The role and contribution of educational activities in UNESCO Mountain Biosphere Reserves

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Abstract

The provision of educational activity in BRs is officially guided by Education for Sustainable Development (ESD), a UNESCO endorsed education programme. However, the independence accorded to BRs, and the diversity of circumstances they represent, mean they also innovate educational activities to reflect local characteristics. In addition, the ways in which Mountain Biosphere Reserves (MBRs), specifically, implement educational activity is less well known. This research, therefore, was conducted with the aim of exploring and understanding the role and contribution of educational activities in MBRs, with reference to the influence of institutional and local factors. For this study an online survey was conducted in 2021, with staff from 43 MBRs, from 23 countries, and followed up with 10 qualitative interviews. All data were collected from staff based in MBRs who have knowledge and/or experience of delivering educational activities to local audiences. Survey questionnaires were conducted in English, Spanish and Portuguese, and interviews were conducted in English.

Results indicate that MBRs provide a diverse range of educational activities, and that outdoor experiential learning, with small audience groups, is viewed as the most effective approach. While educational aims and objectives are largely aligned with ESD guidance, some are adjusted to reflect the characteristics of the MBR, local land use and the needs of local communities. Educational content is sourced and customised independently by MBR staff, though there is widespread request for a UNESCO MAB educational content platform. Increasing knowledge and understanding is prioritised over behaviour change, and targeting behavioural change relating to local land use is more tangible than when associated with climate change, which remains a complex framing challenge. Insufficient funding is identified as the primary inhibitor of more effective educational activity, in particular for MBRs from lower income countries.

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Abbreviations and acronyms

BR*	Biosphere Reserve
DA	Designated Area
EE	Environmental Education
ESD	Education for Sustainable Development
ESMD	Education for Sustainable Mountain Development
GAP	Global Action Programme
GNI	Gross National Income
IP	Intergenerational Practice
MAB	Man and Biosphere (programme)
MBR*	Mountain Biosphere Reserve
M&E	Monitoring and Evaluation
NGO	Non-Governmental Organisation
SDG	Sustainable Development Goal
SMD	Sustainable Mountain Development
UHI	University of the Highlands and Islands
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organisation

* please note, this paper will reference both BR and MBR throughout, as relevant.

1. Aims and objectives

The purpose of this study is to understand the role and contribution of educational activities in UNESCO Mountain Biosphere Reserves (MBR).

Within this purpose, the study aims to explore and understand the types of educational activity being delivered under the guidance of Education for Sustainable Development (ESD). This extends to include educational content that contributes to the outcomes of MBRs, which by definition share similar objectives.

The study explores the motivations and benefits of delivering educational activities, as well as the barriers and challenges. In addition, the study aims to clarify the role that educational activities play across MBRs, and identify how different approaches toward educational activity contribute to their objectives and outcomes.

The specific research questions are:
1. What types of educational activities are being conducted in MBRs?
2. What types of content and materials are being used?
3. What are the targeted objectives and outcomes?
4. What are the benefits and challenges of delivering educational activities?
5. Who are the educators and the audiences?
6. To what extent do educational activities align with key frameworks? (ESD, UN SDGs, UNESCO MAB)
7. What is needed to improve the quality of educational activity?

2. Literature review

The literature review features three areas of enquiry:

- <u>Institutions, frameworks, and goals</u>

  Key literature relating to the UNESCO MAB programme, UN SDGs and ESD, as institutions and frameworks with a shared focus on education and sustainability.

- <u>Approaches toward environmental education</u>

  Academic debate assessing different approaches.

- <u>Evidence of educational activities in BRs</u>

  Recently documented educational activity in BRs / MBRs.

2.1 Institutions, frameworks and goals

As BRs and ESD are both affiliated with UNESCO, the literature for this subsection is dominated by UNESCO and UN strategy documents, action plans and policy documents. This section is therefore important in understanding the institutional context of educational activity in MBRS.

<u>UNESCO MAB</u>

UNESCO's Man and Biosphere (MAB) programme is an intergovernmental scientific programme aiming to safeguard ecosystems and improve human livelihoods, within the designated boundaries of BRs. Since their inception in 1971, there are now 701 BRs across 120 countries - of which 67% (470) feature mountain landscapes. As UNESCO BRs celebrate their 50th anniversary in 2021, this milestone provides opportunity for reflection and consideration of the future.

Education is one of four main strategic objectives of the UNESCO MAB Programme Strategy (2015-2025) and the resulting Lima Action Plan (2016-2025), one of the UN SDGs and formally represented by ESD, under the UNESCO umbrella. The shared, education-related aim of these entities is for communities living within BRs to increase levels of knowledge, understanding and transformative change in how they live and relate to the natural environment.

The evolution of environmental education (EE) as a function over recent decades has also shaped how it has been implemented in BRs, reflecting a conscious shift toward combining formal, science-based and academic modes of education with informal, practice-based, indigenous and traditional forms of learning.

ESD

In recent years several key UNESCO-authored papers have been published, focusing specifically on the ESD programme. UNESCO is coordinating ESD in the 2030 Agenda for Sustainable Development framework (UN, 2021), and the UN General Assembly Resolution 72/22210 recognises ESD as an *"integral element of SDG 4 on education and a key enabler of all the other SDGs"* (United Nations, 2017).

The ESD for 2030 framework (UNESCO, 2019) identifies five priority action areas:
1. Advancing policy
2. Transforming learning environments
3. Building capacities of educators
4. Empowering and mobilising youth
5. Accelerating local level actions

These five priority action areas all have direct relevance to BRs, and UNESCO recommend that programmes such as MAB and World Heritage should adopt ESD, given their cross-cutting, multidisciplinary synergies. BRs, therefore, are well positioned for alignment with ESD, not only because they are embedded within UNESCO MAB, but also because their designated zones feature teams of educators and local communities where meaningful engagement can occur.

Figure 1 summarises how the five priority action areas of ESD feature alongside two other key frameworks for BRs that also relate to education and sustainable development: UN SDGs and the three core functions of BRs. Essentially, this diagram summarises specific areas highlighted by UNESCO and the UN that inform BR staff in planning programmes of work and educational activities.
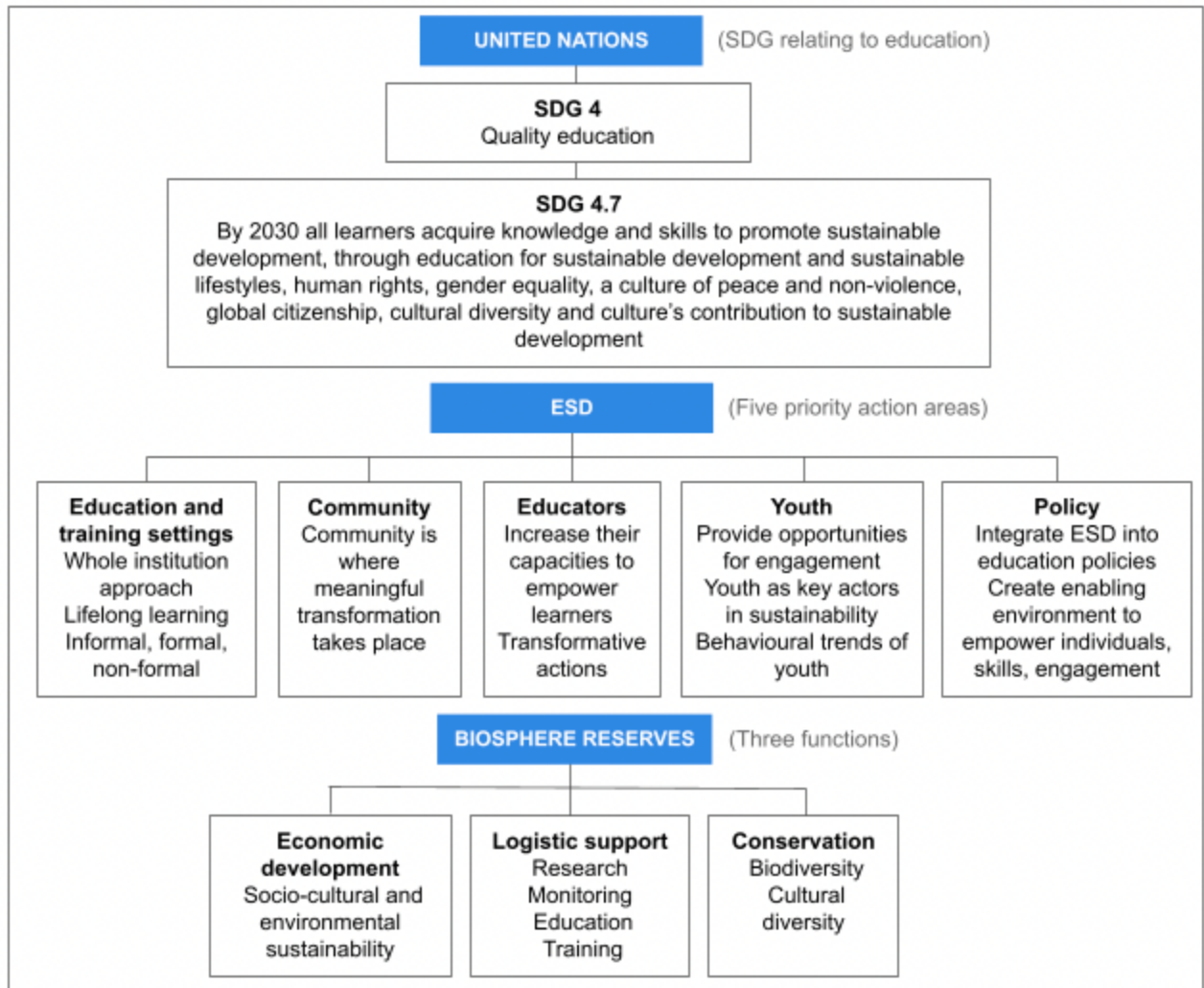
Figure 1: Summary of frameworks referencing education, as relevant to BRs.

It is apparent from some of the overlaps between elements in Figure 1 why BRs are widely viewed as "*ideal to act as laboratories for environmental and social learning*" and how education *'must be an indispensable, integral part of it'* (UNESCO, 2014).

The ESD for 2030 framework (UNESCO, 2019) also identifies 'key notions' that require greater focus, including transformative action, structural changes and technology. It describes transformative action as a process of stages which individuals can progress through, until they reach a tipping point where they have capacity to effect positive change. These stages are not

always experienced in a linear way, as individuals can enter and/or exit at any point along this path, but the overall sequence of stages can be described as:

1) Acquire awareness and knowledge (e.g. learn about biodiversity)
2) Develop an understanding (e.g. learn how ecosystems work)
3) Develop a belief (e.g. *"conservation preserves the environment"*)
4) Develop empathic attitudes (e.g. *"conservation is the right thing to do"*)
5) Conduct behaviours (e.g. planting trees to maintain a habitat).

Because this transformation may require a certain level of *"disruption, courage and determination"* on the part of the (targeted) individual, UNESCO recommend that *"...formal, but also non-formal and informal education, both cognitive and socio-emotional learning, and community and citizenship education"* are deployed (UNESCO, 2019).

Structural disparities are described as a cause of unsustainable development, and ESD addresses the need for careful consideration of communities living in poverty, recommending that implementers be versatile and prioritise livelihoods and improved living conditions. Indeed, ESD may be viewed as a luxury, when people are struggling to survive (i.e. poverty, conflict). However, UNESCO also highlights that in some BRs low literacy levels mean educators need to help them *"visualise the future both with and without their natural environment"* (UNESCO, 2011). Clearly, the full complexity and relevance of ESD is less relevant where people are trying to survive on a daily basis, though UNESCO argues this should not negate the overall, longer-term benefit of ESD for those communities who are in need (UNESCO, 2019).

A noteworthy aspect of the three key notions (transformative action, structural changes, technology) for the 2020-2030 framework is that they emerged from a UNESCO review of the Global Action Programme (GAP) for ESD in 2015-2019, and therefore give some indication of current focus that also have implications for this study. In particular, transformative behavior change is a key, desired outcome of ESD and BRs, and yet income inequality is a barrier to it - and one requiring a more nuanced approach.

BR core functions

Regarding the three core functions of BRs as set out by UNESCO, education sits within a 'logistic support' function, alongside research, monitoring and training. It is noteworthy that the other two functions relate to conservation and economic development, and so logistic support can be viewed as a key enabler of these two other functions that enable them to be taught, implemented and assessed.

Research and monitoring are specialist areas of activity, typically conducted by evaluators within BR teams, or by external agencies. The reference to training implies the transference of specific information and skills to selected individuals, to develop their ability to carry out some assigned task(s). Education, however, appears a somewhat less specific task, and more aligned with imparting fundamental knowledge and understanding of natural environments and sustainable development to local audiences.

2.2 Approaches toward environmental education

There is considerable literature regarding different approaches to environmental education (EE) and outdoors education pedagogies. A concise review of some of these is useful for this study, as it contextualises the educational activities that take place in MBRs, and provides a broader, pedagogical context for situating ESD.

Typically, practitioners of EE have focused on pedagogical approaches that feature experiential learning, fieldwork, adventure activities, eco-reflection and evaluation (Blenkinsop et al., 2016), to name but a few. Essentially, experiential learning is built around *"what you experience is what you remember"*, and helps learners *"construct knowledge, skill, and value from direct experiences"* (Archie, 2003). Indeed, some practitioners claim that scenarios in which learners are encouraged to do something they are not used to, or comfortable with, brings a greater potential for learning (Priest & Gass, 2005). Thomas (2015) makes the case for learner-centred experiences because they provide scope for participants to transition into leaders / teachers, and moments for reflection and evaluation. However, in reality, the application of experiential learning is diverse, as it is shaped by personal orientations and interpretations.

In terms of the main aims of EE, Stohr (2013) describes it as a learning process that *"increases people's knowledge and awareness about the environment"* and "*fosters attitude, motivations and commitments to make informed decisions and take responsible action"*. However, activating changes in attitude and action can require a level of empowerment on the part of the learner, and various approaches for this are proposed and assessed in the literature. How EE is framed can have an impact on how learners engage and ultimately feel empowered to make any changes to their behaviour. For example, when a learner hears the word 'nature', subconsciously a number of different memories, emotions and values are triggered. These associations are known as 'frames' (Real World Learning Model, 2020) and when actively applied can prompt learners to engage with the deep frames associated with topics such as sustainability and climate change. Činčera et al (2021) argue that depending on how issues are framed, positive frames (*'most people act responsibly'*) and negative frames (*'people harm the environment'*) can have different impacts on people's behaviour.

Another approach practitioners of EE follow is to consider environmental values as the drivers of responsible environmental behavior, as the ultimate goal of EE. When applying Schwartz's Theory of Basic Values (2012), EE is typically located under the value category 'Universalism' and for many practitioners this is where their teaching is oriented from (Činčera et al, 2021). However, this orientation can clash with other societal groups who hold different values (e.g. a learners parents). For example, climate change has prompted clashes of opinion within societies in recent decades, leading some authors to recommend that environmental education focus on scientific facts rather than directly aiming to shape learners' values (*'facts, not fear'*).

How learners understand concepts such as 'sustainability' is also debated in the literature. Sustainability can be viewed as emergent from a western, scientific discourse, and is not a universally acknowledged concept or understood in the same way by all cultures. In an attempt to enhance this understanding, an approach in Mexico focuses on the 'culturalisation' of EE through which the practices of indigenous and traditional societies, based on co-evolution between society and nature, are incorporated into the modern definition of sustainability (García-Campos, 2019). Given the historical trajectory of cultural conquest in the Americas, this approach asserts that the

'ecology of differences' can flow in both directions, and that a key focus on promoting an *'ecology of knowledge–wisdom'* can bring about a mutual understanding of sustainability.

The application of EE in low-income countries presents a challenge where audiences are severely restricted in their choices due to poverty, and which prompts them to make unsustainable decisions on a daily basis. Such scenarios are exacerbated by limited access to education, and the subsequent lack of environmental understanding can weaken the prospect of pro-environmental behaviours. While there are no easy solutions in such cases, an environmental education intervention in Madagascar demonstrated how topic-specific teacher training prior to lessons were effective in conveying environmental knowledge, and reaching learners' parents (Schüßler et al, 2019). Cases such as these highlight how low income settings present greater barriers than in higher income settings, and how a simple objective such as facilitating a teacher and a group of learners to come together can represent a significant achievement in itself.

It is clear there are many considerations and views around which pedagogical approaches are most effective for EE. However, Killen's conclusion (2007) that *"no single teaching strategy is effective all the time for all learners"* seems sensible, given that *"student learning will suitably adapt to content, context, and learners' needs"*. Indeed, the importance of teachers adopting *"a broad range of strategies that respond to different aims and contexts"* seems both pragmatic and wise, given the challenges of teaching in unpredictable, outdoor settings (Evans et al, 2020).

2.3 Evidence of educational activity in MBRs

The literature referencing educational activities practiced in BRs over recent years reflects a diversity of contexts and approaches. While the majority of BRs are guided by ESD, they do not all directly reference this framework, which likely reflects the wide variety of contexts that BRs are situated in, and their relative independence in how they implement their activities.

Participatory approaches

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When considering educational activities in BRs, it is useful to consider a linear spectrum, with theory (i.e. academia, universities) at one end, and practice (i.e. natural environments, local communities) at the other. The opportunities presented along this spectrum are diverse in how educational activities are organised and implemented. Bringing the two ends of this spectrum closer together in a meaningful and effective way is a challenge, and one that is increasingly being explored. For example, while universities typically seek to generate scientific knowledge that is universally valid, implementing this theoretical knowledge in the real world settings of BRs is often difficult. Walk et al (2019, pp. 297-308) argue that because BRs are ostensibly sites for testing interdisciplinary approaches, participatory governance and collaborative decision-making can be applied to facilitate greater engagement between academia and local communities. Such an approach puts an onus on academics to positively accept the sometimes contradictory requirements of local communities, and to participate in co-design of problem framing.

Walk et al go on to provide examples where universities and local farming communities in a BR in Germany jointly analysed the agricultural use of peatland areas and developed solutions for more sustainable management. While this applied example goes beyond educational activities per se, it usefully illustrates how problem-based and research-based learning can lead to practical solutions. Key elements of this process included facilitation of reciprocal feedback and building in opportunities for reflection. As a result, the authors observed a shift in participating universities from an *"inside-out perspective"* to an *"outside-in perspective"*, and from *"producing scientific findings"* to "*involvement in a knowledge co-production process"*.

Recently, there has been increasing coverage of alternative approaches to education and learning, or 'knowledge integration'. In particular, attention is being drawn to ways in which indigenous and traditional forms of learning and more formal, scientific approaches are applied in a more purposeful and integrated way (Reed et al, 2019). Knowledge integration is where indigenous, traditional, scientific and modern forms of knowledge overlap, leading to new types of social learning.

Another example of academia engaging with local people has been documented from Mount Hakusan BR, Japan (Mammadova, 2017). In this case, university students made numerous field

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visits to the MBR to spend time with local villagers, gather information and experience local environment and culture. It was observed that students' understanding and appreciation for both the natural environment and the local traditional culture was significantly enhanced, to the extent that they had some influence in local people viewing their way of life more positively than before. This case study demonstrates how carefully planned educational interventions can bring benefits to learners from both academic and traditional community backgrounds, and how such experiences can prompt deeper appreciation of local environments and ways of life.

ESD in BRs / MBRs

A comprehensive resource book for educators published by UNESCO provides extensive tools and guidance on how to implement ESD in BRs in South-Eastern Europe and the Mediterranean (UNESCO, 2013). In particular, this book references the benefits of immersive and interactive ESD for young people, the importance of engaging with people with learning difficulties and disabilities, and developing communication skills to ensure inclusion across all communities. The authors also outline four levels of objectives for environmental education / ESD programmes (Hungerford et al, 1994), which bear some similarities to the key notion of transformative action as described in the ESD 2030 framework (albeit more applied). These four levels are framed as:

1. Ecological foundations
2. Conceptual awareness
3. Investigation and evaluation
4. Capability for environmental action

While the above schema is intended to function in a sequential way, the authors recommend that the objectives of a programme are discussed with learners so they can adjust the goals to their needs. Again, the recommendation here is similar to that referenced earlier by Walk et al, in that participatory engagement is important for the quality and success of educational / ESD programmes in BRs. The authors also highlight that this finding has emerged from observations of educational activities in BRs which have suffered from top-down design and insufficient consideration of audience needs. Such approaches can leave untapped *"the precious knowledge and the ideas of local stakeholders"* (UNESCO, 2013).

