Agroecological model farms for different geoclimatic zones of sub-Saharan Africa, a way to autonomously and sustainably produce on small areas and allow food security ?

2023

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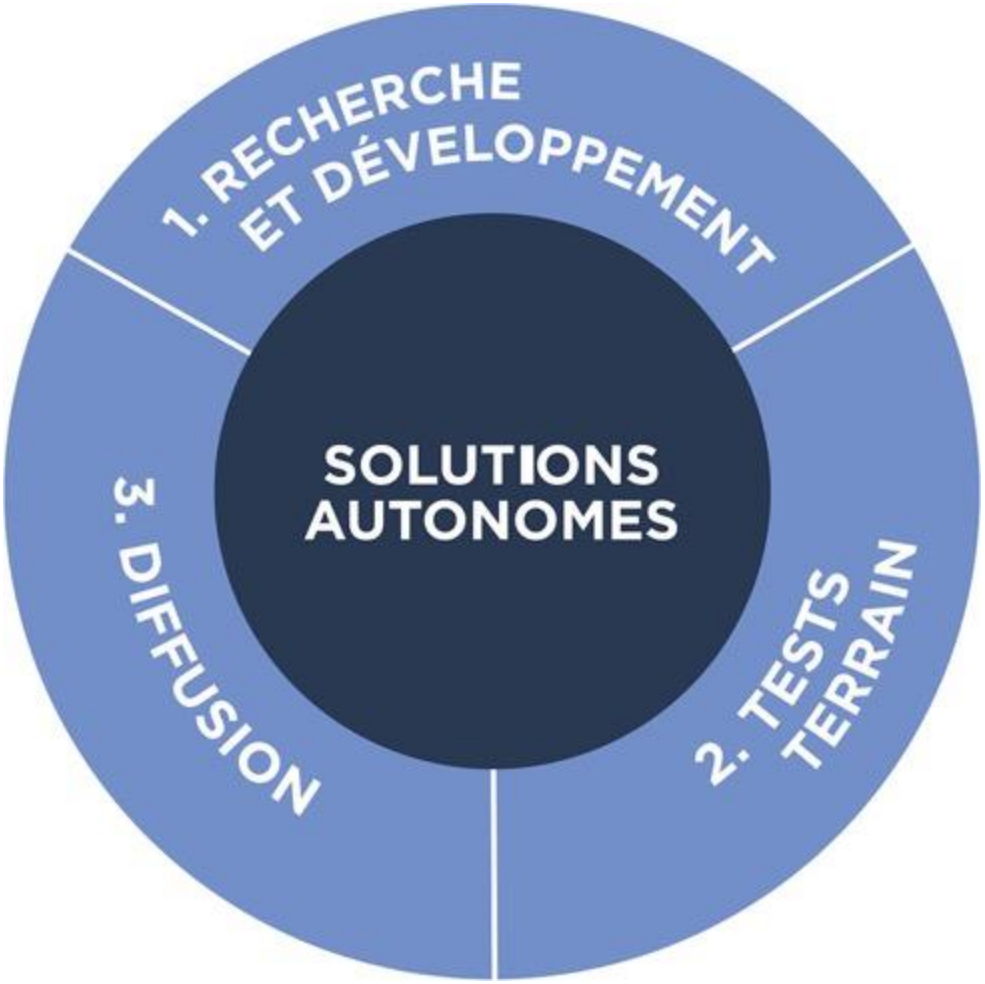

Essential Needs

AGROECOLOGIE

The Agroecology Unit

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RESEARCH AND DEVELOPMENT OF **PRODUCTIVE AND SUSTAINALE AGROECOSYSTEMS**

Attempt to replicate the stability of a natural ecosystem with food crops and productive animals.

- Positive interactions between crops
- Positive interactions with predatory and polizinating insects
- Negative interactions towards weeds and pests
- Resilience of the system due to a wide biodiversity
- Management of resources (water and nutrients) in a closed circuit

RESEARCH AND DEVELOPMENT OF **PRODUCTIVE AND SUSTAINALE AGROECOSYSTEMS**

An Agroecosystemic model is a design/plan of a farm

This farm can produce intensively and sustainably on a small area all commodities needed for subsistence (Vegetables, Cereals, Fruits, Animals, Cash crops)

The farm produces without the use of synthetic and external pesticides and fertilizers

The animals produce the necessary manure for the farm (in addition to compost and green manure)

The small size of the farm correspond to the mean area of farms in the target region

RESEARCH AND DEVELOPMENT OF **PRODUCTIVE AND SUSTAINALE AGROECOSYSTEMS**

Development of **“Agroecosystemic models”** for different geoclimatic regions of Africa.

The model is created according to the following criterias:

- Type of climate (Koppen classification)
- Length and intensity of rainy season (inside the climate zone)
- Main type of soils
- Commodities usually produced and eaten in the region

RESEARCH AND DEVELOPMENT OF **PRODUCTIVE AND SUSTAINALE AGROECOSYSTEMS**

The model is created in collaboration with the local partner of target zone.

The model combines traditional practices of target zone/country, practices of other countries as well as results of scientific research in agronomy and agroecology.

AGROECOLOGIE

PROJECTS OF AGROECOLOGY UNIT

- The agroecological models are then tested and improved through a network of pilot farms

- Phase 1: mother farm of family/village scale (1-5 hectares)
  - Production
  - Training
  - Research and Development
    - Evaluation of the farm and underlying model efficiency
      - Agronomic efficiency : what are the yields of the different crops, how bad are the attacks by pest and diseases etc.
      - Economic efficiency: is the farm able to sustain itself? What are the investment needed in comparison to the revenues?
      - Sustainability : how are the nutrient fluxes? Is the farm really a closed circle of nutrients and water? Is the soil fertility getting better or not?
    - Adaptation of the model after the results
    - Evaluation realized in collaboration with local universities of target land

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AGROECOLOGIE

PROJECTS OF AGROECOLOGY UNIT

- The agroecological models are then tested and improved through a network of pilot farms

- Phase 2: development of a network of sister farms
  - Disseminate agroecological practices to farmers
  - Test the replicability of the concept by local farmers
  - Each farm also site of production, training and research
  - Results from sister farms also used for model adaptation and perfection

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PHASE II : NETWORK OF SISTER FARMS

- Training of 50 to 100 farmers is organised on the farm
- Following the training, the farmers propose a concept of how to set up a sister farm at their home.
- 10 producers, or group of producers, are chosen for the creation of a sister farm
- The farm is created with the means of the farmers but with technical support of AF. A small financial support is given for the launch.

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DISSEMINATION OF MODELS

- To local farmes of project countries/regions
  - Training sessions
  - Sister farms
  - Collaboration with governments or bigger organisations
- To the scientific community and NGO's
  - Scientific publications
  - Online library of agroecosystemic models in open access

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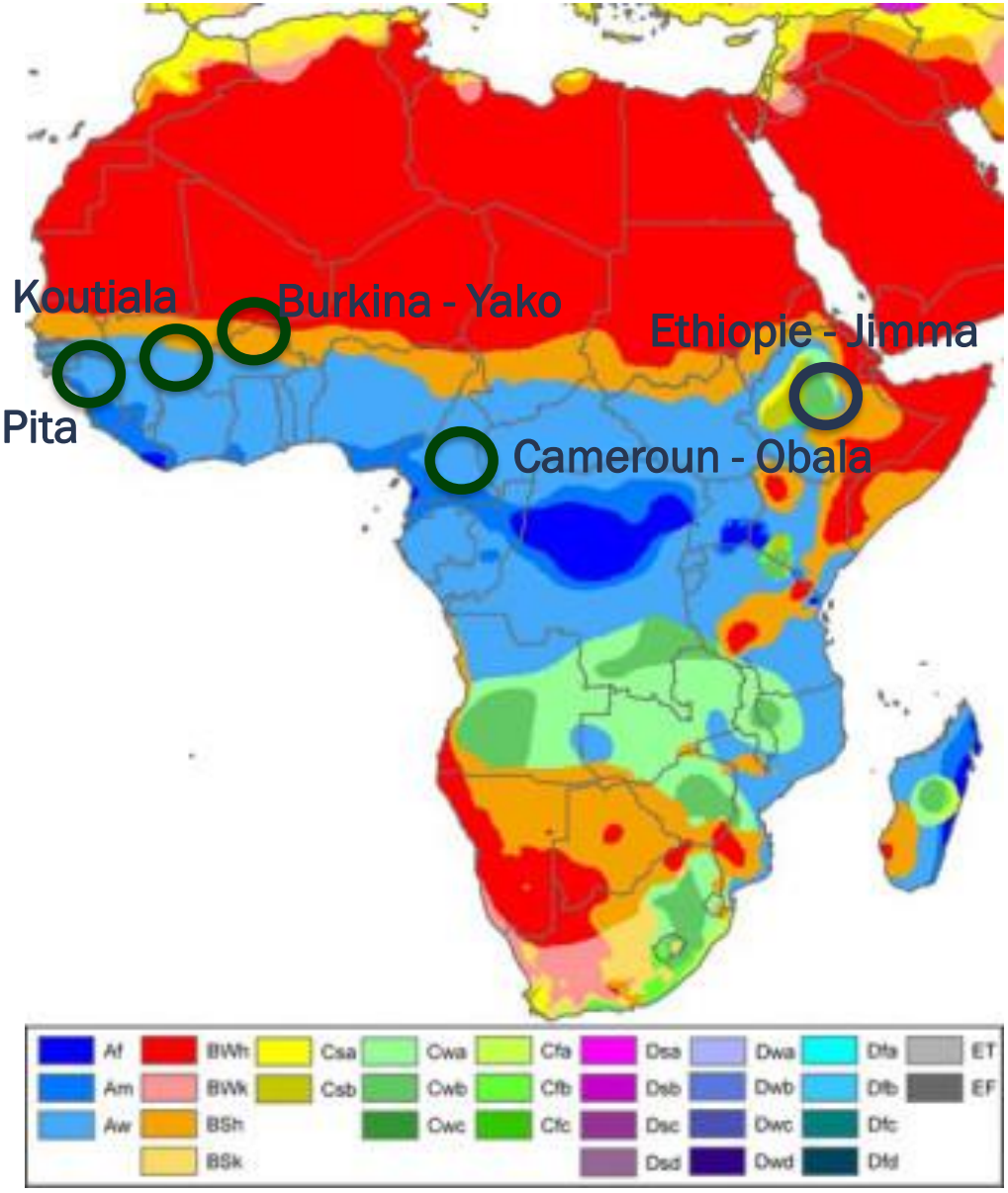
- **TODAY**
  - ✓ 5 complete agroecological farms (mother farms)
  - Network of sister farms to be established starting 2023



