Behavioural changes and lifestyles: the food driver

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Transition towards low carbon societies in a changing world
Paris, 13-14 October 2011

The foresight exercise Agrimonde

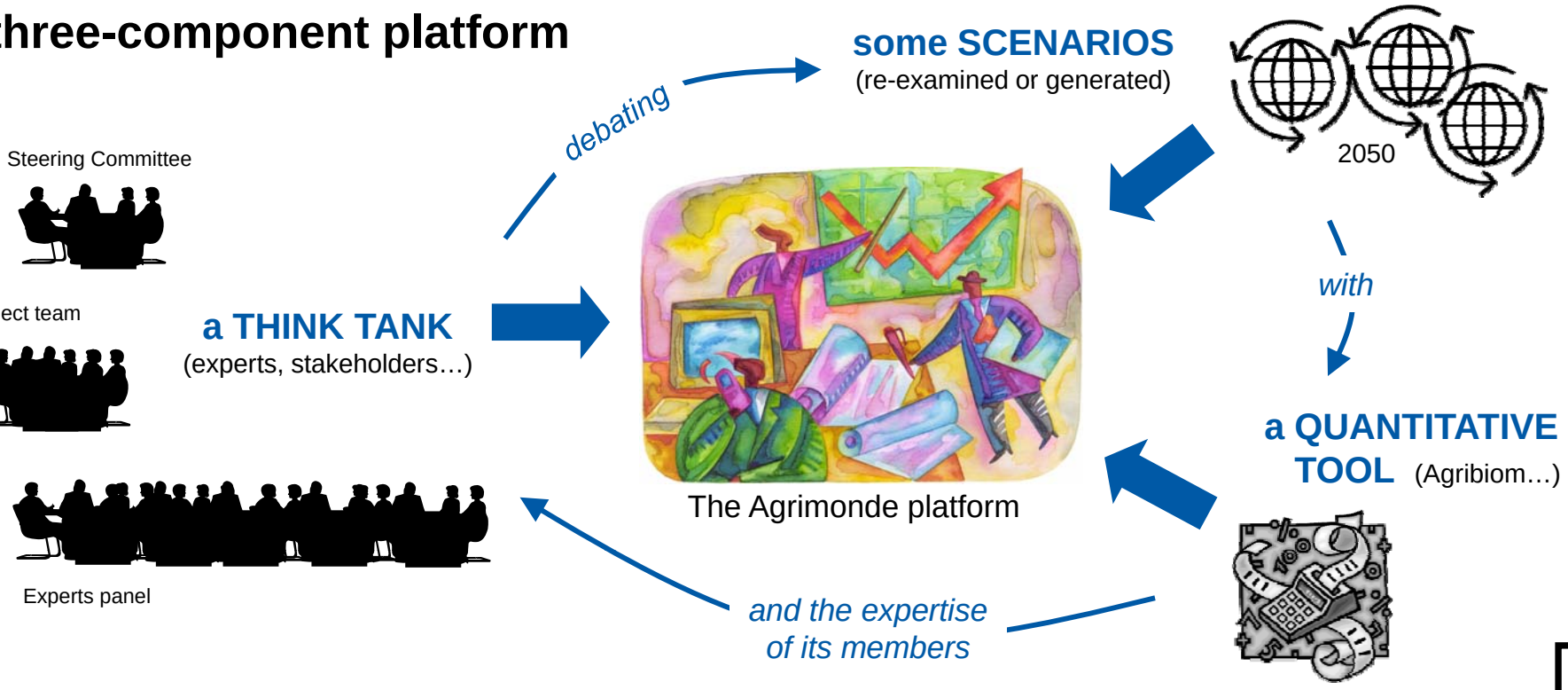
A joint INRA-CIRAD project (2006-2009 = 1st phase)

- French National Institute for Agricultural Research (www.inra.fr)
- French Agricultural Research Centre for International Development (www.cirad.fr)

Objectives

(1) to explore possible futures of food and farming systems up to 2050
(2) to design and debate orientations and strategies for INRA - CIRAD research agendas
(3) to contribute to international debates on food, agriculture and the environment

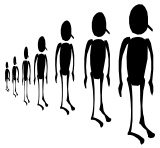
A three-component platform



Agribiom

a biophysical model balancing food calories

Countries => World balances of food biomasses reconstituted (1961-2003, using FAO commodity balances in tons) and/or simulated (2030, 2050…)



Regional POPULATION

Population

Agricultural working population	Rural population other than farmers	Urban citizens