<u>Education audiences</u>

The characteristics of audiences receiving educational activities vary across BRs and MBRs, and influence the selection of objectives and educational approach. A key consideration for educators is the level of transformation that is feasible to achieve with each audience, in terms of shaping their knowledge, attitudes, beliefs and behaviours. UNESCO states that the majority of BR education audiences are school children (UNESCO, 2013), but that a range of other adult groups also feature (e.g. landowners).

One study in Austria describes an intervention that was prompted out of recognition that youth and elderly women were underrepresented in the BR (Mitrofanenko et al, 2018). The authors followed an Intergenerational Practice (IP) approach, an emergent field whereby the interaction of youth and elderly is facilitated, leading to broader social benefits. Education and learning plays a key role in this process, through articulating the meaning and objectives of the BR, how its functions relate to the developments in the region and how they can take on active roles in the BR. The study found a popular component of this IP intervention was exchange between these two lifestage cohorts, which led to greater appreciation of traditional knowledge, skills and livelihoods.

Another example of IP was documented in the Sierra Gorda BR in Mexico, which was initiated when environmental content was introduced into the curriculum of local schools (GIZ, 2016). This prompted the founding of an 'eco youngsters' project (ECOCHAVOS) which familiarised young people with ecosystems and biodiversity and involved them in conservation. The overarching educational approach they followed was to teach children the connections between elements within local ecosystems, and subsequently encourage them to protect and conserve them.

In BRs that experience high numbers of tourists, staff are turning their attention to creating learning experiences for this audience. In Lake Vänern Archipelago BR, Sweden, increasing tourist numbers prompted the development of a holistic approach suffused with educational touchpoints, featuring trails for hiking, trained local guides and a web-based portal guiding visitors on sustainable experiences (Heinrup et al, 2017). Another study in Romania found that higher levels of tourist satisfaction resulted when activities are combined with education experiences, as

audiences become more open to learning about environmental issues in such settings (Barukchieva, 2017).

<u>Education delivery</u>

The majority of documented educational methods and approaches in BRs are designed around active participation and experiential learning, as described in section 2.2. UNESCO also acknowledges that BRs are well positioned to host such experiences, and that *"direct experiential activities organized in the field, provide learners with the opportunity to gain a better understanding of the complex interrelations between the natural, cultural and economic environment"* (UNESCO, 2013).

Alternative methods of delivering educational activity are less documented overall, though one approach employed in Reserve of La Sepultura BR in Mexico implemented Applied Theatre (Heras, 2016). This approach uses performance as a way to connect future visions of the BR with meaningful action among young people. Through this approach participants ask themselves *"what role can I play in this future?"*, accompanied by a critical reflectivity about the complexity of local challenges. In this way, learning about the complexity of social-ecological systems was framed not only as an external concept but also as an emotional, personal, and lived experience. The authors reflected that this approach carried value for young people who are faced with gloomy predictions about global environmental change, as it helps them imagine alternative futures and their potential role within them.

<u>Mountain settings</u>

Experiences of implementing ESD specifically in mountain settings feature in the literature, albeit less than BRs in general. Keryan et al's (2020) study in the Caucasus documented closer participation between universities and local communities, and while it concluded the ESD framework was of value, they also observed that *"integrating sustainability issues into academic work and establishing strong collaboration with local communities requires continuous work, enthusiasm, and resources"*. The lesson learnt here is that building trust with local communities takes time, as do any tangible results.

Mammadova's (2017) study in Mount Hakusan BR in Japan also described a context of gradual depopulation as younger residents move to cities, and an ageing population. Living conditions were described as challenging, with elderly residents in rural villages contending with heavy snowfall through the winter months. Such cases highlight the difficulties many face who live and work in MBRs, and which likely have an impact on educators and audiences alike.

Conclusions

Several key strategy documents published by UNESCO set out how education and ESD should be framed within the MAB programme, with a focus on local, young audiences and the goals of conservation and sustainable development. However, the extent to which educational activity across BRs reflects ESD guidance is less clear, though it should be noted that BRs have a certain level of autonomy in how they manage their activities.

The literature evidences how a range of EE approaches are being tried and tested, with an increasing focus on behavioural psychology in shaping how topics are framed and valued by both educators and learners. In BRs also, a range of educational approaches are being implemented and aligned with UNESCOs vision of BRs as 'testing sites' for sustainable development. Some BRs have learning partnerships with universities while others provide education for school children and tourists. In some cases there are innovations that relate to specific circumstances in individual BRs, such as reaching underrepresented audiences and trialling new approaches (e.g. applied theatre).

Overall, while there is significant literature that describes EE and educational activities in BR settings, there is less on comparable activities in MBRs specifically. This presumably reflects how larger populations are more likely to be associated with non-mountainous BRs, and thus a greater level of educational activity. The literature relating to MBRs describes more challenging environments for BR teams and their local communities.

While the concepts and practices of ESD are intended to guide educational activity in BRs until 2030, this study will focus on 'educational activity' that takes place in MBRs, in order to capture as broad a range of evidence relating to education as possible. However, findings yielded by the

research are assessed against the five priority action areas of ESD, as well as UN SDG no.4 and three core functions of BRs.

3. Study background and setting

3.1 Study rationale

The rationale for this study emerged from background reading which suggests MBRs can benefit from further investigation into how educational activity is implemented and experienced.

As the literature review highlights, educational activity in MBRs is guided by a number of multilateral frameworks (UN SDGs, UNESCO MAB, ESD) that provide guidance on objectives and targeted outcomes. However, given the relative independence that BRs are accorded under their UNESCO designated status, and their diversity of contexts, the extent to which BRs and MBRs align their objectives and targeted outcomes with this guidance is less well known. Therefore, one aspect of this study is to understand how their educational activity is aligned to these frameworks.

The diversity and independence of MBRs means there is some uncertainty around many other related aspects of their educational activity, thus providing the rationale for the research questions in this study. The range and variety of educational approaches and content are less well known in MBRs specifically, as well as detail concerning the educators and the audiences. To what extent audiences benefit from education is clearly an important area to explore, as ultimately they are the focal point of such activity. One key audience is youth, as highlighted in the recent Lima Action Plan Midterm review, which recommends that education should play a key role in achieving greater youth participation (UNESCO, 2016).

The focus on MBRs holds particular interest as mountain environments pose specific challenges, not just in terms of conservation and sustainable development, but also in how educational

activities are conducted. This study aims to understand more about these challenges and how they are experienced by educators and audiences alike.

Looking to the future, asking participants what is needed to improve the quality of educational activity is a key question, given the need for global action related to the natural environment and sustainable development.

3.2 Study context

It is useful to situate the context for this study within a range of different scales of focus.

At the macro, global scale, BRs and ESD represent concepts of sustainable development, environmental protection and education at a time when the effects of climate change, environmental destruction and biodiversity loss are increasing in pace and intensity. In response, multilateral agencies (e.g. UN, UNESCO) are formulating protocols and strategies committing governments to pro-sustainable actions.

At the meso, regional level, BRs are represented differently in terms of their social, political and environmental contexts, and the priorities they face. For example, while BRs in the global north may strategise around how to manage ecotourism, those in the global south are often faced with more existential, immediate threats to their ecosystems, such as illegal deforestation and human settlement.

At the local, micro level, while BRs share a common, UNESCO designated status, they also display variety in terms of how they are funded and managed. Some BRs are well funded by a range of private and public donors, whereas others survive on very limited support, and the commitment of volunteers. In particular, this study aims to explore the role and contribution of educators at this local level, in terms of how their activities are conducted and experienced.

Within these scales of focus, mountains as distinct environments are also experiencing considerable attention, in particular with regard to climate change and biodiversity. As global

temperatures rise, glaciers are impacted, with implications for water provision for lowland populations. Flora and fauna are also affected, with steep mountain gradients witnessing movements of species, as they relocate to temperature and ecosystem niches better suited to their accustomed range.

ESD is also evolving and adapting to these changing social and environmental contexts. At the academic level, the benefits of education are implicit in the application of learned knowledge and scientific research in developing environmental management approaches. At the community level, ESD aims to equip communities with the knowledge and understanding that translates into more sustainable attitudes and behaviours. This study focuses more on the role and contribution of educational activity at the community level, as more formal, academic platforms of education shift the emphasis away from local communities and toward universities and academia.

Figure 2 sets out the overall context, showing the MBR and other key entities and relationships, and is useful to consider when contextualising the research findings in the subsequent section:
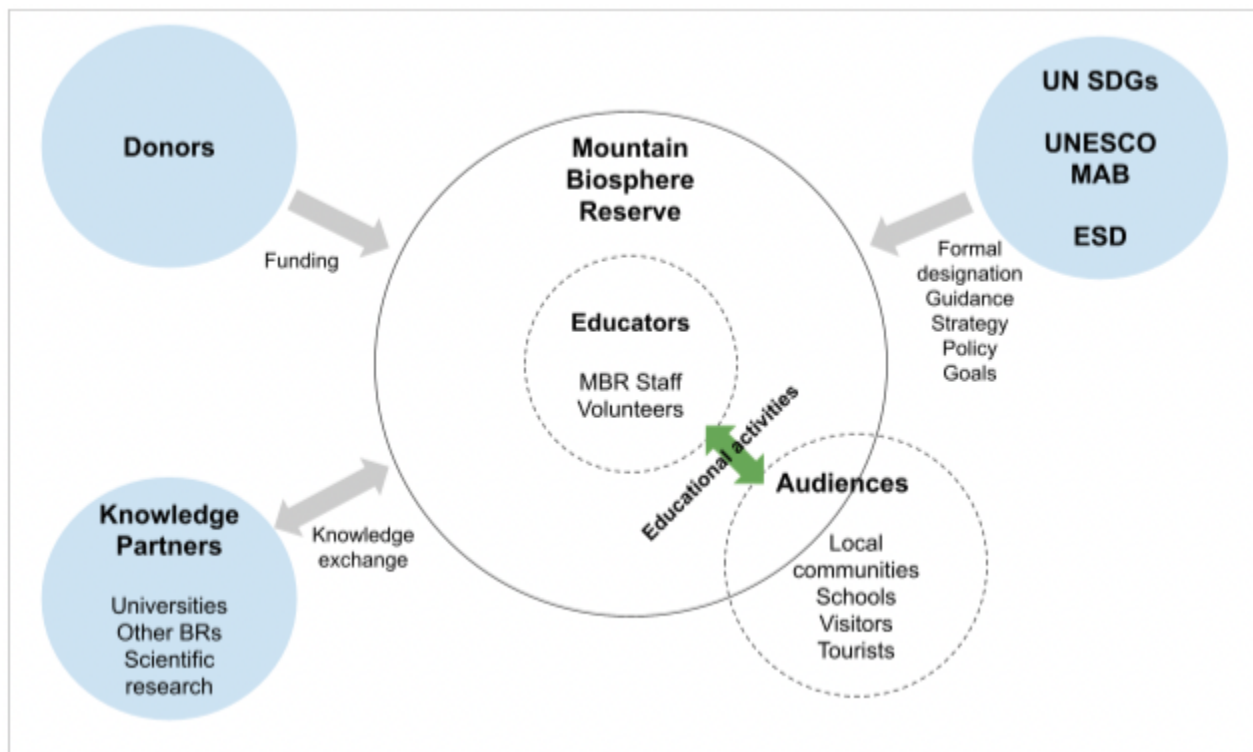
Figure 2: MBRs and their relationship to other key entities and audiences.

In summary, the context for this study is one of considerable change and heightened importance, as MBRs increasingly represent settings where the concept of balancing human and environmental needs are both imperilled and sought after, simultaneously. Within this context, ESD represents a guiding framework through which the tenets of the BR concept can broaden and deepen this process of engagement and understanding with the communities they serve, and beyond.

4. Study activities

The study followed a sequence of iterative phases (Figure 3), each of which informed and/or validated the phase that preceded or followed it. The initial scoping period involved general reading and reflection around the subject area, followed by a focused literature review.
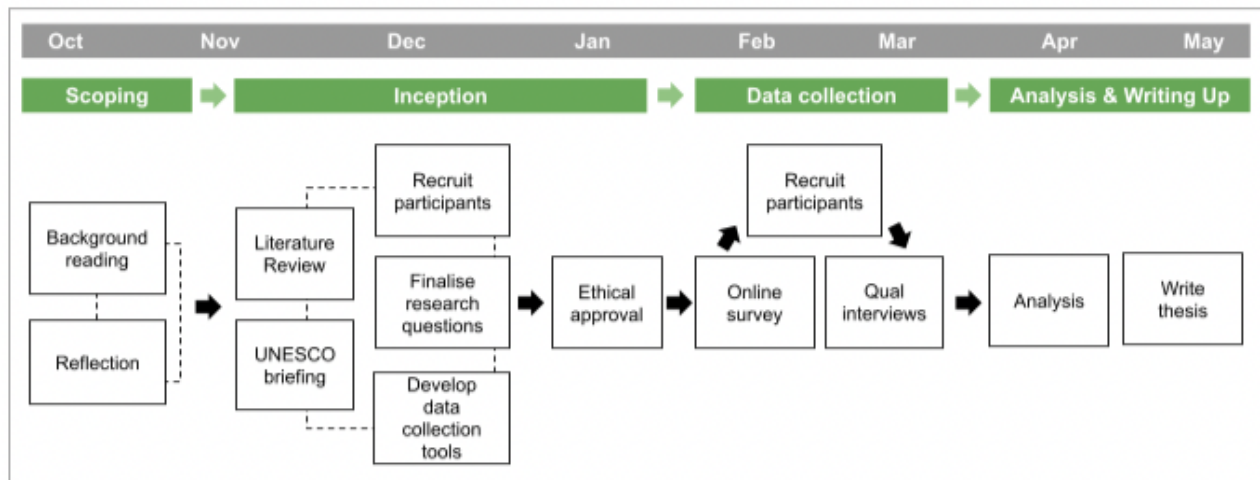
Figure 3: Overall sequence and timing of study activities.

In the inception phase the orientation of study enquiry was finalised, and informed by a literature review and briefing conversations with two UNESCO MAB representatives. This allowed the sample to be completed, ethical approval to be obtained, data collection tools to be developed and the recruitment of participants to begin.

Formative analysis of the survey data allowed key themes to be identified, and informed the identification of participants, and writing of discussion guides, for the follow-up qualitative interviews.

The online survey was completed by participants in January and February 2021, and follow-up qualitative interviews were conducted in March.

Finally, survey and interview data were analysed against the framing of the objectives and research questions. Analysis was also sufficiently open to allow other areas of findings to emerge, and be validated against both quantitative and qualitative data.

4.1 Research approach

The approach was largely determined by recommendations as set out by UHI for dissertation study. However, the sequencing of a literature review, quantitative survey and qualitative interview was appropriate to this study, and enabled for a logical and informed flow of information and decision making.

4.2 Briefing conversations

Two briefings with representatives from the UNESCO MAB secretariat were arranged and conducted in January 2021.

- Chief of Section (MAB Networking: Biosphere Reserves and Capacity Building)
- Associate Programme Specialist (MAB Research and Policy: Ecology and Biodiversity)

These conversations were conducted remotely, and allowed for feedback, information and advice relating to the overall orientation of study, research questions and approaching MBRs for data collection.

4.3 Online survey

The online survey was launched on January 23rd 2021, and remained open for completion for one month, under the free terms of use as provided by JISC (Joint Information Systems Committee). The survey featured 23 questions, and was structured to take approximately 10-15 minutes to complete, mindful of the time requested from a busy, professional audience.

<u>Sample</u>

Identification of suitable participants and MBRs for the online survey were based on the following criteria:

- The MBR is >600m at its highest altitude.

- The MBR has facilitated educational activity in recent years.

- The selected participant currently works in the MBR.

- The selected participant has some knowledge of educational activities in the MBR (direct or indirect).

Appendix 1 details the 43 participants who completed the online survey. MBRs were represented from 23 countries, and from all five of the UNESCO MAB constituent regions.

Potential participants and MBRs were identified through recommendations from Martin Price (formerly UHI), Noeline Raondry Rakotoarisoa and María Rosa Cardenas Tomazic (UNESCO), and self-searching via the UNESCO MAB website.

All participating MBRs featured highest altitudes of >600m, up to 6194m. In addition, only MBRs with significant human populations were considered, either inside or just outside the reserve boundary. This was to ensure that sufficient community interaction was occurring, for educational activities to be viable. Indeed, UNESCO has declassified some BRs in recent decades due to an absence of human population.

<u>Identification and recruitment</u>

73 participants at MBRs were contacted through an invitation email (Appendix 5), introducing the study aims and requesting them to complete the survey. Participants from 43 MBRs completed the survey, with 36 completing the English language version, 6 completing the Spanish language version, and 1 the Portuguese language version.

Of the 30 contacts who did not complete the survey, no reply or reason was provided. It is possible that some email addresses were no longer valid, or emails did not get through spam filters.

<u>Survey questionnaire</u>

The online survey (Appendix 4) covered a wide range of relevant themes, and provided comprehensive response options to generate optimal data. Development of the questionnaire focused initially on identifying key themes, reflecting the study objectives and research questions.

Of the 23 questions, 19 provided multiple choice response options, and 15 of these also featured an 'other' response, allowing participants to provide any responses that did not match the options provided. Four questions featured free text responses where participants could elaborate fuller answers.

The main themes and areas of questioning are summarised in Table 1.

Survey themes	# of questions	Survey questions
Participant role and responsibilities	4	Questions relating to the role of the participant in the MBR.
Delivering educational activities	5	Questions relating to the status of educational activities, topics taught, teachers, beneficiaries, and interest levels of audiences.
Capacity and resourcing	4	Questions relating to curriculum, materials, engagement and funding.
Objectives, challenges, outcomes and improvements	10	Questions relating to objectives, motivations, challenges, outcomes, priorities and suggestions for the future.

Table 1: Summarised survey themes and areas of questioning.

4.4 Qualitative interviews

Following completion of the online survey, qualitative interviews with participants in MBRs were conducted. These follow-up interviews aimed to add detail, complement survey data and enable exploration of emergent themes and areas of interest from the survey.

Sample and recruitment

10 interviews were conducted in March 2021, the majority of whom (9) were the same participants as had completed the survey. One additional, non-survey participant was invited and interviewed, following the same sample criteria as for the survey. Other survey participants were invited for an interview, but were less able to engage in English language discussion, were unavailable for an interview, or did not respond to the request.

Appendix 2 details the participant sample for the qualitative interviews. Interviews lasted 30-45 minutes and were conducted using Zoom. All interviews were audio recorded, with notes added into the analytical framework.

The discussion guide for the interviews was formulated following summary analysis of data from the online survey. This allowed for the identification of trends in the data, and other areas that were less clear - both of which could benefit from follow-up, qualitative enquiry. Appendix 3 summarises the main questions asked in the interviews, and how they relate back to the summaries of survey responses and survey question themes.

4.5 Analysis

Overall, data collected from both quantitative and qualitative research were satisfactory in terms of completeness, extensiveness and reliability. All respondents had some knowledge of educational activities in their MBR and answered the majority of questions fully. In addition to statistical data, the online survey also provided scope for free text, qualitative responses, which were useful in corroborating some survey response selections.

A final total of 44 participating MBRs, across the survey and qualitative interviews, means this study accounts for nearly 10% of global UNESCO MBRs (470 in total).

In some of the charts illustrating survey data in this report, MBRs are also represented by their country's level of Gross National Income (GNI) per capita, as categorised by three levels of GNI per capita, to illustrate any potential variance that reflects differing levels of economic development by country. Each of the 23 MBR-representative countries participating in this survey was assigned to one of three income classifications (lower-middle, upper-middle, high), as defined by the World Bank Atlas method (The World Bank, 2021). Table 2 shows the assignment of MBR countries against this classification.

World Bank classification	GNI per capita	MBR countries in this study
High-income economies	> $12,536	Canada, Germany, Ireland, Japan, Korea, Spain, UK, USA
Upper-middle income economies	$4,046 - $12,535	Costa Rica, Ecuador, Iran, Kazakhstan, Poland, Portugal, Russia, Slovak Republic, Thailand, Turkey
Lower-middle income economies	$1,036 - $4,045	Ghana, India, Kenya, Tanzania
Low-income economies	< $1,035	n/a

Table 2: Assignment of MBR countries of origin against World Bank GNI per capita index.

While there are many development indicators that demonstrate various aspects of national economy, income and development, GNI per capita is closely linked with indicators that measure social, economic, and environmental well-being of a country and its people. As MBRs receive funding from a range of donors, and are closely connected with their local communities, this appears to be an appropriate index for this study.

