

Challenges and Mutations Confronting RZA

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This collective work serves as an introduction to Long-Term Social-Ecological Research (LTSER), with a specific focus on its implementation in France through the French National Scientific Research Committee's (CNRS¹) *Réseau des Zones Ateliers* (RZA) program. It is intended for a diverse audience, including students, researchers, environmental managers and local stakeholders. For the first time, the driving forces behind *Zones Ateliers* (ZA) have put pen to paper to develop a reflective approach to this unique tool, shaped by several decades of existence, to retrace its history, demonstrate its diversity and attempt to define “what are *Zones Ateliers*”.

1.1. A network for ZA

A ZA is part of a territory, most often on a regional scale, and is structured around a functional unit: a forest, a river and its watershed, a mountain range, a city,

1 *Comité National de la Recherche Scientifique.*

an agricultural plain, a coastal area, etc. The aim is to describe, understand and predict the trajectory of social-ecological systems (SES; see section 1.2.3) that have been more or less anthropized in order to formalize and theorize their functioning, and thus assist in their management and governance, or even their transformation. The ZA promotes integrated, long-term research in order to develop a resolutely interdisciplinary and transdisciplinary approach² (Hirsch-Hadorn et al. 2008; Lang et al. 2012) – in the sense of joint research between researchers and local stakeholders (decentralized government services, managers, local authorities, associations, elected officials, fishing or hunting federations, agricultural cooperatives, citizens, etc.) – which requires the establishment of relationships of trust. The aim is to answer one or more specific regional questions, developed in interaction with economic partners: this question at the interface between the environment and society may result from a scientific dynamic fueling societal reflection or emerge via a social expectation or demand reformulated in scientific terms. Such questions incorporate (1) long-term research (retrospective, present-focused and prospective analyses); (2) the implementation of observation protocols, standardized analyses and comparative studies between ZA; (3) opportunities to formalize knowledge through modeling and simulation of the functioning of all or part of social ecological systems; (4) opportunities for experimentation within smaller geographical units called “*Zones Ateliers*”.

Given that each ZA is specific to the territory in which it is located, the core of this book consists of as many chapters as there are ZA in order to better understand the uniqueness of each one and to undertake a retrospective study of its origins, what preceded and led to its creation, and its evolution in terms of its various characteristics (structure, themes, approaches, scales, interdisciplinarity, collaborations with local stakeholders, etc.), while drawing on the issues and salient facts of their territory.

Because they are structured around and revolve around common organizing concepts (environment, sustainable development, ecosystem services, social ecological systems, etc.), because they share certain social-environmental themes and use similar approaches (interdisciplinarity, transdisciplinarity, long-term

² The term “transdisciplinarity” has several meanings (Ragueneau 2023, p. 400). Transdisciplinarity is sometimes defined as transcending disciplines (Blanchard and Vanderlinden 2010), sometimes leading to the creation of a metadiscipline: interactions between disciplines become so strong that we no longer even recognize the contribution of each to the final product. But in sustainability science, transdisciplinarity refers to working with people outside academia: communities, stakeholders, governmental and non-governmental organizations, etc. (Lang et al. 2012). Within the RZA, and in this chapter, the term is used in this second sense.

monitoring, SES experiments, modeling and scenario planning), the ZA “now constitute a network”. The benefits of a network organization have long been recognized:

The diversity of situations studied [in the ZA] requires active networking, with the aim of pooling methodologies, [...] addressing shared scientific issues, and conducting forward-looking discussions. This network also makes it possible to analyze the heterogeneity of territories and their responses in a relevant way. (Lagadeuc and Chenorkian 2009, authors’ translation)

The RZA, certified as a research infrastructure (RI) in 2018, brings together some 15 ZA, and its management promotes, as much as possible, the development of different types of transversal collaboration between ZA (theoretical, thematic, methodological, etc.).

Before presenting each ZA, this introduction is therefore devoted to the network, its history, its particularities and its originality. The purpose of this chapter is to trace the origins of the RZA and follow its development over time: How was it formed? How has it evolved? What was the vision of its successive coordinators and how does it currently fit into the evolution of the world of research, particularly in relation to the sciences of resilience and sustainability? This brief reconstruction of the history of the RZA, enriched by a series of interviews with some of the network’s coordinators from its inception to the present day – Alain Pavé, Christian Lévêque, Yvan Lagadeuc, Gudrun Bornette and Vincent Bretagnolle – leads us to establish the main chronological milestones in the network’s development, define the concepts and methods shared by the ZA, and identify the originality of this initiative in the national, European and international landscape.

Throughout this chapter, from the first attempts at structuring to the present day, the RZA has shown great flexibility. The RZA is a network that is gradually taking shape, with a variable geometry, a network that does not see itself as merely a juxtaposition of the ZA, that questions itself and is sometimes questioned, that reshapes itself under certain pressures (particularly institutional and budgetary), but that never disappears completely, to the point where it now appears to be more institutionally solid. It is a network that has undergone numerous mutations without denying its original foundations – such as interdisciplinarity and transdisciplinarity (see footnote 1) – which enable it to tackle complex issues and be attentive to the needs of the territories (see sections 1.3.1 and 1.3.2). A network that can legitimately promote and embody a project for the transformation of territories (see Chapter 17).

1.2. Polymorphism and mutations

The history of the RZA highlights numerous changes – the network has had different names, various types of internal organization and governance, and several ZA have been created and closed – and sometimes attests to tensions between institutes (see section 1.2.1), while also showing developments in the concepts adopted by the network to define its philosophy. Tracing this history, and in particular its institutional history, also shows that the RZA has gradually reinforced its identity in a context where sustainability science was still in development. This is a relatively new scientific field in France that is still seeking its place (Kates et al. 2001).

1.2.1. *Perpetual change from an institutional perspective*

1.2.1.1. *Changes and turmoil before the creation of the RZA*

The first ZA were certified around 25 years ago, in the wake of the interdisciplinary environmental research program³ (see Figure 1.1). Interdisciplinary Environmental Research Programs (PIREN⁴), created in September 1978, marked the beginning of the development of environmental program at CNRS, and was subsequently replaced by the Environment Program (PE⁵) and the Environment, Life, and Societies Program (PEVS⁶ 1 and 2, Pavé 2001⁷).

Several factors are important to consider in order to understand the creation of PIREN (Jollivet 2001). First, there was the emergence of environmental concerns in France, the existence of a scientific community interested in the future of agricultural production systems and rural areas that had already acquired some interdisciplinary experience, and finally, the impossibility of accommodating this new field of research, the environment, within the evaluation structures of the CNRS. The missions of PIREN were therefore: 1) to provide “decision support” to policy makers “by providing up-to-date scientific data”; to this end, 2) to conduct research to “improve knowledge of the environment”; 3) to “promote applied environmental research”, particularly in collaboration with industry; and finally, 4) to “inform the social-economic sector” (Bernard 1980, cited by Jollivet 2001).

3 *Programme interdisciplinaire de recherche en environnement.*

4 *Programmes Interdisciplinaires de Recherche en ENvironnement.*

5 *Programme Environnement.*

6 *Programme Environnement, Vie et Sociétés.*

7 This name continues to be used in the Seine basin. The *PIREN Seine* which is now part of the *ZA Seine* (see Chapter 2).

The objective of PIREN was therefore to “establish facts relating to fundamental knowledge of the environment, necessary for environmental management and forecasting” (Aubry 1983, cited by Jollivet 2001). Just 4 years after its launch, the program’s management estimated that it involved around 200 laboratories and 650 researchers and technicians. Interdisciplinary by necessity due to the complexity of the issues addressed, PIREN spanned the scientific departments of the CNRS and involved the French Ministry for Environment⁸ (Lévêque et al. 2008).

