Nitrogen management and policies in agriculture of Africa, China and Europe

Jan Peter Lesschen, Zhang Weifeng, Yuxuan Li & Oene Oenema

Wageningen University, Alterra, The Netherlands

China Agricultural University, Beijing

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Outline

- Introduction:
  - Challenges of agriculture
  - Agricultural markets
  - Governmental support
- Comparison of Africa, China and EU-27
- Governmental policies in Africa, China and EU-27
- Some final remarks and conclusions

Background

- Agriculture is large user of fertilizer N
- Regions with too little and others with too much N

- Most countries support agriculture directly and/or indirectly
- Some countries support fertilizer use
- Some countries with too much N, regulate N use

- Purpose of this talk: '*shed some light on the issue*'

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Challenges for agriculture

- How to secure the supply of nutritional and safe food?
- How to guarantee farmers' income
- How to improve resource use efficiency?
- How to minimize nutrient losses?
- How to control animal diseases?
- How to safeguard animal welfare?
- ……
- How to involve all farmers (hundreds of millions)

Central question

- **Are markets and private initiatives sufficient to satisfy societal needs related to food production?**

- Common view: public policy and support needed to:
  - Secure the steady supply of nutritional, safe food
  - Protect markets and secure farmer's income
  - Stimulate innovation
  - Regulate production methods

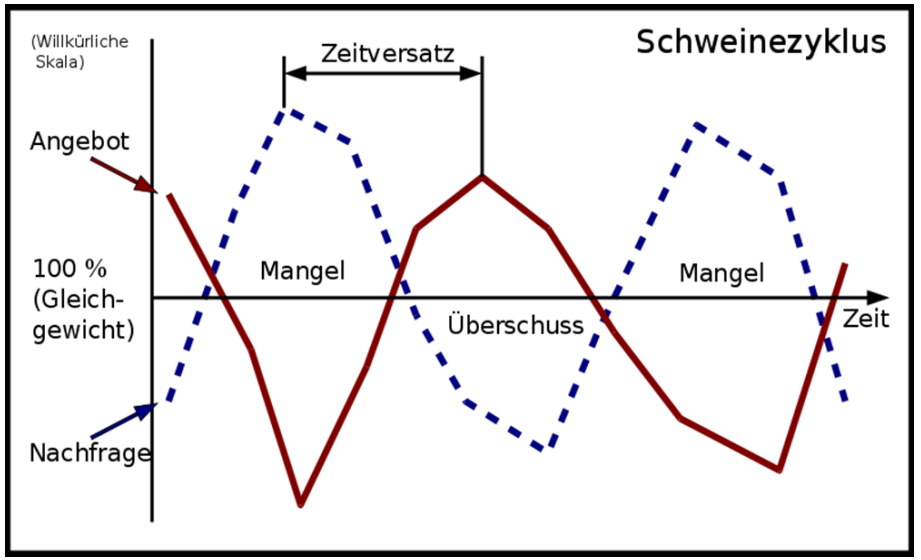
- Strong debate about instruments, effectiveness and efficiency, especially related also to N use and management

Nature of agricultural markets

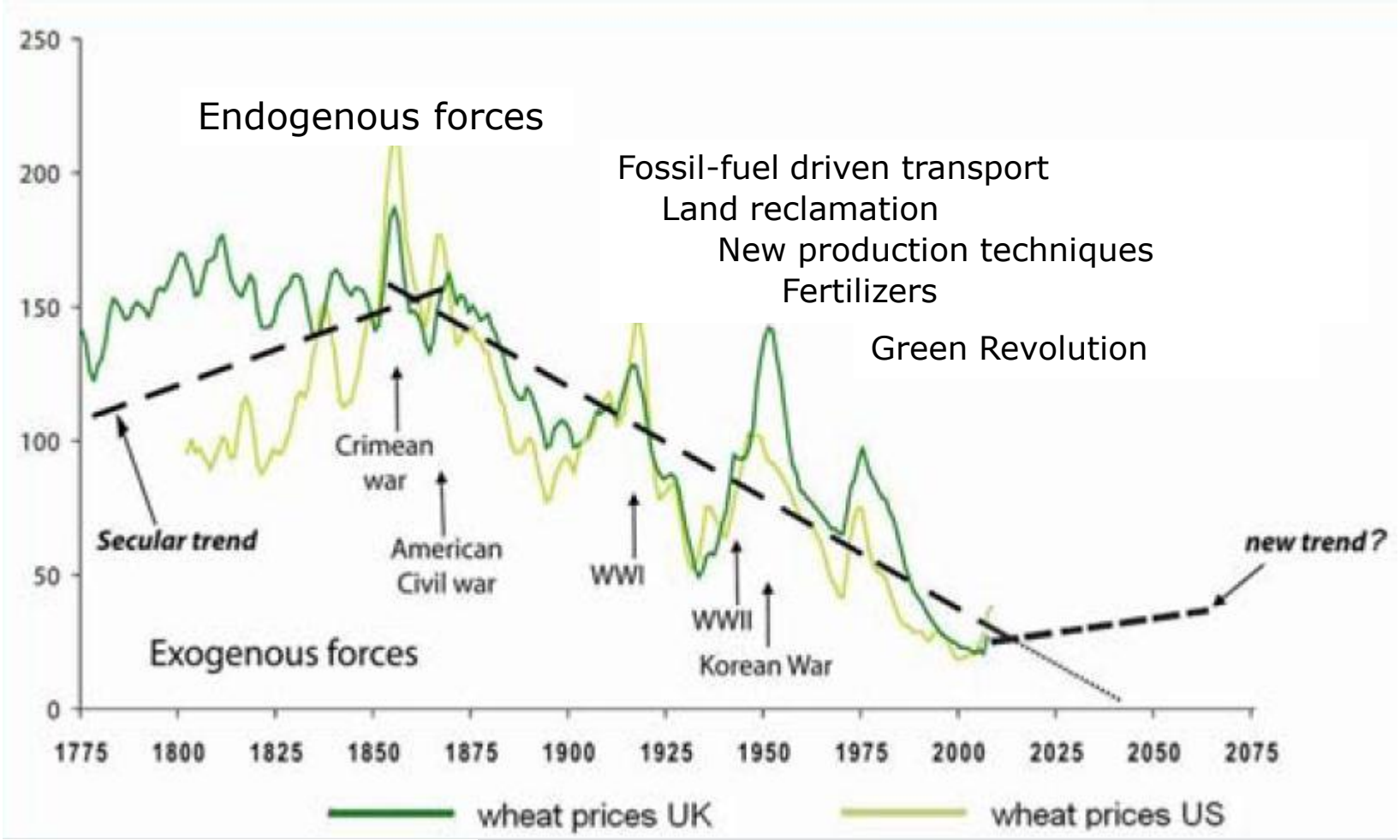
Prone to strong price instability

- Demand and short-term supply are price-inelastic;
- Production vulnerable to climate, wars, diseases, etc.
- Shortsighted expectations cause endogenous price fluctuations;
- Slows down investments and innovations

