

Article

# Delivering Climate-Development Co-Benefits through Multi-Stakeholder Forestry Projects in Madagascar: Opportunities and Challenges

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Received: 15 April 2020; Accepted: 15 May 2020; Published: 18 May 2020

**Abstract:** This paper explores multi-stakeholder perspectives on the extent to which forestry projects that pursue ecological restoration and rehabilitation in Madagascar engage with local communities and can co-deliver climate-development benefits. Drawing on mixed methods (policy analysis, semi-structured interviews, participatory site visits and focus groups) in two different forestry contexts, we show that by strengthening access to capital availability, projects can enhance local adaptive capacity and mitigation and deliver local development. We show that active consideration of ecological conservation and action plans early in project design and implementation can co-develop and support monitoring and reporting systems, needed to progress towards integrated climate-compatible development approaches. Climate mitigation benefits remain poorly quantified due to limited interest in, and low capacity to generate, carbon revenues. Monitoring alone does not ensure carbon benefits will materialize, and this research stresses that institutional considerations and strengthened engagement and cooperation between practitioners and communities are key in achieving both climate mitigation and community development impacts. Multiple benefits can be fostered by aligning objectives of multiple landscape actors (i.e., community needs and project developers) and by systematically linking project deliverables, outputs, outcomes and impacts over time, grounded in a theory of change focused on ensuring community buy-in and planning for delivery of tangible benefits.

**Keywords:** climate and development; forest conservation; REDD; sustainable land management; project monitoring and evaluation; mangroves

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## 1. Introduction

Land degradation is often exacerbated by climate change, threatening multiple socio-ecological systems and the livelihoods of people whose lives depend on them. Ecological restoration and rehabilitation projects are pursued with a view to mitigating the impacts of climate change by storing carbon in plants and soil, while often reducing people's vulnerability and increasing their capacity to adapt [1]. The central role of trees in the carbon cycle has led to innovative international forest governance mechanisms that seek to recognize the value of forests, in addition to their supply of timber, labor, biodiversity and water as ecosystem services [2]. In line with Article 5 of the 2015 Paris Agreement, the pursuit of results-based payments—e.g., through carbon markets and the Reducing Emissions from Deforestation and Degradation (REDD+) framework—provide financial incentives to governments and communities in the developing world to maintain and increase forest cover [3,4].

It is acknowledged that these mechanisms offer potential to deliver “triple-wins” or climate-compatible development, assisting climate change mitigation, but also reducing vulnerability, alleviating poverty and enabling people to adapt [5].

The capacity to exploit synergies between the multiple benefits delivered by trees and multifunctional landscapes through ecological restoration and rehabilitation has been limited to date by spatial and temporal constraints. Spatially, mitigation benefits are typically global, while adaptation benefits are localized [6]. Temporally, mitigation requires long-term commitment, while adaptation can happen more quickly [7], through accumulated coping strategies and in the longer term, through transformation. While multiple forest and landscape restoration benefits such as carbon sequestration, rehabilitation of degraded lands, flood risk reduction and enhanced biodiversity, can be generated in synergy, trade-offs occur when long-term impacts on vulnerability and adaptation capacity are taken into account [8]. For example, a short-term adaptation initiative aimed at building a seawall to protect the community from cyclones and flooding, might attract people to an area perceived as being safe, while it further exposes them to extreme climatic events [9]. Long-term increased vulnerability, or decreased adaptive capacity, deriving from short-term adaptation actions that produce unintended impacts, are defined as “maladaptation” [9].

Adaptation to climate change requires a long-term vision to shift socio-ecological systems towards sustainable trajectories. As identified by Cinner et al. (2018) [10], there are five key domains involved in building long-term adaptive capacity. These include the financial and technological assets accessed by people in time of need, the flexibility to switch across adaptation strategies, the ability of society to organize and share knowledge, the capacity to learn and the agency to determine whether a change is needed. In light of spatio-temporal considerations, it is imperative to plan and evaluate mitigation and adaptation actions simultaneously, with a view to targeting and addressing multiple scales and timeframes to effectively manage climate change impacts [11].

Pursuing long-term mitigation and adaptation is imperative to sustain the livelihoods of natural-resource dependent communities that are affected by climate change [12]. Since the mid-2000s increasing focus has been placed on the need to mainstream restoration actions into the development trajectories of developing countries [13]. By reconciling adaptation, mitigation and development, climate change benefits can be combined with poverty reduction, health improvements and increased food security [14]. Using multiple-benefit approaches is of particular relevance in Southern African Development Community nations, where socio-economic development opportunities are jeopardized by high climatic uncertainty [15]. Despite growing literature on the potential of ecological restoration approaches to generate an array of benefits, there are still several gaps that require further empirical case study investigations [11].

Suckall et al. (2015) [16] report that where joint ecological restoration or rehabilitation and climate appraisals have been attempted, difficulties remain in understanding how well co-benefits map onto the development and climate adaptation challenges perceived by local communities. Analyzing two community-level projects that pursue ecosystem rehabilitation in South Africa, Favretto et al. (2018) [17] observed mismatches in reported and perceived benefits at project and community levels. As noted by Cinner et al. (2018) [10], limited capacity to integrate local knowledge and perspectives into science, policy and practice, coupled with limited participation of local communities in adaptive co-management, constrain the delivery of long-term benefits. An improved understanding of community perceptions is key to allow meaningful community engagement, which is a pre-requisite for projects to deliver on expected outcomes [18]. As different stakeholder groups have different views with respect to mitigation, adaptation and development priorities, understanding how best to assess and integrate local-level perspectives into climate and development policy and practice is key if actions are to secure local buy-in and meet multiple goals.

