



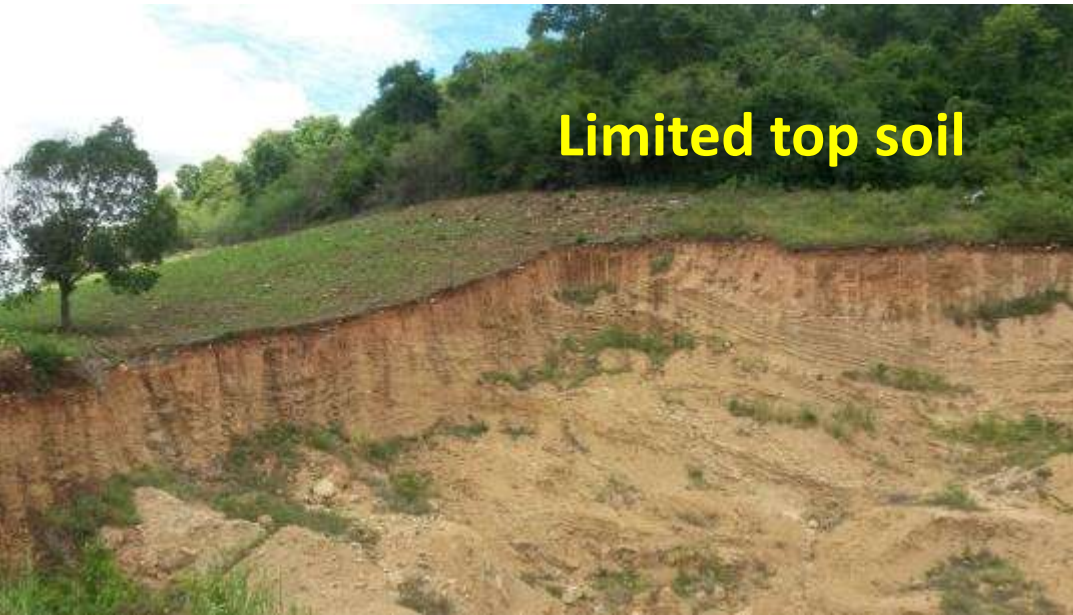
National Multi Stakeholder Workshop “Towards an Agroecology Transition”

Advocacy for a living soil!

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Soil biophysical diversity, climate and topography



Soil, the foundation of agrarian societies

Soil is the basis for:

- Food
- Feed
- Fiber
- Fuel
- Medicinal plants
- Ecosystem services



Soil, a complex integrated living system



2600 tons of soil in 0-20 cm depth



86 tons of SOM
50 tons Soil Organic C

Biodiversity

Connection

Synergies

1 ton microbial-C

In 1 g of soil

- > 4000 species of bacteria
- > 2000 species of saprophytic fungus

On 1 m², ~ 1000 species invertebrates:

- 400-500 Mite
- 60-80 Collembola
- 90 Nematode
- 60 Protozoa
- 20-30 Oligochaete
- 10-12 Earthworm
- 15 Diplopode

Farming in the uplands



Fruit trees and intercropping



Annual upland crops



Soils and natural resources under pressure of intensification ...

- Erosion
- Fertility depletion (and high level of nutrients export)
- Loss in soil biota diversity and abundance
- Compaction
- Chemical pollution
- ...



High CO₂ flux related to the volume of soil disturbed

Bare soil and hills, a mining attitude

Soil under chronic stress
It is a finite resource that should be protected!



Goods and services provided by the ecosystems are almost always either undervalued or simply unvalued. Simply considered as free goods



Depletion

$$C_{\text{input}} < C_{\text{output}}$$



Sequestration

$$C_{\text{input}} > C_{\text{output}}$$

Soils need to be recognized and valued for their productive capacities as well as their contribution to food security and the maintenance of key ecosystem services

Which driver to build a healthy soil?

Plant diversity is the engine that drives soil-crop interactions and enhances ecosystem services (regulation and provision)



Large diversity of crops and cover/relay crops (40 species, 350 cv.)



