Learning to live with social-ecological complexity: An interpretive analysis of learning in 11 UNESCO Biosphere Reserves

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ARTICLE INFO

ABSTRACT

Learning is considered a means to achieve sustainability in practice and has become a prominent goal of sustainability interventions. In this paper we explore how learning for sustainability is shaped by meaning, interpretation and experience, in the context of UNESCO Biosphere Reserves (BRs). The World Network of Biosphere Reserves brings environmental conservation, socio-economic development and research together in 'learning sites for sustainable development.' The World Network is globally significant, with 669 BRs in 120 countries, but as with many paradigmatic sustainability interventions BRs are perceived to suffer from a 'concept-reality gap.' We explore this gap from an interpretive perspective, focusing on participant interpretations of the meaning of BRs and their experiences of working with the concept – with the aim of painting a richer picture of learning for sustainability and the ways in which BRs might fulfil their role as learning sites. We provide a cross-case analysis of learning in 11 BRs around the world, drawing on interviews with 177 participants, and ask: How is the BR concept interpreted and enacted by people involved with BR work? What learning emerges through BR work, as described by those involved? We find that the BR concept is interpreted differently in each location, producing distinct expectations, practices and institutional designs. Learning occurs around common themes – human-environment relationships, actors and governance arrangements, and skills to navigate BR work – but is expressed very differently in each BR. The position of BRs 'in between' social, ecological and economic goals; local places and global networks; and government, private and civil society sectors, provides a valuable space for participants to learn to live with social-ecological complexity. We discuss our results in terms of their contribution to three pressing concerns in sustainability science: (i) power and politics in learning for sustainability, (ii) intermediaries and bridging organizations in multi-level governance, and (iii) reflexivity and knowledge-action relationships. Our comparative hermeneutic approach makes a novel methodological contribution to interpretive studies of sustainability policy and governance.

1. Introduction

Over the past decade understandings of sustainability have been increasingly framed in terms of irreducible complexity, uncertainty and nonlinearity (Biggs et al., 2015a; Leach et al., 2010). Consequently 'learning' has assumed central importance in sustainability interventions, policies and paradigms (Ludwig, 2001; Stirling, 2010). The literature on complex social-ecological systems suggests that knowledge is inevitably provisional and incomplete, and that learning is necessary to

facilitate the continual adaptation of management and governance in contexts of dynamic change (Folke et al., 2005; Armitage et al., 2008; Cundill et al., 2015). In the education for sustainable development literature, learning refers to the acquisition of knowledge, skills, attitudes and values that enable action for sustainable development–with a growing focus on the learning process and the capacities needed to navigate complex social-ecological issues (Vare and Scott, 2007; Wals et al., 2014). Several recent studies have aimed to identify variables that foster learning, and explore how learning in turn leads to

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sustainability outcomes (Armitage et al., 2017; Suškevičs et al., 2017). However, there has been much less attention to the ways in which meaning, interpretation and experience inform the content and direction of learning for sustainability (Miller et al., 2014; Stojanovic et al. 2016). Addressing this gap is vital because the ways in which people make sense of the world affect how they learn about and act in it (Wagenaar, 2011). In this paper we contribute to this research gap with an empirical interpretive study of learning in the UNESCO World Network of Biosphere Reserves (WNBR).

The evolution of the Biosphere Reserve (BR) concept reflects the increasing attention to complexity and learning in sustainability science, policy and practice. Conceived in 1973 under the auspices of the UNESCO Man and Biosphere Programme (UNESCO MAB), the WNBR initially sought to preserve a collection of "representative significant ecosystems" and to encourage basic environmental research and monitoring in these sites (Ishwaran et al., 2008, p.121). In the 1980s and 1990s the BR concept was reinterpreted in light of the growing focus on sustainable development to emphasise three functions: biodiversity conservation, socio-economic development, and logistic support for education, research and monitoring (Batisse, 1986; UNESCO, 1995). The earlier definition of BRs as protected areas gave way to an understanding that BRs would contain three types of zoning – core areas of high ecological value with legal protection, buffer zones of limited human use, and transition areas with larger human populations pursuing sustainable development (UNESCO, 1995). The 2000s and 2010s have seen further evolution of the BR concept, with a growing emphasis on adaptive management, interdisciplinary research and co-production of knowledge between inhabitants, participants and researchers, expressed through the framing of BRs as 'learning sites for sustainable development' (UNESCO, 2008). UNESCO's declaration of BRs as "science for sustainability support sites" (UNESCO, 2016a) highlights the close links between the contemporary BR concept and academic conceptions of complex social-ecological systems (Schultz and Lundholm, 2010; Schliep and Stoll-Kleeman, 2010), as well as the broader grouping of sustainability science (Kates et al., 2001). BRs therefore represent learning sites in both practical and reflexive senses – as a means of fostering the active pursuit of sustainable development, while also enhancing academic understanding of what learning for sustainability might entail and how it might be studied.

Nevertheless, the evolution of the BR concept has taken place in the midst of frustration at an apparent "concept-reality gap" (Coetzer et al., 2014, p.83; Matysek et al., 2006; Price, 2002). This perceived gap has taken two forms. On the one hand it became clear that many 'first generation' BRs designated in the 1970s as ecological baseline areas did not correspond with the evolving meaning of BRs as multi-use zones (Price, 2002; note that this does not necessarily mean that these first generation BRs were performing badly as ecological baselines). The periodic review process inaugurated in the 1995 Seville Strategy consequently aimed to retain the basic integrity of the concept by ensuring "within a reasonable period, that all members of the WNBR do fulfil the three complementary and mutually reinforcing functions of biosphere reserves, so that the reality comes to match the concept" (Price, 2002, p.15). On the other hand, a number of studies have indicated that BRs that *are* attempting to follow the contemporary vision are not meeting expectations for various reasons, including development pressures (Coetzer et al., 2014), antagonism from local government (Mercer and Hyman, 2009), lack of buy-in from local citizens (Yuan et al., 2008), and lack of funding, capacity or governance support (Schliep and Stoll-Kleeman, 2010; Reed, 2016b). These issues highlight the difficulties faced by practitioners in working with the BR concept, in the context of evolving meanings at a global policy level and the messy realities of pursuing sustainability in their own particular contexts. They are also symbolic of the broader struggle to ensure that global sustainability policy programmes achieve practical on-ground effects.

So far, the WNBR has addressed the diverse meanings, expectations and experiences surrounding the BR concept by attempting to ensure conformity with a "clear and shared vision of the BR concept," with a view to encouraging scientific research that identifies 'success factors' and 'barriers' in reaching this vision (UNESCO, 2015, p.14; Cuong et al., 2017). This approach implicitly privileges an empiricist or positivist mode of research (Newing, 2011). In an empiricist approach, experts pre-define the meaning of the BR concept before structuring social action in each BR in terms of 'variables' such as, for instance, stakeholder status, trust, and learning (Schaffer, 2015). Researchers then explore the "bivariate relationships of these variables to outcome criteria," with the aim of enabling practitioners to better manipulate variables in pursuit of desired outcomes (Wagenaar, 2011, p.28). In this vein, two global surveys have explored the relationships between participation, learning and successful ecological and socio-economic outcomes in BRs (Stoll-Kleemann and Welp, 2008; Schultz et al., 2011). Empiricist research is valuable and useful for illuminating general trends (Newing, 2011). However, it is less able to explore how social activity is shaped by the intentions of actors and the significance it has for those involved (Fay, 1996). Terms like 'participation,' 'trust' and even 'biosphere reserve' may have quite different meanings for practitioners in different contexts. Furthermore, the generalist nature of empiricist approaches means they rarely produce results that are directly relevant for any particular BR (e.g. Yanow, 2000), and much of what is most meaningful for those working with the BR concept is omitted from the analysis (e.g. Rolfe, 1998). Consequently, empiricist research – on its own – may actually reproduce rather than close the perceived gap between theory and practice.

