seed madagascar
sustainable environment, education & development

Annual Progress Report
Year 2023

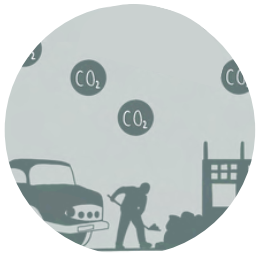
PROJECT SEKOLY MAINTSO

Carbon Offsetting School Infrastructure

About Project Sekoly Maintso

In 2005, SEED Madagascar (SEED) launched Programme Sekoly (Malagasy for ‘school’) to improve access to education for children in the rural Anosy region of southeastern Madagascar. Since then, SEED has over 15 years of experience responding to the need for improved education infrastructure and access to WASH through the construction and repair of school infrastructure. Despite this, the production and transport of building materials to school sites produces carbon dioxide emissions that contribute to climate change. Southeast Madagascar is disproportionately impacted by climate change as increasingly unpredictable and adverse weather patterns leave the communities SEED works with vulnerable to cyclones, flooding, and drought.[1]

Recognising SEED’s responsibility to reduce carbon emissions and protect the environment, Project Sekoly Maintso (Malagasy for 'Green Schools') was launched in 2022. Since then, Sekoly Maintso has been planting trees near school sites to offset the carbon emissions of SEED’s school constructions and repairs and provide natural resources for communities.



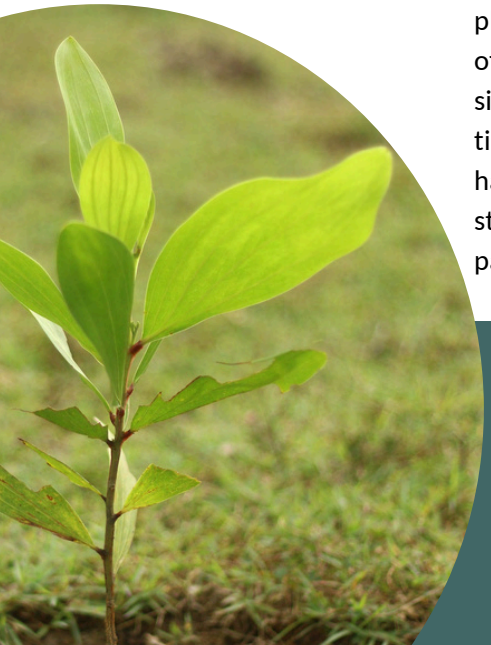
Access to Quality Education

The Sekoly Programme aims to improve health and education outcomes for school-aged children in rural southeast Madagascar. In order to achieve this, SEED constructs and repairs education and WASH infrastructure, supports teachers' livelihoods, delivers complementary education sessions, and fosters parental and community engagement.

Green Schools

Sekoly Maintso involves planting trees on two sites of community-owned land, one carbon offset site with *Acacia mangium* (Acacia), and one community resource use site with species chosen by the community. All the trees in the resource use site will be available for community use, with 20% available for harvesting after five years, following that five-year period, 20% will be available for harvesting every year. To ensure long-term sustainability and site maintenance, when trees are harvested by community members from the resource use site, the same number of trees will be replanted.

Local law or *dina* in Malagasy, are established or strengthened to ensure planting sites are appropriately managed. The *dina* is overseen by a committee of community members and sets out conditions for the use of the planting sites. Conditions include imposing fire bans in the planting sites, establishing time periods for tree harvesting and, outlining numbers of trees that can be harvested. Community engagement is a key focus of Sekoly Maintso, with students planting and caring for fruit trees in all of the planting sites and participating in environmental education sessions.



Carbon Offsetting

WHY ACACIA TREES?
Acacia are planted in the carbon offset site because it is a resilient, fast-growing species with scientific research into its **carbon sequestration*** potential. Acacia are planted before native trees due to their higher survival and growth rates. Once the Acacia are large enough to provide shade, native tree species will be planted within the site to create a pocket of forest.

How Does SEED Offset Carbon Emissions?

