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CLIMATE-SMART
Agriculture
2015



Global Science Conference

March 16-18, 2015
Le Corum, Montpellier France

Prototyping climate-smart agricultural landscapes: a generic modelling framework and application in a tropical island

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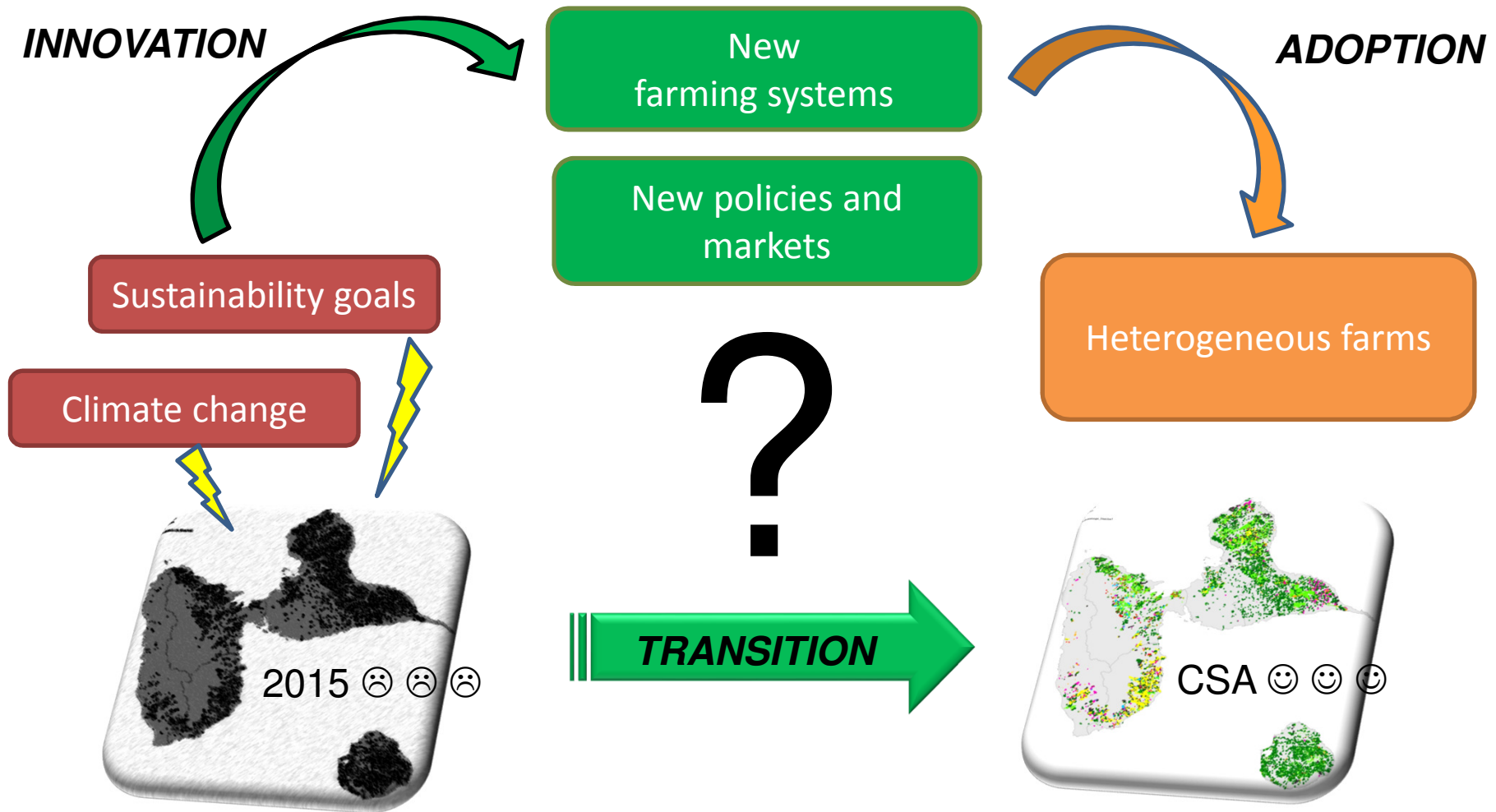
³INRA, UMR 211 Agronomie, F-78850 Thiverval-Grignon, France