Madagascar is one of the world's major biodiversity hotspots, presenting an important study context where the gaps in assessing multiple benefits and mainstreaming community priorities into restoration require urgent attention [19]. Forest policy, projects and research in Madagascar have all historically focused on biodiversity conservation [20], with attention to climate change and development impacts gaining momentum only after REDD+ mechanisms and climate action emerged

onto international and national agendas [5]. Analyzing thirty years of conservation efforts, Waeber et al. (2016) [21] showed that this limited scope of analysis hampers the assessment of progress towards international development goals.

This paper targets the gap noted above, i.e., the need to improve understanding of perceived local co-benefits of ecological restoration across climate and development dimensions with a view to enhance capacity to deliver long-term benefits through integration of local knowledge into practice. It aims to examine perceptions of the extent to which forest projects that pursue ecological restoration and rehabilitation in Madagascar can deliver adaptation, mitigation and development co-benefits to local communities. We focus on two case study projects, based on mangrove reforestation and REDD+ conservation. Such an integrated analysis that links local- and project-level perspectives of climate-development impacts of conservation projects in Madagascar, combining multiple indicators of perceived co-benefits, has not been carried out before. We ask the following research questions:

1. What are the development needs of the forest communities in Madagascar in the face of climate change?
2. What are the adaptation, mitigation and development co-benefits and challenges of forest conservation projects reported by practitioners and communities in Madagascar?

If land degradation and deforestation continue at current rates, this is likely to result in a range of uncontrolled societal, economic and environmental ramifications which hamper the achievement of international agreements and the Sustainable Development Goals (SDGs) [1]. Lessons from this research are relevant across sub-Saharan Africa, as countries seek to progress towards the SDGs and their Paris Climate Agreement Nationally Determined Contributions (NDCs) [22]. Moving towards the United Nations Decade on Ecosystem Restoration 2021–2030, understanding the prerequisites and challenges for multiple benefits to be achieved in climate and development policy and practice, especially those pursuing job creation and ecological restoration and rehabilitation, is more pertinent than ever [23].

## 2. Materials and Methods

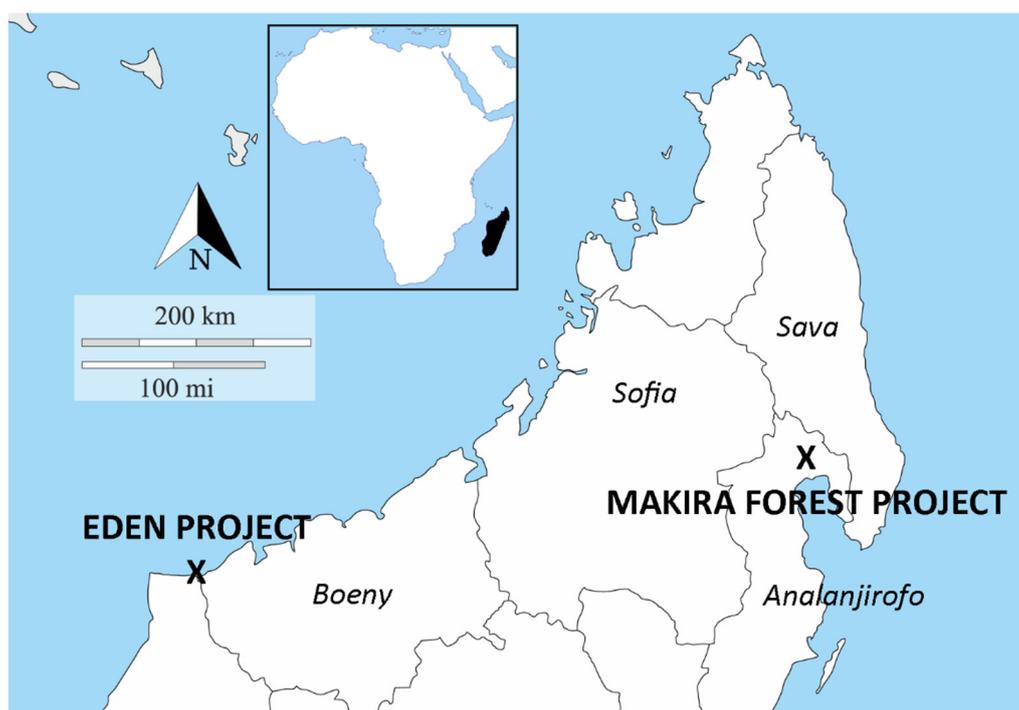
### 2.1. Study Country Context

Madagascar is a biodiversity hotspot and conservation priority area, as well as one of the world's poorest countries [19]. Between 1953 and 2014, 44% of forest was lost nationally [5]. In 2014, forest cover accounted for 8.9 million ha, with an annual deforestation rate of 1.1% reported in the period 2010–2014 (i.e., 99,000 ha/year) [24]. Increasing temperatures impact on temporal and spatial rainfall distribution and exacerbate drought and flood intensity across the southern Africa region [25]. To adapt to climatic changes and cope with extended droughts, subsistence farmers in Madagascar increased forest clearing by up to 17% between 2000 and 2013, compared to pre-2000 levels [26].