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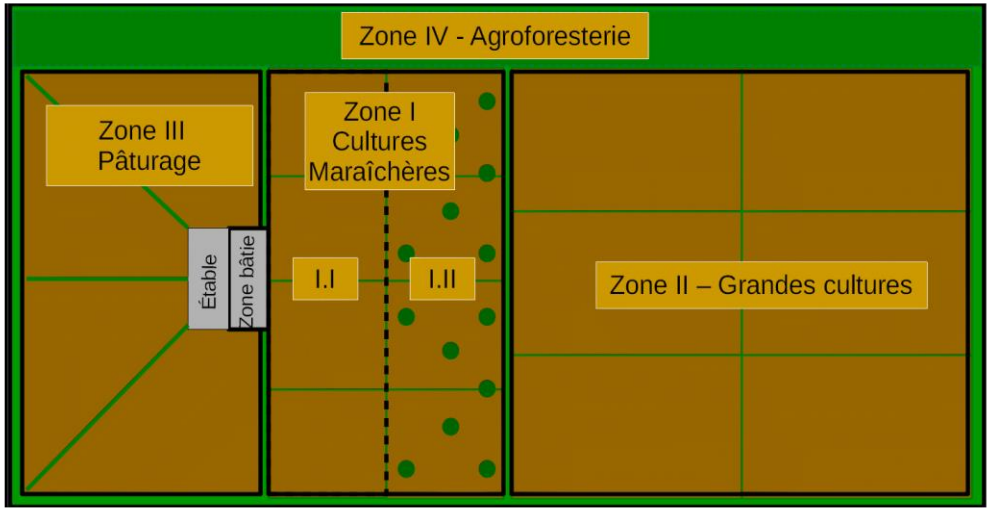
EXEMPLE OF AN AGROECOSYSTEMIC MODEL – CASE OF GUINEA (5 HECTARES)

- The farm contains **four main zones :**
  - ✓ a **tuber and vegetable zone** (I),
  - ✓ a **cropland zone** (II),
  - ✓ a ***pasture zone*** (III),
  - ✓ an ***agroforestry zone*** (IV),
- A **building compound** with a borehole and a house.
- The whole agroecosystem is surround by a ***live productive hedge***



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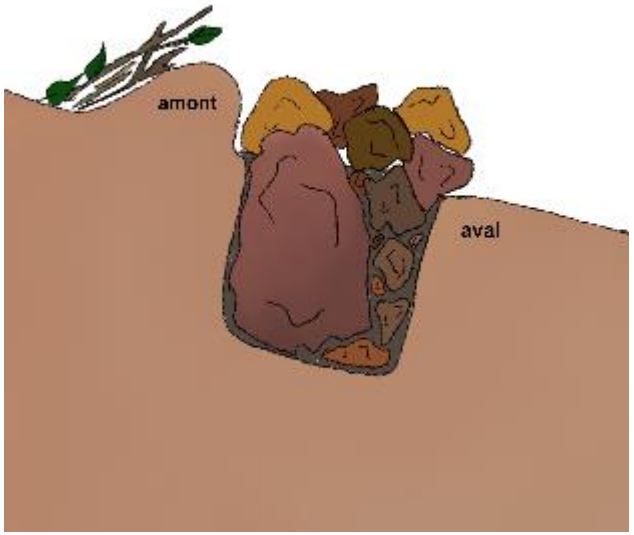
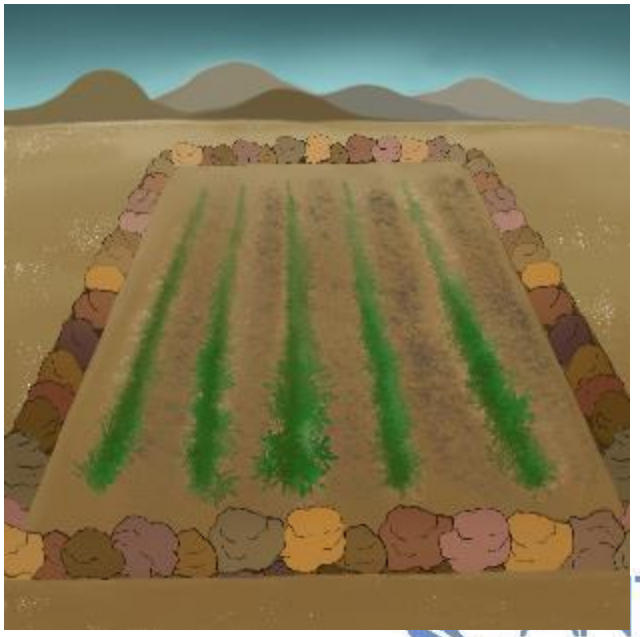
WATER MANAGEMENT

- Borehole with solar pump in arid zones
- Drought resistant varieties
- Use of water retention technique (plot level): stone barriers, hedges, grass hedges





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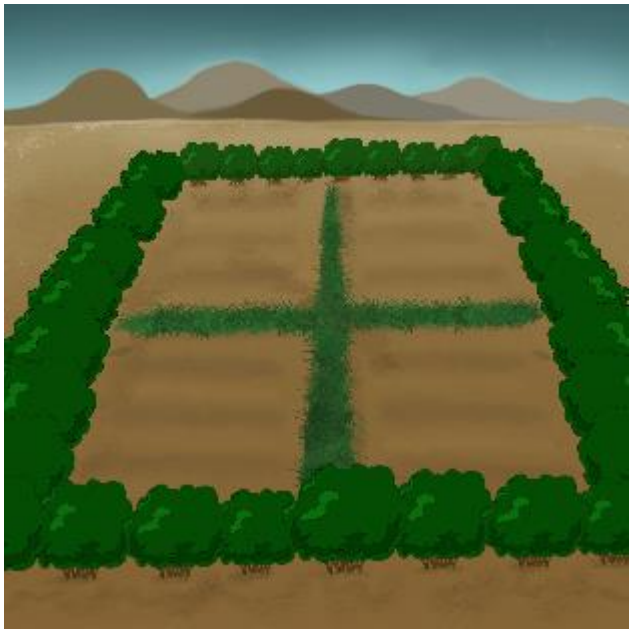
WATER MANAGEMENT

- **Use of water retention technique (plot level)**: stone barriers, hedges, grass hedges



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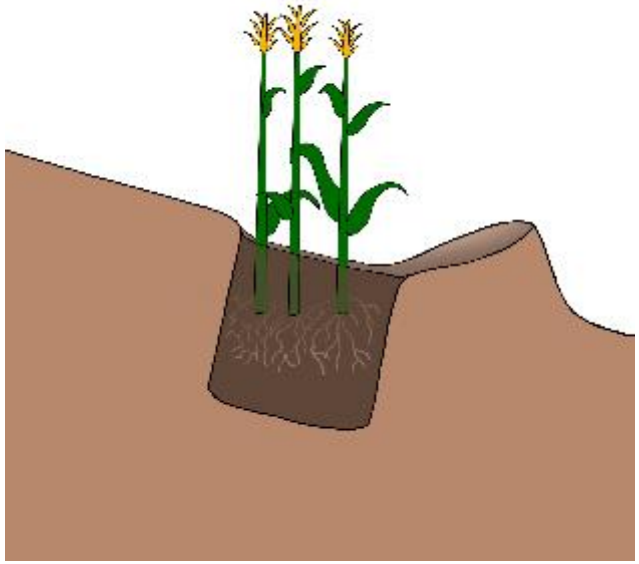
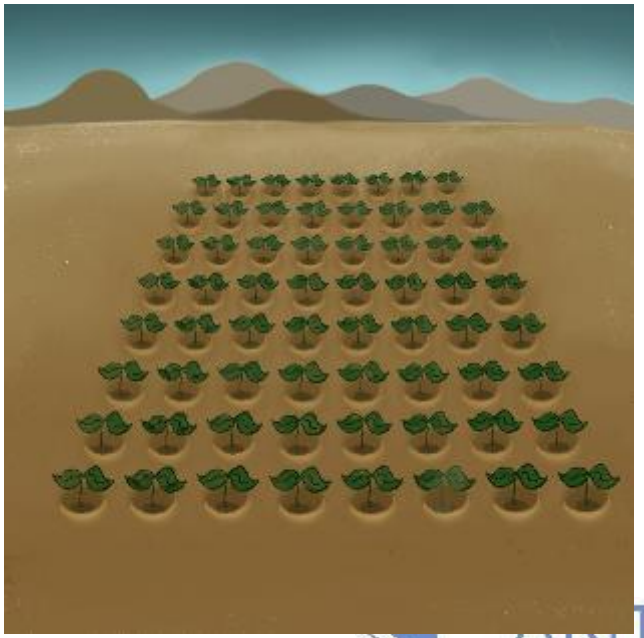
WATER MANAGEMENT

