Presented at: Organic Agriculture and Legal Framework. Second Round Table of the Eastern European Countries. Kyiv, Ukraine, November 5&6, 2008. Research Institute of Organic Agriculture FiBL, CH-Frick.

Advantages of organic farming: Environment and economical characteristics

› Urs Niggli

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Challenges and threats in future agriculture

- 60 % of *ecosystem services* are degraded because of few provisionary services (food, timber, fiber), *Millennium Ecosystem Assessment*, 2005.
- Agriculture exploits in a unsustainable way its most important natural production factors like soil fertility, biological diversity and water (*Pimentel et al.,* 1995, and others.)
- Agriculture is a high energy input production sector although it could be energy-autarchic and could mitigate GHG emission considerably (*Smith et al.,* 2007).
- Agriculture is insufficiently prepared to cope with unpredictability and adaptation to climate change *(Lobell et al., 2008)*

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Challenges and threats in future agriculture

Radical change of research in agriculture needed:

- **Degradation of ecosystems limits or reverses productivity gains.**
- **Ecosystem research is the only approach to cope successfully with food security.**
- **Interdisciplinary research indispensable.**
- **Involving of indigenous/tacit knowledge of farmers crucial.**
- **Very critical assessment of technology impact urgent.**

Johannesburg Report of IAASTD (2008)
International Assessment of Agricultural Science and Technology for Development

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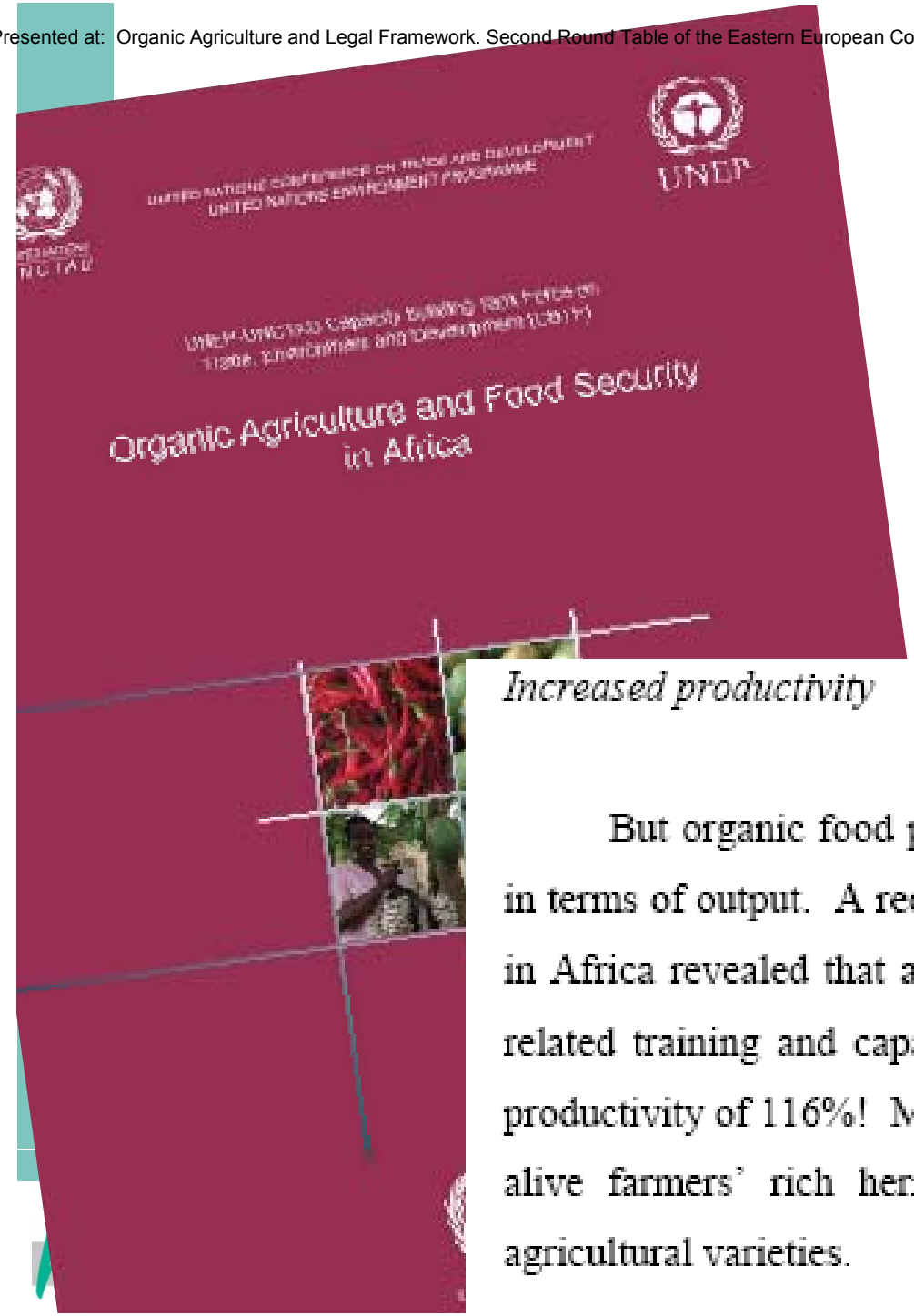

Increased productivity

Dr. Supachai Panitchpakdi
Secretary-General of UNCTAD

But organic food production does not necessarily mean a sacrifice in terms of output. A recent UNCTAD-UNEP study analysing 114 cases in Africa revealed that a conversion of farms to organic production and related training and capacity building led to an increase in agricultural productivity of 116%! Moreover, organic agriculture builds on and keeps alive farmers' rich heritage of traditional knowledge and traditional agricultural varieties.

30 % of fertile soils lost by erosion in the last 40 years.

