

CONTRIBUTED PAPER

Towards biocultural approaches to environmental education—Evidence from Madagascar

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Abstract

Environmental education projects are commonly used by conservation organizations to improve the relations between humans and nature. However, these education projects often overlook local cultural realities. Biocultural approaches offer an alternative lens on the need to decolonize epistemologies to foster more inclusive, contextualized, and relational environmental education. In this research, we examine the extent to which biocultural approaches can enable, strengthen, and facilitate the decolonialisation of environmental education. To do so, we propose four themes that define biocultural approaches to environmental education: place-based learning approaches, local realities, biocultural relations, and inclusive conservation. Through this analytical framework, and drawing on questionnaires and interviews, we examine 61 non-formal environmental education projects across Madagascar. Madagascar offers a unique context due to its high levels of both biological and cultural diversity as well as its colonial legacies. Our results illustrate a diversity of learning tools and pedagogical approaches that recognize the interlinkages between cultural and biological diversity. Yet, ongoing challenges remain, particularly in contexts in which cultural and biological objectives are

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misaligned. We reflect on current limitations and future opportunities, and we provide examples and recommendations to design education projects that support and strengthen Madagascar's biocultural heritage. This research adds to ongoing calls to decolonise environmental education.

KEYWORDS

biocultural conservation, biocultural heritage, conservation education, conservation social science, human–nature connections, Madagascar

1 | INTRODUCTION

Policy efforts are urgently needed to tackle the direct and indirect causes of the global biodiversity crisis (Díaz et al., 2020). There is a global recognition of the need to adopt rights-based and socially just conservation models (Reyes-García et al., 2022). Biocultural conservation approaches are emerging as a promising alternative to conventional biodiversity conservation models, enabling equitable and sustainable futures (Díaz-Reviriego et al., 2024). The concept of biocultural diversity has evolved from initially denoting geographical areas with high levels of linguistic and biological diversity to a multifaceted and contested concept applicable in conservation and sustainability contexts (Bridgewater & Rotherham, 2019; Burke et al., 2023). Gavin et al. (2015) proposed guidelines for biocultural approaches to conservation, defining them as “conservation actions made in the service of sustaining the biophysical and sociocultural component of dynamic, interacting and interdependent social-ecological systems”. Biocultural approaches fundamentally transform the principles of conservation by explicitly adopting a systems perspective, emphasizing nature-culture inter-relationships, and highlighting the interwoven feedbacks between ecological states and human well-being (Sterling et al., 2017; Turner et al., 2022).

For decades, environmental education in biological conservation has been used to improve human-environment relations in different conservation contexts (Ardoin et al., 2020). The goal of these educational approaches is often to equip individuals and institutions to respond to environmental challenges and nurture pro-environmental behaviors and actions (Krasny, 2020). For this reason, environmental education is a core component of many conservation projects aiming to bring about positive social and environmental changes (Freund et al., 2019).

Efforts to adopt biocultural approaches and to frame conservation strategies from locally-relevant perspectives are increasingly adopted worldwide (Burke et al., 2023; Sterling et al., 2017). Yet, mainstream conservation has

often clashed with local needs, values, and knowledge, and education projects are no exception (Bowra et al., 2020; Smith, 2014). In the context of biodiversity conservation, environmental education projects are often led by non-governmental organizations (NGOs) as an extension or, at times, a replacement for the environmental education integrated into the school curriculum (Kimaryo, 2011; Shrestha, 2015). Formal education systems in southern African countries with colonial legacies continue to be grounded in Western viewpoints that are distant from local cultural realities (Hardman et al., 2008; Veriza, 2025). Similarly, NGO-led projects often project Western environmental values (Smith, 2014). Against this background, there are vibrant scholarly discussions about the urgent need to radically transform how environmental education is designed, implemented and assessed (Fricker, 2025; Leguizamón, 2024). Drawing on decolonial theory, this body of work emphasizes the importance of decolonizing environmental education and developing more inclusive, contextualized and relational approaches (Alhinai, 2025; Barreto-Cárdenas, 2025; Shabalala, 2025).

Previous research has sought to operationalize the concept of biocultural diversity by providing principles for conservation (Gavin et al., 2015), context-specific tools for pollinators (Hill et al., 2019), and strategies to address power dynamics (York, 2026). In the field of education, studies have applied a biocultural lens to examine graduate field courses in UNESCO's biosphere reserves (Mammadova, 2017; Medina et al., 2020), and formal school curriculum (García Campos, 2013). Additionally, there are several examples of culturally grounded education initiatives in biodiversity conservation contexts (Bhurekeni, 2022; Chandra, 2022; Rozzi et al., 2006; Vázquez, 2019). A recent review identified biocultural education as an emerging lens emphasizing the need to decolonize epistemologies with both formal and non-formal environmental education activities (Díaz-Reviriego et al., 2024). Consequently, biocultural discussions resonate with decolonial theory regarding the rethinking of environmental education through similar mechanisms. Biocultural approaches challenge the colonial conception of nature by viewing people and nature as inextricably

linked, recognizing a plurality of worldviews and values, and addressing epistemic injustices (Gallegos, 2015; Massarella et al., 2022; York, 2026).

In this research, we aim to examine the extent to which biocultural approaches can enable, strengthen, and facilitate the decolonialisation of environmental education. To do so, we adopt biocultural lenses to understand this phenomenon and illuminate how to decolonise environmental education within the context of conservation. We specifically investigate environmental education initiatives in Madagascar, which offers a unique context to explore these questions due to its outstanding levels of both biological and cultural diversity, as well as its colonial legacies.

