2024

Gula Gula Forest Programs Indonesia Annual Report for 2023

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Annual Report for Gula Gula Forest Programs

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Ecosystem restoration in the Singkarak River Basin, West Sumatra

Annual report year January 2023 – December 2023

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Date of submission: 26 April 2024

Summary

Project overview	
Reporting period	January 2017– January 2024
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, 6. Kecamatan Bukit Sundi, Nagari Dilam
Technical specifications in use	Ecosystem restoration in the Singkarak river basin, West Sumatra Improved land use in the Singkarak river basin, West Sumatra

Project indicators	Historical (2017-jan 2023)	Added/ Issued Jan 2023-jan 2024	Total (rounded off where needed)
No. smallholder households with Payment for Ecosystem Services (PES) agreements	367	21	388
No. farmer groups with PES agreements	7	1	8
Approximate number of households (or individuals) in these farmer groups	367	21	388
Area under management (ha) where PES agreements are in place	271.7	28.2	299.9
Allocation to Plan Vivo buffer (tCO_2) (See Table 8)	12,434*	891	13,325
Saleable emissions reductions achieved (tCO_2) (See Table 8)	65,279	4,679	69,958
Unsold stock at time of submission (PVC), including reservations (= holdings)			32,427**
Unsold stock under reservation			4,544
Plan Vivo Certificates (PVCs) issued to date (incl. buffer)			**77,713**
Plan Vivo Certificates requested for issuance, incl. buffer (2023 Vintage)			**5,570**
Total PVCs issued (including requested 2023 in this report)			**83,283**

* There was a minor miscalculation in the 2022 report (12,433 instead of 12,434), so we included the correct figure here.

** This figure includes reservations of 4,544 and represents the situation until 2023 (Table 9). .

Part A. Project updates

A1 Key events

1. Growing interest in our carbon credits

The year 2023 has been another positive year, but obviously with some (un)expected challenges as well. As the sale of carbon credits increased significantly, as well as the price per credit. Clients in the EU seem to request for our Gula Gula carbon credits, which combine climate benefits with the way we work with and for local communities. In 2023, we also started to monitor our biodiversity impacts, which we hope will further increase demand.

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 an increasing number of farmers see the benefits and express interest in joining the restoration work. Within Solok District, Nagari Dilam is a new village where we have signed "Plan Vivos" with a new farmer group in 2023.

2. Project certification and New PES agreements

On the one hand, it is a bit unfortunate that the socio-political issues described above have had some negative impacts on the amount of new carbon credits that we could generate in 2023. On the other hand, the year 2023 has given us relatively good rains, and replanting efforts have shown good survival rates.

Therefore, this annual report shows that only 28.2 ha were added to our restoration areas in Sumatra in 2023. Namely, in Dilam village, where 21 new farmers have signed the PES agreements in 2023 (Table 1).

Table 1. New participants/areas and signed PES agreements in 2023.

Site name	Agroforestry system	No. Participants	Total area (Ha)	No. trees/ha	Total No. Trees	PES Agreement signed	Eligible for certification
Dilam (FMO7, 2023)	Arabica-based	21	28.2	740	20,868	**Yes**	**Yes**

3. Pilot project on biodiversity monitoring

We conducted a pilot project on biodiversity monitoring, both above-and belowground. For the above-ground measurements we collaborated with Biometrio.earth from Germany with whom we installed bio acoustics in combination with camera traps. They analysed the data, which were very encouraging, especially after getting the Sumatran Tiger on video in our sites. For the belowground biodiversity we collaborated with the Faculty of Soil Sciences from Brawijaya University, Malang, East Java. This

generated interesting results as well, and the plan is to continue on a longer-term basis from 2024 onwards. The main results are presented in this Annual Report.

4. Setting foot in new districts: new challenges

We moved to a new district in West Sumatra, called Pesisir Selatan. The initial village we targeted had to be cancelled in the end due to local socio- political issues. This caused a delay of almost one year to start implementing our restoration work in this district, as a new village had to be found, and the entire Free, prior and informed consent (or FPIC) process had to be finalised first in the new village. We had hoped to include new credits from this area in this report, but the PES agreements will only be signed in mid-2024 (see Section A4). But all went well, so they may be integrated into the 2024 Annual Report. Like in the other areas, we hope that our activities here will trigger interest and willingness to participate from other villages in this new district. It seems to be working already within the village. Where we aimed for 25 ha to offset the unavoidable emissions for the new partner, an increasing number of farmers was asking our team if they could also join the program. By late 2023, over 60 ha was already included.

In 2023, several trips were made to Lampung province, South Sumatra. Here, we collaborate with the Ministry of Backward Regions and Transmigration, with whom our local partner (RPL) signed a MoU in 2022. The local Lampungese population living here is classified as one the poorest in Indonesia. A restoration project could help them with restoring the degraded areas and with improving their livelihoods. We are happy to say that in 2023, the local district office of the Forestry Department has joined us to help with finding the right area to start the program. A young female forestry officer, graduated from Lampung University, has become our local contact point to work fulltime with us. She will work directly with RPL to set up the first 100 ha of restoration activities. Again, where the initial plan was to implement the work in 2023, and to get PES agreements signed, political issues made us to halt the implementation of our restoration activities in the initial village we selected with the Ministry of Backward Regions. Finding a new area and village delayed our work in Lampung by almost one year. However, by late 2023 all this was solved, and the RPL team will work with the forestry officer(s) to get PES agreements signed by late 2024. The first phase of the FPIC process has been successfully finalised (including village selection, Farmer Group Discussion (FGD) meetings to identify potential participants and to discuss their preferences for tree species have already taken place).

5. Tree product development phase to access global markets

The year 2023 also showed the continuation of processing of some selected tree products from the restored food forest area (coffee and clove essential oil). In addition, the composting unit will produce around 8 tons of compost each month to support our farmers with adding compost to planted seedlings.

The imported and roasted Gula Gula coffee (an initial test of 100 kg/year in 2023) was introduced to potential customers in the Dutch and EU market with an informal coffee tasting event (see photos in Figure 1). This event was organised in the city of Woerden, the Netherlands, where both organising companies, CO2 Operate B.V. and Overhoop Koffie, are based. Overhoop Koffie is a coffee roasting social enterprise that works with refugees and homeless people.
The informal coffee tasting event was attended by three high-ranked officials from the Indonesian

Embassy in The Hague. We handed over the first bag of coffee to the first Secretary of the Indonesian Embassy during this event.

The coffee was sold out quickly, and in 2024, we will scale up the imports significantly as the demand is high.

Figure 1. Gula Gula coffee tasting event in Woerden, the Netherlands

A2 Successes and challenges

Also in 2023, we faced various challenges and successes. We left the COVID period behind, and saw that the survival rates were back to "normal". Recent plantings showed a survival rate between 70-80%, which is what we usually achieved after the first year of planting the seedlings. Our move to a new district and province obviously brings new unexpected challenges.

1. Socio-political challenges in the new targeted areas

Pesisir Selatan District

In 2022, we began scoping activities and the FPIC process in a village called Pesisir Selatan, in West Sumatra, that asked us to come to their village. The FPIC process went well at first. However, during one of the visits, the village head told our team to work with another farmer group; a farmer group different from the farmer group we had already started working with, and for which the village head had given us permission.

After a long discussion with the village head, we decided to start working with the farmer group he had

selected, including an explanation about the Gula Gula program and the promise that we would come back to them in the (near) future. Up to this stage, the members of this farmer group refuse to join the program, simply because they felt it was unfair that the other farmer group was already working with us, but was not allowed to continue with the program. They did not want to cause a conflict within the village. This turned into a deadlock.

Turned out the head of the initial farmer group was the competitor of the current village head in the upcoming elections for village head. He was afraid that our project would support his competitor. Although it somehow feels good, that our interventions seem to be really valuable for everyone in a village, we were unfortunately not able to continue there. However, the news of our potential interventions reached a nearby village. They invited us to come to their village. Here, it all went well, and we will sign PES agreements early 2024.

Lampung, South Sumatra

Politics of a different kind hampered our initial efforts in Lampung. Initially, we combined the efforts of the Ministry of Backward Regions in a village with our restoration activities. The ministry started to implement a goat-fattening program to improve livelihoods of the poor Lampungese population. We would integrate this with our restoration activities, also by integrating some fodder trees, such as Lamtoro (*Leucaena leucocephala*)and *Calliandra spp.*. With a one-way bus drive of 25 hours, the RPL staff spent quite some time in the villages to conduct the FPIC process and all necessary activities. When they were about to sign the PES agreements, the village head unexpectedly refused the continuation of our restoration activities. Again, we had to leave the village and find an alternative location. A very sad story for the villagers, as even the ministry was threatening to take out the goat-fattening program, leaving them with nothing. The exact reason why the village head had refused the continuation of the restoration project remained unknown, but possibly the cultivation of oil palm could have become a competitor.

2. Adapting to climate change continues to be a main challenge

Monthly rainfall patterns in the project area from 2019 until 2023 are shown in Figure 2. Again, the rainfall pattern shows a highly erratic pattern. The year 2023 (green line) also began with little and erratic rain, where usually rains should increase a bit (black line). The new rainy season in West Sumatra usually starts around August. However, 2023 shows a relatively dry period from August to October, which used to be the planting season for all crops, including rice, and trees. Rains took off well in November and December, but as can be seen these were highly intense rains. This change in weather patterns is not supporting crop growth, as most rain water will run off, causing erosion and floods.

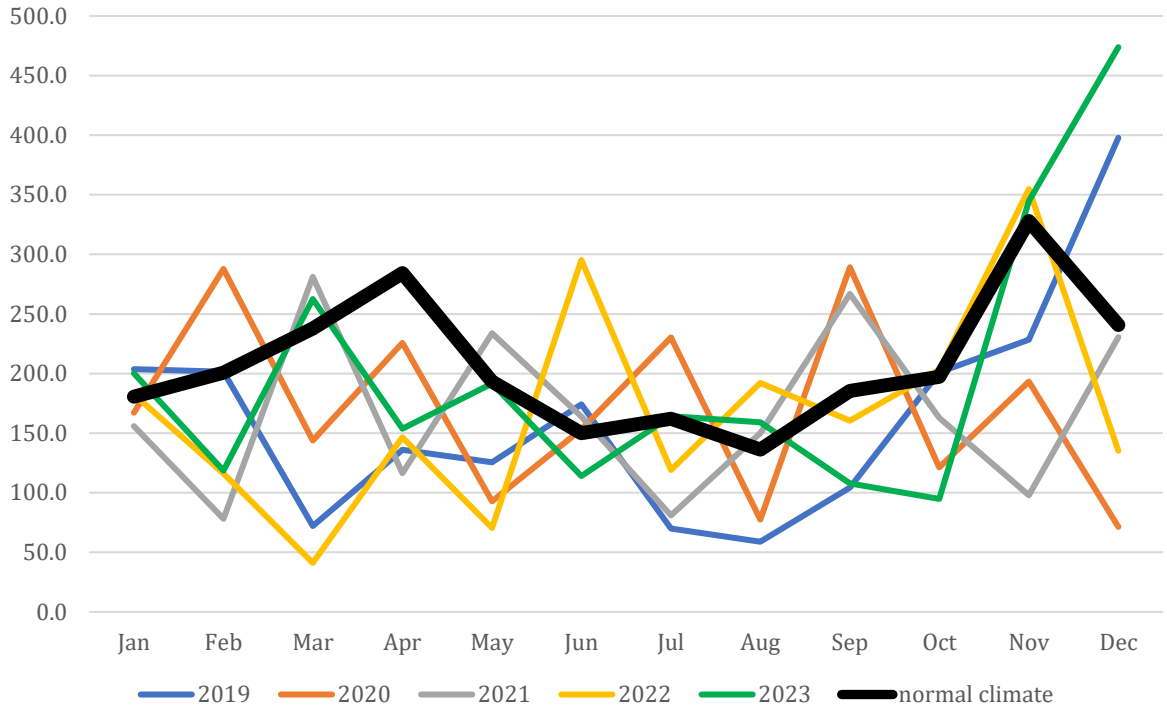


Figure 2. Monthly rainfall in the project area from 2019 until 2023. *Source: village based meteorological stations in Nagari Paninggahan, Sirukam, Selayo, Air Dingin.*

Farmers are adapting to these circumstances, not only by rescheduling planting times. They also increasingly reduce weeding. Weeding is restricted to ring weeding around the seedlings in order to protect the soil against erosion when heavy rains fall, and minimise evapotranspiration in times of no rain.

An increasing number of farmers also let the weeds grow to the extend where the trees can just keep their "head above water" (Figure 3). This type of ring weeding also has the advantage of saving on labour costs and time. They know that once the trees grow and provide shade, most of the weeds will disappear anyway, so ring weeding seems to tackle various issues simultaneously. This kind of farmer-induced adaptation is a very good lesson for us as well. We look at how to optimise this, without causing too much competition between the trees and the weeds, so that we can include this kind of practice in our training sessions on ecosystem restoration for new farmers.

Figure 3. Climate change adaptation, limiting management to ring weeding, let weeds grow as soil cover, and protect existing, indigenous trees for shade.

Also, several new participants have chosen a restoration site, where big trees are found in the vicinity. They know there are many seeds and seedling in the field, as the seeds from these trees will fall into the restoration sites. In most cases, these are indigenous and fast-growing trees, well adapted to the changing weather. AS with assisted natural regeneration, the farmers choose to protect and let these seedlings grow, as they will provide relatively quick shading, which benefits the planted economic valuable agroforestry trees.

A3 Project developments

1. Staff changes in RPL

Also in 2022, staff of our local partner RPL continued to grow (Table 2). In 2023, our growing activities and demand for carbon credits enabled us to hire 4 new staff members for the RPL team. In addition to project staff to supervise the new activities in Pesisir Selatan and Lampung, one person was hired to manage the biodiversity monitoring research and the databases for our increasing monitoring work (Biodiversity, farmer data base, GIS database). An additional person was hired to support the increasing work in the nursery.

Table 2. Staff dynamics of our local partner RPL (2019-2023).

