Adaptive Co-Management

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SUSTAINABILITY
AND THE
ENVIRONMENT

Edited by Derek Armitage, Fikret Berkes,
and Nancy Doubleday

Adaptive Co-Management:
Collaboration, Learning, and
Multi-Level Governance

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Acronyms

AMB	Aquatic Management Board (West Coast Vancouver Island)
BARNUFO	Barbados National Union of Fisherfolk Organisations
CCA	Caribbean Conservation Association
CJC	Community Justice Committee
CJP	Community Justice Program
CMA	Coastal Management Area
CPUE	catch per unit effort
DFO	Department of Fisheries and Oceans
FAC	Fisheries Advisory Committee
FJMC	Fisheries Joint Management Committee
HTC	Hunters and Trappers Committee(s)
HTO	Hunters' and Trappers' Organization(s)
IFA	Inuvialuit Final Agreement
IQ	*Inuit Quajimaqatuqangit* (= Inuit traditional knowledge)
ISR	Inuvialuit Settlement Region
ITQ	Individual Transferable Quotas
LOMA	Large Ocean Management Area
MPA	Marine Protected Area
MSY	Maximum Sustainable Yield
NHLD	Northern Highlands Lake District
NLCA	Nunavut Land Claim Agreement
NWT	Northwest Territories
PC	Parks Canada
PCMB	Porcupine Caribou Management Board
PHTC	Paulatuk Hunters and Trappers Committee
RPP	Report on Plans and Priorities, DFO, 2004-05
RRCs	Renewable Resource Councils
RRSSC	Ruby Range Sheep Steering Committee
TEK	Traditional Ecological Knowledge
WCVI	West Coast Vancouver Island

Preface and Acknowledgments

Co-management is of growing interest among researchers, government, and non-government and community-based actors involved in natural resource management, conservation, and development activities. Co-management may be at a crossroads, however.

Nearly twenty years have passed since Evelyn Pinkerton's influential volume on co-management, *Co-operative Management of Local Fisheries: New Directions for Improved Management and Community Development,* was published by UBC Press. Co-management has since entered the adaptive age. New concerns with adaptive processes, feedback learning, and flexible partnership arrangements are reshaping the co-management landscape. Increasingly, ideas about collaboration and learning are converging in the literature. There is a tremendous opportunity to examine co-management through additional perspectives, explore alternative directions and concepts, and critically examine the emergence of adaptive co-management as an innovative governance approach to social-ecological complexity.

The chapters in this volume evolved over three meetings. They were selected from a commissioned set of papers presented at a two-day symposium, "Moving Beyond the Critiques of Co-Management: Theory and Practice of Adaptive Co-Management," held at Wilfrid Laurier University, Waterloo, Ontario, in February 2005. Researchers and practitioners from Canada, the United States, the Caribbean, and Europe were invited to explore the co-management of natural resources from multiple perspectives. Symposium activities were guided by the following objectives: (1) to bring together researchers and practitioners to discuss the evolution of co-management; (2) to create an opportunity for the sharing of ideas and strategies for innovative governance approaches in the context of social, institutional, and ecological uncertainty; and (3) to explore new avenues and directions that may serve to advance the theory and practice of adaptive co-management. Two follow-up meetings provided an opportunity to share and reflect further upon co-management ideas as they had evolved since the initial symposium: an

authors' workshop held in Ottawa in May 2005, and a set of three panel sessions on adaptive co-management during the Ocean Management Research Network Conference, also in Ottawa, in September 2005.

The symposium and follow-up activities have resulted in a rich and complementary set of papers focusing on adaptive co-management. In particular, this collection highlights a number of emerging ideas and challenges in co-management, and charts potentially fruitful directions for the evolution of co-management in an adaptive age. In this regard, the promises and pitfalls of adaptive co-management explored by the different authors in this volume are grounded in social science, economic, and ecological theory. A diverse set of case studies reveal the challenges and implications of adaptive co-management thinking, and synthesize lessons for natural resource management in a wide range of contexts. The chapters are informed by collective experiences of researchers and practitioners, acquired over the past two decades, and by the work of a growing and diverse community of individuals with new case studies and new questions. The contributions thus offer insights into adaptive co-management as a context for exploring alternative management strategies and evolving forms of government and citizenship.

This book would not have been possible without the contributions of many individuals and organizations. The original symposium was made possible by a Strategic Grant from the Social Sciences and Humanities Research Council of Canada (SSHRC) and the Department of Fisheries and Oceans (DFO) to the Integrated Management Node of the Ocean Management Research Network (OMRN). We are grateful for the support provided by the National Secretariat of the OMRN under the leadership of Tony Charles at Saint Mary's University and, later, Dan Lane at the University of Ottawa. Special thanks as well to Megan Sikaneta, former Coordinator at the National Secretariat, for her assistance in hosting and managing links on the OMRN website (http://www.omrn-rrgo.ca), which greatly facilitated the sharing of materials. Supplementary funding for the symposium was provided by the Canada Research Chair in Community Based Resource Management at the University of Manitoba, and the Cold Regions Research Centre at Wilfrid Laurier University.