Demand

Regional CONSUMPTION

Biomass

FOOD			NON-FOOD (wood, fibres, leather, rubber, tobacco, bio-energies, bio-materials…)
from terrestrial PLANTS	from terrestrial ANIMALS	of AQUATIC origins	

Cal ries

Regional Supply-Use BALANCE

VEGE

MONO

RUMI

AQUA

MARI

Production	Imports – Exports	Food use	Feed use	Seed use	Other use	Waste	Imports – Exports	Production

$P_{r+m} = f$ (feed, pasture, rumi/mono)

Regional PRODUCTION

	Edible	Inedible
VEGE		
MONO		
RUMI		
AQUA		
MARI		

yield

Regional LAND USE

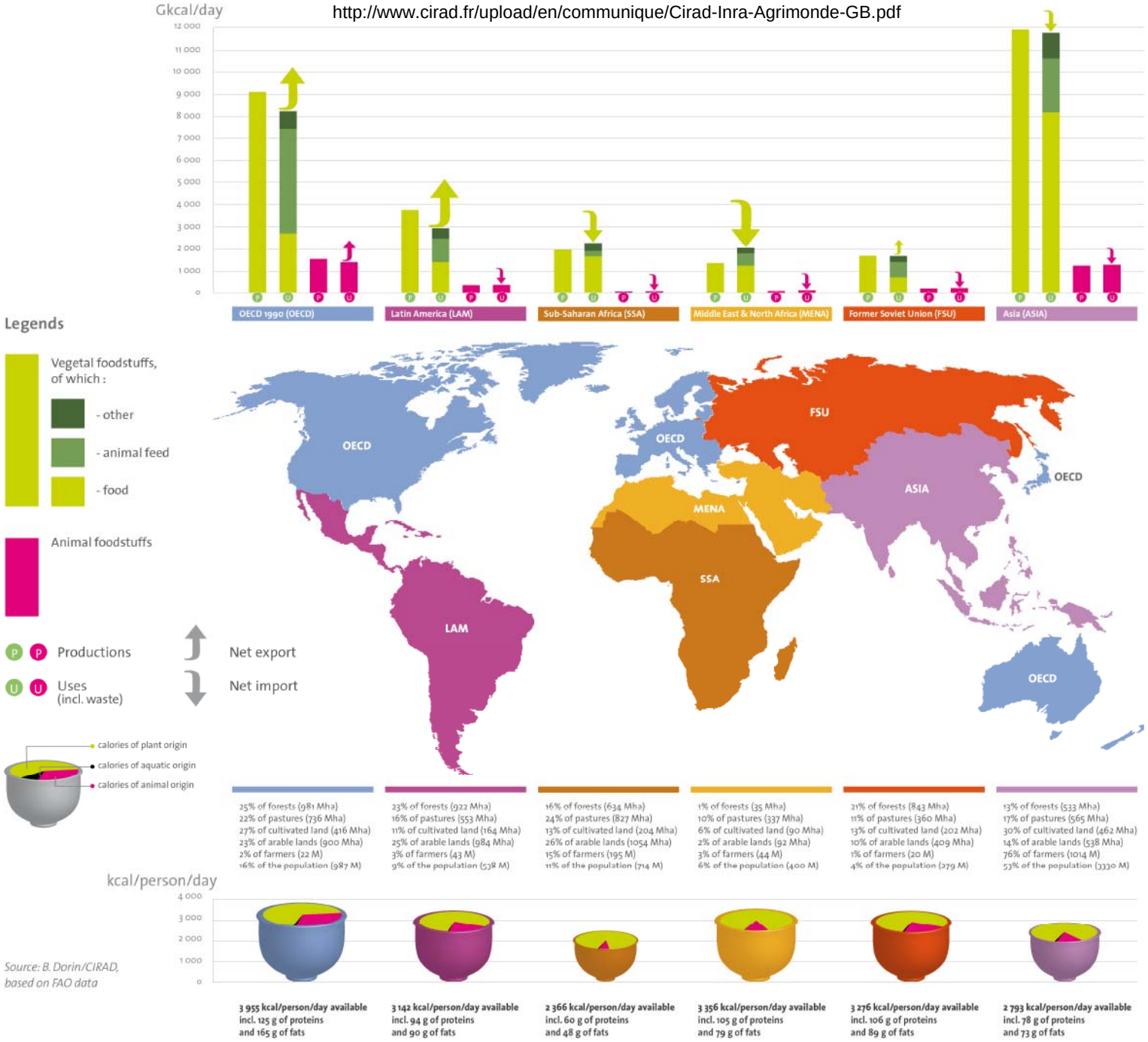
Croplands	totally non-food	Permanent pastures	Forests	Others (mountains, deserts, cities, roads…)	Freshwater

Continental shelves

Towards which new «equilibrium» in 2050 ?