Pig cycle



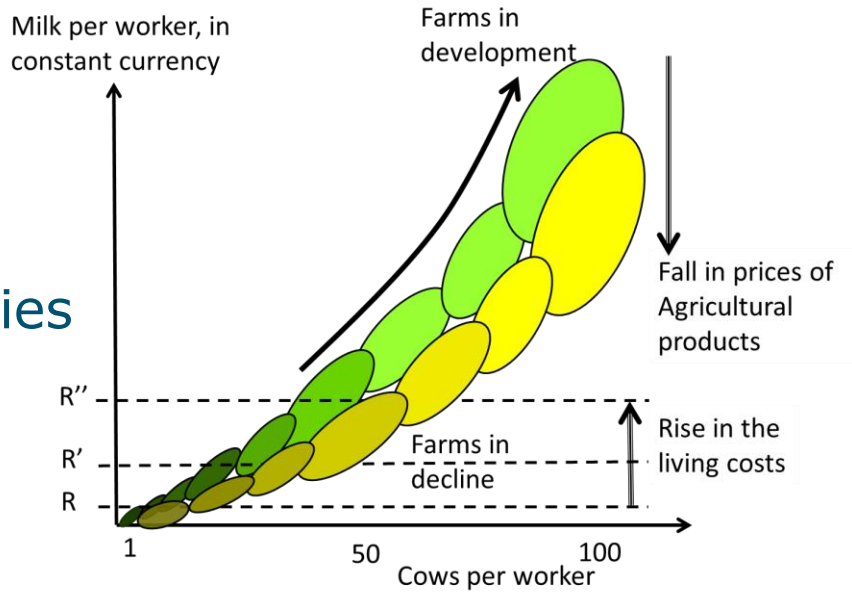
Long-term falling prices of agricultural products, following the development of modern agricultural sciences, puts farmers' income under pressure



Koning et al., 2008

Implications of globalization of markets

- Price of global food commodities is determined by production systems which have the lowest costs.
  - Economics of specialization
  - Economics of intensification
  - Economics of up-scaling
- Farmers in Africa, China, EU and US 'compete' on global markets
- Increasing debates:
  - WTO
  - Governmental support policies
  - Regional markets



Brief history of policies in food production

- Basically, as long as there are people, but focus has shifted:
    1. Food security (from the beginning)
    2. Food safety (from the beginning)
    3. Market competiveness (from end 19th century)
    4. Food quality (from 20th century onwards)
    5. Environmental side-effects (from 1985 onwards
    6. Other functions of the rural area (landscape, biodiversity, water management (from 1990s)

Development of governmental **support** policy

- From 1880s: European Countries
- From 1930s: other OECD countries
- From 1950s: many Asian countries
- From 1960s: Africa, but....

Purpose: to stimulate production, stabilise prices and support domestic farm income

Effects: - Rapid agricultural development & rapid economic growth;

- Distorted world market prices through dumping
- Poor countries unable to support see agriculture stagnate

Governmental support policies

- Development of knowledge infrastructure
  - Promote education
  - Promote agricultural research
  - Promote extension services
- Development of markets
  - Price support
  - Import restrictions
- Support physical infrastructure and production technology
  - Land reclamation, irrigation, drainage, etc.
  - Subsidies on inputs

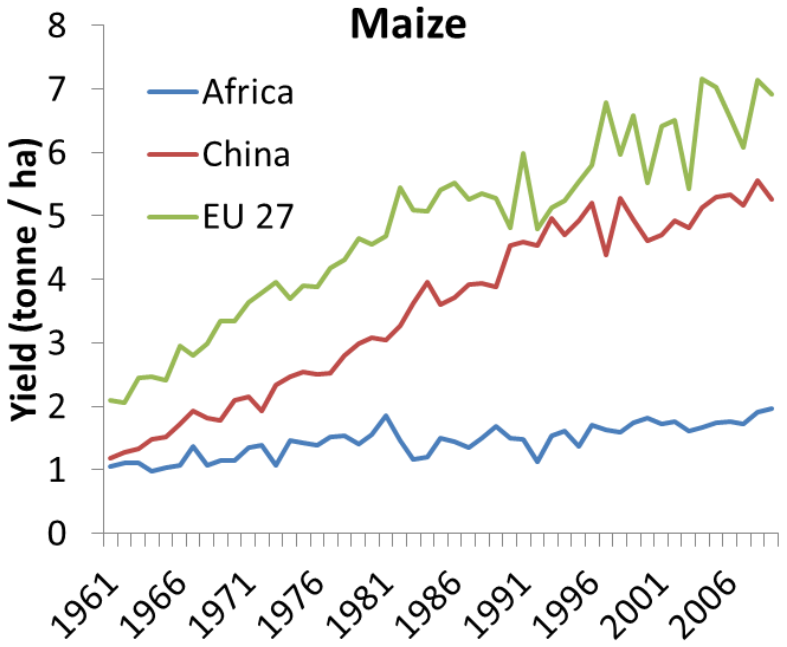
Agriculture in Africa, China and EU-27

Characteristics	Africa	China	EU-27
Type of agriculture	Low input	High input	Regulated
People working in agriculture	~60%	~50%	5%
Number of farmers (millions)	~100	~200	15
Land ownership	unclear	government	~private
Variability in soil fertility	large	modest	modest
Nutrient constraints	multiple	~NPK	~N(.K)
Price ratio fertilizer/product	high	low	low
Area of wheat+maize+rice	< 40%	>60%	>40%
People undernourished	20-40%	<5%	<1%