Climate change impacts are exacerbated by political instability, which, combined with geopolitical approaches that internationalize conservation, result in undervaluing local knowledge and perspectives [27]. Since the 1960s, policy and funding efforts to address the most pressing environmental challenges in Madagascar have focused on biodiversity conservation, with US\$ 700 million of support between 1990 and 2012 [21]. Since 1996, through institution of a system that transfers forest management to communities ("Gelose" law), forest management decisions have been increasingly transferred from government to grassroots community-organizations, and community-based conservation has been put at the center of environmental policy and forest management [27]. The 2003 Durban Accord boosted a decentralized approach to protected areas by emphasizing co-management in biodiversity conservation to achieve poverty reduction [28,29]. Consequently, between 2003 and 2016, protected areas quadrupled and five carbon-rich biomes have been set up through REDD+ projects [5,19]. Madagascar's climate change policy, in particular its National Adaptation Program of Action (NAPA) and its Nationally Determined Contribution (NDC), highlight large-scale reforestation and local community engagement to protect the remaining forests. Through such engagement, these policies seek to both promote socio-economic development and enhance climate change mitigation and adaptation [30,31].

## 2.2. Case Study Project Selection

Two case study projects that pursue ecological restoration and rehabilitation were selected to investigate their climate-development co-benefits, challenges and trade-offs at the community-level (Figure 1). These two projects were selected because they: (i) pursue ecological restoration and rehabilitation with implications for climate adaptation and mitigation, (ii) cover multiple types of forest governance (protected areas and community forest management) in both coastal and inland settings, (iii) involve project target beneficiaries who are highly vulnerable to climate change and have high dependency on the forest for their livelihoods, (iv) have potential to access reduced emissions forestry schemes such as REDD+ and carbon markets, and (v) have a comparable project implementation history of approximately ten years. A total of six projects relevant to the study theme were initially identified. Only two of them met all of the five selection criteria and were therefore chosen as case studies.



**Figure 1.** Forest restoration and rehabilitation case study projects, Madagascar. Source: adapted from D-Maps, 2018 [32].

### 2.2.1. Case Study 1: Eden Projects

Eden is a non-profit organization whose mission is to improve the livelihoods of impoverished Malagasy communities by implementing reforestation and environmental stewardship projects. It operates in the Boeny region, which has an average annual temperature of 27 °C and rainfall ranging between 1000 and 1200 mm. Between 1990 and 2013 roughly 7500 ha of forest were lost in Boeny, with average carbon storage reductions of 2.7 million tons/year, mostly due to illegal logging for construction material and charcoal production [33]. Since 2008, Eden has sustained mangrove reforestation with poor communities heavily dependent on coastal mangroves for fishing. Funded mostly by businesses, Eden's development model employs locals to plant trees, with the aim to enhance income, increase adaptive capacity and stop deforestation, moving towards long-term improved mitigation [34].

### 2.2.2. Case Study 2: Makira Forest REDD+ Project

Since 2012, the Wildlife Conservation Society (WCS) has been managing 372,000 ha of the Makira Forest protected area on behalf of the Madagascar Ministry of Environment and Forests. Makira is

one of the most intact and highly biodiverse remaining rainforest systems in Madagascar, where increasing deforestation has been driven by slash and burn rice agriculture and illegal logging, exacerbated by rapid population growth and poverty [35]. The Makira forest REDD+ project, implemented by WCS since 2005, aims to safeguard the Makira Natural Park (in Analanjiofo, Sava and Sofia regions) and contribute towards national emissions reduction targets. It seeks to align avoided deforestation with ecosystem conservation, while supporting the socio-economic development of communities living around the forest. Makira's implementation model involves: (i) developing contracts to transfer forest resources management to local communities adjacent to the protected area, (ii) strengthening local institutions and land use planning, and (iii) diversifying income through improved agricultural techniques, infrastructure development, conservation enterprise activities and ecotourism. By selling 'Verified Carbon Standard' (VCS) and 'Climate, Community and Biodiversity Alliance' (CCBA) verified carbon credits generated through avoided deforestation, the project aims to market over 31 million tons of carbon offsets to sustain long-term conservation over the period 2005–2034 [35].

### 2.3. Methods

The research questions were addressed using a multi-level, mixed-methods approach (Table 1), where each research question was addressed using the same methods. Fieldwork was undertaken between August and October 2017.

**Table 1.** Summary and sample size of multi-level and mixed-method research approaches used across case studies.

Method	Stakeholder Type	Sample Size (Males/Females) - Case Study 1: Eden	Sample Size (Males/Females) - Case Study 2: Makira	Total
Semi-structured interviews	Community: workers and project beneficiaries	23 M / 27 F	4 M / 6 F	60
Semi-structured interviews	Experts: policy makers, scientists, project developers	4 M / 4 F	2 M / 3 F	13
Participatory site visits	Mixed	2 (size: n = 10 each)	2 (size: n = 5 each)	4
Focus groups	Mixed	2 (size: n = 15 each)	2 (size: n = 5 and n = 15)	4

Stakeholders in the project areas were identified through literature review and interviews with project developers. Sampling criteria included direct targeting of community beneficiaries who were formally employed by Eden or registered with Makira. To avoid sampling biases, after the first local contact was made by the project developer, the remaining participants were chosen in the field, according to their willingness to participate and keeping a balanced gender and age representation based on information derived from local project staff. Project perspectives were addressed through 13 semi-structured expert interviews with: regional-level policy makers (n = 3), scientists (n = 1) and project developers (n = 5 Eden, n = 4 Makira) identified through snowball sampling, with questions focused on background and stakeholder analysis, project achievements and challenges, community engagement, monitoring and evaluation, and policy implications (Supplementary Material 1).

