The environmental effects of protein crops: implications for policy

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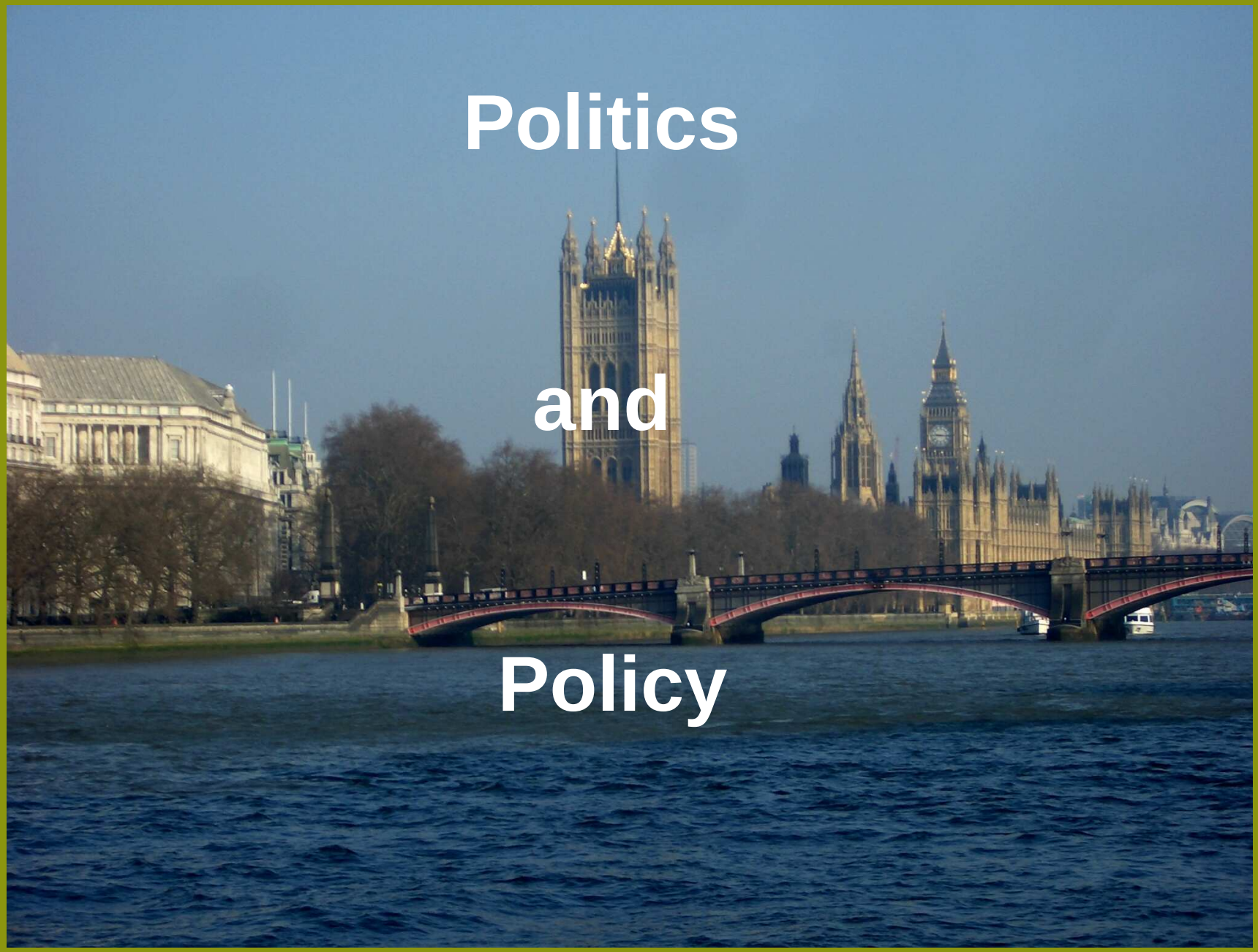


Politics

and

Policy

The purpose of policy is

To convert political vision into change in the real world

The primary responsibility of policy

Security

Justice system

Protecting and enhancing public goods

Policy makers focus on

Public goods

Market failure

Conclusion 1

In considering policy, we must look at the world from the viewpoint of protecting and enhancing public goods

