Darwin Initiative Main: Annual Report

To be completed with reference to the "Project Reporting Information Note": (https://www.darwininitiative.org.uk/resources-for-projects/information-notes-learning-notes-briefing-papers-and-reviews/).

It is expected that this report will be a **maximum of 20 pages** in length, excluding annexes)

Submission Deadline: 30th April 2023

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Darwin Initiative Project Information

Project reference	28-012
Project title	Native grass forage management to feed people and protect forests Alternative titles: Harena Voajanahary sy Kijana Mamokatra; Darwin Initiative - Productive Pasture Partnership (DI-PPP)
Country/ies	Madagascar
Lead Partner	Royal Botanic Gardens, Kew (Kew or within Madagascar Kew Madagascar Conservation Centre, KMCC)
Project partner(s)	Missouri Botanical Gardens Madagascar (MBG), Royal Botanic Garden Edinburgh (RBGE, Caroline Lehmann), University of Pretoria, Plant and Soil Sciences Department and Enterprises University of Pretoria (UP, Wayne Truter), Sarobidy Rakotonarivo, consultant sociologist (ESSA, University of Antananarivo, School of Agronomy)
Darwin Initiative grant value	£454,221
Start/end dates of project	1 November 2021 - 31 October 2024
Reporting period (e.g. Apr 2022 – Mar 2023) and number (e.g. Annual Report 1, 2, 3)	April 2022 – March 2023 Annual Report 2
Project Leader name	Maria Vorontsova & Mamy Tiana Rajaonah
Project website/blog/social media	Project Facebook page https://www.facebook.com/KMCCMBG Twitter @vorontsovams; photos at https://www.flickr.com/photos/36803481@N06/; videos at https://www.youtube.com/channel/UCF-lArgyzK3zMvdG0fCe7hw
Report author(s) and date	By Maria Vorontsova, Livasoa Randriamanalina and Nanjarisoa Olinirina Prisca. Staff responsible for the creation of figures and annexes are listed in the respective legends and titles. All partners and beneficiaries participated in focus groups and discussions during April 2023 and reviewed a report draft.

1. Project summary

We bring a modern approach to address a gap in Madagascar's environmental governance. Grasses and grasslands are neglected through the assumption they are of little value compared to forests. Fires are a long-term problem Madagascar does not have the expertise to manage. We aim to boost the wealth of 90 households and their village communities by integrating botanical knowledge, grassland ecology, agricultural science and fire management expertise to trial management methods which will support key forage grasses (output 1), improve livestock nutrition (output 2), and reduce forest fires (output 3).

Poverty in the Central Highlands of Madagascar is partly driven by poor livestock nutrition. Inefficient exploitation of pastures and native forage grasses, and poor fire management lead to low pasture nutrition as well as damage to fire-sensitive forest patches. Disconnected approaches to agriculture and conservation are preventing progress as interventions fail to consider local ecosystems together with their human residents and their food systems. Poverty is becoming worse, with an average daily household income of 0.56 USD in Itremo (KMCC 2019), and the recorded percentage of the country's population below the poverty line expected to increase to 76.5% for 2020 (World Bank 2020). KMCC and MBG built close relationships with the pastoral communities closest to the forest patches now protected as Itremo, Ibity, and Ankafobe New Protected Areas, giving us a detailed understanding of the local situation (KMCC 2012, MBG 2012, 2018). Our 2019 Darwin scoping project carried out surveys on cattle, grazing practice, and local opinions on these issues.

Malagasy grasses were dismissed as non-native weeds until research by Vorontsova demonstrated ubiquitous and diverse native and endemic species (Vorontsova & Rakotoarisoa 2014, Vorontsova et al. 2016; Hagl 2020). Grasslands were assumed to be anthropogenic until research into their ecology led by Lehmann and Vorontsova in 2016 onwards identified ancient assemblages of highland grazing grasses (Solofondranohatra 2020).

Humped zebu, *Bos indicus* cattle, are of central importance in Madagascar as cultural symbols, rural banks, tradeable products, and working animals. This living tradition has grown disconnected from agricultural policy and herds have dwindled from 23 million in the early 1980s to about 6 million today (IFC 2018) and per capita annual consumption of beef dropped from 17kg per person in the 1970s to just 2kg per person in 2010 (MINAE 2012). Ankafobe, Ibity, and Itremo households own between 0-18 animals each but most are undernourished and calving less than once a year due to inefficient grazing practice and limited use of crop residues.

Unique fire-sensitive forest patches at Itremo, Ankafobe, and Ibity New Protected Areas are home to 15 endemic mammal species, 27 bird species, and 713 plant species. Late dry season fires lit in grasslands to stimulate forage become out of control and penetrate forest boundaries. Such fires have occurred in Ankafobe and Itremo annually (KMCC 2012, MBG 2018), undermining community-led forest conservation.

Poor fire management practices arise from the outdated view that all fires are bad, unnatural, and must be prevented. Modern research confirms that "frequent–cool–small" fires typical for human-inhabited tropical grasslands are a normal component of Madagascar's highland ecosystems like those of mainland Africa, and impossible to prevent (Kull 2004, Archibald 2013, Lehmann et al. 2022). Contrary to popular misconceptions, highland fires have significantly decreased from 1998 to 2015 (Andela 2017; Phelps et al. 2022). Misunderstanding of fire regimes, technically incorrect fire assessment practices that misinterpret satellite counts of fires, and management failures were apparent at Lehmann's 2019 fire management workshop. Research in Ibity confirms that standard fire suppression policies failed to reduce the area burned from 1985 to 2015 (Alvarado 2018).

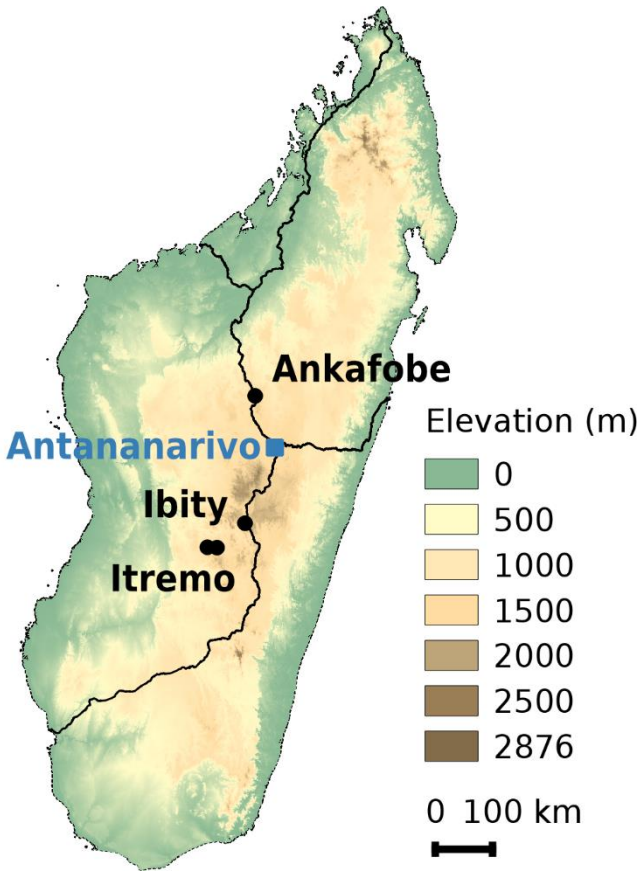


Figure 1. Map of the 3 project sites in Madagascar, by Sarah Z. Ficinski. Kew and MBG head offices are located in Antananarivo. Two parts of the Itremo PA are shown; the project is located in West Itremo. For detailed maps of activities at each site see Annual Report 1.

2. Project stakeholders/ partners

The project originates from and is rooted in its close relationships with the **Malagasy beneficiary communities as well as numerous national and subnational organisations** (listed in Table1), built and managed by the animators and PA managers at the local level, and by project manager Dr Livasoa Randriamanalina (staff diagram in annex 4) and co-leader Dr Mamy Tiana Rajaonah at the national level. These collaborations have been broadened and deepened during year 2 through both ongoing and new activities. Our research permits and forage sample exportation permits were supported by PBZT and issued by MEDD (annex 5,6). Grass and forb voucher herbarium specimens are deposited at PBZT. Sorghum quarantine inspection and import permits were granted by MINAE DPV (annex 17,18) and the seeds are stored at SNGF. Veterinary support was provided by MINAE DSV (section 3.1). For the multi-stakeholder grass guidebook collaboration and project legacy discussions with MINAE, MEDD and FOFIFA see section 12.

Activity and partnerships **between Madagascar and other countries** are proportionally smaller in comparison to our in-country network and have not grown in a similar way, as they have proven less necessary than in-country work. The partnership with the University of Pretoria (UP) improved during year 2 with Malagasy staff training in South Africa in April 2022 (annex 13), two Madagascar site visits by Wayne Truter, and preparation for joint conference travel to the International Grassland Congress in Kentucky, USA (https://www.internationalgrasslands.org/2023-igc/, extended abstracts in annexes 9,12, poster in annex 8). [redacted] The three research groups led by Maria Vorontsova (Kew), Caroline Lehmann (RBGE), and Wayne Truter (UP) have also grown closer.

Within the **core project team in Madagascar**, regular contact through joint field work, weekly meetings between PA managers, and biennial all-staff meetings in Antananarivo (e.g. annex 7) have brought Kew Madagascar and MBG Madagascar teams closer together. Challenges do remain in the Kew – MBG collaboration due the different hierarchical and administrative structures of the two organisations and a greater emphasis on conservation rather than agricultural development at the MBG sites. Standardisation of methodology and the technical aspects of data flow have been technically the most challenging at the Ibity site (see section 7).

The most significant change in the collaborative landscape since year 1 is the start of the much larger Kew-led 6-year DEFRA BLF consortium *Sustainable Management for Future Generations* or *Fitantanana Maharitra Holovainjafy* (FMH, https://www.kew.org/about-us/press-media/madagascar-support-project) working with local stakeholders to develop an inclusive, consensual vision for the sustainable management of natural resources around protected areas, focusing on the Itremo Protected Area as one of its sites. Maria Vorontsova, Mamy Tiana Rajaonah, Tiana Randriamboavonjy, and Caroline Lehmann all work across both projects. The fire work package of the FMH consortium overlaps primarily with output 3 of this project, allowing us to make greater progress on fire work while also focusing this project resource on outputs 1 and 2 (as explained in the October 2022 change request). The FMH consortium work has also enabled this project to gain better connections to the British Ambassador to Madagascar (section 13).

Table 1. List of Madagascar-based organisations engaged by this project, their respective abbreviations used in this report, and English translations. Full project partners listed in the original application are not included. Regional branches of the national government bodies are omitted for simplicity.

1. Ministry of Agriculture and associated bodies

1.1 Ministère de l'Agriculture et de l'Elevage, Directeur Générale de l'Agriculture (MINAE DGA); Ministry of Agriculture, General Agriculture Directorate

1.2 Ministère de l'Agriculture et de l'Elevage, Direction de la Production Végetale (MINAE DPV); Ministry of Agriculture, Plant Protection Directorate

1.3 Ministère de l'Agriculture et de l'Elevage, Direction d'Appui à la Production Animale (MINAE DAPA); Ministry of Agriculture, Animal Production Directorate

1.4 Ministère de l'Agriculture et de l'Elevage, Direction des Services Vétérinaires (MINAE DSV); Ministry of Agriculture, Veterinary Services Directorate

1.5 Centre National de Recherche Appliquée au Développement Rural, Département de Recherche Zootechniques, Vétérinaires, et Piscicoles (FOFIFA DRZVP); National Centre for Applied Research on Rural Development, Department of Zootechnological, Veterinary, and Fisheries Research

1.6 Centre National de Recherche Appliquée au Développement Rural, Département de Recherche Rizicole (FOFIFA DRZ); National Centre for Applied Research on Rural Development, Department of Rice Research

2. Ministry of Environment and associated bodies

2.1 Ministère de l'Environnement et du Développement Durable, Direction Générale de la Gouvernance Environnementale, Direction des Aires Protégées, des Ressources Naturelles Renouvelables et des Ecosystèmes (MEDD DGGE DAPRNE); Ministry of Environment, General Directorate of Environmental Governance, Directorate of Protected Areas, Natural Renewable Resources, and Ecosystems

3. Ministry of Higher Education and associated bodies

3.1 Université d'Antananarivo, Faculte des Sciences, Mention Biologie et Ecologie Végétales (MBEV); University of Antananarivo, Faculty of Science, Department of Plant Biology and Ecology

3.2 Université d'Antananarivo, Ecole Supérieure des Sciences Agronomiques (ESSA); University of Antananarivo, School of Agronomy

3.3 Parc Botanique et Zoologique de Tsimbazaza (PBZT); Tsimbazaza Zoo and Botanical Gardens

3.4 Silo National des Graines Forestières (SNGF); National Seedbank of Madagascar

3.5 Institut d'Enseignement Supérieur d'Antsirabe, Vakinakaratra (IESAV); University of Antananarivo in Antsirabe

4. NGOs

4.1 Fikambanana Fampivoarana ny Tantsaha (FIFATA); Association for the Progress of Farmers

4.2 Fiompina sy Fambolena Malagasy Norvéziana (FIFAMANOR); Centre of Rural and Applied Research [on livestock agriculture]

4.3 Projet d'amélioration et d'Organisation de la Filière Lait (MDB PROFI-Lait); EU and Malagasy Dairy Board Milk Production Project

3. Project progress

3.1 Progress in carrying out project Activities

One year and 5 months since project start, the **overall project infrastructure** of beneficiary households and farms, staff, and project demo farms is now well-established and stable, with all building work complete and fields active, and the schedule of site visits, training events, and beneficiary focus groups running fairly smoothly as the road condition allows. Everyone knows each other well; staff structure diagram is repeated in annex 4.

In addition to the standard research **permits** we have obtained to work inside and outside the protected areas (annex 5,6), a great deal of staff time and effort has been expended on preparing the sequence of papers necessary for the exportation of forage samples from Madagascar to South Africa. We are pleased to report this was successfully completed, even though the permitted maximum export of 50g per species (lower than the 500g normally required by UP for a baseline) will limit the forage analyses possible. The even more time-consuming sorghum importation permit is additional to these and discussed in section 8.

Grassland diversity and productivity analyses (output 1) through standardised plot surveys are supported by our long-term expertise in the Global Grassy Group method and its research community (GGG, https://globalgrassygroup.github.io/; Lehmann et al. 2022), and also by our previous work on regional grass checklists (Nanjarisoa et al. 2017). This part of the project is working well and promises to deliver a high-quality dataset with analyses not previously attempted in Madagascar. The project grass botanist Nanjarisoa is leading this work and has now secured a full year 1 baseline dataset of 630 sub-plots within 30 survey sites across the three project regions (annex 8,9, with deeper analysis in section 3.2). Year 2 surveys have also been completed for 15/30 sites and have not yet been analysed. In February 2022 Nanjarisoa travelled from Madagascar to the UK to spend 3 weeks with Caroline Lehmann's research group at the University of Edinburgh and RBGE, attended two data analysis courses at the University of Edinburgh, and gained R analyses skills to produce the analyses in figures 2 and 3.

Veterinary training visits (output 2, activity 2.10) from the Mandatory District Veterinarians (under 3 different regional branches of the MINAE DSV) were organised and carried out in response to strong beneficiary requests in year 1, following the autumn 2022 change request. Project technicians received theoretical and practical training on zebu health and the care and treatment of sick animals in September 2022 in Ankafobe, October 2022 in Ibity, and January 2023 in Ambatofinandrahana (close to Itremo but more accessible by road). These were then followed by livestock health training sessions for the beneficiaries. Results of the training are also implemented on an ongoing basis by the technicians through their regular household visits. The process was organised, supervised and supported by Dr Livasoa Randriamanalina (our project manager who is also a registered veterinary doctor), e.g. he prescribed and brought vitamins AD3E and mixed B to Itremo to help increase the calving rate (see also section 3.3 figure 6 and the year 1 report for ad hoc veterinary interventions). In Ibity the beneficiaries complained of tick-borne disease during the rainy season, and the livestock technician Rija recommended a twice-monthly wash and tick removal procedure, alongside vitamins and calcium supplements given to the animals every 3 months (Ibity focus group report in annex 23). Results of the other activities under output 2 are presented further down.

Proportionally the least time has been invested into **forest fire management** (output 3) due to proportionally greater contributions from other projects and from the three PA governance systems. In West Itremo the **final choice for the project forest patch** is the one closest to the beneficiary villages, outside the core western block of the Itremo Protected Area, called Ambazimbamena (photo at https://www.flickr.com/photos/36803481@N06/52445009603). Lemurs were seen within the forest patch in September 2022. Project beneficiaries were taken to visit Ambazimbamena to increase awareness and the connection between the village community and PA gallery forests,

and organise help patrolling. Armand Remila (Itremo Protected Area patrol) explains the forest patch patrol system in the video at https://youtu.be/ACAfwzhvOf0 and Jean José Rafanomezantsoa (Itremo Protected Area staff technician) explains the protection of the Itremo Protected Area forests in https://youtu.be/q6m2noHJKaU. More information on output 3 is provided in sections 3.2, 3.3, and the photo point is discussed in section 7.