Soybean (60 cultivars), mungbean, rice-bean and cowpea



Assessing maize (18 hybrids) and cassava (22 cultivars)



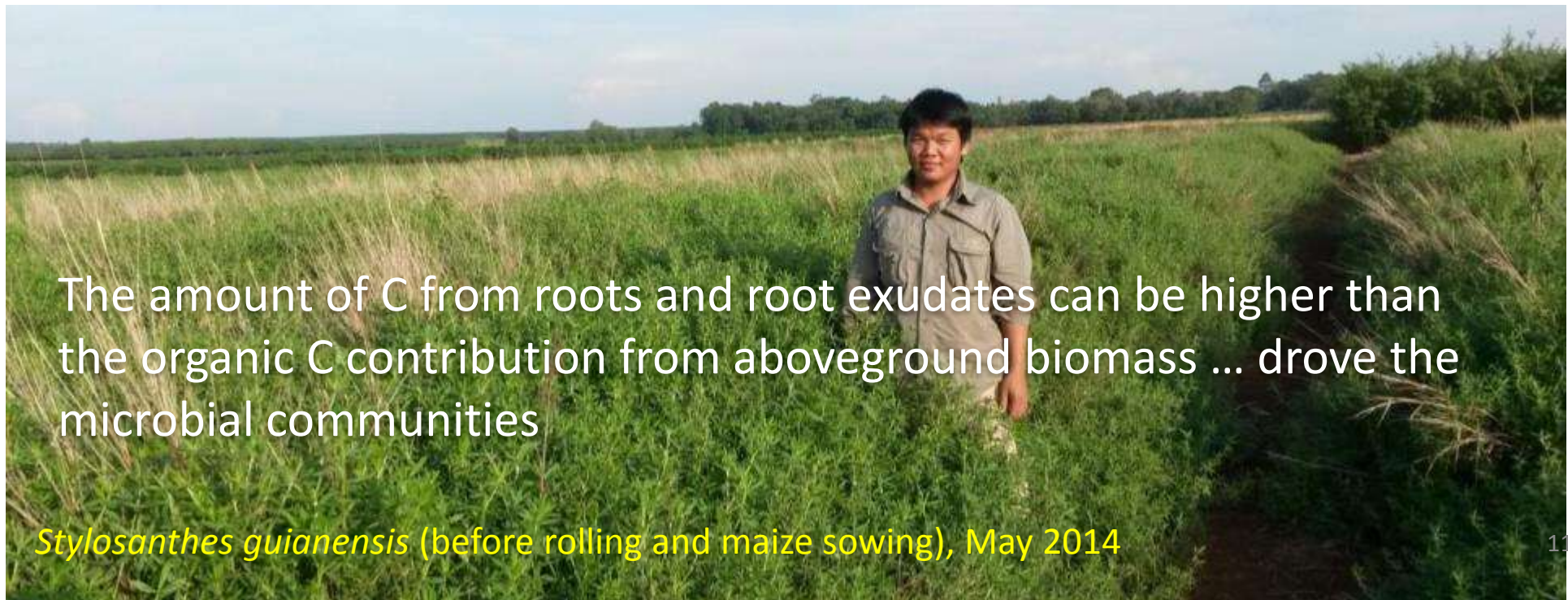
Forages and cover crops (30 species)



180 rice cultivars (from upland to lowland)

Rotation also concerns roots!

We need living roots even during the dry season



Nutrients into an organic form



Replace fertilizers through
N fixing
(plants and microbial)



Continuous input of nutrients and C



Nutrients into an
organic form they
don't leach!