- **Borehole with solar pump in arid zones**
- **Use of water retention technique (plot level):** stone barriers, hedges, grass hedges
- **Use of water retention technique (crop level):** zai holes, half-moons, ridges





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WATER MANAGEMENT

- **Borehole with solar pump in arid zones**
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SOIL AND NUTRIENT MANAGEMENT

- Soil management
  - Permanent cover
  - Crop rotation
  - Minimal soil disturbance (direct seeding when possible)

- Fertilisation
  - Animal manure (cattle, sheeps, goats, poultry)
  - Compost of agricultural by-products
  - Green manure (cover crops + hedges)

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PESTS AND DISEASE MANAGEMENT

- High biodiversity
  - Discontinuity of ressources
  - Income diversification
  - Attraction of insect predators
- Attraction of insect predators
- Crop association
- Crop rotation
- On-site natural pest repellent
- Biofumigation

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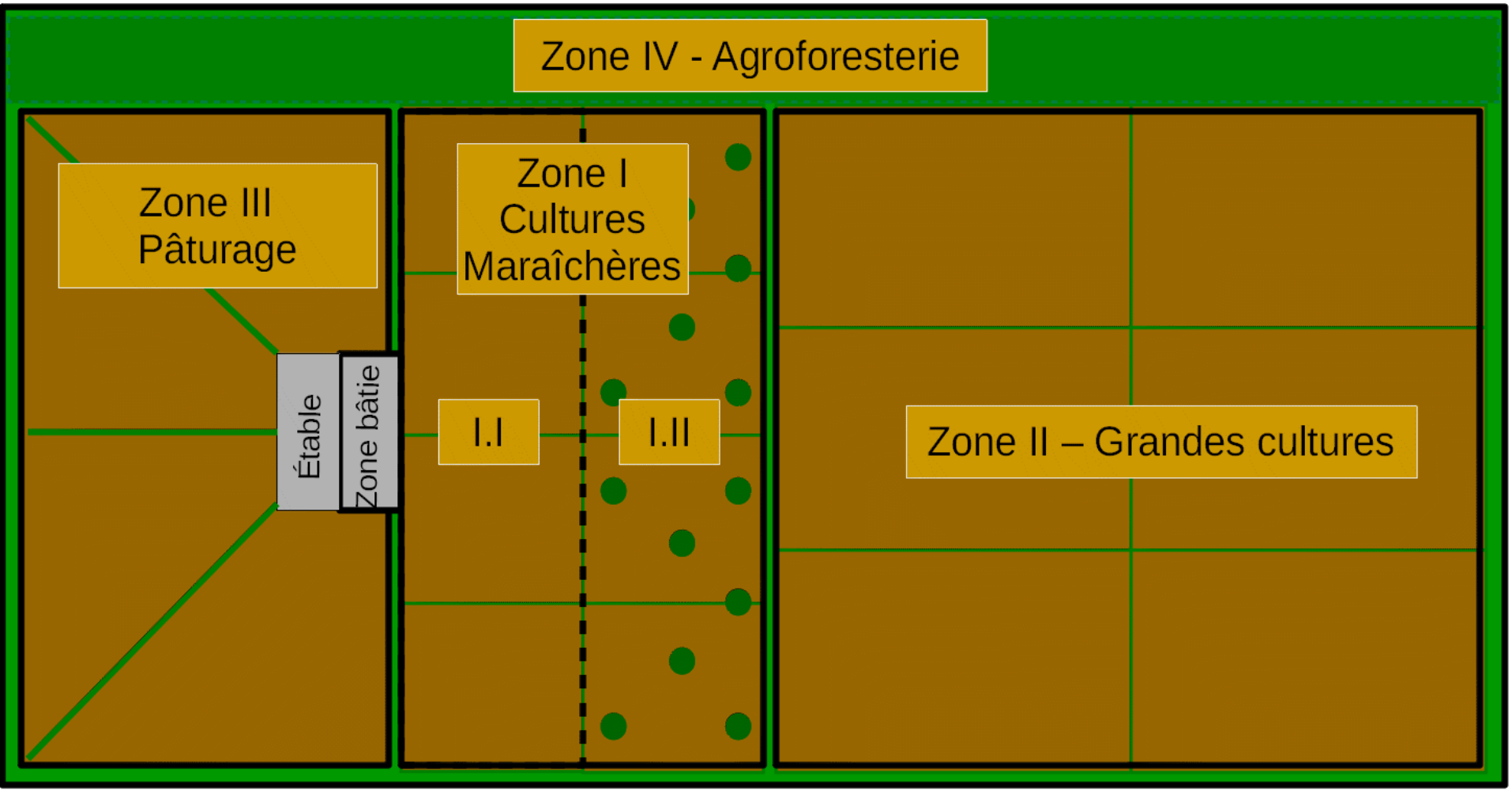

Démarcation des zones

Haie vive productive

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ZONE I.I – VEGETABLE PRODUCTION ZONE

- Intensive vegetable production on 4000 m2
  - Labour intensive
  - Water intensive (strong irrigation needed)
  - Nutrient intensive (strong fertilisation needed)
- All types of vegetables
- Associations and rotations of vegetables
- Separations between plots by ananas

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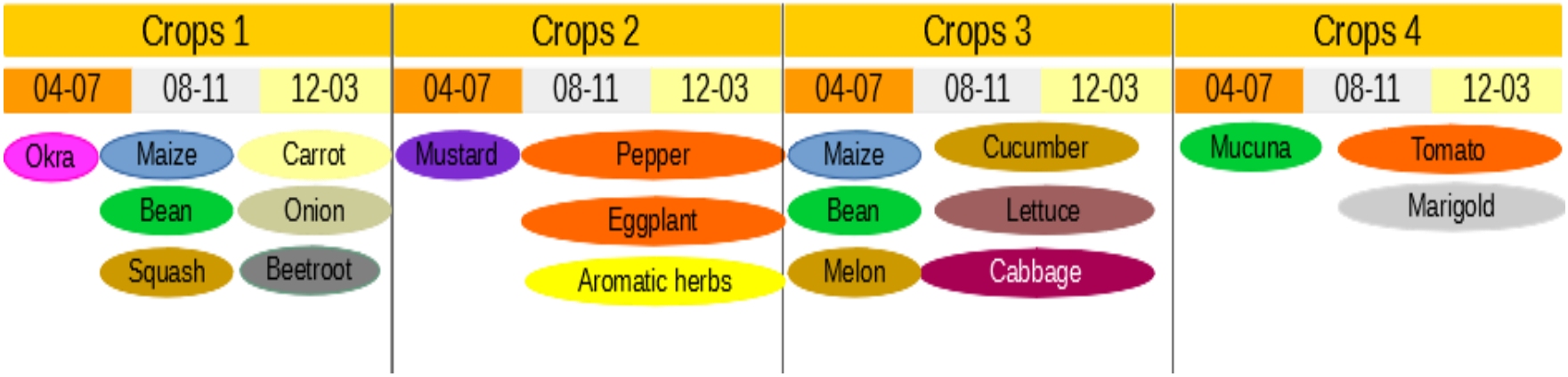
ROTATION OF VEGETABLES



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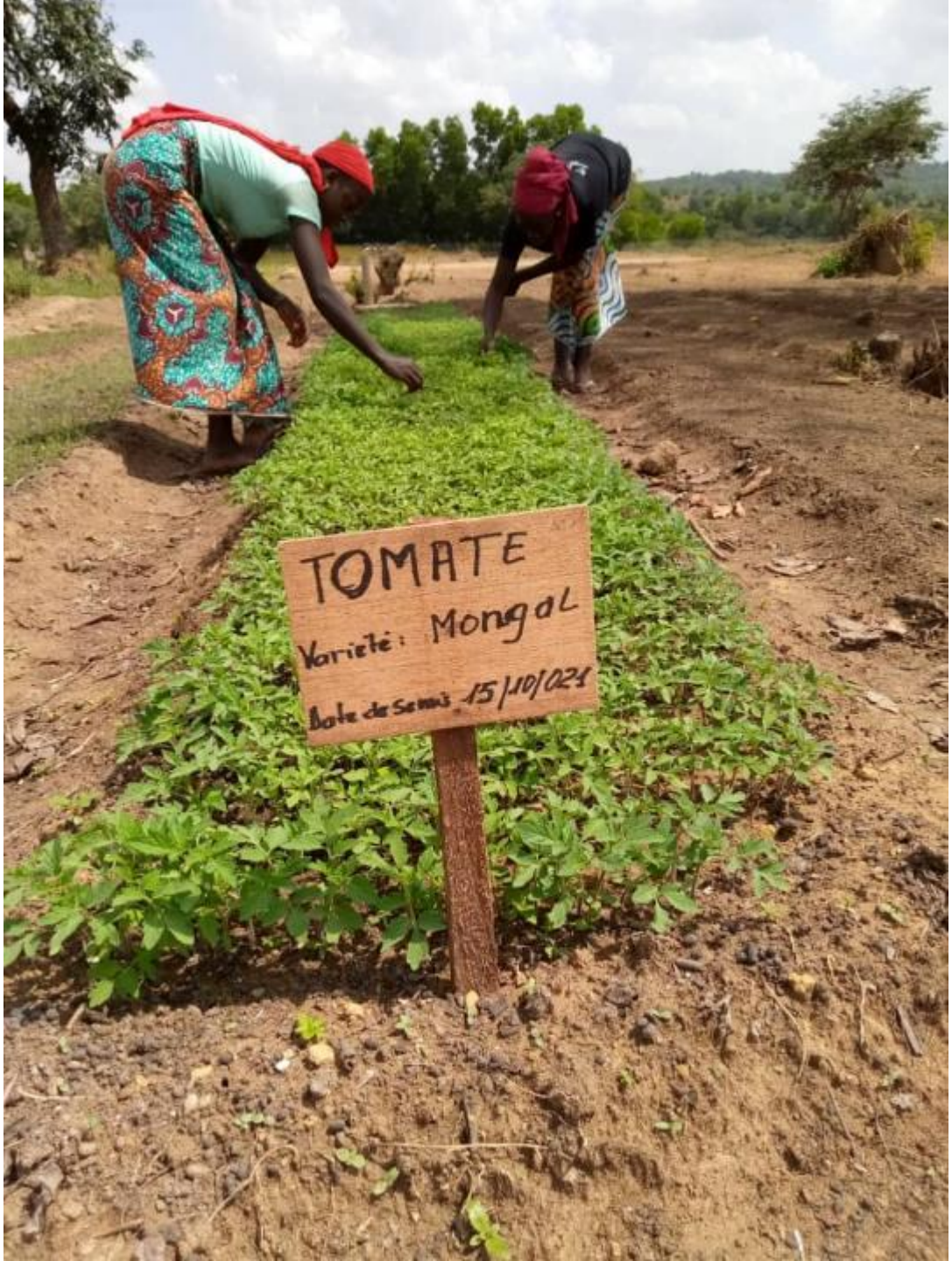
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Date de semis 15/10/024


