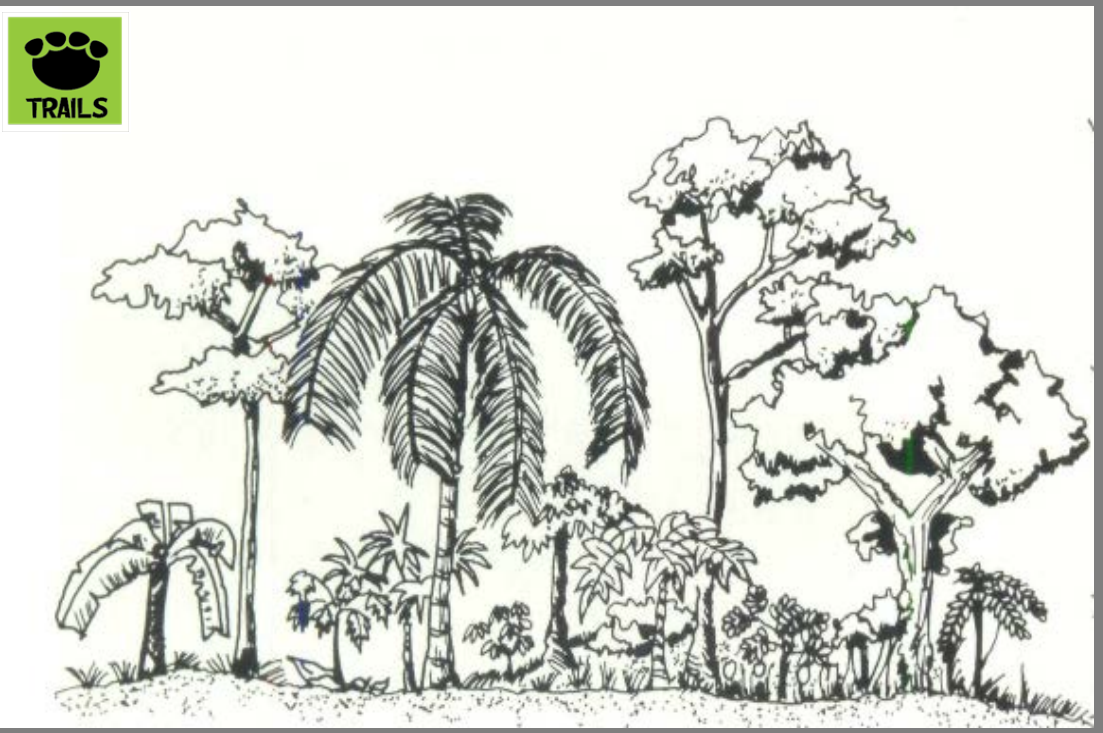
TRAILS
A pilot agroforestry project for oil palm-dominated landscapes

Alain Rival

M. Ancrenaz, I. Lackman, S. Burhan, P. Guizol and M. Djama



Why agroforestry?

- High productivity comes at a cost: soil that is depleted or eroded, watercourses that are polluted or drying up, and a food system that produces 20–40% of greenhouse gas emissions
- We urgently need to transform the food system, including agriculture.
- Agroforestry is land use that combines trees with crops, trees with livestock, or trees with both crops and livestock.
- Agroforestry is a nature-based approach to production and land use

Gassner A and Dobie P. eds. 2022. Agroforestry: A primer. Design and management principles for people and the environment. Bogor, Indonesia: Center for International Forestry Research (CIFOR) and Nairobi: World Agroforestry (ICRAF).

The TRAILS Project, Malaysia (Sabah)

- TRAILS project builds on a complementary partnership.
- TRAILS links academics, NGO, private and public stakeholders.
- TRAILS relies on long term expertise and multidisciplinary approaches from various science fields.
- TRAILS deals with agronomy, forestry and conservation sciences.

Objectives

- To install oil-palm-based agroforestry inside the oil palm plantation
- To undertake mixed planting in real-life conditions, using selected oil palm seedlings and 15 different native forest species
- To monitor the dynamics of regeneration of biodiversity in specific areas: agroforestry plantings, riparian corridors, and oil palm plantations in comparison with native forest.
- To comparatively study oil palm performance in different systems: growth and development, phenology, fruit yields and bunch characteristics.