And we must base positions on science

Protein crops

Aspects of the protein deficit

Resource effects

Environmental effects

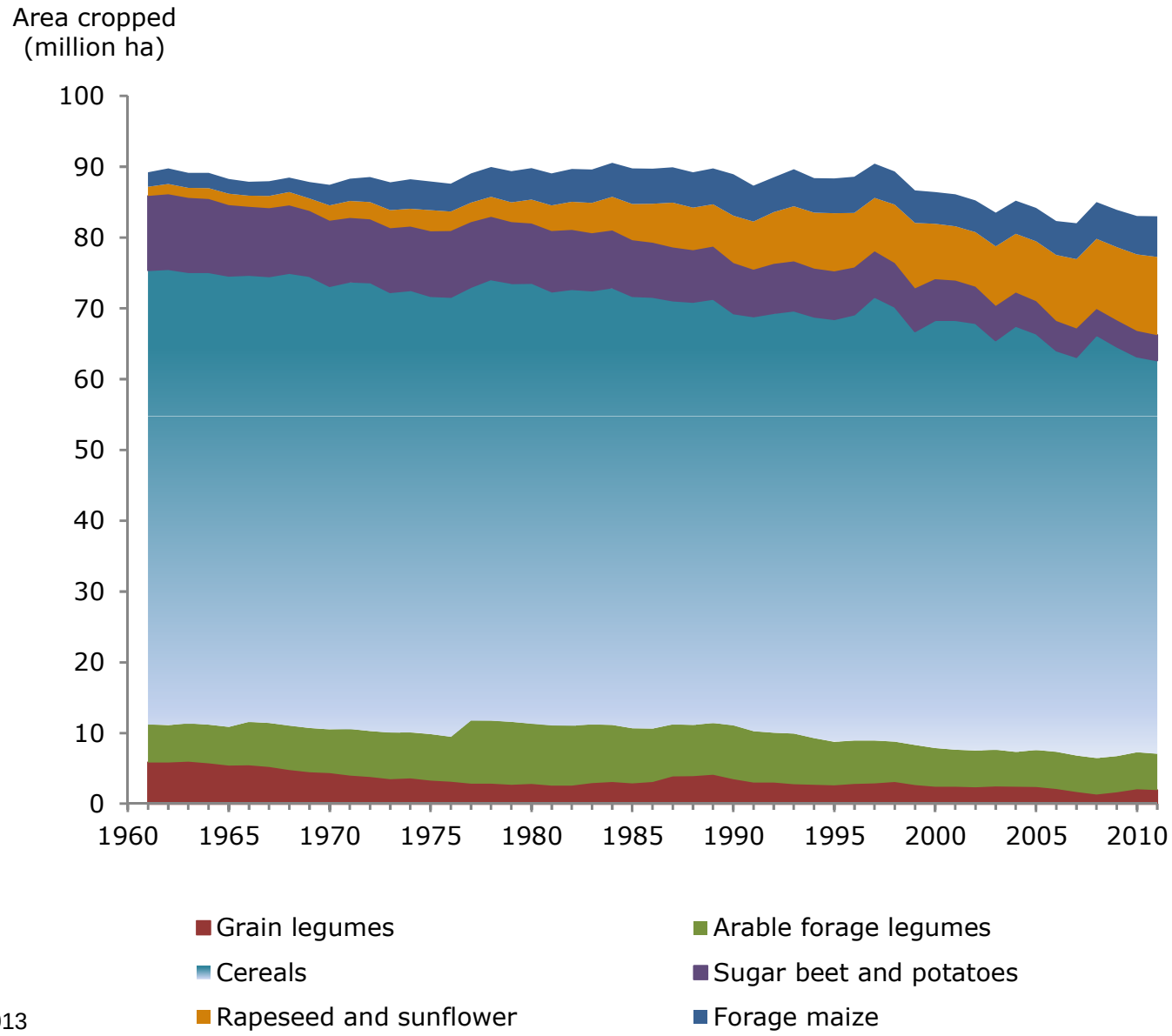
Competitiveness

Policy implications and options

Forage legumes

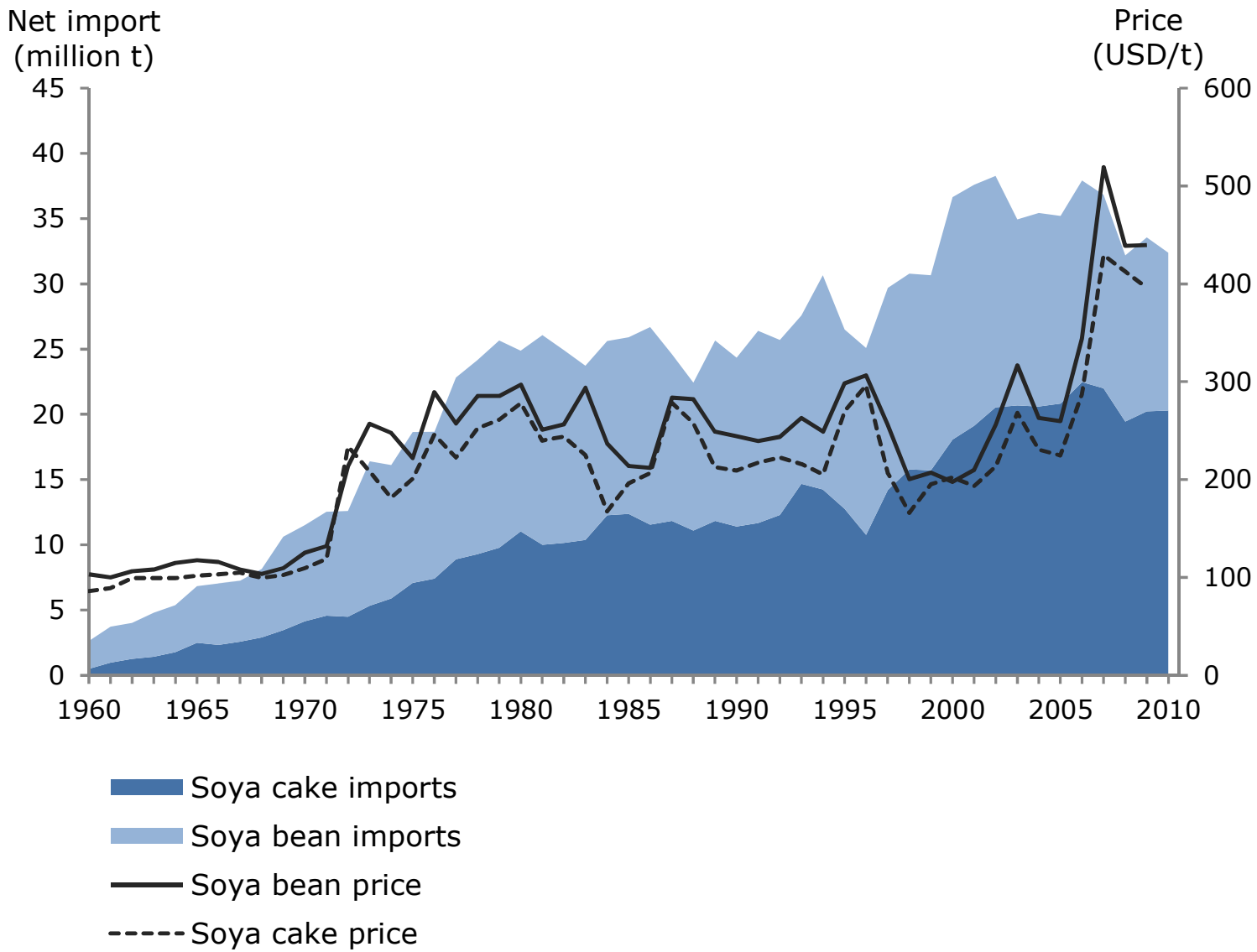
Conclusion 2
Most of our protein does not come from protein crops