A caveat with applying this index in this study is that there is a skew towards MBRs in high and upper-middle income economies, with only four from lower-middle economies.

5. Research findings

5.1 Study participants

Most participants are in long-term roles, having been involved with their MBR for 5-10 years. 33% of participants have been in position for 10 years or more (Figure 4).
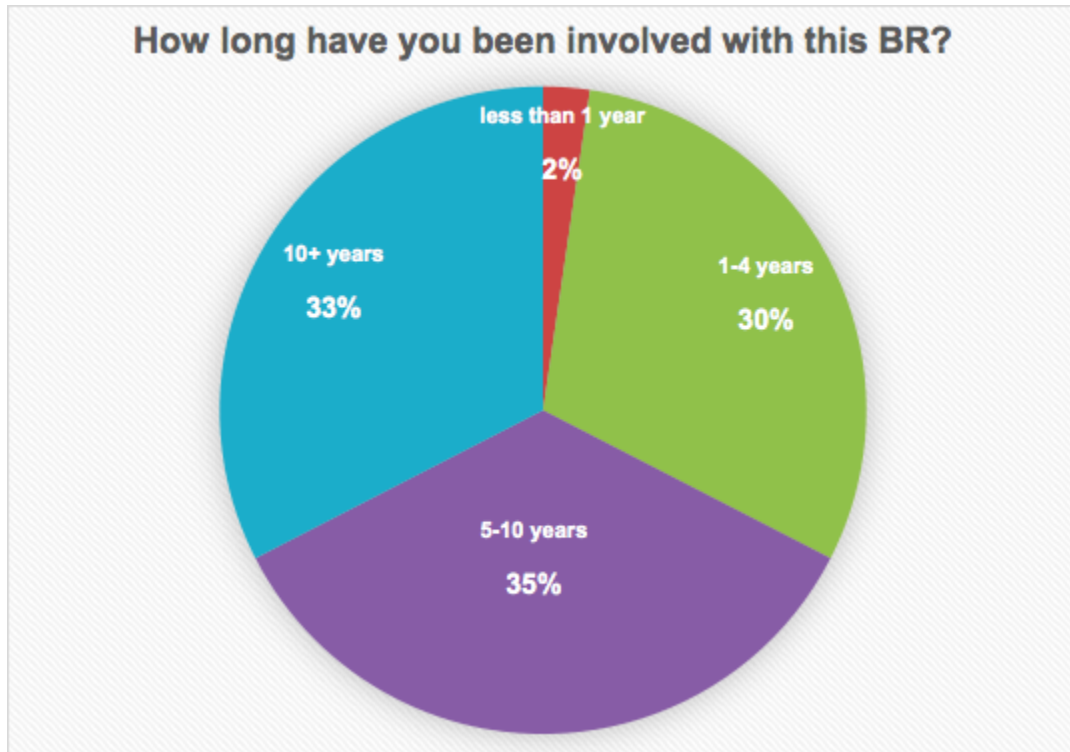
Figure 4: Length of time participant has been involved in the MBR.

The roles of participants vary considerably, but most are managers and coordinators (Table 3, and 95% have some / significant involvement in educational programmes and teaching (Figure 5). The majority of participants are also working with local communities and involved in conservation of the natural environment (Figure 5). This suggests the participants were appropriately positioned to participate in this study.
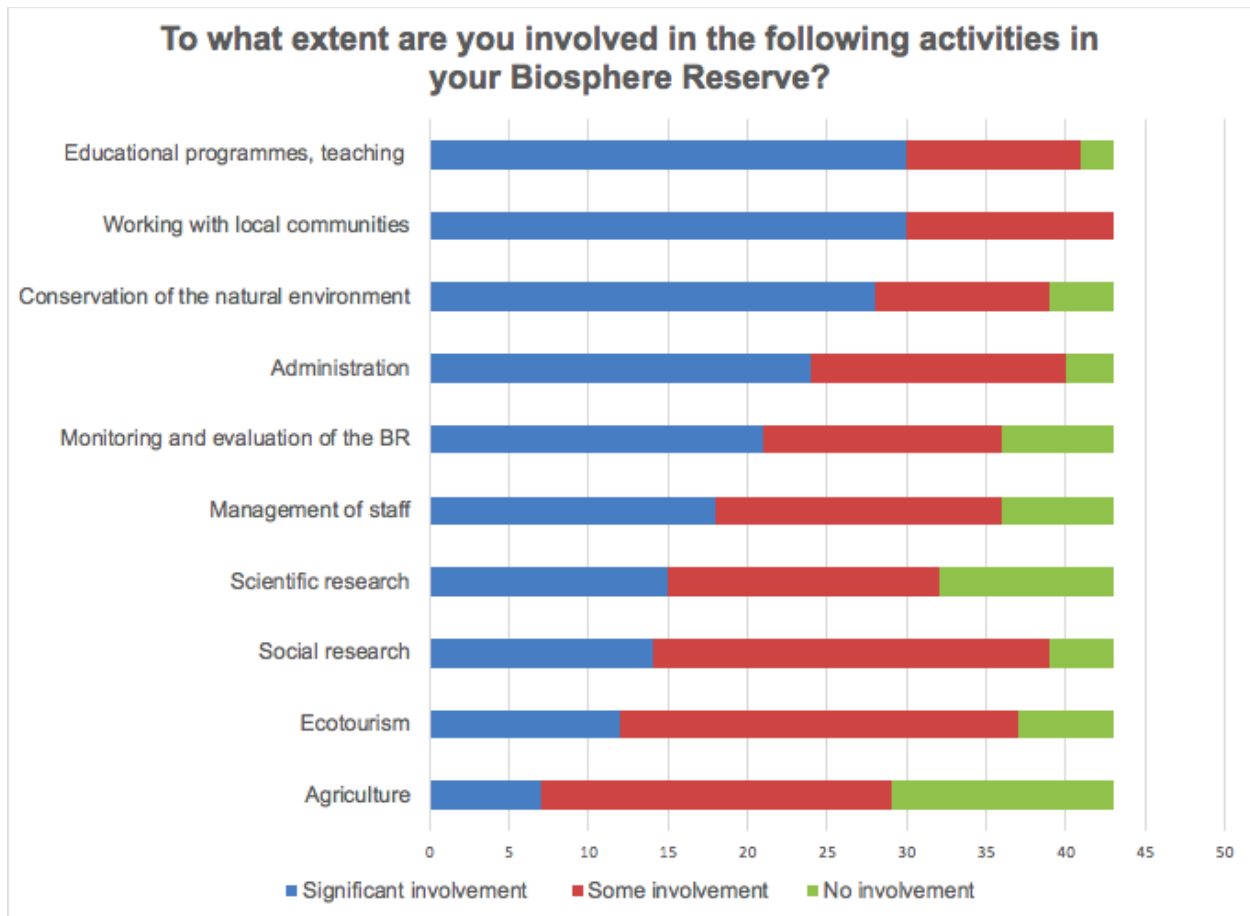
Figure 5: Participant involvement in the MBR.

Participant perceptions of the current status of educational activities in their MBRs are that it is of a '*high*' (43%) or '*mid-level priority - but we would like to make it a higher priority*' (41%) (Figure 6). This suggests educational activities are perceived as an important, aspirational and key priority for MBRs.
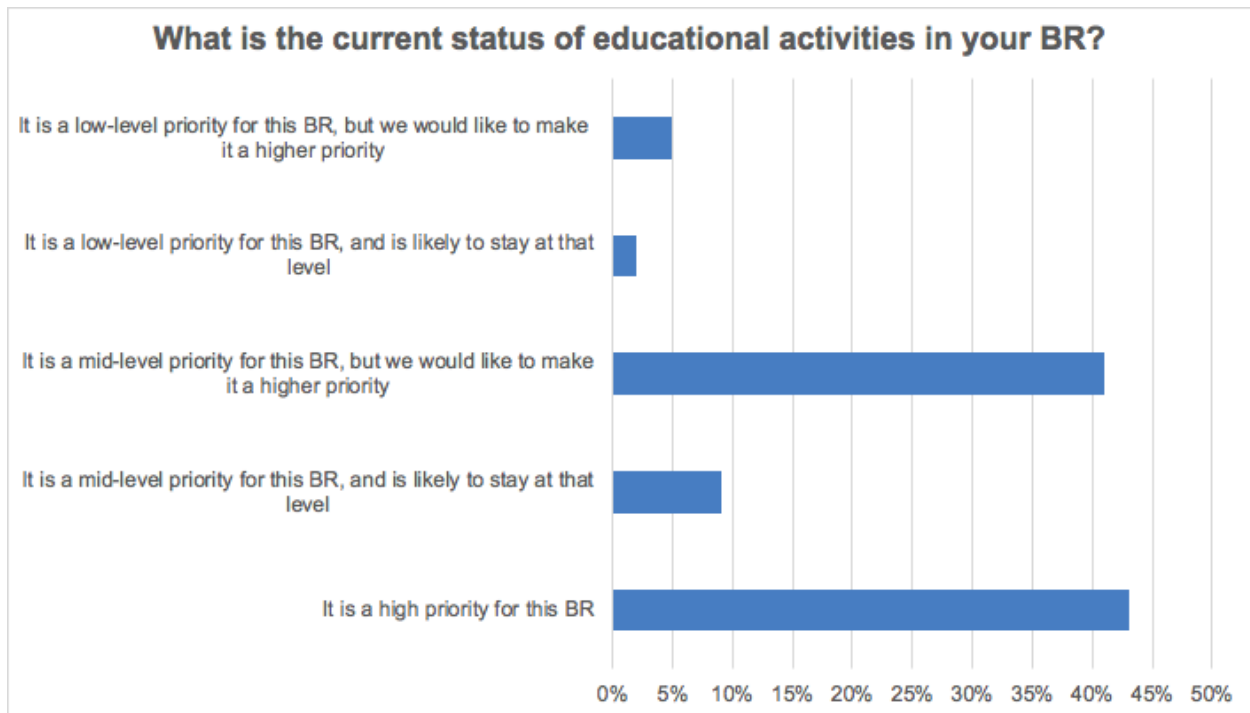
Figure 6: Current status of educational activities in MBR.

Interviews with participants reaffirmed the importance they attributed to education, with several considering it integral to upholding the main tenets of the UNESCO MAB programme.

> *"It is a key part of the work of a BR. Education for sustainable development is very important, you can reach many children and contribute to a better future"*
>
> [ESD Research Associate, Berchtesgadener Land MBR, Germany]

5.2 Education objectives and outcomes

Education objectives

In terms of the aims and objectives of educational activity, improvement of knowledge and understanding of conservation and sustainable development was most cited by the majority of those surveyed (91%) (Figure 7). This was closely followed by educational activity that actively encourages pro-environmental behaviours (79%). This suggests that the focus on achieving a base-level knowledge and understanding of conservation and development is foremost in the minds of MBRs staff, and slightly more so than encouraging behaviour change.
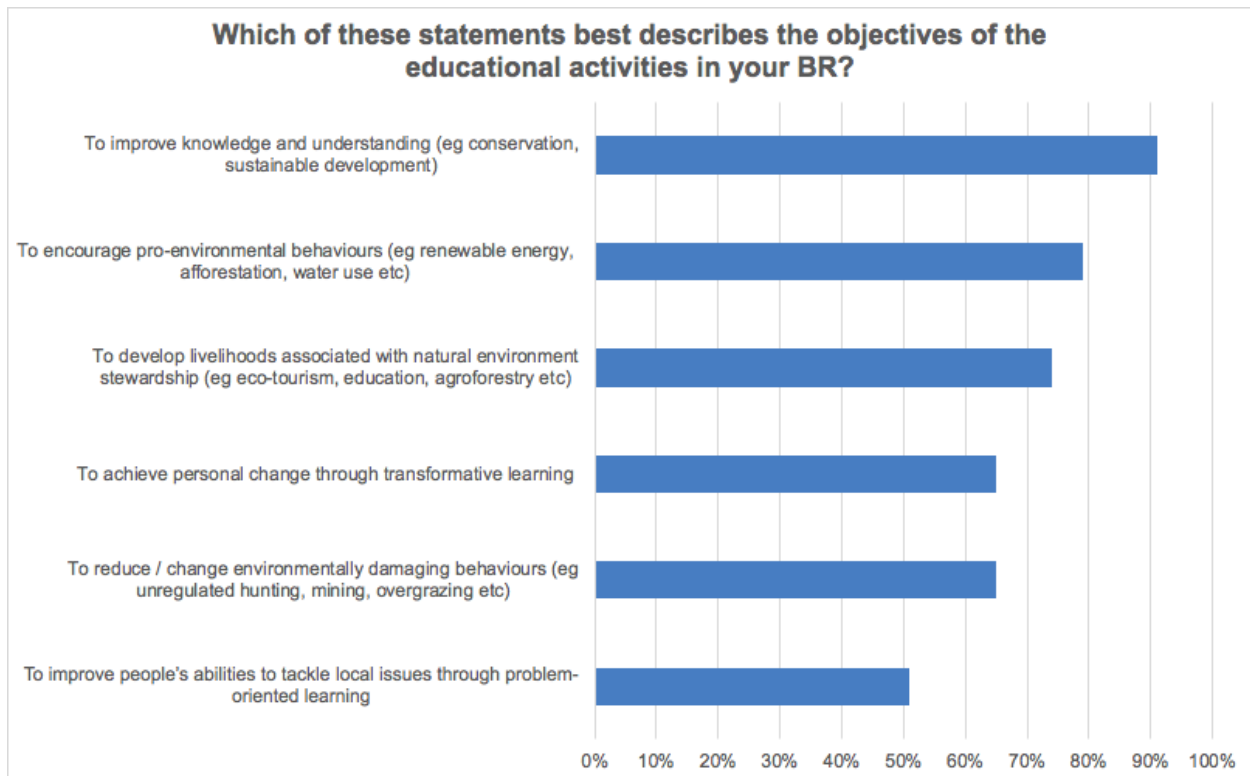
Figure 7: Objectives of educational activities.

The primary focus on increasing foundational knowledge and understanding partly reflects the audiences that educators work with in MBRs, who are predominantly children and young people. In some MBRs the audience also includes tourists, which reduces the opportunities for ongoing engagement with the same cohorts.

However, some study participants have a stronger focus on achieving behaviour change, regardless of age or make-up of the audience. In this way, enhancing attitudes of local communities is viewed as a way of achieving behaviour change with regard to land use in the MBR.

> *"The whole idea behind this is to inspire people toward behaviour change and into taking action, rather than just education's sake"*
> [Biosphere Officer, Kerry BR, Ireland]

Such a distinct focus on a behaviour change objective is more challenging in some MBRs, where local circumstances may pose distinct barriers. In an MBR in Alaska, a key employer is the local

coal mine, and so behaviour change related to climate change is a contentious topic that the MBR education team approaches cautiously.

Local characteristics of MBRs relating to socio-economic and environmental issues shape how education objectives are assessed and framed. While participants adhere to the founding principles of BRs, as defined by UNESCO, they are keen to set objectives that also reflect the needs of their local environment and communities.

For example, for one MBR manager in South Africa, high levels of unemployment and poverty meant education objectives need to prioritise local livelihoods and economic development. The fact that the MBR was also experiencing devastating forest fires due to climate change meant both environmental and social topics remained important, but addressing the social component had a heightened sense of urgency that could not be ignored.

> *"In this BR, economic growth and jobs should be the number one priority"*
> [BR Coordinator, South Africa]

An MBR in Canada added an additional objective to the UNESCO suite of objectives, relating specifically to the First Nations indigenous population. This also carried through into education objectives.

> *"UNESCO has four main functions, and in Canada we add a fifth one - relating to reconciliation with first nations peoples. This is something that is very important and is worked on by every Canadian BR"*
> [Coordinator, Mount Arrowsmith BR, Canada]

In terms of how the objectives of educational activities in MBRs are aligned with the six UNESCO MAB definitions of BRs (Figure 8), the two that participants most agreed with related to BRs as 'sites as learning places for sustainable development' and for 'promoting solutions reconciling the conversation of biodiversity with its sustainable use'. The only notable exception is description no.3 related to BRs as sites for 'testing, understanding and managing conflict prevention'.

To what extent do educational activities in your BR reference these UNESCO descriptions of BRs?

Legend: Not relevant to this BR | To a very little extent | To some extent | To a great extent
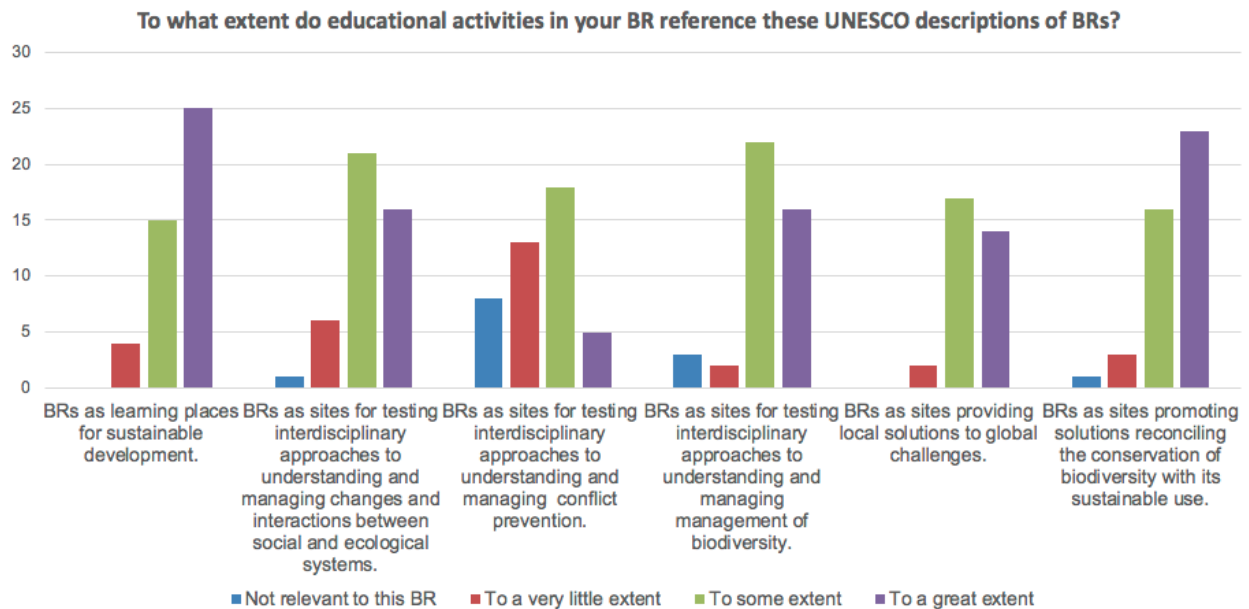
Figure 8: Alignment of educational activities with UNESCO descriptions of BRs.

However, conflict prevention holds more relevance for those MBRs situated in lower-middle and upper-middle income countries (Figure 9). Interviews with participants from these countries relate this to contested land use and competition for natural resources among local communities. However, the focus on BRs as sites for understanding sustainable development and biodiversity remains the overarching focus for MBRs across all levels of GNI.
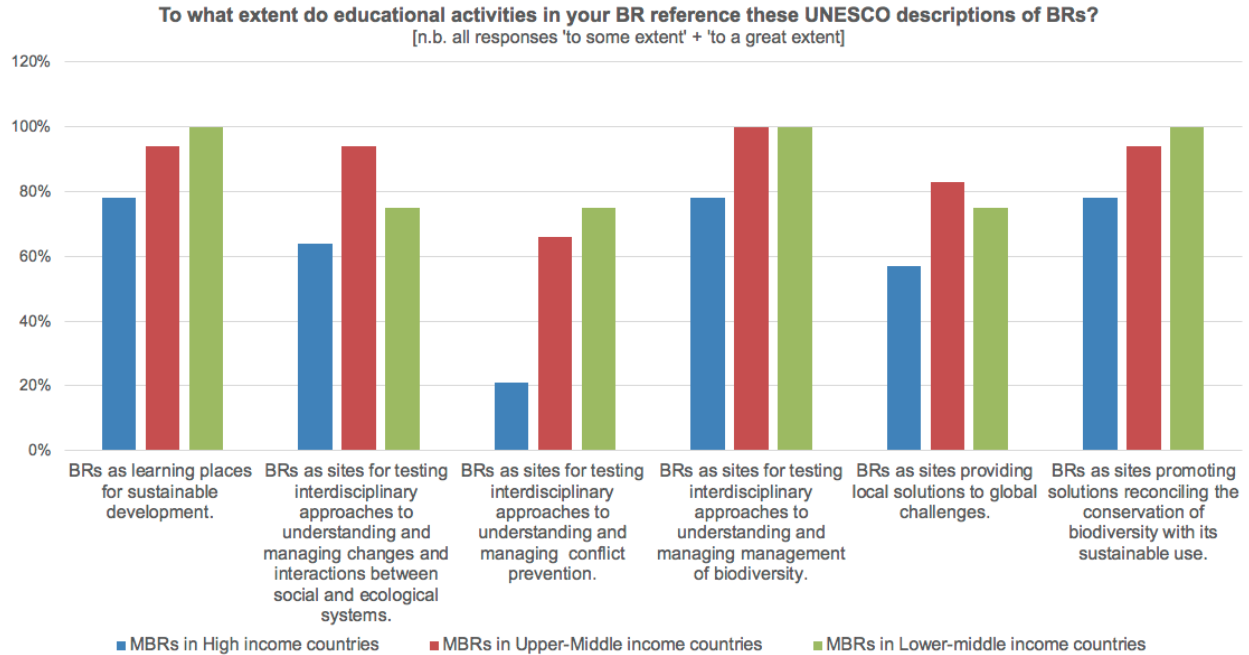
Figure 9: Alignment of educational activities with UNESCO descriptions of BRs - by GNI per capita index.

