Agropolis: why getting involved in agrobiodiversity monitoring

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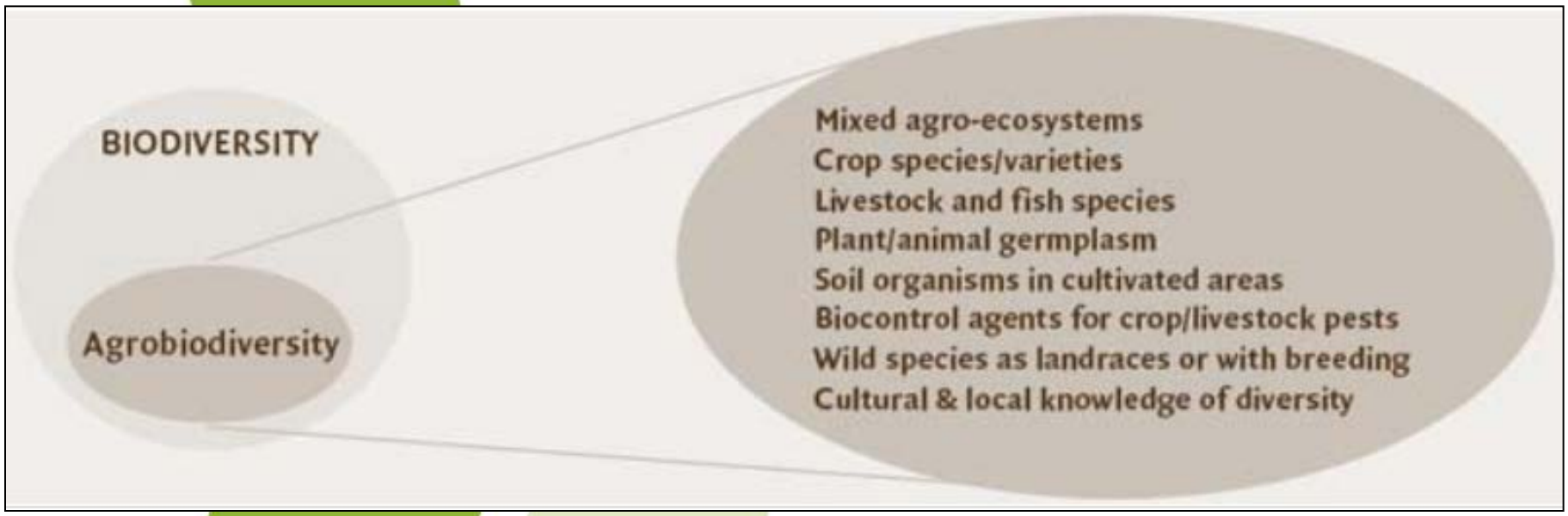

http://www.fao.org/docrep/007/y5609e/y5609e01.htm

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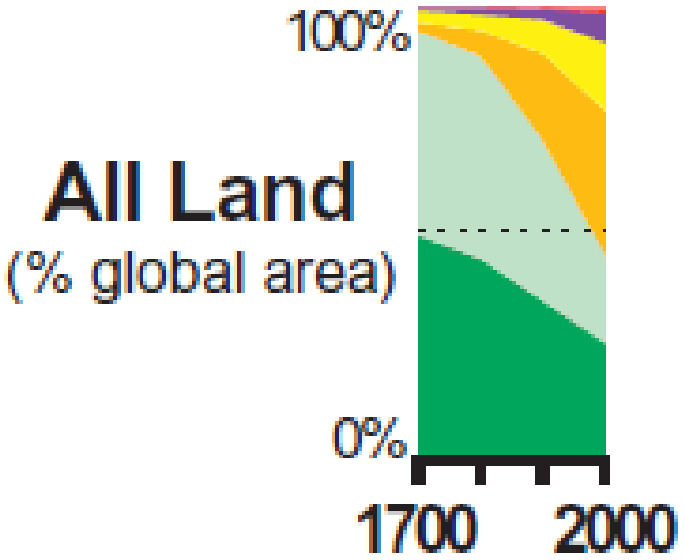
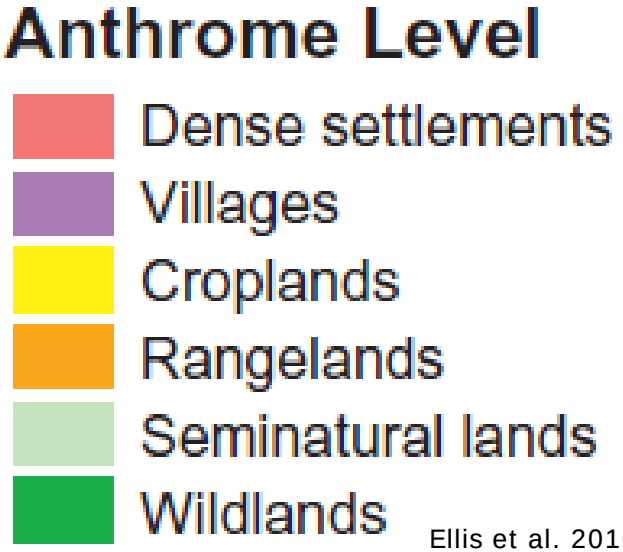
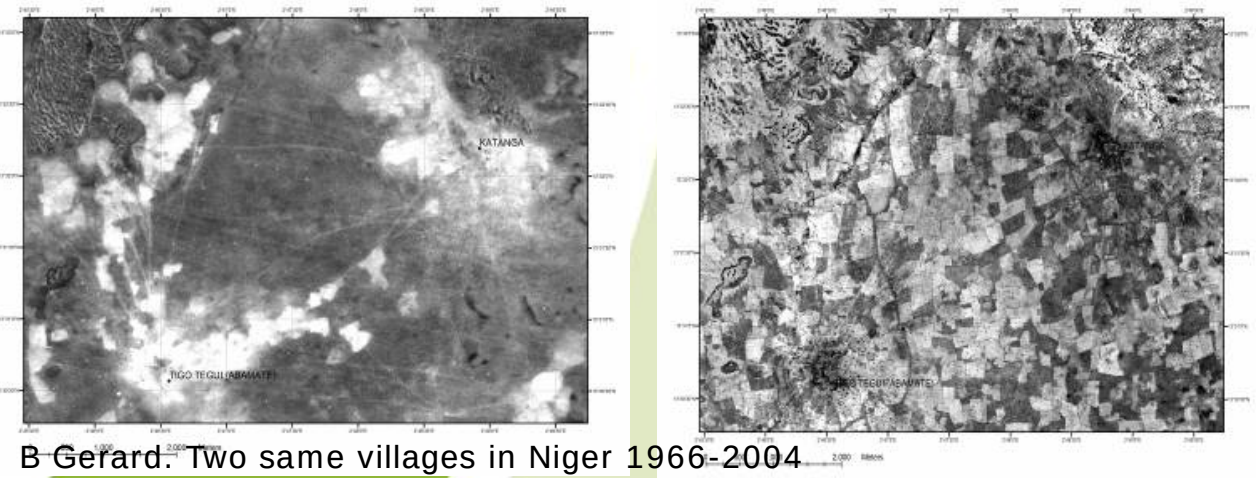
Long and short term trends





