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Isabelle Arpin, Jérôme Poulénard, Richard Bonet, Philippe Bourdeau, Philippe Choler, Hermann Dodier, Jérôme Forêt, Virginie Girard, Bertrand Liénard, Wilfried Thuiller, et al.

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**Organising and enacting inter-organisational coordination. Insights from two case studies in long-term social-ecological monitoring**

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## **Abstract**

This article focuses on the coordination of long-term social-ecological monitoring programmes between different organisations. Effective long-term social-ecological monitoring (LTSEM) is considered to be of crucial importance to inform conservation policies in an era of accelerating global changes. However, many LTSEM programmes are led by individual organisations with a narrow thematic and spatial focus, and fail to provide an integrated understanding of the trajectories of social-ecological systems. Inter-organisational coordination is increasingly presented as a promising way to overcome this limitation of LTSEM programmes, but in practice it remains limited. Our article contributes to understanding this situation by empirically documenting how inter-organisational coordination of LTSEM programmes is organised and enacted in practice. It proposes a working heuristic framework to characterise patterns of inter-organisational coordination based on two criteria: the degree of monitoring centrality and the degree of verticality of inter-organisational coordination. This framework can be used to compare patterns of inter-organisational coordination both across cases and over time. The article also proposes recommendations for the coordination of LTSEM programmes led by different organisations, especially in the early stages of the coordination process.

## **1. Introduction**

In an era of accelerated global change, effective long-term monitoring is essential for informing public policies and taking appropriate action to halt biodiversity loss. Monitoring programmes aim to ‘gather information about some system state variable(s)...at different points in time for the purpose of assessing system state and drawing inferences about changes in state over time’ (Yoccoz et al. 2001: 446). They are considered long-term if they allow signals of environmental change to be distinguished from background noise (Parr et al. 2002), which often requires the active involvement of programme partners over multiple decades. Long-term monitoring promises to help detect early signals of change in a system, disentangle anthropogenic changes from background noise, track the change trajectory over time, inform future predictions and help avoid the occurrence of the predicted worst-case scenarios (Parr et

al. 2002; Lindenmayer et al. 2015; Haase et al. 2018; Dirnböck et al. 2019). The increasing entanglement of ecological and human dimensions in conservation issues has gradually highlighted the need to consider social-ecological systems (SEs) (Preiser et al. 2018) and to move towards long-term social-ecological monitoring (LTSEM) (Haberl et al. 2006; Mollenhauer et al. 2018; Rai et al. 2021), defined as the systematic recording of social and environmental indicators over an extended period (Carilla et al. 2023: A2).

Coordination of existing LTSEM programmes conducted by individual organisations appears to be a promising way to achieve an integrated understanding of SES trajectories, which is crucial given the high level of complexity and uncertainty of conservation issues. Inter-organisational coordination is increasingly being presented as a top priority in LTSEM (Navarro et al. 2017; Kühl et al. 2020). Examples of inter-organisational coordination include the Global Network for Observations and Information on Mountain Environments (GEO-GNOME), the Pan-European Common Bird Monitoring Scheme (PECBMS) and the Scottish Biodiversity Information Forum (SBIF). These initiatives have proved particularly useful for measuring progress towards internationally or nationally agreed-upon targets, such as the Aichi Targets and the Sustainable Development Goals (SDGs). For example, GEO-GNOME provides policy-relevant information on mountain regions to help achieve the SDGs (Adler et al. 2018), and the PECBMS has highlighted the negative impacts of agricultural intensification (<https://pecbms.info>; Kühl et al. 2020). However, many individual LTSEM programmes with a narrow topical and spatial focus on SESs continue to coexist (Haase et al. 2018; Mollenhauer et al. 2018; van der Hel 2019; Kühl 2020). This article contributes to the understanding of why inter-organisational coordination in LTSEM remains limited and suggests avenues for its development.

Coordination in science has been broadly defined as ‘the establishment or strengthening of a relationship among the activities in a system, with the aim to enhance their common effectiveness’ (Hessels 2013: 322). It is increasingly understood as a multifarious and fragile process that unfolds to varying degrees and evolves over time. Inter-organisational coordination is expected to surpass what stand-alone organisations can achieve by building on their respective results while harnessing their complementarities and differences (Manning 2017).

Individual LTSEM programmes have characteristics important for inter-organisational coordination. First, they have a low degree of mutual dependence (Jappe 2009; van der Hel 2019), which is known to negatively affect the need for inter-organisational coordination (Whitley 2000). Participants in such programmes may monitor a particular species, ecosystem or activity in a geographical area without establishing links with monitoring programmes interested in other components of the SES in the same area. The same applies to participants in programmes monitoring the same component in different areas (Jappe 2009). Participants in a given LTSEM programme may have little motivation to invest time in integrated LTSEM and inter-organisational coordination, as they can access resources, publish high-impact papers and be considered successful. Second, individual LTSEM programmes often fail to agree upon goals due to the involvement of various organisations with different statuses (e.g. research organisations, non-governmental organisations [NGOs]) and various participants with their own practices, interests and values (e.g. research actors with different epistemic cultures, state authorities, NGOs, local communities and citizens) (Holzer et al. 2018). This high degree of organisational heterogeneity has been described as hindering inter-

organisational coordination (Provan and Kenis 2008; Wardenaar et al. 2014). However, the organisations running individual LTSEM programmes often have highly stable activities and interactions, in contrast to the high rate of formation and dissolution of linkages in other scientific fields, such as biotechnology (Powell et al. 2005). Indeed, the ability to produce continuous data series over time despite the many organisational, political, financial, scientific and technological changes that occur continuously contributes to the value of long-term monitoring (Ribes and Jackson 2013). Given these characteristics, it can be expected that inter-organisational coordination in LTSEM will be difficult to establish but, once established, will be long lasting.

These characteristics of LTSEM programmes raise two important questions that we aim to address in this article: first, how organisations involved in inter-organisational coordination relate to each other, and second, what activities they undertake together, which is likely to influence the outcomes and effectiveness of inter-organisational coordination (Hessels 2013; Bernard de Raymond 2018). We therefore seek to investigate how inter-organisational coordination in LTSEM is organised and enacted. More specifically, we compare two cases of inter-organisational coordination of LTSEM to address the following research questions: Can patterns of organisation and enactment of inter-organisational coordination of LTSEM programmes be identified and characterised? How can we explain the development of a particular pattern of inter-organisational coordination?

The paper is structured as follows. Section 2 presents our two case studies and our methods. Section 3 describes the characteristics of the organisations involved and how inter-organisational coordination was organised and enacted in both case studies. Section 4 discusses the similarities between the case studies and proposes a working heuristic framework for characterising patterns of inter-organisational coordination. The paper concludes by outlining the operational implications of our study.

## **2. Materials and methods**

We studied inter-organisational coordination in LTSEM empirically, through a case study approach. Case studies aim to investigate contemporary phenomena within their real-life contexts and to understand how and why these phenomena occur (Yin 2009). They can produce generalisable results and can be used to develop theories and heuristic frameworks (Yin 2009). We studied two cases that developed within the same organisation (the French Zone Atelier Alpes [ZAA]) but had different internal characteristics. Both organisations were still in their early stages, with one already established and the other still under construction. Their similarities and differences allowed for a meaningful comparison. We present their contexts before outlining the criteria that we used to characterise the organisations involved, their relationships and the activities coordinated. We then describe our data collection and analysis methods.