Each chapter in this volume was reviewed by an average of three referees. We are grateful to the following individuals, who participated in the peer review of chapters: Burton Ayles, Nigel Bankes, Grazia Borrini-Feyerabend, Hugh Beach, Lisa Campbell, Doug Clark, Johan Colding, Fay Cohen, William Crumplin, Ann Dale, Iain Davidson-Hunt, Alan Diduck, Milton Freeman, Lance Gunderson, Kevin Hanna, Derek Johnson, John Kearney, Anne Kendrick, Gary Kofinas, Al Kristofferson, Robin Mahon, Patrick McConney, Bruce Mitchell, Monica Mulrennan, Heather Myers, Garry Peterson, Ryan Plummer, Robert Pomeroy, Maureen Reed, Henry Regier, Yves Renard, Scott Slocombe, Derek Smith, Sonia Wesche, Melanie Wiber, Doug Wilson, Susan

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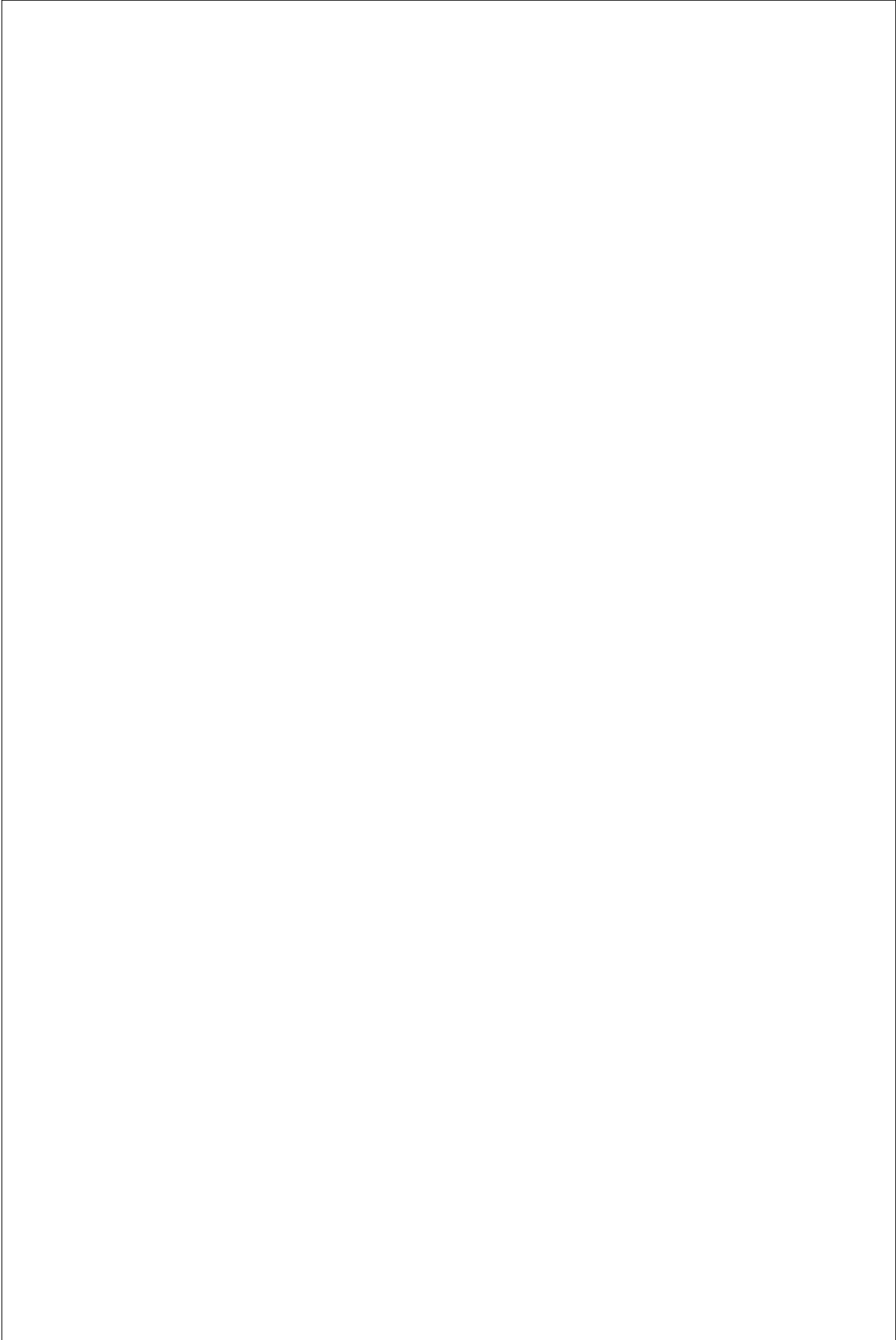
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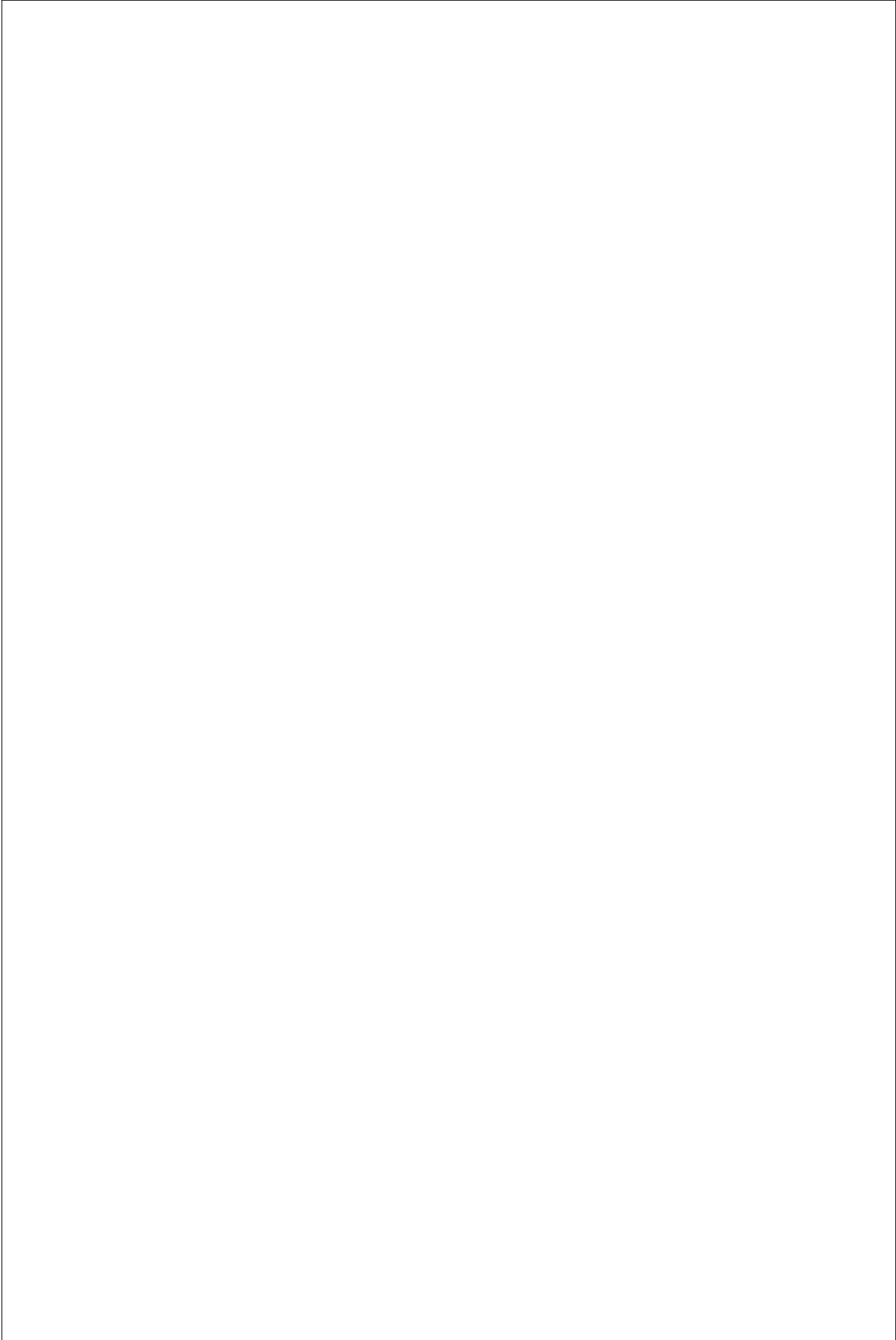
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Introduction: Moving beyond Co-Management