From an institutional point of view, PIREN has had an eventful history. While its initial status was that of an autonomous program, cutting across various scientific departments, over time PIREN came to operate under the control of one or other of the two departments that were then very influential in the field of the environment, namely, Life Sciences (SDV⁹) and Sciences of the Universe (SDU¹⁰, i.e. the French National Institute for Sciences of the Universe (INSU¹¹)) (Muxart 2004). From then on, we witnessed a gradual dismantling of the PE to such an extent that in the early 1990s, several programs set up by PIREN and focusing on the atmosphere at the regional level, remote sensing and the atmospheric phase of biogeochemical cycles gradually left the PE to join INSU. As a result of the new thematic division, the physics and biogeochemistry communities were no longer under the purview of the PE.

The Environment, Life, and Societies Program (PEVS), created in 1994 and placed under the authority of the INSU in 1998, continued to mobilize part of the scientific community around environmental issues (Muxart 2004). In 1999, one of the PEVS’s planning bodies, the Scientific Committee on Societies, Environment, and Sustainable Development (SEDD¹²), was set up with the aim of promoting interdisciplinary research on the environment, bringing together researchers from the Humanities and Social Sciences (HSS), Life Sciences, and Earth Sciences. However, this ambition has encountered conceptual and operational difficulties, with debates “at the crossroads of science and institutions”, particularly concerning the role of HSS in addressing environmental issues (Vivien and Muxart 2011). Although there was little interaction between the various scientific committees of the PEVS, certain transversal actions involving several SEDD members were being carried out. These different programs converged thanks to the ZA label, for which an “inter-committee” and “inter-mission” structure was established.

⁸ *Ministère de l’Environnement.*

⁹ *Sciences De la Vie.*

¹⁰ *Sciences De l’Univers.*

¹¹ *Institut National des Sciences de l’Univers.*

¹² *Sociétés, Environnement et Développement Durable.*

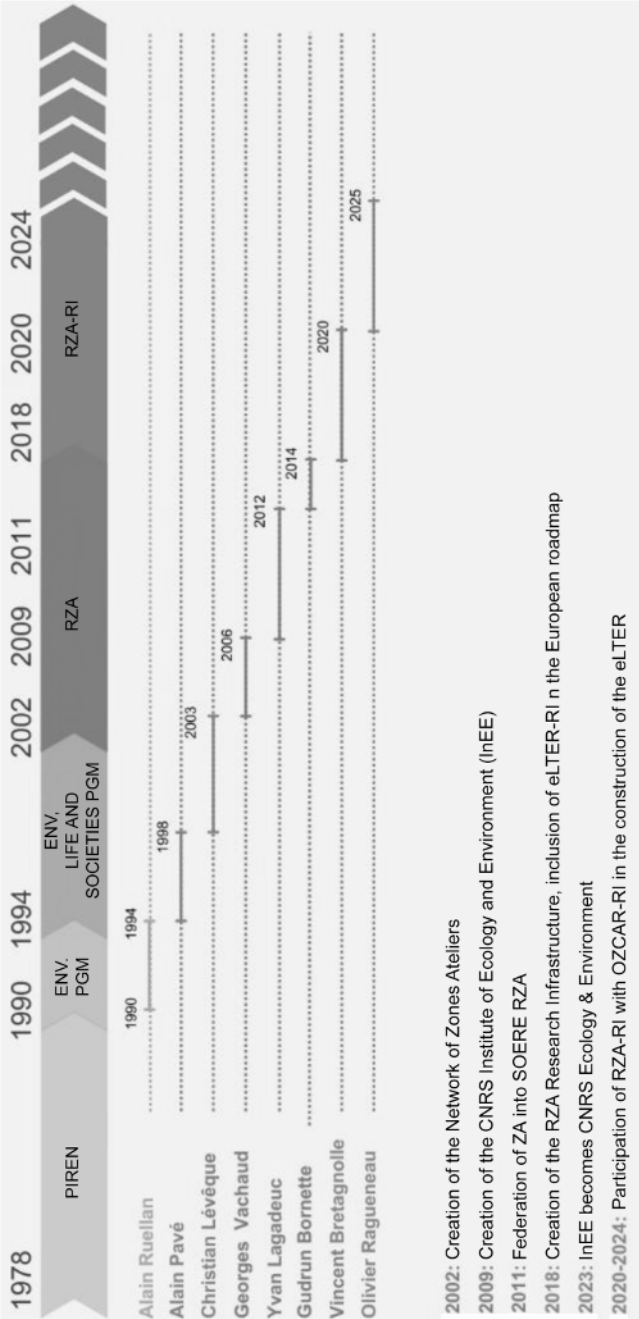


Figure 1.1. Key dates and directions taken by the RZA (RZA 2024). For a color version of this figure, see www.iste.co.uk/ragueneau/zonesateliers.zip

The PEVS was dissolved in 2003, when the SDU department (and therefore the INSU) became responsible for environmental issues within CNRS. However, this attachment to the INSU was quickly abandoned in favor of the creation, in 2006, of a new autonomous scientific department, Environment and Sustainable Development (EDD¹³), with a transversal focus (Vivien and Muxart 2011), under the leadership of Bernard Delay (Delay et al. 2007). The actions of the ZA were then coordinated by the CNRS EDD department before being entrusted to the Institute of Ecology and Environment (InEE¹⁴, renamed the CNRS Ecology and Environment, CNRS E&E¹⁵, in 2023), which succeeded it in November 2009 when the CNRS was subdivided into a dozen institutes (Gail 2013).

1.2.1.2. *The RZA in France: evolution and structuring*

The term “Zone Atelier” was chosen by Christian Lévêque, director of the network between 1998 and 2003. The literal translation of the French is a “workshop zone” and sought to evoke a place where people come together to work on an “objective”, a place where they can express their creativity and experiment with different ways of managing the environment (interview with C. Lévêque, 3 April, 2024). This name had already been used in the early 1990s as part of the Franco-German Institute for Environmental Research (IFARE¹⁶) project, whose French branch was in Strasbourg (Zilliox 1990), interview with Zilliox in *Les Échos* (Rose 1993). The term “Zones Ateliers” first appeared within the Public Interest Group (GIP¹⁷) for research on hydro systems (GIP Hydrosystèmes), created in 1993 in the wake of the PIREN projects on major rivers, including the Plaine d’Alsace (Houi and Verrel 1994; Chartier-Touzé et al. 1997; Arpin et al. 2022). It therefore took only a few years for this term to be chosen and generalized before becoming “official” in 2001.

At the end of 2002, a total of 11 ZA had been certified by PEVS 2, to which three others located outside mainland France must be added (Research on the Antarctic and Sub-Antarctic Environment, Environment and Development in the Amazonian Frontier, Savannas of West Africa) (Lévêque et al. 2008). Most of the former PIRENs were easily transformed into ZA because, as Alain Pavé told us during our interview with him (December 13, 2020), “people were generally used to working together”. The launch of the RZA was therefore well received by the French research community. Internationally, American researchers, who at the time

13 *Environnement et Développement Durable.*

14 *l’Institut Écologie et Environnement.*

15 *CNRS Écologie et Environnement.*

16 *Institut Franco-Allemand de Recherche sur l’Environnement.*

17 *Groupe d’Intérêt Public.*

were developing environmental research that was sometimes less connected to society and local stakeholders, began to take an interest in ZA (interview with C. Lévêque, 3 April 2024).

An international scientific council was set up in 2007 and meets once a year to evaluate and renew the ZA. At that time, the process of creating a ZA corresponded to a “long construction phase that benefited everyone”, as noted by A. Pavé, who had been director several years earlier (interview with A. Pavé, 13 December 2020): there were many discussions and exchanges between the project coordinators and the network’s scientific council.