Building healthy soil: Plant diversity as a driver of soil – crop interactions and ecosystem services

Translating technical principles of Conservation Agriculture into ecological processes



**Minimum or
no soil tillage**



**Permanent soil
cover**



**Specie diversity
and arrangement**

Cropping systems engineering: design and assessment



Early maize followed by cassava



Soybean after sorghum



Maize with Pigeon pea



Farmer field of maize in Battambang

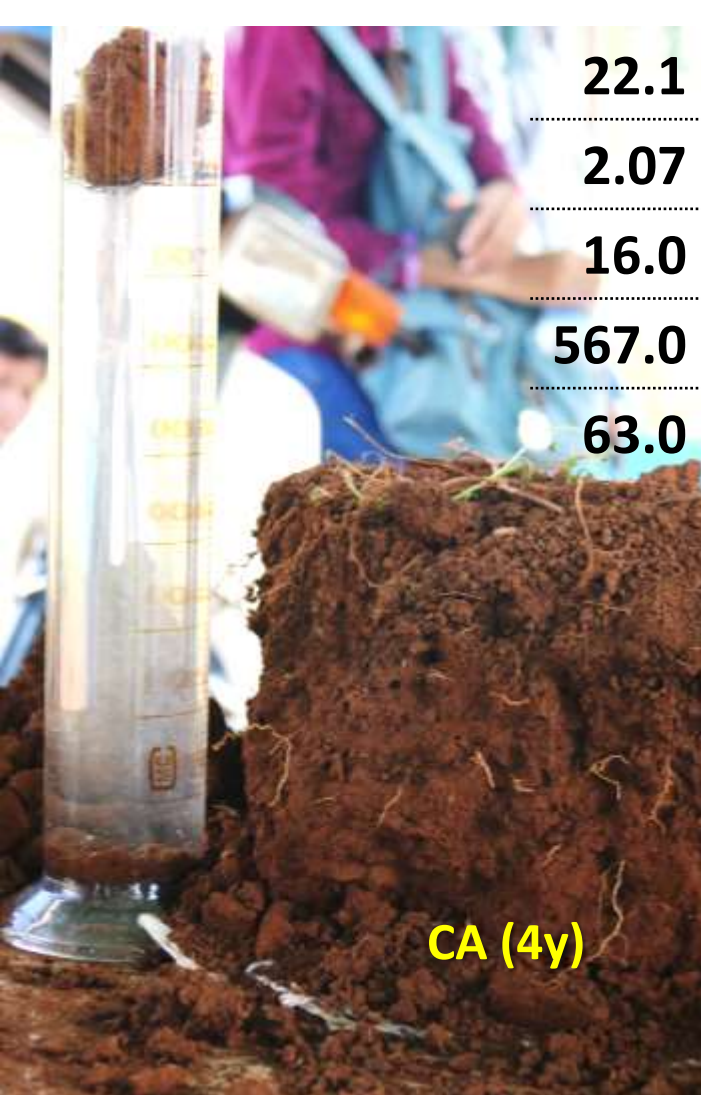


Dry season cassava

Rain-fed red oxisol on basalt

Hok et al., 2015 in Agriculture, Ecosystems and Environment

Boulakia et al., 2014 in Journal Environmental Biology



22.1

Carbon (t/ha)

19.9

2.07

Nitrogen (t/ha)

1.54

16.0

Biodiversity (n° taxa)

10.0

567.0

Abundance (ind/m²)