Current erosion rate: 10 million hectares per year

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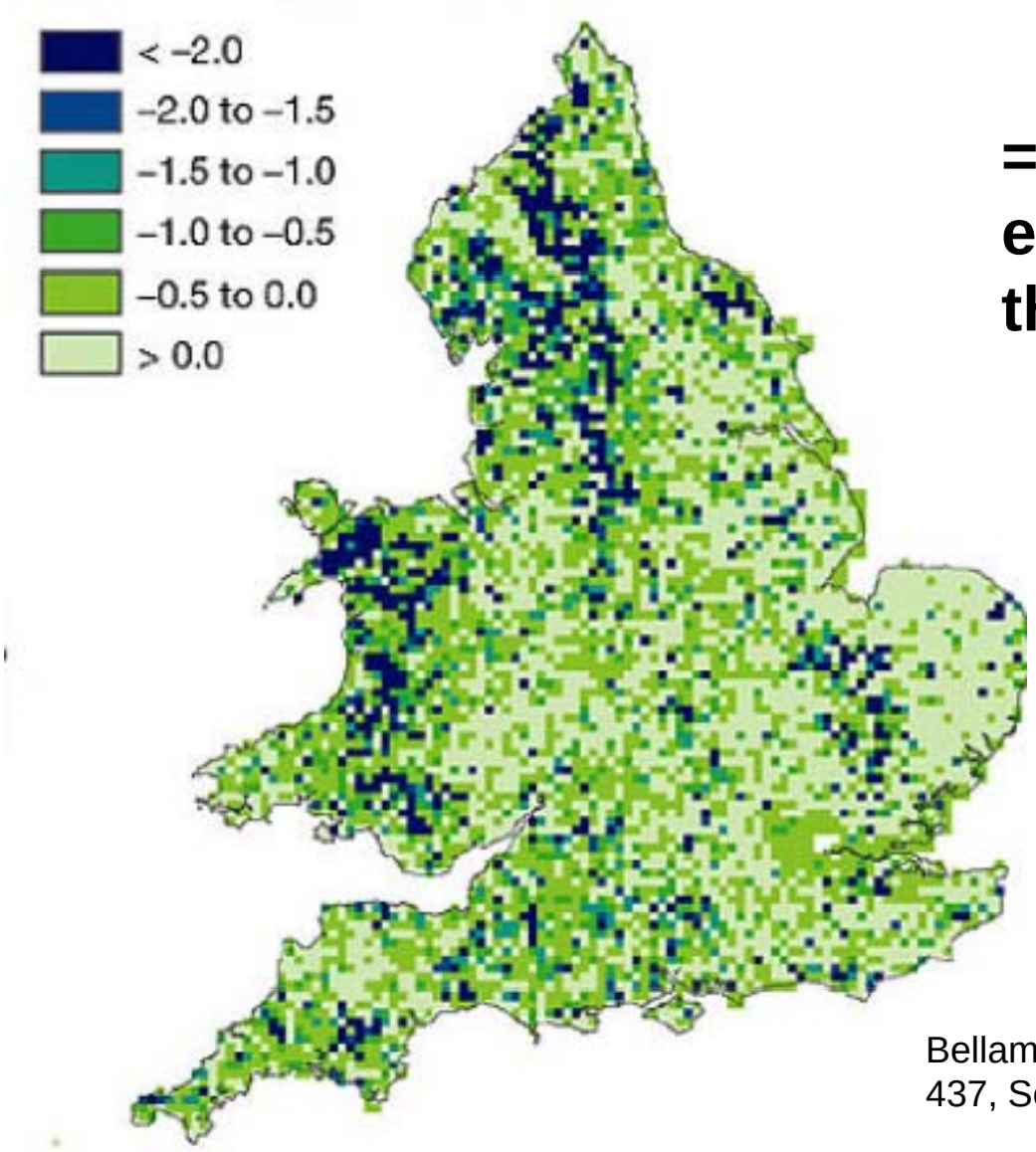
Pimentel et al., 1995, Science

Carbon losses (decomposition of SOM) through intensive croppping in UK & Wales: 1978 to 2003.

g C per kg soil per year



= 8 % of the emissions of the industry

Bellamy et. al.: NATURE, Vol 437, September 2005, 245-247.

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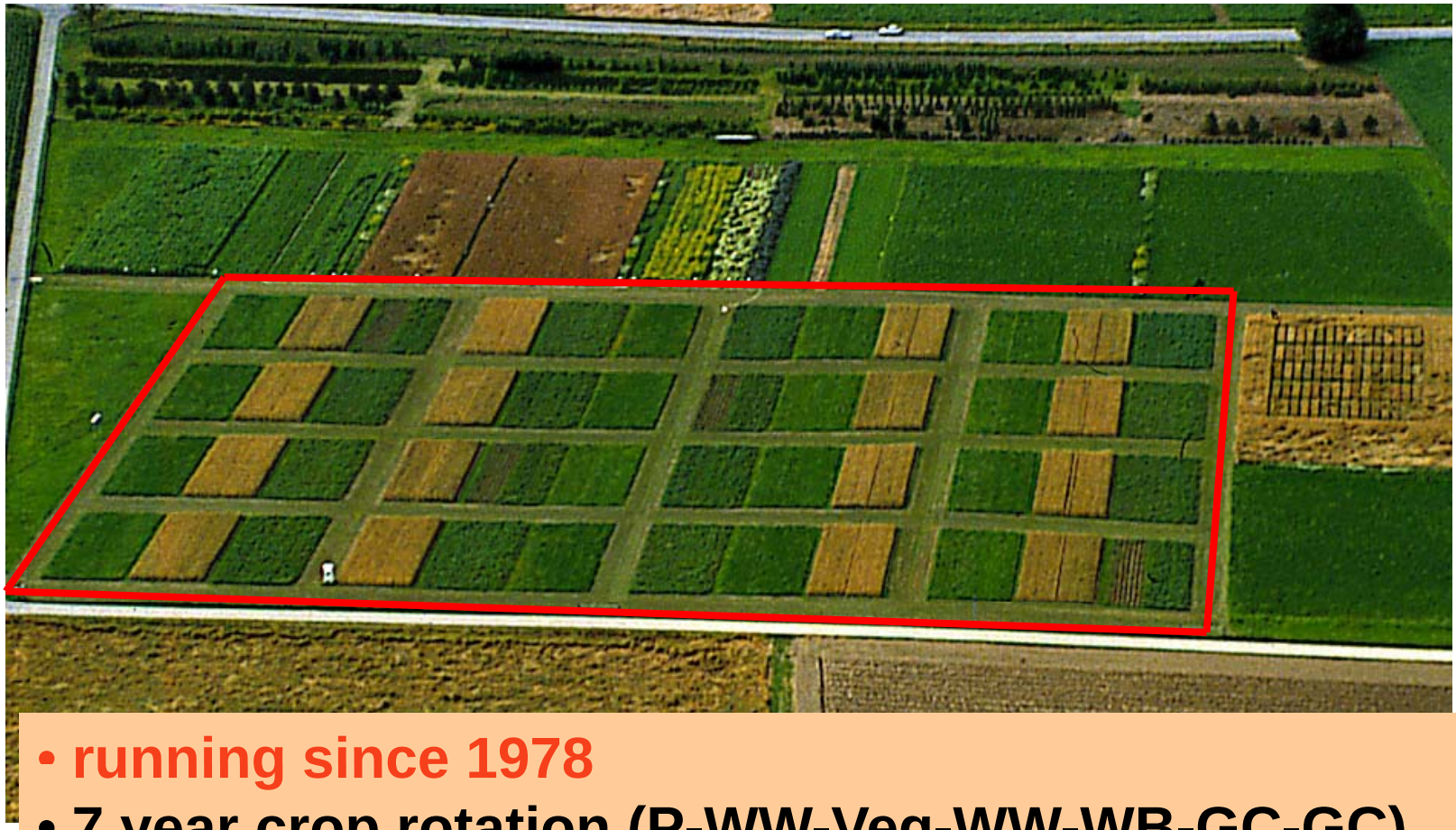
DOK long-term field experiment, Switzerland