The carbon emissions of a school construction are calculated using the Inventory of Carbon and Energy (ICE) database for construction materials.[2] The ICE database is widely used by researchers and professionals as it stores data from academic literature and has strict selection criteria to ensure consistency.

The database provides the carbon emissions for a quantity of a specific material, such as 1kg of cement or 5kg of oil-based paint. Emissions from the materials used to build the schools and classroom furniture, alongside those from any material deliveries or site visits from project staff, are calculated using the ICE database to estimate the total carbon emitted throughout construction.

Next, the number of trees needed to offset the construction is calculated by dividing the total carbon emissions by the amount of carbon sequestrated per tree. Recent findings conclude that the average tropical tree can sequester 50 pounds (22.7kg) of carbon dioxide per year,[3] however, local climatic factors in Anosy would likely reduce the sequestration potential. As a result, Sekoly Maintso estimates that the average Acacia tree will sequester 20 kgCO2 per year over a period of ten years.

Once the Acacia are tall enough, the diameters of a sample are measured at 1.3m above ground level (breast height).[4] The average diameter at breast height (DBH) across the sample is calculated and entered into an **allometric equation**** for *Acacia mangium*. This allometric equation is research-derived and estimates the aboveground biomass of a tree using DBH data. The relationship between aboveground biomass and DBH data is influenced by factors such as climate, land cover, and site management.[5] Sekoly Maintso takes an average of two allometric equations derived from research in Cote d'Ivoire[5] and Malaysia[6] respectively, as there have been no allometric equations for *Acacia mangium* derived from research in Madagascar.

***Carbon sequestration** refers to the process where carbon dioxide is removed from the atmosphere and stored. Trees sequester carbon dioxide in their tissues, bark, and roots through photosynthesis.

****Allometry** is the study of the relationship between the physical characteristics of an organism, for example, the relationship between the aboveground biomass and the DBH of a tree. An allometric equation is derived from research, and in the case of trees, this often involves cutting down a sample of trees, measuring the aboveground biomass and then plotting these data against the tree's DBH or height. A line of best fit is then plotted on the graph, and the equation of this line is the allometric equation as it quantitatively links one physical characteristic with another.

Once the average aboveground biomass has been calculated, the result is multiplied by 0.5 to calculate the average carbon content per tree. This is due to carbon typically accounting for 50% of aboveground biomass.[7]

After the carbon content has been calculated, the result is multiplied by 3.67, the atomic weight ratio of carbon-to-carbon dioxide, in order to calculate the total average weight of carbon sequestered by the Acacia in the sample.[3] This method is summarised in the equation below. The average carbon sequestered per tree is then multiplied by the total number of trees planted to calculate the total emissions sequestered to date.

$$Carbon\ sequestred\ per\ tree = [(0.1173 \times (DBH^{2.454})) + e^{(2.081 ln ln\ DBH)}] \times 0.5 \times 0.5 \times 3.67$$

Emagnevy

6%
Offset

Offsetting: Emagnevy EPP, Mananara II EPP, Sainte Luce EPP, Tsagnoriha EPP, Vatambe EPP

Mandiso

1%
Offset

Offsetting: Mandiso EPP

Note: Current carbon emissions offset at established sites, based on DBH data from July 2023 (18 months after planting).

'Children are the future, it is important that they are motivated to protect the natural environment'

- Haussmann, Project Coordinator

Annual Overview

Following its launch in 2022, Sekoly Maintso saw a year of expansion in 2023. Alongside existing sites in Emagnevy and Mandiso, SEED established a new planting site in Esohihy and identified a new planting site for 2024 in Esinda, bringing the total number of communities involved in the project to four. Across the sites, 2,250 trees were planted to offset three new school constructions, provide resources for two communities to use, and promote environmental stewardship.

In 2023, trees were planted as part of Sekoly Maintso for the first time in Esohihy to offset the construction of Esohihy EPP (primary school) which was completed in November 2022. In addition, trees were planted at the existing Mandiso site to offset the construction of Sarisambo EPP and CEG (lower secondary school) which was completed in December 2023. A similar number of trees for future community use were planted in resource sites in Esohihy and Mandiso, while fruit trees were also planted in both communities by students.

