

University of Alberta

Interdisciplinarity in Ecosystem Management

by

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in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

Department of Earth and Atmospheric Sciences

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PREVIEW

Dedication

To Pablo, Maia and little Tau

The three of you made this possible. Pablo, you have always been by my side, supportive and patient. Maia, you have always been reminding me of what is truly important in life. Tau, you have made me realize once again the magic of life.

Gràcies. Us estimo molt.

PREVIEW

Abstract

Global environmental deterioration demands the involvement of the academic community. Ecosystem management is a discipline within ecology that is especially concerned about doing interdisciplinary research in order to solve environmental problems. However, it is not clear what interdisciplinary work means, what its purpose is, and how it is practiced among ecosystem management researchers. The research presented in this dissertation has the goal of understanding ecosystem management researchers' perspectives and practices concerning interdisciplinarity. It uses a pragmatic framework and a sequential mixed-methods research design to accomplish three particular objectives. First, it investigates the use of the term interdisciplinarity in the ecosystem management literature by evaluating citations and abstracts of 129 peer-reviewed, English language, journal articles via bibliometric analysis. Second, it explores the definition of interdisciplinarity among ecosystem management researchers by surveying 119 individuals using on-line questionnaires. Finally, it examines interdisciplinary perspectives among ecosystem management researchers by interviewing 15 key informants using semi-structured telephone interviews. Results show that ecosystem management researchers share a common understanding of what interdisciplinarity is. However, they are not especially concerned about discussing theoretical considerations of the concept of interdisciplinarity and its practice. In the context of the opportunities and challenges interdisciplinary work presents for the ecosystem management field, the research discusses the role of a deeper engagement with theories of

interdisciplinarity. It encourages theoretical discussions of interdisciplinary work among ecosystem management researchers in order to enhance effective interdisciplinary research efforts and promote further contributions of ecosystem management to solving environmental problems.

PREVIEW

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PREVIEW

INTRODUCTION

1.1. Introduction

Environmental deterioration represents a serious threat to societies (Likens, 1991; Noss & Cooperrider, 1994). Society as a whole, and more specifically the scientific community, have responsibility for reversing and preventing this situation (Gibbons, 1999; Kates et al., 2001; Clark & Dickson, 2003). Ecosystem management (EM) is a field within ecology that addresses environmental problems by supporting and promoting interdisciplinary practice.

Interdisciplinarity offers EM researchers valuable opportunities to contribute to solving environmental deterioration (Norton, 1992; Costanza, et al., 1993; Gunderson et al., 1995; Blockstein, 1999; Berkes et al., 2003). At the same time, however, it represents important challenges for research practice (Heberlein, 1988; Naiman, 1999; Wear, 1999; Jakobsen et al., 2004; Lele & Norgaard, 2005; Keough & Blahna, 2006).

The overarching goal of the research presented in this dissertation is to understand EM researchers' perspectives and practices concerning interdisciplinarity. In the context of the opportunities and challenges interdisciplinary work presents for the EM field, the research attempts to develop theoretical considerations about interdisciplinary activity. It seeks to encourage theoretical discussions among EM researchers in order to enhance effective interdisciplinary research efforts and promote future contributions to environmental problems.

Specific objectives of the research are:

- 1) To investigate the use of the term interdisciplinarity in the EM literature during the last four decades, and detect patterns in it.
- 2) To explore the definition of interdisciplinarity among EM researchers.
- 3) To examine interdisciplinary practice among EM researchers.

1.2. Methodology

The study presented here uses a pragmatist research approach to explore how interdisciplinary work is understood and practiced by researchers in the EM field. The pragmatist approach guides research by focusing on the research problem. It is not committed to any one system of philosophy about reality and the research process. It thus, opens the door to different assumptions and multiple forms of data collection and analysis (Cherryholmes, 1992; Creswell, 2007).

The study uses a mixed-method research design. It includes instruments and procedures traditionally employed in both quantitative and qualitative research (Creswell, 2003; Tashakkori & Teddlie, 2003). Quantitative research creates generalizations of an objective reality and requires significant attention to the measurement of the phenomena studied (Patton, 2002; Neuman, 2003).

