

Part I

Towards the Theoretical Foundation of Coviability

Preview 1: A Multidisciplinary Reading

Discussing coviability induces a diversity of approaches that these first eleven chapters highlight. Each of these works, whether monodisciplinary or interdisciplinary, contributes to understanding what the “co” prefix is linking and what kind of link(s) it defines. Thereby, an explanation of the concepts used is undertaken. The challenge of this part is to present this plurality of disciplinary prisms on the concept of coviability, and thus contribute to nourish an interdisciplinary or even transdisciplinary perspective around this new paradigm.

The genesis of coviability begins here with the concept of viability approached by mathematics. It is defined as a set of constraints in which the system is maintained. Beyond these boundaries, sustainability is no longer assured. Evolutions and dynamics are “regulated” within a given environment.

The first fundamental step in the definition of coviability is thus carried out in the field of mathematics. It was during a seminar in the South of France in 1996 that the idea of “eco-viability” or “coviability” was defined as the joint evolution of a vector and the subset to which this vector belongs.

It should also be noted that whatever the discipline involved in this first part of the volume, the idea of control systematically re-emerges to demonstrate that coviability consists in “controlling the trajectory”. The issue of regulation is clearly emphasized and considered as a keyword throughout the chapters, expressed in one way or another.

The question of bringing the concept of coviability closer to that of the link between social and ecological systems challenges the fantasy of man’s domination over nature and makes it possible to take the completely opposite approach. The very idea of “nature” leads to that of cultural diversity. The world opens up to plurality with the notion of coviability: we will find as many socio-cognitive representations of both nature and societies. “Each one has his own nature”: this affirmation provides the type and modalities of relationships, whether among humans and non-humans or between humans. To the power of “profit” and “service” that produces

the predominant globalized system of relationship to the biosphere, the paradigm of coviability, discussed in this part, emerges to perceive the Western scheme (the naturalistic ontology) as non-universal.

This non-universality stems from the fact that the challenge discussed here is related to the ‘co’ (which etymologically means ‘together’). From now on, the “coviability of social and ecological systems” raises these kinds of questions: do we start from a dichotomy that can quickly slide into an opposition? This is the ambiguity that should be alleviated. Should we rely on this social and ecological dichotomy to get out of the deadlock? However, this ambiguity seems ineluctable even with the attempt to specify that the social would be the human and the natural (the non-human). So, from the beginning, what do we mean?

It is conceivable that it is not a question of being tied to this “sharing” but rather to making it a marker: according to the designated ontology of society-nature relationships (as we see, it is difficult to be disconnected from this combination) the division is consumed (naturalism), or not at all (animism, totemism, analogism). The “co” is understood as non-rigid, mixing the human in the non-human and, according to the paradigms, generating more or less distance between the two entities. Yet, if humanity is claimed to be consubstantial with nature, there are two entities that make it one, two entities that belong to a whole: a planet Earth, with a Biosphere and a Humanity.

Each chapter of this rather theoretical part, while often referring to concrete situations and empirical works, revolves around a form of socio-ecological integration. Indeed, coviability evokes the man/nature antagonism only to overcome it by emphasizing the structure conformed to “with” that is inscribed in the etymology of the “co”. The readers will make the judgment whether some of the authors of the chapters fall into this trap, rightly or wrongly.

Coviability cannot be dictated. The need for criteria or indicators is needed to demonstrate whether or not we are in the sphere of coviability. But what makes “coviability”? Science requires knowledge, on the basis of questioning, analysis, and thinking; it’s our starting point. This first part does not claim to give a definite, exclusive or final answer. It aims rather to present the conceptual frameworks and to link the disciplines in order to stimulate the interdisciplinary emergence of the concept-paradigm of socio-ecological coviability. The understanding will be clarified over the works presented here. There is no prejudiced assumption about the results of this research exercise, which in itself formalizes an interdisciplinary approach. So let us dare to attempt this promising adventure . . .