2 | METHODS

2.1 | Context: Madagascar

Madagascar is a global priority for conservation (Mittermeier et al., 2011) due to its exceptional levels of endemism, including its charismatic lemurs (Goodman, 2023). Malagasy local communities maintain intergenerational connections to their environment through their livelihoods, cultural identities, worldviews, institutions and ecological knowledge, supported by a rich system of customary institutions known as *fady* (taboos) and *dina* (community conventions) (Golden & Comaroff, 2015). Thus, these communities have stewarded the country's landscapes for centuries, which are vital to their cultures and lifeways (Rasolojaona et al., 2021).

Despite decades of conservation efforts (Gardner et al., 2018), Madagascar's biodiversity faces severe challenges amid widespread poverty and inequality (Ralimanana et al., 2022). Although the conservation movement, primarily led by international organizations and funders, has sought to develop equitable models (Gardner et al., 2018), local communities remain systematically excluded from decision-making processes (Scales, 2014). In this context, environmental education has served as a tool to foster community involvement in biodiversity conservation (Razanatsoa et al., 2021). However, both formal and non-formal education interventions are often decontextualized from local realities, reflecting broader trends in Malagasy conservation policy (Rasolonaivo, 2025; Reibelt et al., 2017). Thus, Madagascar offers valuable insights into the potential of biocultural approaches for other African countries facing similar colonial legacies in education and conservation policies. In this article, we use “environmental education” as an umbrella term to embrace concepts such as conservation education, education for

sustainability, and education for sustainable development, recognizing that practitioners in Madagascar often use these terms interchangeably, despite their conceptual differences (Biedenweg et al., 2016).

2.2 | Analytical framework

We developed an analytical framework which we applied as our lenses to examine environmental education projects in Madagascar. This framework emerged from an initial review of literature on biocultural approaches, and builds on the theoretical model defined by Fernández-Llamazares and Cabeza (2018). We propose four themes that define the characteristics of biocultural approaches to environmental education in the context of biodiversity conservation: place-based learning approaches, local realities, biocultural relations, and inclusive conservation (Figure 1, refer to Appendix S1 for additional details about this definition).

2.3 | Data collection

This article draws on two main sources: targeted questionnaires, and follow-up interviews and ground truthing. We recruited participants with non-random purposive sampling methods, targeting anyone knowledgeable about environmental education projects in Madagascar. Thanks to previous years of interactions, including 8 months of in-depth field-based ethnographic work (Table 1), we had created an extensive network which ensured a comprehensive sample of the diversity of education projects and actors.

2.3.1 | Targeted questionnaires

The goal of the online questionnaire was to identify the extent to which environmental education projects in Madagascar are adopting biocultural approaches. We designed the questionnaire based on insights from existing literature on biocultural approaches and decolonising environmental education (read more in Appendix S1). We built the questionnaire on the REDCap (Research Electronic Data Capture) online system (Harris et al., 2009). We pilot-tested the questionnaire to ensure that all questions were clear, culturally appropriate, and feasible (Wardropper et al., 2021). It was available online from 28th February to 4th May 2022.

We sent 277 individual emails primarily targeting conservation and education practitioners, as well as researchers. Additionally, we sought complementary data

Biocultural approaches to environmental education

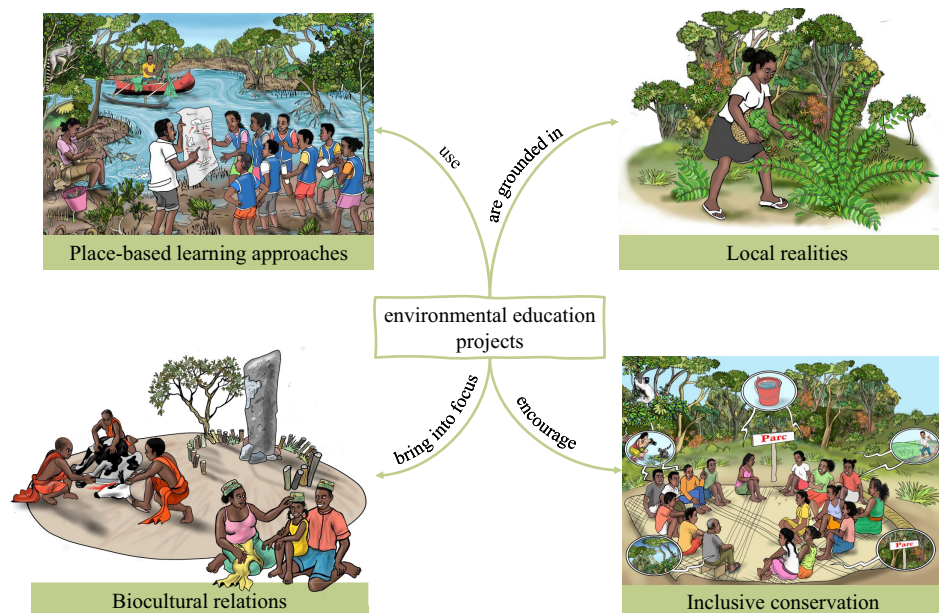


FIGURE 1 Visual representation of the definition of biocultural approaches to environmental education introducing four key themes. Ideally, each education program would adopt the four themes, as they are interwoven among them. [Illustrations: Nady B.F. Ratsimbazafy, 2022].

