



# The use of agroecological (AE) principles to design integrated crop-livestock systems (ICLS) : the case of the French West Indies.

Fanchone A, Stark F, Alexandre G, Diman JL, Gourdine JL, Ozier-Lafontaine H, Sierra J, Tournebize R, and Archimède H



Research



Training



Extension



64<sup>th</sup>

EAAP 2013

AUGUST 26<sup>TH</sup> - 30<sup>TH</sup>, 2013  
NANTES, FRANCE

ANNUAL MEETING  
OF THE EUROPEAN FEDERATION OF ANIMAL SCIENCE





**Agroecology (AE)** → firstly defined as use of ecological methods in research on commercial crop plants (Bensin, 1930) ... Then, after several developments it is now defined both as a science (researchers), a movement (organizations) or a practice (farmers) (Wezel *et al.*, 2009).

**In our study, AE** → set of practices that contribute to a more eco-friendly or sustainable agriculture.

The main principles of AE : 1/ Increase genetic diversification, 2/ Improve energy and nutrient turn-over, 3/ Ensure soil quality 4/ Promote biological interactions,



⇒ Traduced in several practices : *use of green manure and compost as fertilizers, crop rotation and association, selection genotypes adapted to the local bioclimatic context, recycling crop by-products ... (Rabhi 2007).*



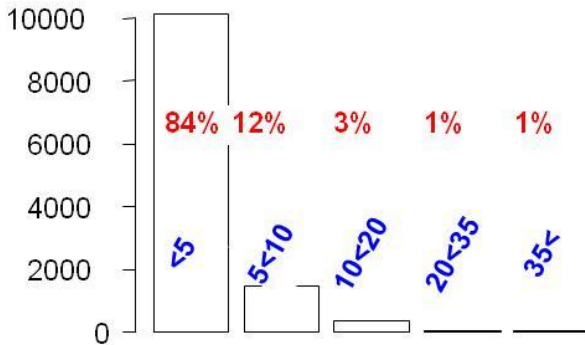
→ In Guadeloupe, one of the small islands of the Caribbean (1,630 km<sup>2</sup>)

→ The agricultural landscape is characterized by a high number of small farms (96% of the farms are lower than 10ha).

→ The mean size of Guadeloupian farm is 5 ha.

→ 80% of farms are mixed systems.

→ Due to their number they contribute to a high proportion of local food



ICLS in Guadeloupe have been poorly studied as a whole and AE practices developed have been studied independently of each other.

⇒ In our conception, the specificity of AE came from the association of several EA principles within the same farm.

→ Design a ICLS using several AE principles → create references & understand the added value of such system.



The main principles of AE:

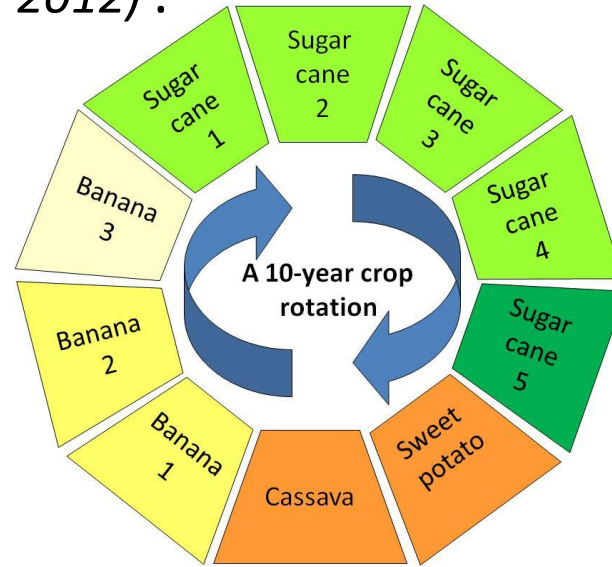
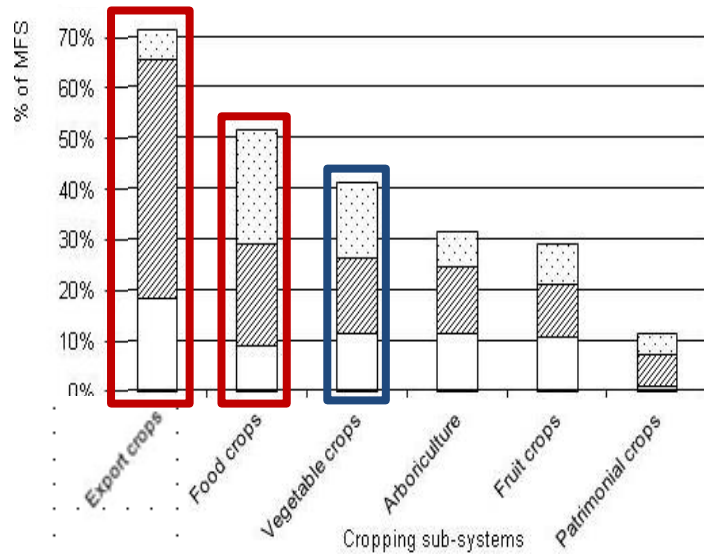
- 1/ increase genetic diversification,
- 2/ improve energy and nutrient turn over,
- 3/ ensure soil quality,
- 4/ promote biological interactions,