Derek Armitage, Fikret Berkes, and Nancy Doubleday

Out of the crooked timber of humanity,
No straight thing was ever made.
– Immanuel Kant

No road is too long with good company.
– Turkish Proverb

This book attempts to bridge two separate but increasingly overlapping narratives, those on co-management and adaptive management. The co-management narrative has been primarily concerned with user participation in decision making and with linking communities and government managers. The adaptive management narrative has been primarily about learning-by-doing in a scientific way to deal with uncertainty. The bridging of these two narratives is, in many ways, a logical development in the evolution of both of these overarching approaches.

Centralized, top-down resource management is ill-suited to user participation, and it is often blamed for the increased vulnerability of resource-dependent communities worldwide (Zerner 2000; Colfer 2005). In response, co-management arrangements have emerged to secure an expanded role for stakeholder and community participation in decision making. Recognition that ecological systems are dynamic and non-linear (Levin 1999) has similarly highlighted the inadequacy of yield-oriented "command-and-control" resource management. Centralized bureaucracies are limited in their ability to respond to changing conditions, an anachronism in a world increasingly characterized by rapid transformations (Gunderson and Holling 2002; Berkes et al. 2003).

Changing ideas about the nature of resource management, ecosystems, and social-ecological systems (integrated systems of people and environment) have been catalyzed by insights from complex adaptive systems thinking

(Capra 1996; Levin 1999). Non-linearity, feedback processes, and system self-organization challenge established assumptions of scientific certainty, stability paradigms in both the ecological and social sciences, and the primacy of expert-driven solutions. In the resource management of the twenty-first century, these assumptions are yielding to new developments and trends, including: (1) the imperative of broad-based participation when devising management strategies that respond to change; (2) the need to emphasize knowledge, learning, and the social sources of adaptability, renewal, and transformation; and (3) an understanding of change and uncertainty as inherent in social-ecological systems. Such changes in direction represent an alternative narrative about how to approach the theory and practice of natural resource management and environmental governance.

