

# ***Innovating in the animal sector for a food secure world***

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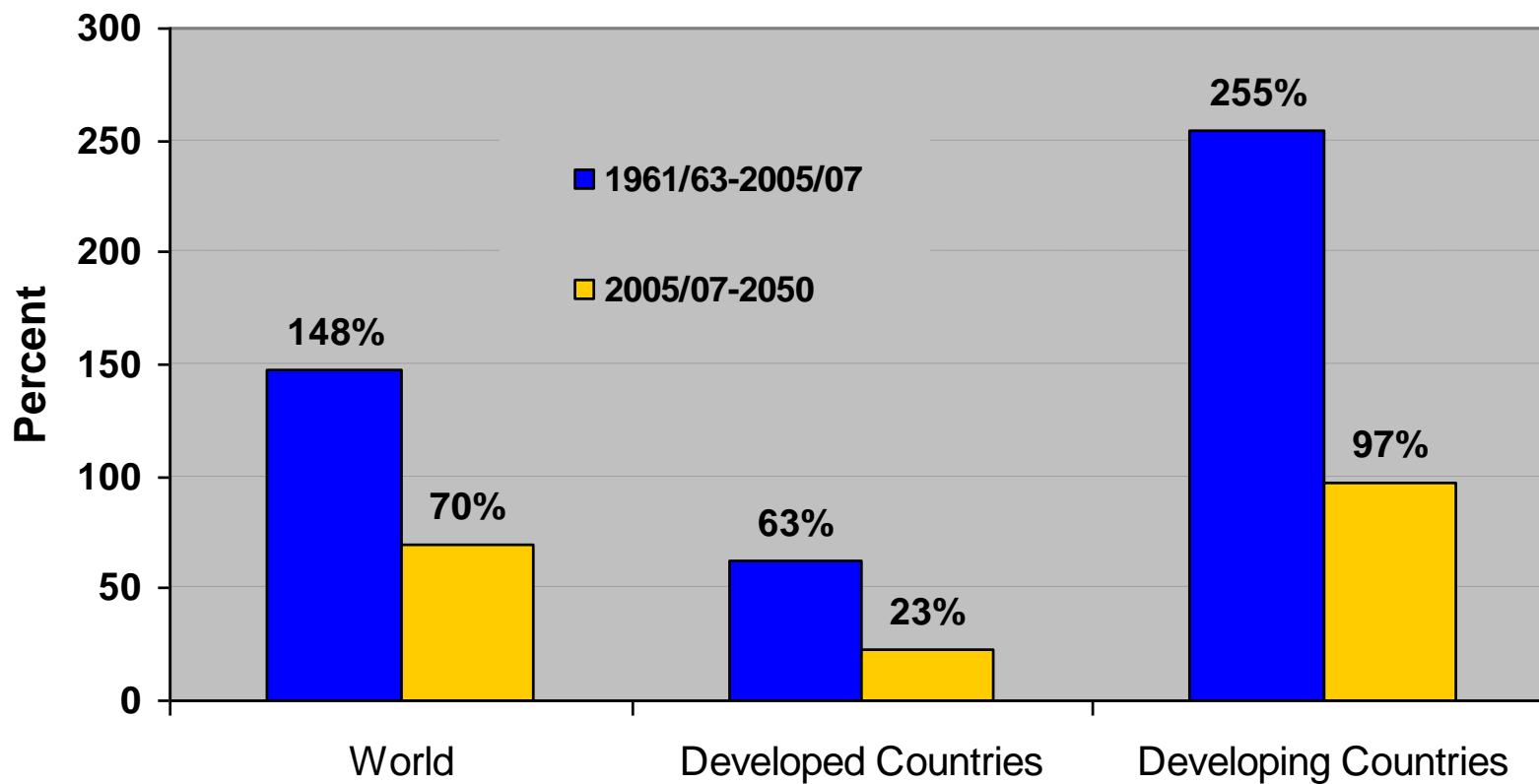
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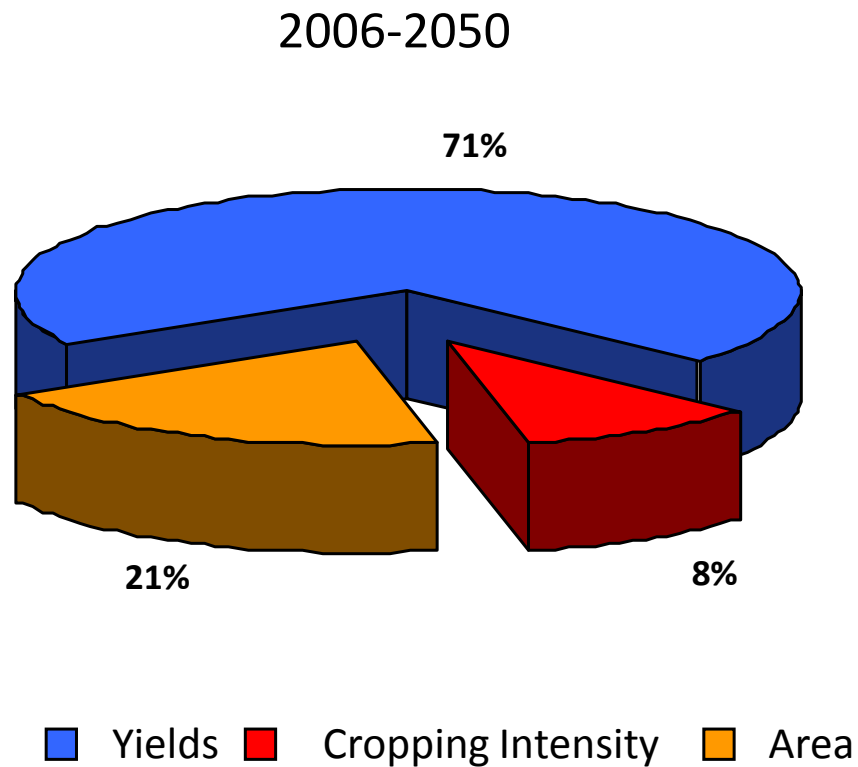
Animal Task Force, Putting the “i” in livestock – innovating for a productive and sustainable livestock sector  
Brussels, November 5<sup>th</sup>, 2014

## FAO Outlook to 2050 (2009) : production increase

### Growth in Agricultural Output Past and Future



## Sources of growth for the future in developing countries



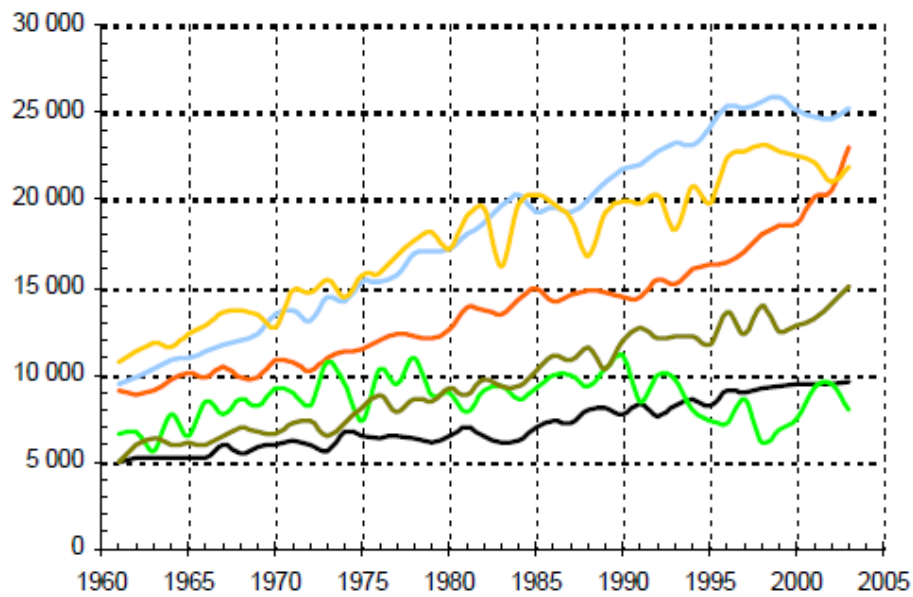
Source: Global Perspective Studies Unit, FAO