281.0

63.0

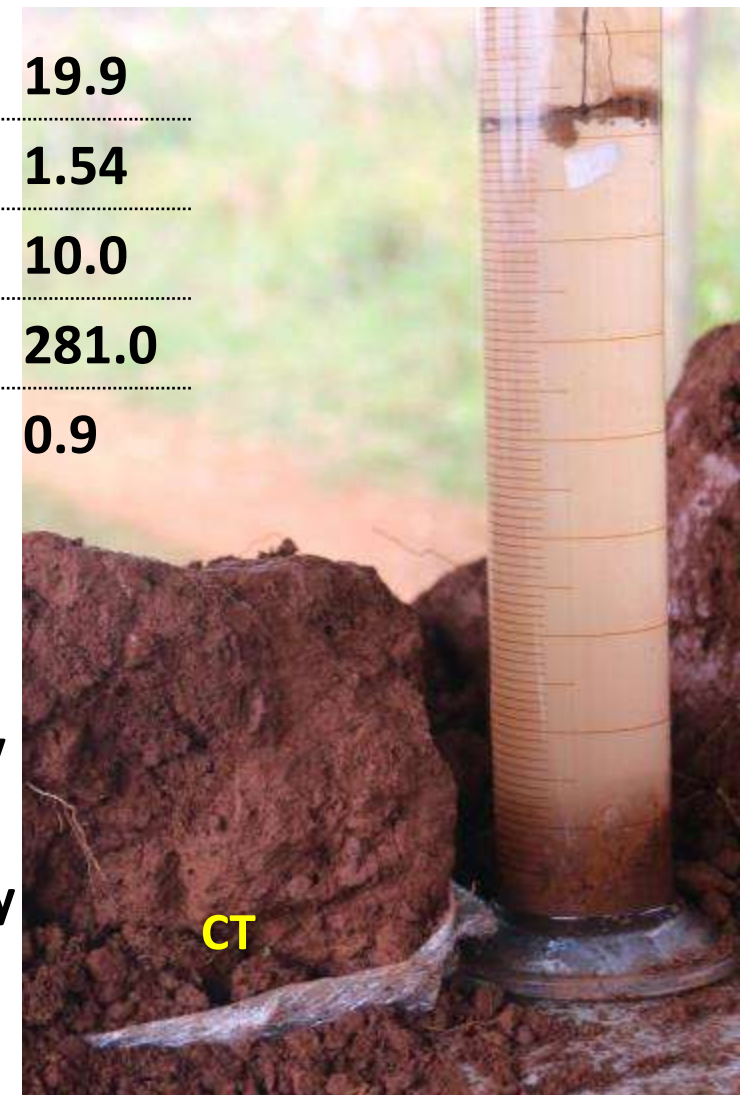
Biomass (g/m²)

0.9



Maintaining soil functions:

- SOC and N accumulation
- Sustaining soil biodiversity
- Improving soil structure and water holding capacity
- Nutrient saving strategies



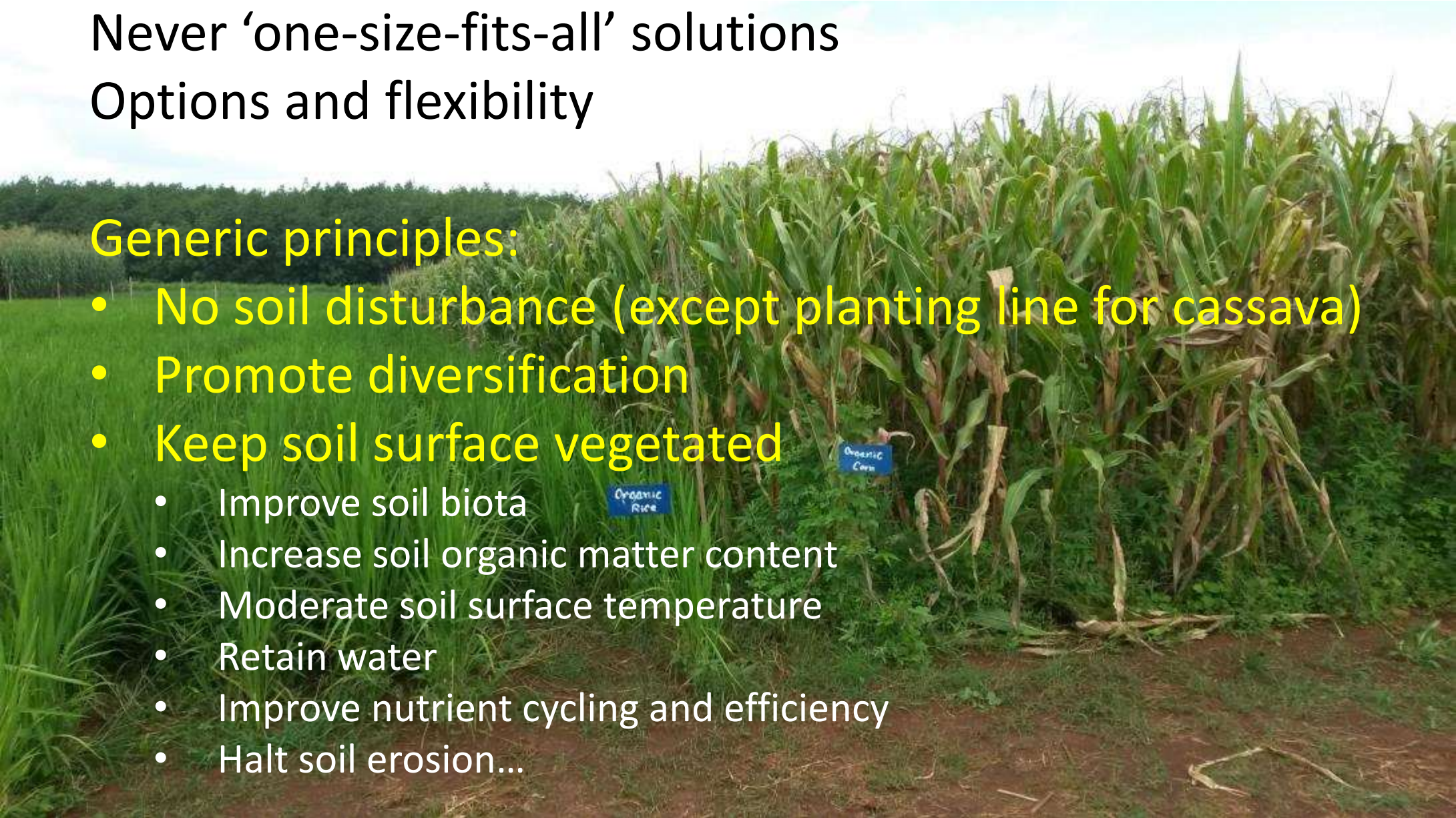
A global approach of landscape management and productivity enhancement

