

Standard Observation SOSOC_032

Governance structure and character

Version 0.6

October 18, 2026

NOTE: THIS PROTOCOL IS STILL UNDER REVIEW



Main Authors

Pablo F. Méndez[1], Floriane Clement[2], Marta G. Rivera-Ferre[1], Sergio Villamayor-Tomas[3], Elisa Oteros-Rozas[4], Bastian Hörmann[5], Veronika Gaube[5]

Review Team

The protocol has been reviewed mainly for stylistic aspects.

[1]Institute of Innovation and Knowledge Management, INGENIO (CSIC-UPV), Universitat Politècnica de València, Valencia, Spain
[2]Dynafor, Toulouse University, INRAE, Castanet Tolosan, France
[3]Institute of Environmental Science and Technology, Autonomous University of Barcelona, Barcelona, Spain
[4]Department of Conservation Biology and Global Change, Estación Biológica de Doñana, EBD (CSIC), Sevilla, Spain
[5]Institute of Social Ecology (SEC), University of Natural Resources and Life Sciences (BOKU), Vienna, Austria

The eLTER Standard Observation protocol can be cited as:

Méndez, P. F., Clement, F., Rivera-Ferre, M. G., Villamayor-Tomas, S., Oteros-Rozas, E., Hörmann, B., Gaube, V. (2026): eLTER Standard Observation protocol SOSOC_032 – Governance structure and character. Version 0.6.

Prepared under contract from the European Commission
Grant agreement No. 871128
EU Horizon 2020 Research and Innovation action

Project acronym:	**eLTER PLUS**
Project full title:	**European long-term ecosystem, critical zone and socio-ecological systems research infrastructure PLUS**
Start of the project:	Feb 2020
Duration of the project:	60 months
Project coordinator	Jaana Bäck University of Helsinki, Finland https://elter-ri.eu/elter-plus

By the end of January 2026 the further work on the protocol was handed over to and executed by the provisional eLTER Head Office and Topic Centre on Interoperability of the emerging eLTER ERIC.

Version	Status	Date	Authors
0.1	Final draft	Feb 2025	all main authors
0.2	Reformatted	Feb 2026	S. Zacharias
0.3	Reviewed and revised	Apr 2026	all main authors
0.4	Project acknowledgements revised	Aug 2026	S. Zacharias
0.5	Split into protocol and companion paper; Analysis 3 and Part F optional	Oct 2026	P. F. Méndez
0.6	Supplementary material added	Oct 2026	P. F. Méndez

SO variable overview

Habitat:
Applies to all eLTER habitat groups.

Variable(s):

- **Governance structure and character of social-ecological systems:** data describing governance actors, institutional dynamics, the political-economic context and power relationships

Contents

Executive Summary **1**

Background **1**

Implementation of the Instrument **2**

1 Introduction **2**
1.1 Scope . . . 2
1.2 Scientific objective . . . 3
1.3 Scientific basis in brief . . . 3
1.4 Companion documents . . . 4

2 Core design principles **4**

3 Instrument design in brief **5**
3.1 The Part D questionnaire in brief . . . 5
3.2 Data analysis in brief . . . 7

4 Before you start **7**
4.1 Minimum compliant implementation . . . 8
4.2 Ethics and data management . . . 9

5 Block 1 – Governance context (Parts A-C) **10**
5.1 Part A – Search and collection of primary and secondary sources . . . 10
5.2 Part B – Definition of the relevant social-ecological boundary and historical processes 14
5.3 Part C – Description of governance actors . . . 15

6 Block 2 – Governance survey and profile (Parts D-E) **16**
6.1 Part D – Governance survey and analysis . . . 17
6.2 Part E – Synthesis into Platform Social-Ecological Governance Profile . . . 24

7 Block 3 – Spatial extension (Part F, optional) **26**
7.1 Part F – GIS-based prototype platform for land property and tenure . . . 27

8 Post-processing and harmonisation across Platforms **28**

9 Data and metadata format **29**

Appendix **36**

A Templates of the Instrument **37**

B Outline of the 'governance profile' document **38**

C Informed consent form **39**

D Interface with eLTER Standard Observation SOSOC_037 Land Use **41**

E Companion paper **44**

Executive Summary

This document presents a mixed-methods *Instrument* for the systematic observation and characterisation of governance structure, character and dynamics across the eLTER RI's Long-Term Socio-Ecological Research (LTSER) Platforms. Platforms may implement a streamlined BASIC Instrument (Parts A-C, every three years) or the full PRIME Instrument (Parts A-E, every six years, with Part F as an optional spatial extension). The Instrument contributes to eLTER's objective of integrating the ecological, social and economic dimensions of sustainability science, by enabling a harmonised yet context-sensitive approach to assessing governance in diverse European regions. A core principle of the Instrument is to generate comparable empirical evidence on how governance functions within the complex social-ecological settings of the different Platforms. The Instrument combines quantitative and qualitative methods to establish a robust baseline for understanding social-ecological governance. It has been designed to be implemented every six years and to support long-term learning, comparative research and the assessment of how governance settings evolve within LTSER Platforms.

Implementation is expected to be carried out by one or two experts per LTSER Platform over a 108-day implementation window. Indicatively (Guidance_gantt tab of the 'master database' (Appendix A)): Parts A-C in days 1-25, Part D in days 26-85 with the interviews over about 50 of them, Part E in days 86-108 including the validation round, and Part F, where implemented, in parallel with Parts D and E from day 60. The first implementation functions as a pilot phase whose aim is to consolidate and validate a minimum viable set of core analytical components that ensure data quality and comparability under the resources currently available. Two elements were deliberately left out of the pilot and will be co-designed for later cycles on the basis of its results, involving experts and stakeholders from all participating Platforms: participatory workshops to integrate the multiple values and perspectives of governance actors, and advanced synthesis techniques for combining mixed-methods evidence into multi-dimensional governance assessments.

Subsequent implementations, every six years, will be preceded by stages of co-design, refinement and adaptation based on lessons learnt and on advances in theory, methodology and technology, so that the Instrument remains scientifically robust, operationally feasible and aligned with eLTER's vision and mission. The procedure is organised in three blocks: governance context (Parts A-C, which constitute the BASIC Instrument), governance survey and profile (Parts D-E) and an optional spatial extension (Part F). The conceptual and methodological foundations of the Instrument are set out in a companion paper (Méndez et al. 2026); the present document contains what is needed to implement it.

Background

The present Instrument is part of eLTER RI's framework for the Standard Observation of social-ecological factors and variables within the Anthroposphere. The Instrument outlines the protocol for the Standard Observation of 'Governance Structure and Character' (SOSOC_032) within eLTER's Long-Term Socio-Ecological Research (LTSER) Platforms. Within eLTER RI, a Standard Observation is defined by three components: (i) the variable of interest, (ii) the method of observation or measurement, and (iii) the protocol guiding its implementation. Two complementary approaches exist across Standard Observations: the PRIME Method and the BASIC Method. The PRIME Method establishes the most comprehensive eLTER standard, while the BASIC Method provides a streamlined yet consistent alternative suitable for broader application. For further information see the eLTER Standard Observations Infosheet (https://elter-ri.eu/media-center/info-sheets).

To align with social science and political science terminology, this document adopts the term *Instrument* instead of *Method* when referring to the PRIME and BASIC approaches for SOSOC_032. This distinction reserves the term 'method' for the specific analytical techniques used to collect,

interpret and synthesise data. Hereafter, the Instruments will be generally referred to as eLTER RI's PRIME and BASIC Instruments for the observation of social-ecological systems (SES) governance.

Implementation of the Instrument

Both the BASIC Instrument and the PRIME Instrument are included in this document.

BASIC Instrument

The BASIC Instrument represents a streamlined version of the PRIME Instrument, designed for Platforms with more limited time, capacity or resources. The BASIC Instrument, to be implemented every three years, includes only Parts A, B, and C of the PRIME Instrument (see Figure 1). Platforms implementing the BASIC Instrument can conclude their observation process after completing Part C. Those three initial Parts produce a foundational dataset on SES governance sources, boundaries, scales, history and actors. The BASIC Instrument is expected to take about 25 working days for one or two experts, and it also produces Sections 1-3 of the 'governance profile' (Steps B2.4, B3.1 and C3.2).

PRIME Instrument In contrast, Platforms implementing the PRIME Instrument every six years will continue beyond Part C, and complete Parts D and E, and Part F where local expertise and time allow (see Figure 1). Those parts include more advanced analyses such as a mixed-methods governance assessment and, optionally, a network analysis and a GIS prototype platform for land tenure analysis; the network data of Part D are collected in every PRIME implementation, so that the analysis can be run later or centrally.

Tiered design and implementation timeline

The BASIC and PRIME Instruments follow a tiered design that seeks to allow all LTSER Platforms to contribute to the eLTER Standard Observation effort according to their local capacities, while ensuring that both BASIC and PRIME implementations remain compatible and comparable within the LTSER Platform network. An idealised implementation timeline, assuming that the piloting Platforms start in the same year, is included in Figure 1. At first implementation (Year 1), Platforms implement the Instrument they chose depending on available resources. In Year 3, all Platforms will produce an update of their governance observation through the BASIC Instrument. In Year 6, Platforms produce new updates using the Instrument they initially chose. Ideally, the PRIME Instrument will be fully reviewed before the Year 6 implementation; the review is conducted by the authors of the Standard Observation together with the pilot Platforms, and is fed by the post-processing of Section 8 and by the Platforms' 'Adaptation_log' tabs. After Year 6, this implementation timeline will iterate.

1 Introduction

1.1 Scope

Understanding how governance of social-ecological systems (SES) operates today, and its historical roots, is fundamental to inform future capacities to change and adapt in the face of the uncertain effects of global environmental challenges on multiple scales (Fischer-Kowalski 2015; Boyd and Folke 2012). Governance is acknowledged as a key factor in understanding current SES dynamics and the prospects for transitions, transformations or pathways towards sustainability (Clark and Harley 2020; Patterson 2016; Rocha et al. 2022), yet our understanding of current governance configurations and of how they can be improved remains limited (Aggarwal and Anderies 2023). The present document addresses this gap for the regions and landscapes delimited by LTSER Platforms, with implications for policies at network scale and for upper-level governance components.

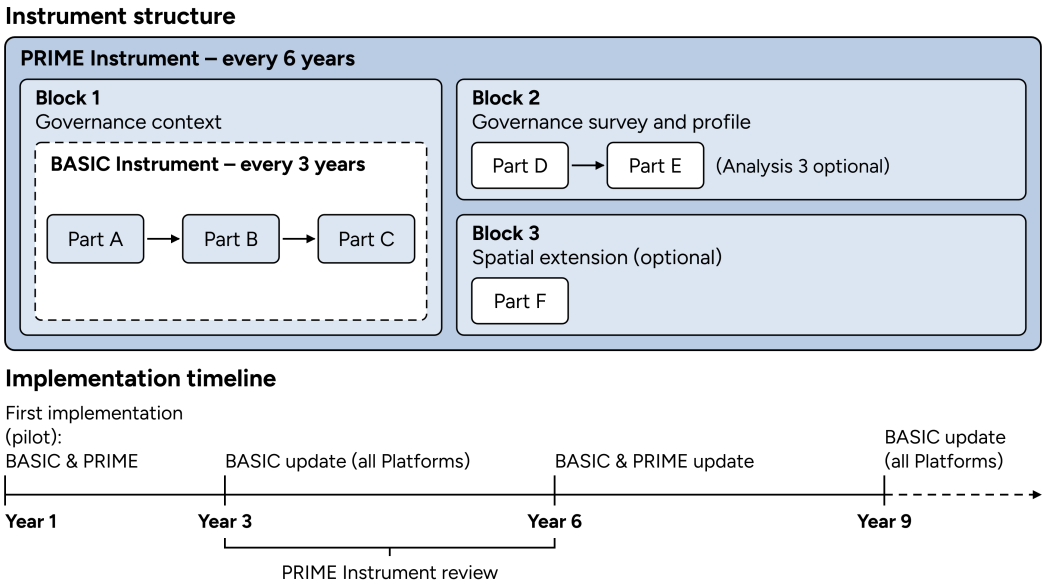


Figure 1: Structure of the Instrument and idealised implementation timeline. Top: the three blocks of the PRIME Instrument (every six years), with the BASIC Instrument (every three years) as Block 1; Analysis 3 and Part F are optional. Bottom: first implementation (pilot) in Year 1, BASIC update by all Platforms in Year 3, BASIC and PRIME update in Year 6 after the PRIME Instrument review, and the cycle repeating thereafter, assuming that the piloting Platforms start in the same year

1.2 Scientific objective

This document aims to guide LTSER Platform managers and other social-ecological research experts in gathering data and information on SES governance within their Platforms using either the BASIC or PRIME Instruments. The overall goal is to produce an observation of key factors in LTSER Platforms that can be aggregated into a holistic characterisation of SES governance.

1.3 Scientific basis in brief

Governance is understood here as the emergent patterns of multi-scale governing actions by governmental and non-governmental actors, private coalitions, scientific communities and civic groups seeking to steer or manage socio-economic and environmental systems (Kooiman 1993; Pierre and Peters 2020). SES are analytical constructs for understanding the complex, uncertain and feedback-driven dynamics linking human and natural systems (Ostrom 2009; Reyers et al. 2018; Biggs et al. 2021). SES governance, the object of this Standard Observation, is the set of structures and processes through which societal actors coordinate, allocate resources, resolve conflicts and share power in managing ecosystems and natural resources (Young 2002; Jordan 2008; Chapin et al. 2009; Méndez et al. 2023), with emphasis on arrangements that promote collective action and the just and sustainable use of ecosystem services (Lebel et al. 2006).

No single framework captures SES governance, and combining analytical frameworks is increasingly advocated (Binder et al. 2013; Cumming et al. 2020; Clement et al. 2024). The Instrument therefore combines core constructs from four frameworks and a minimal social network analysis (Table 1), as a parsimonious and interoperable starting point to be refined after the pilot. The full rationale, the derivation of the questionnaire items and the analysis methods are documented in the companion paper (Appendix E) (Méndez et al. 2026) and in the frameworks-integration workbook that accompanies this protocol.

Table 1: Frameworks and methods underlying the Instrument

Framework or method	What it contributes	Where in the Instrument	Key references
SES Framework	Diagnostic ontology of resource systems and units, governance systems, actors, interactions and outcomes	Module 1 (A-type items and probes)	(Ostrom 2009; McGinnis and Ostrom 2014; Partelow and Winkler 2016)
STEER Framework	Coordination, policy coherence, learning and multi-level adaptation as governance capacities	Module 2	(Pahl-Wostl 2009; Pahl-Wostl et al. 2020)
Polycentric Power Typology	Power by design, pragmatic power and framing power; visibility of power; enabling or repressive effects	Module 3	(Morrison et al. 2019; Gaventa 2006)
Discursive Power	How discourses shape whose knowledge counts and which options become thinkable	Module 4	(Hajer 1995; Clement 2010; Whaley and Weatherhead 2014)
Minimum viable SNA	Ego-network of named contacts per activity type; density, degree, betweenness and actor-type distribution	Module 5, Analysis 3 (optional)	(Bodin and Crona 2009; Prell 2012; Bodin 2017)
Narrative synthesis	Triangulation of quantitative, qualitative and network evidence into a governance profile	Part E	(Popay et al. 2006; O'Cathain et al. 2010; Fetters et al. 2013)

1.4 Companion documents

The Instrument is implemented with three templates, downloaded in Step A1.2 from Appendix A: the 'master database', the Part D 'questionnaire', and the Part D 'raw data' file. The 'governance profile' is written as a Word document from the outline in Appendix B, and the informed consent form is Appendix C. Two further documents support it: the companion paper (Appendix E) (Méndez et al. 2026), which presents the key concepts, the governance frameworks, the derivation of the questionnaire and the data analysis methods, and the frameworks-integration workbook, which keeps the audit trail from framework variables to questionnaire items. Appendix D sets out how the Instrument interfaces with the eLTER Standard Observation SOSOC_037 Land Use (Hörmann et al. 2026) for Platforms that implement both.

2 Core design principles

The design of the Instrument is guided by three core principles.

WAILS as a conceptual umbrella. This document is grounded in eLTER RI's Whole-system Approach for In-situ research on Life-Supporting Systems (WAILS) (Mirtl et al. 2018; Mirtl et al. 2021; Nikolaidis et al. 2021; Zacharias et al. 2024), which provides the overarching conceptual foundation for integrating ecological, social and biophysical observations across scales and ensures coherence with the other Standard Observations across the social, geo-, hydro-, bio- and atmospheric spheres.

Context-sensitive and continuous improvement of harmonisation and standardisation across LTSER Platforms. The concepts, methods, procedures, factors and variables presented here constitute a baseline design that is intended to evolve at each implementation of the BASIC Instrument (every three years) and the PRIME Instrument (every six years), through three interlinked pathways: the stepwise integration of Platform-specific experience and knowledge, whereby observations that initially remain context-specific may become network-wide standards once their broader rele-

vance becomes evident; the integration of conceptual, methodological and technological innovation; and alignment with eLTER RI's approach to standardisation (standard variables and observation methods) and harmonisation (integration of diverse data formats and disciplinary perspectives).

The Standard Observation as method and approach. Many of the factors observed require qualitative pre-analysis, such as interview content analysis, which involves interpretation informed by the analyst's disciplinary background. The Instrument is therefore both a method for systematically observing SES governance and a common framework that informs the diverse analytical approaches employed across LTSER Platforms.

Required expertise. The Instrument is designed for one or two experts per Platform. The lead implementer should be a social scientist with experience of qualitative interviewing and of governance or institutional analysis, able to apply a codebook thematic analysis (Analysis 2) and descriptive statistics in a spreadsheet (Analysis 1); a second person for note-taking, data entry and cleaning is strongly recommended for Part D. Both need the local language and a working knowledge of the Platform's governance landscape, and access to local experts and key informants. The optional components need additional skills: basic social network analysis with free software for Analysis 3, and GIS skills for Part F; Platforms without them still collect the network data and the boundary geometries and leave those analyses for a later cycle or for central processing. Familiarity with research ethics and the GDPR (Section 4.2) is required of the whole team.

3 Instrument design in brief

The PRIME Instrument, and by extension the BASIC one, follows a multiple-case, mixed-methods approach to generate comparative, aggregated observations of SES governance. This overarching design meets three key criteria for integrating quantitative and qualitative data:

1. collectively, the data capture the complex, dynamic, and uncertain nature of SES governance, enabling cross-scale comparison across LTSER Platforms as case studies
2. they provide a robust baseline for eLTER RI SO-based services, supporting both ad hoc data needs and longitudinal research, and
3. they accommodate diverse user requirements for quantitative, qualitative or combined information.

This research design allows the data collected through the Instrument to be combined with results from other Anthroposphere Standard Observation protocols (e.g., economics, demography, resource use, land use, ecosystem services), thereby supporting holistic, multi-dimensional assessments of SES dynamics within LTSER Platforms. The Instrument consists of six parts, which are described below.

3.1 The Part D questionnaire in brief

The questionnaire has five modules. Modules 1 to 4 operationalise the four frameworks of Table 1: each 'design anchor' extracted from a framework was translated into an A-type item, a statement scored on a 1-5 Likert scale, paired with a B-type qualitative probe that asks the respondent to substantiate the score with concrete examples. All A-type items are positively keyed, so that a high score denotes the favourable pole, except items 33 (`PP_PD`, annotated 'High score = concentration'), 35 (`PP_FR`, 'High score = dominance') and 38 (`DP_DOM`, phrased in the same sense), whose wording is kept and whose scores are reverse-coded at data entry (Step D3.4) so that the analysis treats all 42 items alike. Positive keying was preferred over mixed keying because reverse-keyed items add scoring errors and translation ambiguity in a multi-lingual setting, and the exposure to acquiescence bias is mitigated by the paired probes (Krosnick 1999; Tourangeau et al. 2000). Module 5 elicits the respondent's network contacts, up to six per activity type (monitoring, decision making, information

Table 2: The six Parts of the Instrument, grouped into three blocks

Part	Purpose	Main outputs	Recorded in
Block 1 – Governance context *(BASIC Instrument; Section 5)*			
A	Identify and catalogue documentary, policy, grey literature and media sources describing the Platform's SES and its governance	Source collection (.RIS) with metadata and 'source_id'	'master database' (Appendix A), 'Sources' tab
B	Define the spatial and temporal frame of observation and identify key historical events shaping current governance	Events log, SE boundary geometries, historical narrative and boundary justification	'master database' (Appendix A); 'governance profile', Sections 1–2
C	Identify and describe governance actors, including under-represented groups	Actor catalogue with 'actor_id' and under-representation summary	'master database' (Appendix A); 'governance profile', Section 3
Block 2 – Governance survey and profile *(PRIME Instrument; Section 6)*			
D	Administer the mixed-methods questionnaire to at least 30 actors; conduct quantitative and qualitative analyses and, optionally, network analysis	Likert statistics, coded themes, network metrics and maps	'raw data' (Appendix A) and 'data analysis' files
E	Synthesise the three evidence streams into a validated Platform governance profile	5–7-page governance profile and validation summary	'governance profile', Sections 4–5
Block 3 – Spatial extension *(PRIME Instrument, optional; Section 7)*			
F	Where GIS expertise and time allow, develop an optional minimal GIS prototype of land property and tenure within the SE boundary	SES boundary map, tenure map and layer metadata	`2_Data/Boundary_GIS/`; 'master database' (Appendix A), metadata tab

sharing), with tie strength, directionality and perceived trust. Every item carries a code tag (e.g., `SES_GS_RULES`, `STEER_LEARN`) that is used throughout the data files. Platforms may add platform-specific qualitative questions after the core items (Note 4) but must not alter the wording of core items or the Likert scales.

Probe tiering in the pilot. All 42 A-type items are scored in every interview. The B-type probes are tiered: the 16 **core probes** of Table 3, at least one per sub-dimension, are asked in every interview; the remaining 26 probes are **optional** and are asked when the respondent scores 1 or 5 (the extremes, where an example is most informative and where acquiescence is most consequential), when the respondent volunteers an example, or when time allows. Core probes were chosen because their construct is the hardest to interpret from a score alone and because their answers feed the Part E themes and the cross-checks with Parts B, C and the network data. The tier does not change the questionnaire: optional probes remain in it, and a Platform may treat an optional probe as core if its sub-dimension is locally central.