### **2.1. Case studies**

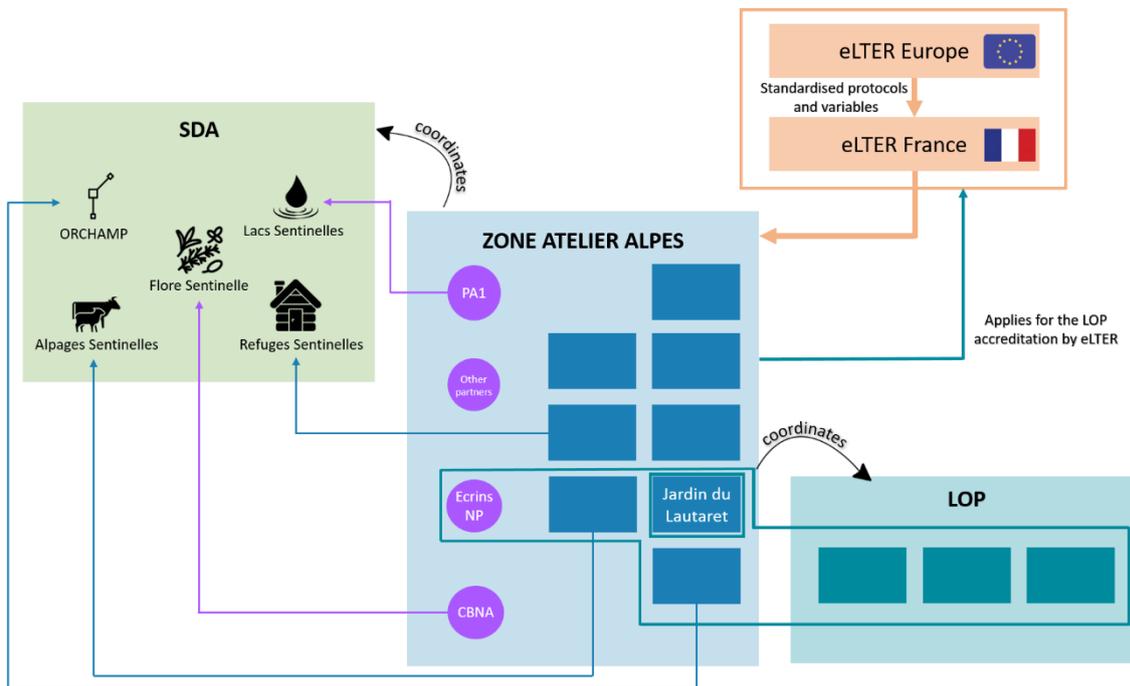
Created by the National Centre for Scientific Research (CNRS)<sup>1</sup> in the early 2000s, the Zones Ateliers (ZAs) are the French version of the long-term social-ecological research platforms that exist at the international level (Mirtl et al. 2018). ZAs have members that are research

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<sup>1</sup> See <https://www.cnrs.fr/en>.

labs, primarily in ecology and Earth sciences, and partners from outside academia (Arpin et al. 2023). The ZAA seeks to study the interactions among climate, biodiversity and human societies in the French Alps. It is characterised by a strong tradition of collaboration among researchers, protected area managers and other practitioners. The ZAA is involved in two cases of inter-organisational coordination: the Sentinelles des Alpes (SDA) programme and the Lautaret-Oisans project (LOP) (see Figure 1 for an overview of the two cases).

Insert Figure 1: Actors involved in the two cases of inter-organisational coordination studied. Blue rectangles represent research labs. Purple circles represent societal actors. SDA: Sentinelles des Alpes; LOP: Lautaret-Oisans project; PA: protected areas; CBNA: Alpine National Botanical Conservatory; NP: National Park. For the sake of visibility, funders are not represented.



The creation of SDA was initially conceived by the managers of two protected areas that are heavily involved in long-term monitoring programmes. In 2016, they persuaded other programme managers to jointly call for the creation of ‘an Alpine cooperation platform for a coherent strategy for biodiversity knowledge and conservation at the scale of the French Alps’, which they called SDA. Their key motivations were to secure more funding for monitoring programmes and to avoid the duplication of effort and competition. The main potential funder at the time was the French Biodiversity Agency (OFB), which was willing to support monitoring programmes as long as they demonstrated their capacity to work together. The ZAA was identified as a suitable coordinating actor that would offer the project scientific credibility and was asked to submit a full project to the OFB. SDA was officially launched in 2018 as a loose entity managed by the ZAA leadership team. A steering committee composed of the leaders of each member programme and the ZAA was established at the time of its creation. Two people were recruited successively on fixed-term contracts to help manage both SDA and the ZAA, one from 2018 to 2020 and the other in 2021. The OFB funded both contracts, and the second was co-funded by a government organisation that manages the design and implementation of sustainable development policies for the French Alps.

The LOP was developed as a potential platform for eLTER, a hierarchically structured pan-European research infrastructure currently under construction (Mollenhauer et al. 2018). The aim of eLTER is to ‘understand the complex interactions between people and nature over the long term’<sup>2</sup> by implementing a ‘whole-system approach’ to SESs (Zacharias et al. 2021). This approach combines the perspectives, methods and data of the natural sciences; Earth system sciences; and, to a lesser extent, human and social sciences. The eLTER infrastructure is part of the drive to transform science in Europe into European science (Nedeva and Stampfer 2012), which is expected to surpass the achievements of individual European countries and attain a level of global excellence. The goal is also to transform ecology into ‘big science’ (Zimmerman and Nardi 2010), meaning large-scale science that can process large amounts of data and is comparable to prestigious and well-funded disciplines such as nuclear physics. One major action of eLTER is the establishment of a network of complementary sites across Europe where ‘essential variables’ of SESs will be monitored over the long-term across five spheres: the geosphere, hydrosphere, atmosphere, biosphere and sociosphere.

The ZAA has been involved in eLTER since 2018, with the crucial support of one of its members, the Jardin du Lautaret. The Jardin du Lautaret is a ‘service unit’ of the CNRS that manages the scientific facilities and equipment at the Lautaret pass (2,058 masl) and provides researchers with technical and logistical support for their scientific work and their stays at the Jardin. A major asset that the Jardin du Lautaret offered to a potential eLTER platform was its involvement in several research infrastructures, allowing for integrated monitoring of SESs. For the LOP, the ZAA acted as both a coordinating and a coordinated organisation. In addition, it sought to bring together research teams with different disciplinary backgrounds and potentially other actors to monitor an area according to eLTER’s requirements. It was also one of the numerous organisations willing to submit a project for eLTER accreditation. In this article, we focus on how inter-organisational coordination was experienced by the ZAA as a coordinating organisation.