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 CO2 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 - present	Nursery Coordinator	Nursery development, seedling raising and management	Manager Nursery Program
10	Ferdi Syah Putra	Male	Jan 2023- present	Nursery Assistant	Seedling raising, mapping and tree monitoring support	Assistant Nursery Program
11	Verdynan Wahab	Male	Dec 2022 – present	Bio-acoustic field staff	Forester	Enumerator for bio-acoustic assessment
12	Ilham	Male	May 2023 - present	Nursery Assistant	Seedling raising, mapping and tree monitoring support	Assistant Nursery Program
13	Habibburahman	Male	Juni 2023 - present	Project Officer	Forester, community engagement	Manager Pesisir Selatan, West Sumatra
14	Meisha	Female	July 2023 - present	Project Officer	Forester, community engagement	Manager Pesisir Barat, Lampung program
15	Yudha Saktian S	Male	Dec 2023 - present	Project Officer	Mapping/GIS specialist, environmental science	Biodiversity, database and spatial analysis Officer

By far, most of the staff consists of young people. This relates to another pillar of us, which is to build capacity for local, young, people. They are the future in general, and for sustainable development in particular. In the nursery, additional staff was hired, as the nursery keeps growing in size. A team photo is shown in Figure 4.

Figure 4. The team in October 2023 in front of the field office.

With growing staff numbers, RPL has also opened a great field office, where everyone stays during the week. Some of the young staff also stay there over the weekend (Figure 5). The team has made the design, and it has become their home away from home. The field office is the place where they eat, sleep and most importantly, socialise. Nearby farmers regularly visit them in the evening, to talk, have fun or join in for karaoke. The field office is centrally located for the field activities. Each site can be reached within a maximum of 30 minutes by car or motorcycle. The composting unit is next to the office, and the place also serves a training centre for our farmers. In addition to learning about the composting process, it is also a nice learning and inspiration site for farmers to develop their multi-strata agroforestry systems. The trees that can be seen on the drone picture in Figure 5 in between the office and the composting unit are in fact part of a mixed coffee agroforestry system. Farmers can walk around, discuss and get ideas for establishing their own restoration sites.

Figure 5. The newly established RPL field office for RPL work, overnight stays, visits, meetings and training.

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 8 established farmer groups, varying in size of members (Table **3**a and Table 3a). 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. Tables 4a and 4b show that in total we are covering 362.1 ha of restoration area in different ages of restoration, while in total we work with 435 farmers and their families.

Table 3a. Established farmer groups, members, restoration sites and size.

Site name	Paninggahan (VD2017-1)	Paninggahan (VD 2017-2)	Air Dingin (VS2020-1)	Paninggahan (FMO 1a,2021)	Paninggahan (FMO 1b,2021)	Selayo (FMO 2a, 2021)	Selayo (FMO 2b, 2021)
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

Site name	Paninggahan (VD2017-1)	Paninggahan (VD 2017-2)	Air Dingin (VS2020-1)	Paninggahan (FMO 1a,2021)	Paninggahan (FMO 1b,2021)	Selayo (FMO 2a, 2021)	Selayo (FMO 2b, 2021)
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	11.0	2.5

Table 3b. Established farmer groups, members, restoration sites and size.

Site name	Sirukam (FMO 3, 2021)	Koto Baru/ Air Dingin (FMO 4, 2021)	Paninjawan (FMO 5a, 2022)	Paninjawan (FMO 5b, 2022)	Sirukam II (FMO 6, 2022)	Dilam (FMO 7, 2023)
Kecamatan	Payung Sekaki	Lembah Gumanti	X Koto di Atas	X Koto di Atas	Payung Sekaki	Bukit Sundi
Nagari	Sirukam	Air Dingin	Paninjawan	Paninjawan	Sirukam	Dilam
Jorong	Kubang Nan Duo	Koto Baru	Balansiah, Ky Aro, Pasar, Gt. Tabek, Gurun, Kubu dan Batu Laweh	Air Batumbuk	Kubang Nan Duo	Rimbo Tangah, Tambang, Baru Karak
PES agreements signed	Jan-21	Jan-21	May-22	May-22	May-22	Nov 23
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	Kelompok Tani Rimbo Tambang Sepakat
Sub Group	None	None	None	None	None	None
No of participants	34	15	37	6	29	21
Total area (ha)	45.7	14.5	34.6	4.5	29.8	28.2

3. 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 2023. 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. For an overview of the species composition per system, see Annex 1. 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 hectare and species composition.

Desire for biodiversity monitoring

One recommendation from the validation report in 2020 was to conduct systematic biodiversity monitoring. We started a pilot project in February 2023 using science-based biodiversity monitoring, both aboveground and belowground (agro)biodiversity. Being the agents of soil structures, the belowground biodiversity work focused on the presence of worms (numbers and species). Together with staff and students from Brawijaya University in Malang, East Java, and RPL staff, we selected representative sites to conduct both aboveground and belowground biodiversity research, and to collect soil samples from these plots to analyse potential soil carbon variations among different ages of agroforestry systems. By August 2023, reports for both the aboveground and belowground biodiversity were finalised. More details can be found in section E4.

Table 4. 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 have been collected ***Reccomendation 1****: We recommend that a periodic survey of mammal and bird species is included in the biodiveristy monitoring plan.*	- *Field measurements have been conducted by students from Brawijaya University. Baseline field data for Imperata grasslands, semak/belukar (shrubs) and fern vegetation from the field resemble the data we used from various sources of literature. A pilot study phase has been completed in 2023, showing very interesting results, both for above-ground and belowground biodiversity monitoring. Early May 2024, a continuous monitoring of aboveground biodiversity will start for a period of 3 years.*

A4 Future Developments

1. Project Expansion and New Partnerships

In 2023, we continued our activities in West Sumatra and additionally expanded to a new province, namely South Sumatra province, where we are working in Lampung.

West Sumatra, Pesisir Selatan

In Pesisir Selatan District, the FPIC process was finalised late 2023 after some challenges which are described in Section A2.1. This project comprises a so-called insetting project, in which a Dutch partner producing Asian food ingredients, sauces and food is investing in the area for rehabilitation. They are interested in products from the *Melinjo* tree under a multi-year contract, hence will obtain carbon credits within its own value chain.

Melinjo nuts are grown in Pesisir Selatan district, used to make "emping krupuk", which is a type of chips, usually consumed as a side dish with Indonesian food. This new partner is a major producer of the emping krupuk in the Netherlands and in the EU at large. In the future, the company aims to buy *Melinjo* nuts and nutmeg from this food forest which is going to be developed in a degraded area (see Figure 6). The signing of PES agreements is planned for May 2024. This degraded area is in close proximity to natural forest areas. Restoring this degraded area is important, as regular wildfires are expected to further destroy the adjacent natural forest areas. Setting up restoration activities in this area will thus also support forest protection. A number of sites are ex-rice fields (see Figure 6). Low production and lack of irrigation water for many years due to deforestation and climate change, forced people to stop rice cultivation, even though it has always been the backbone of the Minang culture. Although the FPIC process was largely completed in 2023, PES agreements will only be signed in April/ May 2024, and therefore this area is not yet included here for certification.

Figure 6. Degraded areas in Pesisir Selatan, including abandoned rice fields (middle, right).

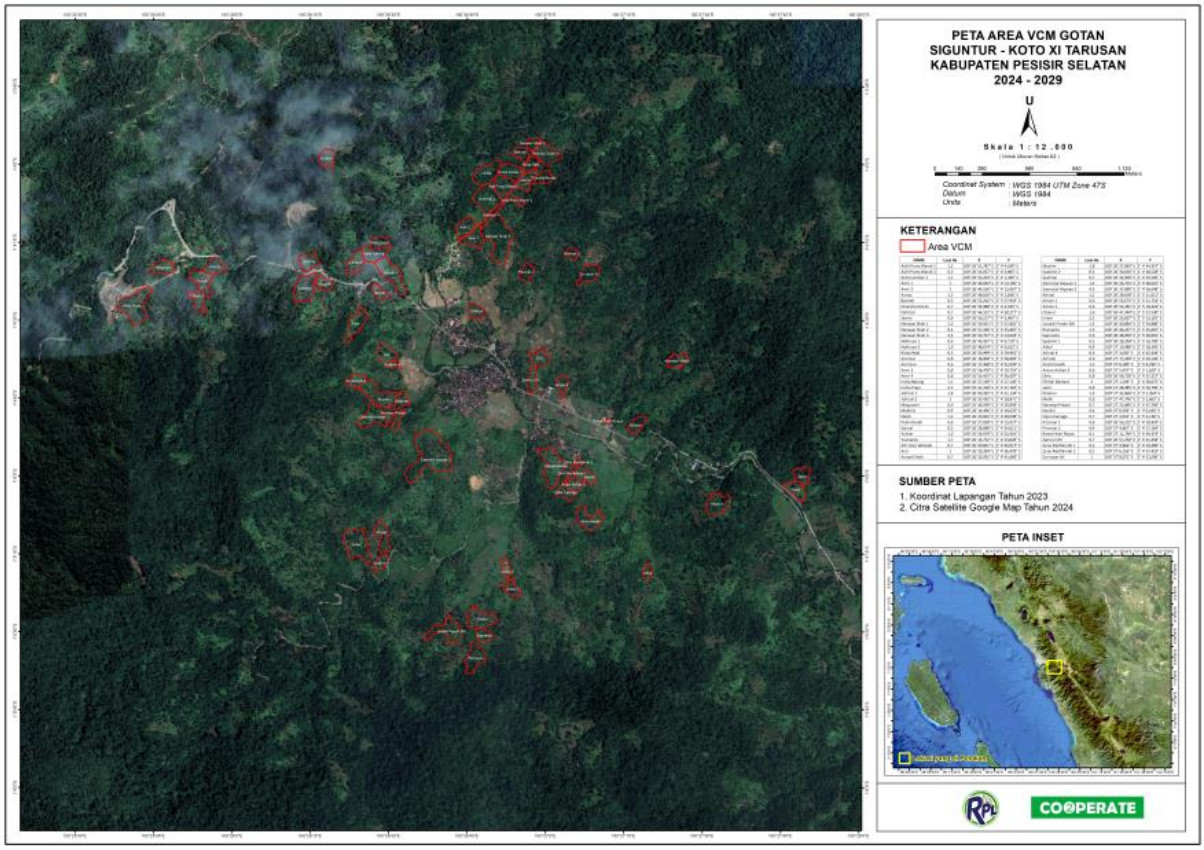


Figure 7. Example of the remote sensing photo of the area in Pesisir Selatan, made by RPL GIS staff.

South Sumatra, Lampung

In mid-2022, after signing an MoU with the Ministry of Backward regions and Transmigration in Jakarta, we began collaborating with this ministry in Lampung Province, South Sumatra. A former transmigration area, now mostly abandoned, showed that local Lampungese people are reclaiming what is now degraded land (see Figure 8). Our news staff, Meisha, was trained by RPL staff "on the job". She came to West Sumatra to join the fieldwork of all RPL staff during a 4-week period. The first 50 ha of degraded land to be restored were identified in 2023. Farmers who are interested to join this project have also been identified. The FPIC process is going well so far, and we hope to start planting the trees late 2024.

Figure 8. Baseline situation of the restoration area in Lampung province.

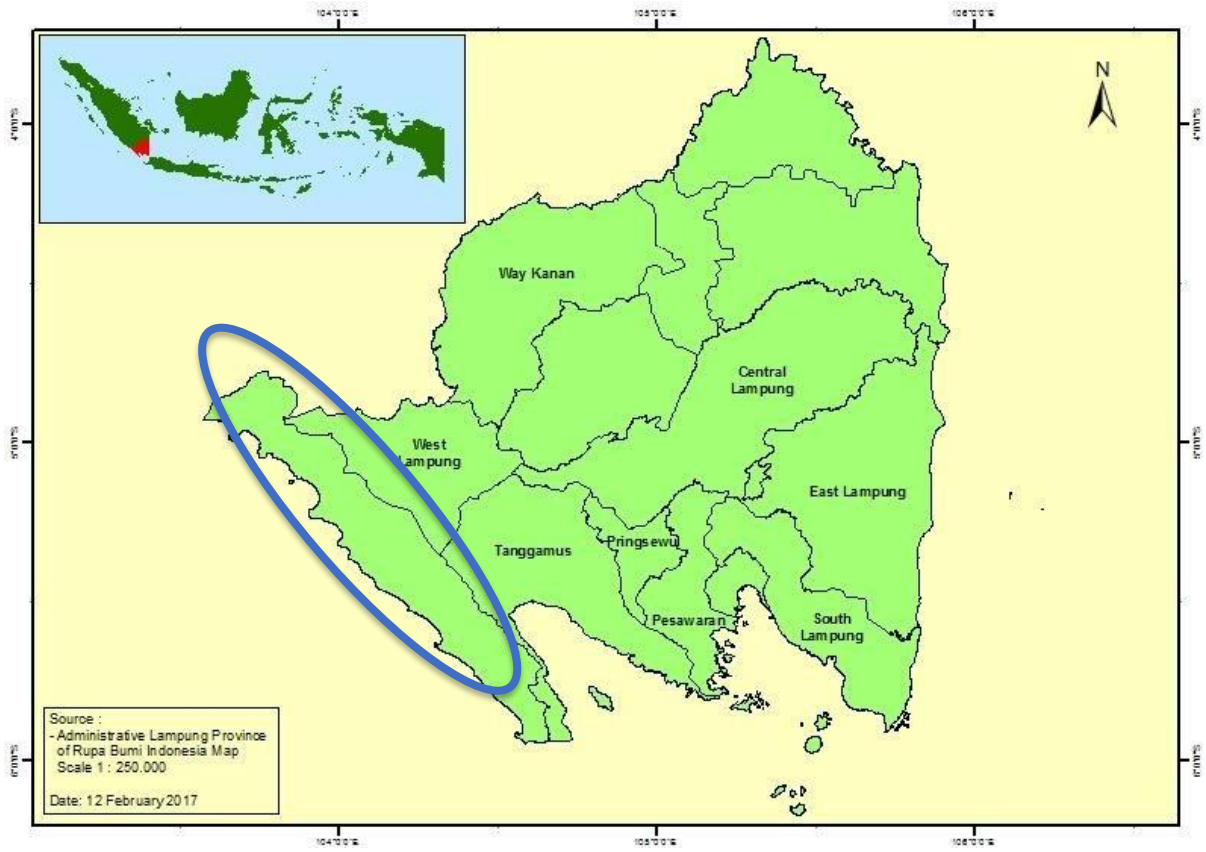


Figure 9. Map of the new restoration sites (in blue) in Lampung Province, South Sumatra.

West Timor: The Fashion Forest

In West Timor, East Indonesia, we started a new ecosystem restoration project in 2019-2020. With the local community, we 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 distributing *Leucaena leucocephala* (fodder tree) seedlings. However, cows and deer have eaten them. Only the Gliricidia seedlings remained untouched by roaming, hungry cattle and wildlife. As soils in this area are severely degraded, with hardly any biomass, we continue to focus on soil improvements by planting Gliricidia cuttings to accumulate biomass and fix nitrogen in the soil, before we can start planting other species intensively. The Gliricidia trees are now 2-3 years old, and a thin layer of biomass has formed. Hopefully in 2024, we can start restoration activities in this area in a more intensive way.