Table 3: Core probes asked in every interview; all other B-type probes are optional

Module and sub-dimension	Core probe (item code)	Rationale for inclusion
Module 1 – Social-Ecological System (SES)		
Resource system	1B `SES_RS_BOUND`	Boundary claims and disputes; cross-checks the Part B boundary
Resource units	6B `SES_RU_ACCESS`	Advantaged and excluded groups; informs equity and inclusion themes and Step C3
Governance system	7B `SES_GS_RULES`	Key rules, their enforcement and effects
Governance system	10B `SES_GS_ADAPT`	Changes in rules or practices and how they occurred; informs the adaptiveness theme

Continued on next page

Table 3 continued from previous page

Module and sub-dimension	Core probe (item code)	Rationale for inclusion
Actors	11B `SES_A_DIVERS`	Most influential and missing actor types; cross-checks Part C and the network
Interactions	14B `SES_I_COLLAB`	Successful and unsuccessful collaborative processes; cross-checks the network
Outcomes	19B `SES_O_ACC`	Evidence of accountability or its absence; links to transparency and power
Module 2 – STEER		
Coordination	21B `STEER_CSCOORD`	Cases where cross-sector coordination succeeded or failed
Implementation	23B `STEER_IMP`	Major gaps between commitments and implementation in practice
Coherence	26B `STEER_FUNCOH`	Duplicated, unclear or missing roles; informs the mandate-clarity theme
Learning	31B `STEER_LEARN`	Examples of learning cycles and the changes they produced
Module 3 – Power		
Design	33B `PP_PD`	Who establishes rules and who has the authority to change them
Pragmatic	34B `PP_PR`	Who controls budgets and enforcement
Effect	37B `PP_ENAB`	Power relations that enabled or obstructed inclusion
Module 4 – Discourse		
Dominance	38B `DP_DOM`	Dominant discourse and characteristic phrases; also addresses framing power
Knowledge	40B `DP_LEG`	Integration or exclusion of local and traditional knowledge

3.2 Data analysis in brief

Part D data are analysed with four methods in their minimal form, chosen so that a single coder can apply them under resource constraints: (i) descriptive statistics of the Likert scores (mean, standard deviation and median) (Norman 2010; Boone and Boone 2012); (ii) descriptive coding of the probe responses followed by a lightweight codebook thematic analysis (Saldaña 2013; Braun and Clarke 2006; Gale et al. 2013); (iii) optionally, where local expertise and time allow, a minimum viable social network analysis reporting density, degree and betweenness centrality, actor-type distribution and, optionally, reciprocity, in normalised form and together with the number of respondents and nodes (Bodin and Crona 2009; Prell 2012); and (iv) a narrative synthesis that triangulates the three evidence streams into the governance profile (Popay et al. 2006; Fetters et al. 2013). Steps D4.3 to D4.5 and Part E give the procedures. The first (pilot) implementation aims only to produce a baseline that captures the main governance patterns without exhaustive analysis, can be applied by a single coder, produces structured outputs comparable across Platforms and leaves space for further development (e.g., intercoder reliability, participatory feedback loops, advanced modelling). Statistics are computed per item and summarised per sub-dimension; module-level means are reported only as a coarse overview.

4 Before you start

The first implementation of the BASIC and PRIME Instruments serves as a **pilot phase**, testing and refining procedures to ensure efficiency and consistency across LTSER Platforms. Implementers should view this cycle as an opportunity to identify what works best in practice: **where a task admits different options, these are presented in BLUE BOXES, indicating the most effective**

approach given the proposed timeline and locally available resources. Feedback on workflow, time management and data quality will be essential to improve and standardise the Instrument for future cycles.

KEY REMINDERS

- Platforms applying the **BASIC Instrument** complete Parts A, B and C only; data collection may stop after Part C, which provides a sufficient baseline on governance context, boundaries and actor structure. Platforms implementing the **PRIME Instrument** continue with Parts D and E, and with Part F where local GIS expertise and time allow.
- The procedure is organised in three blocks (Sections 5 to 7); the BASIC Instrument is Block 1. Some tasks can run in parallel: Parts A-C may overlap; Parts D and F can begin once B-C are nearly complete; Part E follows Part D and can run in parallel with Part F.
- Before starting, review the full Instrument to understand scope, modules and timing; familiarise yourself with the ethics and data management rules (Section 4.2), the consent form and data security; use the provided templates to standardise data entry before desktop work and fieldwork; and securely store recordings and datasets after each day.

4.1 Minimum compliant implementation

Table 4 lists, per Step, the minimum output that must exist for a Platform to count as having implemented the Instrument, and where it is recorded. Every Step is required for the Instrument indicated; within Steps, items marked optional in the procedure (e.g., focus groups in C3.1, optional probes) remain optional, and Analysis 3 and Part F are optional as a whole. The last column is for the pilot record: mark each Step as done, skipped or adapted, with a one-line note in the 'Adaptation_log' tab of the 'master database' (Appendix A), since this record is the evidence on which the Instrument will be revised after the pilot.

Table 4: Minimum compliant implementation checklist

Step	Minimum output	Recorded in	Pilot record
Block 1 – Governance context *(BASIC and PRIME Instruments)*			
A1 Scoping	Folder structure created; templates downloaded	Local folder, `2_Data/`	
A2 Collection of sources by type	Sources of the four types with metadata, `source_type` and `source_id`; .RIS exports; list of potential interviewees	'Sources' tab; notes for D1.4	
A3 Finalisation	All sources carry a unique `source_id`	'master database' (Appendix A)	
B1 Scoping	None (preparation)		
B2 Historical events	`Events_log` with `event_id`; 1–2-page historical narrative with timeline graphic	`Events_log`; 'governance profile', Section 1	
B3 Spatiotemporal scope	`SE_boundary` entry; 2–3-paragraph justification; boundary geometries (.shp or .GeoJSON)	`SE_boundary`; 'governance profile', Section 2; `2_Data/Boundary_GIS/`	
B4 Finalisation	All events carry a unique `event_id`	'master database' (Appendix A)	
C1 Seeding the actor list	Preliminary 'Actors' entries with `source_id`	'Actors'	
C2 Formal registries	'Actors' completed from registries; uncertain records corroborated or flagged	'Actors'	
C3 Under-representation	Missing voices added; 1–2-page summary	'Actors'; 'governance profile', Section 3	

Continued on next page

Table 4 continued from previous page

Step	Minimum output	Recorded in	Pilot record
C4 Finalisation	All actors carry a unique `actor_id`	'master database' (Appendix A)	
Block 2 – Governance survey and profile *(PRIME Instrument)*			
D1 Preparation and piloting	Adapted (and translated) questionnaire; consent forms; list of at least 30 respondents; pilot interview completed	'questionnaire' (Appendix A); 'raw data' (Appendix A), Interviews tab	
D2 Interviews	At least 30 interviews: scores for all A-type items, core probes (Table 3), network data; recordings or notes	Questionnaire copies; recordings	
D3 Data storage and processing	Interviews tab complete; scans stored; scores in the Module tabs; `Edge_List`; validation checks completed	'raw data' (Appendix A); `2_Data/Interviews/`	
D4 Data analysis	'data analysis' file; Analysis 1 statistics and charts; Analysis 2 codes and themes; Analysis 3 metrics and maps (optional)	'data analysis' file	
E1 Priority themes	8–10 themes with one integrated paragraph each	'governance profile', Section 4	
E2 Profile and validation	5–7-page governance profile; validation feedback summary (1–2 pages)	'governance profile', Sections 4–5; `3_Analysis/`	
Block 3 – Spatial extension *(PRIME Instrument, optional)*			
F1 Base layers	Harmonised layers clipped to the SE boundary, with metadata	`2_Data/Boundary_GIS/`; `GIS_platform_metadata`	
F2 Property and tenure data	Parcel layer with the minimum fields	`2_Data/Boundary_GIS/`	
F3 Final maps	SES boundary map; tenure map	'governance profile'	
Deposit *(Section 9)*			
Deposit package	Data package in the eLTER data-reporting format, with its metadata record	eLTER repository (to be confirmed, Section 8)	

4.2 Ethics and data management

The rules below apply to every Part and Step. The consent form is Appendix C, the identifier scheme is Note 1 and the deposit format is Section 9.

Informed consent. Every interviewee (Part D) and every actor consulted in the validation round (Step E2.2) gives explicit, documented consent before participating, on the form of Appendix C prepared in Step D1.3. The form states the scope of the Standard Observation, how the inputs are used in the data files and in the 'governance profile', that the interview is recorded and may be transcribed with software (Note 5), the right to withdraw at any stage without consequence, and the conditions of anonymity. Signed forms are stored in '1_Admin/' and are never deposited. Experts and key informants consulted in Parts A-C are recorded as sources ('Expert judgement', Step C1.2) and are told how their input is used before their names are entered.

Third-party personal data. The 'Actors' tab and the network module (Module 5) record individuals and organisations who are not respondents. Record organisations by name and individuals by role and organisation; keep contact details ('actor_address', 'actor_contact_info') only in the 'master database' (Appendix A), which is not deposited in that form; and refer to individuals in the analysis files, the network maps and the 'governance profile' by 'actor_id', category and scale only.

Confidentiality and anonymisation. Respondents are identified in the 'raw data' (Appendix A) and 'data analysis' files only by 'interview_id'. Quotations and examples in the 'governance profile' are attributed by structural attributes (sector, organisation type, scale), as stated in Appendix C, so that identities cannot be reconstructed; a respondent is named only with written consent after

reviewing the text. Remove or obfuscate identifying details before the profile leaves the implementing team.

Record keeping and audit trail. Every Step leaves a verifiable trace: the folder structure of Step A1.1 ('1_Admin/', '2_Data/', '3_Analysis/'), the file-naming conventions of the templates, the unique identifiers of Note 1, the 'Adaptation_log' tab for deviations from the procedure, and the separation of the 'raw data' (Appendix A) file from the 'data analysis' file (Note 8). Keep raw data separate from cleaned or analysed data, regularly check that file names, versions and locations are consistent across the team, keep the project's folder structure and use version control.

Storage and archiving. All data collected through the Instrument (primary and secondary sources, survey outputs, recordings, transcripts, spatial data) must be saved frequently and stored in secure, access-controlled locations, in compliance with the General Data Protection Regulation (GDPR) and eLTER RI data-protection guidelines. Always save a backup copy of all files after every working session; store the master versions in encrypted drives or institutional cloud storage with restricted access, especially folders containing personal identifiers or audio files; never store identifiable or sensitive data on personal or shared unsecured devices; and store recordings and datasets securely after each day of fieldwork. These measures ensure data integrity, participant confidentiality and long-term comparability across LTSER Platforms.

Deposit. At the end of the implementation, the final data products and their metadata record are deposited in the eLTER repository in the data-reporting format of Section 9. Recordings, scans, transcripts, contact details and consent forms stay with the Platform under its retention rules and are never deposited.

Use of AI-based tools. Automated transcription and translation services may be used under the conditions of Note 5. Automated coding or summarisation does not replace the analyst's coding (Analysis 2) or the synthesis of Part E during the pilot, so that coding remains comparable across Platforms.

5 Block 1 – Governance context (Parts A-C)

Block 1 produces the foundational dataset on the Platform's governance sources, boundaries, scales, history and actors, in the 'master database' (Appendix A) and in Sections 1-3 of the 'governance profile'. It constitutes the BASIC Instrument: Platforms implementing BASIC stop at the end of Part C. Parts A, B and C may overlap.

5.1 Part A – Search and collection of primary and secondary sources

Objectives: (i) to systematically identify and store references to the most relevant documentary and media sources describing the LTSER Platform's social-ecological system and its governance; (ii) to produce a searchable 'master database' (Appendix A).

BOX 1. DOWNLOADING COMPLETE SOURCES VS METADATA-ONLY APPROACH

Two options are available for the search and collection process. **Option 1, search and download sources into a local database:** experts locate all relevant documents (laws, reports, theses, etc.) and store complete copies in a structured local repository (e.g., Zotero or institutional drive) with metadata; this gives long-term preservation, offline access, text-mining potential and data sovereignty, at the cost of storage and maintenance overhead, copyright and licensing issues and version control. **Option 2, collect links only (metadata-only approach):** experts compile a curated database of URLs and reference metadata without downloading the full content; this is lightweight and quick, easy to update, licensing-safe and

good for transparency, but URLs and institutional repositories often change structure over 6-year cycles, access is not guaranteed and the analytical potential is limited.

Two key decisions at this stage:

1. Given probably limited resources at the Platform level and the ongoing development of eLTER RI's Information System (Cyberinfrastructure), the first implementation of Part A of the PRIME Instrument will prioritise a metadata-only approach (Option 2 above). Local experts responsible for implementation should collect reliable web links and detailed metadata for each source, ensuring traceability and future integration once central storage systems are fully operational.
2. Since the first implementation will act as a pilot phase with limited resources, Part A will focus on a comprehensive (not systematic) review. This approach balances depth and feasibility, yielding valuable insights for defining governance boundaries, testing methods, and informing the design of a future, fully systematic review. In any case, the Steps below aim to ensure rigour and reproducibility by adhering to systematic standards, following transparent, in-depth search protocols, defining predefined inclusion/exclusion criteria, and providing rigorous metadata documentation.

5.1.1 Step A1 - Scoping

A1.1: Open a project folder structure on a secure, access-controlled local computer (mandatory) and institutional cloud storage (recommended). See suggested structure below.

Folder name	Contents / notes
`[Platform name]_SOSOC_032_[YYYY]/`	Root folder
└`1_Admin/`	Store here the formal permissions and safeguards that ensure that data collection, handling and reporting comply with ethical research standards (they vary across countries; standard components are the Institutional Ethics Approval from your university or research institute's ethics committee, GDPR compliance for EU data storage and processing, the informed consent form of Appendix C and a Data Sharing Agreement if integrating into eLTER RI; local permissions for region-specific data or archives are optional), and the signed informed consent forms of all actors participating in interviews
└`2_Data/`	Store here the three template files ('master database' – Appendix A, 'questionnaire' – Appendix A, 'raw data' – Appendix A), the .RIS exports of the source collections and the 'SE boundary' files; raw data and field materials go in the three subfolders
└`Sources/`	Downloading sources is not mandatory during the first implementation; difficult-to-access or at-risk sources may be stored here at the implementers' discretion
└`Boundary_GIS/`	Boundary geometries (Part B) and all Part F layers, datasets, metadata exports and maps
└`Interviews/[interview_id]/`	One secured subfolder per interviewee, named by 'interview_id' (the anonymisation code; see the 'Interviews' tab of the 'raw data' (Appendix A) file): recording, scanned or digital questionnaire with the Likert scores, scanned qualitative notes, transcript
└`3_Analysis/`	Store here the 'data analysis' file, the network outputs and maps, and the 'governance profile' document (Appendix B)

A1.2: Download the following template files from Appendix A to your local computer and mirror cloud storage, and save them in the '2_Data/' folder:

(a) '1_[Platform name]_SOSOC_032_master_database_[YYYY].xlsx' (hereafter 'master database' file).
(b) '3_[Platform name]_SOSOC_032_Part_D_questionnaire_[YYYY].docx' (hereafter 'questionnaire' file); to be adapted and translated as described in Step D1.2.
(c) '4_[Platform name]_SOSOC_032_Part_D_raw_data_[YYYY].xlsx' (hereafter 'raw data' file).

The 'governance profile' document is created in Part B from the outline in Appendix B, and the informed consent form is prepared in Step D1.3 from Appendix C; neither is a separate template.

A1.3: Familiarise yourself with the 'Sources' tab within the 'master database' (Appendix A) and its 'source_type' column (canonical, policy_legal, grey, media).

For example: review the examples in the first rows of the 'Sources' tab and enter some sources that you are familiar with (complying with the Inclusion/Exclusion criteria, see panel below). Once familiarised with the 'master database' (Appendix A), proceed to Step A2.

NOTE 1 - INCLUSION/EXCLUSION CRITERIA AND '_IDs'

(a) Applying the Inclusion/Exclusion criteria of Note 2 consistently is essential to ensure consistency, transparency and comparability in data collection across Platforms: clear criteria distinguish relevant from irrelevant sources, prevent bias and maintain methodological rigour.
(b) The Unique Identifier ('source_id') column of the 'Sources' tab, and in general any '_id' code across the files shared alongside the Instrument ('source_id', 'event_id', 'actor_id', 'interview_id'), are crucial to keep traceability, interoperability and data integrity across all Parts: they allow every source, actor, interview or dataset to be unambiguously referenced, linked and updated, enable cross-referencing between governance documents, actors and mixed-methods data for the integration in Part E, and support comparability across Platforms and time within the broader eLTER information infrastructure. Keep a consistent logic by following the '_id' numbering of the examples provided. At deposit, 'interview_id' serves as the EVENT_ID of the eLTER data-reporting format, whereas 'event_id' denotes a historical governance event (Section 9).

NOTE 2 - INCLUSION/EXCLUSION CRITERIA APPLICABLE FOR ALL STEPS BELOW

Inclusion (default)

- Documents produced within the established Platform's boundary and related to relevant historical processes
- Documents addressing governance, policy, institutions, land tenure/use, resource use, social groups, and economic activities that affect or are affected by the Platform's SES governance
- Scholarly work with transparent methodology and locational information
- Media and oral sources with verifiable provenance

Exclusion (unless justified):

- Materials lacking provenance (unknown author/date/location) unless corroborated.
- Purely anecdotal/unverifiable social media content (exception: if used to document public discourse and archived with provenance).
- Out-of-scope technical material (e.g., purely lab ecology with no social dimension), unless directly connected to governance.

5.1.2 Step A2 – Collection of sources by type

Four types of sources are collected in the single 'Sources' tab of the 'master database' (Appendix A), distinguished by the 'source_type' column: canonical documents (authoritative or key reference materials that describe the Platform's social-ecological context), policy and legal documents (official legal, regulatory and policy documents that give structure to the social-ecological context), grey literature (documents produced outside traditional academic or commercial publishing channels, containing valuable information) and media and oral sources (materials that convey information through public communication or personal accounts rather than formally published documents).

A2.1: For each type, collect reliable web links and detailed metadata for each source and save them in your preferred Reference Manager (e.g., Zotero, Mendeley, EndNote, etc.) compatible with .RIS format for exchange purposes, in one collection per type named 'Sources_canonical', 'Sources_policy_legal', 'Sources_grey' and 'Sources_media'. Examples and search strategies per type:

(a) Canonical documents. Examples of sources: peer-reviewed articles, relevant preprints, scientific-technical reports, regional environmental reports, theses, dissertations, NGO assessments, etc. Search strategy: for all sources, rely on your own expertise, local experts, databases, and web searches. For academic sources specifically, also run systematic searches in Google Scholar, Scopus, Web of Science, etc., as judged proper, using standardised keyword strings.

(b) Policy and legal documents. Examples: the most relevant regional or land-use plans, protected-area management plans, policy documents, and national/regional legislation/regulations affecting the Platform. Search strategy: rely on your own expertise, local experts, databases, and web searches. Fallback option: if any source material is too diverse or complex to collect, such as multi-level regulations or legislation, collect up-to-date regional plans and policies, or even research articles, where such legislative documents are documented/analysed and clearly referenced. Explain this choice in the 'methodological_note' column.

(c) Grey literature. Examples: government and agency reports, other relevant NGO publications, consultancy reports, policy briefs, white papers, conference papers or presentations, working papers, environmental impact assessments, project deliverables, etc. Search strategy: rely on your expertise, the knowledge of other local experts, and databases and web searches to collect only the most relevant sources for the Platform. Email local NGOs, universities, consultancies, etc., requesting reports.

(d) Media and oral sources. Examples: newspaper or magazine articles about local environmental issues; radio or TV reports or documentaries on conservation conflicts; online news portals or blog posts covering regional environmental debates; oral histories from local elders; diaries, etc. Search strategy: rely on your expertise, the knowledge of other local experts, and databases and web searches. Focus only on the sources most relevant to the Platform.

A2.2: Enter the collected sources one by one in the 'Sources' tab of the 'master database' (Appendix A), setting 'source_type' to canonical, policy_legal, grey or media and following the 'source_id' convention of the examples (the type prefix CNL, LEX, GRY or MED is kept in the identifier). Difficult-to-access sources or sources at risk of being taken down from the web can be stored in the '2_Data/Sources/' folder at the implementers' discretion.

A2.3 (important parallel task): Start listing potential interviewees that emerge from the source collection process (link to Part D).

5.1.3 Step A3 – Finalisation of sources in 'master database'

A3.1: Clean metadata, ensure Unique Identifiers 'source_id' are assigned to all collected sources.

5.2 Part B – Definition of the relevant social-ecological boundary and historical processes

Objectives: (i) to define clear spatial and temporal limits for the standard observation of social-ecological governance; (ii) to study and produce a timeline of key historical events shaping current governance.

BOX 2. PLATFORM BOUNDARY VS SUB-SYSTEM BOUNDARY

Two options are available for defining the social-ecological spatial boundary, which also influences the definition of the temporal frame. **Option 1, full Platform boundary:** for example the municipal aggregates, National Park borders or an eLTER-recognised polygon that covers the entire spatial extent of the LTSER Platform, aiming to capture the complete governance landscape and the interactions among all major social and ecological subsystems within the region. Advantages: region-wide governance overview, improved cross-Platform comparability, multi-level socio-ecological interactions, integration with eLTER datasets and indicators. Disadvantages: time and resource demanding, oversimplification of local dynamics, masking of internal heterogeneity, difficulties to engage all stakeholders at large scales. **Option 2, representative sub-system:** for example a watershed, valley or land-use cluster that is demonstrably representative of the main governance challenges faced by the broader region included in the Platform, allowing a detailed, resource-efficient assessment while maintaining relevance to platform-wide dynamics; its selection must include a justification of representativeness (e.g., geography, actors, land use, threat profile). Advantages: deeper analysis with limited resources, simpler data and stakeholder management, method testing before scale-up, pilot for full Platform rollout. Disadvantages: may miss external governance drivers, less representative of the full Platform, reduced comparability across regions.

Key recommendations at this stage (to be reassessed in future implementations):

1. For the first implementation, it is recommended that Part B focus on a representative subsystem (option 2 above), as this enables efficient testing of methods and data integration within available resources. The identification and selection of such a sub-system should consider data accessibility, stakeholder diversity, governance relevance and social-ecological representativeness, ensuring meaningful insights that inform future full-scale implementations.
2. However, Platforms may choose a complete boundary approach if conditions favour comprehensive coverage. These conditions include, for example, a manageable spatial scale (e.g., a small or well-defined Platform), existing integrated datasets and previous governance studies, adequate resources and staff capacity to handle broader data collection, and high policy relevance of cross-scale governance interactions.
3. The temporal frame is left to the discretion of implementers to allow for flexibility in capturing each Platform's unique historical context and governance evolution. As general guidance, it should be set by identifying key historical environmental and socio-political events that shape present governance configurations.