Cereal production is remarkably stable in Europe



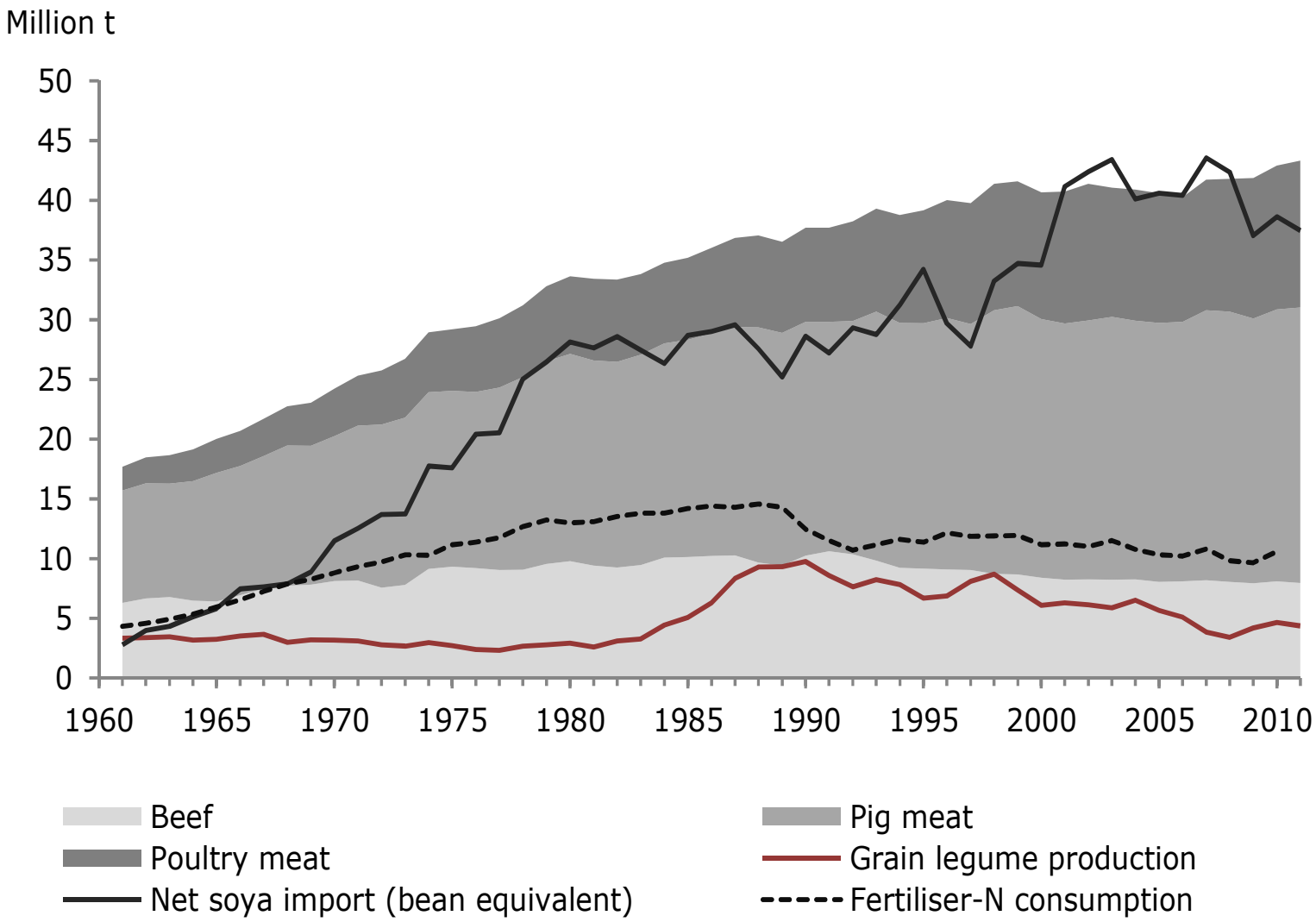
Source: FAOstat 2013

Europe is one of the world's largest users of soy



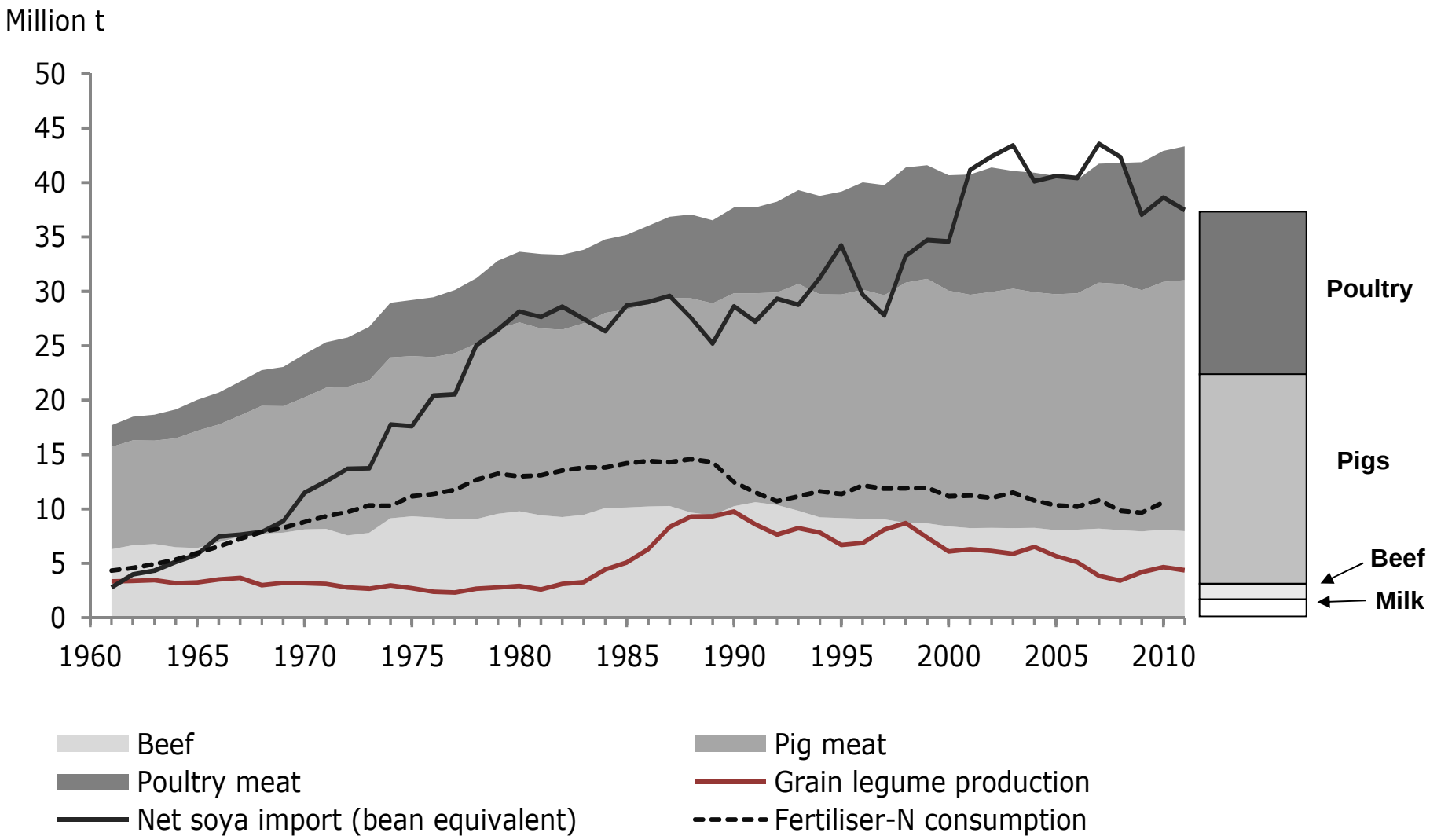
Source: FAOstat 2013

Growth in livestock production is the driver



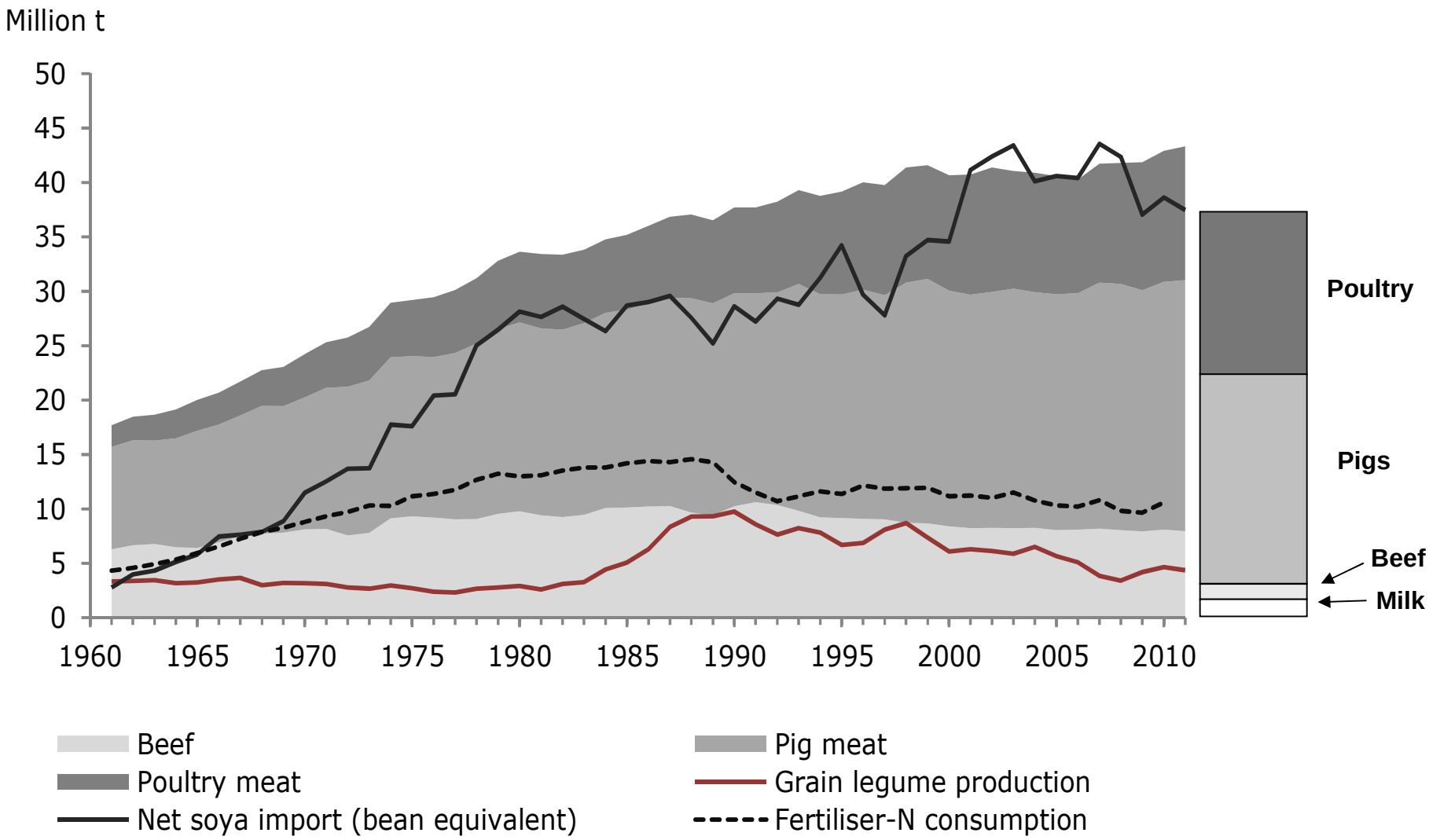
Source: FAOstat 2013.

Growth in poultry and pig meat consumption is the driver behind increased plant protein imports



Source: FAOstat 2013.

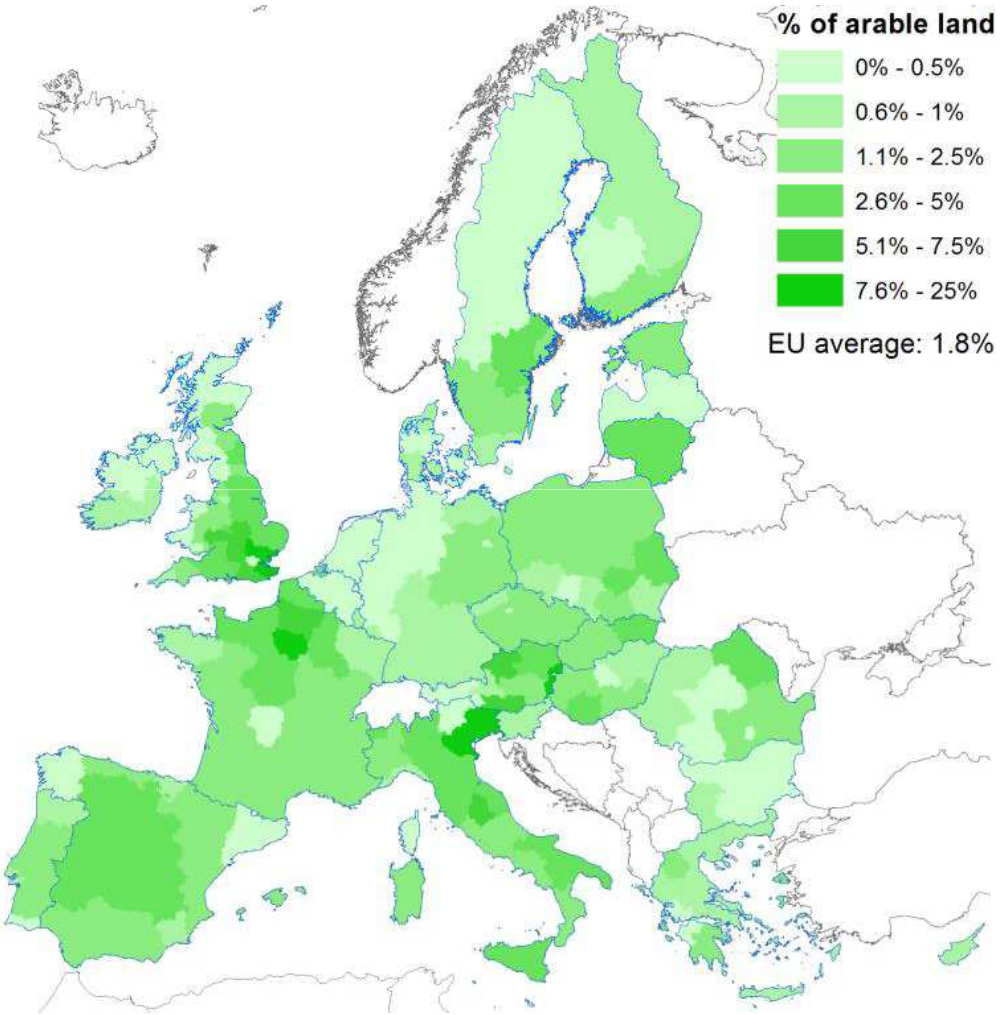
Conclusion 3
If we are serious about the sustainable development of food systems, then we must look at consumption



Source: FAOstat 2013.

