2023

Gula Gula Food Forest Program Indonesia Annual Report for 2022

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29-9-2023

Annual Report for Plan Vivo projects

Table of Contents

List of Tables and Figures

Ecosystem restoration in the Singkarak river basin, West Sumatra

Annual report year Jan 2022 - Dec 2022

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Date of submission: 9-6-2023

Summary

Project overview	
Reporting period	1st January 2022 – 31st December 2022
Geographical areas	Singkarak river basin, Solok District, West Sumatra
	1. Kecamatan Junjung Sirih: Nagari Paninggahan
	2. Kecamatan Lembah Gumanti, Nagari Air Dingin/Koto Baru
	3. Kecamatan Kubung, Nagari Selayo
	4. Kecamatan Payung Sekaki, Nagari Sirukam
	5. Kecamatan X Koto Di Atas, Nagari Paninjawan,
Technical specifications in use	Ecosystem restoration in the Singkarak river basin, West Sumatra

Project indicators	Historical (2017-jan 2022)	Added/ Issued Jan 2022 - Dec 2022	Total
No. smallholder households with PES agreements	295	72	367
No. farmer groups with PES agreements	5	2	7
Approximate number of households (or individuals) in these farmer groups	295	72	367
Area under management (ha) where PES agreements are in place	202.8	68,9	271.7
Allocation to Plan Vivo buffer (tCO_2) (See Table 9)	9,521	2,913	12,434
Saleable emissions reductions achieved (tCO_2) (See Table 9)	49,985	15,295	65,280
Unsold Stock at time of Submission (PVC) (= holdings)	all unsold, because none were issued	16,196 sold (= retired) 43,309 unsold	16,196 sold (= retired) 43,309 unsold
Unsold stock but reserved under a 5-year "Tiger Contract" (Tiger package, see Figure 9)			11,755
Plan Vivo Certificates (PVCs) issued to date			49,985
Plan Vivo Certificates requested for issuance (2022 Vintage, 2022-2023)			15,295
Total PVCs issued (including this report)			65,280
Total PVCs under reservation as part of a 5-year "Tiger contract"			11,755

Part A. Project updates

A1   Key events

We submit the second annual report to Plan Vivo Foundation.

The year 2022 has been a very positive one of organic growth. As the sale of carbon credits increased significantly, as well as the price per credit, everyone feels very proud achieving the formal recognition of our climate benefit activities, as well as the way we work with local communities. It has inspired a growing number of local farming households to request for joining our restoration activities.

A growing demand for our carbon credits allowed us to strengthen and scale our activities. We extended our activities into more areas within and outside Solok District. Within existing villages, more participants were added, as more and more farmers see the benefits and express interest in joining the restoration work. Within Solok District, Nagari Paninjawan is a new village where we started working. New activities have started in a new district, called Pesisir Selatan. Here, we will start with a 50 ha degraded site to be restored. As in other areas, we hope that this will trigger interest and willingness to participate, so that we will broaden the work here in the coming years, by adding more restoration sites.

We are also looking forward to begin our work in a completely new province, namely Lampung province in South Sumatra. Here, we collaborate with the Ministry of Backward Regions and Transmigration, with whom our local partner signed a MoU in 2022. It is a former transmigration area, a severely degraded landscape where transmigrants have left. The land is handed over to the local Lampungese, who are classified as one the poorest people in Indonesia. A carbon project could help them to restore the land and improve their livelihoods. An area of 100-150 ha will be targeted for restoration. First phase of the FPIC process has been done (mapping, village selection, potential participants and their preferences for tree species have been discussed). The First half of 2023, the entire FPIC process will be finalised, so that by late 2023 the first trees can be planted.

By the end of 2022, another 50 ha (and 50-60 new participants) in a new Nagari and different province has been identified for starting up new activities. We have started new activities in district *Pesisir Selatan*, West Sumatra. This is an insetting project where, among other trees, melinjo and nutmeg trees will be planted to serve the demand of the client, an Indonesian food company in the Netherlands. PES agreements will be signed early/mid 2023, so planting will be done by the end of 2023.

The year 2022 also showed the start and full operation of our processing units. The composting unit produces around 8 tons per month, the first 100 kg of coffee was processed by the end of 2022, and will be shipped to the Netherlands early 2023. The large distilling unit for essential oil production is in operation, and should gain more momentum in 2023.

Project certification and New PES agreements

After the initial project validation, we have successfully added new participants and restoration areas.

In 2022, 86 new participants have joined the Gula Gula Food Forest Program in West Sumatra, adding 85.4 ha to our restoration areas. This figure includes Dilam, but no PES agreements had been signed by late 2022, as the FPIC process only started late 2022. Therefore, Dilam will be added in the Annual Report of 2023.

This means that in 2022, **72** PES agreements have been signed.

A change in the contractual PES agreement on paying individual farmers was proposed by new farmer groups. They wanted to have the money as a group. In this way, the total amount is invested for the benefit of the entire group, such as buying tools, including bush cutters and drilling machines to make holes for the trees. RPL will continue to monitor that the money is indeed used for the benefit of the entire group. These are decisions made by individual farmer groups but and form another interesting learning moment for us. We will propose such options during the FPIC process for future PES agreements. New participants can decide by themselves how they like to have their carbon payments used. This will then be included in the contracts.

Table 1 New participants/areas in 2022, and signed PES agreements

Site name	Agroforestry system	No. Participants	Total area (Ha)	No. trees/ha	Total No. Trees	PES Agreement signed	Eligible for certification
Paninjawan (FMO 5a, 2022)	Robusta-based	37	34.6	1500	51,900	Yes	Yes
Paninjawan (FMO5b, 2022)	Robusta-based	6	4.5	1500	6,750	Yes	Yes
Sirukam II (FMO 6, 2022)	Arabica-based	29	29.8	2000	59,600	Yes	Yes
Dilam (FMO 7, 2022)	Arabica-based	14	24.3	1500	24.750	**No**	**Not yet**

Tree product development phase to access global markets

Finally, another exciting development is the fact, that the first 100 kg of green beans from our "restoration coffee" sites was produced by the end of 2022. Both Robusta (50 kg) and Arabica (50 kg) will arrive mid-April in the Netherlands, where CO_2 Operate will develop a great tasting coffee with a local roaster.
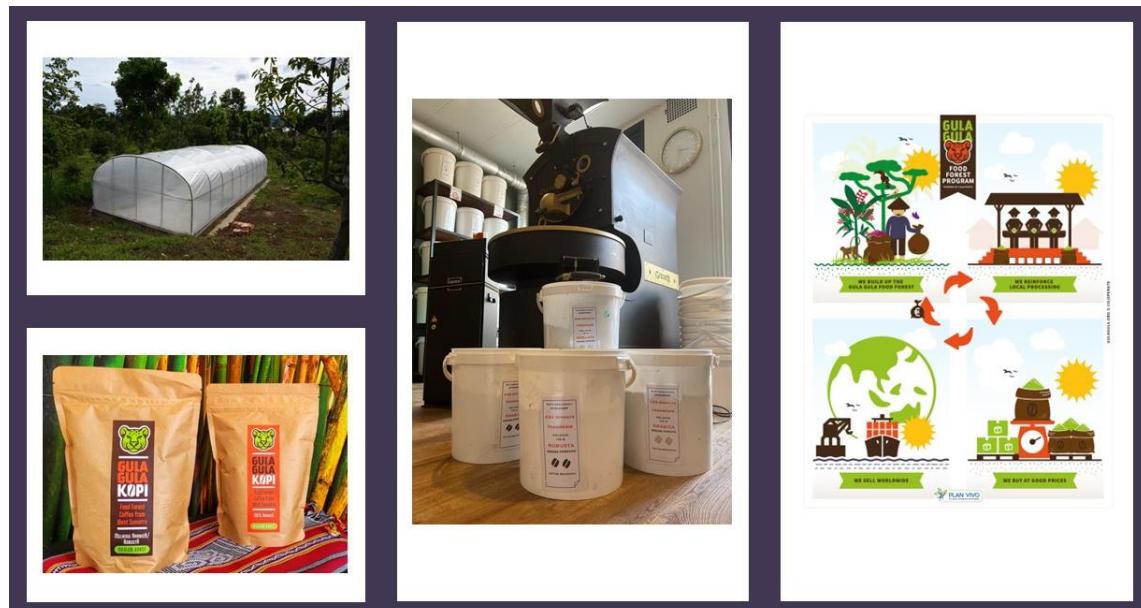
Figure 1 Closing the loop: from planted trees to coffee cup

A2   Successes and challenges

Although 2022 was quite a successful year in carbon sales and adding new areas to our activities, there have also been some major challenges. Successes are described in previous section with the additional participants and restoration sites, while our processing units are all up and running well. Challenges mainly relate to a changing climate and the aftermath of the COVID period.

1 Impact of the COVID period

COVID has obviously put challenges to our work, and 2022 showed the aftermath of the COVID years on the restoration sites.

Evaluating the effects of COVID on survival rates.

In the fourth quarter of 2022, the field staff of RPL has done a tree count focussing on survival rates. It turned out that the survival rates have been significantly lower compared to "normal years". We therefore evaluated if COVID could be an important factor, especially since survival rates are again back to "normal" after COVID. A number of reasons have come to the fore, which are indeed directly caused by the COVID period.

- Low quality seedlings from Forestry Department because of:
  - Travel restrictions in general but for staff in particular limited ability to get good quality seeds.
  - Staff returned home, because of travel restrictions. Hence, labour shortages also reduced management of the nursery and seedlings.

- Socio-economic issues at farmer level
  - In the matrilineal Minangkabau culture, men join the wife's house and family after marriage. Turned out, that a substantial number of male participants were managing the land of their own parents. However, being married to someone from another village made them to return home to the wife's family during Corona, causing the trees to be left unmanaged. Growing weeds started to compete with the trees.
  - Returning family members from off farm employment (jobless or returned home because of Corona travel stress) reduced household income and put a burden on the family food security with more mouths to feed.
  - In some FMO villages, rice cultivation has already been abandoned years ago. Large scale deforestation has significantly reduced water availability for irrigation. Even the staple food crop rice must be bought nowadays.
  - Our Corona protocols for the team limited their travel, while they were also regularly not allowed to go into the villages (men would stop them at the entrance of the village). This caused few management options for the program.