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ZONE I.I – **SEMI**-AGROFORESTRY

- **Production on 4000 m2**
- **Association of tubers** (sweet potato, cassava, yam, cocyam) **with fast-growing perrenials** (papaya, banana, plantain, ananas)
- Tuber cultivation often means high soil disturbance and risks of fertility loss and erosion. Tubers are therefore associated with perrenials that protect the soil from erosion.
- **Separations between plots by ananas**

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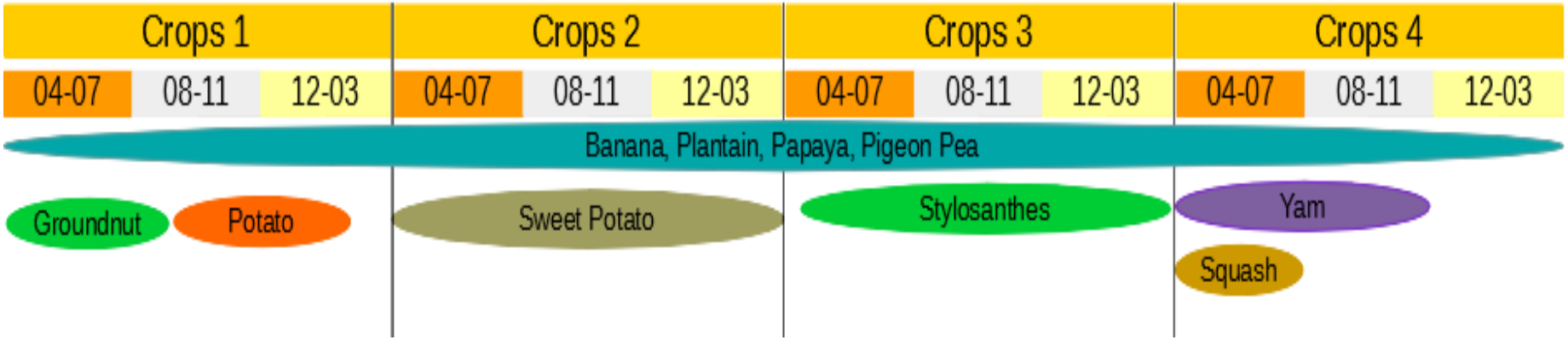
ROTATION IN ZONE I.II



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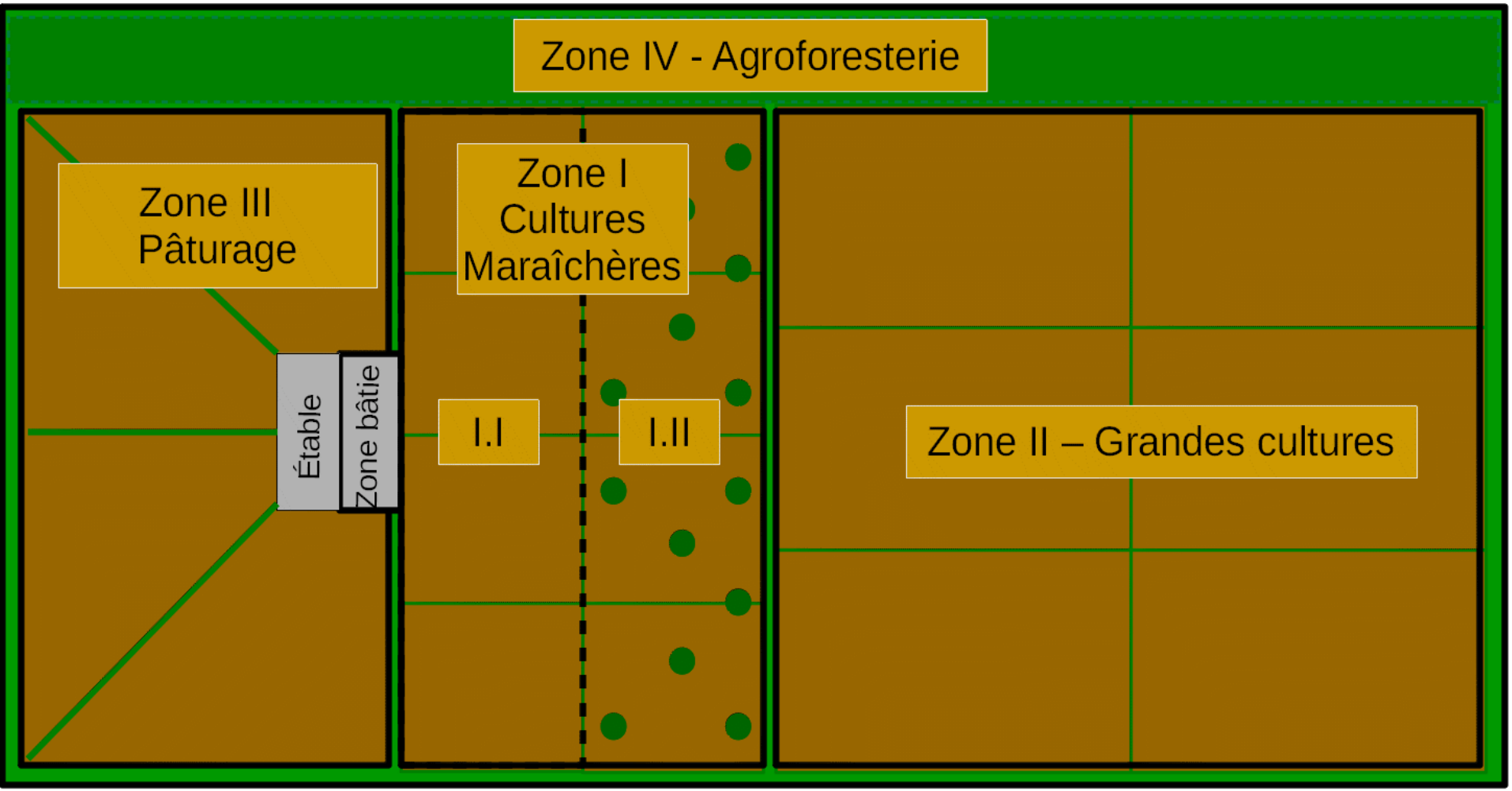

Démarcation des zones

Haie vive productive

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ZONE II – CROPLAND

- **Legume and cereal production** (maize, fonio, groundnut, cowpea, bean, bissap)
  - Crops demanding less care, less water, less fertilisation
  - Crops less susceptible to attacks of pests and diseases
- Only during rainy season (no irrigation)
- 18'000 m2, 6 plots
- Crop associations and rotation
- Separations between plots by brachiaria grass

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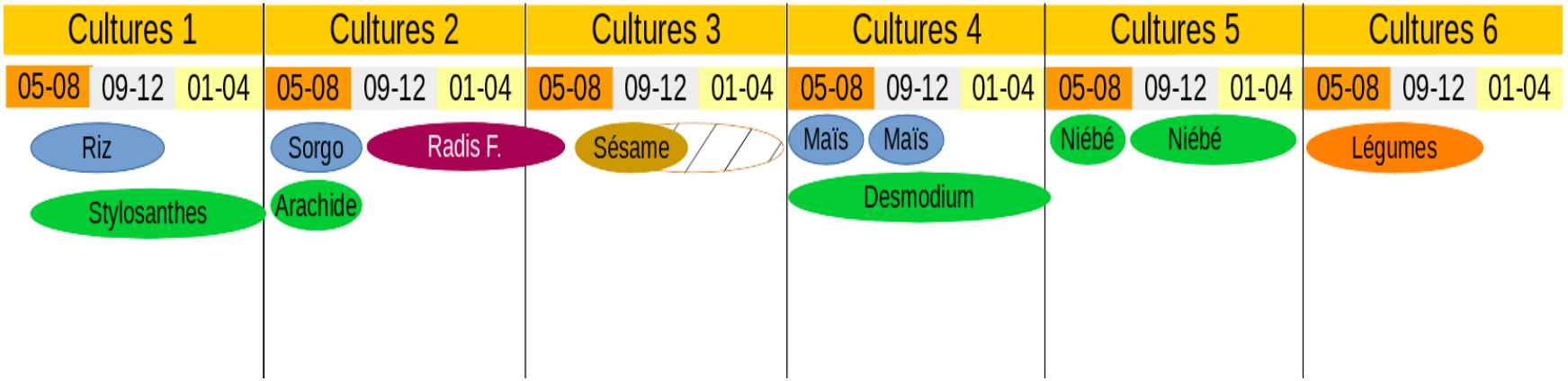
ROTATION IN ZONE II