In 2023-2024, we also started to include the home gardens for more intensive tree planting. Here, fruit trees and other useful trees are planted, including *Leucaena leucocephala* (cut and carry fodder tree, picture on the right in Figure 10) and cotton (picture in the middle of Figure 10). The home gardens are around the house and well fenced-off, hence safe for roaming cattle. Home gardens are usually managed by the women in the household.

Figure 10. Women usually manage and operate the fenced-off home gardens around the house.

PART B. Project activities

B1 Project activities generating Plan Vivo Certificates

1. New PES agreements signed

As mentioned before, new PES agreements have been signed. Table 5 summarises the number of participants and areas where PES agreements were signed. In total, 21 PES agreements are signed for an area of 28.2 ha in 2023.

As indicated in an earlier section, the tree compositions of these agroforestry systems are similar 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, meaning 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 5. No. of participants and areas where PES agreements were signed, 2023.

Site name	Agroforestry system	No. Participants	Total area (Ha)	No. trees/ha	Total No. Trees	PES Agreement signed	Eligible for certification
Dilam (FMO 7, 2023)	Clove-based agroforestry system	21	28.2	740	20,868	Yes	Yes
Total		21	28.2		20,868		

Table 6. Variation in baseline situations in the restoration sites under certification (updated with new sites). *Some figures may not add up exactly, because they were rounded off scientifically.*

Name of agroforestry system	Baseline	Area (Ha)	No smallholder households	No farmer Groups
Ecosystem rehabilitation – clove-based agroforestry systems	Imperata	19.9	35	1*
Improved land management – clove-based and robusta-based agroforestry systems	Imperata	43.7	113	1* Same as above
Improved land management – arabica/ cinnamon-based and mahogany/cinnamon-based agroforestry systems	Ferns	80.0	102	2
Improved land management - arabica/cinnamon-based, clove-based and robusta-based agroforestry systems	Shrubs	156.3	138	5
Total		299.9	388	8

*The location of these systems is in the village Paninggahan. In this area, there is only one large farmer group, divided into 2 subgroups. One subgroup focuses on ecosystem restoration, while the other focuses on the conversion of commercial vegetable areas 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 may first of all depend on the selected tree species. For instance, clove trees need wide spacing, as they will grow into big trees, but also farmers need a ladder to harvest the cloves. So spacing is needed for this. In other cases, farmers may wish to intercrop with vegetables (*Tumpang sari*) for the first 2-3 years, until 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 more and more supporting farmers to plant some additional trees in the open spaces (*sisipan*), once vegetables can no longer be intercropped.

Figure 11. In Paninggahan village, trees are planted in various densities, depending on tree species and a farmer's wish to plant annual crops in the first 2-3 years of tree establishment.

2. Professional, large nursery developed

With growing areas and activities, the nursery continues to expand. For this reason, RPL was able to hire 2 additional staff to help in the management of the nursery.

Figure 12. Local women from surrounding villages who were hired to fill polybags with soil and seeds.

During the peak periods, when soil needs to be mixed, and seeds must be placed in the polybags, local people from surrounding villages are hired to put the soil and seeds in the polybags. Heavy duties, including mixing of soil with compost is done by men (our nursery staff), while the women put the soil and seeds in the polybags. In total around 10-11 women work in the nursery for a total of 21 days per person. In this way, surrounding villagers also benefit from the presence of the nursery.

- The nursery is part of the Gula-Gula Forest Program (GGFP) which is located in the village of Sirukam, Solok Regency, West Sumatra Province. Rimbo Pangan Lestari (RPL) is the local partner of GGFP in West Sumatra who conducts the program together with the local farmers. The purpose of this nursery is to provide the tree seedlings for GGFP farmers for land restoration using agroforestry system.
- We expanded the current nursery to raise larger amounts of seedling for the program. The nursery installation was done from January – March 2023. The first seedling activities started in April 2023 with various tree species.
- The type of tree species for the program are chosen by farmers. This means that tree species may vary from one site to another site.
- Time needed to raise seedlings varies among the tree species. It can take 4 – 8 months before they are ready to be planted in the field.
- Timing to start the seedling activities also varies, due to seed availability and weather issues, caused by a changing climate. The period to release the seedlings to the farmers may therefore differ, even for one species.
- We have reached a target of 81,000 seedings in November 2023, and are adding it into 150,000 seeds and seedlings by April-May 2024.

Table 7. Tree species list and counts in the nursery per 30 November 2023.

No	Tree Species (Indonesia)	Tree Species (Latin)	Number of trees
1	Kopi Robusta	*Coffea canephora (Robusta)*	15,635
2	Kopi Arabika	*Coffea arabica (Arabica)*	22,862
3	Kulit manis	*Cinnamomum verum (Cinnamon)*	24,981
4	Jengkol	*Archidendron pauciflorum*	2,000
5	Cengkeh	*Syzigium aromaticum (Clove)*	9,527
6	Alpokat	*Persea americana (avocado)*	1,000
7	Kayu Africa	*Maesopsis Emenii Engl*	4,395
8	Bayur	*Pterospermum javanicum Jungh*	960
		Total number of trees	**81,360**

B2 Project activities in addition to those generating Plan Vivo Certificates

1. Further improvements of coffee quality

Our coffee was graded (called cupping) by ThisSide up coffee in Amsterdam, the Netherlands. On a scale from 0-100, both varieties reached over 80 points (82 for Coffee Robusta and 85 for Coffee Arabica). This means that the coffee falls in the specialty coffee market segment, which is considered high quality coffee by experts. We are working with the farmers to increase the quality of the coffee above 90 points, which will give the highest price for the coffee. One important aspect is to select the best beans without defects, e.g. no small holes in the beans caused by insects. In addition, beans will be a bit larger when compost is added in sufficient quantities, which also increases the scoring. We will start with providing compost from our own compost units for free to coffee farmers. For 2024, we aim to buy at least 1 tonne of coffee beans from the farmers in our projects.

2. Kopi luwak; an unexpected new, highly valuable product in our sites

During our previous field visit, some farmers complained about the “musang” (civet cat). They were eating the best and ripest coffee cherries, and were subsequently excreting many small heaps of these best raw coffee beans in the sites. According to the farmers, these beans were now useless.

The civet cat picks and eats the ripest and flawless red coffee cherries, and inside the civet’s stomach and intestine, the beans start to germinate by malting. This reduces their bitterness and improves their taste. When performed in the wild, these two mechanisms achieve the same goal as selective picking by the farmers and the wet or washing process of coffee milling.

We got quite excited seeing many of these excreted beans in the coffee agroforestry sites. It means there is the one and only real natural production of the famous *Kopi luwak* in our sites. Where most *Kopi luwak* these days stem from intensive farming methods, where civet cats are kept in “animal-cruel” battery cages and are force-fed coffee cherries, this is the real and natural *Kopi luwak* from Civet cats in the wild.

After explaining to the farmers that the coffee made from these excreted beans is called *Kopi luwak*, one of the most expensive coffees in the world, especially when collected from the wild, obviously, the farmers started sharing our excitement. They became eager to collect the beans from the sites and sell to us at a higher price, turning "their assumed losses" into a high-end and exclusive product.

Between 5-10 farmers have taken up the collection of "natural *Kopi luwak"* beans. Others are looking at what it will bring. This period is one of raising awareness and interest in collecting the excreted beans in the field.

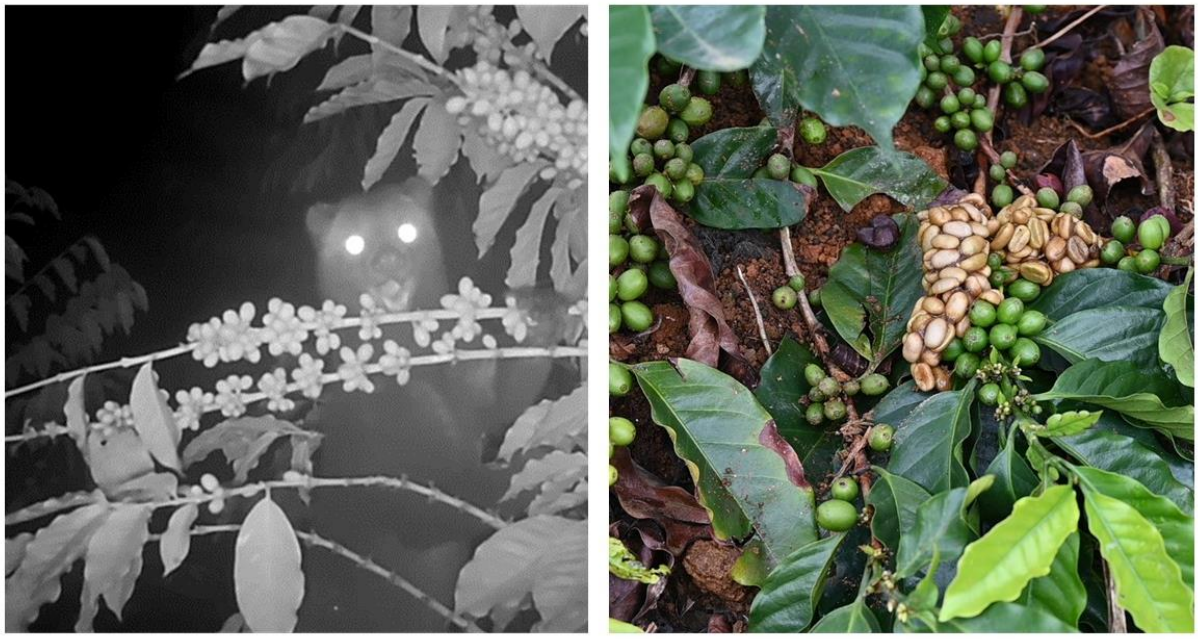


Figure 13. Civet cat (photo on the left) and a heap of excreted beans (photo on the right) in a coffee-based agroforestry site.

3. Biodiversity impact study

In 2023, we completed a pilot project on the use of bio acoustics and wild cameras to see if these technologies could help us in monitoring impact on biodiversity. The pilot turned out to be highly successful, where we even got the Sumatran Tiger (*Panthera tigris sumatrae*) on video.

In addition, we also collaborated with staff and students from Brawijaya University in Malang, East Java, to conduct research on belowground biodiversity, focussing on agrobiodiversity.
Besides soil samples and carbon storage tests in the soil, worms were collected as an indicator for soil health. Here, encouraging results were also deducted. The complexity of the entire research means that we will continue to work on both topics, above- and belowground biodiversity in 2024 as we plan to set up a multi-year continuous monitoring systems for aboveground biodiversity. Details of the results for the biodiversity monitoring pilot project can be found in section E4.

PART C.

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 restoration 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
- Land is outside the State Forest Land Area
- 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 restoration contract.
- Have agreed on (and co-signed) the restoration contract.

A PES agreement is only signed when:

- An offsetting client has signed a contract with the project coordinator, CO_2 Operate B.V. for a certain offsetting target.
- Or in the case of FMO bank or our business angel, have received the development capital.
- Recently, since sales of our carbon credits are going well, CO2 Operate and the local partner invest upfront in restoring new degraded areas using their own financial reserves. On average, a 100 ha (and co-signed) per year can be restored with the available funds.

This guarantees that carbon funds are secured and available to start working with the farmer participants, and no disappointments occur among the poor, local farmers.

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 8. For 2023, we have a new request form the village of Dilam, where PES agreements were signed in 2023.

Table 8. 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. See Annex 2 for outcomes of the calculations without rounding off) (colour coding: historical, certified systems/areas and new systems/areas).*

				A	B	C=A*B	D	E=D*C	F=C-E
Site code	Site name	*Tech specs System*	No. participants	Total area (ha)	Carbon Potential (tCO_2/ha)	Total ER's (tCO_2)	*% buffer*	No. of PVCs allocated to buffer this period	Saleable ER's (tCO_2)
VD2017-1*	Paninggahan (bukit Panjang 2017)	*Clove-based*	35	19.89	225.81	4,491.36	*16*	718.62	3,772.74
VD2017-2	Paninggahan (Subaka, 2017)	*Clove-based*	45	14.36	189.42	2,720.07	*16*	435.21	2,284.86
VS2020-1	Air Dingin (2020)	*Arabica - cinnamon*	87	65.52	357.85	23,446.33	*16*	3,751.41	19,694.92
FMO2021-1a	Paninggahan (FMO 1a)	*Robusta-based*	3	2.20	286.18	629.60	*16*	100.74	528.86
FMO2021-1b	Paninggahan FMO 1b	*Clove-based*	65	27.10	298.54	8,090.43	*16*	1,294.47	6,795.96
FMO2021-2a	Selayo (FMO 2a)	*Robusta-baed*	5	11.00	228.88	2,517.68	*16*	402.83	2,114.85
FMO2021-2b	Selayo (FMO 2b)	*Clove-based*	6	2.50	245.14	612.85	*16*	98.06	514.79
FMO2021-3	Sirukam (FMO 3)	*Arabica/ Cinnamon-based*	34	45.70	261.52	11,951.46	*16*	1,912.23	10,039.23
FMO2021-4	Koto Baru/ Air Dingin (FMO4)	*Mahogany/ Cinnamon-based*	15	14.50	347.90	5,044.55	*16*	807.13	4,237.42
FMO2022-5a	Paninjawan	*Robusta-based*	37	34.60	265.62	9,190.45	*16*	1,470.47	7,719.98
FMO2022-5b	Paninjawan	*Robusta-based*	6	4.50	272.21	1,224.95	*16*	195.99	1,028.96
FMO2022-6	Sirukam II	*Arabica-based*	29	29.80	261.52	7,793.30	*16*	1,246.93	6,546.37
FMO2023-1	Dilam (FMO 7)	*Clove-based*	21	28.20	197.52	5,570.06	16	891.21	4,678.85
	TOTAL		367	299.87	3,438.11	83,283.09		13,325.30	69,957.79

Part D. Sales of Plan Vivo Certificates

D1 Sales of Plan Vivo Certificates

The Gula Gula Food Forest Program 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 2023, we have seen a further increase in the sales of the carbon credits. More and more larger companies in the EU are finding us to purchase carbon credits to minimise their unavoidable emissions. In 2023, we retired 16,656 carbon credits as part of sales to a variety of clients in Europe. Reservations 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 9 breaks down the carbon credits sold in 2023, divided by vintage year (year of planting).

Table 9. Status 2023: Sales, reservations, and remaining, unsold credits in 2023.