Conclusion 4
There is a big difference between a protein policy and a protein crops policy

The proportion of EU cropland used for protein crops is low



Since 1961 the area has declined from 4.6 to 1.8% of arable land in Europe

Source: EuroSTAT 2013

This means that the Europeans are foregoing whatever

resource

and

environmental

effects protein crops have

Resource effects

Protein crops require no nitrogen fertiliser and the need for fertiliser in the following crop is lower

Photo: RAUCH Landmaschinenfabrik GmbH

Resource effects

Break crop effect:

Reduced crop diseases

Improved soil conditions

Improved soil fertility

15 – 25% yield increase

in following crop yield

These are all ‘internal’ benefits

Break crop effect:

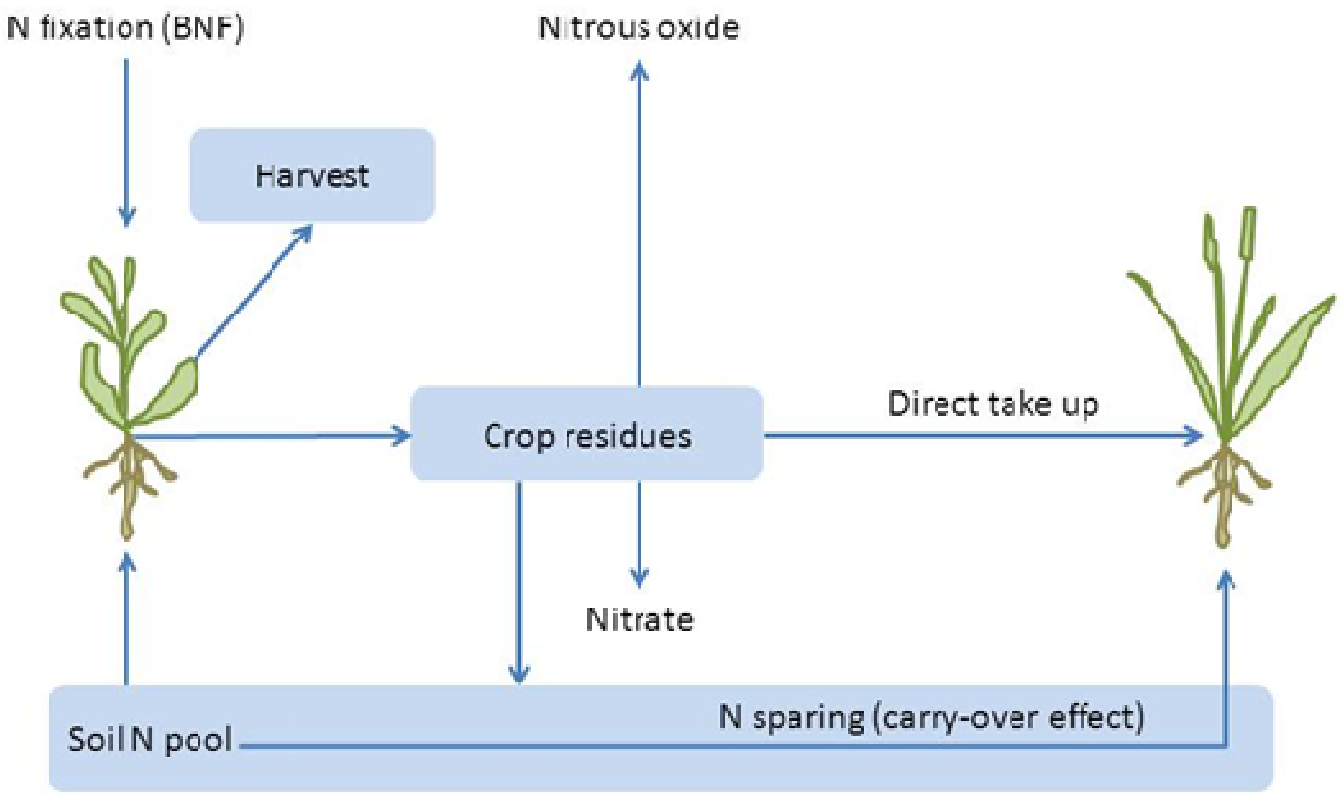
Reduced crop diseases

Improved soil conditions

Improved soil fertility

15 – 25% yield increase in following crop yield

‘External’ environmental benefits – nitrogen cycle



Lower greenhouse gas emissions (particularly nitrous oxide)

Reduced fossil energy CO_2 emissions

‘External’ environmental benefits – biodiversity

Mass flowering

Crop diversity

Soil organisms

‘External’ environmental benefits – land use change

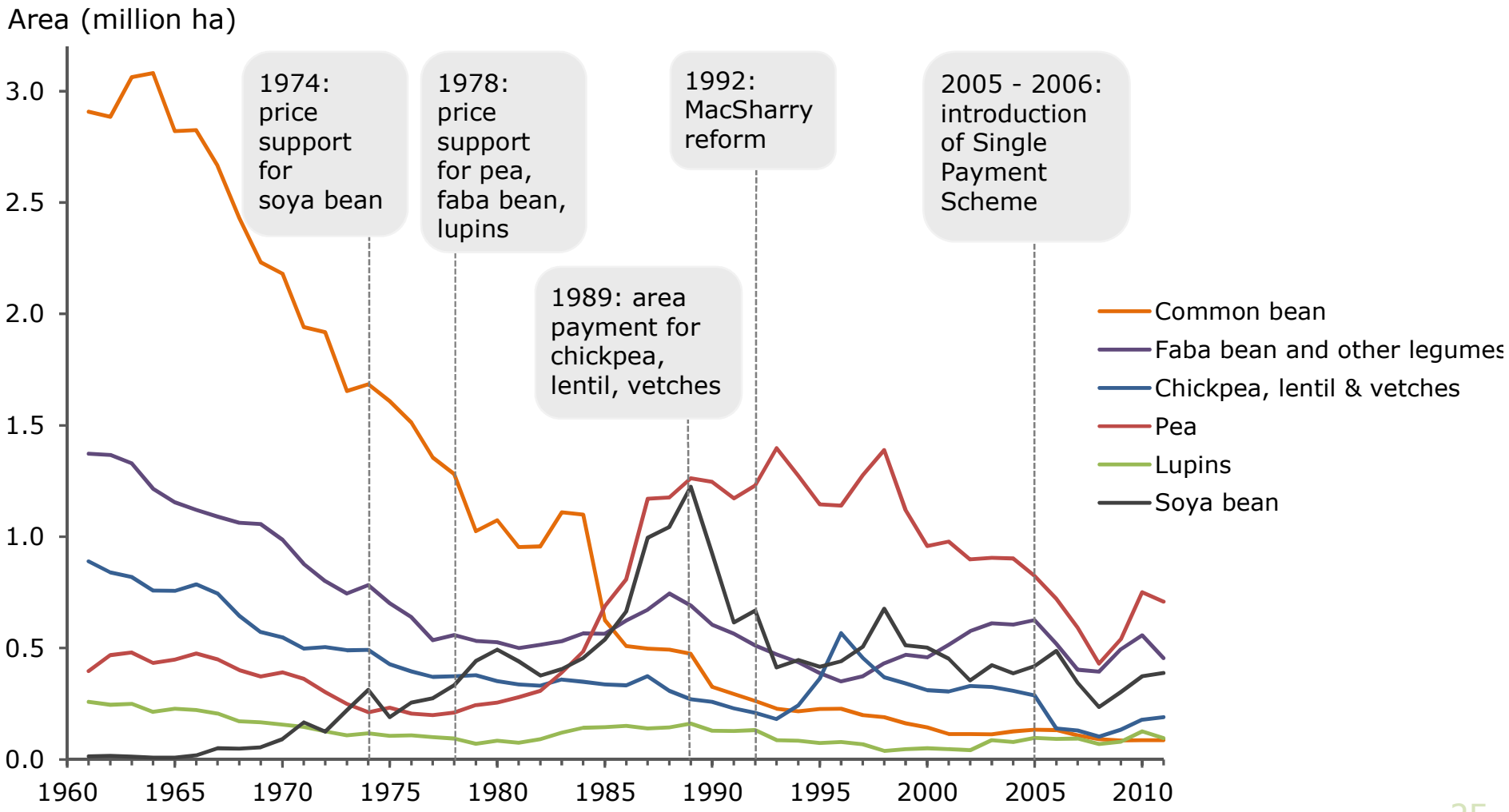
Source: Paula Fridman/Carbis, Business Week May 22, 2008

‘External’ environmental benefits – life cycle

Study	% change in environmental impact						
	Energy demand	GHG emission	Ozone	Eutro-phi-cation	Acidi-fica-tion	Eco-toxi-city	Land -use
Comparison of soya-based and domestic legume-based feed							
Sweden, pork[1]	-16	-13		-31	-40	-36	
Sweden, pork[2]	-19	-10					24
Germany, pork[3]		-5					
Spain, pork[3]	-6			17			32
France, chicken meat[3]	-6	-10					
France, eggs[3]	-4	-10	-5			+	
Comparison of soya-based and farm-produced feed							
Germany, pork[3]	-19	-16	-25	-11	-10		

