DMC development in Cambodia

A tool for economic and territory development

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DMC development in Cambodia

A tool for economic and territory development

Plan

1/ Potential place of DMC in Agriculture Development

2/ Construction of DMC based cropping systems for upland rainfed agriculture

3/ Toward an ambitious plan for upland cultivation development ?

4/ Conclusion

1/ Potential place of DMC in Agriculture Development

1/ Potential place of DMC in Agriculture Development

An agricultural sector of declining economic importance but which still underpins the Cambodian society

A base of the Cambodian society …

- 80,5 % rural population (2,34 / 2,85 millions households – census 2008)
- > 2,0 millions households grow rice
- 90 % of the poor live in countryside
- 80 % of the poor people depend on rice cropping
- Agricultural sector provides 70% of the employment (stable proportion)

With declining economic importance

- 1998, "Agriculture" produces 3,5 m.t rice and weights # 45% national GDP
- 2008, '' '' 7,0 m. t rice '' < 35% national GDP
- The Agricultural sector covers the needs for the national self-subsistency
- but many regions often face a food crisis during "bad years"
- Growing but irregular surplus from year to year, a limited diversification of the products and a narrow national market …
  - o constrain the emergence of an agro-industrial sector (added value)
  - o favour informal trade exchanges across frontiers (Thailand / Vietnam)

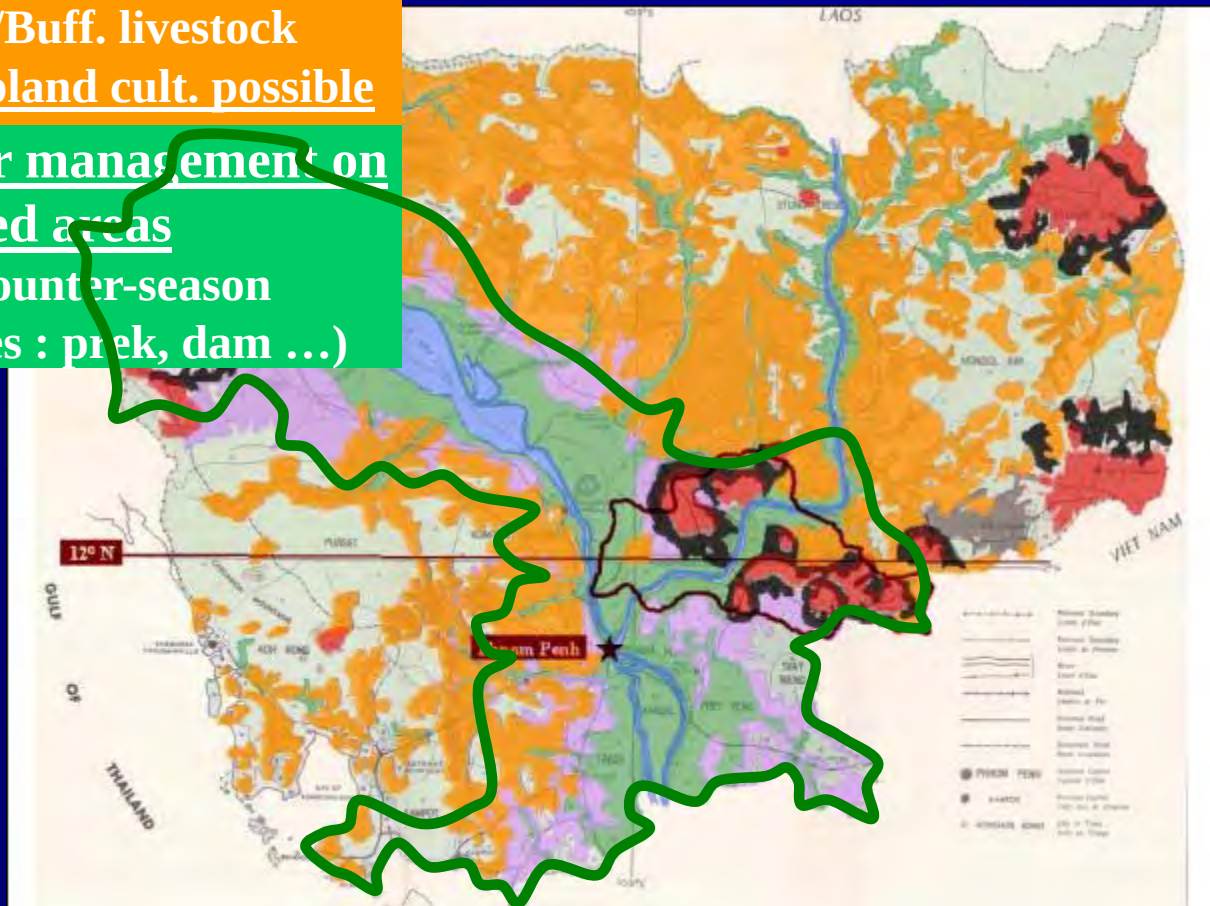
1/ Potential place of DMC in Agriculture Development

Fundamental geographical reminders

4 major Agro-ecosystems … cropped or "crop-able"

Rainfed lowland rice on Sandy plains (*strictly rain dependant*)
Rice, associated to Cattle/Buff. livestock
Ann. / Perennial based upland cult. possible

Floating Rice or Water management on deeply flooded areas
Water management for counter-season cultivation (different types : prek, dam …)

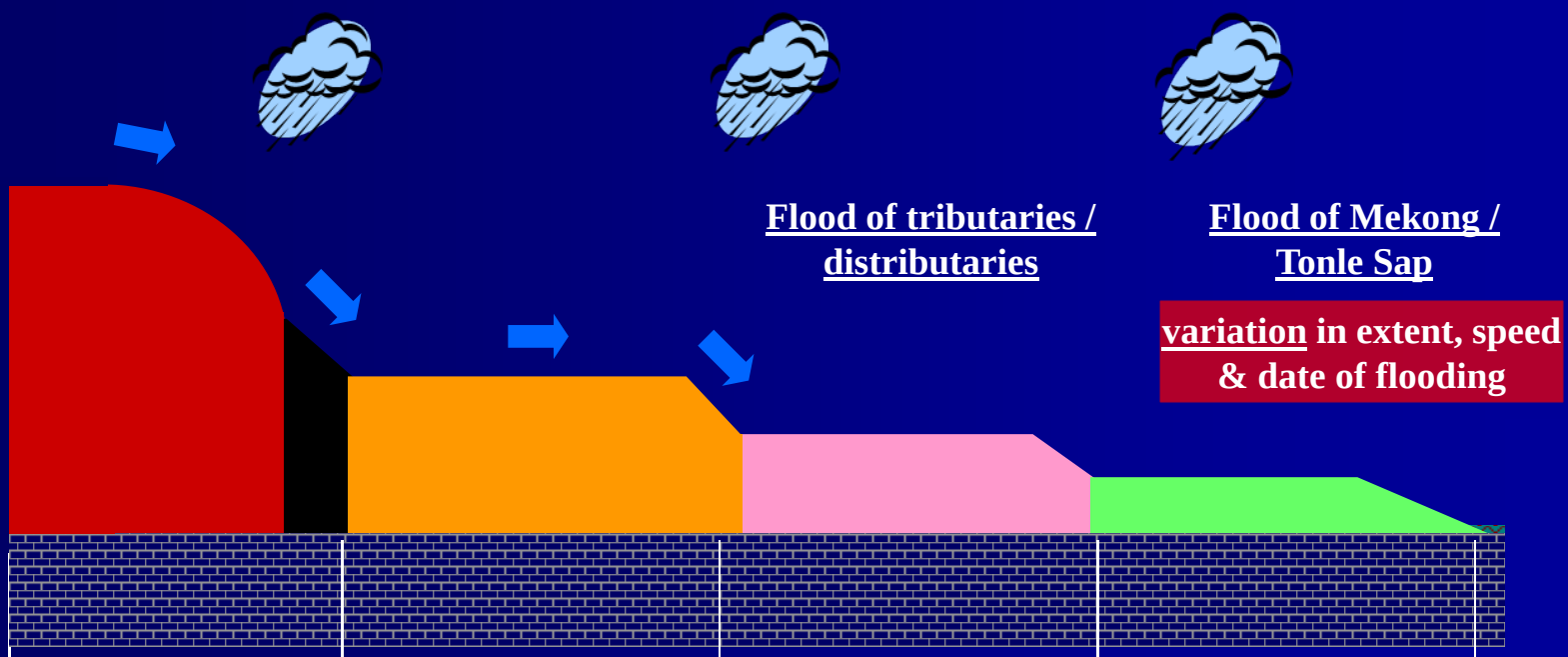


1/ Potential place of DMC in Agriculture Development

Fundamental geographical reminders

Some constraints of the physical conditions: soils, climate and flood

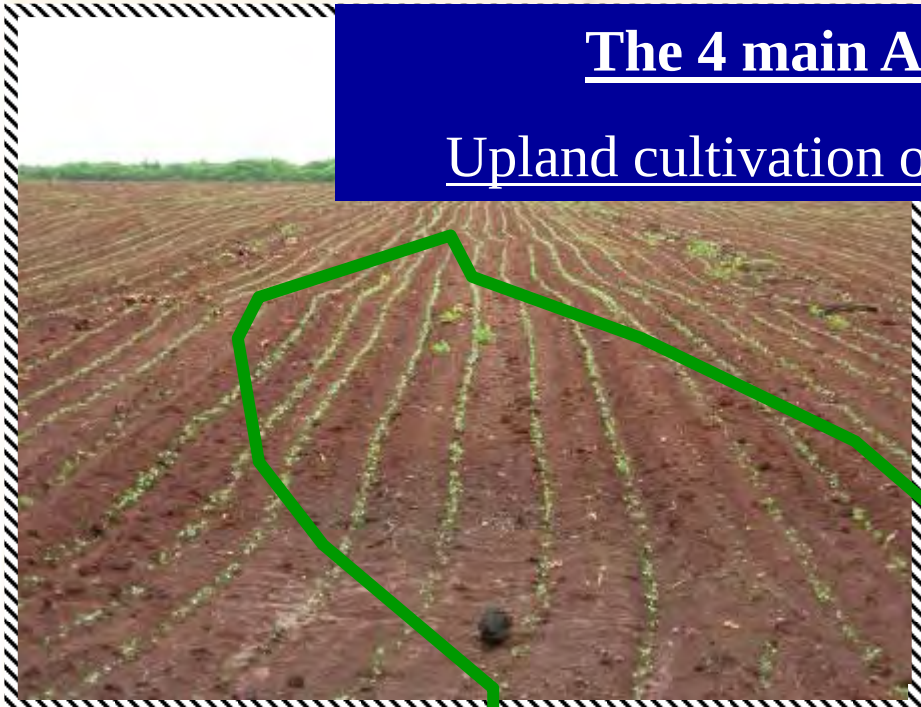
Soil | **Flood**

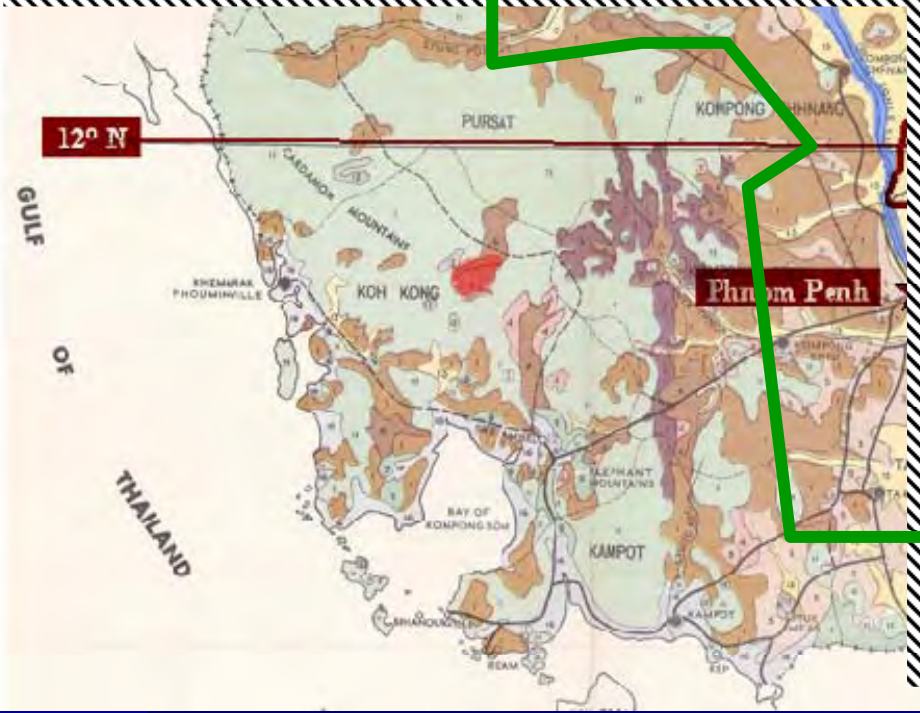


Plateau & hill	Sandy Plain	Hydromorphic Plain	Flooded areas
Great soil potential (basaltic substratum)	**Poor sandy Soil > 60 % of ricefield**	Clay-silt Soil (greater soil x water potential)	"Alluvial soils"
Upland agriculture	**Main part of the natonal land reserve?**	Rice crop - hazardous, surplus in the West reg.	Water management & counter season rice

The 4 main Agro-ecosystems

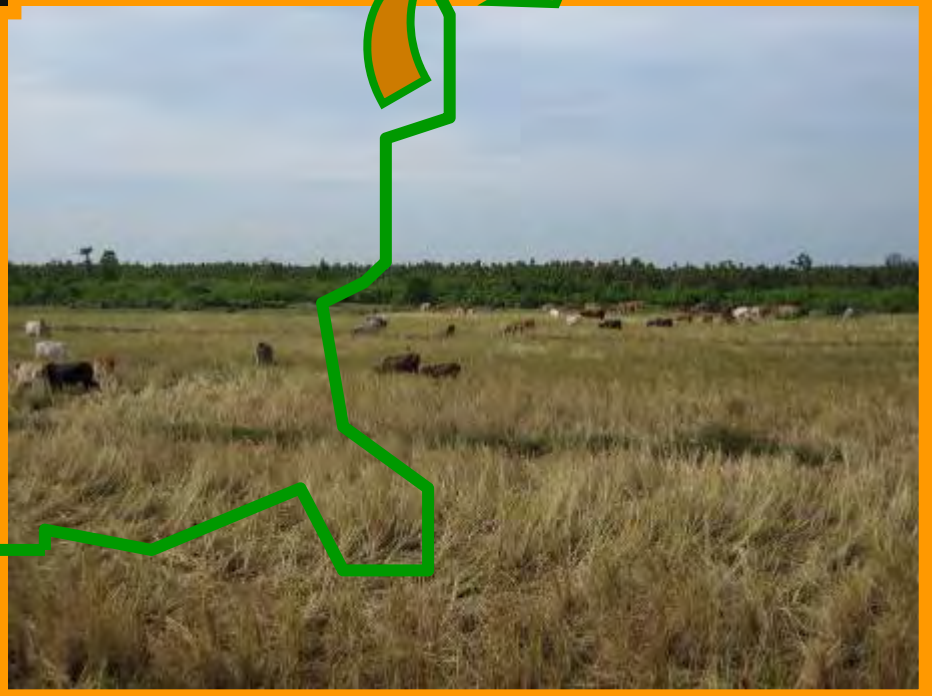
Upland cultivation on Red and Black soils