Quantitative methods are therefore adequate to detect patterns in the use of the term interdisciplinarity in the EM literature (Objective 1), and to investigate the definition of interdisciplinarity among EM researchers (Objective 2). Qualitative research stresses the socially constructed nature of reality, and attempts to secure depth and detailed understanding of the phenomena studied (Lincoln & Guba, 1985; Denzin & Lincoln, 2000; Maxwell, 2005). Qualitative methods are therefore suitable to explore in-depth understandings of interdisciplinarity (Objective 2), and to examine how EM researchers experience and give a meaning to interdisciplinary practice (Objective 3).

1.3. Structure of the dissertation

This dissertation is structured around the three particular objectives of the research project (see Figure 1-1 for an overview of the research project). It contains six chapters. The present is the first chapter (*Chapter 1. Introduction*). It introduces the work by establishing research objectives, research methodology, and structure of the dissertation. The following chapter (*Chapter 2. Background*) provides the research context. It sets the basis for the subsequent chapters by presenting the concepts of interdisciplinarity and EM as well as their corresponding academic fields: interdisciplinary research and EM research. Chapters 3, 4 and 5 are the substantive chapters of the dissertation. They were conducted sequentially, and are presented as independent entities, with their own methods, results, discussion, and conclusions. Each chapter addresses one of the particular research objectives, informs and introduces the following objectives, and supplements previous objectives. A version of each chapter has already been published in academic journals or is in the process of being submitted for publication¹.

Chapter 3 (*Literature Evaluation*) fulfils Objective 1 by investigating the use of the term interdisciplinarity in the EM literature. Specifically, it presents the results of a bibliometric analysis of citations and abstracts of 129 international, peer-reviewed, English language journal articles published between 1970 and 2008. This chapter reveals that a minority of EM works both mention interdisciplinary research and engage with theories of interdisciplinary research. This chapter opens discussion about how EM researchers include interdisciplinary work in their research, and the current role of theoretical considerations about interdisciplinary activity in the EM field.

Chapter 4 (Questionnaire Survey) fulfils Objective 2 by making explicit the meaning of interdisciplinary work among a set of EM researchers. It presents the results of an online close-ended questionnaire that surveyed 119 researchers who are first, second or corresponding authors of the works used on the bibliometric analysis conducted in Chapter 3. Results indicate researchers differ on the terminology used for interdisciplinary research; however, they share a common

¹ A version of Chapter 3 has been already published in *The International Journal of Science in Society*. Versions of Chapters 3 and 4 are in preparation to be submitted for publication in *Science, Technology and Human Values*, and *Conservation Biology* respectively.

understanding of what interdisciplinarity is. Findings situate EM in the broader context of interdisciplinarity in science, and promote further discussions about the concept in EM and its contributions to advancing EM research.

Chapter 5 (Interview Study) fulfils Objective 3 by examining the process of doing interdisciplinary work in the EM field. This component of the project used semi-structured telephone interviews to conduct an in-depth evaluation of 15 active EM researchers. Results suggest that discussions about interdisciplinary practice are not part of EM's mainstream research activity, and when such discussions are present they do not include explicit and detailed descriptions of the interdisciplinary process. This chapter concludes by identifying those theoretical discussions that do take place within EM as well as those occurring outside the field, and encourages a dialectical engagement between EM researchers and those outside of EM studying theories of interdisciplinarity.

Finally, *Chapter 6 (Conclusion)* synthesizes the previous chapters and identifies relationships between them. It outlines the major contributions of the research, discusses research limitations and introduces areas for future work.