Sources: FAOSTAT, 2013;
Voortman, 2010;
IAC, 2004

Yield gaps

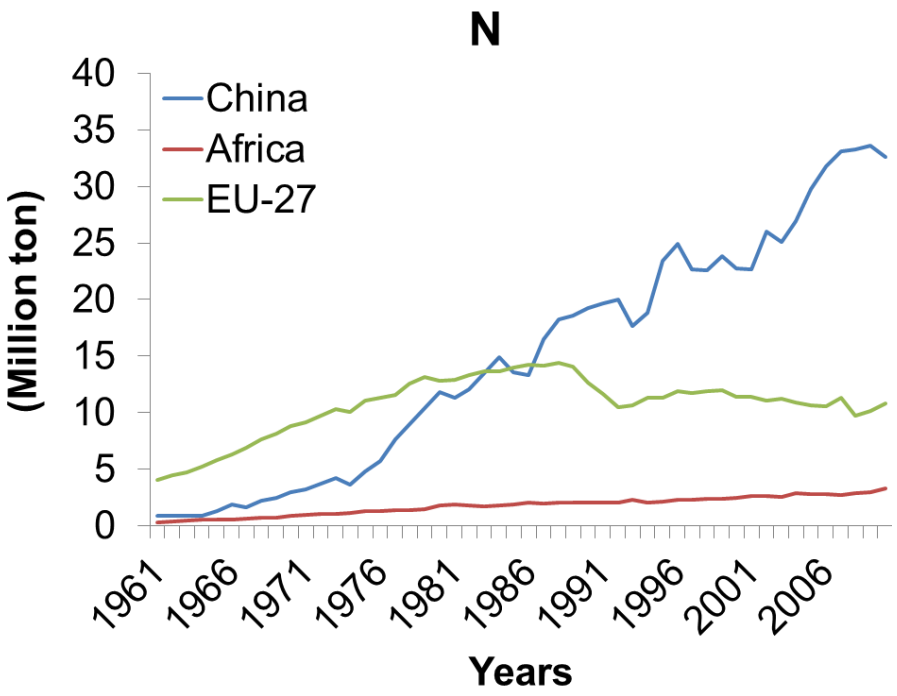
- Differences between
  - Potential yield (or water-limited yield) and
  - Actual yield
- Yield gaps differ between regions:
  - EU: factor 1-2
  - China: factor 1-3
  - Africa: factor 2-8
- Main reasons:
  - Nutrient limitation (N, P, ..)
  - Pest and diseases
  - Poor crop management

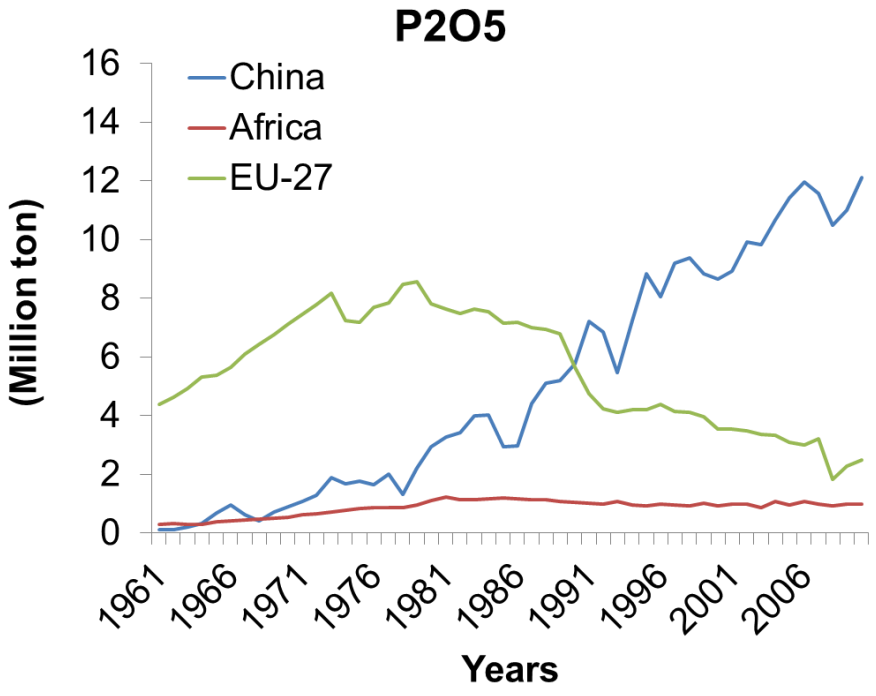


Contrasting fertilizer N and P use

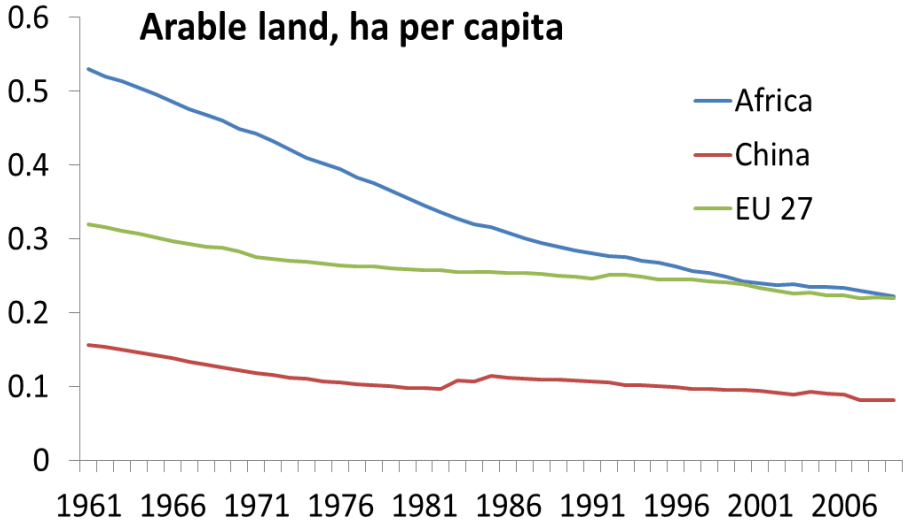
- Low and rather stable use in Africa
- Rapidly increasing use in China
- Decreasing use in EU-27

