

# Data collection for assessing social-ecological systems (SES): Brief step-by-step guide <sup>1</sup>

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**Purpose.** The purpose of the Social-Ecological Systems (SES) framework is to provide a theoretical foundation for explaining why some farming systems are able to succeed in transitioning to agro-ecological approaches, and to govern the use of a resource over time in a sustainable manner while other cases fail or never make the effort. The SES assessment aims to improve the understanding of barriers and drivers of agro-ecological transitions both at individual and collective scales. The step-by-step process provides guidance on developing and carrying out the data collection for SES assessments including the identification of possible data sources and explanation of the variables to be collected.

## What is a social-ecological system assessment?

The definition of a Social-Ecological System (SES) is “an integrated complex system that includes social (human) and ecological (biophysical) sub-systems in a two-way feedback relationship” (Ostrom, 2009; Berkes *et al.*, 2011). SES represents a framework under which several theories and natural rules (laws) are used to explain complex situations and create better targeted strategies and policies. The SES framework enables links between technical, environmental, social and economic and political dimensions of agro-ecological transition within a complex set of interactions. Changes in the Action Situation of the SES are sought to address dilemmas of agro-ecological transitions, which requires an improved understanding and knowledge of innovations at different levels of the SES and farming systems. For example, the replacement of pesticides could lead to unsustainable development, if only based on avoiding harmful substances and not supported by intensive knowledge transfer and learning at SES level and corresponding change in farm operations.

**Project background.** The SES assessment in UNISECO aimed at understanding barriers which make the transformation towards Agro-Ecological Farming Systems (AEFS) difficult or impossible. The assessment was made in case studies in 15 European countries covering a range of different production systems, socio-economic and policy contexts and different transition stages. The in-depth understanding of the farming systems in the case studies obtained from the SES assessment, and the assessment of the current sustainability performance, provided the basis for the co-construction of strategies to promote transitions to agro-ecological farming systems, and of the assessment of sustainability trade-offs of these strategies. Building the co-construction of the strategies on the application of the SES framework has advantages, in the context of the UNISECO project, of: i) a detailed consideration of the specific local context of each farming system in the proposition of suitable concrete actions to initiate or enhance agro-ecological transitions; ii) improved understanding of the processes behind the barriers and drivers that need to be addressed.

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## **Step-by-step guide to applying the methodology**

### **1. Defining the research question**

Every case study requires definition of tailored research question mirroring the typical sustainability challenge (e.g. loss in biodiversity, weak economic sustainability) and corresponding dilemma(s). In principle the research question could ask how to resolve the dilemma in the particular case study situation. Research questions of the Social-Ecological Systems (SES) assessment will explore drivers and barriers that have led to the current state of the sustainability of the farming system, and identify possible changes in the action situation that could facilitate transition towards AEFS.

Examples of case study specific research questions defined in the UNISECO project are:

- *How can good performance of arable land management be maintained in organic dairy farms in Vysočina region (Czech Republic) to reduce arable soil degradation and water pollution by pesticides while ensuring economic viability?*
- *How can cropping system diversification be promoted in a highly specialised and market-oriented winegrowing area via the adoption of agro-ecological practices, to increase biodiversity and improve landscape management while maintaining the profitability of farming through local value chains?*

Members of the Multi-Actor Platforms should be engaged for the identification of key challenges for the farming systems (SES), and for feedback on the object of the research question to ensure its relevance to the case study.

### **2. Defining the boundaries of the Social Ecological Systems**

The reason for defining boundaries of system is to keep the focus of those elements which form the system, and to be able to distinguish between actors with direct roles within the farming systems and actors with supporting roles in the external settings of the system. Understanding the boundaries help with focusing data collection on answering the research questions and avoiding the collection of unnecessary data which could limit the manageability of the research.

The boundaries of the Social-Ecological Systems are defined by distinctions between the elements of the system, and its social, economic and political settings. They are determined by factors such as the geographic location of the resource system and the boundaries of the areas within which the same challenges are being faced. This is particularly relevant for spatially (regionally) defined case studies. However, the definition is more problematic with network-based case studies for which the boundaries of the resource system may not be clear. In such a case the resource system still plays a role in defining the boundary, but the definition should also take account of the common issue or dilemma faced by the management of the resource system (e.g. arable land managed in a way that leads to a water deficit) and the actors relevant to the Socio-Ecological System.

