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Review

Participatory governance for people and nature in multifunctional landscapes — insights from Biosphere Reserves

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Participatory approaches are put forward to ensure that governance for the well-being of humans and nature is legitimate and effective, particularly responding to global challenges of ecosystem degradation and climate change. As model areas for sustainable development with explicit goals of participation, the UNESCO World Network of Biosphere Reserves can provide insights on participatory governance arrangements, outcomes of participation, and obstacles for participation. Through a literature review, we found that transparent communication and fair distribution of benefits and trade-offs enhance participation. Early involvement, skilled facilitation, and the capacity to develop shared values among diverse interests improve outcomes. Project-driven participation, deficient capacity to handle conflicting interests, and mechanisms of exclusion hinder participation. Biosphere Reserves (BRs) can leverage already existing actor initiatives, local knowledge, and practices. We identified a need for studies of causal links between participation and BR outcomes, including unpacking the meaning of different modes of participation.

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Introduction

The UNESCO Man and the Biosphere (MAB) programme's World Network of Biosphere Reserves (WNBR), now encompassing 759 Biosphere Reserves (BRs) worldwide [1], is intended to provide model approaches for sustainable development. The programme aims to contribute to the goals of multilateral agreements for biodiversity conservation [2], climate action [3], and sustainable development [4,5], whilst simultaneously addressing sustainability concerns in a diversity of local contexts [6]. BRs serve three functions: conservation of biodiversity and biocultural diversity, social and economic development, and logistic support for research and learning. BRs include core areas that are protected areas, buffer zones that surround the protected areas and allow for activities compatible with sound ecological practices, and transition zones that support sustainable activities and often include towns and cities. The work in BRs is often done through partnerships, connecting international organizations to national and local governance. The Technical Guidelines for BRs give room for flexible governance arrangements, ranging from government-led to NGO-led [7]. The wide variation in governance across BRs offers opportunities to study a wide range of modes of local participation in governance and management for sustainable development, and their outcomes [8,9]. The Seville Strategy, adopted in 1996, has participation of local actors in governance and management of BRs as a specific objective [10], and participation of all relevant stakeholders in designation, implementation, and monitoring processes of BRs is explicitly stated as part of being model sites for sustainable development [5]. All governance structures across the WNBR should be positioned as 'tools' to enable meaningful stakeholder participation in BR management, and recent evolutions of the operational guidelines for BRs position 'participation' as their fourth function [7].

For this paper, we reviewed emerging lessons from BRs on processes and outcomes of participation in BR governance. We focused on recent papers, published 2022–2025. Through searches in Web of Science and Scopus databases (last search July 29th, 2025) using the search string ("biosphere reserve*" OR "biosphere

area") AND (particip* OR collabo*) AND (governance OR co-management) in topic/title, abstract, keywords, we found 46 unique papers. After an initial scan of the papers using keyword search (participat*, governance, management, biosphere), we excluded 12 papers that did not comply with the inclusion criteria. We included articles where the study, or part of the study, was conducted in one or several BRs. Further, the study, or part of the study, included results on outcomes (including as perceived by actors) of participation/non-participation, of actors within the BR in BR governance or management. We included studies of participation in other organizations within the BR (beyond the BR coordinating body), where authors showed a clear link to BR governance, but excluded studies where we could not identify such a link. Given the theme of this special issue, *50 years of learning from the World Network of Biosphere Reserves*, we also included key papers from before 2022 offering insights on participation in governance of BRs. In total, we included 50 papers. Collectively, the papers provided examples from BRs with a wide range of contexts, BR age, and governance arrangements. However, we did not identify enough studies with data that could allow for a quantitative analysis of correlation between contextual factors and participation, or outcomes of participation.

In the first section below, we define key concepts and the categories we use to illustrate the mode of participation described in the studies. In the following subsections, we summarize insights on each mode of participation and insights on correlation between participation and BR outcomes. We conclude with a section on limitations of the review and ways forward for research on participatory governance in BRs.