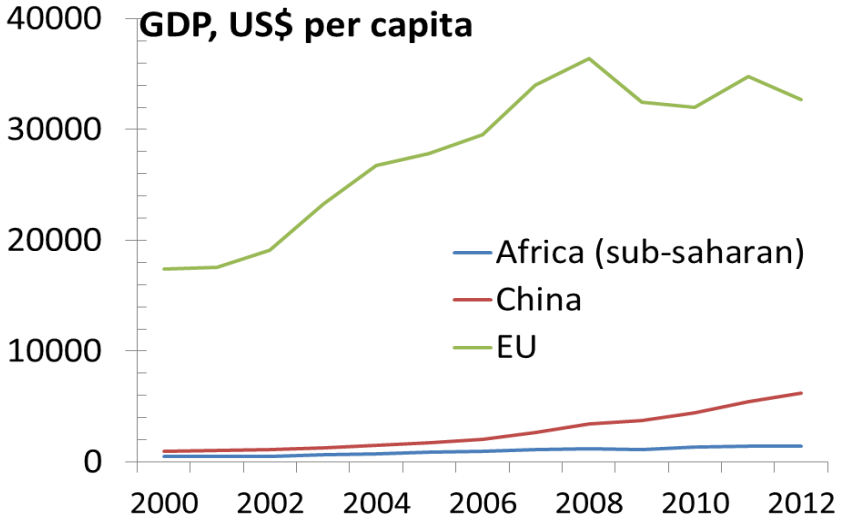
Source: FAOSTAT



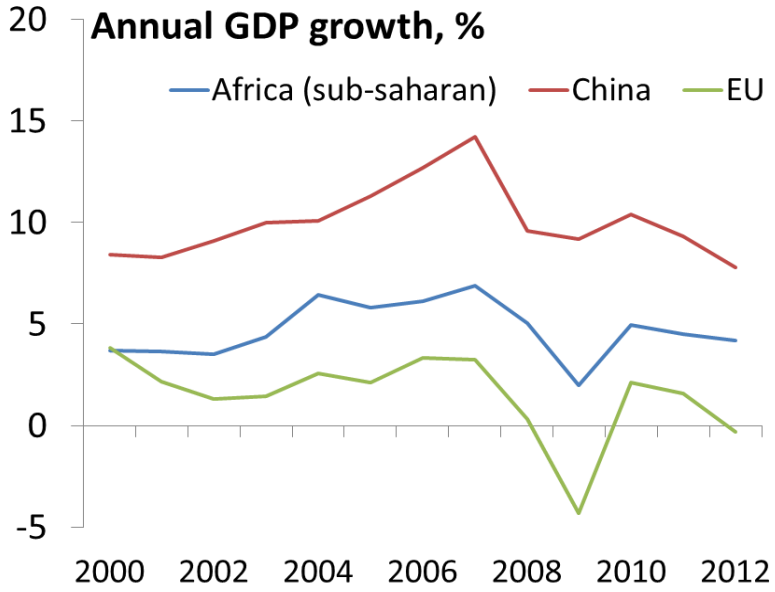


Arable land and GDP per capita





- Decreasing land per capita
- Huge differences in:
  - *GDP per capita*
  - *GDP growth per year*



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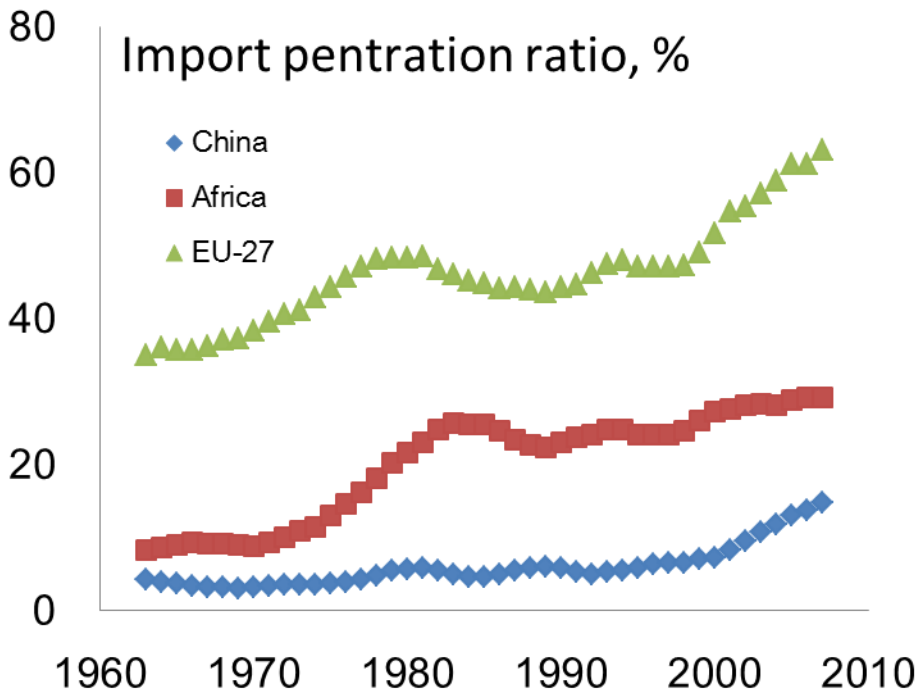
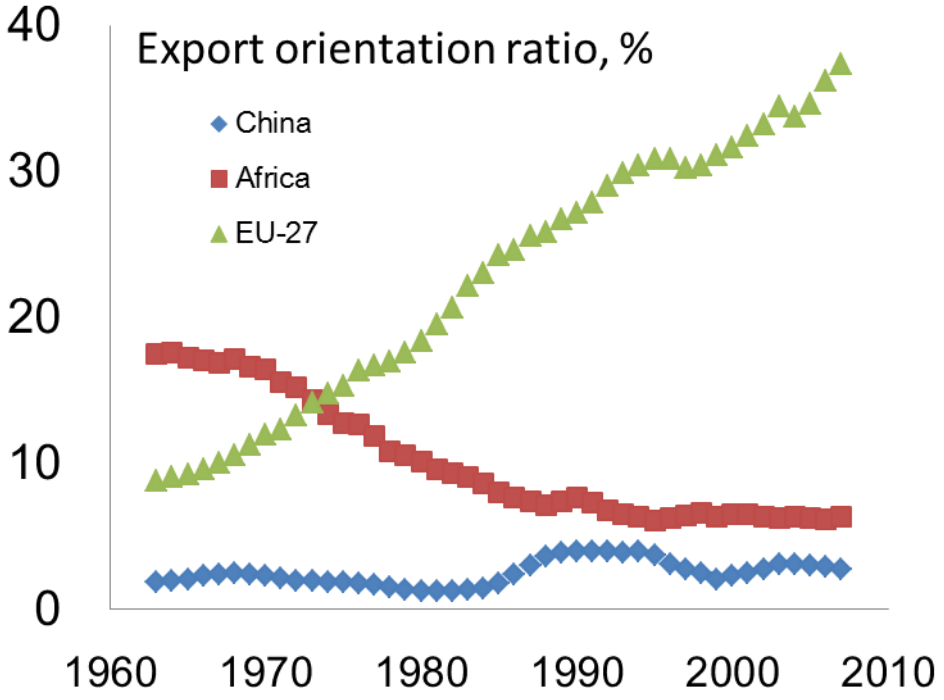
Source: World Bank

