

Embracing Ecological Learning and Social Learning: UNESCO Biosphere Reserves as Exemplars of Changing Conservation Practices

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Abstract

Biosphere reserves were first created in 1976 to help scientists, managers, and communities better understand how to conserve biodiversity and improve human–environment interactions. Since then, biosphere reserves have evolved from a primary focus on ‘ecological learning’ to a broader orientation that includes ‘social learning’. The purpose of this paper is to trace how this shift became intertwined with changing expectations about the purpose and philosophy, criteria for site selection, and assessment of effectiveness of biosphere reserves as exemplars of conservation and sustainable development. Drawing on academic reports, policy and other archived documents from the international and Canadian programs, and interviews of key participants, this paper examines how international priorities changed and became expressed on the ground in designation processes and research practices of Canadian biosphere reserves. Our research indicates that social dimensions of learning have been added to earlier ecological objectives. This addition has had a dual impact. While laudably broadening perspectives on research, learning, and learners to include social scientists and local people more effectively, a heightened emphasis on social dimensions has increased the complexity of anticipated outcomes tied to governance and social goals. Biosphere reserves must now establish research and management approaches that encompass both ecological and social dimensions of learning reflecting collaborative and interdisciplinary research and practice that include local perspectives and assessment goals. These changes may require improved clarity for determining where future biosphere reserves should be created and how they should be managed.

Keywords: biosphere reserves, conservation, sustainability, sustainable development, ecological learning, social learning, UNESCO, biodiversity, political ecology, environmental history

INTRODUCTION

A biosphere reserve is not a protected area... One of the issues, difficulties, or problems is that people are so looking for simplistic answers that they keep on thinking of a biosphere reserve as a protected area, sort of like a park.

— Interview with Reed, March 2010

This quotation, excerpted from an interview conducted in 2010 with a prominent scientist associated with Canadian biosphere reserves, suggests that biosphere reserves are not easy to classify. First established in the mid–1970s under the Man and the Biosphere (MAB) program of the United Nations Education, Scientific, and Cultural Organization (UNESCO), biosphere reserves are technically not protected areas. Or, at least, they are non–conventional protected areas (Price 1996; Batisse 1997). Biosphere reserves contain a core area typically protected under national or sub–national legislation. The core area forms part of a set of zones marking a gradual intensification of resource use as a means to foster understanding of human impacts on ecological and cultural systems. Biosphere reserves today carry out three functions: promote the conservation of biological and cultural diversity; advance the aims of sustainable development¹; and provide

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logistical support for research, learning, and public education (UNESCO 2000). Furthermore, since their inception, biosphere reserves have been promoted as ‘living laboratories’ or ‘learning sites’ that can help scientists, managers, and more recently, local communities better understand how to achieve conservation of biodiversity and sustainable development (e.g., Batisse 1982; Schultz and Lundholm 2010). They have long been described as ‘representative’ sites wherein relevant environmental change can be monitored, policies or practices can be ‘tested’, and lessons can be learned to inform environmental policy and management practice (Batisse 1982; Batisse 1995; UNESCO 2007). Consequently, the aims of biosphere reserves are much broader than environmental conservation alone. Nevertheless, their configuration and their history over the past 40 years illustrate changing ideas about how to practice conservation.

The purpose and practices of biosphere reserves have shifted over the past 40 years as the MAB program evolved. The purpose of this paper is to explain how ideas about conservation, sustainable development, and learning in this MAB program have evolved by critically examining the history of biosphere reserves from the 1970s to the present. It emphasises the interplay between international plans established by UNESCO and this MAB program, and national-level implementation in Canada. Specifically, the paper addresses three questions:

1. What were the international priorities for conservation and learning and how have they changed throughout the history of the MAB program?
2. How did these international priorities become translated into criteria for the designation of biosphere reserves?
3. How did these priorities become expressed ‘on the ground’ in the designation processes and research practices of Canadian biosphere reserves?

This shift has meant that there is now greater emphasis on including local people in supporting the goals of sustainable development. Including local perspectives reflects an on-going debate surrounding protected areas management more broadly to consider the livelihoods and the perspectives of local people when advancing a conservation agenda (see Adams and Hutton 2007; Fischer 2008; McNeely 2008; Berghöfer 2010). Changes in the mandate and practices of biosphere reserves have also been accompanied by a corresponding change in ideas about what and how we might learn when establishing protected areas and to whom we might refer (e.g., Lotze-Campen et al. 2008; Schultz and Lundholm 2010). Although conceptually discrete, the increased emphasis on learning has linked three ideas in practice: the desire to engage local people in conservation and sustainable development, the search for appropriate strategies and social groups to become engaged in learning, and the changing criteria for selecting biosphere reserves. We explore these ideas using conceptual and analytical approaches of political ecology and environmental history. Drawing on political ecology, we view practices associated with conservation and sustainable development in biosphere reserves as part of political processes associated with research practice that affected the siting of biosphere reserves and activities within them. We also embed

our work within a narrative tradition of environmental history to gain a deeper understanding of how such practices emerged and became embedded over time.

We begin by describing our methodological approach and provide a historical overview of two key periods of biosphere reserve creation and learning. Next, we review relevant debates in ideas about conservation, emphasising how learning has been conceived and executed. With these foundations, we then analyze descriptions and research activities of the international and Canadian biosphere reserve programs. As conservation and sustainable development objectives became an interconnected part of the mandate of biosphere reserves, the scope of learning activities and learners broadened. As social science researchers began to tackle research questions addressing management processes and broader governance arrangements in Canadian practice, the distinction between research and management foci became blurred. We draw out these changes, focusing on implications for the biosphere reserve program and for broader practical agendas related to conservation and sustainable development.

METHODOLOGICAL APPROACH

Data sources and analysis

Our research on biosphere reserves is set within an inductive and interpretive research tradition in social science and humanities (Gomm et al. 2000) seeking to generate knowledge from intensive immersion within a particular context. Emphasis is placed on ‘general fitness’ and ‘transferability’ of knowledge gained rather than the ability to generalise through statistical inference (Lincoln and Guba 2000). Empirical support for the paper is based on review of academic literature about biosphere reserves as well as policy and program documentation relating to the MAB program internationally and its application in Canada. Documents reviewed were made available from the archives at Wilfrid Laurier University in Ontario Canada (Francis fonds and Roots fonds), the offices of Canadian Biosphere Reserves Association (CBRA), and personal records maintained by those engaged in biosphere reserves. The narrative tradition in environmental history is used to draw attention to change over time in how Canadian biosphere reserves responded to international parameters, to each other through the Canadian context, and as individual reserves. Such perspective allows a specific and tangible way to trace how ideas and practices follow and flow through time.