However, there seemed to be a lack of real coordination between the different ZA (interview with Y. Lagadeuc, 26 October 2020): exchanges between the ZA were too rare and scientific dynamics between ZA were virtually non-existent. Some of the ZA were working very well, others less so and will be closed. Around 2011, the network experienced a real crisis. “If we wanted to do something with the ZA, we needed a network”. The network director, Yvan Lagadeuc, therefore sought to reaffirm certain principles: (1) ensuring long-term research, (2) developing a collective vision and establishing a common theoretical framework for human/environment relations, and (3) repositioning the RZA in a visible international context. To do this, the ZA drew inspiration from Long Term Ecological Research (LTER), a national network of ecological observatories set up in the United States (a collaboration agreement was signed in 2012 with LTER, and the RZA became a partner in a project on sustainable cities funded by the National Science Foundation). The RZA then drew on the concept of social ecological systems developed in the United States (Grove and Burch 1997; Grimm et al. 2000; Collins et al. 2011) and attempted to integrate more HSS. Contacts were established with several American initiatives, such as the one in the Rockies or the Kellogg Biological Station in Michigan, where there was a significant HSS component; the one in New Orleans, which addressed the relationship between nature and society, particularly in the aftermath of Hurricane Katrina; and those concerning urban contexts such as Baltimore and Phoenix, Arizona. The ZA *Environnementale Urbaine de Strasbourg*, certified in 2010, is part of this trend (see Chapter 10). European partnerships were also being forged within the Alter-Net network (whose vice-presidency is held by Y. Lagadeuc), which gave rise to IR eLTER a few years later.

Between 2010 and 2020, two important steps were taken to continue the structuring effort. First, the ZA were brought together under an Observation and Experimentation System for Research and the Environment (SOERE¹⁸) RZA, called

18 *Système d’Observation et d’Expérimentation pour la Recherche et l’Environnement.*

the SOERE-RZA for short, which was certified by the Ministry of Higher Education and Research and Innovation (MESRI¹⁹) for the first time in 2011 and renewed in 2015. On the other hand, in May 2018, the RZA was recognized by the MESRI as a Research Infrastructure (RZA-RI), whose objectives go well beyond those of SOERE, taking into account the evolution of the national and European landscape in terms of RIs, the growth and critical mass of the network, as well as the unique environmental challenges co-constructed with academic actors and stakeholders in the territories. This transition from SOERE to RI was carried out by V. Bretagnolle, then Director of the RZA, and his deputies. The RZA-RI is included in the national RI roadmap, supported by the ministry and overseen by the National Alliance for Environmental Research (AllEnvi²⁰). The RZA is quite unique in the French landscape of environmental RIs, as it is the only social-ecological RI. It is not really a physical infrastructure but is rather built on personnel and relationships. In conjunction with the Management Committee (Codir²¹), which brings together all the directors of the ZA, the RZA's management has affirmed its desire to give greater consistency to the network in order to develop comparative approaches between ZA. It is at this point that transversal inter-ZA actions are launched and facilitated.

Finally, two years after receiving its certification, the RZA-RI contributes to the French node of the European Long Term Ecosystem Research Infrastructure (eLTER) network, jointly with the Critical Zone Observatories: Research and Application (OZCAR²²). This partnership is included in the European Strategy Forum on Research Infrastructures (ESFRI). As a social-ecological infrastructure, the RZA contributes significantly to the structuring of LTSE platforms within the eLTER.

1.2.1.3. *RZA-RI: consolidation and governance*

Today, the RZA-RI comprises 16 ZA in mainland France, the French Southern and Antarctic Lands, and Zimbabwe (see section 1.2.2). Two other ZA are currently being set up (French Guiana and French Polynesia). Members belong to various supervisory bodies: the CNRS, 58 French universities, 23 foreign universities, 26 leading business and engineering schools and 24 other public research institutions, in particular the French National Research Institute for Agriculture, Food and Environment (INRAE²³), Research Institute for Development (IRD²⁴), the

19 Ministère de l'Enseignement supérieur et de la Recherche et de l'Innovation.

20 Alliance nationale de recherche pour l'Environnement.

21 Comité de direction.

22 Observatoires de la Zone Critique – Applications et Recherches.

23 Institut National de la Recherche Agronomique.

Agricultural Research Centre for International Development (CIRAD²⁵) and the French Research Institute for Exploitation of the Sea (Ifremer²⁶). The most recent figures estimate the network's workforce at nearly 1,800 people, including 240 doctoral students, which is equivalent to 520 full-time equivalents (16% permanent CNRS staff, 39% permanent non-CNRS staff and 45% non-permanent staff from all supervisory bodies).

The missions of the RZA's social-ecological RI can be defined in terms of research and services. In terms of research, this involves: (1) understanding how social ecological systems function and describing their past, present and future trajectories; (2) facilitating joint inter-ZA research activities (comparison, testing hypotheses along gradients, etc.); and (3) thinking about/rethinking our research practices – inter- and transdisciplinarity (see section 1.3.2), relationship to science, technology, politics, social and environmental responsibility in higher education and research, researcher engagement, etc. In terms of services, this involves: (1) offering the national and international scientific community pilot sites for joint research in sustainability sciences (issues, infrastructure, interdisciplinary skills, network of stakeholders, etc.); (2) collecting, managing and making data available, with a view to open science; (3) offering a unique, interdisciplinary and transdisciplinary training framework; and (4) co-producing knowledge to support regions in their desire to transform toward greater sustainability.

As a young RI, efforts since 2020 have focused primarily on consolidating the RZA as a network. To this end, the RZA-RI has succeeded in obtaining a coordination and communication officer position in 2023 and benefits from the support of a project manager who devotes a small portion of her time to RI. Together with the current director (O. Ragueneau) and deputy director (V. Lea), they form the RZA's executive committee, whose governance is gradually being strengthened:

– The Management (Mgmt) team consists of this executive committee and five deputy directors in charge of the services provided by the infrastructure (eLTER, data and open science, services and indicators, systemic modeling, communication and links with the Third Sector of Research). The role of the management team is to assist the director in implementing and monitoring actions contributing to the RI's activities, participating in its coordination, communication and representation.

24 *Institut de Recherche pour le Développement.*

25 *Centre de coopération Internationale en Recherche Agronomique pour le Développement.*

26 *Institut français de recherche pour l'exploitation de la mer.*

– The Management Committee (Codir), which brings together the Mgmt and all the directors of ZA, participates in defining the RI's operating and development strategy, defining the principles of access to the RI, preparing, organizing and managing relations with Europe, and finally, producing the RI's activity reports. It meets twice a year.

– The network has a new Management committee (Copil), which met for the first time in 2023, bringing together members of MESRI, AllEnvi, CNRS and various RZA partners (IRD, INRAE, CIRAD, Ifremer, the French National Institute of Health and Medical Research INSERM²⁷, vice-presidents of research or training at universities, etc.).

– At the time of writing, an External Scientific Council (CSE²⁸) and a Partners' Committee (CdP²⁹) were seeking to bring together the heads of stakeholder networks under consideration.

Finally, the ZA Think Tank (LIZA³⁰) is a fundamental part of the system for working on transversal issues. It brings together the leaders of the Workshop Groups (WGs) set up to develop inter-ZA actions.

1.2.1.4. *Networked operating mode and transversalities between ZA*

Until the early 2010s, the RZA consisted more of a group of juxtaposed ZA than a true network. Interactions between ZA were rare between scientific council meetings. The network was therefore a “collection of very heterogeneous and independent structures” (interview with V. Bretagnolle, 18 December 2020).

In 2010, joint actions were launched, such as those focusing on urban ecosystems, which were entrusted to the ZA urbaine de Strasbourg. In September 2013, under the coordinatorship of Vincent Bretagnolle and during a national training workshop organized at the oceanographic observatory in Banyuls-sur-Mer, several actions were developed with a view to create a genuinely functional network. One workshop was dedicated to the scientific structuring of the ZA, discussing the idea of comparative approaches between ZA, as well as possible work along gradients of all kinds (climate, degree of anthropization, etc.). Several transversal actions were then implemented to strengthen the links between ZA and to ensure that the network, which became SOERE in 2011, ultimately represented

²⁷ Institut National de la Santé et de la Recherche Médicale.