Increasing import and export of N in crops





Governmental policies

	Africa	China	EU-27
Knowledge infrastructure			
• Education	-/+	+	++
• Research	-/+	+++	+++
• Extension services	-/+	+	++
Development of markets			
• Price support	0	+++	++
• Import restrictions	0	++	-/+
Infrastructure & technology			
• Land reclamation	0	++	+
• Subsidies on inputs	-/+	+++	-/+
• Direct payments to farmers	0	++	++

Koning et al., 2008; Oenema et al., 2011; IAC, 2004; Li et al., 2013

Subsidies (in billion US$/year)

	Africa	China	EU-27
Direct payments	<1	25	45
Fertilizers	<1	~18	0
Pesticides	<1	4	0
Irrigation water	0	3	0
Improved seeds	0	4	0
Soil sampling & nutrient management	0	1	0
Machines, buildings	0	4	~3
Services & development	0	?	~15

Sources: Oenema et al., 2011; IAC, 2004; Li et al., 2013

Policy instruments used in Africa

- 1960-1970s: subsidies (on fertilizers)
- 1970-1980s: structural reforms
  - Privatization
  - Institution building; infrastructure, research
  - Currency devaluation
- Donor support (until 1990s)
- Various other suggestions and initiatives

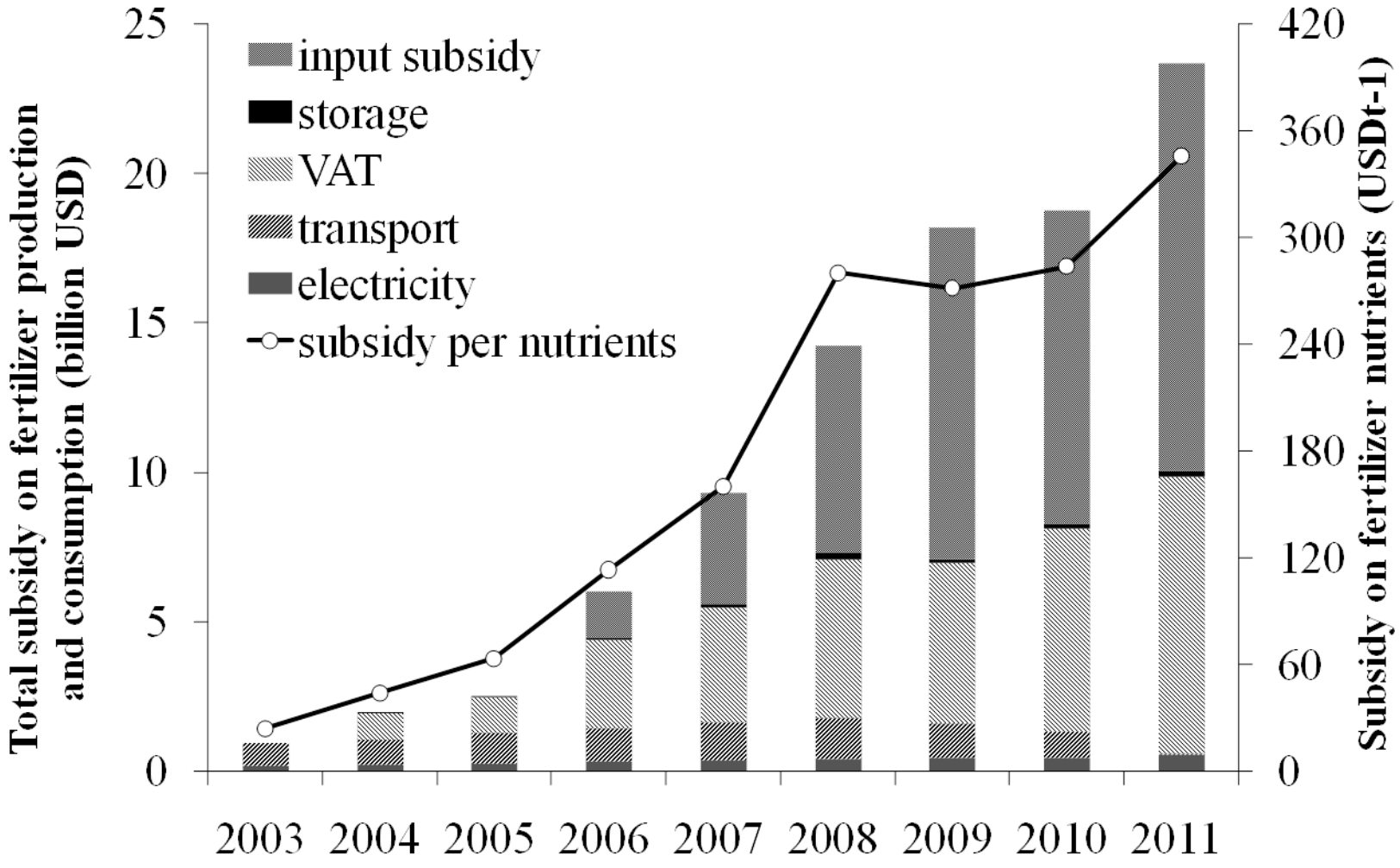
- So far, not successful; too fragmentary, too many constraints

Governmental policy in China

- Strong emphasis on food security
  - Input subsidies, especially fertilizers
  - Knowlegde infrastructure (research)
  - Direct payments