Ellis et al. 2010
History Database of the Global Environment - HYDE



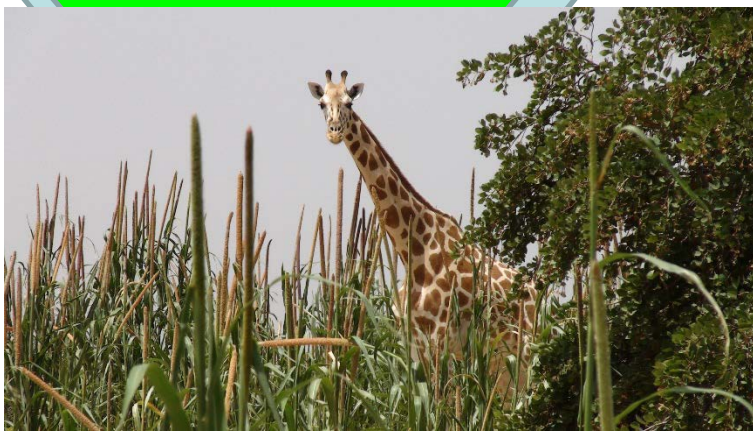
B Gerard. Two same villages in Niger 1966-2004

BIODIVERSITY

AGROBIODIVERSITY

BIODIVERSITY

AGROBIODIVERSITY



- (agro)biodiversity is at the same time:
  - a service of agro-ecosystems through its intrinsic value and its associated cultural services
  - the result of the management of other services (in particular production)
  - a component in the delivery of a large range of other services.
- This makes the analysis of relationships between management, (agro)biodiversity and ecosystem services particularly complex.
- Need to better understand dynamics associated with agrobiodiversity

Le Roux et al. 2008

GAP in knowledge where monitoring might be an asset

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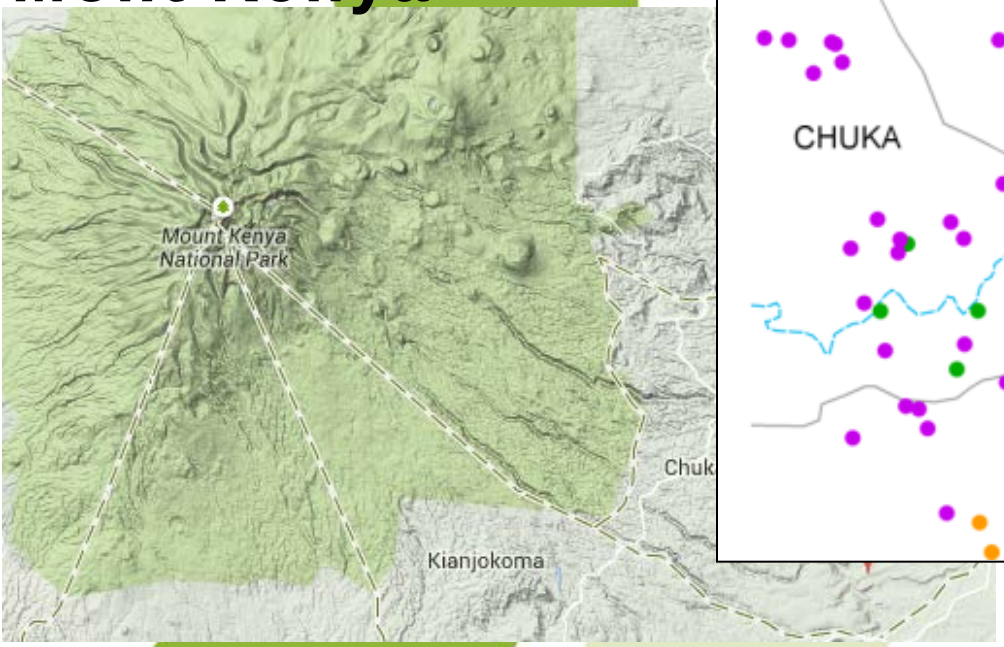
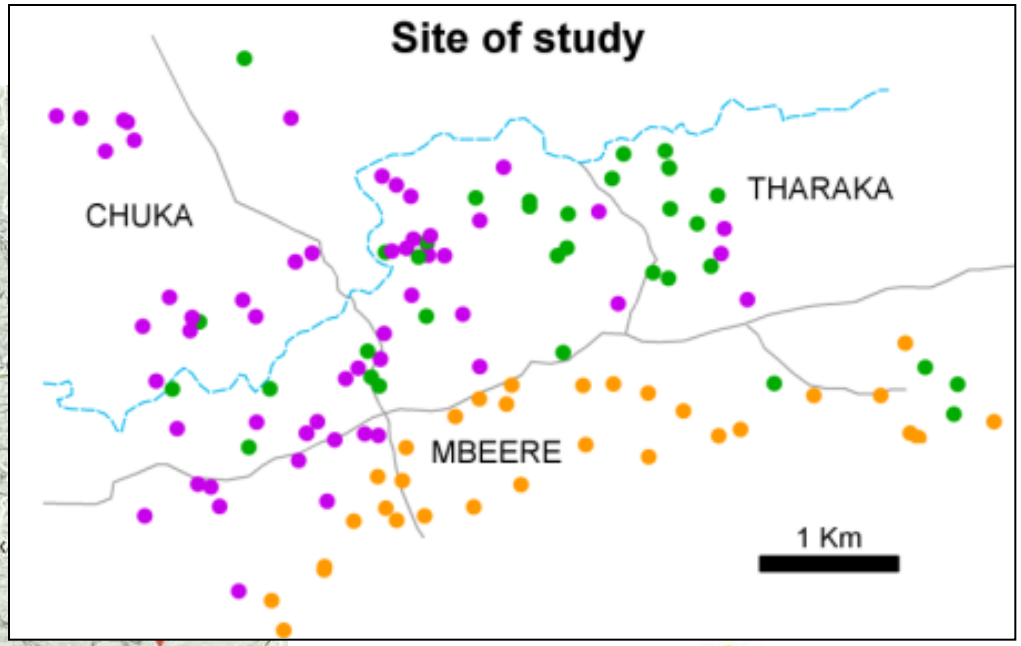
Testing the relation between farmers' social organization and spatial patterns of crop diversity