This alternative narrative is taking shape through a number of recent interdisciplinary international efforts, such as the sustainability science program (Clark and Dixon 2003), the Millennium Ecosystem Assessment (2005), the Equator Initiative of the United Nations Development Programme (UNDP 2005), and *World Resources 2005* (UNDP/UNEP/World Bank/WRI 2005). These efforts share an explicit concern with the complexity of social-ecological systems, and an emphasis on learning from experience. They deal with multiple objectives, multiple knowledge systems, scale issues, stakeholder participation, and balancing top-down with community-based approaches. None of these efforts, however, systematically examines how the two narratives, co-management and adaptive management, can be combined. This volume aims to fill that gap.

Establishing the Foundations: Co-Management, Adaptive Management, and Adaptive Co-Management

Regarding the first narrative, trends towards *collaborative management* approaches are an outcome of the limitations of a "command-and-control" bureaucracy (Holling and Meffe 1996) and the privileging of formal science (Allen et al. 2001). Collaborative or cooperative management are generic terms "conveying the sharing of rights and responsibilities by the government and civil society" (Plummer and FitzGibbon 2004, 63). There are multiple strands of collaborative management, including integrated conservation and development, participatory natural resource management, participatory appraisal and participatory action research, decentralization and devolution, and community-based natural resource management and co-management (Berkes 2002). Co-management in particular has evolved as a more formalized management strategy with which to link local communities and governments. Some of these arrangements are codified in law, as in the various indigenous land and resource rights cases in the United States, Canada, Australia, and New Zealand.

> *Box 1.1*
> **Definitions of co-management**
>
> - "A political claim [by users or community] to share management power and responsibility with the state" (McCay and Acheson 1987, 32)
> - "The sharing of power and responsibility between the government and local resource users" (Berkes et al. 1991, 12)
> - "Power-sharing in the exercise of resource management between a government agency and a community organization of stakeholders" (Pinkerton 1992, 331)
> - "A partnership in which government agencies, local communities and resource users, NGOs and other stakeholders share ... the authority and responsibility for the management of a specific territory or a set of resources" (IUCN 1996).

There is no single appropriate definition of co-management (Box 1.1) because there is a continuum of possible co-management arrangements in the degree of power sharing (Borrini-Feyerabend et al. 2004). However, potential benefits of co-management include more appropriate, more efficient, and more equitable governance, and the improvement of a number of processes and functions of management (Box 1.2). In responding to demands for a greater role for resource users and communities in environmental management, co-management arrangements serve to democratize decision making, foster conflict resolution, and encourage stakeholder participation.

> *Box 1.2*
> **Benefits of co-management**
>
> Benefits can be considered through processes and goals such as (1) co-management for community-based economic and social development, (2) co-management to decentralize resource management decisions, and (3) co-management as a mechanism for reducing conflict through participatory democracy.
>
> Co-management may enhance the functions of (1) data gathering, (2) logistical decisions such as who can harvest and when, (3) allocation decisions, (4) protection of resources from environmental damage, (5) enforcement of regulations, (6) enhancement of long-term planning, and (7) more inclusive decision making (Pinkerton 1989, ch. 1).

Collaborative forms of management have also gained strength as policy makers and decision makers recognize that systematic learning and innovation under conditions of uncertainty are more likely to emerge through meaningful interaction of multiple stakeholders. In a collaborative management context, local knowledge and experience have equal status with experts and expert knowledge (Cardinal and Day 1999). Collaborative institutional arrangements, flexible policy conditions, and social organization are central to the stimulus of social learning, innovation, and adaptive capacity (Woodhill and Röling 1998; Armitage 2005). Policy decisions regarding natural resources are increasingly less a matter of appropriate expertise or the domain of specialist institutions, and more a question of negotiation and agreement among stakeholders (Brunner et al. 2005). These considerations bring co-management into the sphere of the second narrative.

A learning approach focusing on improving policy and practice in the face of uncertainty, *adaptive management* is often presented as a tool to frame the philosophical, methodological, and practical challenges associated with the management of natural resources (Holling 1978; Walters 1986; Lee 1993; Gunderson et al. 1995). Management strategies and policies are considered experiments (Lee 1993), and learning is encouraged through both structured experimentation and management flexibility. Hilborn and Walters (1992) have outlined a number of defining features of adaptive management: (1) identification of alternative hypotheses; (2) assessment of whether further steps are required to estimate the expected value of additional information; (3) development of models for future learning and hypotheses; (4) identification of policy options; (5) development of performance criteria for comparing options; and (6) formal comparison of options. The political, institutional, and individual risks of adaptive management are well documented (Lee 1993). In response, emerging hybrids of adaptive management involve integrated approaches to science and policy in which multiple actors are actively engaged in risk sharing around problem definition, analysis, and resolution of social-ecological challenges for the common good (Brunner et al. 2005).

Goals and objectives in hybrid adaptive management contexts are redirected from a traditional focus on economic productivity and maximum sustainable yield towards an integrative understanding of the system dynamics, feedbacks, and thresholds that may undermine social-ecological resilience. Increasingly, the concept of resilience is inimical to the application of adaptive management, and it refers to the capacity of a system to absorb disturbance without flipping into a qualitatively different state (Gunderson and Holling 2002). As a locus for adaptive management, resilience encourages a reconsideration of conventional science as an unambiguous source of information required to deal with contested social-ecological challenges. Resilience thinking helps to direct learning around key variables

that enable linked social-ecological systems to renew and reorganize along sustainable trajectories in the face of perturbation. Resilience is a normative concept, however, and efforts to define it must be situated in the context of contested and evolving human interests and the uncertainties of human interaction.