## Highest land productivity in ASIA

Note : 10 000 kcal =  
 ~ 2.4 kg of soybean  
 ~ 2.8 kg of rice milled  
 ~ 2.9 kg of pea  
 ~ 3.0 kg of wheat  
 ~ 15.0 kg of potato  
 ~ 58.8 kg of tomato

— SSA  
 — LAM  
 — ASIA  
 — FSU  
 — MENA  
 — OECD

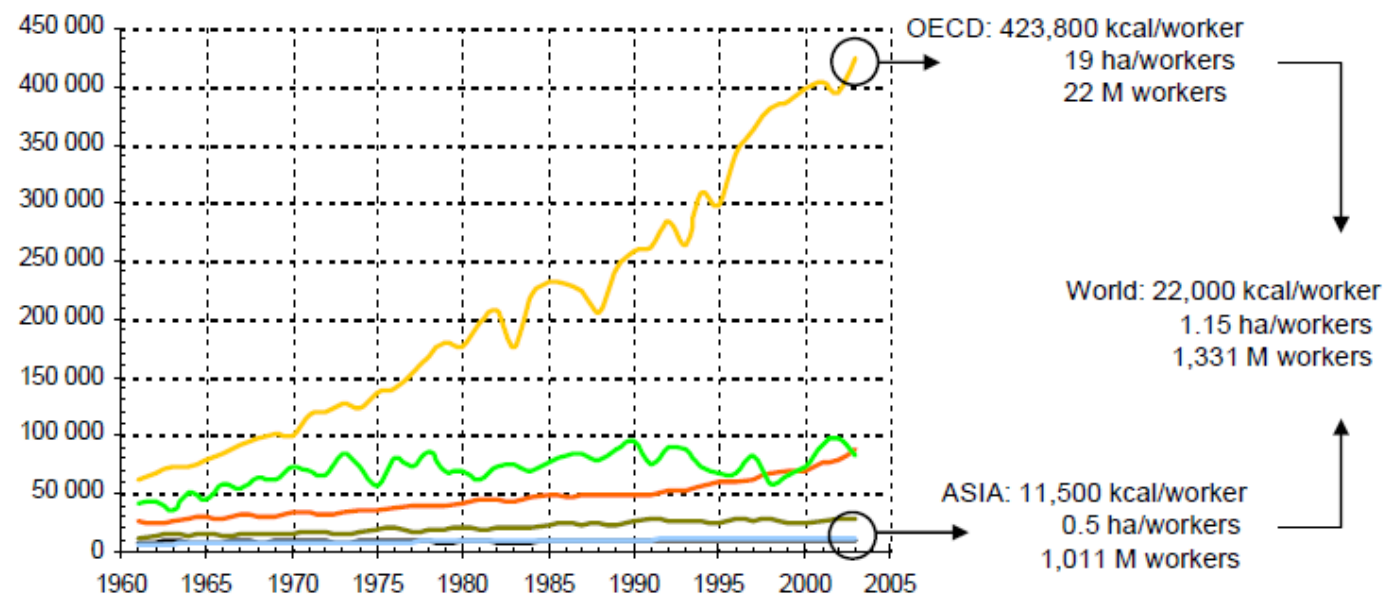
Vegetal kcal / day / cultivated hectare



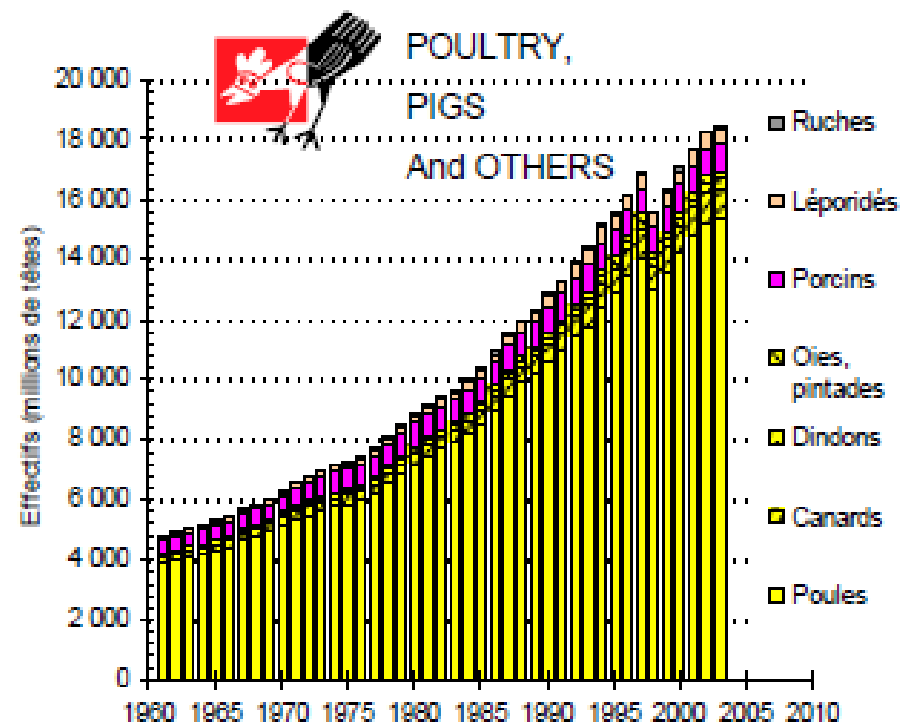
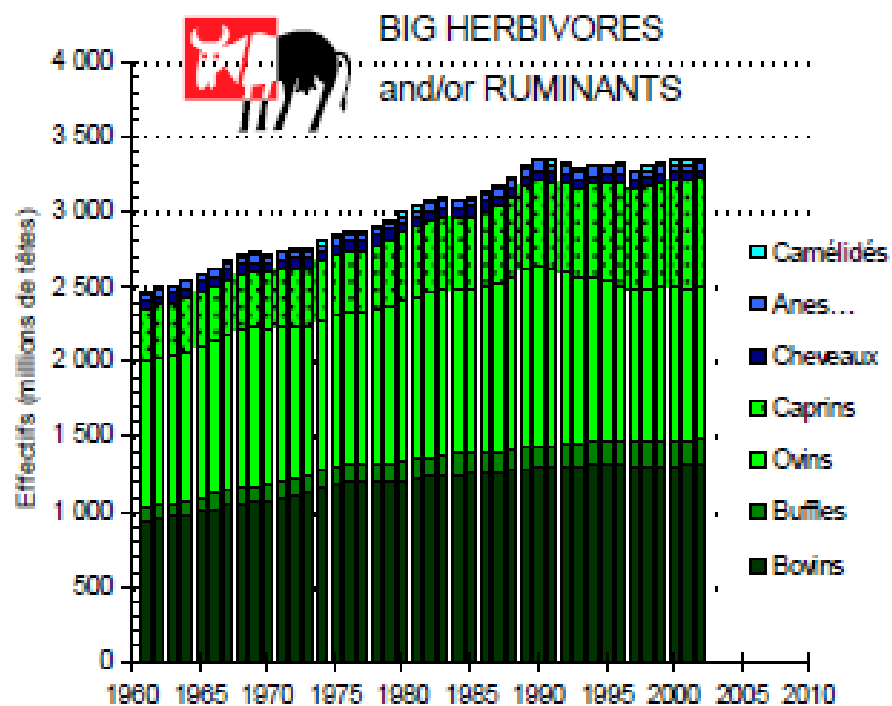
Source : Dorin out of FAO data