2 Climate change is real in the area

In addition to low management during the COVID years, Figure 2 below shows a highly erratic rainfall pattern from data in 4 of our villages, where a meteorological station exists. Erratic and less rain. The thick black line is a multi-year average over the past 10 years of "normal rainy seasons". It can be seen that most of the rainfall is below this average and highly erratic. Where it goes above the multi-year average, they are clearly short periods of very intensive rains. The effectiveness of these short, intensive rains is very low for crop and tree growth, as most rains will run-off, because soils are still dry and

compacted, not being able to absorb sufficient quantities of water in such a short period of time. This has serious effects on survival rates. The rainfall data clearly support the stories of our participants.

Usually, when rains increase for more than a week from October onwards, it usually marks the start of the rainy season. So, we planted the trees after one week of good rains. However, the rains decreased and even stopped soon after planting, sometimes for several weeks. These periods of no rain cause strong dry winds to develop, which do a lot of harm to young seedlings. It has been like that for several years now. We do not really know anymore what is the best and safest time to plant the seedlings, as the weather has become very unpredictable.

More than ever, our team continues to monitor the weather forecasts for the medium and longer term. In addition, the ANR techniques become even more important. Soil coverage using pressed or slashed vegetation will minimise evapotranspiration. Finally, we will start to provide compost for free to the participants from our composting unit. Not only will it provide a good natural fertiliser, but compost also has good properties in water retention and absorption of water. This might be important in times when short but heavy rains may not lead to decent levels of penetration into the soils. At least we hope to improve the soil conditions around the tree crops.

A small adjustment made by some farmer groups is that they used some of the carbon payments to buy a drilling machine to make holes for the trees to be planted. Such drills speed up the planting process considerably, hence hopefully the planted trees could still benefit more from potential good but short rains, especially when combined with compost (see Figure 13).
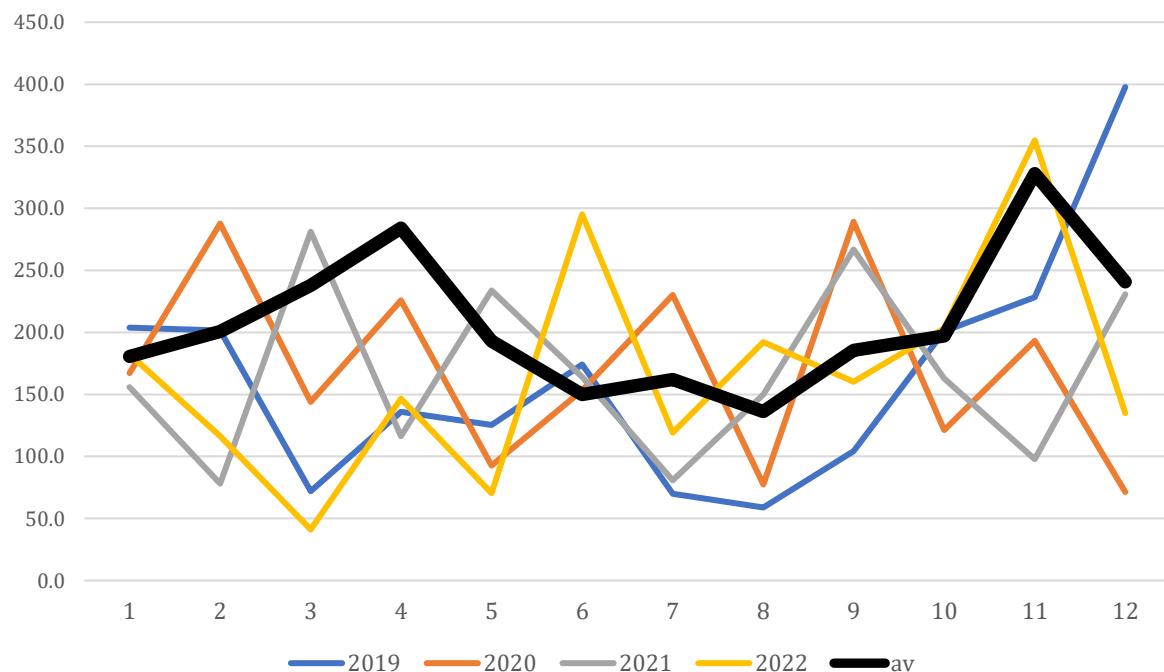
Figure 2 Rainfall pattern in the project area (2019-2022)

Source: village based meteorological stations in Nagari Paninggahan, Sirukam, Selayo, Air Dingin

Both the COVID years with low management and monitoring options combined with the erratic rainfall pattern, has seriously affected the survival rates of the trees. Where we usually have survival rates of 85% and above from the start, the hard times over the past years have reduced the survival rates to on average 56% for all sites. The year 2023 will be a year of replanting. Clearly, the sites under VS2020-1, FMO 1a, FMO 1b, FMO 2a, FMO2b, FMO 3, FMO 4 were planted in 2020-2021, the Corona years. Here, replanting the dead trees is of utmost importance. We are confident that survival rates will increase tremendously, seeing the fact that FMO5 and 6 were planted after Corona, showing a very high survival rate again. Here, planting was done late 2022, hence still in progress of begin planted fully. Clearly, management is back to normal, as well as monitoring by or field staff. Another important improvement is the fact, that the enlargement of the nursery to the size of an entire soccer field (0.5 ha), we can now simultaneously raise seedlings for replanting and for the new sites in one seed to seedling cycle.

Table 2 Tree planting progress and survival rates in all sites

	Target PES Agreement	ha	Planted	To be planted*	Survival	% Survival	(re)planting 2023	%(re) planting 2023
VD2017-1 VD2017-2	23,898	34.1	26,406	-	26,380	110.4*	-	-
VS2020-1	131,040	65.5	131,040	-	43,334	33.1	87,706	67
FMO2021_1a	3,300	2.2	1,378	1,922	1,035	75.1	2,265	69
FMO2021_1b	20,325	27.1	9,767	10,558	5,426	55.6	14,899	73
FMO2021_2a	16,950	11.3	10,199	6,751	6,168	60.5	10,782	64
FMO2021_2b	1,650	2.2	998	652	561	56.2	1,089	66
FMO2021_3	91,400	45.7	64,963	26,437	43,849	67.5	47,551	52
FMO2021_4	29,000	14.5	19,039	9,961	11,674	61.3	17,326	60
FMO2022_5a	51,900	34.6	9,386	42,514	9,320	99.3	42,580	82
FMO2022_5b	6,750	4.5	630	630	624	99.0	6,126	91
FMO2022_6	59,600	29.8	19,550	40,050	14,737	75.4	44,863	75

*After some replanting and filling open spaces (a practice called *sisipan*) after abandoning intercropping of chili peppers, more trees were planted and survived (almost 3000 additional trees) compared to the initial target. This explains the more than 100% survival.

Consequences

For the majority of participants, who were managing the trees in their own village, they turned to intensive vegetable cultivation, leaving the trees unattended. Vegetable cultivation gives them a short term cash income and food. However, where participants were integrating vegetables into the trees, survival is still high. The trees benefit from the management of vegetables (Table 2).

A3   Project developments

The year 2022 showed a further increase in offsetting contracts and generated a substantial amount of funds from carbon credit sales. This increase also allowed for our local partner *RPL to grow* from 6 to 9 fulltime staff members, while a short-term contract for a person to support the activities for the biodiversity assessment, which started December 2022. In 2022, an additional person was hired to coordinate the nursery activities and its enlargement. By late 2022, the Nursery became the size of one soccer field (0.5 ha). The new person is an expert in nursery development and management, and with some funds from a US-based organisation to extend the nursery, his expertise is timely and much needed to move into a professionally-run nursery.

Table 3 Staff dynamics of our local partner RPL (2019-2022)

No	Name	Sex	Period	Position	Expertise	Responsibilities
1	Farida	Female	Nov 2019 - present	Director	Applied climatologist and watershed management	control and oversee all business operations, people and first contact for CO_2 Operate.
2	Bubung Angkawijaya	Male	Nov 2019 - present	Program Manager	Anthropologist, social mapping and community specialist	-FPIC process, -Inclusive business building
3	Jefri Rozi Satriadi	Male	Nov 2019 - present	Project Officer	Geographer, Mapping/ GIS specialist, community engagement	Manager Van Duijnen Paninggahan & FMO Paninggahan-Selayo area
4	Zettrisman	Male	February 2020 - present	Project Officer	Agronomist, organic farming, composting,	- Manager Verstegen and FMO Paninjawan - Capacity building Organic farming all sites
5	Ahmad Haryono	Male	July 2020 - present	Project Officer	Forester, Mapping/ GIS specialist, community engagement	Manager FMO Sirukam, Sirukam II and Dilam
6	Andri Saputra	Male	July 2020 – December 2021	Project Officer for RVO	Biologist, community development	Contract end due to end of 1st phase RVO funding
7	Aristya Wulandari	Female	July 2020 – present	Finance Officer	Animal husbandry and nutrition, financial quality assurance	Finance manager
8	Eka Jaya Putra	Male	July 2021 - present	Project Officer Assistant	Horticulture farming, community engagement	Manager Verstegen, FMO Koto Baru/Air Dingin
9	Bakri	Male	Dec 2022	Nursery Coordinator	Nursery development,	Manager Nursery Program

No	Name	Sex	Period	Position	Expertise	Responsibilities
					seedling raising and management	
10	Ferdi Syah Putra	Male	Jan 2023	Nursery Assistant	Seedling raising, mapping and tree monitoring support	Assistant Nursery Program
11	Verdynan Wahab	Male	Dec 2022 – April 2023	Bio-acoustic field staff	Forester	Enumerator for bio-acoustic assessment

Various young people are engaged in the management of the project sites. Senior management is entirely female, the fieldwork entirely men, a typical Minangkabau matrilineal socio-cultural division of work.