Mont Kenya



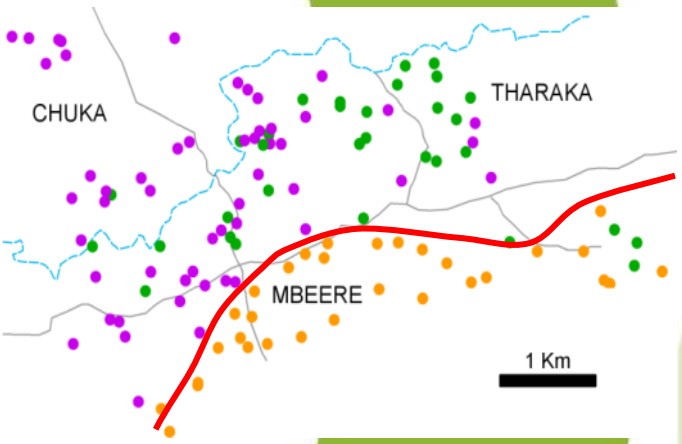


V Labeyrie et al. PlosOne 2014

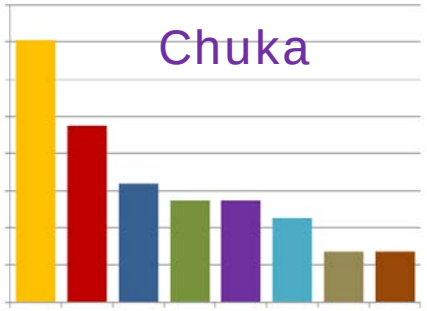
Thanks to V Labeyrie & C Leclerc for slides

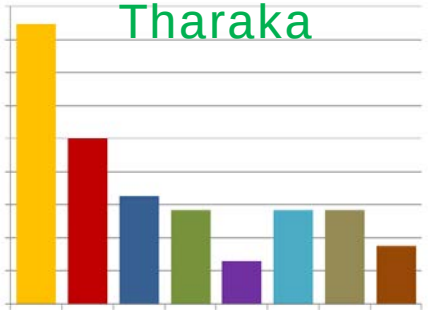
Farmers' social organization and crop diversity patterns

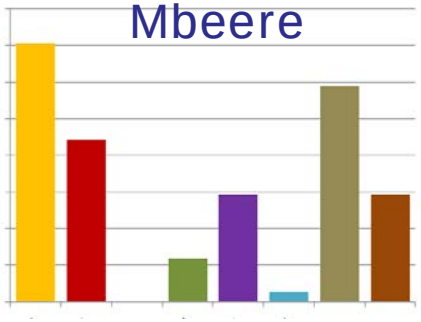
Ethnolinguistic groups



Uneven distribution of named sorghum varieties







V Labeyrie et al. PlosOne 2014

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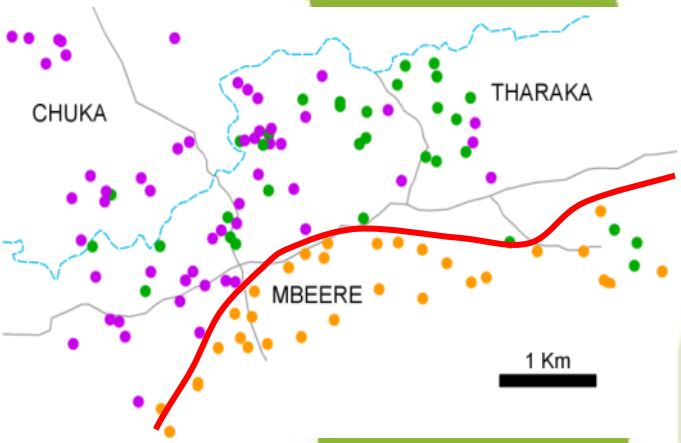
Ethnolinguistic groups