In this part, eleven chapters are attempting to lay the first foundations of socio-ecological coviability on a disciplinary plurality bringing together in this first enterprise ecology, mathematics, systems engineering, law, anthropology, biology, geography, and philosophy:

List of des chapters in Part I:

Chapter 2 Coviability and biodiversity conservation within anthroposystems

Chapter 3 Coviability, through the lens of the mathematical theory of viability

- Chapter 4** A Mathematical Approach to Coviability: Concept, Modeling and Control
- Chapter 5** The Relationships Between Man and His Environment: A Systemic Approach to the Viability of System Earth
- Chapter 6** Socio-ecological Viability and Legal Regulation: Pluralism and Endogeneity
- Chapter 7** The Paradigm of Coviability Defined by the Adequacy Between Social Usefulness and the Ecological Function: The Legal Challenge of the Socio-ecological Connection
- Chapter 8** Local ecological knowledge and the viability of relations with the environment
- Chapter 9** A Biological Approach to Coviability: Biotics Interactions and Dynamics of Biodiversity
- Chapter 10** A Geographical Approach of the Socio-ecosystem Coviability
- Chapter 11** A Rupture Between Human Beings and Earth: A Philosophical Critical Approach to Coviability
- Chapter 12** When Coviability Meets Ecosystem Services: The Case of Reunion Island's Coral reefs

An ontology of coviability and a synthesis of this transdisciplinary exercise will be the subject of the last two chapters of the volume, just before the concluding chapter.

The intention here is to build an ontology of coviability. This ambition requires a work of construction beyond disciplines, an attentive listening open to collaboration and a continuous maturation in the requirement of thinking. Such an enterprise is time-consuming and the present research is capturing this challenge on the medium term. The present volume is just the primary milestone. As an early outcome of this exercise, a first trans-disciplinary summary based on the contents of this volume will be attempted in the last two chapters. However, it will be necessary to consider them as the instigation of more ambitious work to be pursued.

From now on, it should be noted that a first experiment is attempted, which founds the basis of a summary by relying on an analytical reading of each text, followed by the construction of heuristic maps. A heuristic map, often referred to as a cognitive or mental map, is a diagram that allows the associative path of thought to be visually represented. To that end, for each chapter, the few keywords or “reminder words”, that are particularly relevant and necessary for understanding and memorizing the text, are retained. These words serve as a basis for each map, which is both a snapshot of the reader's feelings, with all the ambiguity of an external or non-specialist interpretation, and a vision of the essential terms of the subject, with the links connecting them (refinement or correlation).

Three ways are therefore possible to achieve this:

- Each author is responsible for feeding, from his writing, the undertaken ontological work. Backed by a specialist of the method, he/she participates in the ontological construction. However, the author can rightly consider that the elicitation work that he/she is producing, is already the needed research;

- A single reader seizes the whole and thus tackles a set of fields of which he/she is not necessarily specialist. This course of action presents at the same time the advantages and disadvantages induced by the uniqueness of the reader, in particular the induction of different biases according to the theme and disciplines;
- A plurality of readers makes it possible to blur the variable biases of understanding while reading the meaning given by the author, because of the meanings understood according to the individual and his disciplinary affiliation.

We chose here the second way, assuming the “risk of bias” presented above.

Using the Freemind software, we have drawn the maps presented below for the chapters in Part I (and in the introductions of Parts II and III). The Chap. 26 summarizes this “Transversal ontology analysis”.

The Chap. 2 summarizes, through a very general vision, the major issues around coviability and relies on the concepts of system, viability, interaction and coevolution of natural and human systems (Fig. Preview 1.1).

Chaps. 3 and 4 from a mathematical perspective, deal with the theory of viability and that of systems and their control. The theory of viability is based on the notion of evolution (deterministic or multiple) implemented by an evolutionary engine based on regulation laws (Fig. Preview 1.2).