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BUILDING COMPOUND

- 1000 m2

- Constructed infrastructures
  - Borehole with pump and water tank
  - House for warden
  - Toilets
  - Fence to securize the farm
  - Barns for animals

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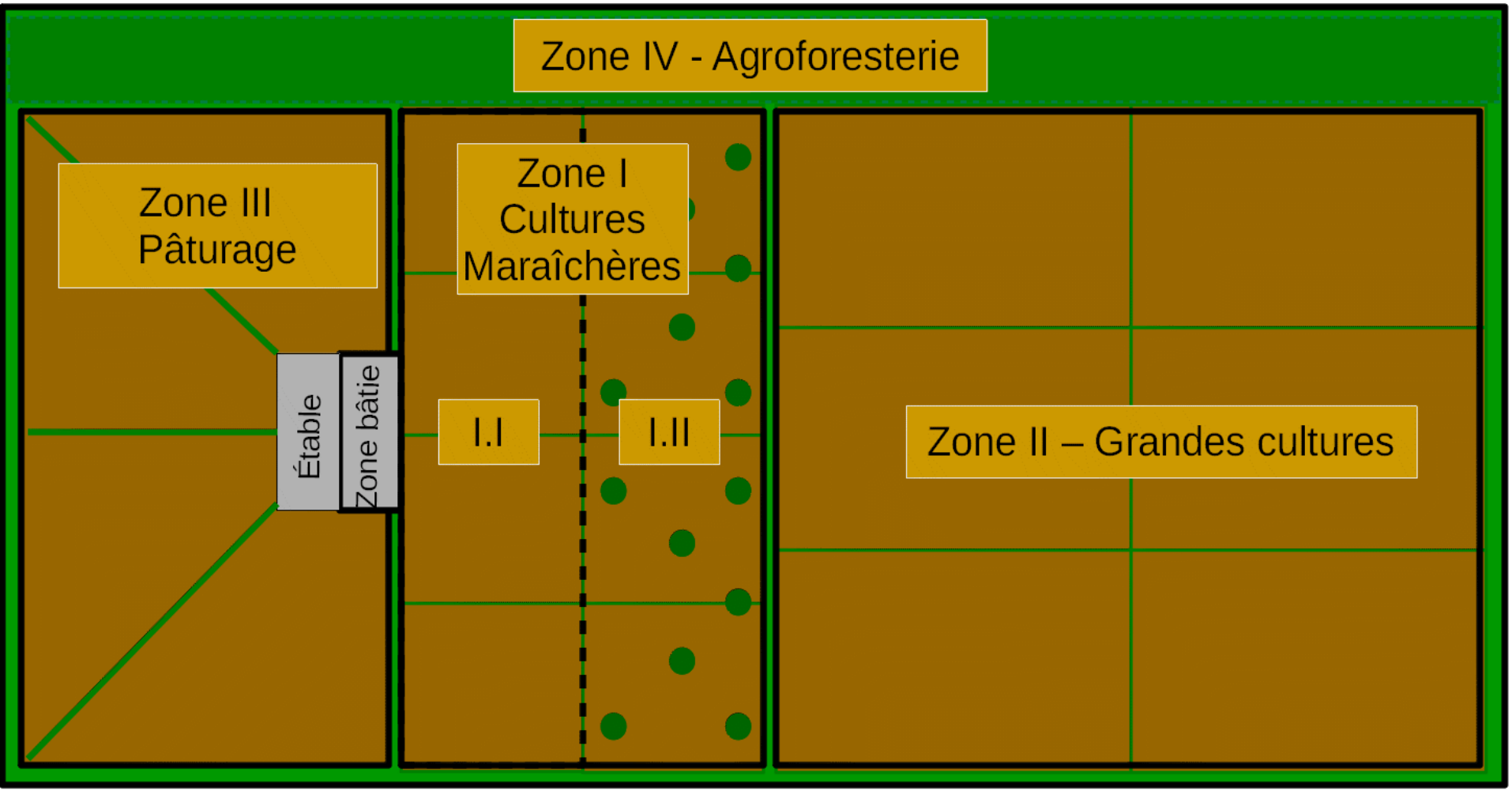

Démarcation des zones

Haie vive productive

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PASTURE ZONE (III)

- 18’000 m2
- Sowing of quality pasture
  - Grasses: Brachiaria, Pennisetum, Andropogon, Panicum etc.
  - Legumes: Stylosanthes, Mucuna, Cowpea, Pigeon Pea etc.
- Rotating pasture
- Separations between plots by pigeon pea
- Barn for poultry (hens, chickens, ducks) and for ruminants (sheep, goat, cows)
- Production without antibiotics
- Different uses of animals
  - Manure production
  - Bank
  - Pest and weed control
  - Valorisation of byproducts
  - Meat production

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AGROFORESTRY ZONE (IV)

- 3’000 m2
- Associations of fruit trees, fodder trees, wood trees and annuals (cassava, sweet potato)
- Pasture of animals once system installed

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LIVE PRODUCTIVE HEDGES

- 1000m2
- Protects the farm from wind, pests and diseases
- Maintain humidity in the agroecosystem
- Limit erosion
- Limit animal divagation
- Produce fodder
- Produce medicinal and phytosanitary products (acacia, moringa, neem)

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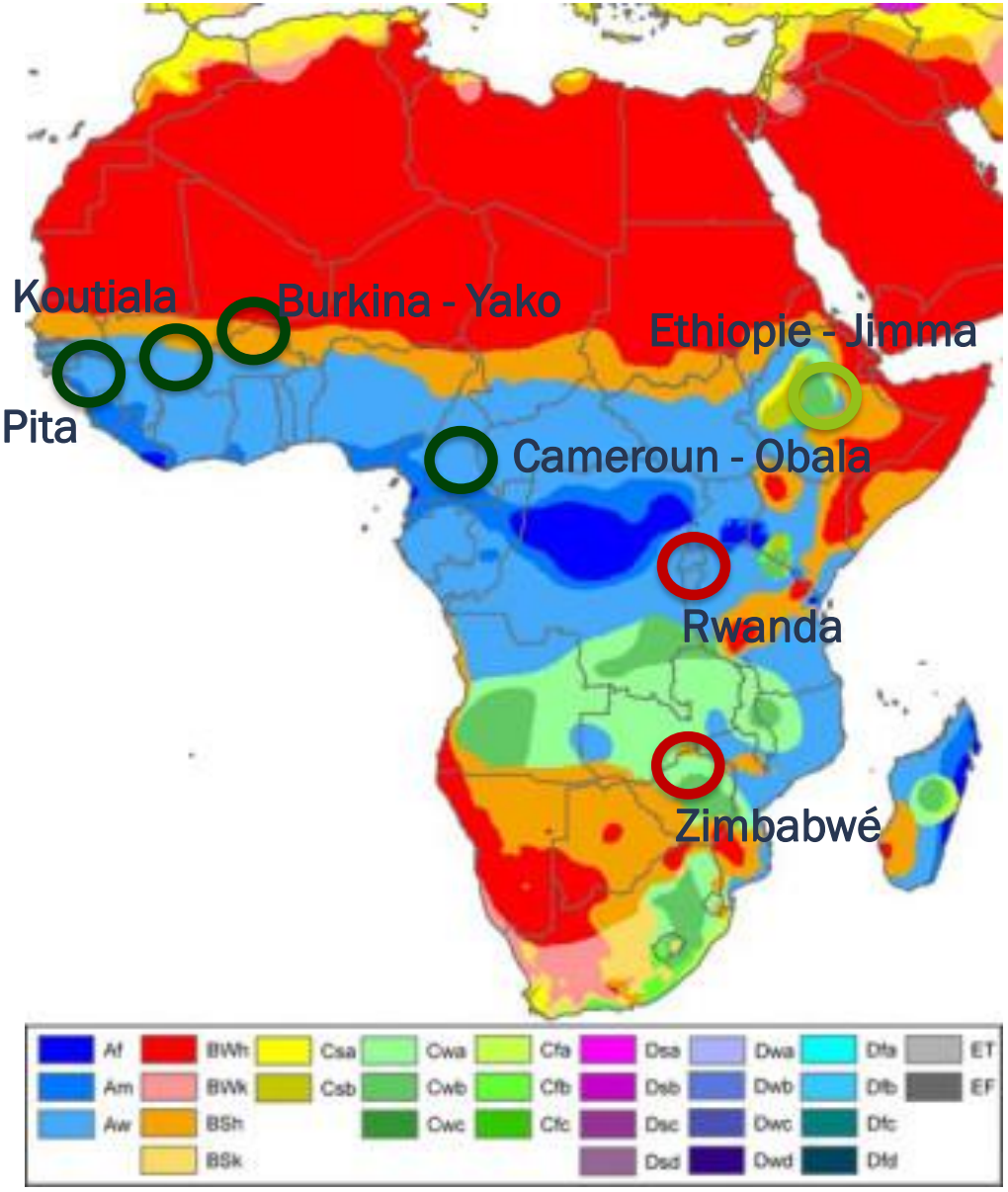
➢ TODAY