Two study villages (those with the longest implementation histories) were selected under each project. In Eden, these covered its coastal activities as the core of Eden's operations. In the Makira case, two villages of easier access were targeted from among the seventy-three villages within which the project operates. By focusing on two Makira villages, the data produced a valuable understanding

of key project benefits and challenges, at a comparable scale to the Eden case. Community-perspectives were addressed through 60 semi-structured interviews with local workers and project beneficiaries (n = 50 with Eden, out of a total of 234 direct beneficiaries across the two study villages, and n = 10 with Makira, out of 95 direct beneficiaries across the two villages), 4 focus groups (n = 2 Eden, each with n = 15 participants, n = 2 Makira, respectively with n = 5 and n = 15 participants), and 4 participatory site visits (n = 2 Eden, each with n = 10 participants, n = 2 Makira, each with n = 5 participants). Semi-structured interview samples sizes align with approaches followed in qualitative research more broadly [36]. The larger sample of interviewees under Eden is due to the higher number of direct beneficiaries in each village compared to Makira. Open invitations were circulated by village heads prior to carrying out focus groups and site visits, with sample sizes ranging between 5 and 15 participants and being aligned with approaches followed in comparable studies [37]. Questions expanded the themes covered in expert interviews, emphasizing the perceived opportunities and challenges to deliver adaptation, mitigation, and development at the community-level (Supplementary Material 2).

Data were input into a modified analytical framework, originally developed for assessing ecosystem restoration and rehabilitation projects in South Africa (Table 2). Adaptation is considered as people's capacity to "anticipate and respond to change, to minimize the consequences, to recover, and take advantage of new opportunities" to deal with climate impacts [10] (p. 117). Mitigation is defined as the reduction of emissions of greenhouse gases and increased uptake of such gases by the Earth system such that atmospheric greenhouse gas concentrations decline [38]. Development is defined as sustaining SDG achievement through the enhancement of short and long-term capabilities, assets and activities needed for a means of living [16,39]. We acknowledge that neither adaptation nor development happen separately, and some of their dimensions might overlap. Results are grounded in the indicators used in the analytical framework, the utility of which lies in its qualitative assessment and integration of local-level perceptions of co-benefits and challenges in climate change and development practice. Where quantitative measures of climate impacts are absent, the gathering of perceptions of such climate impacts allows for trends and patterns to be identified. Patterns of categories from responses were grouped under key themes that were used to adapt the original analytical framework (Table 2). Through this thematic analysis, phrases from interview notes (including semi-structured interviews, field visits and focus groups) were assigned an ID based on their related type of benefit, categorized into relevant themes and inserted into the analytical framework. Data was analyzed drawing on comparative qualitative analysis approaches, where the same set of indicators used in the framework was compared across case studies [40].

**Table 2.** Analytical framework for adaptation, mitigation and development co-benefits and challenges of case studies: definitions and indicators.

<b>ADAPTATION: People’s capacity to anticipate and respond to change, to minimize the consequences, to recover, and take advantage of new opportunities to deal with climate impacts</b>
ASSETS
Financial and technological resources accessed by people in time of need (e.g., fish species, savings or credit to purchase bigger boats, irrigation systems)
FLEXIBILITY
Opportunities to switch across adaptation strategies (e.g., changing occupation, fishing and cropping strategies, temporarily or permanently)
SOCIAL ORGANISATION
Cooperation (e.g., formal or informal community organizations) and knowledge sharing to deal with change
LEARNING
Ability to generate and absorb information about adaptation options
AGENCY
Power to mobilize the other components of adaptive capacity to respond to environmental change
MITIGATION: Reducing emissions of greenhouse gases & increasing uptake of such gases by the Earth system
Planting trees and restoring soil to sequester carbon
DEVELOPMENT: Sustaining Sustainable Development Goal achievement through the enhancement of short and long-term capabilities, assets and activities needed for a means of living
HUMAN
Skills, knowledge, training, education, labor power, livelihood diversification
SOCIAL
Networks, connectedness, relationships of trust, information exchange, empowerment
NATURAL
Access to land, water, wildlife, flora, forest, soil organic carbon
PHYSICAL
Infrastructure and production equipment
FINANCIAL
Savings, access to regular income and credit, insurance

Source: adapted from Favretto et al. (2018) [17]

Data generated by one method was triangulated and validated by the other methods. While expert interviews were carried out independently by the lead researcher, community-level data collection involved two local translators, with interview notes taken by the lead researcher in English.

### 3. Results

Results of both case studies are jointly presented here to address our two research questions, focusing on the identified community development priorities and climate adaptation challenges (3.1), and on the project co-benefits and challenges (3.2) across climate-development dimensions.