The theory of systems and their control expresses coviability as a harmonious evolution of connected systems, which evolve together towards one or more equilibrium states (Fig. Preview 1.3).

Chapter 5 proposes the systemic perspective of the Earth system. The latter is a complex system in which various interactions exist within the environment in which it is immersed. The viability of this system depends on the coviability of these interactions (Fig. Preview 1.4).

Chapter 6 describes the legal and anthropological aspects declined in terms of legal regulation system (Fig. Preview 1.5).

Chapter 7 discusses the paradigm of coviability in terms of the adequacy between the social utility (relationship to natural elements and the satisfaction it provides in

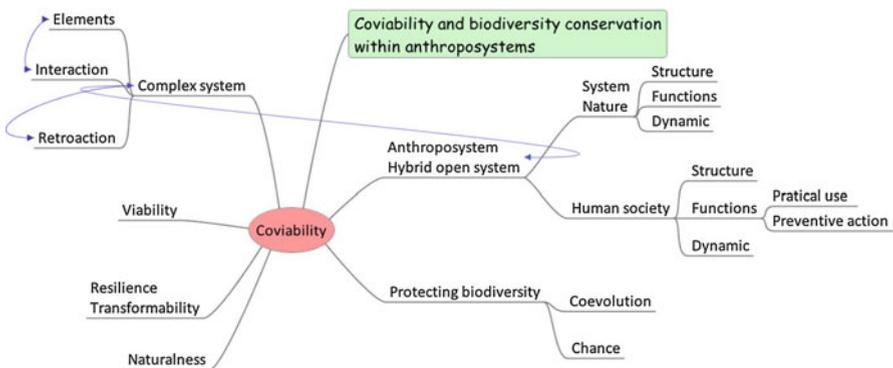


Fig. Preview 1.1 Mind map of Chap. 2 (©Thérèse Libourel)

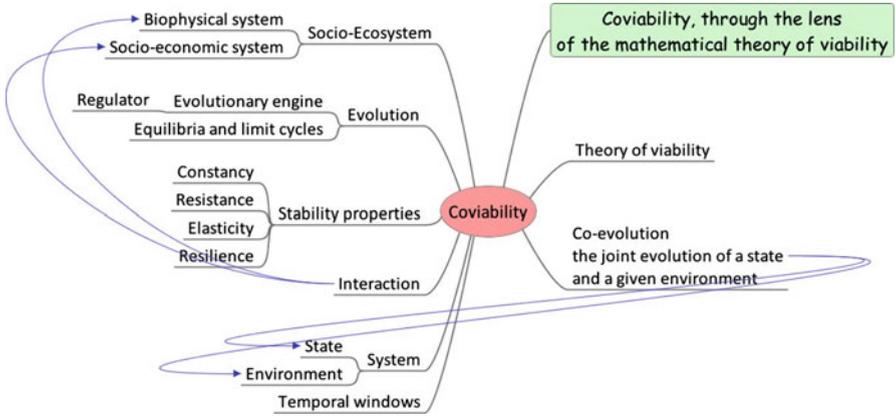


Fig. Preview 1.2 Mind map of Chap. 3 (©Thérèse Libourel)

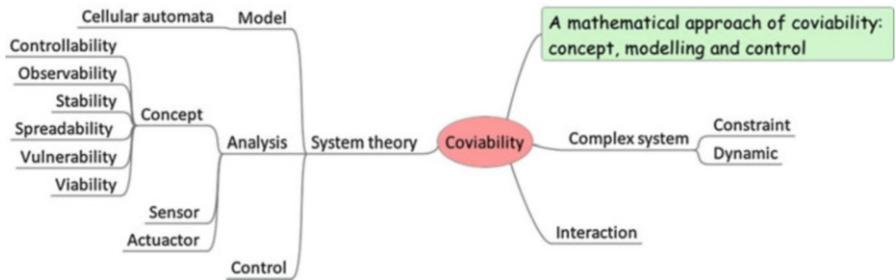


Fig. Preview 1.3 Mind map of Chap. 4 (©Thérèse Libourel)