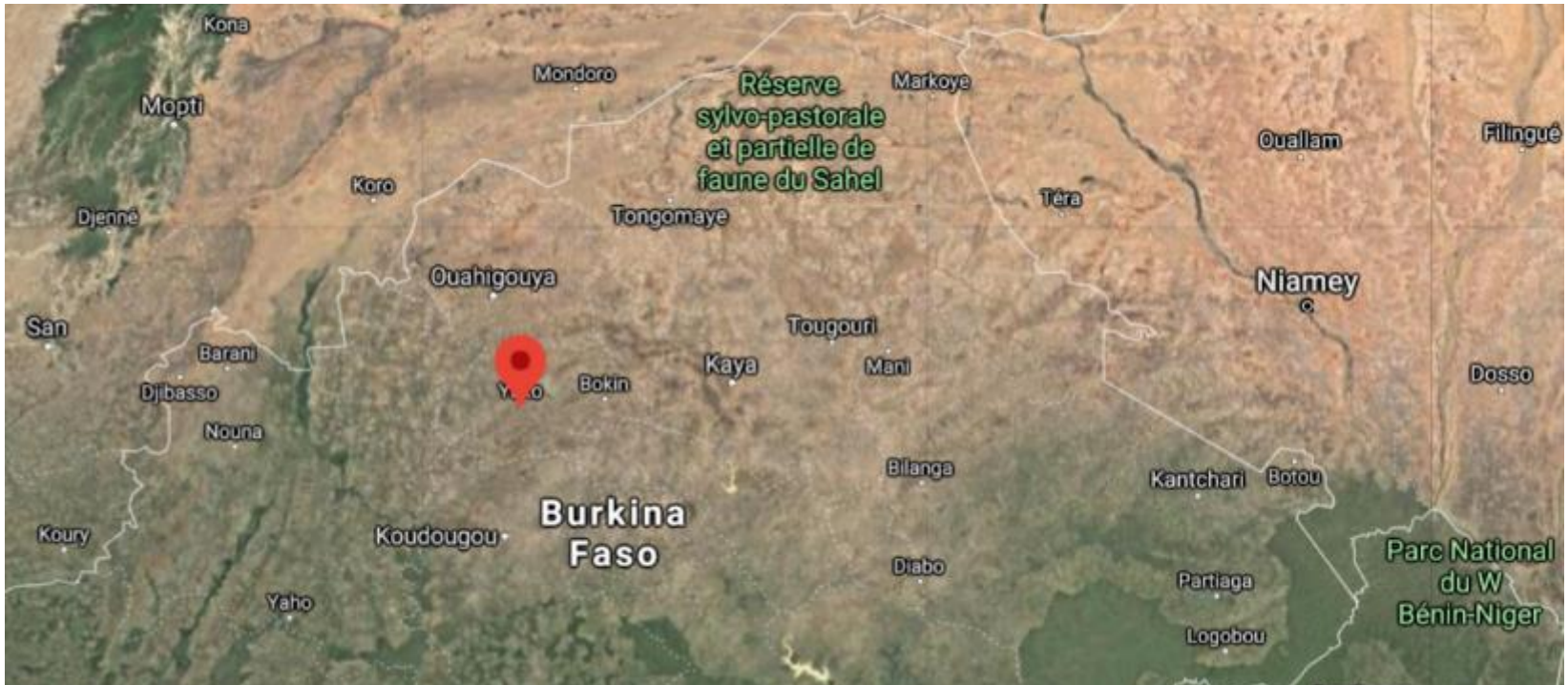
- ✓ 4 complete agroecological farms (mother farms)
- Network of sister farms to be established starting 2022
- ✓ Future farms in Ethiopia and Rwanda (mother + sister farms) in 2022
- ✓ Future farms in 2023, maybe Zimbabwe ?



AGROECOLOGIE

YAKO FARM, BURKINA FASO

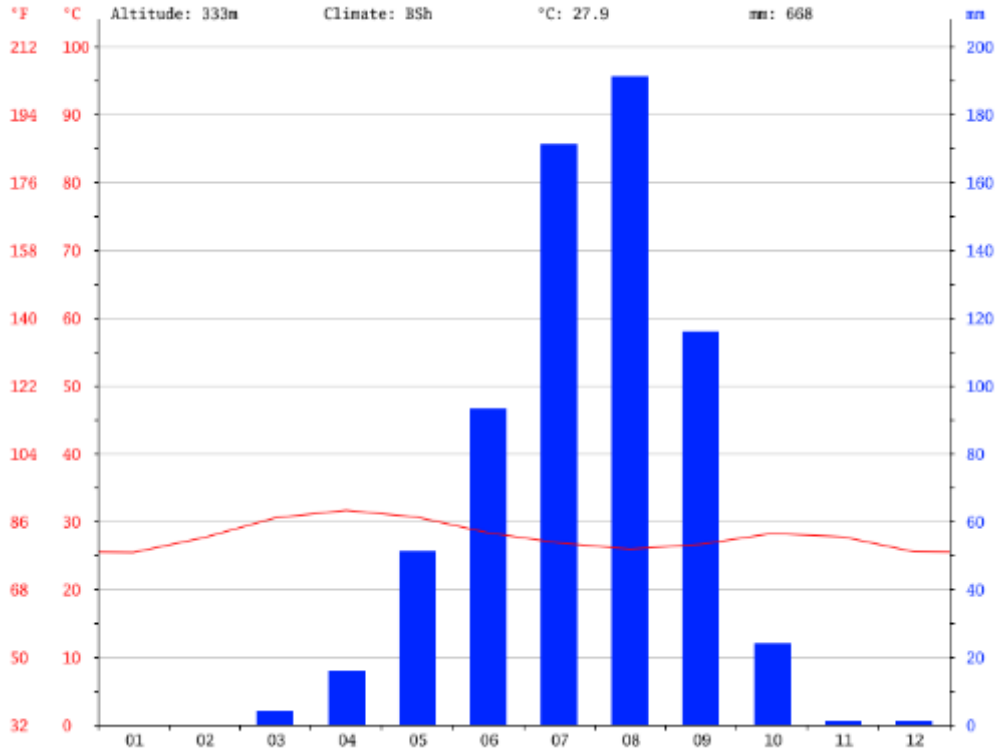
- Location: Yako, Burkina Faso
- 1 hectare (to be augmented to 3 hectares)
- Start June 2019
- Partner: Association Komsaya, INERA, Ministry of Agriculture



AGROECOLOGIE

YAKO FARM, CLIMATE

Dry Semi-Arid Climate
Rainy season of 3.5 months
668 mm rainfall



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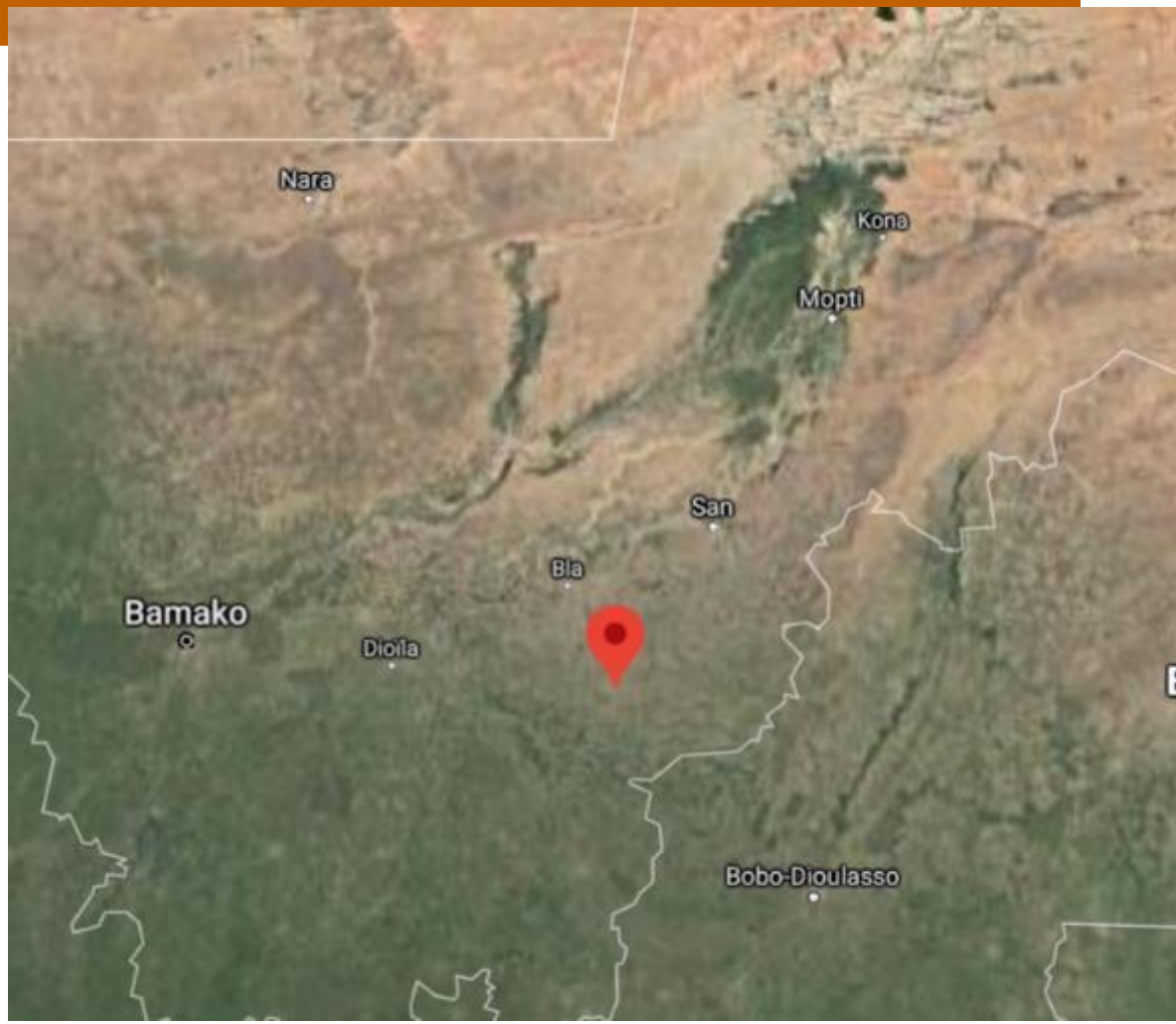
AGROECOLOGIE