		A	B	C	
Planting/ starting year certification	PVCs to retire for that vintage in 2023	Retired in 2023*	Balance before reservations	Reservations under multi-year contract 2023	Net amount for sale for 2024
2019	4,207	571	3,636	0	3,636
2020	11,869	2,258	9,611	0	9,611
2021	17,712	12,381	5,331	3,444	1,887
2022	15,295	1,446	13,849	1,100	12,749
Total*	**49,083**	**16,656**	**32,427**	**4,544**	**27,883**

*The newly requested vintages for 2023 are not included here.

Part E. Monitoring results

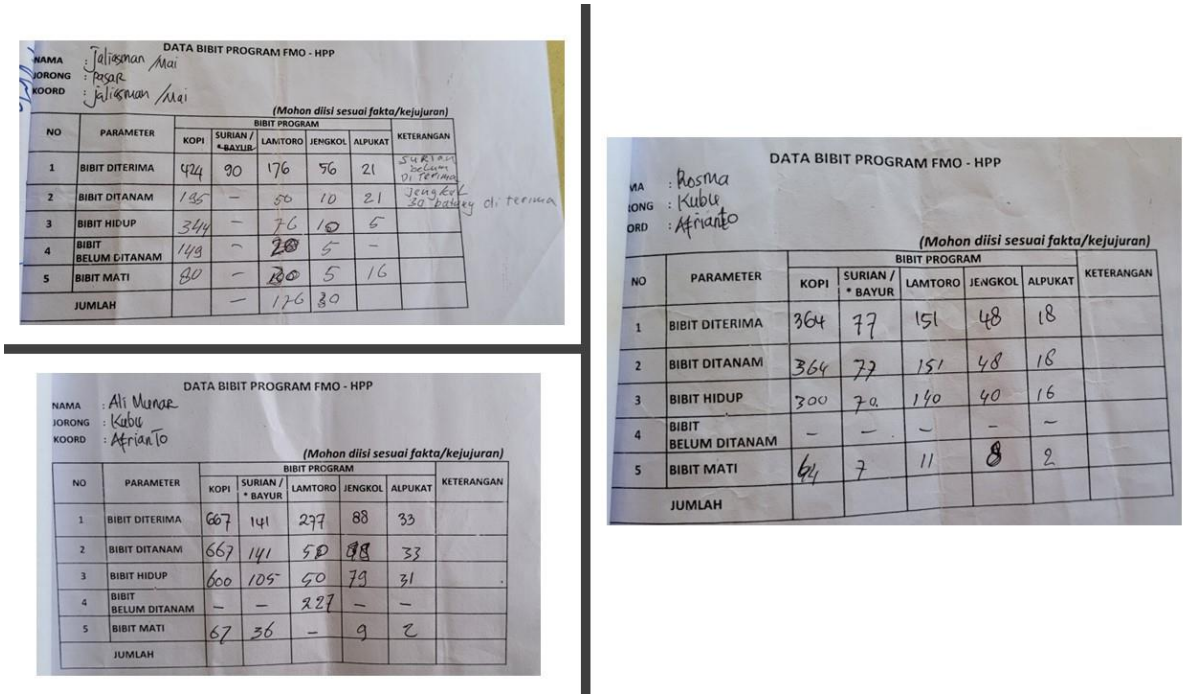
The tree-based systems in the Minangkabau society of West Sumatra have shown to contribute to a substantial number of SDGs. Monitoring progress towards the SDGs is growing in importance for the Gula Gula Forest Programs, now that some areas are reaching the age of full productivity in relation to environmental services and economic production (the harvesting potential).

We have developed a number of indicators which we think are important and where we can measure the impact on people's livelihoods and environment. In Figure 14 all SDGs are summarised, which can be found in Minangkabau society. In this report we focus on the tree planting component on the left (SDG 1,3,13,15), although SDG 2,4,5 are included to some extent as well in the socio-economic section of this report (Table 12).

Figure 14. Minangkabau agricultural practices can contribute to a variety of SDGs.

E1 Ecosystem services monitoring

Staff of our local partner is fulltime in the field during weekdays, working with the participants and monitoring progress. More and more farmers are trained to do their own monitoring. The team has provided them with a simple form, that the farmers fill in (Figure 15). Once a month, the group meets with the project officer of the RPL team, responsible for that particular area to discuss these forms, and where needed, make the necessary arrangements for replanting.



DATA BIBIT PROGRAM FMO - HPP

NAMA : Jaliaman Mai
JORONG : Pasar
KOORD : Jaliaman Mai

(Mohon diisi sesuai fakta/kejujuran)

NO	PARAMETER	BIBIT PROGRAM					KETERANGAN
		KOPI	SURIAN / * BAYUR	LAMTORO	JENGKOL	ALPUKAT	
1	BIBIT DITERIMA	424	90	176	56	21	Surian belum di terima
2	BIBIT DITANAM	185	–	50	10	21	Jengkol 30 belum di terima
3	BIBIT HIDUP	344	–	76	10	5	
4	BIBIT BELUM DITANAM	149	–	200	5	–	
5	BIBIT MATI	80	–	100	5	16	
	JUMLAH		–	176	30		

DATA BIBIT PROGRAM FMO - HPP

NAMA : Ali Munar
JORONG : Kubu
KOORD : Afrianto

(Mohon diisi sesuai fakta/kejujuran)

NO	PARAMETER	BIBIT PROGRAM					KETERANGAN
		KOPI	SURIAN / * BAYUR	LAMTORO	JENGKOL	ALPUKAT	
1	BIBIT DITERIMA	667	141	297	88	33	
2	BIBIT DITANAM	667	141	50	88	33	
3	BIBIT HIDUP	600	105	50	79	31	
4	BIBIT BELUM DITANAM	–	–	247	–	–	
5	BIBIT MATI	67	36	–	9	2	
	JUMLAH						

DATA BIBIT PROGRAM FMO - HPP

MA : Rosma
ONG : Kubu
ORD : Afrianto

(Mohon diisi sesuai fakta/kejujuran)

NO	PARAMETER	BIBIT PROGRAM					KETERANGAN
		KOPI	SURIAN / * BAYUR	LAMTORO	JENGKOL	ALPUKAT	
1	BIBIT DITERIMA	364	77	151	48	18	
2	BIBIT DITANAM	364	77	151	48	18	
3	BIBIT HIDUP	300	70	140	40	16	
4	BIBIT BELUM DITANAM	–	–	–	–	–	
5	BIBIT MATI	64	7	11	8	2	
	JUMLAH						

Figure 15. Examples of monitoring forms, filled in by our participating farmers.

Usually, the farmer will replace the trees with the same trees. However, if farmers see that a certain species is not growing well in their land, they will opt for another species that is showing good growth in their land. Usually, the first 2 years of establishment show the highest variation in successes or failures (a general figure from the literature shows that there is a death rate between 20-50% in the first 2-3 years). This is caused not only because trees are still small/fragile, weather conditions (rain in particular) can therefore have a large impact on the survival rates during the establishment phases of the trees in the field. With the changing climate, storms, dry spells or very heavy rains all affect the small seedlings. Careful monitoring and updating the planting schemes requires intensive collaboration with the participants. In addition, a more formal monitoring/evaluation with the head of the farmer groups and respective farmers is done before the annual carbon payments. Table 10 summarises survival rates and progress in replanting. We are recovering from the COVID years, Recent planting shows a more favourable survival rate, compared to the years of COVID. Figure 2 also shows that by the end of 2023, rains were intense, causing floods and landslides. One field of our participants was part of a landslide. Luckily, a minor incident, only affecting 2 ha, and the farmer only started planted recently.

Table 10. Tree survival and replanting needs.

Site Code	Program year	Planted Year	Target	ha	Number of tree (2023)	Replanting (2023)	Survival* * (2023) No.	%	Need to replant (2024)	Period to Replant
VD2017-1 VD2017-2	2017	2018	23,898	33.2	26,406	-	26,380	110 %*	0	n.a.
VS2020-1	2019	2020	131,040	65.5	131,040	11,267	52,280	40 %	78,760	Started replanting Jan 2024 (gradually)
FMO2021 _1a	2021	2021	3,300	2.2	1,991		1,312	40 %	679	Continued replanting Jan 2024 (gradually)
FMO2021 _1b	2021	2021	20,325	27.1	10,408	1,069	6,232	31 %	4,176	Continued replanting Jan 2024 (gradually)
FMO2021 _2a	2021	2021	16,950	11	14,469	4,270	10,476	62 %	3,993	Continued replanting Jan 2024 (gradually)
FMO2021 _2b	2021	2021	1,649	2.5	1,475	607	1,152	70 %	323	Continued replanting Jan 2024 (gradually)
FMO2021 _3	2021	2021	91,400	45.7	69,568	4,605	48,517	53 %	21,051	Continued replanting Jan 2024 (gradually)
FMO2021 _4	2021	2022	29,000	14.5	22,513	3,474	15,238	53 %	7,275	Continued replanting Jan 2024 (gradually)
FMO2022 _5a	2022	2022	51,900	34.6	41,644	32,258	23,115	45 %***	18,529	Focusing on planting in 2023 since distribution target still on process
FMO2022 _5b	2022	2022	6,750	4.5	4,612	3,982	2,728	40 %	1,884	
FMO2022 _6	2022	2022	59,200	29.8	33,990	14,440	26,769	45 %	7,221	Focusing on planting since distribution target still on process

*In the end, more trees were planted/protected and survived in the field compared to the target.

**survival rates include the replanting of trees in 2023.

*** From this point down survival rates seem relatively low, but as explained the first planting is still in progress, meaning not all trees had been distributed yet.

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 regarding discussions 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 is done by the farmer group and the high motivation of participants to join the restoration activates has shown few drop outs. Table 11 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 Food Forest Program 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. In 2023 there have been no changes, all are still active.

Table 11. 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
0		0	In 2023, no farmers left the program or were replaced.	2023	

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

E3 Socioeconomic monitoring

The socio economic monitoring consists of to what extent the tree crops can provide an income that might ultimately match the West Sumatra minimum wage, which is set at around € 184/month in 2023 (wageindicator.org). So far, we have not conducted any systematic socio-economic survey to evaluate the income gains from tree planting under the VCM scheme. A full socio-economic survey will be conducted starting April 2024. At the time of writing this report, the questionnaires are being tested with some farmers. Once the questionnaires are considered useful, and with potential adjustments, a group of 12 students from Andalas University in Padang will start the survey, as part of their MSc program.

The main issue covered in the survey is the income obtained from the restoration activities, including carbon payments and the use of annual crops in the early stages of tree establishment. Integrating annual crops seem more and more important for farmers. It also has other advantages, as for annual crops, the farmer has to manage intensively, hence trees are taken care off at the same time, often on a weekly basis. Often, farmers use (our) compost for the annual crops as well, and in doing-so some nutrients are also taken up by the young seedlings which grow in between the annual crops.

Figure 16. Especially when farmers change from vegetable gardening to tree cropping, many prefer to intercrop until the tree canopy closes.

Not many agroforestry systems are in the stage of full production. Hence, we aim to include the older sites, which could not be part of the certification process, as they were developed over 5 years ago, when we started the certification process (one of the criteria when getting a project certified for carbon). But since the trees in these areas are over 8 years old, we can find out here what fully-grown trees are able to produce in kilograms and income. The research is supposed to be finished mid-2024, and a separate document will be written on the outcomes.

Table 12. 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$) received/tree crop	N.A.	N.A.	Main income earners, clove trees, only bear fruit after 6-7 years. Most coffee arabica was planted 3 years ago, and is bearing fruits in 2023/2024.
Monitor progress post harvesting tree products	➢ #kg tree products being part of post harvesting ➢ # Income (U$) from selling (semi) processed products	Post harvesting units in testing phase First test batch of 100 kg dried coffee beans exported to Netherlands.		The large, new distilling unit is not functioning well. Farmers seem less committed, even though the oil can be sold at good prices. We may move the unit to another village where they asked for such a distilling unit. The high demand for the "regenerative coffee" from our sites, and more coffee being produced as coffee trees grow older will allow us to scale up exports to at least 1000 kg in 2024.
Annual Carbon cash payments to farmers	➢ Total Annual Carbon payments (U$) received by farmer participants	**$13,460**	$15,380	Serious delays in payments were caused by not yet reaching annual targets for various climate-related and COVID effects previous years.. All delayed payments took place in 2023.
Monitor direct women engagement in restoration activities	➢ # women direct involvement in the program # women indirectly involved	**22%** direct women engagement in restoration activities. All women are involved as the managers. In the matrilineal society of the Minangkabau the women own the land. **10** local women hired for working in the nursery to establish		Gender division seems low. However, in the matrilineal Minang society, women own the land. So, in all sites, women are involved as landowner/manager of their sons or husbands to work the land. 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 the upland areas, where access is not easy, and , where most of the restoration activities take place.

Activity	Socio-economic indicators	Results /progress		Explanation /potential mitigation strategy
		polybags with seeds (a total of 21 days/person)		
Inclusion of farmer participants in PES agreements	➢ # of participants managing restoration area with PES agreement	**383**		In total we have 383 participants/families with a PES agreement in 2023.
Capacity building				
Agricultural training post harvesting	➢ # people directly/indirectly engaged in agricultural training ➢ #people attending post harvesting	**141** participants engaged in one or more field training sessions in 2023 (see Annex 4 for details) Also, RPL Director attended agroforestry workshop by Tropenbos Int., Jakarta.		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 (Kelompok tani)	➢ # farmer groups	**9** farmer groups have been established until 2023, of which 1 in 2023.		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 13. 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	32	5	27
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	26	10	16
13	Dilam (FMO 7,2023)	Clove based	21	0	21
		TOTAL	**383**	**69**	**314**

Ethnobotany survey

In 2023, one student from Brawijaya University in Malang, East Java, who was part of the team conducting the fieldwork on belowground (agro)biodiversity conducted an ethnobotany survey to understand tree choices by local farmers, and what the uses of the trees and plants are.

Figure 17 shows some of the indigenous species used in our restoration activities and their uses by the local community. In particular *petai* and *jengkol* are often selected by farmers as part of the restoration activities. Both products are a very popular food product, and therefore always fetch high prices when sold. A complete list of trees and plants and their uses can be found in Annex 5.

Gigantochloa atter (buluh talang), used for 'malamang' / as a cooking utensil for 'lamang' traditional wedding food in West Sumatra

(a) *Amomum compactum* (kapulaga) and (b) *Zingiber officinale* var. Amarum (jahe emprit) used for spices

(a) *Archidendron-pauciflorum* ('jariang') known as jengkol and (b) *Parkia speciosa* ('patai') known as petai, daily food ingredients

Figure 17. Some examples of indigenous trees and shrubs and their uses.