TABLE 1 Compilation of methods that contributed to the research design, divided by three stages.

When?	What?	Who?
Stage 1. Preparatory		
2018–2022	In-depth interviews, on-site visits on-site & online workshops	Environmental education practitioners across the country
Stage 2. Targeted questionnaires		
2022	Targeted questionnaires	89 complete questionnaires 61 individual education projects
Stage 3. Follow-up interviews and ground truthing		
2022	On-site visits	Three conservation organizations across Madagascar
2022	Follow-up semi-structured interviews	Eight practitioners from conservation organizations +2 researchers
2022	2-day workshop	Environmental education practitioners + Ministry of Education 46 participants, 34 organizations

Note: Stage 1 refers to research conducted prior to this study, and Stages 2 and 3 are data collection tools used during this research.

by posting advertisements on social media platforms (Twitter and Facebook). To maximize the response rates,

we resent the email a few days before the closing date and encouraged participants to share the link with others who might be interested.

The questionnaire lasted around 15 min, was available in three languages (English, French, and Malagasy), and included three sections: (1) general characteristics about the education project (e.g. location, target group, and teaching language); (2) questions to understand how education projects were relevant to local cultural contexts (e.g., learning tools, topics, knowledge systems, and expected outcomes); and (3) further information about the project and the respondent (e.g., employment sector and profile of respondent). Find the complete set of questions in Appendix S2.

2.3.2 | Follow-up interviews and ground truthing

Following the questionnaire, we conducted follow-up interviews with a subset of the respondents to gain in-depth understanding of the questionnaire's answers. We conducted a total of 10 semi-structured interviews (June–October 2022) with eight practitioners and two researchers who agreed to be contacted further. Each interview lasted around 1 h, with most conducted in person. During the interviews, we presented the preliminary results of the questionnaire and discussed potential reasons for the observed patterns, a process referred to as “member check” (Shenton, 2004) (see the interview guide in Appendix S3).

TABLE 2 Relation between the four themes from the analytical framework and the questionnaire's questions, including question type.

Theme	Item	Questionnaire question	Question type
All	–	Is this education project relevant to local cultural contexts? Why?	Yes/No Open-ended
Place-based learning approaches	Learning tool	Select the learning tool(s) used in the education project	Multiple answer from provided options
	Sense of place	To what extent is to foster emotional connection with the landscape, sense of home and identity an expected outcome from the education project?	Likert scale (1 = definitely not, to 5 = definitely)
	Intergenerational communication	To what extent is to promote intergenerational communication an expected outcome from the education project?	Likert scale (1 = definitely not, to 5 = definitely)
Local realities	Teaching language	Teaching language of the initiative	Multiple answer from provided options
	Knowledge systems	To what extent is the education project based on scientific knowledge, local knowledge or practitioner knowledge?	Likert scale (1 = not at all, to 5 = completely)
Biocultural relations	Topics	Select the content/topic(s) of the education project	Multiple answer from provided options
	Local culture	To what extent is to recognize local cultural values, beliefs and knowledge an expected outcome from the education project?	Likert scale (1 = definitely not, to 5 = definitely)
Inclusive conservation	Role of local communities	What were the roles of the local communities during the education project?	Likert scale (1 = not at all, to 5 = completely) on the following roles: participants, advisers, contributors, partners, designers and leaders
	Dialogue over conservation	To what extent is to facilitate dialogue between local communities and conservation practitioners an expected outcome from the education project?	Likert scale (1 = definitely not, to 5 = definitely)
	Participation in conservation	To what extent is to encourage meaningful participation in conservation and management an expected outcome from the education project?	Likert scale (1 = definitely not, to 5 = definitely)

Note: All questions presented belong to section 2 of the questionnaire, with the exception of “teaching language”.

Additionally, during June–July 2022 we visited three on-site education projects across Madagascar; we participated in the World Mangrove Day in northwest Madagascar; and we co-organized a two-day in-person workshop with representatives from 34 organizations, including environmental education practitioners working in conservation organizations, protected area managers, and representatives from the Ministry of Education. These experiences, together with our previous field-based ethnographic work (Table 1), provided an in-depth and contextualized understanding of the questionnaire results.

2.4 | Data analysis

We received 93 questionnaire responses, dismissing 4 for being incomplete. From the remaining 89, we randomly chose one entry per project for those education projects

that had multiple responses. Ultimately, our analysis included 61 individual projects.

Data analysis focused on section 2 of the questionnaire, along with the teaching language question from section 1. The remaining questions provided descriptive information. We organized the questionnaire's items according to the four themes of our analytical framework, as outlined in Table 2. The open-ended question ‘Is this education project relevant to local cultural contexts? Why?’, contributed to all four themes using a content analysis approach (Saldana, 2021). Direct quotes were derived from the 89 individual responses for this question.

The questionnaire included closed, open, and Likert-scale questions. For the latter, affirmative responses were those marked as “completely and considerably” or “definitely and probably”. We conducted quantitative analysis using IBM SPSS Statistics (version 28), and qualitative analysis with ATLAS.ti 22. The open-ended answers,

along with qualitative responses from follow-up interviews, enriched the quantitative results, providing further context. Finally, we summarized our main findings in Table 3, detailing current practices and offering suggestions for future possibilities based on existing decolonial and biocultural literature, as well as examples from Madagascar.