Following the extensive archival research, lead author Maureen Reed conducted interviews with 16 prominent people who served Canadian biosphere reserves at the national level, primarily, although not exclusively, with the Canada–MAB committee from the 1970s to the present. These interviewees included active and retired academics, federal civil servants, and volunteer practitioners. Their experience within the MAB program ranged from less than five to more than thirty years: seven had been involved with individual biosphere reserves or the national network prior to 1995, seven had been involved

both prior to and since 1995, two had been involved since 1995. Interviews lasted ninety minutes on average. With permission, interviews were recorded verbatim and transcribed for qualitative analysis, using the program ATLAS.ti. Interviews were reviewed three times. Codes were initially established based on the research objectives and refined during subsequent review of transcripts. Where possible, published documents and notes were also subjected to coding. Less formally, lead author Maureen Reed has been an observer of the Canadian network of biosphere reserves for about 10 years, attending annual general meetings as well as meetings of individual or regional clusters of biosphere reserves. In 2007 and 2010, she co-conducted three periodic reviews of Canadian biosphere reserves and since 2010, she has served on the Canada-MAB committee.

Two periods in the international and Canadian biosphere reserve programs

UNESCO's Man and the Biosphere (MAB) program was established in 1971. Under the MAB program, the first biosphere reserves were designated internationally in 1976 and in Canada in 1978. Internationally, 55 percent of biosphere reserves were established in the first 20 years. In Canada, six biosphere reserves were designated between 1978–1995, 10 have been designated since (Table 1). Interestingly, although the rate of biosphere creation has dropped recently internationally, it has accelerated in Canada.

For the purposes of this paper, two distinct periods can be identified.² Period One (between 1976 and 1995) marks the genesis and first applications of the concept of biosphere reserves, including a time of 'considerable reflection and refinement of the concept and its practice' (Ishwaran et al. 2008: 124). It was a time of 'ecological learning', meaning that natural science questions and research were ascendant. Period Two (from 1996 to the present) brought the addition of 'social learning' to more conventional Western scientific approaches of ecological learning. This period marks the time wherein the greatest conceptual and practical changes were implemented relating to including people in the management of biosphere reserves. Ecological learning and social learning are not mutually exclusive; indeed, in the second phase of biosphere development, they co-existed. Ideas about who should learn and what was being learned shaped conservation and scientific practice. Questions about learning affected statements of purpose and philosophy, complicated the criteria for site selection, and altered the ability to assess the effectiveness of biosphere reserves as exemplars of conservation and

sustainable development. The addition of social learning affected the kinds of research and learning undertaken and the social groups considered to be critical participants in these learning processes. Thus, the focus on the biosphere reserve program exemplifies a broader societal shift and expansion in research activities associated with the inclusion of local people in conservation and sustainable development practices.

A context for shifting ideas about conservation and learning

Political ecologists remind us that conservation efforts are not applied to neutral or blank territories. Rather, efforts to conserve biological diversity and support sustainable development are political exercises steeped in uneven power relationships that distribute the costs and benefits of such efforts unequally across social groups and geographic landscapes (Reed 2007a, b; Apostolopoulou and Pantis 2010; Hurley and Carr 2010; Otero 2011). While some political ecologists focus on how external forces of economic globalisation drive local socio-ecological agendas (see Schroeder et al. 2006; Hurley and Carr 2010), and others examine what groups have access to and control over strategic and environmental resources (McCarthy 2002; Apostolopoulou and Pantis 2010), this paper considers how and whose knowledge is used and how that knowledge frames the discussion about conservation and sets priorities for local action (see also Reed and McIlveen 2006; Robbins 2006). While political ecologists have argued that such studies may be best understood by detailed case studies at the regional scale (see Walker 2003; Hurley and Carr 2010), recent efforts suggest the need to link intensive approaches that explain local contexts with more extensive approaches that allow for more general understandings of social-ecological systems (e.g., Birkenholtz 2012). Hence, this study focuses on how an international conservation/development program became translated and implemented within a nation state, including how research and learning expectations changed over time. We offer an alternative examination of the interplay of global priorities and local actions, illustrating how conservation knowledge and objectives are situated within broader social and political contexts, and demonstrating the heterogeneity of opinion and practice of conservation on the ground.

The introduction of "society" in conservation ideals and practice

The concept of 'conservation' has changed internationally in the science and management of protected areas since the early twentieth century. This alteration has been, in part, from a concept of conserving 'pristine nature' that scientists could study, quantify, predict and potentially control, towards a contemporary perspective that acknowledges the influence of humans who interact with nature in ways that are fundamentally unpredictable and thereby uncertain (Holling and Meffe 1996; Ludwig 2001; Adams and Hutton 2007). Biosphere reserves, both in their formation and implementation, shared in the

Table 1
Number of biosphere reserves designated internationally and in Canada 1976–July 2011

	1976-1995		1996-July 2011	
	<i>N</i>	%	<i>N</i>	%
Internationally	320	55	260	45
Canada	6	38	10	62

Ishwaran 2008; UNESCO website 2011 <http://www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/biosphere-reserves/>

concept, goals, and implementation strategies of conservation and have been at the forefront of using these sites as locations for systematic learning. Although meeting reports and other Canadian discussion documents suggest there were efforts to bring social science into the conception and selection of biosphere reserves at the outset of the MAB program, early practices drew primarily on the expertise of natural scientists. Consequently, as with other types of protected areas, early examples from the establishment and management of biosphere reserves clearly support the observation that ‘conservation planning is dominated by people trained in the natural sciences, and who draw fairly exclusively on science-based paradigms in their thinking’ (Adams and Hutton 2007: 167).

Acknowledging the influence of humans and human unpredictability—both in the broader conservation movement and within biosphere reserves—supported a corresponding shift in goals from solely understanding and conserving specific ecosystem structures and types to understanding and maintaining conditions for resilience (Berkes et al. 2003; Walker et al. 2004; Silvapalan et al. 2012). Two observations arise from this acknowledgement. First, while the idea that ecological and social systems are coupled is not particularly new, there remains a lingering debate about whether local people should be included in conservation practice (Mathevet and Mauchamp 2005; McNeely 2008; Fischer 2008; Berghöfer 2010) and if so, what local people might contribute (e.g., Pullin and Knight 2009; Mathevet and Mauchamp 2008). The conversation surrounding *shared* learning, or at least adopting an integrated framework for research that actively and reflexively interrogates epistemology both during the creation of a research program and throughout its duration, is just emerging (Murphy 2011).

The second observation is that the notion of unpredictability that characterises literature on resilient socio-ecological systems offers an opportunity for systematic learning. This opportunity has long been expressed in resilience literature through its support of adaptive management (Holling 1973; Walters 1986). While the emphasis on learning is not new, it is here that serious questions are now being asked about who learns, how learning exercises might have differential effects for different social groups, and how learning approaches can be used as strategies for public engagement or empowerment rather than simply to support ‘professional’ research programs or management practice (Schultz and Lundholm 2010; Armitage et al. 2008; Lundholm and Plummer 2010; Murphy 2011). Asking these questions connects to the concerns of political ecologists regarding what social groups gain and lose in the allocation of resources and in the processes by which decisions are made. Biosphere reserves—established explicitly to support biodiversity conservation, sustainable development, and learning—offer a means to explore how and to what effect such objectives become operational in practice. The introduction of ‘sustainable development’ as a key function of biosphere reserves in the mid-1990s extended their scope to address more explicitly objectives such as maintaining local livelihoods, including local people in decisions, and

maintaining respect for the rights and responsibilities of local and indigenous peoples (UNESCO 2000, 2002).