3.2 Progress towards project Outputs

The project grassland pastures are situated in the coldest and the most seasonal part of Madagascar (Figure 3A), on highly acidic soils with a deficiency of phosphorus (Figure 3B). **Regional grass diversity** analyses (annexes 8,9) show a total of 123 Poaceae species (34% endemic and 56% native) recorded across the broader project area, with 30 of these (17% endemic and 73% native) found within the project pastures. The pastures are home to mostly fire-associated C4 grasses with broader distribution ranges than those found in wet forests and rocky outcrops. **Pasture mean species richness** across sites is 8-9 plant species with 4-5 grasses per 1m diameter sub-plot circle in Ibity and Ankafobe, with a markedly lower richness of 4-5 plant species with 2-3 grasses in Itremo (Figure 2). The figures for Ibity and Ankafobe reflect our expectations but the markedly lower species richness in the westernmost project location of West Itremo is a surprise. It could be related to the western aspect of the slope in Itremo and its relationship with local fire regimes. West Itremo is also the least accessible with a significantly lower population density, possibly associated with a smaller and more recent adventitious flora. The relationship between species richness and fire frequency follows expectations from previous work as a fire return interval of ca 3 years is likely to be closer to pre-human local fire regimes than annual burns. Consistently high species richness in Ibity is in line with its pre-project history of fires every 3 years or less. The data presented here are the year 1 baseline with no change analysis so far, but we are nevertheless satisfied with species richness as an indicator, due to its simplicity as well as widespread availability of comparative data.

The frequency of key forage grasses in the pastures is tabulated in annex 9 table 1 with the following 5 species qualifying for key forge status, starting with the most common: *Loudetia simplex, Aristida rufescens, Panicum luridum, Schizachyrium sanguineum*, and *Hyparrhenia rufa*. All of these are native; *Aristida rufescens* and *Panicum luridum* are endemic. All were observed to be heavily grazed. All are fire bunch grasses with the exception of *Panicum luridum*, which is a creeping broad-leaved perennial forage. Depending on the outcome of the forage analysis at UP it is possible indicator 1.2 may need to be adjusted to aim for an increase in more broad-leaved and less fibrous species with as *Panicum luridum*, although community members do not agree that creeping broad-leaved are better forage (annex 34, section 3.3).

Pasture biomass production between 1.6-6.1t/ha is in line with previous reports from Fianarantsoa (Figure 4; annex 9 table 2; annex 12), with inter-region variability driven primarily by the local fire frequency pre-project. If correct this could be a cause for optimism, as it may indeed prove possible to restore pasture productivity if fire return times can be reduced down to once every 3 years. The preliminary estimate of the **grazing capacity** baseline (calculated by assuming nutritional equivalence with similar South African grasses, before the forage nutrition measurements are completed for the Malagasy grasses, method training photo at https://www.flickr.com/photos/36803481@N06/52444472901) across the experimental sites is estimated to be 1.2-1.4 ha for the complete nutritional needs of a single 250kg zebu (annex 12), actually a higher capacity than we feared may be the case. It is likely that far higher livestock head counts can be supported with little risk of overgrazing.

Fodder flow supplementation by crop residue preservation and the exploitation of new forage crop (output 2) has been successful in spite of the highly variable situations and interventions across the project. This part of the project work is challenging to fully quantify and compare due to the multiple variables, variability between beneficiary household cultures and agrisystems, demo farm locations, and sites situated in climatically different parts of the highland (and therefore significant differences in the methodologies prioritized), as well as the challenges encountered by the cultivation of first the locally available sorghum, and then the

South African SS1000 Sorghum x Sorghum x Sudan hybrid cultivar we imported in January 2023 (details in section 8).

The Itremo demo farm (0.5 hectare sorghum (photo https://www.flickr.com/photos/36803481@N06/52782757203), 0.5 hectare Brachiaria https://www.flickr.com/photos/36803481@N06/52782286261) has performed the best, producing 800kg of dry rice straw, 715kg hay from Brachiaria, and 365kg (730 kg/ha) dry matter sorghum harvest from 30kg of the local variety seed by December 2022. Final yield for the local sorghum variety is 2.7t/ha. In January 16 kg of newly imported SS1000 were planted across 1 ha, producing 180kg/ha and again overwhelming the demo farm capacity to produce silage (although SS1000 underperformed compared to its potential due to late planting following importation delay). The demo farm livestock produced 1200kg of compost, which was used for the sorghum plantation. We are proud of the combined function of the new cowshed (https://www.flickr.com/photos/36803481@N06/52866213495) channelling fertiliser directly to the compost pit (https://www.flickr.com/photos/36803481@N06/52866213865), the new hay storage structure (https://www.flickr.com/photos/36803481@N06/52866264463), and the new elevated silage silo (https://www.flickr.com/photos/36803481@N06/52865248127) replacing the original silage pit on Wayne's advice (video of the old silage pit and advice at https://youtu.be/tiYhu3H_LNw). Following twice monthly visits to the demo farm, 70% of the **Itremo project beneficiaries** started growing sorghum on their own land and making silage by digging a silage pit. Beneficiaries are satisfied with the increase in their milk production (analysis in figure 6A, photo at https://www.flickr.com/photos/36803481@N06/52781743612), and are particularly grateful for regular project technician visits, with whom they report a good relationship (informal notes from the beneficiary meeting on 23 April 2023 in annex 12). The project is grateful to the technicians Mampiharitra Rabendrina (zebu, https://www.flickr.com/photos/36803481@N06/52865825946) and Lucien Rakotonirina (plants, https://www.flickr.com/photos/36803481@N06/52865827056) who have moved their families to the project base in Amborompotsy, Itremo, making themselves permanently available on site. Milk has traditionally been given away for free in this area rather than sold, and a decrease in the heads of livestock over the last few decades led to a prohibition on milk sale. Local communities were however open minded to our project work and we were permitted to begin selling milk to the local catholic mission, creating a **novel income stream for the project beneficiaries**. In September 2022 the project site inspection team received the unexpected gifts of a sheep, two lambahoany (traditional female garments), and peanuts, signalling community gratitude (photo at https://www.flickr.com/photos/36803481@N06/52782529354).

The Ankafobe demo farm (2 hectare sorghum) created the highest storage of rice straw with 1000kg stored (photo at https://www.flickr.com/photos/36803481@N06/52782696060), but only 22kg/ha dry matter sorghum harvest from the local variety. The poorest soil quality with high iron toxicity (annex 10, annex 12 figure 2), high wind speeds at the hilltop forage crop field (https://www.flickr.com/photos/36803481@N06/52042244884), and year 1 drought in the middle of the wet season made sorghum production the most challenging at this site. Perennial Brachiaria was removed to make way for the SS1000 sorghum, a decision which may have negatively impacted overall production. Following advice by Wayne in September 2022, 27kg of Tephrosia was planted as a windbreak for the sorghum field, and the location of the forage demo field was adjusted and divided into 36 parcels across 2 ha in Ampitandrefana and Mormo (photo at https://www.flickr.com/photos/36803481@N06/52782301006). 700kg of ashes from the burnt forest (info on the Ankafobe fire in section 3.3 and box 1) were used to fertilize the sorghum. 21 **Ankafobe project beneficiaries received** 50kg of local sorghum for planting and reported sorghum yields of 3-5kg each on their private fields. Advice to households included the removal of plastic from livestock enclosures (video explanation by UP MSc student Alexis Oosthuizen at https://youtu.be/8w0YlOdBBQk also gives an idea of the challenging windy conditions).

The Ibity demo farm (1 hectare sorghum and 1 hectare Brachiaria) produced 110kg Brachiaria hay, 800kg rice straw storage, and 230 kg/ha dry matter sorghum harvest from the local variety. Unlike the other sites, it also produced and stored 115kg native grass hay. Demo sorghum silage production needs adjustment to achieve the correct fermentation process, encountering greater technical challenges at this site with the departure of the South Africa trained animator Sandra Nantenaina. A unique experimental procedure was followed at Ibity to

compare the planting of different sorghum seed quantities with different fertilisers (page of a report in annex 22); a comparison to other sites did not prove immediately easy to carry out. **The Ibity project beneficiaries** agreed with our interpretation of the soil and fertiliser analysis from their farms to explain their sorghum yields (e.g. photo at https://www.flickr.com/photos/36803481@N06/52782752158). While fokontany (smallest administrative divisions) Ambero, Ambatolahy and Ihasy received satisfactory yields from fair soils, fokontany Fierenantsoa and Apopoha are now applying fertilizer to tackle soil acidity. A video of Wayne's advice to Jean-Claude is at https://youtu.be/mw7Oo9yR3gc. Five beneficiaries have finished building a new barn based on the demonstration farm model. Fifteen of them have made hay and made silage from sorghum (annex 12; photos of a new beneficiary built and owned barn with a new system for hay storage, improved cow body condition score, and a new sorghum plantation are shown in figures 3-6 within annex 12). Beneficiaries confirm that sorghum accelerates the onset of oestrus and visibly increases milk production. They report that feeding cows with chicken broth after birth as recommended also hastens oestrus (Ibity focus group report in annex 23). Across the project, **all beneficiary households** have stored a total of 150 kg of hay during the wet season, and made 120 kg of sorghum silage; half of the project households have successfully fed silage and hay to their zebu for the first time (appendix 12). The PA manager Brice Funk Lee reports a new community profit of 1,801,000 MGA (£324) made by 28 beneficiary households during the past year through new sales of fertiliser to outside customers.

Analysis of **fires** (output 3) in the Itremo Protected Area 2019 – 2022 (figure 5) shows clear and predictable seasonality with the greatest area burned consistently around October in the late dry season. The similarity of this pattern to South Africa and northern Australia suggests that preventative burns in the early dry season are likely to be similarly effective in our project sites. Indeed these are already proving successful at the most pioneering site of Ibity (annex 30) with the longest history of fire research. The first preventative burns at Itremo are currently being designed with a view to implementation in the 2023 dry season.

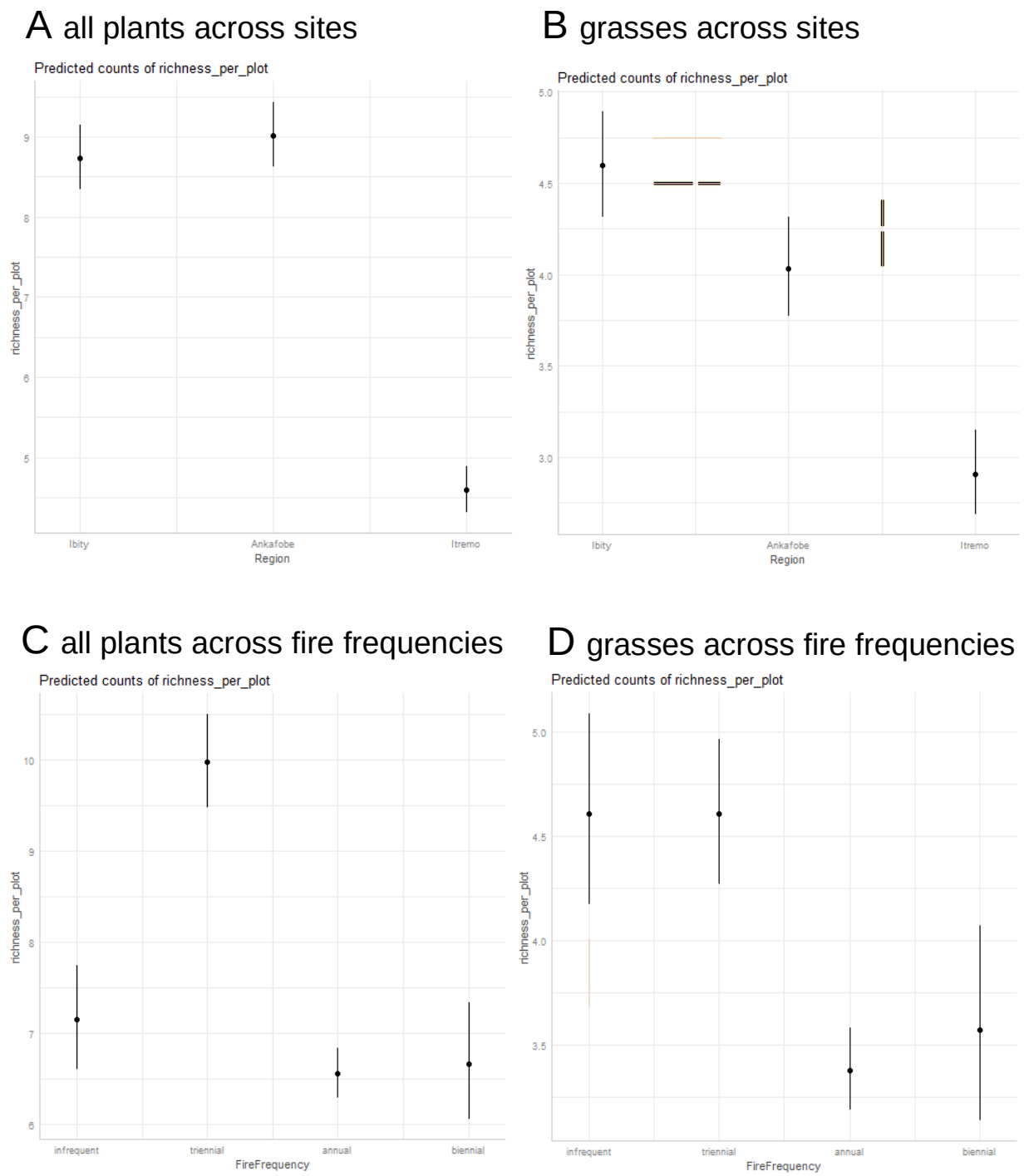


Figure 2. Baseline analysis of native grass and forb species richness per 1m diameter plot circle in project demonstration farms and communal pastures. **A, B** Diversity across sites is 8-9 plant species with 4-5 grasses in Ibity and Ankafobe, with markedly lower richness of 4-5 plant species with 2-3 grasses in Itremo. **C, D** Diversity across fire regimes suggesting the highest species richness may be associated with fire return times of ca 3 years. Analysis by Nanjarisoa Olinirina Prisca (project grass botanist) with support from Anya Courtenay and Jakub Wieczorkowski (members of Caroline Lehmann's research group).

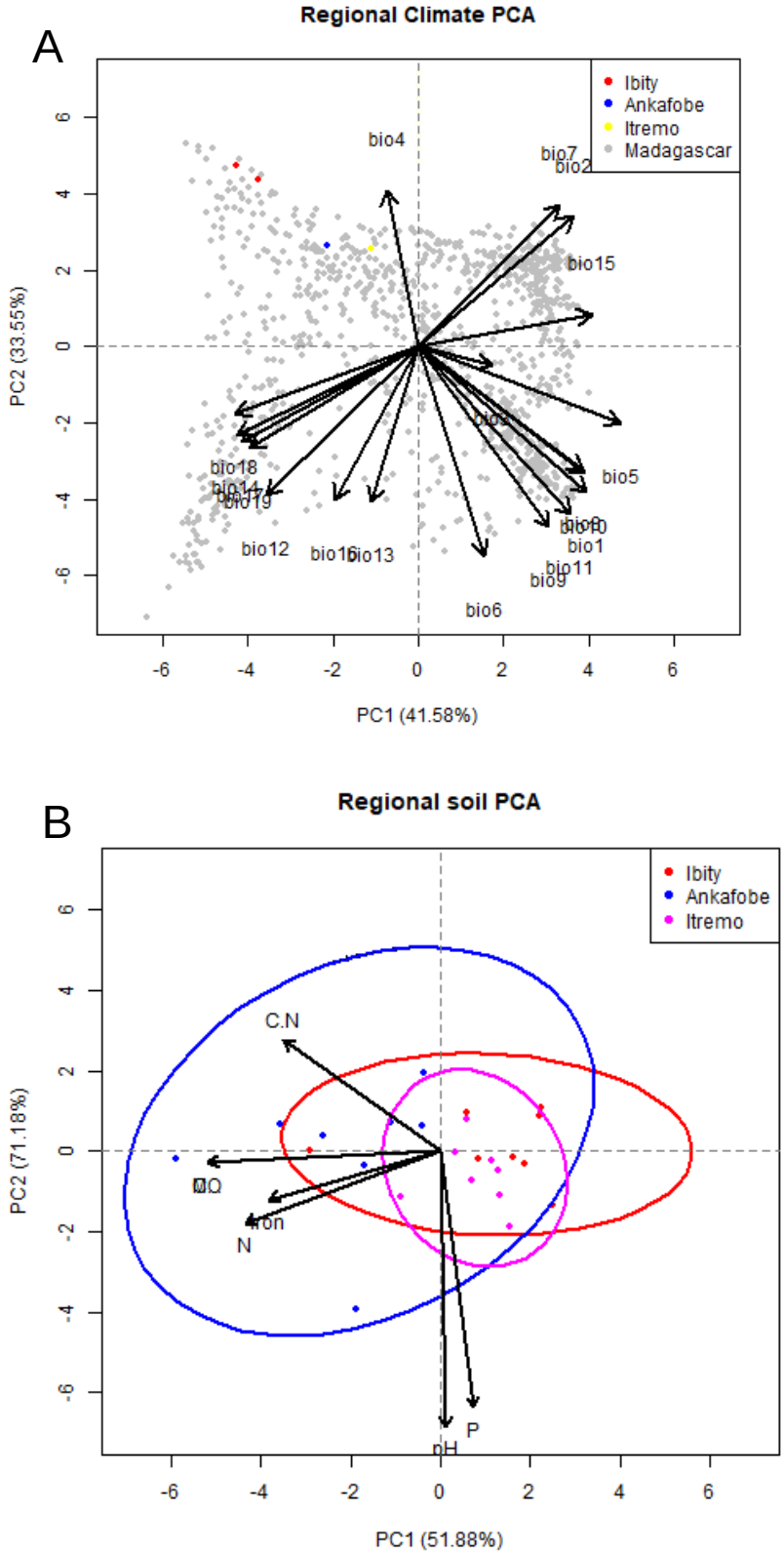


Figure 3. Baseline analysis of the **potential drivers of native grass and forb diversity** in project demonstration farms and communal pastures. **A. Project site diversity relative to Bioclim** variables for all Global Grassy Group datasets in Madagascar (Lehmann et al. 2022; Lehmann et al. 2022). Diversity across the project sites is driven primarily by temperature seasonality, and especially so at the higher elevation site of Ibity. **B. Project site diversity relative to soil** for demonstration farms and beneficiary farms across the project. Acidity (pH 4.3-4.8 for the majority of locations, see annex 10, annex 12 figure 2) appears to be the primary structuring factor. Soil composition is the most diverse across Ankafobe. Analysis by Nanjarisoa with support from Anya Courtenay and Jakub Wieczorkowski.