#### 3.1. Community Development Needs in the Face of Climate Change

Under both cases, the bulk of development needs reported at community level revolved around socio-economic development difficulties that are commonly identified in resource-poor and remote contexts, which ultimately limit a project’s capacity to co-deliver wider climate and development impacts. Eden’s villages lack adequate access to drinking water. According to the community, there

is a need to increase the number of boreholes and to install filters to improve the currently poor water quality. The fast growing population demands more school facilities, up to college level, as well as secure access to basic health care, both of which are currently non-existent: “Here people get ill because we lack drinking water and hospitals... Our population is growing rapidly and we lack school facilities” (F1, focus group). The coastal villages remain isolated from the closest city, which can only be reached through a 12-hour boat trip in optimal weather conditions. Mobility between city and village needs to be improved to enable access to markets and basic goods, plus access to hospitals in case of emergency. According to focus groups, connectivity would be enhanced by equipping boats with diesel engines and building a cemented deck to access the muddy village entrance. The need to better connect to external markets also links to the need to support, financially, the establishment of local wholesalers to secure local supplies throughout the year: “It requires a lot of money to start, and our strongest difficulties are in the rainy season” (F1, focus group). Due to the high levels of unemployment and lack of local financial institutions, most villagers are unable to borrow money to fulfil their basic needs or aspirations. Improving access to credit is reported as a measure needed to enable the start-up of new small businesses to alleviate poverty. Under Makira, while the need to raise environmental awareness and deliver agricultural training is an agreed priority among the interviewees, focus groups unanimously reported similar priorities as the ones noted by the Eden’s community. They revolve around the need to increase access to drinking water, improve basic health care and enhance access to basic education: “Education is key to sustain the sustainable development of our village” (#66, community member, male).

Difficulties in the pursuit of basic development needs are exacerbated by climate impacts linked to changing rainfall patterns and temperatures over the past decade. Starting with Eden,  $n = 25$  respondents observed that rainfall quantity has been sufficient and stable between 2007 and 2014, while a drought occurred between 2015 and 2017. To adapt to the lower and delayed rain, people are forced to postpone the planting of food crops: “I wait to plant until it rains, now around January/March. Before 2007, it was in December/February” (#9, community member, male). Over the same timeframe,  $n = 22$  respondents reported that rainfall intensity has increased, resulting in decreased crop yields and a limited capacity to adapt: “It is a problem for the rice crops, I can’t adapt” (#19, community member, female). According to  $n = 19$  respondents, the maximum temperature perceived during dry periods has increased. We observe that in order to adapt to the reported climatic challenges, particularly in water-scarce periods, adaptation is commonly pursued by changing cropping practices, which is understood as the “flexibility” dimension of adaptive capacity [10]. As reported in three extreme cases, no food is grown during the drought “I will not plant any food crops this year” (#25, community member, female). Under Makira the perceptions gathered on climate change are limited due to the smaller sample, however similar patterns and challenges as in Eden are observed. Particularly, an increased rainfall intensity reported by  $n = 2$  respondents resulted in increased flooding and crop damage: “Before it was stable. Now, when it rains, it rains a lot and we have flooding. When it doesn’t rain it gets very dry” (#70, community member, female). The capacity to adapt to changing temperatures and rainfall remains limited: “Maximum temperature increased, minimum is much colder. This has decreased agricultural productivity, also because we don’t adapt” (#67, community member, female).

### *3.2. Benefits and Challenges of Forest Conservation Projects Reported at the Practitioner and Community Levels*

Climate-development benefits and challenges reported across case studies are presented according to the two climate dimensions—mitigation (3.2.1) and adaptation (3.2.2)—assessed in our analytical framework.

#### *3.2.1. Mitigation and Development*

While climate change mitigation is acknowledged in both cases, it is under-reported by Eden project staff and not recognized by the community. Eden acknowledges carbon sequestration “as a

co-benefit to raise awareness and mobilize resources among business partners” (#2, project developer). However the project lacks carbon mitigation empirical data, and no baseline carbon assessments were carried out prior to commencement of Eden’s activities. No monitoring is being implemented to assess the extent to which the 200 million mangrove trees planted over a decade are delivering mitigation: “We know that we sequester carbon but we are not focused on mitigation... it’s very demanding to get certification” (#2, project developer)<sup>1</sup>. The lack of monitoring and systematic carbon assessment pose serious limitations in the capacity of the project to prove its mitigation benefits, monitor them and access mitigation funding. Despite the project not generating direct development benefits through mitigation revenues, one community member showed a basic appreciation of carbon sequestration derived by mangrove restoration: “Eden explained to us that there is carbon in the leaves of the mangroves. The carbon is needed to protect human health” (#7, community member, male).

In Makira’s case, as expected in a REDD+ project, carbon certification has been put in place and enhanced carbon stocks from avoided deforestation are a recognized benefit by project developers. According to VCS, the net annual greenhouse gas emissions reductions of the Makira project for the 2010 to 2013 monitoring period amounted to 1,267,462 t CO<sub>2</sub>-e [41], which accounts for roughly 4% of Madagascar’s total annual emissions from land-use change and forestry in 2011 [42]. However, as of 2017, the project had not been able to access certified carbon markets. Only a few small private transactions of around 200 tons on average were processed through the voluntary market. Despite Makira having implemented all the means needed to monitor sequestration and obtain formal certification, challenges remain in the actual capacity to put the system in place and make it function as a long-term source of income (#63, project developer). Makira’s mitigation benefits were not directly mentioned by community respondents. The villagers are aware that it is a “carbon” project, but their understanding focuses on the financial (i.e., development) benefits generated by carbon revenues, rather than on mitigation itself.