- running since 1978
- 7 year crop rotation (P-WW-Veg-WW-WB-GC-GC)
- 0 – bio dynamic - organic - IP - conventional
- Loess soil, 833 mm precipitation, 9.4 ºC temperature

Mäder, P., Fließbach, A., Dubois, D., Gunst, L., Fried, P. und Niggli, U., 2002: Soil fertility and biodiversity in organic farming. Science 296: 1694-1697

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Selected results of the DOK trial (CH)

	Organic		Conventional
Winter wheat Yield	4.7 t/ha	- 15% ←	5.6 t/ha
Fertilisation NH_4NO_3 Equivalent	122 kg/ha	- 60% ←	360 kg/ha
Energy Diesel Equivalent	340 l/ha	- 30% ←	570 l/ha
Plant protection Active Ingredients	0-200 g/ha	- 97% ←	6.0 kg/ha
Soil fertility Microbial Biomass	40 t/ha	+ 60% ←	24 t/ha
GHG emissions per ton (entire rotation)		- 18 % ←	

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Mäder, Fliessbach, Niggli (2002), Science 296

DOK trial: Soil fertility, biomass, stability

Bio-dynamic Farming

IPM, stockless

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Mäder et al. 2002, Science

DOK trial: Percolation stability and run-off

Fotos: Fliessbach Nov. 2002

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Biodynamic Farming

IPM, stockless

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Mäder et al. 2002, Science

Floods and water erosion

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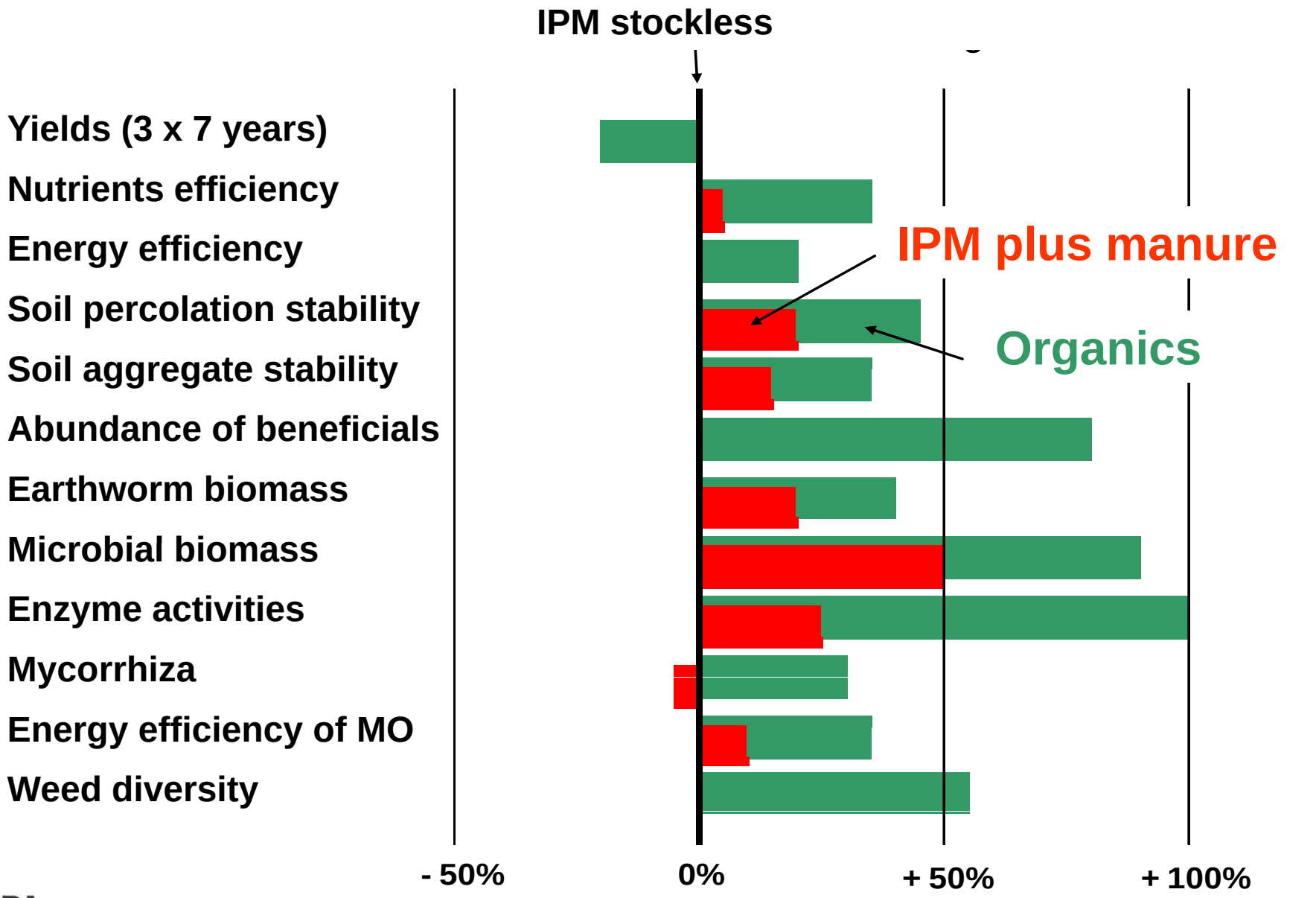
OA: multi-targeted approach to sustainability