Participation in Biosphere Reserve governance

Following the Technical Guidelines for BRs, we define governance as "the structures and processes that determine how decisions about a biosphere reserve are taken and how stakeholders are included" [7]. UNESCO-MAB is intentionally non-prescriptive in the requirements for BRs' governance arrangements, and the Statutory Framework only requires appropriate structures to be proposed or in place at the time of nomination [10]. This flexibility is considered a key asset for the tailoring and self-determination of what is most appropriate to local social-ecological contexts. Management refers to the actions within a BR toward achieving the goals defined for the specific BR, which are described in a management policy or plan required for each BR [10]. We use the term *actors* to refer to local people, communities, and organizations living and operating within the BR areas.

We describe modes of participation using the categories *Information sharing and consultation with local actors; Participation in implementation of Biosphere Reserve functions*, *Involvement in goal setting*, and *Representation in decision-making body* (see definitions in Table 1) building on Mohedano Roldán et al. (2019) [11] who adapted Arnstein's Ladder of Citizen Participation [12] for the context of BR governance. Arnstein's Ladder of Citizen Participation has been criticized for a hierarchical view of participation, with the highest rung of participation as the goal, which may not correspond to actors' preferences [13]. It has also been criticized for implying that the problem to be addressed remains constant, while in reality, problems are unique, require different levels of

Table 1

Mode of participation, definition based on the adaptation for BR governance context by Ref. [11] of Arnstein's Ladder of Citizen Participation [12], and examples from BR literature.

Mode of participation	Definition (based on Ref. [11])	Examples
Information sharing and consultation with local actors	How the BR shares information and consults local actors about BR activities	Information, and to overcome that the BR concept remains abstract to actors, was necessary for actor engagement [22]. Improved information about the BR and BR activities was a prerequisite to build collaboration among BR actors [20].
Participation in implementation of BR functions	Participation of local actors in day-to-day management and monitoring efforts	Contracts between individual actors within the BR and the BR to improve the actors' environmental practices, where actors in return were given the right to publicly show their link to the BR, including peer control mechanisms [36]. Local actors collaborated with BR management organizations (some as employed) in projects related to conservation, reforestation and agroforestry, ecotourism development, economic development, biodiversity monitoring, and education [51].
Involvement in goal setting	Participation of local actors in setting the goals for the BR	BR designation resulted from a community-government collaborative initiative [49].
Representation in BR decision-making body	Local actors who are represented in the BR's steering committee, board, or similar	Representation of actors takes place via technical and advisory support committees — an advisory role to support the decision-making process of the BR coordinating body through representing a broader group of actors [15]

participation, and may be determined in the process of participation [13]. Further, the ladder focuses on different levels of power as defining roles and responsibilities, while these often emerge in the participatory process based on the construction of actors' interests in the situation [13]. We therefore underline that we use the modes of participation without hierarchy in their importance for BR actors and outcomes. We also acknowledge the context specificity of which type of participation is appropriate for the fulfillment of BR functions, and from the perspective of inclusivity, depending on the issue at hand and the BR-specific context. It was not always possible to discern the mode of participation when 'participation' was used as a broad concept without a clear definition. For example, stakeholder participation was identified as the most important factor influencing the level of success of BRs in a Delphi process with scientists in BR research and managers from national MAB committees [14]. However, the factor 'participation' was broadly defined and did not specify what type of participation was considered contributing to BR success, and in which contexts.

Information sharing and consultation with local actors

We found that participation of actors was enhanced by transparent communication about, and fair distribution of, benefits and trade-offs in the BR. Research reported that local actors often have low awareness that they live in a BR, and about what a BR is [15–20]. Studies showed that a key first step for participation is information that makes BR actors aware of the BR, its purpose, and activities [21–23], and that such information has encouraged actors to support the BR and implement activities in line with the designation [14,20]. However, for participation to successfully contribute to fulfilling BR goals, research emphasized that awareness about the BR is not enough in itself [14,15,21,24,25]. Examples showed the importance of a realistic understanding among local actors of the opportunities and trade-offs that the BR designation implies for their activities, to avoid future skepticism and mistrust when expected benefits are not realized [16]. For example, mechanisms for sharing benefits from activities in the BR, as well as enforcement of conservation regulations, must be equitable and transparent [19,26,27].

