Original Article

Lessons for ensuring continued community participation in a mangrove blue carbon conservation and restoration project in Madagascar

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Abstract

Successful conservation projects that restrict or change access to common pool resources require meaningful community participation not only through consultation but also by empowering communities to take a leading role from the early stages of its design. In this study, community participation was assessed in the Tahiry Honko community-led mangrove blue carbon project in southwest Madagascar using the Spectrum of Public Participation tool developed by the International Association for Public Participation. Trends of community participation at village meetings were assessed using the meeting records from 2014 to 2019. Performance in the project activities was assessed based on the indicators of success. It was learned that: (*i*) careful scheduling of meetings is crucial to avoid community fatigue; (*ii*) anonymous democratic votes are an effective, inclusive approach to address domination in a group activity and obtain informed consent; (*iii*) creating a comfortable space for women is vital to promote their participation in decision-making; (*iv*) voluntary approach with meal compensation is effective to engage all community groups in mangrove replanting; (*v*) competitive process is crucial to recruit motivated volunteers for mangrove forest patrols; and (*vi*) dissemination of patrol results is helpful in developing an adaptive strategy in the absence of effective enforcement of rules.

Keywords: community participation, Tahiry Honko, mangroves, Bay of Assassins, Madagascar

Introduction

Mangroves are among the most productive ecosystems in the world and have important economic benefits (Salem and Mercer, 2012; Rizal, 2018). They support fisheries, and provide raw material for construction, opportunities for tourism and recreation, coastal protection, erosion control, nutrient cycling and water purification (Barbier *et al.*, 2011; Barbier, 2015; ITTO, 2013). Despite the important role played by mangroves, they are threatened by alarming rates of deforestation; the area of mangroves decreased globally by 104 million ha between 1990 and 2020, with an average annual loss of 21,200 ha between 2010 and 2020 (FAO, 2020).The declining condition of mangroves has placed their ecosystem services at increasing risk and threatens the well-being of individuals and local communities (MEA, 2005) Additionally, if mangroves are degraded, the carbon stored in the soil is released, resulting in CO_2 emissions that contribute to climate change (Hamilton and Friess, 2018; Pendleton *et al.*, 2012). The conservation and restoration of mangroves has been recognised as an

important component to not only mitigate climate change (Ellison *et al.*, 2020; Taillardat *et al.*, 2018) but also to maintain the considerable ecosystem goods and services that they provide (Macreadie *et al.*, 2017; Hutchison *et al.*, 2014). Payments for Ecosystem Services (PES) schemes have been promoted as an innovative approach to provide financial incentives for protecting and restoring threatened marine ecosystems (Murray *et al.*, 2011). While the large majority of carbon-based PES projects concern terrestrial forests (Warren-Rhodes *et al.*, 2011), this approach has also been used to finance the protection and restoration of blue carbon ecosystems, such as mangroves (Alongi, 2011; Plan Vivo, 2020; Vanderklift *et al.*, 2022).

Tahiry Honko, which means 'preserving mangroves' in the local dialect, is a Plan Vivo registered community-led mangrove carbon project located in the Bay of Assassins (BoA), southwest Madagascar (Blue Ventures, 2019), established in partnership with the marine conservation organisation Blue Ventures (BV). The aim of this project is to promote a sustainable, long-term PES scheme through the sale of Plan Vivo Certificates or PVC, to reduce deforestation and degradation, and to restore mangroves in the BoA. A PVC represents the long-term sequestration or mitigation of one ton of CO2e by a Plan Vivo-certified project. Tahiry Honko generates more than 1000 PVCs per year through the conservation and restoration of over 1,200 ha of mangrove surrounding the BoA during the 20-year project period. Since this is designed as a community-led project and restricts access to the mangrove resources in the bay, participation of the community at various stages in developing the project is crucial and viewed as a basis for project success (Thwala, 2010). According to Sherry R Arnstein (Arnstein, 1969), there is a critical difference between going through the empty ritual of participation and having the real power needed to affect the outcome of the process. In the context of project development, participation refers to an active process whereby beneficiaries influence the direction and execution of development projects rather than merely receiving a share of project benefits (Paul,1987). Participation is based on the key human rights principles of individual autonomy and self-determination as part of basic human dignity (FAO, 2016; UN, 2013). The right to participate has also been included in several conventions regarding specific topical areas, most notably health and the environment. Agenda 21 of the Rio Declaration and Forest Principles recognises: indigenous rights to land, intellectual and cultural property, and the right to maintain their customary and administrative practices; the need for greater participation in decision-making; and the value of their involvement in forest management and conservation (WHO, 2002). Article 2 of the Declaration on the Rights of Persons Belonging to National or Ethnic, Religious and Linguistic Minorities affirms that persons belonging to minorities have the right to participate effectively in cultural, religious, social, economic and public life (United Nations, 1992). Aspiration 6 of Agenda 2063-African Union calls for the active involvement of all citizens in decision making in social and environmental development (African Union Commission, 2015). The United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) declares indigenous people's particular rights to free, prior, and informed consent (FPIC) in matters which affect their lives and livelihood (United Nation, 2007). In Plan Vivo Projects, FPIC principles apply to Indigenous Peoples and local communities with statutory or customary rights to land or resources in the project area (Plan Vivo, 2021). FPIC is not just a result of a process to obtain consent to a particular project; it is also a process in itself, and one by which Indigenous Peoples are able to conduct their own independent and collective discussions and decision-making (FAO, 2016)

While Rakotomahazo (2019) argues that participatory approaches were particularly well-suited to the planning and development of Tahiry Honko, the trend and level of community participation, including women, merits further examination to extract lessons for ensuring continued community participation. Women are often marginalised from participation in community decision-making (FAO, 2016), and their participation is crucial to ensure greater success and sustainability of projects because they are important mangrove resource-users, so restriction of access to mangrove impacts their livelihoods. Tahiry Honko is a performance-based PES initiative and the monetary rewards to communities are conditional on performance and indicators of success (Blue Ventures, 2019). Therefore, it is essential to examine the factors shaping community performance in project activities to understand how community participation influences performance (Wunder, 2005). Thus, this study aimed to assess community participation within the 10 partner villages in the BoA in planning and developing Tahiry Honko. During the six-year period from 2014 to 2019, from the first introduction of the concept of a carbon project to the villages to the validation of the project by Plan Vivo, lessons learned were extracted

for continued community participation. Lessons were extracted by i) assessing the trend of attendance and rate of participation of community members within the 10 villages in village meetings and decision-making processes, and ii) evaluating the participation and performance of the communities in the project activities, especially in mangrove replanting, forest patrolling and Dina (local regulations designed and instituted by the community association to govern the mangrove uses in the project area) enforcement, all of which impact the expected climate benefits of Tahiry Honko and are related to the PES rewards (Blue Ventures, 2019). For this study, it was important to understand the participation of community members in mangrove replanting which is among the main project activities, as this is viewed as a key to success in ecosystem restoration (Stone *et al.*, 2008; UNEP, 2020). The assessment included forest patrols because the presence of rangers on the ground is viewed as the best way to control illegal forest activities (Covey and McGraw, 2014; Ratcliffe, 2004; Tranquilli *et al.*, 2014), and active surveillance is considered among the strongest deterrents to illegal activity (Gonedelé Bi *et al.*, 2019). The performance of the community in enforcing Dina was also assessed, as law enforcement is considered a central tenet of successful conservation (Ratcliffe, 2004; Tranquilli *et al.*, 2014).