We followed online questionnaires guidelines (Wardropper et al., 2021) and ensured qualitative research trustworthiness (Shenton, 2004). We held frequent debriefing meetings among co-authors, and feedback from colleagues supported our process. Our long-term engagement with education practitioners in Madagascar made us confident in the data representativeness. Yet, our goal was not to provide generalizable results but to enhance understanding of biocultural approaches to environmental education by weaving together quantitative and qualitative data. We acknowledge that the self-administered questionnaires were open to the respondents' interpretation, necessitating cautious interpretation of the quantitative results, as they reflect perceived understandings rather than absolute numbers (see Appendix S6 for limitations). These aspects are further elaborated in Section 3, alongside qualitative results.

2.5 | Ethics and positionality

We are a diverse group of authors, working at the intersection of conservation and education, with backgrounds in agroforestry, conservation, biology, environmental education, ethnobiology, and social sciences, as well as extensive research experience in the country. Our authorship includes two environmental education practitioners and three Malagasy authors. We acknowledge that our analytical lenses are shaped by these identities, and we have strived to present perspectives of the research participants as integrally as possible, acknowledging that we cannot speak on behalf of the whole environmental education community in Madagascar.

The research was approved by the Ministry of Environment and Sustainable Development, Madagascar (7 December 2021, 436/21/MEDD/SG/DGGE/DAPRNE/SCBE.Re) and followed the Code of Ethics of the International Society of Ethnobiology. While no institutional ethical clearance was required, we adhered to the EU's General Data Protection Regulation and informed participants of our ethical guidelines. The project was conducted under a careful process of Free Prior and Informed Consent, and personal data was secured and anonymised. We obtained written consent from representatives of those projects that are directly featured in this study.

Participation was strictly voluntary, with no payment provided, and follow-up interviews were conducted with participants that explicitly expressed their interest. During on-site visits we showed respect for community protocols and customary law.

3 | RESULTS

Among the respondents, 46% were project organizers, 20% were educators, and 11% external collaborators or funders, while only 8% were participants in the education projects. Most respondents worked in non-governmental organizations (57%), followed by research institutions (23%) and government agencies (10%). Our results included projects led by both international and Malagasy organizations, but we found no substantial differences in the information reported based on the identity of the organizations (see Appendix S5).

3.1 | Overview of the education projects

Most education projects targeted primary schoolchildren (72%), followed by secondary school youth (62%), teachers and educators (52%), and local community members (39%). The majority of projects were led by conservation-focused NGOs (54%) and associations (20%), with fewer led by the government (8%), the private sector (7%), and universities (7%). Projects were distributed across Madagascar, with at least one in each of the 23 regions except Betsiboka. Most projects (59%) occurred in rural areas, and more than half (56%) took place in or around protected areas. Additional details can be found in Appendix S4.

3.2 | Theme 1: place-based learning approaches

The education projects used a diversity of learning tools (Figure 2): printed materials (e.g., booklets, comic books, and posters) were the most common one (used by 75% of the projects). On average, half of the projects also used fieldtrips, overnight camps and excursions (51%), despite their high costs. Interviewees agreed that fieldtrips are powerful tools to foster a sense of place, particularly for children who have never visited those natural areas. Some respondents (30%) reported using storytelling, theater, dance and music. For example, several respondents mentioned the adaptation of traditional songs and dances (such as *vako-drazana* [across Madagascar], *hiragasy* [particular to Merina], and *dombolo* [Antanala]) with environmental topics, which were often performed during celebrations. Three respondents also mentioned the use of radio.

Theme 1 | Place-based learning approaches

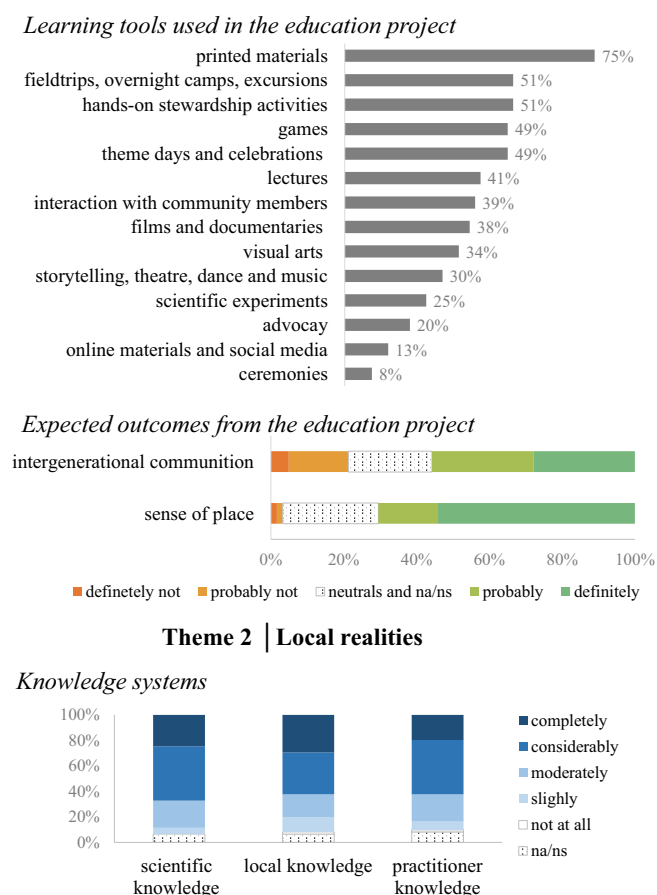


FIGURE 2 Main results from online questionnaires referring to theme 1 (place-based learning approaches) and theme 2 (local realities).

