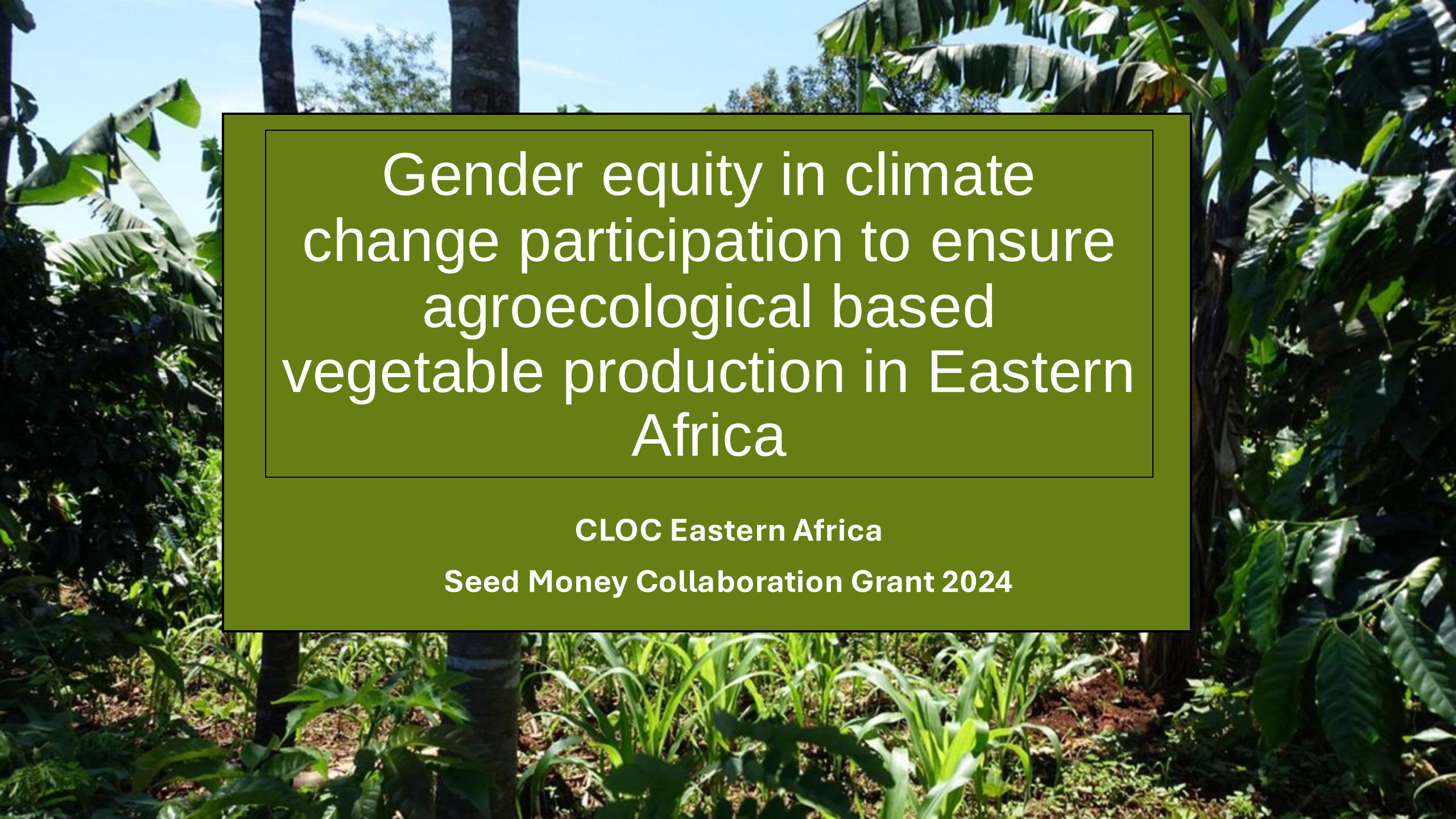


Gender equity in climate change participation to ensure agroecological based vegetable production in Eastern Africa

CLOC Eastern Africa

Seed Money Collaboration Grant 2024

Team composition

research network
SWITZERLAND – EASTERN AFRICA

CETRAD
Centre for Training and Integrated Research in ASAL Development

Jimma University College of Agricultural and Veterinary Medicine
Obsuman Damena Muleta
Kisii University
Dr. Jacqueline Walubwa
Antenna Foundation
Quentin Theiva à Hauariki

GENEVA GRADUATE INSTITUTE
INSTITUT DE HAUTES ÉTUDES INTERNATIONALES ET DU DÉVELOPPEMENT
GRADUATE INSTITUTE OF INTERNATIONAL AND DEVELOPMENT STUDIES

ANTENNA FONDATION

JIMMA UNIVERSITY

FONS SCIENTIAE
KISII UNIVERSITY

AGROECOLOGY

AN AGRICULTURAL SCIENCE AND PRACTICE FOR SMALL-SCALE FARMERS IN SUB-SAHARAN AFRICA

BUT WHAT IS AGROECOLOGY?

- Swiss foundation committed to scientific research and the dissemination of innovative and accessible technological, economic and medical solutions

ANTENNA
FONDATION

AGROECOLOGIE

The AgroEcology Unit

ANTENNA FONDATION

RESEARCH AND DEVELOPMENT OF **PRODUCTIVE AND SUSTAINABLE 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 pollinating 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

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 criteria:

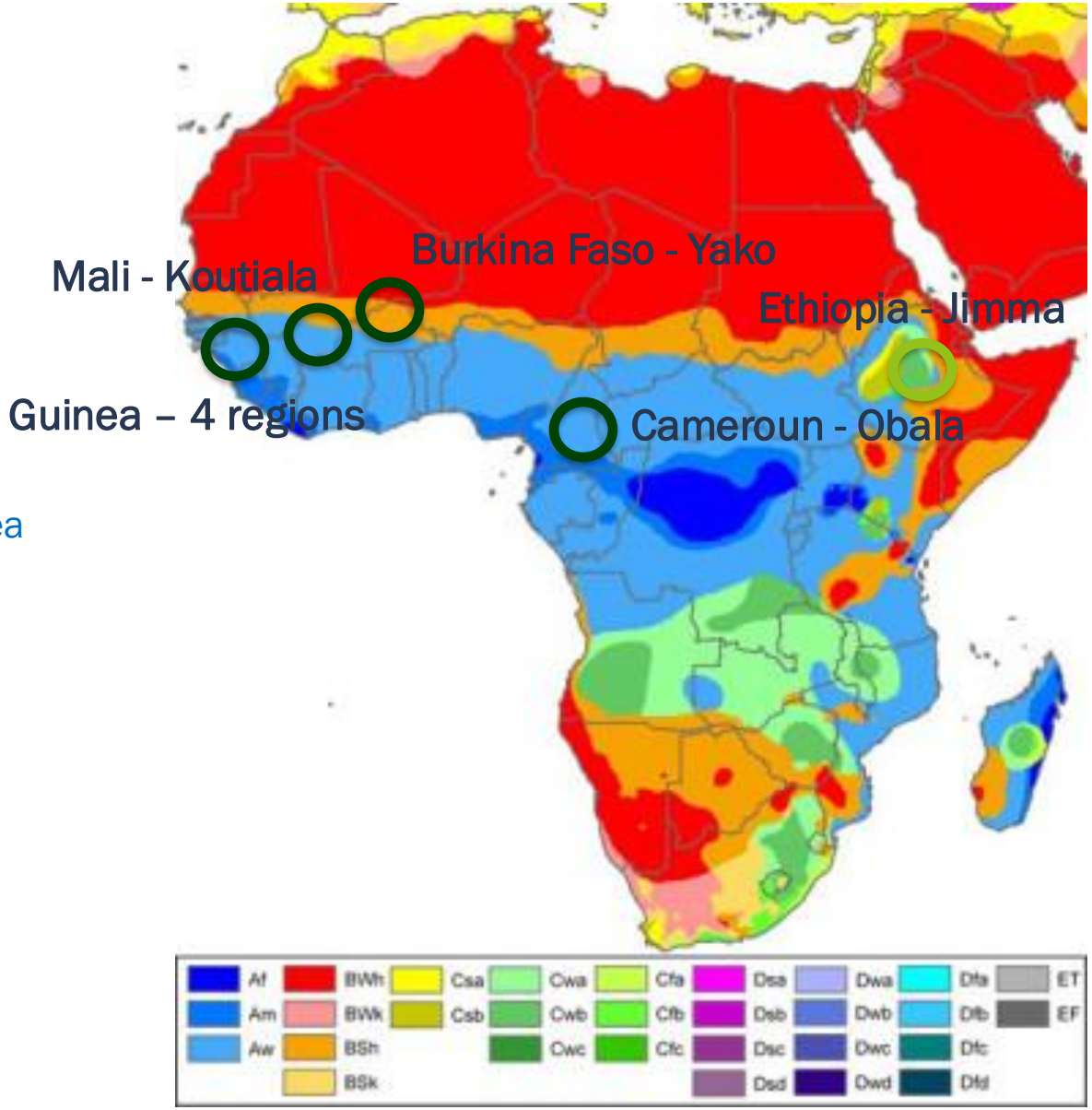
- Type of climate (Koppen classification)
- Length and intensity of rainy season (inside the climate zone)
- Main type of soils
- Commodities usually produced and eaten in the region

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.