Biosphere reserves as learning platforms: from ‘field laboratories’ to ‘learning sites’

A common thread that runs through historical and contemporary descriptions of biosphere reserves is terminology specifically related to learning goals and practices. Biosphere reserves have been described as ‘field laboratories’ (Batisse 1982), ‘living laboratories’ (Batisse 1996; UNESCO 2000), ‘learning laboratories’ (e.g., Ishwaran et al. 2008; Brunckhorst 2010), or ‘learning sites’ (Schultz and Lundholm 2010) to differentiate biosphere reserves from classical protected areas aimed at protecting biological diversity and sometimes maintaining compatible recreational opportunities (such as in different kinds of national parks). Together, these phrases (field laboratories, living laboratories, learning laboratories and learning sites) suggest a range of concepts and opportunities along a continuum rather than discrete points with mutually exclusive characteristics. Although these concepts are all rooted in ideas of research and learning, they suggest different learning purposes and audiences that have changed over time. ‘Field laboratories’ suggests a classic scientific description of a natural science laboratory within nature, where observation, conservation, and control can be maximised without human participation. This terminology is consistent with our conception of ‘ecological learning’ in which scientists seek to understand ecological principles and how conservation can be used as a tool to protect ecological integrity or biodiversity. The practice of ecological learning need not be interdisciplinary. It can be rooted within the discipline of ecology and follow disciplinary codes of practice. Knowledge is gained by scientists and then shared with managers and practitioners.

The terms ‘living laboratories’ and ‘learning laboratories’ are ambiguous, but suggest situations wherein some researchers adhere more closely to the aspirations of ecological learning while others are more aligned to social learning. ‘Learning sites’ is possibly the most permissive term. It appears to be consistent with the idea of ‘social learning’ that has generated a very large literature in environmental studies (e.g., Lee 1993; Schusler et al. 2003; Armitage et al. 2008; Berkes 2009; Reed et al. 2010; Schultz and Lundholm 2010). We have adopted the definition of social learning as ‘a change in understanding...situated within wider social units or communities of practice through social interactions’ (Reed et al. 2010: n.p.). This definition would suggest that learning sites can be forums for social learning wherein learning activities and locations are suitable for groups to address questions about sustainable development and human-environment interaction (see also, Schultz and Lundholm 2010; Stoll-Kleeman et al. 2010). ‘Learning sites’ also implies the co-construction of knowledge among a broad range of scholars and practitioners, both volunteer and paid (Stoll-Kleeman and Welp 2008; Lundholm and Schultz 2010; Stoll-Kleeman et al. 2010). As the context for learning is social interaction, social learning also implies research that is

collaborative, interdisciplinary and reflexive (Murphy 2011). And last, social learning implies learning that is explicitly aimed at addressing research problems embedded within its social context wherein research results will address problems of interest to academics, local residents, and practitioners. The descriptive phrases that characterised biosphere reserves as sites of learning have been subtly altered over time. These alterations suggest shifts based on who learns and how the learning takes place. In some cases, descriptions altered to reflect practice/expectations; in others, practice/expectation altered to reflect description. The following analysis of the international and Canadian biosphere programs focuses on how biosphere reserves were depicted, with explicit attention to learners, learning, and the construction and dissemination of knowledge. We examine for what reasons, when, and by whose efforts, certain places became biosphere reserves.

EARLY CONCEPTIONS: ECOLOGICAL LEARNING FROM 1976 TO 1995

Early international experiences

Early descriptions of the functions of biosphere reserves placed emphasis on *in situ* conservation and monitoring of ecosystems and biological diversity, research related to ecosystem function and management, and the training of specialists and encouragement of environmental education (e.g., Batisse 1982). While aiming to ‘improve the relationship between human society and the Biosphere’ (Roots 2000: 3), biosphere reserves were to serve as sites of good scientific practice, wherein scientists alone would determine what problems were significant and how they were to be addressed. Speeches and documents from UNESCO and biosphere scientists from the 1960s and 1970s contained a tacit assumption that the application of scientific ideas and methods could lead, more or less automatically, to improvements in environmental management. The learners, therefore, were primarily characterised as scientists who would then transmit their knowledge to managers. For example, in Paris 1968, then Deputy Director General of UNESCO opened the inaugural meeting about Biosphere Reserves by saying, ‘modern science might help select and develop rational methods for the use of the resources of the biosphere while ensuring their conservation’ (UNESCO 1968: 1). To ensure both conservation and scientific study of possible methods of use, the program promoted a zonation system, where the core area of the biosphere was strictly conserved, but ‘destructive types of research’ could be carried out in buffer areas (Franklin 1977: 263). By 1981, biosphere reserves had been formally introduced in several countries. A communiqué of a 1981 UNESCO conference noted that ‘one of the most distinctive features of biosphere reserves is that they constitute field laboratories, in which, by application of the scientific method, solutions can be found to the problems facing local populations, and consequently nations, regions and the biosphere as a whole’ (UNESCO, MAB, UNESCO–ICSU 1981:3).

In this period, biosphere reserves served science first, people second (Goodier and Jeffers 1981). Jerry Franklin, a plant ecologist and then chair of the U.S. Man and the Biosphere Committee, declared in 1977 that each biosphere reserve was selected based on its ‘significance’ as a natural ecosystem (judged on its diversity and integrity, or ‘naturalness’). A biosphere reserve’s usefulness and success would depend on each biosphere’s ability to become ‘active sites for scientific research and monitoring’ (Franklin 1977: 267). These comments reinforce the perception that scientists were to be the people doing the primary learning. Indeed, Franklin’s article, published in *Science*, was promotional: he wanted scientists to be made aware of ‘the existence and potential’ of these new research sites (Franklin 1977: 262). Scientists would then ‘transmit’ knowledge they gained to managers and policy-makers, as part of the educational mandate of the biosphere program. Furthermore, despite nominally being a program of both natural and social sciences, biosphere reserves were established within the natural sciences division of UNESCO as part of Project 8, *Conservation of Natural Areas and of the Genetic Material They Contain* (Franklin 1977). Thus, conservation of biodiversity remained a principal rationale for their creation. Natural scientists remained the principal investigators on the vast majority of research projects initiated within or about biosphere reserves.

Within this science-based mandate, ecological learning took precedence, particularly lessons that could be learned from the growing field of terrestrial ecology. Terrestrial ecologists were key scientists in defining the MAB program. They sought out core ecosystems that could provide lessons relating to the demise of and ecological conditions necessary to protect the biological diversity of terrestrial ecosystems around the globe. Indeed, by 1990, Batisse lamented that too much emphasis had been placed on *terrestrial* ecology, as rising concerns for *marine* ecosystems had not been matched by designation of marine biosphere reserves (Batisse 1990). This lament, couched as it was within the confines of ecological science, reinforced the belief that professional ecologists were the rightful arbiters of what constituted appropriate problems and how these problems should be studied.

Determining the appropriate location of biosphere reserves was central to the scientific agenda. According to Batisse (1982: 101), then Deputy Assistant Director–General for Science at UNESCO, the biosphere reserve program was created to establish a ‘world-wide network of ‘representative ecological areas’ to cover all major representative natural and semi-natural ecosystems’. Such a network would make biosphere reserves effective tools for linking conservation and development and thereby help to fulfill the broad objectives of MAB. Early designations were based on establishing a global system of ‘biogeographical provinces’ (established by Udvardy 1975) that helped scientists identify potential ecosystems to be designated within nation states. Some countries, such as Canada, also included information from national or provincial ecological land classification schemes where they existed (Francis 2009, pers. comm.).