Montpellier

March 16-18, 2015

The challenge of transition to CSA landscapes



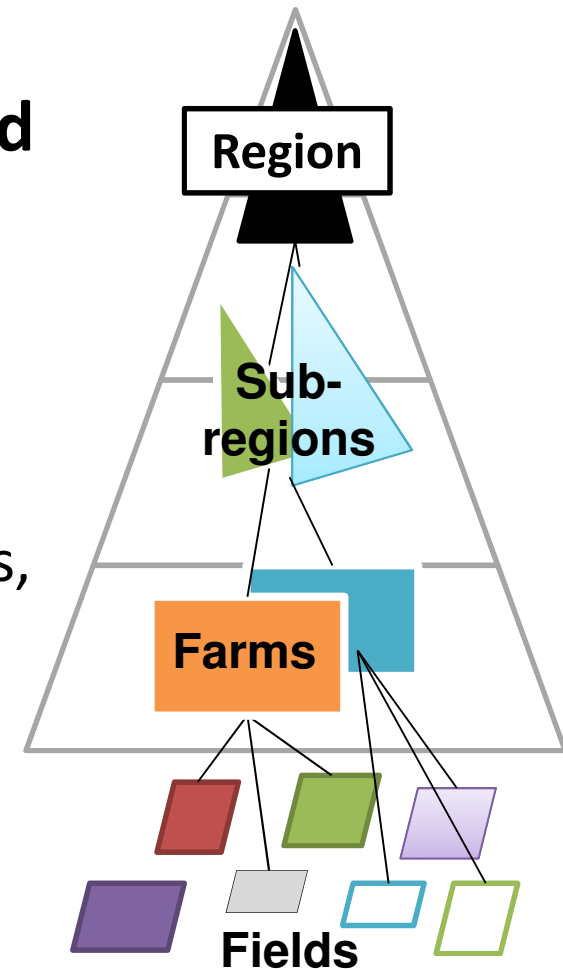
Aims of the research: an integrated model

→ Prototyping mosaic of cropping systems satisfying CSA objectives and sustainability goals

→ As a function of a set of innovations at multiple scales defining an “adaptation scenario” toward CSA

→ While accounting for farmers’ resources, risk attitudes and spatial heterogeneity

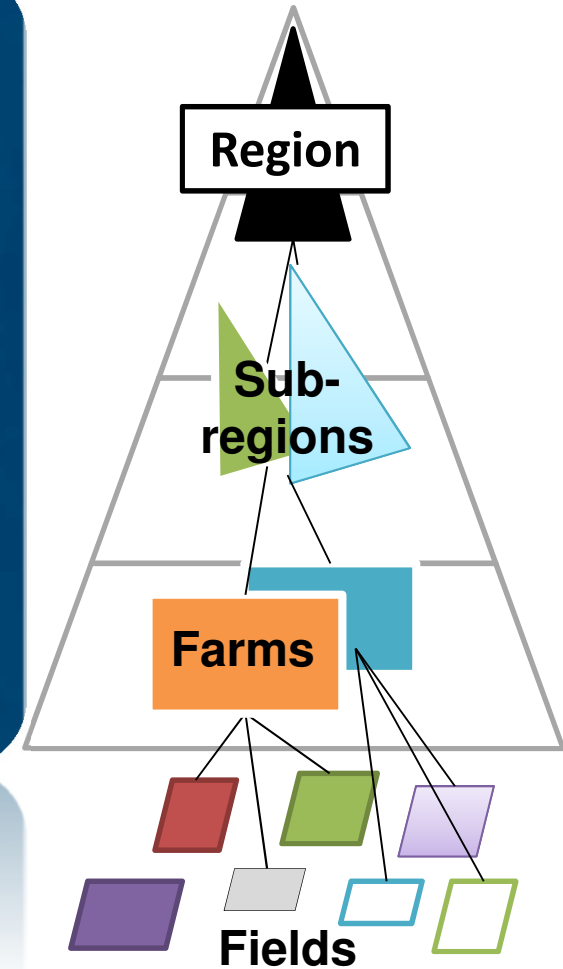
→ Assessing the mosaic with a set of indicators