A4   Future Developments

1. Project Expansion and New Partnerships

In 2023 we continue to expand our activities in West Sumatra, covering other districts as well. We will spread our wings to South Sumatra (Lampung province). Here, we will work closely with (field)staff from the Ministry of backward regions and transmigration. The area is defined under Indonesian policies as backward (poor), and we will add our carbon project to the activities that the ministry is implementing here (goat farming, composting). The fashion project in West Timor is reaching a decent size and clear directions. We aim to get the fashion forest certified under Plan Vivo in 2023. Finally, mid-2023 we aim to visit Flores to look at a potential new site. A befriended NGO working in Flores has expressed interest to join and collaborate with the Gula Gula Forest Programs team. Their work on coffee agroforestry is in villages where there are also large degraded areas, which could be restored.

West Sumatra:

Pesisir Selatan

In Pesisir Selatan District, we are ready to start implementing the melinjo/nutmeg food forest with a Dutch company producing Indonesian/Asian sauces and snacks. Melinjo nuts are used to make *emping krupuk*, a kind of chips, usually eaten as a side dish with Indonesian food. The partner is a major producer of the krupuk emping. In the future, the company aims to buy melinjo nuts and nutmeg from this food forest. Signing of PES agreements is planned for the first half of 2023. The area has been identified and mapped in 2022. Farmer groups are ready to get started the first half of 2023.

Paninjawan

The PES agreement in Paninjawan have been signed, and distribution and planting of seedlings was done by the end of 2022.

South Sumatra:

Lampung

Mid 2022, after signing a MoU with the Ministry of Backward regions and Transmigration in Jakarta, we began collaborating with them in Lampung Province, South Sumatra. This is a very poor region, and

therefore one of the focus areas of the Ministry. By late 2022, we have identified a new degraded area (ex-transmigration area), where transmigrants have left, and now a degraded area has been reclaimed by the local Lampungese population. In order to restore the ecosystems here, the ministry has asked our assistance to work with them on setting up a carbon agroforestation program. The first 100 ha will be under our restoration activities in 2023. Farmers have already been identified, trees that are chosen by the farmers are Damar, avocado, durian, petai, cengkol and sengon. Almost all are indigenous species.

Our VCM program will be combined with a goat fattening program for the local farmers, funded by the Ministry. In this way, the farmers benefit from both interventions, and poverty can be reduced significantly. The goat manure can be used for a composting unit to serve the trees, similar to what we have in our West Sumatra site.

Figure 3 Baseline situation of the restoration area in Lampung province

Figure 4 Map of new site in Lampung Province, South Sumatra

West Timor: the fashion forest

In West Timor, East Indonesia, we have started a new ecosystem restoration project.
Starting in 2019 with some seed funding from a Dutch NGO and modest CSR funds from a German textile company. The local community began planting *gliricidia* cuttings for biomass accumulation and N-fixation on severely degraded land in an area of 400 ha. The local Forestry Department contributed by giving out Leucaena Leucocephala seedlings. However, cows and deer have eaten them all. We saw that gliricidia was not touched upon, hence we focus for soil fertility improvements on this species only in the communal areas. Leuceana is still preferred by the local community (it is an important fodder tree), but they will be planted in their confined areas close to the house, where cows and deer cannot enter.

New partnerships are being formed:
- The local **NGO Besi Pae** coordinates and implements the field activities.
- In 2021, **SukkhaCitta, meaningful clothes,** has joined as a partner. This award-winning Indonesian

social enterprise provides additional tree planting funds from their online sales while we are building a more strategic partnership with them on agroforestry cotton cultivation and natural dye production from indigenous trees. These funds specifically went towards supporting the creation of saplings, whilst income from climate finance continued to support the management of new trees and farmer payments.

- Late 2021, **UNDP** provided a grant for community-building, prepare for certification and do a feasibility study for this project, which is aimed towards scoping new activities and geographic regions to include in the project. They also collaborate with us in the project using their expertise and staff time.
- From 2022 onwards, we have begun to involve the local government as well, through the official collaboration between RPL and the Ministry of Backward regions and transmigration. Two young, enthusiastic staff members of the local district office have been appointed to work with us. Great to have them on-board.

Figure 5 Planted Gliricidia cuttings already developing leaves, while new ones will be added in the degraded communal areas to build soil biomass.

2 Growing number of farmer groups

With new areas being under restoration, covering different villages, farmer group members in existing groups have increased, while in new villages new farmer groups are being established. In total we work with 7 established farmer groups, varying in size of members (Table 4 a, Table 5 b). Whenever new people like to join the project, they must first of all be accepted by the members of the farmer group. However, Minang culture is very open to newcomers from all aspects of life, even from other socio-cultural backgrounds. Hence usually anyone can join, as long as they adhere to the group's objectives and workplans.

Table 4 (a) Established farmer groups, members, restoration sites and size

	Paninggahan (VD2017-1)	Paninggahangahan (VD 2017-2)	Air Dingin (VS2020-1)	Paninggahan (FMO 1a,2021)	Paninggahan (FMO 1b,2021)	Selayo (FMO 2a, 2021)	Selayo (FMO 2b, 2021)
Site name							
Kecamatan	Junjung Sirih	Junjung Sirih	Lembah Gumanti	Junjung Sirih	Junjung Sirih	Kubung	Kubung
Nagari	Paninggahan	Paninggahan	Air Dingin	Paninggahan	Paninggahan	Selayo	Selayo
Jorong	Subarang, Kampuang Tangah, Gando	Subarang, Kampuang Tangah, Gando	Aia Sonsang, Koto, Cubadak, Data	Subarang, Kampuang Tangah, Gando	Subarang, Kampuang Tangah, Gando	Lurah Nan Tigo	Lurah Nan Tigo
PES agreements signed	Oct-17	Oct-17	Sep-20	Jan-21	Jan-21	Jan-21	Jan-21
Farmer Group	Kelompok VCM Paninggahan	Kelompok VCM Paninggahan	Kelompok Tani VCM	Kelompok VCM Paninggahan	Kelompok VCM Paninggahan	Kelompok Tani VCM Selayo	Kelompok Tani VCM Selayo
Sub Group	Kelompok Bukit Panjang	Kelompok Bukit Subaka	None	Kelompok Bukit Panjang	Kelompok Bukit Subaka	None	None
No of participants	35	45	87	3	65	5	6
Total area (ha)	19.9	14.4	65.5	2.2	27.1	11.3	2.2

Table 5 (b) Established farmer groups, members, restoration sites and size

	Sirukam (FMO 3, 2021)	Koto Baru/Air Dingin (FMO 4, 2021)	Paninjawan (FMO 5a, 2022)	Paninjawan (FMO 5b, 2022)	Sirukam II (FMO 6, 2022)
Site name					
Kecamatan	Payung Sekaki	Lembah Gumanti	X Koto di Atas	X Koto di Atas	Payung Sekaki
Nagari	Sirukam	Air Dingin	Paninjawan	Paninjawan	Sirukam
Jorong	Kubang Nan Duo	Koto Baru	Balansiah, Ky Aro, Pasar, Gt. Tabek, Gurun, Kubu dan Batu Laweh	Air Batumbuk	Kubang Nan Duo
PES agreements signed	Jan-21	Jan-21	May-22	May-22	May-22
Farmer Group	Kelompok Tani Cirubuih Indah Nan Jaya	Kelompok Tani Bukit Panjang Saiyo	Kelompok Hutan Pangan Paninjawan	Kelompok Hutan Pangan Paninjawan	Kelompok Tani Cirubuih Indah Nan Jaya
Sub Group	None	None	None	None	None
No of participants	34	15	37	6	29
Total area (ha)	45.7	14.5	34.6	4.5	29.8

Document update

New farmer participants are joining who are developing or have already developed additional agroforestry systems. We have however calculated the time averaged carbon stock/ha for the new participants with PES agreements in 2022 (Table 9) The tree compositions of these agroforestry systems are similar as to the agroforestry systems already certified under Plan Vivo, however, sometimes the configuration (design) is slightly different (See Annex 1 for an overview of the species composition per system). The desktop carbon estimations in Excel show that the potential carbon stocks are somewhat similar from the previous estimations. This is due to number of trees per ha and species selection.

Baseline data

Baseline sampling for all sites (ferns, Semak/belukar, imperata) could not be done until late 2022, due to the recovery from the COVID period and to evaluate all sites in relation to tree survival. This was taken up by the end of 2022, together with the Brawijaya university, Malang. However, actual fieldwork started early January 2023, hence we will provide the baseline carbon stocks based on actual fieldwork in the AR of 2023. If required by Plan Vivo, we may adjust data (if needed) in the PDD in 2023, as it could change the C- stock per ha for all systems.

In the current assessment, the estimated (literature-based) time-averaged aboveground biomass (AGB), belowground biomass (BGB), total biomass and carbon stock of the baseline systems are as follows

(assuming burning every 3 years):

Imperata/Fern

AGB:	2.0	t/ha
BGB:	9.1	t/ha
Total biomass:	11.1	t/ha
Total carbon:	5.1	t/ha

Fern

Total biomass:	18.7	t/ha
Total carbon:	8.6	t/ha

Shrub/belukar

Total biomass:	26.0	t/ha
Total carbon:	12.0	t/ha

Biodiversity monitoring

Biodiversity research with Andalas University did not really go as planned. Initially, they were hesitant to do fieldwork, as Corona was still not under control early 2022. After that, they got involved in other (large-scale) projects that a proposal could not be finished. Consequently, the biodiversity research was delayed. Mid 2022, we started to discuss the biodiversity research with some of our old colleagues from ICRAF Indonesia in Brawijaya University, Malang, East Java and a befriended German social enterprise, called Biometrio.earth (experts in above ground biodiversity, using bio acoustics techniques. In a short time, we were able to write a joint proposal for above and below-ground biodiversity, with which we were also able to secure 50% of the needed funds from a Dutch organisation, working on sustainability issues for the private sector (MVO Nederland). The fieldwork has started early 2023, and the report with main findings is due by the end of May 2023 (Table 6). A summary of the results will be included in the next Annual Report.