- **TODAY**
  - ✓ 8 complete agroecological farms (mother farms)
  - Network of sister farms in Ethiopia, Burkina and Guinea
  - ✓ Model farm for training in Kenya



11

CHAPTER 1 : INTRODUCTION

- The problems of modern conventional agriculture
- An alternative: agroecology
- Lecture aim and program

PROBLEMS CAUSED BY MODERN AGRICULTURE

- Water pollution
- Endangered human health
- Loss of biodiversity
- Global warming
- Soil degradation

SPECIFIC CAUSES OF THESE PROBLEMS

- Monoculture
- Poor or excessive use of pesticides
- Poor or excessive use of fertilisers
- Excessive greenhouse gas (GHG) emissions
- Erosion and leaching
- Other drivers of soil degradation

SPECIFIC CAUSES OF THESE PROBLEMS

- **Monoculture**
- Poor or excessive use of pesticides
- Poor or excessive use of fertilisers
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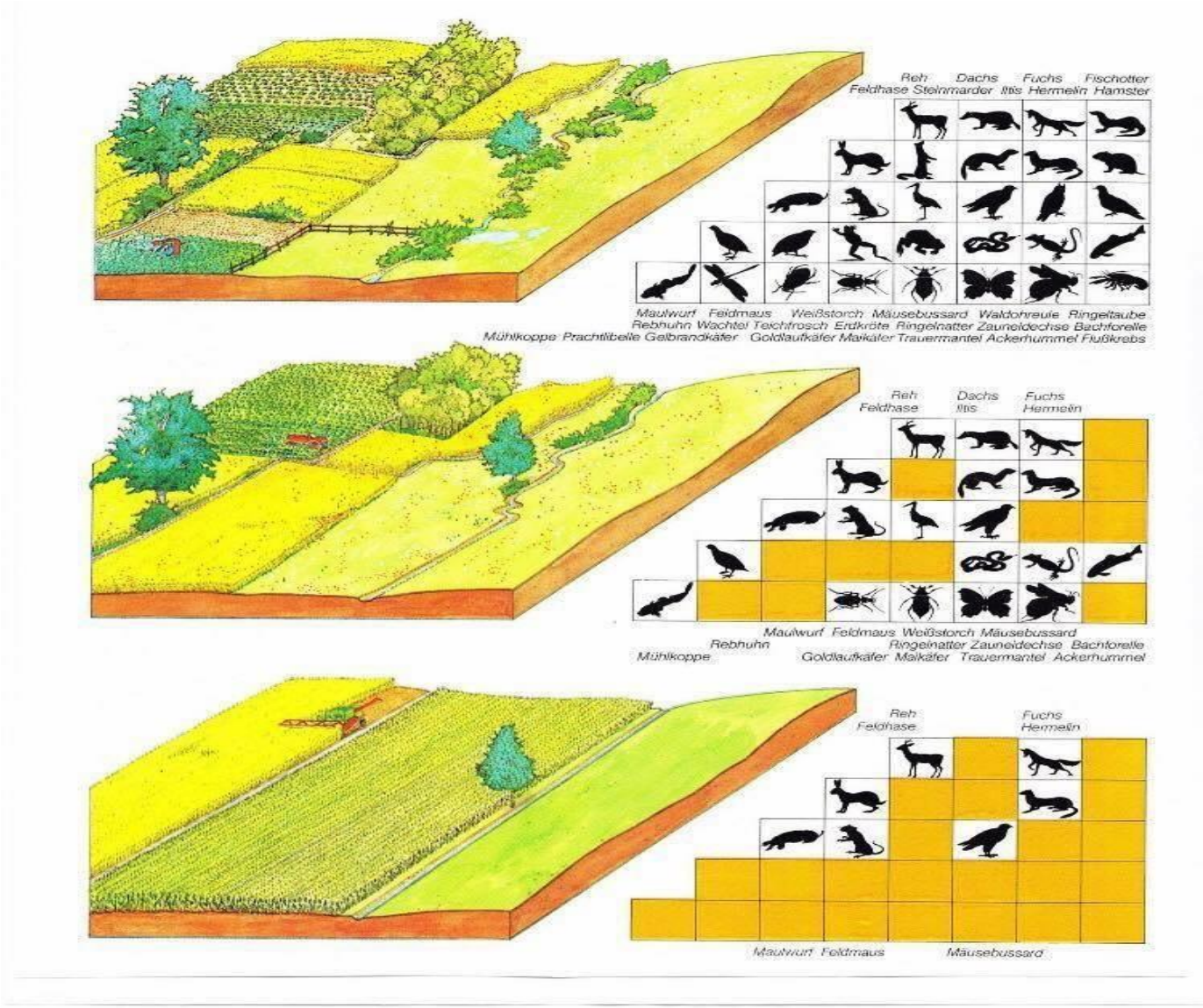
- Erosion and leaching
- Other drivers of soil degradation

MONOCULTURE

Loss of biodiversity

- Weak system resilience
- Dependence on pesticides
- Soil depletion



SPECIFIC CAUSES OF THESE PROBLEMS

- Monoculture
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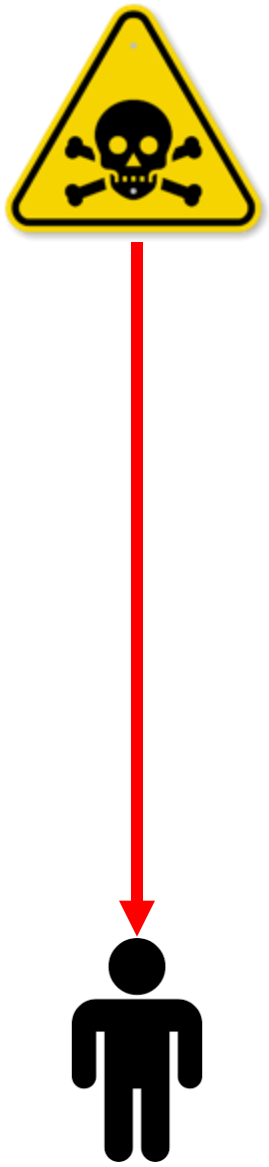
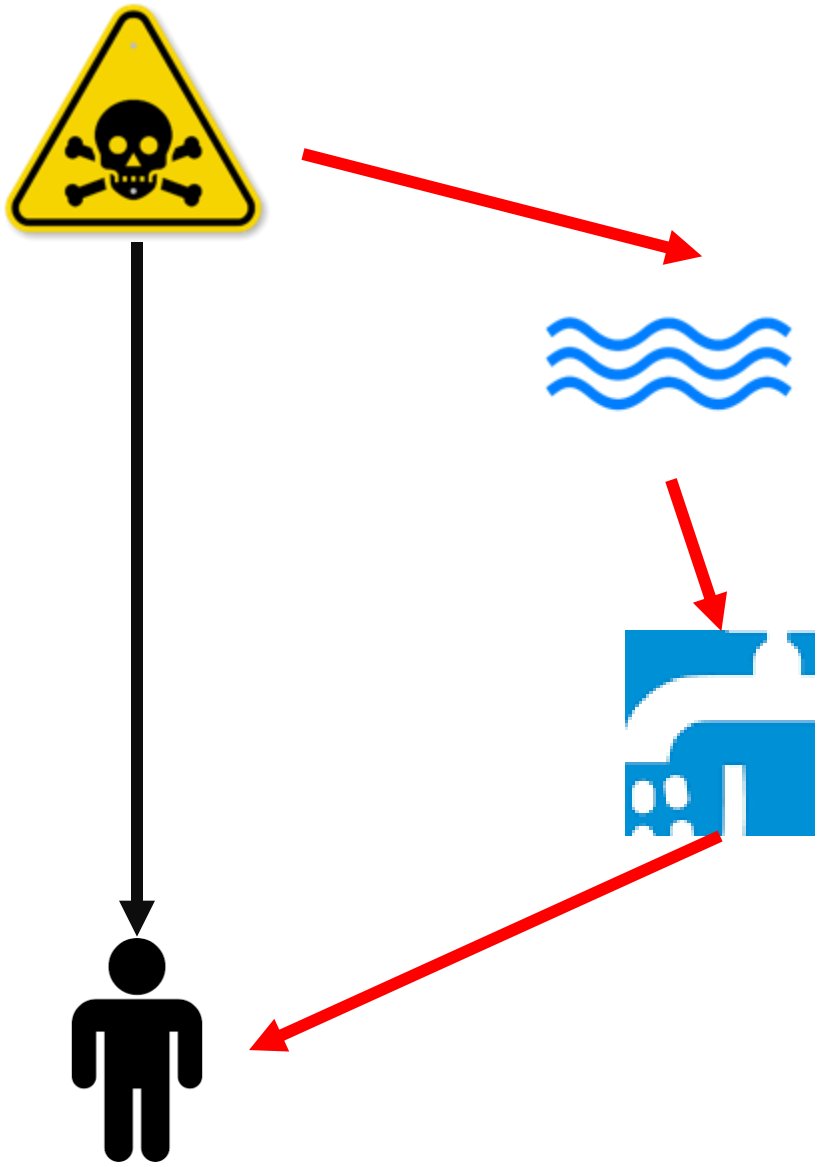
- Other drivers of soil degradation

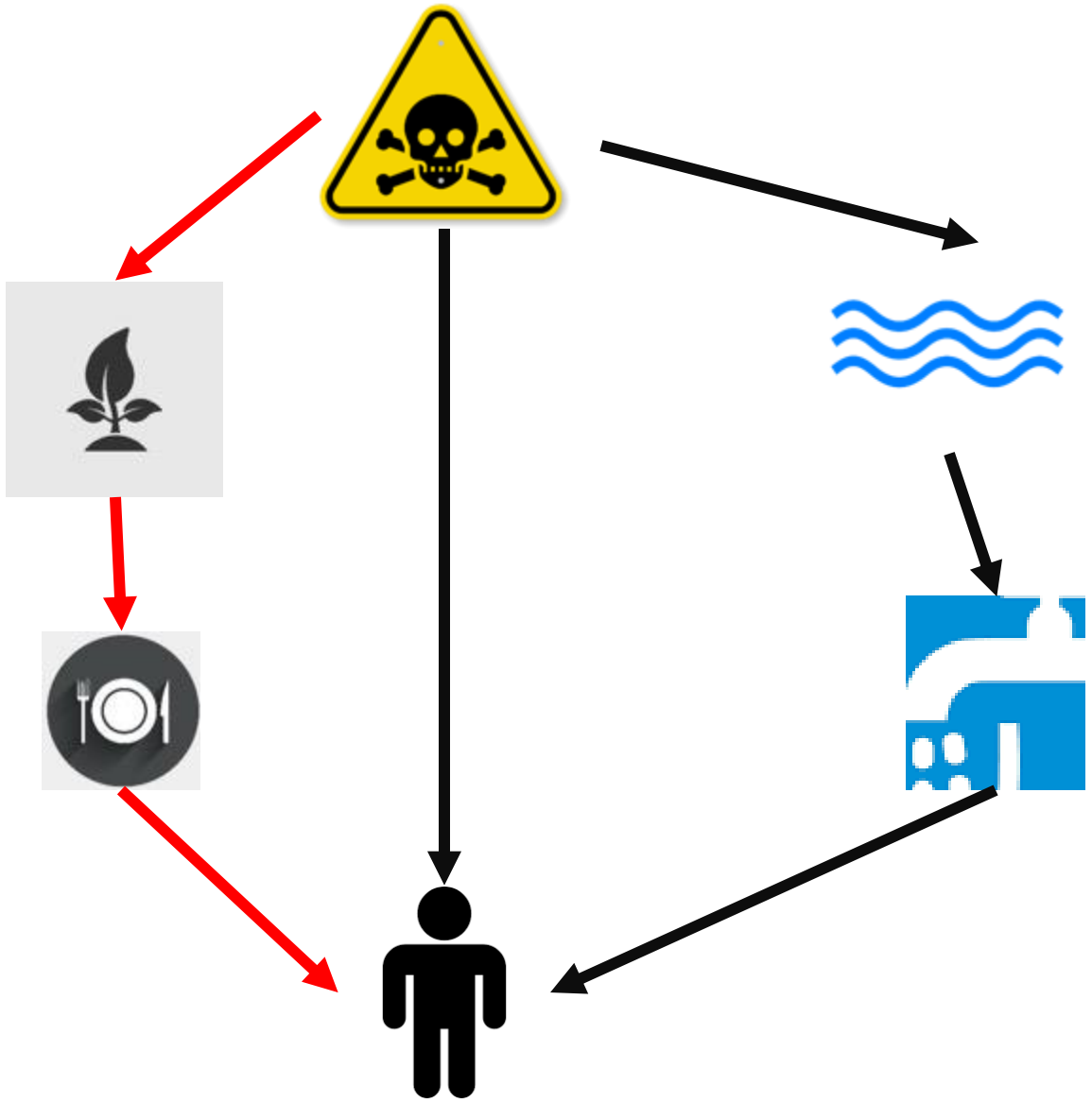
HEALTH PROBLEM



HEALTH PROBLEM



HEALTH PROBLEM



HEALTH PROBLEM

«In an investigation published on 10 September 2020, Public Eye reports that in 2018, some 81,615 tonnes of pesticides banned for use in Europe were nevertheless manufactured there and then exported outside the European Union (EU).»