Table 14 shows the various uses of (indigenous) trees that were seen as important to the respondents. Food, spices and medicinal uses are the most important uses and helps to explain the agroforestry species chosen by the farmers sin our sites. Annex 5 provides an overview of all tree species that were identified by the respondents as important during the research. For one, these insights allow us to foresee and help explaining to new participants what trees they may select, based on a number of uses. All trees and plants were selected for their multi=purpose uses. Most of the trees and plants had at least 2 different uses, but a large part had at least 3 different use. These included medicines, food (ingredients), fodder for livestock or wood for construction purposes.

Table 14. Important usages to consider when selecting (indigenous) trees/shrubs.

Use category	Reported uses	Species involved	ICF
Animal fodder	208	15	0.93
Building material	240	12	0.95
Ritual uses	73	2	1
Medicines	671	45	0.93
Hedge	100	4	0.97
Handicrafts	367	14	0.96
Food	1076	44	0.96
Spices (food ingredient)	519	16	0.97
Organic fertiliser	126	9	0.94
Firewood	152	18	0.89
Total	**3,532**	**179**	
Number of respondents	**98**		
Uses/species		**2,03**	
Average ICF			**0,95**

Figure 18 below shows what parts of the trees are used for the purposes mentioned in Table 14. Fruits and leaves are by far the most important parts of the tree that are being used by the local communities. These usages and most other uses except the stem (12%) mean that our agroforestry systems can be considered sustainable land uses. The trees are only of use by the local community when the trees are left standing, as harvesting useful products continue only when the trees are left to grow, and not by cutting trees down. Only cinnamon and timber trees are the exception, but these losses have been incorporated into our carbon calculations.

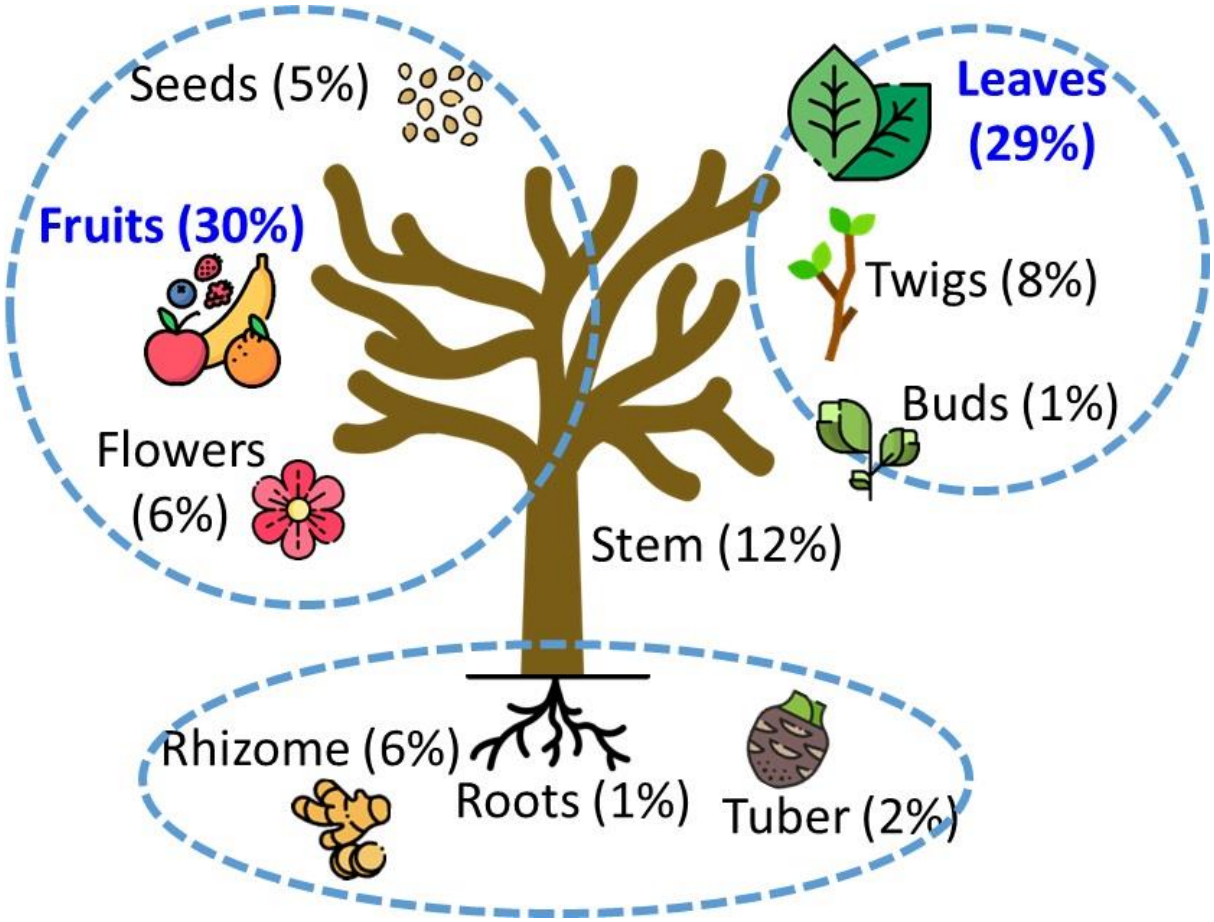


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Figure 18. Various uses of protected and planted trees in the restoration sites of Gula Gula Forest Programs (Source: Results farmer focus group discussions. Ethnobotany research, Brawijaya University 2023. For CO_2 Operate).

E4 Environmental, climate and biodiversity monitoring

Table 15 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 contract 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. However, the rough figure we keep in mind is that we aim to add around 100-150 ha per year. Therefore, we mention results/progress towards yearly targets (not necessarily coinciding with a calendar year) in the table rather than annual targets being met or not (as they may cover different calendar years). 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		As rains were very intense in 2023 (Figure 2), no wildfires threatened the project sites.	
Monitor progress carbon sequestration	• # Total aboveground Carbon stock (time-averaged) • Belowground time averaged Carbon stock/ha • # Soil organic matter change/ha		Carbon assessment still to be done. Late 2023 we started discussing the TreeO app with which carbon measurements in the field is made easy. Contract will be signed early 2024 so that work can start.	The carbon assessment will be done first half of 2024.
Monitor changes in rainfall (if any)	• # mm of monthly rain in project sites	Figure 2 shows the updated figures until 2023		Rainfall data collected from meteorological stations in our villages.
Environment/Restoration impact				
Restore degraded land	• # of ha reforested under PV (ha)	299.9	New areas in Pesisir Selatan and Lampung.	Due to socio-political issues , activities in these new areas are delayed by 6-12 months. To be included in 2024.
Plant agroforestry trees	• # of agroforestry trees planted		358,116 (planted	

Climate mitigation impact				
Activity	Indicator	Results /progress		Explanation /mitigation strategy
		According to plan	Not according to plan	
	under PES agreements	458,762 (under PES agreement)	until Dec 2023)	
	• # trees per ha (average)	1314 range 700 - 2000		
	• # 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	21,086		Indigenous trees, already present in the land are protected, while regenerants are able to grow after ANR.
Aboveground Animal/bird species biodiversity	• # Report on aboveground # quantification of biodiversity, using bio-acoustics	2 reports finalised according to deadline donor (August 2023)		Report on above-ground biodiversity.
Belowground (agro)biodiversity	• Report on (agro) quantification of biodiversity belowground	Report finished in August 2023, meeting deadline of donor.	Planned for 2022, but getting funding & (local) expert-partners only finalised late 2022	

Source: Field monitoring data RPL.

In addition to protecting (indigenous) trees and wildlings in the field, a large number of the planted agroforestry trees are also indigenous or local species. They are either local to the area, the island of Sumatra or other islands of Indonesia. These include 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 considered 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 former 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.

Climate, carbon sequestration in our sites

Although a complete carbon assessment has been postponed to 2024 for all sites and ages, in 2023 we have conducted a carbon assessment as part of the biodiversity monitoring pilot project. Staff and students from Brawijaya University have done a first assessment of the carbon sequestration of the various ages of agroforestry systems in our sites (from Imperata grasslands to Agroforestry systems (AF) of over 8 years old). The natural forest (old growth secondary forest) was taken as the control unit, assuming that old multi-strata agroforests may resemble the structure of natural forest in relation to percentages of carbon of the various components. Figure 19 below shows the results. It shows that the old agroforestry system (AF old) indeed has a balanced division among above and belowground carbon (45% soil C), similar to a natural forest (50% soil C). We assume that this kind of balance holds important functions for providing habitat functions for both above and belowground biodiversity.

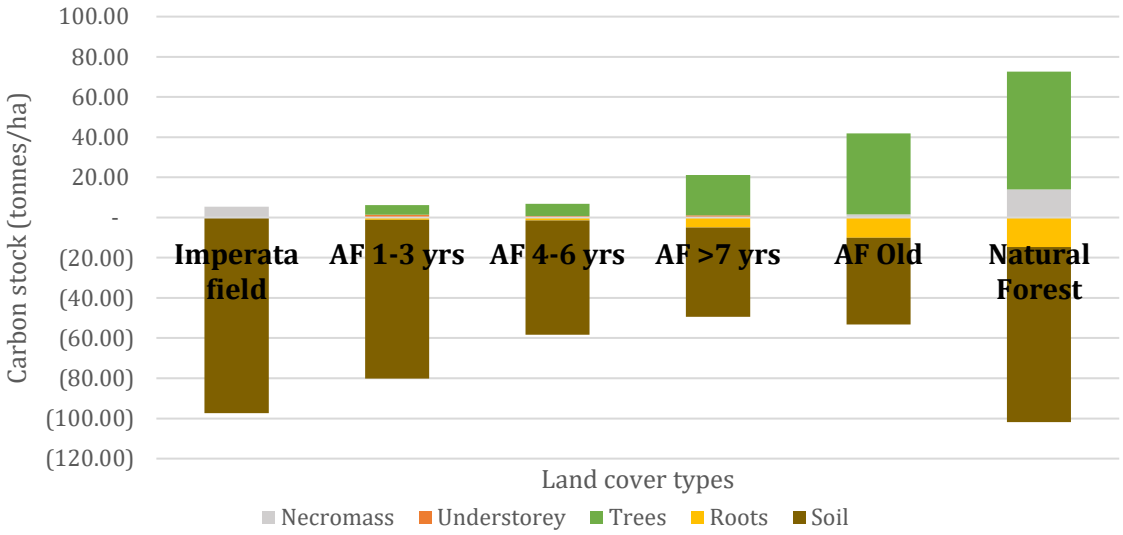

Figure 19. Carbon sequestration changes in ageing agroforestry systems (AF), compared to natural forest.

Biodiversity monitoring: Main results from our pilot project in 2023

Seeing more and more evidence of wildlife in our sites over the past years (footprints of animals, broken twigs, leaves of young trees eaten by animals, excreted coffee beans and so on), it was of utmost importance we would start monitoring biodiversity change. Having sites in all different ages (Figure 20), it would give us the opportunity to monitor restoration sites from the baseline scenario to old agroforestry systems (over 8 years old).

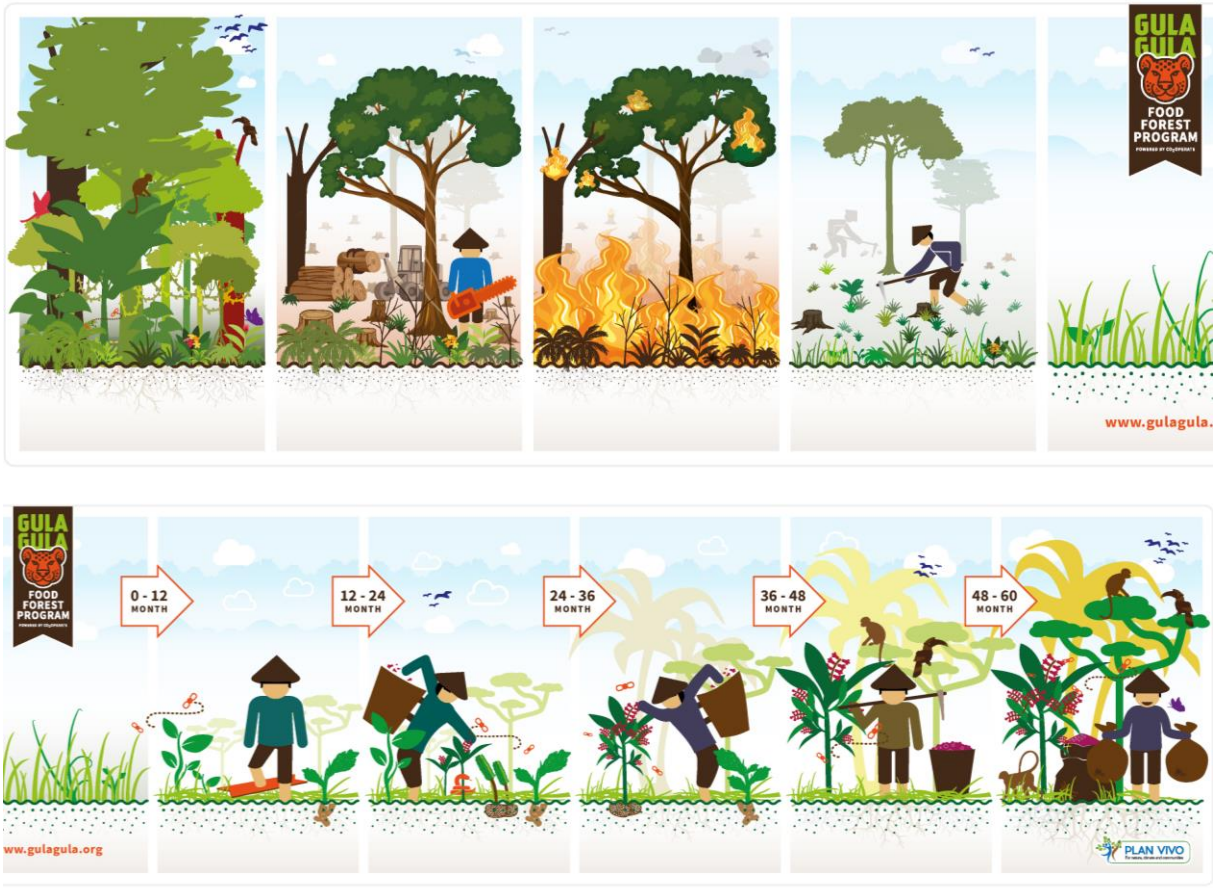

Figure 20. Schematic land use transformation from forest through grasslands to restored land with various agroforestry options (from top-left to bottom-right). (Source: CO_2 Operate B.V. / YOWZA for Gula Gula Forest Programs).