5.2.1 Step B1 – Scoping

B1.1: Familiarise yourself with the 'Events_log' and 'SE_boundary' tabs in the 'master database'. Then proceed to Steps B2 and B3, which can be performed iteratively, as the final decision on spatiotemporal scope (B3) depends on the progressive identification of historical events (B2).

5.2.2 Step B2 – Identification of candidate historical events

B2.1: Relying on your expert knowledge, Part A's canonical sources and local consultations if required, extract key events (legislation, land reforms, major policy shifts, environmental changes,

natural disasters, establishment of protected areas, industrialisation).

Suggested minimum lookback: 30 years, where feasible; longer if critical.

B2.2: Enter entries into the 'Events_log' tab of the 'master database' (Appendix A). Record 'event_id' and 'source_id' consistently.

B2.3: Use the 'Events_log' to identify structural legacies that influence current governance. Extract key events to set a synthesis timeline based on the most relevant social/environmental inflexion points. Try to select those that have the most significant bearing on current governance.

B2.4: Based on the key events extracted, build a succinct 1-2 page historical narrative in the 'governance profile' document (Section 1). Add a simple graphic outline of the timeline for rapid visualisation.

NOTE 3 – ABOUT THE TIMELINE

The historical timeline should aim for a minimum robust observation, not an exhaustive record. The focus should be on key social, environmental and governance events that have significantly shaped current governance dynamics. The goal is to ensure interpretive clarity, not complete historical coverage, within available time and resources.

5.2.3 Step B3 – Decision on spatiotemporal scope

B3.1: Document the selection of the social-ecological system or sub-system spatiotemporal scope using the 'SE_boundary' tab in the 'master database' (Appendix A). Write a short justification (2-3 paragraphs) in the 'governance profile' document (Section 2).

B3.2: Generate the complete Platform and sub-system polygon geometries in a GIS (QGIS suggested, not mandatory; link to Part F).

B3.3: Save the polygon geometries in shapefile/GeoJSON within your local '`2_Data/Boundary_GIS/`' folder. Name output files using the following convention: '[Platform name]_SOSOC_032_[system or sub-system]_boundary_[YYYY].shp' (hereafter referred to as the 'SE boundary' files). For the sub-system, the geometry can be approximated if there is no certainty on its biophysical or social limits.

5.2.4 Step B4 – Finalisation of events in 'master database'

B4.1: Clean metadata, ensure Unique Identifiers 'event_id' are assigned to all collected events.

5.3 Part C – Description of governance actors

Objectives: (i) to map and describe the core governance actors related to social-ecological governance within the LTSER Platform; (ii) to create a comprehensive catalogue of governance actors.

5.3.1 Step C1 – Seeding the actor list

C1.1: Familiarise yourself with the 'Actors' tab within the 'master database' (Appendix A).

For example: review the example in the first row of the 'Actors' tab and enter some actors that you are familiar with (see examples in panel below). Once familiarised with this, proceed to Step C1.2.

C1.2: Using local expertise, continue extracting actor names from the compiled sources to create preliminary entries in the 'Actors' tab of the 'master database' (Appendix A), including their 'source_id' (see example of actor categories in the panel below). The 'source_id' can be either (i) formal IDs from the 'Sources' where evidence on the actors was found, or (ii) adding "Expert judgement + [source]" if the reference comes from local expert knowledge.

EXAMPLES OF ACTOR CATEGORIES

- State actors: national agencies, regional authorities, municipal councils, protected area administrations, and enforcement agencies
- Market actors: companies (agricultural, forestry, fishing, tourism), utilities, investors
- Civil society: NGOs, community organisations, cooperatives, religious groups
- Research and education: universities, research stations, LTSER site managers
- Resource user groups: farmers, fishers, pastoralists, recreational users
- Under-represented groups: indigenous peoples, migrants, seasonal workers, low-income households, youth, women's associations, tenants/leaseholders
- Intermediaries and brokers: consultants, local champions, funders, social enterprises.

5.3.2 Step C2 – Adding formal registries

C2.1: Continue populating the 'Actors' tab from expert knowledge and compiled sources, and, e.g., from lists of public agencies, registered NGOs and companies from official registries.

C2.2: During Part D (interviews), use the snowball approach to ask for missing actors. You can also make ad hoc calls or emails, or continue asking key informants.

C2.3: For uncertain sources, try to validate entries with at least one other corroborating source per actor and flag uncertain records for follow-up.

5.3.3 Step C3 – Under-representation analysis

C3.1: Identify missing voices and add them to the 'Actors' tab (e.g., women, migrants, seasonal workers). Suggested steps:

a) Search through the compiled documents to look for mentions
b) Make contact with communities with low representation or marginal group representatives
c) Ask key informants to identify missing groups
d) Use poverty maps, demographic data and migrant worker locations to find likely absent groups
e) Optional: carry out focus groups (can be done within the 108-day window) to surface marginalised voices
f) Ethical safeguards: ensure informed consent, anonymity and local ethics approvals if/where required.

C3.2: Summarise the results (1-2 pages) in the 'governance profile' document (Section 3).

5.3.4 Step C4 – Finalisation of actors in 'master database'

C4.1: Clean metadata, ensure Unique Identifiers 'actor_id' are assigned to all collected actors.

6 Block 2 – Governance survey and profile (Parts D-E)

Block 2 is the core of the PRIME Instrument: Part D administers the mixed-methods questionnaire and runs the three analyses, and Part E synthesises them into the validated governance profile

(Sections 4-5 of the 'governance profile'). Part D can begin once Parts B and C are nearly complete; Part E follows Part D.

6.1 Part D – Governance survey and analysis

Objective: (i) to generate a baseline understanding of SES governance within LTSER Platforms, (ii) enabling cross-platform comparisons and informing standardised observation.

The following step-by-step implementation protocol can be flexibly run by two researchers over 60 days to: (i) administer the included questionnaire to $\geq$ 30 respondents (2 hours maximum; about 100 minutes with the core probes only), and (ii) run a lightweight, harmonised analysis of the quantitative, qualitative and network data gathered. The questionnaire contains complete modules for each of the frameworks described in Section 1.3; B-type probes are tiered into core and optional (Table 3).

Suggested team: Interviewer 1 (lead interviewer/analyst), Interviewer 2 (note-taker/recorder/data entry).

6.1.1 Step D1 – Preparation and piloting: getting ready, adapting and planning fieldwork

D1.1: Familiarise yourself with the relevant files stored in your '2_Data/' folder: 'questionnaire' (Appendix A) file and 'raw data' (Appendix A) file.

D1.2: Using the 'questionnaire' file (Appendix A), adapt it to the semi-structured interviews to be carried out in your Platform. Read carefully the note below on adapting the questionnaire, and then follow the next three steps:

a) Review the complete questionnaire's core questions and examples. Then, if required, adjust the questionnaire and the examples provided for the focal system/subsystem and the social-ecological boundary of your Platform (chosen in Part B) minimally
b) Under the core questions, add any other qualitative context-specific questions deemed necessary for your local context. See instructions in questionnaire file
c) Once finalised, translate the questionnaire into the local language if necessary, since some respondents might not feel comfortable working in English. Keep a bilingual master (English and the local language side by side in the 'questionnaire' file), record who translated it, keep the Likert anchors fixed to one standard translation of the five labels, and record the language of each interview in the 'Interviews' tab

NOTE 4 – PLACE-BASED ADAPTATION OF THE QUESTIONNAIRE

The questionnaire is provided in a general, modular form so that LTSER Platform managers and local experts can adapt it to their specific governance contexts, ecological characteristics and pressing social-ecological challenges, since governance operates differently across socio-political, cultural and environmental contexts and locally informed adaptation enhances validity, participation and learning. At the same time it is a standardised instrument: keep the overall structure and the Likert wording consistent throughout, so that all respondents across Platforms interpret and answer the core questions in the same way and differences in results reflect real variations in governance rather than differences in phrasing. Adapt by adding qualitative context-specific questions that address unique governance challenges, ecosystem characteristics or institutional arrangements; place them after the core questions and mark them as "Platform specific". This maintains a shared baseline for cross-Platform analysis while capturing locally relevant governance dynamics.

D1.3: Ethical setup. Prepare the informed consent form from Appendix C as a Word document, add your institutional logo if required, and save one personalised copy per interviewee as '[interview_id]_informed_consent.docx' (hereafter 'informed consent' forms); signed forms are stored in '1_Admin/'.

D1.4: Identify key actors. Prepare a list of at least 30 respondents in the 'Interviews' tab of the 'raw data' (Appendix A) file. Try to cover the main governance sectors through judgment sampling from the actor list produced in Part C (policy, management, research, NGOs, underrepresented communities). Include diverse power levels and perspectives.

D1.5: Pilot and revise. Test the interview with one or two local actors, as required, to check the flow, clarity, and timing. Revise minor wording, but not question structure or Likert scales.

D1.6: Prepare tools. Get the 'questionnaire' (Appendix A) and 'raw data' (Appendix A) files ready. Check that your '2_Data/Interviews/' folder is ready to receive one secured subfolder per interviewee, named by 'interview_id', for recordings, backup scans and transcripts.

NOTE 5 – ETHICAL USE OF AI-BASED TRANSCRIPTION SOFTWARE

Automated (AI-based) transcription and translation services reduce the cost of processing recordings and may be used under the following conditions.

(a) Consent: the consent form (Appendix C) states that the recording may be transcribed with software; a respondent who objects is transcribed manually or from the notes.
(b) Service: use only a service approved by your institution, with a data-processing agreement, servers in the EU or in a jurisdiction with an adequacy decision, no retention of uploaded files and no use of them for model training; never upload recordings to free consumer tools or to tools whose terms allow reuse of the content.
(c) Pseudonymisation: upload files named by 'interview_id' only; delete the uploaded files and the transcripts from the service once retrieved; store the transcripts in the interviewee's subfolder (Step D3.2).
(d) Verification: the recording remains the primary record; check every transcript against it for names, numbers, negations and technical terms, and mark unclear passages rather than guessing; translate only what the analysis needs, such as quoted excerpts.
(e) Scope: use these tools for transcription and translation only; coding, theme building and interpretation (Analysis 2, Part E) are done by the analyst, so that coding remains comparable across Platforms.
(f) Record: note the tool, its version and the date in the 'transcript_file' entry of the 'Interviews' tab or in the 'Adaptation_log' tab.

D1.7: Schedule interviews. Contact all actors and arrange appointments for approximately the next 50 days. IMPORTANT: send them the personalised 'informed consent' for signature and a copy of the 'questionnaire' (Appendix A) in advance so they can prepare for the interview.

6.1.2 Step D2 – Interviews: complete all interviews

NOTE 6 – INTERVIEW MODALITIES

1. Questionnaire in printed copies vs digital tablet

Mode	Advantages	Limitations
Printed copies	Easy to use in remote locations, no technical failures, and comfortable for respondents unfamiliar with digital tools	Manual data entry and transcription workload, higher risk of entry errors, scanning burden, and risk of physical loss or damage
Digital tablets	Immediate data capture, reduced transcription error, easier consistency checks, secure storage, quicker data transference	Sensitive to battery, may be uncomfortable for some respondents, less flexible for drawing or annotating

Recommendation: Use digital tablets where feasible for efficiency and data quality, but keep printed copies as a fallback, especially when respondents prefer paper.

2. In-person vs online interviews: Whenever possible, the questionnaire should be administered through in-person interviews. This format helps to build trust, clarify questions on the spot, and capture richer qualitative insights. If in-person interviews are not feasible with some actors, fallback options include:

- Video calls (e.g., Zoom, Teams) – preferred remote option for maintaining interaction
- Phone interviews – suitable when internet connectivity is poor
- Fallback options must follow the same ethical and recording procedures.

D2.1: Before each interview, get all necessary materials/tools checked and ready. Depending on local resources and conditions (see Note 6), a digital tablet or printed copies of the questionnaire can be used. In any case, please ensure the interviewee has a copy of the questionnaire during the interview.

D2.2: Before each interview, complete 'interview_id', 'interviewer', 'date', 'time' and 'location' in the 'Interviews' tab and also note them in your printed or digital copies of the questionnaire.

D2.3: During each interview (2 hours max.), follow the next steps:

a) Collect the 'informed consent' signed and confirm consent. Emphasise voluntary participation and anonymity of responses
b) Introduce purpose and respond to any doubt the respondent may have at the beginning
c) Record audio if consent is given. If no consent is given, focus on taking detailed notes and emphasise that these will be anonymised
d) Provide the respondent with a copy of the questionnaire so that they can follow the questions and Likert scales as they are asked
e) Go through all the modules, reading first each quantitative question (A-type questions) and examples
f) Record the respondent's score (1-5)
g) After each quantitative question, read the qualitative probe (B-type question) if it is a core probe (Table 3); read an optional probe when the respondent scores 1 or 5, volunteers an example, or time allows. Invite short responses and examples
h) Take detailed notes for the B-type questions (as a backup for the audio file and for rapid access during analysis).

6.1.3 Step D3 – Data storage and processing (CRITICAL ACTIONS): Immediately after each interview, follow the steps below in the 'raw data' (Appendix A) file

D3.1 – Interview list: register interview and clean metadata in the 'Interviews' tab, ensuring Unique Identifiers (see Note 7 on cleaning data).

D3.2 – Recordings: upload each recording to the interviewee's subfolder '2_Data/Interviews/[interview_id]/'. Follow the name convention provided in the 'Interviews' tab, 'recording_file' column.

D3.3 – Data scans and digital storage:

a) Scan printed copies or store digital files from each interviewee questionnaire, including their Likert scores, uploading a copy to the interviewee's subfolder '2_Data/Interviews/[interview_id]/'. Follow the name convention provided in the 'Interviews' tab, 'quant_scan_file' column.
b) Scan printed copies of the qualitative notes or store digital files for each interviewee and upload a copy to the same subfolder. Follow the name convention provided in the 'Interviews' tab, 'qual_scan_file' column.

D3.4 – Quantitative and network data processing: from each questionnaire, enter the following data in the 'raw data' file

a) Likert scores from quantitative questions (A-type questions, Modules 1-4). Use for each module its respective tab marked with the suffix '_quant' (e.g., 'Module1_SES_quant', 'Module2_STEER_quant', etc.). For items 33 (`PP_PD`), 35 (`PP_FR`) and 38 (`DP_DOM`) enter the score as given by the respondent; the tab reverse-codes it (6 minus the score) in the columns 'PP_PD_rc', 'PP_FR_rc' and 'DP_DOM_rc', which are the values used by the statistics and the analysis
b) Network data (Module 5) into the 'Edge_List' tab
c) Data from the qualitative probes (B-type questions, Modules 1-4) will be further processed in other steps below.

D3.5 – Finalisation of data processing (CRITICAL ACTION): Verify completeness, correct coding, consistent scales, duplicates and Unique Identifiers harmonisation. Perform as-needed data validation and metadata checks. See some general guidance in Note 7.

NOTE 7 – GUIDELINES FOR CLEANING DATA AND MAKING THEM READY FOR ANALYSIS

1. Maintain consistent coding and formats:
   - Use the exact item codes provided in the 'raw data' file template
   - Keep respondent IDs and, in general, all '_id' fields consistent
   - Enter all Likert-scale responses as numbers only (1-5)—no text, symbols or comments in those cells.
2. Check completeness and validity:
   - After data entry, scan for blanks or out-of-range values (i.e., anything not 1-5 in quantitative columns)
   - Highlight missing data and verify with interview notes before finalising
   - Ensure statistical (mean, SD, median) columns display a numeric average—if `#DIV/0!` appears, some values are missing.
3. Keep one record per respondent per module:
   - Ensure one respondent per row

- Do not merge or split responses across rows or modules.

6.1.4 Step D4 – Data analysis

D4.1: Get the 'governance profile' file ready.

D4.2 – From raw data to data analysis (CRITICAL ACTION): Make an exact copy of the 'raw data' file and save it in the '3_Analysis/' folder. Name it using the following convention: '[Platform name]_SOSOC_032_Part_D_data_analysis_[YYYY].xlsx' (hereafter 'data analysis' file).

NOTE 8 – DIFFERENCE BETWEEN THE 'raw data' AND 'data analysis' FILES

The 'raw data' file ('[Platform name]_SOSOC_032_Part_D_raw_data_[YYYY].xlsx') is used during and immediately after the interviews for data entry and cleaning: it is structured to enter responses directly from the questionnaire forms, ensuring consistent coding and numeric entry across modules, and it calculates module-level means automatically for rapid feedback. The 'data analysis' file ('[Platform name]_SOSOC_032_Part_D_data_analysis_[YYYY].xlsx') is a separate working file created as an exact copy of the 'raw data' (Appendix A) file after cleaning (D4.2); it is where coded notes, summaries, charts and tables for each governance dimension and brief interpretive notes per module are produced to inform the 5-7 page governance profile. Do not analyse in the 'raw data' (Appendix A) file.

D4.3: Perform a minimal quantitative descriptive summary of the information gathered through the A-type questions, following the procedure below.

Analysis 1 – Minimal quantitative descriptive summary

a) In the 'data analysis' file, check that descriptive statistics ('ModuleX_Mean', 'ModuleX_STD', 'ModuleX_Median') for each respondent within each module have been correctly calculated
b) Calculate overall averages (composite means for each module) and standard deviations for all modules, as summary indicators of how respondents perceive a particular governance dimension in an aggregated and comparable form; the per-item summary rows (n, mean, SD, median) at the foot of each '_quant' tab give the item-level values used in Step E1.1. Keep calculations in the 'data analysis' file at your discretion
c) Create radar and bar charts to get a quick visualisation of the governance assessment data and insights that are easy to interpret. Keep charts in the 'data analysis' file at your discretion
d) Before continuing to interpret or synthesise results further, perform the qualitative procedures described in Step D4.4 below. Synthesis interpretation approaches are proposed later in Part E.

D4.4: Categorise the information gathered through the B-type questions (qualitative probes), following the procedure below. This procedure follows a linear coding approach (see Box 3).

BOX 3. CODING APPROACH AND INTERCODER RELIABILITY

Since this is the first implementation of the PRIME Instrument under limited resources, the most likely scenario is that Platforms will rely on single coders with varying levels of training. Follow a **linear coding approach**: first assign initial codes, then group them into themes and subthemes, and only then interpret (Part E). It is slower and more rigid than an iterative approach, in which coders move flexibly between coding, categorising and interpreting, and cross-cutting patterns may emerge late, but it is clear and easy to document, enhances trans-

parency and replicability, and suits coders who are new or working alone when consistency and comparability are priorities and time and capacity are limited. The iterative approach, which demands experienced analysts and coordinated coders, is left for later rounds once intercoder reliability and shared coding frameworks are established. **Recommendation on intercoder reliability:** once the first implementation is completed at all Platforms, the network of Platforms should conduct an intercoder reliability exercise involving coders from all Platforms, to test the consistency of coding categories across contexts, refine a shared codebook and strengthen the comparability and scientific robustness of governance observations.

Analysis 2 – Minimal qualitative categorisation method

a) Prepare and review the transcripts and scanned qualitative notes from each participant, including responses to the qualitative probes (B-type questions), as well as notes from the platform-specific questions and other potential notes not recorded in the scanned files
b) Get ready to start the categorisation process across Modules 1-4 in the tabs with the suffix '_qual' within the 'data analysis' file
c) Initial coding: categorise responses using concise "codes" that capture the main ideas from respondents. To that end, for each module:
   - c1 Start in Module 1 (Module1_SES_qual), categorising notes from the first interview
   - c2 Record 'interview_id' (e.g., INT-LTSER-DNB-0001) and 'question_code' (e.g., SES_RS_BOUND)
   - c3 Although short responses to qualitative probes were requested during questionnaire administration, they might deal with different issues. Review the transcripts and the notes from the qualitative probe at hand (e.g., SES_RS_BOUND) carefully
   - c4 Prioritise the most relevant issue and write a summary of the verbatim response in 'summary_response'. If possible, record any 'illustrative_quote' verbatim that can be used in later reporting to give findings a voice and credibility
   - c5 Assign a short code to the summary in the 'initial_code' column (1-3 words). Codes should be close to the language used by respondents (descriptive, not interpretive). For example - Verbatim summary: "It is always difficult to know who is responsible for water allocation", Initial Code: Unclear Mandates
   - c6 Fill in 'response_id' using the following convention: SES_RS_BOUND_R1. If other relevant issues have been identified for the same qualitative probe, include up to three additional issues in new rows below, copy-paste previous columns from the above response, but assign a new 'response_id': SES_RS_BOUND_R2, SES_RS_BOUND_R3, SES_RS_BOUND_R4.
   - c7 Do not proceed further with the rest of the columns from 'theme' onwards (this is done in other steps below)
   - c8 Repeat c.2-c.6 for every core probe (Table 3) and for every optional probe that was asked, from SES_RS_BOUND to DP_SPEC_3, until Modules 1-4 have been finished. For probes that were not asked and for non-answered platform-specific, open-ended questions, do not add any row.
d) Thematic identification: identify themes and subthemes for all the summary responses and illustrative quotes extracted in the previous step. To that end, from Modules 1 to 4 and row by row for each previously coded response:
   - d1 Theme assignment: assign a preliminary 'theme' that represents the broader governance issue reflected by the responses and the 'initial_code' assigned. For example: Initial code: Unclear Mandates, Theme: Institutional coordination
   - d2 Subtheme refinement (optional, only if clear sub-themes can be identified): add granularity where needed by noting 'subthemes' that reflect specific aspects within a broader theme. For example: Theme: Institutional coordination, Sub-themes: Boundary definition, Jurisdiction overlaps, Cross-scale alignment, Mandate ambiguity

d3 Write a concise 'initial_interpretive_note' (1-2 sentences) explaining what the identified theme and subtheme reveal about governance

d4 Note observations or triangulation remarks in 'analyst_notes'.

e) Before continuing to interpret or synthesise results further, perform Step D4.5 below. Synthesis interpretation approaches are proposed later in Part E.

D4.5 (optional): Where local expertise and time allow, perform a minimum viable social network analysis, following the procedure below. The network data ('Edge_List', Step D3.4) are collected and cleaned in every PRIME implementation whether or not this analysis is run, so that it can be run later or across Platforms.