KOUTIALA FARM, MALI

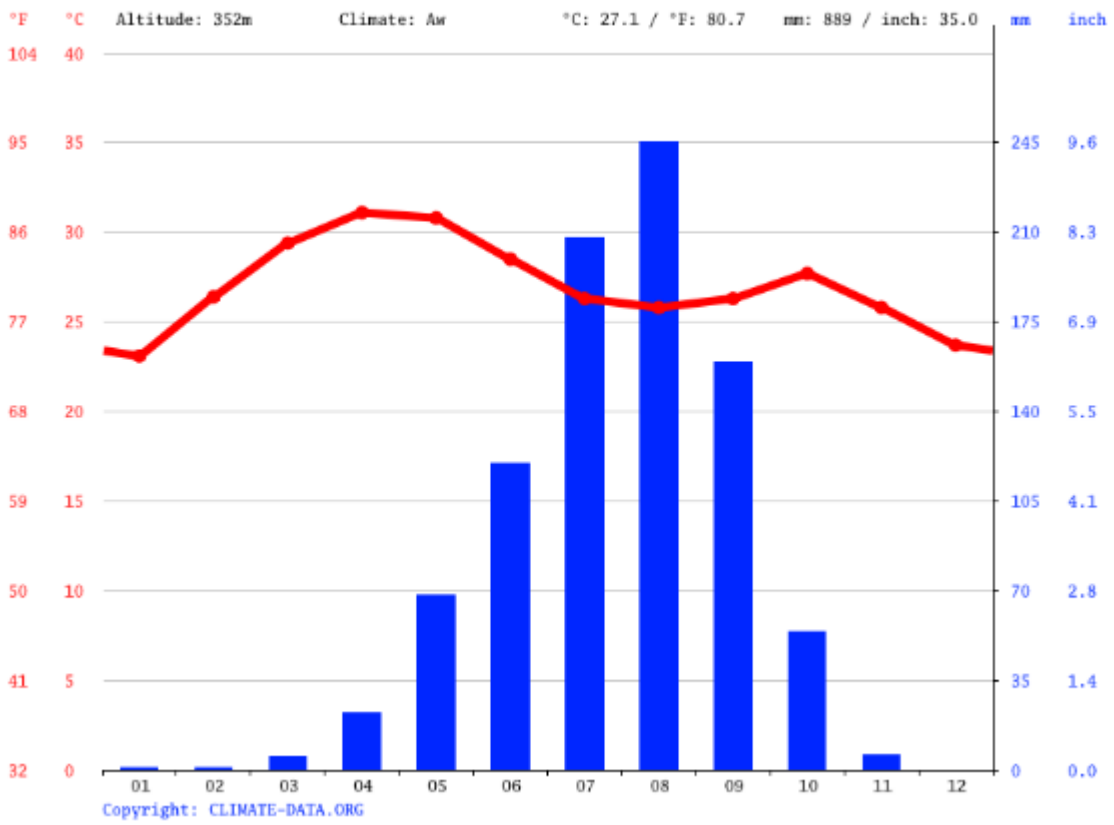
- Location: Koutiala, Mali
- 4 hectares
- Start Mai 2020
- Partner: AMEDD, IPR-IFRAD



AGROECOLOGIE

KOUTIALA FARM, CLIMATE

Transition Dry Semi-Arid Climate
To Tropical Savanna Climate
Rainy season of 4.5 months
889 mm rainfall

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AGROECOLOGIE

PITA FARM, GUINEA

- Location: Pita, Guinea
- 5 hectares
- Start June 2021
- Partners: Solidarité Suisse Guinée, Ministry of Agriculture, IRAG

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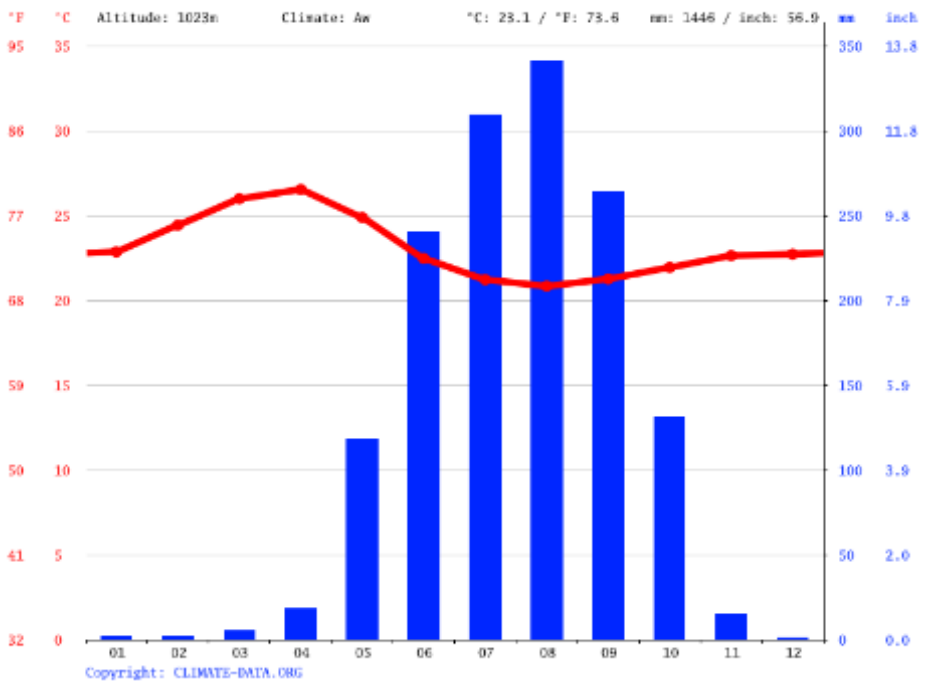
AGROECOLOGIE

PITA FARM, CLIMATE

Tropical Savanna Climate with dry Winter
Rainy season of 6 months
1446 mm rainfall
1000 m altitude