Table 6 Progress against corrective actions from validation report going into 2022

Document	Corrective action	Activity against this
Validation report	***FAR01*** Not all of baseline monitoring data for indicators described in the PDD has not yet been collected ***Reccomendation 1****: We recommend that a periodic survey of mammal and bird species is included in the biodiveristy monitoring plan.*	- *Although baseline carbon data are based on literature from the region, there is a need for field measurements. The Students from Brawijaya university will conduct baseline assessments for the carbon data (report due May 2023). Baseline data will be collected on imperata grasslands, semak/belukar (shrubs) and ferny vegetation.* - *The field work has started early 2023, after securing 50% funding late 2022. Main results are due May 2023 from above- and belowground biodiversity and changes in soil quality. We use bio acoustics, camera traps and soil sampling methods for belowground biodiversity. We aim to set up a periodic monitoring system for above- and belowground biodiversity, based on this program wide inventory.*

Figure 6 Setting up above-ground biodiversity measurements using bio-acoustics, started December 2022.

PART B. Project activities

B1   Project activities generating Plan Vivo Certificates

- As mentioned before, new PES agreements have been signed.

Table 7 summarises the new PES agreements. In total new Plan Vivo Certificates would be needed for 72 participants and an area of 68.9 ha. Here, trees were planted in 2022.

As indicated in an earlier section, the tree compositions of these agroforestry systems are similar as to the agroforestry systems already certified under Plan Vivo. The desktop carbon estimations in Excel show that the potential carbon stocks are within the range of the previous estimations; no significant differences have been found between the new systems and the similar existing systems. Annex 1 provides a detailed lay out of the species and number of trees planted in each system.

Table 7 No. of participants and areas where PES agreements were signed, 2022.

Site name	Agroforestry system	No. Participants	Total area (Ha)	No. trees/ha	Total No. Trees	PES Agreement signed	Eligible for certification
Paninjawan (FMO 5a, 2022)	Robusta-based	37	34.6	1500	51,900	Yes	Yes
Paninjawan (FMO5b, 2022)	Robusta-based	6	4.5	1500	6,750	Yes	Yes
Sirukam II (FMO 6, 2022)	Arabica-based	29	29.8	2,000	59,600	Yes	Yes
Total		72	68.9		118,250		

Table 8 Variation in baseline situations in the restoration sites

Name of agroforestry system	Area (Ha)	No smallholder households	No farmer Groups
Ecosystem rehabilitation – Imperata baseline	*82,2*	*95*	*1**
Improved land management – Imperata baseline	43,7	113	1* Same as above
Improved land management – Ferns	80,0	102	2
Improved land management – Shrub	128,1	117	4

*This concerns the village Paninggahan. Here, there is one large farmer group, divided into 2 subgroups, one focusing on ecosystem restoration, the other working in the conversion of vegetable area into agroforestry (improved land management).

Within these 4 farmer-developed systems (clove-based, arabica/cinnamon-based, Robusta-based and mahogany/cinnamon based) the significant variation in number of trees planted by the individual participants means that there are various subsystems, with varying amounts of time-averaged carbon stock. It shows that farmer preferences and site differences are being taken into consideration. Where less trees are planted, it is mainly based on the fact that here, there were vegetable gardens. Participants in these areas regularly wish to intercrop with vegetables (tumpeng sari) for a few years, mostly a local variety of chilis before the canopy closes. Less trees per ha (wider spacing) mean that a few years of

vegetable cultivation is possible, and in combination with annual carbon payments further bridges the gap between income from vegetables and tree crops In the village of Paninggahan, where the older restoration sites exist, we are focusing on filling the open spaces (*sisipan*), now that vegetables can no longer be intercropped due to a widening of the tree canopies. When the restoration started, some participants would choose a wider spacing (and hence lesser trees per ha), in order to enable the cultivation of chili peppers in between the young trees for 2-3 years. But now that the canopies provide too much shade to allow the cultivation of chillis, the wider spacing might still allow some trees in between (see picture below).

Figure 7 Additional trees can be planted in the "open space" (*sisipan*) as a result of chilli cultivation in the early stages of site restoration.

B2   Project activities in addition to those generating Plan Vivo Certificates

Product processing phase

The building of the processing units with co-funding from Dutch RVO was completed in 2022. As we were able to build tall at relatively low costs, making use of local craftsmen and materials, a substantial part of the funding was not used. The project was extended, because RVO allowed us to use the remaining funds for building a bio-composting unit as well. In 2022, all units are up and running. The coffee drying unit faced severe storm damage, (they never experienced such strong winds). The plastic cover was completely destroyed, and a new one will be installed before the next harvest-period. Farmers say it is a result of climate change, that such strong winds occur every now and then.

Professional, large nursery

With growing areas and activities, we were able to attract co-funding to extend our nursery, and make it into a professionally manged, 0.5 ha (1 soccer field) large nursery. We hired a specialist in nursery

establishment, maintenance and seedling raising. He works fulltime in the nursery, and has planned for all replanting and planting to be done in 2023. With this large nursery we will be able to easily accommodate for all demand, as one cycle generates 400,000 – 500,000 seedlings. The nursery has access to sufficient quantities of water the whole year round. Activities to build the extension started in December 2022 (Figure 8).

Figure 8 A more professional nursery of one soccer field in size.

Part C. Plan Vivo Certificate issuance submission

C1   Contractual statement

All claims and reservations are made since 2017 onwards. This issuance submission is entirely based on signed PES agreements with participants complying to all the minimum requirements stated in these agreements. Minimum requirements consist of:
- Be (or have become) a member of the farmer group with which the contract is signed
- As such, accepted by the farmer group members as being "able" to restore the land
- Understand and agree on all aspects in the contract.
- Have the land available, and it was mapped by our team of RPL
- Tenure security is clear
- Have chosen and included the Plan Vivo (tree choices and numbers of each species to be planted in the area) of the member in the contract.
- Have agreed on the contract.

A PES agreement is only signed when an offsetting client has signed a contract with the project coordinator, CO_2 Operate BV for a certain offsetting target, or in the case of FMO bank, have received the development capital. This guarantees that carbon funds are secured and available to start working with the farmer participants. In 2022, the total number of participants with PVs under PES agreements from the beginning is 367. Another farmer group joined end of 2022 from Dilam village. However, they have not signed the PES agreement yet. Here, we will start to restore 24.3 ha for 14 new participants.

C2   Issuance request for Plan Vivo Certificates allocated to new participants and land

The issuance request for PVCs, allocated to participants from 2017 onwards, is provided in Table 9. The village of Dilam is not included Table 9, as the PES agreements have not been signed yet.

Table 9 Total saleable PVCS since 2017, before sales and reservations (including buffer planting). *Some figures may not add up exactly, because they were rounded off scientifically. (colour coding:* historical systems *and* new systems*).*

Site code	Site name	Tech specs System	No. participants	A Total area (ha)	B Carbon Potential (tCO₂/ha)	C=A*B Total ER's (tCO₂)	D % buffer	E=D*C No. of PVCs allocated to buffer this period	F=C-E Saleable ER's (tCO₂)
VD2017-1*	Paninggahan (bukit Panjang 2017)	Clove-based	35	19.9	225.8	4,492	16	719	3,773
VD2017-2	Paninggahan (Subaka, 2017)	Clove-based	45	14.4	189.4	2,721	16	435	2,285
VS2020-1	Air Dingin (2020)	Arabica - cinnamon	87	65.5	357.9	23,446	16	3,751	19,695
FMO2021-	Paninggahan	Robusta-	3	2.2	286.2	630	16	101	529

Site code	Site name	Tech specs System	No. participants	A Total area (ha)	B Carbon Potential (tCO$_2$/ha)	C=A*B Total ER's (tCO$_2$)	D % buffer	E=D*C No. of PVCs allocated to buffer this period	F=C-E Saleable ER's (tCO$_2$)
1a	(FMO 1a)	based							
FMO2021-1b	Paninggahan FMO 1b	Clove-based	65	27.1	298.5	8,091	16	1,294	6,796
FMO2021-2a	Selayo (FMO 2a)	Robusta-baed	5	11.0	228.9	2,518	16	403	2,115
FMO2021-2b	Selayo (FMO 2b)	Clove-based	6	2.5	245.1	613	16	98	515
FMO2021-3	Sirukam (FMO 3)	Arabica/ Cinnamon-based	34	45.7	261.5	11,951	16	1,912	10,040
FMO2021-4	Koto Baru/ Air Dingin (FMO4)	Mahogany /Cinnamon - based	15	14.5	347.9	5,045	16	807	4,237
Subtotal Historical (2017-jan 2022)						59,506		9,521	49,985
FMO2022-5a	Paninjawan	Robusta-based	37	34.6	265.6	9,191	16	1,470	7,720
FMO2022-5b	Paninjawan	Robusta-based	6	4.5	272.2	1,225	16	196	1,029
FMO2022-6	Sirukam II	Arabica-based	29	29.8	261.5	7,793	16	1,247	6,546
Subtotal Added/ Issued Jan 2022-jan 20223						18,209		2,913	15,295
	TOTAL		367	271.7	-	77,716	-	12,433	65,280

C3   Allocation of issuance request

All credits up to 2021 have been certified, and are mostly sold or reserved by private sector clients. Some clients just want the certificates, others like to communicate the story of Gula Gula as well, while others prefer to work with us on restoring a degraded site from its degraded state. For these reasons, we developed three packages from which they can choose. We have a varied portfolio now of 1 year clients, 3 year clients and 5 year contracts with clients (the Tiger package: see Figure 9).

This works very well, and potential clients or partners (for a multi-year collaboration) can compare the options and see where their priority lies.