Analysis 3 – Minimum viable social network analysis

a) Network mapping. If possible, use free software (e.g., Gephi, R/igraph, Kumu) to visualise the network:

a1 Represent:

- Nodes = actors
- Edges = relationships (weighted by strength)

a2 In the resulting visualisation, label clusters or communities manually (e.g., "Science actors," "Local users," "Policy bodies").

b) Network construction. Before computing any metric, build the edge list as follows:

b1 Matching. Match every 'Target_Actor_Name' in the 'Edge_List' to an 'actor_id' in the 'Actors' tab. If the name is an organisation, use the organisation's 'actor_id'; if it is an individual, use the 'actor_id' of the organisation they represent, and note the individual in 'Notes'. Add any named contact absent from the 'Actors' tab as a new actor (Step C2.2). Record unresolved matches in 'Notes' and exclude them from the metrics.

b2 Node set. Nodes are all respondents plus all matched contacts. Flag each node as 'interviewed' (yes/no), since metrics for non-interviewed nodes rest only on ties reported by others.

b3 Layers. Keep the three activity types (NA_MON, NA_DEC, NA_INFO) as separate layers for the metrics in (c), and additionally compute a merged network in which a tie exists if it was reported in any layer, with 'Tie_Strength' taken as the maximum across layers. Report layer and merged results side by side; the merged network is the one used for the maps in (d).

b4 Directionality and reciprocity. Treat ties as directed from respondent to named contact. A tie is reciprocated only when both actors were interviewed and each named the other; compute reciprocity (optional) over the subset of dyads where both ends were interviewed, and report the size of that subset. The self-reported 'Directionality' field (UNI/BI) is kept as a node attribute of the reporting respondent, not used to infer the other party's tie.

b5 Reporting. For every metric in (c), report alongside it the number of respondents, the number of nodes, the number of interviewed nodes and the number of ties. Use density and normalised degree and betweenness (values in 0-1 or per cent) rather than raw counts, so that Platforms of different size can be compared.

c) Core metrics calculation (minimum viable set). Compute the following measures:

c1 Network density: proportion of actual ties vs possible ties, used e.g., to show overall connectedness of the governance system, computed on the merged network and on each layer; because the boundary is respondent-defined, density describes connectedness among the sampled actors, not of the Platform as a whole

c2 Degree centrality: connections per actor, used e.g., to identify key connectors or brokers in the system

c3 Betweenness centrality: how often an actor connects others indirectly, used e.g., to reveal

potential coordinators or gatekeepers

c4 Actor type distribution: count of actor categories (using the actor categories of Part C), indicating governance diversity and inclusiveness.

c5 Reciprocity (optional): % of ties reported in both directions among dyads where both actors were interviewed (see b4), used e.g., to explore mutual recognition and trust.

d) Generate the following outputs: (i) network map showing node size (degree centrality) and colour (actor category), edge thickness (tie strength) and, where useful, edge style or colour for tie type (collaboration, information sharing, etc.), (ii) annotated network map showing, for example, clusters of actors (e.g., research cluster, local landowners, public administration), separation between communities (silo structures), actors bridging or connecting clusters, etc., (iii) map highlighting central actors (highest degree centrality), brokers or gatekeepers (highest betweenness), and peripheral or isolated actors

e) Once the network analysis is done, or if it is not run, start Part E.

6.2 Part E – Synthesis into Platform Social-Ecological Governance Profile

Objective: to integrate quantitative patterns, qualitative insights and network structures into a coherent, comparable governance profile that highlights core governance issues, dynamics, strengths, challenges and opportunities.

6.2.1 Step E1 – Identify and synthesise the priority governance themes

E1.1: Extract a manageable set of governance patterns appearing consistently across quantitative, qualitative and network data in the 'data analysis' file and network outputs. Follow the next procedure:

a) Identify quantitative signals by looking at means, SDs and medians (from D4.3) and note them down in the 'governance profile' file (Section 4):
   - A low mean (<3) might reflect widespread governance weakness
   - High mean (≥ 4) might reflect governance strength
   - High SD (>1) might reflect contested or uneven experiences
   - Clusters of low scores across modules might reflect systemic issues
   - For Example:
     - *Role/leadership clarity issues: Mean = 2.7 and SD = 1.1 might reflect widespread ambiguity and disagreement*
     - *Trust issues: Mean = 2.8, SD = 1.1 might reflect uneven trust across actors*
     - *Data sharing issues: Mean = 4.0, SD = 0.6 might reflect consistently strong cooperation*

b) Review the list of qualitative themes and subthemes (from D4.4) and note down the most prominent ones in the 'governance profile' file (Section 4). Search particularly for:
   - Themes repeated across many respondents
   - Themes spanning multiple modules (e.g., trust appears in SES, STEER, power modules)
   - Themes strongly tied to governance processes (coordination, learning, power, inclusion)
   - For example:
     - *"It is difficult to know who is leading the response to the last floods" might reflect coordination/role clarity issues*
     - *"We trust data, but very often we do not trust each other", might reflect trust asymmetry*
     - *"Women and young farmers never participate in coordination meetings" might reflect exclusion/low representation*

c) Where Analysis 3 was run, review the network data (from D4.5) and note key insights down in the 'governance profile' file (Section 4). Search for:

- Which are the central actors? Who is peripheral?
- Are there silos (separate clusters)?
- Are underrepresented actors missing entirely?
- Is information flowing through diverse brokers or bottlenecked?
- For example:
  - *Two agencies dominate betweenness = power concentration*
  - *Local users and NGOs appear peripheral = weak participation/trust issues*
  - *Dense information network = strong collaboration capacity*
  - *Siloed clusters = low policy coherence*

d) Theme selection rule: select 8-10 themes that appear in at least 2 out of the 3 evidence sources to guarantee robustness; where Analysis 3 was not run, select themes that appear in both the quantitative and the qualitative evidence. Note them down in the 'governance profile' file (Section 4). For example: *Coordination and role clarity; Overlapping mandates; Trust asymmetries; Inclusion and participation; Knowledge and information flows; Power balance and dominant actors; Adaptiveness and learning; Cross-sector coherence; Resource fairness*

E1.2: Continue working in the 'governance profile' file (Section 4). Write an integrated paragraph for each theme finally selected to start creating a cross-Platform comparable narrative that synthesises quantitative, qualitative and network evidence. Use the following template for each theme:

a) First sentence: review the quantitative signals and state what respondents scored high/low and comment on variation. For example: *"Trust levels scored low (mean 2.8) and varied greatly across respondents (SD 1.1)"*

b) Second sentence: review the thematic qualitative insights and extract what respondents explicitly said. For example: *"Interviews revealed consistent references to uneven trust between municipal and regional actors"*

c) Third sentence (where Analysis 3 was run; otherwise omit): review the network observations and add structural evidence. For example: *"The network map shows many local NGOs at the periphery, reflecting the identified trust asymmetries"*

d) Fourth sentence: write a short interpretation by integrating the meaning of the above insights. For example: *"These results suggest that trust remains a central barrier for cross-scale coordination in the Platform"*

e) Thematic narrative: write a whole paragraph synthesising the previous four sentences. For example: *"Role clarity and coordination—Quantitative scores indicate that coordination and leadership roles are not clear across managing organisations (mean 3.1). Also, results show a notable variation among respondents (SD 0.9). Qualitative accounts consistently show that respondents think mandates for water resource management generally overlap and that there is uncertainty about who leads joint initiatives. Network results reinforce these perceptions. The results show structural fragmentation among key coordinating actors, notably weak links between local and regional institutions and other actors, such as citizen-led NGOs. Taken together, these patterns suggest that coordination in the LTSER Platform is operational but fragile, and highly dependent on specific individuals rather than institutionalised processes"*

6.2.2 Step E2 – Write and validate the final LTSER Platform Governance Profile

E2.1: In the 'governance profile' file (Section 4), write a 5-7 page Platform Social-Ecological Governance Profile including (i) a more elaborate interpretation of the 8-10 thematic narratives finalised in the previous step, and (ii) a 1-2 page final summary focusing on governance strengths, weaknesses, challenges and opportunities, which closes Section 4 (Section 6 of the profile is the half-page conclusion, Appendix B). The following simple structure can be used:

a) Overall strengths can be derived from high quantitative scores, positive qualitative themes and

strong network positions. For example: *"Data sharing processes are strong and supported by dense reciprocal exchanges among managing organisations and the civil society"*

b) Overall weaknesses can be derived from low means, negative narratives and network marginalisation. For example: *"Role ambiguity and mandate overlaps among managing organisations pose persistent coordination challenges and, in critical cases such as floods, severe coordination failures"*
c) Cross-scale or actor differences can be extracted from the thematic categorisations directly. For example: *"Regional authorities described coordination as effective, while local actors felt excluded from key decision-making processes"*
d) Priority governance challenges can be established based on frequency, severity and cross-data confirmation. For example: *Trust asymmetry; Power concentration in 2-3 agencies; Low participation of marginalised groups*
e) Governance opportunities can be established from integrative insights from all data sources. For example: *"Knowledge brokers connecting science, managing organisations, citizens and other local users, are key to support more inclusive learning processes"*

E2.2: Rapid validation. Confirm whether the profile generated reflects the actors' understanding of how governance actually works in the Platform, and identify any key gaps or inaccuracies. Follow the next procedure:

a) Prepare an online form including the following open questions:
   - What aspects feel most accurate or recognisable?
   - What seems missing, oversimplified, or unclear?
   - Are there any key actors, relations, or events that should be added?
   - Do you agree with how strengths and weaknesses are described? Why or why not?
   - In one sentence, how would you describe governance in this Platform?
b) Add additional questions if deemed necessary for the local Platform context
c) Through email, share the profile and the online form with 8-10 of the respondents interviewed and with 6-8 actors who did not participate in the interviews but can provide governance insights. In both groups, choose actors who represent different roles, including at least 1-2 actors each from a less-represented group.
d) Ask the actors to read the profile, reflect on it and respond to the questionnaire, and send it back within a stated deadline (e.g., two to three weeks). The focus can be, for example, on: the described main governance features (e.g., collaboration, learning, power relations), the interpretive statements (*"Governance is adaptive but fragmented"*), the network insights or actor roles. Ask them to underline or note anything that feels accurate/inaccurate, surprising or missing
e) Review all feedback and summarise common points (1-2 pages) in a separate section in the 'governance profile' file (Section 5).

E2.3: Store the final 'governance profile' in your local folder '3_Analysis/'.

7 Block 3 – Spatial extension (Part F, optional)

Block 3 is optional: Platforms implement it where local GIS expertise and time allow, and the PRIME Instrument is complete without it. Block 3 builds the GIS prototype of land property and tenure within the social-ecological boundary defined in Part B. It depends on the boundary geometries of Step B3 and on external data providers, can start once Parts B and C are nearly complete, and runs in parallel with Parts D and E.

7.1 Part F – GIS-based prototype platform for land property and tenure

Objectives: (i) to build a prototypical GIS platform for mapping and describing land property and tenure within each LTSER Platform, (ii) to support the future visualisation of governance-relevant spatial patterns, integration with other parts of the Instrument and with land-use data from other Standard Observations, and more advanced spatial analysis.

BOX 4. LTSER PLATFORM SCALE VS MANAGEABLE SUB-SYSTEM

Part F can be carried out either at the scale of the entire LTSER Platform or of a manageable subsystem that still captures relevant governance and property diversity. At **Platform scale** the extensive spatial area might exceed the capacity of the Platform in the allocated time; data access requires contacting several cadastral offices with heterogeneous formats and rules; property diversity is high but challenging to process comprehensively or meaningfully; GIS processing involves heavy, complex datasets, long processing time and higher technical risk; and governance patterns might become diluted by spatial complexity, although future iterations must allow for complex patterns. A **manageable sub-system** might be a better fit within available resources, with realistic data compilation and cleaning; it typically involves 1-2 data providers, giving faster and more consistent data acquisition; it can still capture a representative mix of property types; its smaller datasets ease harmonisation, projection and attribute checks; and it gives clearer spatial insights that directly support governance analysis, at least during the piloting phases.
Recommendation: For the pilot implementation phase of the Instrument, it is recommended that Platforms focus on a manageable subsystem rather than the entire LTSER spatial extent. A well-chosen subsystem (e.g., a watershed, a valley, or a cluster of municipalities) still captures essential ownership and property diversity while keeping workloads realistic.

7.1.1 Step F1 – Collect and prepare base layers

F1.1: Prepare and store all layers and datasets produced in Part B in the '`2_Data/Boundary_GIS/`' folder.

F1.2: Gather the essential spatial layers that describe the physical context of the chosen subsystem, following the recommendation provided in Box 4. Include the following:

a) SES boundary layer defined in Part B (complete Platform or selected subsystem)
b) Vector layers for municipality boundaries, district/province boundaries, protected area boundaries (if applicable) and other functional layers to spatially reference governance actors or jurisdiction overlaps
c) Standard reference layers to support Platform geographical understanding and mapping: rivers (hydrological) network, roads and major infrastructure, elevation/slope, etc.
d) For every layer, please record metadata using the template provided in the 'GIS_platform_metadata' tab within the 'master database'.

F1.3: Ensure all layers can be combined into a single analysis environment. Follow the next steps:

a) Check for geometry errors, fix invalid polygons, and remove duplicated features and empty attributes
b) Harmonise coordinate systems by reprojecting all layers into a single Coordinate Reference System (CRS). Recommended: ETRS89/LAEA Europe (EPSG:3035) for EU-wide consistency
c) Clip all layers to the SES boundary (clipping mask) to keep layers manageable and focused on the governance-relevant geography.

7.1.2 Step F2 – Compile property and ownership data

F2.1: Identify and collect relevant data sources. For example, information can be collected from:

a) Cadastral registries (national or regional)
b) Land parcel databases (e.g., national LPIS, but only if ownership fields exist)
c) Property tax offices
d) Municipal land records
e) Protected area administration data on public/state-owned parcels
f) Forestry or agricultural agencies (parcel ownership or lease arrangements)
g) Land consolidation agencies (if applicable in the country)

F2.2: Request and acquire the data using official request channels. If owner names cannot be shared, request, if possible:

a) Ownership type: public, private, municipal, state, NGO, collective, commons, church, corporate, foreign or absentee investor
b) Parcel ID
c) Notes on lease or management arrangements (if available)

F2.3: Convert cadastral data to GIS-ready format (shapefile preferred), linked to parcel IDs. If only textual records are provided, join them to parcel geometries using parcel ID.

F2.4: Create or harmonise the following minimum fields:

a) parcel_id (stable identifier)
b) owner_type (public, private, municipal, state, NGO, collective, commons, church, corporate, foreign or absentee investor: the same list as in F2.2)
c) tenure_form (freehold, lease, concession, usufruct—if data available)
d) institution_name (if public or institutional)
e) notes (uncertainties, missing values, discrepancies)
f) source (registry name and year)

7.1.3 Step F3 – Final maps

F3.1: Produce two simple maps to be included in the Platform's governance profile

a) SES Boundary Map, including SES boundary, municipal boundaries, protected-area boundaries and other key reference features deemed relevant depending on each Platform context (e.g., hydrological network, elevation, major infrastructure)
b) Tenure Map, including parcel boundaries, owner type and tenure form using distinct colours, legend and metadata.

8 Post-processing and harmonisation across Platforms

Harmonisation of results across LTSER Platforms is essential to ensure that the outputs generated locally can be meaningfully compared, aggregated and interpreted at the European level. After each Platform produces its quantitative summaries, qualitative categorisations, network outputs and governance profiles, all materials will be centralised in a shared repository for post-processing. This process will facilitate cross-checking of metadata and coding structures, as well as the reconciliation of methodological differences that may arise during local implementation.

Notably, Part D's questionnaire development risked losing place-based nuances and local realities, as well as introducing overlaps among frameworks and disciplinary biases. Therefore, the first

pilot implementation of the Instrument will be co-evaluated with implementers to inform future improvements to the questionnaire. The evaluation exercise will be mainly focused on (i) comparing whether and how each framework efficiently informed quantitative scoring and qualitative probes, (ii) discussing disciplinary biases and overlaps, (iii) potentially missing factors that might be key at local levels (are the frameworks aligned with local realities?), and (iv) assessing overall workload and implementation efficiency. This will help refine the questionnaire's next iteration and periodic updates reflecting new theoretical and methodological advancements.

9 Data and metadata format

Reporting is conducted in accordance with the rules and conventions specified in Peterseil and Geiger (2020) regarding file naming, file formats, and metadata scope. For this Standard Observation, the data consist of the three templates described in Part A (Excel workbooks for the 'master database' (Appendix A) and the Part D 'raw data' (Appendix A), a Word file for the 'questionnaire' (Appendix A)), the 'governance profile' document (Appendix B), RIS exports of the source collections, and boundary and parcel geometries as shapefile or GeoJSON in ETRS89/LAEA Europe (EPSG:3035). All records carry the unique identifiers defined in Note 1 ('source_id', 'event_id', 'actor_id', 'interview_id'). The general and the variable-specific metadata are set out in Tables 6 and 7. Fields marked 'to be confirmed' depend on the decisions on the repository and the access regime (Section 8).

Deposit package. The workbooks, the 'governance profile' and the GIS files are working files. What is deposited (Section 8) is a data package in the eLTER data-reporting format of Peterseil and Geiger (2020): CSV files in UTF-8, or one Excel file with one table per entity, named '[country code]_[site code]_SOSOC_GOV_[year]_V[YYYYMMDD]', with the DEIMS identifier of the Platform as SITE_CODE throughout. The mapping is: one STATION row per declared extent (Step B3.1; centroid in WGS84 and a GEOSPAT_FEATURE reference to the 'SE boundary' file); METHOD with one row per variable code (the 42 item codes and the network attributes), its description and its unit (dimensionless for Likert scores); DATA in row format, one row per score with VARIABLE equal to the item code, TIME equal to the interview date and EVENT_ID equal to 'interview_id', and one row per probe summary, code and network tie with text values; EVENT with one row per interview ('interview_id', dates, interviewer, mode); REFERENCE listing every code list used (source types, event types, actor categories and scales, probe tiers, tie attributes, Likert and trust scales), with the 'Sources', 'Events_log' and 'Actors' tabs as further reference tables; and LICENSE.TXT with the conditions of use. Dates are written in ISO 8601 throughout. Recordings, scans, transcripts and consent forms are never deposited (Section 4.2).

Table 6: General metadata for SOSOC_032

Field	SOSOC_032
SO name/code	SOSOC_032 Governance structure and character
Included variables	One variable, delivered as four data products: governance context (Parts A-C), governance survey (Part D), governance profile (Parts B, C and E), boundary and land tenure geometries (Parts B and F)
Data collection	Internally collected by the LTSER Platform, drawing on externally sourced documents, registries and cadastral data
Contact person	The Platform manager named in the title block of the 'governance profile' (Appendix B); eLTER-level contact to be confirmed
Keywords	Social-ecological governance; governance actors; institutions; power; polycentricity; discourse; social network analysis; land tenure; LTSER Platform

Table 7: Variable-specific metadata for the SOSOC_032 data products

Field	**Governance context** (Parts A–C)	**Governance survey** (Part D)	**Governance profile** (Parts B, C, E)	**Boundary and tenure geometries** (Parts B, F)
Identification				
Variable name	Sources, historical events, boundary and actors of SES governance	Likert scores, probe summaries and ego-network ties on SES governance	Platform Social-Ecological Governance Profile	SE boundary (Part B) and, where Part F is implemented, land tenure layers
Unit	One record per source, event and actor	Scores 1–5 per item and respondent; one coded summary per probe; one tie per named contact	Narrative text (pages)	Polygons with attributes
Resolution				
Legacy data available	No (first implementation)	No	No	Registry year recorded in 'source' (F2.4)
Temporal resolution	Every 3 years (BASIC and PRIME)	Every 6 years (PRIME)	Every 6 years (PRIME)	Every 3 years for the boundary; every 6 years for the tenure layers (PRIME, optional)
Spatial resolution	Platform or declared sub-system (B3.1)	As for governance context	As for governance context	Parcel, within the declared extent
Data format				
Data type	Tabular	Tabular; audio recordings and scans kept locally	Text	Vector
File format	XLSX ('master database', Appendix A); RIS	XLSX ('raw data', Appendix A); PDF scans; MP3	DOCX or PDF	SHP or GeoJSON, EPSG:3035
Geo-reference	No (scale of actors and events as text)	No	No	Yes
Collection method				
Data collection	Internally collected from externally sourced documents, registries and expert judgement	Internally collected	Internally collected	Externally sourced cadastral data, internally processed
Data holder	LTSER Platform; repository to be confirmed	LTSER Platform; repository to be confirmed	LTSER Platform; repository to be confirmed	LTSER Platform; repository to be confirmed
Data source	Part A sources, official registries, local expertise	Semi-structured interviews with at least 30 governance actors	Outputs of Parts B–E	Cadastral and land registries (F2.1)
Specific method	Document review and expert judgement	Interview panel: 42 Likert items with probes and an ego-network module	Narrative synthesis with triangulation and a validation round	GIS compilation
Method details	This protocol, Parts A–C; companion paper (Appendix E)	Part D and the 'questionnaire' (Appendix A); companion paper (Appendix E)	Part E and Appendix B; companion paper (Appendix E)	Part F
Processing				

Continued on next page

Table 7 continued from previous page

Field	**Governance context** (Parts A–C)	**Governance survey** (Part D)	**Governance profile** (Parts B, C, E)	**Boundary and tenure geometries** (Parts B, F)
Data harmonization	Controlled vocabularies and identifiers (Note 1; actor categories)	Fixed Likert wording; codebook; actor categories	Appendix B outline; 2-of-3 triangulation rule	EPSG:3035; 'owner_type' and 'tenure_form' lists (F2.4)
Data processing	Cleaning (A3, B4, C4)	Analyses 1–3 (D4): descriptive statistics, thematic coding, network metrics	Theme selection and validation (E1–E2)	Geometry checks, reprojection, clipping, joins (F1.3, F2.3)
Access and management				
Contact person	Platform manager (Appendix B title block)	Platform manager	Platform manager	Platform manager
Access	To be confirmed	To be confirmed	To be confirmed	To be confirmed
Access cost	To be confirmed	To be confirmed	To be confirmed	To be confirmed
Terms of use	To be confirmed	To be confirmed	To be confirmed	To be confirmed
Confidentiality	Personal data (actor names, contact details): GDPR applies; access to be confirmed	Pseudonymised by 'interview_id'; recordings, scans and consent forms stay with the Platform	Anonymised (Appendix C)	No owner names (F2.2)
Data contract	To be confirmed	To be confirmed	To be confirmed	To be confirmed
Keywords	As in Table 6	As in Table 6	As in Table 6	As in Table 6
Additional comment	First implementation is a pilot; deviations are recorded in the 'Adaptation_log' tab	As for governance context	As for governance context	As for governance context

References

Aggarwal, R. M. and J. M. Anderies (2023). "Understanding how governance emerges in social-ecological systems: insights from archetype analysis". In: *Ecology and Society* 28.2, p. 2. DOI: 10.5751/ES-14061-280202.

