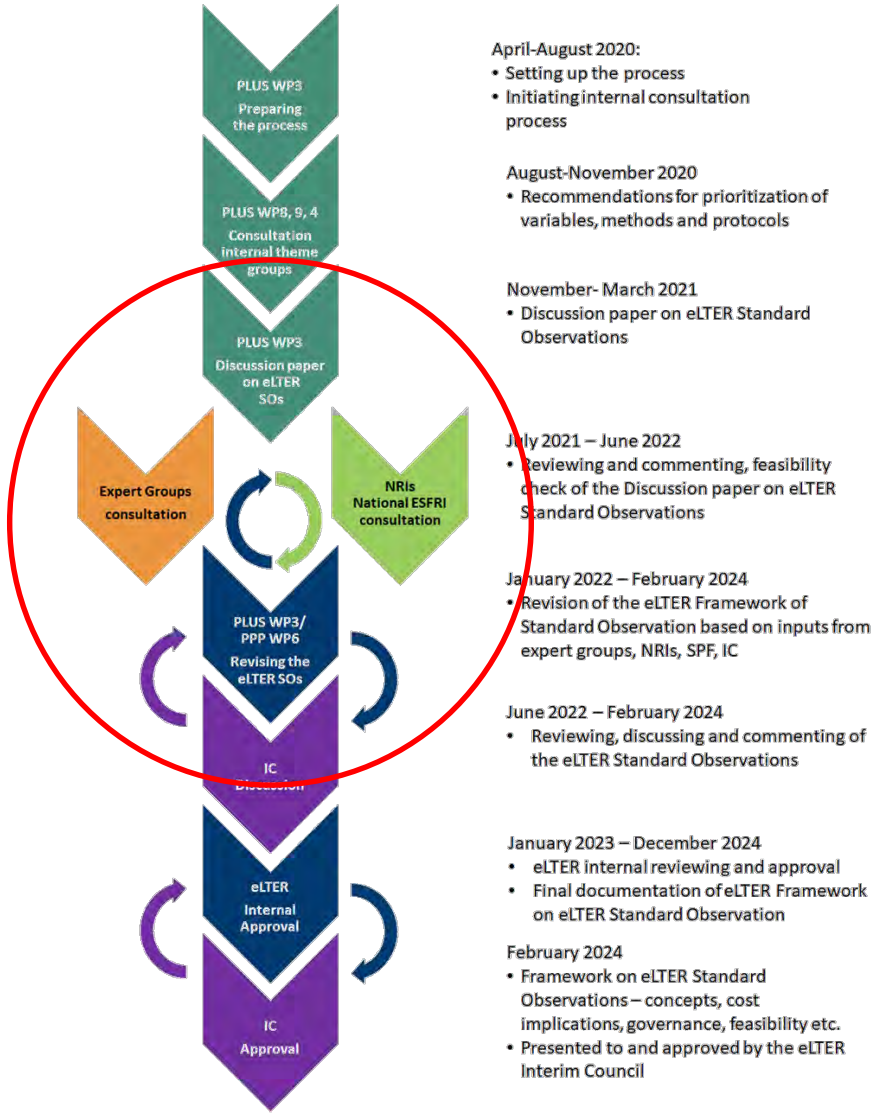
→ (i) nothing is set in stone and (ii) especially the variables of category B will go into the next process step in the next months, a consultative discussion process

- Start of consultation process with
  (i) expert groups,
  (ii) NRIs



Category B – high priority, but needs further discussion

Category A – very high priority



April-August 2020:
- Setting up the process
- Initiating internal consultation process

August-November 2020
- Recommendations for prioritization of variables, methods and protocols

November- March 2021
- Discussion paper on eLTER Standard Observations

July 2021 – June 2022
- Reviewing and commenting, feasibility check of the Discussion paper on eLTER Standard Observations