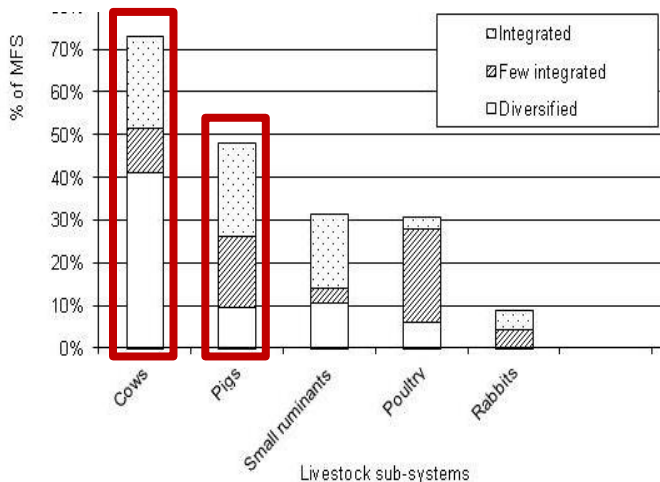
# 1/ ↗ genetic diversification = ↗ Cultivated & Functional biodiversity

→ Cultivated biodiversity

From a characterization made from 115 on-farm survey: ICLS in Guadeloupe have a high cultivated biodiversity with more than 10 species within the same farm (*Stark et al. 2012*).



Legumes as cover-crops



5 bulls



3 cohorts of 10 pig

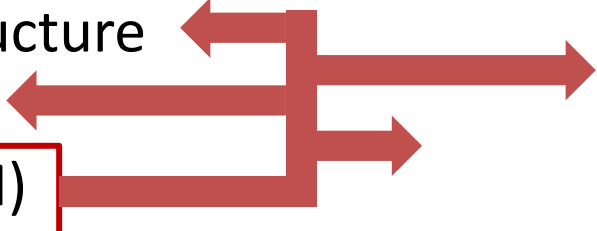
Creole (local) genotypes

# 1/ ↗ genetic diversification = ↗Cultivated & Functional biodiversity

→ Functional biodiversity = ensure adequate conditions for microorganisms

*Mainly soil biodiversity (easier to manage in our context)*

→ Soil organism biodiversity is regulated abiotic and biotic factors:

- Climate: temperature, moisture.
  - Soil texture and structure
  - Soil pH.
  - Organic matter (OM)
- 



- ↗ Soil OM content ( decomposition of crops residues & roots)
- ↗ Soil structure (high & deep root development).