<u>Education outcomes</u>

The focus on improving knowledge and awareness is also evident in how participants observed *outcomes* among audiences as a result of educational activity in MBRs (Figure 10). The greatest (positive) shifts were observed in relation to awareness and understanding of the natural environment and sustainable development (49%), whereas such shifts were less evident in relation to audience attitudes (26%) and behaviours (23%).

Which of the following outcomes have you mostly observed among audiences as a result of educational activities?
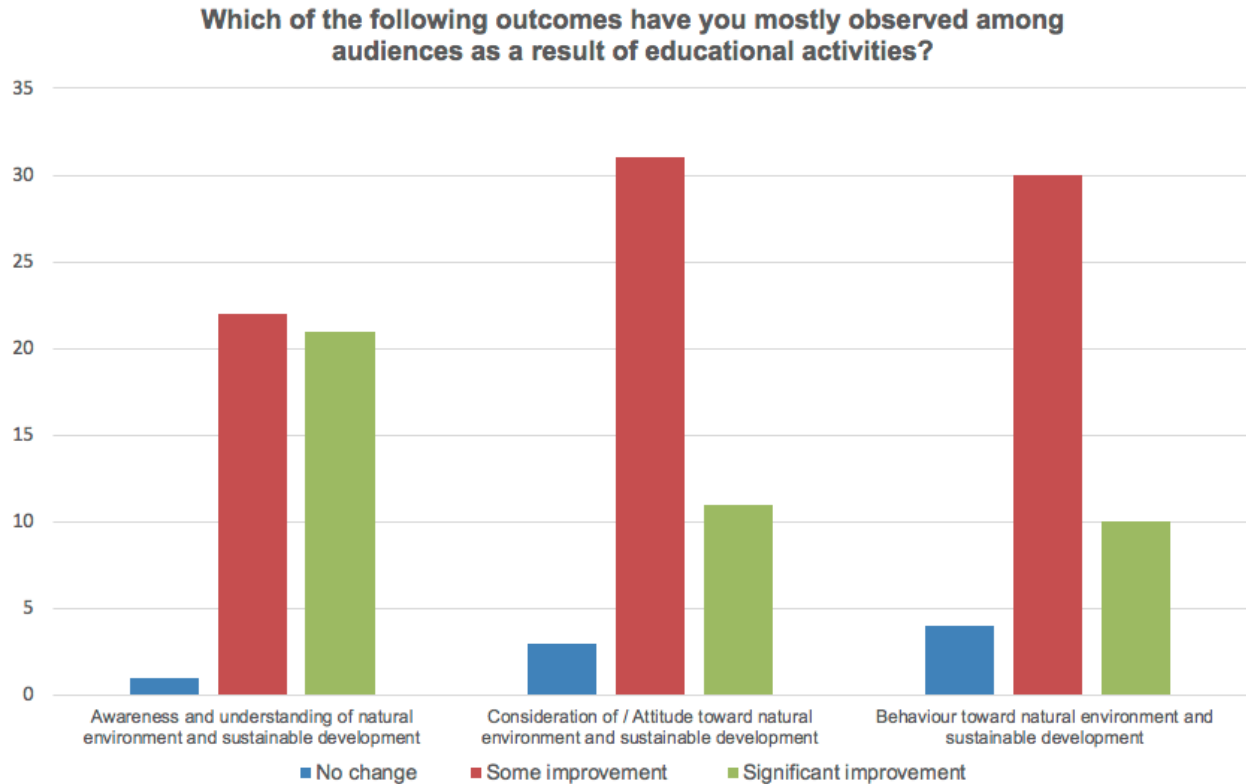
Figure 10: Observed educational activity outcomes among audiences in MBRs.

Qualitative interviews, however, again revealed that the specific characteristics and circumstances of the MBR and their staff shape the extent to which education objectives achieve improvements in knowledge and awareness and/or shifting attitudes and behaviours. For example, in one MBR in Ireland the participant had a background in environmental education and behaviour change, and specifically targeted changes in attitudes and behaviours among local communities. In Japan, however, the focus was on improving knowledge and understanding, given a trend of depopulation, urbanisation and an ageing population.

These preferred alignments again underline how delivering education to establish knowledge and awareness is the primary focus, but is closely followed by a more adaptive approach related to ecosystem management and sustainable development - as local circumstances permit.

5.3 Educational content and materials

Educational content

A wide variety of topics are taught in MBRs (Figure 11), in particular ecosystems and biodiversity, sustainable development and tourism, which are taught 'frequently'.
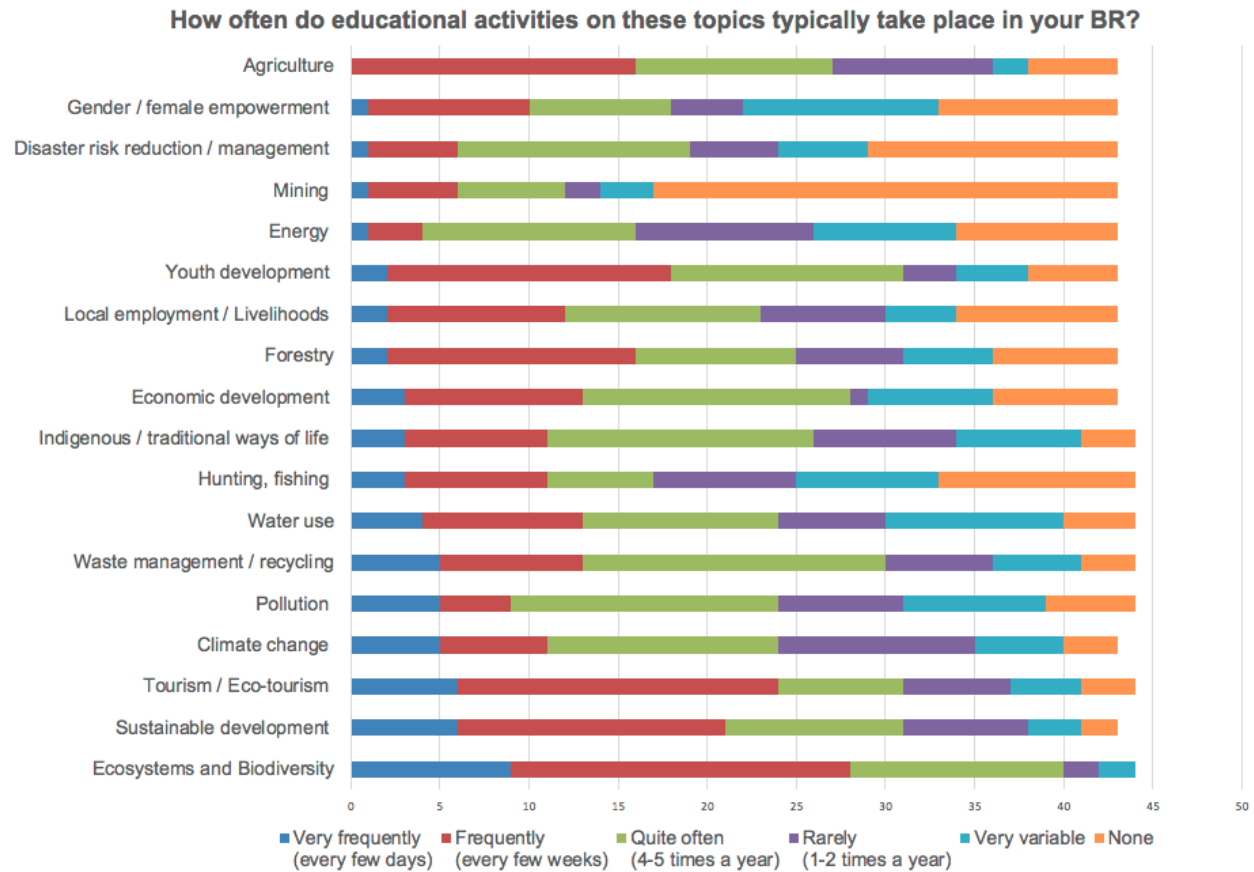
Figure 11: Frequency of educational activities by topic.

Sustainable development and environmental protection are two closely intertwined, key topics, and MBR managers view them as tangible and highly relevant topics for local communities. Inevitably, local issues influence topics that are taught, and the way they are delivered. Examples of issues highlighted by study participants as of particular importance include:

- Invasive species
- Deforestation
- Coal mining
- Mass tourism
- Unemployment, poverty

- Affordable housing

- Depopulation

- Extreme weather, glacier melt (climate change)

- Livestock, agriculture, forestry

> *"Poverty is a challenge when you want to stop deforestation, as they rely on firewood for cooking"*
> [Youth leader, Mt.Elgon BR, Kenya]

The majority of these issues relate to land use and how local communities engage with their environment. As interviews with study participants demonstrated, these issues are often contentious, and education is viewed as a way for MBRs to inform local communities on the impact of some of these practices.

> *"BRs are models for sustainable development, but they are always rooted in tensions and conflict. But that is the point, and we all have to carry that tension at the forefront of what we do"*
> [Coordinator, Wester Ross BR, United Kingdom]

Cognisant of these tensions, MBR staff are diplomatic and pragmatic in how they integrate these local topics into their educational activities. A key aspect here is how these issues vary with regard to causal behaviours at the local and/or global level. Climate change in particular was widely mentioned as an issue affecting mountain regions, with extreme and erratic weather patterns impacting ecosystems and local communities.

> *"We notice there is more extreme heavy rain and the mountains are getting more dangerous, so it is very important for the inhabitants to learn about this"*
> [ESD Research Associate, Berchtesgadener Land BR, Germany]

However, the causes of climate change also reflect behaviours on a global-scale, and one that therefore cannot be solely mitigated or controlled by local communities. This is particularly the case with those MBRs situated in regions characterised by low carbon emissions (e.g. Africa).

As a topic, climate change is delivered 'quite often' (Figure 11) and in some cases is viewed as contentious for local people. In one MBR in North America, the reliance of the economy on local coal mining means climate change is a challenging topic, though staff were making gradual progress by teaching visibly tangible topics, such as biodiversity and geology, and then gradually introducing climate change once audiences are more familiar with the context.

> *"The local highway is buckling, as it is built on a huge glacier that is melting due to climate change, so we make field trips there and talk about the geology...and then try to add in the climate change message, and that way, people get it"*
> [Science and Resources Team Leader, Denali BR, USA]

In other cases climate change is considered too complex and distant for local people to engage with, especially where they are trying to attract people toward BRs in a positive context:

> *"Climate change...no. We don't talk to them about big problems, we keep small problems, as they are easier to discuss and understand"*
> [Executive Officer, Gerês-Xurés MBR]

On the other hand, many of the issues cited relate to local land use, and are being referenced in the educational topics being taught to local communities. Through highlighting local examples, educators in MBRs raise awareness of local communities in the hope that damaging practices and behaviours can be challenged and changed.

> *"We have a huge problem with invasive species, like Rhododendron. A big problem is that people have it in their gardens, and right next to farmland, so we have to get the message out"*
> [Biosphere Officer, Kerry BR, Ireland]

Some study participants align aspects of educational content with local socio-economic issues, to raise awareness of how BRs can meet the needs of both people and the environment. This is

viewed as a community-led approach, targeting tangible aims for local people, and ties them closely with the aims and objectives for the BR as a whole.

> *"We tend to go with the priorities of the communities. Our strategic plan was based on talking to communities, to draw out common themes and desires...so things like affordable housing, which helps young people stay in the area"*
> [Coordinator, Wester Ross BR, United Kingdom]

The logical extension of focusing educational activity on socio-economic challenges and opportunities is training, and in some cases participants were training local people on specific programmes.

> *"Typically we pick something that is indigenous or local, such as a mountain plant, and build a business around it. A current example is honeybush tea"*
> [Coordinator, Cape West Coast BR, South Africa]

Of note here is where two participants observed how older local residents were engaged in traditional land use and agricultural practices, many aspects of which were sustainable, yet they were unaware of the concept of sustainability as couched in the language of international development (as described by Garcia-Campos, 2019). However, in both cases this promising scenario was countered by an ageing population, depopulation and a disengaged younger population. In the MBR in Japan, they were keen to find ways to harness their knowledge and to pass it onto others.

> *"Most of the people are old and they don't understand the BR concept or the sustainability concept - but I think they are doing sustainability in how they use natural resources"*
> [BR council advisor and Assoc. Prof. Univ. of Tsukuba, Mount Hakusan BR, Japan]

In Canada, a focus on inclusion of First Nations in public life is increasingly evident in MBRs. Mount Arrowsmith BR is working with indigenous communities and considering how their unique environmental knowledge can feature in their education content.

> *"We are thinking about developing youth programmes specifically for sharing indigenous knowledge, such as the cultural and traditional uses of plants, their use in medicines"*
> [Coordinator, Mount Arrowsmith BR, Canada]

Educational materials

The majority of MBRs (88%) create and adapt their own teaching materials, typically sourced from their own knowledge, and supplemented by the knowledge of local communities and via online sources (56%) (Figure 12).
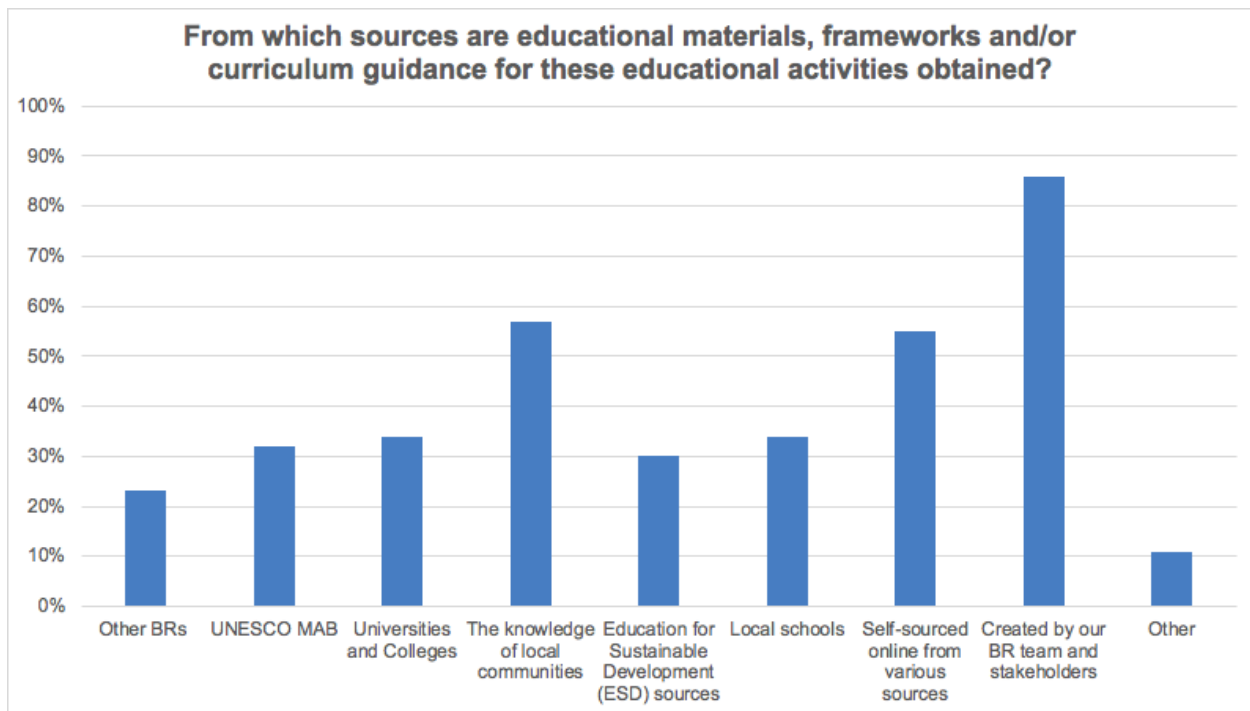
Figure 12: Sources of educational materials, frameworks and curriculums.

Aside from UNESCO MAB setting their designated status and core functions, BRs and MBRs enjoy a certain level of independence in how they manage their activities and conduct education. This extends to how they source content for teaching, as there is no set BR curriculum per se.

> *"We create them ourselves. We borrow materials from UNESCO, universities, the*
> *internet...we don't have to adhere to standard programmes"*
> [ESD Research Associate, Berchtesgadener Land MBR, Germany]

Also of note here is that 58% of participants source material from the knowledge of local communities when creating teaching materials. These preferred sources suggest MBRs are resourceful and locally-minded in how they devise and tailor educational content to meet needs of audiences.

Searching, collecting and verifying sources of education content from online sources is widespread among MBR educators, and is particularly useful for remote MBRs.

> *"We look online mostly. A number of sites on biodiversity, and other aspects of*
> *park management. That is where we get the know-how"*
> [Youth leader, Mt.Elgon BR, Kenya]

However, for those MBRs in regions outside of the main UN language groups, there are limitations in how able they are to identify materials in their native languages, or the time and cost of getting them translated.

> *"...the local community who do not understand English, so there's a need for*
> *English to Swahili translation, which could be done by local people - but they*
> *would need funding*"
> [Youth leader, Mt.Elgon BR, Kenya]

Content sourced from formal institutions and platforms, such as universities, colleges, ESD and UNESCO are all used to some extent, but less so than self-sourced materials, as described. Some

MBRs have ongoing connections with colleges and universities, where there is some exchange of students, teaching opportunities and learning materials.

> *"But for sustainable development goals we draw from UNESCO, and we have*
> *expertise we utilise from university professors in the field"*
> [Science and Resources Team Leader, Denali BR, USA]

Study participants suggest UNESCO could create a core platform of BR content that could then be customised to reflect the needs of individual BRs. Such a central repository of relevant and high quality content could provide clarity on key generic topics, such as biodiversity, climate change, human activity etc., that affect BRs across all types of landscape. Such content need not go into extensive detail, but provide a structure of key themes and topics, and prompts for further development of specific areas of content as required.

> *"There is scope for an overarching organisation like UNESCO to produce*
> *materials around themes like ecosystem services, targeted at different age groups. I*
> *don't like to use the world 'curriculum', but it could give you the baseline for*
> *people to start with, because at the moment I am essentially creating the content*
> *myself"*
> [Biosphere Officer, Kerry BR, Ireland]

Interestingly, sourcing educational content from other BRs was the least selected (23%) of the response options. While MBRs are in contact with other BRs / MBRs, typically in the same country, there is limited, coordinated sharing of educational material due to different environmental and social characteristics of the reserves. While there was some interest in connection between MBRs specifically, there was also recognition that many MBRs also featured other landscapes as well as mountains (coastal, riverine etc.).

Levels of interest in networks between MBRs / BRs was greater in regions where shared environmental issues, culture and language made this more appealing. For example, in East Africa, where there are commonalities of language (e.g. Swahili), landscape and culture, and in South

Africa, where greater engagement between BRs in sharing education materials could help ameliorate the impact of funding issues.

5.4 Educators and audiences

<u>Educators</u>

Those delivering educational activities in MBRs reflect a wide range of backgrounds, specialisms and organisations (Figure 13). Full time MBR staff, local volunteers and NGOs are most commonly represented.