Mäder et al. 2002, Science

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Co-benefits of organic farming

- Nitrate pollution reduced by 35 to 65 %.
- No herbicide and pesticide residues in soils, water and foods.
- Strongly reduced soil erosion or even restored carbon storage by using leguminous plants, green manure and recycling livestock manure.
- Higher diversity on farm, field, species and crop genetics level.
- Improved water use efficiency.
- Reduced fossil fuel use.

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Carbon sequestration in long term experiments

Field trial	Components compared	Carbon gains (+) or losses (-) kg ha^{-1} yr^{-1}
DOK experiment, CH	Organic, FYM composted	42
(Mäder, *et al.*, 2006)	Organic, FYM fresh	-123
1977 - 2005	IP, FYM, mineral fertilizer	-84
	IP, mineral fertilizer	-207
SADP, USA, 1994-2002	Organic, no till	1 829
(Teasdale, *et al.*, 2007)	Conventional, no till	0
Rodale FST, USA	Organic, FYM	1 218
(Hepperly, *et al.*, 2006;	Organic, legume based	857
Pimentel, *et al.*, 2006)	Conventional	217
Bavarian farm survey	18 organic farms (average)	402
(Hülsbergen and Küstermann, 2008)	10 conventional farms average)	-202
Frick reduced tillage	Organic, ploughing	0
experiment, 2002-2005	Organic, reduced tillage	879
(Berner, *et al.*, submitted)		

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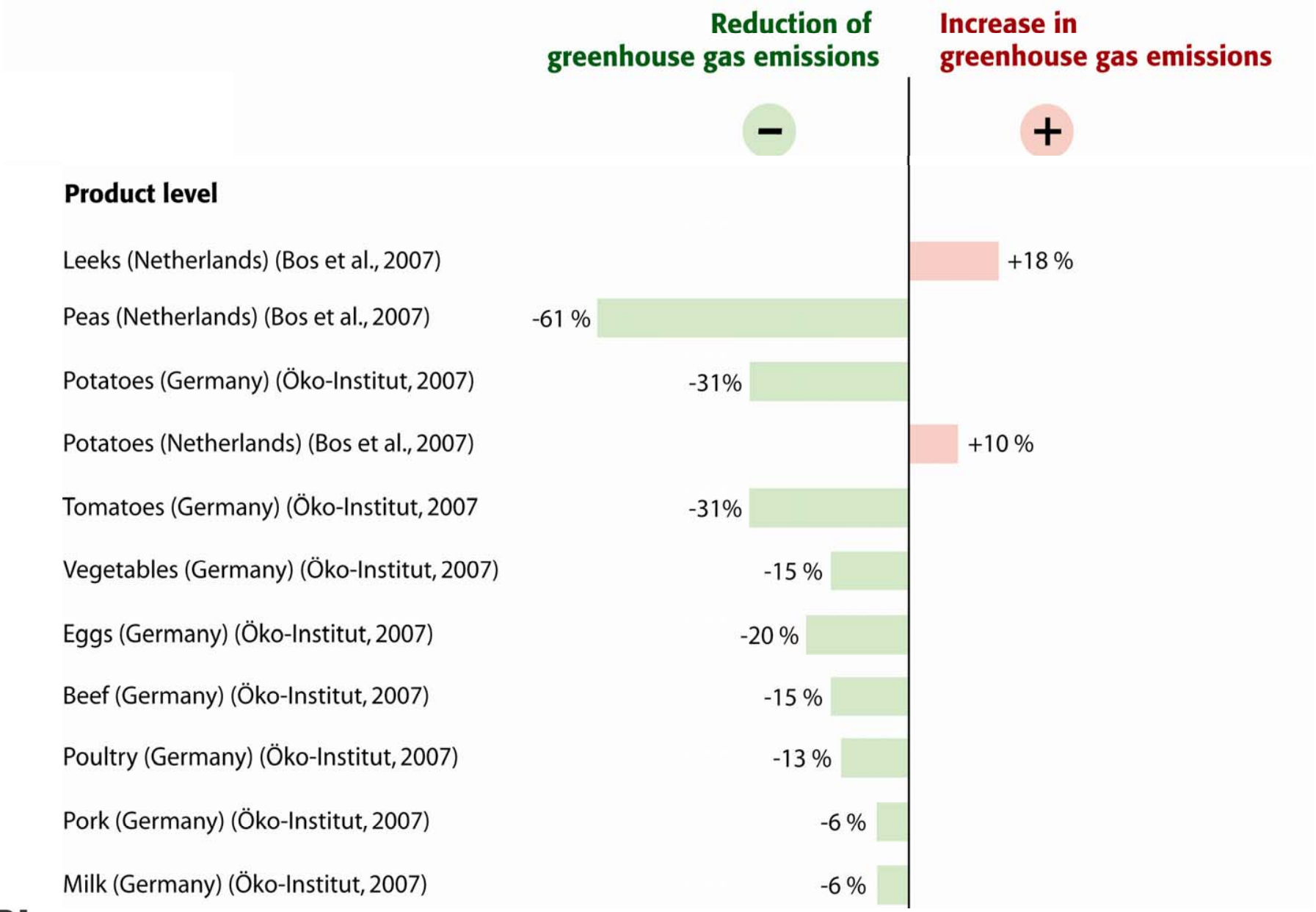
Per ton emissions of GHG: organic vs. conventional