HORNBILL

A One-Year Commitment includes:

✔ Plan Vivo certified carbon credits

✔ A customized certificate

✔ Gula Gula Forest Program logos for communication

GIBBON

A Two Year+ Commitment includes:

✔ Plan Vivo certified carbon credits

✔ A customized certificate

✔ A Gula Gula Forest Program Annual impact report

✔ Use of our logos and other promotional materials

✔ An opportunity to purchase your own sponsor project page on explorer.land, to integrate into your website

TIGER

A Five-Year Commitment includes:

✔ Restoration of your own, exclusive food forest area

✔ Plan Vivo certified carbon credits

✔ A customized certificate

✔ Effective communication support on your restoration activities through:
- *Annual impact report of the Gula Gula Forest Program*
- *Annual statistics on social and environmental impact*
- *Individual sponsor project page on explorer.land, to integrate into your website*
- *Regular updates and pictures to use in your communication channels*
- *Use of our logos and other promotional materials*

✔ Requires a minimum offsetting of 500 tons CO_2/year

Figure 9 Package options for joining the Gula Gula Forest Programs

Part D. Sales of Plan Vivo Certificates

D1   Sales of Plan Vivo Certificates

The Gula Gula project has previously issued uncertified credits prior to Plan Vivo certification. These credits have already been sold and a proportion of the climate benefits achieved within this report are allocated to allow these uncertified credits to be converted to PVCs (from 2017 onwards). In 2022, we retired 16,196 carbon credits from the market account as part of sales to a variety of clients in Europe. Reservation will be sold to clients with whom we have a multi-year contract. This is in most cases a 5-year contract which enables the client to restore a specific degraded area into a productive food forest. Table 10 below breaks down the carbon credits sold in 2022, divided by vintage year (year of planting).

Table 10 Sales, reservations and remaining, unsold credits in 2022

		A	B	C	
Planting/ starting year	PVCs to retire for that vintage	Retired in 2022*	Balance before reservations	Reservations under multi-year contract	Net amount for sale
2019	6,058.4	1,851	4,207.4	2,000	2,207.4
2020	19,694.9	7,826	11,868.9	6,890	4,978.9
2021*	24,231.1	6,519	17,712.1	1,400	16,312.1
Total	**49,984.4**	16,196	33,788.4	10,290	23,498.4

*This includes the certificates given for carbon sequestration from 2017 onwards, which was not yet certified at that time (see AR 2021).

Part E. Monitoring results

E1 Ecosystem services monitoring

Staff of our local partner is fulltime in the field during weekdays, working with the participants and monitoring progress. Usually, the farmer will replace the trees with other trees. However, if farmers see that a certain species is not growing well, they will opt for another species that shows good growth in their land. Usually, the first 2 years of establishment show the highest variation in successes or failures. Not only because trees are still small, weather conditions (rain in particular) can have a large impact on the survival rates during the establishment phases of the trees in the field. Careful monitoring and updating the planting schemes requires intensive collaboration with the participants. The team of RPL monitors and coordinates tree planting progress by the participants according to their PVs. Once all is planted, continuous monitoring brings forward potential tree deaths and problems associated with tree growth. In addition to adjusting the tree data in their excel sheets per farmer, a more formal monitoring/evaluation with the head of the farmer groups and respective farmers is done before the annual carbon payments. Actual tree counting and potential recent changes are included in the excel sheets of RPL. A summary of these data sheets can be seen in Table 11, also showing the replanting schedule for the 2023 rainy season. All should be done during the rainy season of 2023, made possible by the extension of the nursery. It clearly shows that during the Corona years the death rate has been high, caused by lack of management and monitoring by the team, as they could not visit the villages (see also Section A2). If all is according to the sheets and PES agreements, the members of the farmer group are paid. If not, carbon payments are withheld until all issues have been solved and if needed replacement trees are planted. The two main targets include the planting of the tree seedlings, after distribution, either trees in a new area or as part of replacement planting of trees that did not survive.

Table 11 Tree survival and replanting needs

Site Code	Program year	Planted Year	Target	ha	Planted	Survived (Early 2023)	Need to replant	Replant	Replant when	Survival Rate (%)
VD2017-1 VD2017-2	2017	2018	23,898	33.2	26,406	26,380	-	-		99.9
VS2020-1	2019	2020	131,040	65.5	131,040	43,334	-	87,706	Started replanting May 2023 (gradually)	33.1
FMO2021_1a	2021	2021	3,300	2.2	1,378	1,035	500	1,765	FMO 1a_1b : starting replanting 2024. Still need to wait for the available seed from RPL nursery	75.1
FMO2021_1b	2021	2021	20,325	27.1	9,767	5,426	-	15,984		55.6
FMO2021_2a	2021	2021	16,950	11	10,199	6,168	500	10,282	FMO 2a_2b : starting replanting 2024. Still need to wait for the available seed from RPL nursery	60.5
FMO2021_2b	2021	2021	1,650	2.5	998	561	-	1,089		56.2

Site Code	Program year	Planted Year	Target	ha	Planted	Survived (Early 2023)	Need to replant	Replant	Replant when	Survival Rate (%)
FMO2021_3	2021	2021	91,400	45.7	64,963	43,849	-	47,551	FMO 3_4 : starting replanting 2024. Still need to wait for the available seed from RPL nursery	67.5
FMO2021_4	2021	2022	29,000	14.5	19,039	11,674	-	17,326		61.3
FMO2022_5a	2022	2022	51,900	34.9	9,386	9,320	42,514	66	FMO 5a_5b : focusing on planting since the tree distribution is still on process	99.3
FMO2022_5b	2022	2022	6,750	4.1	630	624	6,120	6		99.0
FMO2022_6	2022	2022	59,600	29.8	19,550	14,737	39,948	4,915	FMO 6 : focusing on planting since the tree distribution is still on process	75.4
TOTAL			435,813	270.5	293,356	163,108	89,582	186,690		

Adjustments to be implemented during 2022:
- As the workload increases, some efforts are being made to train the farmers in keeping their own records. However, the staff of RPL mentioned that it is better that they continue to do it, as "third party". Participants and RPL field staff collaborate more intensively on monitoring tree growth and survival rates.
- The bio composting unit started to produce around 5-7 tons of compost per month. It needed some experimentation to develop the best mix to achieve good quality. After several rounds of testing, the team has been able to develop a "recipe" that matches the SNI, or the national Indonesian Standard. It means they can sell it to anyone. However, it was decided that first of all the participants should receive the compost for their tree growing activities.
- During Corona bad quality seedlings were given by BPDAS to RPL and the participants, resulting in a very low survival rate of seedlings from BPDAS in particular. With the new person for the nursery and seedling raising, RPL will make a careful selection of good quality seedlings themselves in the nursery of BPDAS, before they load the seedlings on the truck.

E2   Maintaining commitment

As stated in section A4(2), new participants can become a member of the farmer group, after democratic consultation within the group and once the new members agree to the rules set by the farmer group. The group is very strict on discussing with new participants on their availability to do the work in relation to the land they want to manage. In addition, attending meetings is another important aspect. Due to the strong social control within the group, individual members are easily monitored by other group member to ensure all activities are done in time, or individual members join any group work. If a member does not perform according to the group rules, they may be supported by the other member, if there are good reasons for not being able to join (e.g., illness, deaths in the family, and so on). If the reasons are related to lack of interest, the member gets 2 warnings from the group. If after 2 warnings, the member is still not doing his/her job, he/she will be replaced. The selection done by the local farmer group and the high motivation of participants to join the restoration activates has shown few drop outs. Table 12 summarises minor replacements since 2017, mainly due to illness, death or off

farm employment elsewhere. However, it should be noted that, in all cases, the new participants (all from the same family/clan, as the person that left) were happy to continue the land's involvement in the Gula Gula project and actively manage the land. Therefore, the loss of participants did not constitute a loss of expected emission reductions, since the land and trees remain the same.

Table 12 Participants who left the program, reason why and solution

Number of Participants	Contract	Area (ha)	Reason for leaving	When	Replacement
1*	VD2017 1	0.7	Lack of management due to Illness	2017	Replaced by 2 new persons, (area 0.5 ha) (0.2 ha)
1	VD 2017-2	1.2	Bad health	2020	Replaced by 4 new persons (0.2 ha, 0.5 ha, 0.4 ha, 0.1 ha)
1	FMO6,2022	0.6	Resigned (job elsewhere)	2021	Early beginning of program, so simply replaced.
3	VS2020-1	2.5	Three people passed away	2021	Family members now manage the areas. Two of them are the son of de deceased person (0.8 ha and 0.4 ha), while the father of a young deceased person (accident) took over (1.3 ha). This means no change in land area and trees.
1	FMO2a-2b, 2021,	0.4	Land conflict with his wife's family	2022	Replace the area by another member
11	VS2020-1	7.7	Resigned for job elsewhere, move to other province, lack of management due to other main job (horticulture)	2022	The portion of 4,7 ha replaced by new area from 5 other farmer group member and the other 3 ha the land managed by Verstegen farmer group

*Due to privacy reasons, we do not put names here, however records are kept for each participant based on their names within each farmer group.

E3   Socioeconomic monitoring

First of all, we committed to the idea that our efforts of food forest establishment on degraded areas should provide the participants on average a monthly income above the official minimum wage for West Sumatra, set at around € 184/month in 2023(wageindicator.org)). Using the number of trees and species planted per ha, and looking at local prices (Solok district corona years have made it impossible to do socio-economic surveys. In addition, since the certified area is from 2017 onwards, the first harvest was expected in 2021-2022 for some trees. With a delay, the full socio-economic survey on income from all crops will be done in 2023 (as already mentioned in the previous annual report). This will be the baseline to start monitoring each year, and see how incomes increase as trees mature and harvests increase. Only when all trees reach maturity in harvest potential, we can make a sound judgement of whether we have achieved our goal of a minimum wage from the food forest area. For instance, clove trees, one of the main cash earners for the farmers, but they only reach their maximum harvest potential after 7-8 years.