1961 → Resources, productions, trade and uses of food biomasses (2003) → 2050 ?

http://www.cirad.fr/upload/en/communique/Cirad-Inra-Agrimonde-GB.pdf



Scenarios 2050
AGO AG1

Collective expertise, hypotheses, debates…

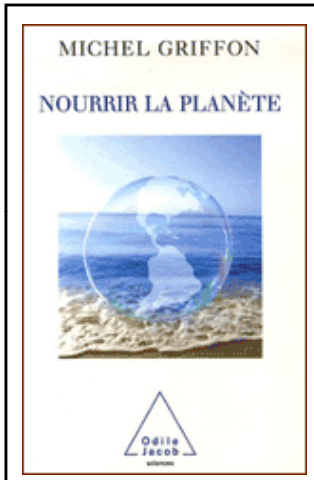
Agribiom simulations

The “AG1” and “AGO” worlds

Two scenarios “reprocessed”

The *Doubly Green Revolution* scenario

Source: Griffon M., 2006. Nourrir la planète. Pour une Révolution doublement verte, Odile Jacob, Paris



The Green Revolution, which was introduced on a world scale after World War II, made it easy to ignore the threat of hunger. But the Green Revolution also encouraged overpopulation; it ravaged the environment in many places; it created inequalities in the sharing of the planet’s wealth, and these inequalities have made the threats we must face in the coming decades even greater than those the world had to confront in the early twentieth century.

Agrimonde platform

The “Agrimonde 1” scenario (AG1)

The “Agrimonde GO” scenario (AGO)

The *Millennium Ecosystem Assessment* scenarios

Source: MEA, 2005. Ecosystems and Human Well-being: Scenarios, The Millennium Ecosystem Assessment, Washington DC.

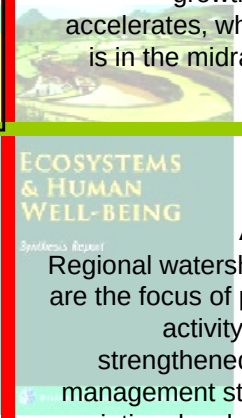
Global Orchestration
A globally connected society that focuses on global trade and economic liberalization and takes a reactive approach to ecosystem problems but that also takes strong steps to reduce poverty and inequality and to invest in public goods such as infrastructure and education. Economic growth in this scenario is the highest of the four scenarios, while it is assumed to have the lowest population in 2050.

Globalization

Techno-Garden
A globally connected world relying strongly on environmentally sound technology, using highly managed, often engineered, ecosystems to deliver ecosystem services, and taking a proactive approach to the management of ecosystems in an effort to avoid problems. Economic growth is relatively high and accelerates, while population in 2050 is in the midrange of the scenarios.

Reactivity

Proactivity



Order from Strength
A regionalized and fragmented world, concerned with security and protection, emphasizing primarily regional markets, paying little attention to public goods, and taking a reactive approach to ecosystem problems. Economic growth rates are the lowest of the scenarios (particularly low in developing countries) and decrease with time, while population growth is the highest.

Adapting Mosaic
Regional watershed-scale ecosystems are the focus of political and economic activity. Local institutions are strengthened and local ecosystem management strategies are common; societies develop a strongly proactive approach to the management of ecosystems. Economic growth rates are somewhat low initially but increase with time, and population in 2050 is nearly as high as in Order from Strength.

Regionalization

Summary of global assumptions / findings

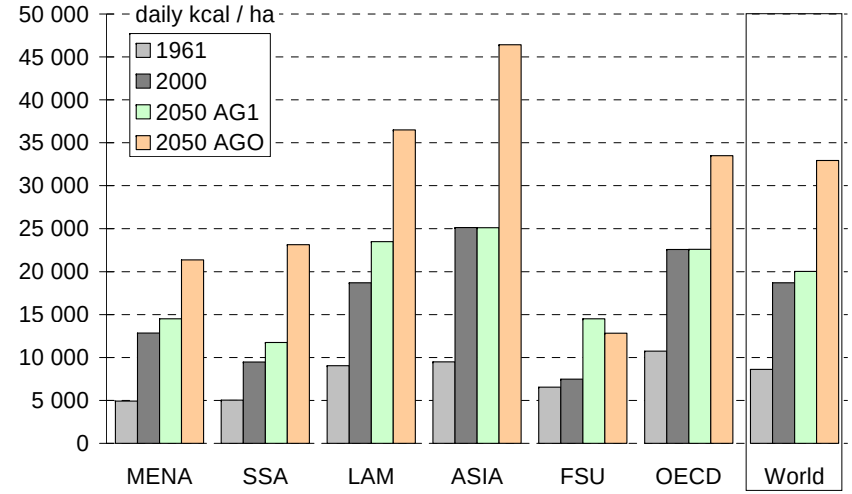
	Agrimonde GO a 'trend' scenario	Agrimonde 1 a 'normative' scenario
Guidelines	Free trade, economic growth, industrialization, urbanization	Agro-ecology & biodiversity, equity development, rural employment
Food **Consumption**	Westernization of diets with growing animal products	No under- & over-nutrition, 'reasonable' share of animal products
Food **Production**	Few large-scale agro-industries producing cheap standardized food	Mosaic of complex agro-ecosystems providing diversified foods & services
Agricultural **Technology**	Biotechnologies, irrigation, fertilizers, pesticides	Biological synergies boosted with local knowhow & modern science, saving capital, fossil fuel & water
Environment	Reactive management regarding climate, epidemic & economic risks	Proactive management towards resilience, conservation, GHG mitig.