An emergent outcome of the co-management and adaptive management narratives, *adaptive co-management* may represent an important innovation in natural resource governance under conditions of change, uncertainty, and complexity. Working definitions of adaptive co-management are provided by a number of authors (Box 1.3). As Olsson and colleagues (2004) note, a key feature of adaptive co-management is the combination of the iterative learning dimension of adaptive management and the linkage dimension of collaborative management in which rights and responsibilities are jointly shared.

Although much focus is on the local scale, where issues of management performance are felt most directly, adaptive co-management is a flexible system for environment and resource management that operates across multiple levels and with a range of local and non-local organizations. Key features of adaptive co-management include a focus on learning-by-doing, integration of different knowledge systems, collaboration and power sharing among community, regional, and national levels, and management flexibility (Olsson et al. 2004). In this regard, adaptive co-management provides an evolving and place-specific governance approach that supports strategies that help respond to feedback (both social and ecological) and orient social-ecological systems towards sustainable trajectories. Such strategies include dialogue among interested groups and actors (local/national); the development of complex, redundant, and layered institutions; and a combination of institutional types, designs, and strategies that facilitate experimentation

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Box 1.3

Definitions of adaptive co-management

- "A long-term management structure that permits stakeholders to share management responsibility within a specific system of natural resources, and to learn from their actions" (Ruitenbeek and Cartier 2001, 8)
- "A process by which institutional arrangements and ecological knowledge are tested and revised in a dynamic, on-going, self-organized process of learning-by-doing" (Folke et al. 2002, 20)
- "Flexible, community-based systems of resource management tailored to specific places and situations, and supported by and working with, various organizations at different scales" (Olsson et al. 2004, 75).

> *Box 1.4*
>
> **Selected features of adaptive co-management**
>
> - Shared vision, goal, and/or problem definition to provide a common focus among actors and interests
> - A high degree of dialogue, interaction, and collaboration among multi-scaled actors
> - Distributed or joint control across multiple levels, with shared responsibility for action and decision making
> - A degree of autonomy for different actors at multiple levels
> - Commitment to the pluralistic generation and sharing of knowledge
> - A flexible and negotiated learning orientation with an inherent recognition of uncertainty.

and learning through change (Dietz et al. 2003). Box 1.4 captures some of these features.

As a conceptual and operational bridge, adaptive co-management is an interdisciplinary endeavour. Two relatively well-developed literatures provide a foundation upon which to extend the theory and practice of adaptive co-management. Many of the ideas shaping this volume emerge in large measure from the first, the field of common property (McCay and Acheson 1987; Ostrom et al. 2002; Ostrom 2005), over the past fifteen to twenty years, and its implications for collaborative management. There are a number of key works upon which this volume builds, including those that have critically engaged the concepts of co-management (Pinkerton 1989; Singleton 1998; Borrini-Feyerabend et al. 2000; Wilson et al. 2003; Nadasdy 2003; McConney et al. 2003; Borrini-Feyerabend et al. 2004).

The second literature upon which this volume builds concerns adaptive management and other approaches that address uncertainty and complexity, including the consideration of humans and ecosystems as an inseparably linked social-ecological system. Key contributions in these areas include those by Holling (1978), Walters (1986), Lee (1993), Gunderson and colleagues (1995), Berkes and Folke (1998), Levin (1999), Gunderson and Holling (2002), and Berkes and colleagues (2003).

Emerging Themes in Adaptive Co-Management

This volume builds upon the works cited above and poses the critical question: How can we move beyond the limits of co-management? Complex systems insights suggest the importance of adaptation and learning. Attributes associated with co-management, including flexibility and social learning, resonate with complex systems thinking. This volume highlights,

therefore, the salient dimensions of adaptive co-management that move co-management theory and practice towards issues not systematically addressed in the current literature. These issues include:

- the importance of the evolutionary dimension of co-management, and the recognition that institution building, trust building, and social learning all require time and repeated rounds of learning-by-doing
- the consideration of adaptive aspects, which takes co-management into the realm of complex adaptive systems, addressing issues of scale, multiple perspectives and epistemologies, uncertainty and non-linearity, self-organization, and emergence
- the development of a framework to study the linkages of different levels of political organization, such as the community level with the regional and/or national levels of government
- the expansion of the study of partnerships, recognizing that in many real-life co-management situations, one finds a rich web of network connections involving private actors and public actors
- the recognition of a diversity of government agencies with different roles and relationships and a diversity of interests within "communities"; rarely is "the state" or "the community" a monolithic actor.

In considering these dimensions of adaptive co-management, there is no single or "correct" locus of attention. Rather, as the chapters in this volume reveal, a number of emerging and overlapping themes provide a touchstone for analysis, synthesis, and policy development (Figure 1.1). A brief summary of each theme follows.