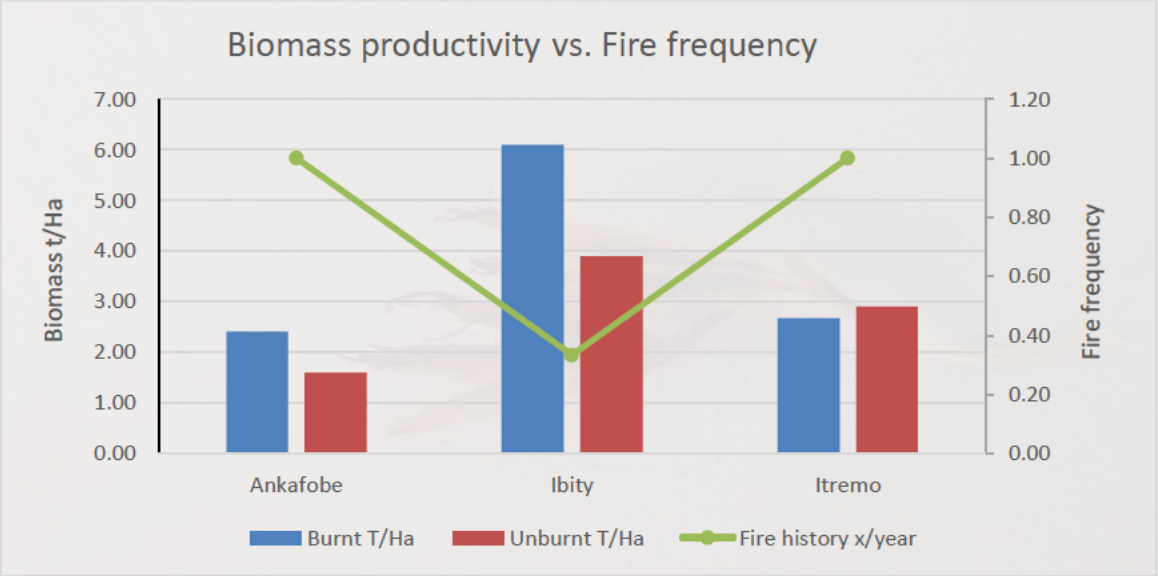


Figure 4. Pasture biomass productivity compared across burned and unburned experimental pastures, also summarised in annex 9 table 2. Prior to the start of the experimental manipulations fires were annual at Ankafobe and Itremo, but took place every 3-4 years at Ibity, potentially explaining the higher productivity at Ibity. Analysis by Nanjarisoa.

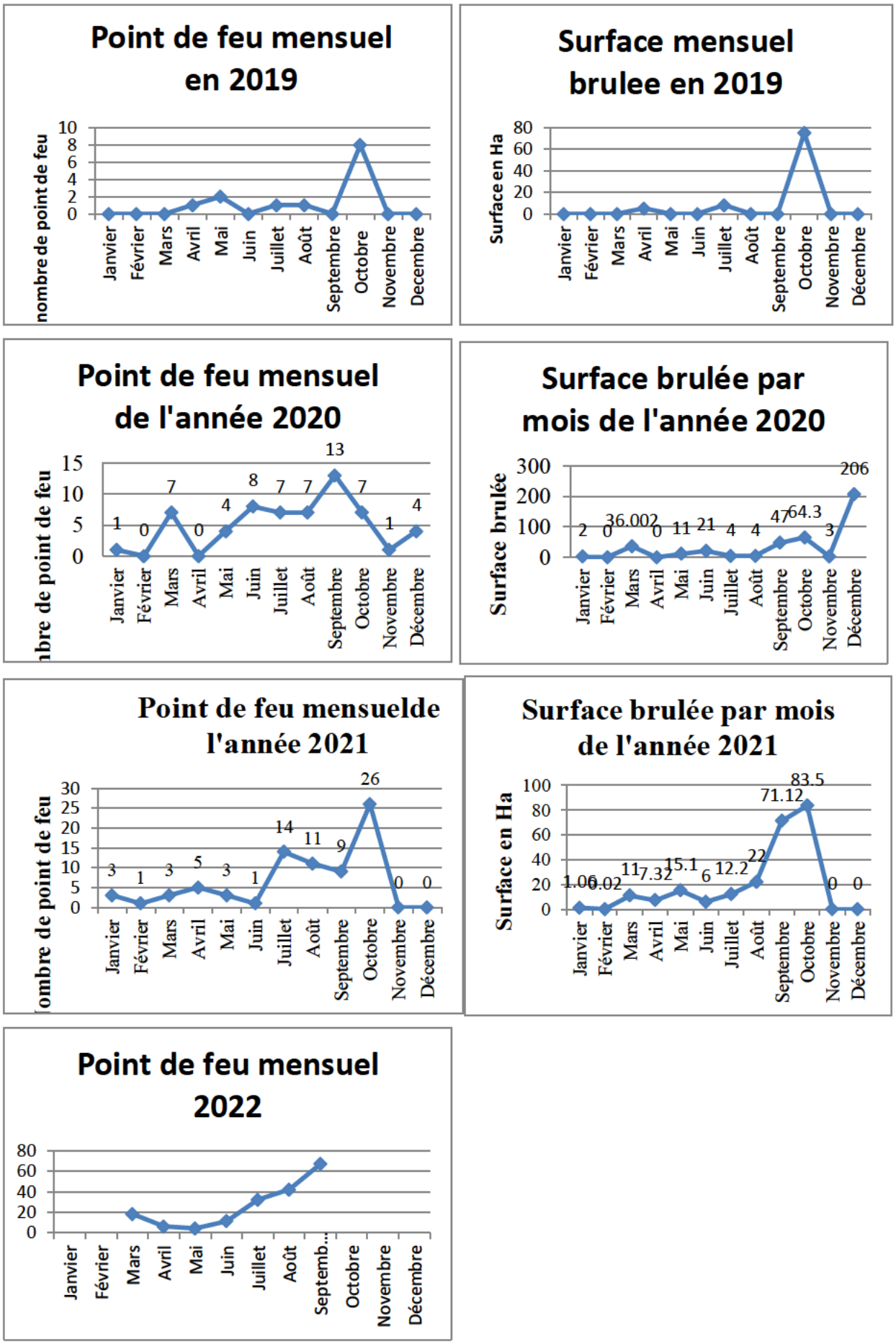


Figure 5. Analysis of fire records in the Itremo Protected Area 2019 - 2022. Ignition counts versus surface burned per year. Analysis by Tiaray Brichard, Buffini Chao Foundation project *Enhancing Lives and Livelihoods Via Community-led Conservation on the Itremo Massif*.

3.3 Progress towards the project Outcome

We feel we have cause for optimism, with progress indeed being made towards the project outcome statement *Improved grazing system management capacity among 90 pastoral farming households in Ankafobe, Ibity and Itremo leading to healthier cattle, sustainable grassland exploitation, and reduced loss of grassland and forest biodiversity.*

The **direct provision of professional agricultural advice to beneficiary households** seems to have been the most popular and effective project intervention to date. Regular support and advice to households by visiting plant and animal technicians and the animators at each site has been most frequently cited as a valued benefit, significantly more popular than the subject-specific focus groups, or the subject-specific training by international professionals (assessment from focus groups and informal conversation with staff and beneficiaries; the agreed October 2022 change request removed the requirement for a formal assessment before and after training sessions). Agricultural and value chain successes are described in section 3.2. Two additional household case studies of **improved capacity** are presented in Box 2.

Baseline assessments of **community perceptions** (indicator 0.1) using the *Multidimensional Poverty Index, Months of Adequate Household Food Provisioning, Household Food Insecurity Access Scale baseline*, and subjective well-being assessed by the *Global Person Generated Index* all point to greater food insecurity in Itremo possibly linked to lower life satisfaction reported there (annex 34 figures 1, 2, 3, 6). Belief in community trust and individual agency is nevertheless highest in Itremo (annex 34 figures 9-11). We are reassured that expectations of the project interventions are largely positive (annex 34 figures 12-17) with little conflict expected between sorghum plantation and other land used such as food crops or tree planting (annex 34 figure 18).

The average **cattle condition score** (indicator 0.3) baseline May 2022 – March 2023 is 2.77 units across the 114 cows within the project, actually somewhat higher than the pre-project expectation of 2-2.5 units. The timeline for cattle condition as well as weight (figure 6B,C) was captured fully from early dry season in May 2022 and we are reassured to not observe a weight or condition decline during the late dry season September – December. We are also reassured that the apparently most vulnerable site of Itremo with the highest human poverty (annex 34 and above) shows the highest livestock weight, an achievement believed to be at least partly due to project work.

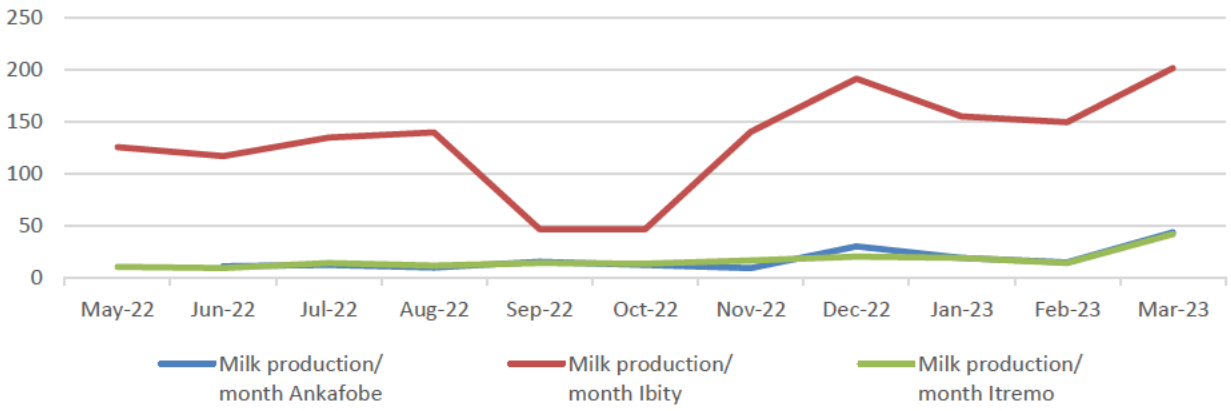
The average baseline **milk production** (indicator 0.4) is 56.4 litres/month, equivalent to 1.9 litres/day, timeline in figure 6A. Pre-project expectation of 3-4 l/day was made on the assumption of dairy cows whereas in practice the majority of project cows in Ankafobe and Itremo are the smaller and more resilient zebu, with little tradition of milking. In Ibity half of the beneficiary households were already commercial producers of milk owning more expensive dairy hybrids pre-project (e.g. Mr Solofo Harilala Francis Njaratiana discussed in Box 2); it is therefore unsurprising that Ibity milk production is higher across the board, with a correspondingly high dry season drop, suggesting that better project feed support in the dry season is likely to increase milk production further. **An overall 50% increase in milk production is seen across project sites from May 2022 to March 2023 (Figure 6A), an improvement judged meaningful by our experts** Livasoa and Wayne even though a more robust comparison will not be seen be seen until year 3 when inter-annual analysis becomes possible.

A total of 40 pregnancies were recorded with an **average calving rate** (indicator 0.6) of 13% across the 114 beneficiary cows within the project, timeline in figure 6D. This baseline calving rate is far below the pre-project expectation of 40%, highlighting pre-existing nutritional depletion and the need for these project interventions. We believe the most efficient project implementation is at Itremo, facilitated by the smoother communication and management chain, yielding the greatest benefits seen in higher livestock weight as well as calving rate there (20% calving rate, figure 6D), a significant production achievement which took place without a damaging drop in the mothers' weight and condition.

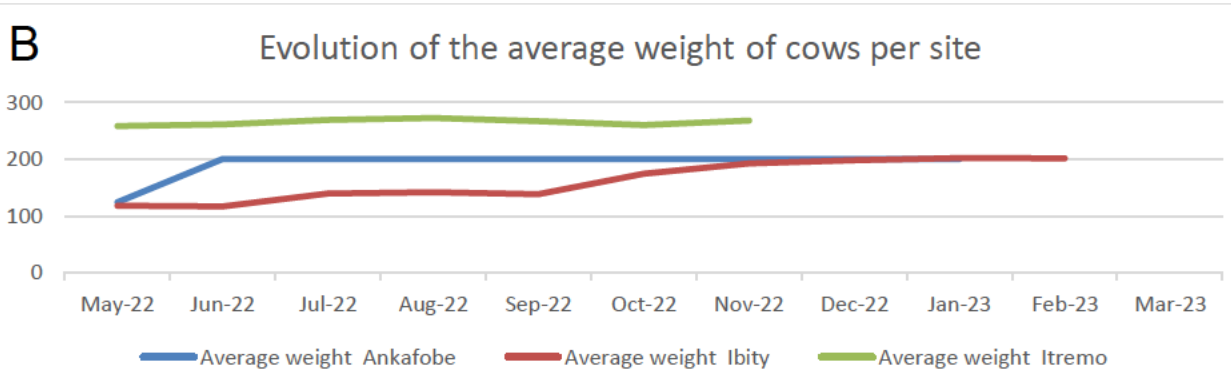
Plant and animal diversity has so far been successfully preserved within the Ibity and Itremo Protected Area patches of forest using forest cover intactness as a proxy for biodiversity (indicator 0.5). Unfortunately in Ankafobe a **late dry season fire destroyed the greater forest fragment**, a distressing event for all concerned (annex 26,29, Box 1). This loss of forest to fire does not appear to have been easily preventable even with a combination of the double project fire break, the rapid system of fire alerts, and community mobilisation for firefighting, although it seems that this project work made a significant contribution to successfully saving the remaining forest smaller forest fragment (map in Box 1) where many of the lemurs took refuge. We will use the photopoint data (reviewed in section 7) for a deeper study of what happened. The close collaboration with the *Fitantanana Maharitra Holovainjafy* will continue to support the development of fire safety work.

The weakest link from the outputs to the outcome is perhaps the **native pasture management** (indicator 0.2), and the connection between output 1 and the outcome. High quality year 1 analyses have been delivered by output 1, as well as training and focus group work, but of the three outputs this one has shown the least obvious immediate benefit from the first full year of data (Itremo grass focus group report in annex 11). Native creeping forage grasses are perceived as less effective for grazing than fire grasses (annex 34 figures 15, 16), a community opinion that contradicts project assumptions for reasons we have not fully understood. The **native grassland pastures seem more nutritionally depleted** by the short fire return times than we had initially understood, and a longer period of grassland restoration work may be required – a narrative which is at odds with the widespread tree planting programs across Madagascar's grasslands. **Potential conflict between the tree planting programs versus native pasture improvement work** is also clear to the communities: the baseline sociology assessment of project perceptions reports that significant conflict was expected between cattle grazing versus pine or Eucalyptus plantations by 70% of respondents in Ibity and Itremo (annex 34 figure 19). Grasses and grasslands are the core expertise of the project leader so we may have been disproportionally confident about the contribution of output 1 while not prioritizing it sufficiently highly for resource.