Biggs, R., H. Clements, A. de Vos, C. Folke, A. Manyani, K. Maciejewski, B. Martín-López, R. Preiser, O. Selomane, and M. Schlüter (2021). "What are Social-Ecological Systems and Social-Ecological Systems Research?" In: *The Routledge Handbook of Research Methods for Social-Ecological Systems*. Ed. by Biggs, R., de Vos, A., Preiser, R., Clements, H., Maciejewski, K., and Schlüter, M. 1st ed. London: Routledge, pp. 3–26. DOI: 10.4324/9781003021339-1.

Binder, C. R., J. Hinkel, P. W. G. Bots, and C. Pahl-Wostl (2013). "Comparison of Frameworks for Analyzing Social-ecological Systems". In: *Ecology and Society* 18.4, p. 26. DOI: 10.5751/ES-05551-180426.

Bodin, Ö. (2017). "Collaborative environmental governance: Achieving collective action in social-ecological systems". In: *Science* 357, eaan1114. DOI: 10.1126/science.aan1114.

Bodin, Ö. and B. I. Crona (2009). "The role of social networks in natural resource governance: What relational patterns make a difference?" In: *Global Environmental Change* 19, pp. 366–374. DOI: 10.1016/j.gloenvcha.2009.05.002.

Boone, H. N. and D. A. Boone (2012). "Analyzing Likert data". In: *Journal of Extension* 50.2, 2TOT2. DOI: 10.34068/joe.50.02.48.

Boyd, E. and C. Folke, eds. (2012). *Adapting Institutions: Governance, Complexity and Social-Ecological Resilience*. Cambridge: Cambridge University Press. DOI: 10.1017/CBO9781139017237.

Braun, V. and V. Clarke (2006). "Using thematic analysis in psychology". In: *Qualitative Research in Psychology* 3.2, pp. 77–101. DOI: 10.1191/1478088706qp063oa.

Chapin, F. S., G. P. Kofinas, and C. Folke, eds. (2009). *Principles of ecosystem stewardship: resilience-based natural resource management in a changing world*. New York: Springer. DOI: 10.1007/978-0-387-73033-2.

Clark, W. C. and A. G. Harley (2020). "Sustainability Science: Toward a Synthesis". In: *Annual Review of Environment and Resources* 45, pp. 331–386. DOI: 10.1146/annurev-environ-012420-043621.

Clement, F. (2010). "Analysing decentralised natural resource governance: proposition for a "politicised" institutional analysis and development framework". In: *Policy Sciences* 43, pp. 129–156. DOI: 10.1007/s11077-009-9100-8.

Clement, S., J. Jozaei, M. Mitchell, C. R. Allen, and A. S. Garmestani (2024). "How resilience is framed matters for governance of coastal social-ecological systems". In: *Environmental Policy and Governance* 34, pp. 65–76. DOI: 10.1002/eet.2056.

Cumming, G. S., G. Epstein, J. M. Anderies, C. I. Apetrei, J. Baggio, Ö. Bodin, S. Chawla, H. S. Clements, M. Cox, L. Egli, G. G. Gurney, M. Lubell, N. Magliocca, T. H. Morrison, B. Müller, R. Seppelt, M. Schlüter, H. Unnikrishnan, S. Villamayor-Tomas, and C. M. Weible (2020). "Advancing understanding of natural resource governance: a post-Ostrom research agenda". In: *Current Opinion in Environmental Sustainability* 44, pp. 26–34. DOI: 10.1016/j.cosust.2020.02.005.

Fetters, M. D., L. A. Curry, and J. W. Creswell (2013). "Achieving integration in mixed methods designs—principles and practices". In: *Health Services Research* 48.6, pp. 2134–2156. DOI: 10.1111/1475-6773.12117.

Fischer-Kowalski, M. (2015). "Social Ecology". In: *International Encyclopedia of the Social & Behavioral Sciences*. Ed. by Wright, J. D. 2nd ed. Amsterdam: Elsevier, pp. 254–262. DOI: 10.1016/B978-0-08-097086-8.91038-9.

Gale, N. K., G. Heath, E. Cameron, S. Rashid, and S. Redwood (2013). "Using the framework method for the analysis of qualitative data in multi-disciplinary health research". In: *BMC Medical Research Methodology* 13, p. 117. DOI: 10.1186/1471-2288-13-117.

Gaventa, J. (2006). "Finding the spaces for change: a power analysis". In: *IDS Bulletin* 37.6, pp. 23–33. DOI: 10.1111/j.1759-5436.2006.tb00320.x.

Hajer, M. A. (1995). *The Politics of Environmental Discourse: Ecological Modernization and the Policy Process*. Oxford: Clarendon Press. DOI: 10.1093/019829333X.001.0001.

Hörmann, B., V. Gaube, I. Charpentier, and L. Halada (2026). "eLTER Standard Observation protocol SOSOC_037 – Land Use". Version 0.3, October 2026, under review.

Jordan, A. (2008). "The Governance of Sustainable Development: Taking Stock and Looking Forwards". In: *Environment and Planning C: Government and Policy* 26, pp. 17–33. DOI: 10.1068/cav6.

Kooiman, J., ed. (1993). *Modern governance: new government-society interactions*. London: Sage.

Krosnick, J. A. (1999). "Survey research". In: *Annual Review of Psychology* 50, pp. 537–567. DOI: 10.1146/annurev.psych.50.1.537.

Lebel, L., J. M. Anderies, B. Campbell, C. Folke, S. Hatfield-Dodds, T. P. Hughes, and J. Wilson (2006). "Governance and the Capacity to Manage Resilience in Regional Social-Ecological Systems". In: *Ecology and Society* 11.1, p. 19. DOI: 10.5751/ES-01606-110119.

McGinnis, M. D. and E. Ostrom (2014). "Social-ecological system framework: initial changes and continuing challenges". In: *Ecology and Society* 19.2, p. 30. DOI: 10.5751/ES-06387-190230.

Méndez, P. F., F. Clement, G. Palau-Salvador, R. Díaz-Delgado, and S. Villamayor-Tomas (2023). "Understanding the governance of sustainability pathways: Hydraulic megaprojects, social-ecological traps, and power in networks of action situations". In: *Sustainability Science* 18, pp. 303–321. DOI: 10.1007/s11625-022-01258-0.

Méndez, P. F., F. Clement, M. G. Rivera-Ferre, S. Villamayor-Tomas, E. Oteros-Rozas, B. Hörmann, and V. Gaube (2026). "Observing governance structure and character in long-term social-ecological research: conceptual and methodological foundations of eLTER Standard Observation SOSOC_032". Companion paper to the SOSOC_032 protocol, manuscript in preparation.

Mirtl, M., E. T. Borer, I. Djukic, M. Forsius, H. Haubold, W. Hugo, J. Jourdan, D. Lindenmayer, W. H. McDowell, H. Muraoka, D. E. Orenstein, J. C. Pauw, J. Peterseil, H. Shibata, C. Wohner, X. Yu, and P. Haase (2018). "Genesis, goals and achievements of Long-Term Ecological Research at the global scale: A critical review of ILTER and future directions". In: *Science of The Total Environment* 626, pp. 1439–1462. DOI: 10.1016/j.scitotenv.2017.12.001.

Mirtl, M., I. Kühn, D. Monteith, J. Bäck, D. Orenstein, A. Provenzale, S. Zacharias, P. Haase, and M. Shachak (2021). *Whole System Approach for in-situ research on Life Supporting Systems*

in the Anthropocene (WAILS). Abstract EGU21-16425, EGU General Assembly 2021 (vEGU21), 19–30 April 2021. DOI: 10.5194/egusphere-egu21-16425.

Morrison, T. H., W. N. Adger, K. Brown, M. C. Lemos, D. Huitema, J. Phelps, L. Evans, P. Cohen, A. M. Song, R. Turner, T. Quinn, and T. P. Hughes (2019). "The black box of power in polycentric environmental governance". In: *Global Environmental Change* 57, p. 101934. DOI: 10.1016/j.gloenvcha.2019.101934.

Nikolaidis, N., D. Orenstein, P. Choler, J. Bäck, B. Barov, M. Brown, T. Dirnböck, J. Gaillardet, H. Haubold, S. Rennie, J. Watkins, M. Kaukolehto, and M. Mirtl (2021). *eLTER RI Strategic Plan*. Deliverable D1.1, EU Horizon 2020 eLTER PPP Project, Grant agreement No. 871126.

Norman, G. (2010). "Likert scales, levels of measurement and the 'laws' of statistics". In: *Advances in Health Sciences Education* 15.5, pp. 625–632. DOI: 10.1007/s10459-010-9222-y.

O'Cathain, A., E. Murphy, and J. Nicholl (2010). "Three techniques for integrating data in mixed methods studies". In: *BMJ* 341, p. c4587. DOI: 10.1136/bmj.c4587.

Ostrom, E. (2009). "A General Framework for Analyzing Sustainability of Social-Ecological Systems". In: *Science* 325, pp. 419–422. DOI: 10.1126/science.1172133.

Pahl-Wostl, C. (2009). "A conceptual framework for analysing adaptive capacity and multi-level learning processes in resource governance regimes". In: *Global Environmental Change* 19, pp. 354–365. DOI: 10.1016/j.gloenvcha.2009.06.001.

Pahl-Wostl, C., C. Knieper, E. Lukat, F. Meergans, M. Schoderer, N. Schütze, D. Schweigatz, I. Dombrowsky, A. Lenschow, U. Stein, A. Thiel, J. Tröltzsch, and R. Vidaurre (2020). "Enhancing the capacity of water governance to deal with complex management challenges: A framework of analysis". In: *Environmental Science & Policy* 107, pp. 23–35. DOI: 10.1016/j.envsci.2020.02.011.

Partelow, S. and K. Winkler (2016). "Interlinking ecosystem services and Ostrom's framework through orientation in sustainability research". In: *Ecology and Society* 21.3, p. 27. DOI: 10.5751/ES-08524-210327.

Patterson, J. J. (2016). "Exploring Local Responses to a Wicked Problem: Context, Collective Action, and Outcomes in Catchments in Subtropical Australia". In: *Society & Natural Resources* 29, pp. 1198–1213. DOI: 10.1080/08941920.2015.1132353.

Peterseil, J. and S. Geiger (2020). *eLTER PLUS – Field Specification for data reporting (1.0)*. Zenodo [Technical note]. Version 1.0. DOI: 10.5281/zenodo.6373410.

Pierre, J. and B. G. Peters (2020). *Governance, politics, and the state*. 2nd ed. Political analysis. London: Red Globe Press.

Popay, J., H. Roberts, A. J. Sowden, M. Petticrew, L. Arai, M. Rodgers, N. Britten, K. Roen, and S. Duffy (2006). *Guidance on the Conduct of Narrative Synthesis in Systematic Reviews. A Product from the ESRC Methods Programme*. Version 1. Lancaster: Institute for Health Research, Lancaster University.

Prell, C. (2012). *Social Network Analysis: History, Theory and Methodology*. London: Sage.

Reyers, B., C. Folke, M.-L. Moore, R. Biggs, and V. Galaz (2018). "Social-Ecological Systems Insights for Navigating the Dynamics of the Anthropocene". In: *Annual Review of Environment and Resources* 43, pp. 267–289. DOI: 10.1146/annurev-environ-110615-085349.

Rocha, J., C. Lanyon, and G. Peterson (2022). "Upscaling the resilience assessment through comparative analysis". In: *Global Environmental Change* 72, p. 102419. DOI: 10.1016/j.gloenvcha.2021.102419.

Saldaña, J. (2013). *The Coding Manual for Qualitative Researchers*. 2nd ed. London: Sage.

Tourangeau, R., L. J. Rips, and K. A. Rasinski (2000). *The Psychology of Survey Response*. Cambridge: Cambridge University Press.

Whaley, L. and E. K. Weatherhead (2014). "An Integrated Approach to Analyzing (Adaptive) Comanagement Using the "Politicized" IAD Framework". In: *Ecology and Society* 19.1, p. 10. DOI: 10.5751/ES-06177-190110.

Young, O. R. (2002). *The Institutional Dimensions of Environmental Change: Fit, Interplay, and Scale*. Cambridge, MA: MIT Press.

Zacharias, S., C. Schütze, S. Anttila, N. Cools, J. Bäck, K. Böttcher, P. Haase, I. Kühn, U. Mallast, and M. Mirtl, eds. (2024). *eLTER Standard Observations – variables (eLTER SO variables)*. Deliverable D3.4, version 1.4, 20 June 2024, EU Horizon 2020 eLTER PLUS Project, Grant agreement No. 871128.

Appendix

A Templates of the Instrument

The three templates used in Step A1.2 are embedded in this PDF. To access them, download the PDF and open it in Adobe Acrobat Reader, then click the links below or open the Attachments panel (paperclip icon) and save each file to your computer.

Note: Embedded files may not be accessible through browser-based PDF viewers. We recommend using Adobe Acrobat Reader.

Questionnaire for the semi-structured interviews – Download Word file:

SOC_032 Questionnaire (.docx)

Master database – Download Excel file:

SOC_032 Master Database (.xlsx)

Working file Part D raw data – Download Excel file:

SOC_032 Part D Raw Data (.xlsx)

B Outline of the 'governance profile' document

Create the 'governance profile' as a Word document, stored in '3_Analysis/' and named '[Platform name]_SOSOC_032_governance_profile_[YYYY].docx', with a title block (LTSER Platform, authors, affiliations, finalisation date, file name) and the six sections below. Page limits are maxima. The section numbers are the ones referred to in Steps B2.4, B3.1, C3.2, E1.1 to E2.2.

1. **Historical narrative (Part B).** Following Step B2.4, outline the key historical events influencing current social-ecological governance, linking ecological and institutional developments, and include a concise visual timeline of the main governance changes that influenced ecological components. 1-2 pages.
2. **Justification of the social-ecological spatial scope (Part B).** Following Step B3.1, describe the reasoning behind the selected spatial and temporal boundaries of the social-ecological system or sub-system chosen, justified by governance relevance, manageability and representativeness. 2-3 paragraphs.
3. **Summary of the under-representation analysis (Part C).** Following Step C3.2, summarise which actors or groups are under-represented in social-ecological governance, identify missing voices and possible barriers to inclusion, and suggest ways to enhance participation. 1-2 pages.
4. **Platform Social-Ecological Governance Profile (Part E).** Following Steps E1.1 to E2.1, record the quantitative signals (means, standard deviations, medians), the qualitative themes and subthemes and the network observations, the 8-10 themes selected with one integrated paragraph each, and develop the concise, balanced narrative that describes key governance structural patterns, strengths, challenges and opportunities, with every interpretation explicitly linked to the underlying evidence, and close with the 1-2 page summary of strengths, weaknesses, challenges and opportunities (Step E2.1). 5-7 pages.
5. **Profile validation (Part E).** Following Step E2.2, summarise the main insights gained from the validation process. 1-2 pages.
6. **Conclusions.** Summarise the most critical insights from the analysis, highlighting the Platform's key governance strengths, challenges and patterns, without introducing new data; integrate the main points from the quantitative, qualitative and network findings into a clear overall message, kept short, neutral and forward-looking. Half a page.

C Informed consent form

Reproduce the text below as a Word document per interviewee (Step D1.3), with your institutional logo if required, replacing the placeholders in square brackets; the four placeholders of the data-protection paragraph are completed once, with the data-protection officer, before the first interview. Signed forms are stored in '1_Admin/' and named by 'interview_id'.

[Platform name] Governance Interview – Consent to participate in research

Dear [Interviewee name],
Thank you so much for taking the time to meet with us for a governance interview. We really appreciate it. Before our interview on [date of the interview], we would like to first briefly describe our work, the purpose of our interview with you, and our ethics policy to obtain your informed consent.

Description of the eLTER RI Standard Observation of governance. Our interview with you is conducted in the context of the eLTER RI Standard Observation programme. In particular, this interview is part of the monitoring of governance across all the LTSER Platforms of the eLTER RI across Europe, conducted every six years. The programme's core objectives are to provide a core, harmonised set of variables and associated methods across LTSER Platforms to enable integrative research; to ensure broad spatio-temporal coverage by designing cost-efficient, feasible protocols that Platforms can implement over long periods; to facilitate cross-platform comparability and continental-scale synthesis through shared formats, standards and data interoperability; to support interdisciplinary and transdisciplinary research by linking the socio-ecological (anthroposphere) dimension with the geosphere, hydrosphere, biosphere and atmosphere; and to enable an adaptive infrastructure where observations evolve, protocols improve over time, and integrative research supports long-term sustainability science.

Purpose and format of the interview. Our interview aims to elicit insights into how governance structures, actor interactions and decision-making processes operate within the socio-ecological system of your LTSER Platform. The collected information will inform a governance profile of social-ecological governance and the overall Standard Observation programme of the eLTER RI. Such a profile will support a baseline assessment of governance structure and character, enabling both place-based insight and cross-Platform comparability. Your responses will help us understand how governance actors, power relations, information flows and institutional arrangements shape social-ecological outcomes in the region.

Ethics policy. Our research's ethics policy requires us to explain to you in advance that:

- Even if you agree to participate now, you can withdraw at any time or refuse to answer any question without any consequences of any kind.
- You can withdraw permission to use data from your interview within two weeks after the interview, in which case the material will be deleted.
- You have the opportunity to ask questions about the research.
- All information you provide for this study will be treated confidentially, anonymised, and securely stored in accordance with the General Data Protection Regulation (GDPR) and eLTER RI data-protection guidelines.
- Signed consent forms and original audio recordings will be retained in the secured databases, to which only the project's researchers will have access; they are never deposited in shared repositories.
- Anonymised data derived from the interviews (scores, summarised answers and network information without names) will be deposited in the eLTER RI data infrastructure for long-term research use.
- Unless you agree to be named in a published work (having reviewed or vetted content), in any report on the results of this research your identity will remain anonymous. This will

be done by changing your name and redacting any interview details that may reveal your identity or the identities of people you discuss.

- You are free to contact any of the people involved in the research to seek further clarification and information.

Data protection. The data controller for this study is [data controller: institution, address]. Questions about your personal data can be addressed to [contact for data-protection questions]. The legal basis for processing your personal data is [legal basis]. Your personal data (name, contact details, signed form, recording) will be kept for [retention period] and then deleted; the anonymised research data are kept indefinitely. You have the right to access, rectify or erase your personal data, to restrict or object to their processing, and to lodge a complaint with your national data-protection authority.

Based on the above policy, and with your permission, we will digitally record our conversation, and may transcribe the recording with secure transcription software, to capture your responses accurately and to avoid the distraction of taking copious notes. Please tick the boxes that apply and sign this sheet. Thank you again for your time.

The interviewee.

☐ I voluntarily agree to participate in this research and in this interview.

☐ I agree to the interview being digitally recorded.

☐ I agree to the recording being transcribed with secure transcription software.

☐ I agree to be named in published work, after reviewing the content that concerns me (optional).

Signature: _____ Name: [interviewee name] Date: _____

The researcher.

Signature: _____ Name: [researcher name] Date: _____

D Interface with eLTER Standard Observation SOSOC_037 Land Use

SOSOC_037 Land Use (Hörmann et al. 2026) observes land use at LTSER Platforms through two sub-variables: land-use statistics retrieved from European and national statistics (037-1) and the land-use system and its stakeholders (037-2), the latter through an expert-judgement questionnaire completed by the Platform manager with external experts every three years (BASIC) and, in its PRIME Instrument, about 30 in-depth interviews with owners or managers of farm and forestry holdings every six years. The two Standard Observations share their cycles and their implementing team, and they describe three objects twice: governance and land-use actors, land tenure and ownership, and land-use conflicts. This annex gathers, in one place, the recommendations for Platforms that implement both, so that each object is recorded once and read by both observations; the body of this protocol does not depend on it, and nothing in this annex applies to a Platform that implements this Instrument alone. It does not alter SOSOC_037, whose text is referred to in its version 0.3 (October 2026, under review) and must be checked against later versions. Table 8 lists the interfaces and the recommendation for each; Table 9 maps the stakeholder categories of SOSOC_037 onto the actor categories of Part C.