These products include:

Atrazine, paraquat, dichloropropene, cyanamide, chlorpyrifos, etc.

These products cause:

- Parkinson's disease, infertility, leukaemia and various types of cancer

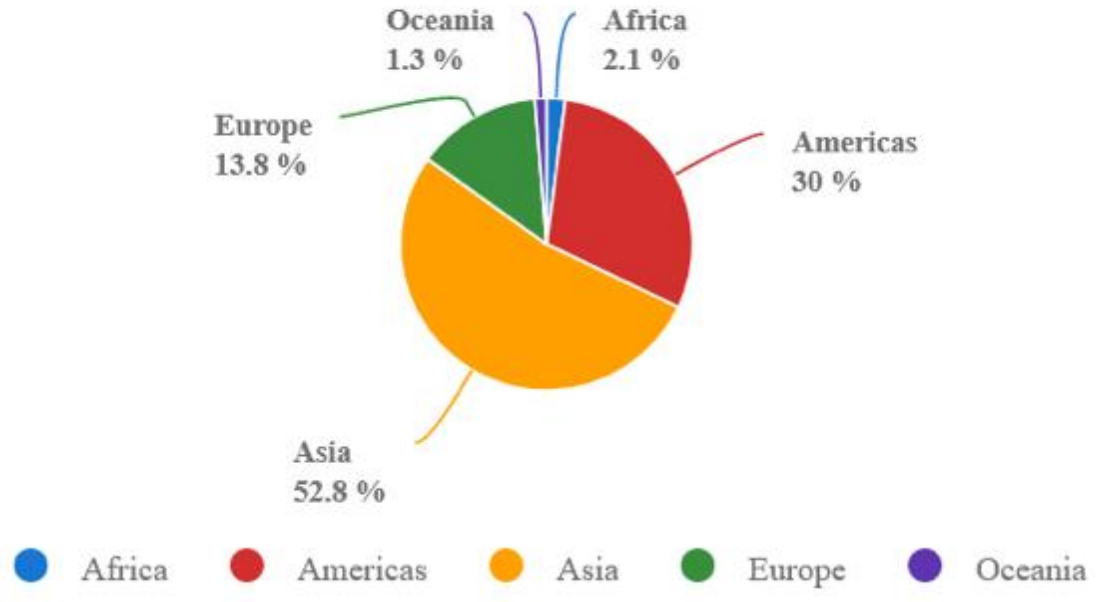
Source : https://www.scidev.net/afrique-sub-saharienne/news/certains-pesticides-interdits-en-europe-sont-vendus-en-afrique-02112020/

ENVIRONMENTAL PROBLEMS

- Water contamination
- Soil contamination
- Loss of biodiversity

IS THIS A PROBLEM FOR AFRICA?

- Pesticides use by continent



- (FAO Stat, 2020)

IS THIS A PROBLEM FOR AFRICA?

1. Waters are still polluted in Africa

   Example: Pesticide traces in Lake Victoria make it impossible to sell fish to the EU (Abong'o, Wangiga, Jumba, & Kylin, 2014)

2. Low user awareness

   Inappropriate application: risk to user, consumer, and environment

3. Insufficient regulation

4. Use of toxic products prohibited in other parts of the world

SPECIFIC CAUSES OF THESE PROBLEMS

- Monoculture
- Poor or excessive use of pesticides
- **Poor or excessive use of fertilisers**
- Excessive greenhouse gas (GHG) emissions
- Erosion and leaching
- Other drivers of soil degradation

POOR OR EXCESSIVE USE OF FERTILISERS

- Fertilisers are products that contain the nutrients that the plant needs to feed itself.
- Nitrogen (N), Phosphorus (P) and Potassium (K) are the most important nutrients for plants.
- Their contribution allows considerable increases in yield.
- P and K come from mines, while nitrogen is obtained from the atmosphere through a chemical process.

POOR OR EXCESSIVE USE OF FERTILISERS

What problems do they cause?

- They are not toxic like pesticides.
- However, they can be washed into rivers and lakes, where they cause EUTROPHICATION.

POOR OR EXCESSIVE USE OF FERTILISERS

What problems do they cause?

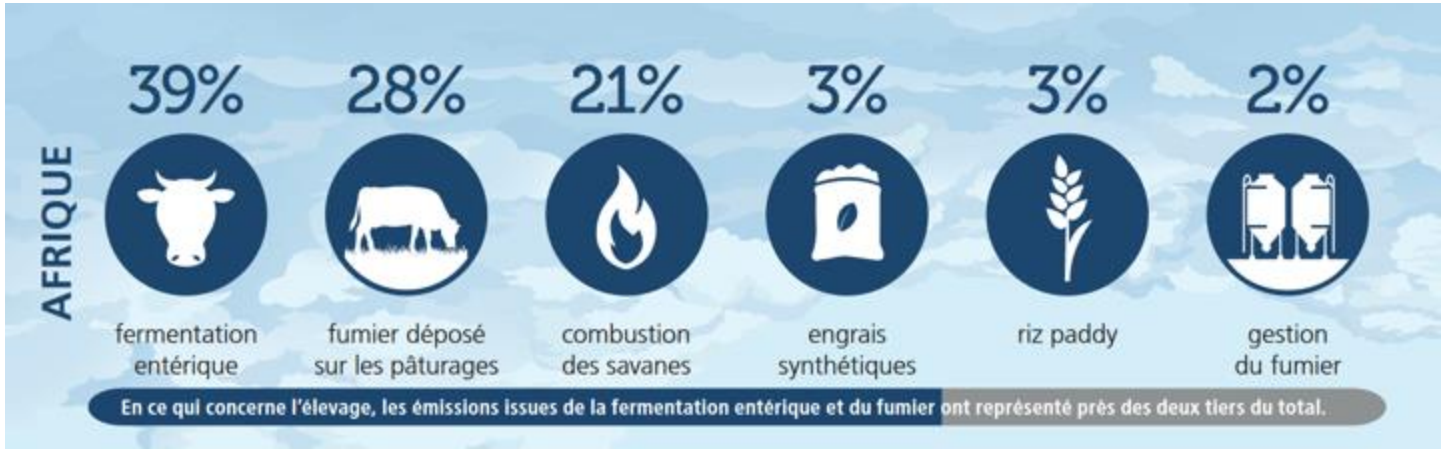
Production of nitrogen fertilizers (N)

- energy consuming (1-2L gasoline/kg N)
- polluting (8.6kg CO2-equ/kg N)

12% of the world's emissions from agriculture are caused by the production of nitrogen fertilizers.

IS THIS A PROBLEM FOR AFRICA?

- Low fertiliser use in Africa makes the problem of water eutrophication marginal.
- The share of African emissions due to synthetic fertilizer production is only 3%.



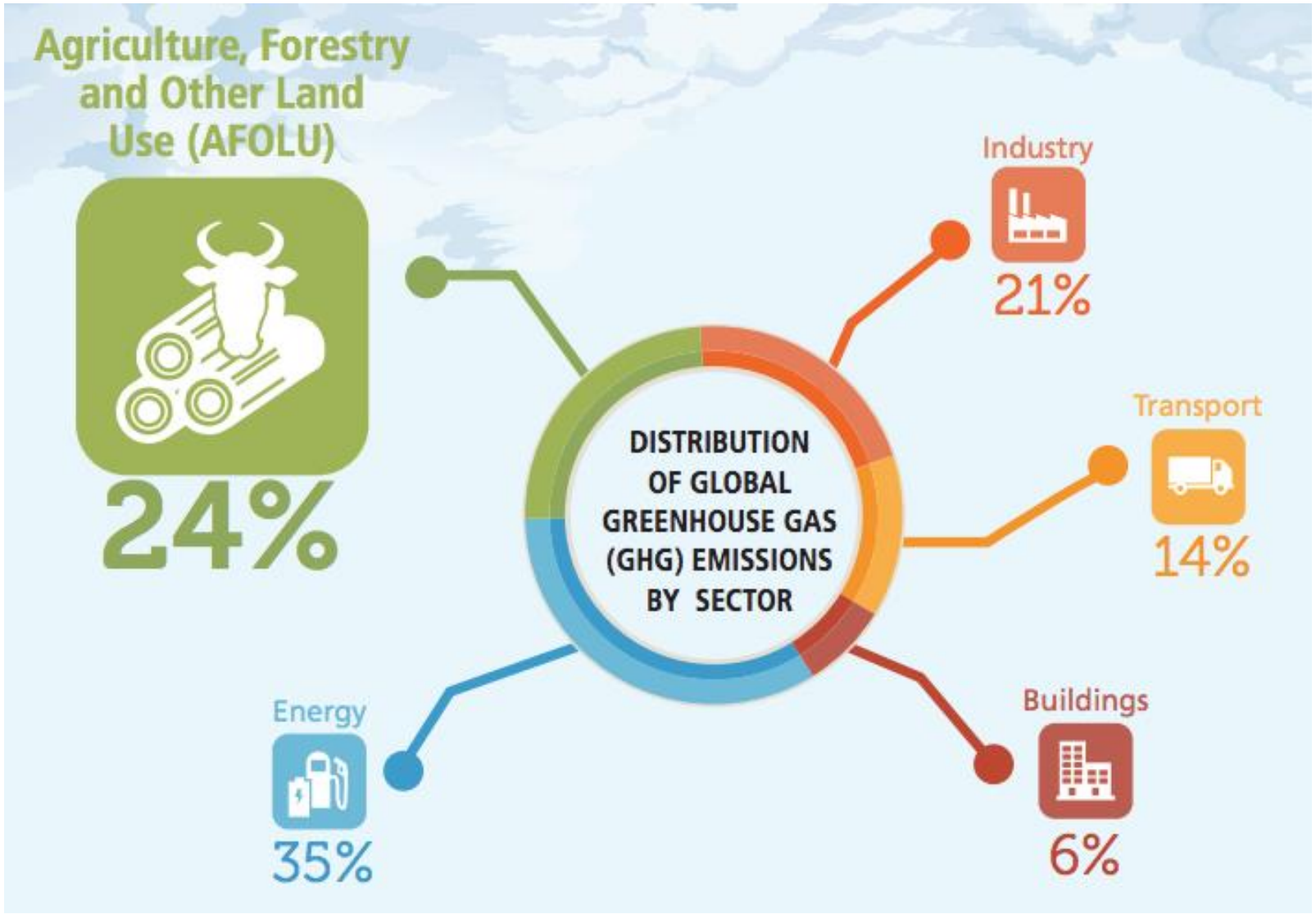
- BUT: cost of fertiliser is too high for many African producers