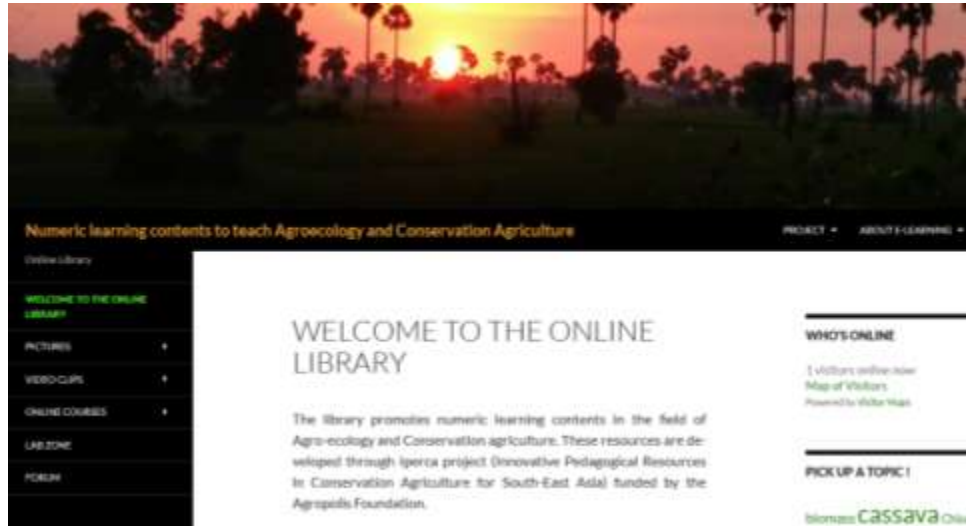
Recreating buffer zones (continuous fauna corridor, rivers protection: water quality and aquatic life, biodiversity, infrastructures protection...) & integration of CA systems (soil potentialities, diversification) with animal husbandry.

Never 'one-size-fits-all' solutions
Options and flexibility

Generic principles:

- No soil disturbance (except planting line for cassava)
- Promote diversification
- Keep soil surface vegetated
 - Improve soil biota
 - Increase soil organic matter content
 - Moderate soil surface temperature
 - Retain water
 - Improve nutrient cycling and efficiency
 - Halt soil erosion...





<http://www.iperca.org/>

<http://casc.cirad.fr/>

Thank you for
attention!

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