Social partitioning of sorghum genetic diversity

Chuka
R.allèlique : **6.1**[a]

Tharaka
R.allèlique: **5.9**[a]

Mbeere
R.allèlique : **4.6**[b]

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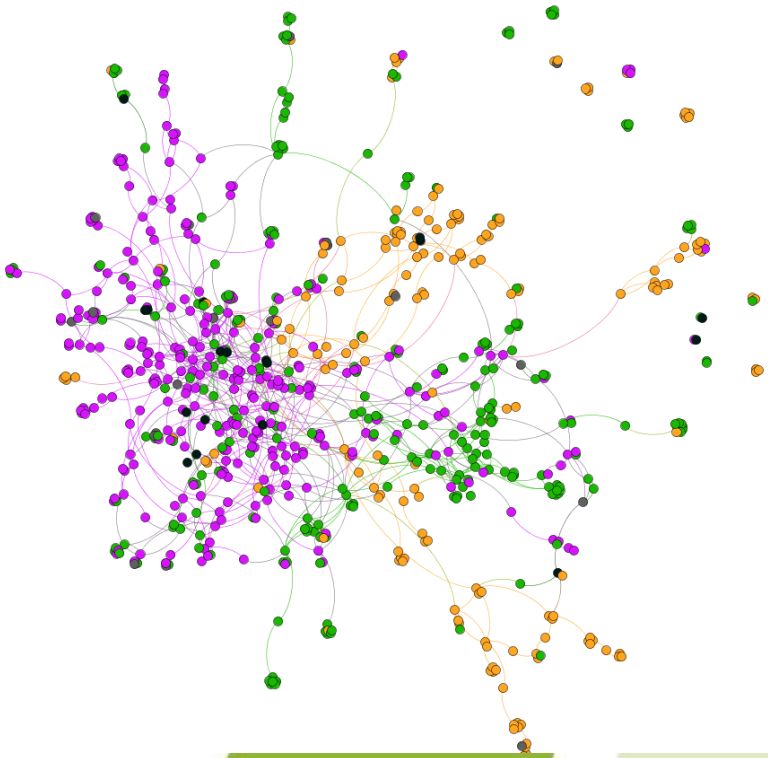
V Labeyrie et al. PlosOne 2014
Thanks to V Labeyrie & C Leclerc for slides

Questions



Does it translate to differential capabilities of adaptation?

How social change impact such pattern and its evolution?

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An example :The ennoblement practice in yam (West Africa)