Aims of the research: an integrated model

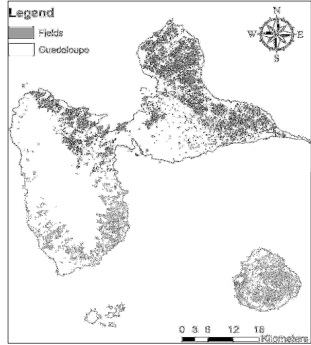


→ Applying the approach to the prototyping of a scenario of CSA in Guadeloupe



The MOSAICA model

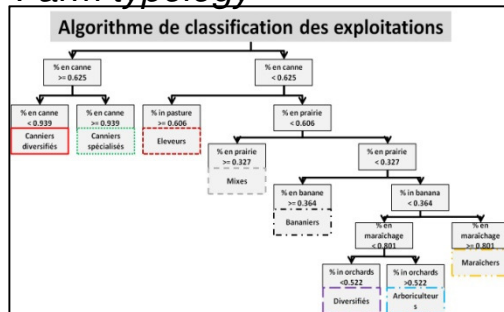
Fields and soil database



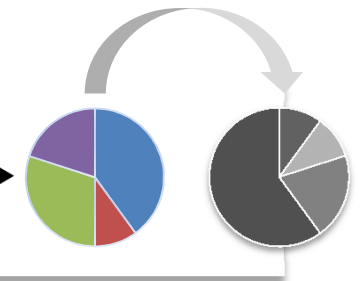
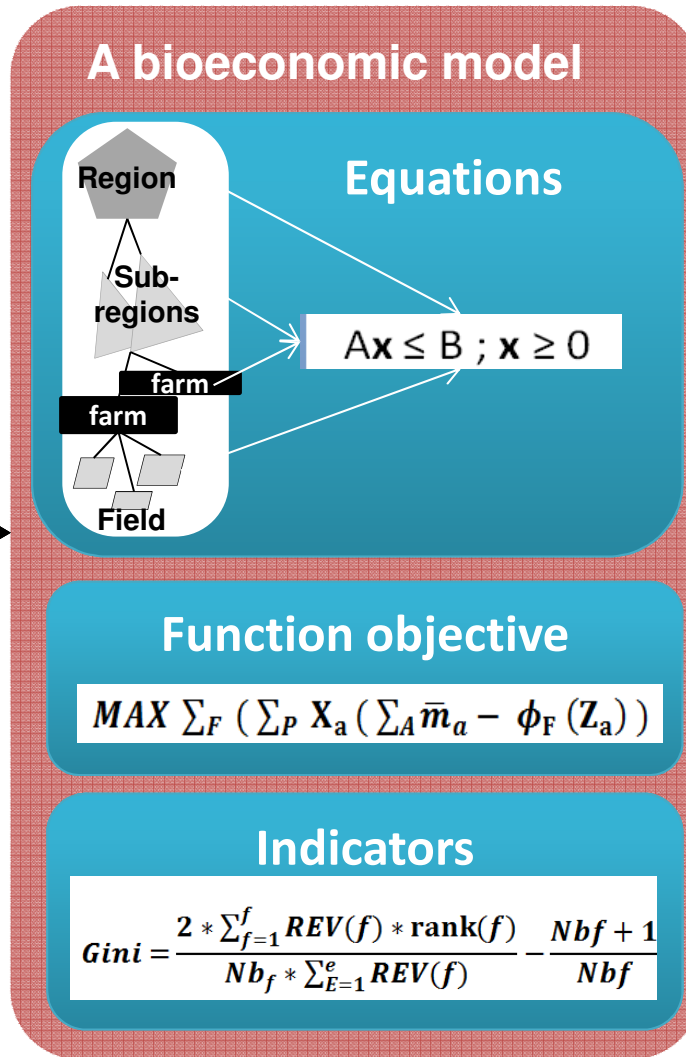
Activities database

	A	B	C
1	ident	Agrumes	Ananas_Paillé
2	PRIX	700	1100
3	VAR_PRIX_P	0	0
4	VAR_PRIX_M	0	0
5	PRIMES	0	-100000
6	RDT	20	18.3
7	VAR_RDT	0.3	0.4
8	VAR_RDT_PL	0	0
9	VAR_RDT_M	0	0
10	RICHESSE	0	0