Table 2
Selected quotations related to designation of biosphere reserves from UNESCO and Canada's action plans in the 1980s

UNESCO 1984-85 action plan	Canada 1987 action plan
Biosphere reserves are protected areas of representative terrestrial and coastal environments. Each biosphere reserve includes representative examples of natural or minimally disturbed ecosystems (core areas) within one of the world's biogeographical provinces. P. 2.	Canada/MAB has 3 objectives in helping complete and maintain the global network of biosphere reserves as called for in the International Action Plan: to establish at least one biosphere reserve in each of the biogeographic regions in Canada. Pp. v and vi.
Action 1: In order to provide the basis for a rational selection of biosphere reserves that would give a complete biogeographical cover, IUCN, in cooperation with UNEP, should prepare and publish: Classification of 'representative ecological areas' on land; and classification of 'representative ecological areas' covering intertidal and marine habitats in coastal areas. P. 5.	The ultimate objective of the biosphere reserve program is to institute a comprehensive global network of protected representative areas. P. 1.
Action 6. UNESCO should immediately establish a Biosphere Reserve Scientific Advisory Panel to refine criteria for the selection and management of biosphere reserves, to evaluate proposals for new biosphere reserves and to review from time to time the effectiveness of the network. P. 5.	Three concerns in the International Action Plan apply to Canada: (a) there is inadequate coverage of the world's biogeographic provinces, including most that occur in Canada; (b) there are major gaps in the kinds of ecosystems in Canada that are represented in biosphere reserves. P. 13.
	Action 1: Adopt the national ecological land classification system, particularly the ecozone maps of Canada, developed by the Canada Committee on Ecological Land Classification and Environment Canada. This is to be used as the basis for selecting regionally and nationally representative areas as biosphere reserves in Canada's land, wetland, fresh and salt water environments. P. 13.
	Action 3: There are extensive gaps in Canada in the biosphere reserve network. Canada could contribute substantially to the expansion of the global network of biosphere reserves by establishing at least one reserve within each of the world's biogeographic provinces that occur within its boundaries. P. 13.

Canada/MAB, Canadian Commission for UNESCO (1987); UNESCO (1984)

UNESCO's 1984 Action Plan revealed strong support for a systematic scientific approach to the designation process (Table 2). For example, the Plan stated: 'one of the principal objectives of the Action Plan is to improve and expand the world coverage of biosphere reserves by representative ecological areas within each of the world's biogeographical regions' (UNESCO 1984: 4). Furthermore, this objective was

to be executed by scientists, not lay citizens. According to the Action Plan, Action 6, or the task of 'refining criteria for the selection and management of biosphere reserves', would be accomplished by 'immediately establish(ing) a Biosphere Reserve Scientific Panel to refine criteria for the selection and management of biosphere reserves, to evaluate proposals for new biosphere reserves and to review from time to time the effectiveness of the network' (UNESCO 1984:5). Although the plan did not explicitly define who those scientists might be, the scientists who were active at the time were academic or public agency researchers from UNESCO or national government agencies who shaped research agendas and programs.

While early documents suggested that biosphere reserves were always intended to embrace social science research (e.g., UNESCO 1984), there is significant evidence that the social sciences played a very limited role in the formative period. An independent review of the international Action Plan stated that 'the majority of biosphere reserves are managed by people trained in the biological sciences who may be more adept at working on ecological, rather than socio-economic, issues. This, too, has led to the under-representation of the social sciences and development function within biosphere reserves' (IUCN 1995:2, cited by Price 1996).

Criticism regarding the under-representation of social science was leveled at both research and management practice. In 1993, an internal UNESCO report commented that despite the apparent universal acceptance of socio-economics in conservation and sustainable development efforts (especially following the World Commission on Environment and Development 1987 report *Our Common Future*)³, the role that people played – both local people and social scientists studying local people – was limited in practice (UNESCO 1993). Furthermore, the report was one among others that indicated that, similar to other 'protected areas', the designation and management of biosphere reserves effectively marginalised or excluded local people from the setting of conservation objectives in the identification of appropriate local activities, and/or undermined local opportunities for sustaining livelihoods (e.g., Ghimire 1991; Nyakweba 1993; for discussion, see Price 1996). Later documents by UNESCO emphasised local engagement and knowledge as well as establishing a stronger presence of social science research within biosphere reserves (e.g., UNESCO 2000; 2002).

Early Canadian experiences

Canada presented an even more forceful approach to designating biosphere reserves across a network of representative biogeographic regions (Table 2). The 1987 National Action Plan documented the 15 ecozones of Canada with their dominant land use practices as a basis for future selection of biosphere reserves. The Action Plan articulated a commitment to establishing at least one reserve within each of the world's biogeographic provinces represented in the country which, the Plan reported, would mean the designation of nine new biosphere reserves, five of which were to be located in northern

Table 3
Designation dates of Canadian biosphere reserves

Year designated	Name and location of Canadian biosphere reserve
1978*	Mont Saint-Hilaire, Québec
1979*	Waterton, Alberta
1986*	Long Point, Ontario
1986*	Riding Mountain, Manitoba
1988*	Charlevoix, Québec
1990*	Niagara Escarpment, Ontario
2000	Clayoquot Sound, British Columbia
2000	Lac Saint-Pierre, Québec
2000	Mount Arrowsmith, British Columbia
2000	Redberry Lake, Saskatchewan
2001	Southwest Nova, Nova Scotia
2002	Frontenac Arch, Ontario
2004	Georgian Bay, Ontario
2007	Manicouagan-Uapishka, Québec
2007	Fundy, New Brunswick
2011	Bras d'Or Lake, Nova Scotia

*Period One designations

territories of the country. At the time of the Plan's publication, only four biosphere reserves had been created, with two following in Period One (Table 3).

Consistent with the international practice (Price 1996), the six first-generation biosphere reserves created in Canada during Period One were focused around either an important site that had been used by scientists for ecological research (e.g. Long Point and Mont St. Hilaire), or a national park or legislated protected landscape (e.g. Charlevoix, Waterton, Riding Mountain, Niagara Escarpment). Research sites such as at Mont St. Hilaire offered immediate fulfillment of the conservation and logistics function of a biosphere reserve. National parks, which could serve as control areas because they restricted human activities, also helped link research agendas and scientists to management priorities. According to one interviewee, 'in earlier years both the interests of scientific research and the broader influence of a national park made the creation of a biosphere reserve logical... these [parks] provided a core of protection, continual monitoring, and the potential for creating knowledge' (Interview with Reed, December 2009). Another interviewee pointed out that an additional benefit for Parks Canada was that biosphere reserves could serve as a means to gain support for the ecological protection element of the government's mandate (Interview with Reed, December 2009).