Which of the following groups help deliver these educational activities?
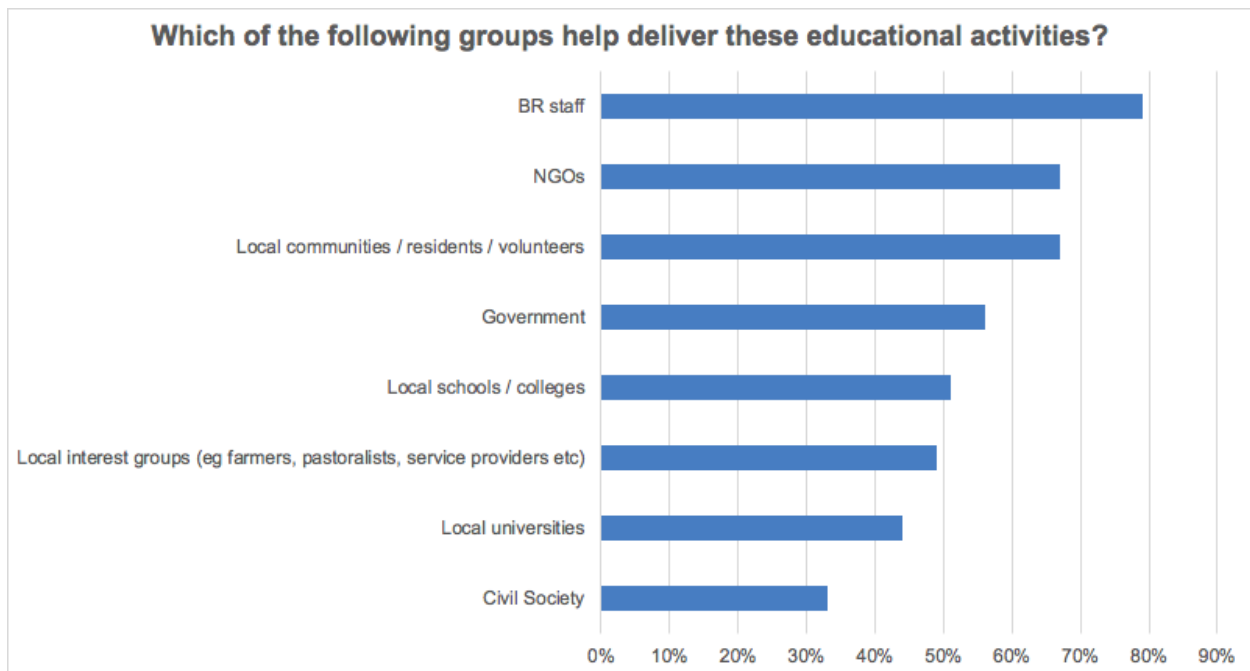
Figure 13: Deliverers of educational activities in MBRs.

The presence and makeup of educators largely reflects characteristics and setting of the MBR, with regard to funding, local demographics, presence of schools and other factors that may create an additional demand for education, such as mass tourism. MBRs in higher income countries tend to have more consistent funding streams and are more likely to have a team of educators with a range of specialisms.

> *"We have two educational specialists, those who focus on the tourists and then educators focus on the kids and they organise it, and do the logistics"*
> [Science and Resources Team Leader, Denali BR, USA]

In addition, local communities in higher income countries tend to have older populations than in lower income countries, with greater presence of retired volunteers who help provide educational activities.

Lower income countries, however, tend to have very limited funding, and rely on a small number of semi-employed individuals to lead their educational programming. The local populations are more likely to be characterised by younger, poorer communities, with less scope for volunteering. However, this situation can also provide opportunities for young people and women.

> *"I'd like to see women and youth involved, especially the youth...as they are unemployed mostly, and can learn about management and teaching"*
> [Youth leader, Mt.Elgon BR, Kenya]

To a great extent the makeup of the education delivery team is shaped by funding, and even in high income countries there is some level of uncertainty with regard to the permanency of contracts for full time educators.

Where there is stable funding, a large cohort of school children, local volunteers and high tourist numbers, these are optimum conditions for a large and dedicated team of educators in MBRs, including specialists. Of the 44 MBR participants in this study, their given specialisms fall into five categories (Table 3). While the majority are managers and coordinators, many also have backgrounds in environmental science, development and/or education.

Role / Specialism	#
Directors / Managers	13
Coordinators	11

Environmental educators	8
Scientists / Researchers	7
Community / Youth engagement / Visitors / Interpretation	4

Table 3: Categorisation of job titles of study participants.

Audiences

Audiences participating in and benefitting from educational activities are dominated by children (91%), adults (84%) and young people (79%), and around half of all MBRs deliver education to older audiences and indigenous people (Figure 14). There is a slight gender skew toward females (56:44), but people with disabilities and/or learning difficulties are the lowest represented audience category (30%), though the overall population of these two categories is not known.
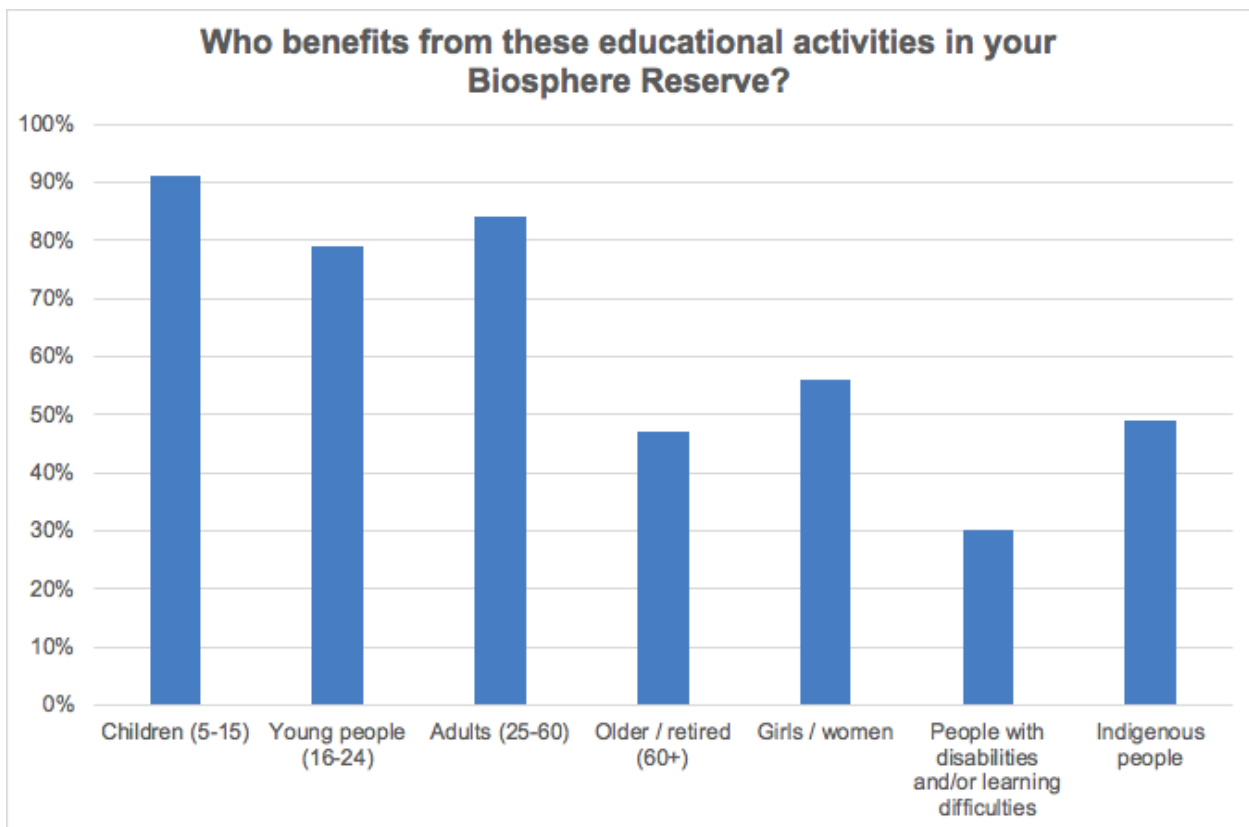
Figure 14: Beneficiaries of educational activities in MBRs.

57% of participants agreed that local communities are *'very interested in and engaged with educational activities'* in their MBR, with only two surveyed participants disagreeing (Figure 15). While interviews with participants demonstrated how varied MBRs are in terms of the characteristics and needs of their local communities, all participants were positive about learning experiences with local people with regard to overall levels of interest and engagement on both sides.

To what extent do you agree / disagree with the following statement: *"Overall, local communities in this BR are very interested in and engaged with educational activities"*
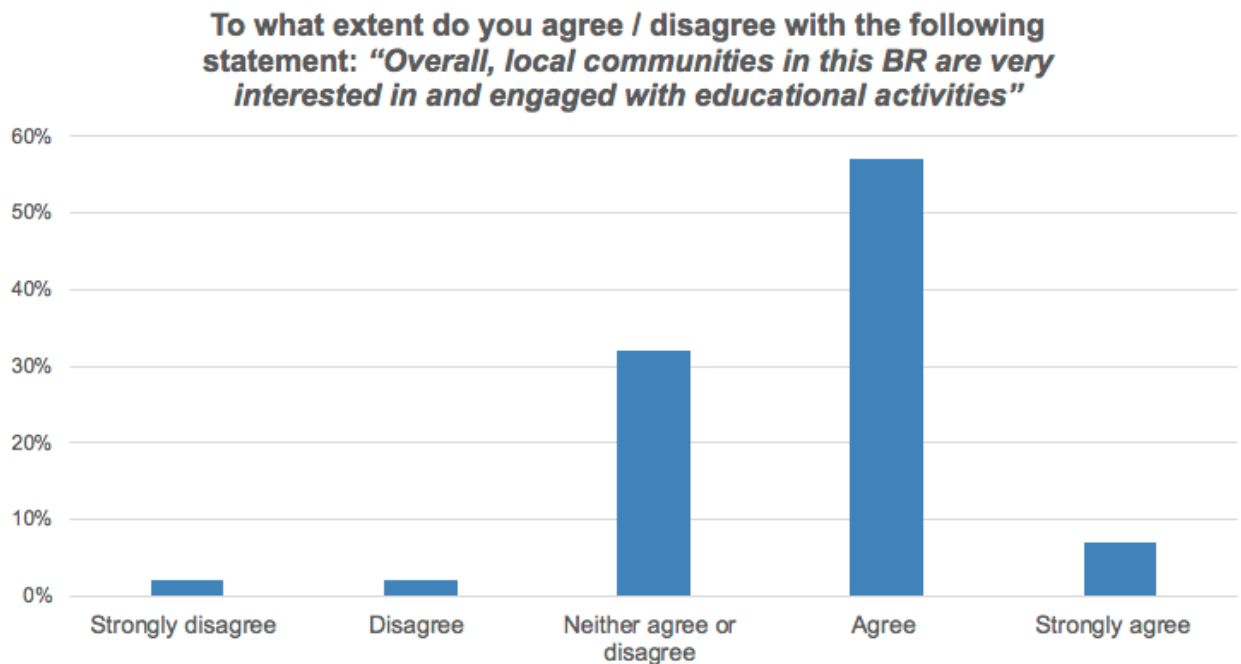
Figure 15: Local community interest and engagement in educational activities.

Qualitative interviews show that recipients of educational activities in MBRs vary across country and region, and by season. For example, for an MBR in North America, a key audience is summer tourists, for whom they provide educational activities in the reserve. However, for MBRs in lower income countries, audiences are more related to ongoing engagement with local communities, as tourism is typically less supported and evident.

Children and young people are widely regarded as valuable audiences, in terms of ease of access via local schools, but also as they are considered amenable to environmental topics and have potential to represent a more environmentally conscious future generation. Primary schools (c.4-11

year olds) in particular are viewed as effective forums for educational activity, as their curriculums are more flexible in accommodating outdoor learning, and some regard this life stage as being particularly open to environmental messages and new learning experiences.

> *"I find primary school students, say, from 8-12 years...they seem to be very much open and exploratory in their mindset at that age"*
> [Biosphere Officer, Kerry BR, Ireland]

Secondary schools (children aged c.12-16/18 years) are viewed as more challenging for education activity as their curriculums are more tightly structured, teachers have less time to liaise with external providers and are less able to allow for activities not directly aligned with exams.

> *"...so we try to say to the teachers this is what we want to teach them - it is the same thing, but in a different way. But it is difficult, as they have exams to do"*
> [Executive Officer, Gerês-Xurés MBR, Portugal]

In addition, teenage children can be considered less receptive to new ways of learning (than sub-teens), due to peer pressure and emergent sensitivities around self identity.

In lower income countries, different challenges are presented in terms of accessing local young people. For example in an MBR in Kenya, moderate levels of literacy and high rates of teenage pregnancy and HIV mean accessing young people requires additional planning and consideration. The MBR manager in this case targeted various public holidays as occasions where young people are more likely to be available, and the provision of meals and transport also helped recruitment.

> *"Teenage pregnancy is high, so many girls are not going to school. There is also a problem with sensitisation of HIV. But, if you find what motivates them, then they come - like meals and transport"*
> [Youth leader, Mt.Elgon BR, Kenya]

While MBR educators are keen to access adults from local communities, in many cases meaningful engagement is challenging due to busy lifestyles, low awareness and interest, and

difficulties in recruiting and attracting older audiences. In lower income countries this can be compounded by costs of transport to get to education venues. In MBRs in Japan and Portugal, depopulation and an ageing population make achieving meaningful education and impact a challenge. This change in demographic can also represent a loss of traditional land use knowledge, that is not always being made up for by new, younger residents.

> *"It's a very traditional culture, mountain culture, a closed mentality and a very old population...so a lack of young people with novelty of ideas and no ways for new ideas to come in"*
> [Biologist, Picos de Europa BR, Spain]

However, accessing and engaging adults and parents in local communities is considered important as they are at a lifestage where their decisions and behaviours can have consequences in terms of land use and impact on the MBR.

> *"The children understand very well what we mean, but then still the parents do the consumerist behaviours...and how can you reach them?"*
> [ESD Research Associate, Berchtesgadener Land MBR, Germany]

Some study participants identify that one indirect way of accessing parents is to educate children and then view them as the conduit through which messages relating to the MBR and environmental sustainability can be discussed with parents at home. In addition, they recognise that children will mature into young people and adults, and therefore represent the attitudes and behaviours of the next generation.

> *"If you start with education in schools... when they return home from a workshop they will say 'this is what we learnt today' and this is what it means, and it might inspire the parent"*
> [Biosphere Officer, Kerry BR, Ireland]

An extension of this approach is to teach both children and parents together, through intergenerational workshops (Mitrofanenko et al, 2018).

> *"I have done some intergenerational workshops and it always amazes me as a lot of the time we find it's the parents who are more engaged on the topic and have more questions"*
> [Biosphere Officer, Kerry BR, Ireland]

Landowners are another key audience for MBRs, and while there is limited evidence of structured educational engagement, in some cases MBR teams are exploring such opportunities with specific aims and objectives relating to their land use. However, a diplomatic approach is also required, in order to avoid local landowners feeling alienated and targeted.

Around 50% of study participants cited indigenous communities as an audience of their educational activities, and their traditional knowledge of land use and plants is of particular interest. While MBRs from Alaska and Canada are actively engaging with indigenous communities, some groups face socio-economic challenges (unemployment, migration) that result in existential issues such as assimilation and loss of culture. Clearly such challenges can inhibit their full engagement as a distinct and valuable 'indigenous' audience.

> *"The Athabaskan community is part of the landscape, but there are only 300 tribal members left, semi-assimilated into white culture. Some villages are abandoned due to economic migration and their subsistence lifestyle is disappearing"*
> [Science and Resources Team Leader, Denali BR, USA]

5.5 Types of education delivery

MBRs deliver educational activities through a wide range of different approaches. The most favoured is field-based, participatory and experiential learning, typically where audiences engage with education in outdoor settings in the MBR (Figure 16).
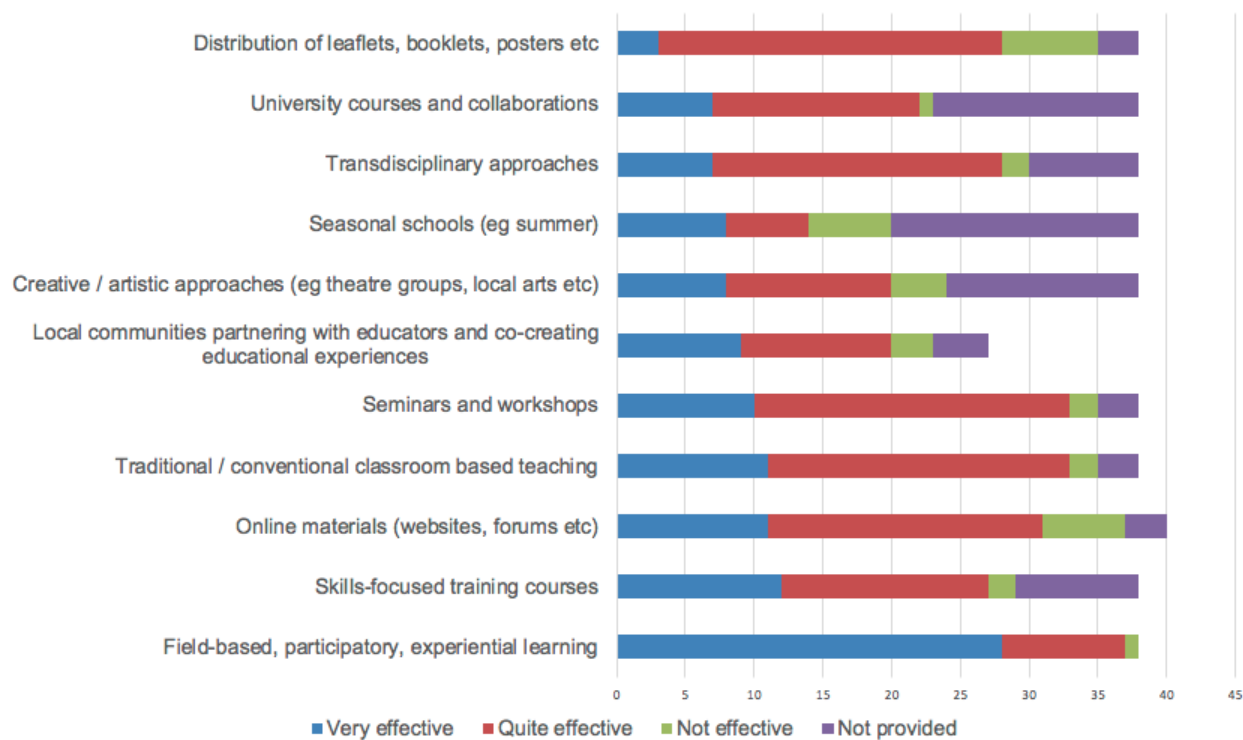
Figure 16: Effectiveness of different methods of delivering education in MBRs.

Study participants reported that field-based approaches are particularly popular and effective, and MBR educators are acutely aware of how such settings create conducive learning environments for people of all life stages.

> *"Children are very happy to go into nature, so when you go into a forest or a river, they are always very interested"*
>
> [ESD Research Associate, Berchtesgadener Land MBR, Germany]

As well as being outdoors, conventional classroom teaching, seminars and workshops are also popular with educators, and to a lesser extent local communities partnering with educators to co-create learning experiences. Although printed and online materials are viewed as 'quite effective', it is noticeable that face-to-face teaching (and outdoors) is the most preferred.

"I believe the best way is to talk to them...and not by the internet, but in small groups, face to face, in their communities"
[Executive Officer, Gerês-Xurés MBR, Portugal]

Being in mountain settings, the additional benefits of meeting face-to-face are that internet connections may be absent (or slow), and that people living in isolated communities find satisfaction in meeting others.

Study participants were asked to share examples of delivering educational experiences that they felt were particularly engaging and effective. These are detailed and categorised in Table 4.

Delivery approaches	Specific examples
Creative / artistic	Calendar art competition Garden design
Open Day / Presentation / Demonstration	Organic waste management MBR stakeholders present land use practices Landowner engagement days Celebration of water Exhibition for the reintroduction of the Bearded Vulture
Environmental educational camps	School forest classes Educational trails Hiking and environmental camps Nature excursions
Participatory sessions / knowledge events	Indigenous knowledge transfer conferences (elders to youth) Youth programme workshops
Specific topic events	Anti-poaching lessons Educating farmers on pollution of water sources Community based tourism Alpinism week Beekeeping programs Mycology Natural cosmetics Local wheat baking workshops Climate change adaptation lessons
Online	Tasks, games and video content
Print	Brochures

Table 4: Examples of effective delivery of education in MBRs.

Table 4 demonstrates the rich diversity of educational activities and their delivery mechanisms that MBRs implement. This diversity is reflected in the MBRs themselves, in terms of their landscape, ecosystems and local communities, and reaffirms the need for MBRs to have sufficient freedom to provide educational activities that best match the characteristics of the reserve.