The definition of the boundary should stem from answering the questions:

- What land/farms deal with the same issue in the resource system management?
- Which actors are inside and which are outside the Socio-Ecological System?

If there is no close cooperation between farmers and other actors (e.g. the only governance structure is the market), the resource system management could be sufficient to distinguish the system boundary, and the farmers are taken as the key actors of the Social-Ecological System.

If there is some additional form of governance between farmers, or between farmers and other types of actors, then the boundary would be defined by the actors (e.g. those actors who commonly deal with the issue in the



resource system management). For example, farmers could come together and regularly share knowledge and experiences of the management of the resource system (e.g. how to deal with drought in vineyards; [Italian UNISECO case study](#)), or to create informal or formal institutions to govern some common actions such as processing or marketing (e.g. [Czech UNISECO case study](#)). It is however important to recognise that boundaries are subject to change during a transition with new, or formerly external, actors becoming part of the system, e.g. due to new forms of collaboration between farmers and value chain actors.

### **3. Understanding the variables of the sub-systems and their different data sources**

A SES is composed of interacting sub-systems, which are the top or first tier attributes of a SES. Each sub-system is described by a set of second-tier variables which in turn can be described in more detail by third-tier variables or indicators (quantitative or qualitative) (Del Mar Delgado, 2015).

*What purpose do the different sub-systems have?* The operationalization of SES for assessing agro-ecological transitions is designed around a core question: What are the most influential variables in each sub-system and how do these variables influence agro-ecological transition in focal action situations? Thus, it focuses on the sub-systems of the framework and understanding their interactions with the aim of analysing the focal action situation and, for UNISECO, the questions to be addressed (Table 1). For a more detailed overview of the variables see section 3.4 in [Guisepelli et al. \(2018\)](#), and [Prazan et al. \(2019\)](#).

**Table 1. Main questions and objectives of each sub-system**

<b>Socio-Ecological Systems Sub-system</b>	<b>Questions of the Sub-systems Addressed in UNISECO</b>
<b>Focal Action situation</b> , Interactions (I) and Outcomes (O) (environmental, social and economic performances and impacts)	What are the agro-ecological performances of the farming systems concerned? What are their transition ‘patterns’ and their drivers and barriers?
<b>Resource systems (RS)</b> , farming systems (from conventional to agro-ecological)	How are farming systems organized and managed? (RS can concern all types of agriculture, conventional or agro-ecological)
<b>Resource units (RU)</b> , agricultural production of the resource systems (RS)	What are the different factors of production and agricultural productions (at the farm gate)
<b>Actors (A)</b> , Farmers; Agri-food value chain; Consumers; Science, innovation, advisory, capacity building; NGOs, civic society organisations, local community representatives; Authorities and Administration ( <a href="#">Vanni et al., 2019; D5.2</a> )	Who are the actors involved in agriculture governance? Who are the major actors able to influence?
<b>Governance (GS)</b> , strategic decision-making bodies	What are the main governance systems (from state regulations to collective rules)? What are the main decision-making processes?
<b>Transformation system (TS)</b> , secondary and tertiary transformation processes	How do the food systems work? Are the farmers the main beneficiaries of the added value?
<b>Products (P)</b> , generated by processes in TS	What are the final marketed products?
<b>Social, economic, and political settings (S)</b>	The general context: economic development; demographic, social and cultural settings; political context and stability; markets, media, environment, etc.

Source: [Guisepelli et al. \(2018\)](#)



#### **4. Collecting data through desk research**

The purpose of the desk research is to collect as much information as possible about the different sub-systems of the SES (Resource system, Resource unit, Governance, Transformation and Products), and about the social, economic and political settings and the ecosystems related to the SES. The data to be collected include: i) information on policies directly influencing the resource management (including laws, regulations and grants); ii) farm economics (e.g. generalised data from FADN on farm type level), to complement qualitative answers of farmers on the economic situation on farm; iii) publicly available statistics on the farming systems studied; iv) environmental and socio-economic indicators at various territorial levels; v) information from recent research studies (e.g. about the main external drivers of the farming systems change).