In this paper, by contrast, we accept that BR practitioners will interpret the BR in legitimately different ways, and indeed that they *must* do so in order to make the concept locally useful and relevant. We therefore explore learning from the perspective of those involved in enacting BRs 'on the ground,' to see how the concept is interpreted and enacted in particular contexts, and what types of learning the participants themselves perceive to be occurring (we use the term 'enactments' to refer to actions justified as BR work by the people undertaking them, i.e. actions that 'bring the concept to life'). This represents an 'interpretive' approach–which focuses on the "meanings that shape actions and institutions" (Bevir and Rhodes, 2002: 130). Rather than structuring action in terms of variables prior to engagement with participants, interpretive approaches seek to understand the conceptual schemes that the participants themselves use to structure their experience (David, 2010). Interpretive research therefore pursues intentional rather than causal explanation, and seeks to illuminate plausible relationships between meanings and outcomes (Fay, 1996). The aim is not to provide BR practitioners with variables to manipulate, but to foster more productive reflection on practice, and enhance the conversation around what is possible and desirable in 'BR work' (e.g. Yanow, 2000, p.19). At stake, then, are two distinct epistemologies, and two distinct ways of thinking about how science may 'intervene' in the world to encourage learning for sustainability. Note that in adopting an interpretive approach we do not advocate for the abandonment of standards around the BR concept (e.g. the Statutory Framework of the WNBR); indeed, these are vital for inspiration, coherence and co-ordination in a global policy programme. Rather, we suggest that standards should develop in rigorous dialogue with the meanings and experiences of all those working with the BR concept.

The distinctiveness of empiricist and interpretive approaches means they are often considered to be conflicting – but the research we present here shows how they can in fact be complementary. In the GLEAN project (A Global Survey of Learning, Participation and Ecosystem Management in Biosphere Reserves), a longitudinal global survey of 146 BRs produced general inferences about how participation, monitoring and knowledge generation relate to perceptions of BR success (Schultz et al., 2011). This empiricist approach also indicated the importance of the qualitative dimensions of participation for learning, such as stakeholder interpretations of the purpose, character and legitimacy of participation in each BR (Schultz et al., 2011). For the next

stage of the research – presented in this paper – we have therefore adopted an interpretive approach to explore how meaning shapes participants' learning in a smaller sample of 11 BRs. Interpretive research is a broad term encompassing many distinct approaches (Wagenaar, 2011), including dialogical approaches such as practice theory (Behagel et al., 2017; West et al., 2016b), and discursive approaches such as critical discourse analysis (Coffey and Marston, 2013; Gellers, 2015), many of which are increasingly used to explore environmental governance and policy. In our research, we use a hermeneutic approach–which focuses on the consciously articulated meanings of individuals and social groups–in the vein of Yanow's (2000) version of interpretive policy analysis, and Wagenaar's (2011) articulation of qualitative policy research. A hermeneutic approach enables us to present a comparative 'snapshot' of meanings across multiple BRs, and allows the experiences of BR practitioners to challenge and refine the conceptual categories and theoretical assumptions embedded in our survey research (after which it may be fruitful to return to an empiricist, causal approach). Our broad, comparative scope is rare in interpretive research (Yanow, 2014) and thus provides a novel methodological contribution to interpretive studies of sustainability governance. Moreover, the iterative approach of the GLEAN project in interrogating a phenomenon from different angles provides an example of the interdisciplinary research BRs are considered uniquely placed to foster.

We begin this paper by introducing our method, before presenting our results according to our two research questions: (a) how is the BR concept interpreted and enacted by people involved with BR work? (b) What kinds of learning emerge through BR work, as described by people involved? We then discuss our interpretive account of learning in BRs in terms of its contribution to three pressing concerns in sustainability science: (i) power and politics in learning for sustainability, (ii) intermediaries and boundary organizations in multi-level governance, and (iii) reflexivity and knowledge-action relationships.

2. Method

We adopted a hermeneutic interpretive approach, which is considered particularly suitable for exploring consciously articulated human perceptions, understandings and meanings (Yanow, 2000; Yanow and Schwartz-Shea, 2006; Wagenaar, 2011). From 2012–2015 we conducted semi-structured, key informant interviews with 177 participants in 11 BRs: Cape West Coast and Kruger to Canyons (South Africa), Bosque Mbaracayú (Paraguay), Sumaco (Ecuador), Doñana (Spain), Menorca (Spain, Balearic Islands), El Hierro and La Palma (Spain, Canary Islands), Western Port and Noosa (Australia) and Mount Carmel (Israel). Of these, nine were selected because they had responded to our previous survey with BR managers (Schultz et al., 2011) and appeared to represent a diversity of approaches to stakeholder participation, integration of conservation and development, and learning. Two of the eleven case studies were conducted in BRs that had not responded to the survey, to increase the range of socio-economic, regional and landscape contexts represented in our cases. All selected BRs were either designated or revitalised after the adoption of the Seville Strategy, which emphasized the three BR functions (UNESCO, 1995). In practical terms, our selection was also guided by the willingness of BRs to participate in our research and the ability of our research team to conduct interviews in the native language. Interviewers were situated 'in the field' at each site, and complemented interviews with direct observation of BR-related activities and reviews of BR documents.

Our first contact in each case was the BR manager or coordinator. We identified relevant activities through discussion with the manager and information in academic papers, media reports and the BR website. We defined 'activity' broadly to include any activities pursued, convened, or participated in under the BR mandate. This included, for instance, distinct 'projects' (e.g. the creation of a regional biodiversity action plan), regularly convened committees (e.g. research or science

Table 1
Biosphere reserves, activities and participants included in our study.

Biosphere reserve, year of field work	Selected activities (number of interviewees)
Bosque Mbaracayú (Paraguay) Field work – 2014	• BR coordination (4) • Creating a *Mancomunidad*, an association of local municipalities (9) • Secondary school for girls, specialising in environmental sciences and tourism services (5) • BR management committee (2) • Employing and training local forest guards for the core area of the Mbaracayú National Reserve (7)
Sumaco (Ecuador) Field work – 2014	• BR coordination (1) • Roundtables on naranjilla production and forestry (4) • Resources and training for local communities in mushroom production (3)
Doñana (Spain) Field work – 2013	• BR coordination (2) • Project to develop and support the continuation of traditional vineyard landscapes (7)
Menorca (Spain, Balearic Islands) Field work – 2012	• MBRA Management committee (2) • MBRA social council (4) • LIFE-Boscos monitoring committee (6) • LIFE-Boscos public workshops (6) • LIFE Reneix volunteer work (3)
La Palma (Spain, Canary Islands) Field work – 2012	• BR coordination (1) • Social commission (5) • Biodiversity commission (4) • Brand of La Palma Biosphere Worldwide Reserve (5)
El Hierro (Spain, Canary Islands) Field work – 2015	• BR coordination (1) • No activities had been undertaken explicitly under the auspices of the BR. Activities closely related to the BR included a waste management programme (3), an environmental volunteer project run by the Cabildo's Department of Environment (2); Horizonte 2020 - a project to plan the desired future of El Hierro (2), and the establishment of a hydro-wind power station (4)
Cape West Coast (South Africa) Field work – 2013	• BR coordination (1) • A project with the Independent Development Trust (IDT) to provide employment to poor communities (8) • A Natural Resource Management (NRM) project with the Expanded Programme of Public Works to provide employment for poor communities clearing invasive alien species (8) • The monthly meetings of the BR Board of Directors (3)
Kruger to Canyons (South Africa) Field work – 2013	• BR coordination (1) • The Environmental Monitors project (9) • Global Environment Facility Small Grants Forum (5) • Environmental Education Forum (4) • Natural Resource Management Projects Forum (3) • Lowveld Protected Areas Forum (4)
Western Port (Australia) Field work – 2014	• BR coordination (1) • Growing Connections project (6) • Research Committee (5)
Noosa (Australia) Field work – 2013	• BR coordination (2) • Balance-UnBalance Conference 2013 (4) • Noosa Biosphere Festival (6) • Biosphere Institute for Sustainability in Noosa (4) • Noosa Climate Action Plan (2)
Mount Carmel (Israel) Field work – 2014	• No activities under the auspices of the BR, but initiatives by INPA that involve local communities were considered 'biospheric', e.g. a woodcutting programme where local contractors were employed to cut wood and communities could collect the leftovers (9)