Secondary forest areas are defined as the control with its associated biodiversity. It is hypothesised that secondary forest and fully grown complex agroforests would have similar ecosystem functions, including their biodiversity characteristics. For belowground biodiversity, the focus is on the role of biomass (C content in the soil) and earthworms. Earthworms are considered the ecological engineers of soil, and being sensitive to contamination in the soil (including pesticides, insecticides, weedkilling agents), they form a crucial indicator for soil health. For aboveground measurements, bio-acoustic technology and AI are the latest developments in biodiversity monitoring. It is animal-friendly (no need for traps and nets causing stress among wild animals), while the recordings capture everything that makes sounds within a large range. The reports with findings were handed in to the donor in August 2023. Here, some major findings from both aboveground and belowground biodiversity work of the pilot project are presented.

Main finding(s) from aboveground biodiversity research

The bioacoustics were deployed over one month, considered one cycle of measurements. Already one can see that when an agroforest grows and gets older, the soundscape becomes more complete and more colourful (the purple and blue colours are more evenly spread throughout the square) (see Figure 21). This means that sounds are more varied/complex, pointing to the fact that a larger variety of insects and wildlife are present in the older agroforestry sites. The old Agroforestry (AF) system clearly resembles the soundscapes from the control, the secondary forest. This simple soundscape shows indeed that when our agroforestry mature, more wildlife is present in these systems. The young Agroforestry sites mainly show blue/purple colour at the bottom, which points to a much lower abundance of biodiversity.

The wild cameras that were placed near the bioacoustics equipment to get living proof of wildlife have revealed incredible footages of various types of animals and birds (See Figure in Box 1). Although we sometimes see tiger footprints in our sites, we never encountered one.

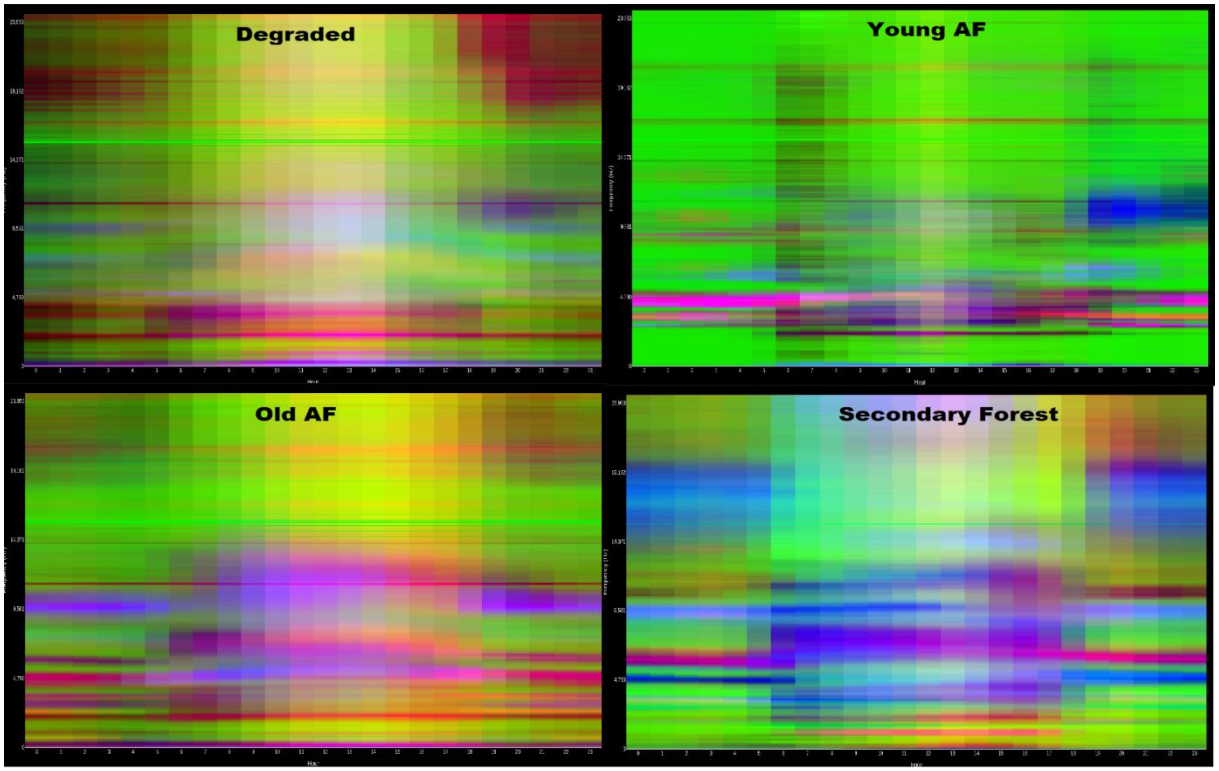

Figure 21. Soundscapes of the various stages (age) in our agroforestry systems.

Box 1. Amazing and scary: The Sumatran Tiger on video

The person responsible for changing the sd cards and monitoring of the cameras was excited to check for the first time whether there were animals captured by the cameras. He did feel a bit scared seeing the tiger already on his first round. He also lost his excitement a bit to be in charge of this. But the farmers put his mind at ease. "Don't worry about the tiger, the tiger is our friend. We know how to "talk" to the tiger. From now on, one of us will always join you when you need to check the cards or replace the batteries. We will talk to the tiger, if there happens to be one when you are checking the cameras."

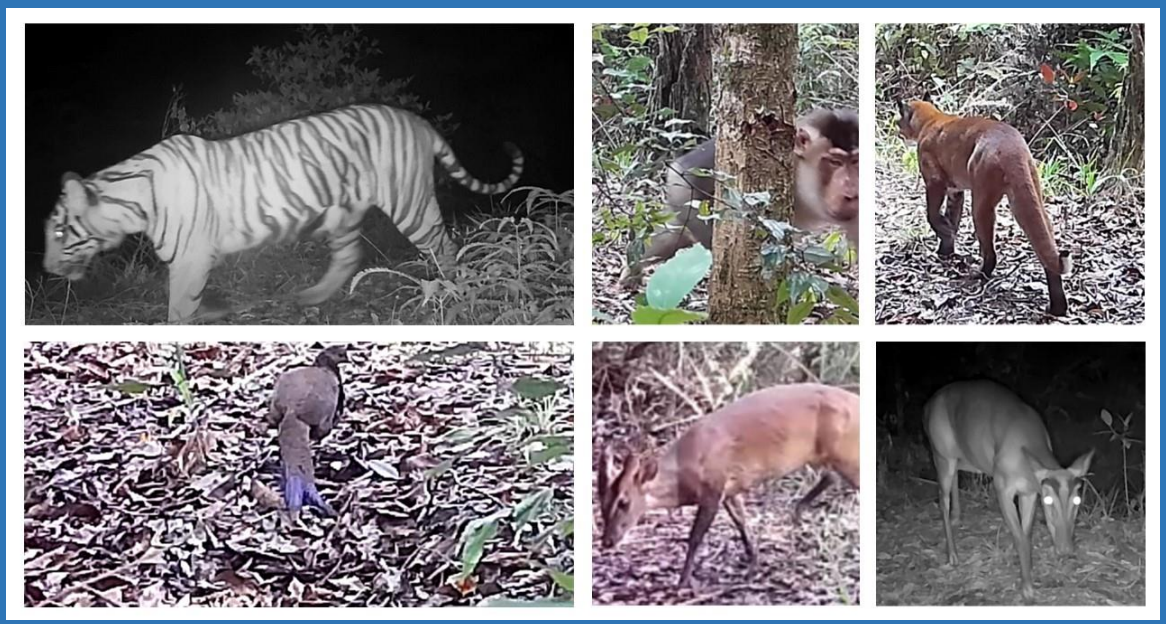

Figure. Some of the amazing results from our wildlife cameras during the pilot study.

It was amazing that already after 2 weeks, the tiger showed himself on 2 cameras, which were 8 km apart from each other. Also, another rare species shows up, the Asiatic golden cat *Catopuma temminckii* or *Kucing mas* in Indonesian). This animal is classified as near threatened in the IUCN red list. The relatively large animals we captured with the cameras clearly show that the somewhat older agroforestry systems in particular not only provide habitat functions, but also corridor functions for larger wildlife to walk from one patch of forest to another. Furthermore, a total of 169 bird species could be identified. In our annual report of 2022, we already mentioned that at least 4 nests of wild bees were found in our older sites. These bees are said to nest only in areas where forest ecosystems are largely intact (see Figure in Box 2). Their presence shows that our agroforestry systems mimic natural forest areas when they grow older. In October 2023, we found another wild bees' nest in a different site, about one hour drive from the other area where we encountered the other nests. This proofs that our agroforestry development is able to provide both hunting and habitat functions for a wide array of wildlife.

Box 2. When returning biodiversity hampers the biodiversity research

When we wanted to identify plots in our oldest sites, the farmers who would join us to their fields, said we might not be able to go there. He pointed at the sky, where 6-7 eagles were circling over the old sites. They explained that the eagles are looking for the wild bee nests, to eat the larvae. The nests are actually developed in the old agroforestry systems. But that is very interesting, as we were told that wild bees usually build nests in rather intact forest ecosystems, right? It means our restoration is providing a habitat for wildlife, including wild bees.

They continued explaining that the eagles attack the nests to eat the larvae. With the eagles circling around, the wild bees will be on high alert be very aggressive when approaching the nests. Turned out, that the week before we arrived, two farmers passed away after being attacked by the bees. As I really wanted to see the nests, they decided to go up, but stop at a safe distance. It is not the tiger to be scared of they said, these bees are the most dangerous animals of the forest. Using a tele lens, I was able to make this picture of the bees, Indeed an impressive amount. The research was delayed by 2 weeks, after which they nests were gone. The farmers said that when the larvae have developed into bees, the group will move to another area. This was in February/March 2023, When I visited the sites again in October 2023, we found wild bee nests again, but in a different area, where trees are getting big. The older, more mature agroforestry systems really seem to provide a good habitat for building bee nests.

Figure. Eagles attack the nests of wild bees to eat the larvae.

Belowground (agro) biodiversity

Staff and students from the Faculty of soil sciences of Brawijaya University in Malang, East Java, are known for their research on soil changes in agroforestry systems in general, and looking at earth worms in particular. Earth worms are a very important indicator for soil health, so a group of students worked on these issues on soil changes in our sites (soil carbon and type and numbers of earthworms).

Among our farmers there are differences in thinking about worms. Where farmers have some education, they know that earthworms are important for soil health. However, some low educated farmers (primary school) do not always understand the role of worms. As one of the farmers explained to the soil science students (see Box 3).

Box 3. Earthworms are not a pest?

"Rather than beneficial, I have always believed that the worms are a pest, trying to destroy my plants. So, I have always put salt on the soil to get rid of worms. So, that is a big mistake, aduuuh. Thank you so much for teaching us this, as no one tells us this.

This kind of thinking is understandable when working with poor, low educated farmers, as an earth worm looks a bit like a pest. Our team has a new task to add to the capacity building program/training on ecosystem restoration. It must be clearly explained that earth worms are very important in soil health, hence they should not try to kill them. In short, three ecological groups of worms can be identified (see also Figure 22):

- Epigeic worms live on top of the soil and live off the decaying biomass;
- Endogenic worms make horizontal burrows and "eat soil";
- Anecic worms are the largest, and make vertical burrows. These worms are crucial in helping water to infiltrate through the vertical burrows they make, sometimes up to 2 metres deep.

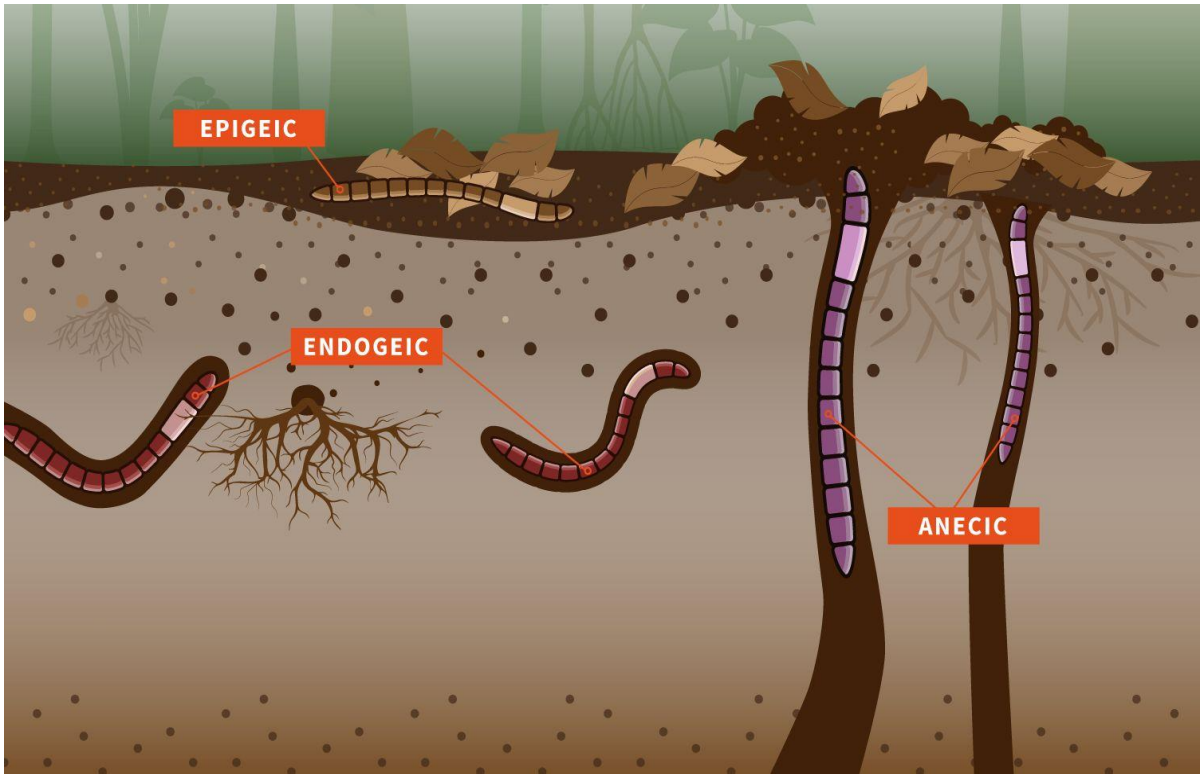

Figure 22. Three main ecological groups of earth worms (Source: YOWZA for Gula Gula Forest Programs).