- Strong emphasis on industrial developments
  - Pull of labourers to cities
  - Currently, 80% of rural areas is from city workers
  - Changing diets

Increase of subsidy on fertilizer use in China



Li et al., 2013

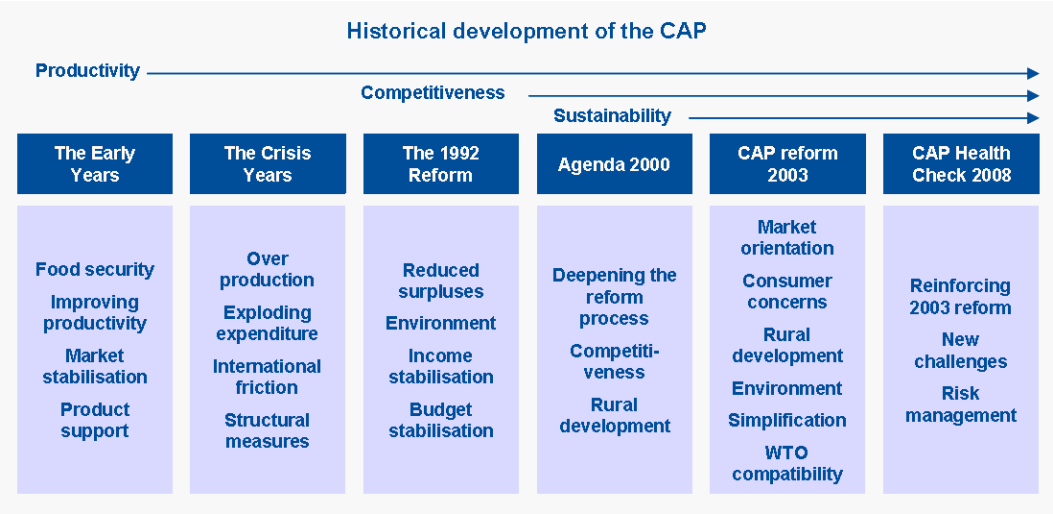
Common Agricultural Policy (CAP) of EU

Original objectives of CAP (1957):

- To increase agricultural productivity by promoting technical progress
- To ensure a fair standard of living for the agricultural community
- To stabilize markets
- To ensure stability of supplies
- To ensure that supplies reach the consumers at reasonable price

Common Agricultural Policy of EU

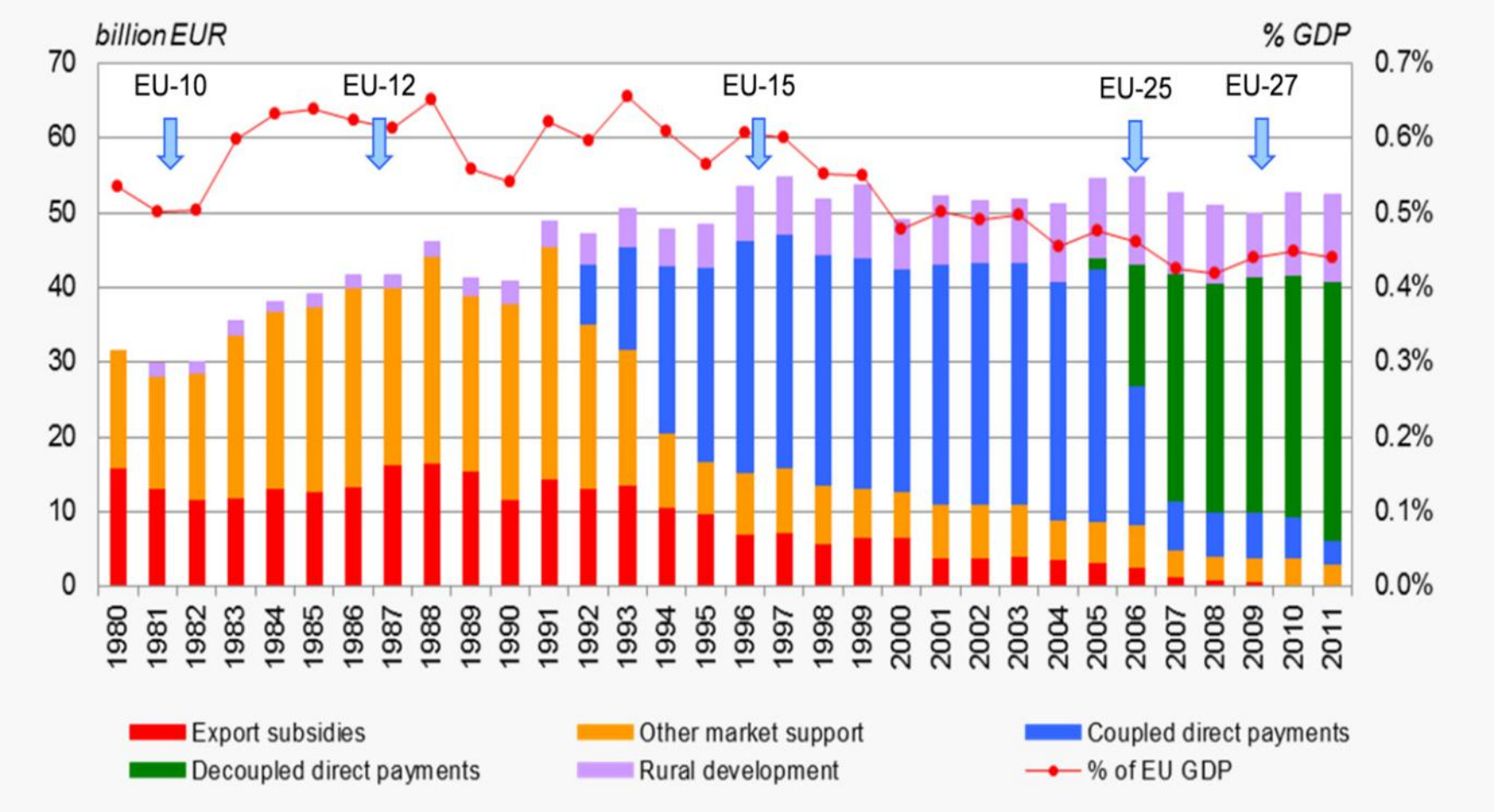
- CAP was very successful, but increasing costs
  - to get rid of surpluses of produce
  - to environment and landscape
- Reforms of the CAP: 1992, 1999, 2003, 2013; integration of environmental objectives in CAP: cross compliance