Despite having a national strategic action plan based on "biogeographical provinces"⁴, interviewees noted that during the early years, selection of biosphere reserve sites was 'opportunistic'. The idea of a biosphere reserve was easy to promote because it did not change legislation or regulation and thus, was viewed as a no-harm proposition at the local level. One interviewee observed: 'Well the concept sounds so good, it's so wholesome and yet so non-threatening, that areas would want to become designated just for whatever small benefit designation might bring... there's no harm in it' (Interview with Reed, December 2009). Furthermore, for some, the plan was viewed as a quasi-government position paper, rather than

a broader-based instrument that might engage a spectrum of public agencies and civil society organisations. Additionally, correspondence among key players revealed that the time required from first consideration to designation of a biosphere reserve had increased from one to several years. The length and detail of nomination documents also increased. Lack of funding limited the creation of biosphere reserves to those places with tenacious volunteers who had time to invest in the process of selection and designation. Consequently, despite clear intentions and articulation of priorities, the National Action Plan was not executed and representation by ecosystem was never realised.

Nevertheless, the idea of representation by ecosystem had a lingering effect. Interviews with longstanding participants in the MAB program revealed mixed opinions about the importance of ecological representation. Nine of the 16 people interviewed disagreed with the idea of ecological representation as a defining criterion for biosphere reserve designation. However, as discussed in a following section, the idea of representation based on ecological criteria remained a consideration and thus some form of systematic representation remains salient. Despite their limited impact with respect to specific designations, two elements from the international (1984) and Canadian (1987) action plans define the period and shaped subsequent debates:

- a. the primary motivator for biosphere reserve creation was based on identifying 'natural' ecosystem characteristics worthy of conservation efforts; and
- b. designation should be based on a systematic approach rooted in notions of geographic representation.

Canadian biosphere reserves also met research and monitoring objectives of natural scientists. The benefits of longstanding ecological monitoring were observed by Fred Roots (2000: 3) who noted that despite the loss of interest in the research community associated with global change to use biosphere reserves as research monitoring sites:

In some cases, a Biosphere Reserve has been in a position to provide scientific information about a major environmental or biological event that has economic or human implications. This happened in Canada, when the Mont St. Hilaire Biosphere Reserve found itself in the middle of the devastating ice storm of 1998, and, *from a background of several decades of research and data collecting in the area*, was in an unique position to provide a scientific assessment of the long-term ecological effects as well as the immediate biological and socio-economic damage, and to help provide a basis for compensation policies and recovery plans connected to a natural event that cost the country more than a billion dollars (our emphasis).

The claim of Roots (2003) is borne out by the dominance of natural science research carried out at this biosphere reserve. A review by the lead author of research outputs conducted at Mont St. Hilaire (Canada's first biosphere reserve) between 1978 and 1995 and recorded in a database by the Gault Research Centre of McGill University revealed that of 224

research outputs (including scientific papers, reports, theses, and books or book chapters) listed in the database, 219 (98 percent) reflected research in the natural sciences.

Long Point Biosphere Reserve is also a first-generation biosphere reserve in Canada, having received its designation in 1986. The biosphere reserve houses the oldest continuously operated bird observatory in North America (established in 1960) and was once a site for the national program of the Ecological Monitoring and Assessment Network (active from 1994 to 2010). Motivation for its designation came from ecological scientists who were conducting an inter-university research initiative under the umbrella of the Great Lakes Ecosystem Rehabilitation Group. Their research, (from 1977 to 1985), revealed the importance of this site for understanding the effects of anthropogenic interactions on the Great Lakes ecosystem. Beginning in 1981, the associated researchers lobbied government and the Canada–MAB committee to consider this location for a biosphere reserve (Francis 2000). At the time of its first periodic review in 2000, research was almost entirely devoted to ecological topics including multiple studies of land birds and waterfowl, monitoring for wildlife-vegetation interactions, ecology of lime, sediment transport, water quality studies, and forest corridor inventory and restoration. Although some studies involved local people in learning about the region (e.g., forest corridor research), the study of the monitoring of sport fishing stocks is the one that came closest to social science (see Francis 2000). There is no question that natural scientists were the key learners during this period in Canada.

In summary, during the period 1976–1995, international and Canadian biosphere reserves were characterised by two primary functions: conservation of biodiversity and support of related scientific research. As such, ecological learning dominated during this period. Although research in biosphere reserves was embedded in questions of societal interest (such as the loss of biodiversity), researchers working in biosphere reserves internationally and in Canada initiated and conducted research according to their own agendas, questions, values, and methods. In short, biosphere reserves served science. This focus shifted in Period Two wherein the needs and interests of local people became more important in determining the locations of and implementing research programs associated with biosphere reserves.

CONTEMPORARY CONCEPTIONS: SOCIAL LEARNING FROM 1996–PRESENT

Contemporary international experiences

Following the 1987 World Commission on Environment and Development (Brundtland Commission) and on-going international discussions that people must form part of the ‘conservation solution’, UNESCO began to place greater emphasis on the needs and interests of people living in protected areas. This emphasis built on the momentum around sustainable development that was gained through the

publication of the Commission’s report, *Our Common Future* (1987). Although MAB has always, at least in theory, been dedicated to learning about human–environment relations, this relationship gained prominence by the mid-1990s (see Price 1996 for a summary discussion). The second period, 1996–present, officially introduced a new function to the biosphere reserve program: sustainable development involving the conservation of cultural diversity and livelihoods. The introduction of this function officially recognised and affirmed the importance of understanding and learning about human–environment interactions and, more particularly, the role of human use of the landscape, even if that ‘use’ might be viewed from the perspective of classical ecologists as ‘destructive’ or ‘degrading’ of biodiversity.⁵

The Seville Strategy of 1995 documented a greater acceptance of human use to enhance the program’s natural science roots. A conference paper distributed at the Congress noted that the purpose of biosphere reserves ‘is to preserve and generate natural *and cultural values* through management that is scientifically correct, *culturally creative* and operationally sustainable’ (UNESCO 1995: 1, our emphasis). Furthermore, the paper declared (UNESCO 1995: 2): the ‘inclusion of the sociological dimension is crucial to the achievement of truly effective management.’ While this participatory discourse entered the global environmental management deliberations with the Rio Earth Summit in 1992, it formally entered into the UNESCO documentation about biosphere reserves following the Seville Conference in 1995.

Official inclusion of ‘sustainable development’ as a defining function also revealed a broadening of focus that shifted the emphasis from baseline natural science research in the core regions to investigating and evaluating models that would support sustainable development and protection of local livelihoods and cultural diversity, while maintaining ecological integrity. Such emphasis directed attention to issues of governance, particularly aspects like who gets involved, how they might work together, and how the benefits and costs of different development paths might be allocated. For example, the Statutory Framework stated ‘organisational arrangements are provided for the involvement and participation of a suitable range of *inter alia* public authorities, local communities and private interests in the design and carrying out of the functions of a biosphere reserve’ (UNESCO 1996: 17). A brief description by Ishwaran, Perkin and Tri (2008: 130) reinforces this broader focus: ‘Learning together with accumulation and transfer of knowledge in a range of natural and social science disciplines to all relevant stakeholders, including managers, decision-makers, and the local community, will be key to the future of biosphere reserves as learning laboratories for sustainable development’. Interestingly, this statement by Ishwaran et al. suggests that scientists (both natural and social) will be responsible for the research but then will *transfer* that knowledge to all relevant stakeholders; yet, the UNESCO document specifically calls for the involvement and participation of various stakeholders in design and execution of all functions, including research.