The tuber of a spontaneous plant is harvested

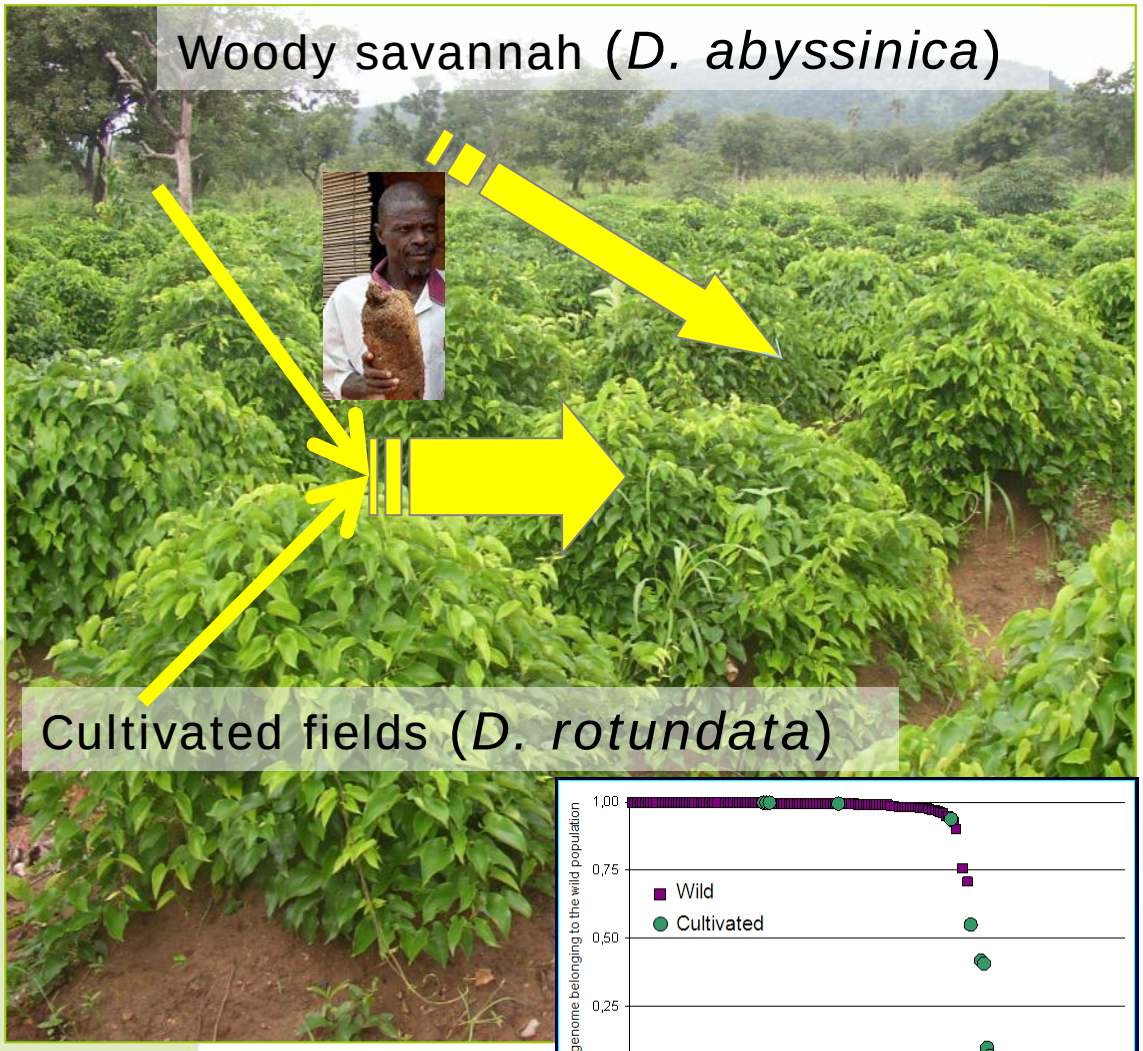
Pre-ennobled yam

Vegetative Multiplication (3-6 years)

Integration into the cultivated pool

Wild x Cultivated x Traditional knowledge

The resilience of this evolutionary dynamics will depend on:
-the resilience of the wild environnement (land use planning?)
-the resilience of the ennoblement practice (cultural tradition)



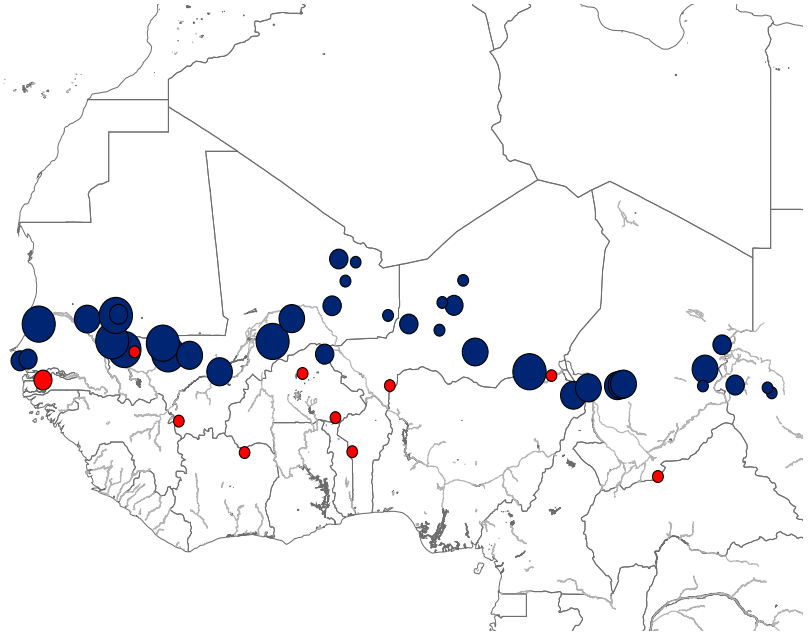
Scarcelli et al. Mol. Ecol 2006
Scarcelli et al. BMC Plant 2014

But lack of dynamics and monitoring…

- How such system evolved in a changing world
  - More land use for crop
  - Social modification
  - Relevance for long term adaptation?

In-situ assessment of wild diversity – pearl millet

Diversity of **wild** and **cultivated** pearl millet



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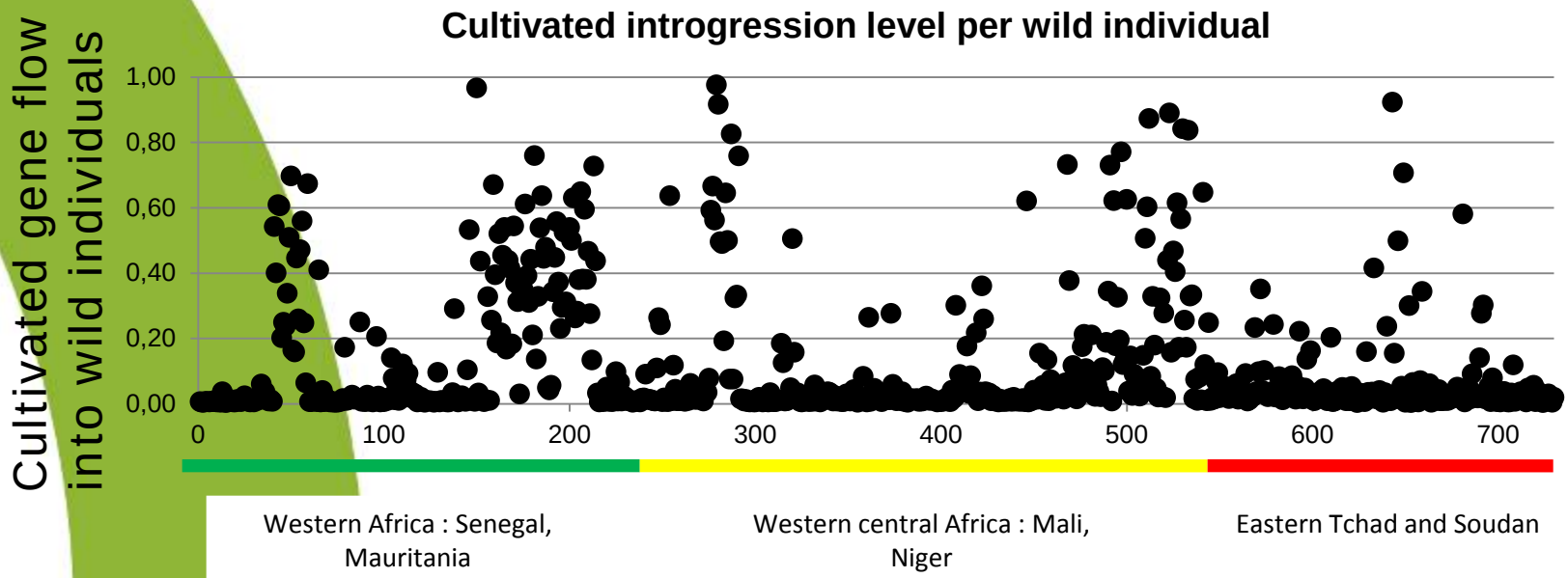

Conclusion

Widespread and impact diversity assessment beacuse it leads to local diversity hotspot.