²⁸ Conseil Scientifique Externe.

²⁹ Comité des Partenaires.

³⁰ Laboratoire d'Idées des Zones Ateliers.

more than the sum of its parts. These actions relate as much to data production and management as to more conceptual work.

In terms of measurements and observations, networks are gradually being set up within the RZA to participate in various initiatives. At the international level, for example, several ZA are joining the TEABAGS network (Djukic et al. 2018) to measure the degradation of organic matter in soils. At the national level, in conjunction with the RECOTOX network (INRAE, CNRS Ecology and Environment, AllEnvi), under the NEONET project nine ZA are joining together to assess the persistence of neonicotinoids in crops. NEONET brings together 13 French partners and more than 20 sites to analyze and quantify the risks associated with the persistence of these neonicotinoids in field crops (Mougin et al. 2018).

In addition, a major project to pool data through the Banking Data Together (BED³¹) project was launched in 2016 and is still ongoing (see Chapter 17). The aim of this project is to improve the quality and interoperability of the data collected and archived by researchers working in the ZA in France. The BED approach is to work on the documentation and traceability of information as soon as it is collected in order to make the data Findable, Accessible, Interoperable and Reusable (FAIR) (Wilkinson 2016).

On a conceptual level, several transversal initiatives have been launched. These include, in particular, a Transversal Approach on Human-Nature relations (ATHN³²), as well as work on the governance of social-ecosystems, which led to the organization of a national training initiative on the subject in Brest in 2017. This initiative has enabled links to be forged with the European GOSES network, which works on SES governance. The coordinator of this European network at the time was J.-M. Church, who went on to play a major role in the creation of the *ZA Argonne* (ZAAR, see Chapter 15).

Still from a conceptual point of view, and following the impetus given by Yvan Lagadeuc, the network took up the concept of social ecological systems to work on adapting it to the level of the ZA. Between 2015 and 2018, a group of around 20 people, mainly ZA directors, met once or twice a year to develop the conceptual framework presented in the publication that appeared in 2019 (Bretagnolle et al.). This interdisciplinary work strengthened the links between ZA coordinators and, through lengthy discussions, helped to forge a vocabulary that was, if not common, at least shared. The resulting conceptual framework is presented in section 1.2.3 (see Figure 1.4).

31 *Bancariser Ensemble les Données.*

32 *Action Transversale sur les relations Humain-Nature.*

In line with these transversal actions, and with the aim of facilitating and developing interactions between the ZA, the new management team set up the RZA Think Tank (LIZA³³) in 2020. Aiming to strengthen several key areas (European integration, data management, socio-ecosystem governance, environmental health, etc.) and to open new ones (concepts and practices of inter- and transdisciplinarity, links with university training, think tank activities, communication, etc.), LIZA is structured around a dozen working groups (WGs). These groups pertain to: (1) specific research issues, (2) the services provided by the RI, or (3) research processes (see Figure 1.2). These WGs are intended to serve as melting pots for the development of inter-ZA research projects and for the publication of transversal articles and books. Since the establishment of these WGs, there have been a number of successful examples of transversal collaboration: the work of WG2-Interdisciplinarity led to the submission of an inter-ZA French National Research Agency (ANR³⁴) project, the Ecosystem services provided by streams to adjacent agricultural terrestrial ecosystems STRANGE project, funded in 2023 and involving three ZA. The WG3-Transdisciplinarity participated in the creation of the ANR EQUIP ACTors for more impactful transitions (EQUIPACT³⁵). This action research project, which brings together two RIs (RZA-RI and the National Network for the *Maisons des Sciences de l'Homme*³⁶), two public laboratories, seven associations and the Toulouse Museum, unites members from nine different ZA. It aims to improve the quality and impact of citizen and association participation in co-research with a view to ecological, solidarity-based and democratic transitions, and seeks to enrich the skills of the public researchers involved.

Another strong initiative to develop transversal collaboration, the RZA is setting up a project development grant. It is offered annually to encourage the creation of inter-ZA projects to be submitted to other funding bodies (ANR, Europe, Belmont Forum, etc.). In 2023, for example, the France's Drinking Water Supply (AEP³⁷) is supporting two projects. The first concerns a broad theme, water policies in river basins in light of scientific expertise in these areas, and brings together seven ZA. It has led to the creation of a research consortium and the preparation of a response to the ANR's 5th thematic call for proposals on "Scientific expertise in support of public policy". The second project, "*Zone Art*", aims to promote research-creation, an approach to renewing interdisciplinary and transdisciplinary research practices

³³ *Laboratoire d'idées des Zones Ateliers.*

³⁴ *Agence Nationale de la Recherche.*

³⁵ *EQUIper les ACTeurs pour plus d'im-pacts de transition.*

³⁶ The French National Network of Houses for the social sciences and humanities for national and international scientific collaboration.

³⁷ *Alimentation en Eau Potable.*

(see the first note at the beginning of the chapter on the term “transdisciplinarity”) on social ecological systems in light of current issues. This project involves five ZA. The first researcher-artist residency thus enables the construction of a pilot program that can be replicated in different contexts and demonstrates the place of the arts at the interface between various types of knowledge.

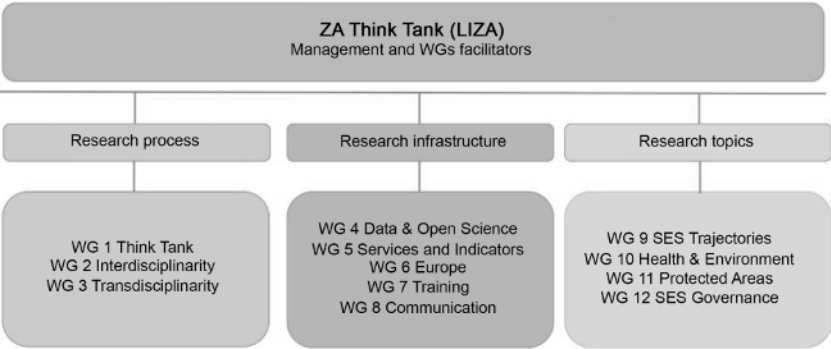


Figure 1.2. *LIZA and its working groups implemented in the 2020 roadmap (RZA 2020)*

Finally, the RZA is launching its winter school, with the first session scheduled for 2022. The winter schools are devoted to RZA themes (social-ecosystems, inter- and transdisciplinarity – see the first note at the beginning of the chapter on the term “transdisciplinarity” – etc.) and illustrating them with issues specific to the host ZA. Their aim is to convey to students – from the ZA but not exclusively – the idea of a systemic approach to SES, to provide methodological keys, and thus to contribute to the dissemination and promotion of accumulated knowledge, particularly within the ZA, which are a key vector for this. Each school involves researchers from several ZA, as well as public and private managers (the French Office for Biodiversity [OFB³⁸], Conservancies of Natural Areas [CEN³⁹], Regional Centers for Forest Property [CRPF⁴⁰], French Geological Survey [BRGM⁴¹], etc.) and staff from decentralized state and regional services (Regional Directorate for the Environment, Development and Housing [DREAL⁴²], Regional Directorate for Food, Agriculture

38 *Office Français de la Biodiversité.*

39 *Conservatoires des Espaces Naturels.*

40 *Centres Régionaux de la Propriété Forestière.*

41 *Bureau de Recherches Géologique et Minières.*

42 *Direction Régionale de l'Environnement de l'Aménagement et du Logement.*

and Forestry [DRAAF⁴³], Region, Departmental Directorate of Territories [DDT⁴⁴], etc.), who work with them to develop the training program in advance. In doing so, the winter school fulfills one of the RZA's training objectives: to promote contact between students and teaching teams and local stakeholders, which is fundamental to helping new professions emerge at the interface between different types of knowledge. Finally, winter schools also serve as a testing ground for innovative teaching practices, particularly through interdisciplinary and transdisciplinary workshops.