Research showed that the difference between a BR and a protected area must be clarified to avoid the perception that BR designation only means more regulations to follow and limits to economic activities [21]. To communicate that BRs embrace development and local participation can be difficult, particularly in contexts where conservation has been used for strict exclusion of people [14,26] and state control over land and minorities [28]. This may occur, for example, in countries where a colonial history of resource disenfranchisement and land disposition has frequently accompanied a conservation designation, or where dictatorship has made people unaccustomed to participation [9]. The legislation (national or sub-national) protecting these areas within BRs may have been or still be conservation-focused and sectoral, and not adapted to cultural practices of human mobility and wildlife mobility [18,21,29,30]. In some contexts, this history plays out as tensions around notions of a BR and misperceptions of legally enforced use restrictions and exclusions. Recent distancing from the naming convention of 'Reserve' (i.e. versus Biosphere solely, Biosphere -Region, -Network, -Area, etc.) is aimed at redressing this misconception and enhancing stakeholder engagement [17,31]. In other contexts, changes beyond the name are urgently needed. For example, internal exclusion factors (participation formally enabled, but largely tokenistic in practice), external exclusion factors (power structures and processes that outright prevented participation), or a combination thereof, prevented meaningful participation in most of the 117 studies of participation and shared governance in Mexican BRs [32]. Another example, from Bia Biosphere Reserve in Ghana, identified a number of issues hampering participation and trust, including meetings in a language that most people were unfamiliar with, or in distant locations; exclusion of certain groups; and exclusion of Indigenous knowledge in favor of technological tools for monitoring [26,33].

Participation in implementation of Biosphere Reserve functions

The effects of participation of local actors in day-to-day management and monitoring efforts in BRs have not been extensively studied, but research has indicated aspects that can strengthen BR management. Youth active in BRs identified biodiversity monitoring and management plans that include local actors as strengths for reaching goals in BRs [24]. Examples from BRs showed that recognition of traditional practices and local and traditional knowledge can strengthen sense of local ownership of management, and be assets for BR management [22,26,33,34]. In Mexico's El Cielo Biosphere Reserve, a decrease in local community contribution to management was found to be a notable contributor to the BR's perceived decline in management effectiveness [35]. Research reported that project-driven initiatives for participation hindered long-term engagement beyond the project duration [15,18,21,30,36], and, in some cases, resulted in fatigue among local actors (e.g. [22]).

A broader perspective on participation in implementation of BR functions includes cases where the BR organization builds on, supports, and connects initiatives that are initiated within the BR geography and align with the objectives of the BR. Several recent studies offered such examples. For example, studies of sustainability innovations in Schorfheide-Chorin, Germany, and Fontainebleau-Gâtinais, France, found the highest transformative potential in 'Participative Transformation Governance' innovations that involved a diverse set of actors interacting in a non-hierarchical manner, and acting as bridging actors to other sustainability innovations [37,38]. The BRs had

central roles in these networks for place-based sustainability innovations [38]. Existing community-led governance structures have the potential to be utilized as bridging organizations when similar participatory governance structures may not yet exist at the BR scale. For example, in Bosawas BR in Nigauragua, the legitimacy of existing inclusive multi-actor collaborative governance platforms was found to be potentially catalytic to improve the BR's landscape governance structure [39]. Participatory institutions were perceived by stakeholders as having sufficient community credibility to promote learning processes, mobilize engagement with other landscape actors, and coordinate sustainability actions across the broader territory of the BR, beyond the initial localities of their establishment [39]. Similarly, in Golija-Studenica BR in Serbia, capitalizing on established community groups in the BR territory was proposed to support learning for greater participation in the BR's decision-making processes [40]. The capacity of BRs to link different actors was identified as a strength by youth active in BRs, and they saw opportunities in BRs as platforms for collaboration [24]. Research also reported that building on and linking activities and actors within the BR can be a strategy to navigate the limited resources that many BRs experience [24] and make management less costly [36].