Table 8: Interfaces between SOSOC_032 and SOSOC_037 (version 0.3) and recommendations for Platforms implementing both

Object	In this Instrument	In SOSOC_037	Recommendation
Actor and stakeholder register	'Actors' tab (Part C): seven categories, scale, roles, 'decision_power', represented groups, under-representation	SOSOC_037 Appendix A, Section 1: stakeholder tables in four categories with functions, resources, power, interest and engagement degree; Section 3.6: interest and influence (1-5) of central stakeholders	Keep the 'Actors' tab as the single register. In Step C2.1, also record for each actor its land-use sector, main functions and degree of engagement in land-use governance ('land_use_sector', 'functions', 'engagement_degree') and flag the actors sampled for the SOSOC_037 interview panel ('in_037_panel'). Fill the SOSOC_037 stakeholder tables from the register using Table 9; where Part D is run, answer Section 3.6 from 'decision_power' and the Module 3 scores
Governance actors and mandates	Part A (policy and legal sources); Part C; Module 1 (governance system), Module 2 (coordination) and Module 3 (who sets the rules); 'governance profile' Sections 3-4	SOSOC_037 Appendix A, Sections 2.4 (extension, consulting and lobbying actors) and 2.5 (governance actors, mandates, legislation)	Answer Sections 2.4-2.5 by reference to the 'governance profile' and the 'Actors' tab rather than by a second description; where only SOSOC_037 runs, its expert description is the governance baseline
Land tenure and ownership	Part F (optional) parcel layer with 'owner_type' and 'tenure_form' (F2.4, whose owner list includes church, commons and foreign or absentee investors); Tenure Map (F3.1)	SOSOC_037 Appendix A, Sections 2.2 (tenure and ownership structure) and 2.3 (who manages the land)	Where Part F is implemented, write Section 2.2 from the Tenure Map and the F2.4 attributes; otherwise Section 2.2, like Section 2.3 (land managers), remains SOSOC_037 content with no counterpart here
Land-use conflicts	'Events_log' (Part B), whose 'event_type' list includes Conflict, with 'actors_involved'; item SES_I_CONFLICT and its probe; Part E themes	SOSOC_037 Appendix A, Sections 3.5 (conflicts and actors involved) and 3.6	In Step B2.2, record land-use and other governance conflicts as events of type Conflict, naming the actors involved, so that the 'Events_log' is the Platform's single list of conflicts; write Section 3.5 from it, and use the conflicts as prompts for the Platform-specific questions of the 'questionnaire' (Appendix A)

Object	In this Instrument	In SOSOC_037	Recommendation
Sustainability challenges and climate change	Items SES_RS_COND, SES_RELSYS and STEER_SESFIT (perceptions)	SOSOC_037 Appendix A, Sections 3.1-3.4; SOSOC_037 Appendix B, Sections 11-12	No shared data; in Step E2.1 cite the SOSOC_037 challenge catalogue instead of describing it
Interview campaigns (PRIME)	Part D: at least 30 interviews with governance actors, about 100 minutes with the core probes, every six years; recordings stored per interview (D3.2)	037-2 PRIME: about 30 interviews (minimum 20) with primary land users, about 90 minutes, every six years; MP3 at 192 kbps or better, transcribed and translated	Keep the two instruments and share the campaign. Run both series in the same year of the six-year cycle; in Step D1.4 draw both samples from the 'Actors' tab and flag the SOSOC_037 panel in 'in_037_panel'; schedule respondents who belong to both pools for two separate sessions rather than one merged interview; record both series in MP3 at 192 kbps or better in the language of the interview (Step D3.2), transcription being optional here and, where produced, kept in the language of the interview with the quoted excerpts translated; use one consent form (below), one coding environment and one archive
Narrative profiles	'governance profile' (Appendix B), Sections 3-4	Template-based narrative with four components: land-use system, land-use stakeholders, sustainability challenges and climate change, land-use conflicts	Nest them. In Step E2.1 do not describe the land-use system: cite the SOSOC_037 components on the land-use system and on sustainability challenges and climate change, and write Section 4 of the 'governance profile' so that it can be cited as the 'land-use stakeholders' component of the SOSOC_037 narrative
Source documentation	'Sources' tab with 'source_id' and 'source_type' (Part A); expert judgement recorded as a source (C1.2)	SOSOC_037 Appendix A Section 3.1: log of experts and credentials, literature and data links; SOSOC_037 Appendix A, Section 4	Keep the SOSOC_037 source log in the 'Sources' tab, with experts as a source type, so that both observations cite the same 'source_id'
Spatial extent	Full Platform boundary or representative subsystem (Box 2), declared in 'SE_boundary' (B3.1)	Whole Platform boundary	In Step B3.1 state in 'SE_boundary' whether the declared extent is the full Platform boundary or a sub-system and record the extent used by SOSOC_037; where this Instrument profiles a subsystem, say so in the SOSOC_037 narrative
Ethics and consent	Appendix C consent form; signed forms in '1_Admin/'; identifiers (Note 1)	SOSOC_037 Appendix: consent of external experts, anonymisation by structural attributes, audit trail, GDPR archiving	Use one consent form for both interview series: add to the first paragraph of the Appendix C form the sentence 'This interview is also part of the eLTER Standard Observation of land use (SOSOC_037), and the information you provide may be used for both'; consult the data-protection officer once for both
Reporting metadata	Section 9, Tables 6 and 7	Section 4, Tables 3 and 4	Tables 6 and 7 use the field structure of SOSOC_037 Tables 3 and 4; produce one metadata record per data product in each observation
Land-use statistics	Not collected; the political-economic settings of the SES Framework are delegated to other Standard Observations	037-1: farm structure and economic indicators from European and national statistics	Cite 037-1 for the farm-structure part of the delegated settings; markets, media and political stability remain uncovered

Table 9: Mapping of SOSOC_037 stakeholder categories onto the actor categories of Part C

SOSOC_037 stakeholder category (Appendix A, Section 1)	Actor category in the 'Actors' tab
1.1 Business and industry	Market actors; Resource user groups where the stakeholder is a primary land user (farm or forestry holding)
1.2 Governance and policy	State actors
1.3 Consulting and representation of interests	Intermediaries and brokers (consultants, extension and advisory services); Civil society or Resource user groups for representative associations, chambers and cooperatives
1.4 Science and research	Research and education
No counterpart	Under-represented groups, retained from Part C (Step C3)

E Companion paper

Méndez, Pablo F., Floriane Clement, Marta G. Rivera-Ferre, Sergio Villamayor-Tomas, Elisa Oteros-Rozas, Bastian Hörmann, and Veronika Gaube. 2026. "Observing Governance Structure and Character in Long-Term Social-Ecological Research: Conceptual and Methodological Foundations of eLTER Standard Observation SOSOC_032." Working paper, version 0.5, eLTER Research Infrastructure, October.

Observing governance structure and character in long-term social-ecological research: conceptual and methodological foundations of eLTER Standard Observation SOSOC_032

Pablo F. Méndez[1], Floriane Clement[2], Marta G. Rivera-Ferre[1], Sergio Villamayor-Tomas[3], Elisa Oteros-Rozas[4], Bastian Hörmann[5], and Veronika Gaube[5]

[1]*Institute of Innovation and Knowledge Management, INGENIO (CSIC-UPV), Universitat Politècnica de València, Valencia, Spain*
[2]*Dynafor, Toulouse University, INRAE, Castanet Tolosan, France*
[3]*Institute of Environmental Science and Technology, Autonomous University of Barcelona, Barcelona, Spain*
[4]*Department of Conservation Biology and Global Change, Estación Biológica de Doñana, EBD (CSIC), Sevilla, Spain*
[5]*Institute of Social Ecology (SEC), University of Natural Resources and Life Sciences (BOKU), Vienna, Austria*

Working paper, October 2026

Abstract

Governance is a key factor in the dynamics of social-ecological systems (SES) and in their prospects for sustainability transitions, yet it is rarely observed in a standardised, long-term and comparative way. This paper presents the conceptual and methodological foundations of eLTER Standard Observation SOSOC_032, Governance structure and character, a mixed-methods Instrument for the systematic observation of SES governance across the Long-Term Socio-Ecological Research (LTSER) Platforms of the eLTER Research Infrastructure. We set out the baseline conceptualisations of governance, SES and SES governance adopted; the four analytical frameworks combined in the Instrument (the SES Framework, the STEER Framework, the Polycentric Power Typology and Discursive Power) together with a minimum viable social network analysis; the six-part structure of the Instrument and the rationale of each part; the six-step procedure by which framework variables were translated into the Likert items and qualitative probes of the governance questionnaire; and the four analysis methods, in their minimal form, that turn the survey data into a comparable Platform governance profile. We close with the design of the first implementation as a pilot and the pathways through which the Instrument is expected to evolve. The operational protocol, templates and audit workbook are published separately as the Standard Observation itself.

Keywords: social-ecological systems; environmental governance; standard observation; eLTER; LTSER Platforms; mixed methods; social network analysis; power

1 Introduction

Understanding how governance of social-ecological systems (SES) operates today and its historical roots is fundamental to inform future capacities to change and adapt in the face of the uncertain effects of global environmental challenges on multiple scales (Fischer-Kowalski 2015; Boyd and Folke 2012). Indeed, governance is acknowledged as a key factor in understanding current SES dynamics and prospects for future processes of change (transitions, transformations, or pathways) towards sustainability (Muñoz-Erickson et al. 2016; Patterson 2016; Kellner 2021; Orach and Schlüter 2021; Muiderman et al. 2022; Rocha et al. 2022). Interventions to foster sustainability

must consider historical legacy and local arrangements of stakeholders, institutions, and power, configuring SES governance (Clark and Harley 2020). However, our understanding of current governance configurations and how they can be improved to address complex and uncertain environmental challenges remains limited (Aggarwal and Anderies 2023). eLTER Standard Observation SOSOC_032 addresses this general research gap, seeking to contribute to a general process of producing knowledge that enhances the understanding of SES governance in the local regions and landscapes delimited by LTSER Platforms. This knowledge has implications for relevant policies on a network-scale and upper-level governance components.

The eLTER Research Infrastructure (eLTER RI) observes social-ecological factors and variables within the Anthroposphere through Standard Observations, each defined by a variable of interest, a method of observation and a protocol guiding its implementation, and offered in a comprehensive PRIME and a streamlined BASIC version. SOSOC_032, Governance structure and character, is the Standard Observation of SES governance within eLTER's Long-Term Socio-Ecological Research (LTSER) Platforms. Its protocol (Méndez et al. 2026) adopts the term *Instrument* for the PRIME and BASIC methods, reserving 'method' for the analytical techniques used to collect, interpret and synthesise data, and contains the step-by-step procedure, the data templates and the implementation timeline. Platforms may implement the BASIC Instrument (Parts A-C: sources, boundary and historical processes, actors; every three years) or the PRIME Instrument (Parts A-F, adding a mixed-methods governance survey, its synthesis into a governance profile, and a GIS prototype of land tenure; every six years).

This paper is the companion of that protocol. It documents the conceptual and methodological choices behind the Instrument so that implementers, reviewers and future co-designers can trace every item of the governance questionnaire and every analytical step back to its sources: Section 2 states the design principles; Section 3 the baseline conceptualisations of governance, SES and SES governance; Section 4 the analytical frameworks combined; Section 5 the structure and rationale of the six Parts; Section 6.1 the derivation of the questionnaire; Section 7 the analysis methods; and Section 8 the design of the first implementation as a pilot and the pathways of future development.

This is an initial, foundational version of the paper: it accompanies the first, pilot implementation of the Instrument and records the design as it stands before that pilot. An implementation paper, reporting on the pilot and on the revisions it motivates, will be co-authored with the Platform managers and experts who take part in the pilot and are interested in contributing.

2 Design principles

The design of the Instrument is guided by three core principles.

2.1 WAILS as a conceptual umbrella

The Instrument is grounded in eLTER RI's Whole-system Approach for In-situ research on Life-Supporting Systems (WAILS) (Mirtl et al. 2018; Mirtl et al. 2021; Nikolaidis et al. 2021; Zacharias et al. 2024). WAILS provides the overarching conceptual foundation for integrating ecological, social and biophysical observations across scales. The WAILS foundation ensures coherence with other Standard Observations across the social, geo-, hydro-, bio-, and atmospheric spheres, thereby facilitating the complementary observation of processes and dynamics relevant to understanding SES governance as operationalised in this Instrument.

2.2 Context-sensitive and continuous improvement of harmonisation and standardisation procedures across LTSER Platforms

The theoretical concepts, methods, and procedures presented here—along with the selected factors and variables—constitute a baseline design for observing governance within Long-Term Socio-Ecological Research (LTSER) Platforms. This design is intended to evolve iteratively at each implementation of both the BASIC Instrument (every three years) and the PRIME Instrument (every six years). The aim is to establish a process of continuous improvement that balances comparability and local relevance through three interlinked pathways:

2.2.1 Stepwise integration of Platform-specific experience and knowledge

Each LTSER Platform provides valuable insights into SES governance through its ongoing and past research. Although this first version of the Instrument seeks to standardise observation, some observations may initially remain context-specific, shaped by distinctive socio-cultural or institutional settings. Over time, these specificities can be incorporated into the Instrument as their broader relevance becomes evident. The central question will be whether newly identified elements should become network-wide standards or remain Platform-level observations. Both options enhance the utility of the Instrument, supporting local analysis while informing higher-level synthesis, project design, and policymaking.

2.2.2 Integration of conceptual, methodological and technological innovation

This iterative approach enables the Instrument to remain adaptive to new developments in SES governance research—whether theoretical, analytical or technological. It also facilitates coordination with other components of the eLTER RI's Standardised Observation Framework and with the broader communities contributing to eLTER RI's integrative services.

2.2.3 Alignment with eLTER RI's approach to standardisation and harmonisation

Standard Observations must ensure both methodological rigor and flexibility, enabling reliable data generation while maintaining compatibility across diverse approaches. This document reinforces the role of standardisation (standard variables and observation methods) and harmonisation (integration of diverse data formats and disciplinary perspectives). Together, they create a robust foundation for long-term, context-sensitive governance observation, supporting gradual alignment across SES disciplines without undermining locally adapted data-collection practices.

2.3 Standard Observation of SES governance as method and approach

The Instruments outlined here not only define key governance factors but also provide an approach for identifying more specific governance data. Many of the factors included require qualitative pre-analysis, such as interview content analysis. This necessarily involves interpretation informed by the analyst's disciplinary background and theoretical orientation. Consequently, the Instrument can be understood as both a method in itself for systematically observing SES governance and an overall approach that provides a common framework to inform the diverse analytical approaches employed across LTSER Platforms. This meta-level structure ensures that the Standard Observation evolves alongside advances in social-ecological research, while preserving coherence and comparability.

3 Key concepts

3.1 Governance

There is no single, widely accepted conceptualisation of governance or a unified rationale for studying its dynamics in human-nature interactions. Instead, governance definitions depend on disciplinary traditions, research foci, and practical objectives. In the literature, governance is seen as a cause of or a solution to environmental problems and related injustices (May 2022). It is also seen as a mechanism that allows network-based ecosystem stewardship to respond to abrupt and unpredictable changes (Folke et al. 2005). Nonetheless, there is general agreement that understanding governance requires analysing its key components to trace historical influences, assess current functions and steer social-ecological systems (SES) towards sustainability. To ensure comparability across approaches, this document adopts a flexible, baseline conceptualisation of governance that can be further developed as the Instruments presented here are implemented, tested, and reviewed in light of new theoretical, disciplinary, and practical insights.

Governance is seen here as an umbrella concept encompassing phenomena such as corporate governance, public-private partnerships, inter-actor coordination, public management, and policy networks (Pierre and Peters 2020). Its conceptual and empirical observation is often obscured, either by conflating governance with theories explaining its operation (Pierre and Peters 2020) or by confusing its structural and dynamic aspects with normative views of how governance should function (Lo 2017). In this document, governance refers to the emergent patterns of multi-scale governing actions by governmental and non-governmental actors, private coalitions, scientific communities, and civic groups seeking to steer or manage socio-economic and environmental systems (Kooiman 1993). This conceptual foundation informs the operationalisation of the SES governance concept proposed here (see below), ensuring its applicability across diverse empirical and theoretical contexts. Although inevitably imperfectly, this document seeks to adopt a neutral stance on governance by acknowledging multiple disciplinary perspectives, balancing contrasting definitions, and focusing on an operational rather than normative conceptualisation. However, subtle implicit leanings emerge in its systems-oriented framing, which seeks to link governance to sustainability and performance.

3.2 Social-ecological systems

This document adopts a broad and integrative conceptualisation of SES, acknowledging diverse disciplinary perspectives on human-nature interactions (Ostrom 2009; Binder et al. 2013; Fischer-Kowalski 2015; Haberl et al. 2016; Liu et al. 2021; Manyani et al. 2024). SES are conceived as analytical constructs for understanding the complex, uncertain, and feedback-driven dynamics linking human and natural systems, which are interdependent and embedded within the biosphere (Reyers et al. 2018; Schlüter et al. 2019; de Vos et al. 2025). Rather than viewing society as external to ecosystems, SES are cohesive, integrated systems characterised by reciprocal interactions (Biggs et al. 2021). Recognising that emergent, system-wide patterns are difficult to predict from individual components due to feedback processes (Lansing 2003; Reyers et al. 2018), this conceptualisation highlights the need for knowledge production that engages with complexity and emergence (Preiser et al. 2018). Overall, this conceptualisation seeks to establish an evolving baseline that connects diverse schools of thought—such as commons studies, social and political ecology, resilience thinking and ecological economics—and aligns with eLTER RI's WAILS approach, while remaining open to future conceptual and disciplinary developments.

3.3 SES governance

Conceptualising SES governance for empirical and standardised observation is inherently complex, primarily due to two challenges. First, underlying theories often embed normative assumptions

about human behaviour that shape how human-nature dynamics are interpreted. Second, disciplinary specificity risks excluding key components emphasised by other approaches. Accordingly, this document adopts an iterative and neutral baseline definition to support future refinement. SES governance is understood as the structures and processes through which societal actors coordinate, allocate resources, resolve conflicts, and share power in managing ecosystems and natural resources (Young 2002; Jordan 2008; Chapin et al. 2009; Muñoz-Erickson et al. 2016; Méndez et al. 2023). Emphasis is placed on governance arrangements that promote collective action and the just and sustainable use of ecosystem services and natural resources (Brondizio et al. 2009; Muñoz-Erickson et al. 2016). Core governance attributes often align with "good governance" principles such as participation, accountability, representation, deliberation, empowerment, and social justice, as well as structural considerations, including networked, hierarchical, or polycentric arrangements (Lebel et al. 2006).

4 Governance frameworks underlying Instrument design

Understanding SES governance requires the integration of diverse theoretical frameworks to adequately address the interplay between social, ecological and institutional dynamics. No single framework can capture the full complexity of SES governance. A broad literature on adaptive and collaborative governance shows the value of improving the fit between governance structures and ecological realities, fostering collaboration and enhancing adaptive capacity (Folke et al. 2005; Lebel et al. 2006; Chapin et al. 2009; Garmestani and Benson 2013; Bodin et al. 2016; Carr-Kelman et al. 2023), and a growing body of work argues for combining analytical frameworks to that end (Binder et al. 2013; Koontz et al. 2015; Cumming et al. 2020; Ghodsvali et al. 2022; Aggarwal and Anderies 2023; Chu et al. 2023; Pichancourt et al. 2025). However, persistent challenges such as conceptual fragmentation, difficulties in operationalising integration and the need to address issues of power, equity and context-specificity, make such an integration a rather difficult challenge (Karpouzoglou et al. 2016; May 2022; Clement et al. 2024). The consensus is that integrating frameworks is an evolving process that must continually adapt to new insights and challenges through reflexive and context-sensitive processes.

The present Instrument thus acknowledges that understanding SES governance requires complementary lenses that help capture social-ecological structures and dynamics, power issues, causation and recurring systemic patterns. Therefore, **Part D of the Instrument—a mixed-methods governance survey and analysis—combines core constructs from key frameworks, seeking a parsimonious and interoperable basis for standardised observation of SES governance across LTSER Platforms.** This combination does not aim at being exhaustive. The goal is to establish a solid and practicable starting point for the systematic observation of SES governance. In line with the foundation of the Instrument's first implementation as a pilot, the proposed combination constitutes a means to test the feasibility and analytical value of an initial set of theoretical frameworks within a harmonised structure. The intention is not to capture every possible variable or nuance of SES governance, but to identify a coherent and functional set of factors and relationships that can guide comparable observations, while leaving room for place-based adaptation. Insights gained from this initial implementation will hopefully allow for progressive refinement, and the inclusion of additional frameworks or dimensions, as well as practical governance challenges identified by Platform actors. Next, a summary of the selected frameworks is included.

4.1 SES Framework

The Social-Ecological Systems (SES) Framework (Ostrom 2009; McGinnis and Ostrom 2014) provides a systematic approach for the diagnosis and comparison of governance settings across diverse resource systems, integrating social and ecological variables (Cumming et al. 2020;

Villamayor-Tomas et al. 2020; Hinkel et al. 2014; Partelow and Winkler 2016). It is widely used in interdisciplinary research and empirical studies for analysing collective action, institutional arrangements and sustainability outcomes in diverse sectors such as fisheries, coastal and marine systems, wildlife management and protected areas (Gain et al. 2019; Palomo and Hernández-Flores 2019; Dressel et al. 2018). The SES Framework facilitates comparative analysis, supporting both theory development and policy practice, through a multi-level ontology that helps systematically locate governance variables and their interactions (Partelow and Winkler 2016; Villamayor-Tomas et al. 2020; Unnikrishnan et al. 2023).

4.2 STEER Framework

The STEER Framework (Pahl-Wostl et al. 2020) constitutes an applied approach to uncover the root causes of coordination failures in water management contexts. The framework supports the development of innovative coordination mechanisms and cooperation strategies, directly informing water policy and management. Although focused on water issues, the STEER Framework emphasises the importance of bridging gaps between different sectors and stakeholders, making it a robust approach for addressing complex governance challenges at systemic level. STEER also foregrounds processes of learning and multi-level adaptation, which make it sensitive to governance dynamics rather than only static structures, which helps determine governance capacities in the face of complex changes (Pahl-Wostl 2009; Pahl-Wostl et al. 2020).

4.3 Polycentric Power Typology

The Polycentric Power Typology helps explain how different forms of power can shape goals, processes, and outcomes in governance (Morrison et al. 2019; Kellner et al. 2024). It has been applied to analysing SES governance, for example, in the climate, marine and inland fisheries sectors, revealing how power asymmetries can lead to both productive collaboration and governance failures (Morrison et al. 2019; Mudliar 2021; Kellner et al. 2024). The framework helps explain why similar polycentric structures can yield different outcomes, depending on how power is distributed and mobilised (Morrison et al. 2019; Carlisle and Gruby 2019). More specifically, it exposes how various forms of power (design, pragmatic, framing) operate within multi-centre governance systems, by helping detect who sets rules, who shapes practice, and how influence is exercised across scales. Two further items extend the typology: the visibility of power relations, drawing on the distinction between visible, hidden and invisible power (Gaventa 2006), and the enabling or repressive effect of power on inclusion and innovation, following the argument that power in polycentric systems can be productive as well as constraining (Morrison et al. 2019).

4.4 Discursive Power

Discursive Power refers to the influence that discourses can have on institutional arrangements, actor preferences and policy outcomes. Discourses are conceived as ensembles of ideas, concepts and categorisations, and more generally epistemic regimes that give meaning to social and physical realities, and which can shape how problems and solutions are framed (Hajer 1995; Clement 2010; Williams 2020). Notably, discourses are seen as a key factor vis-à-vis other key contextual variables such as rules and the political-economic context, to explain how power is exercised and distributed within governance systems (Clement 2010; Whaley and Weatherhead 2014; Vitale et al. 2020). Discursive Power can either reinforce or undermine existing rules and practices, while marginal discourses may struggle to gain traction unless institutional or contextual shifts occur (Clement 2010; Whaley and Weatherhead 2014; Vitale et al. 2020). This discursive lens complements the Polycentric Power Typology by examining how discourses structure whose knowledge counts and which options become thinkable. Module 4 operationalises this lens

through five items; two of them, the legitimacy accorded to local and traditional knowledge and the access of diverse actors to discursive arenas, draw additionally on the literature on invited and claimed spaces of participation (Gaventa 2006).