## A labour productivity boom in OECD

Vegetal kcal / day / agricultural worker



# Reintroducing animal production in global balances

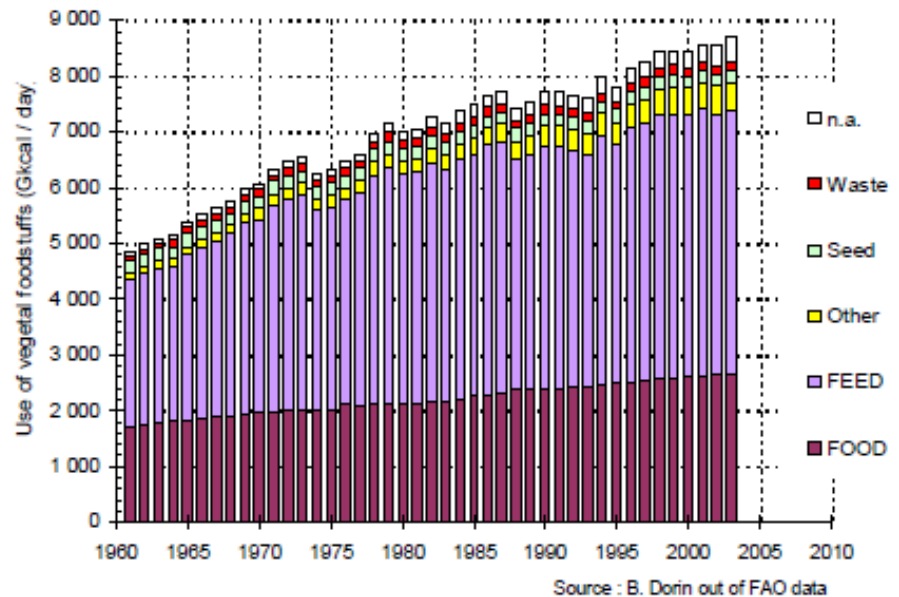


Dorin et al., 2009

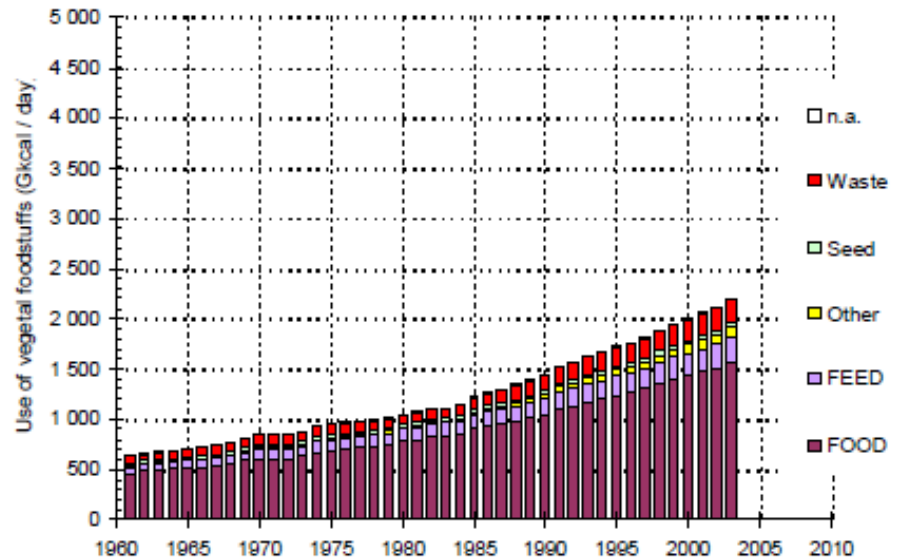
## Differences in feed and food use of cereals

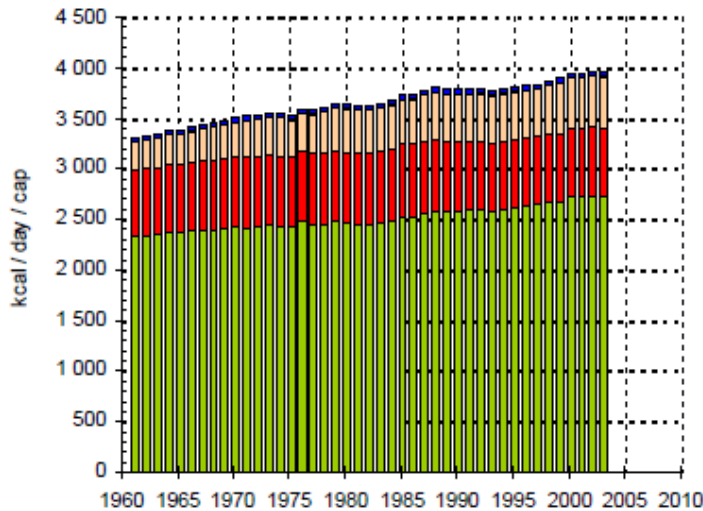
## The cerealisation of livestock ?

Dorin et al., 2009



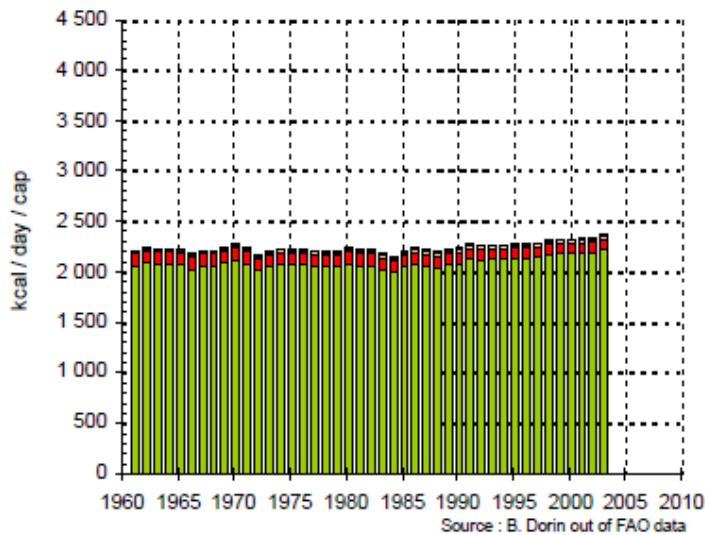
( in 2003, the OECD cattle ate 3 times as much foodstuff as the SSA human population did )





## OECD

- Animal proteins :  
71 g / day on 125 (60%)
- Animal fats :  
89 g / day on 165 (55%)