The information obtained from desk research will reduce the topics and number of questions to be posed of the actors in the SES.

#### **5. Designing questionnaires**

The SES assessment requires specific sets of questions to relevant actors, targeted at the specific context and situation of each case study.

The availability of information in scientific, grey literature and official statistics will differ between countries and regions. In the UNISECO project, guidance was developed for case study partners that included a generic set of questions (section 3.4 in [Guisepelli \*et al.\* \(2018\)](#)).

These questions need to be adjusted to the specific case study context. The questions selected should focus on capturing information which cannot be obtained through desk research. Guidance is provided on conducting the interviews which includes: i) obtaining ethical clearance for the research with human participants; ii) introducing the project to prospective respondents; iii) explaining the purpose of the interviews, and the rights of interviewees (e.g. to withdraw, to anonymity, etc.); iv) opportunities for actors to benefit from the participation (e.g. learning possible ways to initiate or enhance agro-ecological transitions); v) how processes will adhere to all relevant regulations and best practice (General Data Protection Regulation, GDPR).

#### **6. Carrying out interviews**

A survey of key actors of the SES is undertaken using in-depth interviews. Initial contact with candidate members of the Case Study Multi-Actor Platform will be made by the partner leading the local case study, and/or a Champion Stakeholder if such an intermediary has been identified and engaged. Candidate members of the Multi-Actor Platforms receive an information sheet about the project, explaining the roles of the members of the Case Study Multi-Actor Platforms, the use of the data collected, and of the planned interview and the rights of interviewees. An official letter of invitation is sent by the case study partner.

A guiding question for the selection of actors to be interviewed is: “Who is important as an actor in the Social-Ecological System and farming systems to be studied?”.

The actors selected for interview will be informed by the desk research, and any other prior knowledge of the case study and the farming system to be studied. They are expected to cover a diversity of roles and functions in the system, and levels of experiences with agro-ecological practices (e.g. informed by the case study research question and dilemma). Examples of the types of actors to be interviewed at this early stage of the process are:

- Farmers and their representatives (e.g. to provide knowledge of the resource system and resource units, production and practices, and barriers to transition);



- Public administrations, municipalities, NGOs, processors, and marketing bodies (e.g. cooperatives);
- Researchers, advisors and consultants (e.g. to provide knowledge of economic viability of farms, wider socio-economic context, farming practices, and Resource system management);

The approach should be open to the involvement of any other actors with a stake in the Socia-Ecological System and farming systems being studied.

## **7. Processing data collected**

Data from different sources are required for the assessment of the Social-Ecological System. The assessment is mostly qualitative, focussing on principles, systems dynamics, trends, links, processes, attitudes.

Interview records should be anonymised and numbered and coded for further use. The full interview can be recorded, if acceptable to the interviewees, or documented with written notes. A recorded interview should be transcribed and saved to a database of interview responses. An interview with notes would be best undertaken by two people, one to carry out the interview and the other to take the notes. Those notes also need to be formalised and saved to the relevant records database. The process of collecting and handling the data should enable information to be traced back through the records aid transparency and reliability. Note, that to comply with requirements for open data, appropriate metadata and documents will be required to accompany data stored in a repository, accessible under a suitable licence.

The number of respondents per case study is likely to be limited (e.g. c.10), and thus MS Excel is likely to be sufficient for the purpose of data storage. Common templates are required for standard approaches to data storage and reporting, which also facilitate consistent reporting across different case studies. Answers to questions should be grouped according to the type of sub-systems and variables of the Social-Ecological System, and enabling the tabular presentation of summaries.