Most respondents (70.5%) stated that education projects fostered a sense of place (Figure 2). For some, that meant inspiring students to steward their local environments, and for others to reconnect children with the diversity of fauna and flora:

“This project uses local birds to connect regional elementary school students to their neighbourhood ecosystems and it is expected to enhance school children’s awareness, knowledge and attitudes towards local wildlife” [E36].

Above half of the respondents (55.7%) stated that the education projects fostered intergenerational communion (Figure 2). Yet, we could not clarify how exactly they did so, as most of them targeted children or youth from similar age, and older generations were rarely involved in the projects. Some respondents may have assumed that this question referred to communication from children to parents, rather than between elders and younger generations. In this line, some respondents mentioned noticing that participants shared what they had learnt with friends and family members.

3.3 | Theme 2: local realities

Most education projects (97%) used Malagasy as the teaching language. Of those, 74% reported using local dialects. Overall, 17 local dialects were mentioned. Practitioners agreed on the importance of using local dialects to facilitate communication, as well as build trust with the communities. Printed educational materials were often translated to local dialects. Yet, the use of local dialects during oral communication depended on the educator’s cultural background; practitioners coming from other regions (e.g., Antananarivo) mentioned their efforts to learn local dialects.

Diverse knowledge systems were used in the education projects (Figure 2): scientific (used by 67.2% of the respondents), local (62.3%) and practitioner’s knowledge (62.3%). Yet, during the follow-up interviews, respondents couldn’t clarify how and whether local knowledge is used. Despite that, some practitioners mentioned that local communities had a lot of knowledge about the forest, certain animal species or medicinal plants. Respondents provided some examples where local communities were encouraged to share their local knowledge, for example, when acting as guides in nature trips or by sharing their knowledge during education activities:

“The program asks participants to describe how they use the local environment, what benefits they derive, what taboos or social norms exist, especially around hunting practices” [E04].

Respondents explained that education projects were contextualized to local realities by targeting local flagship species and local threats. Some projects explained the connections between daily life practices and the environment, such as the links between small-scale fisheries and mangroves. Additionally, other projects described the benefits of the ecosystems to daily life as well as the local consequences of biodiversity loss:

“This project aims to raise awareness of the local community specifically children and youth about the importance of the protected areas in terms of social, economic and environmental aspects, especially the benefits they receive and the risks they can have if their protected areas are damaged and destroyed” [M13].

3.4 | Theme 3: biocultural relations

Education projects were generally focused around ecological and environmental topics, such as biodiversity and ecosystems (included in 82% of the projects), or reforestation, tree nurseries and vegetable gardens (75%) (Figure 3). Contrarily, few education projects included cultural aspects such as traditional agriculture (16%),

traditional medicine (10%), and respect, social norms and taboos (10%). Interviewees explained that the emphasis on ecological topics may align with the demands and interests of funders, as well as the availability of education materials. Most education projects apparently overlooked the links between biodiversity and culture, despite half of the respondents (50.8%) affirming that some of the expected outcomes of the education projects were to recognize local cultural values, beliefs and knowledge (Figure 2c). Some respondents recognized the importance that culture plays in the success of a project, and the need to respect and consider cultural practices of the area of intervention. For example, one respondent mentioned that cultural rituals were followed, such as the sacrifice of cattle (*zebu*) during celebrations. Another described a game designed to raise awareness on the protection and sustainable management of the *mashes*, an ecosystem of cultural importance. Additionally, one respondent referred to an organization that explicitly incorporated cultural elements in their education materials:

“The association produces tools to support environmental education (illustrated books on endangered marine species such as sea turtles, dugongs and hammerhead sharks). It [the association] conducted socio-cultural surveys with local communities before producing these tools. This was done in order to value their cultures and to strengthen the sense of belonging between the students and their localities” [F04].

Despite these exceptions, organizations generally tended to avoid mentioning cultural topics, often framing them as conservation threats when they did. Interviewees explained that practitioners may avoid cultural topics due to lack of awareness, especially if they were not originally from the area. Or they may see the need to address those topics, believing their role is to introduce “new concepts”, and culture may be seen as something local communities are already familiar with. Additionally, concerns about encouraging people to go inside protected areas led them to avoid certain topics such as medicinal plants. Other cultural practices, such as traditional agricultural practices (slash-and-burn), hunting or charcoal use, were often identified as threats to biodiversity conservation, deemed unsustainable, and suggested that they should be abandoned or changed to more sustainable alternatives.

Practitioners recognized the existence of cultural elements that could enhance biodiversity conservation. Some mentioned the location of tombs and worship sites inside the forest (*fanamasinana*), which made them “sacred” and “untouched” places. They also mentioned cultural representations of certain animal species in folklore such as crocodiles or tortoises. Others reported the existence of taboos (*fady*). In general terms, those cultural aspects were not mentioned in the education projects. Or, if they were, culture was mentioned as something you could pick and select from:

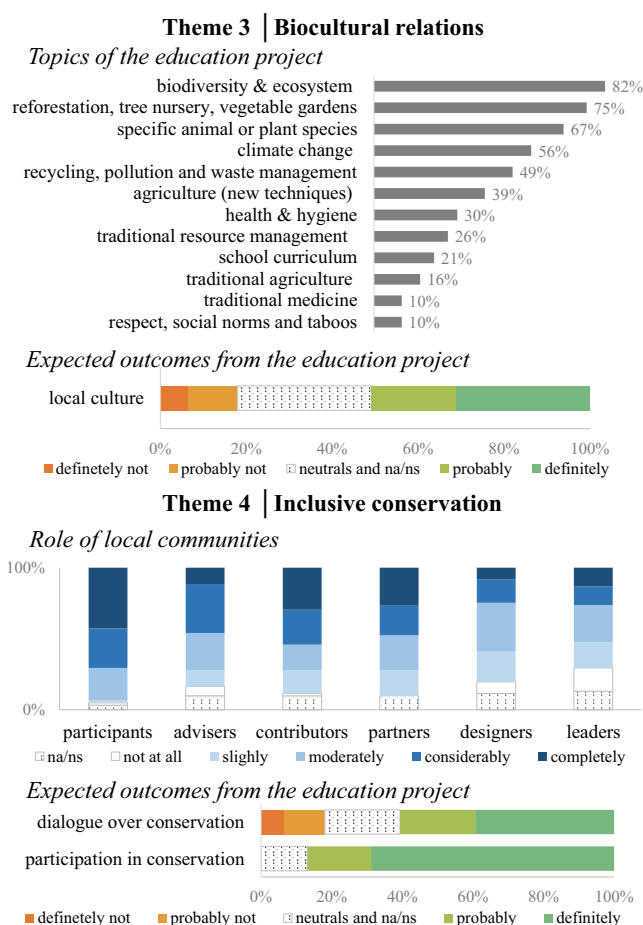


FIGURE 3 Main results from online questionnaires referring to theme 3 (biocultural relations) and theme 4 (inclusive conservation).

“If there are something related to the lemurs and the local culture, we use that to enhance the conservation of the targeted species and their environment. For taboo belief like Aye-Aye, that is also an opportunity for us to talk to the children and the villagers that it is not true that Aye Aye is a bad omen” [E08].

3.5 | Theme 4: inclusive conservation

Most respondents viewed local communities primarily as participants in the education projects (70.5%), but they were also often engaged as advisers (45.9%), contributors (54.1%) or partners (47.5%) (Figure 3). Respondents had varied interpretations of these partnership roles. Some described courtesy visits in which organizations sought permission from local authorities to proceed with their activities. One respondent considered local communities as partners because they facilitated education activities by preparing the location and communicating schedules to participants. Others explained that projects were designed based on the views and needs of local

communities. Less commonly, respondents considered that local communities had a role of designers (24.6%) or leaders (26.2%). The concept of leaders could be understood widely, including participating as local guides during fieldtrips, leading certain sections of the projects, and fully leading the education activities.

While most projects were led by external organizations, we found examples of projects led by local communities. For example, youth groups, often supported by external NGOs, facilitated education activities. Local community associations also led initiatives, and in urban areas, university students and youth associations conducted environmental awareness campaigns. Although many organizations focused on children and youth, some targeted schoolteachers to empower them as educators.

Respondents stated that the education projects encouraged dialogue over conservation (60.7%) (Figure 3), but this often occurred spontaneously, rather than through intentional project design. One respondent mentioned that participants typically shared their

learnings with relatives and friends after the project, while another observed spontaneous discussions on traditional natural resource management practices during teacher training. An exceptional example cited was a tabletop game specifically designed to foster discussions over natural resource management.

Additionally, respondents agreed that the education projects encouraged participation in conservation (86.9%) (Figure 2c), primarily through hands-on activities like tree nurseries, vegetable gardens, and reforestation, rather than self-organization or decision-making. Participation in conservation was often displaced into the future, as many projects targeted children with the hope that they would become the future conservation actors in their region. For example:

“The children environmental education aims to instil a spirit of conservation of natural resources, so that they [the children] can be the messengers of conservation and prepare them to be the actors and advocates for resource conservation in their localities” [F32].

TABLE 3 Current practices, future possibilities, and concrete examples from Madagascar of biocultural approaches to environmental education.

Towards biocultural approaches to environmental education			
Themes	Current practices: from results	Future possibilities: from results and literature	Concrete examples from Madagascar: from field-based participant observations
Place-based learning approaches	Diversity of learning tools Fieldtrips and outdoors hands-on experiences Traditional songs and dances about environmental topics Mostly targeting children and youth	Place-based & land education Embodied nature-based experiences Involvement of community members Interactions younger–elder generations Dance, songs, ceremonies and storytelling	Little Rangers project <i>Chances for Nature, Kirindy Forest</i> Three-days camp in a forest station for children and youth living nearby. Experiential learning, including day and night walks in the forest, an opportunity to see species such as sifakas, mouse lemurs for the first time for many of them.
Local realities	Local dialects in printed materials Unclear role of local knowledge Local ecosystems, local problems and threats Links between environment and daily lives	Local dialects in oral communication Rethink roles of learners and experts Local knowledge in education materials Adapt to local realities Radical listening for community engagement	Wetland Education game (WEdu) <i>Madagascar Wildlife Conservation, Alaotra</i> Role board game that builds upon both local and scientific knowledge. The game, targeted at natural resource users, allows to learn and establish dialogue about sustainable resource use (Reibelt et al., 2018).
Biocultural relations	Biological and environmental topics Existing cultural synergies not exploited Cultural topics avoided or considered as a threat to conservation	Build on local identities and cultural practices Celebrate the biological and culture richness Address biocultural conflicts – open dialogue	Mandala Coloring Booklet <i>L'Homme et l'Environnement</i> Education material that focus on the natural and cultural heritage of Madagascar. The booklet mentions the richness of local culture, traditional medicines, sacred sites, etc.
Inclusive conservation	Hands-on participation in conservation Local communities advise and contribute Mostly led by external organizations Examples of locally-led projects Empowerment-driven programs	Meaningful dialogues Participation in decision-making Support community-led projects Local communities as leaders and co-creators Enhance advocacy skills	Mangrove Club <i>Blue Ventures, Ambanja</i> Children and youth access education activities in marine conservation in a playful way, using games and interactive storytelling. The NGO develops the curriculum by integrating local and scientific knowledge. Each Club is led by a volunteer from the local communities who receives training and accompaniment.