Initial carbon revenues have resulted in minor ‘physical’ development benefits, through construction of three schools with total investments of £13,000. Concerns were expressed about the complexity in disbursing carbon funds to communities, which delays development impacts: “The design of carbon projects and access to funds is complex and time consuming” (#F3, focus group). As reported by WCS, revenues should be shared among communities (50%), WCS (20%), and the Malagasy government (20%), with the remaining 10% covering transaction costs. Difficulties are reported in the administration of the community’s share, with the managing agency (called Tany Meva) being slow in releasing calls for proposals and disbursing the funds: “Most of the money generated through carbon has been kept by Tany Meva until now, they have a long administrative process” (#63, project developer). At the project level, it is noted that the certified carbon market is not sufficiently rewarding: “The price per ton varies a lot... we don’t sell all credits because the market is too low” (#65, project developer). Interviews suggest that coordinated multi-stakeholder partnership is needed to improve the functioning of the carbon credit system and management of available funds. Enhancing community understanding of the carbon sequestration implications of projects will enhance the sense of trust and willingness to cooperate towards the pursuit of shared goals.

### 3.2.2. Adaptation and Development

Enhanced capacity of Eden’s community to cope with a changing climate is observed. As reported by n = 29 respondents, mangrove reforestation implemented over the previous decade has resulted in increased availability of fish, shrimp, and crab—i.e., increased assets, as defined in Table 2: “Mangroves bring a lot of crabs, fish and shrimps. Since Eden arrived the quantity has increased a lot” (#9, community member, male). As a result, when crop yields decrease because of the climatic

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<sup>1</sup> For details about interviewee’s IDs, see the source data deposited on ReShare: <http://reshare.ukdataservice.ac.uk/853523/>, doi:10.5255/UKDA-SN-853523

challenges reported in Section 3.1, people switch to alternative coping strategies—i.e., increased flexibility, Table 2: “Rice yields decreased. To adapt this year I won’t plant, I will go fishing and collect crabs instead” (#29, community member, male).

Financial development benefits generated by Eden support enhancement of adaptive capacity. Eden employs over 100 permanent workers per village to carry out mangrove planting. Over ten years, this has provided job stability which resulted in new skills learned and career development opportunities. This has allowed community beneficiaries to diversify their livelihoods thanks to their improved saving capacity—understood as a “human” development improvement under Table 2. Enhanced income allows an increasing number of primary and secondary needs to be met, like improved access to education. It also helped shift cropping and (often illegal) revenue-generating activities that undermined mitigation efforts (e.g., charcoal production) towards more desirable ones. Traditional livelihood activities before the project commenced included rice production (n = 23 community-level respondents), cassava cultivation (n = 8), corn (n = 5) and sweet potato production (n = 2), as well as fishing, collecting crabs and shrimps, and to a minor extent farming cattle and poultry. Eden is now the main income source for 21 community respondents, who were able to change their livelihood activities based on their varied needs. Many have purchased a pirogue (small boat) and increased their fishing activities (n = 17), resulting in increased adaptation. Others reported that they have replaced fishing income with cattle (n = 7) or started a convenience store (n = 3). However, it was also noted that improved employment opportunities have boosted rapid population growth. This increases demand for basic health, water and education services: “Since (Eden) arrived, people have been returning. Before we had 30 fishermen, now we have more than 100” (#6, community member, male).

Another adaptation impact reported under Eden is derived from strengthened social organization. The establishment of an informal association called Siko—formed independently, but as an initiative of Eden’s local employees (composed of 11 Eden managers and 10 planters)—has enhanced local capacity to adapt to food shortages during droughts. More broadly, creation of a sense of community and trust is perceived by all of Eden’s respondents. Siko results in increased access to informal credit, which strengthens adaptive capacity in droughts: “I can now borrow money or buy things and pay later... people trust me” (#20, community member, female). Lack of access to credit constrains activities that could generate revenues after the projects end. However, a more advanced credit system is considered necessary by the community to enable start-up of new businesses which could allow beneficiaries to become independent from the project.

Under WCS, adaptation assets such as barrage dams and irrigation systems are provided for intensified rice cultivation. This helps channel scarce water to small and productive pieces of land to improve yields. Adaptation is also sustained by shifting cropping practices—i.e., flexibility. Table 2, through agricultural training, i.e., “learning”, delivered by WCS. According to n = 8 community respondents and a focus group (#F4, focus group), the project has shifted traditional cropping practices towards “improved” and “intensive” rice cultivation. Additionally, n = 6 respondents and a focus group (#F3, focus group), reported that WCS provided training and material (i.e., seeds and plastic bags to grow seedlings in nursery) to grow alternative crops such as cacao, cloves, and legumes. This resulted in strengthened capacity to adapt by changing cropping practices, particularly in dry periods. However, some challenges hamper delivery of long-term adaptation derived through agricultural training. There is limited buy-in of trained people on improved techniques due to their excessive complexity and the lag time of benefits. As mirrored by n = 6 community respondents, adoption is hampered by the excessive lag time between the implementation of the new technique and productivity increases (i.e., cacao and cloves), as well as by excessive complexity: “I don’t shift because it is difficult to do the alignment and carry out the calculations” (#66, community member, male). N = 3 respondents noted that suitable land is needed to shift from traditional rice farming (in the mountains) to intensive farming (in flatter areas) and land availability in the village is limited.