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BILONE FARM - CAMEROUN

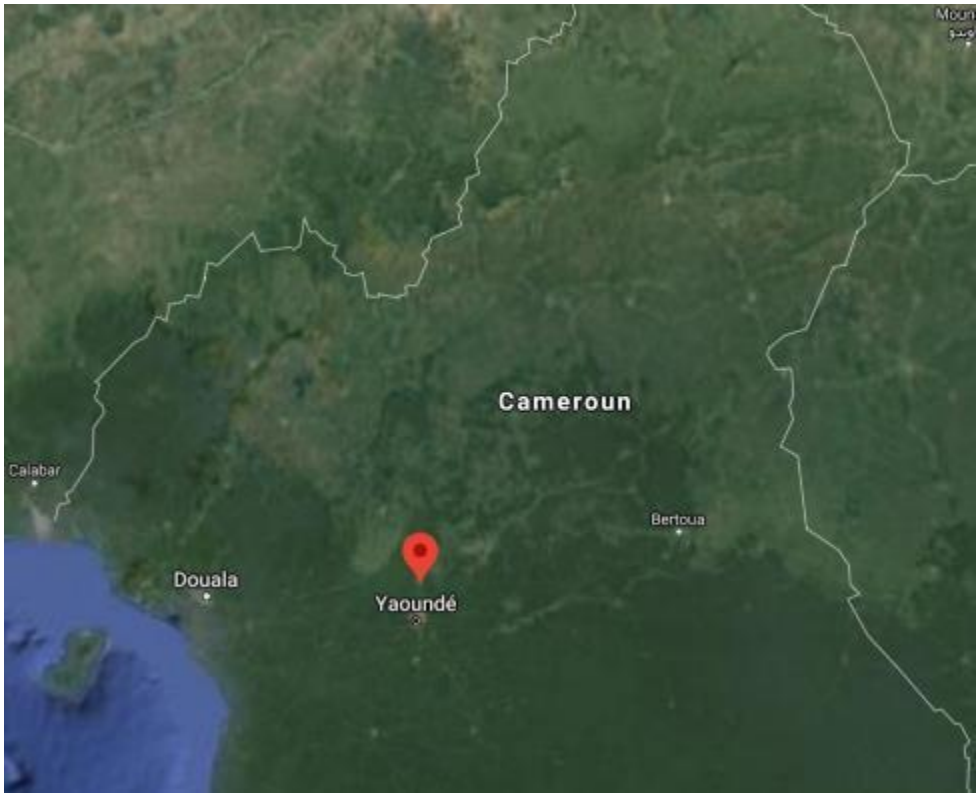
BILONE FARM

LOCATION : OBALA, CAMEROUN

1.5 HECTARES

START: APRIL 2019

PARTNERS: INSTITUT AGRICOLE D'OBALA, AFRICAN SOLAR GENERATION

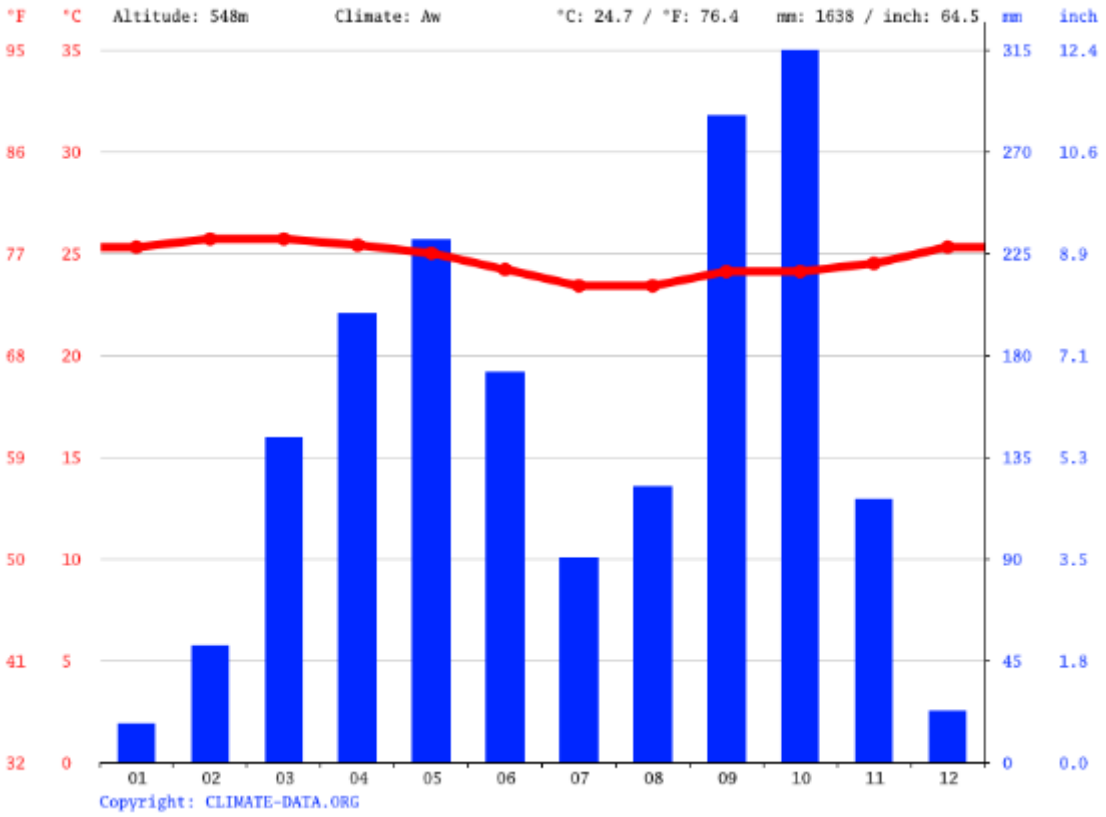


BILONE FARM (CAMEROUN

TROPICAL SAVANA CLIMATE WITH DRY WINTER

RAINY SEASON OF 8-9 MONTHS

1638 MM OF RAINFALL



AGROECOLOGIE

FUTURE FARM IN JIMMA, ETHIOPIA

Coffee-Livestock-Fish-Vegetable integrated farm

5 hectares of coffee

5 hectares of integrated farm (vegetable, cropland, animals)

At Eladale research farm, together with JUCAVM

Project will start in Mai 2022

Agroecosystemic Model currently being created

Possible PhD, MSc, BSc thesis in the next years

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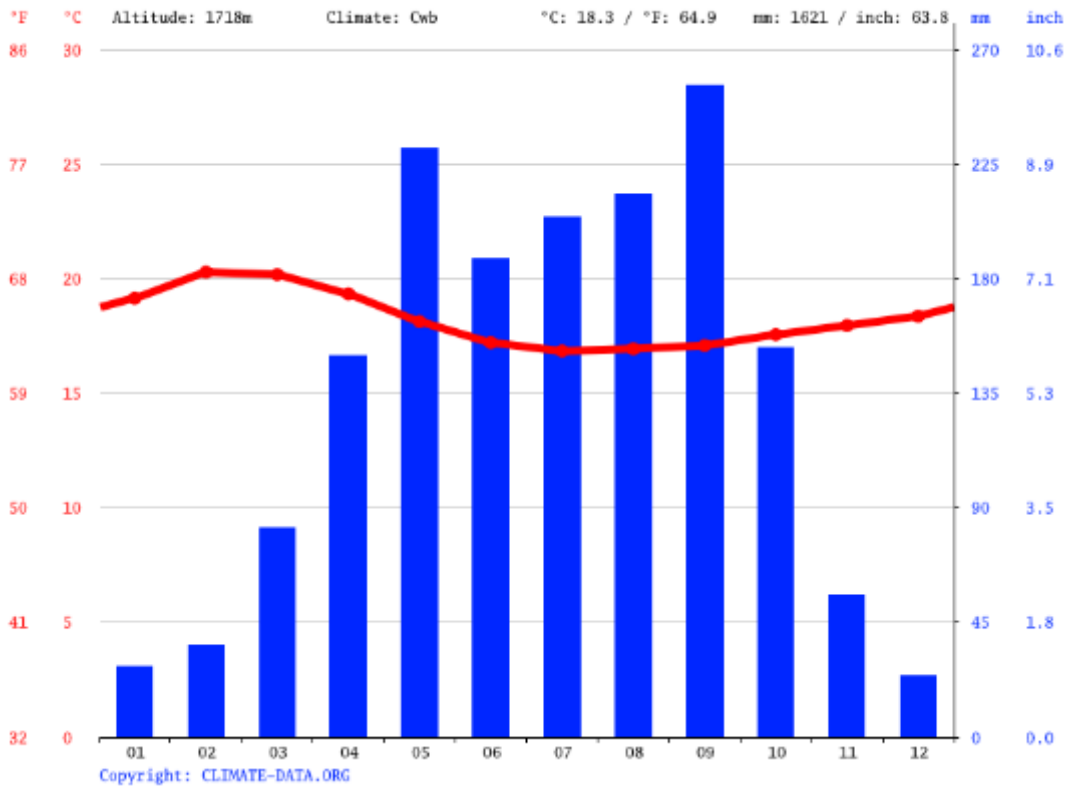
JIMMA FARM

SUBTROPICAL HIGHLAND CLIMATE

RAINY SEASON OF 6-7 MONTHS

1621 MM OF RAINFALL

1700 M ALTITUDE



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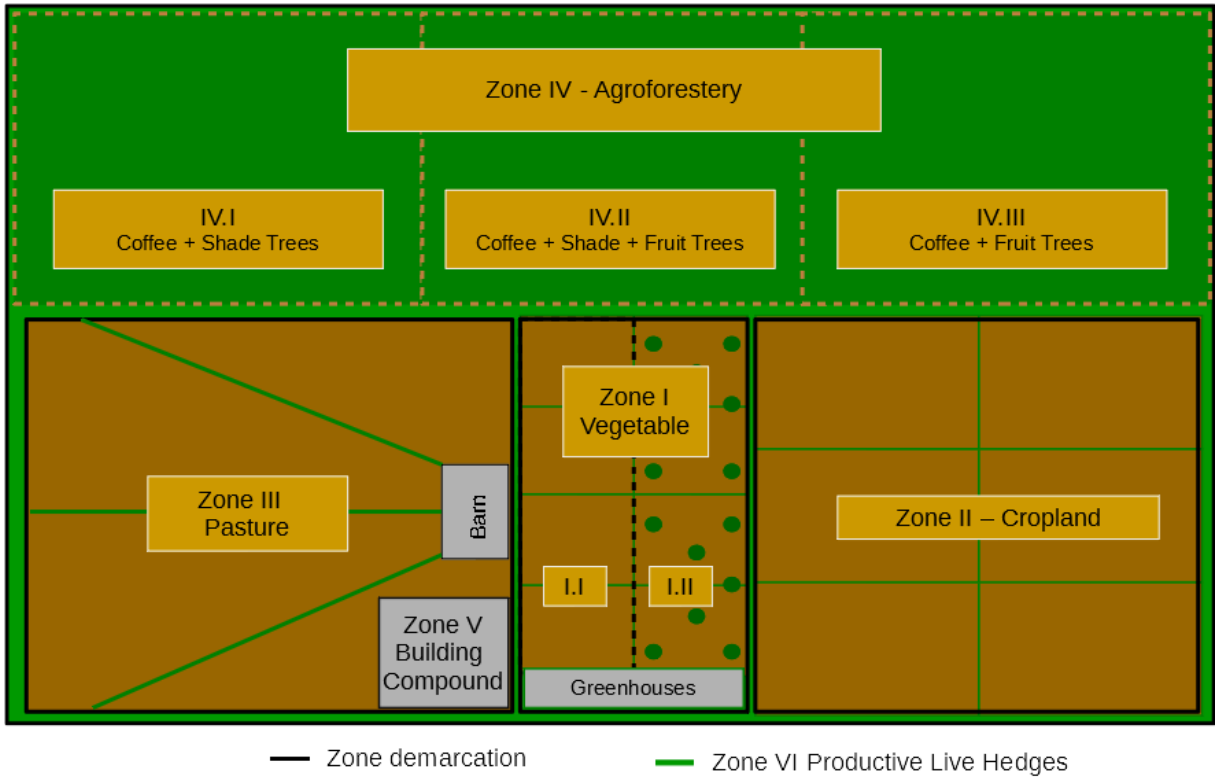
JIMMA AGROECOSYTEMIC MODEL DRAFT



26 septembre 2023

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