Materials and methods

Study site

The study site is located in the BoA, or Helodrano Fagnemotse in Malagasy, situated in the Befandefa municipality and Morombe district, southwest region of Madagascar (Fig. 1). The bay lies in the southern portion of the Velondriake Locally Managed Marine Area (LMMA), which is classified as a Category V protected area under the International Union for Conservation of Nature (IUCN). The LMMA is co-managed by the Velondriake Association (VA) and BV. The BoA encompasses 10 villages, members of which are partners in Tahiry Honko. The population of the area is estimated at 3,992 residents, of which 20 % (806

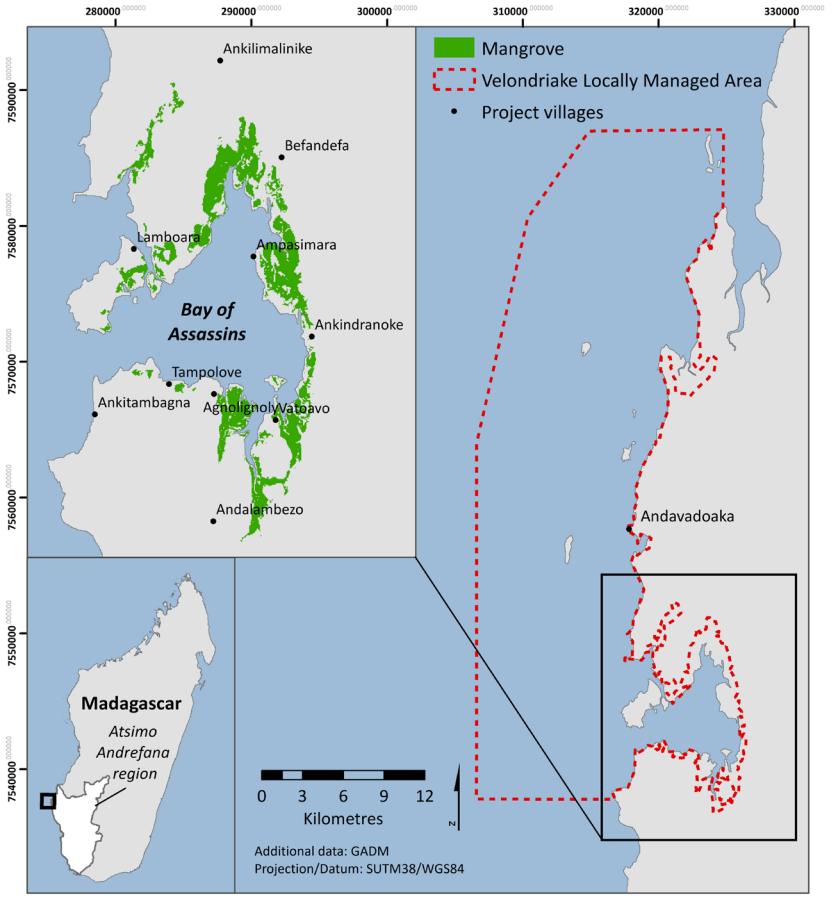

Figure 1. Map of the Bay of Assassins in relation to the Velondriake LMMA, Madagascar.

residents) are adults aged 25–49 years (Blue Ventures, 2015). Around 33 % of the adult population is illiterate and 87 % have completed only primary education (one to six years of education) (Blue Ventures, 2015). The population within the bay is composed of three main ethnic groups: the Vezo, Mikea and Masikoro. It is primarily populated by Vezo traditional fishers who depend on the harvest of marine resources for subsistence and income (Barnes-Mauthe *et al.*, 2013). Historically, the Mikea and Masikoro were more dependent on the dry forests, but due to changing rainfall patterns, resulting in drought and crop failure, many people have migrated to the coast (Stiles, 1998).

The mangrove forest in the BoA covers an area of 1,300 ha (Jones *et al.*, 2016), and has seven of the eight mangrove species found in Madagascar. Between 2002 and 2014, 3.18 % of mangroves in the BoA were lost, which equates to an annual net loss of 0.27 % (Benson *et al.*, 2017). Mangroves in the bay are harvested to provide fuelwood for domestic cooking, building material for housing and construction of lime kilns (Scales *et al.*, 2017).

In response to mangrove loss, communities in the BoA proposed education, awareness raising and law enforcement. They also established three types of management zone within their mangroves: strict conservation, reforestation and sustainable use. Within these management zones, resource use is regulated by Dina (Rakotomahazo *et al.*, 2019). As an example, in the conservation zone, no mangrove harvesting is allowed, while annual quotas were determined by analysis of the forest inventory within the sustainable use areas. In the sustainable use zones, harvesting of timber for lime production is not allowed. In this context, Tahiry Honko was implemented with the aim to incentivise the local communities to participate in and support the activities in preserving and restoring their mangrove forests also to contribute to raising awareness of the importance of mangrove ecosystems. Details of the approach and process are provided in Table 1.

Project interventions and activities

As detailed at length in the Project Design Document (Blue Ventures, 2019), the intervention undertaken in the project area included prevention of ecosystem conversion, ecosystem restoration, and improved land use (forest) management. The three main activities included mangrove replanting, forest patrols and surveillance, and Dina enforcement.

Mangrove reforestation

Degraded areas were delineated by the local community during the participatory mangrove zoning based on their local knowledge (Table 1). The indicators used by communities to identify degraded areas for reforestation were largely based on their perceptions of the clear-cutting area or high density of cut stumps (e.g., more than 50 % of the trees are cut), although this was not formally agreed upon during the mapping exercises, so there is likely some variation between communities in their definition of "degraded". Degraded areas of mangroves were replanted with species of mangrove previously present, mainly *Ceriops tagal*, *Rhizophora mucronata*, and *Bruguieria gymnorrizha*, targets for lime production (Scales *et al.*, 2017). The direct planting of mangrove propagules by hand was the approach applied to replace the harvested trees and restore the degraded area of the BoA (UNEP, 2020). The mature propagules were manually collected from the mother trees, usually a day before planting. The source of the propagules used was strictly local. The planting arrangements were random layouts, ranging from 0.5 m to 1.5 m apart and the three species were planted together. The mangrove replanting activity began in 2015, with community members from the 10 villages (adults, youth, and school children of all genders) taking part on a voluntary basis, but a meal, locally called rima, was offered to all participants after the re-planting session. For the 10 villages, the set objective for the mangrove replanting was 10 ha per year from 2016 (Blue Ventures, 2019). Mangrove planting was scheduled by the community and was usually carried out when the propagules were abundant and mature. Further, big mangrove plantation events were organised during the celebration of International Women's Day (the 8th of March) and Mangrove Day (the 26th July) to raise awareness of the importance of mangrove restoration (Ravaoarinorostihoarana *et al.*, 2023).