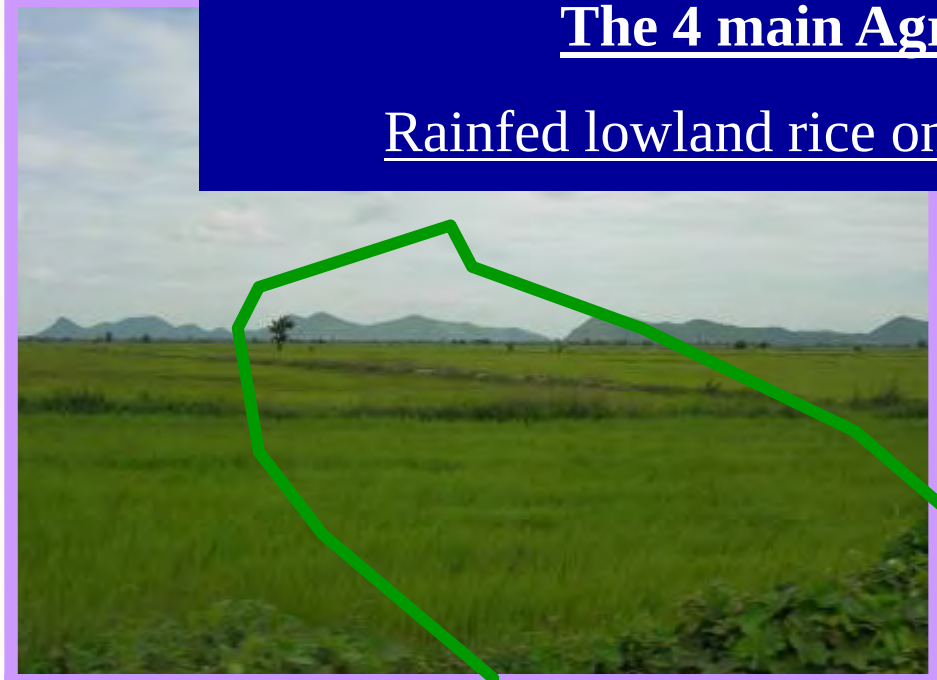
The 4 main Agro-ecosystems

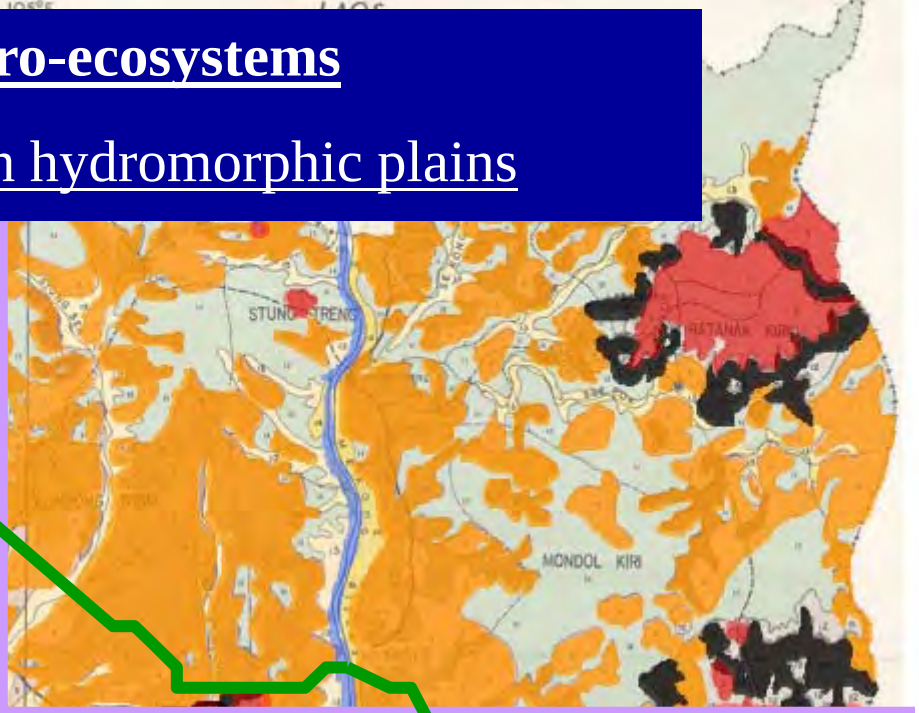
Rainfed lowland rice on Sandy plains



The 4 main Agro-ecosystems

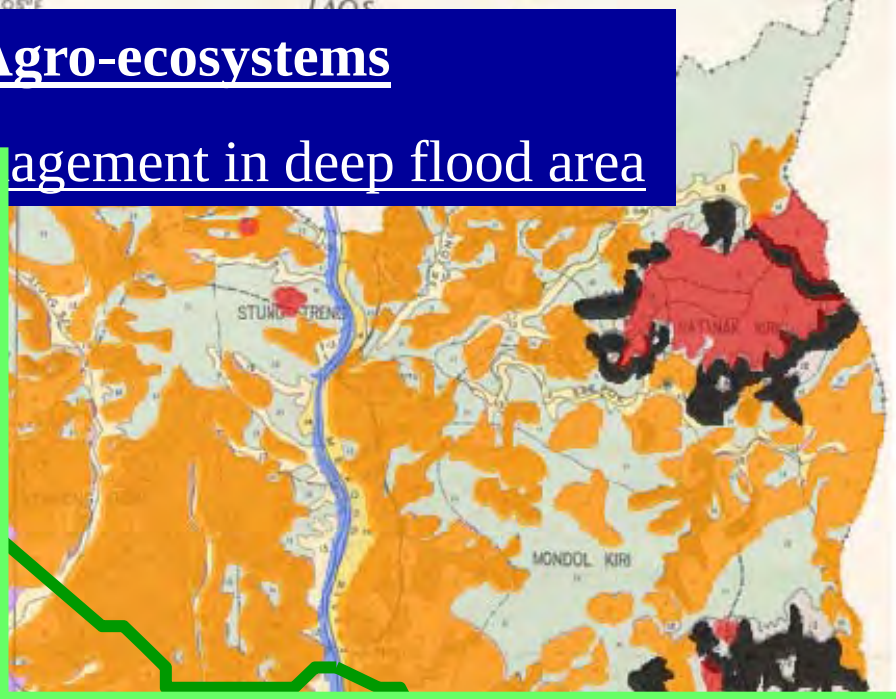
Rainfed lowland rice on hydromorphic plains

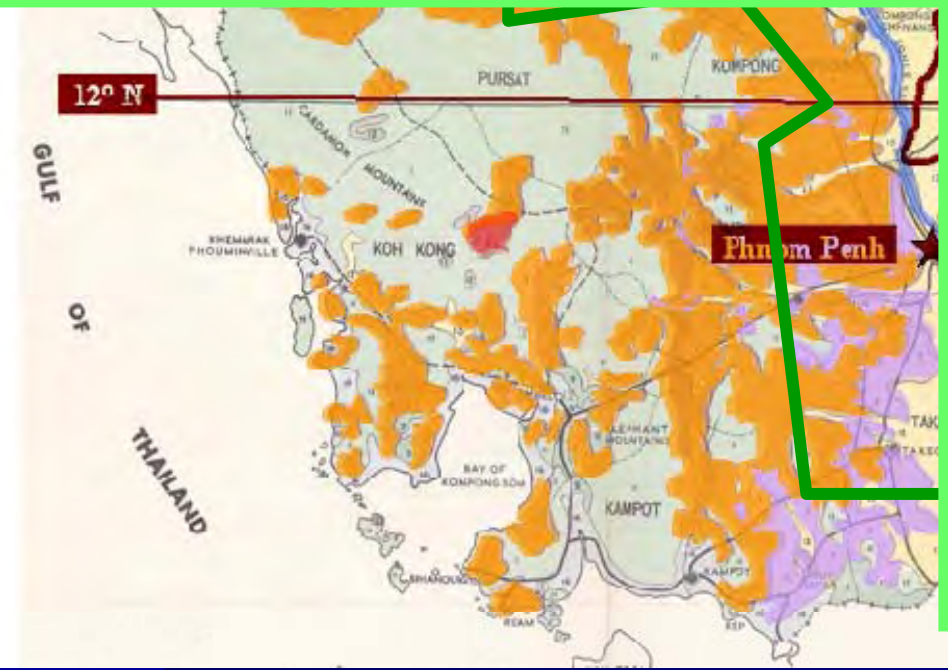




The 4 main Agro-ecosystems

agement in deep flood area





1/ Potential place of DMC in Agriculture Development

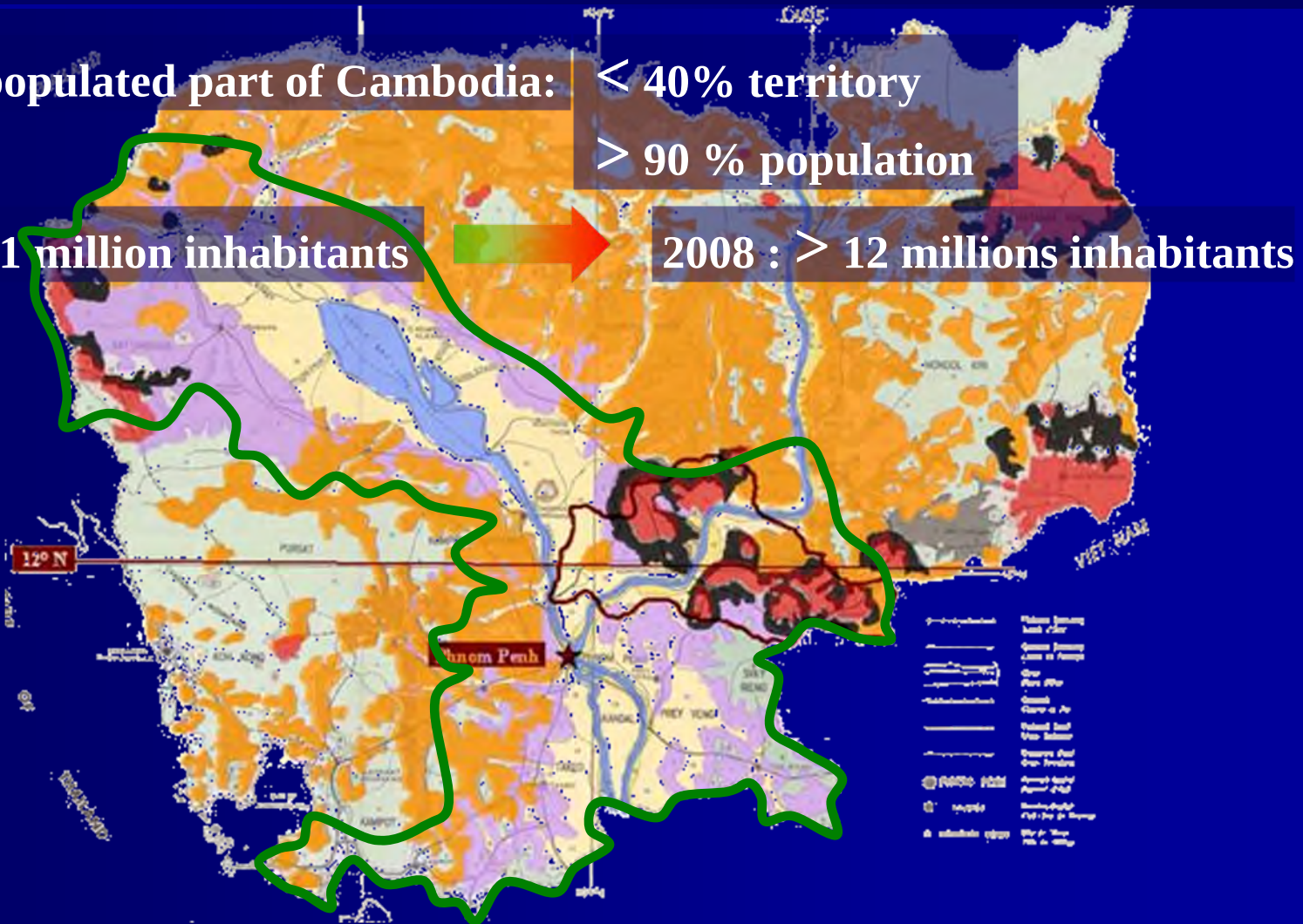
Fundamental geographical reminders

An unevenly population distribution on the national territory

The populated part of Cambodia: **< 40% territory**

> 90 % population

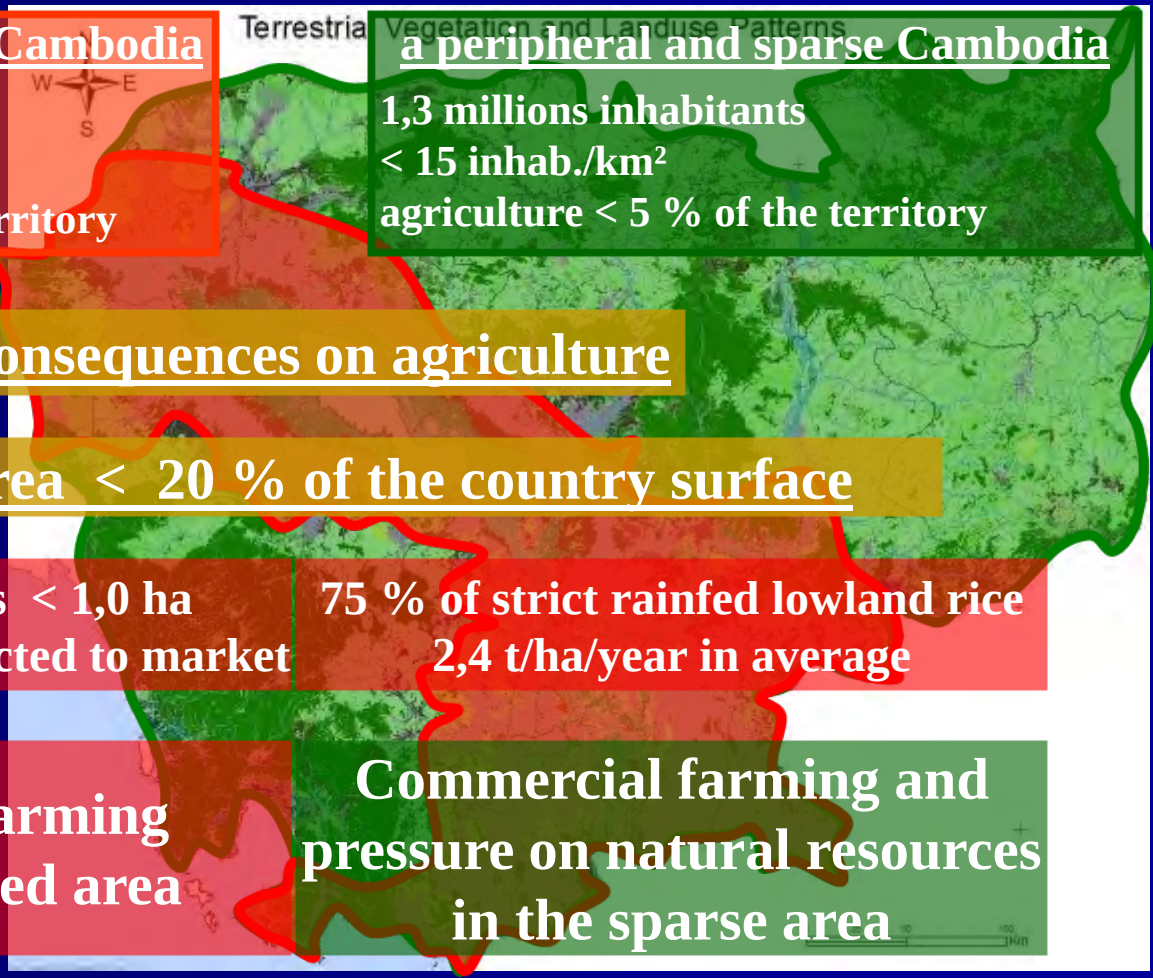
1870 : < 1 million inhabitants → **2008 : > 12 millions inhabitants**