Farm typology



(Chopin et al., 2015)



(Chopin et al., submitted)



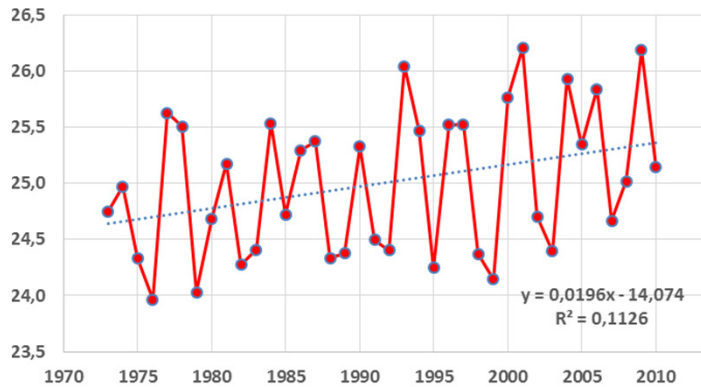
Climate change in tropical islands

- An increase in temperature, rainfall and intensity in extreme events (source: Meteo France)
- A critical issue because:
 - Small tropical island are more vulnerable to CC and markets fluctuations
 - Land availability is limited for ensuring food self-sufficiency
 - Hotspot of biodiversity
- Island = Archetype for transition?

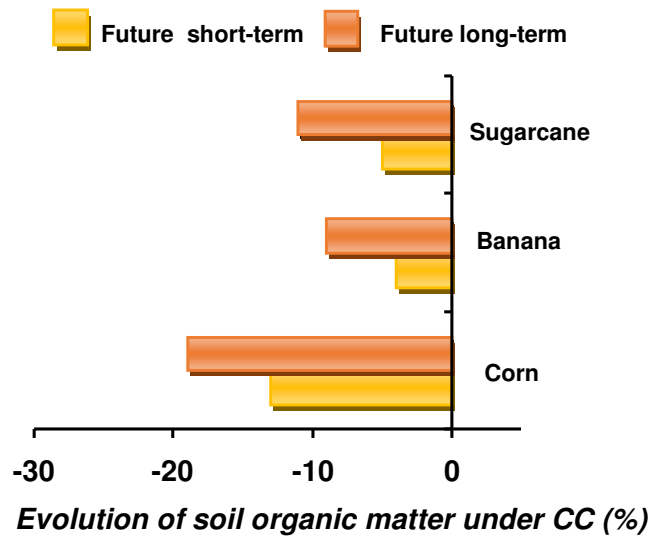
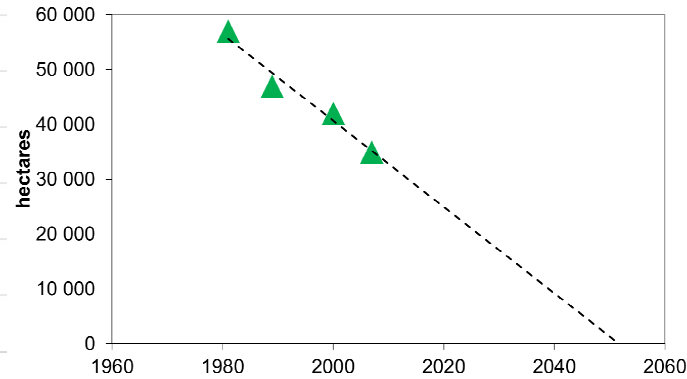