Despite the ups and downs mentioned above, the RZA has consolidated over time, becoming a social-ecological RI in 2018. Since then, efforts have focused primarily on developing transversal links between the ZA. The adventure is far from over: as this overview of the history of the RZA comes to an end, the contours of the RI are being redefined due to the planned merger with the Human-Environment Observatory (OHM⁴⁵, see Chapter 17).

1.2.2. A map that is constantly evolving

The geographical boundaries of the ZA are not strictly defined: varying greatly in size, this territory covers a “mesoscale” (Lévêque et al. 2008; Lagadeuc and Chenorkian 2009) often referred to as regional for convenience (Bourgeron et al. 2009). This scale is particularly well suited to providing a comprehensive description of the models, processes and functions of ecosystems, including relevant social and political factors, necessary for synthesizing current knowledge of SES and their interactions. The geographical outline of a ZA is thus defined by a territory in which several social ecological systems may coexist.

This choice of intermediate scale, favored by the Environment, Life, and Societies Program (PEVS), makes it possible to avoid dealing solely with local problems or addressing issues on a global scale (Lévêque et al. 2008). The “mesoscale” is considered to be the most relevant scalar dimension for approaching these interactions with “reasonable” complexity. The ZA is thus a place where local dynamics confront national and/or global dynamics.

43 Direction régionale de l'Alimentation, de l'Agriculture et de la Forêt.

44 Direction Départementale des Territoires.

45 Observatoires hommes milieux.

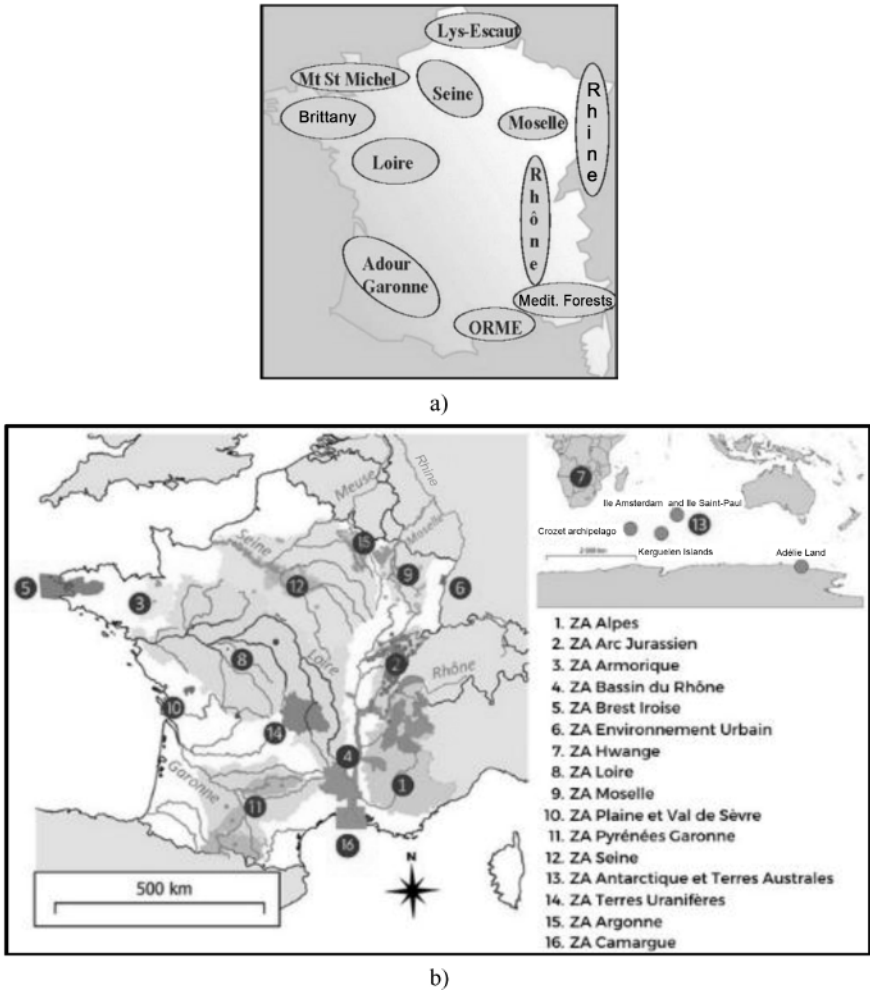


Figure 1.3. (a) Map of Zones Ateliers certified by PEVS 2, taken from (Lévêque et al. 2008); (b) map of Zones Ateliers in 2024, adapted by the RZA from a map by Marie-Noëlle Pons, ZAM. For a color version of this figure, see www.iste.co.uk/ragueneau/zonesateliers.zip

Clearly, this definition of a “mesoscale” remains broad enough to give each of the ZA a certain degree of freedom in defining its boundaries. This freedom is claimed every 5 years when each ZA applies for renewal: depending on developments in the themes, any changes in the composition of the research teams, progress in interdisciplinary work, or the dynamics of interactions with local

stakeholders, the boundaries of a ZA may change and, within its perimeter, certain experimentation sites⁴⁶ may be created or, conversely, abandoned. Each of the following chapters reports on these developments.

At the network level, the map of ZA has changed (see Figure 1.3(a)). A comparison of the 2008 map (Lévêque et al.) with the current map shows the outlines of former ZA that have remained in place – sometimes with a few changes – (*ZA Seine*, *ZA Bassin du Rhône*, *ZA Loire*, for example, see Chapters 2, 4, 6), those of ZA that have been abandoned (*ZA Mont-Saint-Michel*, *ZA Lys Escaut*, *ZA Forêts méditerranéennes*, etc.), and those that were abandoned before being recreated under a different name and with a different focus than the initial ZA (*ZA Adour-Garonne* became *ZA PYGAR*, see Chapter 14). The current map (see Figure 1.3(b)) thus reflects changes in local dynamics, but also in the decision-making of various RZA directors to close or promote the creation of a ZA in a particular region. More recently, the creation in 2024 of the Camargue ZA (see Chapter 16) and plans to create new ZA in Polynesia and French Guiana are an expression of the strong commitment of the CNRS Ecology and Environment.

1.2.3. Evolution of unifying concepts for the ZA

The RZA also evolves, above all, as per the unifying concepts to which it refers and around which it is organized. The ZA, grouped together within the RI, thus share a common conceptual framework, even if each ZA, depending on its history, territory and themes, borrows to varying degrees from the RZA's philosophy.

From a general point of view, the ZA approach has, from the outset, been part of a “sustainable development” approach, defined as a perspective of long-term use and sharing of resources, spaces and territories, structured at the intersection of issues relating to the current and future satisfaction of the fundamental needs of human beings in all their dimensions (food, health, justice, education, quality of life, freedom of expression, etc.) and issues relating to the long-term consequences of current development trajectories (Lévêque et al. 2000; Vivien and Muxart 2011).

One of the first concepts to have played a unifying role for the ZA is that of the environment. At the origin of PIRENs, the term “environment” did not refer to a research subject (Jollivet and Pavé 1993). It was the definition of major programs that made it a field in its own right (Jollivet 2001). While PIREN allows the concept of environment to be approached from a variety of angles, the term primarily encompasses all of the biophysical and chemical environments with which humans

46 *Site Atelier* (SA).

interact. In this case, the environment is only secondarily the context in which individuals and groups live, even if the analysis of causes, which is the domain of technical and social sciences, is not forgotten (Jollivet 2001). Later, in the 2000s, when the ZA emerged, the environment was still perceived as that which surrounds humans, from the local environment of an individual or group of individuals to the global environment, that of all human societies (Lévêque et al. 2000). The environment thus seemed to consist of non-living natural elements (water, air, rocks), living beings (animals, plants, microorganisms) and the derivatives of human activity (energy, transportation, various constructions, developments). Ultimately, even if these entities are conceived as interacting with each other, humans – in the biological sense – are cut off from nature.