committees) as well as on-going initiatives (e.g. in-school education programmes). In many BRs there were only one or two ongoing activities, in which case we were able to explore all of them. In BRs with more activities we selected those that would provide access to a greater diversity of perspectives, i.e. activities involving multiple actors. We first interviewed the leaders of the identified activities, before adopting a 'snowball sampling' approach where we asked leaders (and, in turn, participants) for the details of other people involved who were available for interview. We generally interviewed circa five participants per activity, with a minimum of two interviewed participants (Table 1). We

acknowledge that a greater number of interviewees in a BR might increase the likelihood of identifying diverse interpretations of that particular BR. However, we do not attempt to compare diversity of one BR to another, but rather look for a diversity of interpretations across the whole dataset, and therefore the difference in numbers of interviewees should not affect our conclusions.

We developed a semi-structured interview guide with the following overarching topics: the history of the BR, the specific activity and the interviewees' involvement; the organizational structure of the BR and the activity; perceptions of learning occurring and outcomes achieved through the activity. The interview guide helped us to cover the same topics across all BRs, but specific questions varied according to the particularities of the project at hand, the nature of interviewee engagement and the time available to the respondent for the interview. Interviews lasted between 30 min and 3 h and were audio recorded. They were then transcribed verbatim in the spoken language of the interview (and subsequently translated to English if necessary), and entered into Nvivo 11 for Windows qualitative data analysis software.

We analysed our data using inductive thematic analysis, because we wanted to stay close to the experiences of our participants rather than impose a pre-existing theoretical perspective (Braun and Clarke, 2006). First of all, we reduced the data corpus of 177 interviews to a manageable size by only analysing the answers to questions that directly addressed our key concerns: (a) how the BR concept is interpreted and enacted by interviewees, (b) perceptions of learning experienced through their BR engagement. For the analysis of perceptions of learning we further specified the selection of data, focusing on interviews with 36 participants in five projects. While this reduction of the corpus meant excluding potentially relevant material, this was necessary with the large dataset to focus our research and balance interpretive richness with broad scope. We then inductively coded the data and produced an initial group of thematic categories. These initial categories were further explored through close interpretive reading of the text, memo writing, and the query tools in Nvivo. The first and second authors engaged in all stages of analysis, which allowed them to challenge each other's interpretations. The initial inductive codes were refined and clarified, some codes were combined or removed, and subcategories were added. Our results and discussion in this paper are informed by the final set of codes (Appendix A in Supplementary material). Each interview was conducted and transcribed by at least one of the authors, and all authors reviewed and agreed on the final analysis.

3. Results

We begin this section by exploring our interviewees' interpretations of the BR concept at their particular site, and then examine the activities enacted under the auspices of each BR, using all 177 interviews. A summary table of the histories, management structures, meanings and activities in all 11 BRs can be found Appendix B in Supplementary material. Finally we investigate the types of learning reported by 36 participants in five selected activities. Our findings should not be considered definitive–they are our contingent interpretations of our interviewees' interpretations. Rather they are indicative and heuristically valuable for exploring the different roles that BRs can play in particular contexts, and the types of learning that may emerge.

3.1. Interpretations of the Biosphere Reserve concept

3.1.1. Placing the Biosphere Reserve in historical context

BRs are sometimes presented as "outside interventions" (Stoll-Kleemann and Welp, 2008, p.168). This is evidently true in some locations and in some senses–for instance, it is rarely the case that all citizens in a prospective BR have the opportunity to vote on its creation. However, participants in our study tended not to view BRs as external interventions, but rather situated them in the context of intricate social-ecological histories in their respective landscapes. Participants often

interpreted the designation as a strategic means to codify, institutionalise or provide structure to ongoing–and often explicitly political–movements and initiatives. Some examples serve to illustrate this point. The Kruger to Canyons (K2C) BR lies in the northeast South African provinces of Limpopo and Mpumulanga. The core zone is the iconic Kruger National Park, proclaimed in 1926. The creation of the park involved forced removals of Tsonga communities, and apartheid-era governance from 1948 to 1994 created large, impoverished 'homelands' along Kruger's borders (Pollard et al., 2003). The transition to democracy in the early 1990s presented an opportunity for actors in the region to develop more equitable ways of living with each other, and it was in this context that the idea for the K2C BR emerged. As one participant remembered: "*When Nelson Mandela was released, and even before that, there was really a need from different communities to reach out over borders. So [we] established in the early 1990s what we called at the time the Central Lowveld Development Forum, with different people engaged.*" Consultants were contracted to "*look at the appropriate frameworks that would address the needs for ensuring conservation but also making sure that conservation contributes to sustainable development, or community development.*" The consultants recommended the BR model, and the World Bank financially supported the submission to UNESCO (Pool-Stanvliet, 2014).

Switching continents, the Bosque Mbaracayú BR in Paraguay had similarly intricate beginnings. In 1972, the Paraguayan government sold the area that now forms the Mbaracayú Forest Nature Reserve (the core area of the BR) to a logging company. This company in turn defaulted on a World Bank loan, and the land was transferred to the Bank's control–in the process of which the indigenous Aché populations were forcibly removed (Reed, 2016a, p.79). The Moisés Bertoni Foundation was created in the 1980s with the aim of purchasing the land for conservation, which was eventually secured with help of the U.S. NGO The Nature Conservancy, and the land was declared a National Park within which the Aché were granted hunting and collecting rights (Fig. 1). Participants recalled that widespread deforestation in the 1990s, together with domestic political instability, prompted the Foundation to seek the BR designation: "*During the dictatorship there were many personalities who wanted to take over territories that had an economic value. So, looking for some way of having the international support so that the reserve would really be protected. So in that way the involvement of the United Nations was also sought and for it to be designated a biosphere reserve.*"

For our final example, we switch to El Hierro BR in the Canary Islands. In the 1970s and 1980s neighbouring islands such as Tenerife and Gran Canaria pursued rapid economic development through mass tourism. Our interviewees described how the mass tourism model was

Fig. 1. The Mbaracayú Forest Nature Reserve, which forms the core area of Bosque Mbaracayú Biosphere Reserve. Photo: Alba Juárez Bourke.

not adopted on El Hierro because of the rocky shoreline and wetter climate, limited transport access, the availability of European Union agricultural subsidies, and extant nationalist political ideologies on the island. In the early 1980s, the high cost of electricity production on El Hierro prompted the creation of the Department of New Energies and Innovation. The Department began searching for alternatives to petrol, and proposed a combined hydro-wind power station. El Hierro's 1997 Sustainable Development Plan included the power station proposal and articulated a 'sustainable' tourism model for the island. It was in this context that the idea for BR designation emerged: "*[the BR designation] is important to us because we, the Cabildo [government] of El Hierro and the society of El Hierro, for many years has set this path as our roadmap … We can't compete with the other islands on mass sun-and-beach tourism … We set ourselves apart with a scientific tourism, an ecologic tourism, a sport tourism, a sustainable tourism.*"