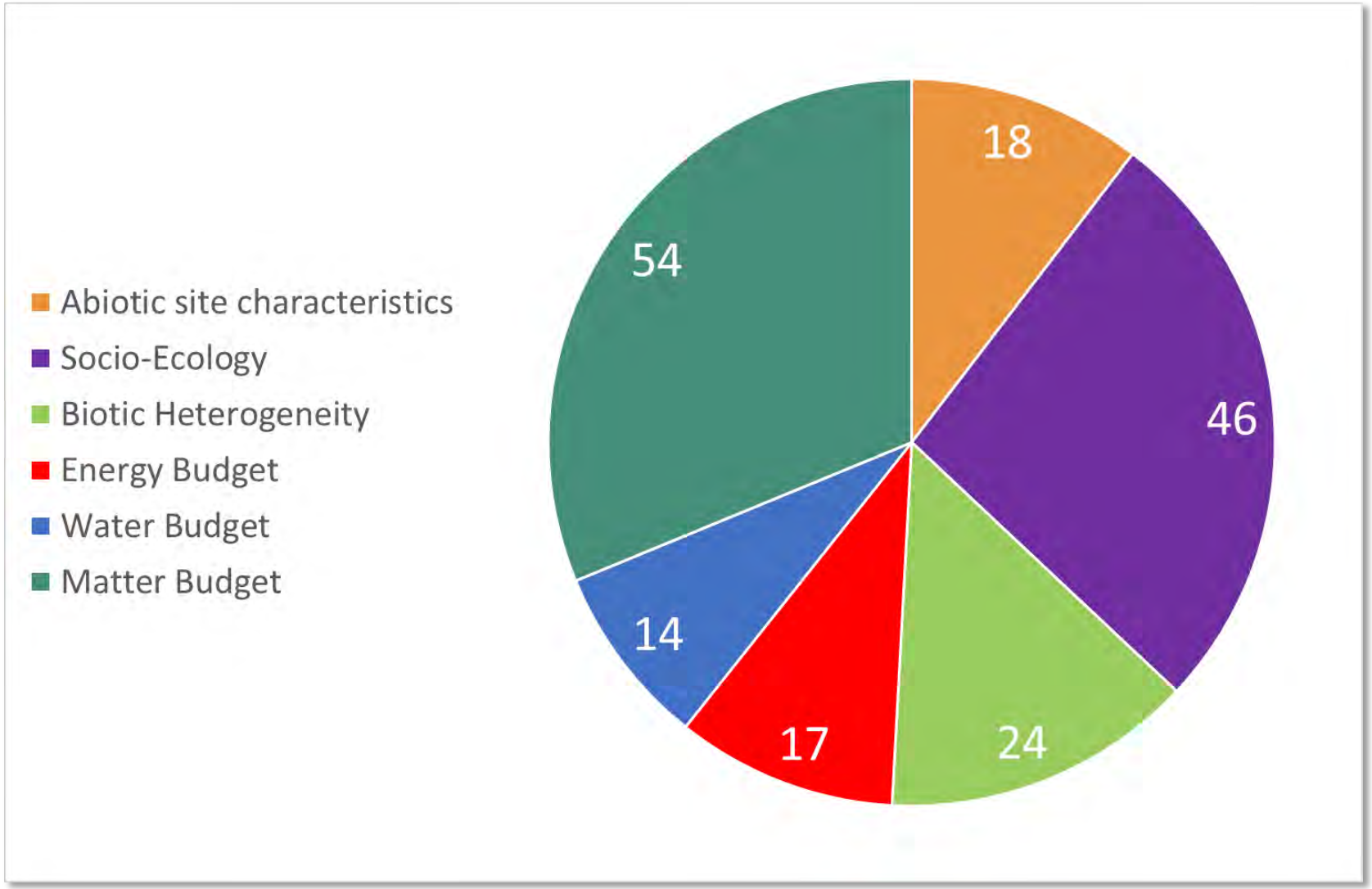
January 2022 – February 2024
- Revision of the eLTER Framework of Standard Observation based on inputs from expert groups, NRIs, SPF, IC