Dorin et al., 2009

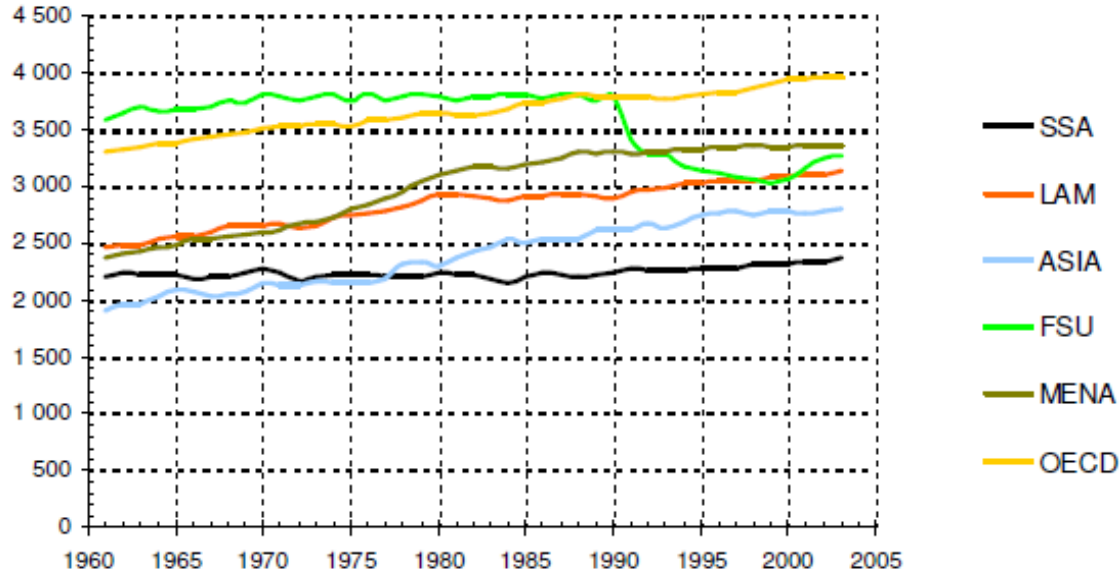
## Sub-Saharan Africa

- Animal proteins :  
12 on 60 g / day (20%)
- Animal fats :  
10 on 48 g / jour (20%)

Source : B. Dorin out of FAO data

Figure 10 : Calories alimentaires disponibles pour l'alimentation (1961-2003)

kcal/jour/hab.

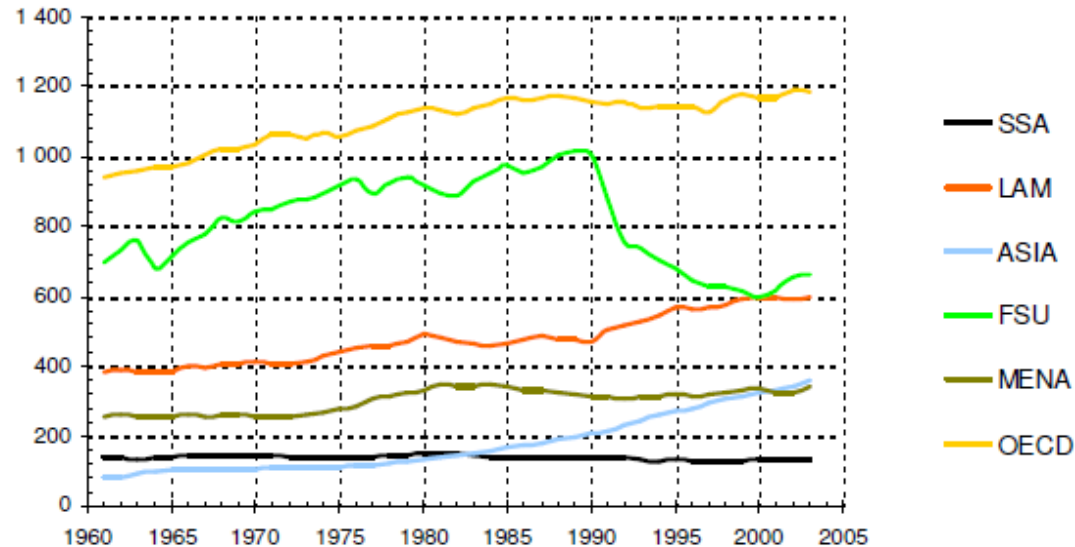


**Total calories available per capita**

Dorin et al., 2009

Figure 11 : Calories alimentaires animales disponibles pour l'alimentation (1961-2003)

kcal/jour/hab.



**Calories of animal origin available per capita**

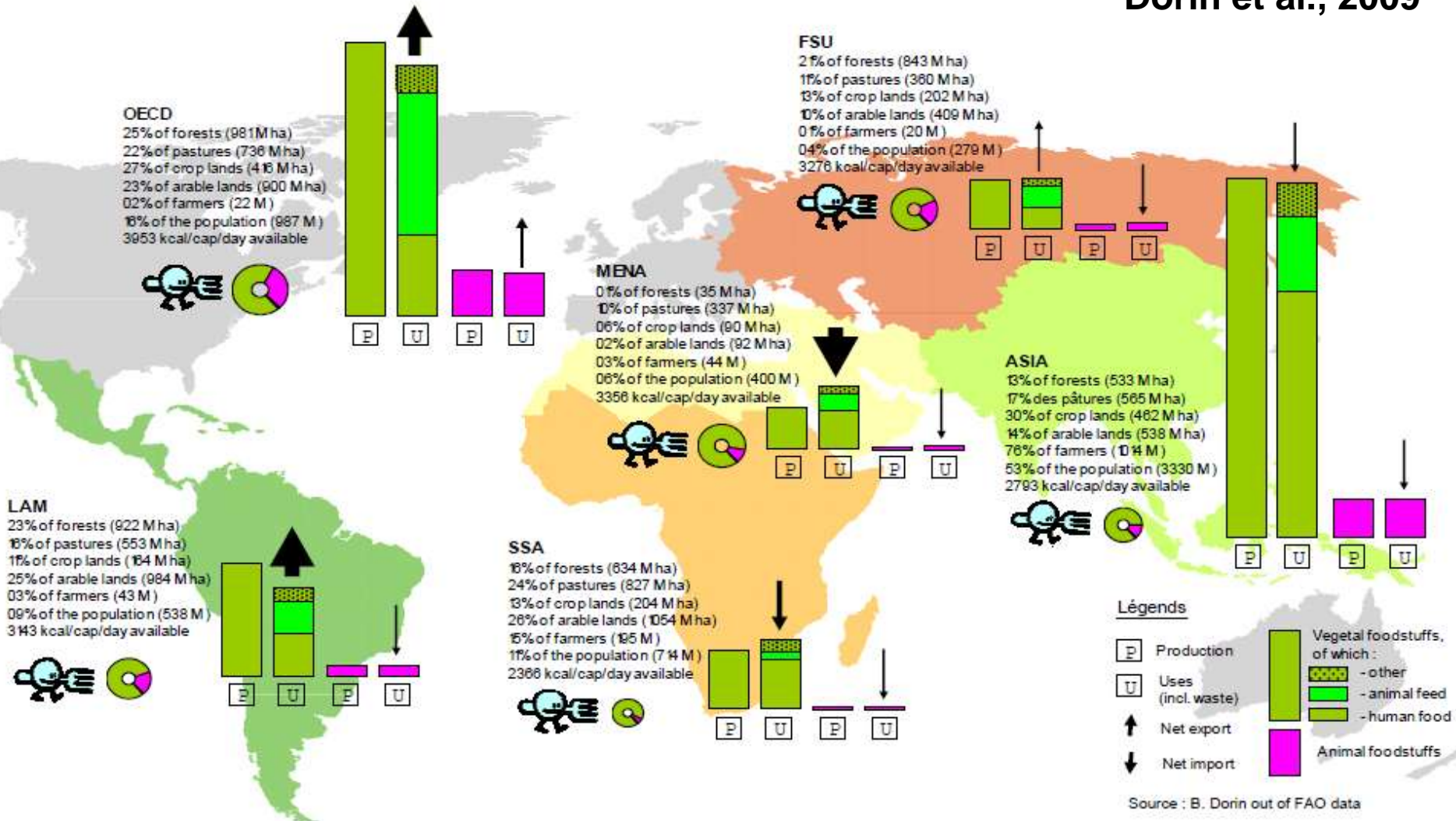


# Agrimonde: animal products and feed in global balances

## Resources, productions, trade and uses of food biomasses (2003)

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

Dorin et al., 2009





## SCAR Foresight Expert Group 3 Report, Février 2011

# “Sustainable Food Consumption and Production in a Resource-Constrained World”

**Annette Freibauer** (chair) (D) - Head of Emission Inventories Group, Institute of Agricultural Climate Research, von Thünen-Institute

