

v7

## Diagnosing & Engaging with Complex Environmental Problems

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The appendices for this version are on-line at either:

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<http://web.pdx.edu/~rueterj/multiple-perspectives>

<b>Chapter</b>	<b>Status for draft v7</b>
Preface	Done
Chapter 1: Introduction	Done
Chapter 2: Major concepts	Done
Chapter 3: Nine Exploratory and Diagnostic Tools	Done
Chapter 4: Patterns of Interaction	Done
Chapter 5: Scale	Done
Chapter 6: Stock and flow systems	Done
Chapter 7: Networks	Done
Chapter 8: Environmental Accounting and Indexes	Need to finish examples
Chapter 9: Risk and Uncertainty	Done
Chapter 10: Values and Worldviews	Need to finish examples
Chapter 11: Optimization of Efficiency	Done
Chapter 12: Games	Done
Chapter 13: Framework for Considering Many Ideas at Once	Done
Chapter 14: Engaging with Different Types of Problems	Done
Chapter 15: Innovation	90% done
Chapter 16: Institutions	½ written
Chapter 17: Project Management, Hedging and Multi-Criteria Approaches	¼ written
Chapter 18: Scenarios	Done – needs example
Chapter 19: Scientific Adaptive Management	Done – needs examples
Chapter 20: Environmental Entrepreneurism	Done

Chapter 21: Evaluating our progress	Done
Appendices (only available on-line): App 1: Major concepts and concept maps App 2: Etudes for learning about the environment App 3: Recognizing complex patterns App 4: Simulations from chapters	
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## Preface

Our civilization faces continuing and expanding environmental threats. Many of these threats are either caused or exacerbated by population growth, increased consumption and resource depletion. In my role as a university professor, I try to help students in environmental science and policy courses acquire the intellectual faculties that will help them engage in solving these problems. This book is an outgrowth of that effort. Over the years, I have found that many students lack the interdisciplinary tools to think critically and to generate their own interpretations. This book is designed to develop these skills and provides a method for scientific evaluation that builds on these skills. In order to do this, they will have to learn many facts, learn how to analyze these concepts and how to bring their beliefs and values to bear.

There are three themes that run throughout this book. Each of these themes is also reflected in the challenges to learning about these problems. This should be expected since the solution of environmental problems requires process structures that are dictated by the problem itself.

The three themes are:

1. **Control:** Each of us has the ability to make a difference, i.e. we have agency. By using innovative and creative approaches each of us can contribute to solution of environmental problems. This may include working in small groups that control situations from the grass roots or ground level, or it may be to effectively participate in larger efforts.
2. **Complexity and Uncertainty:** Everything is connected and you can't just do one thing. The environment includes

geochemical, biological/ecological, and human driven processes that are all interconnected in complex interactions. The complexity is due in part because each action or component is ever changing. This means there is substantial amount of uncertainty in all authentic environmental problems. This brings me to two related points: a) we need to be very cautious of unintended consequences of any of our actions and 2) the worst outcomes often come from trying to force simple solutions onto complex problems.

3. **Values:** By definition, environmental problems are situations that we think could be improved, i.e. not up to its highest potential value. Thus our value judgments are integral to identifying problems and should be reflected in the solutions to those problems at the most fundamental level. This can be done in a scientific, systematic, open and reliable manner.

To that end, we need to be creative and innovative if we are to comprehensively address environmental problems. A key aspect of such an approach requires examining many different ideas and perspectives before making a judgment. This book presents a framework for learning about the issues and framing the problem by attending to many conflicting ideas simultaneously before deciding what action to take. In addition, the actions that I present are broad categories of environmental approaches that are best suited for different combinations of uncertainty, values mismatch and our ability to control or manipulate that portion of the environment.