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Improved management of livestock manure and on-farm production of nitrogen

Global potential to use 160 million tons of nitrogen (and other nutrients) from livestock manure more efficiently on cropland (calculated on the basis of 18.3 billion farm animals/FAO)

Global potential to produce 140 million tons of nitrogen on cropland (Badgley et al., 2007)

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Biodiversity: organic versus conventional

Taxon	Positive	Negative	No difference
Birds	7		2
Mammals	2		
Butterflies	1		1
Spiders	7		3
Earthworms	7	2	4
Beetles	13	5	3
Other arthropods	7	1	2
Plants	13		2
Soil microbes	9		8
Total	**66**	**8**	**25**

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Hole et al., 2005

Utilizing diversity functionally

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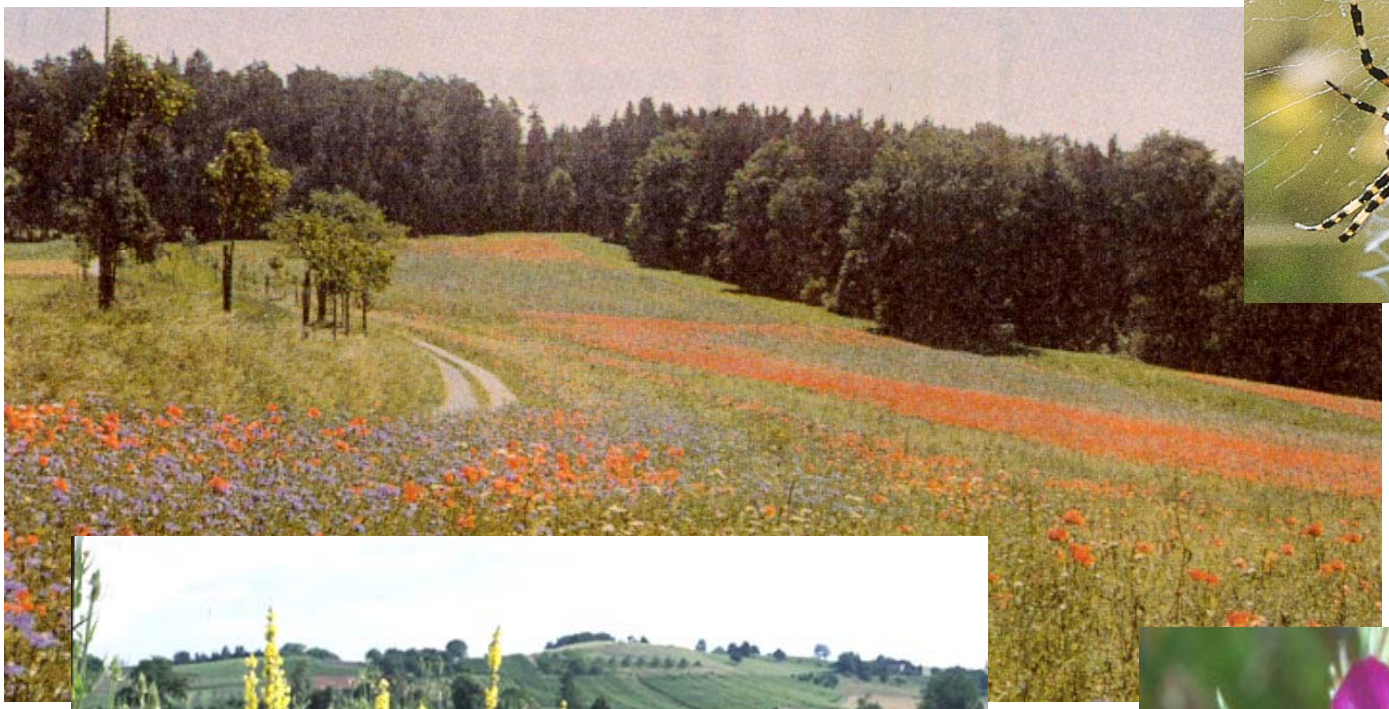
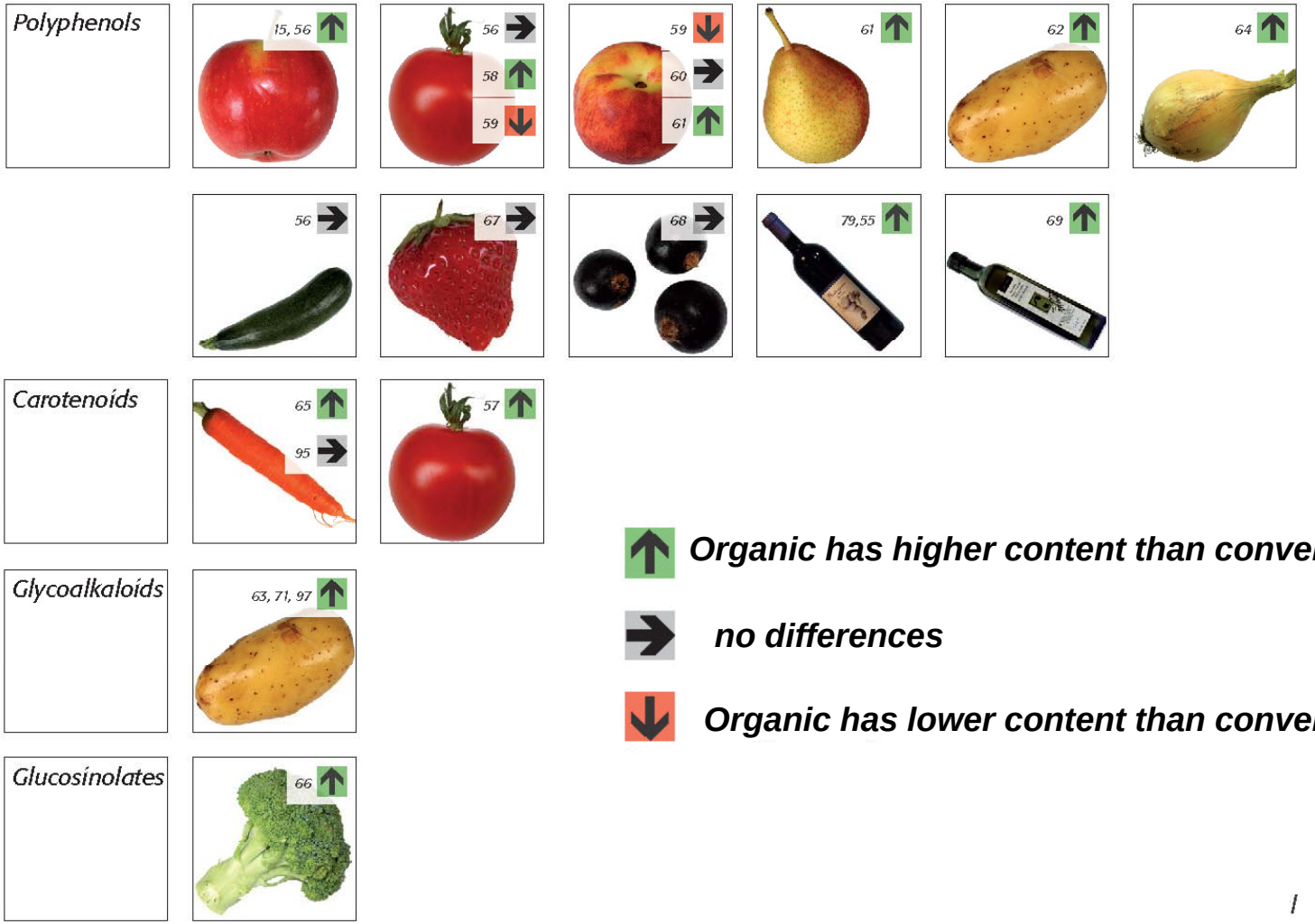
Biodiversity and landscape