Forest patrols and surveillance

Patrolling of the mangrove conservation zone, where harvesting of both dead and live trees is prohibited by Dina, began in 2018 with three surveillance and evaluation committee members (Comité de Suivi et Évaluation, CSE) and one CSE supervisor. Nine additional CSE members were recruited in 2019 upon the request of the communities. The CSEs were recruited through job advertisements open to all residents in the project area, and the use of a competitive process rather than an appointment-based process previously used by the community. In total, 12 CSE members

Table 1. Purpose and approach of the village meetings from 2014 to 2019 at the 10 villages.

Year	Purpose of the village meeting	Approach adopted
2014	Introducing the concept of the Plan Vivo project.	Oral presentation at each of the 10 villages using Microsoft PowerPoint slides, followed by a question and answer session.
	Democratic vote about whether *Tahiry Honko* should go ahead or not.	Anonymous and individual democratic vote for adults at the village level, using color-coded ballots (held a month following the introduction of the concept) • green for "Yes: I want the project", • red for "No: I do not want the project" • white for "I have no idea"
	Discussing the mangrove management plan.	Open discussion to introduce and consult the community on the mangrove management plan.
	Discussing participatory mangrove zoning.	Workshops at the village level to discuss the delineation of preferred different mangrove zones on a printed map (detailed at length in Rakotomahazo *et al.*, (2019).
	Discussing participatory mangrove zoning.	Workshop to validate the participatory zoning map gathering two or three community representatives from each of the 10 villages to address the overlap of mangrove use issue between villages.
2015	Developing *Dina* for mangrove use and management.	Two rounds of village workshops in each of the 10 villages: 1. Sharing of ideas and gathering propositions of Dina for mangrove management at the village level via a working group per gender. 2. Refining the content of Dina in each of the 10 villages.
	Public consultation about *Dina* for mangrove management.	Workshop gathering local and regional authorities, NGOs, partners and community representatives from each of the 10 villages to discuss *Dina* for mangrove management.
	Disseminating *Dina*.	Outreach tours at the *Fokontany* (village council) level and in each of the 10 villages and outside of the project area.
2016	Discussing the mangrove management plan.	Village meeting to present and discuss the sustainable harvesting quota for mangrove wood per year/village and the *Dina* for each mangrove zone.
	Discussing the mangrove management plan.	Public consultation through workshops gathering local and regional authorities, NGOs, partners and community representatives from each of the 10 villages with the aim to pre-validate the mangrove management plan.
	Raising awareness about *Dina* and national law regulating the mangroves.	Village outreach tours with the regional forestry authority (*chef cantonment*) to inform communities of the national law regulating mangroves in Madagascar.
2017	Discussing the mangrove management plan.	Village outreach tours to validate the mangrove management plan and the annual quota per household per village per year, which is the harvest allowance calculated based on the capacity of regeneration of the mangrove forest and the community need.
	Discussing the mangrove management plan.	Dissemination of the validated mangrove management plan across the 10 villages.
	Discussing the sharing of project benefits.	Three rounds of village meetings to discuss and validate the benefits sharing scheme: 1. Discussion about the use and repartition of the carbon revenue. 2. Discussion about the village priority on the infrastructure project (wells, clinics and school building) and estimation of the budget for the project. 3. Final approval of benefit sharing and priorities per village (wells, clinics, school building).
	Discussing the grievance mechanism.	Workshop about the grievance mechanism with civil society organisations (CSO) gathering two community representatives from each of the 10 villages in one village.
2018	Discussing performance indicators for the project rewards.	Village meeting to discuss performance indicators and the conditions attached to the rewards (performance in activities).
	Discussing the grievance mechanism.	Village outreach tours to discuss and present the outcome from the workshop and about grievance mechanisms and validate the procedures.
	External validation of the *Tahiry Honko* project.	Village outreach tours to inform and update the community on the external validation through an oral presentation.
	Raising awareness about the *Dina* and national laws.	Village outreach tours with the regional forestry authority and VA executive committee about *Dina* and national laws.
2019	Raising awareness about the launch of the *Tahiry Honko* project.	Village outreach tour across 10 villages to inform and raise awareness about the official launch and celebration of the project.
	Disseminating the achievements of the project.	Dissemination of updates about the project's achievements through video.
	Discussing carbon revenue.	Village meeting to discuss with the parents of school children about the school subsidiary arrangement of the carbon revenue.

were responsible for the surveillance of the strict protection zone for any infractions, recording the number of cut mangrove stumps they observe on a field sheet. The set objective for the forest patrols was 16 patrols per month (Blue Ventures, 2019) but upon recruitment of additional surveillance and evaluation committee members (Comité de Suivi et Évaluation, CSE), the target was changed to one patrol per CSE member per month for the 12 CSE.

Dina enforcement

The Dina Enforcement Committee (Komity Mpampihatra Dina, KMD) was formally created in 2012 and subsequently restructured in 2016. The KMD is responsible for enforcing or resolving Dina infractions within the LMMA, including illegal mangrove logging once they receive a complaint or report, but is not responsible for surveillance or patrols. There are 30 KMD members, who were democratically elected in 2021 in the Velondriake LMMA; 14 of them were residents of the BoA. The set objective was to enforce and charge over 80 % of the infraction against Dina (Blue Ventures, 2019).

Data collection

Assessing community attendance at village meetings and workshops

From 2014 to 2019, from the first introduction of the project to the official launch of the project, BV supported the organisation of 20 meetings at each of the 10 villages (i.e., 200 village meetings; Table 1). Additionally, four workshops were carried out, gathering representatives of the community from each of the 10 villages to discuss the overlapping of mangrove zones across villages, validation of the mangrove zoning, public consultation about the Dina and a grievance mechanism (a procedure and transparent system for addressing grievances related to the project (UN-REDD, 2013).

Using an attendance sheet, the name and gender (Men/Women) of the adult community members (above 18 years old) who attended the village meetings, as well as the date, the name of the village and the purpose of the meetings was recorded by the BV staff leading and facilitating the meetings. Then, the hard copy of the attendance sheet was scanned for records and evidence. All data were entered into a Microsoft Excel spreadsheet and the total number of attendees across the 10 villages over each year was calculated. To avoid an over-count, as there are multiple village meetings in one year, the average of the total number of attendees within the 10 villages per year was used. The general trend of community attendance per year and per the purpose of the meetings over six years (2014 to 2019) was assessed by calculating the total number of participants across the 10 villages. The rate of attendance at the meetings was assessed by calculating the ratio of the total attendees per year (total average of the ten villages) and the total number of adult residents within the 10 villages. The relation between the trend of participation and per number of meetings carried out per year and per purpose of the meeting were also assessed. Women's participation in the meetings was assessed by calculating the ratio of women and men attending meetings.