## **2.2. Characterisation criteria**

We characterised the organisations involved in the two cases according to four criteria (Gulati 1995; Provan and Kenis 2008; Wardenaar et al. 2014; Bernard de Raymond 2018; Kuhl et al. 2020; Hickey et al. 2023): i) their type and status (e.g. research organisation, state authority, NGO, private sector company, citizens); ii) the existence of a shared history and the level of inter-organisational trust; iii) size, both in terms of the number of organisations involved and the geographical distance covered; and iv) power distribution. Given the various conceptions and definitions of trust and power, it is important to clarify our understanding of these concepts in this paper. Following Provan and Kenis (2008: 9), we define trust as positive expectations about another’s intentions that lead to the acceptance of vulnerability. Our focus is on inter-organisational trust, as this is more critical than inter-individual trust for inter-organisational coordination (Shrum et al. 2001; Provan and Kenis 2008). We are interested in the relational dimension of power, defined as the visible, invisible and hidden capacity to enforce one’s own intentions over those of others (Vallet et al. 2020). This capacity is referred to as ‘power over’ in the literature (Vallet et al. 2020; Osinski 2021).

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<sup>2</sup> <https://elter-ri.eu/mission-vision>, consulted on 4 October 2022.

We characterised the relationships between the organisations involved as i) vertical, in which the coordinating organisation wants and is able to impose strategic decisions on the coordinated organisations, particularly about joint activities, or ii) horizontal, in which the coordinating organisation wants or needs to negotiate the activities that will and will not be coordinated (Manning 2017).

We characterised the activities coordinated as i) monitoring centred, if they concern the monitoring activities themselves (Hessels 2013; Bernard de Raymond 2018), or ii) as monitoring enabling, if they aim to create the necessary conditions for monitoring, such as community-building, resource management or profile-raising (Bernard de Raymond 2018). We also paid attention to which activities were *not* coordinated (Bernard de Raymond 2018).

The criteria we used to characterise the organisations involved their relationships and the activities coordinated, which have both been discussed in the literature as important factors in inter-organisational coordination in science and have emerged as significant themes in the material we collected (see below). Thus, we adopted a deductive and inductive approach.

### **2.3. Data collection and analysis**

We studied the two cases from within and in a collective manner. All co-authors were involved in the cases studied. They included researchers from various disciplines (ecology, soil science, sustainability science, sociology, geography) as well as societal actors. The study was led by a sociologist who fits the definition of a deep insider researcher: ‘a person who has been a member of the organisation or group under research for at least five years’ (Edwards 2002). Indeed, she has had a dual role as a participant and observer in the activities of the ZAA since its inception in 2008 and has co-directed the ZAA since 2020. She decided to reflect with her colleagues and informants on the two cases of intra-organisational coordination in which she and they were involved, rather than considering them as mere informants. Being an insider researcher is known to offer both advantages (e.g. better and faster access to data, practical and experiential knowledge and affects, greater reflexivity and capacity for change in research collectives) and disadvantages (e.g. risks of bias due to the desire to present the studied process or group positively and to avoid internal tensions, blindness to the ordinary) (Bonner and Tolhurst 2002; Unluer 2012; Chammas 2020). We used two classic strategies to counter these disadvantages: clarifying the role of the insider researcher and reflexivity (Bonner and Tolhurst 2002; Unluer 2012; Chammas 2020). Due to the long-standing interest of the lead author in the processes at work in the ZAA and related organisations, her dual role was clear and well accepted from the outset. Reflexivity was exercised at her own level, through personal note-taking and discussion of the case studies with outsider researchers (Bonner and Tolhurst 2002; Unluer 2012; Chammas 2020), but also at the level of the group of co-authors.

#### **2.3.1. Data collection**

Case studies rely on the triangulation of multiple sources of information (Yin 2009). In order to collect rich data and enhance our understanding of inter-organisational coordination, we used a combination of qualitative methods: participant observation, semi-directed interviews and documentary analysis. Participant observation was a key method for producing written accounts and descriptions of joint activities and interactions that could then be reviewed and reflected upon (see e.g. Zimmerman and Nardi 2010). In our case, this task was delegated to

the lead author, who took extensive notes on the formal and informal meetings for SDA and the LOP. She was also able to draw on a wealth of documents, including minutes of SDA and LOP meetings, reports, articles, funding applications and emails, which amounted to dozens of pages for each case. This material provided detailed knowledge of the organisations that initiated or participated in joint activities and how they evolved over time.

In addition, she conducted 14 semi-structured interviews in the autumn of 2022 with 18 participants in the two cases of coordination, including all co-authors. She targeted the scientific or technical managers of monitoring programmes and, if different, the head of their managing organisation, as well as administrative staff (see Table 1 for an overview). The interview guide included questions about their involvement in the cases, the contribution of the different organisations to the emergence and development of the two cases and their interactions, the joint activities that had been planned and (not) carried out and the main sources of difficulty in achieving coordination. All interviews were recorded and transcribed.

	Interview (date, number of informants, duration in minutes)	Roles of interviewees
1	2 November 2022, 1, 50	Scientific director of a sentinel programme
2	3 November 2022, 1, 105	Former member of the SDA and ZAA management team
3	4 November 2022, 2, 52	1: Scientific director; 2: Technical manager of a sentinel programme
4	4 November 2022, 1, 92	Member of the SDA and ZAA management team
5	4 November 2022, 1, 42	Scientific director of a sentinel programme
6	9 November 2022, 2, 57	1: Manager of a sentinel programme; 2: Director of the structure administering this programme
7	10 November 2022, 2, 53	1: Manager of a sentinel programme; 2: Director of the structure administering this programme
8	2 December 2022, 1, 76	Member of the Jardin du Lautaret
9	6 December 2022, 1, 50	Scientific manager of a structure involved in all sentinel programmes
10	14 December 2022, 1, 60	Member of the Jardin du Lautaret
11	20 December 2022, 1, 113	Member of the Jardin du Lautaret
12	23 December 2022, 1, 49	Member of the SDA and ZAA management team
13	9 January 2023, 2, 46	1 and 2: Members of the Jardin du Lautaret
14	12 January 2023, 1, 59	Former member of the SDA and ZAA management team

Table 1: Interview details

### **2.3.2. Data analysis**

The lead author used qualitative analysis software (MAXQDA) to code the interviews according to the above criteria. She used the documents and her field notes to check some facts and understand the interviews. For example, her field notes helped to contextualise the coordination difficulties mentioned in the interviews. In this manner, she developed a preliminary interpretation of the content and organisation of inter-organisational coordination in the two case studies and of the factors that seemed to influence them. She discussed the preliminary findings in two meetings with her co-authors. These discussions helped to clarify what had shaped the relationships between the organisations and had led to the prioritisation of certain joint activities over others. They also allowed for an exploration of how both the relationships and the joint activities might develop in the future and thus had a transformative dimension.

## **3. Results**

### **3.1. Characterising coordinated organisations**

#### **3.1.1. Type and status**

The monitoring programmes involved in SDA were developed separately by entirely independent organisations, each with their own objectives, status, participants, activities and resources (see Table 2 for an overview). The LOP involved research labs; the Jardin du Lautaret, which was a component of academia despite not being a conventional research lab; and one non-academic organisation, Écrins National Park.