Milk quota from 1984-2015

Partitioning of EU-Budget

Total budget in 2010 was €110 billion, 45% to agriculture



Agri-environmental policies in EU-27

UNECE-CLRTAP Gothenburg Protocol

UNFCCC Kyoto Protocol

EU National Emissions Ceilings Directive

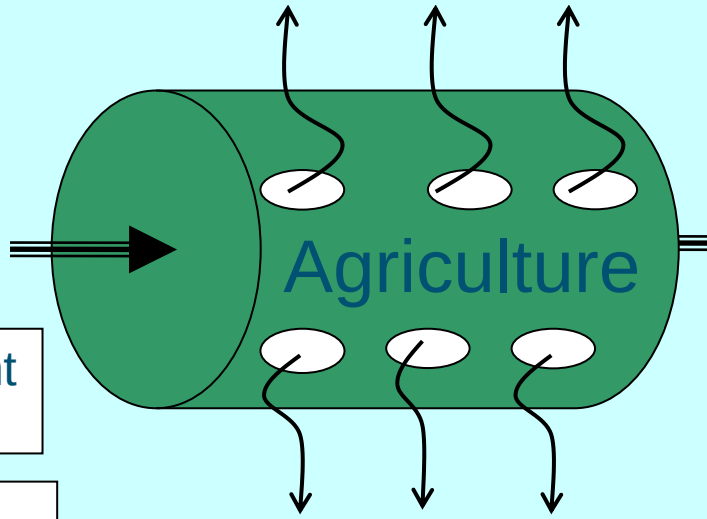
EU Strategy for Sustainable Development

EU IPPC

Emissions to air

EU Birds & Habitat Directives

EU CAP + cross compliance



Resources

Food, Income, Services, Fiber, Fuel

EU Rural Development Program

EU Food Quality Regulation

EU Directive on Pesticides

EU Animal Welfare

Emissions to water

EU Biofuel Directive

EU Nitrates Directive

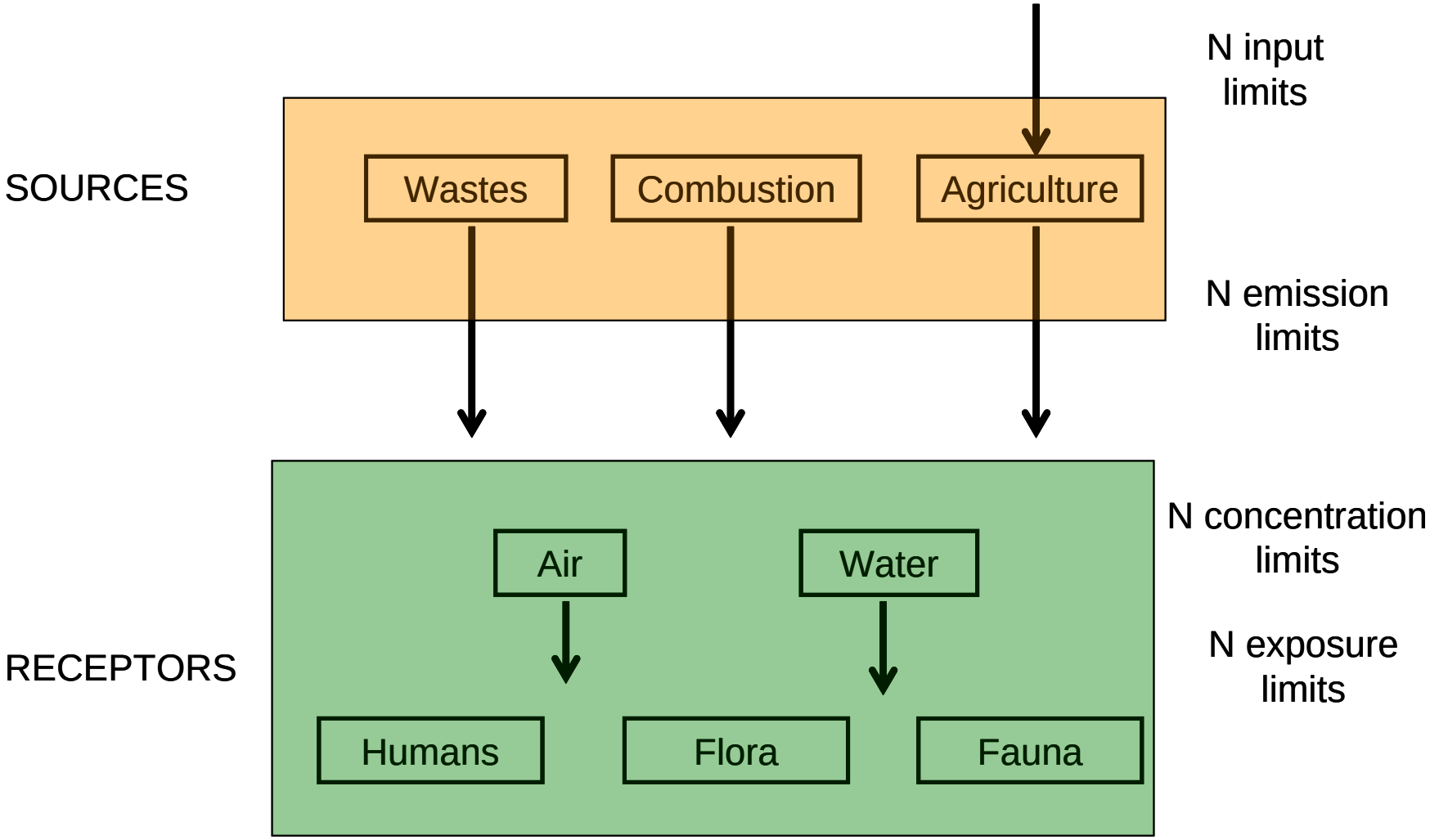
EU Water Framework Directive

EU Soils Strategy

EU Groundwater Directive

Many agri-environmental policies affect N use

Limits on N sources and receptors in EU

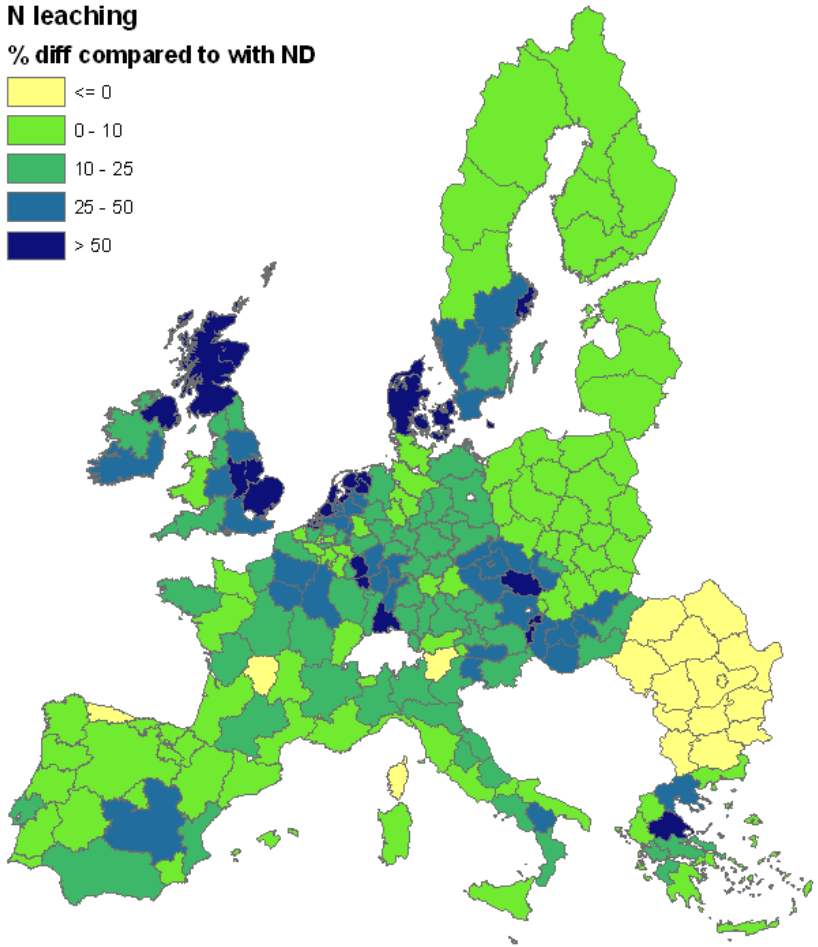


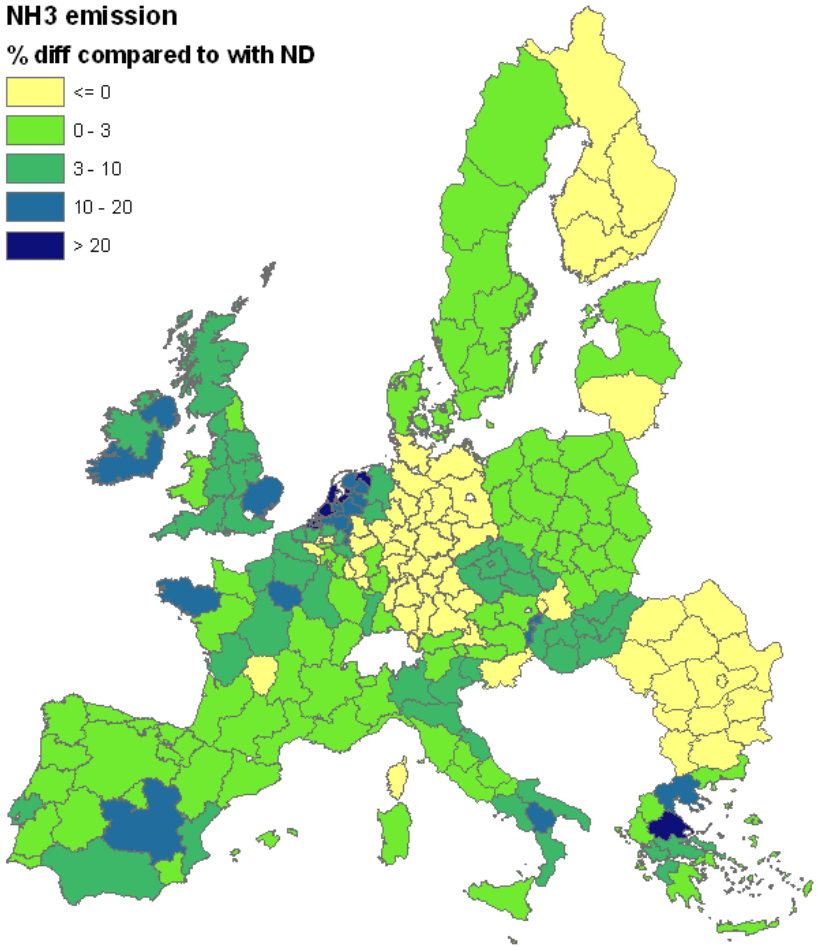
Measures taken by EU-farmers

Packages of measures, farm-type specific, including:

- Increases in productivity through breeding, selection
- Knowledge driven crop husbandry and animal husbandry
- Balanced fertilization, on the basis of soil analysis and crop demand
- Specific measures to reduce N and P losses
    - Low-emissions techiques for manure storage and application
    - Improved animal feeding; Low-protein and P feeding strategies
    - Cover crops
    - ....

Relative change in N emissions from agricultural land due to ND implementation





Velthof et al. (2013)

Some final remarks and conclusions (i)

- Strong government support of agriculture in EU and China
  - Equivalent to 100-300 US$/ha (similar as in US)
  - Support stimulates economic growth, and is only possible with rapid growth
  - Large cost to governments; many reforms needed
- Most policies for African agriculture failed; due to
  - Poor infrastructure (hardware, orgware, software)
  - Huge variability, multiple constraints
- Integration of agriculture support policies with environmental protection policies in EU has just begun

Some final remarks and conclusions (ii)

- Governmental policies in agriculture are diverse and poorly understood; they remain to be debated
- Effects of national policies have increasing effects on global markets due to globalization
- Global food security is best served by stable food prices
- Policies on food production and energy affect each other through biofuel
- Need for international coordination of supply management in several commodity markets

Thank you!

Questions?