3.1.2. Distinct Biosphere Reserve meanings and identities

Within the distinct social-ecological histories recounted by BR participants, the 'meaning' of each of the eleven BRs took on very different forms. These meanings were closely related to the institutional arrangements of each BR. In Doñana (Spain) and El Hierro (Canary Islands, Spain) the institutional responsibility lay with the environmental departments of regional government. At Doñana, the BR was spoken of in terms of a "*protective umbrella*" or a "*figure of protection*" that appeared predominantly as a layer of legislation rather than an organization *per se*. As one participant put it, "*[the BR] has been considered more as an international distinction than as a way to organize and act and work …*" This perspective was echoed in El Hierro, where the BR was framed as a "*label, an identity brand*" or a "*badge*" for work done by the government, that provides a competitive advantage with the other islands: "*I don't think we have to do work to maintain the Biosphere Reserve label. I think that the Biosphere Reserve label is given to us as a reward for our work.*" In South Africa, non-profit companies administered Cape West Coast and K2C BRs. Participants in the Cape West Coast framed the BR as a "*social enterprise*" that provides skills and training to local disadvantaged communities (Fig. 2). Participants considered the provision of economic opportunities particularly important as a means of bridging the socio-economic divisions created by apartheid: "*because we could have been in a state of war here, we were quite close to it.*" In the K2C, participants portrayed the BR as a "*space*" or a "*collaborative platform*" upon which partnerships can be built as a route to socio-economic reconciliation between the impoverished former homelands and the luxury tourist economy in the network of protected areas around the Kruger National Park. K2C has substituted the term 'reserve' in BR for 'region,' and Cape West Coast has removed 'reserve' from its logo, because for many South Africans the term symbolises 'guns and guards' style conservation.

Fig. 2. The Cape West Coast Biosphere information centre. Photo: Simon West.

In Noosa (Australia) the BR took the form of a council-owned non-profit company that is largely managed by community volunteers. Participants treated the BR as a cultural organization that seeks to "*maintain, enhance, recognize, celebrate all of that sense of place that is evident in Noosa.*" Here the arts were particularly prominent, with one participant describing the BR as "*looking at different ways to use creativity to inspire a community around environmental engagement and issues surrounding climate change.*" This explicit use of the BR concept as a means to generate collective meaning and identity for a particular area stands in stark contrast to Mount Carmel (Israel) and Sumaco (Ecuador). These BRs held very little meaning for our interviewees. Sumaco was designated at the prompting of an international aid agency, and Mount Carmel allegedly on the initiative of one person, and the BRs had achieved very little institutional presence at the time of our field research. One Sumaco participant stated, "*few people know what the BR is doing and most of the people don't know anything.*" For a Mount Carmel participant, "*if you take the list of what should happen in a biosphere reserve, like monitoring and working with the local population […] officially we don't have that kind of committee, and we don't have the programme.*" The little resonance that the BR concept did have for participants was that it should work as a means of engaging local communities in conserving the core areas of the BR, effectively representing a 'participatory protected area.'

3.1.3. Negotiating the politics of Biosphere Reserves

These diverse meanings–the BR as 'protective umbrella,' 'marketing brand,' 'social enterprise,' 'collaborative platform,' 'community cultural group' or 'participatory protected area' – were closely related to political context. In Australia participants often perceived government to be wary and even antagonistic to the BR concept as a potential restriction on the power of the state to guide development. In Noosa participants claimed that the council embraced the idea of the BR only when they realised "*it wasn't adding another layer of regulation over the area. They felt there was enough regulatory protection for the values and they didn't want the community to feel that there was another layer of regulation being imposed.*" By contrast, Bosque Mbaracayú BR (Paraguay) operated in a context of extremely low state presence where the provision of services and law enforcement were often absent. Here, the BR was embraced as a means to enhance basic state functions such as provision of education and economic opportunity: "*we've been working with certain political groups for a long time, trying to improve this presence of the state.*"

In Western Port (Australia), participants described a long running dispute over the meaning of the BR that is reflective of broader political tensions in the region and that has fundamentally affected the functioning of the BR. One participant described how community environmental groups involved in the UNESCO nomination process wanted the BR to be an "*activist organization*" that would function as "*a big stick that would be able to block everything.*" By contrast, a faction associated with government envisaged the BR as a 'sustainability' organization that would work alongside residential and industrial developers: "*… we are not an activist organization. We are advocates, but not activists. So we have to be careful who we advocate for and think across our scales of stakeholder groups–because the BR depends on broad stakeholder buy-in from all across government, councils and communities.*" These competing meanings produced different institutional visions. While the 'sustainability' faction wanted to establish the BR as private company because, as one participant notes, "*they thought that was the best way that they could ensure that insurance would work best,*" the 'environmental' faction felt that a private company "*is for making a profit and has different aspirations and quite different modus operandi*" to BR principles. The 'environmental' faction felt that "*there just wasn't enough power given to those who had been the driving force [of the UNESCO nomination] and who saw that the implementation of any work would fall to them and could most effectively be done by them. And that dissatisfaction has continued.*" The Western Port experience vividly demonstrates the interplay of history, politics, and meaning that affect the interpretation and enactment of the BR concept.

To summarize this section, our results highlight the interpretive flexibility of the BR concept–stemming from the different meanings that the concept has taken on over time at the UNESCO level, as well as the contingencies of the sites themselves. Given space constraints in this paper, and the heuristic value of characterizing each BR in relatively simplistic terms, we have only indicated dominant meanings as they appeared to us in our analysis. This does not imply that these meanings are unitary or static. In fact there are multiple extant meanings within each BR and, as we will explore further in Section 3.3, these change through time. Also we stress that we do not consider particular meanings to necessarily 'cause' or come prior to institutional structures. Rather, the complex histories outlined in this section indicate the ways in which meaning, institutional arrangements and ecological assemblages co-evolve. In the next section we unpack the relationships between participants' interpretations of the BR concept and practical activities in each BR.

3.2. Enactments of the biosphere reserve concept

The different meanings of the 11 BRs presage a large variety of practical activities. The BR concept is used by different kinds of actors to do quite different kinds of work in each location. Accordingly, whether an activity is considered 'BR work' is itself a matter of interpretation. In Doñana, where the regional government's environment department was responsible for the BR, the designation existed alongside a whole raft of overlapping legal designations for the area, rather than prompting practical action in itself. As one participant explained, *"you have to keep in mind that Doñana, the Natural Area of Doñana, National Park and Nature Park, which is the same thing, has planning documents that match that of the Biosphere Reserve. Because we as managers of the Natural Area of Doñana, National Park and Nature Park, are also managers of the Biosphere Reserve, of the Doñana World Heritage site, of the Doñana wetland site of international importance. We manage all of that. And all the planning documents of different scales are involved in the management of the Reserve and of the other areas, right?"* What the designation had enabled, however, was a broadened focus on advancing socio-economic development in the transition zone of the BR, enacted for example through a project that experimented with traditional and sustainable agricultural practices and supported the traditional vineyard landscape in collaboration with wine cooperatives.

Similarly, in El Hierro the environmental department of the local government was responsible for the BR. As the designation covers the entire island interviewees interpreted virtually all of government's environmental activities to count as BR activities, including waste collection and recycling, the construction of a hydro-wind energy plant (Fig. 3), and the recruitment of environmental volunteers. The particular value of the BR designation to interviewees lay in its ability to 'sell' the island as a sustainable choice in a competitive international tourist market: *"It's worth it because of the environmental benefits, the impact and the positive image it gives."* In Mount Carmel, the Israel Nature and Parks Authority (INPA) was responsible for the BR designation, but did not actively work with the concept at the time of our field work. Nevertheless, employees considered initiatives that engaged with local communities–for instance employing local contractors to thin the woodland, reducing risk of fire and providing free wood to local communities–to be *"biospheric,"* and noted that the BR designation made it much easier to pass the bureaucratic barriers within INPA that regulated community engagement.