The 1996 Statutory Framework of the World Network of

Biosphere Reserves was the first time that rules of operation and requirements for inclusion of a biosphere reserve in the world network were specified. The Statutory Framework introduced the periodic review of biosphere reserves—a move that was intended to ensure that biosphere reserves continued to satisfy the criteria necessary to retain their membership in the network. These changes affected criteria for site selection and research activities within biosphere reserves.

The purpose of biosphere reserve designation shifted from selecting representative ecosystems according to a systematic assessment of biogeographic provinces to ensuring that biodiversity and cultural diversity are protected through a comprehensive approach. This intention was expressed as the first of four goals of the Seville Strategy, to ‘promote a comprehensive approach to biogeographical classification that takes into account such ideas as vulnerability analysis, in order to develop a system encompassing socio-ecological factors’ (UNESCO 1996: 6). This statement suggests a desire to maintain some form of systematic approach to designation *and* to ensure that local people are involved in establishing parameters for biosphere reserves. However, neither the expectation of meeting geographic criteria of representation nor oversight by scientists to review the designation process was raised.

The trend toward greater local participation in biosphere reserves was reinforced in the Madrid Action Plan (UNESCO 2008). One of the background papers leading up to the Madrid Congress suggested that ‘biosphere reserves exemplify... issues that can be found elsewhere and are representative of the reality of sustainable development...’ (UNESCO 2007: 6). Thus, while representation remained a critical component, the element being represented was no longer an ecosystem, but rather, some form of ‘development system’. Further, the background paper declared ‘In the past 15 years, a shift from a research-driven to a management-driven programme has taken place in MAB as a result of the need to focus on identifying management solutions at the local level. This was accomplished to a certain extent at the expense of scientific research and monitoring’ (UNESCO 2007: 9). Within a management-driven program, then, issues of management and governance of a biosphere reserve and its neighbouring landscape rise in importance and the people who live within and near a biosphere reserve become prominent. This shift provided an opening for new ideas of social learning.

In the Madrid Action Plan, only one target addressed the designation process, stating that individual biosphere reserves must engage in open and participatory procedures. Thus, the idea of systematic representation by biogeographic criteria was dropped entirely. Instead, the Plan established more human-focused goals: ‘to contribute to capacity building and demonstration agendas, to learn from experience and demonstrations, and to contribute to a new generation of professionals and practitioners who can spread the message’ (UNESCO 2007: 5). Thus, by 2008, official documents suggested that biosphere reserves were, in a qualified way, to be created and managed to serve people, rather than to represent

ecosystems within a global system of biogeographical provinces. The qualification arises because the reference to making a contribution to a new generation of *professionals and practitioners who can spread the message* (our emphasis) suggests that engagement remains with a rather elite group involved in one-way transmission of knowledge, rather than a broader spectrum of civil society. Contemporary Canadian experiences can help us understand how this shift to more human-focused goals was interpreted and applied within a national setting.

Contemporary Canadian experiences

Biosphere reserves are ecologically significant regions that promote sustainability and conservation by engaging all community stakeholders. Recognised by UNESCO, they support research, share the resulting knowledge broadly and inform policy-makers. Biosphere reserves address one of the most challenging issues we face today - how to maintain the health of natural systems while meeting needs of communities (<http://biospherecanada.ca>).

Despite bold rhetoric on its internet website, the Canadian Biosphere Reserves Association has not yet established a formal national action plan that might correspond to either the Seville Strategy or the Madrid Action Plan, as is the case with the Canada/MAB committee that formally oversees the Canadian program for MAB. Yet, these international plans have clearly been formative across the Canadian network. As quoted above, the Canadian Biosphere Reserves Association website articulates a concept that retains its base as an ‘ecologically significant region’ promoting both science and community agendas. Other parts of the website promote a connection to the biosphere program’s international roots through vision and mission statements, news items, and its link to the Canadian Commission for UNESCO.

Beyond this superficial and cursory viewpoint, archived documents reveal that the Canadian Biosphere Reserves Association continued to debate whether a systematic plan for representation should be adopted and if so, using what criteria (Francis fonds n.d.). Earlier notions about representation remain, even in the 2000s. Interviews conducted with people long involved in the network revealed mixed opinions regarding the appropriateness of a biogeographical framework that would influence the selection of sites for inclusion in the network. In response to the interview question, ‘Do you think that the network of biosphere reserves should be “representative” of ecosystems like national parks?’, five of sixteen interviewees responded unequivocally ‘yes’, one responded ‘maybe’ and nine responded ‘no’. Three interviewees who said ‘yes’ are still very active in the national association. And even those who decried this approach suggested that one of the ‘gaps’ in the network remains the lack of biosphere reserves in northern Canada. Reference to the lack of a biosphere reserve in northern Canada was a consistent theme across all interviews and remained a salient feature of discussion documents that circulated across the network in 2007 and 2008 (Francis fonds

n.d.).⁶ It is not clear if respondents or discussants included ‘the north’ as a gap in the network because of the ecological and/or social characteristics of northern Canada. Nevertheless, this rather mixed set of responses suggests that the idea of some form of systematic representation remains salient in the contemporary period, even where interviewees denied the importance of biogeographical criteria.

One proposal, submitted by Parks Canada to the Canadian Biosphere Reserves Association in 2007, suggested a system similar to that of the Canada’s National Parks System Plan—a plan based on biophysical geography of the country—be adopted. Members of the association decisively dropped this suggestion. A follow-up discussion paper provided to the Association suggested it continue the process of ‘opportunistic’ planning, based on the happy coincidence of a local organising committee coming forward with a plan to meet the UNESCO criteria for a ‘functional biosphere reserve,’ where the biosphere reserve responds to the UNESCO priorities for ecosystem type (as far as possible), geographic spread across the country, and networking opportunities (Francis *et al.* n.d.).

Informal discussions at annual meetings and interview data suggest that this approach has gained more favour, but it has never been formalised. Until 2008, biosphere reserves typically did not receive core funding from provincial or federal agencies, so that a national strategy related to designation did not appear to be an urgent concern. In 2006, a business plan was created by CBRA followed by a strategic plan in 2009. Neither plan contains any discussion about how future nominations for biosphere reserves in Canada might be addressed (Canadian Biosphere Reserves Association 2006, 2009). In 2010, the Canada–MAB committee was reconstituted and the issue of criteria for designation became an item for discussion. At the time of writing, no official set of criteria has been adopted.

During Period Two, the issue of who was learning and what was being learned also broadened. A key study was initiated by the Period One biosphere reserves in the mid-1990s. The study followed from a memorandum of cooperation signed between Canada, the US, and Mexico in 1995 that committed Canada to making land cover maps from Canada’s biosphere reserves. “Two years later, a partnership centred around the Canadian Biosphere Reserves Association (CBRA) initiated the Biosphere Reserve Landscape Change Project as part of a multi-year plan to develop an integrated data/information management system common to the biosphere reserves in Canada” (Canada MAB 2000: 2). The original six biosphere reserves participated in the landscape change project to improve their understanding of the social, ecological and economic drivers of landscape change and to provide government agencies and others with information to help them learn about the shared history, values, and attributes of their landscapes, and to help guide decision-making towards sustainable development. In addition to providing substantive information about their regions, the publication also aimed to share research and partnership protocols and lessons learned with other governmental and non-governmental organisations. This initiative was not replicated; however, it opened the

door for future research that emphasised social dimensions of ecological change, a greater role for practitioners in identifying research priorities and results, and new ways to conduct research through practitioner-researcher collaboration.