1/ Potential place of DMC in Agriculture Development

Fundamental geographical reminders

"Rice & central Cambodia" *vs* "Forest & peripheral Cambodia"



a central and populated Cambodia

12,1 millions inhabitants
> 200 inhab./km²
agriculture > 55 % of the territory

a peripheral and sparse Cambodia

1,3 millions inhabitants
< 15 inhab./km²
agriculture < 5 % of the territory

Consequences on agriculture

Cropped area < 20 % of the country surface

75 % of the farms < 1,0 ha
80 % farms not connected to market

75 % of strict rainfed lowland rice
2,4 t/ha/year in average

Subsistence farming in the populated area

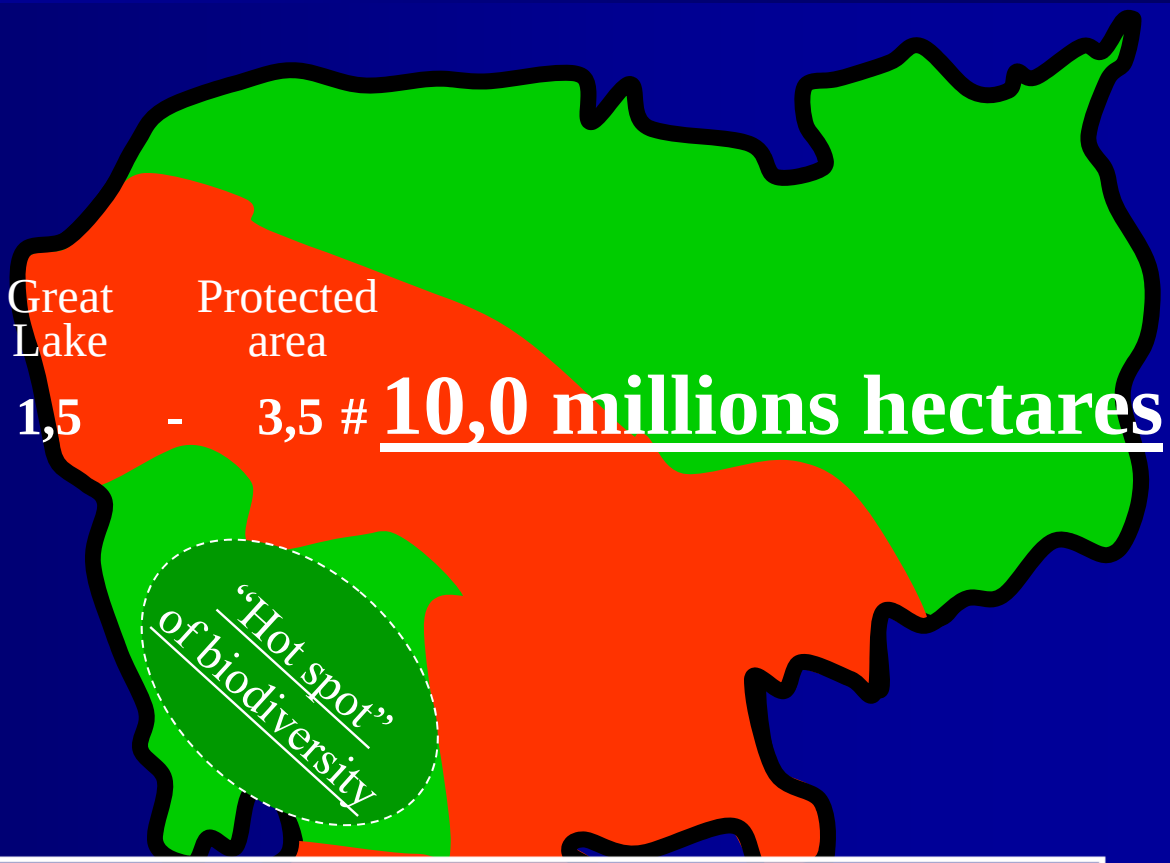
Commercial farming and pressure on natural resources in the sparse area

1/ Potential place of DMC in Agriculture Development

Peripheral Cambodia … A large "public land reserve"

Where and how to plan for sustainable, equitable development ?

Total area of Cambodia		Agricultural area		Great Lake		Protected area	
18,0	**-**	**3,0**	**-**	**1,5**	**-**	**3,5 #**	**10,0 millions hectares**



How this area can support smallholders agriculture and contribute to poverty reduction ?

2/ Construction of DMC based cropping systems for upland rainfed agriculture

… too short time to present DMC development for rainfed lowland rice agro-ecosystems !

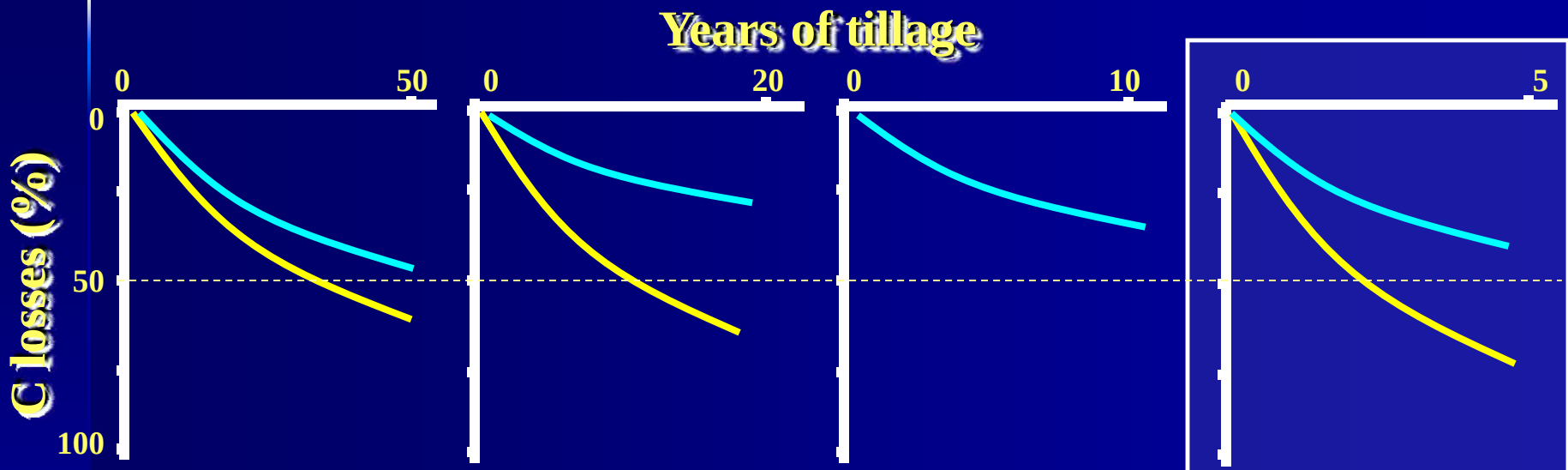
2/ Construction of DMC based cropping systems for upland rainfed agro-ecosystems

Stop plowing … ***the horror pictures show***

2/ Construction of DMC based cropping systems for upland rainfed agro-ecosystems

Stop plowing … and NT on crops residues insufficient

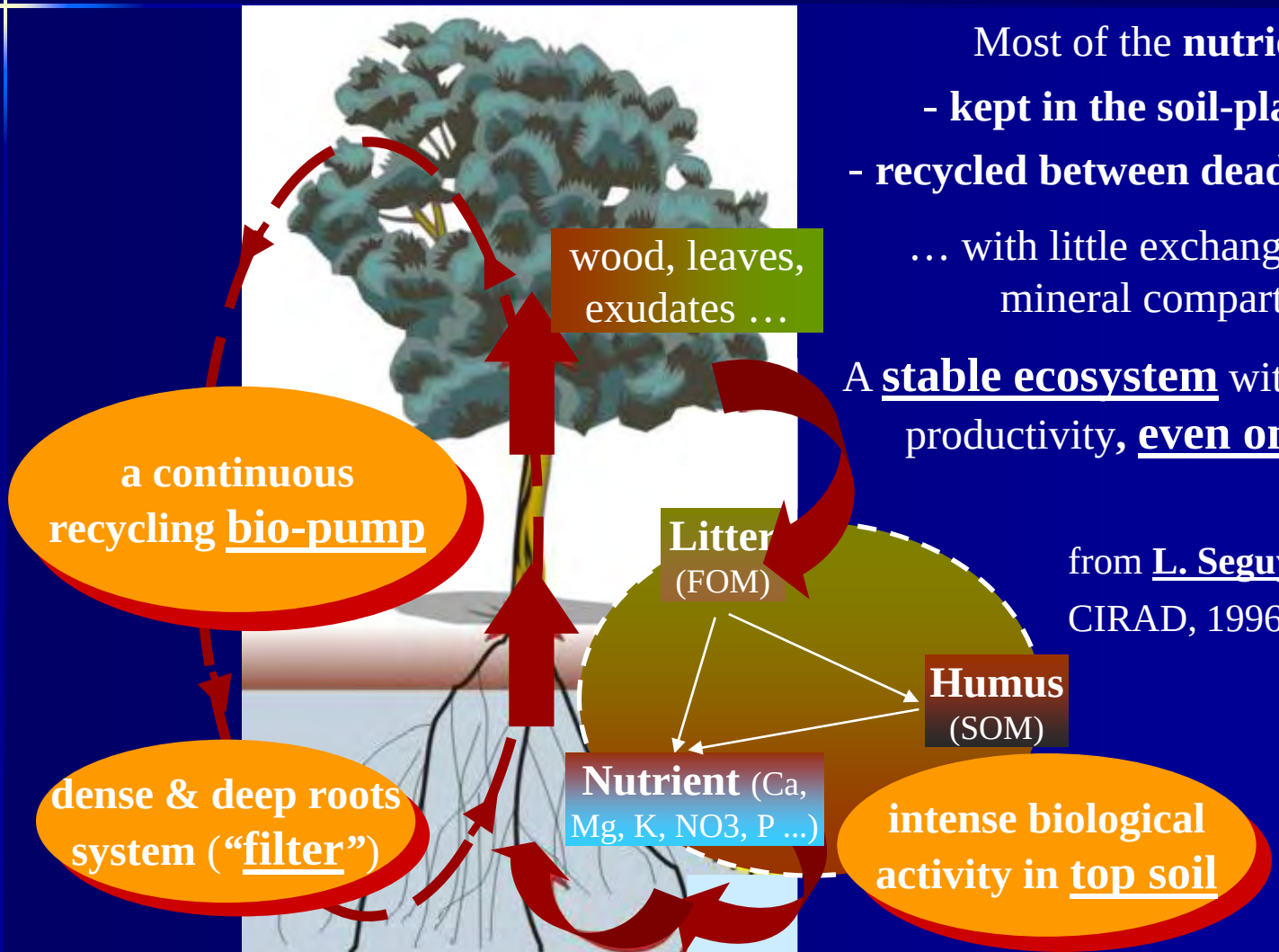
Impact of conventional tillage associate with monoculture in C losses in temperate, sub-tropical and tropical areas



Canada & USA	Pergamino/Sarmiento-ARG	Ponta Grossa - PR	Cerrado – GO & MT
48 a 58 % (Wheat)	24-60 % (Wheat)	35 % (Soybean)	35 a 69 % (Soybean)
Campbell & Souster, 1982; Mann, 1985	Michelena, 1989; Casas, 1998	Sá et al., 2001	Resck, 1998 Seguy & Bouzinac, 2002
Latitude 42° N	Latitude 32° S	Latitude 25° S	Latitude 13 a 16° S
1,0 to 1,2% /y	1,2 to 3,0% /y	3,5% /y	7,0 to 13,8 % /y

2/ Construction of DMC based cropping systems for upland rainfed agro-ecosystems

The *tropical forest* : a model to be reproduced at field scale



Most of the **nutrients** are

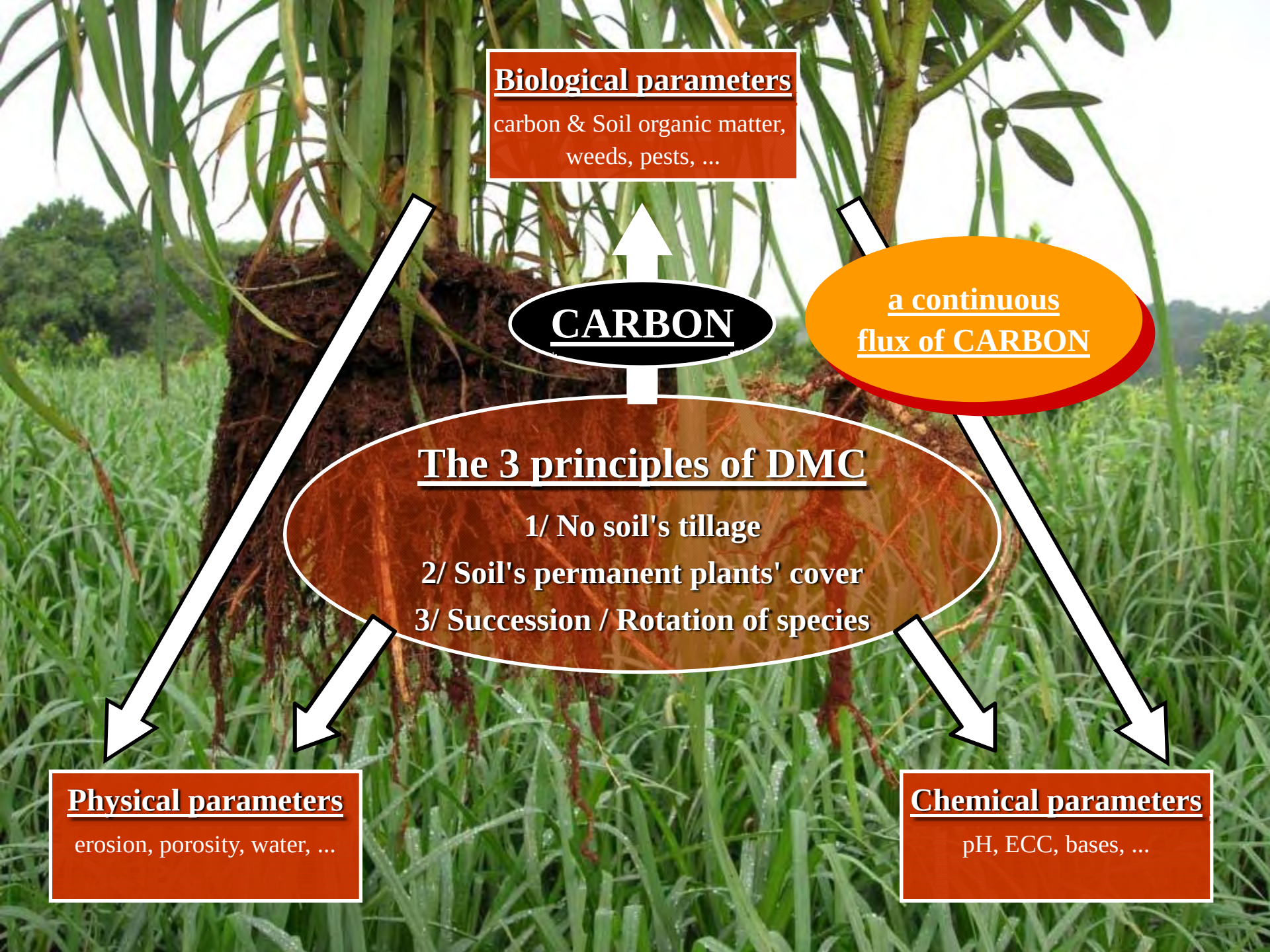
- kept in the soil-plant system

- recycled between dead & alive O.M.