In Figure 10 below we made an estimation of what farmers will get form 1 ha of multi strata food forest. Prices are based on an average of multi-year prices at district level. Coffee is a relatively new crop, and has not yet been included. We are still looking for the right figures for both robusta and arabica.
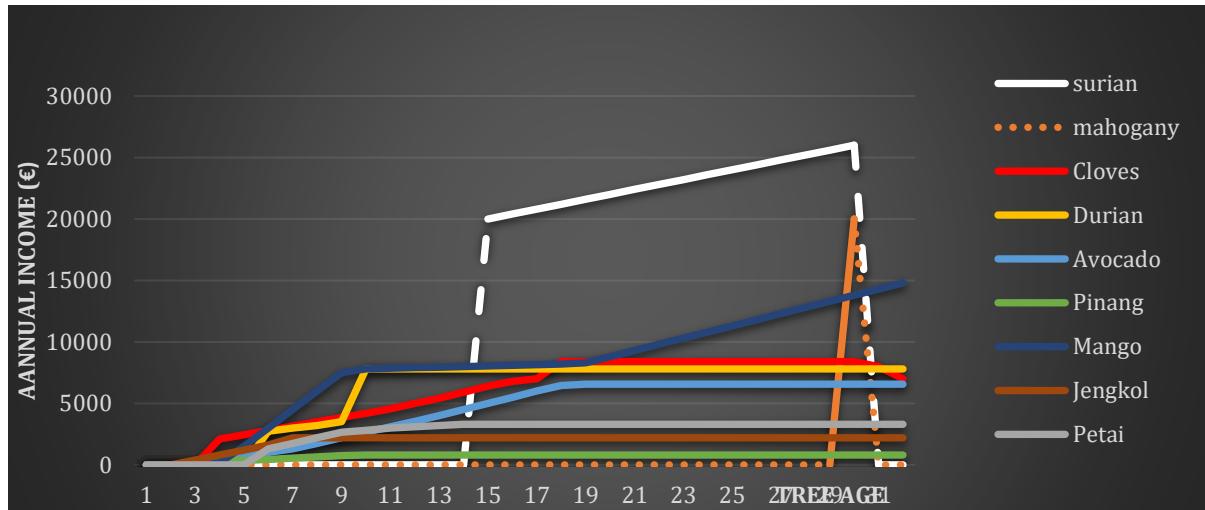
Figure 10 Potential income from the trees on 1 ha of Gula Gula Food Forest

It must be noted, that for timber trees (surian, mahogany) it is a one-time sell off after cutting the tree. The lines therefore show an increase in the price with every year the trees are left to grow before cutting them down. Obviously, the older the tree, the more timber is produced, hence the income will be higher. Usually, for timber trees, they are not cut down during the first 15-30 years. In fact, timber trees are considered a saving for their children/ grandchildren. Petai and cengkol are indigenous trees, providing edible fruits. They are very popular throughout the year, and therefore prices remain good the entire year, even when sold in the local market. Since the participants judge that only a few trees are sufficient, income per ha may seem low, but it comes from relatively few trees. Avocado is a good income earning fruit. The majority of the participants have chosen avocado trees to be planted into their land. In almost all sited they are also doing well. In the lower elevation areas (Paninggahan), clove trees are often chosen as an important cash crop, even though prices can fluctuate tremendously each year. Clove trees have a broad crown, hence clove-based systems have a lower average number of trees in one hectare.

Table 13 Socio economic monitoring results 2022

Activity	Socio-economic indicators	Results /progress		Explanation /potential mitigation strategy
		According to plan	Not according to plan	
Monitor income improvement from tree crops	➢ # Kg harvested/tree crop ➢ # Income (U$) received/tree crop	N.A.	N.A.	Main income earners, clove trees, only bear fruit after 6-7 years. Coffee arabica was planted 2 years ago, and begins to bear fruits now. End of 2023 we will conduct the first socio-economic survey
Monitor progress post harvesting tree products	➢ #kg tree products being part of post harvesting ➢ # Income (U$) from selling (semi) processed products	Post harvesting units in testing phase		Enlarging and testing essential oil production in new distilling unit was done. Coffee exports are planned in 2023, large drying unit was constructed in 2022.
Annual Carbon cash	➢ Total Annual		20 % paid,	Serious delays in payments

Activity	Socio-economic indicators	Results /progress		Explanation /potential mitigation strategy
payments to farmers	Carbon payments (U$) received by farmer participants		summing up to U$ 17,013 (RP 254,116,833,-)	were caused by not yet reaching annual targets for various climate-related and COVID effects (see table 18). Payments took place in 2023.
Monitor direct women engagement in restoration activities	➢ # women involvement in the program	25 % women engagement		Gender division seems low. However, in the matrilineal Minang society, women own the land, men are landless. After marriage, the men will live as "a guest" in the wife's family house. They are supposed to work on and care for the land of the wife and her female family members. This is especially the case for upland areas, where the restoration activities take place.
Inclusion of farmer participants in PES agreements	➢ # of participants managing restoration area with PES agreement	380		In total we have 380 participants/families with a PES agreement in 2022.
Capacity building				
Agricultural training post harvesting	➢ # people directly/indirectly engaged in agricultural training ➢ #people attending post harvesting	103 participants engaged in one or more training sessions in 2022 15 participants trained in post harvesting		75 New farmers are trained in zero tillage techniques, including Assisted Natural Regeneration (ANR). 28 farmers (representatives from all farmer groups) attended training on bio composting (Nagari Sirukam). 5 farmers attended training in post harvesting coffee bean handling and coffee processing 10 farmers were trained in running the larger size distilling unit, in order to achieve National Indonesian Standard quality (NSI).
Formation of farmer cooperative groups	➢ # farmer groups	7 farmer groups have been established, of which 3 in 2022		All participants holding PES agreements are members of these farmer groups.

All in all, more farmers received training, either in zero tillage techniques, or in processing tree products.

With more participants joining the program, the number of farmer groups have grown from 5 to 7. The number of women begin involved in the program has increased a bit from 16% last year to 23 % this year. This may seem low, but in the matrilineal society of the Minangkabau, women are the land owners. Hard and sometimes dangerous work in the upland fields is done mostly by the men. Women usually engage in the rice cultivation (planting, weeding), while the heavy duties (land preparation activities) will be done by the men. Harvesting of rice is a joint activity in many cases.

Table 14 Various agroforestry systems (the PVs), number of participants, male or female

No	Site name	Agroforestry System	No of participants	Female	Male
1	Paninggahan, Bukit Panjang (VD2017-1)	Clove-based	35	2	33
2	Paninggahan, Subaku (VD2017-2)	Clove-based	45	7	38
3	Air Dingin VS2020-1	Arabica/cinnamon	87	17	70
4	Paninggahan (FMO 1a,2021)	Robusta-based	3	0	3
5	Paninggahan (FMO 1b,2021)	Clove-based	65	10	55
6	Selayo (FMO 2a, 2021)	Robusta-based	5	0	5
7	Selayo (FMO 2b, 2021)	Clove-based	6	5	1
8	Sirukam (FMO 3, 2021)	Arabica/Cinnamon	34	10	24
9	Koto Baru/Air Dingin (FMO 4, 2021)	Mahogany/Cinnamon	15	7	8
10	Paninjawan (FMO 5a, 2022)	Robusta-based	37	6	31
11	Paninjawan (FMO 5b, 2022)	Robusta-based	6	0	6
12	Sirukam II (FMO 6, 2022)	Arabica-based	29	10	19
		TOTAL	367	74	293

E4   Environmental, climate and biodiversity monitoring

Table 15 below provides a summary of the various activities we implement to monitor impact on climate, environment and biodiversity. The indicators provide guidelines to our progress. Progress cannot always be defined as annual targets, as we start to restore new degraded areas after an offsetting contract is signed with a client/partner. This can take place throughout the year, and size of the contact also depends on their offsetting needs. After signing, we start the FPIC process, and this could take between 2-6 months before we sign a PES agreement with the farmer groups. Hence, we do not really have annual targets, as each year may show different figures. Finally, planting of trees cannot be planned anymore, as it depends on the rain. Therefore, we mention results/progress in the table rather than annual targets being met or not. Next paragraphs will explain in more detail what has been done.

Table 15 Climate, Environmental and biodiversity impact results

Climate mitigation impact				
Activity	Indicator	Results /progress		Explanation /mitigation strategy
		According to plan	Not according to plan	
Zero burning techniques that prevent wildfires	➢ # Occurrence of wildfires		**2** ha of young food forest were damaged by a wildfire in 2022,	Long dry spells and irregular rainfall caused a wildfire. Farmer groups patrol regularly to check on (wild) fires. Their fast response made that only

Climate mitigation impact				
Activity	**Indicator**	**Results /progress**		**Explanation /mitigation strategy**
		According to plan	Not according to plan	
				2 ha was damaged. Trees that have been affected are all replaced by CO_2 Operate, as part of force majeure in PES agreement.
Monitor progress carbon sequestration	➢ # Total aboveground Carbon stock (time-averaged) ➢ Belowground time averaged Carbon stock/ha ➢ # Soil organic matter change/ha		Carbon assessment was planned in 2021-2022, but because of communities still being scared of COVID, a team could not be set up, and fieldwork was not possible.	The carbon assessment will start late 2023/early 2024.
Monitor changes in rainfall (if any)	➢ # mm of monthly rain in project sites (Figure)	Figure 2		Rainfall data collected from meteorological stations in our villages.
Environment/Restoration impact				
	➢			
Restore degraded land	➢ # of ha reforested under PV (ha)	272		Area is covered with agroforestry systems.
Plant agroforestry trees	# of agroforestry trees planted under PES agreements	435,896		
	➢			
	➢			
	➢ # trees per ha (average)	1314		
	➢ # different species/ha	7-9		
Biodiversity				
Tree species (bio)diversity	➢ # different species found in all restoration area (planted & protected/regenerants)	19		
	➢ # indigenous regenerants (ANR) and protected trees in field	18,492		Indigenous trees, already present in the land are protected, while regenerants are able to grow after ANR.
Aboveground Animal/bird species	➢ (annual) Report on aboveground		Planned for 2022, but	Ready first half 2023

Climate mitigation impact				
Activity	**Indicator**	**Results /progress**		**Explanation /mitigation strategy**
		According to plan	Not according to plan	
biodiversity	biodiversity, using bio-acoustics		funding & (local) expert-partners was only finalised late 2022	
Belowground (agro)biodiversity	➢ Report on (agro) biodiversity belowground		Planned for 2022, but getting funding & (local) expert-partners only finalised late 2022	Ready first half 2023

Source: Field monitoring data RPL

In addition to protecting (indigenous) trees and wildlings in the field, a large number of the planted trees are also considered indigenous or local species. They are either local to the area, the island of Sumatra or other islands of Indonesia. These are cinnamon, cloves (*maluku*), mahogany, mangosteen, *surian, petai, cengkol, shorea* and *durian*. The other tree species (*coffee robusta, avocado, leuceana, soursup* and recently *coffee arabica*) are not indigenous. However, they have become naturalised species as they have been introduced into Indonesia many decades ago.