Alongside these conceptions of the environment – and partly in opposition to them – other concepts are gradually emerging, such as (1) ecosystem services, (2) anthroposystem, and (3) social-ecosystem.

1) The concept of ecosystem services is gradually gaining ground within the RZA. It reflects human societies' dependence on the functioning of ecosystems. This term, which first appeared in scientific literature in the 1970s, gradually became formalized (Costanza et al. 1997; Daily 2003), until it was universally defined in 2005 in the publication of the results of the Millennium Ecosystem Assessment. Classified as provisioning services, regulating services, social-cultural services and supporting services, the "benefits that humans derive from the functioning of ecosystems" (Millennium Ecosystem Assessment, 2005) represent both the qualitative and quantifiable benefits derived by humans and constitute one of the links between biophysical and social models (Liu et al. 2007). This definition is subsequently taken up more or less in the literature (Diaz et al. 2018) and is further developed. For Virginie Maris, the aim is to propose a conceptual and analytical framework that better represents the multiplicity of goods and services that nature provides to humans but also takes into account the diversity of values that underpin the relationships between humans and their environment (Maris et al. 2016). We are therefore faced with a complex notion whose interpretation varies according to the social-economic context and the disciplines of the authors who use this concept. Today, the concept of ecosystem services is the subject of debate within the scientific community and civil society, with some seeing it as necessary for protecting nature and others viewing it as a commodification of nature leading to low sustainability (Laurans et al. 2013; Levrel et al. 2015).

2) The concept of anthroposystem (Lévêque et al. 2000), followed by that of (3) social-ecosystem, which quickly took over, both encourage us to no longer consider – and therefore no longer study in a univocal way – the impacts of societies

on their environment or vice versa, but rather to analyze their interactions, that is, the reciprocal effects of one system on the other and their coupled evolution over the long-term (Lévêque et al. 2008).

The interview with Christian Lévêque highlights the fact that the concept of anthroposystem was itself preceded by that of hydrosystem (which already encompassed the notions of geosystem and ecosystem). It was the desire to integrate more HSS into PIREN programs that led to the emergence of the concept of anthroposystem. “We wanted a unifying term to bridge the gap between the social sciences and ecology!” (interview with C. Lévêque, 10 November 2020). And it was notably thanks to archaeologists and historians, who brought a temporal depth to the project, that this was able to happen. Thus, for the first time in 1997, an archaeologist (Joëlle Burnouf) headed a PIREN, the PIREN Loire, then headed the ZA Loire in 2001 (see Chapter 6), whereas previously PIREN site managers had been exclusively geologists or ecologists.

Taking a resolutely holistic and systemic approach to the study of the interactions between societies and nature, developed since the 1940s in the United States, proponents of the anthroposystem concept propose to group under this term the interactions and co-evolutionary dynamics between natural and social systems:

[The anthroposystem] is defined as a complex, hybrid (Latour 2016) and interactive system between two organized sets consisting of one (or more) social-system(s) and one (or more) ecosystem(s), which are more or less artificial. These systems develop in a given territory and evolve according to a temporal trajectory. (Lévêque et al. 2008, authors’ translation)

Nevertheless, this concept of anthroposystem has been completely overshadowed by that of social-ecosystem.

3) The concept of social-ecosystem shares with that of anthroposystem the fact that it refers to integrated systems linking nature and societies (Berkes and Folke 2000; Holling 2001; Haberl et al. 2006; Liu et al. 2007; Collins et al. 2011). Addressing only the social dimension of resource management without considering ecosystem dynamics or focusing exclusively on biophysical processes as the basis for sustainability decision-making would lead to biased conclusions that could result in unexpected outcomes.

The RZA integrates social-ecosystem approaches around 2008 (interview with Vincent Bretagnolle, 18 December 2020). Between 2015 and 2018, extensive reflection was carried out in order to formalize an innovative conceptual corpus that

now constitutes the theoretical basis of ZA (Bretagnolle et al. 2019). This reflection was necessary because there is a wide gap between theory and practice when it comes to implementing sustainable transformation – most social-ecological frameworks lack operational links between societies and nature to effectively steer SES toward sustainability – and the research process is mostly considered disconnected from the system’s trajectory.

In the founding article of the SES conceptual framework applied to the ZA (Bretagnolle et al. 2019), researchers from the network put forward new proposals for the implementation of conceptual tools for the development of operational levers (see Figure 1.4). They suggest considering the SES as a dynamic entity composed of two articulated interfaces – the Ecosystem Services interface (functions, goods and services, benefits) and the adaptive management interface (collective action, use of multiple resources, practices) – both defined in a given geographical context. These interfaces describe how humans benefit from and manage the complex and evolving interactions between biophysical and social models. They must therefore be treated jointly as coupling agents in social-ecological processes. While the return arrow from ecosystems to society had been widely described in many SES conceptual frameworks – particularly through ecosystem services – the arrow from society to ecosystems had not been sufficiently explained, other than from the perspective of forcing, continuous or accidental pressures (Collins et al. 2011).

The RZA researchers conclude that understanding the key processes underlying the dynamics of interactions – particularly those using adaptive management processes – would help identify avenues for adaptation in collective practices and actions, provide a crucial knowledge base for decision-makers and promote functionality as a prerequisite for SES research programs (Bretagnolle et al. 2019). Issues of collective action, public policy and conflicts of use are therefore explicitly added to the adaptive management chain. Practices are also introduced in order to make this model more operational for local stakeholders.

Other concepts are beginning to emerge within the network and could play a major, structuring role in the future. One of these, mentioned in the most recent RI roadmap (2020–2025), relates to “transformation”, particularly the transformation of territories (see Chapter 17). To what extent will it be possible, at the level of the ZA, not only to study trajectories, which are examined, quantified and experienced, but also to influence them in order to divert them through the joint action of local stakeholders and researchers (interview with V. Bretagnolle, 18 December 2020)? To what extent will it be possible to transform the territory of each ZA in a proactive and conscious manner? What does this say about the changing role of research in society and the issue of researcher engagement? These are all questions that are

being debated within the LIZA Think Tank WG1. To this end, links with institutions, public action, stakeholders and citizens will undoubtedly be fundamental (Ragueneau and Lea 2024, see Chapter 17).