Animal Welfare

Nutritional benefits of organic produce: e.g. secondary plant metabolites



Organic has higher content than conventional

no differences

Organic has lower content than conventional

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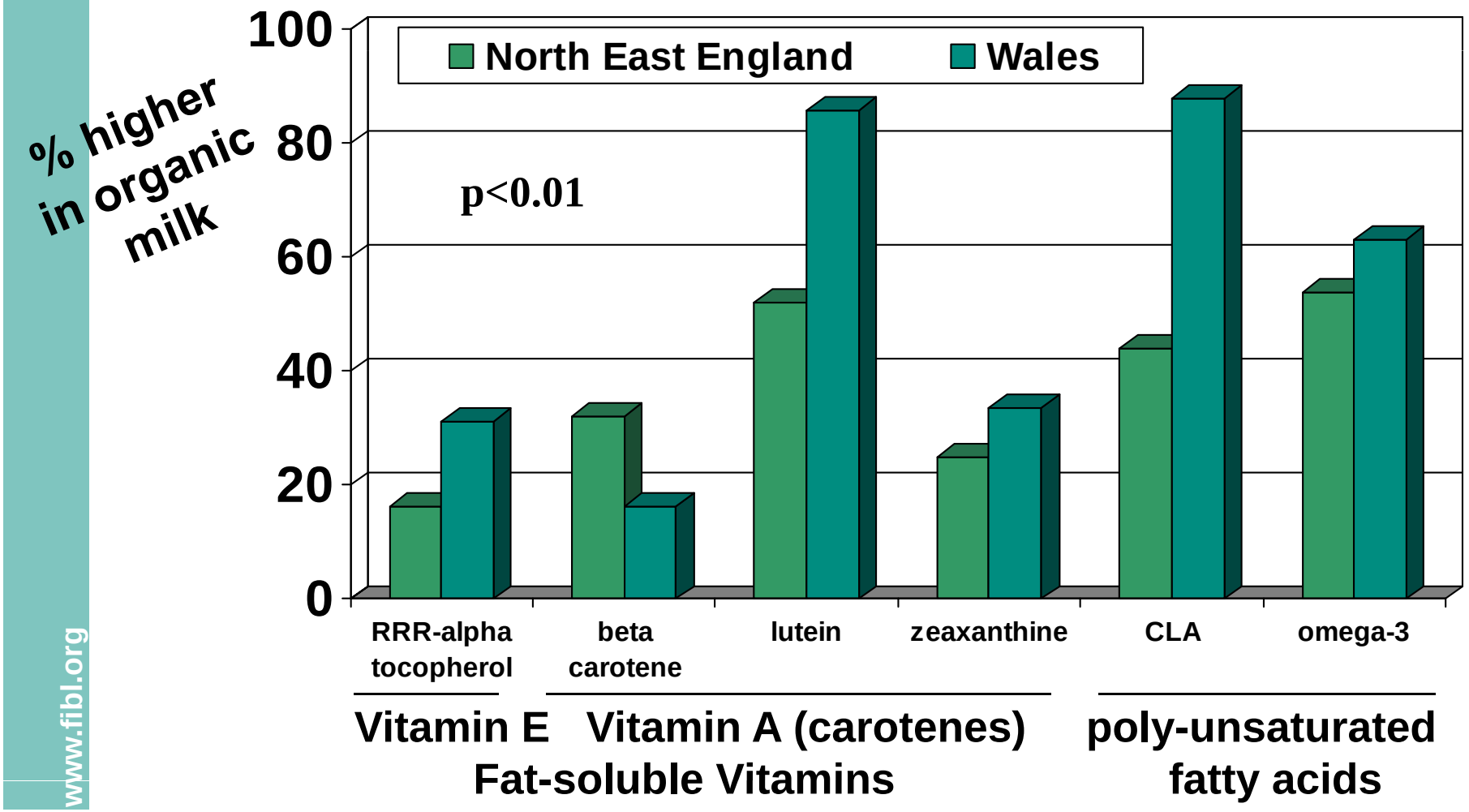