#### **3.1.2. Shared history and trust**

Although the organisations involved in SDA were aware of each other's existence, not all of them had previously collaborated and built close and trusting relationships with the ZAA. Therefore, shared history and trust within SDA were heterogeneous. We found that these factors depended on inter-organisational distance in terms of both action orientation and discipline (see Figure 2). At the inception of SDA, the action-oriented organisations suspected that the organisations focused on scientific production would prioritise an academic approach to LTSEM over their operational and policy objectives. Similarly, the organisations with a strong social science orientation were initially concerned that those with a strong natural science orientation would impede their ability to co-construct their objectives and methods with societal actors. The case of the LOP differed from that of SDA in two ways. First, there was less heterogeneity in shared history and inter-organisational trust. Second, these factors depended mainly on geographical distance from the Jardin du Lautaret. The Jardin du Lautaret had close and mostly trusting relationships with the research teams working in its immediate vicinity. This was due to the long summer stays of the scientists at the Jardin and the contribution of its staff to their fieldwork. The Jardin also had a close relationship with the ZAA, as many researchers involved in the ZAA worked in or near the Jardin. Additionally, a former director of the ZAA served as the Jardin's scientific director.

<b>Monitoring programme (year of creation)</b>	<b>Main objectives and position on a science–policy gradient</b>	<b>Managing organisation and programme managers</b>	<b>Participants in the programme (academic and societal)</b>	<b>Degree of co-construction between academic and societal actors and main activities of the programme</b>	<b>Funders</b>	<b>Sources</b>
<b>Alpages Sentinelles (2007)</b>	To understand climate change in mountain pastures and its consequences for pastoral systems; to identify adaptation strategies for pastoral systems <i>Intermediate position on a science–policy gradient</i>	Interdisciplinary lab on mountain SESs <i>Scientific manager: sustainability scientist from this lab</i> <i>Technical manager: staff from a grazing organisation recruited on a short-term and part-time basis</i>	Ecologists, agronomists, sociologists, climatologists, sustainability scientists <i>Mountain pasture and farming experts, farmers, shepherds, protected area managers</i>	High degree of co-construction with a broad range of societal actors <i>Monitoring vegetation, recording grazing practices, developing/conducting agroclimatic analyses, jointly assessing grazing pressure at the end of the grazing season, hosting transdisciplinary working groups and seminars</i>	Regional programmes, National Fund for Regional Planning and Development as part of the interregional agreement for the Massif des Alpes, European Regional Fund mobilised as part of the Massif des Alpes interregional programme, French Biodiversity Agency (OFB)	Dobremez et al. 2014; <a href="https://www.alpages-sentinelles.fr/">https://www.alpages-sentinelles.fr/</a>
<b>Lacs Sentinelles (2009)</b>	To improve knowledge of the functioning of high-altitude lakes; to identify threats to these lakes and to define management actions <i>Intermediate position on a science–policy gradient</i>	Haute-Savoie Natural Spaces Conservatory <i>Scientific manager: researcher from a limnology lab</i> <i>Technical manager: staff from the natural spaces conservatory and from OFB recruited on a long-term basis</i>	Aquatic ecologists, hydrologists, palaeoecologists, environmental chemists <i>Protected area managers, local authorities, Electricité de France (EDF), fishing federations, OFB</i>	High degree of co-construction between academic actors and protected area managers <i>Compulsory protocols: measuring water transparency, taking multi-parameter probe profiles of the entire water column, recording temperatures at the bottom of the lake and below the water surface</i> <i>Various optional protocols</i>	OFB, National Fund for Regional Planning and Development, EDF, Caisse d'Épargne Foundation, European funds	Birck et al. 2013; <a href="https://www.lacs-sentinelles.org/">https://www.lacs-sentinelles.org/</a>
<b>Flore Sentinelle (2009)</b>	To develop knowledge and skill exchanges and to implement common monitoring protocols and	Alpine National Botanic Conservatory <i>Scientific and technical managers:</i>	Botanists, ecologists <i>Staff from Alpine and Mediterranean National Botanical</i>	High degree of co-construction between academic actors and botanists working in action-oriented organisations	Regions, OFB, European Regional Fund mobilised as part of the Massif des Alpes interregional programme,	Bonnet et al. 2015; <a href="https://floresentinelles.fr/">https://floresentinelles.fr/</a>

	concerted actions for conservation of flora <i>Close to the policy end of the science–policy gradient</i>	<i>staff from the conservatory recruited on a long-term basis</i>	<i>Conservatories, protected area managers, nature protection associations</i>	<i>Monitoring 30 species and four habitats at two spatial scales</i>	National Fund for Regional Planning and Development as part of the interregional agreement for the Massif des Alpes	
<b>ORCHAMP (2016)</b>	To understand the coupled dynamics among climate, land use and the biodiversity of mountain ecosystems over time and space <i>Close to the science end of the science–policy gradient</i>	Research team from the Alpine Ecology Lab <i>Scientific manager: internationally renowned senior ecologist leading this team</i> <i>Technical manager: recruited on a long-term basis and hosted by this lab</i>	Ecologists specialising in different aspects of ecosystems (soil, forests, fauna, flora), meteorologists, entomologists <i>Protected area managers, national botanical conservatories, local authorities, Natura 2000 site managers</i>	Intermediate degree of co-construction between academic actors and protected area managers <i>Compulsory protocols: measuring soil biodiversity through environmental DNA; monitoring vegetation (pin-point, forest inventories, deadwood); passive acoustic monitoring (birds, insects); camera traps (mammals); measuring soil physicochemical properties, temperature and humidity; measuring soil–vegetation profile and changes in land cover and vegetation structure through remote sensing</i> <i>Optional protocols: mapping ancient land use, monitoring macroinvertebrates (pitfalls, nests)</i>	International, European and national research programmes; OFB; Labex OSUG; Regions (Auvergne Rhône Alpes, Occitanie); EDF; Rhône Méditerranée Corse Water Agency; ‘Département’ of Isère; Community of Communes of the Chamonix-Mont-Blanc Valley; Grenoble Alpes Métropole	Calderon-Sanou et al. 2022; <a href="https://orchamp.osug.fr/">https://orchamp.osug.fr/</a>
<b>Refuges Sentinelles (2017)</b>	To understand the relationships among humans, climate and biodiversity; to develop methods of observation and intervention adapted to the high mountains and to use the refuges as places for research and	Research team from a social sciences lab <i>Scientific leader: senior geographer from this lab</i> <i>Technical manager: recruited on a short-term basis and hosted by this lab</i>	Geographers; geomorphologists; ecologists; botanists; education, communication, marketing and management scientists	High degree of co-construction with a broad range of societal actors <i>Monitoring overnight stays in refuges, recording destinations daily, recording key facts and weak signals seasonally, inter-professional debriefing at the end of summer</i> <i>Participatory monitoring of biodiversity around the refuges; study of the</i>	Labex ITTEM, Petzl Foundation, research programme funded by the Swiss National Science Foundation and French National Research Agency, Écrins National Park, French Federation of Alpine and Mountain Clubs	Clivaz et al. 2021; <a href="https://refuges-sentinelles.org/">https://refuges-sentinelles.org/</a>