Specific objectives

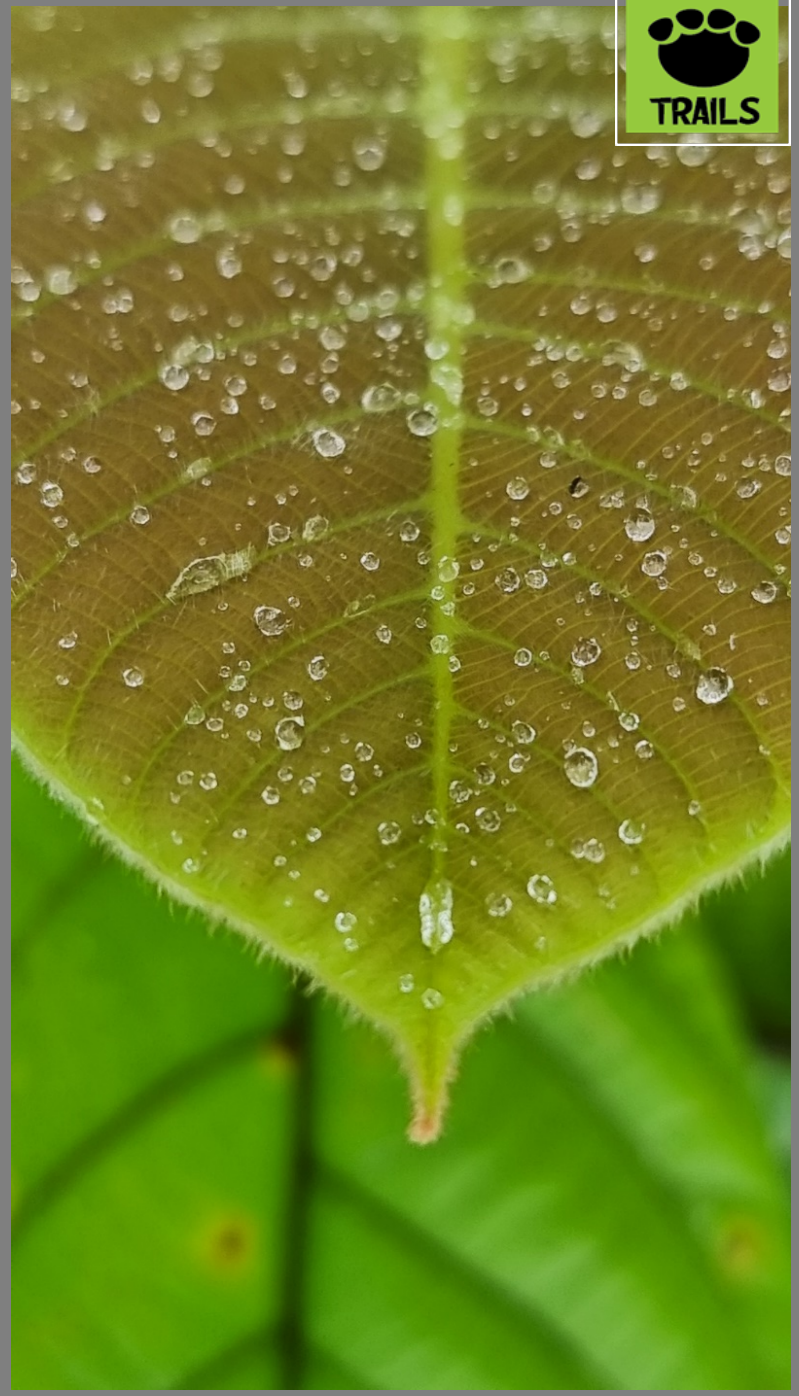
- To understand the key characters of climatic resilience and the bioclimatic condition in the agroforestry parcels

- To assess the ability of mixed planting at improving environmental services, such as:
  - increased biomass and photosynthetic capacity,
  - soil health,
  - water quality
  - abundance of pollinators