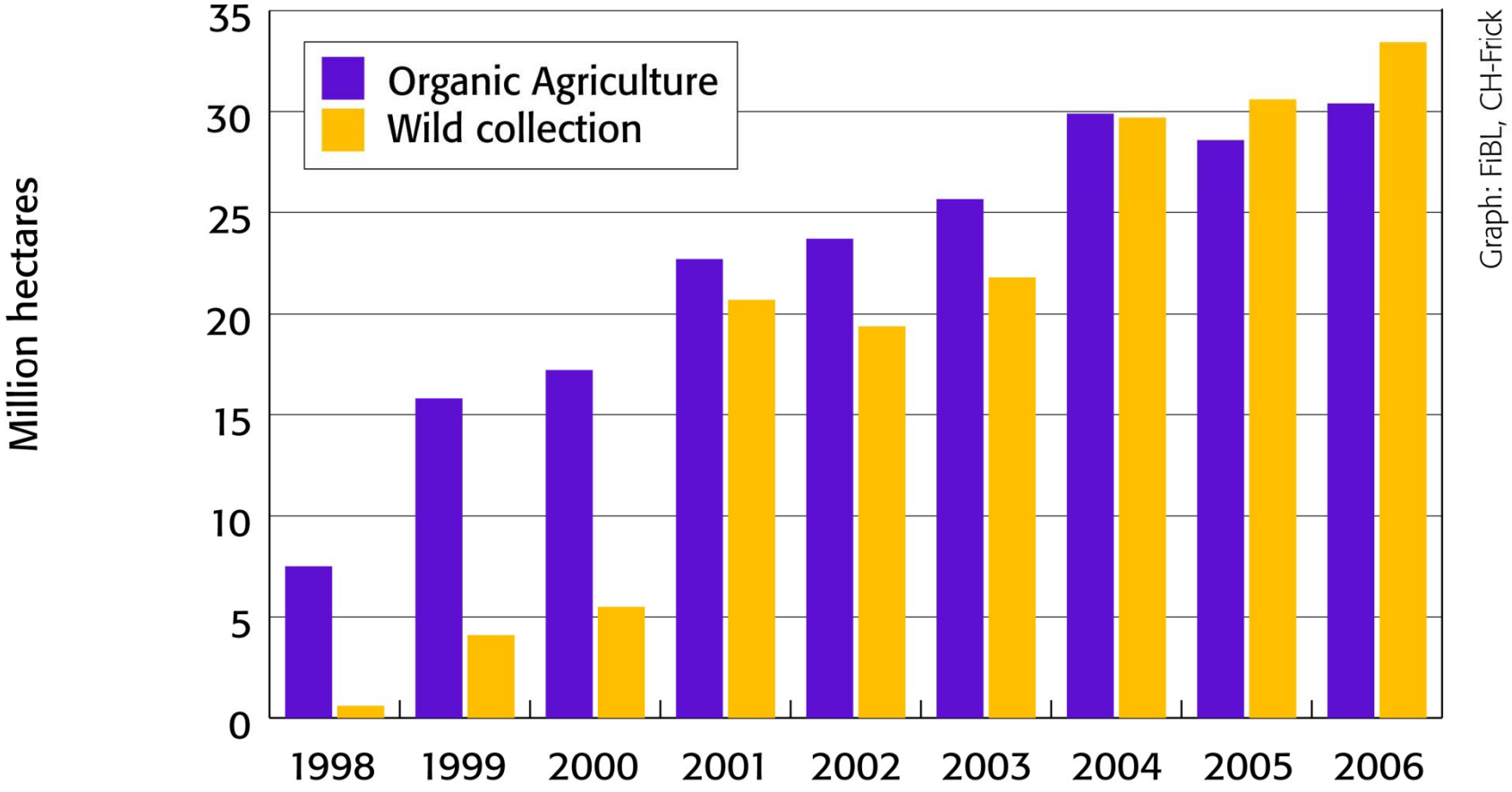
Milk quality (2005/2006)

Effect of organic and conventional production systems



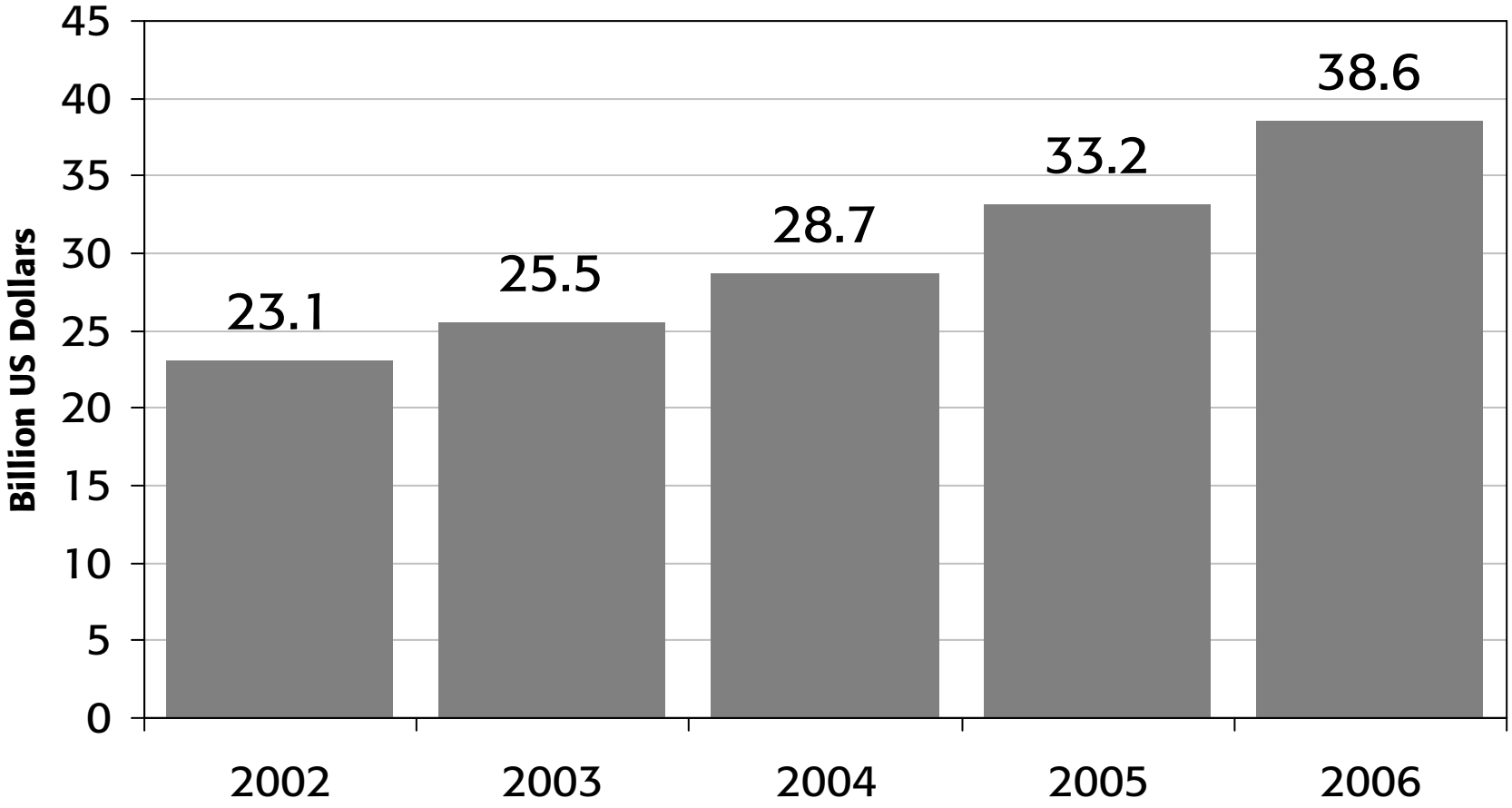
Milk survey in QLIF: DARCOF (DK), IGER (Wales), University Newcastle, Granolo (I)