1 Cederberg and Flysiö 2004; 2 Eriksson et al. 2005; 3 Van der Werf et al. 2005

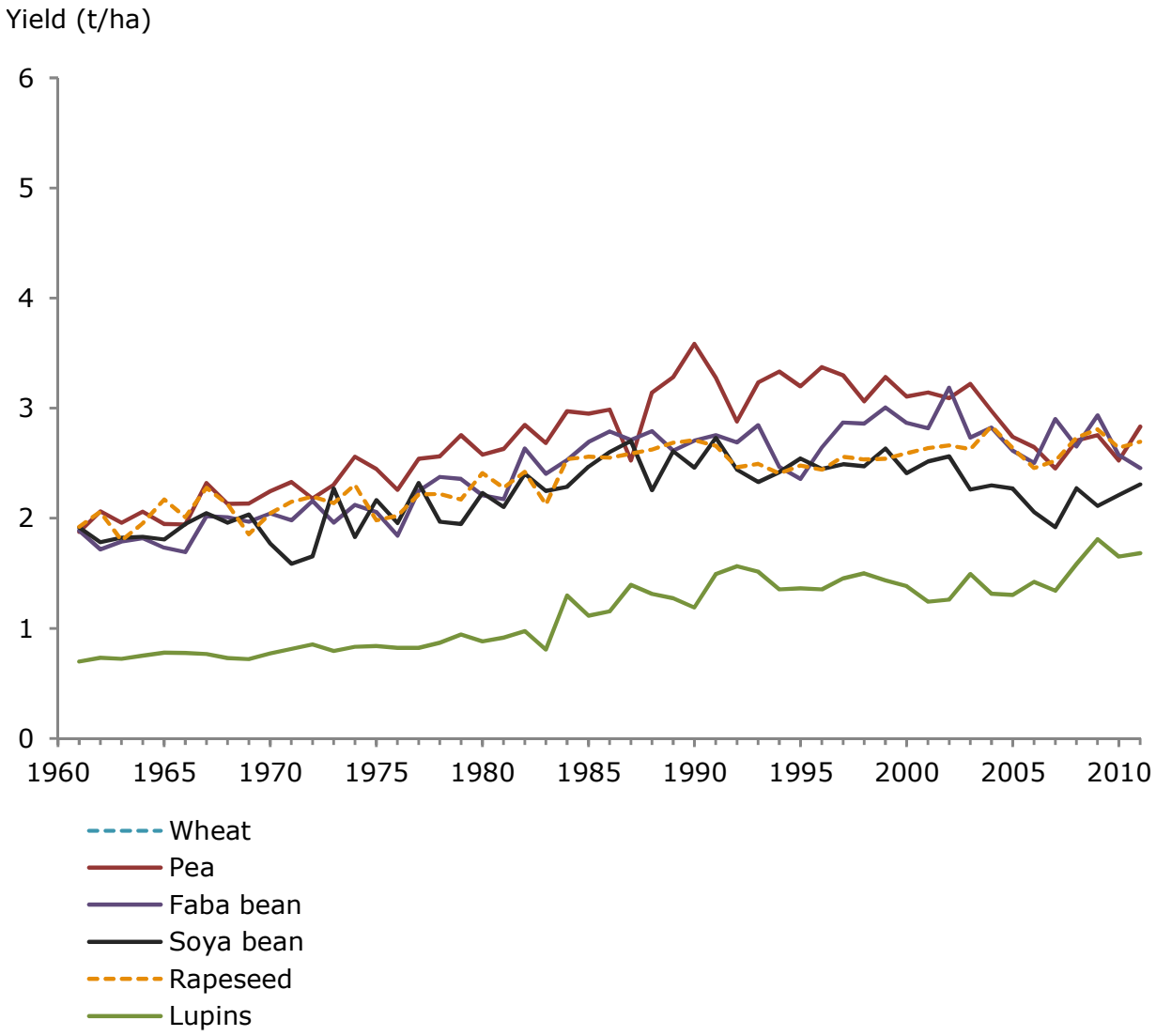
The public benefits of protein crops justify public policy intervention, and farmers respond



If we want more protein crops,

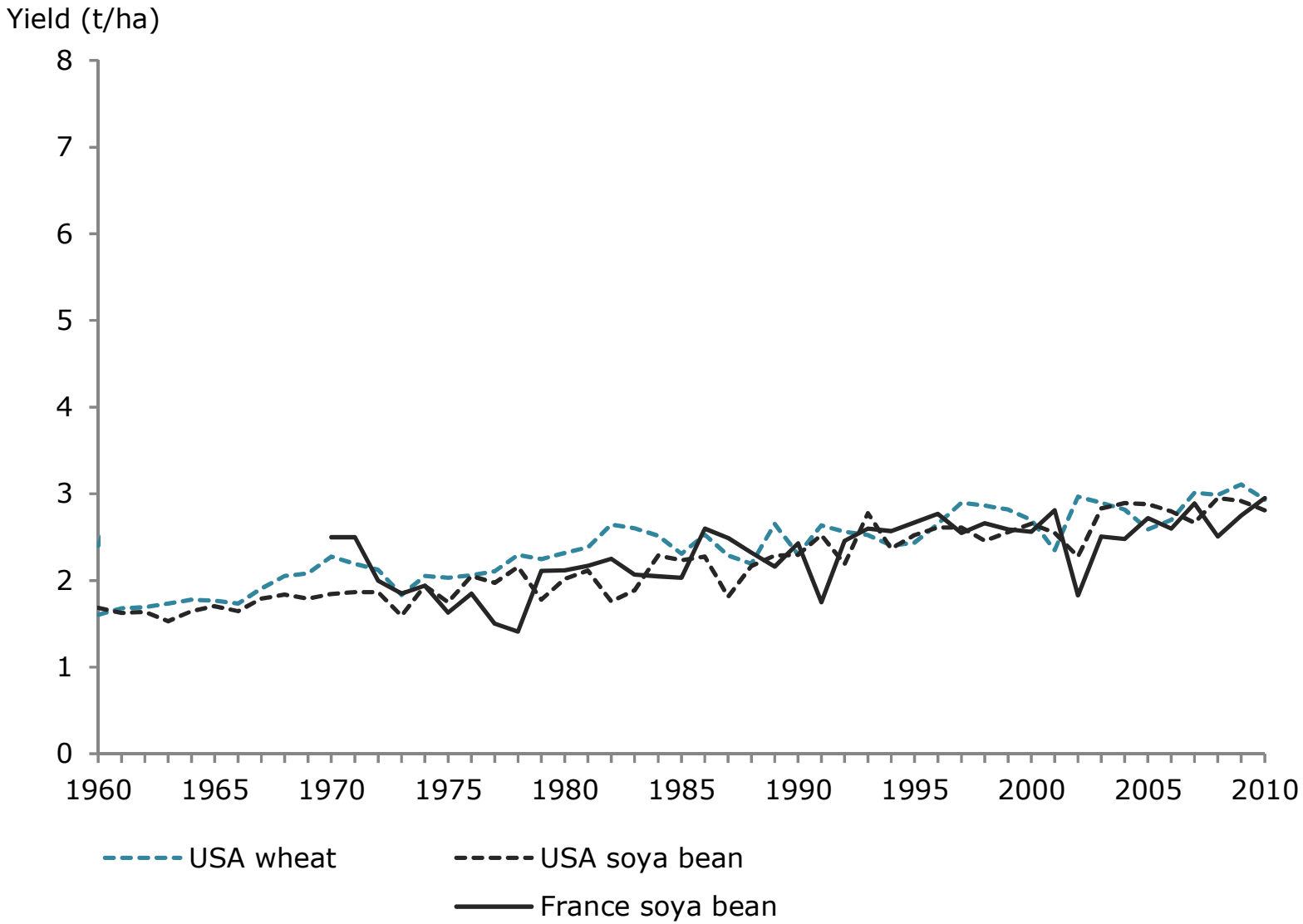
what will this cost society?

European protein crops are high yielding



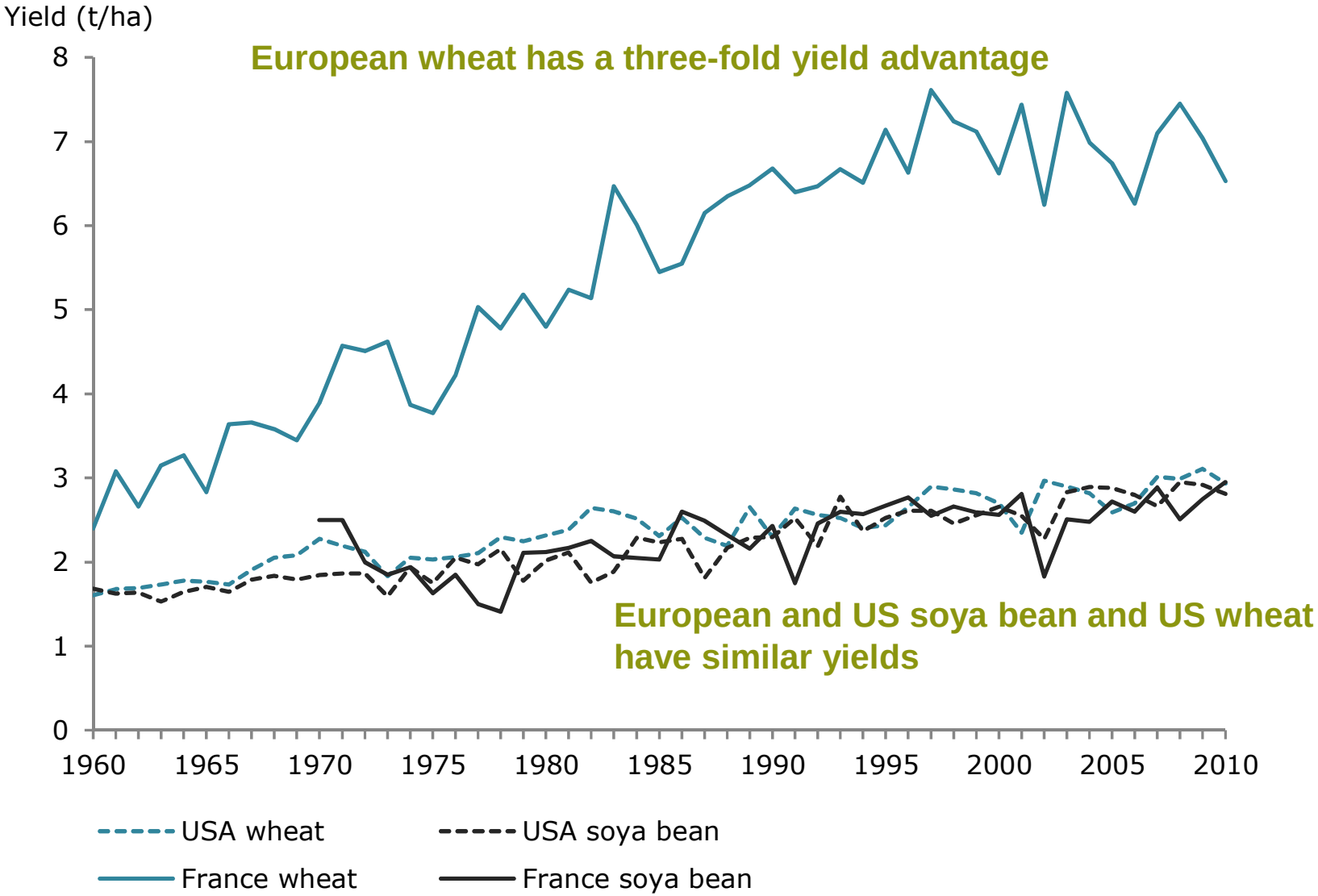
Source: FAOstat 2013.