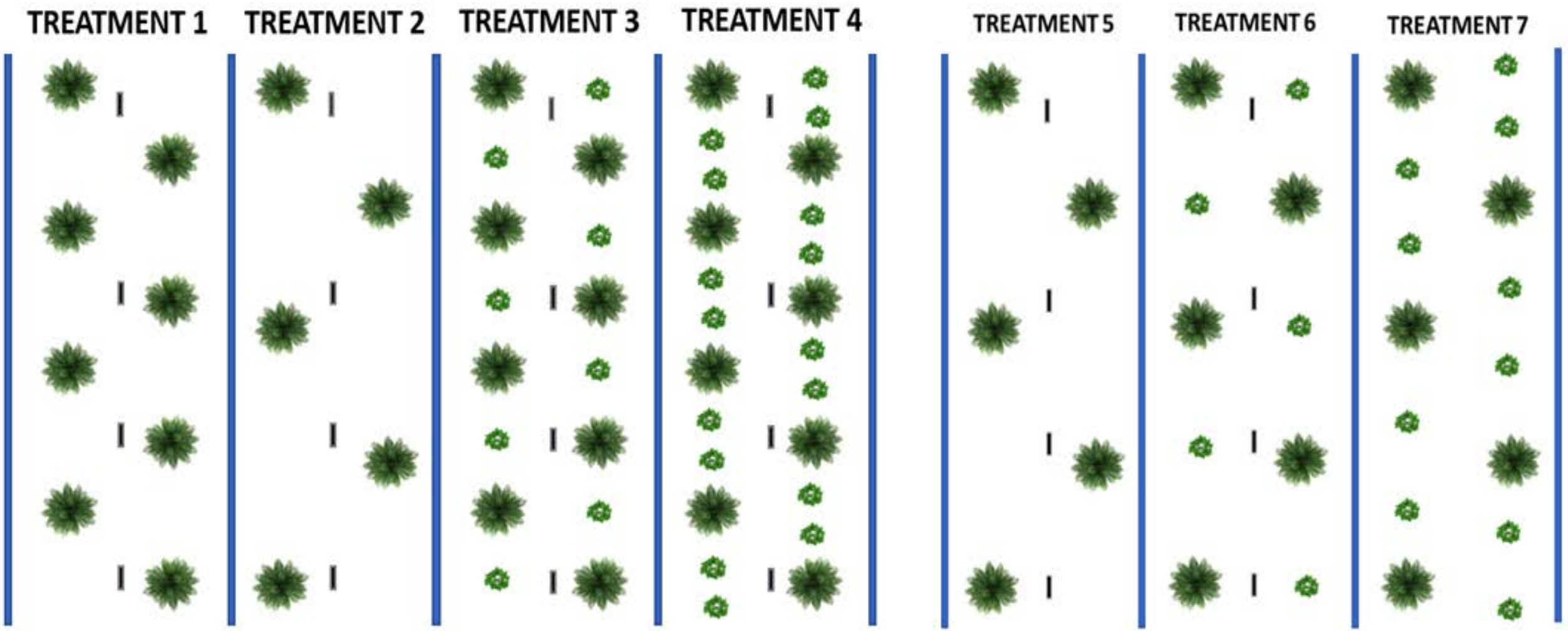
- To analyse the socioeconomic impact of the transition from oil palm monospecific plantation to diversified agroforestry systems.