… with little exchanges with soil mineral compartments

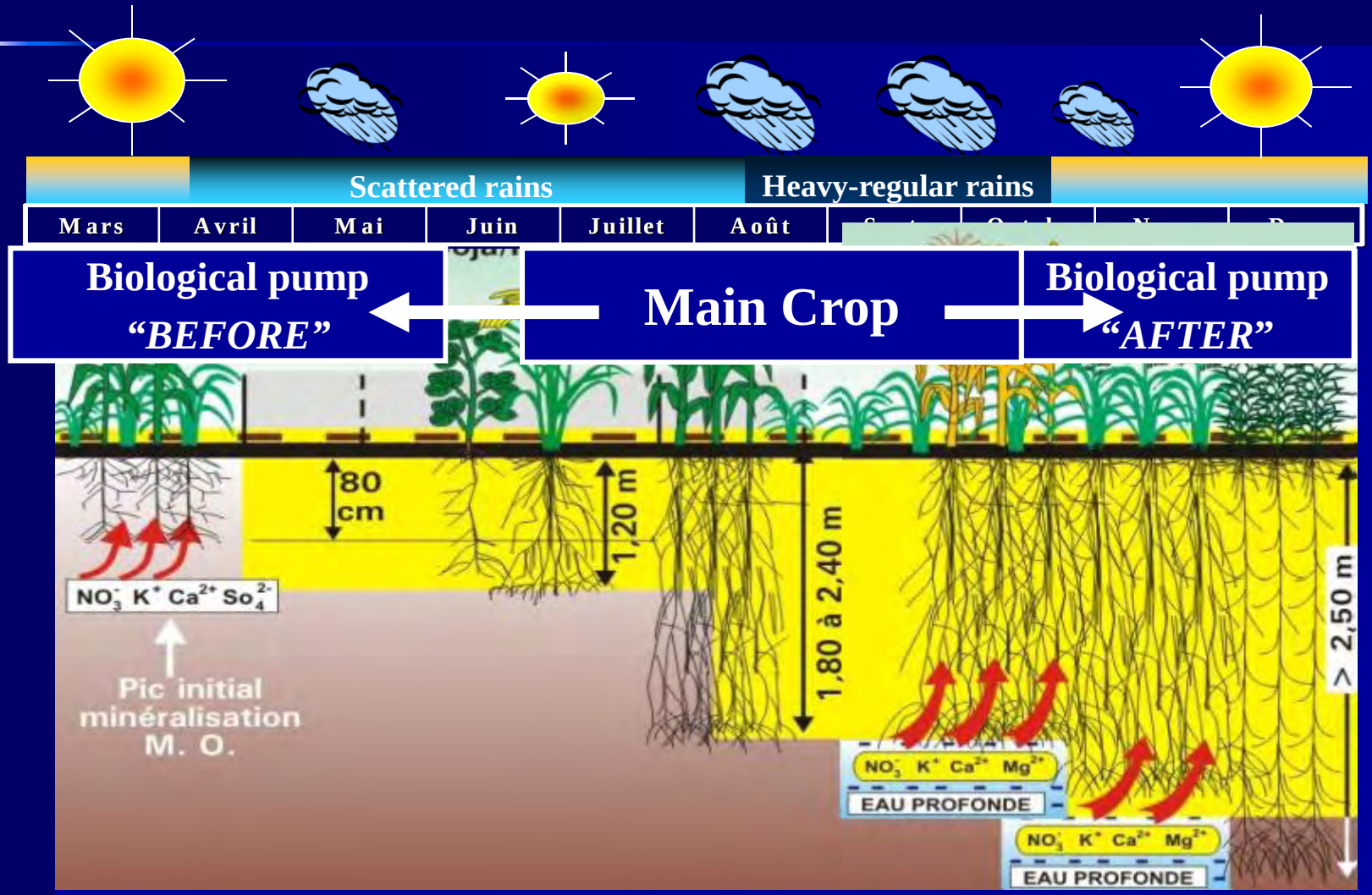
A **stable ecosystem** with high biomass productivity**, even on poor soil**

from **L. Seguy** & **S. Bouzinac,** CIRAD, 1996


Biological parameters
carbon & Soil organic matter, weeds, pests, ...
CARBON
a continuous flux of CARBON
The 3 principles of DMC
1/ No soil's tillage
2/ Soil's permanent plants' cover
3/ Succession / Rotation of species
Physical parameters
erosion, porosity, water, ...
Chemical parameters
pH, ECC, bases, ...

2/ Construction of DMC based cropping systems for upland rainfed agro-ecosystems

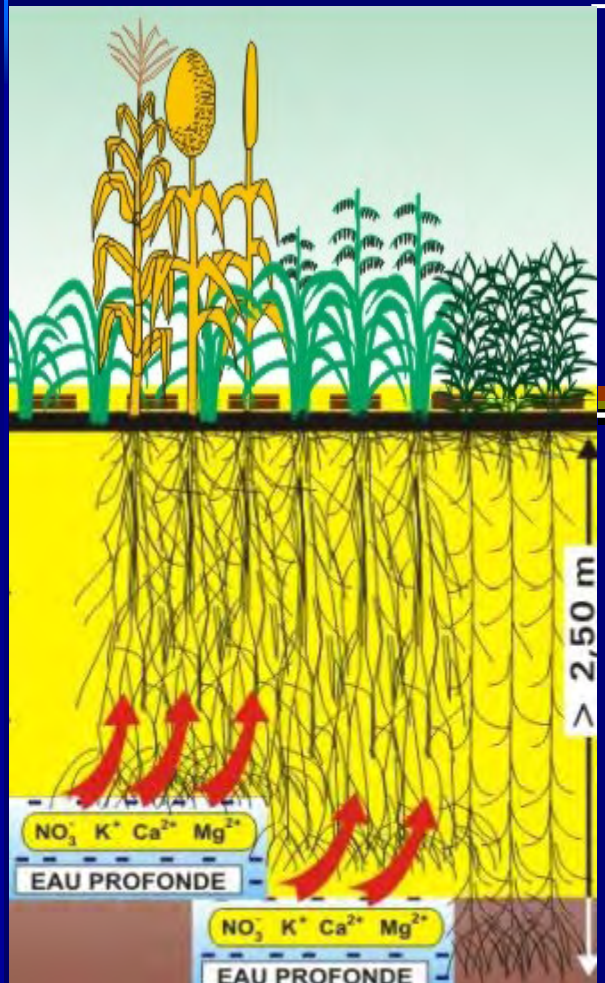
The "notion" of *biological pump*



Source: L **Seguy**, S. **Bouzinac – CIRAD – A. Maronezzi, Agronorte – Sinop/MT , 2002.**

2/ Construction of DMC based cropping systems for upland rainfed agro-ecosystems

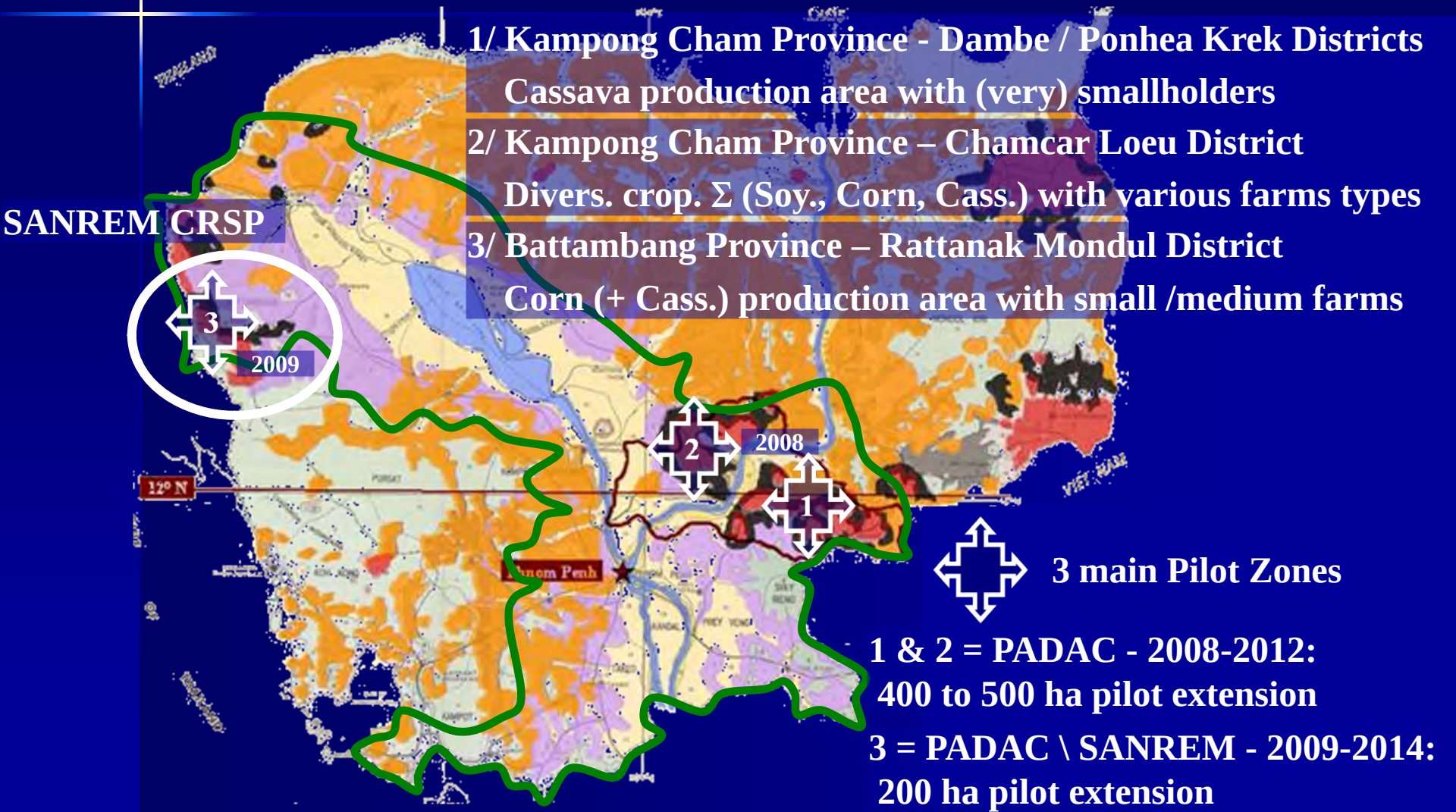
The "Multi-functionality" of *biological pump*



	FUNCTION	EFFECT
Above	*Food*	Nutrient for crops, Fodder for Cattle Biomass for soil's fauna/µflora chains
	Protection	Erosion / run-off, Evaporation, T (°C) *Xenobiotiques* bio-degradation ®
	"Pest-buster"	Weed control (shade, *allelopathy*) Disease (splash effect, blast on rice…®) Insect (…*via biodiv*. … ®)
Below	*C Loader*	C storage - ECC increase, pH buffer … Bio activity / diversity increase ® publi.) Bio-degradation / detoxification (?) ®
	Structure	Roots system *matrix*, decompaction Porosity, Water reserve Aggregation & O.M.% ®
	Recycling pump	Connection to deep water *i.e.* maximization of the water potential Recycling of lixiviated ions NO_3^-, bases ®

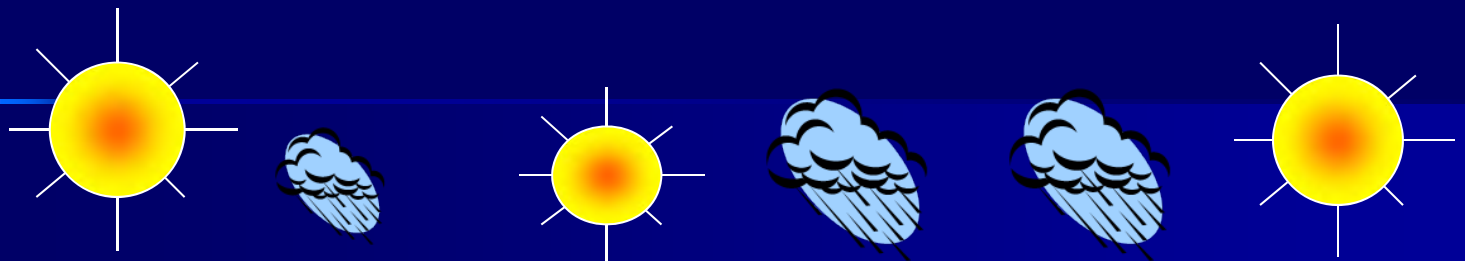
2/ Construction of DMC based cropping systems for upland rainfed agro-ecosystems

Localization of the main PADAC's R&D areas



2/ Construction of DMC based cropping systems for upland rainfed agro-ecosystems

Main Plow based cropping systems (Farmers' references)



Mars	Avril	Mai	Juin	Juillet	Août	Sept.	Octob.	Nov.	Dec.