Is-it a problem? Dynamics?

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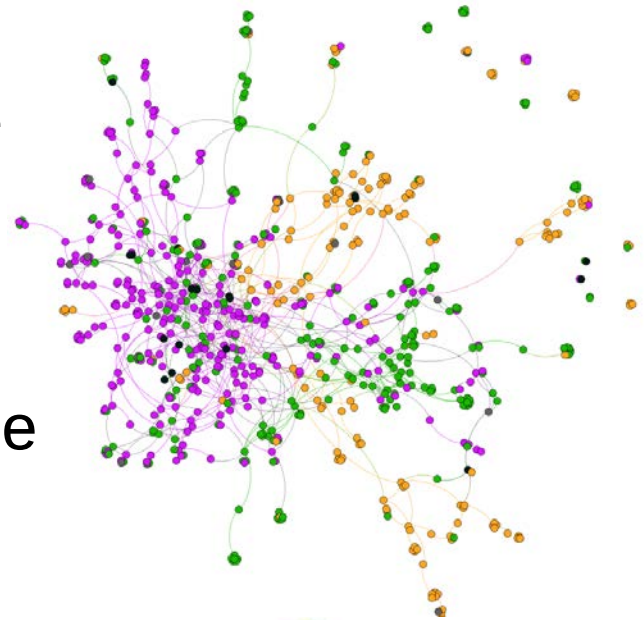
Conclusion

Agrobiodiversity becomes a large fraction of worldwide biodiversity

Understanding dynamics (via monitoring) is necessary to **relate** observation, process and interaction.
It will allow better assessment of our ressources *in situ* and favor the understanding of how such biodiversity is useful.
It will allow consequently a better management of it.



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Thanks


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France and International Agricultural Research

- French support to the CGIAR reform
  - CRPs' success is critical
  - Involvement in CRPs when relevant and possible
  - Consortium in Montpellier
- CRAI (French Commission on International Agricultural Research)


cirad
AGRICULTURAL RESEARCH FOR DEVELOPMENT

Towards an orchestration of global agricultural research

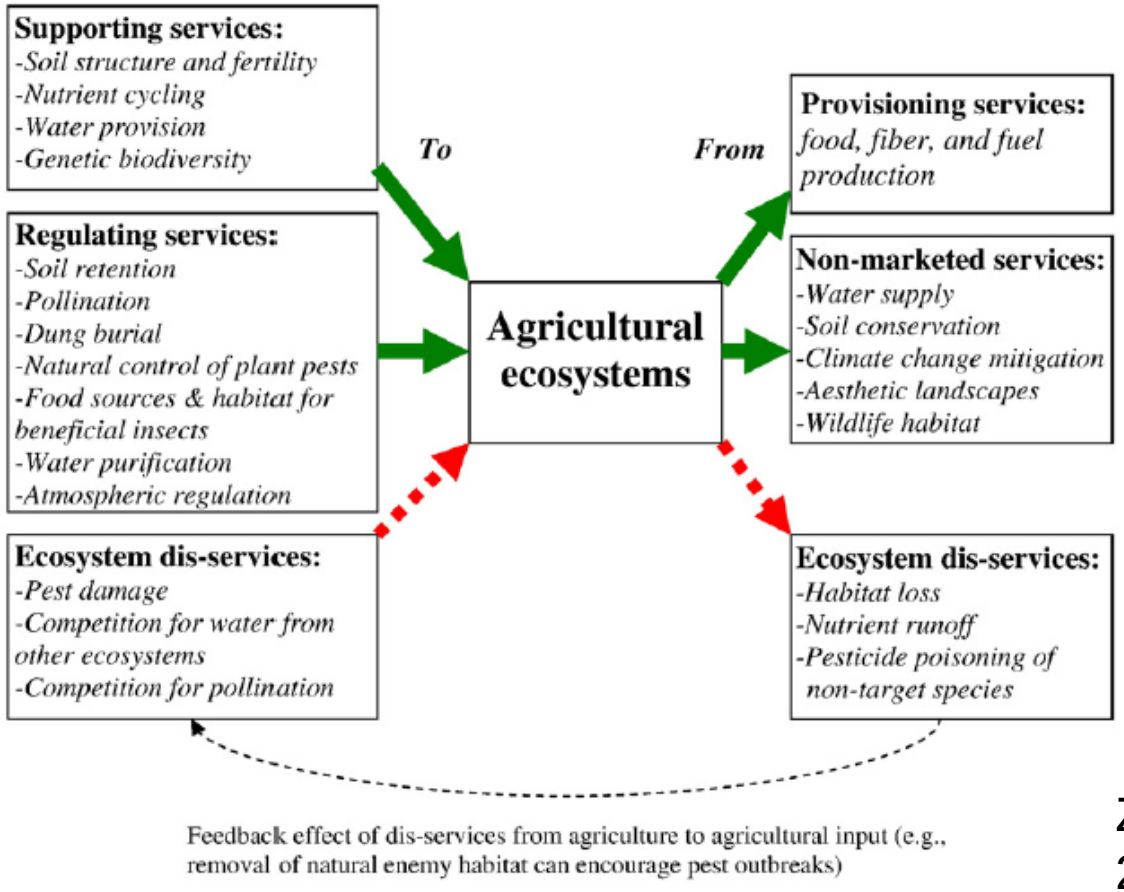
A CIRAD proposal

July 2011

Agricultural research needs to rise to increasingly global and complex challenges. How can it do so, given the emergence of a multi-polar, many-faceted agricultural research system and growing differences between countries?