**Erik Mathijs** (rapporteur) (BE) – Katholieke Universiteit Leuven

**Gianluca Brunori** (IT) - University of Pisa – Department of Agronomy and Management of Agro-Ecosystems

**Zoya Damianova** (BU) - Programme Director Innovation Programme - Applied Research and Communications Fund

**Elie Faroult** (F) - International Consultant, Brussels

**Joan Girona i Gomis** (SP) - Director Irrigation Technology IRTA

**Lance O’Brien** (IRL) - Head Foresight and Strategy Development, Teagasc

**Sébastien Treyer** (F) - Directeur des programmes, Institut du développement durable et des relations internationales IDDRI

[http://ec.europa.eu/research/agriculture/scar/pdf/scar\\_feg3\\_final\\_report\\_01\\_02\\_2011.pdf](http://ec.europa.eu/research/agriculture/scar/pdf/scar_feg3_final_report_01_02_2011.pdf)

# « The Anthropocene » : rethinking scarcities, productivity and sustainability ?

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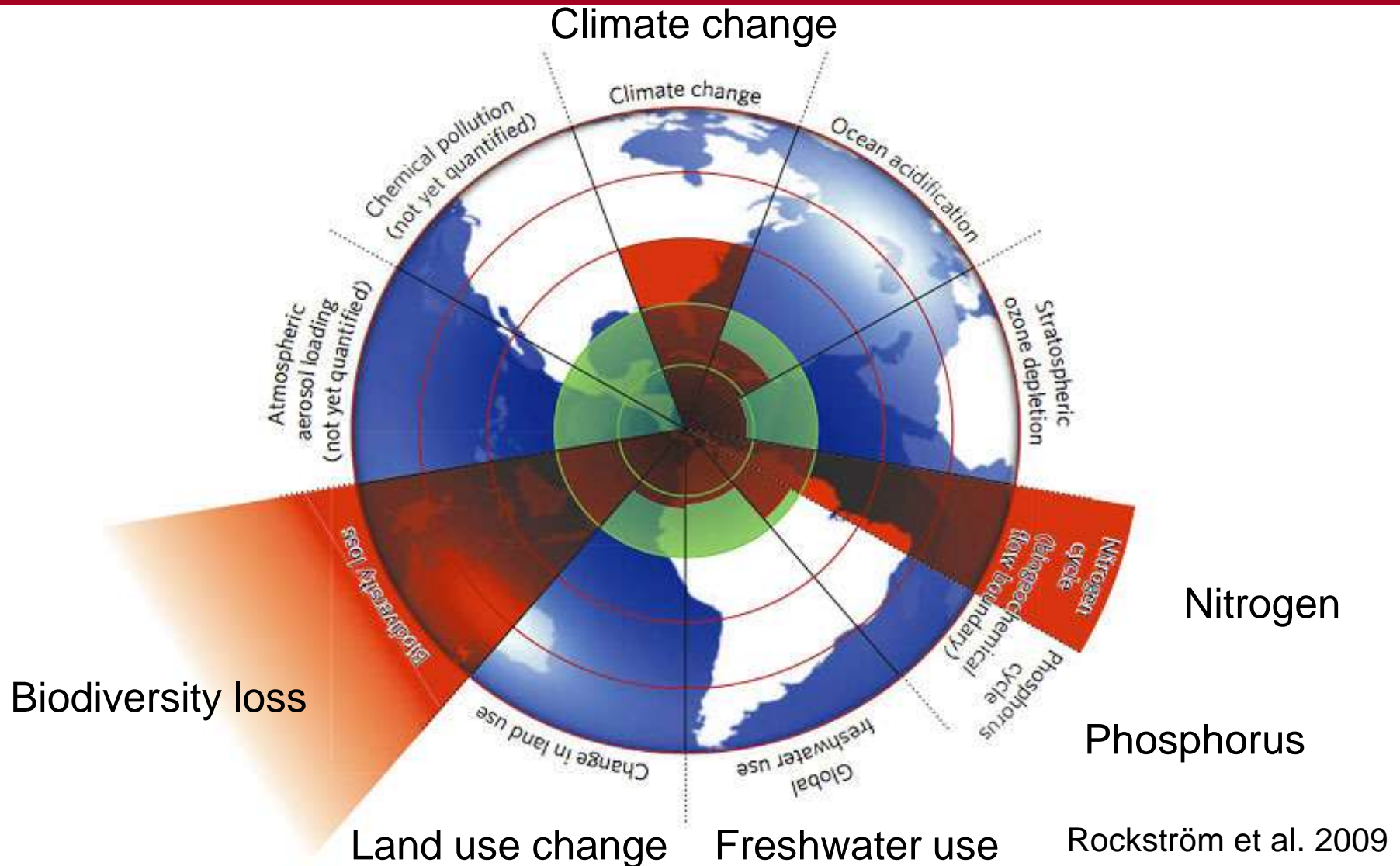
The Anthropocene, an era of global changes

- Environmental, social and institutional changes interconnected
  - Changes of a new quality and magnitude
    - Feedbacks amplify uncertainty and risks and a new amplitude
  - A new speed of changes
    - Time to prepare and act has become a scarcity as well
- Interlinked crises in governance (financial, political, economic, social, envtal) + changes in powers : emerging powers and least developed economies also hit by the crisis
- Efforts towards international coordination, but also domestic changes (climate mitigation, biodiversity,...) are insufficient with respect to the challenge
- Degradation of ecosystems and biodiversity continues

Svedin 2009, Rockström et al. 2009

# “Planetary boundaries: A safe operating space for humanity”

## A question of rapidity and magnitude of changes



# Facing long term challenges – two different narratives

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**Narrative:** discourse based on a coherent set of assumptions and principles underpinning and communicating a certain worldview

Levidow (2008):

- descriptive accounts: claims about objective reality as threats, opportunities and imperatives
- normative accounts: claims about necessary or desirable responses to that objective reality
- policy instruments for carrying out those responses

*“Regardless of its stated aims, a dominant narrative succeeds in the normative sense of gaining resources and power, while pre-empting alternative futures”*

**Making narratives more explicit is necessary to be able to think of alternative futures**

# The *Productivity* Narrative

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- *The problem* - World population 9.2 billion in 2050 - **agricultural productivity slowing down** - rising income levels shift diets to more protein rich food and will increase energy demand - serious threat that food demand will not be met - hunger and political instability - resource constraints and climate change limit the world's capacity to expand food production.
- *The solution* - Scientific advances have the potential to bring forward varieties, breeds and technologies that **boost productivity (of land, of animals...)** and take into account resource scarcities and environmental problems - **massive investments into R&D unleash the innovation potential** -removal of barriers to adoption by farmers, such as infrastructure, trade barriers and access to markets.

# The *Sufficiency* Narrative

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- *The problem* - World population 9.2 billion people in 2050 - dramatic environmental problems - **no Earth capacity to support consumption - current food systems produce waste and overconsumption** - mass health problems - destruction of important ecosystems will have dramatic feedback effects that undermine the foundations of our food systems - more poverty and conflict.
- *The solution* - Scientific advances have the potential to bring forward and **design agro-ecosystems** that are both productive, respectful for ecosystems and resource saving - **demand increases need to be mitigated through behavioural change and changes in business models** - environmental externalities need to be internalized in markets - appropriate governance structures that address disruptive effect of trade.