Complex systems thinking. Complex systems thinking offers a way of examining, describing, interpreting, and cognitively structuring not only ecological systems but also increasingly linked social-ecological systems. Specifically, complex systems thinking highlights the dynamic, non-linear relationships among coupled social and ecological phenomena that result in discontinuities, surprises, system flips, and the potential for multiple equilibrium states. Complex systems thinking provides valuable heuristics for understanding natural resource management, and emphasizes relationships, networks, and feedback processes. Complex systems thinking thus indicates the importance of institutional diversity and flexibility in improving the fit between ecological and social systems.

Adaptive capacity and resilience. Representing a shift in the way managers intervene in complex social-ecological systems, resilience management focuses on maintaining the ability of systems to absorb or buffer disturbance, maintain core attributes, continue to self-organize, and build capacity for learning, experimentation, and adaptation. Adaptive co-management is an institutional and organizational response to complex adaptive systems and

Figure 1.1

Key themes in adaptive co-management
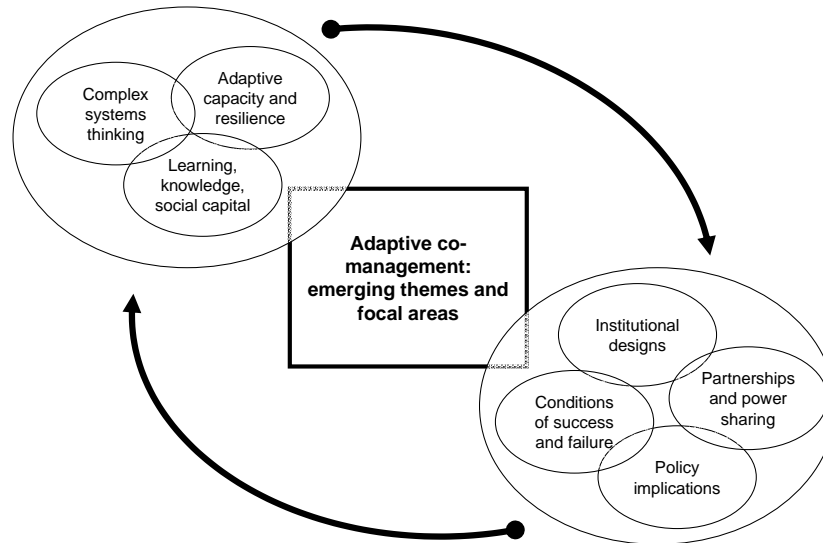
the challenge of resilience management. The institutional and social determinants of resilience management are not yet established, however. Developing adaptive capacity to deal with perturbation and stresses at the scale of institutions and societies provides a further area of examination. Building adaptive capacity is a priority, given the connection to learning and the need for social actors to experiment and foster innovative solutions in complex social and ecological circumstances.

Institutional design for adaptive co-management. A central theme in adaptive co-management inquiry is the institutional designs and frameworks required for effective decision making. The paths of this inquiry may go in many directions, but key features being explored include the importance of cross-scale linkages (horizontal and vertical) that build adaptive capacity and institutional resilience. Related to this are ongoing trends towards decentralization and devolution as a governance strategy, the drivers of which may be as much about political expediency as about broader concerns for institutional performance (e.g., efficiency, sustainability).

Partnerships and power sharing. Interrogating adaptive co-management involves a critical examination of the extent to which alternative governance approaches result in, or develop, decision-making processes that reflect true partnerships, and that devolve power to local resource users and communities. In this regard, cultural difference, unequal knowledge valuation,

the historical role of government bureaucracies in management, and ecological/economic forces of globalization are identified as key influences on the reworking of stakeholder relationships required for the emergence of adaptive co-management.

Conditions of adaptive co-management success and failure. Adaptive co-management can be applied in a wide range of resource (e.g., coasts, fisheries, forests) and geographical contexts. Although context is of critical importance, emphasis is increasingly placed on measuring and monitoring the conditions from which adaptive co-management may emerge, and the success and failure of adaptive co-management in diverse situations. Identification of a common set of structural and procedural prerequisites for success, or common reasons for failure, is helping to build theory and identify key propositions. Studies based on large number of cases and hypothesis testing are important areas requiring further examination.

Learning, knowledge use, and social capital. A key feature of adaptive co-management as an innovative governance approach is the explicit focus on linking collaborative efforts with systematic learning. Learning involves the collaborative or mutual development and sharing of knowledge by multiple stakeholders. Much learning is directed at modifying management strategies or actions (e.g., harvest rates, techniques) without challenging the assumptions upon which those strategies are based. This type of learning is sometimes referred to as "single-loop" learning. In contrast, "double-loop" or transformative learning involves resolving fundamental conflict over values and norms, and promoting change in the face of significant uncertainty, and is identified as a particularly important component of adaptive co-management. The effort to foster double-loop learning requires a commitment to valuing different knowledge sources and epistemologies, however. Double-loop learning is also linked to social capital or the social norms, networks of reciprocity and exchange, and relationships of trust that enable people to act collectively.

Policy implications. Assessments of adaptive co-management must be relevant to policy makers. If adaptive co-management is to be a possible governance approach, its economic and legal requirements should be identifiable and actionable. Thus, identification of opportunities and constraints surrounding the emergence of adaptive co-management involves the examination of the adequacy of existing policy instruments (e.g., legislation, fiscal incentives) and the development of recommendations aimed at creating an enabling policy environment.