This framework comprises five sections. Section 1 sets up the four types of problems and describes how and where we get factual information. Section 2 presents nine intellectual tools that can be used to explore problems and diagnose critical characteristics. Section 3 provides a framework for creating narratives from all of



the different information gathered using the ten tools. It also describes how to use the three dimensions of values, information and control to home in on appropriate and effective modes of engaging with the problem. The final section describes how to reflect one's personal use of the framework. This chapter also describes how to employ some of the tools to scientifically evaluate the effectiveness and quality of work that includes values and uncertainty. Research on environmental problems that involves a community of participants (scientists, agency and government staff, politicians, interest groups, businesses, and involved citizens) generates different types of knowledge than traditional science. It is important that we judge the quality and usefulness of this knowledge in a rigorous and suitable manner.

There are also four appendixes that are available on-line. These include: a list of major environmental concepts and concept maps presented in Chapter 2, an expanded version of the catalog of patterns presented in Chapter 4, a set of "études" for environmental perception, and a link to working versions of the simulations presented in the text.

I'd like to suggest an alternative way to work through the book, one that examines selected chapters and runs through the full framework before going back to the beginning to read the remaining chapters. This is how I use the material in my own class that goes over two academic quarters. The first quarter focuses on case studies and examples from restoration ecology and resource management whereas the second term focuses more on innovations that are designed to improve the environment of the world's rural poor. It allows two exposures to the framework and actually places the evaluation in the middle of the process (instead of being the last chapter).

An example first pass might be:

- Introduction: Chapters 1 (Introduction), 2 (Major Concepts in Environmental Science), 3 (Preview of the Nine

### Exploratory and Diagnostic Approaches and Overview of the Framework)

- Exploratory and Diagnostic Approaches: Chapters 5 (Scale), 6 (Systems), 7 (Network), 9 (Risk and Uncertainty), 12 (Games)
- Framework and Engagement: Chapters 13 (Frameworks for considering many ideas at once) and 14 (Engaging with different types of problems) – Working framework to create narratives and choosing effective modes of engagements
- Modes of Engagement: Chapter 15 (Innovation), Chapter 16 (Institutions), Chapter 17 (Optimal Management), Chapter 19 (Scientific Adaptive Management)
- Evaluation: Chapter 21 (Scientific Evaluation)

A second round through the material could be:

- Introduction: review Chapters 1 (Introduction) & 3 (Nine Exploratory and Diagnostic Tools)
- Exploratory and Diagnostic Tools: Chapters 4 (Patterns), review 6 (Systems), 8 (Environmental Accounting), 10 (Values and Worldviews), 11 (Optimization)
- Framework and Engagement: Chapters 13 (Frameworks for considering many ideas at once) and 14 (Engaging with different types of problems) –
- Modes of Engagement: Review chapters 15 (Innovation) and 16 (Institutions), study Chapter 17 (Optimal management), Chapter 18 (Scenarios) Chapter 20 (Environmental Entrepreneurism)
- Evaluation: Chapter 21 (Scientific Evaluation) focusing on the performance and quality of transdisciplinary projects

On a personal note, while working on this book I realized that approaching problems in this manner leads to a valuable style of

personal and professional development. The framework requires keeping an open mind while intentionally attempting to employ different cognitive tools and descriptions of human values. Being purposefully ambiguous for a period of time while doing this work, opens up a space for new ideas, different types of conversations and innovative solutions. The cost of confusion and our innate aversion to ambiguity is balanced by the value of delaying judgment. Better decisions can be made when more ideas are in the mix. I have found that there are pieces of this framework that I needed to develop in my own work. For example, I have a range of experiences with lakes and systems analysis, but I really needed to be able to understand and analyze patterns so I reframed one of my research questions to examine the fractal dimensions of lake shorelines. In addition, this framework has helped me understand how my on-the-ground (on-the-water actually) experience, my tacit knowledge and my appreciation for different cultures and value systems all tie together, i.e. how all the disparate pieces of my life can be coordinated into an effective whole. I hope that it might also be a helpful framework for you, one that helps bring together your life experiences, tacit knowledge and values into an environmental awareness and action.