	1961-2003	2003-2050	2003-2050
Population	**+ 1.71** %/year	**+ 0.75** %/year	**+ 0.75** %/year
Production of plant foods (kcal)	**+ 2.22** %/year	**+ 1.31** %/year (+ 84 %)	**+ 0.53** %/year (+ 28 %)
Production of animal foods (kcal)	**+ 2.15** %/year	**+ 1.85** %/year (+137 %)	**+ 0.40** %/year (+ 21 %)
Yield of plant foods (kcal)	**+ 1.93** %/year	**+ 1.16** %/year	**+ 0.09** %/year
Cultivated area	**+ 0.29** %/year	**+ 0.41** %/year	**+ 0.68** %/year
Pasture area	**+ 0.25** %/year	**+ 0.16** %/year	**– 0.33** %/year
Export of plant foods (kcal)	**+ 3.70** %/year	**+ 3.13** %/year (+ 325 %)	**+ 4.60** %/year (+ 740 %)

Main quantitative assumptions

		2003	2050 - AG1	2050 - AGO
Uses	Population	6.2 Gcap	8.8 (+42%)	8.8 (+42%)
	Human food	3,000 kcal/day/cap 17% Non-Veg	**3,000** **17%** Non-Veg	**3,590** (+19%) **23%** Non-Veg
	Other uses	~14,440 Gkcal/day	Feed (Agribiom) + seed (3%) + waste (max 4%) + other (max 5%)	Feed (Agribiom) + seed (3%) + waste (max 4%) + other (max 5%)
Ressources	Food yields	~19,190 kcal/day/ha	~20,030 (**+4%**)	~32,940 (**+75%**)
	Crop land - for N-Food	~1,530 Mha neg.	~2,105 (**+38%**) 224 Mha	~1,860 (**+21%**) 217 Mha
	Pastures	~3,330 Mha	~2,845 (**–14%**)	~3,585 (**+8%**)
	Forest	~3,905 Mha	no change	no change

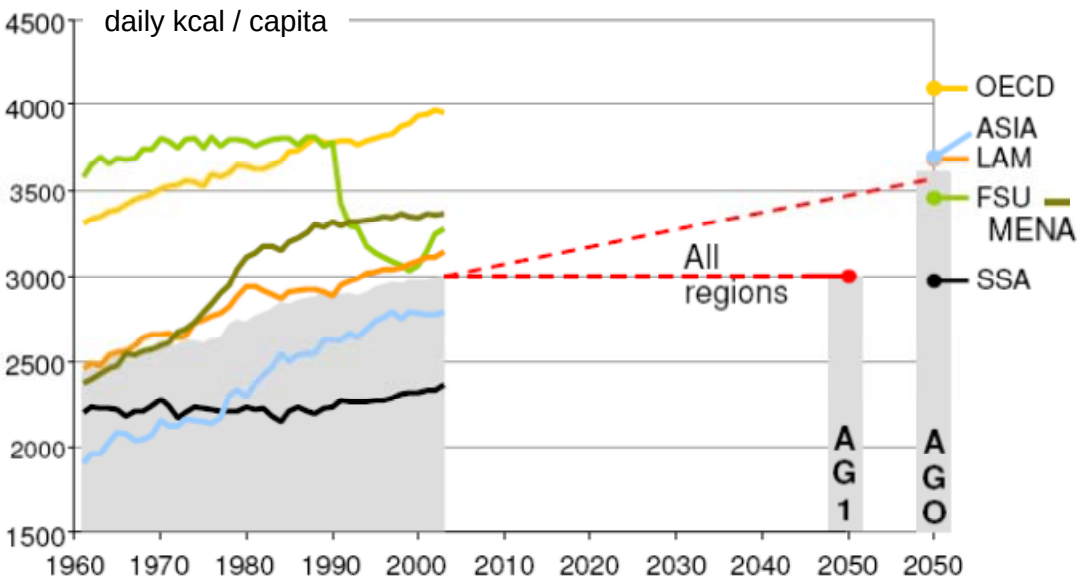
Trade : h01 : trade of plant food only (i.e. no trade of animal foodstuffs or by-products)
h02 : import of animal foodstuffs instead of import of plant feed