From 2000 forward, there was also a noticeable increase in social science research in individual biosphere reserves and about biosphere reserve activities in Canada as social scientists became interested in determining how sustainable development might be enacted on the ground. Topics studied related to community capacity (e.g., Mendis 2004), governance (e.g., Pollock 2009; Pollock *et al.* 2008; Whitelaw 2006) and reflexive research practice (e.g., Mendis-Millard and Reed 2007). These research programs were often undertaken with local people in one or more of the following activities: setting research questions, determining design, undertaking data collection and analysis, and interpreting the results. Additionally, researchers documented the role of charismatic individuals and local community-based committees in developing the proposals for biosphere reserves, determining their governance structure, and subsequently managing biosphere reserves (e.g., Mendis 2004; Pollock *et al.* 2008). In these ways, research and management activities became more closely connected as did researchers and practitioners.

Periodic reviews of two biosphere reserves designated in Period Two of the biosphere reserve program (Clayoquot Sound and Mount Arrowsmith) also indicated a broader mix of research within and about their regions. For example, the Clayoquot Sound Biosphere Reserve Periodic Review identified 154 research publications in the biosphere reserve since 1995. Of these, 84 (55%) addressed social, cultural or governance questions, while 70 (45%) addressed natural science topics (Francis *et al.* 2010).⁷ The periodic review report for Mount Arrowsmith, also designated in 2000, indicated that reviewers consulted a range of reports and articles that had been made available at the Mount Arrowsmith offices including 11 natural science and 7 social science documents (Reed *et al.* 2010). These data, however, are taken from the periodic reviews conducted and should be considered as a heuristic only (Egunyu and Reed 2012). Nonetheless, the broader mix of research across natural and social science questions indicates an introduction of new research themes, perspectives, and ideas to biosphere reserves.

As a broader spectrum of researchers entered the physical spaces of biosphere reserves and contributed to the biosphere reserve lexicon, they also brought new tools for research that are more rooted within traditions of ‘action research’, ‘participatory research’ and ‘community-based research’. These research practices introduced new ideas about who *manages* biosphere reserves and for what purpose. Social science researchers viewed managers not solely as paid professionals but also as local people—often volunteers—who undertake projects and make decisions about lifestyle, livelihoods and ecosystems. Furthermore, local people were no longer viewed solely the objects or the subjects of research but also as ‘co-creators of knowledge’. For example, a study of community capacity in Clayoquot and Redberry Lake

Biosphere Reserves engaged biosphere reserve volunteer board members and general residents in determining the kinds, characteristics, and accessibility of local natural, social, economic, and human capital available to assist local people (Mendis 2004; Mendis-Millard and Reed 2007). Additionally, the Clayoquot Sound Biosphere Reserve partnered officially with researchers at the University of Victoria for five years (beginning 2001) to undertake a community-university research alliance funded by the Social Sciences and Humanities Research Council of Canada (SSHRC). A key output of this alliance was the establishment of a “Standard of Conduct for Research in Northern Barkely and Clayoquot Sound Communities”, created with members of the local community, scholars at the University of Victoria, and the Nuu-chah-nulth First Nations (available at <http://www.clayoquotalliance.uvic.ca/>). In 2011, with additional financial support from SSHRC, the Canadian Biosphere Reserves Association and all reserves individually partnered with academic researchers across Canada to learn how they might engage in social learning and networking strategies to achieve biosphere reserve objectives more effectively. This pattern of community-based research emerges from a positive coincidence of changes in the framework governing the MAB program as well as changes in the funding programs structuring academic research, particularly social science research, in Canada.⁸ Regardless of the origins, research that is co-designed by academic researchers and local people to benefit management practice, opened up the discussion about conservation objectives, priorities, and challenged the previously tacit assumptions that distant and objective observers are best placed to set up the research and the management agendas.

DISCUSSION AND IMPLICATIONS

Biosphere reserves internationally, and in Canada, have gone through two distinct periods with respect to their conceptual evolution. The first period was of ‘ecological learning’ in which scientists—primarily terrestrial ecologists—were to learn about ecosystem change. This period and its practitioners were embedded in a more classical conservation approach. Biosphere reserves were considered to be sites of ecological value selected to serve as ‘field laboratories’ for scientific research purposes. The primary learners were scientists who could then transmit that knowledge to managers, an ill-defined group composed of paid and volunteer workers. The second period of biosphere reserve learning priorities introduced ‘social learning’ through ‘learning sites’ to the natural science lexicon. While not mutually exclusive, each period implies a different set of criteria for representation in the network, determining who would be involved in research and learning, and how their work might be assessed. Our discussion will focus on the implications of social learning expectations in biosphere protocols, practices, and assessments.

The post-Seville period (1996–present) represents a time in which interests of local people became more prominent in guiding the processes identified by UNESCO and in shaping

research agendas. ‘Sustainable development,’ a concept that includes human use of ecosystem services, has become one of the core functions of the biosphere program. The views and needs of local people therefore became salient in a more concrete way. Maintenance of cultural diversity, local livelihoods and the protection of ecological goods and services to meet human needs became more prominent in the rationale for the creation of biosphere reserves, the work conducted by local practitioners and researchers, as well as the criteria for determining a fully functional biosphere reserve—including those reserves that had been established under the Period One phase of ecological learning (Price 2002; Price et al. 2010). These priorities are also evident internationally through a range of guiding documents including the Seville Strategy and Statutory Framework, the Madrid Action Plan, and a range of supporting UNESCO documents (e.g., UNESCO 2000; 2002; Bouamrane 2006; 2007). Hence, the message that local people were essential to the success of the biosphere reserve program became prominent in the higher order documents and plans of the international program.

This paper demonstrates that biosphere reserves have also moved from advancing a science-driven to a social learning-driven agenda that emphasises local and participatory research. This is clearly evident in Canada where closer links between social scientists and practitioners became established through the 2000s, allowing local people to gain a more prominent role in helping to shape research questions and methods (see Mendis-Millard and Reed 2007; Reed and Peters 2004). In some cases, natural scientists have also worked more closely with local residents. In Clayoquot Sound, a scientific symposium was held in 2011 to exchange lessons learned between scientists and practitioners regarding the preceding 15 years of ecosystem management. In Mont St. Hilaire, recent studies on the protection of forest corridors and ecological services have involved local residents in community restoration projects (Reed pers. comm. 2012). Hence, research conducted in the 2000s introduced strategies that included practitioners, residents, and scholars in research practice and exchange of knowledge. These efforts suggest the possibility of a third phase of learning across biosphere reserves, that of ‘social-ecological learning’. Current research on learning for social-ecological resilience and ecosystem management (e.g., Folke et al. 2005; Davidson-Hunt 2006; Schultz et al. 2007; Armitage et al. 2008; Berkes 2009; Lundholm and Plummer 2010; Schultz and Lundholm 2010; Murphy 2011) demonstrates key elements of such an approach. However, the way we have conceived this type of learning is broader than simply learning how social and ecological systems are interrelated. Its application requires careful consideration of how learning will be undertaken. Most certainly, social-ecological learning will be interdisciplinary (perhaps even transdisciplinary) and collaborative. More challenging will be to consider with whom (within and beyond the confines of academic discourse) scholars, practitioners and local people will collaborate and how they will do so to encourage learning through mutual exchange and knowledge creation rather than one-way transmittal. Such consideration

will require explicit consideration of both ‘conventional’ and ‘marginalised’ knowledge holders, and an effort to address the power imbalances among them. Such discussions such discussions must be ‘frontloaded’ or ‘upstream’ of the research process, at the idea and planning stage, and should include iterative and reflexive practices (Murphy 2011).