	<p>the co-construction and dissemination of scientific culture</p> <p><i>Intermediate position on a science–policy gradient</i></p>		<p><i>Mountain guides, hut keepers, protected area managers</i></p>	<p><i>phylogeny, taxonomy, historical ecology and ecological conditions of high-altitude plants</i></p>		
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Table 2: Description of the five member programmes of Sentinelles des Alpes

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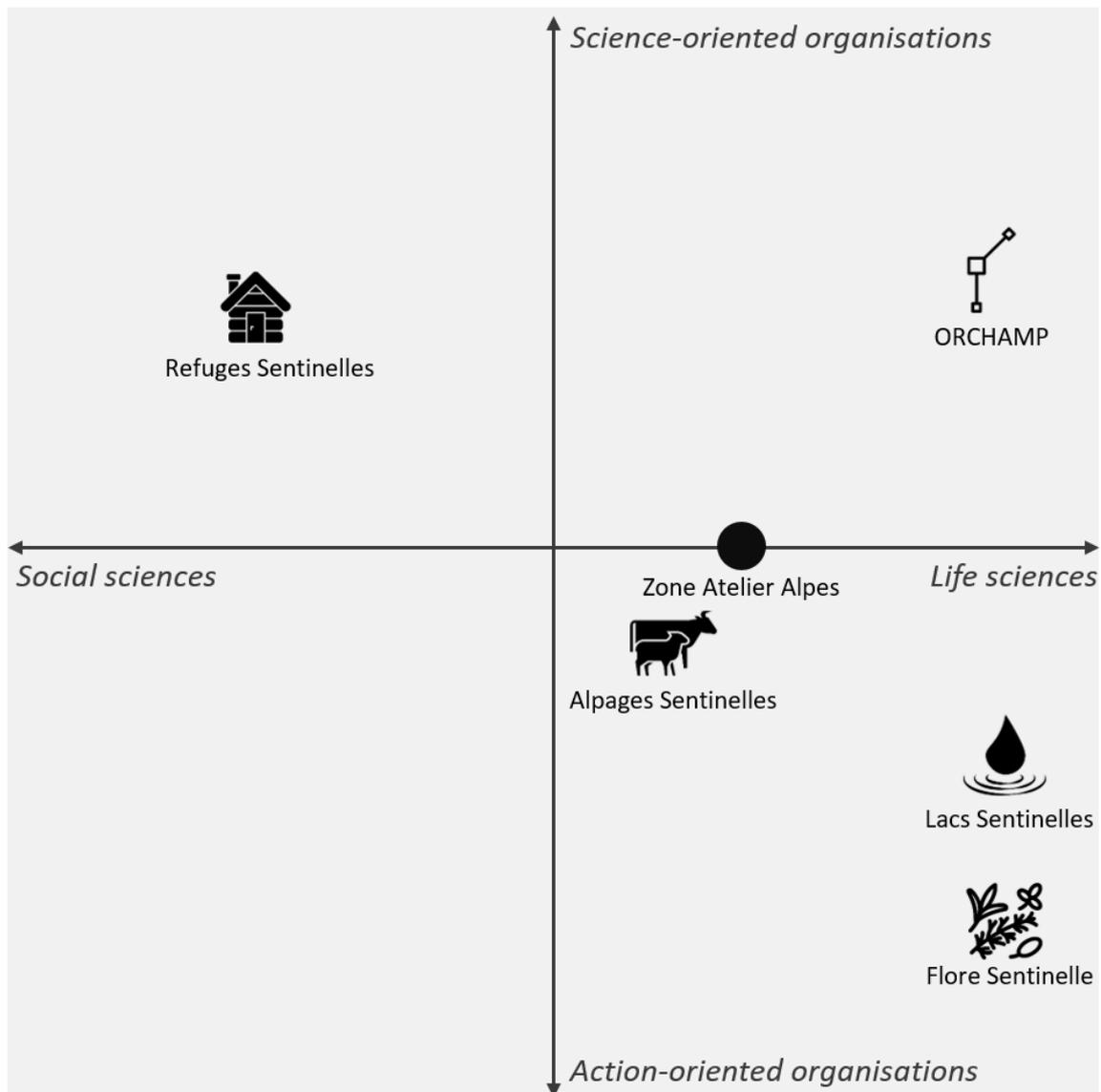
### 2 **3.1.3. Size**

3 SDA coordinates five monitoring programmes run by specific organisations, which cover the  
4 entire ZAA. The nature and number of the coordinated organisations appeared to be very  
5 stable, as expected in a field with a high degree of standardisation and routine. For the LOP,  
6 the number of actors involved and the geographical coverage of the project were still being  
7 discussed at the time of writing. The original plan was to define a vast area encompassing the  
8 Jardin du Lautaret and to coordinate multiple labs and organisations conducting monitoring  
9 activities in various scientific fields, such as ecology, SES science, hydrology, climatology  
10 and glaciology. However, as the requirements and associated logistical constraints and costs  
11 of eLTER became clearer, the project was reduced to the immediate surroundings of the  
12 Jardin du Lautaret. The decision to downsize the LOP was made because of the difficulty of  
13 involving geographically distant labs in joint discussions and activities. In both cases,  
14 therefore, only a few organisations were involved. The geographical area covered ranged  
15 from a few or tens of square kilometres in the case of the LOP to around 40,000 km<sup>2</sup> in the  
16 case of SDA.

### 17 **3.1.4. Power distribution**

18 In SDA, the distribution of ‘power over’ was uneven, with human and financial resources, as  
19 well as academic prestige, significantly influencing the capacity of organisations to exert  
20 power over others. Academic prestige itself was influenced by the disciplines involved, with  
21 ecology having a higher status than the social sciences (see Figure 2). Monitoring  
22 programmes were run by either research teams or non-academic organisations or by a  
23 combination of both. ORCHAMP was led by a successful ecology research team with access  
24 to funding sources at the local, national and European levels. Refuges Sentinelles was  
25 initiated and led by social scientists and faced funding challenges. The other programmes had  
26 an intermediate level of access to funding and resources. It is important to note that certain  
27 monitoring programmes had greater financial and human resources than the ZAA itself. The  
28 distribution of ‘power over’ was less uneven in the LOP. The Jardin du Lautaret had as much  
29 ‘power over’ as the research labs because it was one of the few places in France that could  
30 meet the stringent requirements of eLTER. As a result, it received much attention at the  
31 national level. Écrins National Park had a strong scientific department, was an important  
32 partner of the ZAA and maintained close relationships with all the labs involved in the LOP.

33 Figure 2: Positions of the five programmes of SDA in terms of action orientation and  
34 discipline. The scales of the two axes are arbitrary.



35

36 In summary, the LOP exhibited less heterogeneity than SDA in terms of the organisations  
 37 involved, their shared history and inter-organisational trust. Furthermore, ‘power over’ was  
 38 more evenly distributed among the organisations. Now, let us examine how inter-  
 39 organisational coordination was organised in both cases.