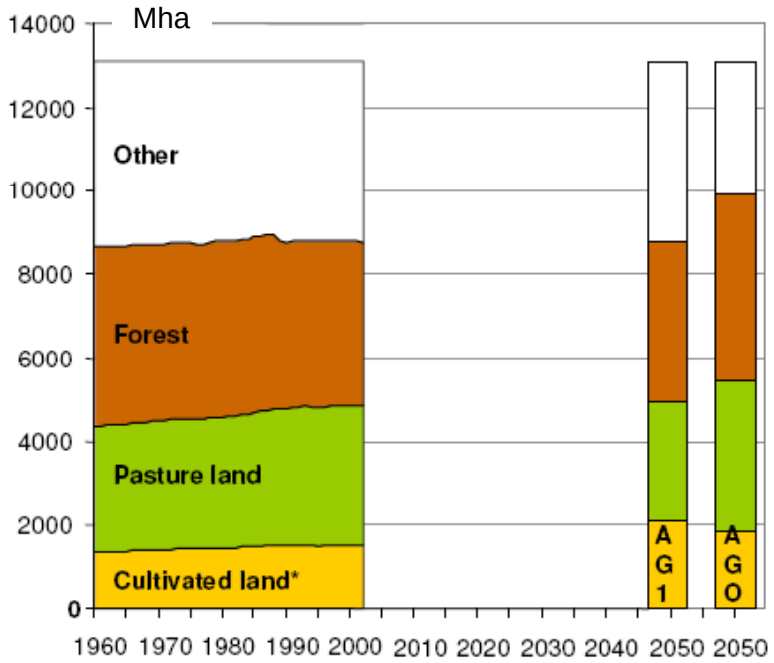


Yield

Land

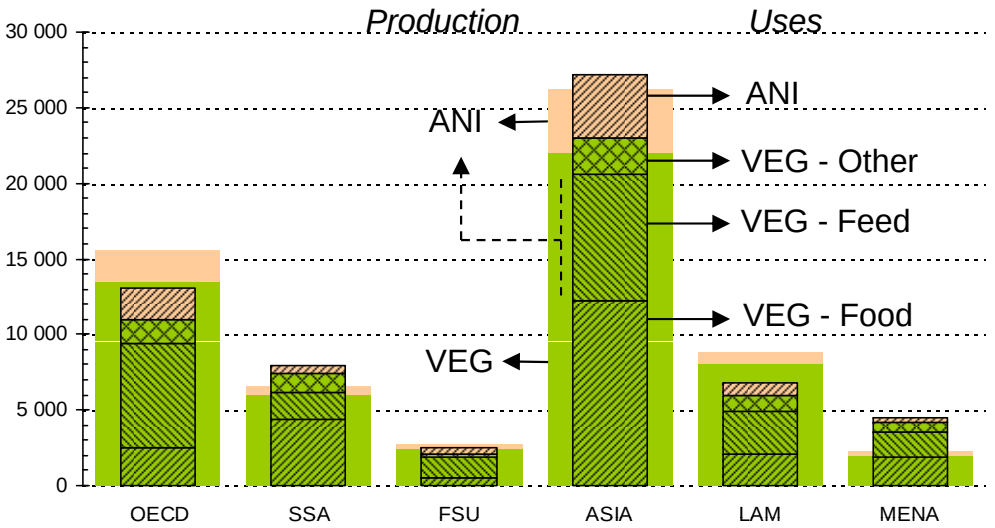
Food

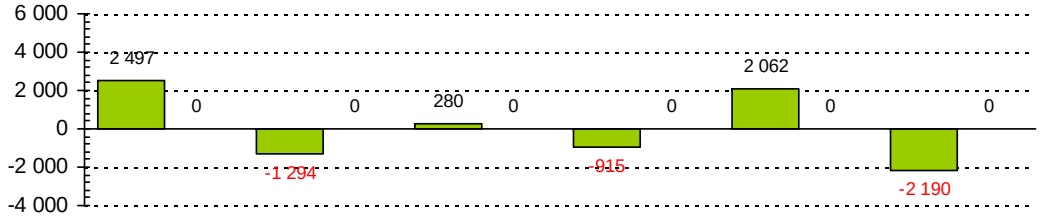


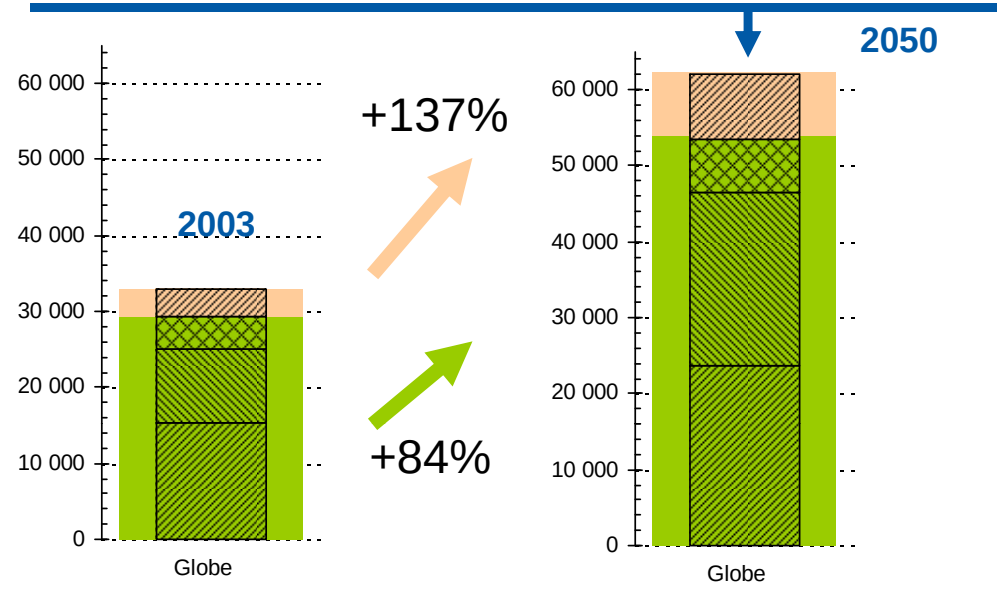


Scenario 2050 - AGO

AGO.h01

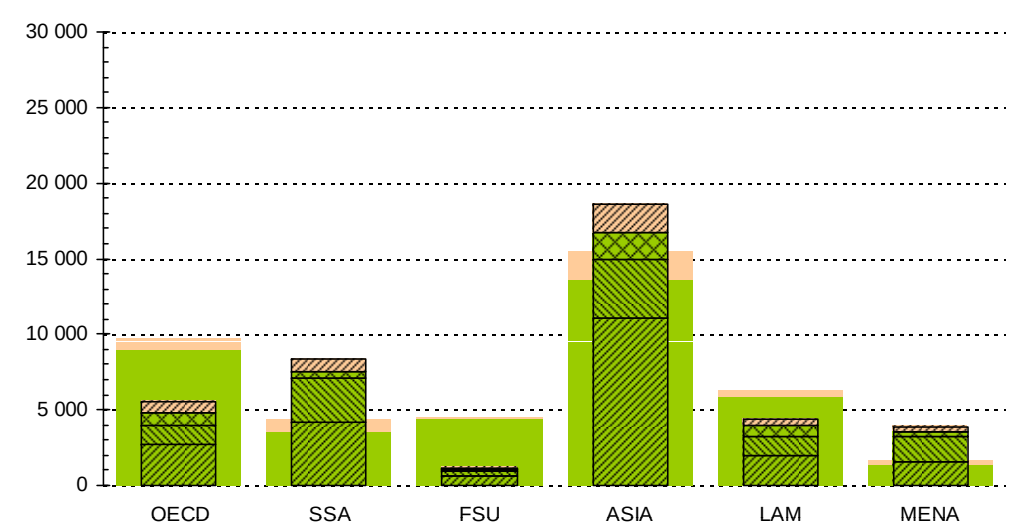


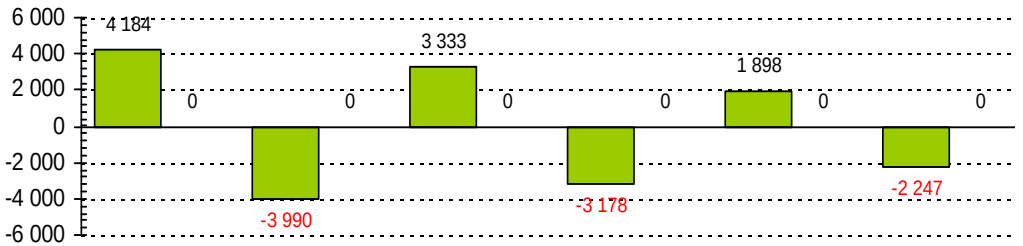


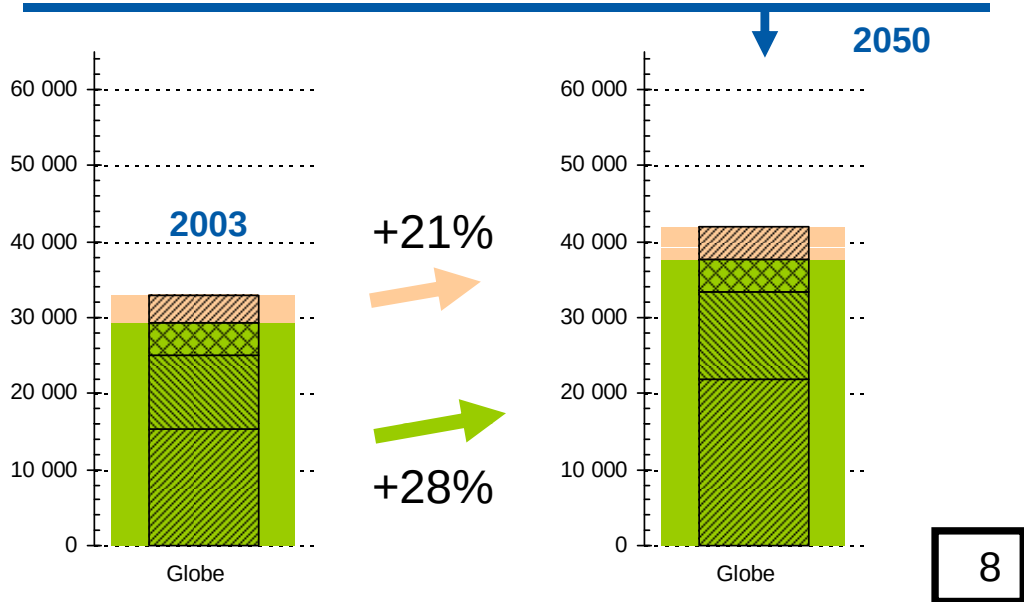


Scenario 2050 - AG1

AG1.h01







Main lessons from 2 scenarios (3 open questions)

The planet can feed 9 billion people in 2050
However…

(1) The contents of each person's plate (quantity + ingredients + presentation) will be a key driver for:
- solving important human health problems (from under-nutrition to obesity)
- preserving some ecosystem services (climate/disease/flood regulations, pollination…)
- saving some agricultural inputs (water, fossil fuels, fertilizers, pesticides…)
- reducing post-harvest losses and food wastes