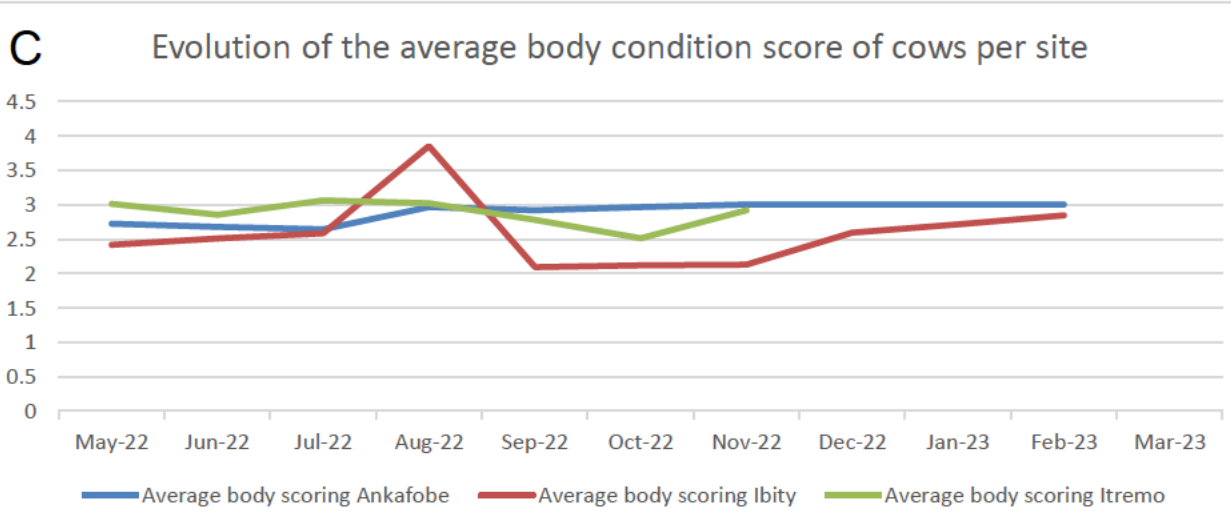
A


Average milk production by households during the project year 2 (in litres)
250
200
150
100
50
0
May-22
Jun-22
Jul-22
Aug-22
Sep-22
Oct-22
Nov-22
Dec-22
Jan-23
Feb-23
Mar-23
Milk production/ month Ankafobe
Milk production/ month Ibity
Milk production/ month Itremo

B


Evolution of the average weight of cows per site
300
200
100
0
May-22
Jun-22
Jul-22
Aug-22
Sep-22
Oct-22
Nov-22
Dec-22
Jan-23
Feb-23
Mar-23
Average weight Ankafobe
Average weight Ibity
Average weight Itremo

C


Evolution of the average body condition score of cows per site
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
May-22
Jun-22
Jul-22
Aug-22
Sep-22
Oct-22
Nov-22
Dec-22
Jan-23
Feb-23
Mar-23
Average body scoring Ankafobe
Average body scoring Ibity
Average body scoring Itremo

D

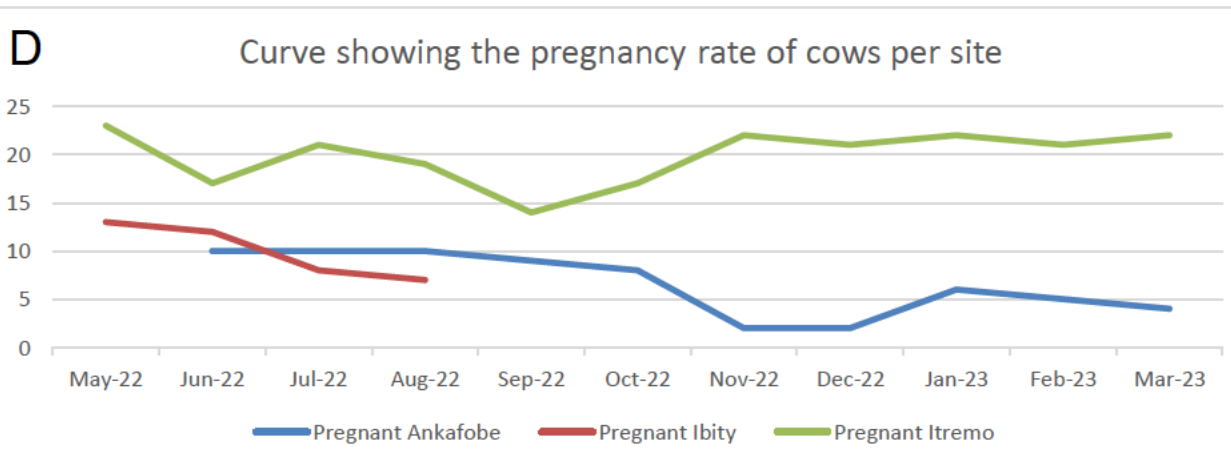

Curve showing the pregnancy rate of cows per site
25
20
15
10
5
0
May-22
Jun-22
Jul-22
Aug-22
Sep-22
Oct-22
Nov-22
Dec-22
Jan-23
Feb-23
Mar-23
Pregnant Ankafobe
Pregnant Ibity
Pregnant Itremo

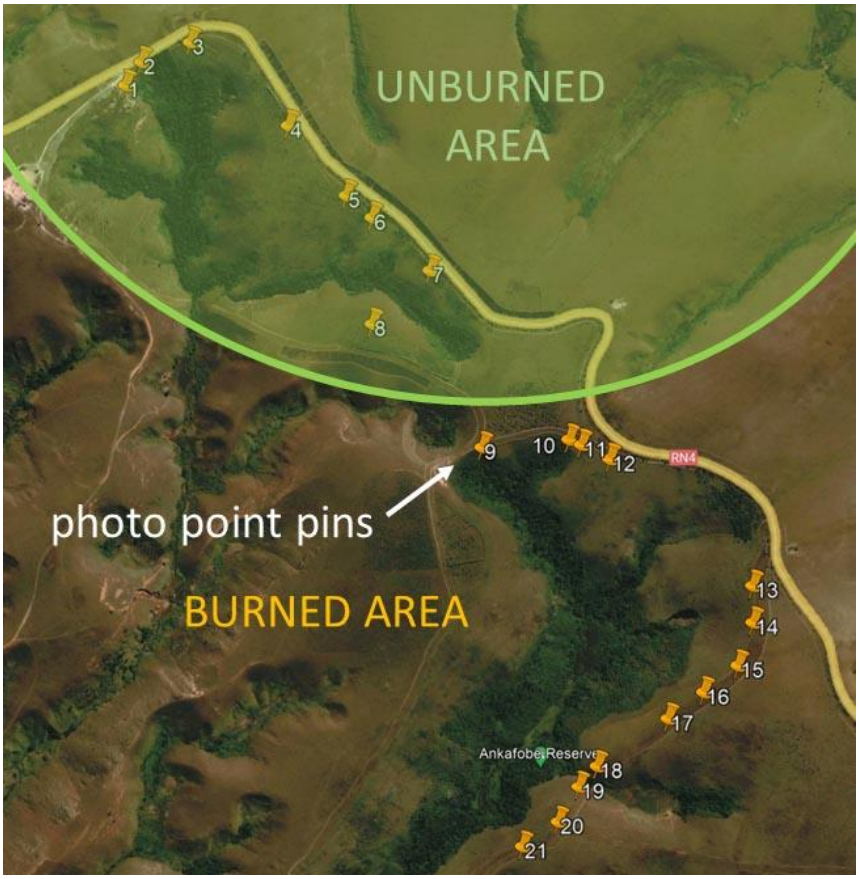
Figure 6. Heath and productivity of the cows owned by the project beneficiaries across the three project sites from May 2022 (early dry season) to March 2023 (wet season). **A. Milk production** average per household per month. In the commercial milk producing region of Ibity, beneficiary households feed their cows with sorghum twice a year, between May and July, and from December onwards, so milk production also follows this pattern (50 – 200 litres per day). **B. Animal weight** average. The weight of the Ibity cows has increased by 100 kg through feeding sorghum and native grass hay. **C. Body condition score** average. The scale is estimated from photographs (example in annex 19) from poor (1), fairy poor (2), optimal condition (3-4) up to undesirably obese (5). A remarkable improvement in body condition score (from 2.4 to 3.8) was observed in Ibity in August 2022 with the use of sorghum silage and native grass hay. **D. Percent calving rate.** The supply of vitamins (Vitamins AD3E and mixed B) plays an important role in calving. In Itremo vitamin supplementation in collaboration with the District Veterinarian has led to an increase in the number of pregnant cows. Analysis by Livasoa Randriamanalina.

Box 1. Ankafobe forest fire on 5-9 October 2022 and the post-fire recovery. Photopoint photographic timeline captured before, after, and in the wet season after the fire. The following technical notes are in addition to the report in annex 29 and the corresponding note published by the Missouri Botanical Gardens at https://discoverandshare.org/2022/10/28/garden-plans-restoration-after-fire-burns-35-acres-of-precious-forest-in-madagascar/. Photographs by Hafaliana Rakotoarison and the Ankafobe team.

The fire arrived at Ankafobe from the southeast, driven by high winds. Dinasoa Tahirinirainy received the Firecast alert and left Antananarivo around 7pm on 5 October. The firefighting teams of estimated 100 people total included local communities, Andranofeno village gendarmes, MEDD, and MBG staff. Fire fighting efforts outside the south-eastern forest patch continued for approximately 5 hours but failed due to high winds. After 22 hours the fire was eventually successfully stopped at the double firebreak around the smaller north-western forest patch, the fire termination line marked roughly in green. The total duration of the fire was 4 days.

The two selected photopoint image sets show the timeline. Green tree canopy is visible again six months after the fire.

Box 1 continued. Map of the two project forest patches in Ankafobe:



Closeup of forest recovery at Photopoint 20, 6 months aftre the fire, at the end of the 2023 wet season with good rains:

3.4 Monitoring of assumptions

No change from year 1 and the assumptions hold true, except for the following:

Assumption on trust and engagement: *Continued community trust and engagement; most management associations choose to participate in the project (risk mitigated by 17 years of trusting relationships already built in Ankafobe, Ibity and Itremo, enthusiasm expressed at the scoping workshop, and investment to ensure full community engagement in project)*

Comments: Largely correct over the past year. The demo farm in Ankafobe has been the least impressive due to the exposed and windy location of the sorghum field, alterations to the original cowshed (https://www.flickr.com/photos/36803481@N06/52443955952) design and security concerns at the new more remote location of the replacement cowshed; 4 of the 30 households withdrew from the project stating their disappointment and have been replaced by new volunteers. Engagement does appear to be continuously quite high across the overall project; 10 of 30 Amborompotsy Itremo households are considered by our staff to be less motivated than the others and this is due to the household circumstances rather than any project actions, e.g. many of the less motivated households found they lack the time to participate in project work due being employed in other time-demanding jobs.

Assumption on rainfall: *Rainfall patterns remain within local average ranges (risk mitigated through monitoring and adjustment of plot design)*

Comments: While the 2021 – 2022 wet season had an unexpected Ankafobe mini-drought in the middle, around the same time as Cyclone Batsirai and floods further south (see year 1 report), the 2022 – 2023 wet season has had abundant rains across the project sites. Demo sorghum yields have not performed as well as they could have done in either year, as both years suffered from delays in obtaining the seed batches resulting in late planting. We are nevertheless pleased that fairly reasonable yields were seen across the sites this year, successfully proving value of the sorghum silage method to the beneficiaries. The project remains vulnerable to rainfall variability for the rest of its duration.

Assumption on grasses: *Invasions of alien grasses and forbs do not significantly increase (risk mitigated through monitoring and adjustment of plot design by the grass and forb botanist, and cultivating Sorghum cultivars which have proven non-invasive)*

Comments: A previously unknown grass weed invasion has been recorded (section 16) and is in need of monitoring, even though significant effects on project work have not been observed to date

Assumptions on fire: *No sudden change in fire regime e.g. following drought (risk mitigated through monitoring and adjustment of firebreak design and preventative burns). No fires deliberately started in the forest (risk mitigated by decreasing community need for fires through improved dry season livestock nutrition supply by outputs 1 and 2, and increased community control over fires)*

Comments: The reality of Madagascar's fire politics is such that true causes of ignitions usually remain unknown, and the exact history of the Ankafobe fire in October 2022 is unlikely to be established. Overall, highland fires are decreasing over time (Phelps et al. 2022), so it is unlikely the Ankafobe fire is connected to a fundamental change in fire regime. Further research will be carried out.

3.5 Impact: achievement of positive impact on biodiversity and poverty reduction

The project impact statement is *Conservation of biodiversity and improved welfare of communities in the Central Highlands of Madagascar through optimal grazing of cattle and management of grasslands.* We feel a significant impact on human development and community welfare is already being achieved through improvements to livestock farming production and especially milk production, resulting in profits described in sections 3.2 and 3.3. The project also helped save the unique biodiversity in the northern forest fragment of Ankafobe from the October 2022 fire, described in section 3.3. Progress in grassland

management has been somewhat slower, but we are hopeful that our rapid development impact will make our communities better placed and better motivated to make progress on grassland management in the remaining 1.5 years of the project.

4. Project support to the Conventions, Treaties or Agreements

No change from year 1.

5. Project support to poverty reduction

In spite of the fact that full baseline data are still only available for the first full year of the project, direct and significant livelihood improvements for the 90 project households in the Least Developed country of Madagascar have become evident during the past year, with a 50% milk production increase the most significant (section 3.2), likely driven by improved fodder flow and animal weight. Each beneficiary household received approximately 250g of local sorghum, and 50% of them have successfully fed silage and hay to their zebu for the first time (annex 12). Ibity beneficiaries made new profit from selling fertiliser, while Itremo beneficiaries have established a novel milk sale value chain (section 3.2). The link between human nutrition and the availability of milk is well established, and these improvements appear to be highly valued by the households. Beneficiaries report strong motivation to increase the number of cows they own, clearly linking this project work with the wishes of the ancestor spirits significant in Malagasy culture, and suggesting the progress may be durable. Two project beneficiary case studies are presented in Box 2.

We are working with Malagasy government partners (table 1) to not only secure durability for the achievements of this project, but also understand how the achievements can be best utilised for broader agricultural production food system resilience in the future (details in section 12).

Box 2. Two project beneficiary case studies recorded by Maria Vorontsova, Wayne Truter, and Livasoa Randriamanalina during household mentoring and through an informal interview on 26 March 2023 at Ambatolahy, Ibity. Both have given verbal consent to the publication of their images, video, and interview materials.

(1) Mr Solofo Harilala Francis Njaratiana (known as Njaratiana, https://www.flickr.com/photos/36803481@N06/52865984284) is the elected beneficiary representing the Ambatolahy village in Ibity. His ancestors lived in this village until his grandfather entered military service in nearby Antsirabe and the family moved there. The ancestors want good Malagasy people to be farmers, and the family moved back to the village of Ambatolahy when Njaratiana was 6 months old. Living in the same place as the ancestors holds great importance and he likes village life due to the pleasant space and ample supply of land available for agricultural expansion. He is now an experienced zebu farmer and learned about the project during the local launch event when he heard about the proposed work on zebu forage. Within this village he was the only one motivated to join the project so it was easy to get elected.

In addition to growing carrots and vegetables for sale and building an enclosure for pigs, Njaratiana owns two heads of cattle: the 7-year-old dairy hybrid Kiala Mavo ("yellow", https://www.flickr.com/photos/36803481@N06/52865820491/) currently eight months pregnant with her third calf, and her 1 year 3 month old bull calf Le Felana ("white star", https://www.flickr.com/photos/36803481@N06/52865239747/). The calf was removed from his mother at 3 months and this did not disrupt milk production. Prior to the project start he collected fresh wild grasses and brought them to the livestock as he did not feel it was safe to use communal pasture due to the danger of dahalo bandits, especially dangerous at night and during the dry season. Vegetable farming takes place in the morning and he starts feeding his cattle around midday. Njaratiana sells the milk to Socolait, the big milk factory in Antsirabe. Socolait representatives visit daily to test and collect fresh milk, and bring his payment every Wednesday. Every year milk prices increase and especially so during the dry season: he currently receives 1700 MGA/litre, increased from 1500 MGA/litre. He is satisfied with Socolait as the payments are on time, and unlike some of the neighbours his milk has never been rejected through testing.