In places where the BR was linked to a specific organization or agency, there tended to be more explicit agreement among interviewees about what constituted BR work. In Noosa, the seven community boards that formed the non-profit company Noosa Biosphere Ltd generally initiated BR activities. One participant described the type of projects adopted: *"it is not just about pulling out weeds or that kind of thing. That is important, but that is not necessarily what our job is. So I think the idea of being involved in things like running conferences, information sharing sessions, workshops–is the sort of thing that a lot of people think we should be doing."* Recent activities included the Noosa Biosphere Festival, Balance-Unbalance (an international conference bringing together science and art around environmental issues), the Noosa Climate Action Plan, and conceptual development of the proposed Biosphere Institute for Sustainability in Noosa (BIS:N). In direct contrast, Cape West Coast BR was primarily enacted through two government-funded programmes that employed poor communities to remove invasive vegetation (Fig. 4). Alongside clearance of invasive acacias, the IDT (Independent Development Trust) project placed participants with 'host organizations' that operated within the BR, including an indigenous cultural centre and a fossil park. As the BR coordinator clarified, *"the first goal is to create jobs. So, that's kind of the main focus."*

Fig. 3. Gorona del Viento, a hydro-wind energy plant in El Hierro Biosphere Reserve. Photo: Alba Juárez Bourke.

Fig. 4. Participants removing invasive vegetation as part of the Natural Resource Management (NRM) project at Cape West Coast Biosphere. Photo: Simon West.

Participants did not tend to present activities as emerging seamlessly from a strategic vision or planning process. A common feature of interviewee accounts was that activities often emerged unpredictably through the interplay of changing political contexts, biophysical change, the availability of funds, the presence of energetic individuals, and perceptions of what the BR could or should be doing. For example, the financial crisis in Spain just before our field work was raised by participants in island BRs like El Hierro, La Palma and Menorca as an important reason for their emphasis on developing sustainable economic opportunities in tourism and agriculture, through the development of quality labels for marketing. A more detailed example of this interplay comes from the K2C. Here, participants described how the BR, designated in 2001, was fairly quiet for the first few years of operation, until the meeting of a few particular individuals prompted the realization "*that the projects in the K2C area were too small individually, so we thought we could see how we could pull various projects together.*" This led to the creation of the so-called 'Anyway Group' that brought together various conservation and educational actors in the region in order to gain access to financial grants from the Global Environment Facility (GEF). In other words, the BR concept was used to "*[form] networks in order to obtain collective outcomes.*" The K2C convened multiple overlapping forums to this end, including the Environmental Education Forum, the Lowveld Protected Areas Forum, the Natural Resource Management Projects (NRMP) Forum, and the GEF Small Grants Forum. Simultaneously, the fact that core zones of South African BRs are generally managed by South African National Parks (SANParks) enabled them to benefit from the SANParks Buffer Zone Policy, which mandates conservation and sustainable development action in the National Park buffer zones, thus overlapping with the buffer zones of the BRs. Moreover, the enactment of South African BRs was substantially shaped by the opportunities provided by the Expanded Public Works Programme (EPWP), which seeks to create jobs for poor communities. The Environmental Monitors project in K2C, and the NRM and IDT projects in Cape West Coast, all originated from EPWP programmes. To summarize, we find that the particular activities undertaken in BRs are highly contextual. But contextual should not be taken to mean 'local.' Rather, convergences of local, national and global forces shape the enactment of BRs in particular places.

3.3. Learning emerging from biosphere reserve engagement

Given the diverse enactments of the BR concept, how does learning manifest itself in BR work? How might the different meanings of the BR–as protective umbrella, marketing brand, social enterprise, collaborative platform, community cultural group and participatory protected area–inform the notion of BRs as 'learning sites for sustainable development?' In this section we examine the learning reported by participants as they engage with the BR concept (Appendix C in Supplementary material). We focus on five BR activities selected because they a) occur in BRs that hold more substantial meaning for participants, b) represent enactments of prominent meanings in their respective BRs, and c) encompass a variety of learning opportunities for participants. The projects are the traditional vineyard landscape project in Doñana (Spain), the Balance-Unbalance conference in Noosa (Australia), the Growing Connections project in Western Port (Australia), the Environmental Monitors project in K2C (South Africa) which trains and employs people from poor communities to support host organisations with environmental monitoring, and the *mancomunidad (*association of municipalities) created in Bosque Mbaracayú (Paraguay) to build local governance capacity.

3.3.1. Reassessing human-environment relationships

A central theme that emerged across the projects was participants' changing understandings of human-environment relationships. Participants often reported that BR work had encouraged them to see the landscape and people around them in a different light. For instance,

citizens and community members frequently described learning to value the local environment together with social and economic aspects. In Mbaracayú BR, the *mancomunidad* created a tourism plan and conducted tourism training with indigenous Aché communities. A number of Aché participants reported learning about, or rediscovering, knowledge of local ecosystems and species–and described this as a way of reclaiming cultural heritage that they felt they had lost:

> "Beforehand I often didn't know, right? Instead of protecting the environment, I didn't know. I cut down any tree, right? I didn't know it had life. But when I accepted that … when I myself love myself, I also want to take care of the plants like that; native plants, plants that aren't native, fruit… Everything that surrounds me, I think 'like this I have to defend, because they have a right.' If no one defends, who's going to defend? I can defend a plant, a person can defend a plant. And that's what changed me. Actually the values–before I had anti-values. I started to change, going back to values, recovering values as an Aché. The Aché never used to cut down forests, never stole, never looked for other food, they always had their own food. So I think we have to … there's a lot to be recovered. But I'm on it now, I'm on this path now."

Nevertheless, this learning was situated within histories of exclusion and oppression, evident in the reluctance of other Aché participants to solely credit the BR (and the Foundation responsible for BR management) for this understanding: "*we live in the forest and we love the forest. Not only because the Moisés Bertoni Foundation tells us, but we love the forest.*" For other participants in the tourism plan, however, it was the experience of seeing their local area with an 'external gaze' that enabled them to appreciate their environment: "*[I had] the good company of the tourists from Germany, from everywhere, and I was with them. Then I said, 'look at what we have.' I began to sincerely feel the richness we have.*"

By contrast, BR participants working for conservation organizations often reported that they had learned about the importance of emphasizing the economic values of the environment, as a result of closer contact with local communities through BR work. In Mbaracayú, several Foundation staff participating in the *mancomunidad* claimed to have learned that making conservation financially beneficial to communities is an important aspect of conservation. One described it as a move from "*we can't touch, we can't look*" towards "*let's conserve, but let's generate money.*" In the K2C Environmental Monitors project (Fig. 5), participants from private nature or game reserves reported that engagement with communities outside the reserve enabled them to look back on the reserve with an 'outsiders' perspective (in a similar sense to participants in the Mbaracayú tourism plan, above):

> "So you see, you're seeing different aspects of it because you're seeing the outside picture, and you're seeing the pressures coming

Fig. 5. Participants in the Environmental Monitors project, Kruger to Canyons (K2C) Biosphere Region. Photo: Cláudia Florêncio.

from outside of a conservation area that are pressurizing on our pristine areas. Those pressures are now realistic and you have to tackle those in an economic way, you can't sit back and say, 'well we must keep this area because it's beautiful and I want my children to see it.' You've got to say, 'I want to keep this area because it's worth something to these people, it's their livelihoods, plus it's beautiful, plus I want to show it to my children, plus it's going to bring in money for the next three hundred years, plus and it's going to be an opportunity for these people to do this, this, this and this in the future."