Assessing community participation in mangrove replanting

At each routine mangrove replanting session, the name, gender, and groups participants belonged to (e.g., women's association, school children, and those from conservation clubs) was recorded on a printed field data collection sheet, as well as the number and species of mangrove planted. The coordinates (latitude and longitude) of the boundary of the replanted area were recorded into a GPS Garmin device. Data was entered into a Microsoft Excel spreadsheet. The same data were collected at major mangrove replanting events, for example, during the celebration of International Women's Day, World Environment Day and World Mangrove Day. These events gathered many invitees, including officials, partners and community representatives from outside of the 10 villages Using the mangrove replanting database, the trend of the number of community members participating in mangrove replanting per year for seven years (2015-2021) was assessed by calculating the average of total participants within the 10 villages per year. If the village undertook more than one session in a year, the number of participants was averaged to avoid double counting of the same person participating in multiple sessions. Then, the ratio of adult women to men and adults to youth was calculated, and the rate of participation in mangrove replanting assessed by calculating the ratio of adult participants to total adults in the project area.

Assessing performance of the community in the project activities

Performance here is defined as the ability of the community to achieve the set objectives in the project activities. When the communities within the 10 villages fail to meet the set objective, the climate benefits expected from the project activities are not reached.

• Mangrove replanting

Community performance was assessed based on the set objective to replant 10 ha per year, as defined as follows: (i) high, if replanted 10 ha or more; (ii) medium, if replanted between 8-10 ha; and (iii) low, if replanted below 8 ha. Data in the Blue Ventures mangrove replanting database (detailed in section 2.2.1) were analysed using Microsoft Excel, and the total area (ha) replanted per year over seven years (2015 to 2021) was calculated. Accomplishment per group, namely adults, youth and invitees for the special events, was measured. The rate of participation and the total area (ha) replanted per year was calculated by dividing the total participants by the total adult residents in the project area to understand if the rate of participation was impacting performance of mangrove replanting.

• Mangrove forest patrols and infraction surveillance

A Microsoft Excel spreadsheet was used to record the number of patrols that occurred every month and served as a database for the forest patrollers. The total number of patrols conducted over four years, from 2018 to 2021, was calculated for the 12 CSE. The performance of the community in the patrol activities was categorised as: (i) high, if the number of patrols was 144 and above per year (over 12 patrols/year/CSE); (ii) medium, if the number of patrols was between 84 and 144 per year (7 to 12 patrols/year/CSE); and (iii) low, if the number of patrols was below 84 per year (below 7 patrols/year/CSE).

• Dina enforcement

The number of complaints received was recorded in a spreadsheet along with details about the enforcement of Dina charges made by the KMD, date, village, nature, action taken, resolution, and fine amount. Infractions/complaint data were filtered and the percentage of complaints received by Dina enforced and charged was assessed using a Microsoft Excel spreadsheet. The performance of the community in Dina enforcement was categorised as: (i) high if over 80 % of Dina infractions are enforced and charged; (ii) medium if 50-80 % of Dina infractions are enforced and charged; and (iii) low if below 50 % of Dina infractions are enforced and charged.

Level of community participation

The level of participation of the community in implementing the project and the decision-making processes at various stages of the project development and activities was assessed using the Spectrum of Public Participation developed by the International Association for Public Participation (IAP2). The spectrum describes five levels of participation: inform, consult, involve, collaborate and empower (Fig. 2). The relevant level of community participation was selected based on the various village meeting approaches adopted and the expected outcomes from the village meetings and workshops outlined in Table 2, referring to guidelines developed by the United States Environmental Protection Agency in Figure 3 below (US-EPA, 2017).

INCREASING IMPACT ON THE DECISION

	INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
PARTICIPATION GOAL	To provide the public with clear and relevant information to assist them in understanding the project and the intended outcomes. Pitch information to a wide audience and potential stakeholders.	To obtain public feedback on analysis, approaches, and/or decisions.	To work directly with the community throughout the process to ensure their opinions, concerns, and aspirations are consistently heard and considered.	To partner with the community in each aspect of decision including the development of alternatives and the identification of the preferred solution.	To place final decision making in the hands of the community.
PROMISE TO THE COMMUNITY	We will keep information accessible, clear, and updated.	We will keep you informed, listen to and acknowledge concerns and aspirations, and provide feedback on how community input influenced decisions.	We will work to ensure that your concerns and aspirations are directly reflected in the alternatives developed and provide feedback on how public input influenced the decisions.	We will look to you for advice and innovation in formulating solutions and incorporate your advices and recommendations into the decisions to the maximum extent possible.	We will implement what you decide.

Figure 2. Spectrum of Public Participation used to assess the level of community participation adapted from IAP2 (©International Association for Public Participation www.iap2.org)

Table 2. Number of village meetings from 2014 to 2019 in each of the 10 villages (200 total).

Year	2014	2015	2016	2017	2018	2019	TOTAL
Number of meetings	4	2	2	5	4	3	20

Extracting lessons learned

Lessons learned were extracted through the analysis of the records of attendance sheets at village meetings, participation and performance in the project activities, as well as through informal conversations with the community members within the project area about topics unrelated to this study. The lessons learned that are shared in this paper were not derived through a formal process but rather based on an understanding of the best practices to ensure continued community participation in Tahiry Honko.

Results

Trend of attendance rate of community at village meetings

A total of 20 village meetings were held from 2014 to 2019 across all of the 10 villages (Table 2). The maximum number of meetings per year was five, which was achieved in 2017.

The results show that the rate of participation every year from 2015 to 2019 was higher than that recorded in the first year (2014). However, despite an increase in community attendance rate at the village meetings for the first three years (2014 to 2016), a decrease in attendance rate was recorded in 2017 when large numbers of meetings (five) were held in each of the 10 villages (Table 2, Fig. 4).

The attendance rate at village meetings ranged from 29 % in 2014 to 43 % in 2016, with 234 and 350 adults attending respectively out of a total of 806 adult residents in the BoA. The overall attendance rate across all 20 meetings held across each of the 10 villages was 37 %, of which 50 % of attendees were women (Table 3). The lowest rate of attendance was recorded at the participatory mangrove zoning meeting (18 %) whereas the highest rate was at the meeting to discuss the performance indicators (50 %).

Results from the 200 village meetings from 2014 to 2019 showed that in the BoA, women and men were proportionally represented. The attendance rate of women was very high, representing 76 % of total attendance at the consultation with parents about the school subsidies and 59 % for the anonymous democratic vote to decide whether the project should go ahead or not.