# Sufficiency – an incentive to reshape innovation pathways

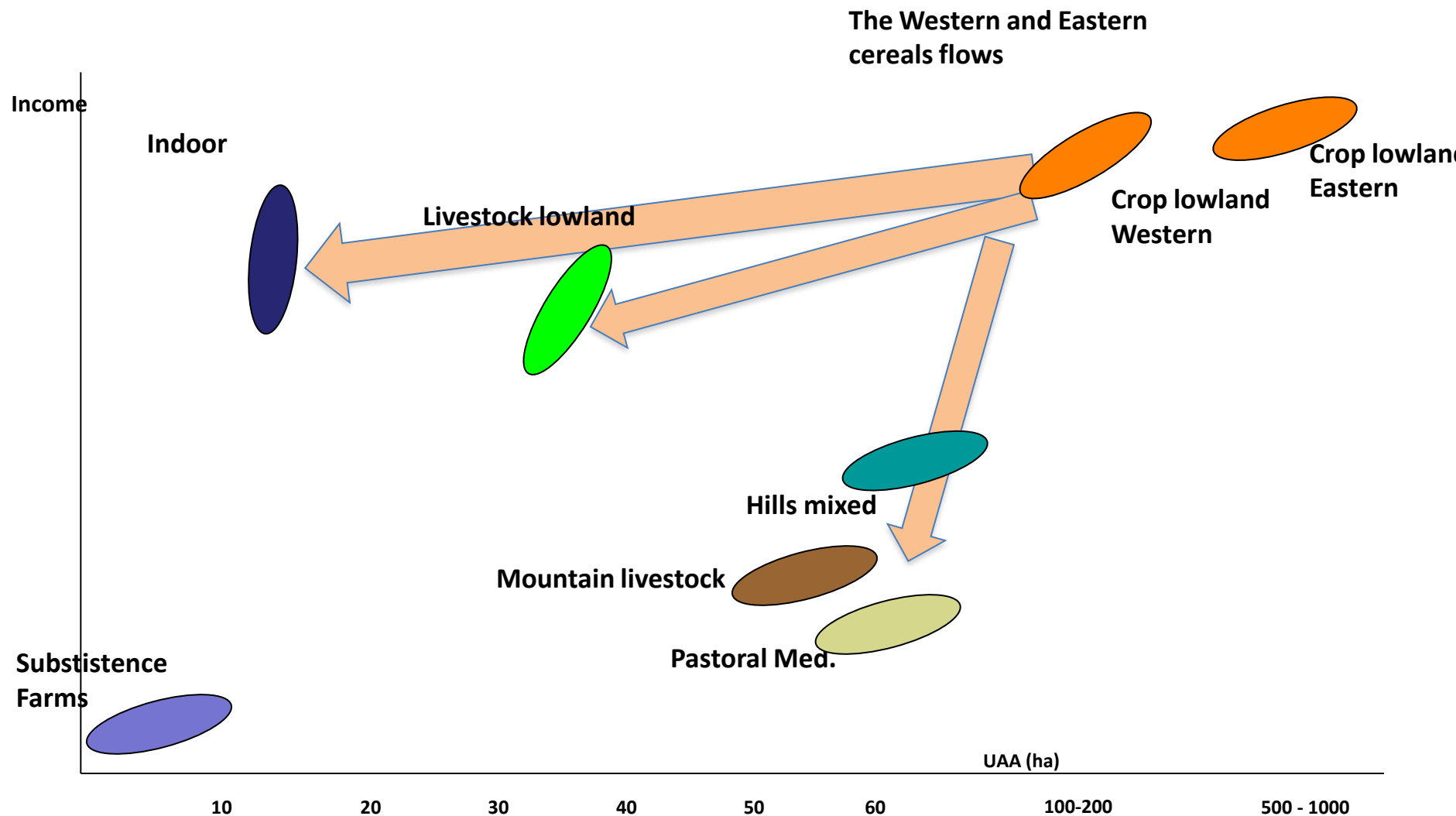
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- Consumption patterns
- Consumption behaviours and marketing strategies
- Business models
- Innovation at the scale of the systems – processes/value chain
- Animal production systems and their trends
- Economies of scale vs. economies of scope
- Diversification vs. standardisation



# What scale of systems : the scale of European Agriculture

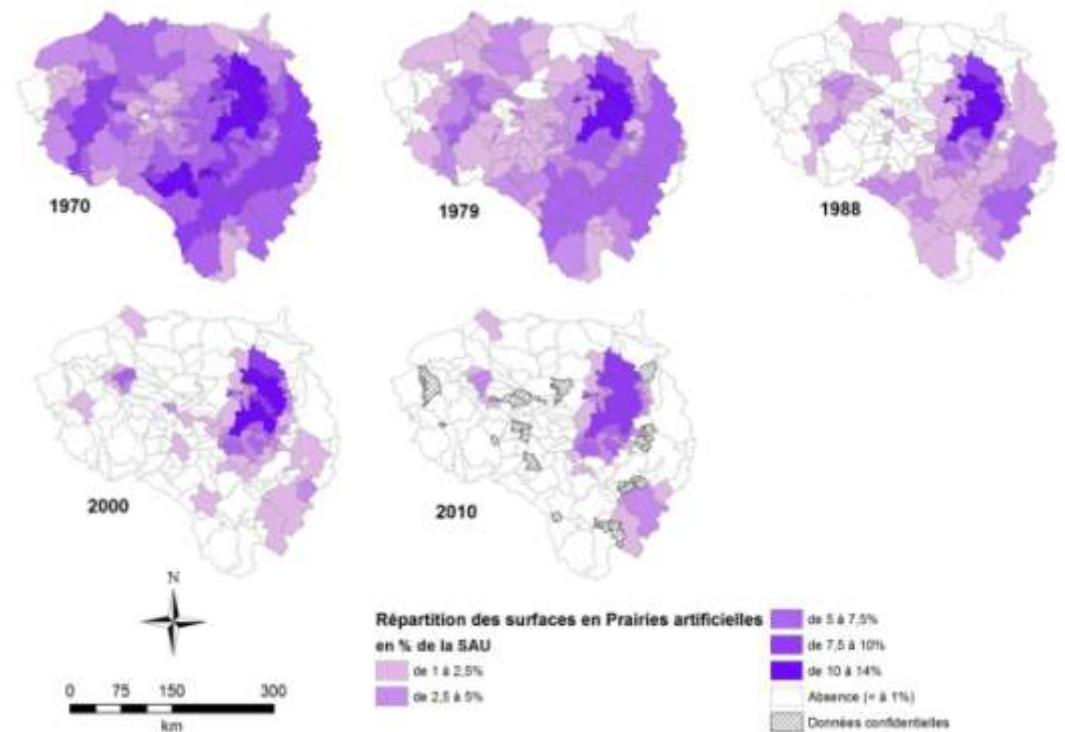
## Feed flows as central features (Xavier Poux, 2012)



# Seine river basin : cropping systems are always more specialised and simplified

Meynard, et al. (2013)

- Regional specialisation: large cropping regions
- Livestock and mixed livestock/cropping are receding
- Areas in wheat, maize, rapeseed; legumes are receding
- Crop rotations always shorter