Such participants suggested they had developed a greater willingness to engage with, for instance, the possibility of admitting traditional healers from nearby communities to harvest medicinal plants within the boundaries of their reserves. In the very different context of the relatively wealthy coastal settlements of Noosa, Australia, participants in the Balance-Unbalance conference described the development of what they saw as a more holistic perspective incorporating economic and social as well as environmental factors. "*Whereas before I would have said, 'no development at all' – now I understand that development is actually a fundamental part of a community's growth, because without development and economic growth and diversity then the community tends to stagnate. And if you don't have the community there, then who is going to protect the environment? And that is that interdependency that I was talking about earlier. I have come to look more at the whole system rather than just at the one natural element.*"

3.3.2. Becoming aware of other actors and governance arrangements

Many participants across the five projects reported learning about other people. A general pattern was that work with the BR concept had made participants more aware of the range of actors operating across the landscape, as well as their relative capabilities, skills and needs. The precise forms that this learning took were distinct to each project. In the *mancomunidad* in Mbaracayú, the Foundation staff reported a greater awareness of the conditions that prevented local communities from participating effectively. As one staff member noted: "*Paraguay comes from a very old dictatorship. And although that ended 25 years ago it's still little time for a process of greater involvement of the people. People were very unaccustomed to participate, to meet, to demand, to know their rights and that sort of thing […] And that takes a lot of time. And we must invest resources. And we must invest primarily in social capital.*" Staff also learned about the challenges of engaging with local government actors:

"We did projects in which we did training in those municipalities, where they were given GPS, computers. There was someone who was taught GIS and three months later he was no longer there. Because many of the officers respond, in those small municipalities, to political issues and not administrative real issues. So, that has meant that the computer that was purchased for environmental office of a municipality is either in the mayor's house, or in the office doing something else and nobody even knows what it was for…"

In the Growing Connections project (Western Port), participants in the Project Implementation Committee (PIC) also explained that they had learned about other government and council actors working in the region.

"As local government you have this perception of state government as these evil beings that are trying to ruin the world, but then when you are working with an officer you realise that they're just the same as you, and they're controlled by the constraints of the organization that they are working for. And I suppose it's similar for community members that have that perception of me."

The emphasis in Growing Connections of learning about different government actors and arrangements was mirrored in the steering committee of the Environmental Monitors project in the K2C. One participant noted that being able to "*sit around a table … over a cup of*

tea" led them to see "*a different side of different organizations, and instead of throwing blame at them or pointing fingers, I can actually understand them and go, 'jeez, I actually realise* that *must be quite tough for them to do this.' Or 'maybe we can help in this way because they're not fully capacitated to do that.'*" Participants in Western Port and K2C also reported the value of participation for getting to know who *not* to work with in the future. A participant in the Environmental Monitors project recounted being rebuffed after proposing to collaborate with a fellow participant, and explained, "*I don't have a grudge about it, there was no betrayal of trust or anything at all, it is just that now I know, you know, if I'm setting up new projects he is not one to look for as a collaborator.*"

3.3.3. Developing skills and capacities to do biosphere reserve work

Participants described learning particular skills to navigate BR work. Many of our interviewees painted an ad hoc and slightly chaotic picture of their everyday work with the BR concept. For instance, participants in the *mancomunidad* identified a failure to systematize information and record 'lessons learned' – "*so we make the same mistakes again.*" Nevertheless, participants reported an unpredictable accrual of learning through everyday practice. As one put it:

"These are issues that are … day to day. They're processes. You learn it in conversation, you learn it when you develop an action and you realize that it didn't work, why it didn't work. In the reflection. Or when some things if they worked, why they worked. So it's a lot about conversations. A lot about talks, a lot about reflections. But about reflection in action. While developing actions we are reflecting, why this works, why it doesn't work. There isn't a moment of enlightenment; it's several moments that build up."

The dynamic exchanges that characterized work in the *mancomunidad* suggested a different means of intervening and effecting change: "*Because they are complex processes. Complexity doesn't mean that you can't act on it, it means that you have to have a different view, you have to understand relationships.*" Nevertheless this is not easily practised, and participants reported frustration with their occasional inability to, as one participant in the Growing Connections project explained, "*identify which components I can change and which components I can't change and then be much more intelligent in getting productive, positive, enthusiastic outcomes. And instead my reaction has been to get increasingly difficult and increasingly upset and increasingly stressed, which is clearly a dumb way of handling it–you know […] in hindsight I'm a pretty slow learner!*"

Indeed, learning *how* to engage with others was just as prominent for our interviewees as learning *about* others. The Foundation staff in Mbaracayú explained how their work with indigenous Aché communities had required them to develop empathy, in order to understand alternative ways of viewing the world, "*and from that way of looking, which is often different from ours, build a way of looking, a common space. And this is a process that takes time, it takes patience, it takes a lot of openness, say. And we have to let go a little of our own single vision to understand the other's vision.*" In Noosa, participants explained how they had learned to steer discussion of BR issues away from partisan politics. "*It is important to, I guess, to show people that these are issues that are relevant to everybody. It is not just a greenie, left-wing, radical agenda–it is very much at the heart–it is important to every business and different walks of life.*" A crucial, and perhaps unique (among the BRs in this study) aspect of this strategy was to learn to have fun. "*It is not all about education–it is about fun. And it is about community. The community comes together, they have fun, and they interact. They all get together.*"

3.3.4. Learning to navigate the BR's position 'in between'

So far we have shown how BR work appears to foster learning about different domains, and about actors who participants might not otherwise meet or work with. This draws attention to the BR as a concept that sits 'in between' ecological, social and economic goals; government, the private sector and civil society; and global networks and local places. Our final theme captures the way that participants'

learning–about human-environment relationships, other actors and governance structures, and skills and capacities to do BR work–together informed greater awareness about their position 'in between' that became manifest in evolving BR goals and strategies.

Bosque Mbaracayú is located in an area with very low state presence. Foundation staff described how, at first, the BR functioned almost as a replacement government. "*We built health centres with international resources, we built schools […] a bus terminal so people can have a terminal.*" However, staff began to realize that this approach was unsustainable. "*At one point, the Foundation was playing a role I think was disproportionate in the region, and the State was absent. So we started to change our approach and said, 'no, we must strengthen local governments so that they take responsibility*.'" The BR aimed to mobilize its position 'in between' to improve the capacity, coordination and empowerment of communities, and local and central government. "*On the one hand strengthening local governments, municipalities, governance. On the other hand links, build bridges between the central government and the territory.*" This trajectory was mirrored in Western Port, where conflicting demands on the BR from civil society and local government had hobbled the BR's ability to attract funding and develop projects. The participation and inter-council links engendered by the Growing Connections project, as well as a governance review by an external consultant, enabled participants to articulate a clearer role for the BR: "*I don't think [the BR] really knew what its role is. It struggled […] But I think it's now got it. I think as soon as they realized they didn't have to be the doer, [and that] they were the facilitator, and take on that role, it all starts to fall together […] The penny is finally starting to drop.*"

Nevertheless, the 'in between' position of BRs is not altogether comfortable, and many participants reported learning about the challenges that come with this position. For instance, the collaborative nature of the Growing Connections project meant that full-time professional staff and volunteers were required to work alongside each other, and tensions had arisen between participants with different expectations and requirements. "*In voluntary organizations it's very hard to be directive, you've got to be more coercive, and that can lead to individuals operating in ways that are contrary to the intentions of the Board and of management, simply because they are volunteers and they can.*" In Doñana, participants in the vineyard project portrayed the position 'in between' as a destabilizing rather than liberating experience: "*progress in the natural area and in the area of the Biosphere Reserve, in the contemplation of the region, the sustainability of the territory, makes us move in a constant schizophrenia because we have to be giving immediate response to the local, to the imperative, to the need of people, to allow projects to advance, while they are telling us from the outside: very careful with this, do that, and don't [do that], and of course [this] is a difficult situation.*" To summarize, the BR's position 'in between' multiple goals, sectors and scales brings unique challenges as well as opportunities, and continuous navigation of an ever-shifting context.