Community participation in mangrove replanting

The overall participation rate of community members in mangrove replanting from 2015 to 2021 was 35 % of the total adult population of the BoA (281 adults out of 806 adults). There was a considerable increase in the participation rate during the first

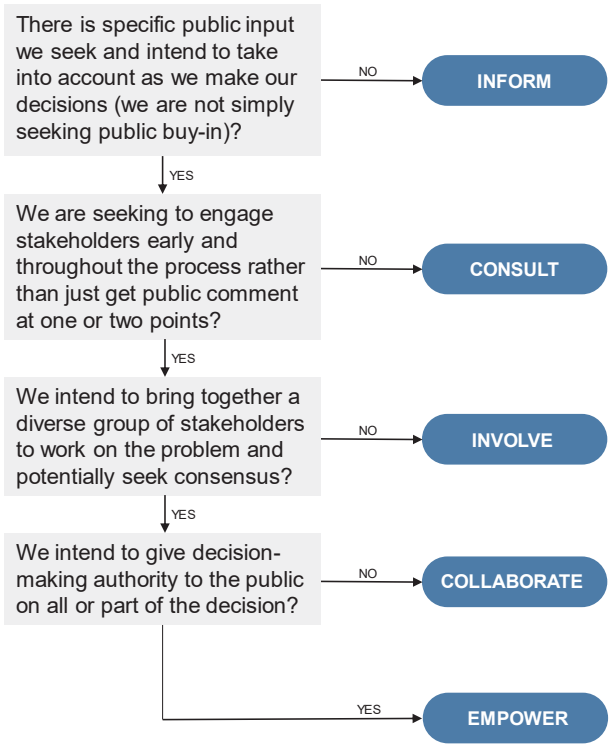

Figure 3. Flowchart used to support the assessment of the level of participation. (*adapted from:* EPA Public Participation Guide, 2017)

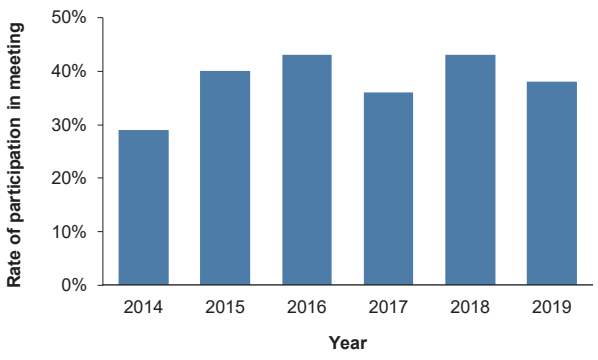

Figure 4. Rate of participation at village meetings across 10 villages between 2014 and 2019.

Table 3. Purpose of the village meetings and the total number and percentage of attendees by total population and the percentage of women attending meeting in the 10 villages.

Purpose of the village meeting	Total number and % of total adult population (men and women) attending meeting	Attendance rate of women (% of total attending meeting)
Introduction of the Plan Vivo carbon project	226 (28%)	49%
Anonymous democratic vote on the project	307 (38%)	59%
Information on the mangrove management plan	258 (32%)	40%
Participatory mangrove zoning	143 (18%)	27%
Round 1: Developing *Dina* for mangroves	354 (44%)	48%
Round 2: Developing *Dina* for mangroves	295 (37%)	53%
Developing the mangrove management plan	306 (38%)	58%
Outreach with the forestry regional authorities	393 (49%)	40%
Validation of mangrove zoning	256 (32%)	55%
Dissemination of the validated mangrove management plan	236 (29%)	50%
Round 1: Benefit sharing and priority infrastructure projects	359 (45%)	47%
Round 2: Benefit sharing and budgeting	306 (38%)	42%
Round 3: Validation of benefit sharing	284 (35%)	49%
Discussion of grievance mechanism	287 (36%)	49%
Discussion about performance indicator thresholds	400 (50%)	53%
Outreach with the regional forestry department	314 (39%)	38%
Information and update on the external validation	382 (47%)	57%
Update about project achievements	304 (38%)	50%
Update on the official launch celebration of *Tahiry Honko*	339 (42%)	58%
Consultation of the parents on the school subsidiaries	270 (33%)	76%
Average	301 (37%)	50%

four years, from 13 % in 2015 to 56 % in 2018. The rate of participation fell in 2019 but the highest rate was recorded the following year, which was 58 % in 2020 (Fig. 5). Every year, the participation of women in mangrove replanting activities was higher compared to men (Fig. 6). However, there was an increase in the participation of men from 2015 to 2018 with the highest participation recorded in 2020 (186 men). The number of youths (i.e., school children and those from conservation clubs) participating in mangrove replanting was lower compared with adults for the first six years of the project, from 2015 to 2020 but there was a considerable increase in youth participation in 2021 which was higher than adult participation (Fig. 7).

Community performance in the project activities

Mangrove replanting

From 2015 to 2021, the total degraded mangrove area replanted in the BoA was 84.2 ha. As shown in Figure 8, the smallest area replanted was recorded in 2015, the first year of the mangrove replanting, and the highest area replanted was in 2021. The adults of the 10 villages successfully replanted 59.1 ha of degraded area,

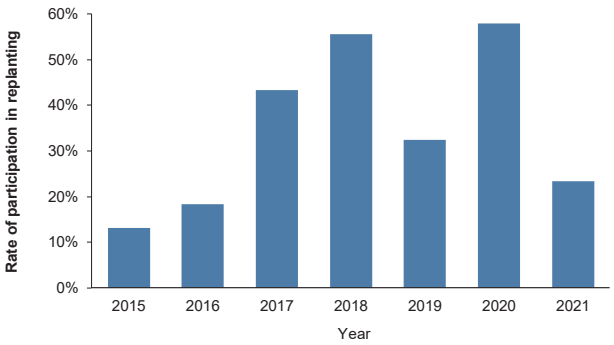

Figure 5. Participation rate of adults in mangrove replanting from 2015 to 2021.

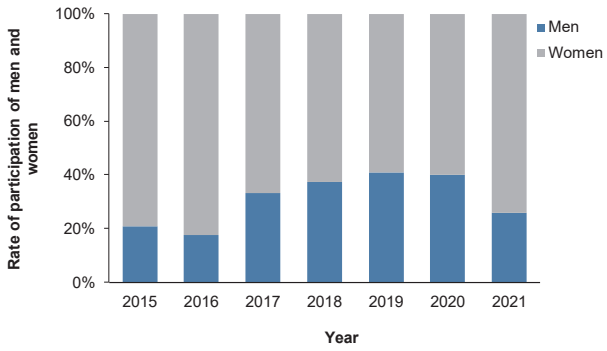

Figure 6. Rate of participation of men and women in mangrove replanting from 2015 to 2021.

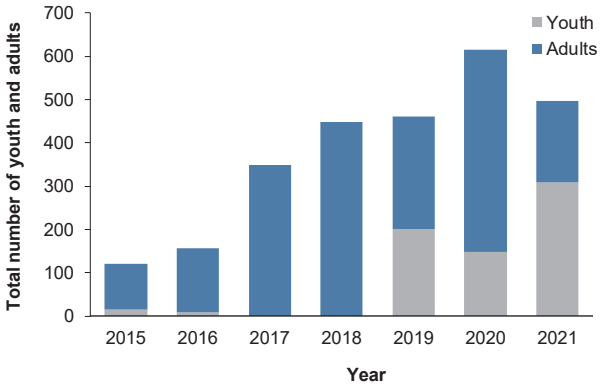

Figure 7. Participation of adults and youth in mangrove replanting from 2015 to 2021.