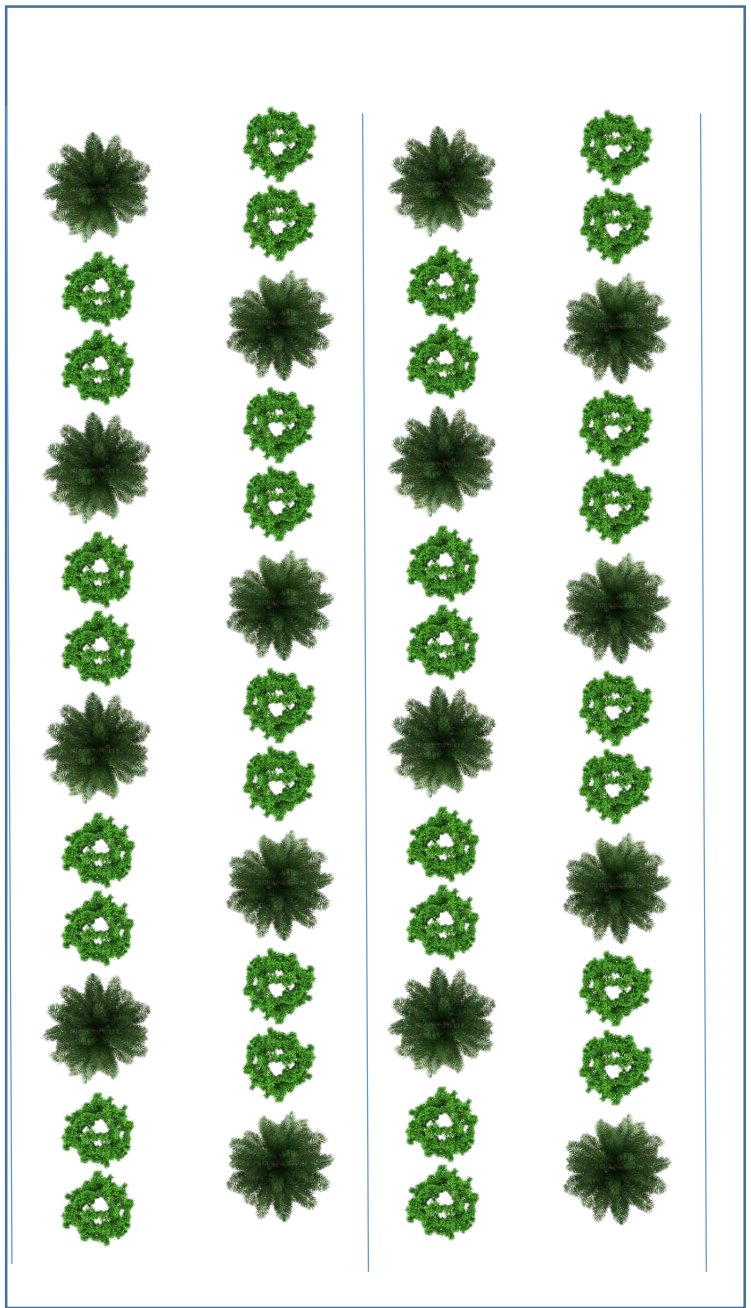
TRAILS in numbers

- ✓ Allocated area : 100 ha
- ✓ Present planted area : 37 ha
- ✓ Planted forest species : 15
- ✓ Planted trees : 3,000
- ✓ Specific planting designs : 3



TRIAL 1 - Oil palm-based interplanting





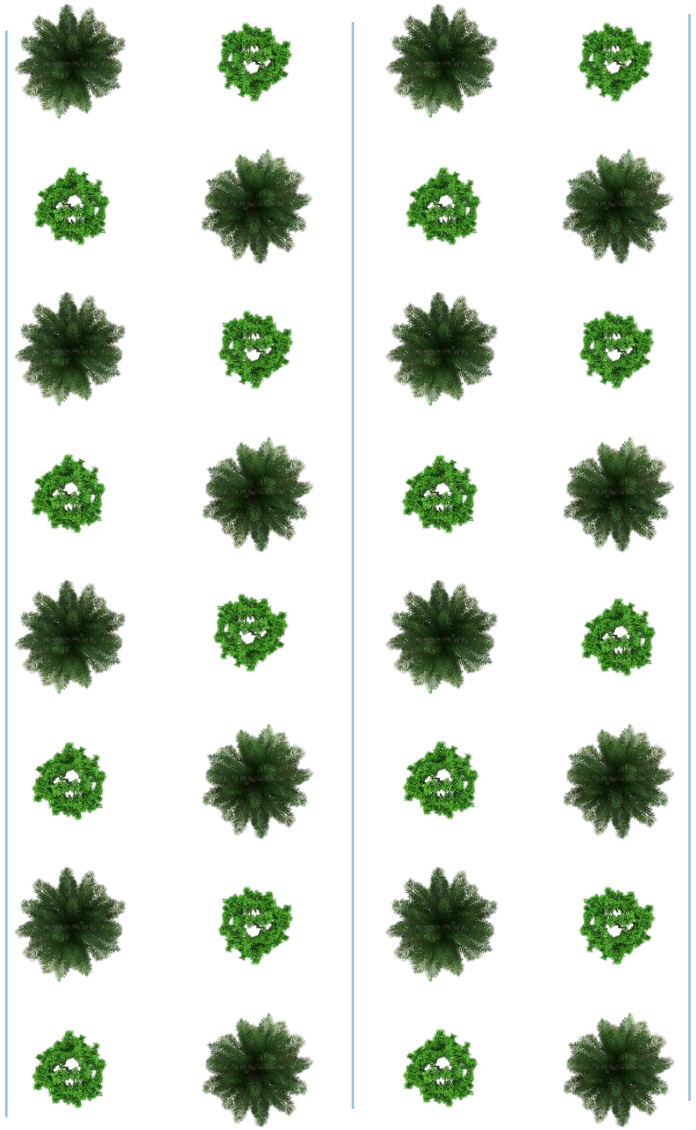
Expected results

- Impact of the reduction of oil palm density (143 to 93 palms/ha)
- Effect of forest trees co-planting on oil palm productivity
- Changes in biodiversity parameters
- Changes in biophysics parameters (soil, water, plant)

Design

- One single trial made of 5 blocks
- Forest species: *Nauclea subdita*
- One fast growing native species generating light shading.