Such a rich variety of modes of learning also provides opportunities for educators to achieve meaningful outcomes from these engagements with local people, with regard to attitudes and behaviours. One such example in an MBR in Ireland relates to a visual example demonstrating the benefits of retaining sphagnum moss landscapes with regard to water retention and purification. Such a distinct example gives a sense of what is achievable with adult audiences such as local landowners, and the potential implications of this on local land use within MBRs.

> *"I like to use very visible examples for habitat awareness training for farmers. We have three tubs - one has healthy sphagnum moss in, one has a slightly degraded habitat and one has bare earth, and they have outlets at the bottom and you pour water in and then you see water coming out at the bottom. The sphagnum moss one, you have to pour 3-4 times more water in to even get any water coming out, and it comes out crystal clear. In the slightly degraded habitat one it comes out a bit quicker and it comes out a bit brown, and in the very degraded habitat one it comes out brown and straight away. When farmers see that for the first time, it has a strong visual impact - they were like 'Oh Jesus! If only someone had showed us this years ago we would have understood it much better'"*
> [Biosphere Officer, Kerry BR, Ireland]

Ultimately, study participants are aware that it is in the broader interests of all communities living within the MBR that land use is managed in an effective way, as the outcomes benefit everyone. Finding ways to demonstrate and teach this to people helps contribute toward this shared understanding and aim.

"We teach the Shamba system whereby communities are allowed to plant trees in degraded areas, and I think that does have a great impact, and we can also teach them issues to do with management of the reserve"

[Youth leader, Mt.Elgon BR, Kenya]

In terms of cohort size for educational activities, the general consensus is that engagement is stronger with smaller groups than larger ones, as this enables for a more appropriate and effective level of teaching and discussion.

"We say a maximum of 15 in a workshop, whereas in a school you are stuck with say 30-35 with one teacher, which makes it a very different dynamic"

[Biosphere Officer, Kerry BR, Ireland]

While online forms of education were ranked third (Figure 16) as an effective mode of educational activity, interviews suggest online delivery is viewed as complementing face-to-face modes, rather than as primary delivery approach. This ranking also reflects the recent shift toward internet-based teaching as a result of the Covid-19 pandemic and restrictions on public gatherings. However, disparities in internet access, ownership of devices and literacy levels mean online modes of delivery are still largely provided by higher income economy countries (Figure 17).

Percentage of MBRs study participants who rated online forms of educational activity as 'very effective' (by income level of national economy)
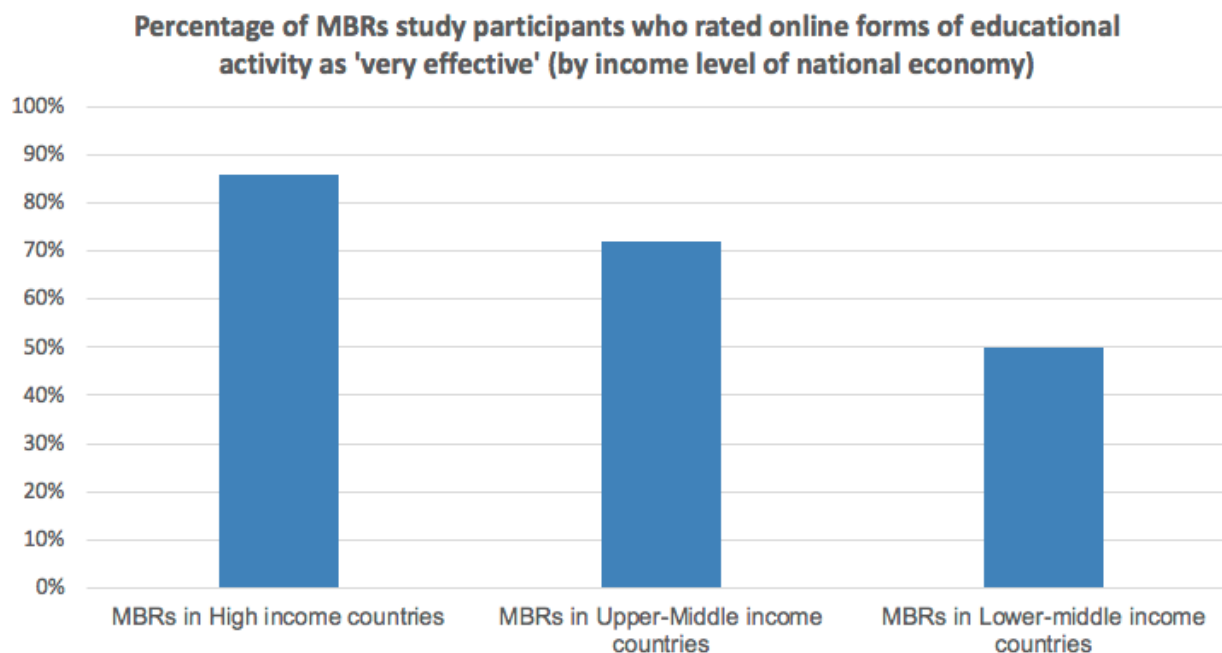
Figure 17: Online forms of educational activity rated as 'very effective' by GNI.

Finally, two MBRs viewed technological innovations as playing a role in enriching educational experiences for young people. In Alaska, an acoustic ecologist creates applications for children to visualise birds through their recorded bird song, and in South Africa an MBR coordinator is planning to develop an Artificial Intelligence (AI) educational course at the MBR, in the field of agro-economy. Both examples highlight how fusing the outdoors experience with technology can create a compelling mode of education.

> *"One thing we do is a hybrid where our acoustic ecologist uses software to record the environment and turns the acoustics into visualisations, so when you look at the screen and see three different birds, you can recognise the sounds of the birds outside. Then we tell them about the bird's conservation needs. Kids love going out, but when you connect a gizmo to it...that makes it more powerful"*
> [Science and Resources Team Leader, Denali BR, USA]

> *"AI is my business field, applied to environmental agro-economy and climate change, and there are many startups emerging in this now. If we offered an AI Biosphere Reserve course it would be hugely popular"*

[Coordinator, Cape West Coast BR, South Africa]

5.6 Funding for educational activity

Funding arrangements for educational activities in MBRs vary considerably, with a mix of national and local grants featuring most prominently (Figure 18). Interestingly, 28% reported having no funding allocated for education at all, relying instead on the commitment of volunteers.
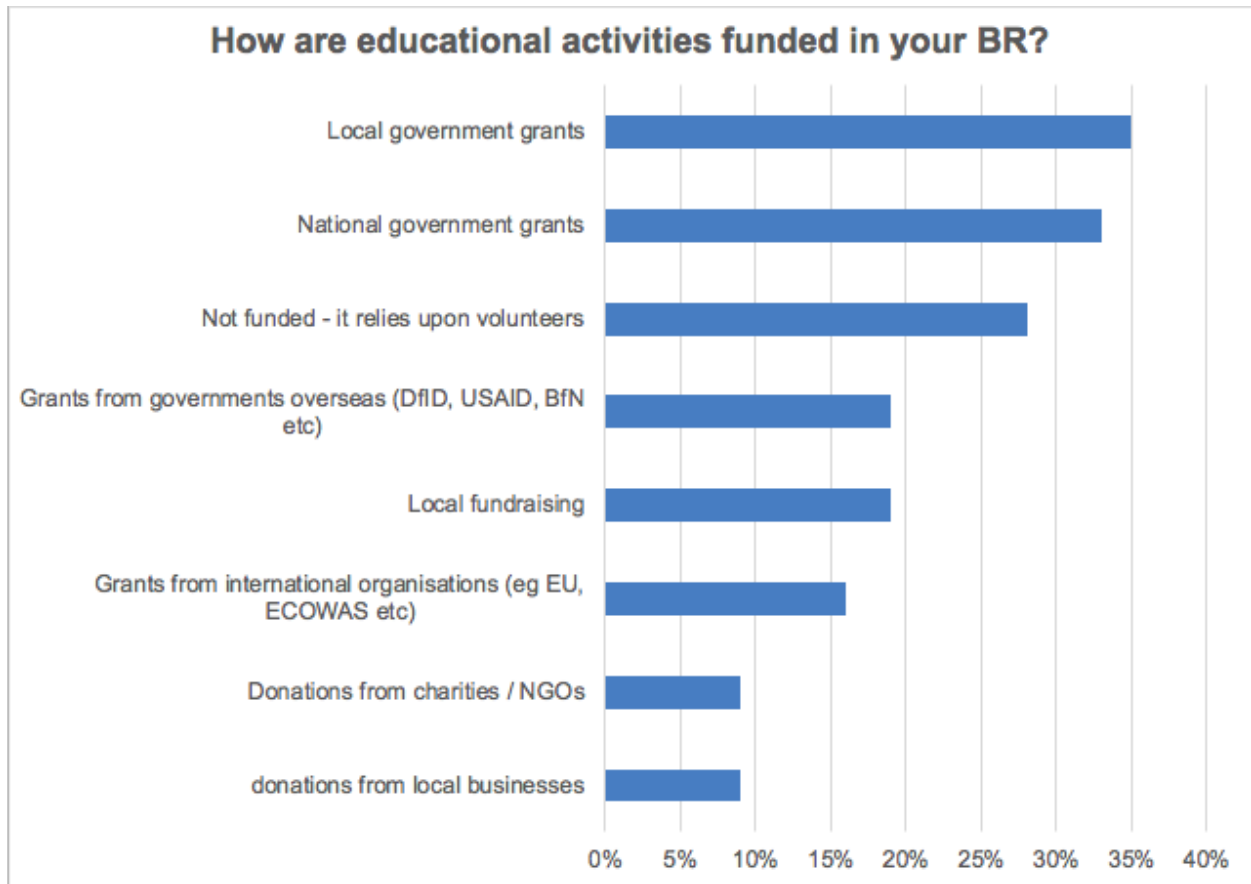
Figure 18: Funding of educational activities in MBRs.

There is some variance in funding streams by level of GNI per capita, as shown in Figure 19 where MBRs from lower-middle income countries struggle with no funding, a reliance on volunteers and donations from charities, and to some extent, government grants. MBRs from High-income countries, meanwhile, receive most of their funding from national and local government,

implying a more reliable, longer-term funding stream. MBRs from Upper-middle income countries appear to have the broadest range of funding, across all source options provided in this survey.
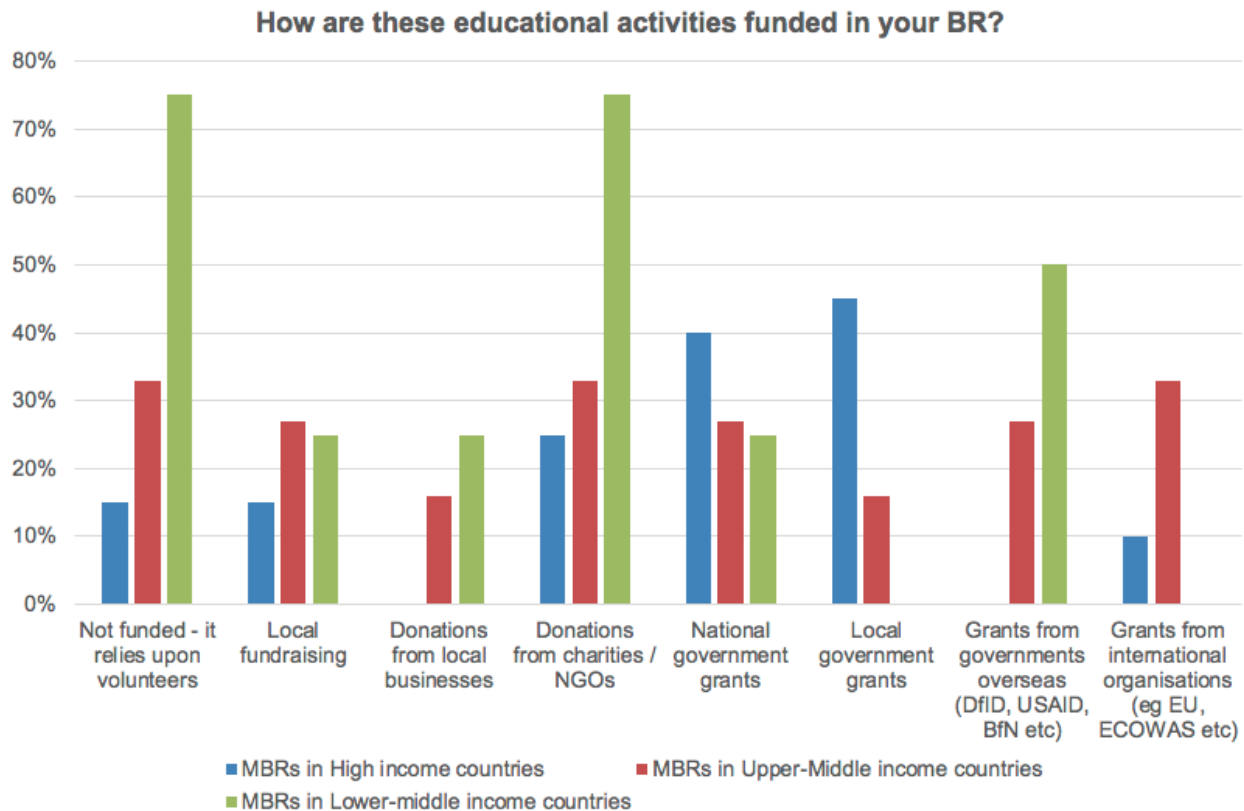
Figure 19: Funding of educational activities in MBRs by GNI.

As mentioned, some of the MBRs studied lack funding for educational activities. In such cases, commitment of staff, sometimes unpaid for periods of time, is what maintains a level of educational activity - although the quality of education would be improved with funding.

> *"Finance is an issue, as with no funding there is a chance you can deliver - but only at a minimal level"*
> [Youth leader, Mt.Elgon BR, Kenya]

However, MBRs in higher income economies also contend with limited and/or intermittent funding streams allocated to educational activity. The effects of this are most evident in their ability to deliver courses, and uncertainty around the duration of contracts for educators, which

makes planning for the future challenging. In addition, staff spend time and effort on applying for new sources of funding, which could otherwise be spent on teaching.

> *"With permanent jobs and more people in the education part of our administration, we could do more work and give better quality and quantity of education. We could reach more people"*
> [ESD Research Associate, Berchtesgadener Land MBR, Germany]

Interviews with participants suggest they try to circumvent this challenge through capacity building, relying upon volunteers and optimising activities based on their limited resources.

> *"Eventually...it all comes down to funding. Educational activity is also done by volunteers and we work with other groups to have more capacity to deliver our aims and goals"*
> [Coordinator, Wester Ross BR, United Kingdom]

When asked to identify the greatest challenges of providing educational activities across a range of issues (Figure 20), lack of funding is also the most cited reason (31%).
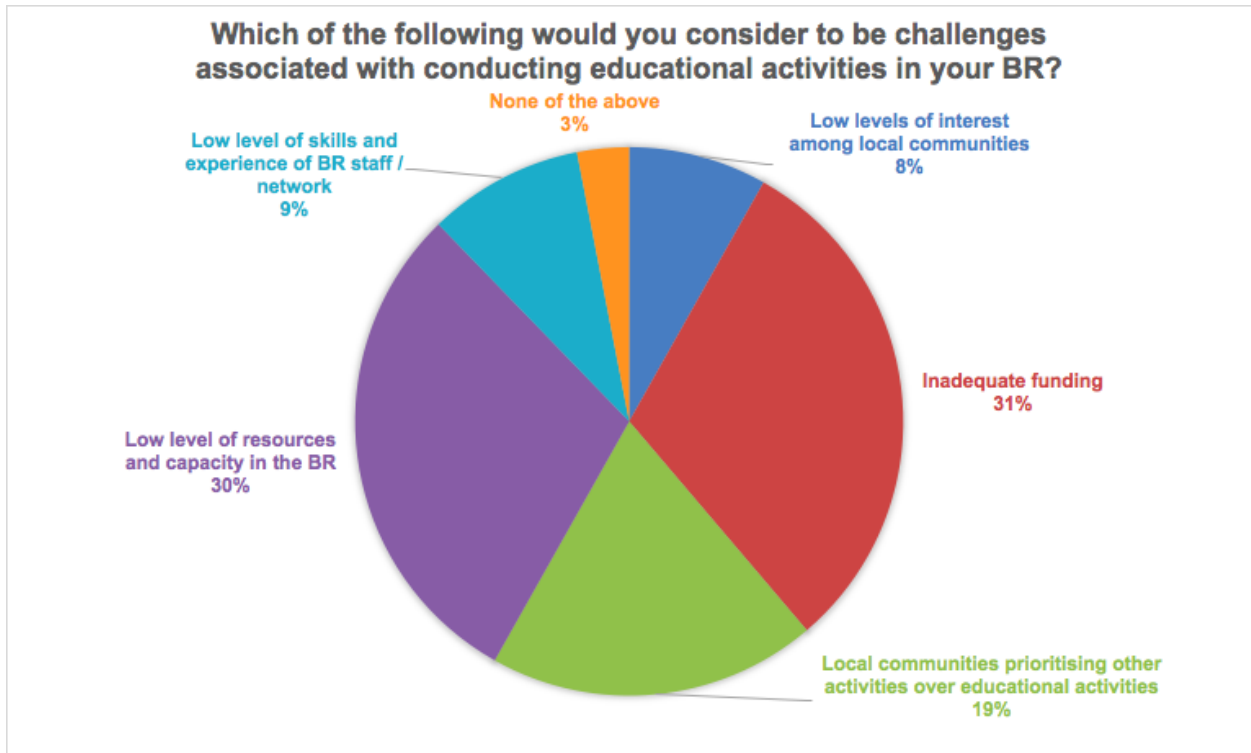
Figure 20: Challenges of conducting educational activities in MBRs.

When asked what types of change would improve the quality of education being provided, the majority of participants identified greater funding (33%) as the most significant and desired change (Figure 21).
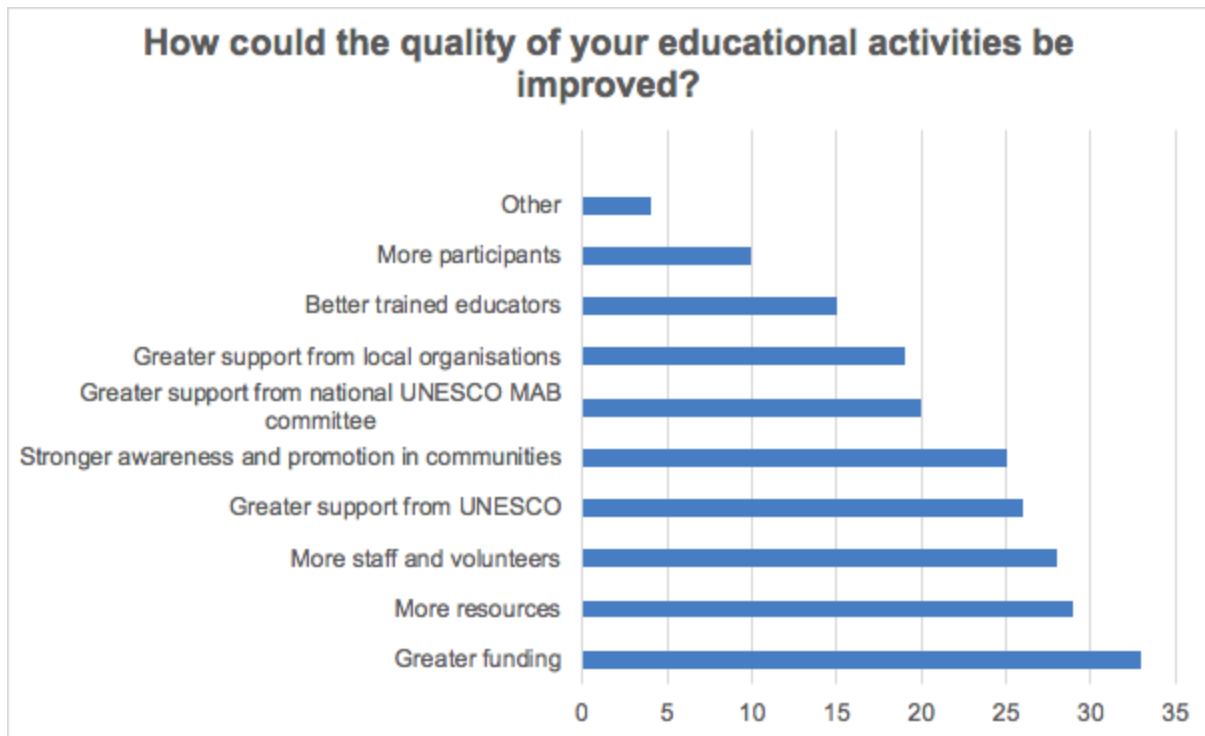
Figure 21: Improvements to quality of educational activity in MBRs.