Proportion of managed meadows



**Brésil. Araentine**  
20 000 - 35 000 km<sup>2</sup> SAU

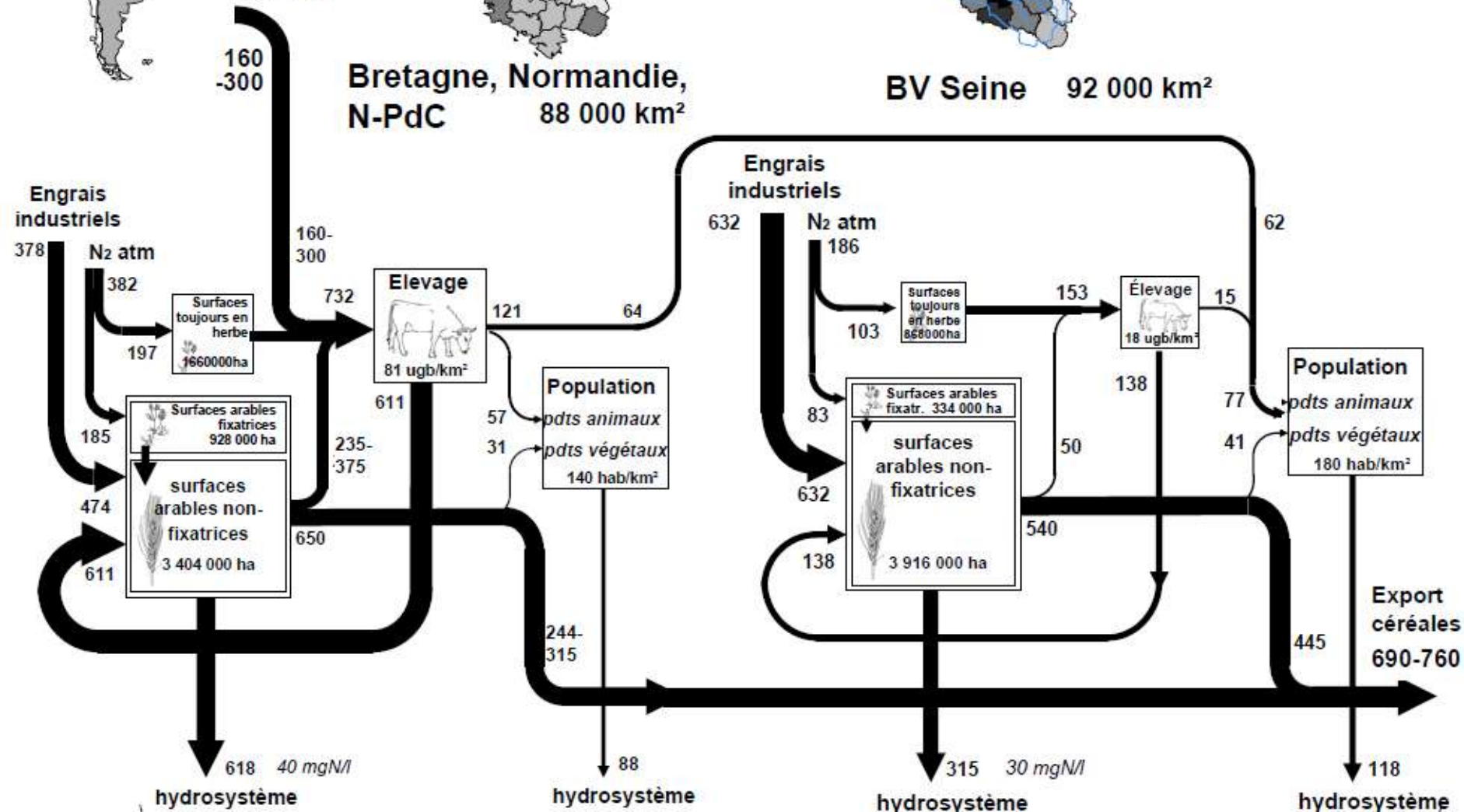
Import  
aliments  
du bétail



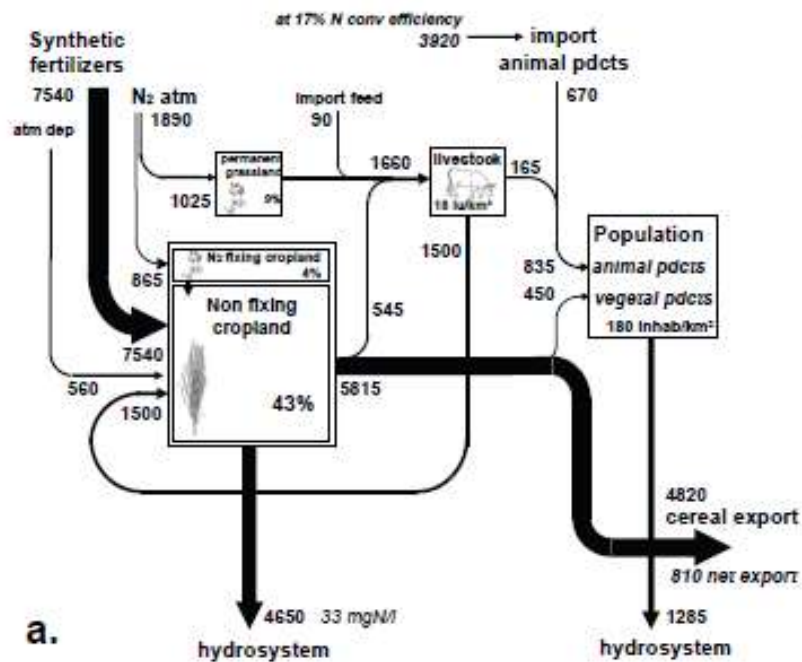
**Bretagne, Normandie,  
N-PdC** 88 000 km<sup>2</sup>



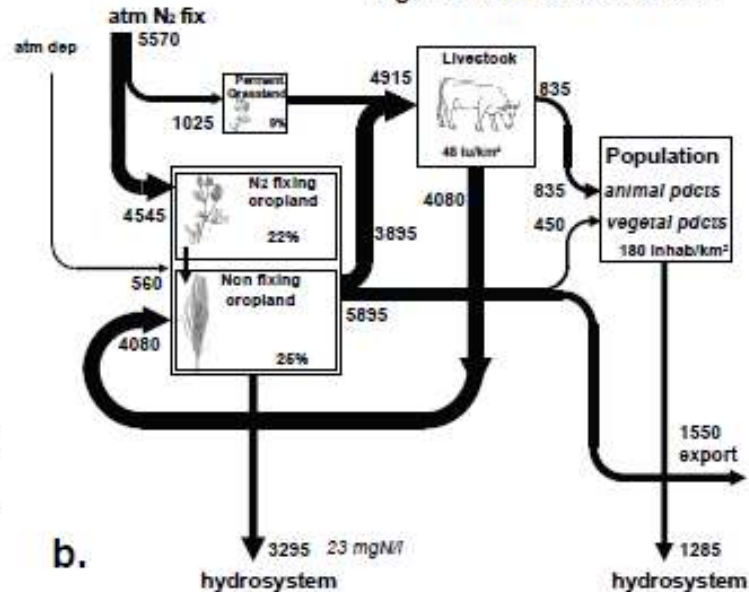
**BV Seine** 92 000 km<sup>2</sup>



### Current (2006) situation



### Organic and Local scenario



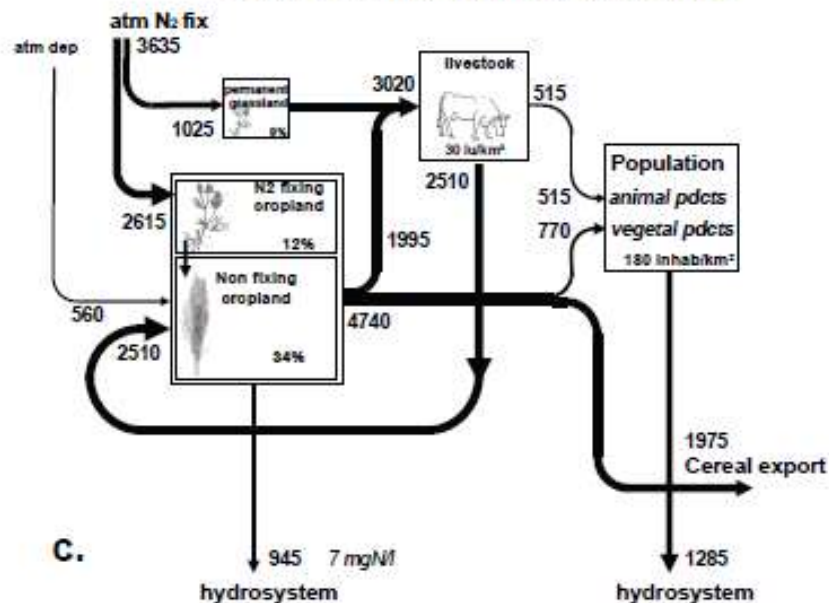
### Seine watershed (92000 km<sup>2</sup>)