Project technicians helped Njaratiana learn and adopt the methodologies of making hay, growing sorghum for forage, making silage, and feeding silage to the livestock. On their recommendation Njaratiana has also experimented with grazing the cattle directly on the farin'omby (forage crop *Cenchrus purpureus*, also known as Kizozi) grown within the core village area, instead of cutting foliage to bring to the livestock, and the livestock seem to like it. From 8 litres/day prior to the project, milk production has now increased to 12 l/day. Having originally purchased Kiala Mavo at 1 year of age for 650,000 MGA, a number of people have now offered to buy her for 1,000,000 MGA but he is not interested in selling. Nanja showed him wild grasses and he has considered the possibility of native communal pasture grazing, but has so far decided against it due to the dahalo threat. Of all the project benefits he particularly appreciates technician visits with direct knowledge transfer and would prefer them to visit twice a month instead of the current monthly visits. Njaratiana's neighbour has observed his good result and also wants to become a project beneficiary.

During the farm visit Wayne has recommended finding a way of starting feed much earlier in the day as he is confident this will increase milk production even further (video at https://youtu.be/miTAFuMzwUI). Any milk rejected by Socolait through their testing should be given to pigs for rapid weight gain, something the locals have not tried, rather than attempting to sell it elsewhere.

In the future Njaratiana would like to own more cows in order to produce more milk for sale. He has two children and would be keen for them to continue the business, at least as a first job.

Box 2. Continued

(2) Jean-Louis (https://www.flickr.com/photos/36803481@N06/52865818211/) owns 2 zebu cows, Kala Mavo ("yellow") and Kala Kirioka ("spots"), and 1 zebu bull he raised from a calf. Emotional attachment to his zebu is sufficiently strong Jean-Louis would not consider selling them. They produce 5 l/day of milk. The calf was separated at 4 months and milk production stopped [a significant distinction of non-dairy zebu breeds]; the mother appeared thin so further milking was not attempted.

Jean-Louis is interested in breed improvement and milk production, but has not been able to afford an expensive dairy hybrid. None of the cows are currently pregnant as he is looking for the right parent. During the household mentoring session Wayne shared his experience of treating livestock differently to the thinking applied to human society; the cow can be covered by her own calf a maximum of two times, to give a maximum third generation inbred offspring, after which the consequences of inbreeding become disadvantageous.

Silage making was not attempted as Jean-Louis was waiting for additional fertiliser. Wayne recommended not waiting but using chicken manure instead, or sugar cane, whey with salt, or any good legume in moderate quantity, as too much legume causes silage to rot (video at https://youtu.be/pzrPm9FqJQU). Tephrosia is already being grown so adding legume is feasible.

6. Gender equality and social inclusion

In traditional Malagasy society women usually do not speak at meetings and this custom persists further away from main roads. Our project site in Itremo, Amborompotsy is on the road RN35 and has a culture of an intermediate level of female empowerment when compared with other sites in Madagascar, significantly more open than Kew's previous Darwin projects working on yams in the north of the country. In our project women have and express their own opinion, and both female project beneficiaries can take the floor in meetings. At each beneficiary meeting in Amborompotsy we see at least one vocal woman registered to represent her household (often because her husband is busy with a more prestigious job), seen in the project beneficiary meeting videos from September 2022 https://youtu.be/3TIfKpSZx0o and also April 2023 https://youtu.be/sCySGd_lLfI. Informal reports through project staff suggest that in Amborompotsy the female household representatives are better at project participation and implementation, while more men are late to project meetings to show authority and independence.

We had initially planned to recruit at least 50% households with either married women or led by single women. In practice it became apparent that no single women households owned cows, likely linked to the fact that women do not traditionally drive ploughs, and are therefore unable to benefit from Amborompotsy's largest income stream for livestock owners, hiring out a 2-oxen cart with a man and a set of equipment for 20,000 MGA a day working 8am – 1pm. Plenty of land is available in Amborompotsy and the main restriction on agricultural production is labour to work the land; milk had traditionally been shared for free in the community; so locally the main economic motivation for keeping zebu is agricultural labour. Women have been responsible for planting sorghum and making silage, as originally envisaged.

It seems that the obvious presence of active female project leadership in KMCC (Dr Helene Ralimanana and Tiana Randriamboavonjy), MBG Madagascar (Dr Jeannie Raharimampionona) as well as the international expert team (Dr Maria Vorontsova and Dr Caroline Lehmann) has made a good impression at the Malagasy government stakeholder meetings (section 12) partly in connection with senior female leadership in MINAE and MEDD.

Please quantify the proportion of women on the Project Board[1].	50% of the members are female: 3 out of 6, including 2 out of 3 Malagasy board members (project management structure in annex 4)
Please quantify the proportion of project partners that are led by women, or which have a senior leadership team consisting of at least 50% women[2].	60% of the partners are led by women: 3 out of 5, including 1 out of 2 Malagasy partners (project management structure in annex 4)

7. Monitoring and evaluation

The nature of this project means that the progression and causality from agricultural support activities to increased milk production, improved zebu health and calving rate, and then to human health and welfare sems fairly clearcut. The choice of indicators, the practicalities of data collecting and reporting, and the technical setup for monitoring and evaluation all seem to be working and broadly appropriate – although the fodder and livestock indicators in output 2 and the outcome are unnecessarily cumbersome and in need of further simplification. The challenges reflect not merely the design of monitoring and evaluation but also weakness in the overall project scope where staff are overcommitted, sometimes leading to poor communication and then delayed data sharing.

In spite of being somewhat cumbersome, the GGG plot method and the associated plot database and R scripts (output 1) are successful at structuring the grassland data gathering and creating a pipeline to scientifically robust analysis of grassy ecosystems (section 3.2), with publishable and reusable research and career development for Nanjarisoa. The Kobo Android app and web system has proven successful at data collection on beneficiary household statistics, agricultural data, and regular standardised livestock photographs for Body Condition Score (BCS also known as NEC in French; Kobo screenshots in annex 19; Output 2 and Outcome). Fodder and livestock indicators could be measured less often; either weight or body condition scoring could be dropped. Microsoft SharePoint External folder share has been set up by RBG Kew for rapid data transfers between project partners, and has been working well proportionally to the available internet signal. Only the Ibity site has experienced difficulty using the Kobo app and transferring data to and from Microsoft SharePoint.

We are particularly excited about the **photo point method, a method to record fire histories on the edges of forest/savanna boundaries across multiple seasons**, a project innovation from South Africa implemented by Caroline Lehmann in Madagascar for the first time (output 3). The legacy of colonial and postcolonial fire suppression has made fire into a highly sensitive topic in Madagascar with a threat of incarceration for anyone accused of starting a fire. Anti-fire attitudes are particularly prevalent in the conservation community with penalties for Protected Area management responsible for any burns within their areas. Local records of fire histories and fire protection histories are therefore not easily shared or discussed. The photo point method records photographs towards the forest and away from the forest at each set location (Box 1, annexes 26-28), and is simple to execute for anyone with a camera. For example, the Ambazimbamena forest patch in Western Itremo https://www.flickr.com/photos/36803481@N06/52444493906/ is surrounded by 20 photo points now marked in permanent yellow paint: e.g. number 1 https://www.flickr.com/photos/36803481@N06/52444771144/ and number 20 https://www.flickr.com/photos/36803481@N06/52444937585/. Romain Benjamina (project animator at Itremo) explains the photo point method and monitoring of the Ambazimbamena forest edge in a YouTube video in October 2022: https://youtu.be/bJrf9HuohUE. The approaches are not yet fully standard between sites and methodological adjustments still being

[1] A Project Board has overall authority for the project, is accountable for its success or failure, and supports the senior project manager to successfully deliver the project.

[2] Partners that have formal governance role in the project, and a formal relationship with the project that may involve staff costs and/or budget management responsibilities.

made in Ankafobe (annex 26), but the power of the photopoint method lies in the fact that photos contain significant useful data regardless of the exact technical details of the application. The dataset being built up by this project will be the first consistent longer-term photographic record of fire edges in central Madagascar. The *Fitantanana Maharitra Holovainjafy* project consortium is also considering adopting this method.

8. Lessons learnt

We learned that novel and technically impressive foreign solutions often appear to be an appealingly simple fix for food system productivity, but in practice foreign imports require significant additional adjustment to be effective, and can prove less efficient than better known in-country alternatives. The **SS1000 forage sorghum cultivar** is a Sorghum x Sorghum x Sudan hybrid, a complex hybrid from two sweet sorghum *Sorghum bicolor* progenitors and Sudan grass *Sorghum* × *drummondii,* bred for maximum silage yield across a range of conditions (datasheet screenshot in annex 14). Culm internodes have a strong sweet taste (photo of human tasting at https://www.flickr.com/photos/36803481@N06/52865237317). Under optimal conditions it should be capable of producing 60 tonnes/hectare wet and 35 t/ha dry yield from planting 25 kg/ha of seed, with a more realistic ambition of 10 t/ha appropriate for the Malagasy highlands with no fertiliser application. Since direct seed supply in Madagascar failed following the pandemic bankruptcy of our commercial subsidiary partner, in year 1 we planted the locally available older multi-purpose sorghum cultivar grown through FOFIFA (year 1 report). This year we invested very significant and unplanned time and financial resource into buying and shipping one tonne of SS1000 cultivar seeds to Madagascar, including seed treatment and certification (annex 15,16), negotiation with DHL shipping in both countries, customs on entry to Madagascar (annex 17, 18, photo taken on release from customs at https://twitter.com/vorontsovams/status/1614046839547781120), a Malagasy quarantine authorisation process, and arranging longer-term cold storage for the seeds SNGF. It remains unclear whether we will see a return on this investment. Quarantine authorisation to plant a new foreign cultivar can be granted only for parcels of land personally viewed by one of the Quarantine Service inspectors. Insufficient time and financial resources were available to have the inspector personally visit every one of the 90 beneficiary household fields, many of which are remote, so this year we gained authorisation to trial SS1000 only at the demo farms. Due to the extended delay at Toamasina customs SS1000 was planted late, missing the first rains in December, and delivering substandard yield this year. This substandard yield was nevertheless large and impressive at Itremo (photo of sorghum much taller than Romain at https://twitter.com/vorontsovams/status/1643199778971369475), rapidly exceeding the capacity of the new larger silage talk built in Amborompotsy from Wayne's design (https://www.flickr.com/photos/36803481@N06/52865248127; https://www.flickr.com/photos/36803481@N06/52865827406). The yield of SS1000 will begin to decline substantially after the third generation of seed unless additional seed is imported, highlighting the possibility that far too much resource was invested in obtaining SS1000 instead of using the easy locally available multi-purpose FOFIFA cultivar. Depending on next year's results it is possible the full value of the import cannot be realised within the timeline of this project. We would recommend importation of new cultivars only after thorough testing of in-country alternatives with a thorough scoping of staff time.

9. Actions taken in response to previous reviews (if applicable)

Feedback items from Annual Report 1:

1. *During the writing of the Annual Report, the project team realised that a number of complex and time-consuming activities were not taken into account in the original Logframe activities and indicators. The team now feel that completion of the project in full may be beyond its capacity, and highlights its failure to complete all activities in the second part of Output 2 and 3. As a consequence, the reviewer recommends that the Logframe be revised accordingly and discussed with Darwin through a Change Request.*

Reply: following reviewer comments we reviewed the situation at the biannual all-staff meetings in Antananarivo, and submitted a non-financial change request with an updated

logframe in October 2022. We requested to support and strengthen the agricultural work in output 2, by moving resource away from fire protection in output 3, since fire protection and management has recently received extra support from the Biodiverse Landscape Fund *Fitantanana Maharitra Holovainjafy* consortium project, as well as Buffini Chao Foundation project *Enhancing Lives and Livelihoods Via Community-led Conservation on the Itremo Massif.* After additional feedback from Darwin on the logframe, the revised logframe presented here was approved in April 2023. Overall we feel that the situation has improved somewhat but some resourcing issues and staff overcommitment remain: this project and especially its agricultural component in Output 2 is so large everyone is overstretched, but our commitment to the beneficiary households and the demo farms has already been made. The different project components all rely on one another and it has not proven possible to completely remove any of the components. Protected Area managers have not supported the idea of removing fire protection from the project completely. Work on this issue will need to continue.

2. *It is interesting to read about the native grass and forb diversity in the plots, particularly comparing the preliminary data from communal plots and the demo plots that have previously been uncultivated and not extensively grazed. Are there any issues with species identification, for example due to grasses not flowering at the time of the surveys?*

Reply: historically the core research expertise of the Project Leader Maria Vorontsova is in the identification and classification of Malagasy grasses. The Grass Botanist Nanjarisoa also has 10 years of experience in grass ID. We are confident we have the best grass identification expertise available in Madagascar, and our generalist botanist colleagues at Kew Madagascar and the Botanical and Zoological Garden of Tsimbazaza help identify any difficult forb species not already covered by our active iNaturalist Malagasy plant identification community, project initiated and run by Kew at https://www.inaturalist.org/projects/zavamaniry-gasy-plants-of-madagascar (plot circle picture https://www.flickr.com/photos/36803481@N06/52782303781, voucher plant press https://www.flickr.com/photos/36803481@N06/52444914260, species ID verification https://www.flickr.com/photos/36803481@N06/52865998844, more info in year 1 report). As part of the GGG plot method (designed for herbaceous plant herbarium diversity and taxonomy research alongside the ecology, Lehmann et al. 2022) we work in the late wet season for maximum flowering, examine all non-flowering plants, spend time dividing them into the most likely species units, assign them numbers, and collect vouchers for herbarium comparison in the vegetative state. As with all plot methods some under-recording of species not in flower (or fully dormant under the ground) remains inevitable; we believe that our specialist method is a significant advance on the current alternatives.

3. *In an effort to help the 'poorer sectors of local society', the project is employing other local people from beneficiary households where possible, in manual work associated with project activities, such as fence erection and firebreak clearing. However, it is not clear how these poorer households will benefit in the longer term.*

Reply: the project has chosen to focus is on the households wealthy enough to own at least one cow. We believe trickle-down economics do work in our village communities to a significant extent, via a variety of routes. Opportunities for manual labour employment will increase as livestock production increases. With more livestock the cost of hiring zebu cart labour in Itremo will decrease (see section 6), enabling more land to be cultivated by a greater number of households, as the limiting factor for cultivation is currently agricultural labour using oxen carts. With increased milk production the prices are expected to either drop or at least rise less rapidly; the Itremo tradition of giving away milk for free to the neighbours is also continuing sporadically. Increased fertiliser sales in Ibity are expected to lead to lower prices of fertiliser in the area, enabling poorer households to increase their rice yields. We also hope that with larger herds the fear of the dahalo bandits will decrease, motivating more households to be able to own livestock or at least sheep.

4. *The essential project setup activities undertaken over the first five months appear under the Outcome, but actually relate to an Output 0, which is a little confusing, and could be clarified in a revised Logframe.*

Reply: We are not confident we have understood exactly which logframe layout the reviewers would prefer instead, and therefore not sure whether the revised logframe presented here is an adequate response

5. *The project team should review the budget table to match expenditure and grant with totals presented*

Reply: Project finance staff shortages have unfortunately affected RBG Kew UK post-pandemic at the same time as significant new project funding had to be processed by the organisation, while salary reform has taken place at Kew and MBG during the past year (annex 41). We have been more successful this year but challenges remain also with budget management connectivity between Kew UK and Kew Madagascar, with different accounting software used by the two sites.

10. Risk Management

The long-term poor quality of the road Route Nationale 35 between Ambatofinandrahana and Itremo remains a significant ongoing risk to all activities in Itremo, especially combined with the ongoing lack of internet access at Amborompotsy in west Itremo. Progress on road condition has been made this year with one large new bridge completed and opened over the Nahaverazana River, so vehicles no longer need to drive through the river as we did in the autumn 2022 (video of Kew Landrover crossing the Nahaverazana River in at https://youtube.com/shorts/BXXAzFONms0?feature=share). Roadworks have so far only covered the area immediately adjacent to Ambatofinandrahana, so both access and journey stress and duration remain uncertain towards Itremo (video of Kew Landrover on wet road in January 2023 https://youtube.com/shorts/6JhqiBzJr1o?feature=share; photo of road in April 2023 https://www.flickr.com/photos/36803481@N06/52866270583/, road becoming a ravine https://www.flickr.com/photos/36803481@N06/52865241762, https://www.flickr.com/photos/36803481@N06/52865986869, sections of bridges missing with DIY bridge repairs a part of every journey, video https://www.flickr.com/photos/36803481@N06/52444995505 https://www.flickr.com/photos/36803481@N06/52444556911 and picture https://www.flickr.com/photos/36803481@N06/52444509226, common stops to repair the road https://www.flickr.com/photos/36803481@N06/52865252252, traveling in convoys so vehicles can pull each other out https://www.flickr.com/photos/36803481@N06/52866270158). Progress has also been made this year with internet connectivity as a satellite internet connection was installed in the new occupied by the *Fitantanana Maharitra Holovainjafy* project office in Ambatofinandrahana (photo at https://www.flickr.com/photos/36803481@N06/52865997924). Organizing long distance travel via Route Nationale 35 to Amborompotsy proved too challenging for the commercial satellite internet technical staff from Ambositra to install the same setup this year but this is planned for early next year.