Figure 22 shows there is some variance in how greater funding would be viewed as the most significant change - by MBRs across the income levels of countries. In six of the nine selected improvements there is a pattern of a decreasing percentage of (i.e. highest to lowest) significance attributed to each, from Lower Middle to Upper-Middle to High levels of income. This pattern suggests levels of GNI correspond inversely to their levels of need as related to their quality of educational activity.
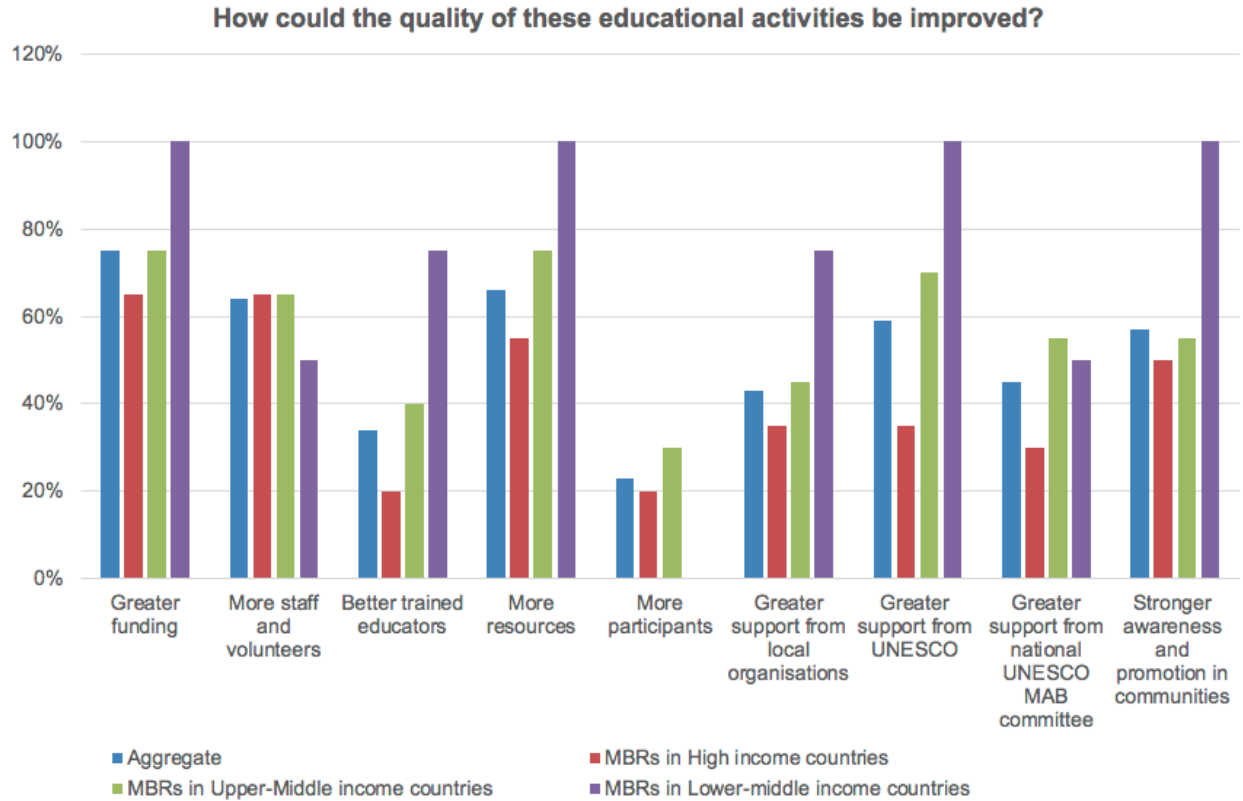
Figure 22: Improvements to quality of educational activity in MBRs by GNI per capita index.

Adequate levels of funding were also identified as the most important factor for ensuring engaging and effective educational activities in MBRs (Figure 23). While effective organisation and engaging and skilled educators were also considered as contributing factors, funding emerged as the key determinant factor.

Please rank the following in terms of their importance in ensuring an engaging and effective educational experience

Factor	%
Adequate funding	~30%
Effective organisation	~26%
Engaging and skilled educators	~23%
Well developed strategy	~20%
Interest from local communities	~12%
Engaging and appealing educational materials	~9%
Identification of tangible benefit (eg livelihoods)	~7%
Institutional support	~4%
Support in kind (materials, venues, transport etc)	~2%

Figure 23: Key factors in ensuring engaging and effective educational experiences.

It is also noteworthy how participants ranked interest levels of audiences, educational materials and support lower than the other factors, as discussed. Indeed qualitative interviews suggest they do possess good levels of organisation, experience and commitment, and that funding is the catalyst most needed to strengthen their capacity to deliver more effectively.

5.7 Mountain settings

The majority of participants believe that high-altitude mountain settings are more challenging landscapes in which to deliver educational activity (Figure 24), than other types of landscape.
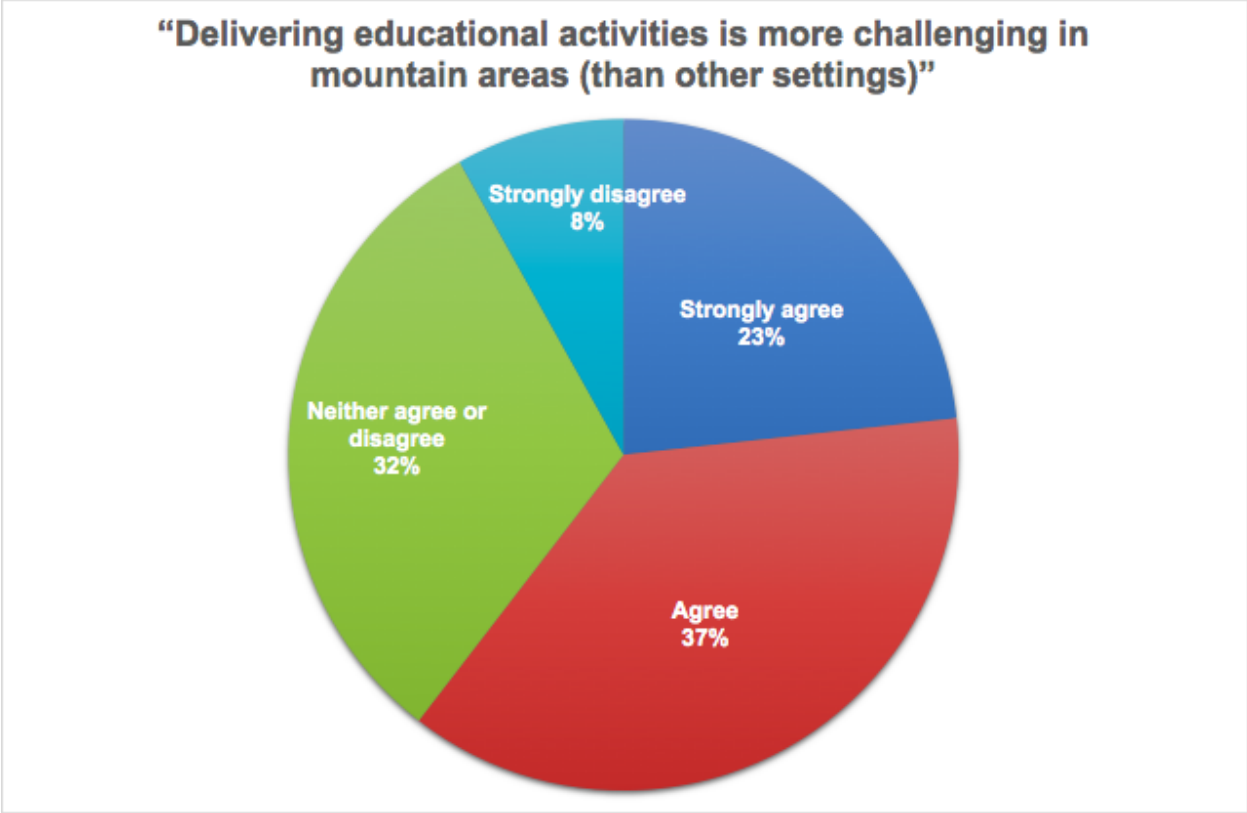
Figure 24: Challenges of delivering educational activities in mountain areas .

Such challenges relate to isolation of some communities, limited transport infrastructure and a challenging climate and topography. Local communities from MBRs in lower income countries are more likely to be impacted by these issues, with regard to getting to and from educational settings.

> *"We have poor roads, especially in the rainy season, and it is hard to access*
> *certain regions, so this requires sacrifices to attend education due to poor roads"*
> [Youth leader, Mt.Elgon BR, Kenya]

In higher income countries, the quality of transport infrastructure means local communities are less affected by extreme weather, and are therefore more able to attend educational activities throughout the year.

> *"The terrain is not a barrier at all"*
> [Coordinator, Mount Arrowsmith BR, Canada]

Interestingly, mountain ranges within some MBRs are largely uninhabited, privately owned and little visited by the public. In such cases, the mountains have a somewhat distant, inaccessible and symbolic presence.

> *"The mountains are largely inaccessible. You have to be mobile and able to trek for six hours. They are in the background for most people"*
> [Biosphere Officer, Kerry BR, Ireland]

5.8 Impact of COVID-19

The 2020/21 COVID-19 pandemic is affecting many MBRs and their delivery of educational activity. MBRs in higher income countries in Europe have been particularly affected, through the tightening and relaxing of lockdown restrictions. Temporary relaxation of restrictions have often resulted in greater visitor numbers to MBRs, with increases in human waste, littering and impact on local ecosystems.

However, for those periods when lockdown restrictions have been fully in place, MBRs have been unable to deliver any face-to-face educational activity. In its place, staff have shifted their delivery to online, including webinars and provision of written materials.

> *"With COVID we have not been able to go out and do any in-person workshops, so we are trying to transition to more covid-friendly resources that teachers can use in the classroom, or parents can use at home"*
> [Coordinator, Mount Arrowsmith BR, Canada]

However, shifting focus to online modes has also made MBRs acutely aware of the importance and value of connecting in-person with local communities.

> *"So now it's less of having that direct contact...and more a case of asking them to create a piece and submit it online. It's difficult, but we are trying"*
> [Biosphere Officer, Kerry BR, Ireland]

During periods of easing of lockdown restrictions, some MBRs have been able to conduct outdoor educational activity, albeit in smaller numbers.

5.9 The future

Finally, when asked about the future of educational activity in their MBRs, the majority are very optimistic (77%), as shown in Figure 25.
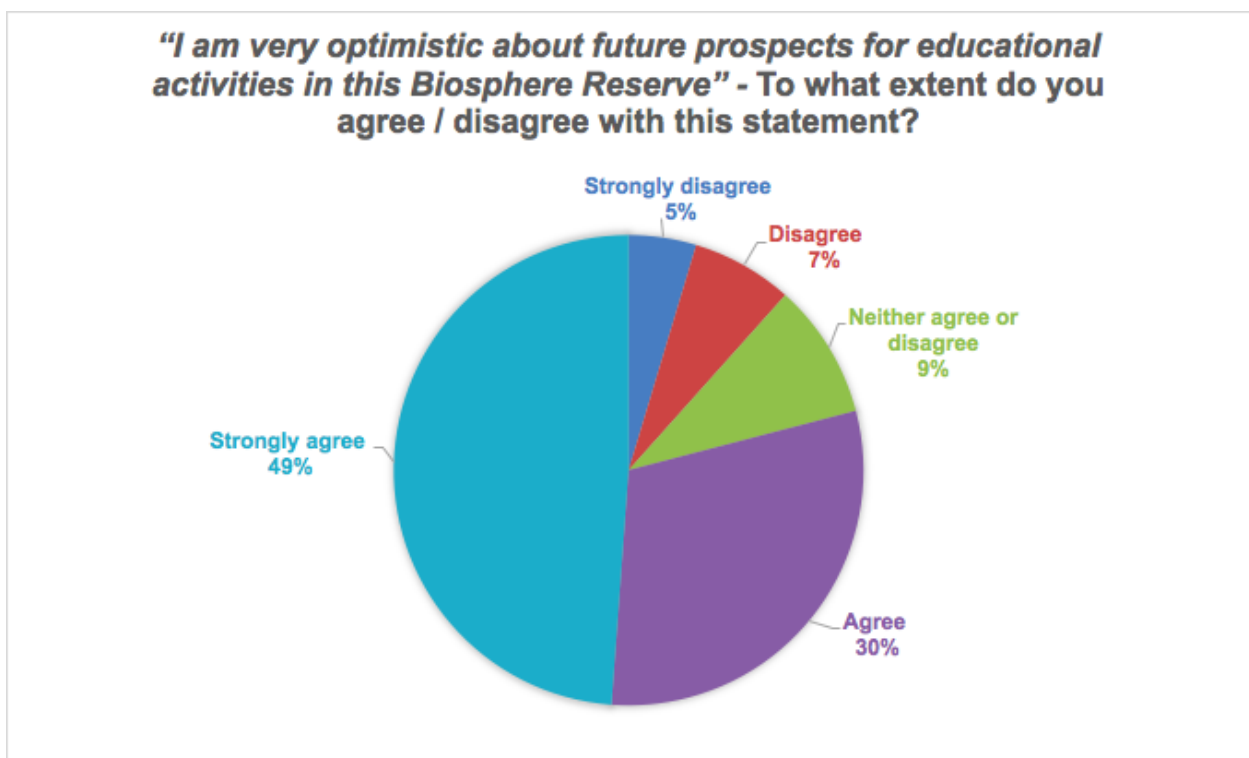
Figure 25: Levels of optimism regarding educational activities in MBRs in the future.

A range of suggestions were made as to how the future of educational activities could be enhanced, which fell into the following five categories:

Greater funding

Requests for greater and more sustainable funding were widespread among participants. Greater funding would enable MBRs to employ staff for longer contracts, develop infrastructure and build capacity.

<u>Stronger networking and exchange</u>

Stronger networks with other BRs, government, universities and other institutions were viewed as a way of developing education provision and other aspects of their work.

<u>Greater UNESCO support</u>

The majority of participants requested greater support from UNESCO, mostly relating to an educational platform of content for BRs, capacity building, M&E tools and a more active and ongoing engagement.

<u>Stronger engagement with local communities</u>

Participants are seeking stronger engagement with their local communities, to achieve greater impact through their educational activities. This includes better marketing communications, applying education to solve local problems and greater appreciation of community knowledge.

6. Interpretation

The findings suggest MBRs are delivering a rich diversity of topics and educational experiences, and are innovative in their engagement with local communities. The providers of educational activity in MBRs come from a range of relevant backgrounds, and are characterised by high levels of motivation and commitment.

MBR educators are resourceful and customise and create their own educational material, partly in response to the lack of formal materials provided by UNESCO. Materials are prepared from various sources, though there is a widespread request for UNESCO to create a platform of content for Biosphere Reserves that can be downloaded and customised by MBRs to suit their needs.

There appears a significant opportunity here for UNESCO and ESD to play a role in providing BR-specific education materials.

Of all the different methods and approaches of delivering education, the most preferred are face-to-face, experiential, outdoors and in small groups. In such scenarios the setting matches the content, and creates a positive context with holistic benefits for all.

For those who receive educational activities, the primary audience is school children, with local schools enabling access to large numbers of children. MBR staff are keen to engage with adults and landowners, yet accessing both remains a challenge. While youth are highlighted in ESD as a key target audience, participants concede they remain harder to access than children, due to constrained school curriculums. Greater engagement with youth remains a challenge and an opportunity for MBRs.

The aims and objectives of educational activities in MBRs are largely aligned to those of ESD and the UNESCO MAB programme. Table 5 indicates the extent to which study findings align with the Five Priority Areas of ESD, and are coded by a traffic light rating (right column), signifying the level of alignment. While all findings are self-reported by educators, and evaluation questions were not closely framed against these definitions, it nevertheless provides a useful indication of the role and contribution of educational activities in MBRs against these Five Priority Areas.

ESD - Five Priority Areas		Alignment of study findings against ESD Five Priority Areas	Rating
Policy	Integrate ESD into education policies.	Evidence of ESD objectives in MBR education materials.	■
	Create an enabling environment to empower individuals, skills, engagement.	MBR educators aim to empower audiences through engagement, knowledge and skills.	■
Learning environments	Whole institution approach, from early childhood to higher education.	Main focus on primary schools, due to more open curriculum; less evidence of higher education partnerships.	■
	Lifelong learning.	Evidence of reaching all life stages.	■

	Cooperation between informal, formal, non-formal.	Some evidence.	🟧
Educators	Increase their capacities to empower learners.	Educators are resourceful and have capacity to empower audiences (if fully funded).	🟧
	Transformative actions.	Transformative change is challenging, due to the young age of audiences and complexities of framing climate change narrative.	🟥
Youth	Provide opportunities for engagement.	MBRs are seeking to engage more with youth audiences.	🟧
	Recognise youth as key actors in sustainability.	Young people aged 16-24 are the third most reached audience, and BRs recognise their importance as the next generation, and aim for greater engagement.	🟥
	Tap into behavioural trends among youth.	Access can be limited due to constraints of secondary school curriculum; some perception of youth as less open in trying new experiences than children.	🟥
Community	Community is where meaningful transformation takes place.	MBRs are highly focused on local communities. Targeting behaviour change relating to land use remains a primary focus. Greater engagement with local adult audiences remains challenging for some.	🟧

Table 5: Mapping of study findings against ESD five priority action areas.

The primary stated objective for most MBRs is to improve levels of knowledge and understanding of environmental and sustainable development, closely followed by behaviour change. The secondary prioritisation of behaviour change partly reflects the audience they are teaching (i.e. mostly children and young people), as corroborated in the UNESCO MAB ESD resource handbook: *"The characteristics of the target-group for any EE / ESD intervention in BRs...determine to a large extent the content of the intervention"* (UNESCO, 2013).

These priorities are also mirrored in the observed *outcomes* of educational activities (n.b. self-reported by MBR study participants). MBR educators are realistic that with children the focus should be on creating a foundational level of knowledge and understanding, whereas changing

behaviour is more significant and urgent in the realm of adults, as their behaviours tend to be more impactful.

Behaviour change is also referenced in the five priority areas of ESD, articulated as 'meaningful transformation' and 'empowering learners'. While behaviour change is the ultimate goal of education in BRs, participants feel it is most tangible to target at the local land use level, where actions are more visibly connected to outcomes - e.g. deforestation. Climate change, though, poses the greatest threat, and is foremost in the minds of participants. However, framing climate change through a behaviour change lens in MBRs is complex, as the causal factors are global and any tangible, visible improvements at local level are potentially decades away, if at all. Nevertheless, it remains the greatest, existential threat to the environment and humanity, and should be prioritised in MBR educational activity.

The majority of MBR participants cite limited funding as the greatest barrier they face in delivering educational activity, particularly in lower income countries where there can be long periods with no funding. However, limited funding also affects job security in higher income countries, prompting them to spend valuable time and effort applying for grants.

The challenges of living in mountain areas are significant, and can impact on people's ability to travel and participate in educational activities, particularly those in lower income countries. Disparities in levels of national income also shape how educational activities are conducted, with MBRs in lower income countries experiencing other pressing socio-economic issues that compete for their attention. Lack of funding can be exacerbated by unemployment and poverty, which in turn negatively impacts on land use and the natural environment. While the UNESCO MAB programme targets social equity and inclusivity, some MBRs are facing socio-economic difficulties to a degree that their ability to implement educational activity for local audiences is significantly affected.

The challenges posed by the 2020/21 Covid-19 pandemic have affected all MBRs, prompting staff to shift their education programmes to online modes. While this experience has strengthened the

online capacity of many MBRs, it has also served as a reminder of their preferences for face-to-face interaction.

Finally, a SWOT analysis (Figure 26) gives some indication of the current status of education in MBRs. While the list of *weaknesses* and *threats* suggest there are significant challenges, the *strengths* and *opportunities* suggest the motivation of MBR staff and their strong connections with local communities and the MBR mean they remain well positioned to provide quality educational activities.