### 40 **3.2. Organising inter-organisational coordination**

41 Initially, the SDA management team had a vertical relationship with the monitoring  
 42 programmes, attempting to steer their activities to fulfil the agreement with the OFB.  
 43 However, this approach caused some tension. The programme managers emphasised that  
 44 SDA should not interfere in the financial management of the programmes or take an excessive  
 45 share of the total funds available. The leaders of SDA had to abandon their initial plan to take  
 46 the lead in organising the annual meetings of the programmes. Similarly, the idea of bringing  
 47 all the programmes together at ‘master sites’ to work together and achieve joint monitoring  
 48 was seen as an imperative that could be decided not by SDA but by the programmes  
 49 themselves. Respect for the ‘identities’ of the programmes, as articulated by their leaders and  
 50 managers, was another issue discussed. Action-oriented organisations, in particular,

51 emphasised their differences from research labs. In the words of a manager of a programme  
52 with a strong action orientation:

53 ‘The red line would be to try to turn us into something we are not... We can work with  
54 researchers, but we still have a strong orientation towards public policy and providing  
55 practical and operational answers to managers. And we will keep that’ (interview 6,  
56 interviewee 1).

57 SDA’s role was primarily viewed as making suggestions and facilitating joint discussions,  
58 thereby leaving programme leaders and managers to make decisions according to their own  
59 objectives and agendas. Horizontal rather than vertical relationships were thus quickly  
60 established between SDA and the monitoring programmes.

61 In the LOP, inter-organisational coordination was, in practice, shared between the ZAA and  
62 Jardin du Lautaret. For example, they both participated in the eLTER-related meetings  
63 organised regularly at the national level, communicated decisions at the European level about  
64 what and how to monitor in eLTER and jointly planned meetings with local research teams to  
65 discuss their potential involvement in the project. Their relationship with these teams was  
66 clearly horizontal. The only way to involve the teams in the project was to convince them that  
67 meeting the requirements of eLTER was possible. However, the LOP leaders relayed  
68 eLTER’s decisions on what and how to monitor to the research teams interested in the project.  
69 They therefore had a role of ‘transmission belt’, which gave a certain vertical dimension to  
70 the organisation of the LOP (see Figure 1).

71 In summary, there were some differences in the organisation of intra-organisational  
72 coordination between the two cases. After a brief initial attempt to establish a vertical  
73 organisation, the relationships had become essentially horizontal in SDA. They were  
74 somewhat more vertical in the LOP, due to its integration in a hierarchically structured  
75 European project. There were more marked differences in the way inter-organisational  
76 coordination was enacted in the two cases.

### 77 **3.3. Enacting inter-organisational coordination**

#### 78 **3.3.1. Monitoring-enabling activities**

79 In both cases, inter-organisational coordination involved three types of monitoring-enabling  
80 activities – resource management, community-building and profile-raising – but to different  
81 degrees and with different levels of difficulty.

82 In SDA, inter-organisational coordination of resource management involved submitting joint  
83 funding applications and organising a biennial partner conference for presenting  
84 achievements, perspectives and future needs. In both the applications and the partner  
85 conference presentations, the monitoring programmes wrote and presented their own sections,  
86 while SDA managers collected and collated the programmes’ contributions in due course,  
87 presented SDA’s specific activities and discussed financial issues with the funders.  
88 Community-building consisted of formal and informal inter-programme meetings and  
89 workshops held several times a year. These meetings mainly involved the discussion of  
90 peripheral issues, such as the meaning and modalities of observation, communication or the  
91 role of emotions in long-term monitoring programmes, rather than monitoring activities. They  
92 never took place in the field despite the time devoted to fieldwork in each programme, as one  
93 programme leader lamented: ‘Too bad, but we never meet in the field’ (interview 5). Inter-

94 organisational coordination of profile-raising began when the former manager of SDA wrote a  
95 white paper describing SDA, the programmes and their monitoring protocols. It spurred the  
96 design of a visual aid depicting a mountainside with the five programmes stylised to highlight  
97 their similarities and complementarities. An animated video was then produced to showcase  
98 the objectives and main methods of the monitoring and SDA programmes, with the aim of  
99 raising awareness of the programmes beyond a limited circle of specialists. The production of  
100 the video also allowed for the harmonisation of the programmes' logos and the creation of one  
101 for SDA. SDA and monitoring programmes were shown on numerous occasions, and the  
102 video was distributed widely.

103 In the LOP, resource management activities were instead about human resources. In  
104 particular, the LOP leaders sought to fill the vacant manager position at the Jardin du  
105 Lautaret, as they believed that meeting eLTER standards would be impossible without a new  
106 manager. As a result, they jointly decided to temporarily withdraw from eLTER activities to  
107 persuade the CNRS headquarters to grant them a position, which was challenging given the  
108 scarcity of positions in the French academic world. Initially, the LOP leaders were  
109 enthusiastic about building a large monitoring community around the Jardin du Lautaret.  
110 However, the endeavour was deemed unsuccessful, and there was growing support for the  
111 idea of retreating to the immediate surroundings of the Jardin du Lautaret, as explained by a  
112 member of the Jardin du Lautaret staff:

113 'I liked the idea of a large platform that would bring together all the scientific partners. But it  
114 doesn't work very well, and it's complicated to get all these people together and get them to  
115 agree. We've tried to get them to come, but they've got their sites on the other side of the  
116 [Lautaret] pass or elsewhere and they just don't come.... Things are much easier with the  
117 teams that have long worked with us' (interview 10).

118 Community-building also entailed establishing relationships with the leaders of similar  
119 projects in France and other European countries. This also proved to be difficult. The LOP  
120 leaders had no direct links to other eLTER platform project leaders. Participation in the  
121 monthly remote eLTER meetings at the national level was unattractive due to the complex  
122 organisation and terminology of eLTER and the rotation of French eLTER representatives. As  
123 a result, several people became discouraged and stopped participating. Profile-raising  
124 activities included presenting the project at various local and national meetings and writing an  
125 application that had to be revised multiple times to reflect design changes in the eLTER  
126 platforms and sites at the European level. A member of the Jardin du Lautaret expressed  
127 disappointment and frustration with the process of writing the application, noting the  
128 difficulty of involving scientists and research team leaders beyond those closely related to the  
129 Jardin du Lautaret:

130 'We have written a lot of applications. It's been going on for three years.... It's a slow and  
131 sluggish process. The first shared Google document stayed up for three months without any  
132 comments. There are still a lot of people who have barely read it' (interview 11).

### 133 **3.3.2. Monitoring-centred activities**

134 Inter-organisational coordination of monitoring-centred activities was not a primary focus of  
135 SDA. Its initial objective to share sites, protocols and data among programmes had not been  
136 achieved at the time of writing. While there was some coordination regarding equipment, each

137 programme continued to make autonomous decisions about its sites, protocols and data. This  
138 was fully acknowledged by the programme leaders and managers:

139 ‘Frankly, I have the impression that we have a real weakness here, that we have managed to  
140 talk to each other, to get to know each other, to have really fruitful discussions. But, on the  
141 other hand, I have the impression that we don’t have many concrete activities in common and  
142 that it remains very complicated because of the differences in culture, objectives and  
143 approaches. So, I think we are still largely each in our own lane’ (interview 6, interviewee /2).