Number of trees planted per ha varies between 700 and 2000, depending on the kind of trees and farmer preferences (the average being 1355 trees/ha). Trees with wide canopies, like clove trees do not allow a large number of trees per ha, as it would cause too much competition. Farmers also do not prefer too many trees in a clove-based systems as harvesting cloves requires the use of ladders hence space is needed to climb the trees. Fields where arabica is planted, it concerns small trees, hence here sometimes up to 2000 trees/shrubs can be found.

The variation is also caused by the fact that some of the food forest systems are on ex vegetable cultivation areas. Farmers still preferred to cultivate some vegetables (mostly chili) for another 2-3 years, before the canopy of the trees would close to enable further vegetable cultivation. Here the agroforestry system is a bit more open, to allow several years of vegetable cultivation in between the growing trees. After discussion with the farmer groups managing ex vegetable areas, gaps will be filled with more trees. A list has been compiled already, and the 2023 rainy season will allow them to plan additional trees.

Biodiversity monitoring: flora and fauna

Initial testing of biodiversity return some years ago, using a few camera traps has shown that there is quite some wildlife roaming around in the food forests. In 2022, we found another exciting but dangerous proof of biodiversity increase, namely the fact that several wild forest bee colonies had put up their nest in the older agroforestry sites. Apparently, these bees only nest in intact forests or where the vegetation resembles forest ecosystems. This means that our mature food forest sites show clear signs of bringing back forest ecosystem types of environments. For the community this may be less favourable, as these bees appear to be very aggressive. The week before we visited the sites, 2 villagers were killed and one was still in hospital after being attacked by the bees. Part of their aggression can be explained by a growing number of eagles flying over the older sites, attacking the bee nests in order to

eat the larvae (Figure below). Where we would regularly see one eagle, we saw 6 now. The good news is, that once the young bees fly out, the colony moves on, hence farmers can attend to their food forest again after the colonies have disappeared (usually after 4-6 weeks).

Figure 11 Wild forest bees are nesting in our old agroforestry sites, in turn attracting eagles which feed on the larvae

With all these specific features of biodiversity increase, it was of utmost importance we would start developing the biodiversity monitoring in a measurable way and based on scientific grounds, in order to really show data-driven biodiversity impact.

A lot of time was used to involve the Faculty of Biology of Andalas University, Padang. However, in the end the staff seemed too busy to work with us. In August 2022, Paul Burgers met with former colleagues and friends from ICRAF Indonesia and Brawijaya University, Malang (East Java). They showed high interest in conducting below-ground biodiversity research. Similarly, Paul Burgers also met people from Biometrio.earth, specialising in using bio acoustics for above-ground biodiversity inventories.

By late October 2022 a joint proposal was sent to the Dutch organisation MVO Nederland, and the proposal was selected to obtain a (50%) co-funding. to conduct a program-wide biodiversity inventory. his allowed us to implement both above- and belowground biodiversity in all our sites, with ages ranging from 1-10 years of restoration activities (see the continuum of Figure 12, starting from the Gula Gula logo to the right).

Figure 12 Schematic land use transformation from forest through grasslands to restored land with various agroforestry options. (Source: CO$_2$ Operate BV)

Secondary forest areas are defined as the control or climax vegetation and its associated biodiversity. It is hypothesised that secondary forest and fully grown complex agroforests would have similar ecosystem functions and its associated biodiversity characteristics. Discussing the set up and preparations for the fieldwork were made from October-December, and the fieldwork started in January 2023. For belowground biodiversity, the focus is on the role of biomass and earthworms in changing soil quality and structure. The above-ground bioacoustics is a great technology. It is animal-friendly, based on recording animal sounds, as small as insects. It means we do not need to set up traps and nets to catch animals and cause a lot of stress for the animals. By the end of May 2023, a report with main findings needs to be handed in to the donor MVO Nederland. In addition, one student was attached to the inventory, specialising in ethnobotany. She will focus on local knowledge of tree uses and why farmers selected certain tree species or protect certain plants or trees in the field.

Figure 13 Fieldwork for belowground biodiversity inventory began early 2023.

Outcomes

Evidence of outcomes

With ageing food forest areas, evidence of change become increasingly visible, also providing learning sites for our returning new activities.

Evidence of Environmental lessons

A major lesson learned is that the use of Assisted Natural regeneration has its limits, restricted to areas which are in the forest "buffer zone", where enough natural regenerants are present and baseline vegetation consists of a bit woody Imperata grasslands and/or shrubs of 50-100 cm (to make pressing successful). In recent years, our restoration activities are further away from the forest buffer zones, These areas have often been subject to former monoculture plantations of crops and vegetables, where pesticides and insecticides have been used. Treeless landscapes covered with ferns (and very few shrubs) are increasingly the baseline for restoration. In areas where ferns are the main baseline vegetation, pressing is not possible, as ferns bounce back after pressing. Slashing the vegetation has shown encouraging results as a zero burning/zero tillage system. However, it is more labour intensive.
In some areas, soils are highly depleted, with hardly any vegetation left, that soil biomass needs to build up first. This is the case in West Timor, where we planted gliricidia first to add biomass. At first, we mixed the planting with leuceana leucocephala species. However, roaming cattle and wild deer liked it too much, so all young trees were eaten by them. We saw that they did not touch gliricidia, so that is why we only plant gliricidia now. Table 16 below summarises the choices between the various options, although regularly we combine various restoration options.

Table 16 Restoration techniques used for various baseline circumstances

	Assisted Natural regeneration (ANR)	Minimum/ zero tillage	Planting/vegetative propagation of N-fixing trees
Distance to forest	Forest buffer zone	No/little influence from forest	No/little influence from forest
State of degradation	Degraded	Severely degraded (no trees)	Highly degraded
Baseline vegetation	Imperata grasslands, with shrubs and natural forest regenerants, some trees.	Predominantly ferns, with some shrubs, imperata, no/few existing trees.	Bare land, hardly any baseline vegetation present. Some shrubs or trees.
Labour intensity	Labour extensive (family labour only)	Medium labour intensive Often combination of family labour with some hired labour.	Highly labour intensive Group activity at community level.
Green manure from baseline vegetation	High	Low-medium	Low
Use of compost/manure	Low - Medium	Medium - high	Medium-high

Using pH meter to further identify soil conditions

Over the years we found, that trees in some areas had a bit of a slow start. Soil conditions were identified as a potential cause. In order to make a better judgement of the soil conditions, our local partner started using a pH meter to look at the pH of the soil. Knowing that a pH of 6-6.5 is needed for normal plant growth, knowing the baseline situation allows us to plan for any additional input requirements, especially if the baseline vegetation is scarce (hence green manure is little). Adding compost and/or manure where trees are planted is a good way to ensure trees adapt easily to the local field conditions, and growth is ok. With the establishment of a centrally located, large compost unit, producing around 8 tons of compost per month, so far, all trees receive compost treatment. For 2023, we aim to look into the option whether providing compost should be part of the PES agreement, and for which trees in particular. To ensure that all participants make use of the compost for better tree growth. We found, that some compost that we handed out in 2022, was applied to their vegetable garden, instead of using it for the trees. One solution is, that we should check the use, by ad-randomly digging a hole close to the tree and 1-2 metres away from the trees. There should be a clear distinction in colour, where the soil mixed with compost is much darker in colour. A simple monitoring point we could use to ensure the compost is/was used for the trees.

Evidence of socioeconomic lessons

Since the beginning, we have established performance-based farmer groups. These have shown to be very effective in working together and getting the work done. Having participants to co-decide on new members has increased social control within the groups, members discuss freely about potential issues to be solved, whether at group level or at the level of individual members.

Despite the fact that farmers in the communities we work in have been growing a variety of agroforestry tree species for a long time already, we realised that some basic knowledge on best practices related to harvesting and processing to achieve a certain quality (hence a higher price) was almost absent. One reason seems to be the lack of an incentive to provide a high quality product, as they mostly are paid based on weight, not quality. As we will pay based on quality, training on harvesting techniques and good tree management has been integrated into the Gula Gula Food Forest Program. In relation to coffee, we found that farmers had no clue how to harvest coffee berries. They were not aware of picking the red berries only. They take all berries from the branch by pulling all at once, both green and red ones. This mixture is one of the reasons for getting a low price for the beans. Therefore, we organised training sessions on coffee bean harvesting. Farmers were surprised to hear that they should only pick the ripe, red berries, but of course happy to know what they should do. As we intend to buy the coffee, we would pay them a much better price if the quality of the berries is high. This is a simple adjustment, and farmers are already practising the picking of red berries.

These improvements enabled us to start collaborating with the participants to set up processing units for selected tree products, coffee and essential oil production from clove leaves. Not only will it add to an increase in income, it also means that current non-participants can benefit from the restoration efforts. Non participants will learn from the participants how to produce good quality beans and to collect clove leaves, enabling non participants to also sell their products to our village-based processing units.

Part F. Payments for Ecosystem Services

F1   Summary of PES payments

PES cash payments are recorded and paid each year. There is however a change in payment schedules. So far, we have paid individual farmers reaching the annual target we agreed with the farmer groups. Cash payments are a bonus for good work done (mostly tree planting and management based on survival rates), and is around U$ 110 per ha. As mentioned in Table 18, we paid a total of U$ 17,000 in direct cash payments to the farmer groups in 2022. Not all was paid, as not all targets were achieved, due to the last months of COVID and bad rains, which made the groups to decide to keep the seedlings in the nursery, where there is enough management and water for the seedlings to survive for several months. Other PES payments come in the form of training on tree and product management, all seedlings are raised in the nursery and can be obtained for free. We have invested in processing units for coffee and essential oils. This allows them to sell semi-processed products, rather than raw materials. Processed products fetch much higher prices, and are seen as a very positive contribution according to the farmers.