Many BRs position themselves as coordinating platforms to enable collaboration and navigate conflict across a diverse group of landscape actors [6,7]. They provide examples of how the UNESCO BR designation can be leveraged to encourage broader participation [14,16,28,41–43]. For example, BR managers in Kogelberg BR, South Africa, described key roles the BR plays connecting and building relationships among actors across landscapes, and enhancing community engagement [15]. Other articles explained that BRs can operate as relational gateways and bridging organizations [6,44], and link actors to coordinate landscape actions and/or facilitate self-organized governance networks, particularly for actors who were not well connected to other actors in the BR territory (e.g. [45]). In this respect, examples showed that BRs have the potential to drive regional governance by creating new institutional entities bringing actors together (steering committees, intermunicipal collaboration) [23,46]. Other examples showed that BRs can be neutral convenors recognizing the (sometimes conflicting) values held by actors related to landscapes and desirable development trajectories [15,47,48]. This neutrality supported capacity to handle conflicts among different interests [23,46], and to work toward shared values related to BR functions [49]. The bridging role enabled greater access to capacities and resources for responsive landscape management [15]. There were, however, examples of BRs competing for (or being perceived as competing for) funding or landscape management roles with other actors, even those with aligned sustainability goals [15,50]. As these other actors may fulfill key roles in the landscape and contribute to broader participation in BR activities from their networks, such tensions require careful navigation.

Involvement in goal setting and Representation in decision-making body

Relatively few studies reviewed specifically addressed aspects of participation in setting BR goals, and representation in BRs' decision-making body. In this section, we therefore combine the results for the two modes of participation. Youth active in BRs identified aspects of governance as central among phenomena and drivers of change in BRs, identifying strong local-level governance and local participation within broader governance as strengths of BRs and for implementation of BR goals [24]. In the Dominican Republic, increased participation was identified by a broad set of actors as a key aspect for improving governance of Jaragua-Bahoruco-Enriquillo BR, with conflict resolution mechanisms, agreed-upon regulations for access to natural resources, and voice and participation in decision-making as the most critical issues [52]. In Mariñas Coruñesas e Terras do Mandeo BR in Spain, actors identified fewer governance issues related to agroecological initiatives than in a comparable non-BR area, indicating that the BR's model of stakeholder participation in decision-making resulted in greater satisfaction with the governance [41]. Key perceptions related to BR success that emerged in interviews from BRs in Portugal included genuine involvement of local actors that mobilized people's deep-rooted ties to, and care for, the land, and a sense of belonging [22].

Participatory, youth-led performance evaluations of BR management in La Campana–Peñuelas BR in Chile[1] identified the lack of citizen participation in the management committee and poor integration of Indigenous communities as critical detractors to BR performance and key weaknesses of the BR's governance system [53]. A study including three BRs in Canada found that while the BRs have multi-stakeholder boards as a forum for engagement with local actors, the boards were often seen as biased toward elite actors, rather than a representation of the inhabitants, with limited opportunity for broader public involvement [50]. In this respect, practical tools may offer some value. Research showed that Participatory Geographical Information Systems (PGIS) with BR actors can inform co-management

[1] The authors note in the very end of the paper that in February 2024, a State of Emergency and period of national mourning was declared in Chile as widespread wildfires caused extensive casualties and loss of life (https://wmo.int/media/news/wildfires-cause-huge-loss-of-life-chile-amid-heatwaves-south-america). Extensive areas of the La Campana–Peñuelas Biosphere Reserve were impacted [53]. In May 2024, the BR Management Committee was reactivated to include civil society and Indigenous Peoples.

[53,54]. In the case of Mar Chiquita BR in Argentina, serious games were used to simulate the diverse roles of stakeholders in management, representing real-world interests in a low-risk, exploratory manner, while also navigating potential areas of conflict and/or trade-offs that emerged [55]. Examples from Australia, France, and transboundary BRs in West Africa indicated that early involvement of actors, for example, in the initiation of a candidate BR, can facilitate dialogue between actors with different interests and perceptions [29,49]. Examples also highlighted the importance of BR capacity to facilitate participation and dialogue, for example, to involve experts in participatory methods [29], and to provide training to stakeholders willing to become involved in BR decision-making, to ensure more meaningful participation [7,26].