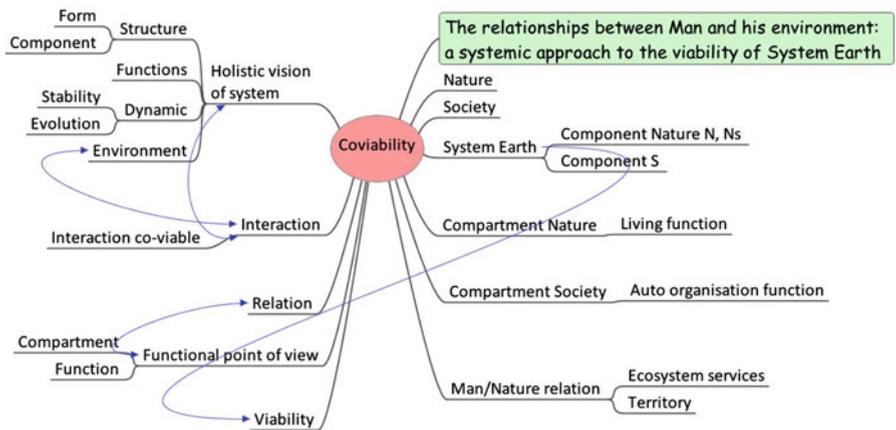


Fig. Preview 1.4 Mind map of Chap. 5 (©Thérèse Libourel)

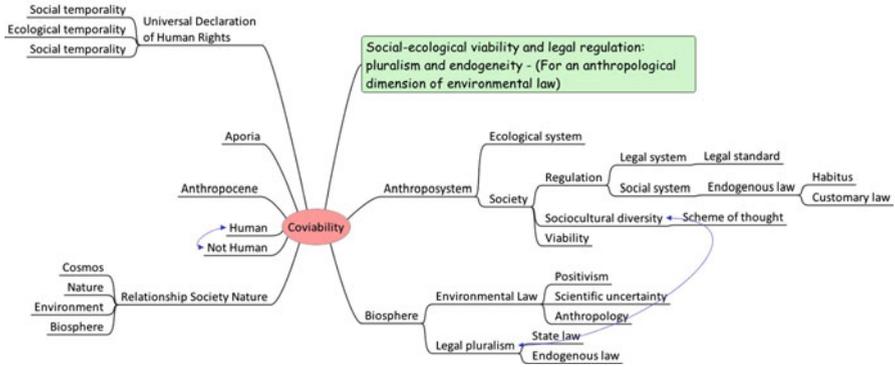


Fig. Preview 1.5 Mind map of Chap. 6 (®Thérèse Libourel)

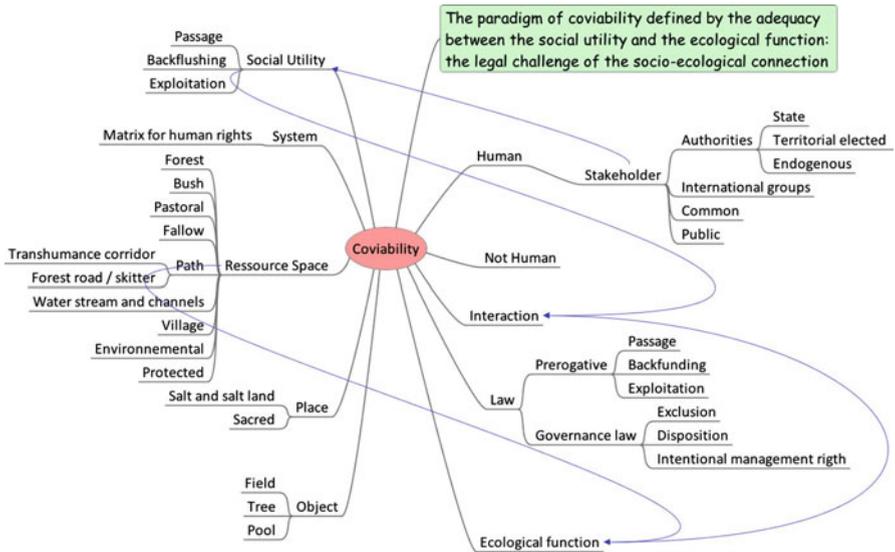


Fig. Preview 1.6 Mind map of Chap. 7 (®Thérèse Libourel)