The implications of this shift in learning practice for biosphere reserve designation are less clear. Indeed, research by Lisen Schultz and Cecilia Lundhom (2010) with biosphere reserve managers across the network of world biosphere reserves demonstrated confusion and complexity. Answers to the questions ‘Who is supposed to learn?’ and ‘What is supposed to be learned?’ revealed no consensus. Addressing these questions is important for clarifying the purpose, strategic priorities, contributions and practical applications that biosphere reserves offer to conservation and to sustainable development. Answers to these questions will also help biosphere reserves articulate program goals, identify appropriate strategies for implementation, and define evaluation criteria, thereby raising their profile and significance in broader conservation *and* sustainable development agendas. The addition of cultural diversity and sustainable development to the conservation agenda is still contested among some academics (e.g., Fischer 2008; Berghöfer 2010). This debate clearly points to the political issues that attend ecological research and practice. While we welcome the addition of cultural diversity and sustainable development along with an expanded understanding of learning, we recognise that progress towards these ends will require a stronger strategic focus and greater attention to the political dimensions of conservation and learning than is currently articulated. As our understanding of what we can learn from protected areas broadens, and roles and responsibilities for environmental management become more widely distributed among a wider range of ‘scientists’ and ‘citizens,’ it behooves us to clarify what we seek to learn, who will seek to learn, how lessons learned will inform those working in biosphere reserves, and by what criteria success (or failure) will be determined.

Clarification regarding the learning process is directly related to the learning landscape, or the site of the biosphere reserve, an area that also requires attention. In 2008, the Madrid Action Plan articulated just one target relating to the designation process, stating that individual biosphere reserves must engage in open and participatory procedures (UNESCO 2008). Yet this statement offers little guidance in either directing research projects or selecting sites for new biosphere reserves. While the primacy of ‘representative ecological area’ has waned in Period Two, it has not died out. Neither has the idea of ecological bioregions been replaced by a coherent strategic vision of what kinds of sites should be selected and what kind of work biosphere reserves should do. We are not suggesting that using an ecological criterion for designating biosphere reserves is an apolitical choice. Rather, because it is rooted in a unified (if narrow) western scientific methodology, there are greater possibilities for consensus for those who share its assumptions. Indeed, as scientists were the primary decision

makers relating to the location of biosphere reserves and the research activities within them, decision criteria *appear* more transparent, even for those who do not adhere to this methodology. If local and traditional knowledge holders now have a clear place in designing research plans, then perhaps parameters regarding location will have to reflect, at least in part, local and traditional ecological knowledge. How this might be achieved is a significant challenge.

Choices on learning sites, processes and outcomes on the basis of social criteria as opposed to natural criteria are messier, subject to fuzzy definitions that embed socio-cultural nuances and value differences, potentially incompatible methodologies, and a broad suite of strategies for application. Moving toward social-ecological learning as the primary research mode and as a rationale for the designation of biosphere reserves requires continuous questioning of where knowledge can or should be created, who creates knowledge, how knowledge becomes legitimated and used, and who gets to decide. Political, social, economic, cultural, and spiritual research questions related to sustainable development in addition to natural conservation, and defined specifically by and for local needs, may require individual biosphere reserves to set their own parameters – which creates immense complications for setting national and international priorities. Where once the standards reflected attributes of the ‘natural’ environment, can international priorities define social-ecological *landscapes* at the local level? The definition of ‘open and participatory procedures’ does not define an end goal, product, outcome, or place. As this paper demonstrates, future refinement of international and national priorities for conservation, sustainable development, and learning in the MAB biosphere reserve program may involve examining the intersection of policies and practices across scales of implementation and across changing ideas of conservation and learning. There remain complex conceptual and practical challenges for practitioners, political ecologists, environmental historians and other researchers to untangle.

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NOTES

1. We have adopted the terminology of sustainable development throughout the paper (except in one direct quotation) as this term is used in official documents pertaining to biosphere reserves. We recognise that some researchers who conduct research in and about biosphere reserves prefer the terminology of sustainability to avoid the conflict within the literature and practice of “development”. Our choice to adopt the term is to ensure

consistency throughout the paper and with UN terminology and does not necessarily reflect a specific position in this debate.

2. Ishwaran et al. (2008) suggested three periods: 1976-1984; 1985-1995; 1996-present, arguing that the highest rate of designation of new biosphere reserves took place in periods one and three, while period two marked a time of introspection. From the perspective of “learning”, however, we argue that the entire period up to 1995 is similar and distinct from the period from 1996 to present.
3. The 1987 report of the World Commission on Environment and Development [the Brundtland report after its commissioner], *Our Common Future*, popularised the notion of sustainable development internationally. This Commission was followed by international and national-level initiatives, summits, and agreements aimed at reconciling the dual ‘imperatives’ of environment and economy under the umbrella term, ‘sustainable development’.
4. This is the terminology used in the plan.
5. From the beginning, biosphere reserve documents describe the possibility of allowing for and studying ecological degradation. Recall a quotation from Franklin earlier in the paper alluding to the possibility of ‘destructive research’ within biosphere reserves. Additionally, some of the early documents of the Canada/MAB committee spoke about the possibility of selecting degraded landscapes as sites for biosphere reserves in order to study how degradation and restoration might be achieved. However, these possibilities were not implemented in practice as the criterion for designation remained firmly with sites that had, at their core, a status that protected them from degradation by humans. Not until the Seville Strategy was there more explicit discussion of human values and use as influencing the location and management practices of biosphere reserves.
6. There is one Canadian biosphere reserve located in northern Québec. The reference to ‘the north’ here refers to the region north of 60° latitude or the ‘territorial north’.
7. There is no real way to know if this proportion between types of research is, in part, a reflection on the geographical and socio-political situation in which the Clayoquot Sound biosphere reserve is located. A 2006 review of research listed in the websites of Period One and Period Two biosphere reserves and posted by the Canadian Biosphere Research Network suggested a similar pattern. That is Period One biosphere reserves clearly emphasised natural science whereas Period Two biosphere reserves struck a greater balance between social and natural science contributions. However, just as with the qualification about the documentation from the periodic reviews, data from these sources should be considered only as general guides because there is no way to know what proportion of research was actually reported on the websites (see Reed 2009).
8. We acknowledge one of the reviewers for this observation.

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