Soy yields in the USA and France

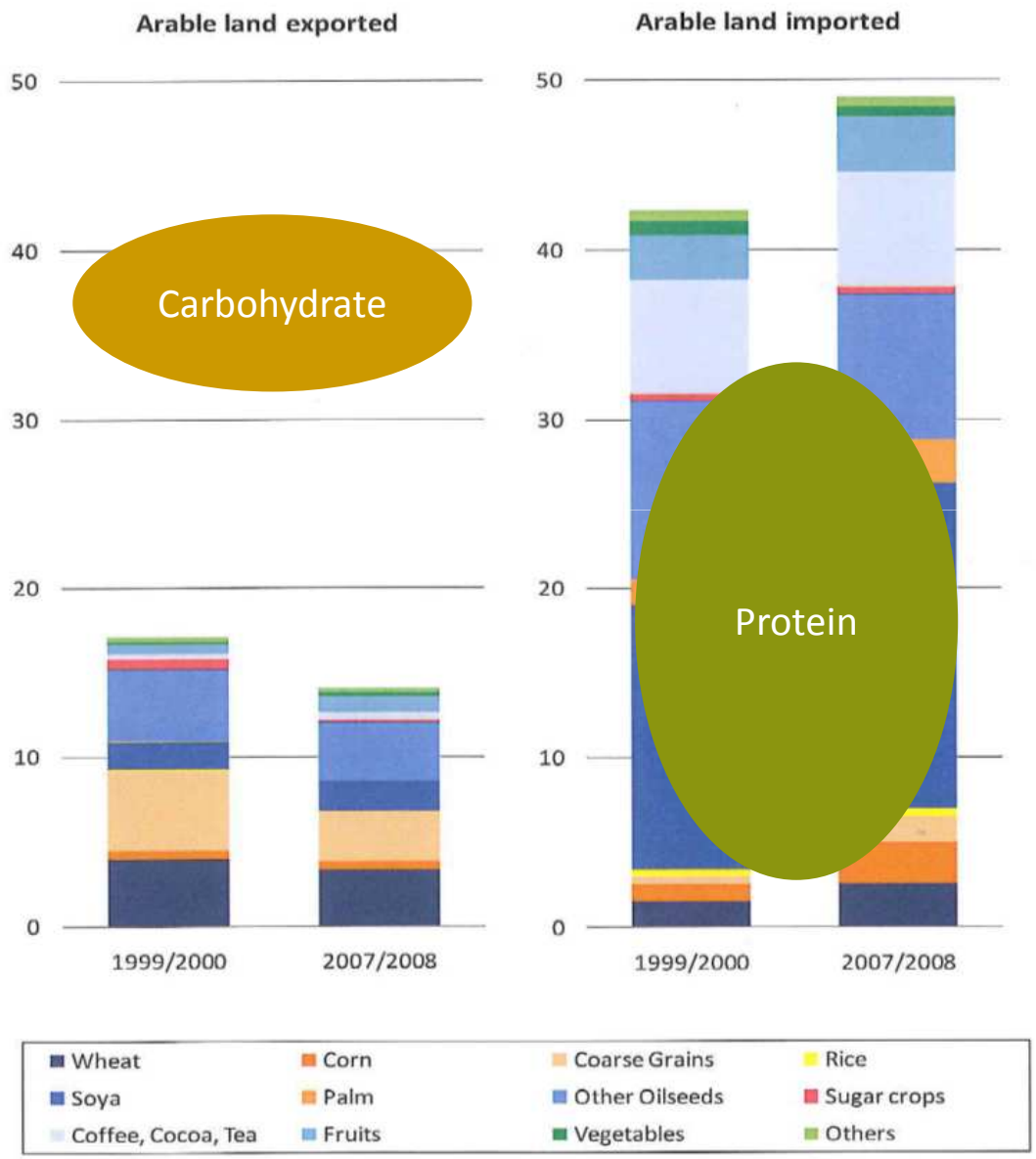


Source: FAOstat 2013.

European protein crops are high yielding, but Europe is a world champion in growing wheat



European livestock production depends on imported protein – and crop land outside Europe



Von Witzke & Noleppe 2010

Conclusion 5

The problem is not that we cannot grow good protein crops.

It is that we are exceptionally good at growing wheat & co.

Cropping sequence gross margins

Case study, year	Annual gross margin incl. precrop effect (€/ha/yr)		
	Legume rotation	Rotation without legume	Deficit of legume rotation
Regional data, averaged 2000-2004 [1]			
Germany Saxony-Anhalt	278	281	-3
Germany lower Bavaria	142	167	-25
Denmark Fyn	193	213	-20
Switzerland Vaud	926	1107	-181
Spain Castilla y Leon	55	53	2
Spain Navarra light soil	331	330	1
Spain Navarra deep soil	354	347	7
France Barrois	243	243	0
France Picardie	425	428	-3
Regional data averaged 2001-2007 [2]			
France Eure et Loir	737	738	-1
France Seine Maritime	833	839	-6
Germany Niedersachsen	745	792	-47
Spain Castilla-La Mancha	136	137	-1
UK East Anglia	813	852	-39
Average	**477**		**-24**
Range	**53 to 1107**		**-181 to 7**

Sources: Calculations based on data from:

[1] von Richthofen et al. (2006b) (Considered precrop effects: yield effect on 1st subsequent crop, fertiliser saving, pesticide saving, reduced tillage).

[2] LMC International (2009) (Considered precrop effects: Yield effect on 1st subsequent crop, N fertiliser saving)

Crop-level gross margins

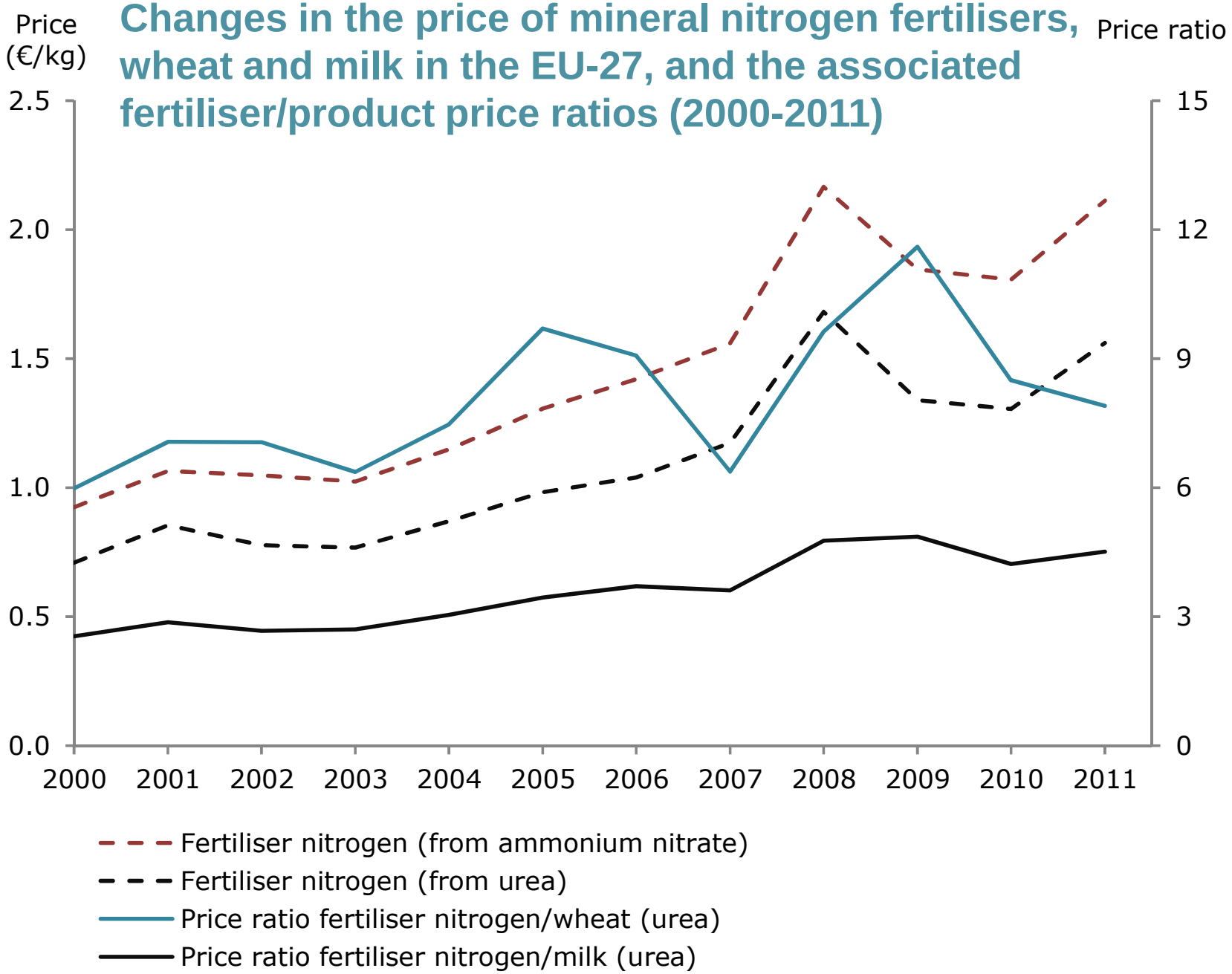
Case study, year		Annual gross margin (€/ha)	Gross margin deficit of legume compared to other crop (€/ha)			
			Wheat	Maize	Barley	Rapeseed
Netherlands, 2008 [1]						
	Pea	631	-571			
	Faba bean	796	-406			
	Lupin	616	-586			
France Midi Pyrenées, 1999-2003 [2]						
Rainfed loam	Soya bean	245	206	68	29	-196
	Pea	-48	-87	-255	-264	-489
Rainfed clay	Soya bean	253			188	58
	Pea	-52			-117	-247
Irrigated loam	Soya bean	83		-410		
	Pea	153		-340		
Irrigated clay	Soya bean	189		-214		
	Pea	190		-213		
France Ariege, 2009 [3]						
	Pea	-181	-622			
Average		**240**	**-344**	**-227**	**-41**	**-219**

Sources: Calculations based on data from: [1]Kamp et al. (2010), [2]Mahmood (2011), [3]Chambre d'Agriculture de l'Ariege (2009) in Mahmood (2011).