4. Discussion

We began this paper by asking, how are BRs interpreted and enacted by the people tasked with bringing them to life, and what types of learning emerge as a result? Our interpretive approach revealed a striking diversity of meanings, activities and learning in the 11 BRs. For instance, while the K2C emerged in post-apartheid South Africa as a 'collaborative platform' to reconnect national parks with previously excluded and marginalised local communities, El Hierro was used primarily as a 'marketing brand' to provide an advantage in the competitive Canary Islands tourist market. Activities ranged from art-science conferences in Noosa, to work teams clearing invasive species in Cape West Coast. Participants learned to reassess human-environment relationships, become aware of other actors and governance arrangements in their region, and develop skills and capacities to do BR work–but these common patterns were expressed very differently in each location. Together this learning became manifest in a greater

awareness of the BR's postion 'in between,' which shaped the ongoing coevolution of meaning and action around the BR concept in each location. For instance, participants at Western Port reported a shift towards a 'connector' role in local governance networks, while those at Bosque Mbaracayú were increasingly focused on building civic capacity rather than replacing basic state functions.

In some senses our finding of high diversity is unsurprising, given that our approach highlights specificity rather than general patterns, and that we focus on participants' self-reported learning, which limits our ability to capture learning beyond their particular context. In some interpretive approaches, the next stage of analysis might be to reduce this diversity by developing secondary concepts at a more abstract level (e.g. Bazeley, 2009), while empiricists might seek to 'test' our findings on a broader, statistically significant sample of BRs (e.g. Roldán, 2017). In this paper, however, we choose to draw on the diverse accounts of BR practitioners to inform three pressing theoretical concerns in sustainability science: (i) politics and power in learning for sustainability, (ii) intermediaries and bridging organizations in multi-level governance, and (iii) reflexivity and knowledge-action relationships.

Before we proceed, it is important to acknowledge that recognizing a diversity of interpretations and enactments may seem to some like an 'anything goes' approach to the BR concept, thus diluting its value (for discussion of the 'anything goes' issue in interpretive research more broadly see Fay, 1996 and Schwartz-Shea, 2006). On the contrary, we reiterate that our study focuses on people working in BRs designated by UNESCO, whose interpretations therefore matter greatly for the topic at hand. An interpretive approach, in Yanow's (2000, p.8) words, frames differences of interpretation not as 'right' and 'wrong,' but as "different ways of seeing, understanding, and doing, based on different prior experiences." Therefore, we do not seek to pass judgment on the relative merits of the interpretations we identify. Our aim is rather to empirically trace the ways in which the broad UNESCO criteria are interpreted by particular people, in particular contexts, to do particular kinds of work, consequently shaping learning in particular ways–far from anything goes. In an interpretive approach the value of any particular interpretation of the BR concept is an open empirical question that explores how particular groups establish interpretations they consider 'good' in line with their interests, objectives and values, and those of UNESCO as expressed through formal monitoring mechanisms such as the periodic review.

4.1. Politics and power in learning for sustainability

Politics and power are increasingly important topics in the literature on sustainability governance and policy interventions intended to foster learning, including adaptive management (Armitage et al., 2009), adaptive governance (Karpouzoglou et al., 2016), climate adaptation (Tschakert et al., 2016) and sustainability transitions (Smith and Stirling, 2010). However, Eriksen et al. (2015) identify a need for methodological and theoretical innovation to bring politics and power to light, including, as Avelino et al. (2016) point out, more comparative empirical studies of how politics shape the enactment of learning-based sustainability governance. Our comparative interpretive approach contributes here in several ways.

Our results highlight the ways in which the BR designation has been strategically used by different actors in our 11 cases to support particular initiatives, interests and agendas in their regions. The diverse examples we present reveal the processes of contestation through which the meaning, form, and control over BR initiatives in any particular place take shape. This contestation may exist despite potential consensus over the broad purposes of BRs established by UNESCO. As Smith and Stirling (2010) note in relation to sustainability transitions, rhetorical consensus is often possible at a broad level, but "more specific environmental, economic, and social criteria are hotly contested, with profound implications for favoured pathways." The locus of contestation may be between those actors working with the BR concept and

'external actors' in the region–for instance, the initial tension in Noosa between the community interests pushing the idea of the BR and the local council's reluctance to endorse greater regulation. Or it may be between different interests competing to 'own' the BR designation (and the work that happens as a result). For example, in borrowing the theoretical language of Eriksen et al. (2015) we can see how the enactment of the Western Port BR has been shaped by contestation over the meaning of the BR designation, involving distinct subjectivities ('environmental' and 'sustainability' identities), authority structures (councils, community, and research organizations), and types of knowledge (ecological, economic, administrational).

By situating our analysis of learning within these processes of contestation, we highlight the normative assumptions and interests that shape learning for sustainability. Our results therefore challenge the idea of a 'neutral' learning for sustainability that can be unproblematically scaled up and reproduced around the WNBR–instead emphasizing the situated nature of learning emerging through the interplay of particular purposes and interests (which may be more or less inclusive) with the broad understandings of sustainability articulated by UNESCO. For instance, conservation practitioners in the K2C reported that by engaging with BR initiatives, they had learned about the need to make conservation practices economically viable and inclusive. This is eminently understandable (and potentially desirable for a broad local constituency) in the context of a Kruger landscape ridden with the unequal socio-economic and ecological legacies of apartheid. Nevertheless, such learning rests upon normative, inherently contestable criteria (e.g. the economic valuation of ecological systems) that are strongly disputed in South Africa and at the global level (West et al., 2016a). Our research therefore fosters a critical emphasis in the learning for sustainability literature, as advocated by Smith and Stirling (2010) and Leach et al. (2010), encouraging questions such as 'learning for whom?' and 'whose learning counts?'

4.2. Intermediaries and bridging organizations in multi-level governance

In the literature on sustainability governance there is a growing interest in how individuals and organizations that link actors and levels may foster learning and improved governance of complex issues (e.g. Ernstson et al., 2010; Stewart and Tyler, 2017). This 'in between' role has been described in terms of 'intermediaries' in the sustainable socio-technical transitions field (Moss et al., 2009), and 'bridging organizations' in adaptive and multi-level governance (Cash et al., 2006). While the concepts of intermediaries and bridging organizations have distinct lineages, they both describe actors that perform 'bridging functions,' such as facilitating dialogue, providing guidance, sharing information, pioneering new forms of collaboration and interaction, resolving conflict, and stimulating sense-making (Moss et al., 2009; Green et al., 2015). Our results contribute to an emerging literature on the interpersonal, interactive, human aspects of bridging (Brouwer and Biermann, 2011; Crona and Parker, 2012), which forms a necessary complement to structural accounts of bridging using, e.g., network analysis (Berdej and Armitage, 2016).

Our results show that participant interpretation of the role and position of the BR within a governance landscape affects the emergence and performance of bridging functions over time. Moss et al. (2009) point out that intermediaries are often not 'planned' as such, but instead emerge from pre-existing organizations or individual roles (often in response to particular issues). Moreover, Moss et al. suggest that because of the precarious nature of intermediaries the activities they perform often change in relation to fluctuating funding, personnel and organizational mandates. We see these characteristics at play in our cases. BRs were not originally planned as intermediaries, but their status 'in between' goals, scales, and sectors means that the designation often sits in a quintessential bridging position. In several of our cases practitioners working with the BR concept had become aware of this, and had begun to explicitly exploit their position 'in between' in

defining the BR's role and planning and funding BR activities. Indeed, some participants 'discovered' the bridging potential of BRs through the difficulties of navigating their 'in between' position–including a lack of stable funding, political hostility, and fluctuating staff levels–which caused a search for ways to productively frame BR work and 'add value' to existing initiatives. For instance, actors at Bosque Mbaracayu recognized through local political instability that their initial enactment of the BR was unsustainable, prompting them to reconceive their role towards capacity-building and supporting other institutions. Nevertheless, actors responsible for the BR designation may also not recognize, not be supported, or explicitly resist the potential of their BR to play an active bridging role. For example, several participants in El Hierro BR interpreted the BR designation as a 'badge' for existing local government activities.