→ Alternatives needed

SPECIFIC CAUSES OF THESE PROBLEMS

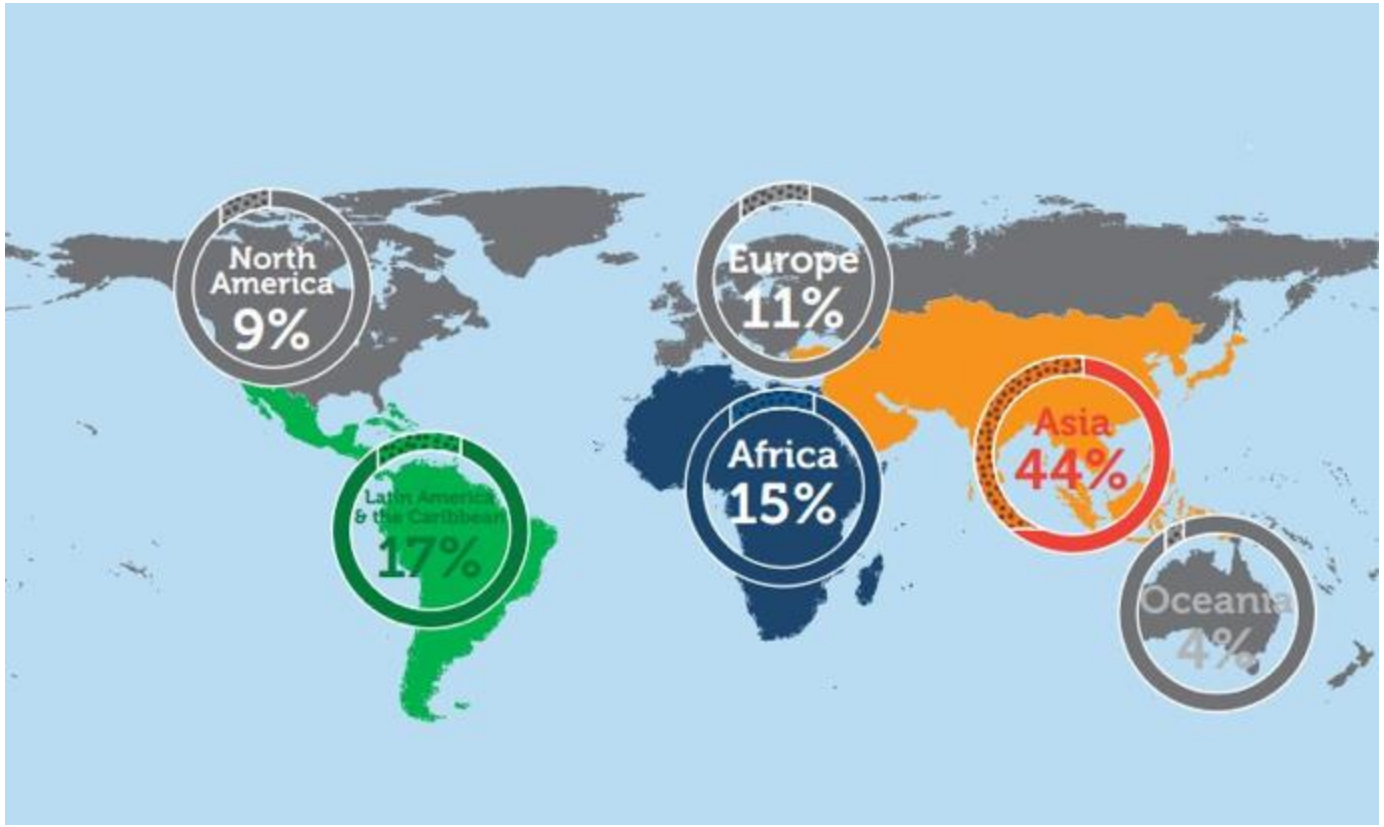
- Monoculture
- Poor or excessive use of pesticides
- Poor or excessive use of fertilisers
- **Excessive greenhouse gas (GHG) emissions**
- Erosion and leaching
- Other drivers of soil degradation

GREENHOUSE GAS EMISSIONS (GHG)



GREENHOUSE GAS EMISSIONS from agriculture, forestry and other land uses (FAO, 2016)

GHG EMISSIONS FROM AGRICULTURE



Africa:

- 15% of the global population
- **4% of total GHG emissions**

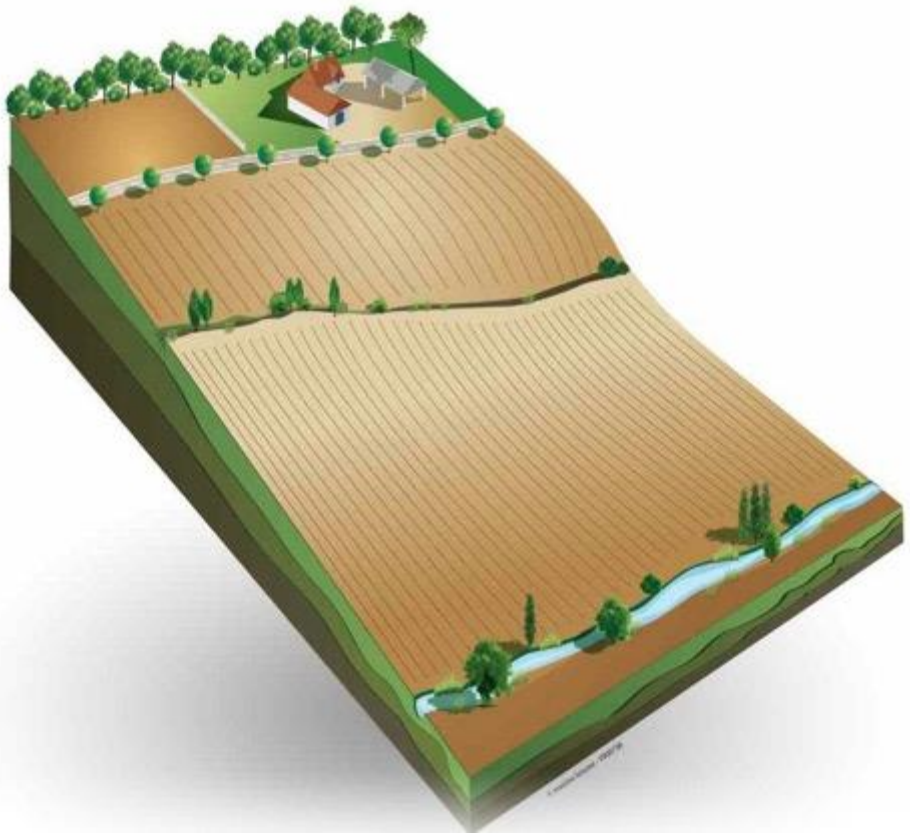
SPECIFIC CAUSES OF THESE PROBLEMS

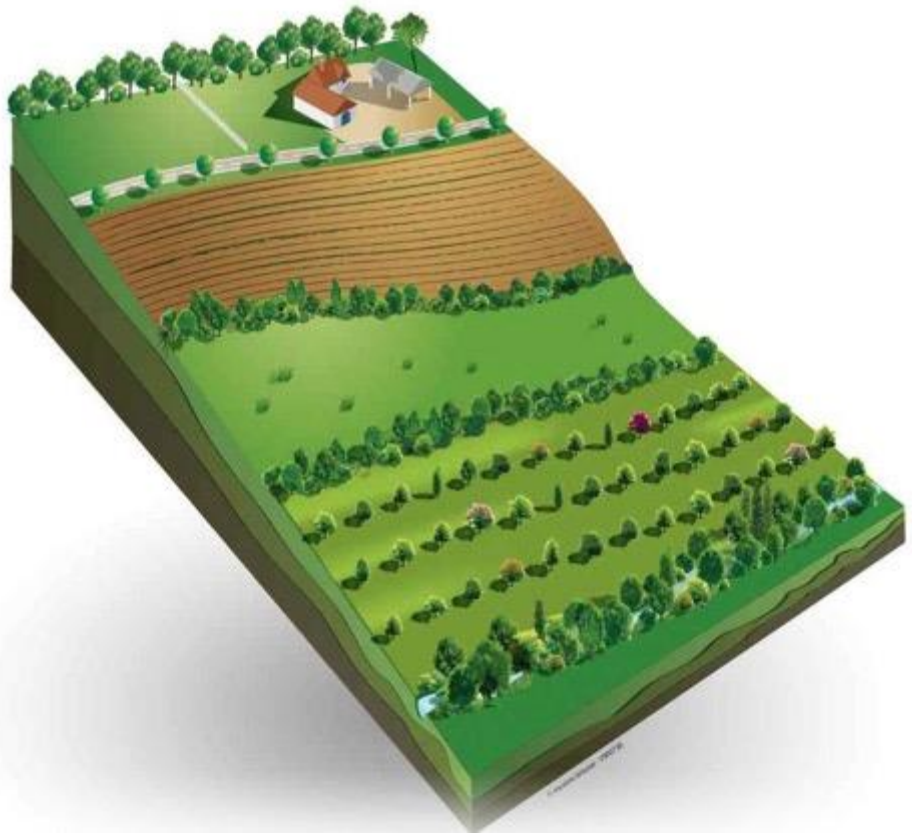
- Monoculture
- Poor or excessive use of pesticides
- Poor or excessive use of fertilisers
- Excessive greenhouse gas (GHG) emissions
- **Erosion and leaching**
- Other drivers of soil degradation