June 2022 – February 2024
- Reviewing, discussing and commenting of the eLTER Standard Observations

January 2023 – December 2024
- eLTER internal reviewing and approval
- Final documentation of eLTER Framework on eLTER Standard Observation

February 2024
- Framework on eLTER Standard Observations – concepts, cost implications, governance, feasibility etc.
- Presented to and approved by the eLTER Interim Council

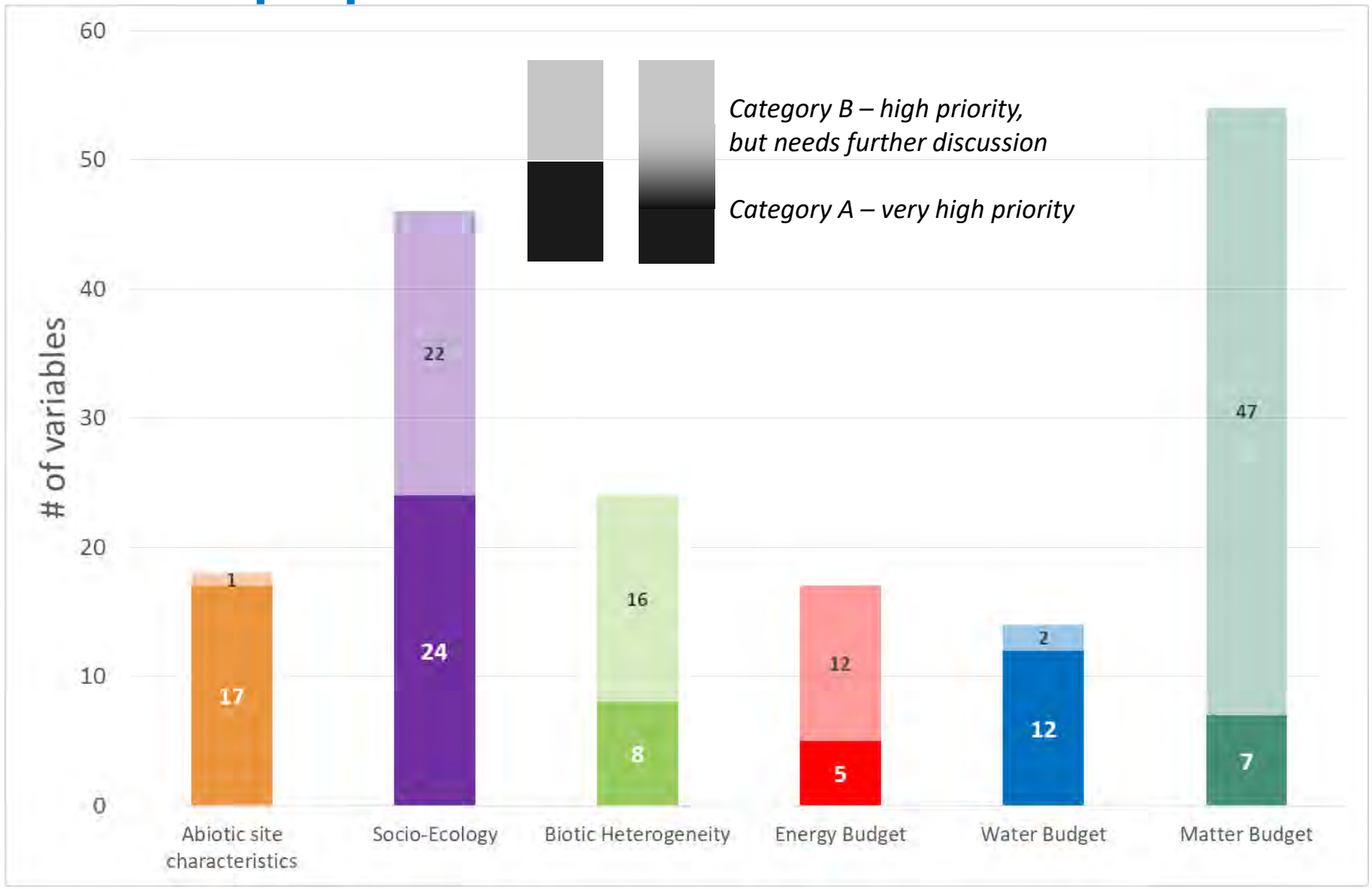
The Variables proposed



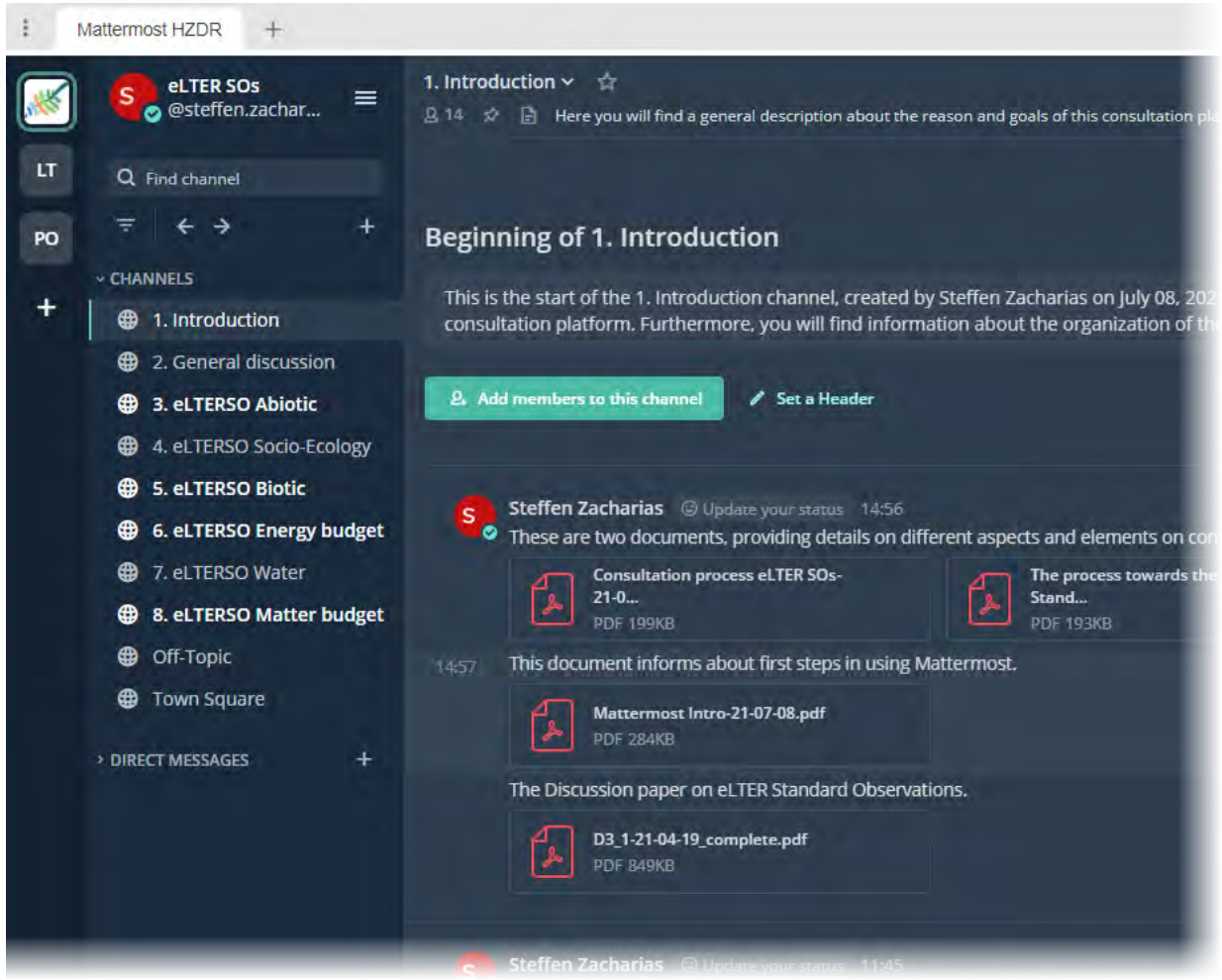
Ranking principles for the criteria for the selection of variables criteria following and adapted from Costa et al., 2016; GEOBON, 2017