144 In contrast, inter-organisational coordination was mainly about what and how to monitor in  
145 the LOP, with the goal of meeting the requirements of eLTER while also considering local  
146 interests and resources. The LOP leaders brought together the Jardin du Lautaret’s closest  
147 partners to collectively select the essential variables of SESs that they could reasonably  
148 commit to monitoring in the long-term.

149 In summary, inter-organisational coordination primarily involved monitoring-enabling  
150 activities in SDA and monitoring-centred activities in the LOP. However, there was less  
151 asymmetry between the two types of activities in the LOP. Interestingly, the participants in  
152 both cases reported starting with the easier activities and abandoning or postponing the more  
153 difficult ones. This is illustrated by the following two quotes, the first from a programme  
154 manager in SDA and the second from a scientist involved in the LOP:

155 ‘I pushed hard to say, “Well, if we’re going to work together, let’s work on things that are less  
156 scientific but that we have in common.” And I put communication forward quite quickly  
157 because it’s easy to see that we have common problems in terms of communication.... It was  
158 very unifying, and so we were less technical. At the end of the day, the technical aspects are  
159 very specific to each programme. And I had the impression that it would take a bit longer to  
160 find the technical meeting points’ (interview 6, interviewee 1).

161 ‘It was easy to take the variables and protocols suggested by eLTER and see which ones we  
162 would follow. It raises questions, but it’s relatively straightforward work. You quickly get the  
163 feeling that you can meet the requirement. It’s quite simple: there’s a list; we’ll do the  
164 measurements’ (interview 4).

## 165 **4. Discussion**

166 We compared the organisation and enactment of inter-organisational coordination in two  
167 cases related to LTSEM that developed simultaneously within the same French organisation.  
168 We paid particular attention to the joint activities conducted by the organisations. Below, we  
169 discuss the similarities between the cases and propose a working heuristic framework for  
170 characterising the patterns of inter-organisational coordination in LTSEM.

### 171 **4.1. Similarities**

172 In both cases, establishing inter-organisational coordination proved to be challenging, as  
173 anticipated in a field with low mutual dependence among scientists, such as LTSEM. We  
174 expected that there would be fewer difficulties in the LOP than in SDA, given the greater  
175 heterogeneity of the organisations in SDA. However, this was not the case. The LOP leaders  
176 had to retreat to the immediate surroundings of the Jardin du Lautaret and managed to involve  
177 only research teams that already had a close collaboration with the Jardin. At this stage,

178 achieving more integrated SES monitoring on a larger scale seemed impossible. We also  
179 expected that collective action would be sustainable once coordination was established.  
180 Considering the early stage of inter-organisational coordination in both cases, it would be  
181 premature to take a definitive stance on this matter. However, collective action in the case of  
182 SDA was still very fragile and entirely reliant on the ability to secure the position of an SDA  
183 manager. In the case of the LOP, sustainable inter-organisational coordination should be  
184 ensured if the project proceeds, given the low heterogeneity of the organisations involved and  
185 the project's inclusion in a European research infrastructure that requires a long-term  
186 commitment.

187 Another similarity between the two cases is the dynamic nature of inter-organisational  
188 coordination. Initially, various strategies were attempted to promote collective action. The  
189 SDA leaders transitioned from vertical to more horizontal relationships, while the LOP  
190 leaders significantly reduced the initially planned size of the integrated monitoring area.  
191 Furthermore, inter-organisational coordination gradually modified the relationships among the  
192 organisations, allowing for the coordination of a broader range of activities. This was  
193 particularly evident in SDA. Indeed, programme managers had recently considered the  
194 possibility of joint internships and field meetings to discuss their practices and the possibility  
195 of sharing monitoring sites and protocols since they had recently become familiar with each  
196 other. In summary, community-building led to a shift towards monitoring-centred activities.  
197 However, there was no intention to revert to more vertical relationships, and it was generally  
198 assumed that SDA would continue to suggest and facilitate but not direct. The LOP also  
199 showed some subtle changes, such as plans to visit other candidate platforms in France and  
200 abroad, indicating a move towards monitoring-enabling activities. In both cases, therefore, the  
201 coordination patterns were somewhat mutable. However, despite the similarities, there were  
202 significant differences in the coordination patterns of the two cases. We have developed a  
203 heuristic framework based on our results and the literature to characterise these patterns.

#### 204 **4.2. Patterns of coordination: A working heuristic framework**

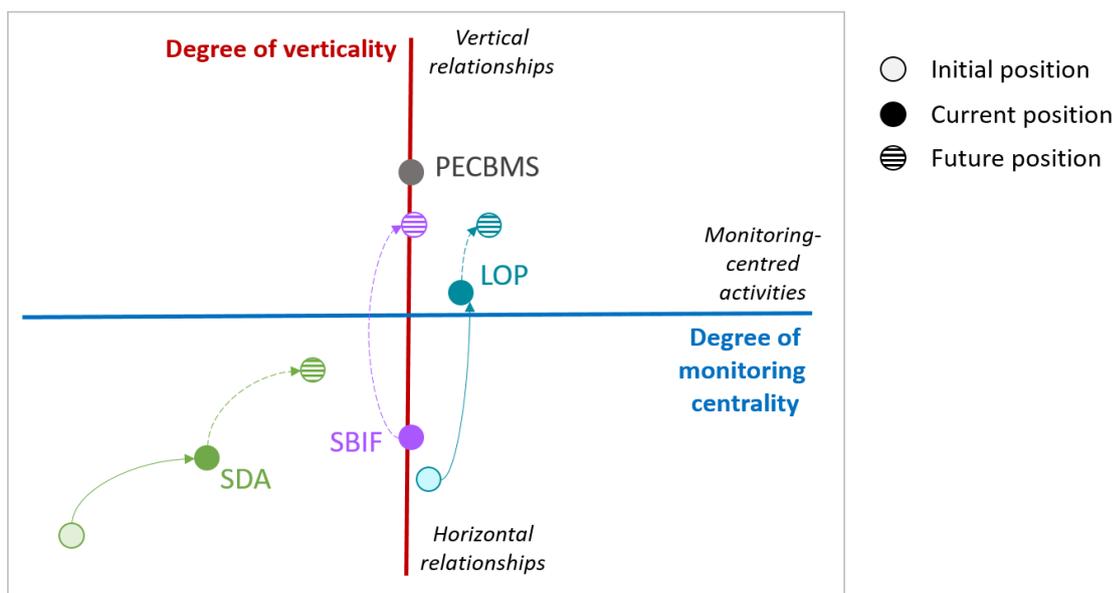
205 We propose characterising inter-organisational coordination in LTSEM using two criteria: the  
206 degree of monitoring centrality and the degree of verticality. The former refers to the degree  
207 to which inter-organisational coordination targets monitoring-centred activities or monitoring-  
208 enabling activities such as resource management, community-building and profile-raising.  
209 The latter refers to the degree to which the coordination involves vertical or horizontal  
210 relationships. SDA exhibited low levels of both monitoring centrality and verticality. The  
211 LOP, in contrast, had a high level of monitoring centrality and an intermediate level of  
212 verticality.