One unexpected risk we were previously unaware of for rainy years is **Malagasy migratory locust, *Locusta migratoria capito***. These are a regular occurrence across the Malagasy highlands and pose substantial risk to all crops and objects made of plants such as roofs, and especially more remote areas such as Itremo where the MINAE pest control response is slower. During an attack all normal activity is terminated and everyone able to do so goes to the fields to create noise and fire to prevent the swarm from settling (video of locust swarm arriving and disrupting our project beneficiary meeting https://youtu.be/psRGD9XfMhU, swarm intensifying https://youtu.be/psRGD9XfMhU, second swarm returning to the project forage crop field the next day https://youtu.be/fyMFMVvWI98).

[redacted]

[redacted]

11. Other comments on progress not covered elsewhere

No additional comments.

12. Sustainability and legacy

In order to secure durability for the achievements of this project as well as understand how the project achievements can be best utilised for broader agricultural production food system resilience in the future, we have made a significant investment into networking with Malagasy stakeholders. Our greatest achievement towards long-term legacy this year is our successful engagement of multiple Malagasy government stakeholders, achieving an enthusiastic relationship, greater understanding of their needs, and greater collaboration on both this project and legacy ideas. Government stakeholders were engaged using two parallel routes described below:

(1) Sharing grass and grassland research and inviting **stakeholders interested in forage grasses and weeds to contribute to the new grass species reference book (output 1)**. We held two stakeholder workshops for Malagasy organisations interested in grasses and potentially co-authoring the new guide to the highland grasses of Madagascar. The following organisations sent representatives (see table 1 for abbreviations): MINAE DGA, MINAE DAPA, MINAE DPV, MEDD DGGE, FOFIFA DRZVP, FOFIFA DRD, MBEV, ESSA, IESAV, FIFATA, FIFAMANOR, MDB PROFI-Lait, CAS MBC, MBG. The first workshop on 9 June 2022 (29 participants) was our first connection point to Madagascar's agricultural development community working with forage grasses and weeds. Kew was introduced by our MEDD sponsors, staff presented our research and proposal for the new book (pre-recorded presentation by Maria Vorontsova at https://youtu.be/zgLnlHU4K3k), and set out the benefits of a potential collaboration. The second workshop (https://www.flickr.com/photos/36803481@N06/52444516326 ; minutes and attendance in annex 35) on 6 October 2022 (22 participants) focused on the practical arrangements for the new book. A proposed page layout was presented (https://twitter.com/vorontsovams/status/1577950249393557509) and a collaboration agreement was proposed and discussed. Further smaller meetings were held in February and March 2023 to finalise agreements for book contributions. Discussions are ongoing, the most recent page mock-up is presented in annex 36, and the first full draft of the new book is due to be submitted to Kew Publishing by 31 December 2023. In addition to producing a much-needed reference book we believe this process is building connections between Kew's native grass diversity knowledge and the Malagasy organisations interested and able to apply this knowledge to agricultural development.

[redacted]

[redacted]

13. Darwin Initiative identity

This project has established a clear identify and a distinct professional and social network in Madagascar, linked to the Darwin logo and to the UK government. The British Ambassador to Madagascar visited the project site in Ankafobe in November 2022, as part of the *Sustainable Management for Future Generations* or *Fitantanana Maharitra Holovainjafy* project launch.

In addition to the ongoing work reported in year 1, this year the blue project t-shirts with a prominent Darwin logo and caps were printed and distributed to the project beneficiaries, staff, and key stakeholders (e.g. annex 23 last page; https://www.flickr.com/photos/36803481@N06/52865983634). Project t-shirt culture is popular in the Malagasy development communities and the project members are now easy to spot in the distinctive blue outfits.

The project Facebook page https://www.facebook.com/KMCCMBG/ is run by representatives from all three sites, Livasoa Randriamanalina, and Maria Vorontsova. It is now well-established and active within the Malagasy scientific, NGO and development community, with 680 followers, largely 25-34 years old and based in Antananarivo, 53% male and 47% female. Within the last 20 days the posts reached 2,170 people, with 1,797 engagements. We did not judge it appropriate to spend further budget on Facebook advertising this year, but we are considering it for project legacy outreach in years 3-4. The Twitter communications to the international community continue to be cross-posted to 1,584 followers by @vorontsovams, usually with the project hashtag #kijanamaharitra; Twitter continues to generate significantly less engagement than Facebook. Links to Biodiversity Challenge Funds have been made on both Facebook and Twitter and both have been shared by the Biodiversity Challenge Funds, e.g. Facebook on 14 February 2023 [redacted]

14. Safeguarding

Has your Safeguarding Policy been updated in the past 12 months?	Yes, currently in the process of being updated as part of the *Fitantanana Maharitra*

	Holovainjafy (annex 40)
Have any concerns been investigated in the past 12 months	No
Does your project have a Safeguarding focal point?	Yes Ando RAMIANDRISOA, Safeguarding and Logistics Responsible for Kew Madagascar Conservation Centre and the *Fitantanana Maharitra Holovainjafy* [redacted]
Has the focal point attended any formal training in the last 12 months?	No; started work 27 April 2023
What proportion (and number) of project staff have received formal training on Safeguarding?	Past: 15% [4 out of 27] Planned: 80% [8 out of 27]

Has there been any lessons learnt or challenges on Safeguarding in the past 12 months? Please ensure no sensitive data is included within responses.

[confidential please] An incident occurred within another project close to one of the sites. During the resulting process staff learned and practiced the safeguarding reporting process as well as exploration of options for how to move forward. This learning experience included the need to discuss the feelings of staff and local communities, and taking a decision on which activities are temporarily paused or continued. Local activities were paused for 2.5 weeks until the regional government response was completed.

Does the project have any developments or activities planned around Safeguarding in the coming 12 months? If so please specify.

The following items are now available in draft form:

1. Separate forms for consent for adult and child photography and video (*Formulaire de consentement au tournage*)
2. Incident reporting and communication form (*Formulaire de reception des incidents et preoccupations en matière de protection*)

During the next 12 months these will be finalised, and utilization will begin.

15. Project expenditure

All figures presented here are the draft budget pending final review with Kew Finance where we expect the classification of some costs to change. Salary reform took place this year across both Kew Madagascar and MBG Madagascar (annex 41) with insufficient notice received by the project to make a timely change request. The change request we submitted to Darwin in November 2022 was not approved until April 2023 so we were unfortunately not able to initiate the next adjustment prior to financial year end. Sorghum importation and associated costs were not known to project staff until the University of Pretoria financial reconciliation and invoice received by Kew in March. Further detail in section 9 reply 5.

Table 1: Project expenditure <u>during the reporting period</u> (1 April 2022 – 31 March 2023)

Project spend (indicative) since last Annual Report	**2022/23 Grant (£)**	**2022/23 Total Darwin Costs (£)**	**Variance %**	**Comments (please explain significant variances)**
Staff costs (see below)				
Project Leader and expert on grasses	[redacted]			

KMCC coordination; M&E; steering group member	[redacted]
Co-Leader; coordination with ministries	
Coordination with ministries and for Itremo	
Grass and forb botanist	
Driver/mechanic	
Project manager, M&E	
Animator, M&E Itremo	
PA manager Itremo	
Technician for cattle, Itremo	
Technician for grasses, Itremo	
Fire patrols and fire break clearing, Itremo	
MBG coordination; M&E; steering group member - 5%	
PA manager Ankafobe - 25%	
PA manager Ibity - 25%	
Animator, M&E Ankafobe - 100%	
Animator, M&E Ibity - 100%	

	[redacted]
Technician for cattle, Ankafobe - 100%	
Technician for grasses, Ankafobe - 100%	
Technician for cattle, Ibity - 100%	
Technician for grasses, Ibity - 100%	
Fire patrols and fire break clearing, Ankafobe - 100%	
Fire patrols and fire break clearing, Ibity - 100%	
Expert on fire	
Consultancy costs	
Overhead Costs	
Travel and subsistence	
Operating Costs	
Capital items (see below)	
6x project cattle (£300 each)	
Smartphones and solar chargers (coordinator, animator, technician shared); 1 GPS; 1 radio	
Monitoring & Evaluation (M&E)	
Others (see below)	
Forage analysis	
Consumables, printing tshirts, booklets, posters	
Sorghum seeds, quarantine and importation	

				cost of the seed importation, shipping, and customs process from South Africa to Madagascar
Soil analysis at U Antananarivo	[redacted]			
Vehicle and motorbike maintenance				
Fire protection clothing, boots, secateurs, presses and field equipment				
Agricultural equipment for communities				
Banking and shipping charges				
Communications costs				
TOTAL	**155,252.00**	**158,182.72**		

Table 2: Project mobilising of matched funding during the reporting period (1 April 2022 – 31 March 2023)

	Matched funding secured to date	Total matched funding expected by end of project
Matched funding leveraged by the partners to deliver the project.	[redacted]	
Total additional finance mobilised by new activities building on evidence, best practices and project (£)		

16. OPTIONAL: Outstanding achievements or progress of your project so far (300-400 words maximum). This section may be used for publicity purposes

I agree for the Biodiversity Challenge Funds Secretariat to publish the content of this section (please leave this line in to indicate your agreement to use any material you provide here).

A new weed arrival to Madagascar was detected by Nanjarisoa during her trip to Ambarinakanga-Ibity to collect smallholder manure and ash for analysis in November 2022. The southern Eurasian annual beard grass *Polypogon monspeliensis* (https://www.facebook.com/KMCCMBG/photos/a.106791478587770/189698350297082/; weed profile at https://www.cabidigitallibrary.org/doi/10.1079/cabicompendium.68317) has started invading rice paddies and Nanjarisoa reports that Ambarinakanga's farmers are concerned about this recent invasive species as it has a strong negative effect on rice plantation productivity. Madagascar's governance has no plant import regulatory mechanisms and no mechanisms to record and manage plant invasions and the country is therefore particularly

vulnerable to new weeds. Our finding confirms the earlier 2020 tentative photo record by Angelo Andrianiaina further south near Ambositra, at https://www.inaturalist.org/observations/64225316. Once the taxonomic verification is complete we plan to publish a brief report in a peer reviewed journal.

Figure 7. The easily recognisable inflorescence of *Polypogon monspeliensis* in a rice paddy at Ambarinakanga-Ibity, November 2022. Photo by Nanjarisoa Olinirina Prisca.

File Type (Image / Video / Graphic)	File Name or File Location	Caption, country and credit	Online accounts to be tagged (leave blank if none)	Consent of subjects received (delete as necessary)
image	https://www.facebook.com/KMCCMBG/photos/a.106791478587770/1896983502970 82	The easily recognisable inflorescence of *Polypogon monspeliensis* in a rice paddy at Ambarinakanga-Ibity, November 2022. Photo by Nanjarisoa Olinirina Prisca	Facebook: Harena voajanahary sy kijana mamokatra, Bat Vorontsova, Olinirina Prisca Nanjarisoa. Twitter: @TeamKMCC, @KewScience, @vorontsovams, @NanjarisoaP	N/A

Annex 1: Report of progress and achievements against logframe for Financial Year 2022-2023

Project summary	SMART Indicators	Progress and Achievements April 2022 - March 2023	Actions required/planned for next period
Impact **Conservation of biodiversity and improved welfare of communities in the Central Highlands of Madagascar through optimal grazing of cattle and management of grasslands**		Livestock production improvements already reported in sections 3.2, 3.3, 5. Contribution made to saving one of the Ankafobe forest fragments from fire (section 3.3; box 1)	[redacted]
Outcome **Improved grazing system management capacity among 90 pastoral farming households in Ankafobe, Ibity and Itremo leading to healthier cattle, sustainable grassland exploitation, and reduced loss of grassland and forest biodiversity**	0.1 *Global Person Generated Index* data and Likert scale questionnaire surveys show a positive cause and effect relationship between the project interventions and **perceived wealth and well-being** among the 90 project household members in September 2024	Baseline sociology assessment completed in annex 34, described in section 3.3	Midline assessment to be carried out June – August 2023
	0.2 Five **key native forage grasses** (chosen from *Aristida rufescens, Aristida tenuissima, Brachiaria subrostrata, Cynodon dactylon, Cyrtococcum deltoideum, Digitaria longiflora, Eragrostis lateritica, Panicum luridum, Panicum umbellatum, Paspalum scrobiculatum*) and five native forbs increase in frequency in 30 project demonstration farm and communal pasture plots in Ankafobe, Ibity and Itremo by 20% from measured baseline in February 2022 to February 2024	See section 3.2 Output 1 indicator 1.2	See Output 1 indicator 1.2
	0.3 **Average cattle condition** in 90 – 400 cattle owned by 90 project households in Ankafobe, Ibity and Itremo improved from the estimated baseline condition score	Average cattle condition score baseline in 114 project cows is 2.77 units across Ankafobe, Ibity and Itremo between	Monthly data recording to be continued

	of 2 – 2.5 units to condition score of 3 – 3.5 units between December 2021 and September 2024	May 2022 – March 2023. Timeline in figure 6C; narrative in section 3.3	
	0.4 **Milk production** in 30 – 150 milk cows owned by 90 project households in Ankafobe, Ibity and Itremo improved from the estimated baseline of 3 – 4 litres per day per cow to 4.5 – 5 litres per day per cow between December 2021 and September 2024	Project baseline average is 1.9 litres/day for the beneficiary cows being milked across Ankafobe, Ibity and Itremo. The dataset is skewed by the Ibity average of 4.4l/day including the commercial dairy hybrids. Timeline in figure 6A; narrative in section 3.3	Monthly data recording to be continued
	0.5 **Plant and animal diversity within 3 patches of forest** within Ankafobe, Ibity and Itremo Protected Areas preserved at current levels through fires not increasing between January 2022 – January 2024	Successful in Ibity and Itremo but forest was lost to fire in Ankafobe; see annex 26, 29, section 3.3, and box 1.	Deeper study of what happened; continuation or fire management work; close collaboration with *Fitantanana Maharitra Holovainjafy*
	0.6 **Post project annual calving rate** reaches 70% in the cattle owned by the 90 project households in Ankafobe, Ibity and Itremo, improved from the estimated baseline annual calving rate of 40%, between September 2024 and September 2039	Baseline annual calving rate is 13% across the 114 beneficiary cows in Ankafobe, Ibity and Itremo. Best results are seen in Itremo with a 20% calving rate (figure 6; narrative in section 3.3)	Monthly data recording to be continued
Activity 0.1 National project launch and assessment workshops in Antananarivo		Completed in year 1 (year 1 report)	Assessment due in year 4
Activity 0.2 Regional project launch and assessment workshops in Itremo, Ibity, and Ankafobe area villages		Completed in year 1 (year 1 report)	Assessment due in year 4
Activity 0.3 Animator and technician site exchange visits		Completed as part of the baseline social survey (method in year 1 report, baseline report in Annex 34)	Due to be repeated during midline assessment June – August 2023
Activity 0.4 Ministry and foreign expert site visits		Foreign experts visited Itremo in June 2022 (Lehmann); all sites in September 2022 (Vorontsova and Truter, https://www.flickr.com/photos/36803481@N06/albums/72177720303078597/with/52443955952/); Itremo and Ibity in March 2022 (Vorontsova and Truter,	High level ministry visit planned for year 3 (section 12, table 2)

		https://www.flickr.com/photos/36803481@N06/albums/72177720307984023/)	
Activity 0.5 3 hectares of land secured at each site for temporary use during the project, contracts drawn up and signed		Completed in year 1 (year 1 report)	N/A
Activity 0.6 4 cattle purchased for each site, legal process completed		Completed in year 1 (year 1 report)	N/A
Activity 0.7 30 cattle owning households engaged at each site		Completed in year 1 (year 1 report), small minority chose to leave the project and have been replaced (section 3.4)	N/A
Activity 0.8 New local associations formed		Discussions began during project beneficiary meetings	To be completed in year 3
Activity 0.9 Demonstration farm property and project cattle handover to the new local associations		Discussions began during project beneficiary meetings	To be completed in year 4
Activity 0.10 Community-led project and well-being review organised by Sarobidy Rakotonarivo		Baseline sociology assessment completed in annex 34, described in section 3.3	Midline assessment to be carried out June – August 2023
Output 1. Improved preservation, understanding and more efficient exploitation of native and endemic forage grasses and forbs, in native grasslands near villages	*1.1* **Native grass and forb diversity increase** from an estimated baseline of 4 – 5 species to 6 – 7 species per 50 × 50m plot in 30 plots in project demonstration farms and communal pastures in Ankafobe, Ibity and Itremo between February 2022 to February 2024	Baseline diversity assessments completed and presented in section 3.2	
	1.2 Five native key forage grasses and five native forbs **increase in frequency** in 30 project demonstration farm and communal pasture grazing plots in Ankafobe, Ibity and Itremo by 20% from measured baseline in February 2022 to February 2024	Baseline frequency assessments completed and presented in annex 9 table 1	