1/ disc Sesame disc Soybean

2/ disc Cassava Monoculture

3/ disc Maize disc Maize

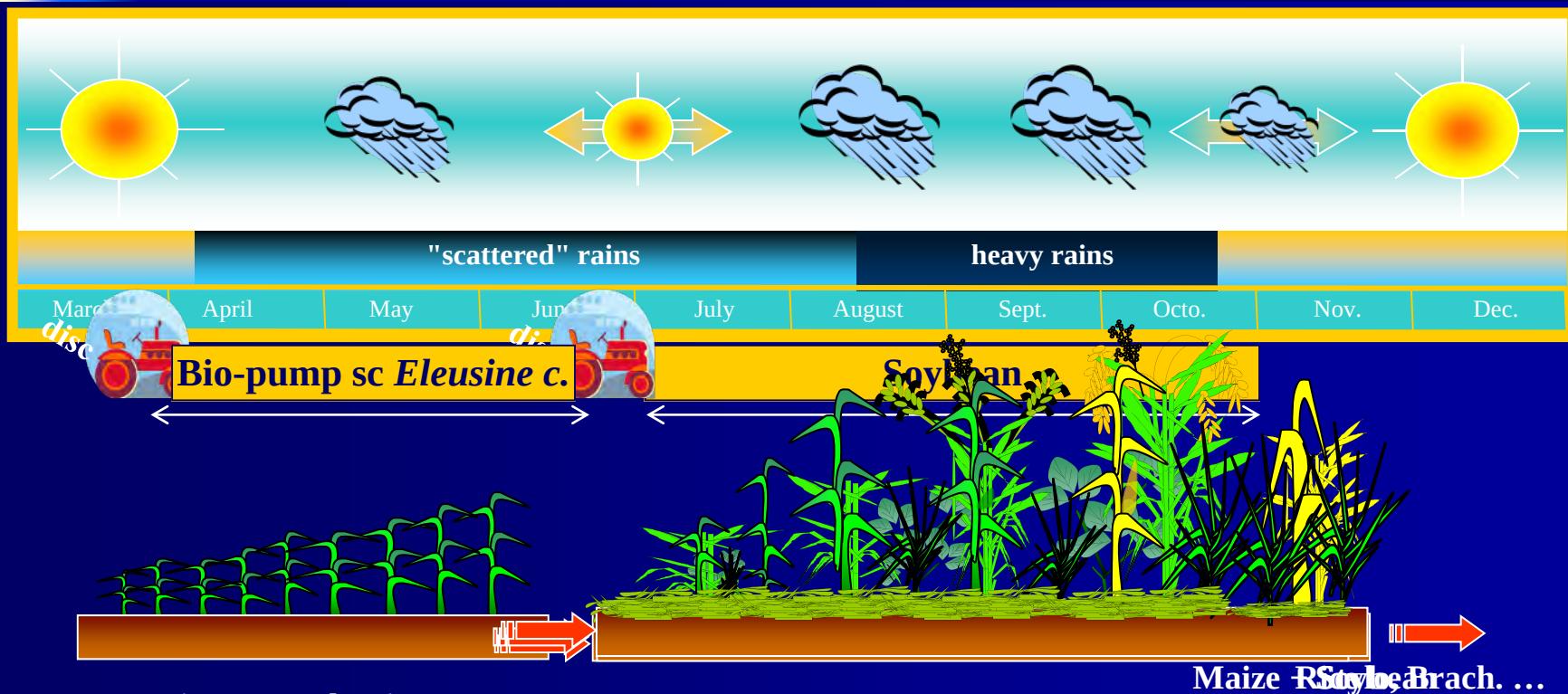
High technical and economical randomization + soil's degradation

→ irregular and decreasing profit margins

→ progressive shifting to perennial … when capital available!

2/ Construction of DMC based cropping systems for upland rainfed agro-ecosystems

First DMC based, using short term biomass production



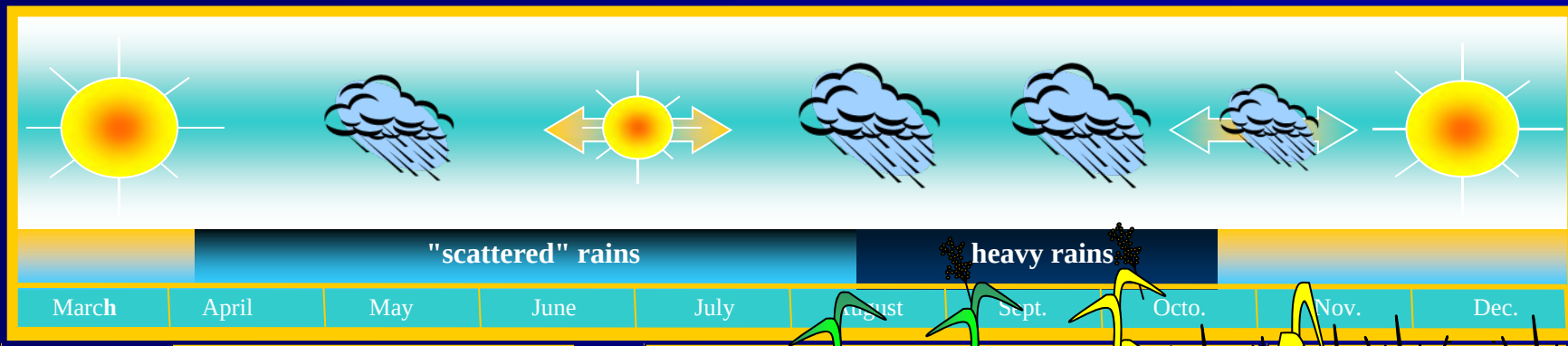
Bio pump Eleusine c.

or Eleusine + Cajanus,
Sorghum, Millet …

2/ Construction of DMC based cropping systems for upland rainfed agro-ecosystems

The “second” generation, using long term biomass production

Step 1: association of Bio-pump lc with Maize



Year 1

Bio-pump sc

Maize + Bio-pump lc …

…Bio-pump lc

Year 2

Maize + Stylosanthes guianas (Stylosanthes guianas)

Stylosanthes guianas → **Maize or Soybean**

2/ Construction of DMC based cropping systems for upland rainfed agro-ecosystems

The “second” generation, using long term biomass production

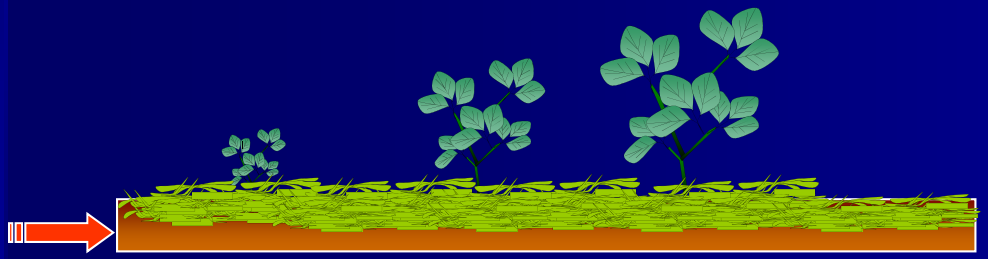
Step 2: association of Bio-pump lc with Rice and Soybean

Year n: Rice + Stylosanthes

Year n + 1: Rice + Stylosanthes

Year n + 1: Maize + …

Stylosanthes is oversown by no till planter at # 40 DAS



Year n: Soybean + Brachiaria

Year n + 1: Soybean + …

Year n: Soybean + Stylosanthes

Year n + 1: Rice + Stylosanthes

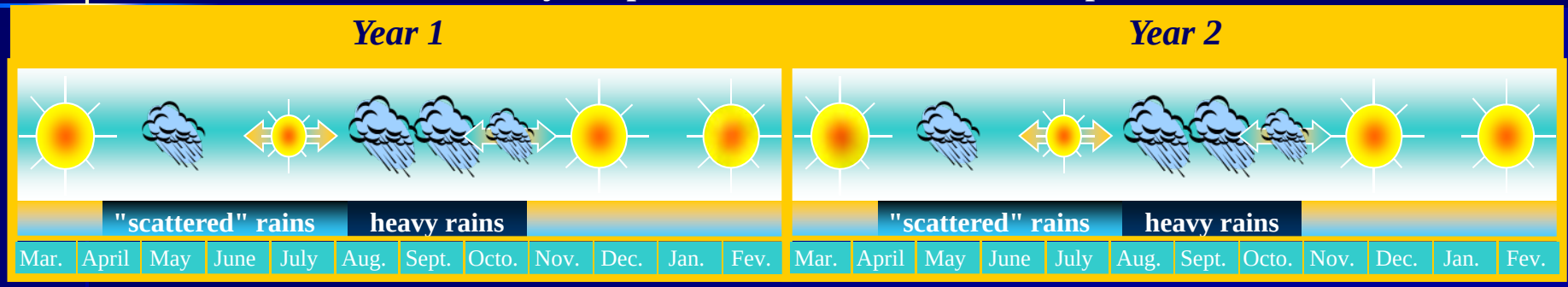
Year n + 1: Maize + …

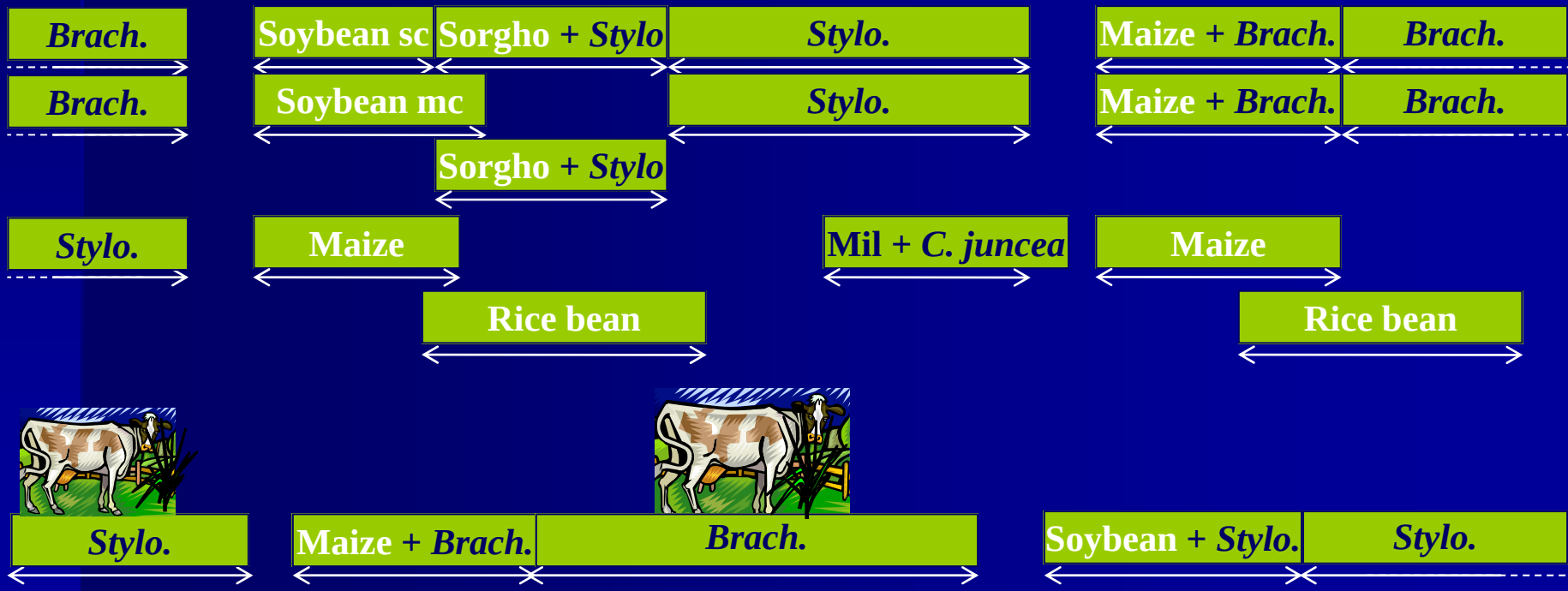
Stylosanthes or Brachiaria is broadcast sown at first Soybean’s yellow leaves appearance

2/ Construction of DMC based cropping systems for upland rainfed agro-ecosystems

First DMC – Economic analysis and cropping systems' "tuning"

1/ secondary crop 2/ livestock 3/ input reduction





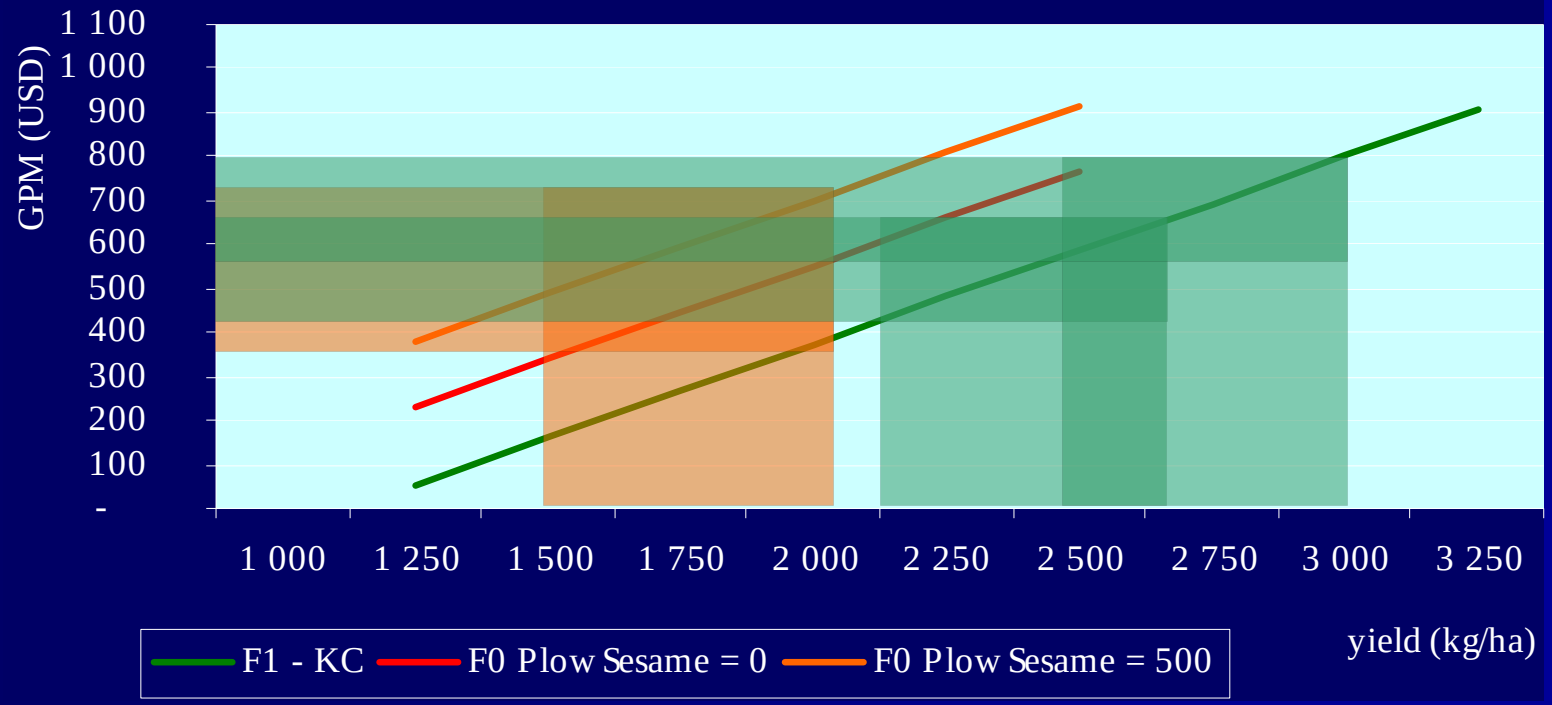
2/ Construction of DMC based cropping systems for upland rainfed agro-ecosystems