Interplanted Rows

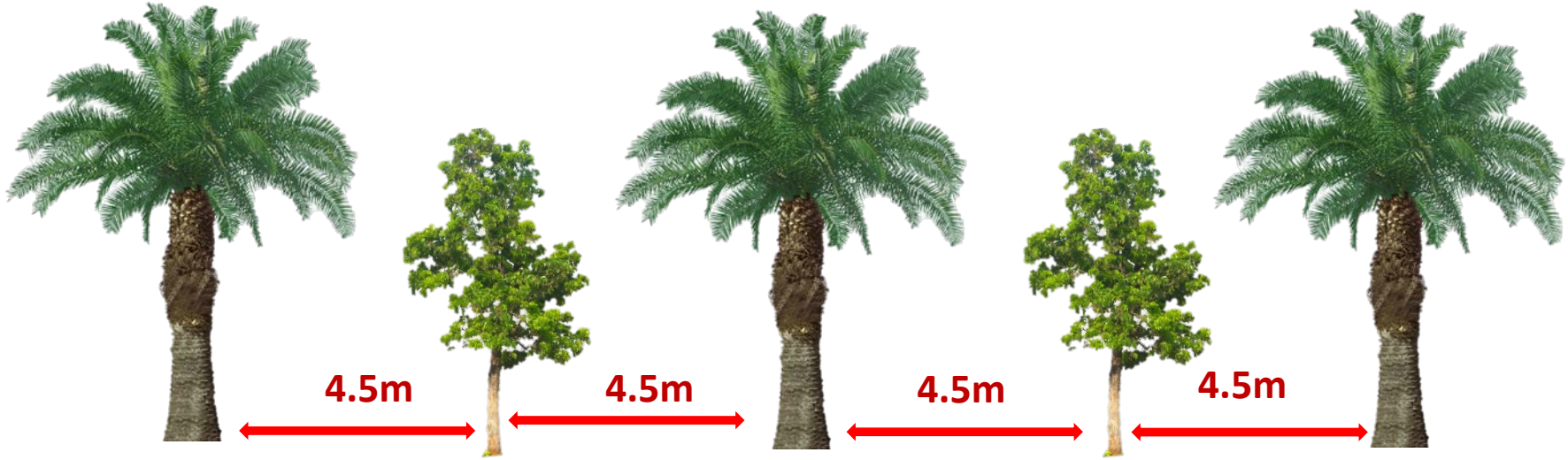


TREATMENT 3

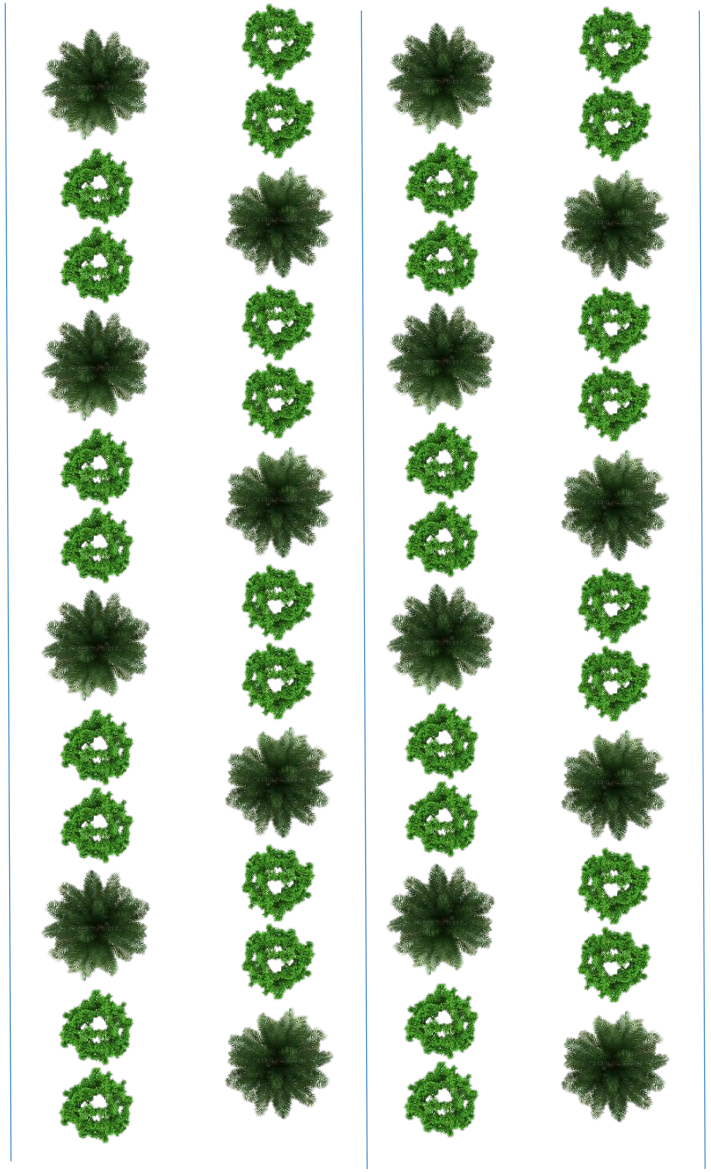
1 forest tree is planted

between 2 palms on the line (64 trees)