In Esinda, a tree nursery was created, with a local planting assistant recruited and trained by SEED to manage the nursery. A *dina* (local law) was established in Esohihy to manage the planting sites by outlining terms of use for the two sites, such as determining that trees in the resource use site can be rotationally harvested five years after planting. Seedlings planted both this year and last were monitored for survival and growth rates across all sites, and replants were carried out as required.

Community engagement was a focus of the project with stakeholder meetings, *dina* leadership training, and environmental education sessions held by SEED. Educational sessions were delivered to students in two communities about the importance of sustainability and tree planting to promote environmental stewardship.

This 2023 Annual Progress Report provides an overview of the activities conducted by SEED at each planting site.

IN 2023, SEKOLY MAINTSO PLANTED:

1,020

Carbon offset trees

1,030

Resource use trees

200

Fruit trees

Emagnevy

Established Site

Established in 2022, Emagnevy is an existing Sekoly Maintso site. In 2022, a total of 1,093 trees were planted to offset the construction of Emagnevy EPP (primary school) and Tsagnoriha EPP, the refurbishment of Sainte Luce EPP, and the repair of both Mananara II EPP and Vatambe EPP. In 2022, 325 resource use trees and 144 fruit trees were planted.

Activity Update

- Leadership training was delivered to the *dina* committee to build capacity and strengthen *dina* management.
- Survival, growth, and DBH data were collected regularly, and seedlings were replanted as required by the planting site assistant.
- A fuel-efficient stove was provided to Emagnevy EPP by SEED for use in the school canteen to further reduce carbon emissions.
- Seeds were sown in the nursery by the planting assistant in preparation for the offset of Mahatalaky Lycée (upper secondary school) in 2024.

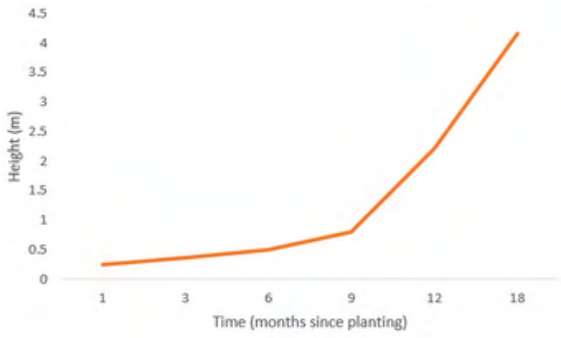
Carbon Offsetting Calculations

EMAGNEVY EPP
68,229 kgCO2 — 341

TSAGNORIHA EPP
74,403 kgCO2 — 372

SAINTE LUCE EPP, MANANARA II EPP, VATAMBE EPP
75,958 kgCO2 — 380

Growth Rate of Seedlings



Community planting session

Student planting a fruit tree

Planting assistant preparing the nursery

Esinda

Future Site

Identified in 2023, Esinda will be a new planting site in 2024 where the constructions of Esinda EPP and Beandry EPP will be offset.

Activity Update

- Meetings were held by SEED with key stakeholders, such as the *Chef Fokontany* (village leader), during which the locations of the planting sites were decided.
- A local planting assistant was recruited and trained by SEED to manage the nursery.
- A nursery was constructed by the planting assistant in December 2023, and seeds were sown in preparation for the offset of Esinda EPP and Beandry EPP in 2024.

Carbon Offsetting Calculations

ESINDA EPP

68,229 kgCO2 — 338

BEANDRY EPP

75,958 kgCO2 — 343

Community meeting with SEED staff

Planting assistant caring for seedlings in the nursery

Community meeting with SEED staff

Esohihy

New Site

Established in 2023, Esohihy is a new site for Sekoly Maintso, where trees were planted to offset the construction of Esohihy EPP.