- opening larger opportunities for non-food productions (bio-energies, build. materials…)
- promoting a diversity of production systems, landscapes and rural livelihoods

➡ What does a "sustainable food system" mean (content / tradeoffs / pathway) ?

(2) Food trade can secure some regional food needs and avoid huge migrations, provided the net-deficit regions/populations can:
- pay for their food imports (local opportunities of incomes?)
- rely on a fair, transparent & LT secured international trade regulation system

...enhancing small farmers incomes & environment-friendly

➡ How to design such a international trade system ? a UNOFS ?

(3) Preserving or improving agricultural yields calls for breakthroughs:

- Need for much less polluting & less dangerous techniques (for workers, flora, fauna…)
  based on: - much better exploitation of ecosystem services (pollination, IP…)
  - new technologies (ITC, genetics, monitoring…)
  - scientific & local knowledge (social learning processes)

- "Ecological intensification" might emerge as an interesting option
  for sustainable biomass production and for food security of poor farming families,
  provided institutional and technological lock-in situations can be overcome

- Need to reframe the usual yield/area dilemma & the production/protection divide
  - city/countryside <=> urban & peri-urban agriculture…
  - forest/agriculture <=> agro-forestry, agro-ecology…
  - "high yield - land sparing" (*humans outside the nature*)
    <=> "wildlife-friendly farming" (*humans into the nature*) (Green & al, 2004)
  - …

→ Which renewed technological patterns ?
- how to think outside conventional boundaries ?
- which organizational/institutional breakthroughs ?