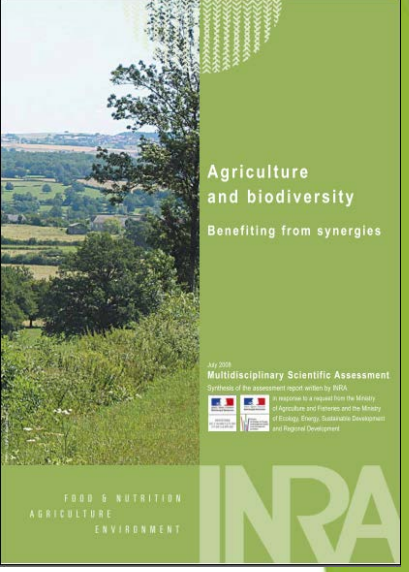
CIRAD suggests that coordination of global agricultural research for development (AR4D) should be founded on strategic intelligence designed and shared by all stakeholders. For this, it is essential to include the least advanced countries and to strengthen their research capacity.

…by managing and enhancing the existing resources (incl. Agrobiodiversity) and processes in agroecosystems



Zhang et al 2007

Fig. 2 – Ecosystem services and dis-services to and from agriculture. Solid arrows indicate services, whereas dashed arrows indicate dis-services.



OUTPUT SERVICES

MARKET PRODUCTION

Primary production:
- Efficiency
- Stability: biotic controls
- Stability: abiotic variability
- Fodder production stability

Livestock production:
- Efficiency
- Fodder quality
- Quality of animal products

Other marketable products

INPUT SERVICES

Soil structure
Water availability
Fertility
Microclimate
Biotic control
Invasion control
Pollination
Livestock health

AGRO-ECOSYSTEMS

ADDITIONAL PRODUCTION

Water production
Water quality
Climate regulation
Fire regime regulation
…man health
Biodiversity
…versity conservation
Cultural & aesthetic value

after Le Roux et al. 2008 (after Zhang et al 2007)

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RIO+20
THE EARTH HAS LIMITED RESOURCES !
Europe
USA
... SO DO WE
CHAPPATTE
Int'l Herald Tribune

Genetic Resources : a global issue

- Strong interest in genetic resources
- French research in genetic resources :
  - Very much on the « in situ » side of PGR
    - Ethnobotany (Haudricourt, Portères)
    - Population genetics and evolutionary biology
    - Even ex situ collections are seen as major assets for research (diversity, domestication history)
  - Decentralized *ex situ* PGR conservation system

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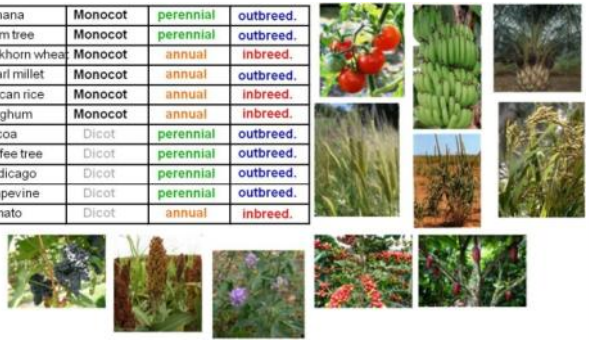
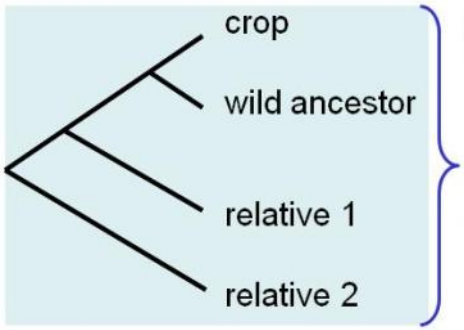
Crop biodiversity research and resource center

- An **open platform for genetic and genomic resource** conservation, management and analysis
- A **research programme** addressing key challenges on **Mediterranean and tropical crop diversity** for agriculture and sustainable development
- A demand-oriented **training platform** for Southern scientific communities

cirad INRA IRD Institut de recherche pour le développement SupAgro Montpellier la Région Languedoc Roussillon

Banana	Monocot	perennial	outbreed.
Palm tree	Monocot	perennial	outbreed.
Einkhorn wheat	Monocot	annual	inbreed.
Pearl millet	Monocot	annual	outbreed.
African rice	Monocot	annual	inbreed.
Sorghum	Monocot	annual	inbreed.
Cocoa	Dicot	perennial	outbreed.
Coffee tree	Dicot	perennial	outbreed.
Medicago	Dicot	perennial	outbreed.
Grapevine	Dicot	perennial	outbreed.
Tomato	Dicot	annual	inbreed.