4 | DISCUSSION

Our results reveal that education projects in Madagascar include certain elements that align with biocultural approaches, by seeing people and nature as inextricably linked, recognizing a plurality of worldviews, and addressing epistemic justice (find some illustrative examples in Figure 4). While great advances are being made, ongoing challenges remain towards the decolonisation of environmental education, particularly in contexts where cultural and biological objectives are misaligned. We next discuss our findings considering current practices and examining future possibilities outlined in Table 3.

4.1 | Towards embodied experiences to foster a sense of place

Our results indicate that education projects use a diversity of learning tools, emphasizing place-based experiences such as field trips and hands-on outdoor experiences to foster affective bonds between learners and their local environments. This aligns with the principles of place-based education, which promote experiential learning, learning from the local environment, and a sense of place (Smith & Sobel, 2010). However, while nature-based experiences have well-documented benefits (Macht, 2016), they often reflect Western notions and overlook the sociocultural and economic contexts of the participants (Bowra et al., 2020). Our results suggest that the efforts invested organizing fieldtrips to natural areas reflect a colonial conception of 'pristine nature' separated from humans (Gallegos, 2015). In contrast, a biocultural perspective emphasize human-nature interactions (Carrière et al., 2022), recognizing that rural Malagasy people may see nature as essential for their nutrition, health and cultural ties (Scales, 2012). For this reason, we call educational approaches that embrace the land education paradigm (sensu Bowra et al., 2020) challenging colonial

structures (Wildcat et al., 2014). Initiatives should reflect the lived realities of the participants (Datta & Jean Kayira, 2022) and cherish children's daily interactions with their environment through play or subsistence activities (Porcher et al., 2022).

Our results do not clarify whether community elders, spiritual leaders, and custodians of local knowledge are actively involved in the education projects. Engaging community members is essential for grounding programs in local knowledge and ensuring intergenerational transmission of knowledge and skills, thereby supporting cultural continuity and social memory of landscapes (Bowra et al., 2020). Previous studies have described a range of initiatives to promote intergenerational communication (Cincera et al., 2021). For example, the radio project *Echoes of the Forest (Akon'ny Ala)* around Ranomafana National Park incorporated local folk stories, and elders occasionally participated as guest storytellers in school sessions (Razafindravony et al., 2023).

4.2 | Education grounded in local resources, themes and values

Our findings illustrate that education projects are often contextualized to local environments and daily practices, aligning with increasing calls on contextualized education that is flexible and aligned with children's realities (Skerrett, 2018). The Malagasy National Policy on Environmental Education (2013) also emphasizes the importance of addressing local problems, yet the school curriculum often lacks culturally specific content (Rasolonaivo, 2025; Veriza, 2025). Thus, NGOs enrich the learning process by connecting it to local realities, particularly those targeting teachers who incorporate this approach inside schools (Niens et al., 2021). Several organizations mentioned designing projects based on local needs, particularly in technical training and alternative livelihoods. However, our results do not indicate whether



FIGURE 4 Examples from education projects: (a) trip inside the Kirindy Forest during the Little Rangers project (Chances for Nature); (b) community elders participating in the WEdu role board game in Alaotra (Madagascar Wildlife Conservation); and (c) one of the sessions of the Mangrove Club (Blue Ventures) in Ambanja led by a community member.

projects begin with a solid understanding of local views and aspirations. An exception is the comic book *arovy fa harena* at Lake Alaotra, developed considering local values and realities (Maminirina et al., 2006).

Our results show that projects are conducted in local dialects. This may enhance local understanding and acceptability (Owens & Nzumba, 2021), and help ground the initiatives in local social–ecological systems, as language is central to cultural identity (Skerrett, 2018). However, our results suggest that the incorporation of local knowledge in education activities is limited, contrasting with extensive literature on local ecological knowledge across Madagascar (Porcher et al., 2022; Razafindraibe et al., 2013). This may be due to project designers often not being from the area, which complicates the use of local knowledge. Additionally, it requires rethinking the role of educators, acknowledging that they are not the sole experts (Skerrett, 2018), recognizing youth as knowledge-holders (Smith, 2014), and allowing community members to teach alongside teachers (Owuor, 2007). It is also important to acknowledge that local knowledge may not be explicit; it often involves social interactions and is anchored in daily practices (Alhinai, 2025). Therefore, promoting cultural, spiritual, and land-based practices through indigenous pedagogies—such as storytelling, dance, songs, or seasonal ceremonies—may be essential (Bowra et al., 2020; Shabalala, 2025).