First DMC – Economic analysis and cropping systems' "tuning"

1/ secondary crop 2/ livestock 3/ input reduction

Gross Profit Margins (USD/ha)

DMC: Brach. / Soybean + Brach. *vs* **Plow** reference: Sesame / Soybean



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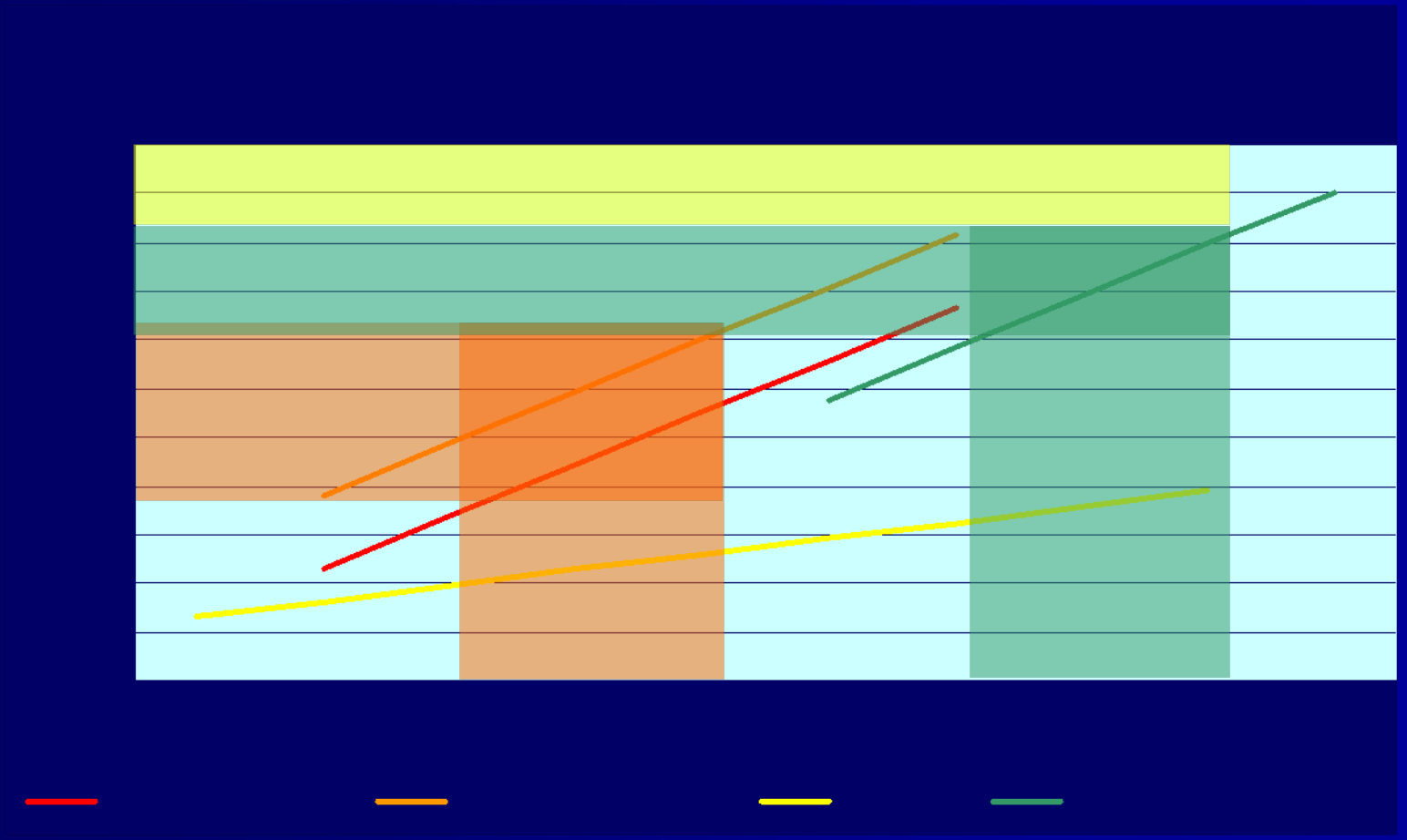
First DMC – Economic analysis and cropping systems' "tuning"



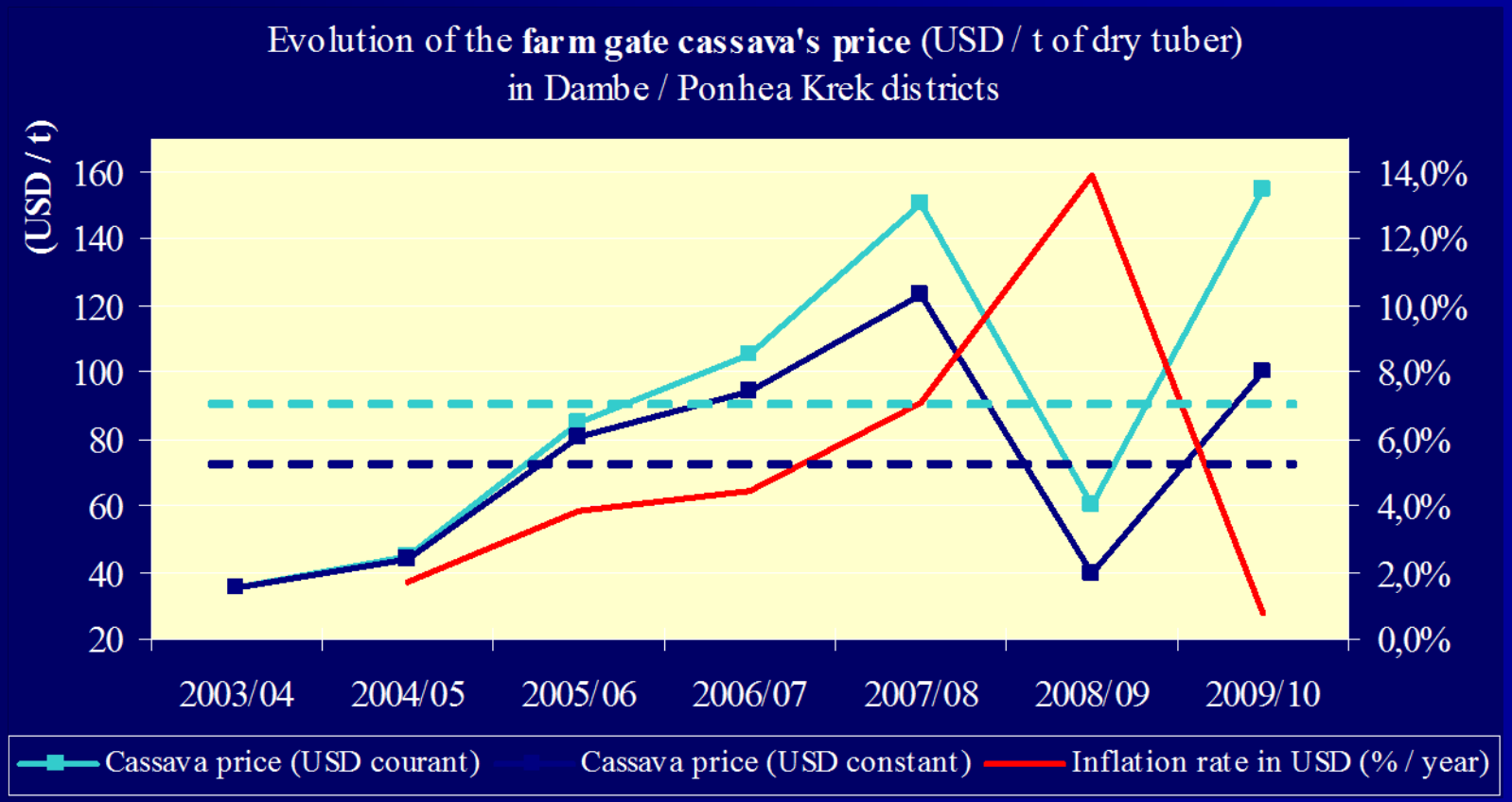
From PDAC - Soybean sowing (on Brachiaria) with "VENCE TUDO" – June 2009

Demo Plot Sampor II: Soybean on Brachiaria (October 2009)

Bos Khnor Station: Secondary crop of Sorghum (December 2009)

2/ Construction of DMC based cropping systems for upland rainfed agro-ecosystems

The case of Cassava



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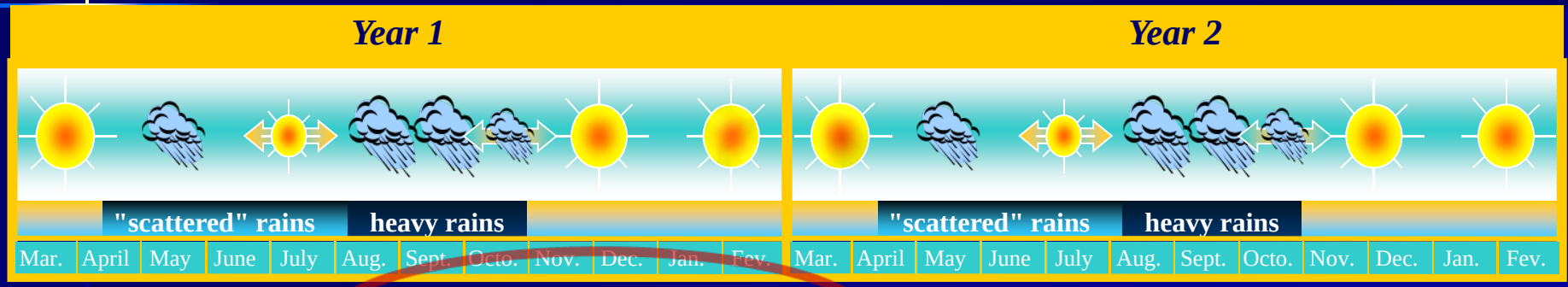
The case of Cassava



Cassava + *Stylo.* | *Stylo.* | Cassava + *Stylo.* | *Stylo.*

Reduced growth of the Stylo.

due to shade, dry soil's conditions at Cassava's harvest and early replanting in Year 2

Active growth of the Bio-pump lc

Cassava + *Stylo.* | *Stylo.* | Maize + *Stylo.* | *Stylo.*

Cassava + *Stylo.* | *Stylo.* | Rice + *Stylo.* | *Stylo.*

Cassava + *Brach.* | *Brach.* | Soyb. + *Stylo.* | *Stylo.*

Chamcar Loeu: First attempt of strip tillage prior to Cassava (February 2010)

3/ Toward an ambitious plan for upland cultivation development?

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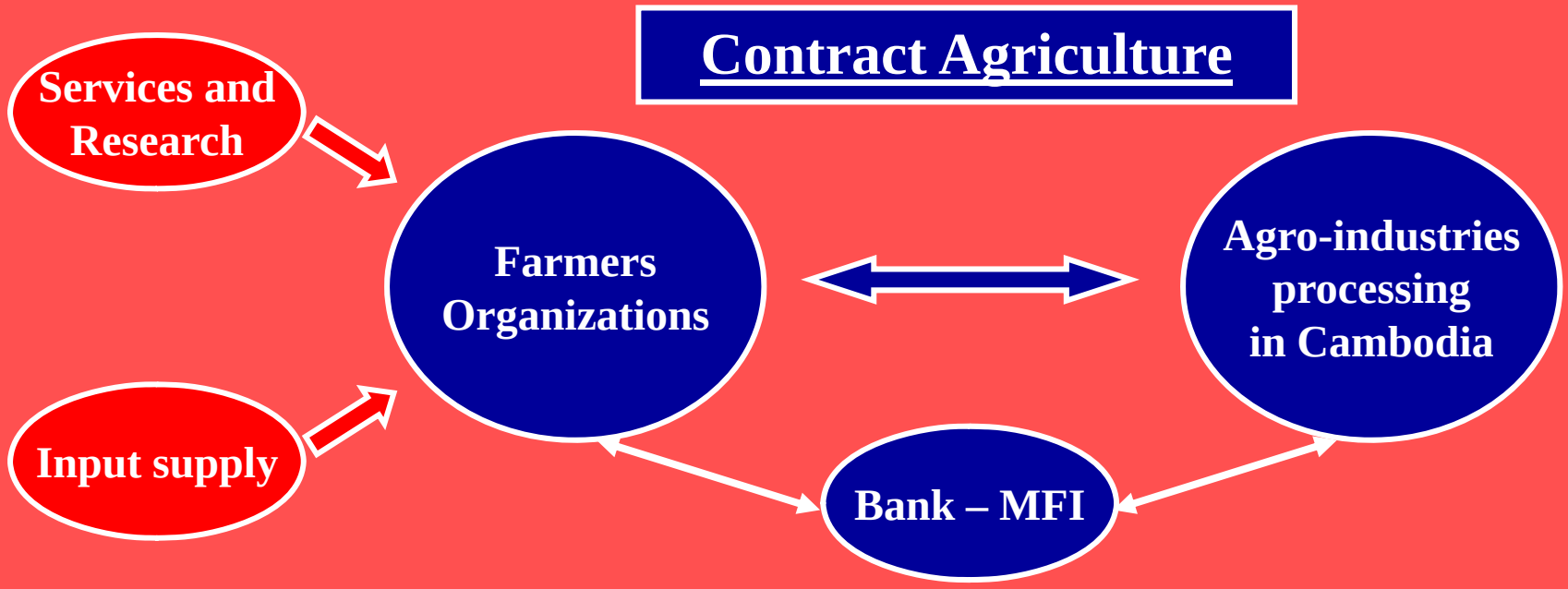
For what kind of family based agriculture / farming ?

Open & Transparent Markets **



** With supervision: e.g. Public auction sale system (cf Thai rubber sector), Δ local - international price monitoring

3/ Toward an ambitious plan for upland cultivation development?

For what kind of production systems ?