Domestication
bottlenecks,
Selection footprint
LD evolution
…

Molecular evolution
rate of divergence
selection footprints
Allele and sites

Population genomics

SP1 Comparative crop population genomics

SP2 Crop Adaptation to climate change

SP3 Cereals in Africa

Pearl millet
(*Pennisetum glaucum*)

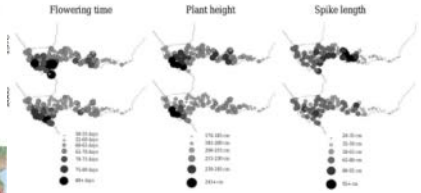
Cross-pollinating
Traditional cultivation

Rice
(*Oryza sp*)

Self-pollinating
Traditional cultivation

Medicago truncatula

Self-pollinating
Model plant
Natural populations



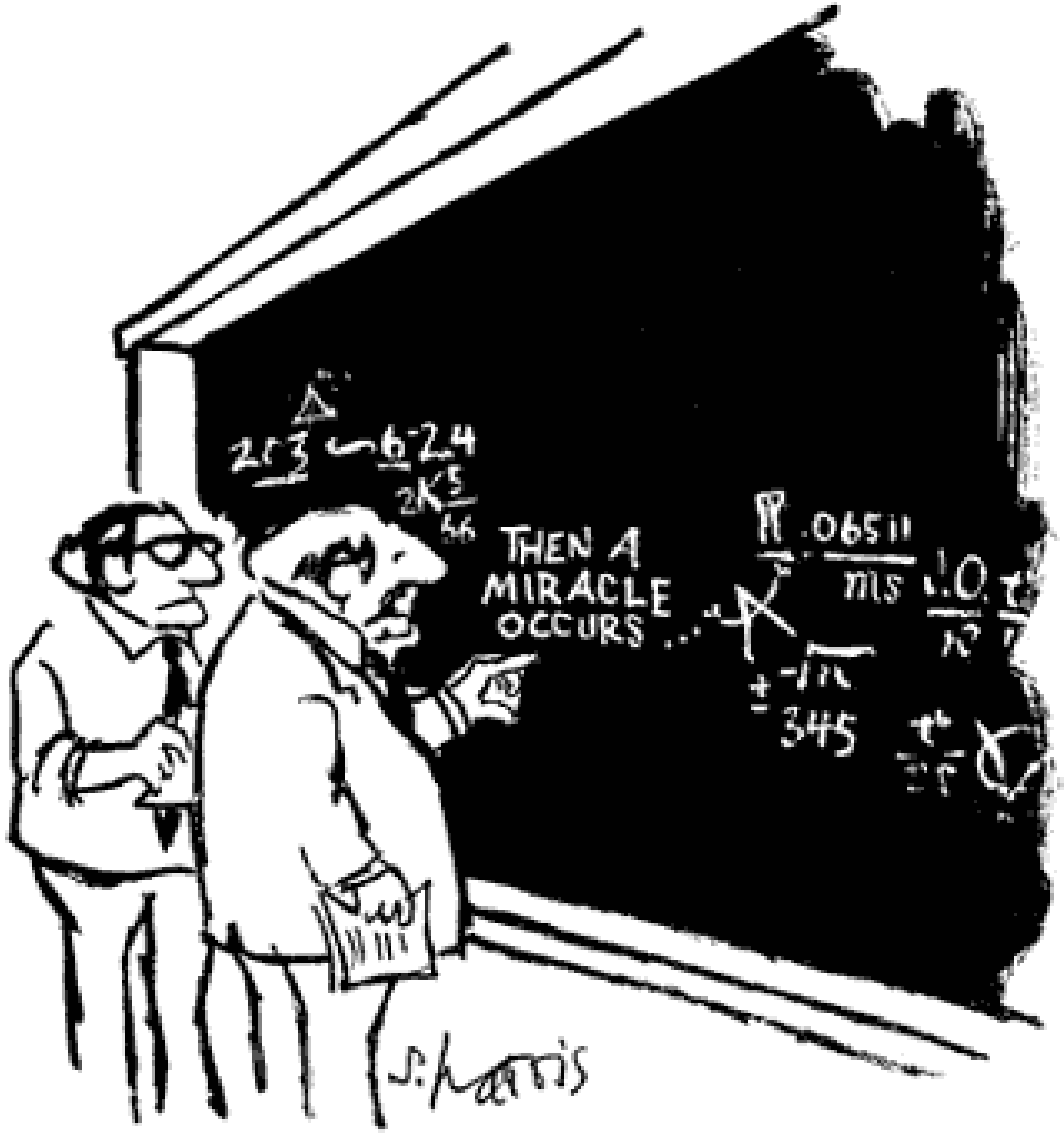
International training course on Agrobiodiversity analysis

- 2-week course (in French)
  - Week 1 : Population genetics
  - Week 2 : Biology x Social Sciences

- 2010 : Morocco
  - 23 trainees from 13 countries
  - 17 trainers (Arcad, IAV Hassan II, Bioversity, ...)

Why contribute to a CGIAR initiative on the in situ management of agrobiodiversity?

- Insert our activities and expertise into a global effort
- Help mobilize of other local skills and teams
  - agrobiodiversity and ecological intensification
- Old and new partnerships
- Test and share methodologies
- Synergies between datasets, study sites



"I think you should be more explicit here in step two."

Challenges

- Necessity of building partnerships between few organizations to move things forward at the conceptual and practical level

- Necessity of sharing existing research results about on-going or past projects

- Necessity of collecting critical mass of data and information to make meaningful assessment on larger scale

Three areas of cooperation

1. **Help building international consensus** on key GRFA policy issues: non-Annex 1, non food/non-feed uses, non-plant GRFA, in situ…
2. **Strengthen linkages between conservation and use**: *how to increase benefits from conservation of GRFA to the widest range of stakeholders?*
   - Diversity characterization; GR diversity exploitation through pre-breeding strategies; information management and exchange; transfer of knowledge and research tools from major crops to minor crops
3. **Increase on farm conservation relevance and policy support**

A twofold role for researchers

1. Producers of knowledge and evidences to address these key research issues

but also…

2. Users of genetic resources and key intermediaries between several actors who do not necessarily share the same objectives
   - Ensure better institutional fit between existing practices and regulatory frameworks