A need in CSA landscapes in Guadeloupe

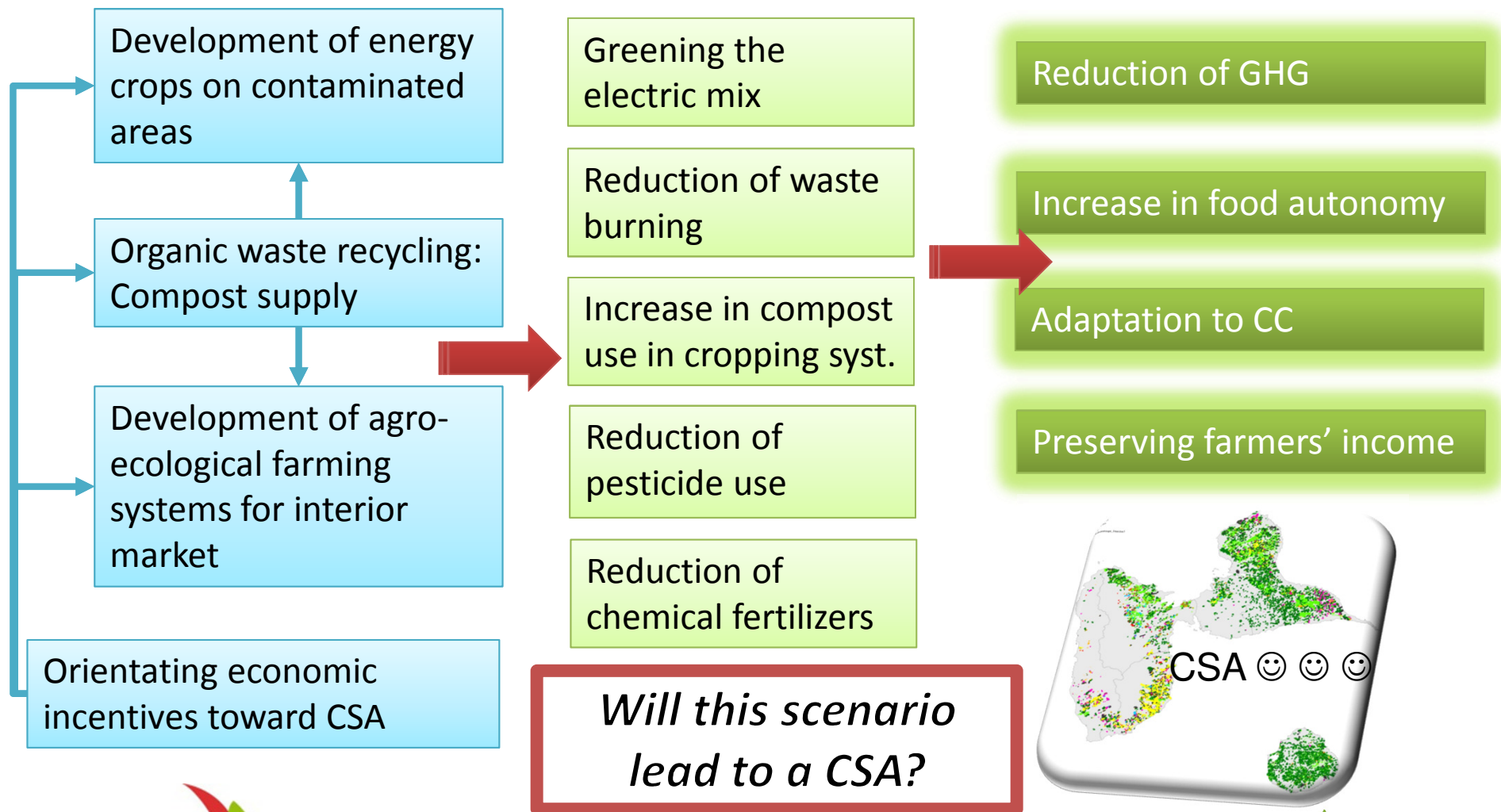
Temperature (°C) in Guadeloupe



Decrease in agricultural area



Scenario approach: transition to CSA through innovations at multiple level

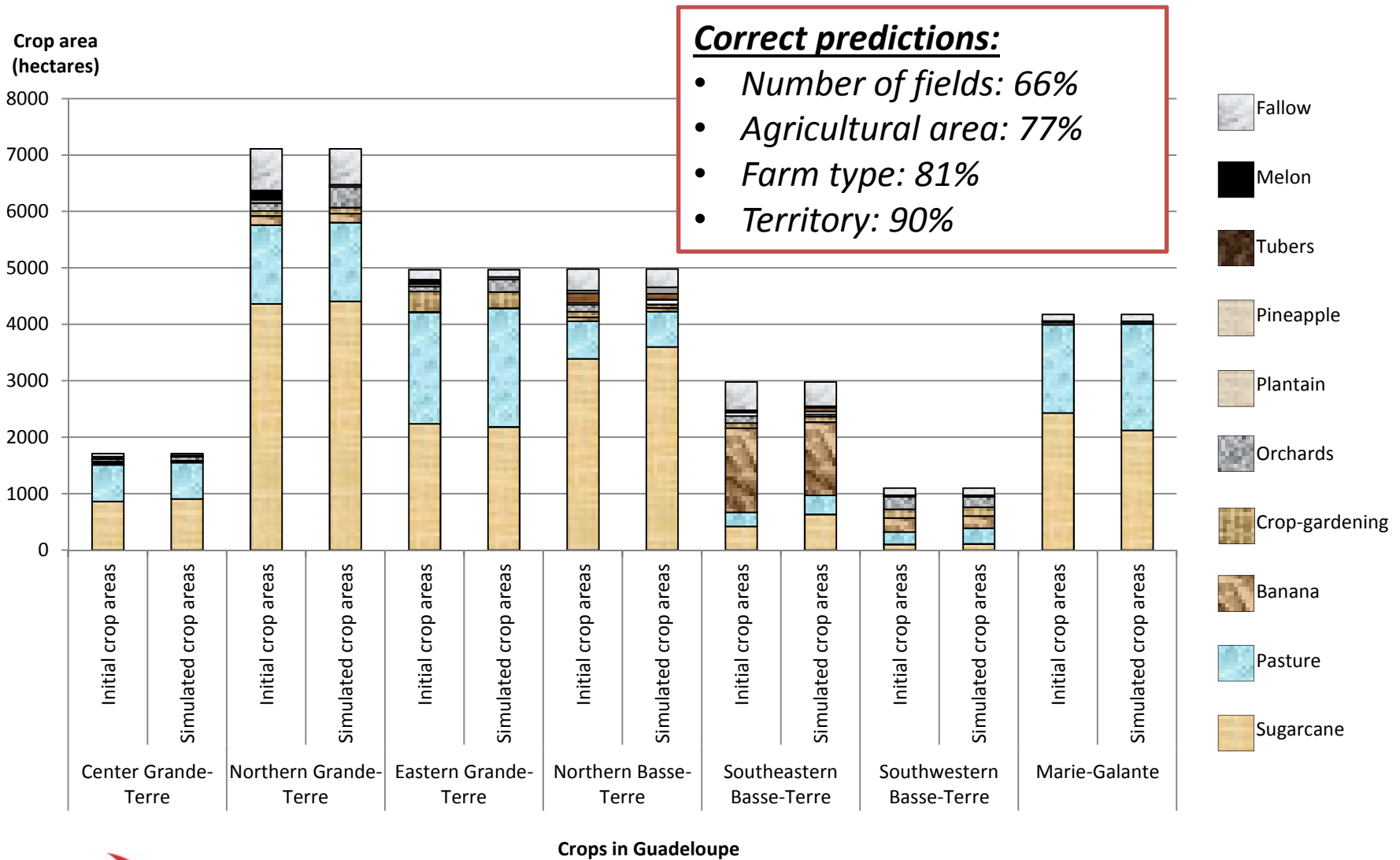


Scenarization with the MOSAICA model

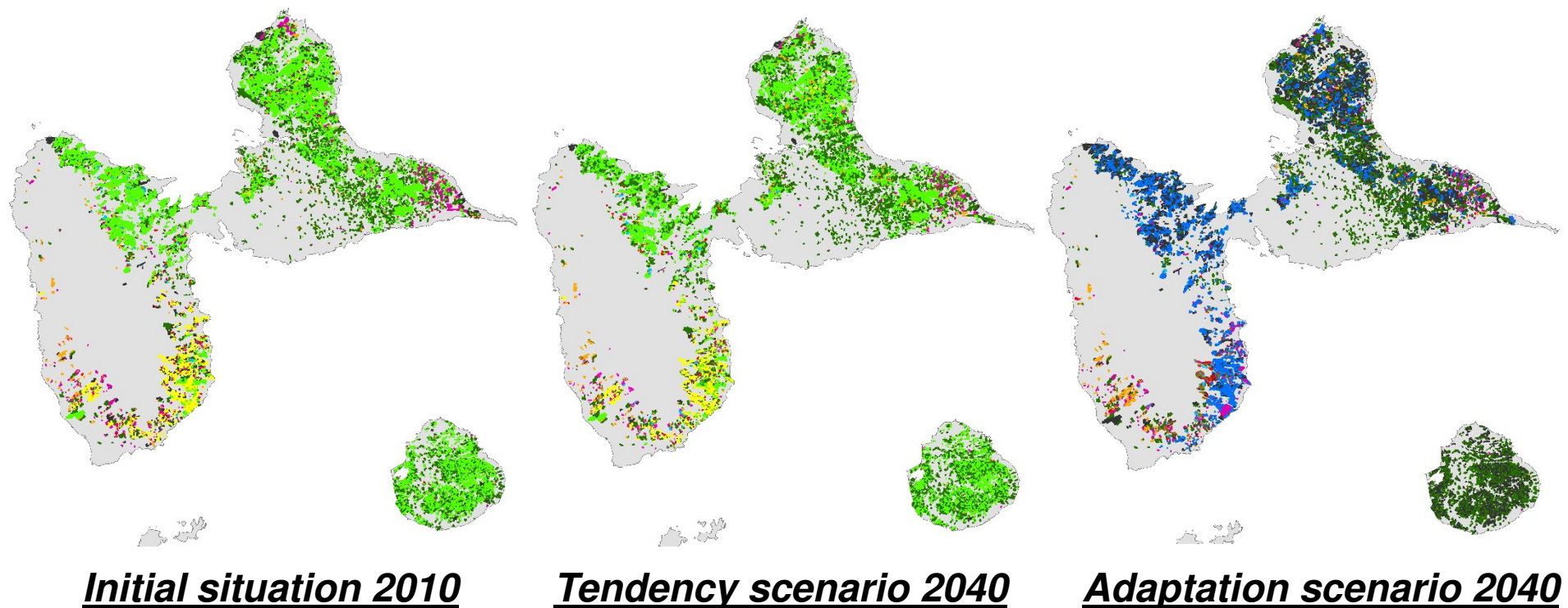
Scenario parameters	« Tendency » scenario 2040	« Adaptation » scenario 2040
All activities	CC affects yields and SOM	CC affects yields and SOM
New activities	NO	Crop-energy agro-ecology Horticulture agro-ecology
New agricultural policies	NO	AES compost + pesticide-free Reallocation of subsidies amount per hectare



Model calibration



Simulation of landscapes evolution



→ **Agricultural landscapes are greatly changed by the « adaptation » scenario**