To follow up…

- Need to debate food and agriculture scenarios
  at various regional levels (…with various stakeholders)

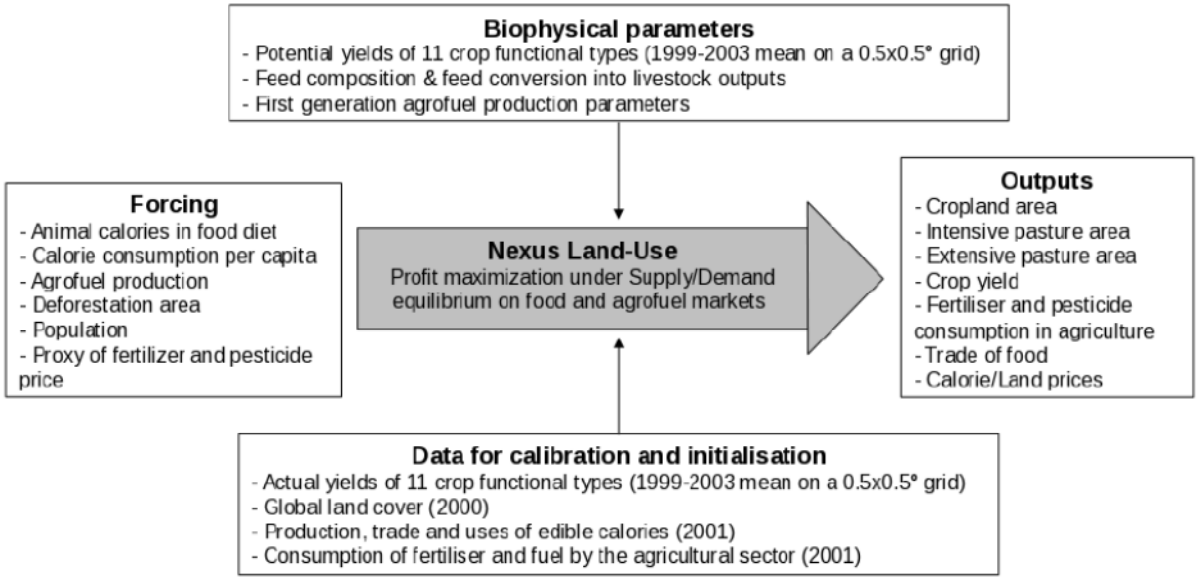
- Need to involve a large set of actors, stakeholders …and academic disciplines into food production,
  food security, food safety and food quality issues!

- Need to better simulate
  - economic markets / regulations
  - induced consumptions of fossil fuel, water…
  - GHG emissions/sinks (C, CO_2, CH_4, N_2O…)
  - regional employments / incomes / migrations
  - …/… and biodiversity ?

- …/…

at CIRED-CIRAD :

The ‘Nexus Land-Use’ model



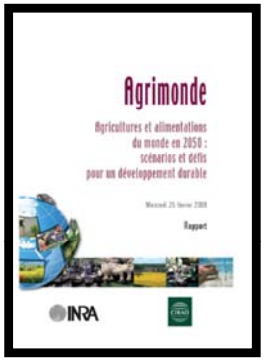
Agrimonde materials available on the web & elsewhere

http://www.cirad.fr/actualites/toutes-les-actualites/articles/2009/science/resultats-de-la-prospective-agrimonde
http://www.inra.fr/l_institut/prospective/agrimonde
http://www.inra.fr/audiovisuel/web_tv/la_vie_de_l_inra/conf_presse

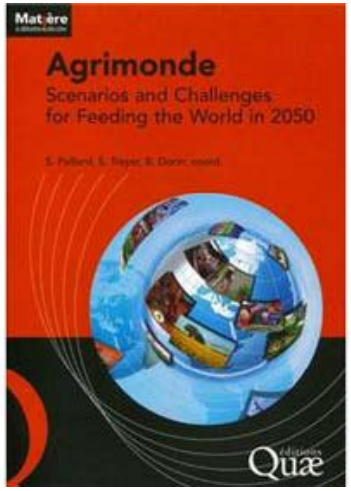
Preliminary results
8 pages brochure
May 2008

FR & EN

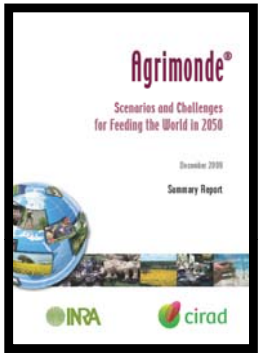
REPORT
200 pages
Feb. 2009



BOOKS
FR (2010) & EN (2011)



SUMMARY REPORT
32 pages
June, December 2009



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BROCHURE
12 pages
Oct 2009

FR only

VIDEOS
Presentations & debates
Feb,Oct 2009, Jan 2011

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