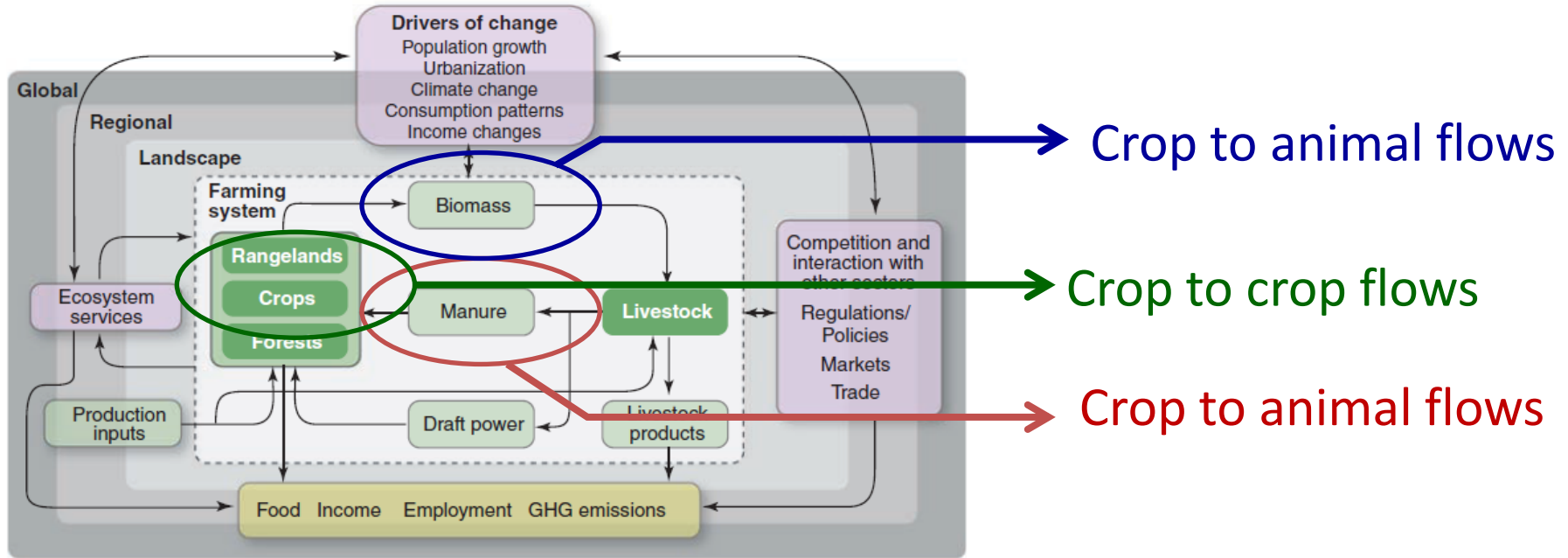


- ↗ Soil OM content ( decomposition straws).
- ↗ Ensure microclimate for microorganism.



- ↗ Soil OM content ( 50 % aboveground / 50% underground).

## 2/ improve energy and nutrient turn over

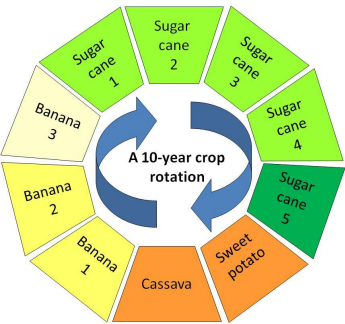


→ Crop to crop flows consist in crop rotation & crop association  
→ use of sugar cane and legumes ↗ OM recycling

→ Crop to animal flows: crop by-products and part of production is the basis of animal food.

→ Crop to animal flows: ≈ 50t of compost can be produced yearly and can be spread during tillage or at specific part of the cycle

## 2/ Ensure soil quality: ↗ Soil structure, ↗ Soil fertility, ↗ Soil biodiversity, → health status, ...



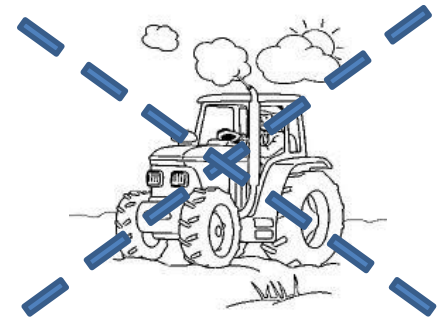
**Sugar cane** is known to:

- ↗ soil structure & soil fertility.
- ↗ break cycle of other crop pest ∴ need for pesticides ... ↗ soil health status.



**Sugar cane straw as mulch:**

- Allow negatives conditions to weed development ...
- ... ∴ need for pesticides ↗ soil health status.



**Minimum tillage** and use of **small mechanization:**

- soil structure



**Cover-crops:**

- Allow negatives conditions to weed & pest development ... ∴ need for pesticides ↗ soil health status.

**Legumes:**

- Provide nutrient (nitrogen) ... ↗ soil OM ∴ need for fertilizers ↗ soil structure & soil fertility

## 4/ promote biological interactions



### **Cover-crops:**

↗ use of solar radiation and water by the use of different layers.



### **Sugarcane straw as mulch:**

- Provide an Habits for soil flora and fauna

## Conclusion :

The association of several EA principles within the same farm but induce a very complex system is possible .

⇒ Theoretically this system would be more sustainable than conventional (non integrated) systems.

This system has been established since June 2012 at the agricultural high school of Guadeloupe.



From a modeling using IMPACT<sup>®</sup> (*Herrero et al., 2007*) use of all AE principles within the same farm highly increases labor.

E.g. association of animals implies 1,226 more related to animal feeding. The gain (mainly related to save of inputs) did not covered the additional need for labor (*Fanchone et al., This congress*).

→ Labor is a lock in such system.

# Perspective :

→ Strategies aiming at decreasing need for labor.

→ direct harvesting of crop residues by animals





Thank you!



- [Audrey.Fanchone@antilles.inra.fr](mailto:Audrey.Fanchone@antilles.inra.fr)



64<sup>th</sup>

EAAP 2013

AUGUST 26<sup>TH</sup> - 30<sup>TH</sup>, 2013  
NANTES, FRANCE

ANNUAL MEETING  
OF THE EUROPEAN FEDERATION OF ANIMAL SCIENCE