4.5 Minimum Viable Social Network Analysis

Social Network Analysis (SNA) is used to study social relationships and patterns among actors (individuals or organisations). SNA relies on mathematical, statistical and computational tools to model and analyse the network structure of social systems and their inner dynamics (Scott 1988; Wasserman and Faust 1994; Butts 2008; Borgatti et al. 2009). The present Instrument adopts a Minimum Viable SNA as a baseline for future, more comprehensive Social-Ecological Network Analyses (SENA). Given the diversity of LTSER Platforms and the limited time and resources available during the pilot phase, the first implementation of the Instrument is designed to allow for the systematic capture of essential relational data—actors, interaction types, directionality, and perceived trust. The resulting network is an aggregated ego-network: each respondent names up to six contacts per activity type (monitoring, decision making, information sharing), so the network boundary is defined by who was interviewed and whom they named, not by a census of all actors in the Platform. Network metrics are therefore descriptive of the sampled governance core rather than of the whole system, and are reported in normalised form together with the number of respondents and nodes, so that Platforms of different size and sampling intensity can be read side by side. The goal is to prevent excessive data demands on implementers or respondents, while ensuring an early harmonisation of data structures and coding schemes, and facilitating comparability across Platforms. This approach thus establishes the fundamental network architecture upon which more complex SENA—incorporating multiplex ties, dynamic properties and ecological linkages—can be built in later iterations of the Instrument (Sayles et al. 2019; Bodin et al. 2016; Bodin et al. 2019).

5 Instrument structure and rationale

The PRIME Instrument, and by extension the BASIC one, follows a multiple-case, mixed-methods approach to generate comparative, aggregated observations of SES governance. This overarching design meets three key criteria for integrating quantitative and qualitative data:

1. collectively, the data capture the complex, dynamic, and uncertain nature of SES governance, enabling cross-scale comparison across LTSER Platforms as case studies
2. they provide a robust baseline for eLTER RI SO-based services, supporting both ad hoc data needs and longitudinal research, and
3. they accommodate diverse user requirements for quantitative, qualitative or combined information.

This research design allows the data collected through the Instrument to be combined with results from other Anthroposphere Standard Observation protocols (e.g., economics, demography, resource use, land use, ecosystem services), thereby supporting holistic, multi-dimensional assessments of SES dynamics within LTSER Platforms. The Instrument consists of six parts, whose rationale is described below; the step-by-step procedure of each part is given in the protocol (Méndez et al. 2026), where the Parts are grouped in three blocks: governance context (Parts A-C, which constitute the BASIC Instrument), governance survey and profile (Parts D-E) and an optional spatial extension (Part F). Part F and the network analysis (Analysis 3) are optional in the pilot, subject to local expertise and time; the network data are collected in every PRIME implementation so that the analysis can be run later or centrally.

5.1 Part A – Search and collection of primary and secondary sources

Part A aims at identifying, collecting and cataloguing all relevant documentary and multimedia sources that describe the social-ecological and governance context of each LTSER Platform. It structures the search for primary (e.g., laws, regulations, plans), secondary (e.g., scientific and technical reports) and other contextual sources (e.g., media, interviews, grey literature). A rigorous, transparent approach ensures the collection of local credible and comprehensive evidence, while maintaining comparability across Platforms. This approach also aims at reducing bias in source selection, tracking provenance for reproducibility and ensuring inclusion of non-traditional and local knowledge sources (e.g., oral histories). This approach underpins all subsequent parts of the Instrument by providing a verifiable corpus of materials that reflect the multi-scalar, socio-ecological features and context of each Platform.

5.2 Part B – Definition of the relevant social-ecological boundary and historical processes

Part B aims at specifying the spatial and temporal frames of reference for the governance profile (Parts D and E). It integrates ecological, administrative and socio-economic mapping to contextualise LTSER Platforms governance structures within their historical trajectories. Establishing clear spatial and temporal boundaries is critical to allow for the analysis and comparability of governance observations. LTSER Platforms encompass overlapping jurisdictions and shifting land-use regimes. Therefore, delineating their historical dynamics is important to capture how land use and environmental change, resource management and political dynamics continue to influence current governance patterns. This part seeks to anchor governance observation within each Platform's social-ecological evolution, enabling both cross-site synthesis and reference to the distinct historical trajectories of each region.

5.3 Part C – Description of governance actors

Part C involves the systematic identification and description of governance actors affecting or being affected by environmental or conservation decision-making and resource use (public authorities, private entities, NGOs, research institutions, local communities, underrepresented or marginalised groups, etc.). Understanding who takes part in governance and how the different actors interact is foundational for assessing socio-ecological dynamics. Part C makes visible both formal and informal actors, revealing asymmetries in representation, authority and resource access. Inclusion of under-represented groups enhances the legitimacy and inclusivity of the overall assessment. By standardising actor descriptions, Part C ensures that each Platform's governance landscape can be compared and that structural biases, coordination gaps or success cases in local governance can be empirically detected.

5.4 Part D – Governance survey and analysis

Part D integrates semi-structured in-person interviews with baseline social network elicitation, to capture how actors, institutions and relationships shape governance within each LTSER Platform. Through focused semi-structured interviews, implementers will identify key actors, interactions, coordination mechanisms, learning processes and power relations. The approach merges insights from the frameworks described in Section 4 above. Part D also seeks comparative, reproducible analysis across Platforms, while ensuring theoretical rigour. The general goal is to establish a consistent foundation for external users looking for a robust image of local governance or wishing to perform more detailed social-ecological governance studies using their preferred frameworks, informed by the PRIME Instrument's outputs.

5.5 Part E – Synthesis into Platform Social-Ecological Governance Profile

Part E provides a structured approach for synthesising the quantitative, qualitative and network findings generated in Part D into a coherent Platform Social-Ecological Governance Profile. The approach relies on a narrative synthesis method that integrates multiple evidence types to reveal governance strengths, challenges and cross-scale dynamics. Part E allows analysts to identify recurrent governance themes, examine convergence and divergence across evidence sources, and finally produce a concise interpretive narrative. The resulting profile serves as an initial baseline for comparative SES governance research. It also seeks to create a foundation for deeper synthesis techniques in future implementation cycles.

5.6 Part F – GIS-based prototype platform for land property and tenure

Part F, optional in the pilot where GIS expertise and time allow, develops a minimal GIS prototype to map and document land property and tenure within each LTSER Platform: who holds the land (owner type), under what legal form (freehold, lease, concession, usufruct) and within which administrative and protected-area jurisdictions. Spatial representation of tenure is essential to understand how governance actors, property rights and jurisdictions intersect across the landscape. Part F integrates existing spatial datasets—such as administrative boundaries, cadastral records and reference layers—into a single georeferenced framework clipped to the social-ecological boundary defined in Part B. The GIS-based prototype visually represents governance-relevant spatial patterns and supports integration with the actor and institutional data collected in Parts C and D. The prototype seeks to ensure reproducibility, comparability and readiness for future spatial analyses, including the integration of land use and land cover from other eLTER Standard Observations, as eLTER's data infrastructure evolves. Over successive implementation cycles, this prototype will serve as a consistent reference for assessing spatial governance dynamics and tenure change.

6 From frameworks to questionnaire

Part D and Part E constitute the core part of the Instrument because they conjointly generate and systematise the primary empirical evidence, and transform it into an integrated governance profile that can be compared across Platforms. Together, Parts D and E help convert raw perceptions into actionable insights on SES governance issues and dynamics. They therefore deserve a separate section to explain how the frameworks described in Section 4 were integrated into Part D's questionnaire (Section 6.1) and how the resulting data are analysed to produce an LTSER Platform Social-Ecological Governance Profile in Part E (Section 7).

6.1 Derivation of Part D's questionnaire

The development of the mixed-methods questionnaire included in Part D followed an iterative process aimed at extracting operational questions and examples from the frameworks described in Section 4. As mentioned above, the overall goal was not to provide an exhaustive or definitive instrument. The goal was to establish a coherent and minimal, but robust foundation that could be refined in subsequent Instrument implementations. The followed procedure simplified complex, context-dependent governance processes into standardised items that were then included in Part D's questionnaire. Below, a brief description of the steps followed for framework integration is offered.

6.1.1 Step 1 – Framework scoping

Seminal works establishing core variables or dimensions of analysis for each conceptual framework were identified. These seminal works were then coded to identify 'core constructs'. These

constituted dimensions that were both essential to the theoretical integrity of each framework and observable in practice through actor interviews. The variable lists used were the SES Framework second-tier variables of Ostrom (2009) as revised by McGinnis and Ostrom (2014), the STEER framework variables of Pahl-Wostl et al. (2020), the three forms of power of Morrison et al. (2019), and a set of five discursive-power constructs synthesised for this Instrument from Clement (2010), Whaley and Weatherhead (2014), Vitale et al. (2020), and Williams (2020). The full audit trail, including the variables delegated to other Standard Observations (the social, economic and political settings S1-S7) or to Parts A, C and F and Module 5 of this Instrument, is kept in the frameworks-integration workbook that accompanies the protocol.

6.1.2 Step 2 – Extraction of core constructs and design anchors

Core constructs were translated into 'design anchors'. These constituted concise operational statements linking theoretical concepts to observable aspects of governance. The design anchors were then written to be general enough for application across diverse LTSER contexts, yet specific enough to elicit clear empirical observations.

6.1.3 Step 3 – Generation of quantitative and qualitative items

Each design anchor was transformed into two complementary items:

A-type questions, quantitative items expressed in Likert-scales: allowing respondents to self-assess the degree or intensity of the phenomenon. A positive phrasing for the Likert scales was chosen following two criteria: (i) to help standardise interpretation, (ii) to align responses toward comparable numeric polarity. The latter criterion sought to ensure that all Likert items score high for positive interpretations, thus allowing for more consistent interpretation, easier averaging and reliable cross-item comparison. Uniform positive keying was preferred over a mix of positively and negatively worded items, even though mixed keying is the usual remedy against acquiescence bias (the tendency to agree regardless of true opinion), because reverse-keyed items add scoring errors and translation ambiguity in a multi-lingual setting. The resulting exposure to acquiescence is mitigated by pairing every A-type item with a B-type probe that asks respondents to substantiate their score with concrete examples (Krosnick 1999; Tourangeau et al. 2000). Three items keep a wording in which a high score denotes concentration or dominance (PP_PD, PP_FR and DP_DOM); their scores are reverse-coded at data entry, so that the analysis treats all 42 items alike, and the wording will be reconsidered after the pilot.

B-type questions, qualitative probes designed to capture narratives: examples and contextual clarifications directly from respondents. These probes aimed at helping uncover the how and why behind quantitative (numeric) responses.

Probe tiering in the pilot configuration. Asking all 42 probes in every interview would produce, for 30 respondents, on the order of 1,260 coding units for a single coder. In the pilot configuration the protocol therefore tiers the probes: 16 core probes, at least one per sub-dimension, are asked in every interview, and the remaining 26 are asked when the respondent scores 1 or 5, volunteers an example, or time allows. The extreme-score trigger keeps the mitigation of acquiescence bias where it matters most, since agreement bias manifests as inflated high scores, while the per-sub-dimension coverage preserves the qualitative anchoring of every construct. Core probes were selected where the construct is hardest to interpret from a score alone (power, discourse, rules and their enforcement) and where the answers feed the cross-checks with Parts B and C and with the network data. The tier is reversible: optional probes remain in the questionnaire, and the pilot record will show which of them were asked and which produced material used in Part E.

6.1.4 Step 4 – Contextual examples and coding tags

Three or four examples per question were drafted to provide interpretive guidance to both respondents and interviewers. These examples sought to reflect a range of situations across social, ecological and/or institutional contexts. Each question was assigned a code tag (e.g., `SES_GS_RULES`, `STEER_LEARN`) to allow for systematic data handling and cross-Platform comparability.

6.1.5 Step 5 – Cross-framework harmonisation

Constructs with conceptual overlap were aligned to ensure terminological and analytical coherence. Where frameworks diverged, both perspectives were retained, recognising that governance processes are multi-layered and can often have dual conceptual entry points. These steps sought to minimise overlaps while preserving the specific interpretive lens of each framework. They also allowed for a minimum level of redundancy to enhance data reliability and validity and mitigate response bias.

6.1.6 Step 6 – Standardised questionnaire

Core constructs, design anchors, quantitative and qualitative items, and illustrative examples were cross-checked for conceptual fidelity and clarity to achieve balanced coverage of governance dimensions across diverse contexts; these can be refined after pilot implementation.

7 Data analysis methods: from survey data to governance profile

A complete governance analysis typically requires extensive time, multiple coders, advanced triangulation, and participatory validation. The procedure for analysing data gathered through Part D's questionnaire combines four methods in a fundamental form, seeking to optimise local resources at each Platform. First, (i) a minimal quantitative description and (ii) qualitative categorisation are performed, followed by (iii) a minimum viable social network analysis. Results from those methods are then processed to produce (iv) a final governance profile narrative synthesis, which is done in a separate part of the Instrument (Part E, Section 5.5).

This four-part, mixed-methods approach seeks to produce a coherent, credible and resource-efficient understanding of SES governance in LTSER Platforms through complementary evidence streams. Results from the quantitative summaries seek to highlight broad tendencies and divergences, while qualitative categorisation seeks to capture nuance, meaning and contextual depth. Then network analysis seeks to reveal the potential structural relationships that shape local coordination, power relationships and information flows.

The final narrative synthesis integrates results from the previous three (quantitative, qualitative and network) methods, enabling Platforms to generate a robust and comparable governance profile. The first (pilot) implementation of the Instrument aims only to produce a baseline that:

1. captures the main governance patterns without exhaustive analysis,
2. can be applied by a single coder under resource constraints,
3. produces structured outputs that can be compared across Platforms, and
4. leaves space for further development in future implementations (e.g., intercoder reliability, participatory feedback loops, advanced modelling)

Next, a brief description of the methods used is offered.

7.1 Minimum quantitative description of Likert responses (A-type questions)

Quantitative indicators from the A-type questions Likert scales are summarised using simple but robust descriptive statistics (mean, standard deviation and median), to provide aggregated signals of how respondents perceive governance issues as reflected in the 'design anchors' mentioned above. Such anchors stem from the four frameworks described in Section 4, which are integrated in Modules 1-4 of Part D's questionnaire (Module 5—SNA—required a different approach, see below). This design seeks to offer a minimalist and informative set of signals that can be compared across Platforms, while avoiding model-heavy interpretations. Statistics are computed per item and summarised per sub-dimension; module-level means are reported only as a coarse overview. The signals are:

- means can offer a standardised profile of strengths and weaknesses,
- standard deviations help to identify areas of disagreement or uncertainty,
- medians seek to provide stability where distribution skew may occur (Norman 2010; Boone and Boone 2012).

7.2 Minimum qualitative categorisation (B-type questions)

Interview notes from the B-type qualitative probes are coded using an initial descriptive coding pass, during which coders assign short codes to summaries of verbatim responses from interviewees, staying close to their language (Saldaña 2013). Codes are then categorised into themes and subthemes through a lightweight thematic analysis in its codebook form (Braun and Clarke 2006; Gale et al. 2013) that allows coders to capture governance patterns, as well as the interviewees' perceptions on barriers, strengths and opportunities. This approach emphasises consistency, transparency and parsimony (Miles et al. 2014), in a context where the most probable scenario is a single-coder implementation under limited resources.

7.3 Minimum viable social network analysis

A minimal SNA approach (Bodin and Crona 2009; Prell 2012) is applied to capture the most basic structural features of governance through simple and interpretable metrics. In this basic structure, nodes represent actors and edges reflect collaboration ties and strength as perceived by respondents. Running the analysis is optional in the pilot, subject to local expertise and time; collecting the network data is not. Three essential metrics are calculated: density (connectedness), degree centrality (key connectors) and betweenness centrality (potential brokers) (Bodin and Crona 2009; Prell 2012; Bodin 2017). Also, metrics such as reciprocity and actor-type diversity measures can complement the picture if time and resources are available in the Platform at the time of analysis. This minimal set of metrics is sufficient to reveal governance configuration patterns without requiring full-scale SNA expertise or computational tools.

7.4 Narrative synthesis for the governance profile (Part E)

The final governance profile is developed by integrating results from the previous three methods through a narrative synthesis approach (based on e.g., Dixon-Woods et al. (2005) and Popay et al. (2006)). The synthesis aims at identifying recurrent themes through a process of triangulation (convergence) of quantitative signals, qualitative accounts and network structures (Lucas et al. 2007; O'Cathain et al. 2010; Fetters et al. 2013; Creswell and Plano Clark 2017). The followed approach allows coders to note convergence and divergence patterns across evidence types, thus helping them to refine interpretations while avoiding overgeneralisation. The result is a coherent, 5-7 page governance narrative that summarises the main strengths, challenges, cross-scale patterns and structural dynamics of social-ecological governance at each of the LTSER Platforms. This approach is deliberately lightweight—yet conceptually rigorous—in order to

allow for cross-Platform comparability while remaining feasible and efficient for Platforms with limited resources and/or analytical capacity.

7.5 Coding approach and intercoder reliability

Since the first implementation of the PRIME Instrument takes place under limited resources, the most likely scenario is that Platforms will rely on single coders with varying levels of training. The protocol therefore prescribes a linear coding approach, in which coders follow a strict sequence: first assigning initial codes, then grouping them into themes and subthemes, and finally interpreting results. The approach is clear and easy to document, enhances transparency and replicability and is suitable for training or pilot phases; its costs are that it is slower and more rigid, that cross-cutting patterns may emerge late and that it requires multiple data passes. It is best used when coders are new or working alone, when consistency and comparability are priorities, and when time and capacity are limited, which is the situation of the first LTSER governance assessment. The alternative, an iterative coding approach in which coders move flexibly between coding, categorising and interpreting as new insights emerge, encourages reflection and pattern recognition, integrates insights faster and adapts to complex qualitative data, but is harder to standardise across Platforms, may blur the boundary between coding and interpretation and demands experienced analysts coordinating and sharing drafts; it is an option for later rounds, once intercoder reliability and shared coding frameworks are established. Once the first implementation is completed at all Platforms, the network of Platforms should conduct an intercoder reliability exercise involving coders from all Platforms, to test the consistency of coding categories across contexts, refine a shared codebook and strengthen the comparability and scientific robustness of governance observations.

8 The first implementation as a pilot, and pathways of development

Implementation of the PRIME Instrument is expected to be carried out by one or two experts per LTSER Platform over a 108-day window. The first implementation of the Instrument will function as a pilot phase, designed to inform the evaluation of two future integrations: (a) participatory workshops to stimulate shared reflection and co-learning on governance processes; (b) advanced synthesis techniques for combining mixed-methods evidence into cohesive, multi-dimensional governance assessments. After a careful assessment of current available resources, it was decided not to include those two elements in the pilot phase. The rationale for this decision is twofold. First, the aim of the first implementation pilot is to consolidate and validate a minimum viable set of core analytical components that ensure data quality and comparability under current limited resources for Instrument implementation. Second, the aim is to inform the future co-design of other key methods to make the Instrument more robust, based on results from the first implementation, and involving experts and stakeholders from all participating Platforms. New methods to be integrated will include, at minimum, participatory workshops aimed at integrating the multiple values and perspectives of governance actors, co-producing knowledge and enhancing the real-world relevance of the Instrument's results.

It is expected that following the current pilot phase (i.e., the first implementation of the Instrument), subsequent implementations—every six years—will be preceded by stages of co-design, refinement and adaptation of the Instrument based on lessons learnt and newly generated insights from previous implementations. These intermediate co-design stages will also help to integrate advances in theory, methodology and technology in the broader field of social-ecological governance research. This iterative approach seeks to ensure that the Instrument remains scientifically robust, operationally feasible and aligned with eLTER's vision and mission.

Harmonisation of results across LTSER Platforms is essential to ensure that the outputs generated locally can be meaningfully compared, aggregated and interpreted at the European level. After each Platform produces its quantitative summaries, qualitative categorisations, network outputs and governance profiles, all materials will be centralised in a shared repository for post-processing. This process will facilitate cross-checking of metadata and coding structures, as well as the reconciliation of methodological differences that may arise during local implementation.

Notably, Part D's questionnaire development risked losing place-based nuances and local realities, as well as introducing overlaps among frameworks and disciplinary biases. Therefore, the first pilot implementation of the Instrument will be co-evaluated with implementers to inform future improvements to the questionnaire. The evaluation exercise will be mainly focused on (i) comparing whether and how each framework efficiently informed quantitative scoring and qualitative probes, (ii) discussing disciplinary biases and overlaps, (iii) potentially missing factors that might be key at local levels (are the frameworks aligned with local realities?), and (iv) assessing overall workload and implementation efficiency. This will help refine the questionnaire's next iteration and periodic updates reflecting new theoretical and methodological advancements.

Overall, these post-processing activities will ensure that the diverse datasets generated during the implementation of the Instrument can be interpreted through shared conceptual grounds, while maintaining place-based contextual richness. Ultimately, this step will help prepare the entire pilot implementation for cross-Platform evaluation, comparative synthesis, and the development of shared vocabularies to inform a coherent, interoperable knowledge base ready for future deployments.

This paper is the initial, foundational version of that knowledge base. The implementation paper that follows the pilot will be co-authored with the Platform managers and experts who take part in it and are interested in contributing, and will report what the pilot changed in the Instrument and why.

Acknowledgements

The authors are grateful to the eLTER PLUS project (European long-term ecosystem, critical zone and socio-ecological systems research infrastructure PLUS), which received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 871128.

References

Aggarwal, R. M. and J. M. Anderies (2023). "Understanding how governance emerges in social-ecological systems: insights from archetype analysis". In: *Ecology and Society* 28.2, p. 2. DOI: 10.5751/ES-14061-280202.

Biggs, R., H. Clements, A. de Vos, C. Folke, A. Manyani, K. Maciejewski, B. Martín-López, R. Preiser, O. Selomane, and M. Schlüter (2021). "What are Social-Ecological Systems and Social-Ecological Systems Research?" In: *The Routledge Handbook of Research Methods for Social-Ecological Systems*. Ed. by Biggs, R., de Vos, A., Preiser, R., Clements, H., Maciejewski, K., and Schlüter, M. 1st ed. London: Routledge, pp. 3–26. DOI: 10.4324/9781003021339-1.

Binder, C. R., J. Hinkel, P. W. G. Bots, and C. Pahl-Wostl (2013). "Comparison of Frameworks for Analyzing Social-ecological Systems". In: *Ecology and Society* 18.4, p. 26. DOI: 10.5751/ES-05551-180426.

Bodin, Ö. (2017). "Collaborative environmental governance: Achieving collective action in social-ecological systems". In: *Science* 357, eaan1114. DOI: 10.1126/science.aan1114.

Bodin, Ö., S. M. Alexander, J. Baggio, M. L. Barnes, R. Berardo, G. S. Cumming, L. E. Dee, A. P. Fischer, M. Fischer, M. Mancilla Garcia, A. M. Guerrero, J. Hileman, K. Ingold, P. Matous, T. H. Morrison, D. Nohrstedt, J. Pittman, G. Robins, and J. S. Sayles (2019). "Improving network approaches to the study of complex social–ecological interdependencies". In: *Nature Sustainability* 2, pp. 551–559. DOI: 10.1038/s41893-019-0308-0.