Balance of landscape's GHG emissions (2010-2040)

SOURCES OF MITIGATION	Difference between « Adaptation scenario » and « Tendency scenario »
Eq. CO2 emissions from electric mix	-68,1
Eq. CO2 emissions from cropping systems	-29,4
Eq CO2 emissions from waste management	-7,95
Eq. CO2 emissions from Land Use Change	-1,29
BALANCE for 30 years (10⁵ Teq CO2)	-106,74



**CSA could make it possible
to reduce GHG emission:**

- ✓ -170% of GHG Emissions from
Agriculture and Forest
- ✓ -10% of GHG Emissions from
the overall Guadeloupe



Impacts on other sustainability issues

Indicators	Units	Initial situation	Tendency scenario	Adaptation scenario
Mean farmers' income	€/ha/year	3510	3110	4940
Energy self-sufficiency from energy crop	%	3%	3%	13%
Food self-sufficiency	%	15%	15%	17%
Proportion of rivers potentially polluted	%	39%	36%	8%
Total amount of subsidies (first + second pillar of CAP)	M€ /year	75	63	61

→ *Our « adaptation » scenario is climate smart* 😊



Conclusions

- ✓ **A promising methodology for designing CSA landscapes:**
 - ✓ Useful to think about how a more climate smart and sustainable future could be
 - ✓ Explicitly represent complexity in agroecosystems across scales
 - ✓ Ability to quantify scenarios' impacts in a spatially explicit way
 - ✓ Integrating knowledge and models from different disciplines

What does it remains to do?

- Testing a combination of crop and livestock management systems adapted to CC
- Dynamics of transition, CSA indicators
- Simulations to assess frontiers between sustainability goals