Most of the contributions to this volume address at least several of these emerging themes (see Chapter 16). These themes give substance to the alternative narrative of resource management and environmental governance in the twenty-first century, and provide a reference point for different authors' explorations of key concepts and theoretical insights; lessons from

on-the-ground experiences with adaptive co-management; the limitations, critiques, and assumptions embedded within the approach; and the evolving concepts and tools influencing adaptive co-management outcomes.

A Roadmap to This Volume

This volume is based on a two-day symposium and two follow-up meetings that took place in 2005. It aims to provide a synthesis of adaptive co-management, drawing on the insights of researchers and practitioners from diverse disciplines, using multiple analytical approaches and engaging with disparate geographies, both in Canada and internationally (Figure 1.2).

The book is divided into four parts to highlight features of adaptive co-management and to focus attention on the emerging themes in this area: (1) theory, (2) case studies, (3) challenges, and (4) tools.

In Part 1, "Theory," four chapters provide an introduction to many of the key concepts and ideas associated with adaptive co-management. Fikret Berkes (Chapter 2) begins by arguing that co-management is more varied,

Figure 1.2

Case study sites
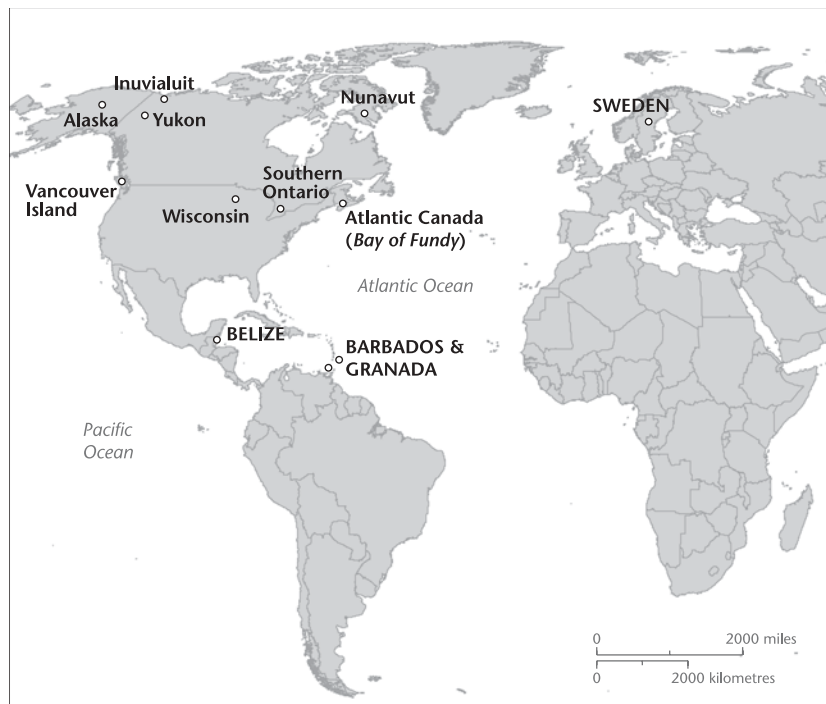
complex, and dynamic than described in a literature that often treats it as a "fixed" or simple category of arrangements. In contrast, Berkes provides an overview of the different "faces" of co-management as power sharing, as institution building, as trust building, as process, as social learning, as problem solving, and as governance. In doing so, he draws attention to the complexity inherent in adaptive co-management and many of the features of the alternative resource management narrative.

In Chapter 3, Ryan Plummer and John FitzGibbon extend this overview and further map the relationships among adaptive management, social learning, and social capital. They thus place much-needed emphasis on the social nature of adaptive co-management, and illustrate the importance of learning and social capital in the context of a multi-level, multi-actor collaborative efforts in three cases of river management in Ontario.

In Chapter 4, Derek Armitage examines the proposition that the livelihoods of people in resource-dependent communities are best characterized as exhibiting multiple dynamic equilibria, and that adaptive, multi-level co-management arrangements are likely to be best suited to respond to the dynamic, self-organizing feedbacks that shape livelihood outcomes. He emphasizes the need for multi-level development of adaptive capacity to facilitate the emergence of adaptive co-management, and proposes an expanded capabilities approach to provide direction in this respect.

Drawing on experiences from the Atlantic fishery for cod and other groundfish, Anthony Charles (Chapter 5) synthesizes much extant theory to identify four "ingredients" of adaptive co-management. As he illustrates, key ingredients for the sustainability and resilience of natural resource systems include: (1) maintaining diverse options for inclusion in a portfolio of resource management measures; (2) pursuing *robust management,* or management that results in a reasonable level of performance even when there is a high degree of uncertainty; (3) ensuring the full utilization of diverse knowledge sources; and (4) supporting institutional reform through new governance arrangements.

In Part 2, "Case Studies," the focus shifts to four chapters that emphasize on-the-ground experiences with building and sustaining conditions for learning and adaptation in a co-management context. In Chapter 6, Patrick McConney, Robin Mahon, and Robert Pomeroy synthesize a number of lessons learned and key challenges to coastal resource co-management from three Caribbean case studies: sea urchin harvesting in Barbados, a beach seine fishery in Grenada, and marine protected areas management in Belize. Co-management is a relatively new concept in the English-speaking Caribbean, and the recent experiences with co-management provide new opportunities for learning in the distinct socio-political, economic, and resource conditions that the authors examine.