		high	low
Relevance	The degree to which the variables represent key elements of the ecosystem integrity concept; Response to drivers of environmental change	Based on expert judgment from eLTER theme lead; the variable is highly relevant for many research themes/disciplines; variable responds highly sensitive for detecting/measuring current and potential future drivers of environmental change	Relevant only for one or few research themes/ disciplines or not highly sensitive for detecting/measuring environmental change
Cost efficiency	Describes required investment and operation costs	Measurement is already available at many locations; instrumentation can be implemented at low cost; fully automated measurements (low personnel costs) possible; low follow-up costs; high durability	Very expensive instrumentation; High follow-up costs (laboratory, cooling costs etc.); labour-intensive; low durability
Operative feasibility	Describes potential for routine measurements at a large number of sites based on standardized methods	Well established standards available, part of routine measurements in international networks; easy to apply; high probability of being harmonised	Extensive expertise needed for operation; logistically difficult, e.g. complex measurement campaigns needed; lack of widely accepted/applied protocol; low probability of being harmonised

The Variables proposed



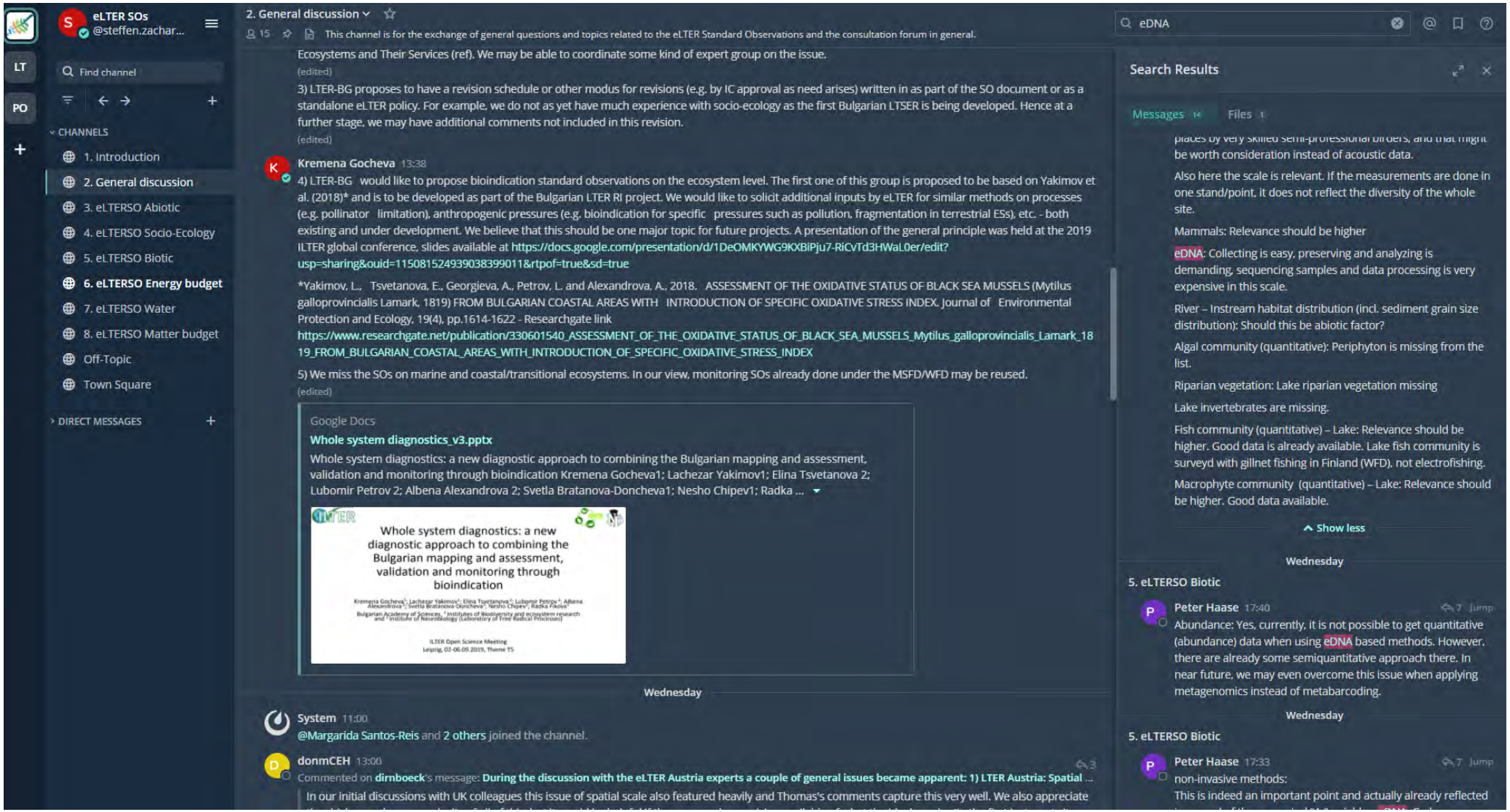
The Discussion Forum on eLTER Standard Observations