trees & palms Spacing is 4.5m

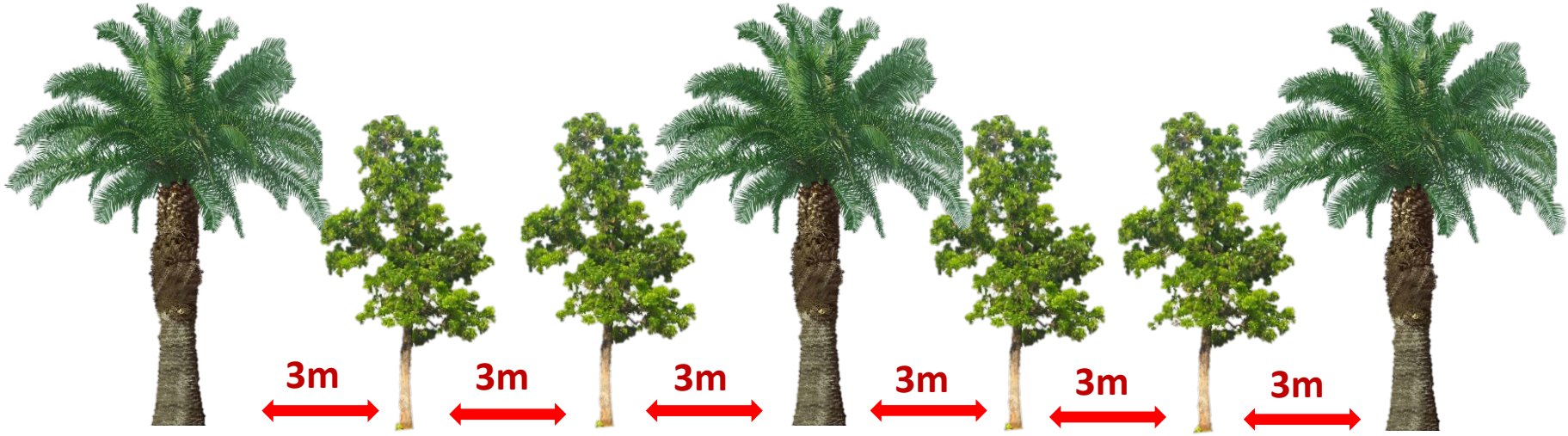


Interplanted Rows

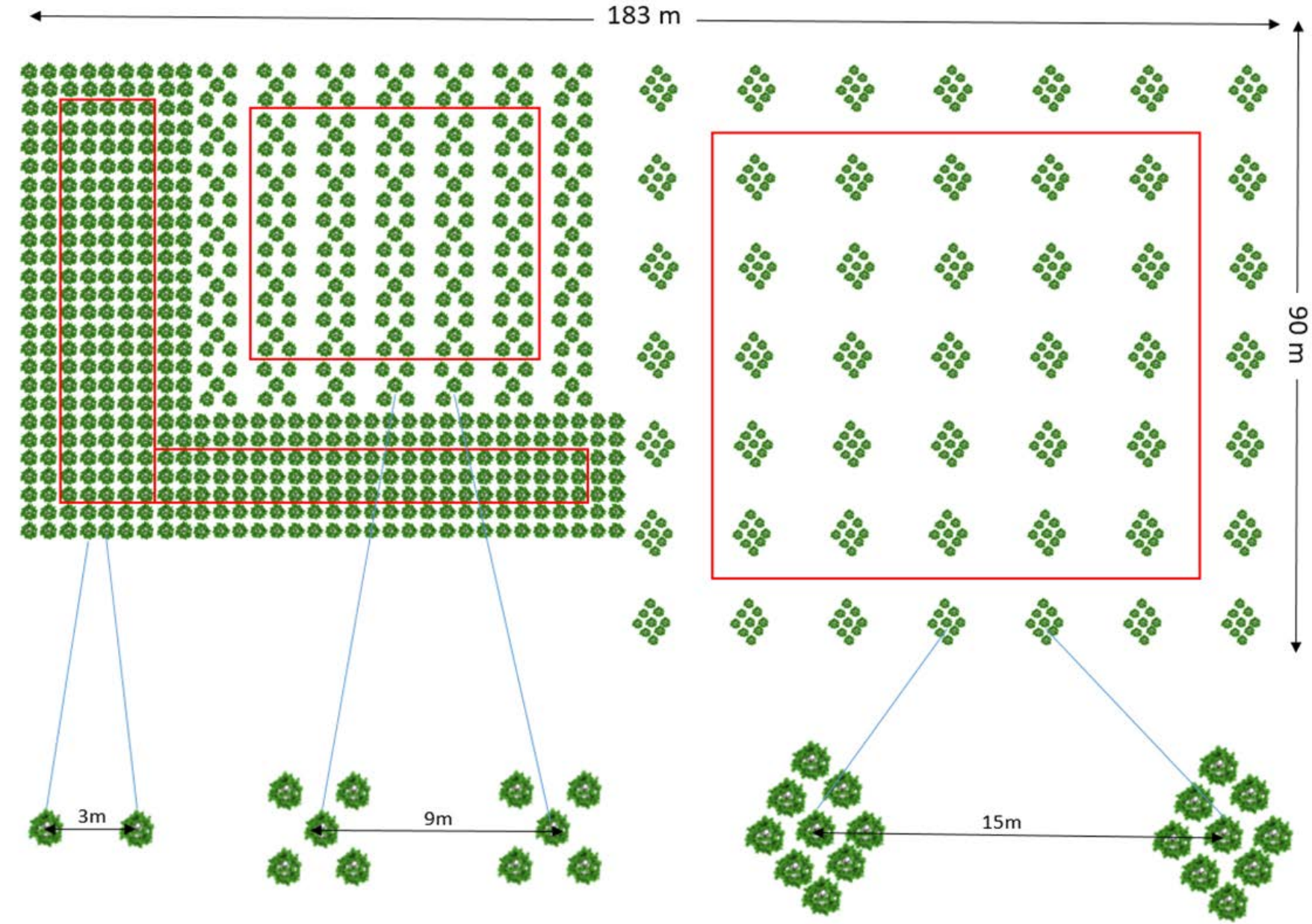


TREATMENT 4

2 forest tree are planted
between 2 palms on the line (128 Trees)
trees & palms spacing is 3m



TRIAL 2 Mixed Forests



Experimental design

- 3 treatments
- Treatment 1 : 10 species 3 X 3 m, comparison of species ; 25 trees per species needed for measurements.
- Treatment 2 : Group of 5 trees per planted at 1 X 1 m , spacing between groups is 9 m.
- Treatment 3 : 9 trees per nucleus 1 X 1 m, spacing between groups of 9 trees is 15 m.

TRIAL 2 Mixed Forests

1	2	3	4	5	6	7	8	9
3	27	19	22	7	22	11	3	14
4	27	26	11	12	4	11	3	26
22	19	7	27	26	12	3	4	11
11	4	3	14	26	12	7	26	19
26	14	27	12	7	4	14	11	22
4	11	22	26	27	14	12	19	7
3	7	19	12	14	11	22	19	27
26	22	14	7	11	19	27	3	4
4	3	12	22	26	26	11	7	14
14	12	3	11	4	22	3	26	27
3	26	4	27	7	19	11	22	14
14	26	22	11	12	4	12	3	19
26	12	3	4	27	22	7	19	27