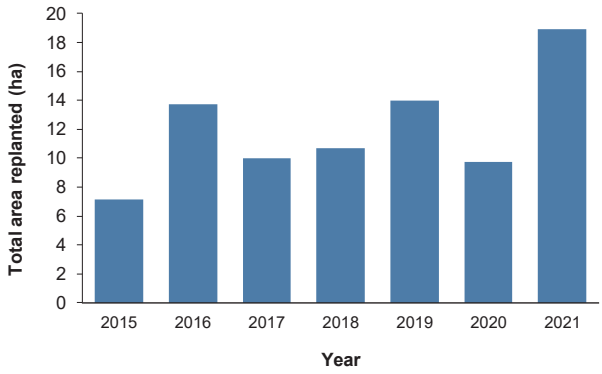

Figure 8. Degraded mangrove area replanted in the Bay of Assassins from 2015 to 2021.

which represented 70 % of the total area replanted, during the routine mangrove replanting session. The total area replanted by special invitees (i.e. other people invited from different villages that are not part of the Tahiry Honko project) during the sessions organised at international events was 16 ha, which represented 20 % of the total replanted area. The youth contribution represented 27 % of the total area planted in 2021, which was 5 ha out of the 19 ha. The performance of the communities in mangrove replanting was low in the first year (2015), less than eight ha, and was medium in 2020 which was below 10 ha (Table 4). In contrast, performance was high from 2016 to 2019, and in 2021 when the annual goal (10 ha) in mangrove replanting was reached.

Mangrove forests patrols

The performance in mangrove forest patrols was high in 2018, when the goal to carry out 16 patrols/month was reached. However, the performance was low the following year, 2019 and medium in the last two years, 2020 and 2021, when the annual goal to carry out 144 patrols and above per year (12 patrol/year/CSE) was not reached (Table 5).

Dina enforcement

The KMD received one report of infractions of illegal logging of mangroves in 2021. The KMD successfully enforced the Dina and the person that carried out the infraction paid the fine. The performance of the community in Dina enforcement was therefore high (over

Table 4. Performance of the community in mangrove replanting.

Year	2015	2016	2017	2018	2019	2020	2021
Area replanted (ha)	7.2	13.7	10	10.7	14	9.8	19
Performance	Low	High	High	High	High	Medium	High

Table 5. Performance of forest patrols carried out by the 12 CSE.

Year	2018	2019	2020	2021
Number of patrols	227	60	139	132
Number of CSE	3	12	12	12
Performance	High	Low	Medium	Medium

Table 6. Performance in *Dina* enforcement.

Year	2021
(%) of *Dina* infraction enforced	100%
(%) of *Dina* infraction charged	100%
Performance	High

80 % of Dina infractions are enforced and charged) (Table 6),

Level of participation in project development and project activities

The level of community participation ranged across each of the five stages of the Spectrum of Public Participation framework (inform, consult, involve, collaborate and empower). There were different levels of decision making at different stages of Tahiry Honko, including individual decision making by anonymous democratic vote, joint decision-making by all of the community by vote by raising hands, and decisions made by the VA, serving as the central governance body for project management and accountable for some of the final decisions (Table 7).

Discussion

Trend and rate of attendance at village meetings

Even though participation of community members is a key human right recognised by law (United Nations, 2007), and effective, meaningful and informed participation in project development is crucial to ensure greater success and sustainability (FAO, 2016; UN-REDD, 2013), there are no commonly agreed indicators measuring successful participation (Vedeld, 2001). It can be argued that there has been continued community participation in the development of the Tahiry Honko project. The decrease recorded in 2017 could be because of the amount of time that elapsed between the introduction of the carbon project concept in 2014 and the first income from the carbon project. Numerous village meetings held in this year may have resulted in a decrease in motivation to attend village meetings. This is in line with results of a participation analysis in PES projects in Uganda, which revealed that anticipated carbon payments seemed to influence community participation (Aganyira *et al.*, 2020). Therefore, careful planning of village meetings is crucial to avoid community fatigue and ensure continued participation. Planning and schedules of the village meetings should be communicated to the head of the village (for example, via letter or phone call) at least a week before the village meeting, so community members are informed well in advance and are prepared. Consolidating the number of village meetings was among the recommendations gathered from the communities in the BoA when starting a new project in another place. Some meetings, training events, and workshops should be combined to reduce and streamline the total number required. From experiences during the development of Tahiry Honko, it can be recommended that the period of time taken for community consultations should be shortened for other projects in the future, thereby avoiding meeting fatigue. The records of the number and gender of attendees, and the purpose for each village meeting, were useful documents not only to assess trends

Table 7. Level of participation of the community in implementing the project, and the different stages of the Spectrum of Public Participation framework.

Key project milestone	Stage of the Public Participation framework
Introduction of the *Tahiry Honko* carbon project *Example: Sharing information about Tahiry Honko and the national law regulating mangroves in Madagascar with the community within and outside of the project area, and the VA. Awareness raising was carried out during village outreach tours, meetings and exchange visits.*	Inform
Decision whether the project should go ahead *Example: Inputs, opinions and feedback from the communities and the VA were gathered during the introduction of the project at meetings and outreach tours. Village meetings were held to obtain community input on the suitable approach to increase participation in mangrove replanting, giving community members and VA the power to make an informed decision. Informed decision/consent from individual/ community/VA obtained. Individual democratic votes and joint votes were used to decide whether the project should go ahead or not.*	Consult
Mangrove zoning *Example: Bringing together a diverse group of community members (loggers, fishers and farmers) to work on mangrove zoning and seek consensus through village workshops and small group sessions.*	Involve
Developing *Dina* for mangrove management *Example: Bringing together a diverse group of community members (loggers, fishers and farmers) to develop* Dina *for mangrove management, and seek consensus.*	Collaborate
Benefit sharing *Example: Engaging the community and the VA to make decisions on the project activity by informing, consulting, involving and therefore empowering them to collaborate to make an informed decision on the benefits of the project and how they should be shared.*	Empower

of attendance but also important written evidence of community participation in meetings and decision-making processes.