In Chapter 7, Burton Ayles, Robert Bell, and Andrea Hoyt move the geographical focus from the South to the North, with case studies of three initiatives in the western Canadian Arctic. They examine how fisheries co-management, within the context of a comprehensive land settlement agreement, has led to adaptive management practices, and, in turn, how these adaptive management activities have fed back to strengthen the co-management process. This chapter offers an interesting counterpoint to Chapter 6 because co-management in the western Arctic involves a more formalized, legislatively driven sharing of management responsibilities between beneficiaries and the responsible government agency, in this case, the Fisheries Joint Management Committee.

In Chapter 8, Evelyn Pinkerton analyzes the West Coast Vancouver Island Aquatic Management Board. She poses a question that cuts to the core of the linkage feature of adaptive co-management: How does a local body based on holistic principles co-manage with a senior governing body based on segmental principles? Her analysis of this particular case exemplifies the difficulties in coordinating, and systematically learning through, the different perspectives of government bureaucracies and community-based actors in an adaptive co-management context.

In the final chapter of Part 2, Robert Pomeroy applies a broad analytical lens to present and discuss key conditions for the successful implementation of fisheries and coastal co-management as identified in Southeast Asia, Africa, and the Wider Caribbean. He notes that key conditions emerging at the regional scale are proving central to the development and sustainability of successful co-management arrangements. Many of the conditions synthesized in his review embrace a wide range of aspects and activities, from resources and fisheries to cultural and institutional dimensions.

In Part 3, "Challenges," three chapters integrate critical perspectives about adaptive co-management in concept and practice. These chapters, in particular, encourage researchers and policy makers to consider the embedded relationships among social actors that influence collaboration, learning, and adaptation, and they bring to the surface issues of power, cultural interplay in both formal and informal contexts, and the complexities of community. With an emphasis on the "local," John Kearney and Fikret Berkes (Chapter 10) question the assumptions about community that frame adaptive co-management. They expand on the concept of interdependence as a way to explore the importance and relevance of community and the local, while moving beyond monolithic conceptions of community driven by both populist and neoliberal narratives.

In Chapter 11, Paul Nadasdy adopts a critical stance in his analysis of Ruby Range sheep co-management in the Yukon Territory, Canada. He considers how adaptive co-management fares against the critique that co-management,

despite claims about local empowerment, serves to perpetuate colonial-style relations by concentrating power in administrative centres rather than in the hands of local/Aboriginal people. In the process, he critiques the linking and learning rhetoric of adaptive co-management and some of its underlying concepts.

In Chapter 12, Nancy Doubleday investigates an apparent case of "dysfunctional intercultural co-management experience" at the community level, specifically the case of community justice in Cape Dorset, Nunavut. While recognizing that the inequalities rooted in power relations and cultural difference are an impediment to adaptive co-management, she explores the role of culture in resilience and adaptive capacity, and the subsequent potential for individuals and groups to engage and lead adaptation under difficult conditions. Doubleday suggests that culture and culture-derived identity may serve as *extra-formal* power-bases and that their implications for adaptive co-management should be differentiated from the role of negotiated formal powers. Chapters 11 and 12, in particular, both examine the political and cultural assumptions implicit in the project of adaptive management, yet each yields different perspectives and insights.

The foundations of adaptive co-management are still emerging. In Part 4, "Tools," three chapters highlight concepts and tools that may facilitate the development of adaptive co-management. In Chapter 13, Gary Kofinas, Susan Herman, and Chanda Meek examine the role of innovation in co-management and propose eight conditions that facilitate innovation. The authors view innovation as an outcome of co-management, and use this lens to link the scholarship of those who focus on power imbalances in formal co-management contexts with that of those who focus on the functional contributions of power-sharing institutions.

In Chapter 14, Per Olsson examines the case of adaptive co-management of the Kristianstads Vattenrike, a wetland complex south of Stockholm, Sweden. Olsson highlights the role of visioning as a tool to frame and direct adaptive co-management efforts. He explores how visioning in this region has played a key role in transforming and changing the social features of the governance system at multiple levels, helping to sustain the system and provide social sources of resilience that are important to adaptive co-management.

Drawing attention to another important tool, Garry Peterson describes in Chapter 15 how scenario planning has been used to build connections among separate groups and start a dialogue about the functioning of an intensively managed and human-dominated social-ecological system, the Northern Highland Lake District of Wisconsin. Peterson illustrates how scenario planning helped to build capacity for adaptive co-management, stimulating shared understanding and cooperation among a range of stakeholder groups.

This volume ends with a synthesis chapter (Chapter 16) on the lessons learned and the implications for adaptive co-management theory development, practice, and policy. Attention is directed towards the key themes previously described, and the manner in which authors touch on these themes to emphasize theory, lessons from the field, challenges, and evolving concepts and tools.

From the outset, the aim of this volume has been to contribute to the evolution of adaptive co-management and to respond to the needs and interests of community-based actors, policy makers, resource managers and other practitioners, and researchers. Most chapters link theory and practice, providing unique insights from case studies and examples representing diverse geographical settings and resource systems. Combined, the chapters in this book provide a perspective on a natural resource management approach that is evolving to meet the increasing challenges of a tightly connected world and the expectations for governance innovation in an adaptive age.

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