22	19	7	27	26	12	3	4	11
11	4	3	27	14	14	7	26	4
26	19	11	26	12	4	3	11	22
4	11	22	14	27	19	19	26	7
3	7	19	22	14	4	14	3	7
22	11	14	12	27	12	26	4	22
12	7	4	14	4	11	3	12	27
3	4	4	27	7	22	19	11	14
12	7	22	11	12	4	14	3	26
27	19	3	4	14	27	7	27	27
22	19	7	27	14	12	3	11	11

3	FICUS SEPTICA	35
4	PTEROSPERMUM JAVANICUM	42
7	EUGENIA CERASSIFORMIS	40
11	EUGENIA SP	35
12	KOODERSIODENDRON PINNATUM	35
14	MICROCOS CRASSIFOLIA	43
19	TOONA SURENI	35
22	MALLOTUS MUTICUS	41
26	EXCOECARIA INDICA	35
27	EUGENIA CERASIFORMIS	47

27	4	14	19	22	14	7	26	12	26	27	7	22	11	19	14	22	19	7	4	3	11
26	12	14	27	19	27	3	26	22	7	14	4	27	22	12	26	3	14	19	19	12	12
4	22	26	14	11	12	12	3	7	26	3	14	22	27	19	7	11	19	22	26	11	3
3	7	14	12	14	27	22	26	27	22	19	26	12	3	4	14	4	7	27	22	7	27
27	22	14	11	7	11	12	27	4	11	4	22	14	7	26	14	11	3	4	27	22	12
7	12	12	19	27	27	7	14	14	27	19	19	4	27	22	14	14	12	7	22	26	22
14	7	27	4	4	19	19	27	4	27	7	7	12	19	7	27	27	22	27	4	4	11