- Instant messaging service **Mattermost**
- **Channels** for thematic blocks to structure the consultation
- Each NRI and expert groups nominates a **consultation contact person** (+ deputy) who acts as the communication interface
- Everyone can contribute directly, read and comment on each other's posts

Mattermost

The Discussion Forum on eLTER Standard Observations

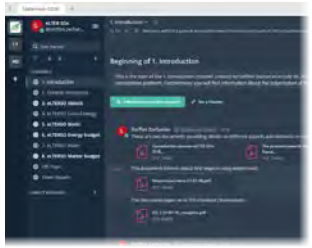


The Discussion Forum on eLTER Standard Observations – Important (exemplary) discussion threads

- **Methods and protocols and costs**
  - "We think that the **focus on automated methods** … is reasonable and highly innovative."
  - "Focus on **Low-cost methods**"
  - "There's a general need for considering **prohibitively high cost** observation as optional and in this case, … recommends them to be downgraded to priority B as a overall rule"
  - Alignment with **existing standards** and activities (e.g. ICP Forest sites)

- **Ecosystem types to be considered by eLTER (e.g. transitional waters, wetlands)**
  - „… an integration of observations specific of **coastal/transitional waters** is necessary …"
  - Include „**Wetland eLTER sites** (e.g. bogs, riparian zone)
  - Include "**Agro-Ecological sites**"

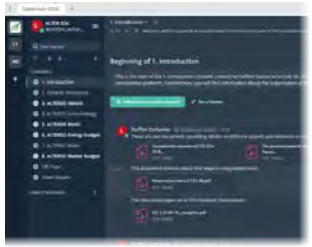
Discussion thread (example)



- eLTER Autria: Biotic Standard Observations - Automated methods versus field surveys
  *"We think that the **focus on automated methods** such as Malaise traps, cyclon samplers etc. **is reasonable and highly innovative**. **However**, first, the **workload to run this kind of measurements can be very high**, depending on the remoteness of a site. **Also, the costs are high**. We therefore, encourage downranking some of these these SOs to priority B but adding simpler field methods as accompanying measurements even as priority A. […]"*