EROSION AND LEACHING

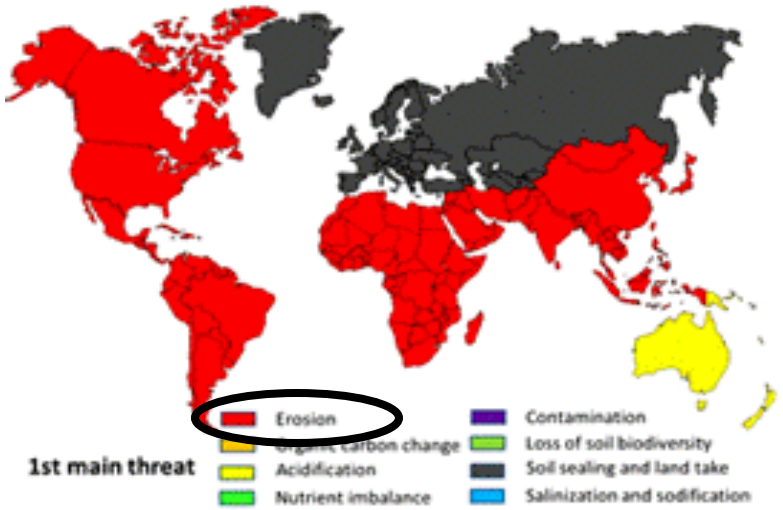
EROSION AND LEACHING

EROSION AND LEACHING





IS THIS A PROBLEM FOR AFRICA?



(Montanarella et al., 2016)

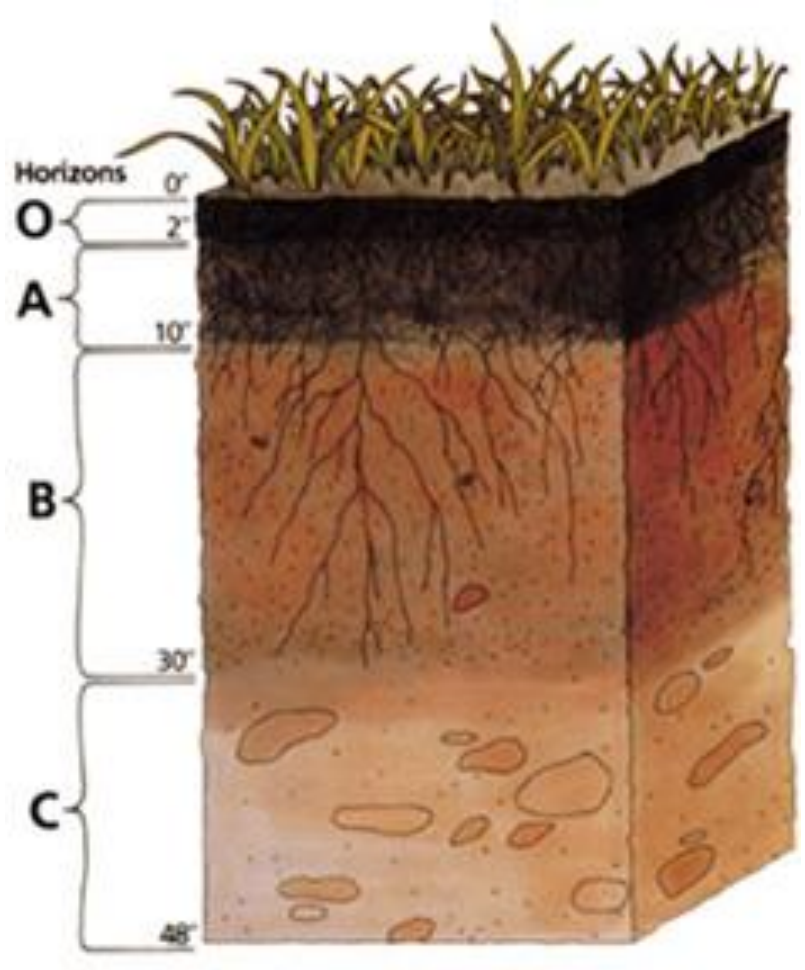
SPECIFIC CAUSES OF THESE PROBLEMS

- Monoculture
- Poor or excessive use of pesticides
- Poor or excessive use of fertilisers
- Excessive greenhouse gas (GHG) emissions
- Erosion and leaching
- **Other drivers of soil degradation**

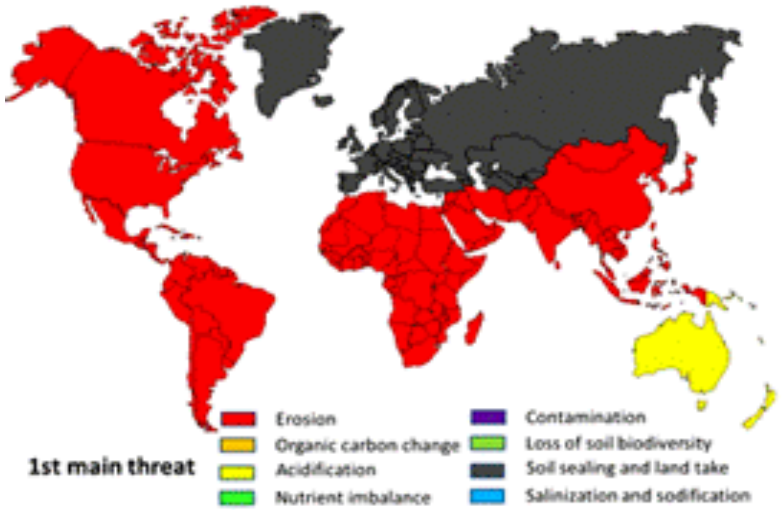
SOIL DEGRADATION - LOSS OF ORGANIC MATTER

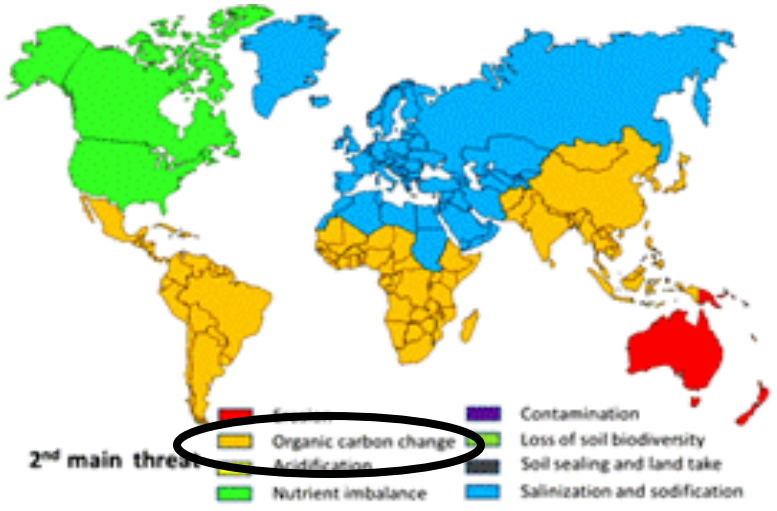
Loss of organic matter:

- Warm, humid climate
- Exposed and open soil
- Absence of organic inputs (compost, manure, slurry etc.)



IS THIS A PROBLEM FOR AFRICA?