The main conclusion from the soil research and worm identification is that there is indeed an increase in soil carbon when the agroforestry systems grow older. More soil carbon relates positively to an increase in worms and worm activity in the soil, which is a positive development for soil health and soil structure. As more biomass falls to the ground, more worms can live from decaying biomass, and their reproduction increases. In particular epigeic worms increase fast, when agroforestry systems grow older. This can be explained by the fact, that more biomass enables more worms, and the reproduction increases. Endogeic and anecic also increase, but not as much as one would have expected from other areas in Indonesia where this research was also undertaken. Recent studies are pointing to the fact, that the (over)use of pesticides and herbicides in general, but round-up (glyphosate) in particular is dangerous for worms. It seems to be specifically killing for the anecic worms, as it really destroys their reproductive health on a long term basis. As quite some areas in our program are converted from what were horticulture areas before, where round-up was regularly used, this could explain the lower figures of growth in endogenic and anecic worms in the project sites. To understand this better, we will continue working with Brawijaya on this topic, and more research will be conducted in 2024 on this topic.

Outcomes

1. Evidence of outcomes

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

2. 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 summarises the choices between the various options, although regularly we combine various restoration options.

Table 16. Restoration techniques used for various baseline circumstances.

Restoration technique	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

3. 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.

4. 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

We consider PES payments both in cash and in kind. Cash PES payments (PES $ in the Table below) are usually paid once a year after the target/objective of that year has been achieved by the participating farmers. 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 an additional bonus on top of in-kind contributions, which include free seedling and distribution costs, training, food and transport to attend meetings and technical assistance by RPL staff (such as monitoring tree survival). As mentioned in Table 17, we paid a total of U$ 28,840 in direct cash payments to the farmer groups in 2023. Quite some payments were a result of delayed payments from 2022 when some targets were not achieved in 2022. Annex 3 provides an overview of all payments in 2023, and why they were delayed or were paid in time. A similar explanation can be given for in-kind payments. Reservations in 2023 are quite substantial, as they include both delays in the progress of the project (see section A2), and funds that will be spent in later years due to the one-time carbon payments for carbon credits that last 30 years.

In general, The reasons for not matching the 40-60 (being more or less going to the farmers in a specific year) can be summarized as:

- Highest field costs are in the first 3 years of a new site. Also, we pay the highest percentage of PES payments in the first 2 years (in total over 60%). This was suggested by the farmers many years ago, the highest investment costs for them are in the first 2-3 years to build the food forest.
- Due to climate change, intended planting in November can be difficult, either through lack of rain or too much rain, which might kill the young seedlings. So many farmers then keep the seedlings in their home garden, often until January/February next year. That means that the high-cost component, compost distribution will also be on hold until they start planting.
- In 2023, we faced challenges in new areas, which we had to leave, due to various reasons (See section A2).
- Since we sell the carbon credits in one, year, the funds obtained must be spread over 30 years as each carbon credit must be surely sequestered for a period of 30 years. (the duration of one cycle). So we keep a reserve for the period from 5-30 years to continue paying a “bonus” to farmers for doing some maintenance to the trees, and to ensure that if some trees die, we can support them with new ones and possibly, other needs.

Table 17. PVCs sold and PES payments done in 2023 (both in cash and in kind).

year	PVCs sold	Wholesale revenue ($)		PES $ disbursed for farmers	In kind benefits *	PES held in trust (for cash and in kind contributions)		% sales to comm. (60%)
	No.	Total	60% (farmers)	$	$	PES $	Reservation	
2023	16,656	333,120	199,872	28,840	81,236	2,822	97,838	55%**

*in kind benefits only concern actual costs that were made (nursery, seedlings, transport, expenditures for training sessions) and not charged to the farmers. Use of field office facilities for farmer training sessions, time of field staff for training and supervision are not included.

**Figure derived from column 5,6 divided by column 4 (60% of sales for the project). Explanation for not fully matching 40-60% divide in this year is given here)

Figure 23. Signing the PES agreements with the Dilam farmer group at the field office.

Part G. Ongoing participation

G1 Recruitment

In 2023, one new area (ha) in the village of Dilam was included, and PES agreements signed. The relatively low addition has been explained before, due to socio-political challenges, which forced us to stop working in some areas (even though we were about to sign PES agreements here). A total of . new participants have joined the restoration activities, and signed the PES agreements. As issues have been solved, the year 2024 will see a relatively large new area and participants, as the 2023 ones are added

on top of new ones for 2024.

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 25 ha. When starting the FPIC process, more and more farmers became interested in joining the program beyond the need for Go Tan. So, we decided not to disappoint these farmers, and we will invest our own funds. In total there will be almost 70 ha being restored. This enabled us to hire a new staff, who will manage this area. 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 be signed the first half of 2024.
- 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. Again, we had to move to another location here, but late 2023, a village far away enough from oil palm plantation influences was eager to join. Again, instead of 2023, the PES agreements are on schedule to be signed in the second half of 2024.
- In West Timor, the project is taking more shape. In addition to the communal lands, where we planting gliricidia for soil biomass, the fenced-off home gardens are now targeted for tree planting. Local farmers wished to plant fruit trees and other useful trees for food close to the house, to ensure that wild deer and roaming cattle will not destroy these trees. As we are still in the process of replanting and adding new areas to those that faced some challenges, we will not yet visit Flores. Most probably we will go there late 2024.

G3 Community participation

Community participation remains a crucial component in all our activities. We always support good suggestions brought forward by the participants. What we learned in 2023, is the use of weeds as a ”blanket” against solar radiation, in times when rains are bad. During FPIC processes in new villages, our team will give this as an example of how to make the site more climate-smart. Details of the community meetings held can be found under monitoring results.
Annex 5 shows some pictures of the farmer and community meetings, and training sessions, which are regularly organised by the field staff of RPL. The good thing is that nowadays most training sessions can be organised in the grounds of the field office. We take care of transport for those who wish to be picked up. But since the office is centrally located, many just use their motorbike to attend the training (if needed, their costs area covered). In other cases, a farmer’s house, the Wali Nagari office or the field sites are good venues for meeting the participants. 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.

Part H. Project operating costs

H1 Allocation of costs (USD$) 2023

The allocation of costs for 2023 is detailed in Table 18. The challenges we faced in opening up new areas for restoration, has delayed investing funds in 2023. These are included as reservations for 2024. The total does not necessarily match the earnings from carbon sales in 2023 ($ 333,120). Some aspects were paid using our own funds in CO2 Operate, a bit of donor support (50%) for the biodiversity research. But the division remains that at least 60% of annual expenditures goes to the participants in Indonesia. This could be direct payments, or in kind including training, seedlings (new and replanting) and compost distribution. The green figures are the costs related to direct certified carbon credit sales, and comply to the 40-60 divide of Plan Vivo's requirement to spend the carbon credit funds. Other funds are either from donors or from the 40% of the carbon credit income which can be used by CO2 Operate. These reserves buildup over the years, and are now also being used to pre-finance new restoration activities, continue replanting and provide additional payments after the first 5 year contract, when the monitoring and supervision goes into the extensive" period, when all trees are planted and grow well.

Table 18. The allocation of costs for 2023, related to carbon sales 2023.

Expense	Narrative	Total (USD$)	Contribution from carbon credit sales	Contribution from other sources			
				R,R,R**	FMO*	MVONI	CO_2 operate
Project costs (60%)							
Technical assistance (VCM) Sumatra	Technical assistance RPL	25,240	18,240			2,000	5,000
	Field costs (tree monitoring, mapping,)	3,835	3,835				
	Community meetings	3,449	3,449				
	PES payments	28,840	28,840				
	Farmer training	28,898	28,898				
Biodiversity impact pilot project							
Brawijaya university Malang, Java	Belowground biodiversity research	11,420	3,000			6,000	2,420
Biometrio.earth	Bioacoustics, aboveground	9,247	3,000			4,000	2,247
Nursery							
Seeds, soil, polybags	Nursery/ seedling costs	9,950	9,950				
Nursery extension		18,037		11,192			6,845
Actual costs 2023		**138,916**	110,076				
Reservation compost for tree planting		30,000	30,000				
Reservations, future PES payments & new investments		70,660	70,660				
Total 2023 (of 60%)		**239,576**	199,872				
costs CO2 Operate (40%)							
Purchase coffee, transport		1,850					1,850
Salaries CO_2 Operate		65,000	52,000		13,000		
Consultancy fees carbon calculations		7,006	7,006				
Actual costs 2023		**73,856**	59,006				
Reservations from remaining 40% of carbon sales 2023		74,242	74,242				
Total 2023 (of 40%)		148,098	133,248 (40%)				
Grand Total ($)		**387,674**	**333,119.8**	**11,192**	**13,000**	**12,000**	**18,362**

*Final instalment FMO development capital contribution done in 2023 (2020-2025)

** In total we received U$ 13,927 from the US-based organisation Reduce, Re-use, Regrow in December 2022. Amount stated here was invested in 2023.

Annexes

Annex 1. Species composition

Name of system	Paninggahan (VD2017-1)	Paninggahan (VD2017-2 2017)	Air Dingin (VS2020-1)	Paninggahan, 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 5 a	Paninjawan FMO 5 b	Sirukam II FMO 6	Dilam
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	740
Avocado		56	50	50	160	50	160	50	120	30	50	50	40
Areca	40	70											
Bayur											60		100
Cinnamon			500					500	500			500	240
Clove	280	140			240		240						250
Cocoa													
Coffee Arabica			1,000					1,000	1,000			1,000	
Coffee Robusta				1,000		1,000				1,010	1,050		
Durian		56											20
Jengkol	40	56		25	75		80			80	80		60
Jirak	40	70											
Lamtoro (Leuceana)			250	250		250		250	250	252	260	250	
Mahogany	140	70	200	75	100				130				
Mangosteen		56											30
Petai	40	56		25	75	50	80						
Shorea													
Soursop													
Surian	140	70		75	100	150	190	200		128		200	

Annex 2. Outcomes Table 8 first column and column A-F (not rounded off)

	A	B	C=A*B	*D*	E=D*C	F=C-E
Site code	Total area (ha)	Carbon Potential (tCO_2/ha)	Total ER's (tCO_2)	*% buffer*	No. of PVCs allocated to buffer this period	Saleable ER's (tCO_2)
VD2017-1*	19.894	225.805639138389	4492.177385019120	*16*	718.7483816030590	3773.429003416060
VD2017-2	14.364	189.415584588523	2720.765457029550	*16*	435.3224731247280	2285.442983904820
VS2020-1	65.520	357.850129385787	23446.340477356700	*16*	3751.4144763770800	19694.926000979700
FMO2021-1a	2.200	286.178842767464	629.593454088421	*16*	100.7349526541470	528.858501434273
FMO2021-1b	27.100	298.543434526578	8090.527075670280	*16*	1294.4843321072400	6796.042743563030
FMO2021-2a	11.000	228.876767122444	2517.644438346890	*16*	402.8231101355020	2114.821328211390
FMO2021-2b	2.500	245.139031345316	612.847578363289	*16*	98.0556125381263	514.791965825163
FMO2021-3	45.700	261.519821167733	11951.455827365400	*16*	1912.2329323784600	10039.222894986900
FMO2021-4	14.500	347.899505886053	5044.542835347770	*16*	807.1268536556440	4237.415981692130
FMO2022-5a	34.600	265.623267399685	9190.565052029100	*16*	1470.4904083246600	7720.074643704450
FMO2022-5b	4.500	272.212505340882	1224.956274033970	*16*	195.9930038454350	1028.963270188530
FMO2022-6	29.800	261.519821167733	7793.290670798440	*16*	1246.9265073277500	6546.364163470690
FMO2023-1	28.200	197.524672722182	5570.195770765540	16	891.2313233224860	4678.964447443050
	299.878		83284.902296214500		13325.5843673943000	69959.317928820200

Annex 3. PES cash payments received by the participants (on time or delayed)

Payment received by farmers on 2023						
Project site	Nagari	Farmer Group	Payment due (date in contract/PES agreement)	Actual payment (date)	Total Amount (Rp)	Reason for delay
Verstegen (2019)	Air Dingin	Kelompok Tani VCM	September 2022 (Second payment)	23 August 2022	48,818,508	Covid-19 resulted in postponing the tree monitoring. Therefore, we used the tree monitoring as a basis for the proposed payment
			September 2023 (Third payment)	-	-	We needed to make sure that farmers replanted the tree before we could propose the third payment
FMO 1a	Paninggahan	Kelompok Bukit panjang	February 2022 (Second payment)	12 August 2023	4,200,000	We needed to make sure that farmers planted a minimum of 80% of the trees before we could propose the second payment
			February 2023 (Third payment)	-	-	Because the second payment for 2022 was paid in August 2023, we needed to postpone the third payment and monitor the replanting process
FMO 1b	Paninggahan	Kelompok Bukit Subaka	February 2022 (Second payment)	12 August 2023	39,750,000	We needed to make sure that farmers planted a minimum of 80% of the trees before we could propose the second payment
			February 2023 (Third payment)	-	-	Because the second payment for 2022 was paid in August 2023, we needed to postpone the third payment and monitor the replanting process
FMO 2a	Selayo	Kelompok Tani VCM Selayo	February 2022 (Second payment)	14 July 2023	16,500,000	We needed to make sure that farmers planted a minimum of 80% of the trees before we could propose the second payment
			February 2023 (Third payment)	-	-	Because the second payment for 2022 was paid in July 2023, we needed to postpone the third payment and monitor the replanting process
FMO 2b	Selayo	Kelompok Tani VCM Selayo	February 2022 (Second payment)	14 July 2023	3,750,000	We needed to make sure that farmers planted a minimum of 80% of the trees before we could propose the second payment
			February 2023 (Third payment)	-	-	Because the second payment for 2022 was paid in July 2023, we needed to postpone the third payment and monitor the replanting process
FMO 3	Sirukam	Kelompok tani Cirubuih Indah Nan Jaya	January 2022 Second payment (20%)	10 May 2023	68,550,000	We needed to make sure that farmers planted a minimum of 80% of the trees before we could propose the second payment
			January 2023 (Third payment)	-	-	Because the second payment for 2022 was paid in May 2023, we needed to postpone the third payment and monitor the replanting process
		Kelompok Tani	January 2022 (Second payment)	25 April 2023	22,649,158	We needed to make sure that farmers planted a minimum of 80% of the trees before we could propose the second payment

Payment received by farmers on 2023						
Project site	Nagari	Farmer Group	Payment due (date in contract/PES agreement)	Actual payment (date)	Total Amount (Rp)	Reason for delay
FMO 4	Air Dingin	Bukit Panjang Saiyo				
			January 2023 (Third payment)	-	-	Because the second payment for 2022 was paid in April 2023, we needed to postpone the third payment and monitor the replanting process
FMO 5a	Paninjawan	Kelompok Hutan Pangan Paninjawan	May 2023 (Second payment)	21 June 2023	43,817,166	On time
FMO 5b	Paninjawan	Kelompok Hutan Pangan Paninjawan	May 2023 (Second payment)	21 June 2023		On time
FMO 6	Sirukam	Kelompok Tani Cirubuih Indah Nan Jaya	June 2022 (First payment)	30 Juni 2022 (20%)	89,400,000	On time
			June 2023 (Second payment)	8 February 2024 (20%)	44,700,000	We needed to make sure that farmers planted a minimum 80% of the trees before we could propose the second payment
FMO 7	Dilam	Kelompok Tani Tambang Sepakat	September 2023 (First payment)	27 October 2023	84,600,000	On time
				TOTAL	466,734,832	

Annex 4. Various (Field-based) training sessions by RPL and others in 2023.