4.3 | From biocultural conflicts to biocultural relations

Our participants recognized potential synergies between conservation values and local values, including informal institutions like taboos and social norms, reflecting previous research (Bhurekeni, 2022; Randimbiharirina et al., 2021). However, our findings suggest that education projects mostly overlooked the interrelations between nature and culture, focusing exclusively on ecological issues or considering existing relationships as a threat or particularly. Only a few organizations mentioned introducing cultural elements into their educational content, such as the NGO l'Homme et l'Environnement (Table 3) and C3 Madagascar, which has created storybooks about marine species reflecting the sociocultural aspects of local communities in northern Madagascar. Biocultural approaches could strengthen the understandings of the intrinsic link between culture and nature, recognizing and building on existing relationships (Shabalala, 2025).

In contrast, cultural relationships with land in our results are often mentioned to criticize unsustainable practices. Conservation experts have demonized cultural practices like slash-and-burn agriculture (*tavy* in many parts of

Madagascar, *hatsake* in western Madagascar) (Scales, 2012), aligning with the prevalent narrative that links landscape degradation in Madagascar to the unsustainable use of fire by local communities (Phelps et al., 2022). Our results indicate that this discourse—labelling local practices as environmentally destructive—is also common in education projects, mirroring similar findings on the coloniality of environmental clubs in Tanzania (Njau, 2024). Adopting biocultural approaches requires recognizing and celebrating synergies between conservation and local cultural values, moving beyond the narrative of blame and criminalization when conflicts exist, and fostering dialogue to identify pathways to maintain cultural practices without undermining biodiversity (Torrents-Ticó et al., 2022). Additionally, it is essential to consider who determines which cultural aspects are valuable for conservation and whose agendas are being served (York, 2026).

4.4 | Towards inclusive and legitimate conservation models

Our findings illustrate that most education projects encourage hands-on participation in conservation activities, which can strengthen youth's empowerment and sense of community, ultimately motivating them to become environmental leaders (Cincera et al., 2021). Some respondents noted the emancipatory role of environmental education in empowering both youths and adults to manage their natural resources (Reibelt et al., 2017). However, our results suggest that most education projects are not specifically designed to foster dialogues on conservation topics or to ensure local participation in decision-making. Role playing-games, participatory theater, intergenerational dialogues and community mapping projects could support learners by facilitating participation and reflection from diverse perspectives, and knowledge systems (Reibelt et al., 2018; Shabalala, 2025).

Our results indicate that while most organizations design their education projects with community consultation, few effectively involve communities in decision-making. Most projects are led by external organizations, although some community-led projects exist. This reflects colonial legacies in the conservation landscape, where communities rarely have meaningful opportunities to participate in the planning and implementation of projects (Eklund et al., 2022; Scales, 2014). Examples outside Madagascar illustrate a potential for community-led initiatives supported by NGOs and external partners (Chandra, 2022). Similarly, biocultural approaches have served as effective advocacy tools that recognize the active roles of Indigenous Peoples and local communities

(Bridgewater & Rotherham, 2019). Future education project efforts could focus on enhancing the advocacy skills of communities with strong ties to their territories, strengthening their rights, and supporting their engagement in decision-making processes (Eklund et al., 2022; Rasolojaona et al., 2021).

5 | CONCLUSIONS

The education projects reviewed in this article illustrate a wide range of learning tools and pedagogical approaches that support Madagascar's biocultural heritage. Our testimonies suggest that ongoing efforts to decolonize environmental education projects coexist with colonial ideologies, and that biocultural lenses can strengthen the pursuit of epistemic justice. Although an exhaustive account of all biocultural education initiatives in the country is beyond the scope of this study, we offer examples and recommendations to inform the design of future emancipatory and culturally grounded education programmes.

Our insights extend beyond Madagascar, highlighting that environmental education programs often reinforce colonial constructions of human-nature relations, with limited space for local epistemologies (Barreto-Cárdenas, 2025; Bowra et al., 2020; Njau, 2024). In contrast, initiatives that integrate local knowledges, customary practices, and community priorities have the potential to disrupt these narratives and foster more inclusive, equitable forms of place-based learning (e.g., Bhurekeni, 2022; Contreras & Camou, 2024). This wider body of work underscores that the challenges that identified in Madagascar are part of systemic tensions between colonial legacies and local biocultural realities.

Overall, this research adds to ongoing calls to decolonize environmental education (Barreto-Cárdenas, 2025; Shabalala, 2025) and break from Western colonial pedagogical traditions that reinforce a nature-culture dichotomy (Alhinai, 2025). Our findings suggest that biocultural approaches can serve as a pathway to decolonise environmental education by foregrounding relational perspectives, embracing place-based learning, and recognizing cultural diversity as integral to biodiversity conservation.

AUTHOR CONTRIBUTIONS

Aina Brias-Guinart, Mar Cabeza, Álvaro Fernández-Llamazares and Lena Reibelt conceived the ideas and designed the methodology. Aina Brias-Guinart and Lovasoa Razafindravony collected the data. Aina Brias-Guinart analyzed the data. Aina Brias-Guinart led the

writing of the manuscript. All authors contributed critically to the drafts and gave final approval for publication.

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CONFLICT OF INTEREST STATEMENT

Lovasoa Razafindravony and Lena Reibelt are members of conservation organizations working in Madagascar.

DATA AVAILABILITY STATEMENT

The data has not been shared in an online repository as it is sensitive information. Statement about ethics in the main manuscript.

ETHICS STATEMENT

The research was approved by the Ministry of Environment and Sustainable Development, Madagascar (7 December 2021, 436/21/MEDD/SG/DGGE/DAPRNE/SCBE.Re).

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SUPPORTING INFORMATION

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