Small (5-10 ha) / medium (10-20 ha) scale farms dominant

Upland cultivation

(sine qua non condition for sustainability: based on DMC)

High degree of diversification

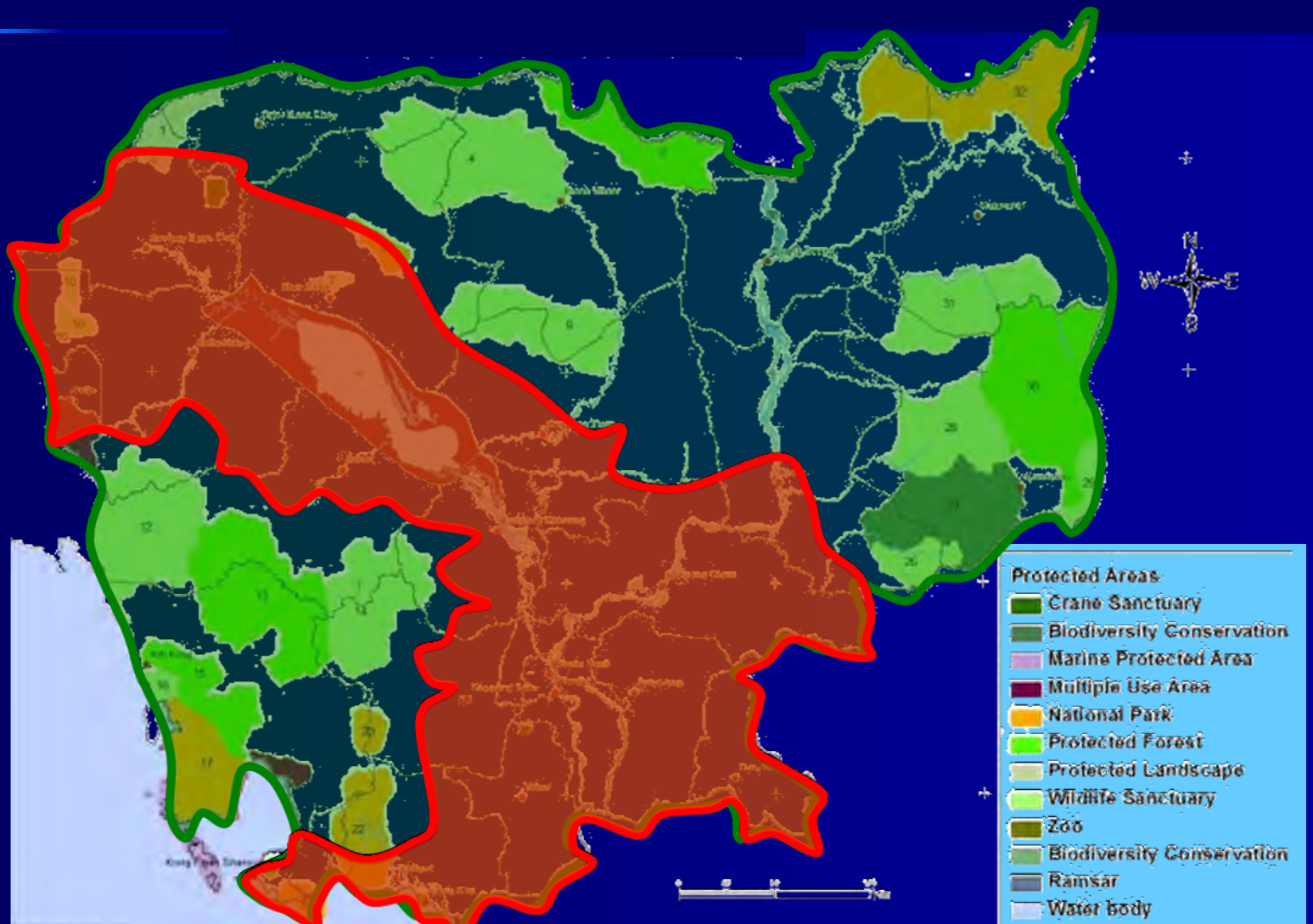
- primary based on annual crops (grain, tubers …)
- and livestock productions
- with progressive integration of tree crops production

High quality products, targeting in first priority national / regional markets

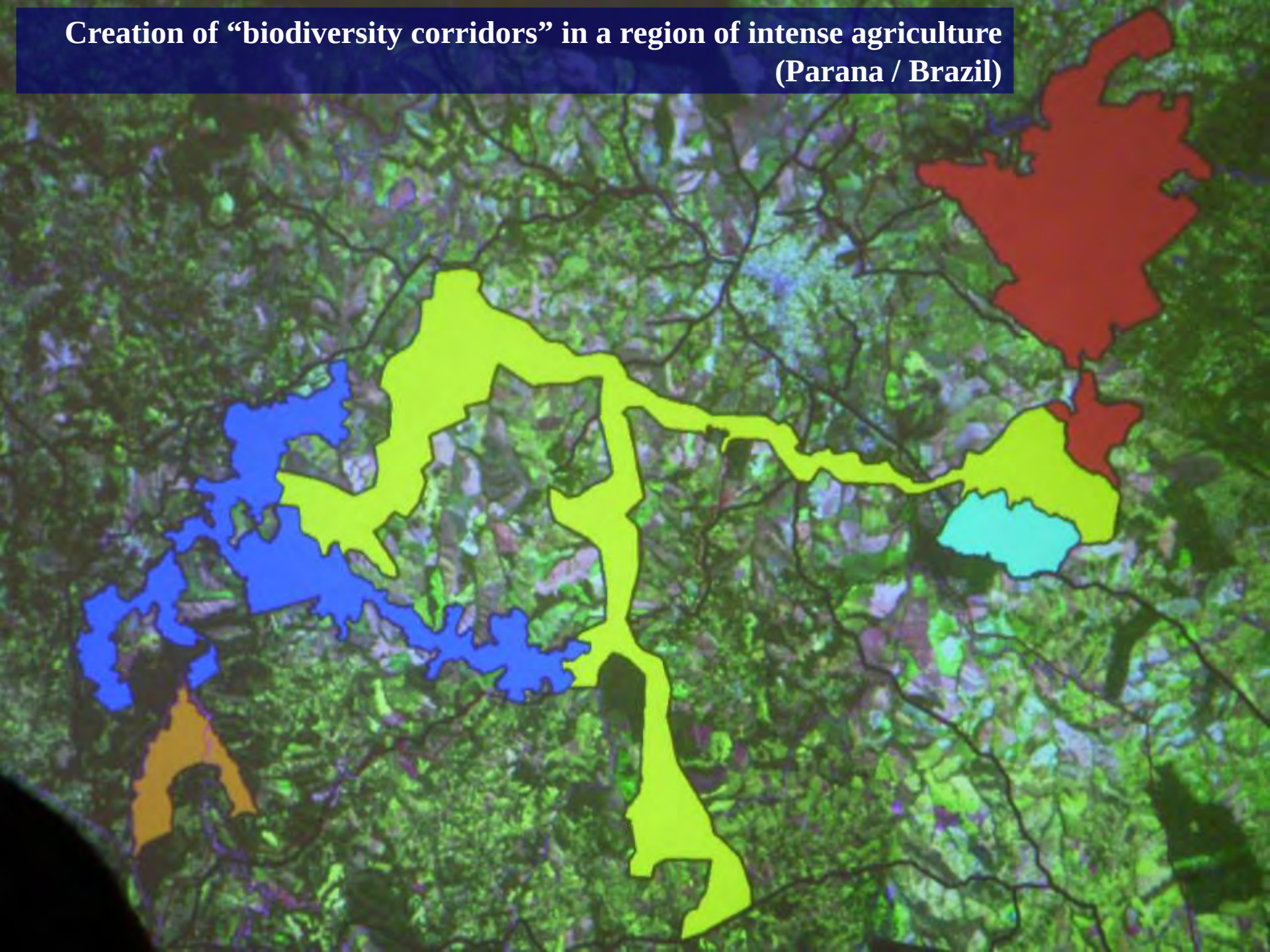
- Post harvest, storage
- Sector organization, R & D

3/ Toward an ambitious plan for upland cultivation development?

Insertion in the Cambodian geography
Upland cultivation and Natural resource conservation

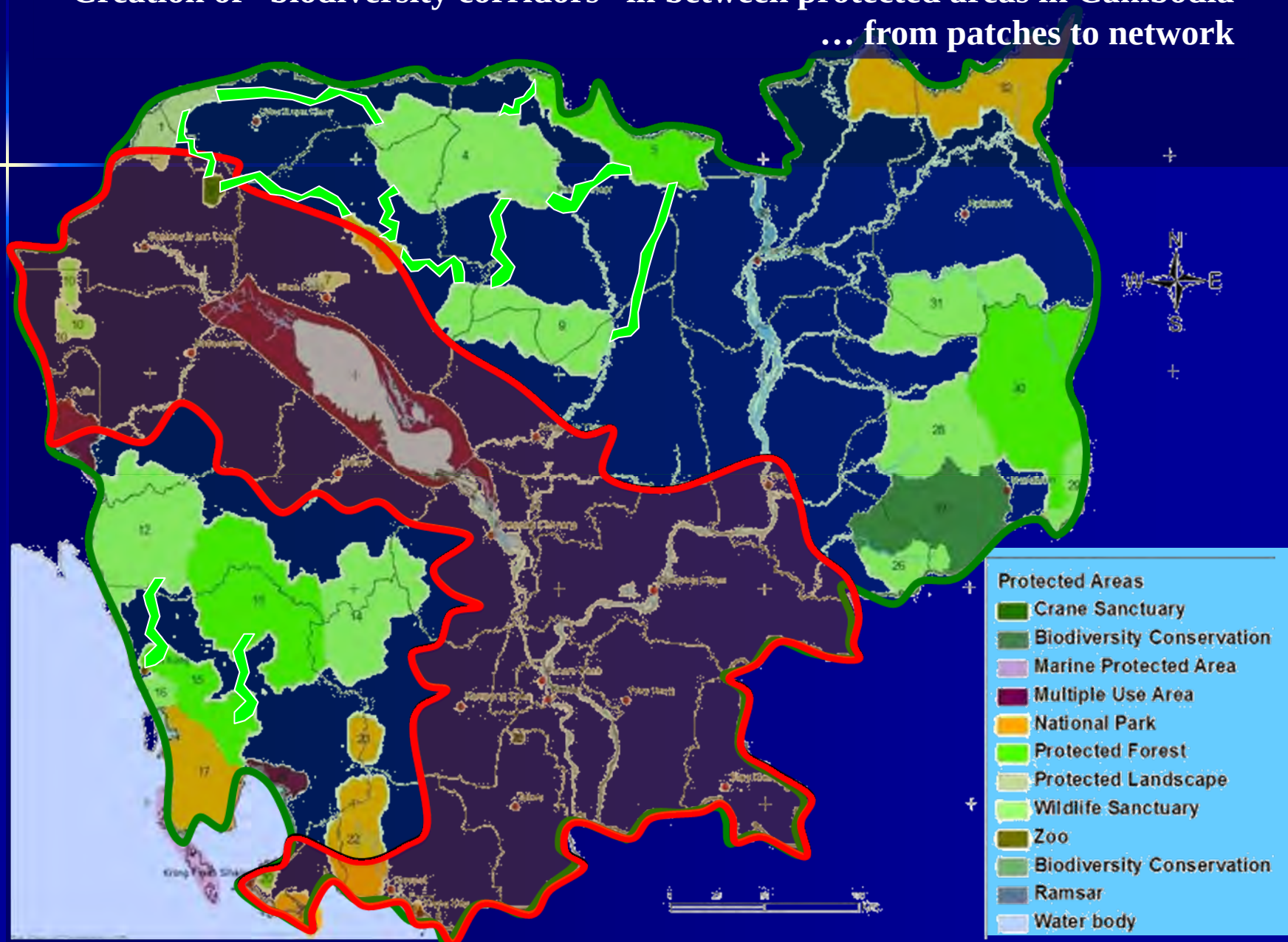


Creation of “biodiversity corridors” in a region of intense agriculture (Parana / Brazil)



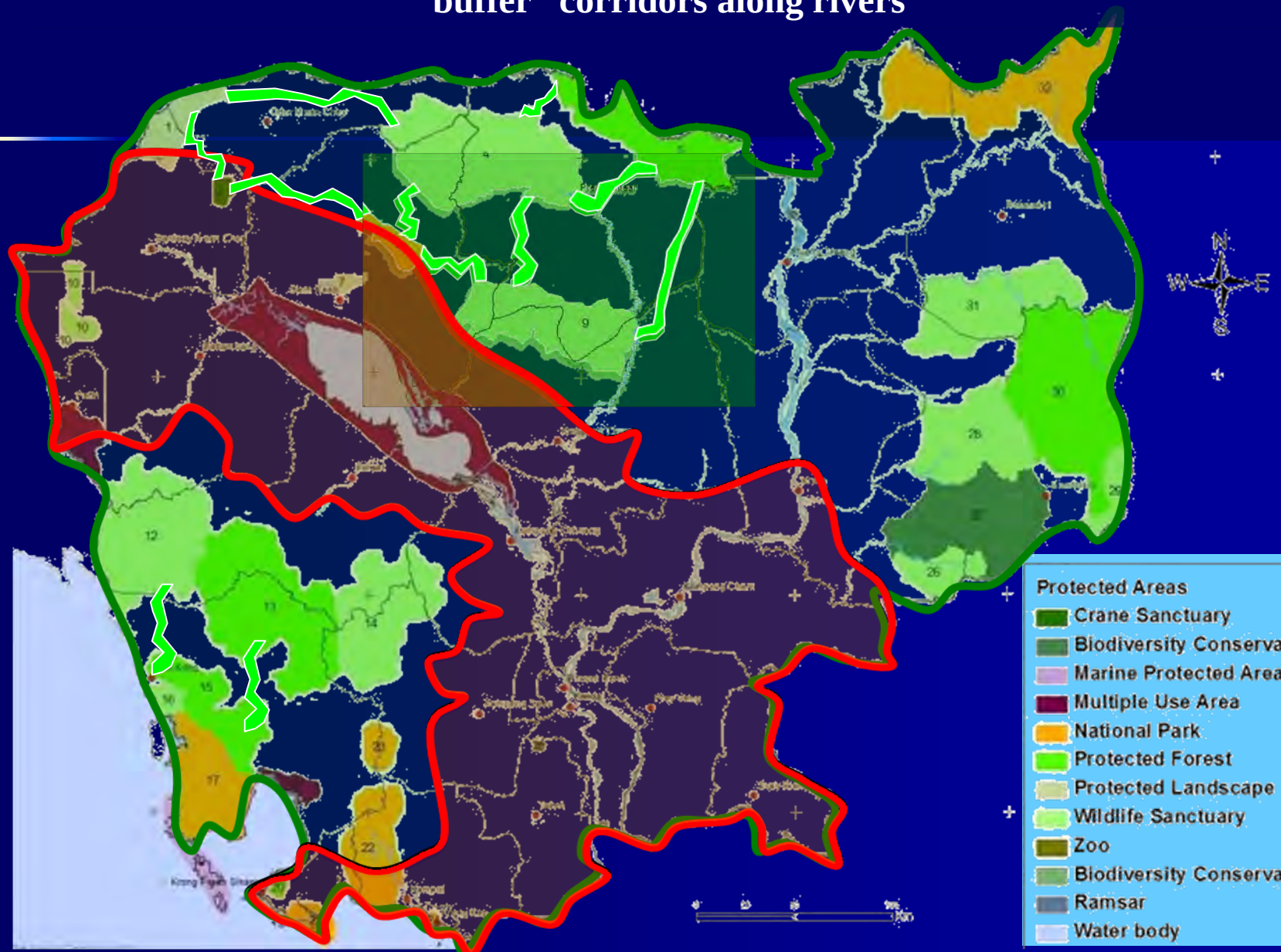
At national scale

Creation of "biodiversity corridors" in between protected areas in Cambodia … from patches to network