A sense of belonging generated across the communities involved with the Makira project fosters adaptation—i.e., social organization, Table 2. By setting formal institutions, such as the grassroots organizations, community management plans are elaborated and implemented: “Since 2008 we’ve

helped 73 communities that surround the Makira forest to develop contracts and management plans at the communal level" (#65, project developer). This view is mirrored by community members, who report that the joint management of natural resources through transferred forest management allows for better sustainable land management: "We have a communal management plan, which is a golden book for us... if we need to cut trees, we ask for a permit (through the COBA) to build locally. We also stop people who come from outside to cut" (#F3, focus group). Concurrently, agricultural training for rice and alternative cash crop production is reported by both developer and community as a development impact which increases adaptive capacity under Makira. By creating producers' associations, WCS aims to sustain long-term people's flexibility to switch to alternative crops: "WCS suggested the formation of teams and created the association, so that they can better support the rice producers and train more people" (#F3, focus group). No direct financial benefits were reported as a result of the adoption of alternative cropping techniques. However, awareness raising, combined with the institution of annual quotas for cutting trees in the area has been reported by both developer and community to result in more sustainable forest use.

Finally, provision of basic infrastructure was reported by project developers and community members as a "physical" development benefit under both Eden and WCS. While two boreholes were constructed by Eden, and several water taps installed by WCS, they were not recognized as adequately addressing the issue of water scarcity and poor quality. Similarly, while both Eden and Makira have provided some early schooling facilities, they are not able on their own to meet the basic educational needs of the population. Projects and government are not keeping up with demand, with policy interviewees suggesting that such services should be the responsibility of external non-state actors: "The Malagasy government is not obliged to provide (basic health and education) services to the villages. It should be the responsibility of external funders" (interview #59, policy maker).

#### 4. Discussion

Our findings demonstrate that forest projects that pursue ecological restoration and rehabilitation can deliver multiple benefits to local communities, which are grouped across the indicators listed in the analysis framework presented in Table 2. After ten-years of project implementation, local adaptive capacity has been enhanced, and mitigation has taken place. There have also been some tangible development benefits.

Perceptions of community and developers under both projects are aligned in terms of short- to medium-term efforts that have built adaptive capacity (see Table 2). By training communities in alternative agriculture, building basic infrastructure and restoring natural capital (e.g., by increasing fish availability under Eden, and controlling forest use under Makira), forestry and tree planting projects improve availability of asset indicators (e.g., fishing equipment or access to credit) and flexibility indicators (e.g., changing cropping strategies) used to cope with climate change impacts. Increased community cooperation through the projects' networks results in improved social organization of adaptive capacity. Increased learning is evidenced by the learning of new knowledge on agriculture and environmental conservation under both Eden and Makira. Our findings show that such strengthened access to capital availability and resources fosters a range of development impacts, as evidenced by the indicators grouped across the five capital assets listed in Table 2 (i.e., human, social, natural, physical and financial). However, agency (or capacity and willingness to mobilize multiple resources to respond to pressing environmental change challenges in practice, as per Cinner et al., 2018 [10]) remains limited. Our findings indicate that increased capital, as evidenced by the indicators, does not automatically translate into enhanced adaptive capacity and development. For example, as recorded in the semi-structured interviews, while the delivery of agricultural training is reported to enhance knowledge and broaden adaptation and revenue generation opportunities, we note low adoption rates, excessive complexity and the lag time of benefits limit achievement of long-term impacts on the ground. The lack of long-term impact metrics limits capacity and willingness to progress towards more "transformative" adaptation and development [43]. This suggests a need to implement a more integrated, holistic approach to landscape management and forest conservation.

The need for integrated climate-development approaches across time and space to sustain livelihoods is shown to be key in light of the high expectations of REDD+ and forest conservation projects, such as Makira, to foster mitigation-driven development [44]. We found that in instances where carbon verification and monitoring are in place, and enhanced carbon stocks from avoided deforestation are a formally recognized benefit, the capacity to generate carbon income and manage the revenues remains limited. We note that the carbon market is perceived as difficult to access not only by 'non-carbon' projects such as Eden, but also by certified REDD+ actors such as Makira. If conservation projects like Eden were to invest in baselining and reporting of mitigation benefits, their capacity to access carbon funding streams would be augmented. This would help overcome major challenges reported across wider climate-development projects, which often lack the evidence base needed to attract continued investments [16]. Monitoring alone does not ensure carbon benefits will materialize, and this research stresses that institutional considerations are key in achieving impact. An adequate understanding of carbon cycles, combined with coordinated work between projects and public institutions across levels, is vital to ensure usability of carbon schemes [45]. For instance, if the capacity to effectively manage carbon funds amongst WCS, Tany Meva (the carbon fund managing agency) and government stakeholders was improved through better coordination, mitigation-development co-benefits of Makira would be enhanced and the carbon sequestered could result in increased development benefits. This suggests that failure to engage diverse stakeholders poses major constraints to the effective delivery of the expected benefits [46]. The pursuit of multi-stakeholder cooperation should be considered as a key priority to enhance capacity of projects such as Makira to address complex climate-development challenges [47].

When looking at the reported community perceptions of climate and development needs and the benefits stemming from projects, there are instances where project benefits address the identified development needs, and instances where they do not. While socio-environmental benefits are appreciated in both projects, local capacity to make use of them is constrained by the need to solve urgent challenges that are not related to forest conservation. Development is constrained by lack of access to basic healthcare, drinking water and education, combined with village isolation and limited access to credit. While Malagasy government policies promote an environmental and socio-economic development discourse aligned with the international story of 'reforestation and REDD+ for development', the state is largely absent in the remote realities where projects operate. Non-state actors are expected to deliver where the government cannot, due to lack of resources, capacity or corruption [48]. In pursuing a more holistic approach, adequate mapping of project benefits onto locally identified challenges must be ensured, rather than simply focusing on primary conservation goals. This indicates that for meaningful long-term engagement of multiple stakeholders in joint climate conservation and development to be achieved, it is essential that the adopted strategies are locally-relevant [49].