Impact of participation on achievement of Biosphere Reserve goals

A systematic review of studies published 1996–2017 on management effectiveness in BRs found that single case studies about management and/or governance were conducted in about 6% of the world's BRs [56]. The review found only one large-scale study investigating the relationship between processes and the achievement of BR goals, namely Schultz et al. (2011) [57]. This study analyzed survey responses from 146 BRs in 55 countries and found that conservation effectiveness was positively affected by participation of scientists but negatively affected by participation of volunteers, possibly due to lack of funding that characterizes BRs with a high dependence on volunteers [57]. Effectiveness in sustainable development goals was associated with participation by local inhabitants. Adaptive co-management practices were associated with a higher level of effectiveness in achieving development goals, and this higher effectiveness did not seem to be at the expense of biodiversity conservation [57]. A quantitative analysis of questionnaires answered by actors involved in BR governance in four BRs in Sweden and Canada showed that variables related to collaboration and learning explained substantial parts of social and ecological outcomes [58]. The study specifically highlighted the importance of quality in the participatory processes for positive social and ecological outcomes [58]. A study of 178 BRs found that local actor participation in BR governance was associated with 21% improvement in social and/or economic outcomes, and 14% improvement in ecological/biodiversity outcomes [8]. However, the study could not test causal relationships between participation and outcomes [8].

One example of a more detailed case study of participation in BR governance was from the Mono Transboundary BR in Togo and Benin, designated in 2017. In Mono BR, participation was studied both from the perspective of BR managers [16] and the perspective of residents [59]. The case exemplified early involvement, where local actors participated in a dialogue process prior to designation, focusing on their land use practices and future plans [16]. The process also included training on ecological interactions. The resulting BR zones took breeding grounds for fish, timber resources, and grassland for communal grazing into consideration, and focused on areas for communal rather than individual benefit [16]. Following the designation, previously existing local organizations were merged into associations and officially given a mandate to manage resources under their territories [16,59]. The organizations were supported by heads of villages, traditional authorities, and local associations of, for example, youth, fishers, and fishmongers [59]. Following the initiation of co-management, residents perceived a decrease in anthropogenic pressures on mangroves on both sides of the border, owing to, for example, as was observed on the Benin side, the strong involvement of customary law and traditional means to protect mangroves [59].

Limitations and future studies

Most of the reviewed studies had a qualitative focus, and few studies had participatory governance in BRs as their main research focus. We acknowledge that while the literature reviewed presents the core analytical foundation for this manuscript, our analysis and interpretations were made through the filter of our specific research goals, which may not necessarily reflect the primary goals and/or research framing of the original sources. We also acknowledge the challenge to attribute outcomes related to BR functions to participation, as outcomes are affected by many factors. Individual studies described different modes of actor participation, but did not systematically compare them. Due to the nature of the reviewed literature, a meta-analysis of effects of participation on BR functions was not possible. There are also clear geographical biases in where research was conducted with the BR as a unit of study [6,56]. Strategies that include peer-reviewed literature in other languages than English may give a more complete view of BR research [32], but would require a multi-lingual review team. Regarding future directions in research, Dabard et al. (2024) [60] suggested strengthening transdisciplinary research that addresses collaboration, politics, and governance to enhance the transformative potential of BRs and bridge the gap between the BR concept and its implementation. Based on our review, we see the need for studies of causal links between participation and BR outcomes. This would be supported by longitudinal studies and comparative analysis of participation and non-participation across BRs, and of different models of participatory governance, in combination with clear definitions and unpacking of the meaning and modes of participation.

Conclusions

The reviewed literature indicated that various forms of participation in BR governance can enhance legitimacy

and effectiveness of BR governance. However, forms that are legitimate and/or meaningful were context-dependent. The review illustrated that appropriate mode of participation depends on the issue at hand, the actors, previous interactions, and the trust built among actors. Building awareness and understanding of the BR idea and functions was identified as a fundamental first step for participation. Several studies showed how BRs can build on and leverage existing initiatives, local governance arrangements, and traditional knowledge practices and rules for resource use when they align with BR goals. Such participation can evolve into more formal participation in BR management and decision-making over time. This review revealed key enabling factors for participation, including effective communication, equitable benefit distribution, and early stakeholder involvement. By contrast, barriers included limited resources resulting in project-driven participation, deficient capacity to handle conflicting interests, misunderstanding of the BR concept, and different mechanisms of exclusion. For a deeper understanding of causal relations between different modes of participation and social-ecological outcomes of BRs, further research is needed. Such studies could compare participation and non-participation, or different modes of participation, with regard to some measurable social and ecological outcomes. However, such comparisons are difficult given the wide range of contexts and potential variables in BRs. While being examples of site-based biocultural conservation that is supported through a global network, challenges remain to implement the ideals of the MAB programme in all BRs, with their wide variety of contexts.

Data Availability

No data were used for the research described in the article.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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