- Moderator Biotic Standard Observations
  *"[…] many thanks for summarizing the very valuable input from the Austrian colleagues. Highly appreciated! As you know we are now discussing the advantages/disadvantages of automated versus "classical" field methods since many, many years. As also mentioned many, many times the **big disadvantage of the "classical" field methods is that we will rarely (if at all) be able to agree on a common protocol** (e.g. sampling of benthic invertebrates in streams). If the Austria team has suggestions for "classical" field methods that will be used in all other countries too, I am more than happy to rank them with an "A". S**econdly, the costs are usually higher for "classical" field methods compared to automated methods** (there might be a few exception!). […] "Regarding sampling frequency, I disagree with 3-5 years intervals for most of the taxa groups for two main reasons: 1. The VAST majority of species that we plan to monitor have a life cycle of 1 year MAXIMUM! 2. and even more important: if you want to investigate temporal trends (and this is to my understanding one of the main ideas of LTER!) then you need at least 10 measurements. A 3-year interval would result in 27 years and a 5-year interval in 47 years! I think, this is way too long!"*

Discussion thread (example)



[…]

- Moderator Biotic Standard Observations
  *"**Voice and image recording**: Both image and voice recognition are two **methods that are still to a certain extent "under development"**. I believe/hope that the current **Lifeplan project** (and many other project working with these to methods) will make sufficient progress in the upcoming years to solve some of the still existing issues. If, however, the technological progress is insufficient, we need to reconsider this option."*

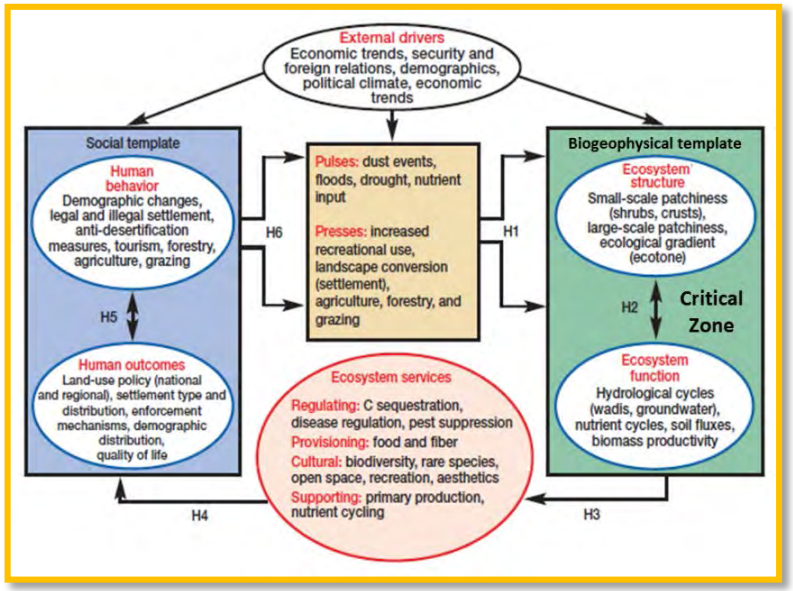
- eLTER PLUS WP1
  *"At next week's meeting, there will be a **session on Innovation in Measurement Technologies** on Friday (22nd Oct, 09-10:30). **One of the talks will present new developments in automated biodiversity monitoring** (image recognition for butterflies and moths, sound recording and analysis based on ML and AI approaches)."*

- eLTER Bulgaria
  *"We would like to propose **bioindication standard observations on the ecosystem level**. The first one of this group is proposed to be based on Yakimov et al. (2018)* and is to be **developed as part of the Bulgarian LTER RI proje**ct. We would like to solicit additional inputs by eLTER for similar methods on processes (e.g. pollinator limitation), anthropogenic pressures (e.g. bioindication for specific pressures such as pollution, fragmentation in terrestrial ESs), etc. - both existing and under development. We believe that this should be one major topic for future projects.*

What are the next steps?