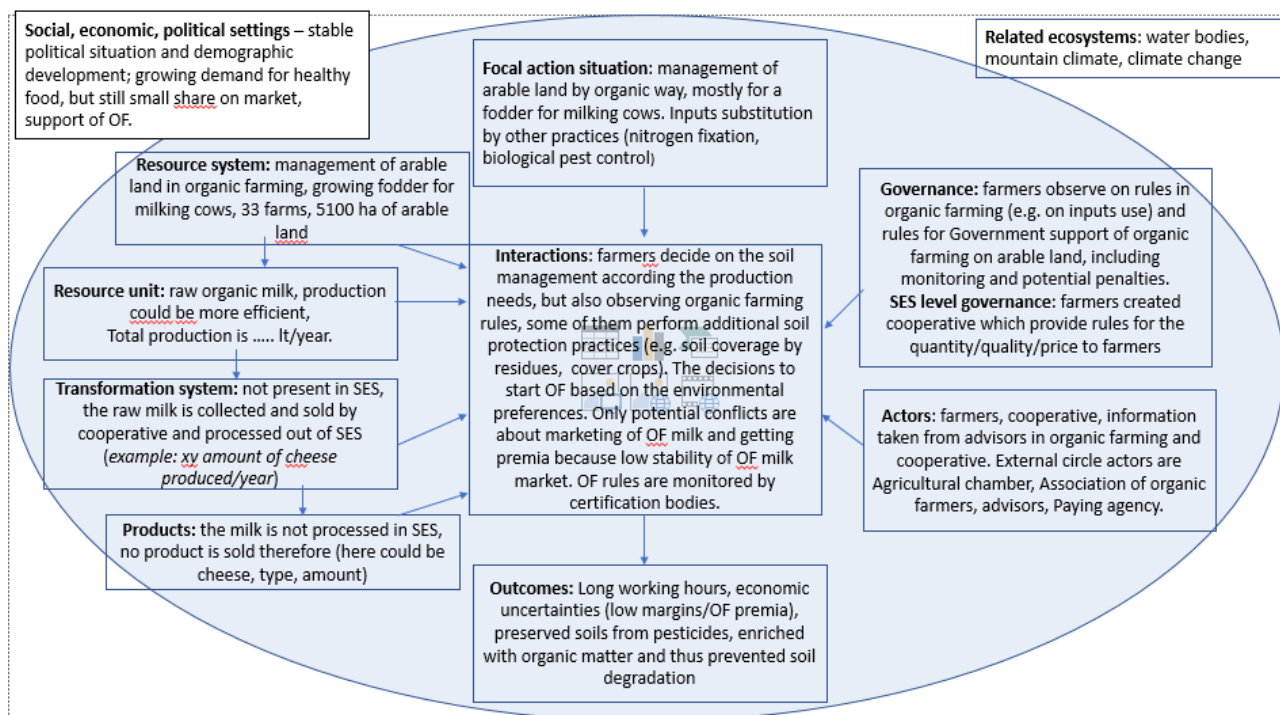
## **8. Deriving conclusions**

The development of conclusions should be guided by the research questions and additional specific questions as appropriate. The challenges to sustainability (environmental, economic, and social) and the transition pathways will differ across the set of farming systems being studied, as will be the current state of the farming system in terms of its levels of innovation and transition process (e.g. conventional to Integrated?). Therefore, the next step in the transition will also differ for each case study, as will the barriers to be addressed and the strategies required for transitions. The SES helps with gaining an understanding of how farmers manage relevant resources (e.g. arable land, grassland), why agro-ecological practices are implemented, and what influence and contributions other actors in the system have on the management decisions.

The assessment of the SES will provide information about how the farming system is governed such as the rules and coordination by market and regulatory policies, and additional and collective rules agreed by actors. Once there is an understanding of the processes and relationships within a system, the barriers to transitions can be identified and pathways planned to enable those transitions.

Figure 1 shows an example of a summary of the assessment of social-ecological system carried out in the Czech case study of the UNISECO project (see Schwarz *et al.*, 2021) for more details.





**Figure 2. Overview of the social-ecological system - Czech case study (Source: own figure based on Ostrom and Cox, 2010; McGinniss and Ostrom, 2014).**

### Additional information:

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Del Mar Delgado-Serrano, M. and Ramos, P.A. (2015). Making Ostrom's framework applicable to characterize social ecological systems at the local level, International Journal of the Commons, Vol. 9, no 2 September, 808–830 <http://www.thecommonsjournal.org>

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