PREVIEW

1.4. Figures

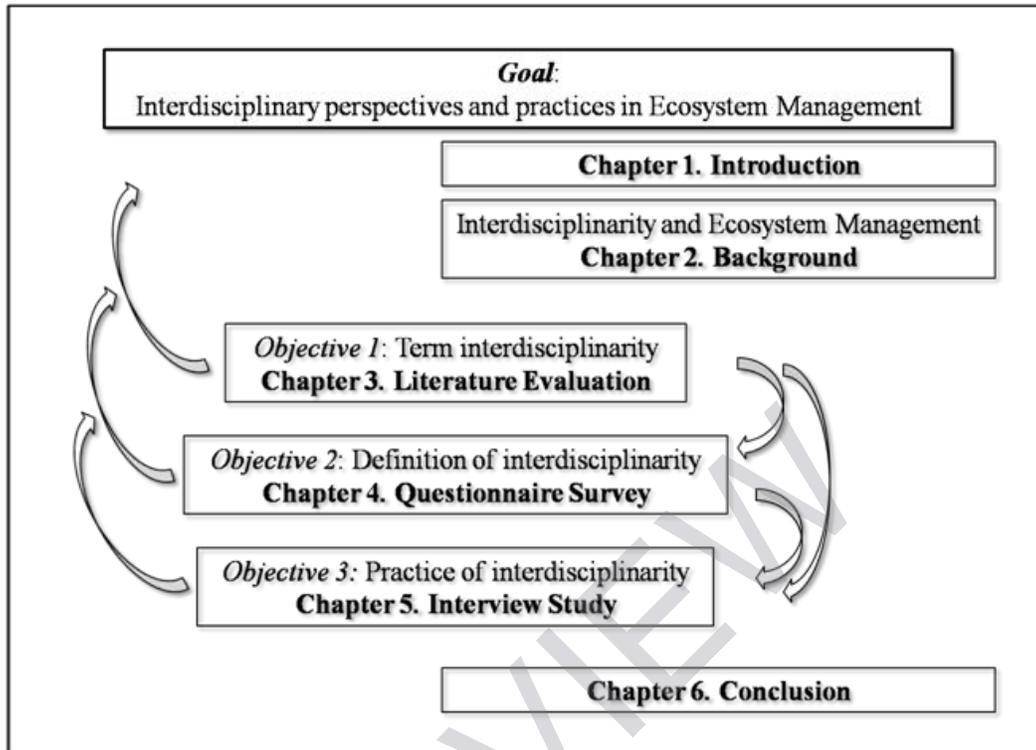


Figure 1-1. Overview of the research project

1.5. References

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**BACKGROUND:
INTERDISCIPLINARY AND ECOSYSTEM MANAGEMENT
RESEARCH**

This chapter provides an overview of two concepts central to the work presented in this dissertation: interdisciplinarity, and ecosystem management (EM). These concepts are the central focus of two separate academic fields: interdisciplinary (or integrative) research, and EM research. The clarification of the meaning of the two concepts and the presentations of the main points discussed in the two fields constitute the basis for developing and contextualizing this research project.

2.1. Interdisciplinary research

2.1.1. Introduction

The term interdisciplinarity refers to the process of producing, teaching and learning scientific information that involves the integration of the insights of more than one discipline or field of study (Klein, 1990). The present work focuses exclusively on interdisciplinary research and uses the expression ‘interdisciplinary research’ (or ‘interdisciplinary work’) to refer to interdisciplinarity. Although ‘interdisciplinarity’ is equivalent to ‘interdisciplinary research’, the work does not prioritize the term ‘interdisciplinarity’. It is mainly used by experts on the theory of interdisciplinary research, but scientists specialized in the different disciplines are not generally familiar with it.

The expression interdisciplinary research has seen increased use in the academic literature of various fields in recent years. Fields such as biotechnology, molecular biology, risk assessment and technology assessment focus on broad issues and demand an interdisciplinary approach (Gibbons et al., 1994). In these disciplines, interdisciplinary research has become somewhat of a buzzword as specialized researchers recognize the need for collaboration. Despite the increased profile of interdisciplinary efforts in research, the meaning of interdisciplinary research, its purpose and its practical applications have rarely been studied in great detail (Moran, 2002; MacMynowski, 2007). In separate areas of study such as integrative (or interdisciplinary) studies experts have been trying to deal with such issues about interdisciplinary research (Chubin et al., 1986; Klein, 2000; Repko, 2008). These theoretical discussions of interdisciplinary research can help specialized scientists to become more self-aware about interdisciplinary work and thus more effective in undertaking it.

The aim of the following sections is to present the meaning of interdisciplinary research in the way that it is increasingly agreed on by experts on the theory of interdisciplinary research. As the concept of interdisciplinary work is based on the concept of discipline, the nature of disciplines must first be discussed. Since

disciplines and interdisciplinary work are the result of the evolution of academia, an overview of the origins and evolution of disciplines and interdisciplinary research are also presented.

2.1.2. The concept of discipline

Interdisciplinary research is generally (although not always) defined as a research process that implies the integration of the insights from more than one discipline. Therefore, the idea of interdisciplinary research is possible only in a disciplinary world, and the concept of discipline is crucial for the concept of interdisciplinary research.