Bodin, Ö. and B. I. Crona (2009). "The role of social networks in natural resource governance: What relational patterns make a difference?" In: *Global Environmental Change* 19, pp. 366–374. DOI: 10.1016/j.gloenvcha.2009.05.002.

Bodin, Ö., G. Robins, R. McAllister, A. Guerrero, B. Crona, M. Tengö, and M. Lubell (2016). "Theorizing benefits and constraints in collaborative environmental governance: a transdisciplinary social-ecological network approach for empirical investigations". In: *Ecology and Society* 21.1, p. 40. DOI: 10.5751/ES-08368-210140.

Boone, H. N. and D. A. Boone (2012). "Analyzing Likert data". In: *Journal of Extension* 50.2, 2TOT2. DOI: 10.34068/joe.50.02.48.

Borgatti, S. P., A. Mehra, D. J. Brass, and G. Labianca (2009). "Network Analysis in the Social Sciences". In: *Science* 323, pp. 892–895. DOI: 10.1126/science.1165821.

Boyd, E. and C. Folke, eds. (2012). *Adapting Institutions: Governance, Complexity and Social-Ecological Resilience*. Cambridge: Cambridge University Press. DOI: 10.1017/CBO9781139017237.

Braun, V. and V. Clarke (2006). "Using thematic analysis in psychology". In: *Qualitative Research in Psychology* 3.2, pp. 77–101. DOI: 10.1191/1478088706qp063oa.

Brondizio, E. S., E. Ostrom, and O. R. Young (2009). "Connectivity and the Governance of Multilevel Social-Ecological Systems: The Role of Social Capital". In: *Annual Review of Environment and Resources* 34, pp. 253–278. DOI: 10.1146/annurev.environ.020708.100707.

Butts, C. T. (2008). "Social network analysis: A methodological introduction". In: *Asian Journal of Social Psychology* 11, pp. 13–41. DOI: 10.1111/j.1467-839X.2007.00241.x.

Carlisle, K. and R. L. Gruby (2019). "Polycentric systems of governance: a theoretical model for the commons". In: *Policy Studies Journal* 47.4, pp. 927–952. DOI: 10.1111/psj.12212.

Carr-Kelman, C., U. Brady, B. A. Raschke, and M. L. Schoon (2023). "A Systematic Review of Key Factors of Effective Collaborative Governance of Social-Ecological Systems". In: *Society & Natural Resources* 36, pp. 1452–1470. DOI: 10.1080/08941920.2023.2228234.

Chapin, F. S., G. P. Kofinas, and C. Folke, eds. (2009). *Principles of ecosystem stewardship: resilience-based natural resource management in a changing world*. New York: Springer. DOI: 10.1007/978-0-387-73033-2.

Chu, V. H. Y., W.-F. Lam, and J. M. Williams (2023). "Building robustness for rural revitalization: A social-ecological system perspective". In: *Journal of Rural Studies* 101, p. 103042. DOI: 10.1016/j.jrurstud.2023.103042.

Clark, W. C. and A. G. Harley (2020). "Sustainability Science: Toward a Synthesis". In: *Annual Review of Environment and Resources* 45, pp. 331–386. DOI: 10.1146/annurev-environ-012420-043621.

Clement, F. (2010). "Analysing decentralised natural resource governance: proposition for a "politicised" institutional analysis and development framework". In: *Policy Sciences* 43, pp. 129–156. DOI: 10.1007/s11077-009-9100-8.

Clement, S., J. Jozaei, M. Mitchell, C. R. Allen, and A. S. Garmestani (2024). "How resilience is framed matters for governance of coastal social-ecological systems". In: *Environmental Policy and Governance* 34, pp. 65–76. DOI: 10.1002/eet.2056.

Creswell, J. W. and V. L. Plano Clark (2017). *Designing and Conducting Mixed Methods Research*. 3rd ed. Thousand Oaks, CA: Sage.

Cumming, G. S., G. Epstein, J. M. Anderies, C. I. Apetrei, J. Baggio, Ö. Bodin, S. Chawla, H. S. Clements, M. Cox, L. Egli, G. G. Gurney, M. Lubell, N. Magliocca, T. H. Morrison, B. Müller, R. Seppelt, M. Schlüter, H. Unnikrishnan, S. Villamayor-Tomas, and C. M. Weible (2020). "Advancing understanding of natural resource governance: a post-Ostrom research agenda". In: *Current Opinion in Environmental Sustainability* 44, pp. 26–34. DOI: 10.1016/j.cosust.2020.02.005.

De Vos, A., A. Quinlan, R. Biggs, E. M. Bennett, B. Martín-López, A. V. Norström, G. D. Peterson, M. Schoon, C. R. Allen, E. Andersson, et al. (2025). "Welcome home! Introducing SocSES: a society for inclusive and impactful social-ecological research". In: *Ecology and Society* 30.2, p. 32. DOI: 10.5751/ES-16164-300232.

Dixon-Woods, M., S. Agarwal, D. Jones, B. Young, and A. Sutton (2005). "Synthesising qualitative and quantitative evidence: A review of possible methods". In: *Journal of Health Services Research & Policy* 10.1, pp. 45–53. DOI: 10.1177/135581960501000110.

Dressel, S., G. Ericsson, and C. Sandström (2018). "Mapping social-ecological systems to understand the challenges underlying wildlife management". In: *Environmental Science & Policy* 84, pp. 105–112. DOI: 10.1016/j.envsci.2018.03.007.

Fetters, M. D., L. A. Curry, and J. W. Creswell (2013). "Achieving integration in mixed methods designs—principles and practices". In: *Health Services Research* 48.6, pp. 2134–2156. DOI: 10.1111/1475-6773.12117.

Fischer-Kowalski, M. (2015). "Social Ecology". In: *International Encyclopedia of the Social & Behavioral Sciences*. Ed. by Wright, J. D. 2nd ed. Amsterdam: Elsevier, pp. 254–262. DOI: 10.1016/B978-0-08-097086-8.91038-9.

Folke, C., T. Hahn, P. Olsson, and J. Norberg (2005). "Adaptive governance of social-ecological systems". In: *Annual Review of Environment and Resources* 30, pp. 441–473. DOI: 10.1146/annurev.energy.30.050504.144511.

Gain, A. K., M. Ashik-Ur-Rahman, and A. Vafeidis (2019). "Exploring human-nature interaction on the coastal floodplain in the Ganges-Brahmaputra delta through the lens of Ostrom's social-ecological systems framework". In: *Environmental Research Communications* 1, p. 051003. DOI: 10.1088/2515-7620/ab2407.

Gale, N. K., G. Heath, E. Cameron, S. Rashid, and S. Redwood (2013). "Using the framework method for the analysis of qualitative data in multi-disciplinary health research". In: *BMC Medical Research Methodology* 13, p. 117. DOI: 10.1186/1471-2288-13-117.

Garmestani, A. S. and M. H. Benson (2013). "A Framework for Resilience-based Governance of Social-Ecological Systems". In: *Ecology and Society* 18.1, p. 9. DOI: 10.5751/ES-05180-180109.

Gaventa, J. (2006). "Finding the spaces for change: a power analysis". In: *IDS Bulletin* 37.6, pp. 23–33. DOI: 10.1111/j.1759-5436.2006.tb00320.x.

Ghodsvali, M., G. Z. Dane, and B. de Vries (2022). "The nexus social-ecological system framework (NexSESF): A conceptual and empirical examination of transdisciplinary food-water-energy nexus". In: *Environmental Science & Policy* 130, pp. 16–24. DOI: 10.1016/j.envsci.2022.01.010.

Haberl, H., M. Fischer-Kowalski, F. Krausmann, and V. Winiwarter, eds. (2016). *Social Ecology: Society-Nature Relations across Time and Space*. Cham: Springer International Publishing. DOI: 10.1007/978-3-319-33326-7.

Hajer, M. A. (1995). *The Politics of Environmental Discourse: Ecological Modernization and the Policy Process*. Oxford: Clarendon Press. DOI: 10.1093/019829333X.001.0001.

Hinkel, J., P. W. G. Bots, and M. Schlüter (2014). "Enhancing the Ostrom social-ecological system framework through formalization". In: *Ecology and Society* 19.3, p. 51. DOI: 10.5751/ES-06475-190351.

Jordan, A. (2008). "The Governance of Sustainable Development: Taking Stock and Looking Forwards". In: *Environment and Planning C: Government and Policy* 26, pp. 17–33. DOI: 10.1068/cav6.

Karpouzoglou, T., A. Dewulf, and J. Clark (2016). "Advancing adaptive governance of social-ecological systems through theoretical multiplicity". In: *Environmental Science & Policy* 57, pp. 1–9. DOI: 10.1016/j.envsci.2015.11.011.

Kellner, E. (2021). "The controversial debate on the role of water reservoirs in reducing water scarcity". In: *WIREs Water* 8, e1514. DOI: 10.1002/wat2.1514.

Kellner, E., D. Petrovics, and D. Huitema (2024). "Polycentric Climate Governance: The State, Local Action, Democratic Preferences, and Power—Emerging Insights and a Research Agenda". In: *Global Environmental Politics* 24, pp. 24–47. DOI: 10.1162/glep_a_00753.

Kooiman, J., ed. (1993). *Modern governance: new government-society interactions*. London: Sage.

Koontz, T. M., D. Gupta, P. Mudliar, and P. Ranjan (2015). "Adaptive institutions in social-ecological systems governance: A synthesis framework". In: *Environmental Science & Policy* 53, pp. 139–151. DOI: 10.1016/j.envsci.2015.01.003.

Krosnick, J. A. (1999). "Survey research". In: *Annual Review of Psychology* 50, pp. 537–567. DOI: 10.1146/annurev.psych.50.1.537.

Lansing, J. S. (2003). "Complex Adaptive Systems". In: *Annual Review of Anthropology* 32.1, pp. 183–204. DOI: 10.1146/annurev.anthro.32.061002.093440.

Lebel, L., J. M. Anderies, B. Campbell, C. Folke, S. Hatfield-Dodds, T. P. Hughes, and J. Wilson (2006). "Governance and the Capacity to Manage Resilience in Regional Social-Ecological Systems". In: *Ecology and Society* 11.1, p. 19. DOI: 10.5751/ES-01606-110119.

Liu, J., T. Dietz, S. R. Carpenter, W. W. Taylor, M. Alberti, P. Deadman, C. Redman, A. Pell, C. Folke, Z. Ouyang, and J. Lubchenco (2021). "Coupled human and natural systems: The evolution and applications of an integrated framework". In: *Ambio* 50, pp. 1778–1783. DOI: 10.1007/s13280-020-01488-5.

Lo, C. (2017). "Going from Government to Governance". In: *Global Encyclopedia of Public Administration, Public Policy, and Governance*. Ed. by Farazmand, A. Cham: Springer International Publishing, pp. 1–5. DOI: 10.1007/978-3-319-31816-5_3282-1.

Lucas, P. J., J. Baird, L. Arai, C. Law, and H. Roberts (2007). "Worked examples of alternative methods for the synthesis of qualitative and quantitative research in systematic reviews". In: *BMC Medical Research Methodology* 7.1, p. 4. DOI: 10.1186/1471-2288-7-4.

Manyani, A., R. Biggs, L. Hill, and R. Preiser (2024). "The evolution of social-ecological systems (SES) research: a co-authorship and co-citation network analysis". In: *Ecology and Society* 29.1, p. 33. DOI: 10.5751/ES-14694-290133.

May, C. K. (2022). "Complex adaptive governance systems: a framework to understand institutions, organizations, and people in socio-ecological systems". In: *Socio-Ecological Practice Research* 4, pp. 39–54. DOI: 10.1007/s42532-021-00101-7.

McGinnis, M. D. and E. Ostrom (2014). "Social-ecological system framework: initial changes and continuing challenges". In: *Ecology and Society* 19.2, p. 30. DOI: 10.5751/ES-06387-190230.

Méndez, P. F., F. Clement, G. Palau-Salvador, R. Díaz-Delgado, and S. Villamayor-Tomas (2023). "Understanding the governance of sustainability pathways: Hydraulic megaprojects, social-ecological traps, and power in networks of action situations". In: *Sustainability Science* 18, pp. 303–321. DOI: 10.1007/s11625-022-01258-0.

Méndez, P. F., F. Clement, M. G. Rivera-Ferre, S. Villamayor-Tomas, E. Oteros-Rozas, B. Hörmann, and V. Gaube (2026). *eLTER Standard Observation protocol SOSOC_032 – Governance structure and character*. Version 0.5, draft. eLTER RI.

Miles, M. B., A. M. Huberman, and J. Saldaña (2014). *Qualitative Data Analysis: A Methods Sourcebook*. 3rd ed. Thousand Oaks, CA: Sage.

Mirtl, M., E. T. Borer, I. Djukic, M. Forsius, H. Haubold, W. Hugo, J. Jourdan, D. Lindenmayer, W. H. McDowell, H. Muraoka, D. E. Orenstein, J. C. Pauw, J. Peterseil, H. Shibata, C. Wohner, X. Yu, and P. Haase (2018). "Genesis, goals and achievements of Long-Term Ecological Research at the global scale: A critical review of ILTER and future directions". In: *Science of The Total Environment* 626, pp. 1439–1462. DOI: 10.1016/j.scitotenv.2017.12.001.

Mirtl, M., I. Kühn, D. Monteith, J. Bäck, D. Orenstein, A. Provenzale, S. Zacharias, P. Haase, and M. Shachak (2021). *Whole System Approach for in-situ research on Life Supporting Systems in the Anthropocene (WAILS)*. Abstract EGU21-16425, EGU General Assembly 2021 (vEGU21), 19–30 April 2021. DOI: 10.5194/egusphere-egu21-16425.

Morrison, T. H., W. N. Adger, K. Brown, M. C. Lemos, D. Huitema, J. Phelps, L. Evans, P. Cohen, A. M. Song, R. Turner, T. Quinn, and T. P. Hughes (2019). "The black box of power in polycentric environmental governance". In: *Global Environmental Change* 57, p. 101934. DOI: 10.1016/j.gloenvcha.2019.101934.

Mudliar, P. (2021). "Polycentric to monocentric governance: Power dynamics in Lake Victoria's fisheries". In: *Environmental Policy and Governance* 31, pp. 302–315. DOI: 10.1002/eet.1917.

Muiderman, K., M. Zurek, J. Vervoort, A. Gupta, S. Hasnain, and P. Driessen (2022). "The anticipatory governance of sustainability transformations: Hybrid approaches and dominant perspectives". In: *Global Environmental Change* 73, p. 102452. DOI: 10.1016/j.gloenvcha.2021.102452.

Muñoz-Erickson, T. A., L. K. Campbell, D. L. Childers, J. M. Grove, D. M. Iwaniec, S. T. A. Pickett, M. Romolini, and E. S. Svendsen (2016). "Demystifying governance and its role for transitions in urban social–ecological systems". In: *Ecosphere* 7, e01564. DOI: 10.1002/ecs2.1564.

Nikolaidis, N., D. Orenstein, P. Choler, J. Bäck, B. Barov, M. Brown, T. Dirnböck, J. Gaillardet, H. Haubold, S. Rennie, J. Watkins, M. Kaukolehto, and M. Mirtl (2021). *eLTER RI Strategic Plan*. Deliverable D1.1, EU Horizon 2020 eLTER PPP Project, Grant agreement No. 871126.

Norman, G. (2010). "Likert scales, levels of measurement and the 'laws' of statistics". In: *Advances in Health Sciences Education* 15.5, pp. 625–632. DOI: 10.1007/s10459-010-9222-y.

O'Cathain, A., E. Murphy, and J. Nicholl (2010). "Three techniques for integrating data in mixed methods studies". In: *BMJ* 341, p. c4587. DOI: 10.1136/bmj.c4587.

Orach, K. and M. Schlüter (2021). "Understanding the dynamics of fish politics: The role of diverse actor interactions in transformations towards co-management". In: *Environmental Science & Policy* 124, pp. 195–205. DOI: 10.1016/j.envsci.2021.06.010.

Ostrom, E. (2009). "A General Framework for Analyzing Sustainability of Social-Ecological Systems". In: *Science* 325, pp. 419–422. DOI: 10.1126/science.1172133.

Pahl-Wostl, C. (2009). "A conceptual framework for analysing adaptive capacity and multi-level learning processes in resource governance regimes". In: *Global Environmental Change* 19, pp. 354–365. DOI: 10.1016/j.gloenvcha.2009.06.001.

Pahl-Wostl, C., C. Knieper, E. Lukat, F. Meergans, M. Schoderer, N. Schütze, D. Schweigatz, I. Dombrowsky, A. Lenschow, U. Stein, A. Thiel, J. Tröltzsch, and R. Vidaurre (2020). "Enhancing the capacity of water governance to deal with complex management challenges: A framework of analysis". In: *Environmental Science & Policy* 107, pp. 23–35. DOI: 10.1016/j.envsci.2020.02.011.

Palomo, L. E. and A. Hernández-Flores (2019). "Application of the Ostrom framework in the analysis of a social-ecological system with multiple resources in a marine protected area". In: *PeerJ* 7, e7374. DOI: 10.7717/peerj.7374.

Partelow, S. and K. Winkler (2016). "Interlinking ecosystem services and Ostrom's framework through orientation in sustainability research". In: *Ecology and Society* 21.3, p. 27. DOI: 10.5751/ES-08524-210327.

Patterson, J. J. (2016). "Exploring Local Responses to a Wicked Problem: Context, Collective Action, and Outcomes in Catchments in Subtropical Australia". In: *Society & Natural Resources* 29, pp. 1198–1213. DOI: 10.1080/08941920.2015.1132353.

Pichancourt, J.-B., A. Brias, and A. Bonis (2025). "Integrating adaptation pathways and Ostrom's framework for sustainable governance of social-ecological systems in a changing world". In: *PeerJ* 13, e18938. DOI: 10.7717/peerj.18938.

Pierre, J. and B. G. Peters (2020). *Governance, politics, and the state*. 2nd ed. Political analysis. London: Red Globe Press.

Popay, J., H. Roberts, A. J. Sowden, M. Petticrew, L. Arai, M. Rodgers, N. Britten, K. Roen, and S. Duffy (2006). *Guidance on the Conduct of Narrative Synthesis in Systematic Reviews. A Product from the ESRC Methods Programme*. Version 1. Lancaster: Institute for Health Research, Lancaster University.

Preiser, R., R. Biggs, A. de Vos, and C. Folke (2018). "Social-Ecological Systems as Complex Adaptive Systems: Organizing Principles for Advancing Research Methods and Approaches". In: *Ecology and Society* 23.4, p. 46. DOI: 10.5751/ES-10558-230446.

Prell, C. (2012). *Social Network Analysis: History, Theory and Methodology*. London: Sage.

Reyers, B., C. Folke, M.-L. Moore, R. Biggs, and V. Galaz (2018). "Social-Ecological Systems Insights for Navigating the Dynamics of the Anthropocene". In: *Annual Review of Environment and Resources* 43, pp. 267–289. DOI: 10.1146/annurev-environ-110615-085349.

Rocha, J., C. Lanyon, and G. Peterson (2022). "Upscaling the resilience assessment through comparative analysis". In: *Global Environmental Change* 72, p. 102419. DOI: 10.1016/j.gloenvcha.2021.102419.

Saldaña, J. (2013). *The Coding Manual for Qualitative Researchers*. 2nd ed. London: Sage.

Sayles, J. S., M. Mancilla Garcia, M. Hamilton, S. M. Alexander, J. A. Baggio, A. P. Fischer, K. Ingold, G. R. Meredith, and J. Pittman (2019). "Social-ecological network analysis for

sustainability sciences: a systematic review and innovative research agenda for the future". In: *Environmental Research Letters* 14, p. 093003. DOI: 10.1088/1748-9326/ab2619.

Schlüter, M., L. J. Haider, S. J. Lade, E. Lindkvist, R. Martin, K. Orach, N. Wijermans, and C. Folke (2019). "Capturing Emergent Phenomena in Social-Ecological Systems: An Analytical Framework". In: *Ecology and Society* 24.3, p. 11. DOI: 10.5751/ES-11012-240311.

Scott, J. (1988). "Social Network Analysis". In: *Sociology* 22, pp. 109–127. DOI: 10.1177/0038038588022001007.

Tourangeau, R., L. J. Rips, and K. A. Rasinski (2000). *The Psychology of Survey Response*. Cambridge: Cambridge University Press.

Unnikrishnan, H., M. K. Gerullis, M. Cox, and H. Nagendra (2023). "Unpacking dynamics of diverse nested resource systems through a diagnostic approach". In: *Sustainability Science* 18, pp. 153–180. DOI: 10.1007/s11625-022-01268-y.

Villamayor-Tomas, S., C. Oberlack, G. Epstein, S. Partelow, M. Roggero, E. Kellner, M. Tschopp, and M. Cox (2020). "Using case study data to understand SES interactions: a model-centered meta-analysis of SES framework applications". In: *Current Opinion in Environmental Sustainability* 44, pp. 48–57. DOI: 10.1016/j.cosust.2020.05.002.

Vitale, C., S. Meijerink, F. D. Moccia, and P. Ache (2020). "Urban flood resilience, a discursive-institutional analysis of planning practices in the Metropolitan City of Milan". In: *Land Use Policy* 95, p. 104575. DOI: 10.1016/j.landusepol.2020.104575.

Wasserman, S. and K. Faust (1994). *Social Network Analysis: Methods and Applications*. Structural Analysis in the Social Sciences. Cambridge: Cambridge University Press. DOI: 10.1017/CBO9780511815478.

Whaley, L. and E. K. Weatherhead (2014). "An Integrated Approach to Analyzing (Adaptive) Comanagement Using the "Politicized" IAD Framework". In: *Ecology and Society* 19.1, p. 10. DOI: 10.5751/ES-06177-190110.

Williams, J. M. (2020). "Discourse inertia and the governance of transboundary rivers in Asia". In: *Earth System Governance* 3, p. 100041. DOI: 10.1016/j.esg.2019.100041.

Young, O. R. (2002). *The Institutional Dimensions of Environmental Change: Fit, Interplay, and Scale*. Cambridge, MA: MIT Press.

Zacharias, S., C. Schütze, S. Anttila, N. Cools, J. Bäck, K. Böttcher, P. Haase, I. Kühn, U. Mallast, and M. Mirtl, eds. (2024). *eLTER Standard Observations – variables (eLTER SO variables)*. Deliverable D3.4, version 1.4, 20 June 2024, EU Horizon 2020 eLTER PLUS Project, Grant agreement No. 871128.