meeting societal needs) and the ecological function. The reading focuses on a matrix of the law of utilities (Fig. Preview 1.6).

Chapter 8, dedicated to the ethno-ecological vision, reviews the fundamental systems and their dynamics, with coviability at the heart of negotiations based on practices, uses and knowledge (Fig. Preview 1.7).

Chapter 9 on the biological approach, deals with interactions between biotic and abiotic elements and highlights the various dynamics of biodiversity (Fig. Preview 1.8).

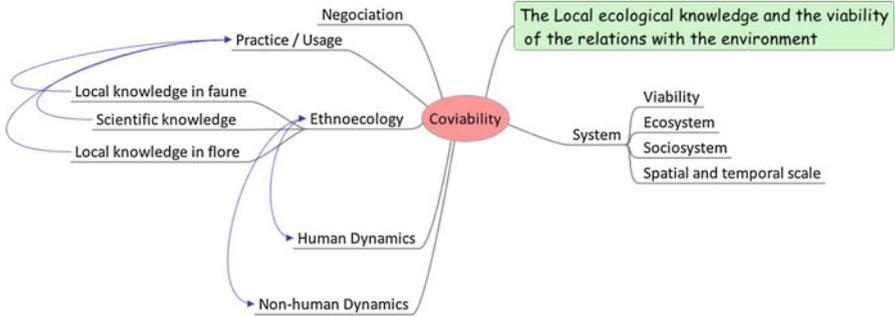


Fig. Preview 1.7 Mind map of Chap. 8 (©Thérèse Libourel)

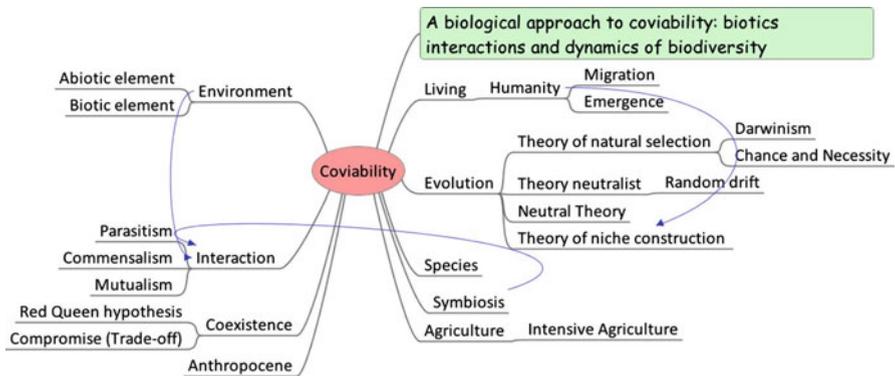


Fig. Preview 1.8 Mind map of Chap. 9 (©Thérèse Libourel)

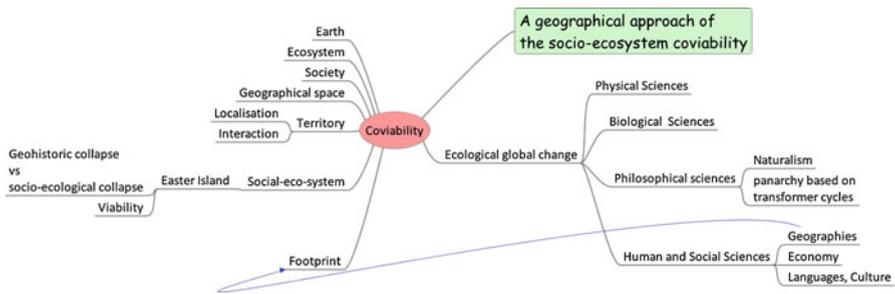


Fig. Preview 1.9 Mind map of Chap. 10 (©Thérèse Libourel)

The geographical perspective of Chap. 10 analyzes the relationships of societies with the Earth via the concept of geographical space defined as the “social product and the system of relationships between sites/places”. The reasoning is supported by the representative case of Easter Island revisited using this approach (Fig. Preview 1.9).