Activity Update

- A *dina*, and overseeing community committee, were established to manage the planting sites. Leadership training with the *dina* committee and two stakeholder meetings to discuss Sekoly Maintso were facilitated by SEED.
- Two signboards displaying *dina* information for the community were constructed outside of the planting sites.
- Survival and growth data were collected regularly, and seedlings were replanted as required by the planting site assistant.
- Two environmental education sessions were held by SEED with students to encourage environmental stewardship. The sessions involved showing educational videos and discussions related to the importance of trees and conservation.
- Ten species of fruit tree, including mango and custard apple, were planted by students in and around the school site.

340

CARBON OFFSET TREES

Planted to offset the carbon emissions of school construction

340

RESOURCE USE TREES

Planted for sustainable community use in five years

100

FRUIT TREES

Planted by students for community use

Carbon Offsetting Calculations

ESOHIHY EPP

64,821 kgCO2

340

Growth Rate of Seedlings

Mandiso

Established Site

Established in 2022, Mandiso is an existing Sekoly Maintso site. In 2022, 350 trees were planted to offset the construction of Mandiso EPP, and 350 resource use trees and 100 fruit trees were planted. In 2023, trees were planted to offset the construction of Sarisambo EPP and CEG.

Activity Update

- Three signboards displaying *dina* information for the community were constructed outside of the planting sites.
- Survival, growth, and DBH data were collected regularly, and seedlings were replanted as required by the planting assistant.
- An environmental education session was held by SEED with students to encourage environmental stewardship. The session involved showing an educational video and discussions related to the importance of trees and conservation.
- Seeds were sown in the nursery by the planting site assistant in preparation for the offset of Beraketa EPP in 2024.

680

CARBON OFFSET TREES

Planted to offset the carbon emissions of school construction

690

RESOURCE USE TREES

Planted for sustainable community use in five years

100

FRUIT TREES

Planted by students for community use

Carbon Offsetting Calculations

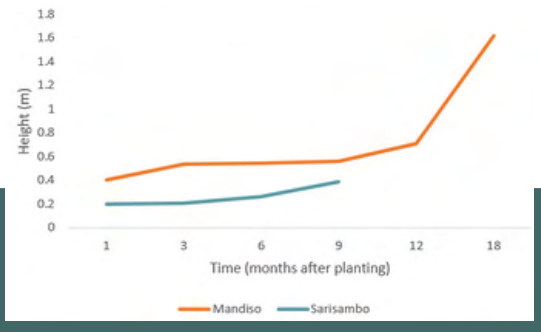
MANDISO EPP

62,756 kgCO2 — 314

SARISAMBO EPP AND CEG

129,581 kgCO2 — 680

Growth Rate of Seedlings



Sekoly Maintso To Date

The figures below detail the planting that has occurred since Sekoly Maintso's inception in 2022 and highlight the schools that have been offset across the planting sites.

2,463

CARBON OFFSET TREES

Planted to offset the carbon emissions of school construction

1,705

RESOURCE USE TREES

Planted for sustainable community use in five years

444

FRUIT TREES

Planted by students for community use

Offset Schools

EMAGNEVY EPP
68,229 kgCO2 — 341

MANDISO EPP
62,756 kgCO2 — 350

ESOHIHY EPP
64,821 kgCO2 — 340

TSAGNORIHA EPP
74,403 kgCO2 — 372

SARISAMBO EPP AND CEG
129,581 kgCO2 — 680

SAINTE LUCE EPP, MANANARA II EPP, VATAMBE EPP
75,958 kgCO2 — 380

Schoolchildren planting fruit trees

Key Learnings & Next Steps

Emagnevy

A fire in the Emagnevy resource use site led to 107 dead seedlings. As a result of discussions with the community in the aftermath of this incident, fire mitigation training and the distribution of fire extinguishing equipment (fire beaters and gloves) will occur in 2024. The construction of Mahatalaky Lycée will be offset in Emagnevy in 2024, with 286 trees to be planted in the carbon offset site and 1,095 to be planted in the resource use site. This large planting in the resource use site at Emagnevy follows the decision to provide each community with an equal number of resource use trees as carbon offset trees. In 2024, a trial of 100 native seedlings will be planted in the carbon offset site. SEED will conduct environmental education sessions with students and the wider community and continue to monitor the planting sites in Emagnevy in 2024.