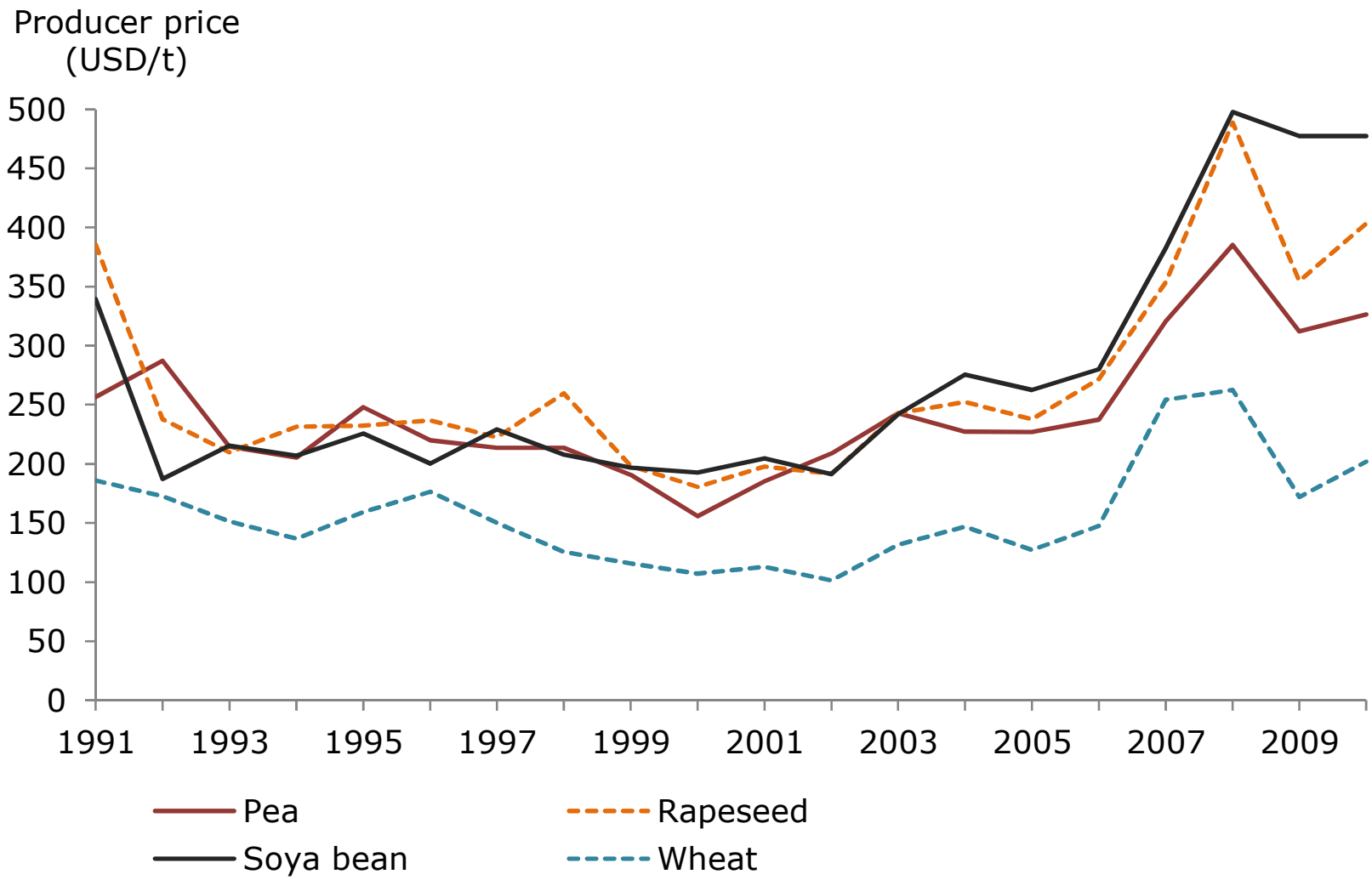
Conclusion 6

**In general,
growing protein crops
reduces farm profit in
Europe.**

Changes in the price of mineral nitrogen fertilisers, wheat and milk in the EU-27, and the associated fertiliser/product price ratios (2000-2011)



Changes in producer prices for main protein crops, rapeseed and wheat in major producer countries (1990-2010)




NEW HOLLAND

Conclusion 6

We must invest in raising the yield of protein crops faster than the yield of wheat & co.

CAP reform:

some principles offered

Photo: J. Logan

- **Multiple and complex public effects point to integrated policy development using complementary policy measures.**
- **Avoid obligation.**
- **Work within a comprehensive protein strategy.**

Policy options within the CAP

- **More stringent crop diversification requirements**
  (greening in Pillar 1)

- **Inclusion of legume crops in ecological focus areas**
  (greening in Pillar 1)

- **Voluntary coupled support schemes**
  (direct support under Pillar 1)

Policy options within the CAP (continued)

- **Legumes via agri-environment schemes (Pillar 2)**

- **Organic farming**

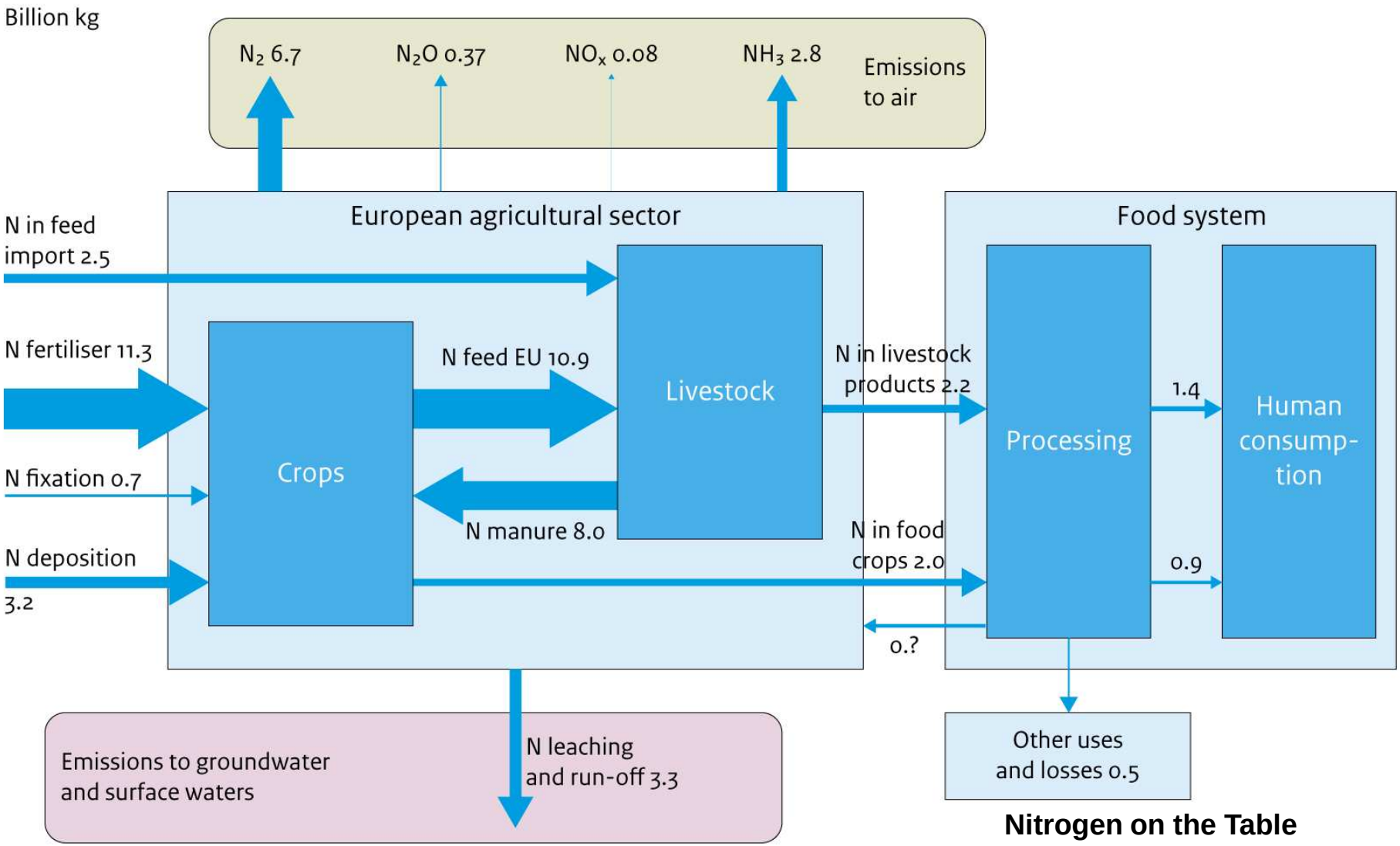
- **Investment into research, breeding, and technical progress**