Uncertainty about how development benefits will be sustained raises concerns about the challenges reported more widely in international conservation and development programs [50]. There is a need to ensure that climate-development projects do not repeat the cycle of hype and disappointment of "conservation fads" [51] (p. 1). We argue that a system change that enables REDD+ and forestry projects to deliver successful adaptation and mitigation needs to include development. Findings here show that by setting up integrated operations across actors with varied operational foci can enhance the capacity to simultaneously tackle multiple challenges and deliver co-benefits. In thinking holistically, mixed operational and funding modalities should be identified at the outset of project development.

We observe that the monitoring and funding limitations reported in our cases derive from a lack of clear vision about the specific long term multi-benefits being sought. To define the missing holistic vision and achieve multiple wins, there is a need to better align community needs and objectives with project and donor commitments [52]. This is an area where climate-development approaches often fail to deliver practical advances, where stakeholder engagement is commonly pursued as a box-ticking exercise to meet demands of multiple donors, rather than addressing clearly identified community needs [53]. In strengthening community and project cooperation and alignment,

knowledge co-production is recognized as a suitable approach to jointly address common priorities [54]. In our case studies we show that monitoring and knowledge co-production should be grounded in a theory of change that explicitly links project deliverables, outputs, outcomes and impacts over time, particularly envisioning the operational modalities, multi-stakeholder cooperation and continuity of funding needed to achieve climate-development wins [55].

By shaping a participatory theory of change, grounded in locally-identified priorities, the capacity of projects to generate a shared understanding and strengthen synergies among multiple stakeholders will be enhanced [46]. All these elements align with the definition of a holistic landscape approach, understood as a long-term collaborative process that brings together diverse stakeholders towards achieving multiple and sometimes conflicting objectives—in our case including adaptation, mitigation, and development [47,55]. These lessons are transferable to a range of internationally-led programs in Madagascar and across the globe, which integrate climate and development dimensions into conservation.

## 5. Conclusions

This study evaluated opportunities from forest conservation projects to address local development needs by pursuing climate objectives in Madagascar. Local and project-level perspectives of the benefits and challenges of two case study projects—focused on mangrove reforestation and REDD+ conservation—were assessed through the use of a multi-benefit framework. We observed that enhancements of local adaptive capacity, mitigation and development can be delivered by projects to local communities by investing in coordinated efforts across levels. This enables effective delivery of co-benefits across the three dimensions in projects originally designed for forest conservation.

For a multi-objective, holistic operational focus to be sustained, adequate monitoring of project benefits onto locally identified challenges must be ensured. Pursuit of locally-relevant strategies allows meaningful long-term engagement of multiple stakeholders. Key enablers in achieving a holistic vision include planning long-term funding and operational modalities at the outset of project development, and establishing monitoring and reporting systems that evaluate underreported co-benefits to inform funders and communities involved. Climate mitigation benefits remain poorly quantified, and uncertainty surrounding carbon markets results in a lack of capacity to enable realization of carbon benefits. Monitoring needs to be accompanied by an adequate multi-stakeholder collaborative strategy, with a view to translate short-term benefits into long-term holistic transformative impacts, through pursuit of an integrated landscape-scale approach to conservation and development. Alignment of community needs and objectives with project and donor commitments is a pre-requisite to enable the development of a theory of change that systematically links project deliverables, outputs, outcomes and impacts over time. Knowledge co-production enables the theory of change to be grounded in locally-identified priorities, with a view to strengthening the shared understanding and synergies among multiple stakeholders. These findings are transferable to internationally-led programs which aim to integrate climate and development dimensions into conservation across sub-Saharan Africa, particularly those pursuing job creation and ecological restoration and rehabilitation.

**Supplementary Materials:** The following are available online at [www.mdpi.com/2073-445X/9/5/157/s1](http://www.mdpi.com/2073-445X/9/5/157/s1), Supplementary Material 1: List of interview questions: policy makers, scientists and academia, Supplementary Material 2: List of interview questions: local workers and project beneficiaries.

**Author Contributions:** Conceptualization, N.F., L.C.S., A.J.D. and C.H.Q.; Formal analysis, N.F., S.A., L.C.S. and A.J.D.; Funding acquisition, L.C.S., A.J.D. and C.H.Q.; Investigation, N.F. and H.L.T.R.; Methodology, N.F.; Project administration, A.J.D.; Supervision, L.C.S., A.J.D. and C.H.Q.; Writing – original draft, N.F.; Writing – review & editing, S.A., L.C.S., A.J.D. and C.H.Q.. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research was funded by the Economic and Social Research Council's Centre for Climate Change Economics and Policy (CCCEP), grant number: ES/K006576/1.

**Acknowledgments:** We thank the staff of Eden Projects, Wildlife Conservation Society, the interpreters Max and Eloise, and the local communities involved with both projects for their exceptional cooperation and logistical support provided on the ground. Special thanks to Larissa for the invaluable assistance and love offered in the field, and for constantly raising intellectually challenging questions that have helped shaping the research. Lindsay Stringer acknowledges the Royal Society as she holds a Royal Society Wolfson research merit award.

**Conflicts of Interest:** The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

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