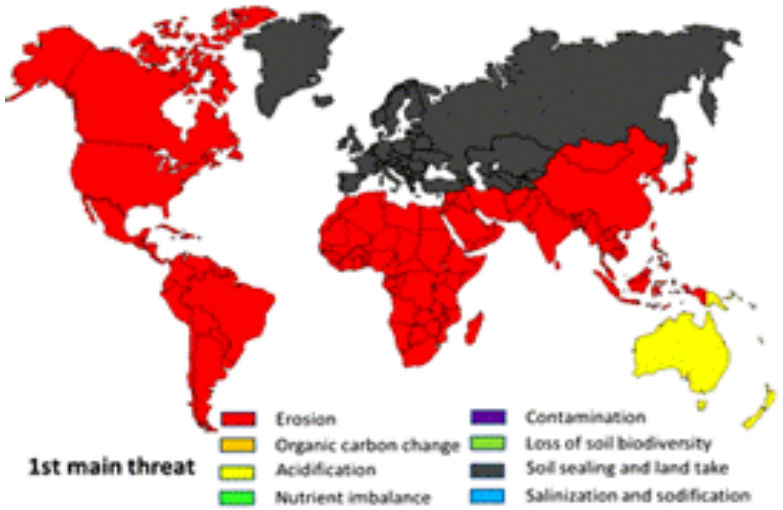




SOIL DEGRADATION – OTHER PROBLEMS

- Acidification
- Compacting
- Salinisation

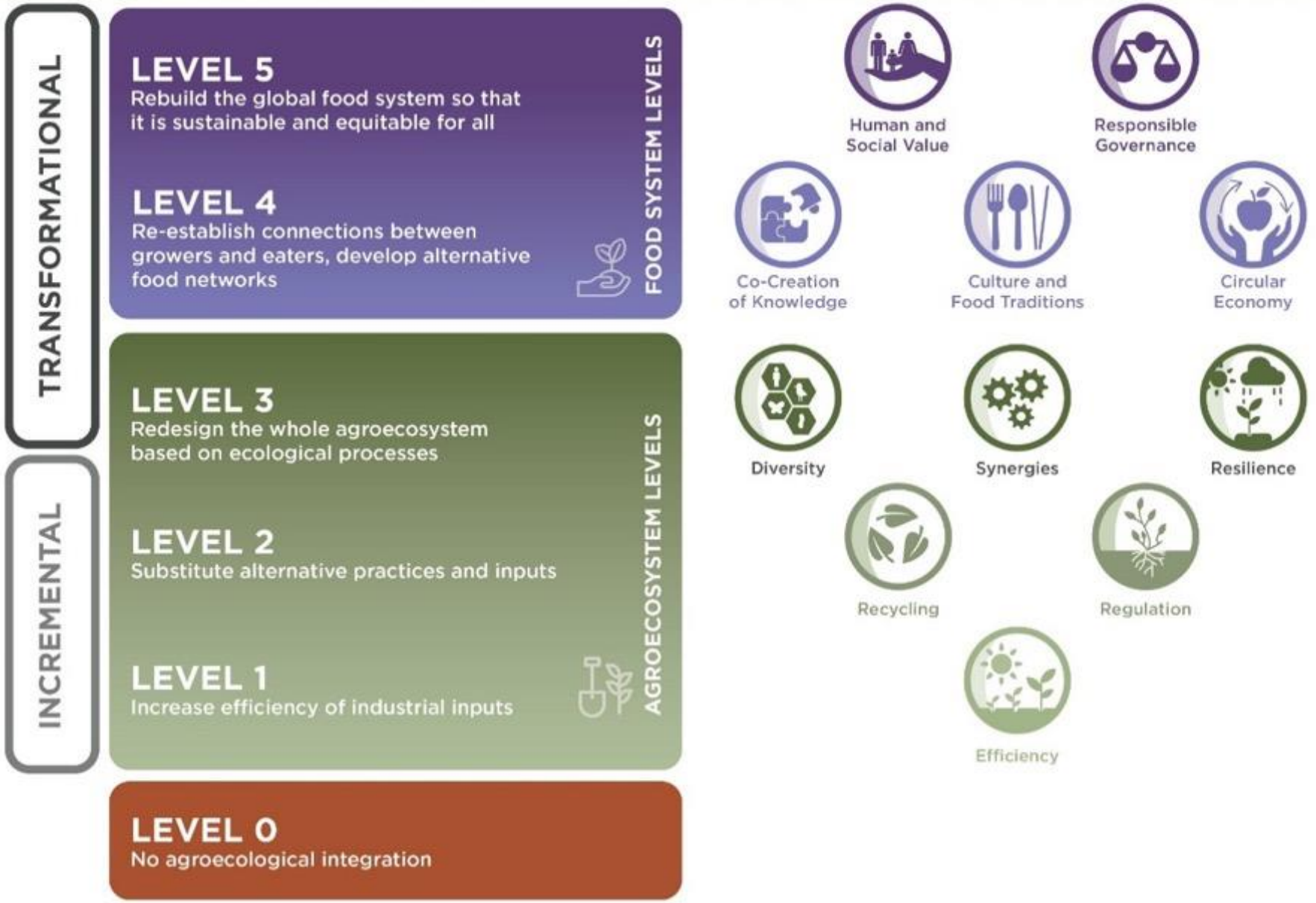
IS THIS A PROBLEM FOR AFRICA?



WHAT IS THE ALTERNATIVE? AGROECOLOGY?

- Agroecology can be defined as a scientific field, an agricultural practice and a social movement.
- It is an innovative, holistic approach to the sustainable and rational use of agricultural and water resources.
- This course will discuss agroecology as a science and agricultural practice only.
- It allows the production of healthy and high nutritional quality foodstuffs, free of residues of products derived from synthetic chemistry.
- The approach aims to produce, regenerate soils and degraded environments as well as promote biodiversity.

5 LEVELS OF FOOD SYSTEM CHANGE AND 10+ ELEMENTS OF AGROECOLOGY



AGROECOLOGY - IN CONCRETE TERMS

Mixed farming and livestock

Crop rotation

Crop association

Sparing irrigation

Minimal soil disturbance

QUESTION TO THE AUDIENCE

- How do you perceive those practices?
- Do you already practice agroecology?
- Can you explain how it is related to agroecology?

AGROECOLOGY - INTRODUCTION

High potential for small-scale food production:

- Cost reduction (pesticides, seeds, fertilizers)
- Income diversification
- Preservation of the soil
- Better resilience to climate hazards in a context of global disruption
- Impact on health

Constraints:

- Complexity of production systems
- Difficulty in marketing a very varied offer
- High labor force required
- Yields sometimes lower than in conventional farming
- Difficulty in managing pests on certain crops (especially vegetables)

AGROECOLOGY - INTRODUCTION

Agroecology is therefore particularly suitable for small-scale food production:

- Small area
- Abundant labor force
- Crop diversity beneficial to farmers

Agroecology has the potential to improve the standard of living of these farmers, especially those in difficulty (infertile soils, irregular or insufficient water resources, few resources).

Production diversity is less amenable to cash crop farming, where farmers are often specialized in a particular crop.

AGROECOLOGY COURSE - OBJECTIVES

The aspects dealt with are the following:

- Agroecological vegetable production
- Pest and disease management
- Soil protection

AGROECOLOGY COURSE - OBJECTIVES

- After this course, the participants will be able to understand the functioning, advantages and disadvantages of an agroecological production system, as well as identify the differences with conventional systems.
- The course alternates presentations with field trips at the model farm.

PROGRAM

	september 17		september 18		september 19	
Topic of the day	agroecological vegetable production	presenters	biological pest and diseases control	presenters	soil fertility	presenters
Morning (4h)	Aim of the workshop	Jacquie	introduction to topic (10-15')	Obsuman	introduction to topic	Quentin
	Expectations of participants	Audience	reminder on role of biodiversity (prevention)	Kisii University expert	threats for soil fertility	Kisii University expert
	Introduction to concept of agroecology and role of biodiversity	Quentin / Kisii university expert	prevention technics (hygiene, plants health, beneficials)	Kisii University expert	prevention technics (soil cover, minimal disturbance, crop diversity, addition of organic matter)	Kisii University expert
	crop rotation and vegetable intercropping	Obsuman	biological treatments (biological repellents, push and pull)	Quentin (repellents) / Obsuman (push and pull)	biological inputs (organic fertilizers, cover crops)	Quentin (cover crops) / Obsuman (organic fertilizer)
Lunch break (1h30)						
Afternoon (3h)	mother farm visit: focus on farm's design and infrastructures that foster biodiversity	Farm manager	farm visit: focus prevention technics and treatments	Farmer manager	farm visit: focus prevention	Farmer manager
	exercise (indeginous practices)	Woman farmer (name to add)	exercise presented by women farmers	Woman farmer (name to add)	exercise presented by women farmers	Woman farmer (name to add)
	vegetable crop rotation or/and intercropping (comparison/justification with agroecological model)	Obsuman/farmer	biological control technics	Kisii University expert / Woman farmer / Quentin / Obsuman	compost preparation (or other farming technique)	Kisii University expert / Quentin / Obsuman
	wrap-up session	Jacquie	wrap-up session	Jacquie?	wrap-up session and exchanges with farmers	Jacquie / Quentin / Obsuman

REFERENCES

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- FAO (2016), ÉMISSIONS DE GAZÀ EFFET DE SERRE issues de l'agriculture,de la foresterie et des autresaffectations des terres
- Montanarella, L., Pennock, D. J., McKenzie, N., Badraoui, M., Chude, V., Baptista, I., . . . Yagi, K. (2016). World's soils are under threat. *Soil, 2*(1), 79-82.

INTERVENTION OF KISII UNIVERSITY EXPERT ON AGROECOLOGY

QUESTIONS?

…

Market garden plot in Obala, Cameroon

CROP ROTATION AND ASSOCIATIONS

Obsuman Damena, Lecturer at Department of Postharvest Management, Jimma University, Ethiopia

CONTENT

- Presentation of tested associations
- Summary
- Conclusion

Traditional plot in Southern Cameroon

BENEFITS

- Benefits of pest control
- Discontinuity of resources
- Greater diversity of insects, more beneficials
- Plants that attract a particular beneficiary
- Trap plants: pennisetum, brachiaria
- General repellent plants (chilli, ginger, onion, garlic, tagetes, nasturtium).
- Specific repellent plants: onion, desmodium
- In case of destruction of a crop by a pest, the associated crop will be able to compensate this loss.

CONSTRAINTS

- Competition between crops for light, water and nutrients
- Requires good knowledge of crops
- Requires good organisation
- More complicated to mechanise

BASIC RULES

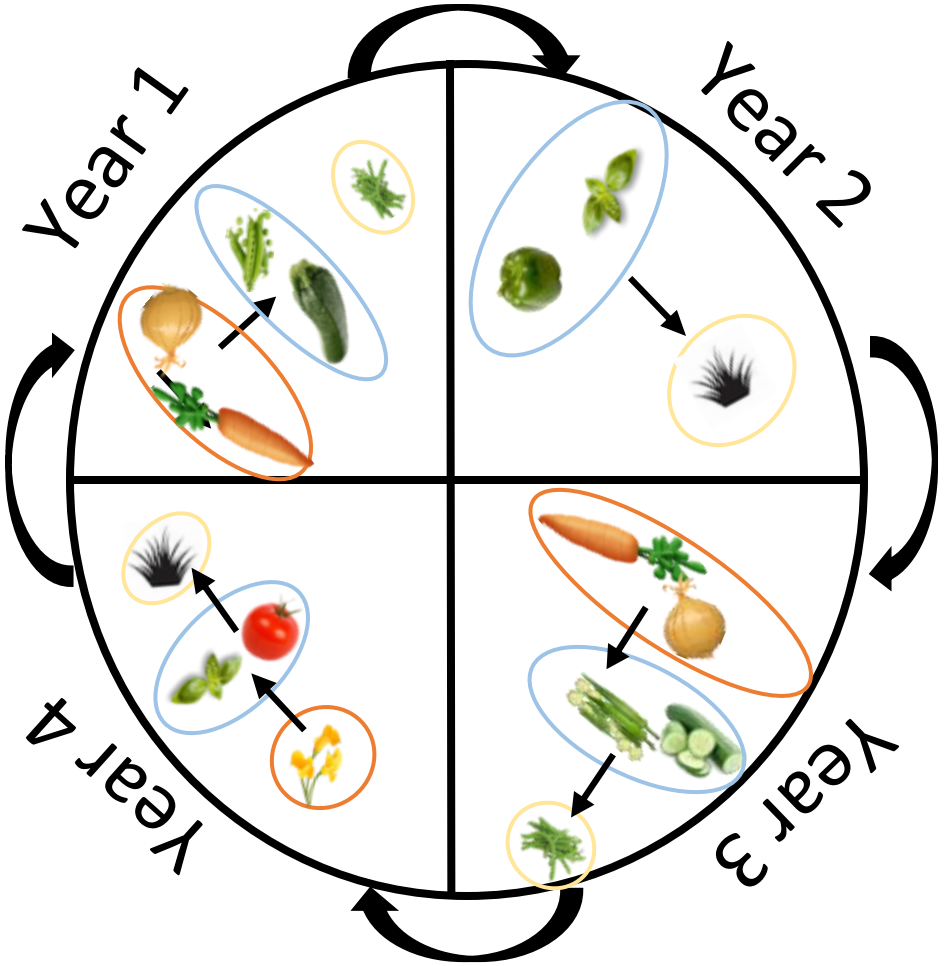
- Combine different families and types of vegetables (leaves/stems, tubers/roots, flowers/fruits)
  - Reduce competition for nutrients
  - Reduces pests and diseases