- the Standard Observations will form part of the hard criteria for the site categories and labelling
- for most of the variables there will be two options for the method to measure it (basic, prime)

→ Decision on methods and protocols for agreed variables



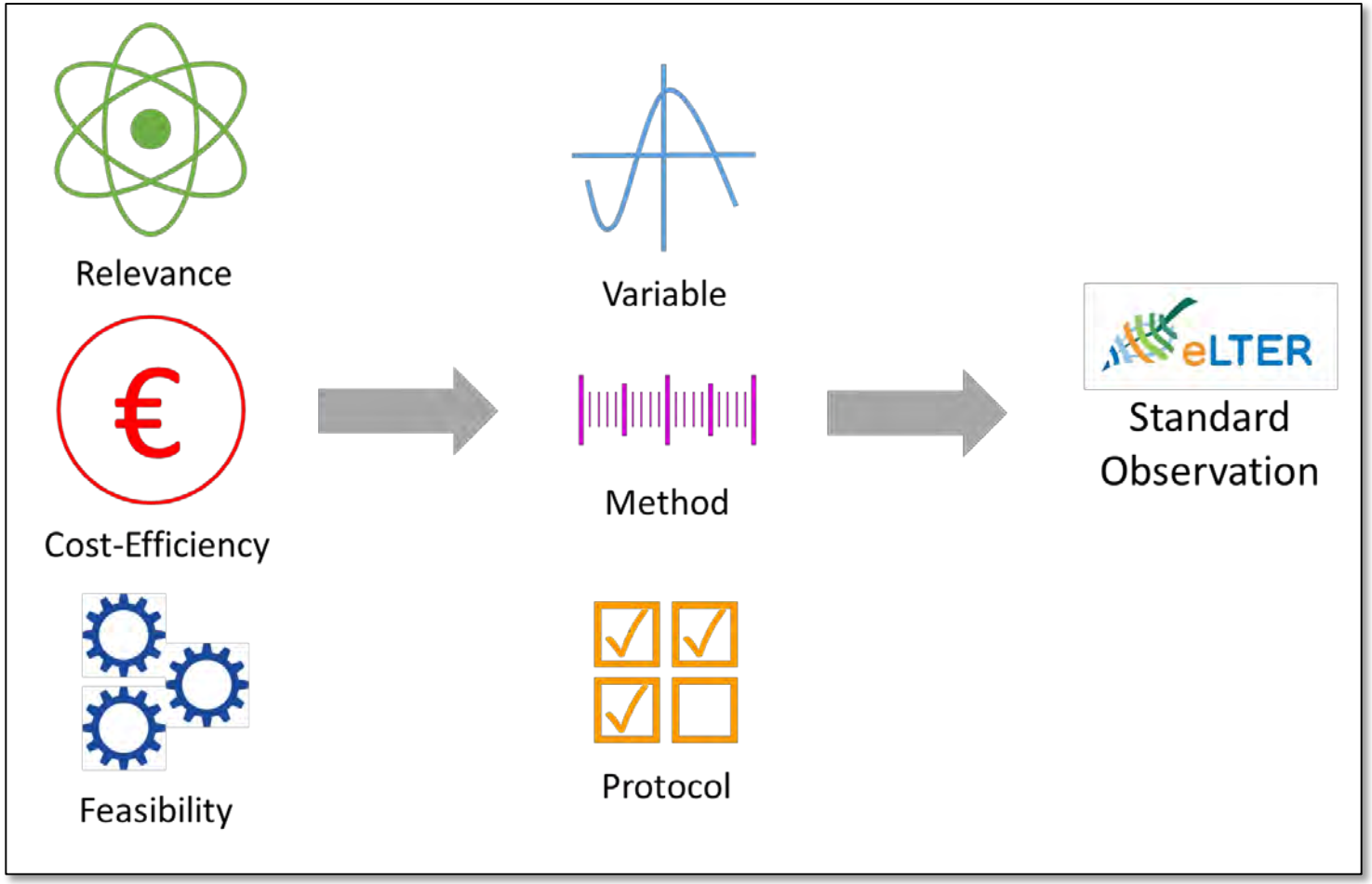
Talk of Michael Mirtl, Friday

Pulse-Press-Dynamics (PPD)
Collins et al, 2011

Variable

Method

Protocol


Relevance
Cost-Efficiency
Feasibility
Variable
Method
Protocol
eLTER
Standard
Observation