Strengths	Weaknesses
Resourceful and committed MBR staff and volunteers Connections with local communities and schools Direct access to the MBR landscape Existing networks with other BRs/MBRs	Limited funding Lack of content platform for BRs / MBRs Ageing population / depopulation within MBRs Limited access to youth and landowners Disparity in national economies Competing priorities (e.g. employment) Challenging mountain environment
Opportunities	**Threats**
Emergent public interest in the environment New funding sources UNESCO content platform for BRs / MBRs Increased networking with other BRs / MBRs	Ongoing Covid-19 pandemic Limited funding sources Limited (active) UNESCO support Damaging local land use (coal mine, oil drilling)

Figure 26: SWOT analysis of study findings relating to educational activities in MBRs.

7. Conclusions

This study was conducted with the aim of identifying and understanding the role and contribution of educational activities in MBRs. In order to assess the factors that shape this, a wide range of elements and issues were explored through surveying and interviewing staff from MBRs, across 23 countries.

A number of elements were identified that establish conditions for effective delivery of education. These are the commitment, resourcefulness and motivation of MBR staff; a focus on outdoor experiential learning, with small groups; the setting of objectives and creation for content that reflects the characteristics of the MBR; sufficient levels of funding.

The setting of objectives and outcomes can be complex. The ultimate aim of MBRs (and specifically ESD) is to achieve transformative change for their resident communities, yet the slow

timescales of (positive) change and global dimensions of climate change mean local land use is a more tangible and topical target of focus. In addition, educators face the dissonant challenge of simultaneously introducing people to the natural environment (positive) and raising awareness of the critical threats it faces (negative).

Overall, there appears to be alignment between the five priority areas of ESD and how MBRs are conducting educational activities. The five priority areas are highly relevant to MBRs, though meaningful engagement with youth and empowerment / transformative actions remain areas of challenge.

Considering these factors, the role and contribution of educational activities in MBRs can be viewed as enhancing how local communities understand and relate to the natural environment, and in doing so, bringing them closer to their surroundings and a sustainable synergy between man and biosphere.

8. Reflections on the study

When reflecting upon this study, I believe the overall design, method and sequencing of activities was appropriate. My interest in mountains, conservation, sustainable development, biosphere reserves and education all coalesced to form the chosen area of study. The literature review further explored these dimensions and revealed three relevant frameworks for educational activities in MBRs (UN SDGs, UNESCO MAB and ESD), and suggested that the role and contribution of educational activity in MBRs specifically was less studied.

Sample selection and recruitment of study participants was generally effective, though it became apparent that only four of the 44 MBRs surveyed were of the lower-middle GNI per capita classification. Ideally more of this classification would have participated, though not all BRs responded to the initial email invitation, including some from these lower income countries.

A method of quantitative survey followed by qualitative interviews seemed appropriate, as the survey aimed to identify emergent findings of interest, to be further explored through semi-

structured discussion with study participants. The presence of secondary data (literature review) and two forms of primary data (survey and interviews) meant data and findings could be triangulated and assessed.

One noteworthy aspect of this study is that both survey and interview data were self-reported - by MBR staff. No data was collected from audiences who receive educational activities, and this should be factored into how the findings are considered. In this sense the data is biased toward those who deliver educational activities, though care was taken to maintain neutrality in how the survey and interview questions were framed and structured. Additional research with recipients of educational activities would complement this study, and provide perspective on how educational activities shape their attitudes, beliefs and behaviours.

A finding that carries significant interest relates to challenges in targeting behaviour change, in particular with regard to climate change. Further research would be useful in clarifying what factors are leading to this and how it can be more effectively framed for audiences.

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Appendices

Appendix 1: Sample of survey participants

UNESCO MAB Region	Country	Mountain Biosphere Reserve	Max. altitude	Participant role
Africa	Ghana	Lake Bosomtwe	600m	BR Manager

	Kenya	Mt Elgon	4301m	Youth leader & climate change activist
	South Africa	Cape West Coast	2000m	Coordinator
		Cape Winelands	1860m	CEO Project Development & Implementation
		Gouritz Cluster	2240m	Environmental Education Project Manager
		Kogelberg	1268m	Coordinator
		Marico	1737m	Scientific Support Manager
		Vhembe	2000m	Coordinator
		Waterberg (2)	2085m	Programme Coordinator / Environmental education & community development
	Tanzania	Gombe Masito Ugalla	1996m	Acting Secretary
Arab states	Lebanon	Jabal Moussa	1500m	Conservation Manager
		Shouf	2000m	Development Coordinator
Europe and North America	Canada	Mount Arrowsmith (2)	1817m	Research & Community Engagement Manager / Coordinator
		Manicouagan-Uapishka	1104m	Scientific Research Development
		Waterton	2918m	Interpretation Coordinator
	Germany	Berchtesgadener Land	2713m	ESD research associate
	Ireland	Kerry	842m	Biosphere Officer
	Russia	Khakassky	2789m	Deputy Director for Research
	Slovakia	Slovenský kras	925m	Environmental Education Coordinator
		Poľana	1458m	National BR Manager

	Spain	Picos de Europa	2646m	Biologist
		Las Sierras de Cazorla y Segura	3482m	Conservation Director
		Sierra de las Nieves y su Entorno	1919m	Coordinator
		Alto Bernesga	2189m	BR Manager
		Ponga	2142m	Reservation Manager
		Sierra del Rincón	2047m	Head of Environmental Education
	Spain / Portugal	Meseta Ibérica / Gerês-Xurés	2000m 1559m	Coordinator Executive Officer
	Poland / Slovakia	Krkonoše / Karkonosze	1602m	Head of Office, Environmental Education
	USA	Big Bend	2388m	Chief of Interpretation & Visitor Services
		Denali	6194m	Science & Resources Team Leader
Asia and the Pacific	India	Nilgiri	2670m	Natural History Society Coordinator
	Iran	Tange Sayad & Sabzkuh	3125m	Facilitator
	Japan	Mount Hakusan	2702m	Secretariat and Academic Advisor
	Korea	Gangwon	1304m	Manager
	Thailand	Mae Sa Kog Ma	1685m	BR Manager
	Turkey	Camili	3415m	Ministry of Environment & Forestry
	Kazakhstan / Russia	Greater Altai (Katon Karagay + Katunskiy)	4506m	Environmental Education Specialist Deputy Director for Science
Latin	Ecuador	Chocó Andino	4480m	Technical Coordinator

| America and the Caribbean | Costa Rica | Agua y Paz | 2200m | Local Management Committee Coordinator |
| | | Savegre | 3490m | Coordinator |

Appendix 2: Sample of qualitative interview participants

UNESCO MAB region	Country	Mountain Biosphere Reserve	Participant role
Europe and North America	Canada	Waterton	Research & Community Engagement Manager
	Ireland	Kerry	Biosphere Officer
	UK	Wester Ross (980m)	Coordinator
	USA	Denali	Science and Resources Team Leader
	Germany	Berchtesgadener Land	ESD research associate
	Portugal	Gerês-Xurés	Executive Officer
	Spain	Picos de Europa	Biologist
Africa	Kenya	Mt Elgon	Youth leader and climate change activist
	South Africa	Cape West Coast	Coordinator
Asia and Pacific	Japan	Mount Hakusan	Secretariat and Academic Advisor

Appendix 3: Summarised qualitative interview questions mapped against survey responses

This table summarises the main questions asked in the interviews (column 4), and how they relate back to the summaries of survey responses (column 3), and survey question themes (column 2).

Survey Q#	Survey questions / topics	Survey response summary	IDI questions
5	**Current status**	Majority felt education was a high priority, or medium and want to make it higher	• *If you selected 'medium status - but want to make it higher status' - why?* • *What is the main, tangible benefit of educational activity in your BR?*
6	**Topics of education**	Most selected were economic development, ecosystems & biodiversity.	• *What topics would you like to see a greater focus on? Why?* • *How do you view the balance between delivering education on economic development and ecosystems and biodiversity?*
7	**Educational deliverers**	Majority selected a mix of formal, informal, local and external modes of education delivery.	• *How do you characterise the optimum mix of educationalists in your BR? Why?*
8	**Beneficiaries from education**	Dominated by children and young people. Slight majority toward females over males. Much less so retired. Good representation of indigenous peoples.	• *Why did you select _____ in your survey response?* • *Who would you like to see benefit more in the future? Why them?*
9	**Local community engagement**	Majority feel local communities <u>are</u> engaged with the educational activities in their BR.	• *How would you describe the community in your BR?* • *How homogeneous is it? To what extent does it feature indigenouss people, or more recently arrived people?* • *To what extent do these different groups / sub-groups engage with your educational activities? Why do you think this is?* • *How do the characteristics of your community shape the educational activities in your BR? (and vice versa)*
10	**Educational delivery**	Field-based is considered by far the most effective, followed by local communities partnering with educators.	• *How do your field-based approaches work?* • *What are the benefits / advantages of this approach?* • *How do co-educational partnerships work best? Why are they effective?*
11	**Examples of engaging education in their BR**	A wide range of examples of good practice were provided.	• *What is it about your example that made it so engaging and effective?* • *How feasible is it to host more events similar to this?*

12	**Educational resources**	Responses suggest they are self-motivated and self-sufficient - but is that a sustainable model?	• *Tell me more about how you create your own educational materials*
			• *How do you feel about this?*
			• *Who creates them? What is the process?*
			• *Why do you create them yourself?*
			  ○ *Lack of other available materials?*
			  ○ *The need to create locally relevant resources?*
			• *How does local / traditional / indgenous knowledge feed into this?*
			  ○ *Can you give any examples?*

13	**Funding**	Very mixed funding models. Donations, grants - or no funding at all.	• *What is your strategy for achieving more funding?* • *Where lie the greatest opportunities and threats?*
14	**UNESCO aims**	Of the six UNESCO descriptions, those referencing BRs as learning places for sustainable development and promoting biodiversity and conservation are the most selected.	• *To what extent are UNESCO definitions of BRs still relevant / appropriate / useful?* • *How much do they translate into effective educational approaches, in your experience? Can you give any examples?*
15	**Educational objectives**	Of the six UNESCO statements, 'improving knowledge and understanding' is the most selected - and more so than those that reference behaviours and actions.	• *To what extent do you provide educational activities to influence knowledge and understanding OR tangible behaviours?* • *Or both?* • *How do you perceive these different outcomes?*
16	**Challenges**	Low / no funding and limited resources and capacity are the key barriers.	• *What would more funding allow you to do?* • *Is it possible to say how much more would you need? (ie percentage more, etc.)*
17	**Improving the educational offer**	As well as low / no funding and limited resources they also request greater support from UNESCO.	• *How could UNESCO support you more?* • *To what extent can direct UNESCO support be useful at the local level? (e.g. resources, materials etc.)*
18	**Outcomes observed**	Greatest observed shifts (i.e. pro-environment / sustainability) are around awareness and understanding - but less so attitudes and behaviours.	• *Why do you think attitudes and behaviours (i.e. pro-environmental / sustainability) are harder to change than awareness and understanding?* • *How do you feel about this?*
20	**Mountain settings**	Mixed responses overall, but a majority believe it is more challenging in mountain settings.	• *What is it about mountain settings that make them challenging to deliver educational activities in?* • *How can any of these challenges be alleviated?*
	Additional questions		• *To what extent would being connected with other educational deliverers in UNESCO mountain region BRs add value?*

			● *If so, what other types of connection are of most value?*
			  ○ *Regional?*
			  ○ *National?*
			  ○ *Language group?*
			  ○ *Similar culture?*
			● *Can you think of any particular (educational) issues, or solutions to issues, that could benefit from greater contact and collaboration?*

Appendix 4: Online Survey questionnaire

Thank you for agreeing to participate in my survey. I would greatly appreciate it if you could complete these survey questions (23) about educational activities in your Biosphere Reserve.

Your responses are confidential and anonymous, and all evaluation data will be securely stored and deleted after six months. I will be happy to share the final report from this dissertation study, should you wish to receive a copy.

Thank you very much for your time!

If you have any questions regarding this evaluation, please contact me:
Email: _____
Phone: _____

Thank you

_____

0- Are you happy to proceed with this survey?
- Yes
- No

You and your role

We would like to start with a few general questions about your Biosphere Reserve and your role in it.

1. Which Biosphere Reserve are you currently involved with?
[FREE TEXT RESPONSE]

_____

2. How long have you been involved with this Biosphere Reserve?
PLEASE SELECT ONE OF THE FOLLOWING:
-   < 1 year
-   1-4 years
-   5-10 years
-   10+ years

3. What is your current role in relation to this Biosphere Reserve?
[FREE TEXT RESPONSE]

_____

4. To what extent are you involved in the following activities in your Biosphere Reserve?
PLEASE SELECT ONE OF THE FOLLOWING FOR EACH ACTIVITY:
-   No involvement
-   Some involvement
-   Significant involvement

ACTIVITIES
-   Conservation of the natural environment
-   Working with local communities
-   Scientific research
-   Social research
-   Educational programmes, teaching
-   Administration
-   Management of staff

- Monitoring and evaluation of the BR
- Ecotourism
- Agriculture
- Other _____

Educational activities

The following questions all relate to educational activities that take place in your Biosphere Reserve (BR). These may include any activities facilitated and/or initiated by the BR that aim to engage certain audiences (eg local people, visitors, schools etc) in the conservation and sustainable development aims of the BR.

5. What is the current status of educational activities in your BR?
PLEASE SELECT ONE OF THE FOLLOWING:
- It is a high priority for this BR
- It is a mid-level priority for this BR, and is likely to stay at that level
- It is a mid-level priority for this BR, but we would like to make it a higher priority
- It is a low-level priority for this BR, and is likely to stay at that level
- It is a low-level priority for this BR, but we would like to make it a higher priority

6. How often do educational activities on the following topics typically take place in your BR?
PLEASE SELECT ONE OF THE FOLLOWING FOR EACH TOPIC:
- Frequently (every few days)
- Quite often (every few weeks)
- Infrequently (4-5 times a year)
- Very rarely (1-2 times a year)
- It fluctuates considerably
- None at all

TOPICS
- Ecosystems and Biodiversity
- Climate change
- Forestry
- Agriculture
- Pollution
- Waste management / recycling

- Energy
- Water use
- Hunting, fishing
- Indigenous / traditional ways of life
- Mining
- Local employment / Livelihoods
- Sustainable development
- Tourism / Eco-tourism
- Disaster risk reduction / management
- Economic development
- Gender / female empowerment
- Youth development
- Other _____

PLEASE NOTE: When answering the following questions please only refer to those educational activities that you selected as being delivered 'Frequently' and 'Quite often' (as selected in Question 6) in your BR.

7. Which of the following groups help deliver these educational activities?
PLEASE SELECT ALL THAT APPLY:
- BR staff
- Local communities / residents / volunteers
- NGOs
- Civil Society
- Government
- Local universities
- Local schools / colleges
- Local interest groups (eg farmers, pastoralists, service providers etc)
- Other_____

8. Who benefits from these educational activities in your Biosphere Reserve?
PLEASE SELECT ALL THAT APPLY:
- Children (5-15)
- Young people (16-24)
- Adults (25-60)
- Older / retired (60+)
- Girls / women

- People with disabilities and/or learning difficulties
- Indigenous people
- Other_____

9. To what extent do you agree / disagree with the following statement: *"Overall, local communities in this BR are very interested in and engaged with educational activities"*
PLEASE SELECT ONE OF THE FOLLOWING:
- Strongly disagree
- Disagree
- Neither agree or disagree
- Agree
- Strongly agree
- Other_____

(Capacity and resourcing)

10. In your judgment, how effective are the following ways of delivering educational activities, as provided in your Biosphere Reserve?
PLEASE SELECT ONE RESPONSE FOR EACH APPROACH
[not provided in this Biosphere Reserve / not effective / quite effective / very effective]
- Distribution of leaflets, booklets, posters etc
- Online materials (websites, forums etc)
- Traditional / conventional classroom based teaching
- Transdisciplinary approaches
- Field-based, participatory, experiential learning
- Creative / artistic approaches (eg theatre groups, local arts etc)
- Local communities partnering with educators and co-creating educational experiences
- Seminars and workshops
- Seasonal schools (eg summer)
- University courses and collaborations
- Skills-focused training courses
- Other_____

11. Please give ONE example of the delivery of an educational activity in your BR that you consider to be particularly engaging and effective for audiences.
FREE TEXT RESPONSE:

12. From which sources are educational materials, frameworks and/or curriculum guidance for these educational activities obtained?
- Other BRs
- UNESCO MAB
- Universities and Colleges
- The knowledge of local communities
- Education for Sustainable Development (ESD) sources
- Local schools
- Self-sourced online from various sources
- Created by our BR team and stakeholders
- Other_____

13. How are these educational activities funded in your BR?
- Not funded - it relies upon volunteers
- Local fundraising
- Donations from local businesses
- Donations from charities / NGOs
- National government grants
- Local government grants
- Grants from governments overseas (DfID, USAID, BfN etc)
- Grants from international organisations (eg EU, ECOWAS etc)
- Other_____

(Objectives, challenges, outcomes and improvements)

14. To what extent do educational activities in your BR reference these UNESCO descriptions of BRs?
PLEASE SELECT ONE RESPONSE FOR EACH APPROACH
[not relevant to this BR / very little extent / to some extent / to a great extent]
- BRs as learning places for sustainable development.
- BRs as sites for testing interdisciplinary approaches to understanding and managing changes and interactions between social and ecological systems.

- BRs as sites for testing interdisciplinary approaches to understanding and managing conflict prevention.
- BRs as sites for testing interdisciplinary approaches to understanding and managing management of biodiversity.
- BRs as sites providing local solutions to global challenges.
- BRs as sites promoting solutions reconciling the conservation of biodiversity with its sustainable use.

15. Which of these statements best describes the objectives of the educational activities in your BR?
PLEASE SELECT ALL THAT APPLY:
- To improve knowledge and understanding (eg conservation, sustainable development)
- To encourage pro-environmental behaviours (eg renewable energy, afforestation, water use etc)
- To reduce / change environmentally damaging behaviours (eg unregulated hunting, mining, overgrazing etc)
- To develop livelihoods associated with natural environment stewardship (eg eco-tourism, education, agroforestry etc)
- To achieve personal change through transformative learning
- To improve people's abilities to tackle local issues through problem-oriented learning
- None of the above
- Other_____

16. Which of the following would you consider to be challenges associated with conducting educational activities in your BR?
PLEASE SELECT ALL THAT APPLY:
- Low levels of interest among local communities
- Inadequate funding
- Local communities prioritising other activities over educational activities
- Low level of resources and capacity in the BR
- Low level of skills and experience of BR staff / network
- None of the above
- Other_____

17. How could the quality of these educational activities be improved?
PLEASE SELECT ALL THAT APPLY:
- Greater funding

- More staff and volunteers
- Better trained educators
- More resources
- More participants
- Greater support from local organisations
- Greater support from UNESCO
- Greater support from national UNESCO MAB committee
- Stronger awareness and promotion in communities
- Other_____

18. Which of the following outcomes have you mostly observed among audiences as a result of educational activities?
PLEASE SELECT ALL THAT APPLY:
Awareness and understanding of natural environment and sustainable development
- *No change*
- *Some improvement*
- *Significant improvement*

Consideration of / Attitude toward natural environment and sustainable development
- *No change*
- *Some improvement*
- *Significant improvement*

Behaviour toward natural environment and sustainable development
- *No change*
- *Some improvement*
- *Significant improvement*

Other_____

19. Please rank the following in terms of their importance in ensuring an engaging and effective educational experience
ORDER FROM 1-9 IN TERMS OF IMPORTANCE (ie 1 = most important)
- Effective organisation
- Well developed strategy
- Adequate funding
- Institutional support
- Interest from local communities
- Support in kind (materials, venues, transport etc)
- Identification of tangible benefit (eg livelihoods)
- Engaging and appealing educational materials

- Engaging and skilled educators

Other_____

20. *"Delivering educational activities is more challenging in mountain areas (than other settings)"*
To what extent do you agree / disagree with that statement?
SELECT ONE OF THE FOLLOWING:
- Strongly disagree
- Disagree
- Neither agree or disagree
- Agree
- Strongly agree
- Other_____

21. *"I am very optimistic about future prospects for educational activities in this Biosphere Reserve"*
To what extent do you agree / disagree with this statement?
SELECT ONE OF THE FOLLOWING:
- Strongly disagree
- Disagree
- Neither agree or disagree
- Agree
- Strongly agree
- Other_____

22. What would you like to see happen in the future with regard to the provision of educational activities in your BR?
[FREE TEXT RESPONSE]

_____

23. Do you have any final comments or suggestions with regard to the provision of educational activities in your BR?
[FREE TEXT RESPONSE]

_____

Appendix 5: Survey invitation email