- Combine appropriate cultivation times:
  - Take advantage of the rapid growth of certain crops to cover the soil

- Combine crops that protect each other through natural processes

ROTATIONS

- Pests and diseases cannot infect the next crop, it is not a host plant.
- The eggs or spores will not survive until the host plant returns to the plot.
- Same principle for weeds.
- Essential to maintain soil fertility

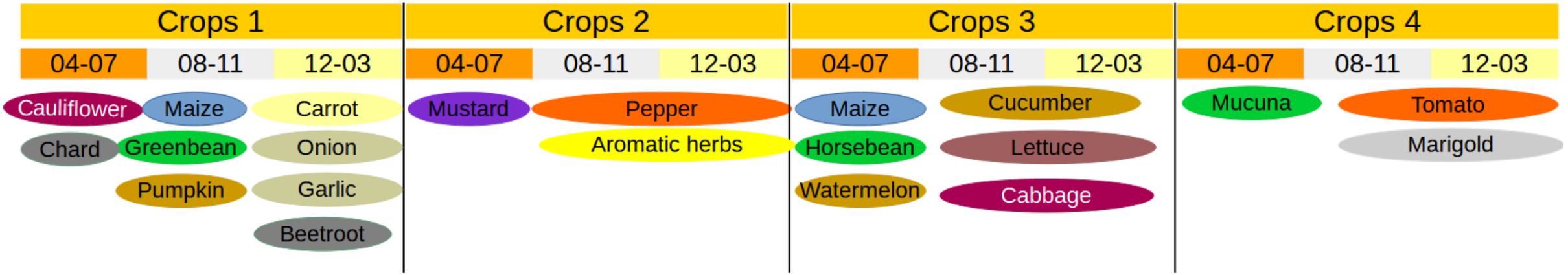


MAIN VEGETABLES

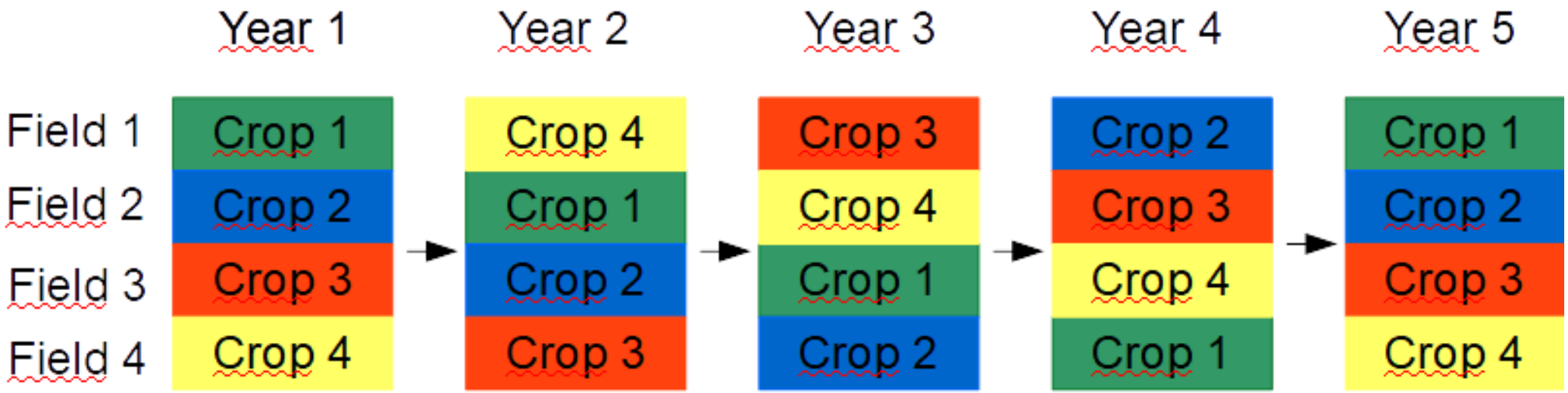
- Breaks must be respected between families as well as between species.

Family	Species	Maximum [%]	Break [Year]	Nutrients	Product
Apiaceae	Carrot, Celery, Parsley	50	4/7		Leaves, Roots
Asteraceae	Lettuce, Chicory	50	4/7		Leaves
Brassicaceae	Cabbage, Radish, Turnip	50	4/7	NK	Leaves
Cucurbits	Squash, Watermelon, Melon, Cucumber, Courgette	30	5/7	NK	Fruit
Alliaceae	Garlic, Onion, Leek	30	5/7		Bulb, Leaves
Malvaceae	Bissap, Okra, Cortea	50	4/7		
Solanaceae	Tomato	30	5/7	NK	Fruit
	Potato	25	5/7	NK	Tuber
	Eggplant, Pepper	50	4/7	NK	Fruit

ROTATION EXEMPLE



ROTATION EXEMPLE



VEGETABLE ASSOCIATIONS
PEST REPELLENT SPECIES

- **Onions, garlic and other alliums: suitable for small, uncompetitive crops**

VEGETABLE ASSOCIATIONS
PEST REPELLENT SPECIES

- **Ginger, Turmeric**
- **Mint**
- **Lemongrass**

VEGETABLE ASSOCIATIONS
PEST REPELLENT SPECIES

- **Aromatic herbs (lamiaceae): basil, thyme, oregano, savory**

VEGETABLE ASSOCIATIONS
PEST REPELLENT SPECIES

- **Tagetes, nasturtium: repels white flies and protects solanaceae.**

Veg, Intercropped With Aromatic Herbs, Jimma, Ethiopia

VEGETABLE ASSOCIATIONS

GENERALITIES

- Alliaceae (garlic, onion) protect Apiaceae (carrot, celery).
- Tagetes and nasturtiums protect Solanaceae and Brassicas.
- Aromatic herbs (Lamiaceae) protect almost all vegetables.

VEGETABLE ASSOCIATIONS

GENERALITIES

- Alliums have a negative impact on legumes.
- Brassicas have a negative impact on rosaceous plants (strawberry).
- Solanaceae-brassicaceae associations are often unfavorable (except potatoes).
- Associations within the same family are very rarely favorable.

COMBINATION OF VEGETABLES : CARROT AND ONION

Advantages :

- Two different families (Apiaceae and Amaryllidaceae)
- Two different types of plant (root and leaf)

This means :

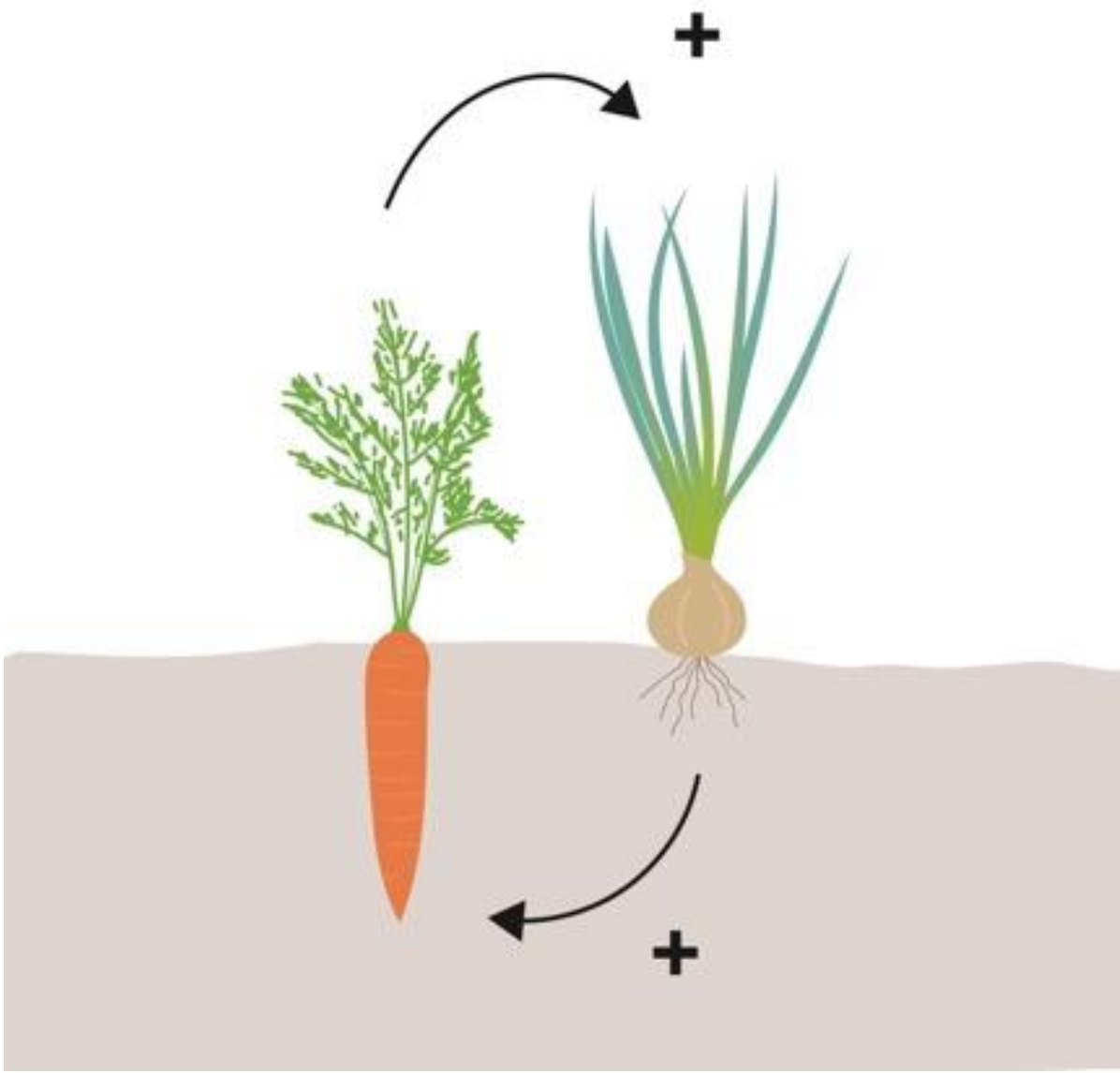
- Little competition for nutrients
- Few common enemies (pest and disease)

Market garden plot, Obala, Cameroon

CARROT AND ONION

Other benefits:

- Amaryllidaceae repel carrot fly.
- Onions have low leaf cover. Carrots protect the soil from erosion through their foliage.
- Cultivation time is similar