Women's attendance in village meetings and their participation in project activities

Despite the traditional attitudes and stereotypes around women in Madagascar which could be harmful to a successful conservation initiative, such as the belief that women are incapable of participating with men in decision-making regarding natural resource management (Rojas, 2001), the records from this study showed that women and men were proportionally represented in village meetings. The participation rate of women was also higher (59 %), compared with men during the anonymous democratic vote in 2014 to decide whether the project should go ahead. This is in line with the results of a gender analysis in the same region where many women were present in meetings organised by NGOs and people from outside the communities (Ramananjohany and Razafiarimanana, 2021). It can be deduced that the approach used in designing and developing Tahiry Honko, including dividing men and women into separate groups when developing Dina governing mangrove use, and anonymous voting to decide on the project, enhanced women's participation and confidence. This approach enabled women to voice their opinions and to overcome any lack of confidence to speak in front of men. Creating a comfortable space and enabling conditions for women in group discussions with men at village meetings is vital to promote women's attendance and participation in village meetings and in the decision-making process. However, in the meetings to discuss participatory mangrove zoning, women's participation was lower than at other meetings (27 %, Table 3). This could be explained by the low number of overall attendees (% of total adult population), or the fact that this meeting took place at the start of the project, or this particular meeting wasn't as well announced. Women's participation was much higher in subsequent meetings, including the meeting to validate mangrove zoning. In Gardner (2020), social marketing initiatives promoting the participation of women in the Velondriake LMMA resulted in an increase of women representation on the Velondriake Board.

Even though women and men were proportionally represented in village meetings and number of women participating in mangrove replanting was higher than men, their involvement in mangrove forest patrols and Dina enforcement remained significantly low. Although the job advertisements to recruit the community patrollers (CSE) were open to all community members living in the BoA, irrespective of gender, to promote gender-equal opportunities (Seager, 2021), only one woman applied and was selected. This situation is in line with the global situation which estimates that only 3–11 % of the ranger workforce is women (Belecky *et al.*, 2019). Almost universally, culturally entrenched gender norms, presumptions, and traditional attitudes, which are often internalised, hold women back from participating in activities that are defined as being physically arduous (Seager, 2021). Although the sole CSE woman found that patrolling is not an easy job, she was excited and motivated. In the interview conducted with her outside of this study, she is quoted as saying that 'my favorite memory in the mangrove is the first time I went on patrol. It was not easy, but it was motivating and exciting. I feel sad that there are still people who cut down the mangroves, so I am happy to be working to protect them' (Blue Ventures, 2020).

Furthermore, while social marketing initiatives carried out in Velondriake LMMA have succeeded in increasing women's participation in the management of resources in the past (Andriamalala *et al*., 2013; Gardner, 2020), there is still low women representation in the KMD. There are only two women in the 30-member KMD. In this study it is presumed that the prevalence of the stereotypical behaviors and socio-cultural attitudes of patriarchy in the BoA hampered women representation in KMD, given that traditionally elderly men hold power to enforce customary laws. The average age of the 30-member KMD, which was 46 years old, seemed to confirm the patriarchy barriers. Nevertheless, even though the participation of women is low, it can be argued that this does not negatively impact the performance in forest patrols and Dina enforcement (see section 4.3 and 4.4).

Participation and performance of the community in mangrove replanting

While involvement of the local community is viewed as crucial for successful mangrove restoration (Stone *et al.*, 2008; UNEP, 2020), the rate of participation required for a successful project has not previously been documented. Even though the results of this study show that the rate of participation of adults in mangrove replanting was 35 %, which was lower than the rate of participation in the village meetings (37 %), this trend did not negatively impact the performance in this activity. The annual set goal to replant 10 ha

of mangrove degraded area was met except in 2015 and 2020, when financial compensation of the participants was not given. Mangrove replanting in 2015 was low because there was no annual objective fixed with the communities until 2016. The peak achievement in mangrove replanting recorded in 2021 (19 ha) can be explained by the youth involvement which contributed up to 27 % of the total area replanted (5 ha). Even though the accomplishment of adults in 2021, without accounting for the achievement of special invitees and youth, surpassed the annual objectives (10.9 ha versus 10 ha), it could be suggested that involving youth is a better approach to raise their awareness in mangrove restoration as future mangrove users, given that the lifetime of the project is 20 years (Blue Ventures, 2019). The involvement of youth in the project activities was also one of the recommendations gathered from the community when scaling up new carbon projects.

The participation of men in mangrove replanting was lower compared with the women every year. This is similar to a study undertaken in the west coast of Karnataka, India, which showed that 70 % of fisherwomen were willing to volunteer some amount of time to mangrove reforestation and only 21 % of the fishermen were willing to replant mangroves, even when paid to do so (Stone *et al.*, 2008). While fisherwomen were willing to participate in mangrove replanting to increase the availability of natural resources that will provide opportunities of alternative income to the community, such as mangrove honey production (Stone *et al.*, 2008), it was hypothesised that social norms in the BoA often suggest that mangrove replanting is a woman's duty, causing the low participation of men. However, the consultations carried out within the villages allowed for understanding of the reasons for low participation of men, and to gather propositions from the community in order to increase men's participation. Given that men might not be able to go fishing and women cannot prepare food for their family during a replanting day, they may not voluntarily participate in the mangrove replanting without a reward. Following discussions with the community, rima (community meals) were offered to all participants after the mangrove replanting sessions, as proposed by the community. As a result, there was an increase in male participation from 21 % in 2015 to 41 % in 2019 when adopting this approach, though this decreased in 2021 due to the higher rate in youth participating in mangrove replanting. Meals given to the participants after the mangrove replanting session seemed to increase the motivation of the local communities, as they had not yet received any benefits from the sale of carbon credits. Therefore, it can be concluded that a voluntary approach to mangrove replanting that includes meal compensation proved to be an effective and sustainable way to engage all community groups and reach the set goals of the project.

However, even though community participation was viewed as a key to reach the mangrove replanting set goals, Ravaoarinotsihoanara (2023) revealed a negative correlation between the number of participants and the survival rate of planted mangrove. This author also recommended that the maximum number of participants in mangrove replanting should be 38 people per hectare.

Performance of the community in mangrove forest patrols and infraction surveillance

Even though the annual goal to carry out 16 patrols per month was reached in 2018, the patrols did not cover all of the strict protection zones due to the small number of CSE (only three people). Although from 2019, the target was changed to 144 patrols per year (12 patrols/CSE/year for the 12 CSE) when nine additional CSE were recruited and assigned to work within their respective villages, high performance in forest patrols was not reached on this change. The adaptation impacted the patrols in 2020 when five of the CSE missed the monthly patrol activity. The COVID-19 restrictions also resulted in a slight decrease of the number of patrols in 2021 when patrols did not occur during lockdown. Even though a peak of number of patrols was recorded in 2020 (139 patrols), there was some illegal cutting of mangrove wood recorded by the CSE in this year. This is in line with overall trends in many regions in Madagascar since COVID-19, where many cases of illegal harvesting and transport of timber were reported from different regions (Malavika, 2020).

Despite the fact that high performance in forest patrols was not reached upon the change of approach from 2019, the CSE confirmed that from their direct observation in the forests during the patrolling activity that there was a reduction of illegal harvesting of mangrove wood in 2021. As reported by studies in different countries, having rangers on the ground is one of the strongest deterrents to illegal activity (Gonedelé Bi *et al.*, 2019; Covey and McGraw, 2014; Tranquilli *et al.*, 2014), and the authors of this paper believe that the recruitment of additional CSE

resulted in a positive impact on overall reduction of illegal mangrove wood harvesting in the BoA. This is also a well-suited approach that minimizes the cost of the forest patrol activity, as accommodation and transport of the CSE did not have to be covered due to the addition of new CSE working in their respective villages, and also allowed for a shorter travel time for each patroller.