- **Support producer initiatives (e.g. Danube Soya)**

Policy options outside the CAP

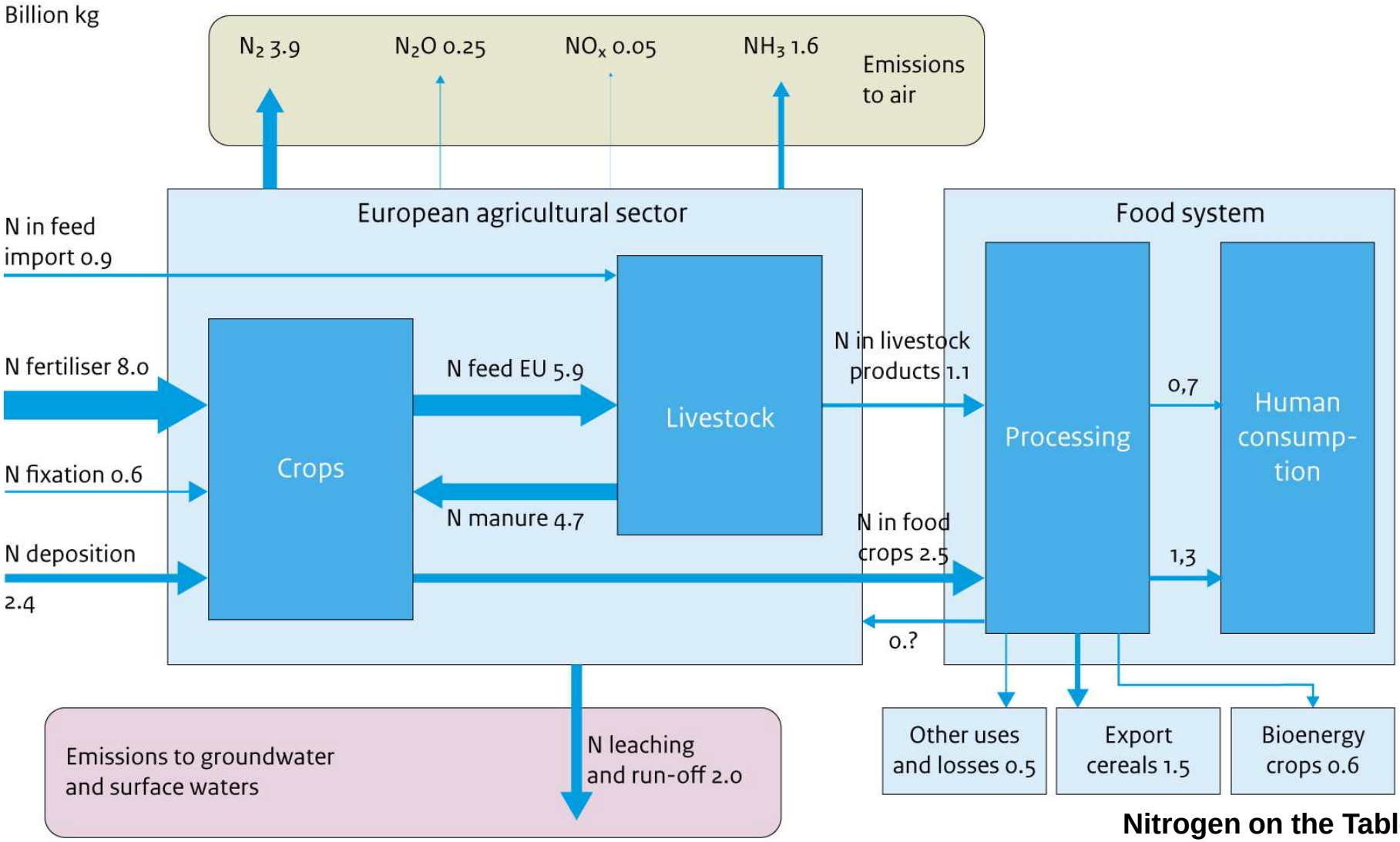
- Climate protection policies
- Nutrient policies
- Resource efficient Europe
- Policies on biodiversity

Nitrogen flows in agricultural sector in EU27, reference 2005



Nitrogen on the Table
TFRN Website

Nitrogen flows in agricultural sector in EU27, -50% meat, eggs and dairy products



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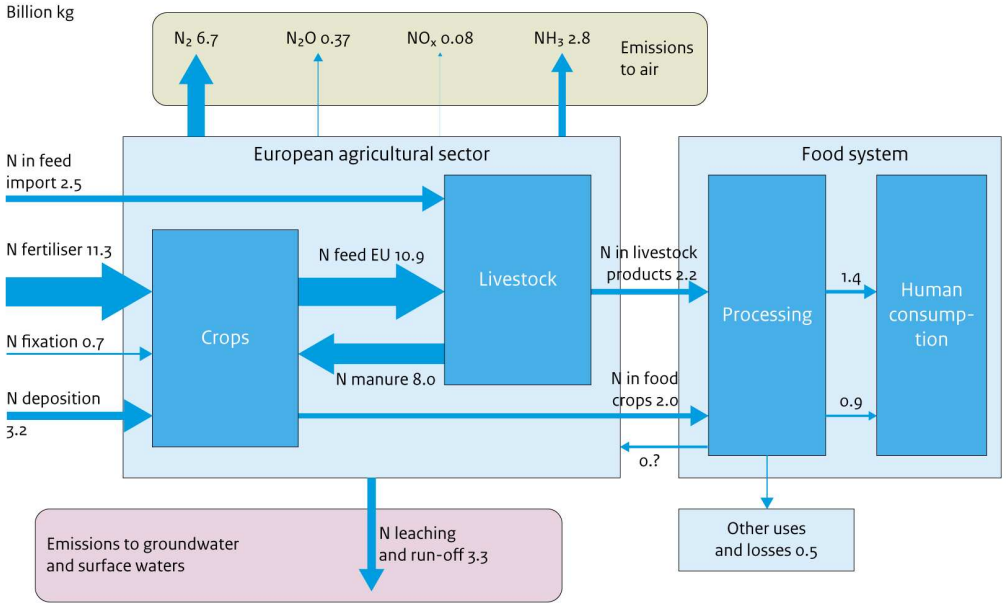

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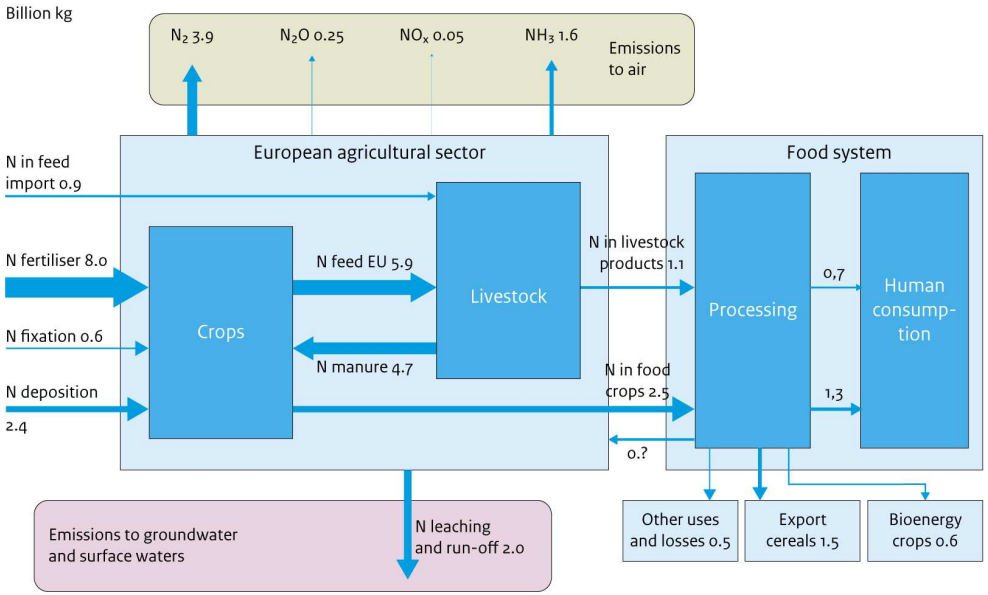

Conclusion 7

If we are really serious about the protein gap, GHG emissions, and public health, then changing consumption would be a cornerstone of policy

Summary

- The plant protein deficit is due to comparative advantage in cereal production combined with self-sufficiency in cereals and livestock for high levels of livestock consumption
- Increased protein crop production will contribute to the development of more sustainable and balanced agriculture
- Public intervention is justified
- Developing better protein crops for farmers enhances their resource conservation and environmental benefits
- Higher fertiliser and soya prices encourage protein crop production

Acknowledgements

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SEVENTH FRAMEWORK PROGRAMME

“But prosperity is not enough”

John Fitzgerald Kennedy, July 1963 (to the Irish Parliament)