CONT'…

Carrot and onion intercropped, Jimma, Ethiopia

WITH LETTUCE

- Carrot and onion: slow growth
- Lettuce covers the ground quickly
- After harvest, carrots and onions grow slowly

Market garden plot, Obala, Cameroon

WITH BEETROOT

Association :

- Beetroot / Chard, carrot and leek
- Spacing: 1m bed, 2 rows of leeks, 2 of carrots and 1 of beetroot

Comments :

- Good implementation
- Market-oriented production
- Lack of diversity in rotation

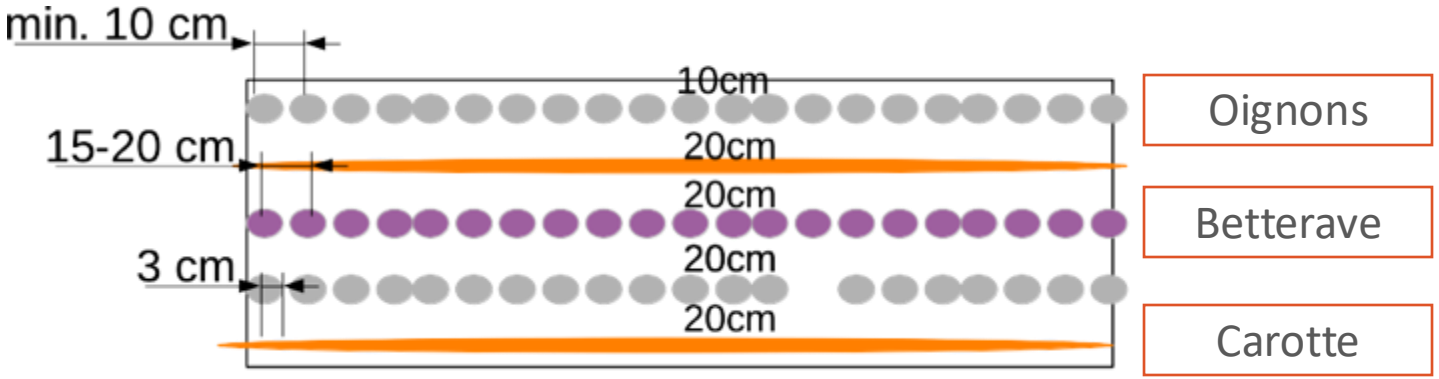
Market garden plot, Obala, Cameroon

Benefits :

- Optimum ground coverage
- Optimum use of space

Comment:

- Spacing too narrow



Market garden plot, Obala, Cameroon

Sister Farms, Jimma, Ethiopia



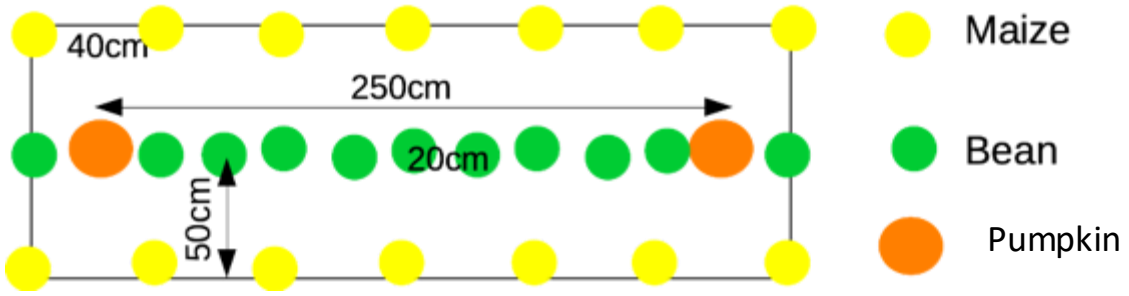
Sister Farms, Jimma, Ethiopia

MAIZE, BEANS AND PUMPKIN

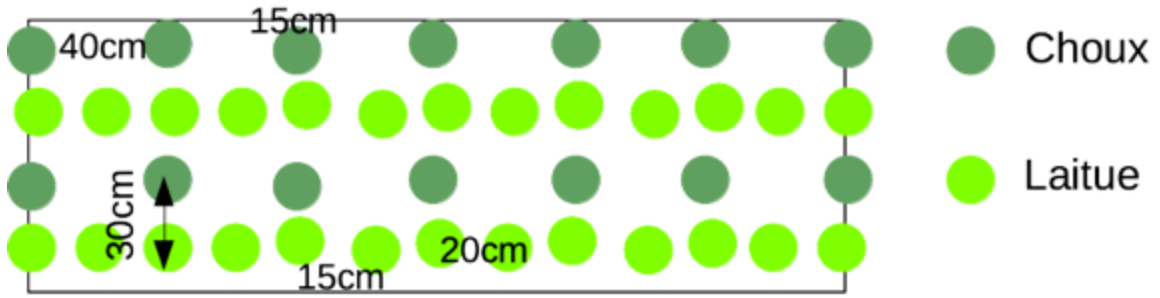
- Spacing: 1m between pumpkin, 0.5m between maize, 0.3m between beans

Benefits :

- Pumpkin covers the soil
- Maize provides a support for beans
- Beans provide nitrogen for other crops
- Each crop comes from a different family (Poaceae, Fabaceae, Cucurbitaceae)



LETTUCE AND CABBAGE



Benefits :

- Plants from different vegetable families and types
- Lettuce covers the ground quickly, cabbage is slower
- Eventually, the lettuce is harvested, the cabbage finishes growing

Recommendation:

- Planting must be synchronised
- The path is wide in relation to the board

Field crop plot on the farm in Pita, Guinea

DIVERSIFIED MARKET GARDEN PLOT

- High biodiversity in a small area (1000m2)
- Product diversity
- Market-oriented
- Still experimenting

Market garden plot in Obala, Cameroon

DIVERSIFIED MARKET GARDEN PLOT

- High biodiversity in a small area

Dalloh's farm, Guinea

DIVERSIFIED MARKET GARDEN PLOT

- Zone 1 - Vegetables
- Carrot, onion and beetroot combination
- Plots separated by rows of pineapples

Pita farm, Guinea

SUMMARY AND CONCLUSION

Experiment within the framework of the proposed rules:

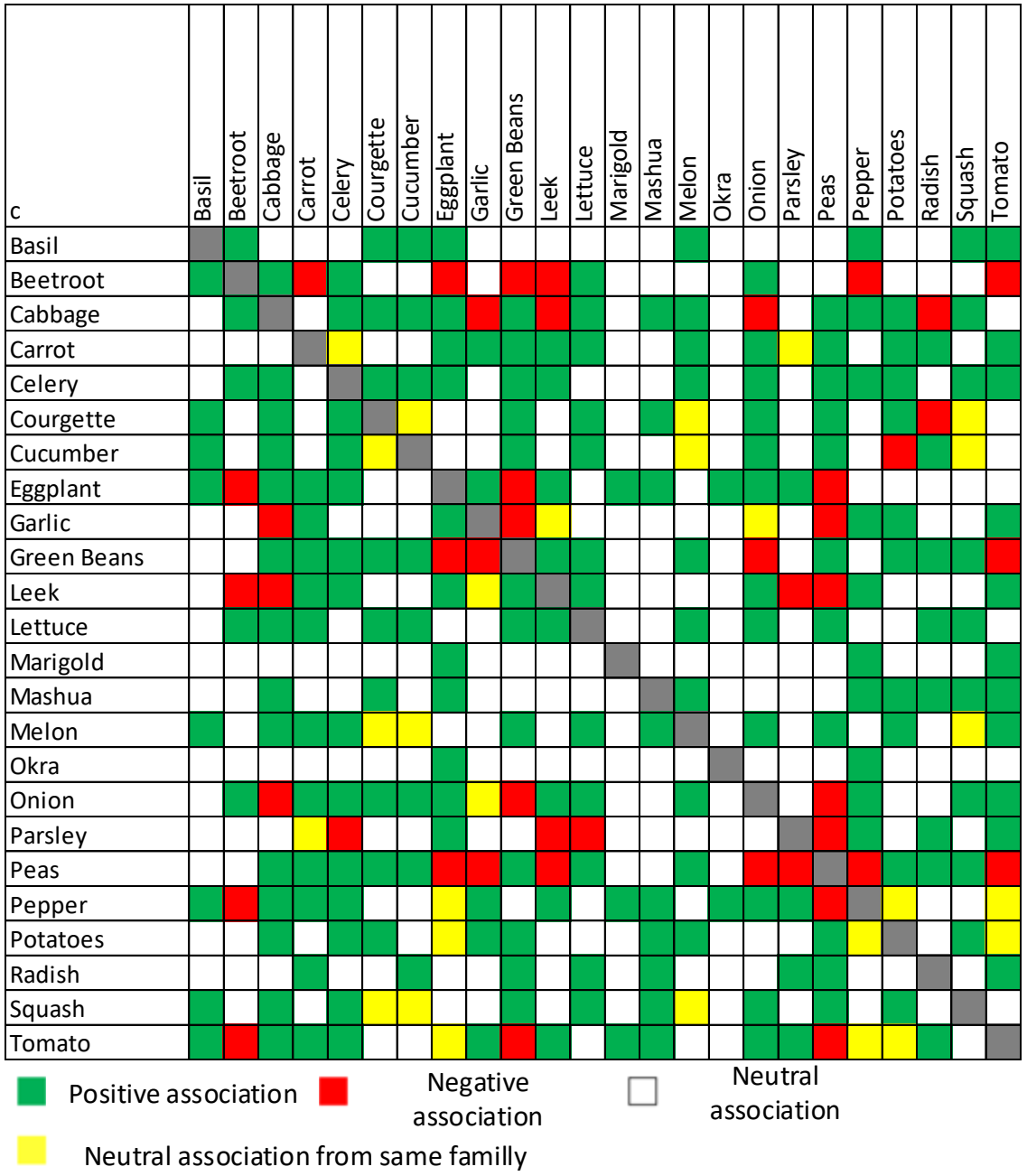
- Families, types of plants (vegetables), table of associations

Take account of wider factors :

- Availability of plant material
- Marketing potential
- Climatic and soil factors

Be aware of the disadvantages, to better control them:

- Competition for nutrients
- Management requires more organisation
- Workload may be greater



QUESTIONS TO THE AUDIENCE

- Who is practicing crop rotation or crop association?
- Can you describe your practice to the audience?

EXERCISE

- Producers design their own crop rotation:
  - Farm separated by plots
    - One year rotation per plots
  - Choice of the crops they want to produce
  - Arrangement of crops rotation / association according to one or two examples

Traditional plot in Southern Cameroon

Thank you for your attention

QUESTIONS?