	1.3 **Grazing value indices** measured for ten key native and endemic grazing grass species candidates (*Aristida rufescens, Aristida tenuissima, Brachiaria subrostrata, Cynodon dactylon, Cyrtococcum deltoideum, Digitaria longiflora, Eragrostis lateritica, Panicum luridum, Panicum umbellatum, Paspalum scrobiculatum*) using Truter standard methodology by October 2022	Forage sample exportation permit and phytosanitary certificate obtained; samples carried to South Africa by Wayne Truter on 27 April 2023	
	1.4 Key native grazing grass **book** (in English and Malagasy), **poster** (in Malagasy), and a community-led short film (in Malagasy) produced by April 2024 in draft form, and July 2024 in final form, guided by Vorontsova and Truter. Grazing grass booklet material submitted to Kew Publishing in July 2023.	Staff member and timetable for book production in place with satisfactory progress; work towards the book described in section 12 with annexes 35,36. Agreement reached with film maker.	
	1.5 **Grass training** in years 2 and 3 for 90 project household members judged useful by majority of project household participants	Completed by Nanjarisoa and Vorontsova at all sites during September 2022. Video of part of the formal teaching session by Wayne Truter and Livasoa Randriamanalina in Amborompotsy at https://youtu.be/3TIfKpSZx0o; in Ibity at https://youtu.be/D35L9w-ywCI. A seminar on Madagascar grass stories by Maria Vorontsova was also shared to staff and is available at https://youtu.be/vbRGdlSzdrc. Additional ongoing training by project staff is continuous. Agreed October 2022 change request removed the requirement for a formal assessment before and after training sessions.	
Activity 1.1 Trial grazing regimes in demonstration farms established, plots fenced off, plot firebreaks created		Completed in year 1 (year 1 report)	N/A
Activity 1.2 Trial grazing regimes in demonstration farms maintained using project cattle		Ongoing	Ongoing
Activity 1.3 Grazing strategy mentoring on common and private land for project households		Ongoing	Ongoing
Activity 1.4 Grass and forb diversity and frequency surveys in project demonstration farm and communal pasture plots, starting in first wet season		Baseline surveys completed across 30 project sites and analyses carried out	Complete year 2 data gathering

		(section 3.2, figures 2,3); year 2 surveys completed for 15/30 sites	
Activity 1.5 Biomass production measured in pasture plots		Completed (annex 9, 12; section 3.2, figure 4)	N/A
Activity 1.6 Pasture productivity calculated in pasture plots		Completed and presented in section 3.2 and annex 9 table 2	N/A
Activity 1.7 Soil samples collected and analysed in pasture plots, communal pasture, Sorghum plantation, and beneficiary household land		Completed; data presented in annex 10,10.5; analysis in annex 12 figure 2	N/A
Activity 1.8 Grassland management strategy tailored to soil analysis, biomass measurements, and pasture productivity measurements made		Completed through soil analysis and beneficiary focus groups; Itremo grass focus group report in annex 11; Ibity agriculture focus group report in annex 23	To be elaborated in year 3
Activity 1.9 Exportation permit for forage samples from Madagascar to South Africa		Completed and carried to South Africa	N/A
Activity 1.10 Grazing value indices measured for ten candidate native and endemic grasses using samples collected and exported to South Africa		Forage sample exportation permit and phytosanitary certificate obtained; samples carried to South Africa by Wayne Truter on 27 April 2023	Data expected during year 3
Activity 1.11 Exchange of experiences and training in community and focus groups, quarterly		Completed but at a lower frequency at once to twice a year due to staff time shortage; Itremo grass focus group report in annex 11; Ibity agriculture focus group report in annex 23	To be elaborated in year 3
Activity 1.12 Specialist grass training for project households, annual		Completed, see indicator 1.5	To be elaborated in year 3
Activity 1.13 Native grazing grass book produced, and distributed (book materials submitted to Kew publishing July 2023; booklet received July 2024)		Staff member and timetable for book production in place with satisfactory progress; work towards the book described in section 12 with annexes 35,36. Agreement reached with film maker.	Book draft to be ready December 2023, submission to Kew Publishing due by April 2024
Output 2. Fodder flow supplemented by crop residue preservation and exploitation of new forage crop	2.1 ***Sorghum* fodder crop plants** established on three 1-hectare demonstration farm plots between August 2023 and May 2024	Sorghum fodder crop plants established on 2 x 1-hectare plots (Ankafobe and Ibity) and 0.5 hectare plot (Itremo). Following beneficiary demand, *Brachiaria brizantha* was additionally established on the same acreage for hay (Appendix 12 table 1)	

	2.2 **Dry matter *Sorghum* harvest** production established on three 1-hectare demonstration farm plots to produce yield above an estimated natural grassland baseline of 4 tonnes of dry matter per hectare, achieving 6 tonnes of dry matter per hectare between April 2023 and April 2024	Year 1 dry matter sorghum harvest from the local variety was 22kg/ha in Ankafobe, 230 kg/ha in Ibity, and 730 kg/ha in Itremo; *Brachiaria brizantha* hay, native grass hay, and rice straw storage are in addition to this (Appendix 12 table1)	
	2.3 **Fodder bank** created by project households including hay and silage improved from an estimated baseline of 1 – 2 tonnes of dry matter per hectare to an estimated 4 tonnes of dry matter per hectare between April 2022 and April 2024	Project households have stored a total of 150 kg of hay during the wet season, and made 120 kg of sorghum silage. Half of the project households have successfully fed silage and hay to their zebu for the first time (Appendix 12). Accurate statistics on the area used for this purpose by the beneficiary households are not available hence these figures have not been converted to tonnes per hectare.	
	2.4 **Fodder training** in years 2 and 3 and **veterinary training** in year 2 for 90 project household members judged useful by majority of project household participants	Completed by Wayne Truter and Livasoa Randriamanalina at all sites during September 2022. Video of part of the formal teaching session by Wayne in Amborompotsy at https://youtu.be/3TIfKpSZx0o; in Ibity at https://youtu.be/D35L9w-ywCI, photo at Ankafobe https://www.flickr.com/photos/36803481@N06/52444473291 . Ad hoc advice was tailored to the situations found et each site, e.g. explanation of why livestock should be kept away from plastic was judged necessary at Ankafobe (video at https://youtu.be/8w0YlOdBBQk). Additional ongoing training by project staff is continuous. Agreed October 2022 change request removed the requirement for a formal assessment before and after training sessions.	
Activity 2.1 Baseline surveys of participant householder cattle		Completed in year 1 (year 1 report)	N/A
Activity 2.2 Training in South Africa for project manager and 3 animators		Completed for co-leader, project manager, and 3 animators in April 2022 (annex 13)	N/A
Activity 2.3 Quarantine service inspection of areas to be planted with imported Sorghum		Completed for demo farms for not for beneficiary project farms (section 8)	Considering paying for quarantine inspection of beneficiary project farms to release the imported seeds to beneficiary households in year 3
Activity 2.4 South African Sorghum seed import		Completed (section 8)	N/A
Activity 2.5 Sorghum trial plots		Completed for local sorghum and ongoing for the imported South African	South African SS1000 to be planted earlier in the year to see its full potential

	SS1000, see indicators 2.1, 2.2 and narrative section 3.2	
Activity 2.6 Sorghum cultivation, harvesting, and feed storage in demonstration farms, during wet season months year 2 onwards	Completed for local sorghum and ongoing for the imported South African SS1000, see indicator 2.2 and narrative section 3.2. Silage advice from Wayne, Amborompotsy video at https://youtu.be/WRgzqiPmgDI	Better results expected from South African SS1000 next year
Activity 2.7 Sorghum cultivation, harvesting, and feed storage by project households, during wet season months year 2 onwards	Completed for local sorghum, see narrative section 3.2; quarantine authorisation not obtained for planting South African SS1000 on beneficiary land	To be continued with local sorghum, will try to obtain additional financial resources to gain authorisation permission to plant South African SS1000 outside demo farms
Activity 2.8 Hay making in demonstration farms, during wet season months	Completed, described in section 3.2. 275kg of Brachiaria hay, 115 native grass hay, and 2400kg of rice straw stored (annex 12 table 1)	To be elaborated in year 3
Activity 2.9 Crop residue, hay making, and fodder bank mentoring with project households	Completed, described in section 3.2	To be elaborated in year 3
Activity 2.10 Training advisory visits from veterinary doctor	Completed, described in section 3.1	Implementation of the training will be continued through monthly technician visits to beneficiary households
Activity 2.11 Cattle farming and monitoring of milk production, body condition and calving in demonstration farms	Completed; monitoring method in Appendix 4; database screenshot in annex 20	Monthly data recording to be continued
Activity 2.12 Cattle farming and monitoring of milk production, body condition and calving with project households	Completed; monitoring method in Appendix 4; database screenshot in appendix 20; results presented in section 3.3. Examples of Ibity household mentoring in Box 2.	Monthly data recording to be continued
Activity 2.13 Exchange of experiences and training in community and focus groups, quarterly	Completed but at a lower frequency at once to twice a year due to staff time shortage; Ibity agriculture focus group report in annex 23	To be elaborated in year 3
Activity 2.14 Specialist fodder training for project households, annual	Completed, see indicator 2.4	To be elaborated in year 3

Output 3. Custom site-based fire management strategies conceived participatively and implemented to prevent late dry season forest fires	**3.1 Burned area** within 3 patches of forest within Ankafobe, Ibity and Itremo Protected Areas not increased from the baseline measured for January 2022 to January 2023 and 2024	Sadly one of the Ankafobe forest patches was lost to fire in October 2022 (box 1). Burned area did not increase in Ibity or Itremo forest patches (annex 26-28).	
	3.2 **Firebreaks** created and maintained for 3 patches of forest using manual clearing and hay making at a minimum of 5m wide with vegetation kept under 15cm tall, within project dry season months May – November during 2022 – 2024	Completed through physical clearing and maintenance which is ongoing; hay making proved impractical far away from villages.	
	3.3 **Fire Management Plans** co-created with communities driven by the PA managers, with a focus around establishing safe burn days and times, weather adaptation and no-fire zones. Plans added to the Protected Area management plans by June 2024 in draft form and by September 2024 in the final form, guided by Lehmann	The first Fire Management Plan (annex 30) completed for Ibity in May 2022 following community discussion, experimentation, and preventative burns. Fire history analysis completed for Itremo (section 3.2) and first preventative burns planned for 2023. *Fitantanana Maharitra Holovainjafy* project fire consortium workshop took place in March 2023 including Itremo and Ibity representation (annex 32). For Ankafobe see section 3.3 and Box 1.	
	3.4 **Fire training** in years 2 and 3 for 90 project household members judged useful by majority of project household participants	Two days of fire management training at Kruger National Park, South Africa, delivered to 3 animators, Livasoa Randriamanalina, and Mamy Tiana Rajaonah staff in April 2022 (annex 13); training delivered by Caroline Lehmann at Itremo in June 2022 (producing photopoint methodology in annex 25); 4-day USFS firefighting course attended by Mamy Tiana Rajaonah in March 2023 (annex 31). Agreed October 2022 change request removed the requirement for a formal assessment before and after training sessions.	
Activity 3.1 Identification of forest patches		Ankafobe project work expanded to include both forest patches; Ibity defined as in year 1; Ambazimbamena forest patch identified in Itremo (section 3.1, 3.3, box 1, appendix 26-28)	N/A

Activity 3.2 Firebreak creation and maintenance using physical clearing and hay making	Physical clearing and maintenance ongoing	Continue physical clearing and maintenance
Activity 3.3 Preventative burn training for the communities and Protected Area staff at the project sites	Completed, see indicator 3.4	To be elaborated in year 3
Activity 3.4 Fire prevention using preventative burns in early dry season	Completed in Ibity (annex 27,30). Planned in Itremo and Ankafobe (indicator 3.3)	To be elaborated in year 3
Activity 3.5 Forest edge data recorded by monthly patrols at set photo points	Completed, annex 26-28, section 7	To be continued in years 3-4
Activity 3.6 Exchange of experiences and training in community and focus groups, quarterly	Completed, see indicator 3.4	To be elaborated in year 3, especially in Ankafobe following the fire
Activity 3.7 Specialist fire training for project households, annual	Completed, see indicator 3.4	To be elaborated in year 3, especially in Ankafobe following the fire
Activity 3.8 Co-writing and consultation to finalise Fire Management Plans to add to Protected Area Management Plans	Completed, see indicator 3.3	First drafts to be attempted for Itremo and Ankafobe

Annex 2: Project's full current logframe as presented in the application form (unless changes have been agreed)

Project summary	SMART Indicators	Means of verification	Important Assumptions
Impact: **Conservation of biodiversity and improved welfare of communities in the Central Highlands of Madagascar through optimal grazing of cattle and management of grasslands**			
Outcome: Improved grazing system management capacity among 90 pastoral farming households in Ankafobe, Ibity and Itremo leading to healthier cattle, sustainable grassland exploitation, and reduced loss of grassland and forest biodiversity	0.7 *Global Person Generated Index* data and Likert scale questionnaire surveys show a positive cause and effect relationship between the project interventions and **perceived wealth and well-being** among the 90 project household members in September 2024 0.8 Five **key native forage grasses** (chosen from *Aristida rufescens, Aristida tenuissima, Brachiaria subrostrata, Cynodon dactylon, Cyrtococcum deltoideum, Digitaria longiflora, Eragrostis lateritica, Panicum luridum, Panicum umbellatum, Paspalum scrobiculatum*) and five native forbs increase in frequency in 30 project demonstration farm and communal pasture plots in Ankafobe, Ibity and Itremo by 20% from measured baseline in February 2022 to February 2024 0.9 **Average cattle condition** in 90 – 400 cattle owned by 90 project households in Ankafobe, Ibity and Itremo improved from the estimated baseline condition score of 2 – 2.5 units to condition score of 3 – 3.5 units between December 2021 and September 2024	0.1 Copies of gender disaggregated social survey results 0.2 Grass and forb species frequency records in 50 × 50m standard grassland plot spreadsheets made by the grass and forb botanist using the grassland monitoring method already established for ecological research 0.3 Cattle body condition photographs for each animal taken quarterly by community technicians for cattle using smartphones, animal rear and side 0.4 Measurements of milk production in 30 – 150 project milk cows made by community project technicians for cattle weekly and recorded in project spreadsheets 0.5 Photographs of forest edges made by monthly Protected Area fire patrols May - December, photographs at set photo points spaced 50 – 200 m apart in each Protected Area Calving date records for 60 – 300 project cows	Political situation stable with no significant civil unrest in Antananarivo or nearby (risk mitigated by our close links with the British Embassy in Antananarivo and multiple long-term trusted local contacts at the sites so we are kept aware of any changes and receive timely advice) Cattle remain central to rice production and income from meat and milk, no successful simultaneous technological improvements introduced (risk mitigated by advice obtained from the Agriculture Ministry and their involvement throughout the project) Cattle rustling is low and does not affect more than 10% of participating households (risk mitigated by animators living at or near the demonstration farms, and employing community members as technicians and fire patrol members, to monitor the security situation and discourage theft) Improved cattle productivity may lead to overgrazing (risk mitigated by close monitoring of the rangeland plots throughout project) Coronavirus situation permits travel at least within central Madagascar for the project duration (risk mitigated by project founded in local communities with less reliance on central and foreign