Table 17 Timing of carbon payments, explaining potential delays

Project site	Nagari	Farmer Group	Payment due (date in contract/PES agreement)	Actual payment done (date)	Reason delay
VS2020-1	Air Dingin	Kelompok Tani VCM	September 2022 Second Payment (20%)	23 August 2022 (10 %) 6 April 2023 (10%)	Due to Covid-19, tree monitoring could not take place. We paid half of the 20% in 2022 after COVID to show our continuous support, and for them to cover some costs for replanting. The other 10% was paid after reaching agreed targets in 2023.
FMO 1a	Paninggahan	Kelompok Bukit Panjang	February 2022 Second payment (20%)	12 August 2023	We had to make sure farmers planted at least 80% of the trees before we could propose the (second) payment.
FMO 1b	Paninggahan	Kelompok Bukit Subaka	February 2022 Second payment (20%)	12 August 2023	We had to make sure farmers planted at least 80% of the trees before we could propose the (second) payment.
FMO 2a	Selayo	Kelompok Tani VCM Selayo	February 2022 Second payment (20%)	14 July 2023	We had to make sure farmers planted at least 80% of the trees before we could propose the (second) payment.
FMO 2b	Selayo	Kelompok	February 2022	14 July 2023	We had to make sure

Project site	Nagari	Farmer Group	Payment due (date in contract/PES agreement)	Actual payment done (date)	Reason delay
		Tani VCM Selayo	Second payment (20%)		farmers planted at least 80% of the trees before we could propose the (second) payment.
FMO 3	Sirukam	Kelompok Tani Cirubuih Indah Nan Jaya	January 2022 Second payment (20%)	10 May 2023	We had to make sure farmers planted at least 80% of the trees before we could propose the (second) payment.
FMO 4	Air Dingin	Kelompok Tani Bukit Panjang Saiyo	January 2022 Second payment (20%)	25 April 2023	We had to make sure farmers planted at least 80% of the trees before we could propose the (second) payment.
FMO 5a	Paninjawan	Kelompok Hutan Pangan Paninjawan	May 2022	22 June 2022	Considered on time since the contract was signed late May 2022
FMO 5b	Paninjawan	Kelompok Hutan Pangan Paninjawan	May 2022	22 June 2022	Considered on time since the contract signed late May 2022
FMO 6	Sirukam	Kelompok Tani Cirubuih Indah Nan Jaya	June 2022 First payment (40%)	30 Juni 2022 (20%) 8 Mei 2023 (20%)	We split the payment as up to 70% of the trees were planted, where target was 80% at least.

Late 2022, discussions with the new farmer groups revealed that they wished to change the individual payments to a payment for the entire group. They prefer to keep the money of everyone in the farmer group account, to be used for the benefit of the entire group. In this way, the farmer group has a substantial fund, with which they can buy for instance bush cutters and a drill to make holes for tree planting. provide bio compost for the trees, support for constructing a well/small water catchment construction in the farmer field, providing some machinery/equipment for digging holes for planting, weeding. If possible and allowed to use some of the budget to support farmers with fast growing plants like sweet potato, egg plant, etc. during the first- second year of the program (it will attract farmers to come to their field to taking care of the plant as well as the trees). These kinds of equipment are for the benefit of the entire group, and will make land management and tree planting easier and faster.

Figure 14 some farmer groups decide to use the carbon payments to buy drilling machines to make tree planting easier and faster for the entire group.

Part G. Ongoing participation

G1   Recruitment

In 2022 new areas (68.9 ha) were included. A total of 72 new participants have joined the restoration activities, and signed the PES agreements. Another 14 have also joined but have not signed the PES agreement yet, as they joined late 2022 (Dilam), and will add |another 16.5 ha to the 68.9 ha. By June 2023, the PES agreement will be signed, hence included in the next annual report.

G2   Project Potential

- Another new area has been included in collaboration with the Dutch-Indonesian food company Go-Tan. The area is located in Pesisir Selatan, West Sumatra Province. Their need for offsetting can be covered in about 20 ha. But in order for us to make it more effective, we will also co fund another 30 ha, making a total of 50 ha. This will enable us to hire a new staff, who will manage 50 ha. Some of the trees that will be planted here are, amongst others, the *melinjo* nut trees and nutmeg trees. The second half of 2023 the nursery should be up and running so that the seedlings can be planted out late 2023/early 2024, in other words, in the next rainy season. The PES agreements will also be signed in 2023.
- Another huge potential area is in Lampung province, South Sumatra. Here, an area of 100 ha has already been targeted to start new restoration activities. First half of 2023, the FPIC process and tree choices will be finished, so that preferred tree seedlings can also be integrated into the nursery and planted late 2023.
- Our work in West Timor is gaining ground. We are working on the final set up of restoration work in addition to what was already done in the communal areas. We hope to send in a technical specifications chapter to Plan Vivo by the end of 2023, to start the process of certification for the initial 100 ha.
- Finally, we are I contact with a befriended NGO on Flores, who have expressed interest to join the mission of CO_2 Operate and the Gula Gula Food Forests program. In 2023 a first visit will be made to the area, and initial discussions to see if we can include the area into the Gula Gula Food Forest programs.

G3   Community participation

Community participation remains a crucial component in all our activities. One example of this is the earlier mentioned change in carbon payments from individual to a group payment. We always support good suggestions brought forward by the participants. Details of the community meetings held fall under monitoring results. Annex 2 shows some pictures of the farmer and community meeting, which are regularly organised by the field staff of RPL. Thes can be organised either in a farmer's house, the Wali Nagari office or in the field. For each site there is a regular update including progress on tree planting, nursery establishment, seed and seedling raising, and challenges encountered (if any), and how they will be solved. The field work by the RPL staff has intensified, and made possible by the building and opening of a great field office in Sirukam village, a centrally located village in our project sites. From here, all sites can be reached within a 30-minute drive using a car or motorcycle. They spend about 4 days a week full time in the field, and sleep in the field office, where 3-4 bedrooms are. So, there is a continuous monitoring and connection to the farmers throughout the week.

Part H. Project operating costs

H1   Allocation of costs (USD$): fiscal year 2021

The allocation of costs for 2022, from the project coordinator, is detailed in Table 18. The costs listed in the next annual report will be subject to the usual Plan Vivo Standard requirements.

Table 18 Allocation of costs 2022 (USD$)

Expense	Narrative	Amount (USD$) Total	Contribution from sale of certified carbon credits	Contribution from other sources			
				Reduce, re-use, regrow**	FMO*	RVO	CO$_2$ operate
Total							
Technical assistance (VCM)	Technical assistance RPL	26,122	24,122			2,000	
	Field costs (tree monitoring, mapping, team meetings)	3,835	3,835				
	Community meetings	3,449	3,449				
	Consultancy fees carbon	15,175					15,175
Nursery							
Original Nursery	Nursery/ seedling costs	4,753	4,753				
Nursery extension		1,998		1,998			
Reservation compost for tree planting		85,000	85,000				
Office costs		11,608	11,608				
Farmer Carbon payments		17,013	17,013				
Sub Total		**168,953**	**149,780**				
Product development	6,245 1,561						
Personnel							
Farmers training						2,254	513
Processing units						4,991	1048
Fee CO$_2$ Operate		63,242	27,106		36,242		
Total		**232,195**	**176,886**	**1,998**	**36,242**	**9,245**	**16,736**

* FMO contributions constitute loans that must be paid back with interest at later dates
** In total we received U$ 13,927 from the US-based organisation Reduce, Re-use, Regrow in December 2022. Remaining funds for nursery extension are invested in 2023

In 2022, the sale of carbon credits has really taken off. With almost €200,000 in sales, we are able to increase our contribution to tree cultivation. For one, we have reserved a substantial amount for providing additional compost to the participants as part of the carbon payments. Remaining funds are kept for tree (re)planting. However, calculations were not finalised yet by late 2022, so is not yet included in the budget of 2022.

In 2022, we also finalised the RVO funds to build processing units. With the funds from RVO we were able to build a composting unit as well, which has been in full operation for over 6 months already in 2022. Testing the quality, showed that the NSI (National Standard Indonesia) has already been achieved, hence it can be sold to anyone, if there is a surplus after providing the participants with compost for their trees. We received a donation from a US-based tree planting organisation, called reduce, re-use, regrow for purchasing hardware for the extension of the nursery (polybags, bamboo poles, paranets, wood, and so on).

Annexes

Annex 1 Species composition

Name of system	Paningg ahan (VD2017-1)	Paningg ahan (VD2017-2 2017)	Air Dingin (VS2020-1)	Paningga han, Junjung sirih FMO 1a	Junjung Sirih, FMO 1b	Selayo FMO 2a	Selayo FMO 2b	Sirukam FMO 3	Koto Baru/ Air Dingin FMO 4	Paninjawan FMO 5a	Paninjawan FMO 5b	Sirukam II FMO 6
Total no. of trees/ha	700	700	2,000	1,500	750	1,500	750	2,000	2,000	1,500	1,500	2,000
Avocado		56	50	50	160	50	160	50	120	30	50	50
Areca	40	70										
Bayur											60	
Cinnamon			500					500	500			500
Clove	280	140			240		240					
Cocoa												
Coffee Arabica			1,000					1,000	1,000			1,000
Coffee Robusta				1,000		1,000				1,010	1,050	
Durian		56										
Jengkol	40	56		25	75		80			80	80	
Jirak	40	70										
Lamtoro (Leuceana)			250	250		250		250	250	252	260	250
Mahogany	140	70	200	75	100				130			
Mangosteen		56										
Petai	40	56		25	75	50	80					
Shorea												
Soursop												
Surian	140	70		75	100	150	190	200		128		200

Annex 2 Pictures community meetings