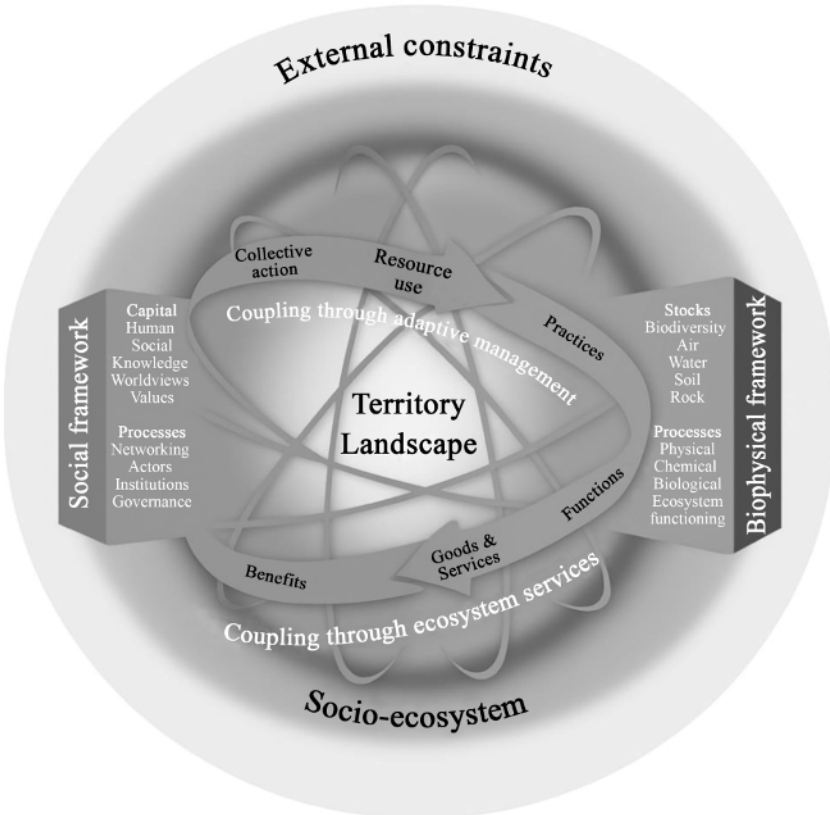


Figure 1.4. *Conceptual framework of the social-ecological systems (SES) within French Long-Term Social-Ecological Research (LTSER) platforms, adapted by the RZA (2025) based on Bretagnolle et al. (2019). For a color version of this figure, see www.iste.co.uk/ragueneau/zonesateliers.zip*

1.3. Interdisciplinarity and interactions with local stakeholders: foundations that are never questioned, but sometimes difficult to implement

Since social-environmental problems have social, technical, economic, ecological and other components – which not only form complex systems (Morin

2005) but also interact to create phenomena with equally complex causes and consequences, known as wicked problems (Levin et al. 2012) – solving them requires a new research approach. This requires moving beyond disciplinary approaches to develop interdisciplinary approaches, interacting with the non-academic world and adopting an open attitude that allows us to take a step back and step outside our comfort zone (Jahn et al. 2012). No single individual or discipline can claim to possess the knowledge needed to understand these problems. The calls from regulatory bodies for systemic approaches are thus becoming increasingly prevalent (Ragueneau 2023). In this context, local stakeholders are as necessary as researchers in order to integrate the best available knowledge and encourage the widest possible ownership of the problems and possible solutions. Because the world is complex, societal challenges must be addressed by combining scientific disciplines with each other, but also with traditional knowledge, practices and experiences (Pestre 2013; Nicolas-Le Strat 2016).

This new research approach may also require “thinking outside the box” and moving toward post-normal science (Funtowitz and Ravetz 1993). This is an appropriate problem-solving strategy when “the facts are uncertain, the values contested, the stakes high, and the decisions urgent”. The scientific process must encompass recognition of complexity and management of uncertainties known to local stakeholders. Co-research can therefore be said to be part of Post-Normal Science (PNS) insofar as it aids decision-making in complex and urgent situations (Funtowicz and Ravetz 1994; Funtowicz 2006). Furthermore, if the scientific process is accompanied by the legitimacy of a plurality of perspectives and ways of knowing, this implies, in practice, very democratic modes of operation within a society characterized by widespread participation and a high tolerance for diversity. For D’Alisa and Kallis (2016), the quality of scientific thinking must now be ensured by an “expanded community of peers”, composed not only of scientists, but also of other legitimate stakeholders, namely all those involved in the issue, who will contribute to ensuring the quality of scientific thinking.

Interdisciplinarity and interaction with local stakeholders are two of the cornerstones of the ZA. Both have been present since the inception of the PIREN sites and have undergone significant evolution. Although broad interdisciplinarity (natural sciences, humanities and social sciences; Kelly 1996) has been strongly desired since the 1980s, it has been slow to develop and still faces many obstacles today. Interaction with local stakeholders, although invoked, was not as explicitly promoted at the launch of PIREN sites – except perhaps for the transfer of knowledge to society or expertise to aid decision-making – but it has grown stronger over time thanks to fieldwork and the determination of certain ZA researchers and RZA directors.

1.3.1. *Interdisciplinarity above all else*

Beyond the juxtaposition of disciplines (multidisciplinarity), even around a common subject of study (interdisciplinarity), interdisciplinarity aims to combine concepts, approaches and tools from different disciplines to work together to solve a problem. Research conducted in ZA thus aims to develop at the interface of many disciplines:

All the experience gained through the CNRS Environment Program shows that the approach to such “hybrid” [natural and social] systems cannot be limited to being multidisciplinary, through a simple addition of disciplinary knowledge, however important it may be. It requires an interdisciplinary practice. This involves, among other things, defining a common scientific problem that cuts across specialties from the outset, answering questions that lie at the interface of several scientific fields – which refers to commonly defined concepts – and subjecting disciplinary results to criticism from other specialists. (Muxart 2004, authors’ translation)

From this perspective, the RZA is a logical continuation of PIREN, whose interdisciplinary approach was part of its DNA from the outset (Jollivet and Pavé 1993; Jollivet 2001). The main missions of PIREN were to promote interdisciplinary research in the field of the environment (Lévêque et al. 2008). With the concept of the social-ecosystem, humans are no longer isolated, and it seems essential to consider a new integrated approach to these social and biophysical systems and to develop the tools and methods to achieve this. The RZA therefore places particular emphasis on cooperation between the life and earth sciences (LES) and the HSS. This ambition for broader interdisciplinarity was clearly stated when the RZA was created: “Research in the natural sciences must necessarily be combined with research in history, sociology, anthropology, economics, law, geopolitics” (Lévêque et al. 2000, authors’ translation), as well as engineering sciences, it should be added.

Several actions have been implemented to facilitate this interdisciplinarity. Cooperation between teams from different organizations has been developed: CNRS, IRD, INRAE, France’s National Museum of Natural History (MNHN⁴⁷), universities, etc. In addition, since 2020, and more particularly at the LIZA level, WGs have been formed of researchers from different disciplines who are developing inter-ZA projects around interdisciplinary issues. In this regard, a partnership with the national network of *Maisons des sciences de l’homme* has recently been established in order to strengthen the presence of the HSS in the RZA.

47 *Muséum National d’Histoire Naturelle.*

And yet, despite these multiple incentives, implementing true interdisciplinarity remains difficult at times, particularly between the two major disciplinary fields of the LES and the HSS (Arpin et al. 2022). Many obstacles to this interdisciplinarity are well known: communication difficulties (Wear 1999), different cultural practices (concepts, schools of thought, evaluation, etc.), university education in disciplinary silos (Hart et al. 2015), a long-standing lack of trust between these disciplinary fields (Snow 2012) and a lack of time and willingness (Wolton 2013). At the time of the RZA's creation, some even considered that in France "this essential cooperation between the social sciences and the natural sciences remains almost entirely to be invented" (Jollivet 2001, authors' translation). Interviews with former directors of the RZA show that the development of interdisciplinarity was always a major concern during their tenure, even if no one denies (on the contrary) that the ZA play an incentive role that gradually promotes interdisciplinarity and allows for a real "rise in power" (interview with G. Bornette, October 1, 2020). For many of the former RZA managers interviewed, interdisciplinarity cannot be decreed: there is the weight of human relationships, and the time needed to build it, which is necessarily long. These reflections echo those of Virginie Maris, for whom interdisciplinarity is not a given, but is built and shaped little by little through experience and collaboration (Maris et al. 2016). The network must therefore continue to promote exchanges and encounters in order to move in this direction. It is in this spirit that, following the transversal actions implemented since 2015, LIZA was developed with its numerous WGs aimed at promoting transversal collaboration between ZA and fostering the emergence of interdisciplinary projects.