No	Topic	Time and Place	Number of participants	Note
1	Robusta coffee cultivation	February 2023, FMO Paninjawan site	30 Paninjawan farmers	Compost fertiliser, pruning, pests and diseases prevention, and harvesting
2	Coffee cultivation	March 2023, FMO Koto Baru site	14 Koto Baru farmers	Compost fertiliser, pruning, pests and diseases prevention, and harvesting
3	Disease prevention and rehabilitation for Robusta coffee	April 2023, FMO Paninjawan site	4 Paninjawan farmers	
4	Coffee replanting training	May 2023, Verstegen Air Dingin site	7 Verstegen farmer	Replanting technique
5	Robusta coffee cultivation	Juli and Agustus 2023, FMO Paninjawan site	30 Paninjawan farmers	
6	Training on ANR/zero tillage	September-October 2023	21 new participants in Dilam	Training by RPL staff
7	Biomass fuel for household cooking stove	12 October 2023	15 Sirukam and Silam farmers	Training from Environmental Engineering Department of Andalas University
8	Biocomposting using Takamura method for household waste	21 October 2023	15 Sirukam and Silam farmers	Training from Environmental Engineering Graduate Program of Andalas University
9	Scaling Agroforestry in Indonesia: Opportunities, challenges and solution pathways in scaling and mainstreaming agroforestry in Indonesia	23-24 November 2023 Jakarta, Indonesia	1 Director RPL (Ai Farida)	Organised by Tropenbos Int, Netherlands Embassy. Ai was one of the presenters to show how regenerative agroforestry for local communities can be successful.

Annex 5. Selected pictures of community meetings/training sessions with farmers.

Monthly gathering to discuss the progress in planting and managing the restoration site.

Annual evaluation of planting/survival achievements, resulting in payments to each participant when all has been achieved. The women make sure everything is done in a good way.

FPIC process: explaining the Gula Gula Gorest Program to new, interested farmers in the office of the village head.

Further discussion with the new participants in Dilam on the contract.

Specific farmer training in the field office of RPL (roof top terrace)

Field training on zero tillage and ANR

Field training on coffee tree management in small groups of individual farmers during field checks

Training by Andalas University staff (Department of Technology) on how to turn household waste into biogas for cooking, using specific biogas burner

Annex 6. List of trees and their uses which are important to the Minangkabau communities.

Scientific Name	*Family*	*Local Name*	*Frequency of Use*	*Category Use*	*Status*
Cymbopogon citratus	Poaceae	Sarai	3	Medicine (0,41); food (0;03); food ingredient (0,56)	Cultivated
Dendrocalamus asper	Poaceae	Buluh batuang	3	Wood for building (0,45); handicraft (0,45); food (0,1)	Cultivated
Gigantochloa apus	Poaceae	Buluh puriang	3	Wood for building (0,49); handicraft (0,49); food (0,01)	Cultivated
Gigantochloa atter	Poaceae	Buluh talang	2	Cultural ritual purposes (0,5); handicraft (0,5)	Cultivated
Imperata cylindrica	Poaceae	Lalang	2	Medicine (0,44); handicraft (0,56)	Wild / natural
Pennisetum purpureum Schum. cv King	Poaceae	Rumput gajah	1	Livestock Fodder (1)	Cultivated
Pennisetum purpureum Schum. cv. Mott	Poaceae	Rumput odot	1	Livestock fodder (1)	Cultivated
Setaria palmifolia	Poaceae	Lintabuang	2	Livestock fodder (0,96); organic fertiliser (0,04)	Wild / natural
Alpinia galanga	Zingiberaceae	Langkueh	2	Medicine (0,03); food ingredient (0,97)	Cultivated
Amomum compactum	Zingiberaceae	Kapulaga	2	Medicine (0,05); food ingredient (0,95)	Cultivated
Curcuma longa	Zingiberaceae	Kunik	3	Medicine (0,46); food (0,08); food ingredient (0, 46)	Cultivated
Curcuma xanthorrhiza	Zingiberaceae	Temu lawak	2	Medicine (0,82); food ingredient (0,18)	Cultivated
Zingiber officinale var. Amarum	Zingiberaceae	Sepadeh kampung	2	Medicine (0,43); food ingredient (0,57)	Cultivated
Zingiber officinale var. Rosc	Zingiberaceae	Sepadeh gajah	2	Medicine (0,43); food ingredient (0,57)	Cultivated
Zingiber officinale var. Rubrum	Zingiberaceae	Sepadeh merah	3	Medicine (0,43); food (0,02); food ingredient (0,55)	Cultivated
Archidendron pauciflorum	Fabaceae	Jariang	1	Food (1)	Cultivated
Calliandra calothyrsus	Fabaceae	Kalandra	3	Livestock fodder (0,24); organic fertiliser (0,6); firewood (0,16)	Wild / natural
Gliricidia sepium	Fabaceae	Sediah/ Saladia	0	-	Wild / natural
Leucaena leucocephala	Fabaceae	Lamtoro	3	Livestock fodder (0,6); organic fertiliser (0,23); firewood (0,17)	Cultivated
Mimosa pudica	Fabaceae	Sikajuik / Sikakajuik	1	Decorative plant (1)	Wild / natural
Parkia speciosa	Fabaceae	Patai	1	Food (1)	Cultivated
Chromolaena odorata	Asteraceae	Rinju halus	3	Livestock fodder (0,02); medicine (0,29); organic fertiliser (0,69)	Wild / natural

Scientific Name	Family	Local Name	Frequency of Use	Category Use	Status
Crassocephalum crepidioides	Asteraceae	Ambuang-ambuang	1	Organic fertiliser (1)	Wild / natural
Elephantopus scaber	Asteraceae	Sikujui	2	Medicine (0,04); food (0,96)	Wild / natural
Mikania micrantha	Asteraceae	Sapik tunggua	1	Livestock fodder (1)	Wild / natural
Titonia diversifolia	Asteraceae	Katendengan / rinju kuning	1	Organic fertiliser (1)	Wild / natural
Musa acuminata (AAA Group)	Musaceae	Pisang manis / pisang susu	4	Livestock fodder (0,14); medicine (0,03); handicraft (0,39); food (0,45)	Cultivated
Musa acuminata × M. balbisiana (AAB Group) 'Silk'	Musaceae	Pisang rajo	4	Livestock fodder (0,14); medicine (0,03); handicraft (0,39); food (0,45)	Cultivated
Musa balbisiana (ABB Group) 'Saba'	Musaceae	Pisang batu / pisang kepok	4	Livestock fodder (0,14); medicine (0,03); handicraft (0,39); food (0,45)	Cultivated
Musa brachycarpa	Musaceae	Pisang kapeh / pisang batu	4	Livestock fodder (0,14); medicine (0,03); handicraft (0,39); food (0,45)	Cultivated
Musa paradisiaca var. sapientum	Musaceae	Pisang buai / pisang ambon	4	Livestock fodder (0,14); medicine (0,03); handicraft (0,39); food (0,45)	Cultivated
Psidium guajava	Myrtaceae	Jambu biji/ Peraweh	3	food (0,46); medicine (0,46); firewood (0,08)	Cultivated
Rhodomyrtus tomentosa	Myrtaceae	Karamunting	2	Medicine (0,2); food (0,8)	Wild / natural
Syzygium aromaticum	Myrtaceae	Cengkeh	4	Medicine (0,04); handicraft (0,21); food (0,02); food ingredient (0,68)	Cultivated
Syzygium malaccense	Myrtaceae	Jambak / jambu bol	1	Food (1)	Cultivated
Syzygium polyanthum	Myrtaceae	Salam	2	Medicine (0,16); food ingredient (0,84)	Cultivated
Colocasia esculenta	Araceae	Taleh	1	Food (1)	Cultivated
Colocasia gigantea	Araceae	Kemumu	1	Food (1)	Cultivated
Xanthosoma sagittifolium	Araceae	Bondang	1	Food (1)	Cultivated
Ageratum conyzoides	Compositae	Rumput angik / Akah-akah	3	Livestock fodder (0,23); medicine (0,62); organic fertiliser (0,15)	Wild / natural
Bidens pilosa	Compositae	Sirangak	4	Livestock fodder (0,63); Medicine (0,09); food (0,03); organic fertiliser (0,25)	Wild / natural
Clibadium surinamense	Compositae	Rinju kasar	1	Organic fertiliser (1)	Wild / natural
Aleurites moluccana	Euphorbiaceae	Dama	2	Wood for building (0,03); food ingredient (0,97)	Cultivated
Hevea brasiliensis	Euphorbiaceae	Karet	0	-	Cultivated
Mallotus paniculatus	Euphorbiaceae	Balik angin	3	Wood for building (0,5); handicraft (0,07); firewood (0,43)	Wild / natural
Durio zibethinus	Malvaceae	Durian	3	Wood for building (0,07); Medicine (0,03);	Cultivated

Scientific Name	Family	Local Name	Frequency of Use	Category Use	Status
				food (0,9)	
Theobroma cacao	Malvaceae	Coklat	2	Food (0,94); firewood (0,06)	Cultivated
Urena lobata	Malvaceae	Puluik	1	Medicine (1)	Wild / natural
Solanum betaceum	Solanaceae	Terung pirus	2	Food (0,5); Medicine (0,5)	Cultivated
Solanum nigrum	Solanaceae	Lumai	1	Food (1)	Wild / natural
Solanum torvum	Solanaceae	Rimbang	2	Medicine (0,45); food (0,55)	Wild / natural
Lantana camara	Verbenaceae	Duri cik ayam	0	-	Wild / natural
Stachytarpheta indica	Verbenaceae	Bungo medan	1	Medicine (1)	Wild / natural
Stachytarpheta jamaicensis	Verbenaceae	Pecut kuda	1	Medicine (1)	Wild / natural
Areca catechu	Arecaceae	Pinang	5	For Adat rituals (0,43); Medicine (0,06); handicraft (0,22); food (0,18); decorative plant (0,11)	Cultivated
Cocos nucifera	Arecaceae	Karambia	6	Wood for building (0,15); Medicine (0,12); handicraft (0,2); food (0,2); food ingredient (0,2); firewood (0,13)	Cultivated
Hyptis brevipes	Lamiaceae	Plompongan	0	(blank)	Wild / natural
Tectona grandis	Lamiaceae	Jati	1	Wood for building (1)	Cultivated
Cinnamomum burmannii	Lauraceae	Kulit manih	3	Medicine (0,13); food ingredient (0,7); firewood (0,17)	Cultivated
Persea americana	Lauraceae	Pokat	3	Medicine (0,29); food (0,69); firewood (0,02)	Cultivated
Peperomia pellucida	Piperaceae	Bayam sendi	1	Medicine (1)	Wild / natural
Piper aduncum	Piperaceae	Sirih-sirihan	1	Firewood (1)	Wild / natural
Saurauia prainiana	Actinidiaceae	Garanun / Gandun	2	Food (0,09); firewood (0,91)	Wild / natural
Spondias dulcis	Anacardiaceae	Kedondong	1	Food (1)	Cultivated
Annona muricata	Annonaceae	Durian belando / sirsak	2	Medicine (0,23); food (0,77)	Cultivated
Cordyline fruticosa	Asparagaceae	Puding	1	Decorative plant (1)	Cultivated
Asplenium australasicum	Aspleniaceae	Sakek	1	Decorative plant (1)	Wild / natural
Ananas bracteatus	Bromeliaceae	Naneh	1	Food (1)	Cultivated
Carica papaya	Caricaceae	Situka / kalikih / batiak	2	Medicine (0,2); food (0,8)	Cultivated
Drymaria cordata	Caryophyllaceae	Pensi-pensi	2	Medicine (0,96); food (0,04)	Wild / natural
Hopea odorata	Dipterocarpaceae	Pelangeh	2	Medicine (0,05); firewood (0,95)	Wild / natural

Scientific Name	Family	Local Name	Frequency of Use	Category Use	Status
Cyrtomium fortunei	Dryopteridaceae	Pakih	1	Decorative plant (1)	Wild / natural
Castanopsis argentea	Fagaceae	Barangan	1	Food (1)	Wild / natural
Rhodoleia championii	Hamamelidaceae	Kasih beranak	2	Wood for building (0,5); firewood (0,5)	Wild / natural
Centella Asiatica	Mackinlayaceae	Pigago	1	Medicine (1)	Wild / natural
Melastoma malabathricum	Melastomataceae	Sikaduduak	2	Medicine (0,94); food (0,06)	Wild / natural
Toona sureni	Meliaceae	Surian	4	Wood for building (0,69); Medicine (0,09); food ingredient (0,13); firewood (0,02)	Cultivated
Artocarpus heterophyllus	Moraceae	Cubadak	3	Wood for building (0,03); handicraft (0,03); food (0,94)	Cultivated
Myristica fragrans	Myristicaceae	Pala	1	Food ingredient (1)	Cultivated
Oxalis carniculata	Oxalidaceae	Asam-asam / asam puyuh	1	Medicine (1)	Wild / natural
Pyrrosia piloselloides	Plypodiaceae	Piti-piti / koin-koin	1	Decorative plant (1)	Wild / natural
Polygala paniculata	Polygalaceae	Uban	1	Medicine (1)	Wild / natural
Rubus rosifolius	Rosaceae	Erbei / Asamrusa	1	Food (1)	Wild / natural
Coffea arabica	Rubiaceae	Kopi	2	Food (0,97); firewood (0,03)	Cultivated
Citrus ablycarpa	Rutaceae	Jeruk limo	2	Medicine (0,29); food ingredient (0,71)	Cultivated
Casearia sylvestris	Salicaceae	Jirak	3	Wood for building (0,56); food (0,04); firewood (0,4)	Wild / natural
Manilkara zapota	Sapotaceae	Sawos / Sao	3	Medicine (0,47); food (0,51); firewood (0,02)	Cultivated
Parasponia rigida	Ulmaceae	Seri / Ramin	2	Livestock fodder (0,04); food (0,86)	Wild / natural