	0.10 **Milk production** in 30 – 150 milk cows owned by 90 project households in Ankafobe, Ibity and Itremo improved from the estimated baseline of 3 – 4 litres per day per cow to 4.5 – 5 litres per day per cow between December 2021 and September 2024 0.11 **Plant and animal diversity within 3 patches of forest** within Ankafobe, Ibity and Itremo Protected Areas preserved at current levels through fires not increasing between January 2022 – January 2024 0.12 **Post project annual calving rate** reaches 70% in the cattle owned by the 90 project households in Ankafobe, Ibity and Itremo, improved from the estimated baseline annual calving rate of 40%, between September 2024 and September 2039		staff; budget for faster internet subscriptions to improve online communications as an alternative to travel)
Output 1 Improved preservation, understanding and more efficient exploitation of native and endemic forage grasses and forbs, in native grasslands near villages	**1.1 Native grass and forb diversity increase** from an estimated baseline of 4 – 5 species to 6 – 7 species per 50 × 50m plot in 30 plots in project demonstration farms and communal pastures in Ankafobe, Ibity and Itremo between February 2022 to February 2024 **1.2** Five native key forage grasses and five native forbs **increase in frequency** in 30 project demonstration farm and communal pasture grazing plots in Ankafobe, Ibity and Itremo by 20% from	1.1 Grass and forb species diversity records in standard grassland plot spreadsheets made by the grass and forb botanist using the grassland monitoring method already established for ecological research 1.2 Grass and forb species frequency records in 50 × 50m standard grassland plot spreadsheets made by the grass and forb botanist using the grassland monitoring method already established for ecological research	Continued community trust and engagement; most management associations choose to participate in the project (risk mitigated by 17 years of trusting relationships already built in Ankafobe, Ibity and Itremo, enthusiasm expressed at the scoping workshop, and investment to ensure full community engagement in project) Rainfall patterns remain within local average ranges (risk mitigated through monitoring and adjustment of plot design)

	measured baseline in February 2022 to February 2024 **1.3 Grazing value indices** measured for ten key native and endemic grazing grass species candidates (*Aristida rufescens, Aristida tenuissima, Brachiaria subrostrata, Cynodon dactylon, Cyrtococcum deltoideum, Digitaria longiflora, Eragrostis lateritica, Panicum luridum, Panicum umbellatum, Paspalum scrobiculatum*) using Truter standard methodology by October 2022 **1.4** Key native grazing grass **book** (in English and Malagasy), **poster** (in Malagasy), and a community-led short film (in Malagasy) produced by April 2024 in draft form, and July 2024 in final form, guided by Vorontsova and Truter. Grazing grass booklet material submitted to Kew Publishing in July 2023. **1.5 Grass training** in years 2 and 3 for 90 project household members judged useful by majority of project household participants	1.3 Grazing value index reports produced by Truter's *African Forage, Fodder, Feed and Food Quality* (AF[4]RICA) *Laboratory* at the University of Pretoria 1.4 Copies of key native grazing grass book and poster, draft and final version pdfs and the community-led short film made available via the project webpage 1.5 Gender disaggregated training attendance sheets and records of verbal feedback	Invasions of alien grasses and forbs do not significantly increase (risk mitigated through monitoring and adjustment of plot design by the grass and forb botanist , and cultivating *Sorghum* cultivars which have proven non-invasive) Coronavirus situation permits travel at least within central Madagascar for the project duration (risk mitigated by budget for faster internet subscriptions to improve video and other online communications as an alternative to travel)
Output 2 Fodder flow supplemented by crop residue preservation and exploitation of new forage crop	2.1 ***Sorghum* fodder crop plants** established on three 1-hectare demonstration farm plots between August 2023 and May 2024 **2.2 Dry matter *Sorghum* harvest** production established on three 1-hectare demonstration farm plots to produce yield above an estimated natural grassland baseline of 4 tonnes of dry	2.1 Photographs of the plantings 2.2 Forage production yield weight measurements made by community technicians for grasses quarterly 2.3 Hay and crop residue yield dry weight measurements made by community technicians quarterly	Continued community trust and engagement; most management associations choose to participate in the project (risk mitigated by 17 years of trusting relationships already built in Ankafobe, Ibity and Itremo, enthusiasm expressed at the scoping workshop, and investment to ensure full community engagement in project)

	matter per hectare, achieving 6 tonnes of dry matter per hectare between April 2023 and April 2024 **2.3 Fodder bank** created by project households including hay and silage improved from an estimated baseline of 1 – 2 tonnes of dry matter per hectare to an estimated 4 tonnes of dry matter per hectare between April 2022 and April 2024 **2.4 Fodder training** in years 2 and 3 and **veterinary training** in year 2 for 90 project household members judged useful by majority of project household participants	2.4 Gender disaggregated training attendance sheets and records of verbal feedback	Land used for the production of *Sorghum* does not compete with food crops (risk mitigated by community decision making on land use and specific questions on land use consequences in project perception questionnaires) Healthy project cattle are available for purchase (risk mitigated by reassuring results of informal enquiries already made by Sedera Ramaromanana) Cattle illness does not increase above current local average (risk mitigated by specialist advice availability from the *National Diagnostic Veterinary Laboratory* accessed through the Agriculture Ministry) Rainfall patterns remain within local average ranges (risk mitigated through climate-responsive approach to all interventions) Coronavirus situation permits travel at least within central Madagascar for the project duration (risk mitigated by budget for faster internet subscriptions to improve video and other online communications as an alternative to travel)
Output 3 Custom site-based fire management strategies conceived participatively and implemented to prevent late dry season forest fires	3.1 **Burned area** within 3 patches of forest within Ankafobe, Ibity and Itremo Protected Areas not increased from the baseline measured for January 2022 to January 2023 and 2024 3.2 **Firebreaks** created and maintained for 3 patches of forest using manual clearing and hay making at a	3.1 Regional assessment of fire regimes in the Ankafobe, Ibity and Itremo areas completed in March 2022, by Lehmann's team 3.2 Photographs of forest edges made by monthly Protected Area fire patrols using the SMART-Mobile app, including monthly photographs	Continued community trust and engagement; most management associations choose to participate in the project (risk mitigated by 17 years of trusting relationships already built in Ankafobe, Ibity and Itremo, enthusiasm expressed at the scoping workshop, and investment to ensure full community engagement in project)

	minimum of 5m wide with vegetation kept under 15cm tall, within project dry season months May – November during 2022 – 2024 3.3 **Fire Management Plans** co-created with communities driven by the PA managers, with a focus around establishing safe burn days and times, weather adaptation and no-fire zones. Plans added to the Protected Area management plans by June 2024 in draft form and by September 2024 in the final form, guided by Lehmann 3.4 **Fire training** in years 2 and 3 for 90 project household members judged useful by majority of project household participants	at 10 set photo points in each Protected Area 3.3 Copies of Fire Management Plans, draft and final version pdfs made available via the project webpage 3.4 Gender disaggregated training attendance sheets and records of verbal feedback In July 2024 this will include testing perceptions of the draft Fire Management Plan.	No sudden change in fire regime e.g. following drought (risk mitigated through monitoring and adjustment of firebreak design and preventative burns) No fires deliberately started in the forest (risk mitigated by decreasing community need for fires through improved dry season livestock nutrition supply by outputs 1 and 2, and increased community control over fires) Rainfall patterns remain within local average ranges (risk mitigated through wider firebreaks and higher frequency of patrols in dry years) Coronavirus situation permits travel at least within central Madagascar for the project duration (risk mitigated by budget for faster internet subscriptions to improve video and other online communications as an alternative to travel)

Activities (each activity is numbered according to the output that it will contribute towards, for example 1.1, 1.2 and 1.3 are contributing to Output 1)

Output 0: Project activities contributing to all outputs

0.1 National project launch and assessment workshops in Antananarivo

0.2 Regional project launch and assessment workshops in Itremo, Ibity, and Ankafobe area villages

0.3 Animator and technician site exchange visits

0.4 Ministry and foreign expert site visits

0.5 3 hectares of land secured at each site for temporary use during the project, contracts drawn up and signed

0.6 4 cattle purchased for each site, legal process completed

0.7 30 cattle owning households engaged at each site

0.8 New local associations formed

0.9 Demonstration farm property and project cattle handover to the new local associations

0.10 Community-led project and well-being review organised by Sarobidy Rakotonarivo

Output 1: Improved preservation, understanding and more efficient exploitation of native and endemic forage grasses and forbs, in native grasslands near villages

1.1 Trial grazing regimes in demonstration farms established, plots fenced off, plot firebreaks created

1.2 Trial grazing regimes in demonstration farms maintained using project cattle

1.3 Grazing strategy mentoring on common and private land for project households

1.4 Grass and forb diversity and frequency surveys in project demonstration farm and communal pasture plots, starting in first wet season

1.5 Biomass production measured in pasture plots

1.6 Pasture productivity calculated in pasture plots

1.7 Soil samples collected and analysed in pasture plots, communal pasture, Sorghum plantation, and beneficiary household land

1.8 Grassland management strategy tailored to soil analysis, biomass measurements, and pasture productivity measurements made

1.9 Exportation permit for forage samples from Madagascar to South Africa

1.10 Grazing value indices measured for ten candidate native and endemic grasses using samples collected and exported to South Africa

1.11 Exchange of experiences and training in community and focus groups, quarterly

1.12 Specialist grass training for project households, annual

1.13 Native grazing grass book produced, and distributed (book materials submitted to Kew publishing July 2023; booklet received July 2024).

Output 2: Fodder flow supplemented by crop residue preservation and exploitation of new forage crop

2.1 Baseline surveys of participant householder cattle

2.2 Training in South Africa for project manager and 3 animators

2.3 Quarantine service inspection of areas to be planted with imported Sorghum

2.4 South African Sorghum seed import

2.5 Sorghum trial plots

2.6 Sorghum cultivation, harvesting, and feed storage in demonstration farms, during wet season months year 2 onwards

2.7 Sorghum cultivation, harvesting, and feed storage by project households, during wet season months year 2 onwards

2.8 Hay making in demonstration farms, during wet season months

2.9 Crop residue, hay making, and fodder bank mentoring with project households

2.10 Training advisory visits from veterinary doctor

2.11 Cattle farming and monitoring of milk production, body condition and calving in demonstration farms

2.12 Cattle farming and monitoring of milk production, body condition and calving with project households

2.13 Exchange of experiences and training in community and focus groups, quarterly

2.14 Specialist fodder training for project households, annual

Output 3: Custom site-based fire management strategies prevent late dry season forest fires

3.1	Identification of forest patches
3.2	Firebreak creation and maintenance using physical clearing and hay making
3.3	Preventative burn training for the communities and Protected Atea staff at the project sites
3.4	Fire prevention using preventative burns in early dry season
3.5	Forest edge data recorded by monthly patrols at set photo points
3.6	Exchange of experiences and training in community and focus groups, quarterly
3.7	Specialist fire training for project households, annual
3.8	Co-writing and consultation to finalise Fire Management Plans to add to Protected Area Management Plans

Annex 3: Standard Indicators

Table 1 Project Standard Indicators

DI Indicator number	Name of indicator using original wording	Name of Indicator after adjusting wording to align with DI Standard Indicators	Units	Disaggregation	Year 1 Total	Year 2 Total	Year 3 Total	Total to date	Total planned during the project
DI-A01	[existing project]	Number of project beneficiaries and project staff who received training on sociology, grasses, agriculture, and fire	People	90 beneficiary men, 90 beneficiary women, 11 male staff, 5 female staff	196	196		196	196
DI-A03	[existing project]	Number of Malagasy state bodies and NGOs (as defined in Table 1, plus KMCC and MBG Madagascar) with improved capability and capacity as a result of project	Number	none	2	9		9	10
DI-B01	[existing project]	Protected Area Fire Management Plans written	Number	Fire Management Plans	0	1		1	3
DI-B05	[existing project]	Number of project beneficiaries becoming members of the new pasture and livestock raising associations	People	90 beneficiary men, 90 beneficiary women	0	0		0	180
DI-C09	[existing project]	Grass and forb (species known to science) herbarium and silica gel reference collections made	Number of collections	Grass/forb	150	600		750	1500
DI-C12	[existing project]	Number of followers on the project Facebook page	People	53% male and 47% female	481	680		680	1000
DI-C18	[existing project]	Number of papers published in peer reviewed journals and conference proceedings	Number	none	0	7		7	10
DI-D02	[existing project]	Number of project beneficiaries whose disaster/climate resilience has been improved		90 beneficiary men, 90 beneficiary women		180		180	180

Table 2 Publications

Title	Type (e.g. journals, manual, CDs)	Detail (authors, year)	Gender of Lead Author	Nationality of Lead Author	Publishers (name, city)	Available from (e.g. weblink or publisher if not available online)
*Grass diversity and pasture quality baseline assessment in central Madagascar	Extended abstract to be printed in conference proceedings at https://uknowledge.uky.edu/igc/	Nanjarisoa, OP; Randriamanalina, L; Truter, W; Rajaonah, MT; Lehmann, CER; Birkinshaw, C; Rakotonirina, L; Miarinjanahary, D; Raharinirina, NL; Vorontsova, MS. Grass diversity and pasture quality baseline assessment in central Madagascar. Extended abstract for the XXV International Grassland Congress. In press.	F	Malagasy	University of Kentucky, Lexington	In press, appendix x
*Smallholder zebu and forage production development in central Madagascar	Extended abstract to be printed in conference proceedings at https://uknowledge.uky.edu/igc/	Randriamanalina, L.; Vorontsova, MS; Rajaonah, MT; Nanjarisoa, OP; Lehmann, CER; Miharinjanahary, D; Ratovoarinjaka, BR; Rakotoarison, HNS; Bendrainy, A; Rijaniaina, C; Rabendrina, AM; Rabeharison, D; Rakotozafy, BF; Rakotoarison, F; Tahirinirainy, D; Randriamboavonjy, T; Ralimanana, H; Raharimampionona, J; Birkinshaw, C; Truter, W. Smallholder zebu and forage production development in central Madagascar. Extended abstract for the XXV International Grassland Congress. In press.	M	Malagasy	University of Kentucky, Lexington	In press, appendix x
Madagascar's fire regimes challenge global assumptions about landscape degradation	Journal article	Phelps, L.N., Andela, N., Gravey, M., Davis, D.S., Kull, C.A., Douglass, K. and Lehmann, C.E., 2022. Madagascar's fire regimes challenge global assumptions about landscape degradation. Global Change Biology, 28(23), pp.6944-6960.	F	British	John Wiley & Sons Ltd, Hoboken, New Jersey	https://onlinelibrary.wiley.com/doi/full/10.1111/gcb.16206

Title	Type (e.g. journals, manual, CDs)	Detail (authors, year)	Gender of Lead Author	Nationality of Lead Author	Publishers (name, city)	Available from (e.g. weblink or publisher if not available online)
The grassy ecosystems of Madagascar.	Journal article	Lehmann CER, Solofondranohatra C, Morton JA, Phelps LN, Ralimanana H, Razanatsoa J, Rakotoarimanana V, Vorontsova MS. 2022. The grassy ecosystems of Madagascar. In: The new natural history of Madagascar 1: 152-168, ed. S. M. Goodman. Princeton: Princeton University Press.	F	British	Princeton University Press, Princeton, New Jersey, USA	https://www.researchgate.net/profile/Maria-Vorontsova/publication/366339219_The_grassy_ecosystems_of_Madagascar/links/639c72d1095a6a7774359c54/The-grassy-ecosystems-of-Madagascar.pdf
Poaceae, grasses (including bamboos)	Journal article	Vorontsova, M. S., S. Dransfield, J. A. Morton, R. A. Rakotonasolo, C. L. Solofondranohatra, N. H. Rakotomalala, H. Razanajatovo, D. Rabehevitra, S. Rakotoarisoa, J. Razanatsoa, and J. Hackel. 2022. Poaceae, grasses (including bamboos). In: The new natural history of Madagascar 1: 585-598, ed. S. M. Goodman. Princeton: Princeton University Press.	F	British	Princeton University Press, Princeton, New Jersey, USA	https://www.researchgate.net/profile/Maria-Vorontsova/publication/366336482_Poaceae_grasses_including_bamboos/links/639c6f13095a6a77743598f2/Poaceae-grasses-including-bamboos.pdf
Madagascar's extraordinary biodiversity: Evolution, distribution, and use	Journal article	Antonelli, A., Smith, R.J., Perrigo, A.L., Crottini, A., Hackel, J., Testo, W,... Vorontsova, M.S. … Ralimanana, H. 2022. Madagascar's extraordinary biodiversity: Evolution, distribution, and use. Science, 378(6623), p.eabf0869. https://doi.org/10.1126/science.abf0869	M	Brazil	AAAS, Washington DC, USA	https://doi.org/10.1126/science.abf0869
Madagascar's extraordinary biodiversity: Threats and opportunities.	Journal article	Ralimanana, H., Perrigo, A.L., Smith, R.J., Borrell, J.S., Faurby, S., Rajaonah, M.T., Randriamboavonjy, T., Vorontsova, M.S.,... Antonelli, A. 2022. Madagascar's extraordinary biodiversity: Threats and opportunities. Science, 378(6623), p.eadf1466. https://doi.org/10.1126/science.adf1466	F	Malagasy	AAAS, Washington DC, USA	https://doi.org/10.1126/science.adf1466

Checklist for submission

	Check
Different reporting templates have different questions, and it is important you use the correct one. Have you checked you have used the **correct template** (checking fund, type of report (i.e. Annual or Final), and year) and **deleted the blue guidance text** before submission?	yes
Is the report less than 10MB? If so, please email to BCF-Reports@niras.com putting the project number in the Subject line.	yes
Is your report more than 10MB? If so, please discuss with BCF-Reports@niras.com about the best way to deliver the report, putting the project number in the Subject line.	no
Have you included means of verification? You should not submit every project document, but the main outputs and a selection of the others would strengthen the report.	yes
Do you have hard copies of material you need to submit with the report? If so, please make this clear in the covering email and ensure all material is marked with the project number. However, we would expect that most material will now be electronic.	no
If you are submitting photos for publicity purposes, do these meet the outlined requirements (see section 16)?	yes
Have you involved your partners in preparation of the report and named the main contributors	yes
Have you completed the Project Expenditure table fully?	yes
Do not include claim forms or other communications with this report.	