It will be readily understood, therefore, that within the vast body of work from the *Zones Ateliers*, the entire spectrum of collaborative approaches, from multidisciplinarity to interdisciplinarity, can be identified. The following chapters illustrate the unique construction of interdisciplinarity within each *Zone Atelier*, as well as the diversity of relationships that develop between disciplines there.

1.3.2. Transdisciplinarity: the growing hybridization of research and knowledge

Within the RZA, transdisciplinarity refers to all joint research between researchers and local stakeholders. Unlike action research, and contrary to what is observed in neighboring countries, particularly Switzerland, the term transdisciplinarity has only recently come into use within the network and more generally in France. Although it is not possible to date precisely when it was first adopted by ZA researchers, it appears that the term was rarely used before 2020 in RZA articles and official documents, which is confirmed by interviews with former

RZA managers. The same is true of the term co-research. Interactions between researchers and local stakeholders have been present since the network's inception, but are referred to in terms of knowledge transfer or decision support: some interviews (C. Lévêque and G. Bornette) describe the approach that was taken (and which may still be taken today, even if it is not exclusive): local stakeholders express a need for knowledge, which researchers then translate into various scientific issues that can be the subject of funded projects. The joint definition of a research issue by stakeholders and researchers is a more recent development: if we consider institutional stakeholders (decentralized government departments, agencies, etc.), this joint definition took place well before 2015 for certain ZA (such as ZAEU, ZAA, ZABR, and ZA); but if we consider non-institutional stakeholders (such as citizens), we probably have to wait until that same date, at the earliest, with the ZAHG and ZA PVS (interview with V. Bretagnolle, December 18, 2020).

Some local stakeholders are long-standing partners of PIRENs and ZA. This is the case for water agencies, which were among the first social-economic partners, particularly due to previous programs concerning wetlands or rivers (interview with C. Lévêque, November 10, 2020). The work relating to the “Rhône hydrosystem” – which relies on the Research, Technical Coordination and Information Group on Water, GRAIE⁴⁸) association for the interface between researchers and local stakeholders – is one of the most notable examples of this, having contributed significantly to the development of the ZABR (see Chapter 4). Other partners are frequently involved in ZA. These include local authorities, decentralized government departments (DREAL, Regional Directorate of Cultural Affairs DRAC⁴⁹, DRAAF), the OFB, protected area managers (nature reserves, national and regional parks, etc.), agricultural cooperatives, hunting and fishing federations, environmental protection associations, businesses, elected officials, etc. Therefore, the mapping of social-economic partners – as well as their interactions with the research community – can vary greatly from one ZA to another, as we will see in the chapters that make up this book.

All these regional stakeholders are part of what is known as the “Third Sector of Research” (TSR⁵⁰). The TSR, which held its conference in the fall of 2020, was followed by a national WG (2021–2022) that brought together most of the associative stakeholders in the social and solidarity economy to draft a charter,

48 *Groupe de Recherche, Animation technique et Information sur l'Eau.*

49 *Direction Régionale des Affaires Culturelles.*

50 Third Sector of Research refers to the research, innovation, knowledge production activities of the non-market sector (associations, unions, local authorities, etc.), the non-profit market sector (social and solidarity economy, professional groups, etc.) and small for-profit organizations (self-employed individuals, agricultural or craft groups, etc.).

which led to the launch of the French TSR Forum in 2023. Today, it enjoys significant institutional recognition from all the presidents of France's major research organizations. The existence of ZA in the regions offers a unique opportunity to experiment with TSR members to bring together needs and find levers that will facilitate cooperation between researchers and regional stakeholders with a view to sustainability (Institut national de la jeunesse et de l'éducation populaire 2020). In addition, the diversity of contexts offered by the ZA makes it possible to explore and/or experiment with different forms of science/society interfaces. Each ZA has a different history of these interactions between science and society, which also take different forms, ranging from popularization to co-constructed research, the production of expert reports and the implementation of participatory science programs. The place of researchers and research in the governance of social ecological systems also differs between the ZA (see Chapter 17), providing an open-air laboratory for exploring the many facets of these interactions.

The participation of local stakeholders is an invaluable asset for better understanding the SES, contributing from a social-political perspective and changing research perspectives by placing the perceptions of each stakeholder within a more systemic approach, with possible conflicts of values and/or interests (Bretagnolle et al. 2018). Nevertheless, there are unfortunately still many obstacles to transdisciplinarity, even though they have been identified (Lang et al. 2012; Lawrence et al. 2022). Local stakeholders do not always feel legitimate, or do not always want to participate in joint research or are sometimes invisible. For their part, researchers may be afraid to get involved or fear losing credibility. Similarly, scientists and politicians remain largely separate, and researchers are often marginalized in decision-making processes on regional strategies (Barnagaud and Drisch 2020).

Within the RZA, as mentioned in relation to interdisciplinarity, transdisciplinarity (see the first footnote at the beginning of the chapter) needs time to develop. It is clear that the ZA in which the interrelationships between researchers and local stakeholders are the most fluid and frequent are, with a few rare exceptions, the oldest ZA. The same is true when considering the integration of local stakeholders in the governance of a ZA or in the co-facilitation of research areas: this is often only possible after several years of existence of the ZA (see Chapter 17).

Therefore, in the chapters devoted to each of the ZA, the history between researchers and social-economic partners is always unique and specific to the territory and the themes developed there. All degrees of interaction exist, from

“simple” knowledge transfer to the most successful co-construction implemented upstream of the projects or collaborations envisaged. At the RZA level, the ongoing establishment of a Partners’ Committee (CdP) as the network’s governing body aims precisely to address some of the obstacles to co-research that have been identified.

Finally, in ZA, in terms of transdisciplinarity (see the first note at the beginning of the chapter for a reminder), the degree of involvement of scientists as stakeholders varies greatly: they may be mere observers or play an active role in action-oriented research areas (Bretagnolle et al. 2019). Scientists are therefore not so many experts delivering knowledge within a ZA as one of the many stakeholders interested in complex adaptation systems. They also participate in management, insofar as they are sometimes involved in the decision-making process. Applying the SES concept therefore implies that researchers are recognized as in the SES they study, thus contributing to (and sometimes even initiating) social-ecological experiments aimed at stimulating changes in practices from a transformative perspective (Gaba and Bretagnolle 2020; Ragueneau and Lea 2024). The role and position of researchers within the ZA are thus perceived in many different ways, according to former RZA directors, and continue to be debated within the network, the scientific community at large and society (Chapter 17). In all cases, researchers are encouraged to question their relationship to knowledge and to develop skills in fields in which they are far from being specialists to overcome the conceptual and communicational barriers of their training in order to allow the emergence of a genuine field of questions and methods (Maris et al. 2016, p. 7).

1.4. Variations and constants

Over time, the RZA has demonstrated great flexibility. The network has changed and adapted by partially altering its organization and functioning in order to adjust to new conditions, sometimes weathering crises without ever disappearing. This may not be far from the idea of resilience (Holling 2001) in certain ecosystems, whose modes of self-organization enable them to maintain a certain sustainability. Despite its many transformations, one constant can be identified: the use of interdisciplinarity and transdisciplinarity. Of course, there are different ways of practicing interdisciplinarity – at the level of a ZA and at the level of the RZA – and different ways of dealing with local stakeholders, all of which vary over time. However, the use of inter- and transdisciplinarity is never questioned. On the contrary, it is constantly invoked. “There can be no variation without constants”, says Bernard Lahire (interview in *Le Monde* on 29 August 2023, authors’ translation). However, this constant is precisely what implies a certain transformation in the way we conduct research by questioning our relationship to

knowledge and developing skills in fields that are foreign to us. The use of inter- and transdisciplinarity is therefore a constant, but one that transforms us. It is this “persistence” in motion, this ability to preserve constants in a protean and evolving manner, that undoubtedly makes the RZA one of the most effective levers for embodying the concept of transformation, the new project of the *Zone Atelier* (see Chapter 17).

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