At regional/ local scale

Keep “continuum” of “natural” area within developed zones and creation of “buffer” corridors along rivers



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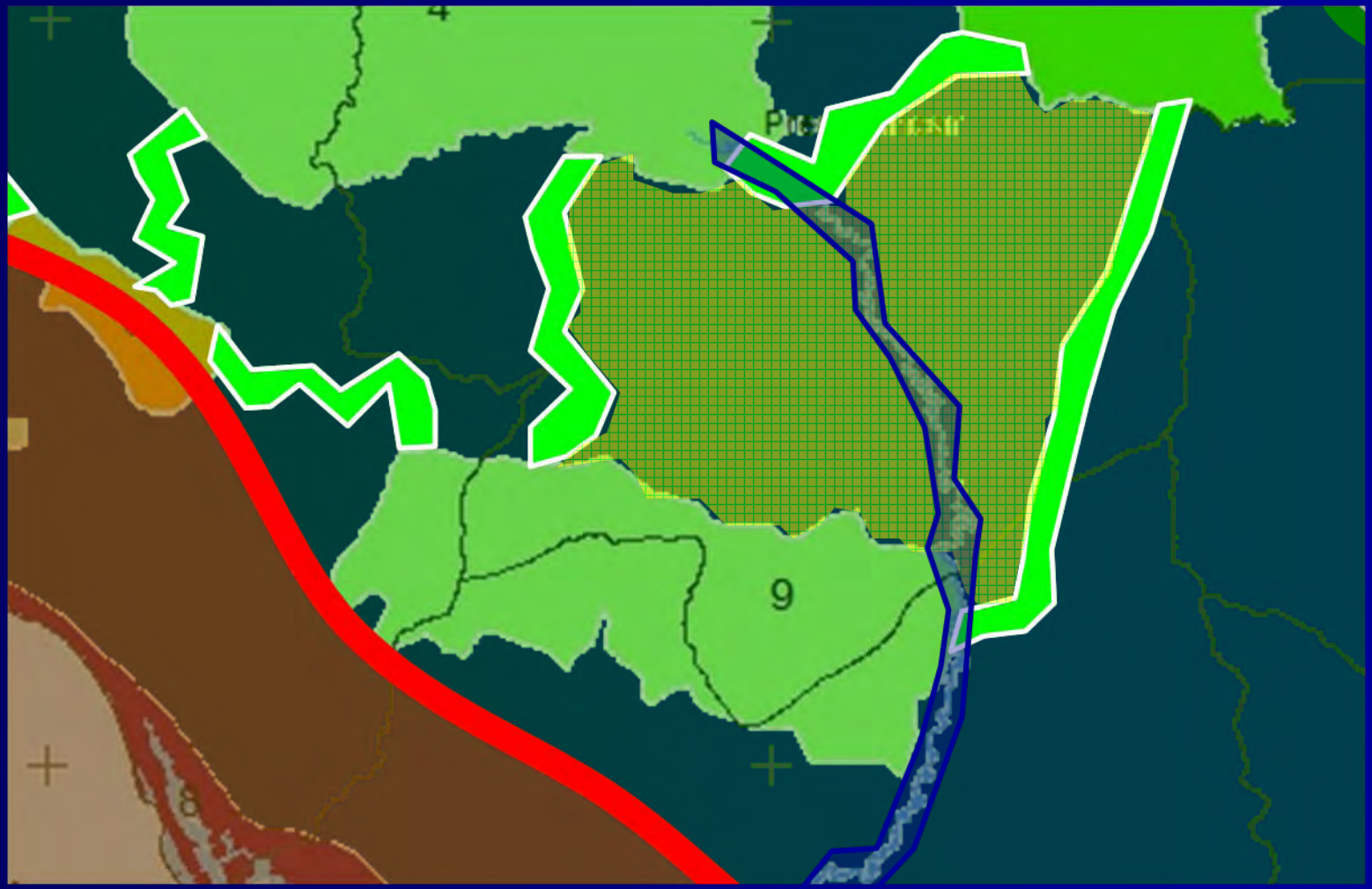
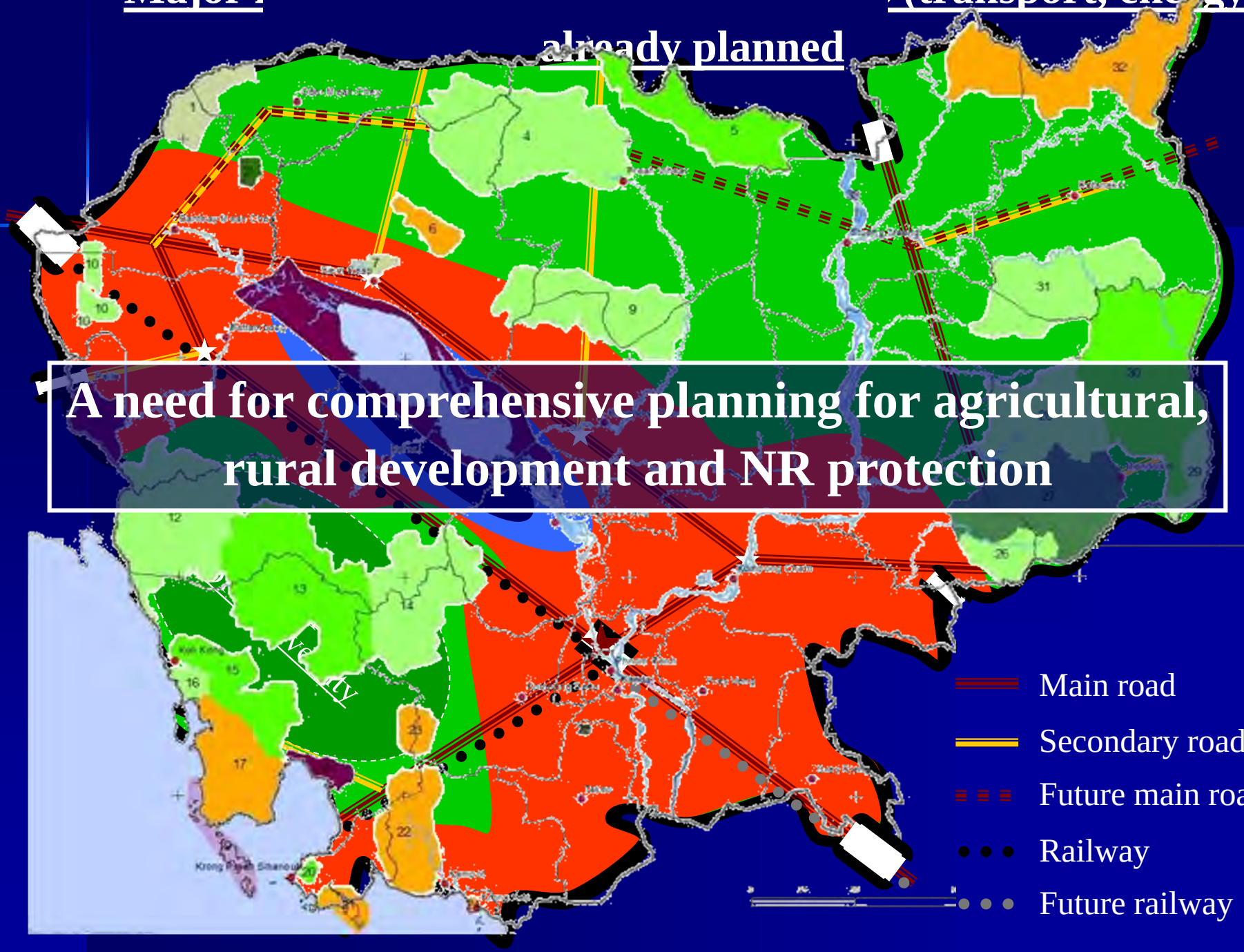


Major i s (transport, energy) already planned



A need for comprehensive planning for agricultural, rural development and NR protection

How to combine efficient and pro-poor agriculture with country planning

Today

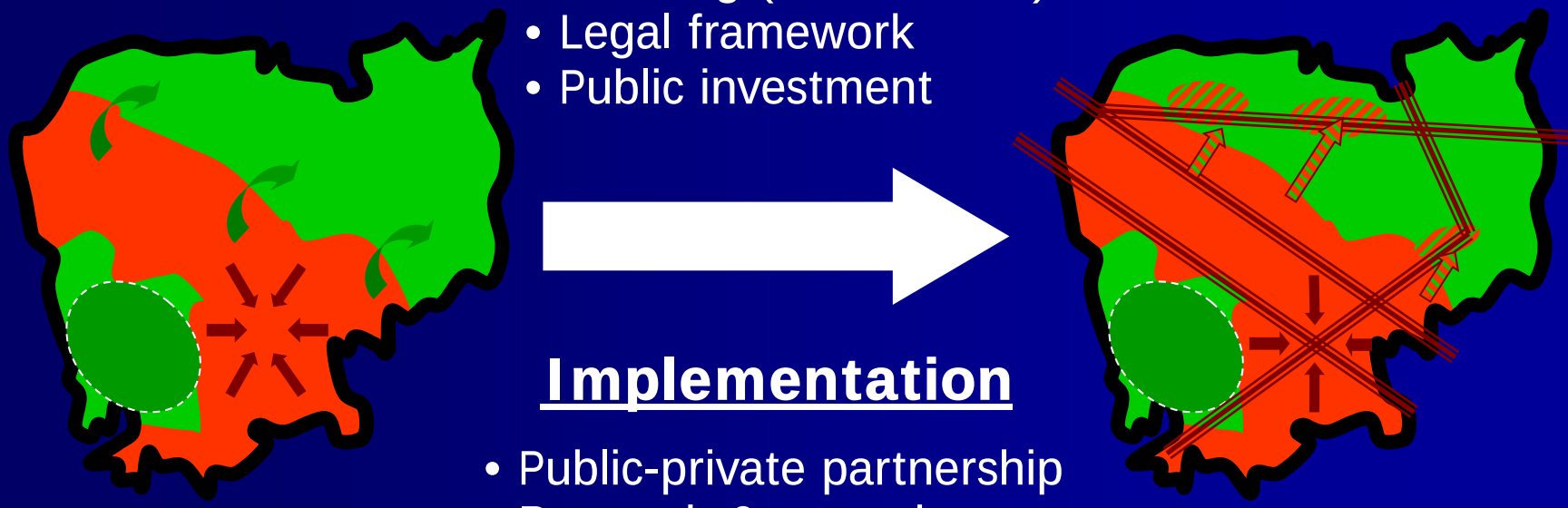
2008: 13,4 mill. inhab.

Tomorrow

2020: 16,0 mill. inhab.
2030: 18,0 mill. inhab.

Strategic policy

- Planning (Land access)
- Legal framework
- Public investment



Implementation

- Public-private partnership
- Research & extension

Where to from here?

3/ Toward an a
development

5 millions ha of

Year	Camb. Pop.	ha DMC	Nb families	"Pop. DMC"	Technicians
2004	Based on Census 2008	Evolution based on 75% progress / year	Number family based on 6 ha/ household Population based on 4,5 people / household		Evolution based on 75% progress / year
2005					
2006					
2007					
2008					
2009					
2010					
2011					
2012					
2013					
2014					
2015					
2016					
2017					
2018					
2019					
2020					
2021					
2022					
2023					
2024					
2025					
2026					
2027					
2028					
2029					
2030		5 000 000			

Year	ha DMC
2004	4
2005	7
2006	12
2007	22
2008	39
2009	71
2010	127
2011	229
2012	412
2013	741
2014	1 334
2015	2 401
2016	4 322
2017	7 780
2018	14 004
2019	25 207
2020	45 372
2021	81 670
2022	147 006
2023	264 611
2024	476 299
2025	857 339
2026	1 543 210
2027	2 777 778
2028	
2029	
2030	5 000 000

4/ Conclusions

The “rediscover” of rural and agricultural development by DPs

WB report in 2008 …

Agricultural and rural development is difficult and take time:

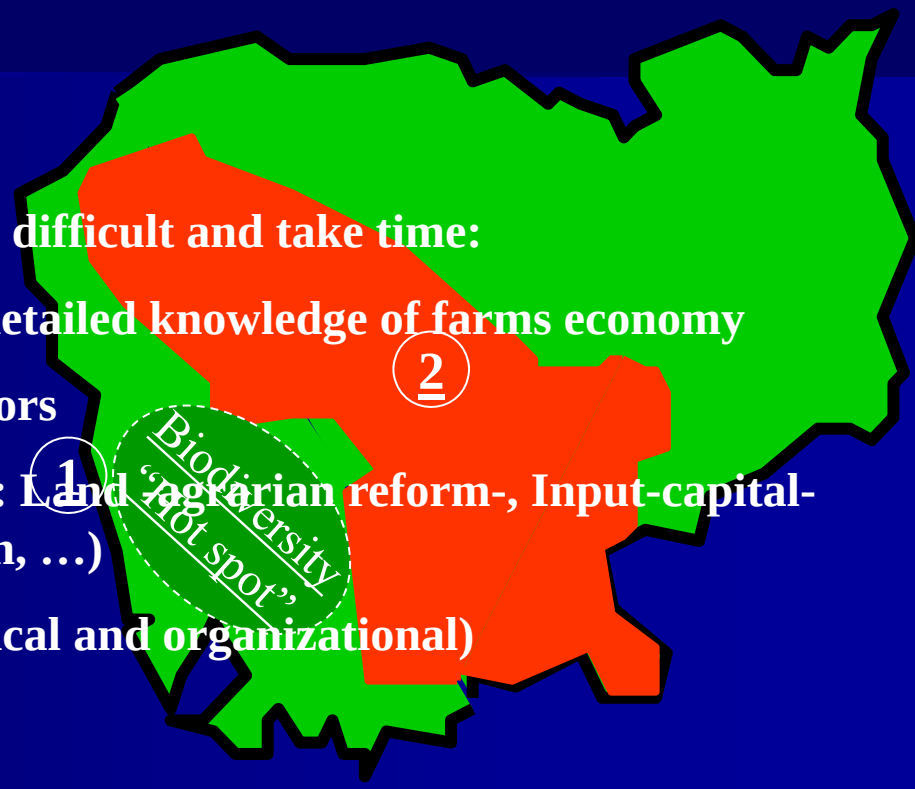
- multi-scale approach based on detailed knowledge of farms economy

- micro-macro economic factors

(access to production factors: Land -agrarian reform-, Input-capital-credit, Labor- mechanization, …)

- adapted innovations (technical and organizational)

- Training-information …



Thank you for your kind attention

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