Discipline is a concept commonly defined as a field of study (or area of academic research practice) characterized by a body of accepted knowledge related to a well-defined subject, established on the basis of generally accepted principles (Kockelmans, 1979; Swanson, 1979; Klein, 1990; Klein, 1996; Salter & Hearn, 1996; Szostak, 2003; Repko, 2008). Disciplines can be identified by communities of scholars working in these fields (Apostel, 1972; Heckhausen, 1972; Becher & Trowler, 2001; Lattuca, 2001). Communities of scholars have institutional recognition in the form of departmental divisions at universities, graduate programs, academic journals, conferences, and scholarly associations (Turner, 2000; Brew, 2001; Ratnam, 2004).

Many scholars in their effort to define discipline list the points that characterize a particular discipline and make it different from other disciplines (see for example: Heckhausen, 1972; Petrie, 1976; Swanson, 1979). The works of Klein (1990 and 1996), Salter & Hearn (1996), Szostak (2003), and Repko (2008) synthesize these characteristics in five interrelated elements:

1. **Phenomena.** Every discipline has a series of subjects or topics of interest in a certain subject area that are addressed by scholars in the discipline. Biology, for example, is focused on the study of life, and within this broad research interest biologists address particular issues such as structure, growth, reproduction, and metabolism of living organisms.
2. **(Evolving) theories.** Every discipline (at a certain moment in time) has a coherent group of general conceptual prepositions such as laws, models, and concepts that are widely accepted by researchers in the discipline. These conceptual prepositions are explanations about some aspect of the world, how it works, and why specific facts are related. Theories are supported by research, and at the same time are essential to conduct research. In biology, an example of theory is evolution. Biologists, in their attempts to contribute to the discipline use evolutionary theory to explain most of the issues they study involving living organisms.
3. **Methods.** Disciplines have a set of accepted research instruments (or tools) and modes of inquiry (or procedures or techniques) to conduct

research. Methods determine the way a scientist gathers evidence, transforms evidence into data, analyses data, uses data to test theories, and produces new knowledge from data (Barnes, 1985; Brew, 2001; Repko, 2008). Some disciplines are open to many different methods, and others are restricted to very specific ones. Some methods such as descriptive and inferential statistics, experiments, questionnaires, or mathematical models are highly generalized across disciplines. Other methods such as systematic review or electronic microscopy are more specific to certain disciplines.

4. **Rules.** Every discipline has a set of normative guidelines that dictate how to pursue 'proper' research. They are criteria for validity and reliability of the research process. They allow researchers to understand, evaluate, and build upon each other's work (Szostak, 2002). Rules of a discipline are consistent with phenomena, theories, and perspectives of that one discipline. But rules are also affected by the institutional organization in the academy. Departmental divisions at universities, academic journals' tendencies, funding agencies' policies, promotion criteria, and scholarly societies' trends influence what is to be rewarded within every discipline (Salter & Hearn, 1996; Brew, 2001; Ratnam, 2004). Traditions and quality standards for publishing research are examples of rules. They differ across disciplines, especially when considering the social and natural sciences (Zuckerman & Merton, 1971; Wanner et al., 1981; Martinko et al., 2000).
5. **Perspectives.** The perspectives of a discipline are the set of agreed upon assumptions that frame the production of knowledge in that discipline. They both reflect and influence a discipline's choice of phenomena, theories, methods, and the existence of particular rules. Perspectives articulate the different disciplinary elements (Szostak, 2003). They define, for example how reality is perceived and how to produce knowledge about it, what constitutes an interesting and appropriate question to study, and what a convincing answer to the question should look like (Newell, 2007). To provide an example of different perspectives we contrast the approach of biology and sociology to study human societies and their interactions with the environment. Biologists view the world as constituted by living interacting organisms in a physical world. They tend to study the social world looking at the deterministic explanations of subjects as exposed to forces and laws of nature, without considering the decision-making capacity of individuals. Sociologists view the world as socially constructed by people that live in it. They tend to study the natural world looking at the understandings of individuals and social groups about the natural world and the decisions of interacting with it without much emphasis on natural or physical restrictions to such decisions.

In summary, disciplines are areas where academic research is carried out. Researchers in each discipline address particular phenomena using a specific set