While a study carried out in India revealed that only 3 % of fishermen and none of the fisherwomen interviewed were willing to work for enforcing mangrove protection, even when paid to do so (Stone *et al.*, 2008), it is assumed that not everyone in the communities would be motivated to undertake forest patrolling without compensation, whether in the form of money or meals. While motivation is one of the forces that led to performance, as when individuals are motivated, they are productive and focus their efforts on the achievement of set goals (Chaudhary and Sharma, 2012; Sharma and Sharma, 2017; Bao and Nizam, 2015), it is believed that the approach adopted in this study to recruit CSE (through job advertisements and the competitive process) could have been a deterrent to non-motivated people.

Performance of the community in Dina enforcement

While the CSE recorded a number of cut mangrove stumps in the strict mangrove protection zone where the Dina prohibits the harvest of mangrove trees, there was only one infraction of illegal mangrove harvesting reported and enforced by the KMD. Even though law enforcement is viewed as crucial for successful conservation (Ratcliffe, 2004; Tranquilli *et al.*, 2014), it is a major challenge for protected areas worldwide, particularly in developing countries (Nolte, 2016). Despite the implementation of social marketing programmes designed to promote enforcement by villagers and local leaders (Andriamalala *et al.*, 2013), Dina application is a major challenge in the Velondriake LMMA (Gardner, 2020) because of the Fihavanana, a local concept meaning "kinship and friendship" (Andriamalala and Gardner, 2010), where community members may be reluctant to apply rules against members of their own community and do not want to report infractions committed by their friends and family. Despite the possibility that not all infractions may have been reported and recorded, the number of cut mangrove stumps counted by the CSE during the monthly forest patrols helped to assess compliance with Dina. It was found that dissemination of information from the forest patrols is helpful to adapt the management strategy in the absence of strong Dina enforcement when the number of cut mangrove stumps is shown to be increasing. When aware of the increase of illegal cutting, mitigation strategies proposed by the community included recruitment of additional CSE members to ensure that monthly patrols covered all of the strict protection zones. Additionally, some community members in each village decided to voluntarily carry out forest patrols in their respective strict protection zones in addition to the monthly patrols undertaken by the CSE. This shows that community members started to take the initiative once they were aware that illegal mangrove harvesting was taking place as they believed that the frequency of patrols was not adequate to dissuade infractions.

Level of community participation in planning and decision making in the project

While community participation has been approached differently by different project practitioners (Paul, 1987), based on the description of the IAP2 and the approach used, communities were informed, consulted, involved, and empowered, and they collaborated throughout the process in developing and making decisions for the project, although the level of participation varied at different stages. Despite the usefulness of the description of the five levels, it was found that the approach adopted from the 'inform' to 'empower' level, such as careful planning of the village meeting to avoid community fatigue and creating a safe and comfortable space for women in decision making process, is vitally important in ensuring continued community participation regardless of the level. Even though the 'inform' level is considered as a weak form of participation, comprising one-way communication where communities are passive information receivers (Arnstein, 1969; Hardy, 2015), the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) declares indigenous people's particular rights to free, prior, and informed consent (FPIC) in matters which affect their lives and livelihood (United Nation, 2007) and the United Nations Permanent Forum on Indigenous Issues (UNPFII) requires that information should be provided on an ongoing and continuous basis throughout the FPIC process (UNPFII, 2005). Given that mangrove forests are traditionally communal resources (GOM, 1997), open to villages outside of the project area, it was found that the 'inform' level is important not only to provide information to the community,

enabling them to make informed decisions about the project, but also to inform the neighboring communities, especially about Dina regulating mangrove use. However, while handbooks and toolkits outlining the planning process and facilitation techniques are available (De Leiuen and Arthure, 2016; US-EPA, 2017), it was found that the complexity of the concept of carbon sequestration itself required a well-designed approach and well suited communication materials adapted to the local context. The consultations carried out with the community allowed us to gather community opinion on the suitable communication materials to share information about the project. Oral presentations in the local dialect with visual support, such as Microsoft PowerPoint presentations and videos, were highly recommended by the community. As the same information needed to be shared across the 10 villages, a pre-recorded video presentation was used when disseminating the results of accomplishments of mangrove replanting and the number of illegal harvesting incidents recorded by the CSE. The pre-recorded video was an effective outreach tool to ensure that the target audience had the same level of information and this also enabled the audience to stay focused.

As described in detail in Rakotomahazo (2019), Tahiry Honko was developed through participatory methods with the aim of promoting engagement of all community members living within the project area, regardless of gender. However, Mosse (2001) argues that participatory approaches are subject to domination by certain groups, due to being plenary and public events. Consequently, marginalised groups, such as women, may struggle to participate and make personal decisions on matters that affect their lives. As carbon projects may impact access to resources for forest-dependent community members, obtaining FPIC of all community members is required and critical for the success of the project (FAO, 2016; UN-REDD, 2013). Adjusting situations and conditions by creating safe and comfortable spaces is crucial to make marginalised groups feel more confident about participating in decision-making (Mubita *et al.*, 2017). It is believed that anonymous democratic voting, a method by which the electorate directly makes their own personal decisions, constitutes an inclusive process that is well suited to the local context in ensuring community consent on project implementation. This is an effective inclusive approach to allow the full range of community members to provide their consent and can also address the issues around often marginalised members of a community (e.g., women) to also be engaged in the decision-making process.

Conclusions

Tahiry Honko is an ongoing initiative that is yet to be systematically evaluated. However, at this stage, it is suggested that the possibility of earning carbon revenue created an incentive and promoted continued community participation in mangrove conservation and restoration in the BoA. Despite some challenges encountered in implementing Tahiry Honko, including the length of time between the introduction of the concept of the carbon project to the community and first income generated from carbon revenue, and the numerous village meetings required, continued community participation was recorded. Participation of the communities in village meetings involving decision making, and in project activities, contributed to the success of the project. To maintain and improve community participation, some meetings and workshops could be consolidated to reduce and streamline the total number required, and to reduce meeting fatigue. While participation has its own strengths and weaknesses, it is important to adopt a well suited approach to the local context in ensuring continued community participation from the 'inform' to 'empower' level. While anticipated carbon payments appear to influence community participation, the lessons learned in this study on best practices for ensuring continued community participation would be applicable to any community-led project that does not offer monetary incentives from the carbon revenue. However, this study is limited to the assessment of the level of community participation and rate of community attendance in village meetings and in mangrove replanting. Further research is needed to investigate the critical factors that influence the involvement and motivation of participants according to their gender, in particular in speaking and decision-making, and participation in activities.

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