Our results also illustrate the profoundly political nature of bridging work, in the sense that bridging often entails connecting and negotiating with actors that carry very different interests, knowledges, identities and levels of authority. As Berdej and Armitage (2016) make clear, bridging work is not 'neutral.' Actors bridge in particular ways between particular individuals and organizations, informed by their own interests, values and abilities. Some are included and others left out. For instance, one participant reported that engaging in BR work in the K2C had enabled him to identify the actors to avoid in the region. In Western Port a participant described how he lacked the ability to identify actors with whom he could work productively, leading to emotional turmoil and stress. Nevertheless, participants also recounted generative political experiences. In Mbaracayú participants described developing the ability to let go of their own views in order to see from and understand the perspectives of others. Likewise, in Noosa BR practitioners described how they had built links between various actors by articulating a 'holistic' rather than explicitly partisan political message. Overall, our results highlight the dynamic interactive and interpretive nature of bridging, as actors locate themselves and their institutions in governance landscapes, fashion niches for themselves, and engage across sectoral and institutional boundaries–in so doing transforming their own understandings of what it means to pursue sustainability, as well as those of the people around them. While most studies of bridging organizations and intermediaries have examined a single organizational or geographic case, our comparative work points towards future research that explores the diverse practices of bridging within global policy networks.

4.3. Reflexivity and knowledge-action relationships

Finally, our finding of high diversity among BR meanings and doings has significant implications for scientific engagement in the WNBR. There have been recent calls for renewed scientific engagement with the BR concept (Reed, 2016a; Coetzer et al., 2014), and the Lima Action Plan adopted by the fourth World Congress on Biosphere Reserves supports the revitalization of a scientific network in the program (UNESCO, 2016b). The MAB Strategy 2015–2025 closely allies the WNBR with sustainability science, emphasizing co-production of knowledge in pursuit of the Sustainable Development Goals and the Aichi biodiversity targets. This provides an opportunity for sustainability science to inform practical action 'on the ground,' and help realise the notion of BRs as 'learning sites for sustainable development.' Nevertheless, the connections between science and action are practically and ethically fraught, and are a contested topic in sustainability science (van Kerkhoff and Lebel, 2006; Popa et al., 2015; Clark et al., 2016). By explicitly discussing our underlying methodological assumptions, comparing them to empiricist approaches, and drawing out the implications for action, our work may help UNESCO to think through how science may be conducted within and inform the development of the WNBR, while at the same time contributing to the emerging literature on reflexivity and knowledge-action relationships in sustainability science.

The interpretive approach we adopt in this paper leads to a distinct set of goals, strategies and actions for scientists seeking to foster learning among BR practitioners. Previous research and UNESCO strategy documents suggest (often implicitly) that BRs represent learning sites in the sense of representative locations where lessons may be derived and then tested and diffused around the wider network and beyond. This empiricist view suggests that scientific experts should support learning by identifying the best approach for successfully implementing a general interpretation of the BR concept (e.g. Cuong et al., 2017). By contrast, our approach presents BRs as situated and contextual enactments of a global policy program. In highlighting contestation, normativity and the existence of multiple valid interpretations, our results problematize the premises of the empiricist approach and lead to a different model of scientific engagement. Interpretive scientific engagement with BRs aims to support learning by encouraging the sharing of diverse interpretations and experiences–helping participants to understand their own work more deeply, illuminating new avenues for action and changes to existing practices (Westling et al. 2014). While this approach creates space for generic lessons learned it does not depend on them for 'successful' scientific engagement with practitioners. Our approach connects to the literature on 'reflective practitioners' (Schön, 1983), as well as to the emerging literature on learning to navigate complexity, which emphasises the need for habits of mind such as 'openness' (acceptance of ambiguity, paradox and unpredictability) and 'situated awareness' (acknowledgment of spatial and historical context, competing values, and cross-scale relations) (Rogers et al., 2013; Biggs et al., 2015b). Through their position 'in between,' BRs provide a valuable means for those involved to learn to live with social-ecological complexity.

Our interpretive approach may also help to nurture reflection and learning among sustainability scientists. By explicitly comparing interpretive and empiricist approaches, we enhance sensitivity to the ways in which "researchers' normative perspectives and experiences influence research findings, the manifestation of accepted knowledge, and the identification of new research directions" (Preston et al. 2015: 131). Reflexivity is not only valuable for its own sake, but because it can improve understanding of the relationships between research, action, and practical outcomes (Preston et al. 2015). A growing body of 'research on sustainability research' is exploring how different (inter- and trans-) disciplinary approaches may connect with practice and produce impact (e.g. Milkoreit et al., 2015; Westling et al., 2014). By fostering a range of empiricist, interpretive and other kinds of research, BRs may represent valuable 'knowledge-action arenas' (van Kerkhoff and Lebel, 2006) for exploring the variety of ways in which science can engage with and contribute to the pursuit of sustainability.

5. Conclusion

In this paper we have adopted an interpretive approach to show how meaning shapes learning for sustainability, in the context of UNESCO Biosphere Reserves (BRs). We have grounded our approach in the perspectives and experiences of BR practitioners, enabling those directly involved in BR work to 'talk back' to theory and contribute to three key topics in sustainability science. Firstly, we have demonstrated the politics and power that infuse learning for sustainability, by highlighting the values that underpin particular interpretations of the BR concept, the ways in which these interpretations are put to work to pursue particular initiatives and agendas, and the ways in which they shape perceptions of learning. Secondly, we have contributed to the literature on bridging organizations and intermediaries by highlighting the innovative and 'interested' ways in which actors continually (re) interpret their roles within complex governance networks. And thirdly, we have added to the emerging literature on reflexivity and knowledge-action relationships in sustainability science by showing how meaning shapes the translation of scientific concepts into action.

Our interpretive approach has also enabled BR practitioners to 'talk

back' to UNESCO strategies and BR scholarship. For instance, the diverse interpretations of the BR concept extant among practitioners suggest that the perceived 'concept-reality' gap is not only about practical barriers to implementing a given vision, but also speaks to profound ontological and epistemic issues about how practitioners work with general, scientifically-derived concepts to effect change in contexts with distinct histories, ecologies and politics. Practitioners do not go about enacting the BR concept simply by attempting to manipulate distinct, universal variables, but also by creatively interpreting concepts in pursuit of particular ends. For example, we have shown how the BR designation is variously interpreted as a 'badge' to reward work done, a 'platform' to stimulate new interpersonal and organizational connections, or a 'social enterprise' to generate employment. Taking practitioner understandings and experiences seriously is therefore essential for reconciling expectations and centralized understandings of the BR concept with outcomes 'on the ground' – in so doing dissolving the perceived gap between concept and reality. Moreover, we have demonstrated the learning that *is* taking place in BRs (despite a scarcity of financial and institutional support) – including reassessing human-environment relationships, becoming aware of other actors and governance arrangements, developing skills and capacities to do BR work – and the ways in which this learning together helps practitioners to navigate the BR position 'in between' goals, scales and sectors. Indeed, the most notable finding of our research is that BRs provide a valuable space for practitioners and scientists to learn to live with social-ecological complexity.

Author contributions

Lisen Schultz (LS) and Simon West (SW) are equal lead authors of this work. LS designed and led the overall research project (GLEAN). SW conducted three Biosphere Reserve case studies and brought the interpretive approach to this analysis. LS and SW both contributed equally to the analysis and writing of the paper. Alba Juaréz Bourke conducted three case studies, and Laia d'Armengol (LA), Pau Torrents (PT), Hildur Hardardottir, Annie Jansson and Alba Mohedano Roldán all conducted one case study each. LA and PT also helped to design the interview guides.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.gloenvcha.2018.03. 001.

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