Esinda

The construction of Esinda EPP and Beandry EPP will be offset in Esinda in 2024, with 681 trees planted in both the carbon offset and resource use sites. A total of 100 fruit trees will be planted in and around the school site after construction is completed in mid-2024. A mural with environmental messaging will also be painted on the finished school, with the design created by students. In 2024, SEED will conduct environmental education sessions with students and the wider community and monitor the planting sites. A *dina* and managing committee, who will receive leadership training, will be established to oversee the planting sites. Fire mitigation training and equipment will also be delivered to community members of Esinda in 2024.

Esohihy

An environmental education session was held with students to share knowledge on tree care and maintenance to improve fruit tree survival and growth rates. SEED will conduct environmental education sessions with students and the wider community and continue to monitor the planting sites in Esohihy in 2024.

Mandiso

Survival and growth rates were initially low for fruit trees and seedlings in the carbon offset site, this was addressed by changing planting techniques and planting seedlings in areas with more shade. Delivery of the education sessions was challenging due to the lack of availability of key resources such as a projector; this will be mitigated through the use of alternative equipment. A new Malagasy language environmental education video will be filmed with community members in Mandiso and shown in the four communities Sekoly Maintso works with. The construction of Beraketa EPP will be offset in Mandiso in 2024, with 344 trees planted in both the carbon offset and resource use sites. Fire mitigation training and equipment will also be delivered to Mandiso community members in 2024.

References

1.World Bank (2021). Climate Change Knowledge Portal. Available at: https://climateknowledgeportal.worldbank.org/country/madagascar. [Accessed 1st March 2024]

2. Jones, C., & Hammond, G. (2019) Embodied Carbon: The ICE Database V3.0. Available at: https://circularecology.com/embodied-carbon-footprint-database.html. [Accessed 1st March 2024]

3. Toochi, E. C. (2018). Carbon sequestration: how much can forestry sequester CO2. Forestry Research and Engineering: International Journal, 2(3), 148-150.

4. Sumida, A., Miyaura, T., & Torii, H. (2013). Relationships of tree height and diameter at breast height revisited: analyses of stem growth using 20-year data of an even-aged Chamaecyparis obtusa stand. Tree physiology, 33(1), 106-118.

5. Traoré, S., Djomo, A. N., N'guessan, A. K., Coulibaly, B., Ahoba, A., Gnahoua, G. M., ... & Guédé, N. Z. (2017). Stand structure, allometric equations, biomass and carbon sequestration capacity of Acacia mangium Wild.(Mimosaceae) in Cote d'Ivoire. Open Journal of Forestry, 8(01), 42.

6. Adam, N. S., & Jusoh, I. (2018). Allometric model for predicting aboveground biomass and carbon stock of Acacia plantations in Sarawak, Malaysia. BioResources, 13(4), 7381-7394.

7.IPCC (2003). Good Practice Guidance for Land Use, Land-Use Change and Forestry. Institute for Global Environmental Strategies.

About SEED Madagascar

SEED is an award-winning, holistic international development charity that envisages a thriving, healthy, and sustainable Madagascar. Our central mission is to work together to build community and environmental resilience in the southeast. We achieve this by working across five departments to respond to the most critical needs: community health, education infrastructure, water, sanitation, and hygiene (WASH), rural livelihoods, and environmental conservation.

Our approach is based on partnership, co-management, and skill-sharing with individuals, communities, local organisations, and government. The programmes lead to lasting change, alleviation of poverty, and support environmental conservation for some of the world's most vulnerable people in threatened and irreplaceable environments, contributing to the UN's Sustainable Development Goals

For more information about Project Sekoly Maintso or any of our other programmatic areas, please visit our website or contact us at info@seedmadagascar.org

seed **madagascar**

sustainable environment, education & development