Fluxes in kgN/km<sup>2</sup>/yr



Billen, Garnier, Lassaletta, 2013

### Organic, Local and Demitarian scenario



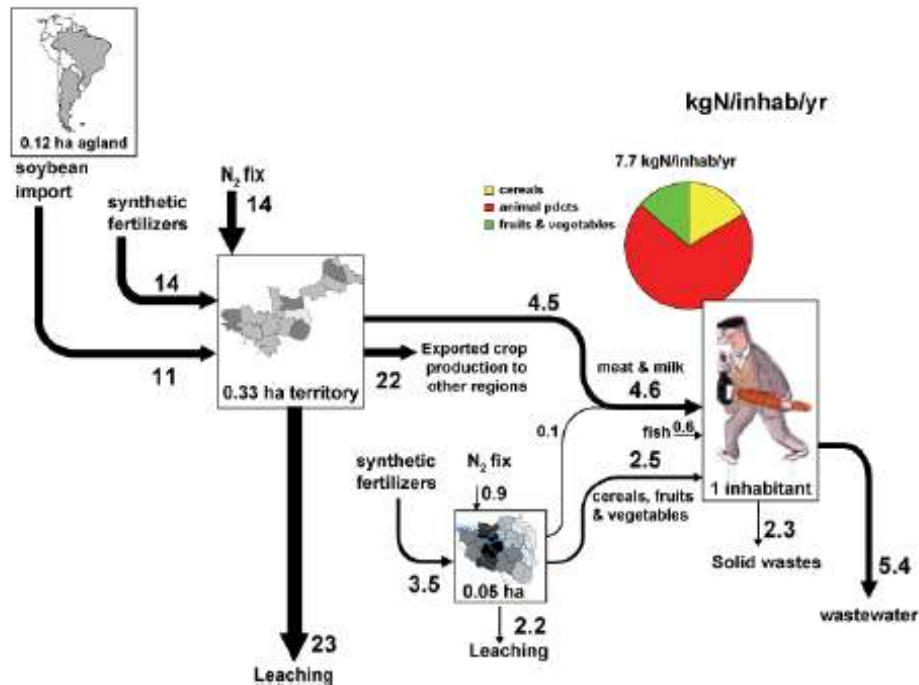


Fig. 1. Schematic representation of the nitrogen imprint of the food supply of one Paris inhabitant. Nitrogen fluxes involved are expressed in  $\text{kg N inhab}^{-1} \text{ yr}^{-1}$ . The figures are derived from the description established in Billen et al. (2011).

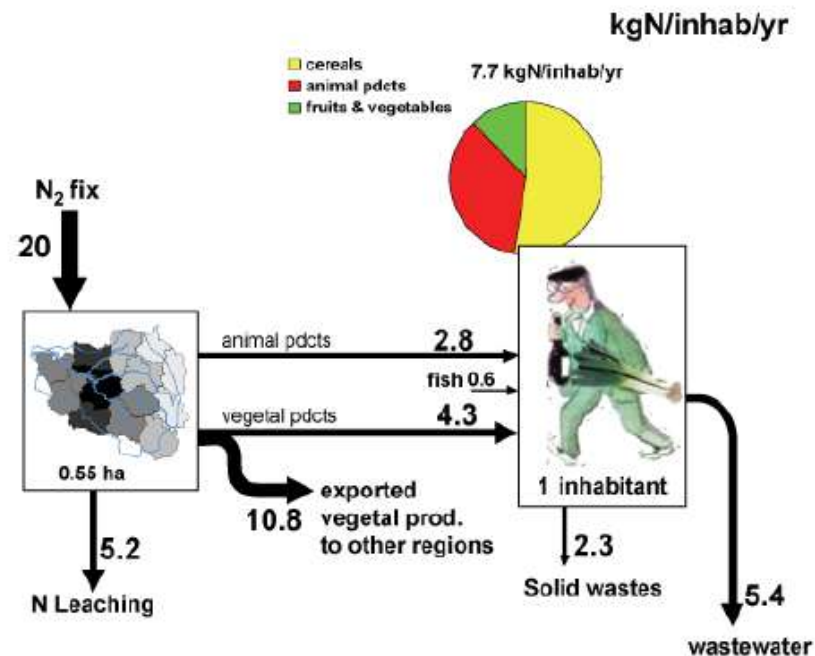


Fig. 6. Schematic representation of the nitrogen imprint of the food supply of one Paris inhabitant in the organic-local-demitarian scenario. The nitrogen fluxes involved are expressed in  $\text{kg N inhab}^{-1} \text{ yr}^{-1}$ .

Billen et al., 2012

# Productivity, sustainability : what performance criteria ?

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- What productivity ?
  - Per animal, per ha, per worker,...
- What performances : biomass, energy, C, N, biodiversity...
- What scale ?
  - Organisms
  - Production systems, ecosystems, landscapes
  - Supply chains
  - Europe's food system
  - ...
- *Do we know how to design an innovation process that maximizes on more than one performance indicator ?*
- *Intensification and sustainable future of extensive systems*
- *Can we deal with diversity/diversification vs. economies of scale ?*

# What innovations are needed ?

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- A diversified portfolio, to explore all types of changes and innovations
- ***Productivity centred eco-innovation***
  - keeping the same system,
  - maximising output per unit of input, mainly technological
    - A resource scarcity paradigm
- ***System-scale eco-innovation***
  - capacity to change products, rediversify
  - adapt to a diversity of shocks and changes, resilience
  - « productive ecosystems » with multiple performance objectives
  - dynamic ecosystems, piloted rather than optimised

## Diversified innovation approaches

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- Co-design of innovative systems with technical institutes, farmers associations, cooperatives , processing industries, stakeholders
- Co-design of multiple performance criteria and evaluation frameworks
  
- Agroecological and organisational innovations
- Designing new innovation processes, socio-technical innovation
- Supporting changes and transitions
- Exploring innovative business models



# Example of a strategic research agenda

## SUSFOOD ERA Net : vision, objectives and challenges

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- Increasing food production sustainably / sustainability of the food chain
- Quality, traceability and safety
- Improved access to food and healthy diets
- Resilience of the food chain
- More sustainable consumption behaviour
- Competitiveness of the agrifood sector, green economic growth, jobs
- *How can food demand be managed ? Re-design of the whole system of processes, markets, and products*

### ***Sustainable food system :***

*supports **food security**, makes optimal use of **natural and human resources**, respects **biodiversity and ecosystems** for present and future generations, is **culturally acceptable and accessible**, **environmentally sound** and **economically fair and viable**, provides consumer w/ **nutritionally adequate, safe, healthy and affordable food***

# SUSFOOD ERA Net : 8 key research areas

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1. **Public policy** coherence *and transition policies*
2. Innovation in **food processing** technologies : *flexibility to use diversified variable raw materials*
3. **Redesign** input, waste and side flow **strategies** to increase **resource efficiency** and provide added value in food products and processing, manufacture etc.
4. **Interdisciplinary** research approach to innovation of food products and use of **new raw materials** for food products
5. Harmonisation of the methods and metrics for **integrated assessment of sustainability** of food products and food patterns : *and simulation of alternative food systems*
6. Connection between **stakeholders and food systems**, *and new business models*
7. Understanding **consumer behaviour** and food choices : *and role of marketing*
8. Integration of **information systems** for personalized and sustainable **choices**

# Merci pour votre attention

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