Chapter 11 provides a philosophical perspective flowing from critical theory.¹ It analyses the various ontologies echoing the perceptions between Nature and Society² and the approach proposed by Marx which highlights the rupture of the interaction between society and nature triggered by capitalism. The modern way of coviability should be based on new intellectual, legal and political referentials (Fig. Preview 1.10).

Chapter 12 focuses on the importance of the feedback loop between ecosystem and socio-systemic services in the human-nature coviability (Fig. Preview 1.11).

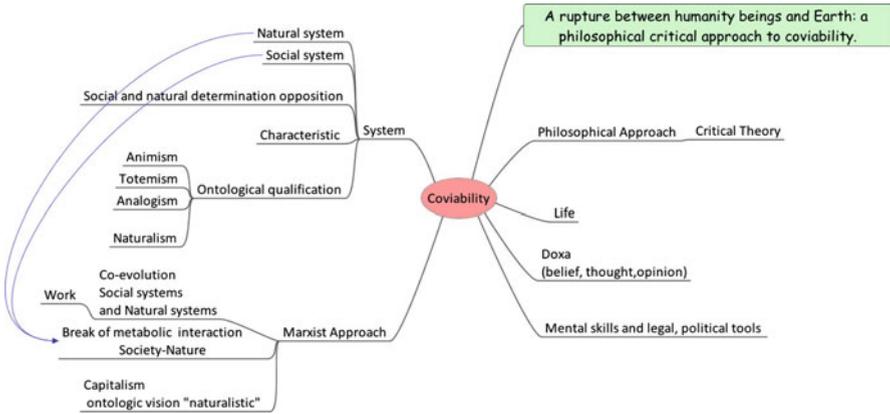


Fig. Preview 1.10 Mind map of Chap. 11 (©Thérèse Libourel)

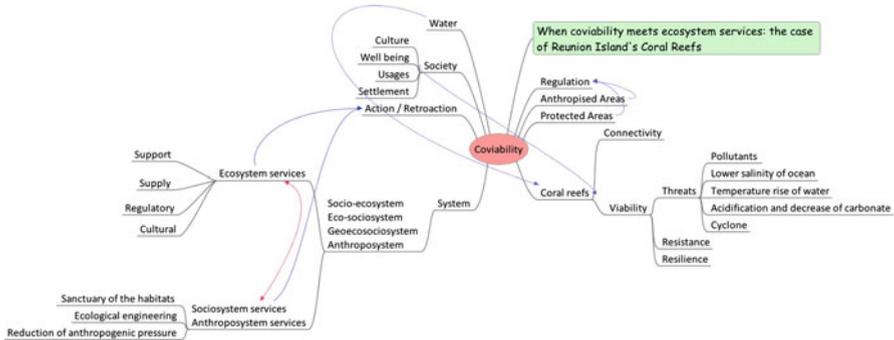


Fig. Preview 1.11 Mind map of Chap. 12 (©Thérèse Libourel)

¹The term “critical” here is understood in the Kantian sense of a thinking on the limits of the claims of certain types of knowledge, be they metaphysical, philosophical or scientific, according to Alvarenga, Raphael & Carre, Louis (2008), “Théorie critique”, in V. Bourdeau & R. Merrill (dir.), *DicoPo, Dictionnaire de théorie politique*.

²Descola Philippe (2005), *Par delà nature et culture*, Gallimard.