213 Given the genericity of these two criteria, we believe that this heuristic framework can be  
214 applied to analyse the organisation and enactment of inter-organisational coordination in  
215 LTSEM in a broad range of cases. For example, the PECBMS and SBIF, which were  
216 launched in 2002 and 2011, respectively, appear to engage in both monitoring-centred and  
217 monitoring-enabling activities and to have an intermediate level of monitoring centrality (see  
218 Figure 3). Inter-organisational coordination appears to be more vertical in the PECBMS than  
219 in the SBIF (Kühl et al. 2020). The PECBMS indeed has a central coordination unit that  
220 communicates with national coordinators responsible for operating the monitoring schemes in  
221 their respective countries (<https://pecbms.info>). Our framework could also be tested for cases

222 of inter-organisational coordination in other scientific domains. The degree of monitoring  
 223 centrality should then be replaced by the degree of research centrality. However, coordination  
 224 patterns are likely to be influenced by factors that depend on the scientific domain. For  
 225 example, geographical proximity may play a more important role in inter-organisational  
 226 coordination in LTSEM than in non-place-based scientific activities.

227 Our framework shows that there is no unique path to inter-organisational coordination. It can  
 228 be used to reflect on the path chosen in specific cases and to discuss the dynamics of inter-  
 229 organisational coordination (see Figure 3). For example, in the case of the SBIF, a  
 230 coordinating organisation was established at the national level to achieve maximum cohesion  
 231 and effectiveness (Wilson et al. 2018). As a result, the organisation of the SBIF is evolving  
 232 towards more vertical relationships (see Figure 3). Making such changes explicit is useful for  
 233 anticipating and preparing for their potential effects.

234 Figure 3: Our working framework showing the initial, current and future positions of four  
 235 cases of inter-organisational coordination in LTSEM, including our two case studies (SDA  
 236 and the LOP). The scales of the two axes are arbitrary. SDA: Sentinelles des Alpes; LOP:  
 237 Lautaret-Oisans project; PECBMS: Pan-European Common Bird Monitoring Scheme; SBIF:  
 238 Scotland Biodiversity Information Forum. The trajectory of the PECBMS could not be  
 239 documented.



240

241 Our framework also invites reflection on the factors that influence coordination patterns: Why  
 242 did vertical relationships and the plan to conduct monitoring-centred activities have to be  
 243 abandoned in SDA, while they remained possible in the LOP? Similarly, why were  
 244 monitoring-enabling activities problematic for the LOP but not for SDA? The heterogeneity  
 245 of the organisations involved is an important clue. In SDA, programme managers felt that  
 246 they had major differences, which they often expressed in terms of the science–policy divide.  
 247 The action-oriented organisations feared that coordination by the ZAA, which they perceived  
 248 as academically driven and oriented, could jeopardise their identities and distract them from  
 249 their goals. This made monitoring-centred activities and vertical coordination difficult.  
 250 Conversely, the geographical proximity and shared attachment to the Alps and their SESs  
 251 made it easier to organise face-to-face meetings within SDA. This facilitated monitoring-

252 enabling activities and horizontal relationships. In the LOP, no organisation felt threatened by  
253 the project as long as eLTER permitted some leeway in the selection of variables to be  
254 monitored. This facilitated monitoring-centred activities and a more vertical pattern of  
255 coordination. Our study therefore suggests that horizontal relationships and monitoring-  
256 enabling activities are better suited to the early stages of coordination between highly  
257 heterogeneous organisations with little shared history, low trust and significant power  
258 asymmetries. Vertical relationships and/or monitoring-centred activities, in contrast, can be  
259 envisaged from the outset when coordinating similar organisations with a long shared history,  
260 high trust and limited power asymmetries.

## 261 5. Conclusions

262 Effective LTSEM is crucial for informing conservation policies and depends especially on the  
263 capacity to achieve inter-organisational coordination. We explored how inter-organisational  
264 coordination in LTSEM is organised and enacted in practice by comparing two contrasting  
265 cases from a French organisation committed to the long-term study of mountain SESs. Based  
266 on this empirical study, we have developed a working heuristic framework that allows  
267 patterns of inter-organisational coordination to be analysed and compared both across cases  
268 and over time. Our framework is based on two criteria: the degree of monitoring centrality  
269 and the degree of verticality of inter-organisational coordination. Further empirical studies are  
270 needed to refine it; to test its ability to account for a variety of cases of coordination; and to  
271 better understand the complex factors and dynamics of coordination patterns, both in and  
272 beyond LTSEM.

273 Based on our findings, we argue that it is crucial to characterise the organisations involved in  
274 inter-organisational coordination in LTSEM in terms of status, shared history, trust, size and  
275 power distribution. Analysing these characteristics before the coordination process begins  
276 should help to anticipate, discuss and overcome the difficulties of inter-organisational  
277 coordination. It should also help in the early stages of the coordination process to choose  
278 between different paths to coordination. In particular, it may be counterproductive to try to  
279 impose joint monitoring-centred activities from the outset, especially when coordinating a  
280 large number of highly heterogeneous organisations with little shared history, low inter-  
281 organisational trust and significant power asymmetries. In such cases, it may be more  
282 appropriate to initiate inter-organisational coordination with monitoring-enabling activities  
283 and lateral relationships. Inter-organisational coordination in LTSEM is a long-term and  
284 dynamic process that aims to enhance the effectiveness of a monitoring system. As a result,  
285 initially impossible activities may become possible as the process unfolds. Coordinating  
286 organisations should therefore adopt a ‘tentative’ (Kuhlmann and Rip 2018) approach to inter-  
287 organisational coordination, that is, one involving experimentation, learning, reflexivity and  
288 reversibility (Kuhlmann and Rip 2018; Schot and Steinmueller 2018). Here, reversibility  
289 refers to a careful and cautious approach to coordination that considers the reactions of  
290 coordinated organisations and remains continuously open to revising choices according to  
291 their effects. Finally, the coordination process may be slow to produce tangible results, such  
292 as the sharing of monitoring sites, standardised protocols and datasets across programmes and  
293 joint analyses of SESs. It may then be seen as ineffective, especially if it tends to prioritise  
294 monitoring-enabling activities over monitoring-centred activities. Thus, coordinating  
295 organisations should be patient and should not expect their efforts to be immediately  
296 rewarded.

297 This leads us to make the following recommendations for developing inter-organisational  
298 coordination and achieving the more integrated long-term monitoring of SESs that is critically  
299 needed to support conservation efforts:

- 300 - Analyse the characteristics of the organisations to be coordinated in terms of status,  
301 shared history, trust, size and power distribution;
- 302 - Consider initiating the coordination process with monitoring-enabling activities and  
303 lateral relationships when coordinating highly heterogeneous organisations with little  
304 shared history, low trust and/or significant power asymmetries;
- 305 - Adopt a tentative approach to coordination that includes experimentation, learning,  
306 reflexivity and reversibility; and
- 307 - Allow sufficient time for inter-organisational coordination to develop before expecting  
308 tangible results.

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