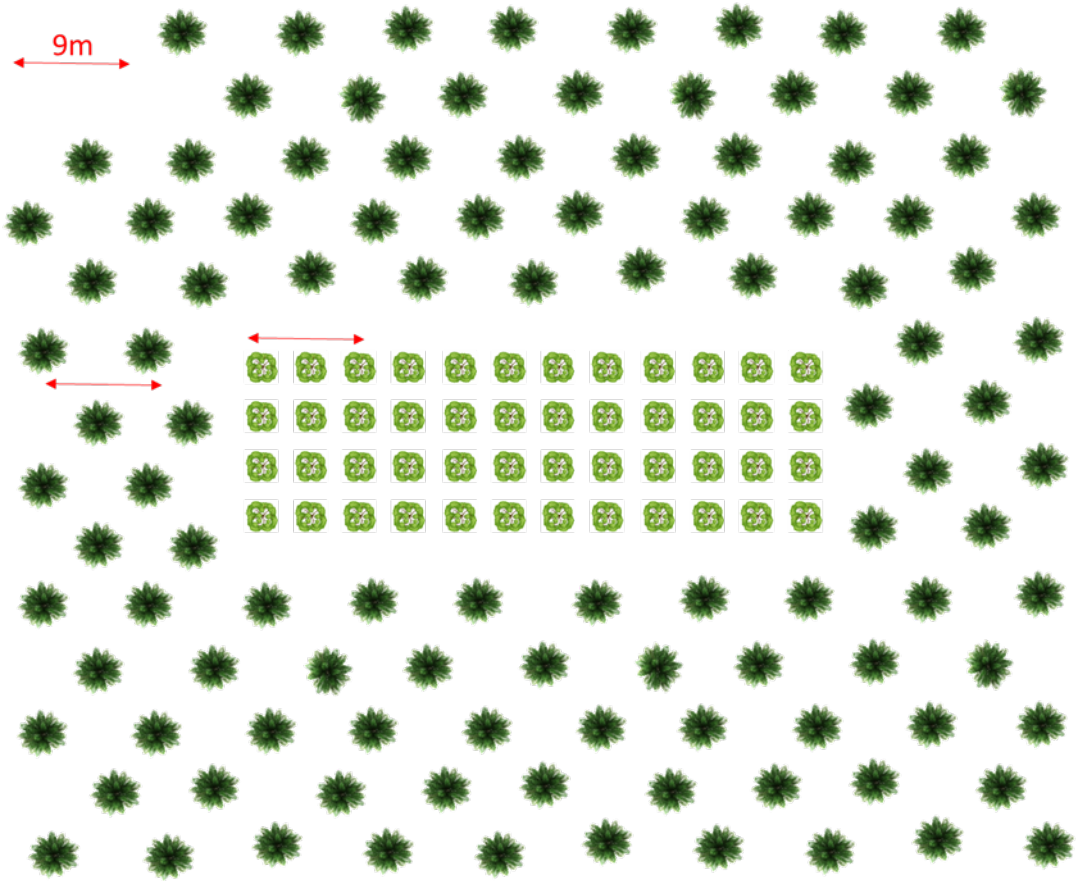
TRAILS

TRIAL 2 Mixed Forests

Expected results

- The present trial was planted with forest trees only, aiming at assessing the ability for agroforestry plantation of ten different selected species of native forest trees.
- Three different planting densities and three types of trees associations (individual trees, group of 5, group of 9) were tested.
- We will improve our knowledge on growth and development characteristics of 10 forest specieds, natives of the Kinabatangan Basin,
- Assessed suitability of native forest species to be successful in agroforestry plantations

TRAIL 3 Forest Islands



Goal

To document the interactions between palms and specific tree species

Experimental design:

- 5 replicates x 48 trees = 240 trees per species
- First set of 4 species: *Nauclea subdita*, *Microcos crassifolia*, *Meiogine* sp, *Mallatus muticus*

Specific objectives

- To assess the productivity of palms around forest trees islands
- To assess the changes in microclimate inside and around the islands
- To assess possible contamination or symbiosis through the microflora (*Ganoderma*)

A 10-years work plan

PROJECT PHASE	YEARS	ACTIVITIES	BUDGET
TRAILS 1	2020 - 2023	• Construction of partnership • Baseline Assessment • Planting Design • Socioeconomic Studies	• 1,000 k€ • 2 years • Private/Public funding
TRAILS 2	2024 - 2026	• Protocols for evaluation - Agronomy • Protocols for evaluation - Biodiversity • Establishing participatory research • Protocols for statistical analysis • Data Collection • Data Treatment (Statistical Analysis) • Training (4 PhDs) • Publications	• 2,000 k€ • 4 years • Private/Public funding
TRAILS 3	2027 - 2030	• Data Collection • Data Treatment (Statistical Analysis) • 2 Post Doctoral Fellows • Publications • Recommendations	• 2,000 k€ • 4 years • Private/Public funding

September 2022

October 2023

April 2024

The best time to plant an oil palm-based agroforests … was 20 years ago.

The second best time is now.

Thank you.
Terima kasih.