Development of organic agricultural land and wild collection areas 1998-2006



Source: FiBL, SOEL & IFOAM Surveys 2000 - 2008. Data consolidation in progress.

Growth of the global market for organic food 2002-2006 (In US Dollars)



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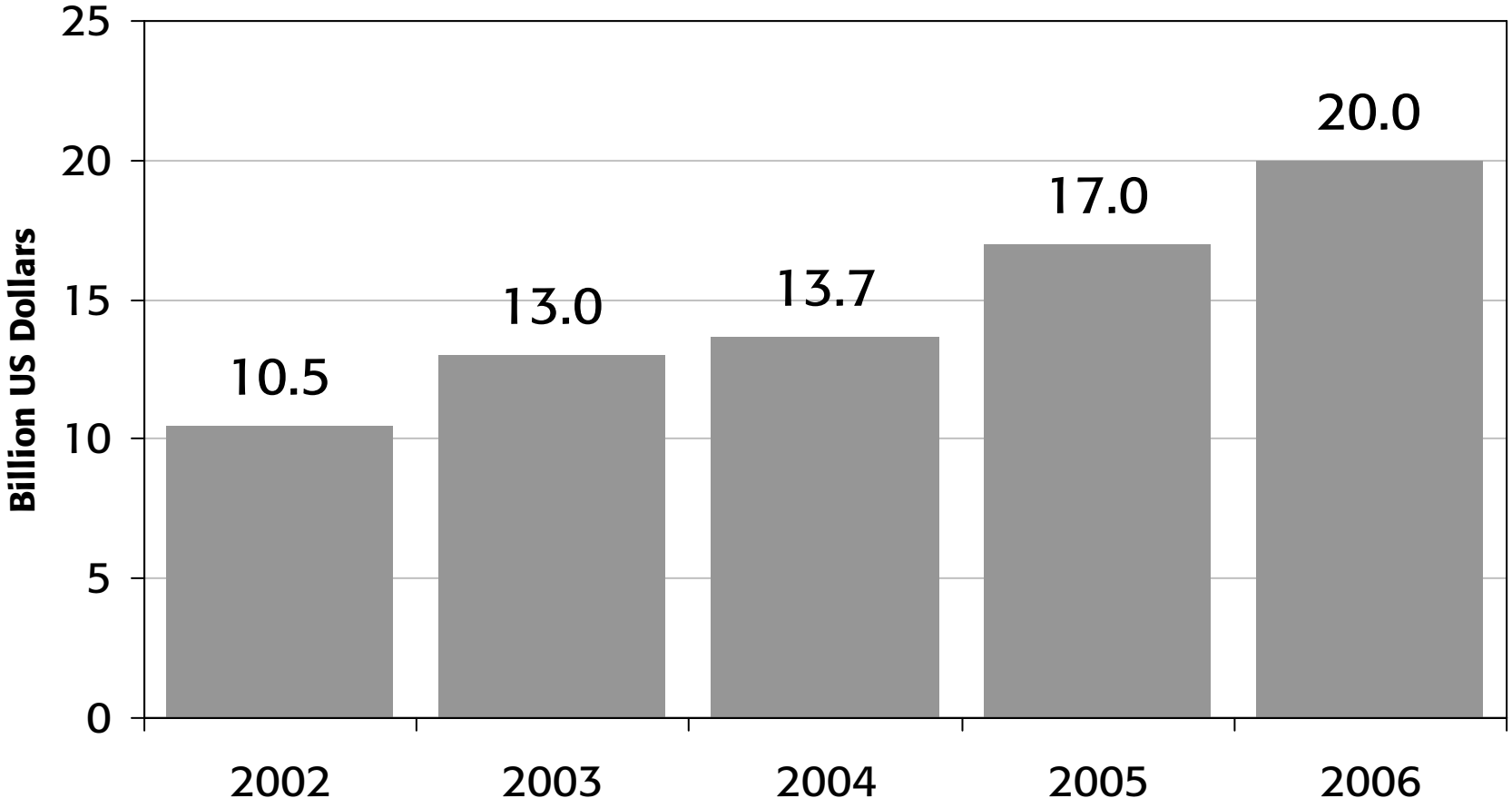
Source: Organic Monitor (Sahota 2008)

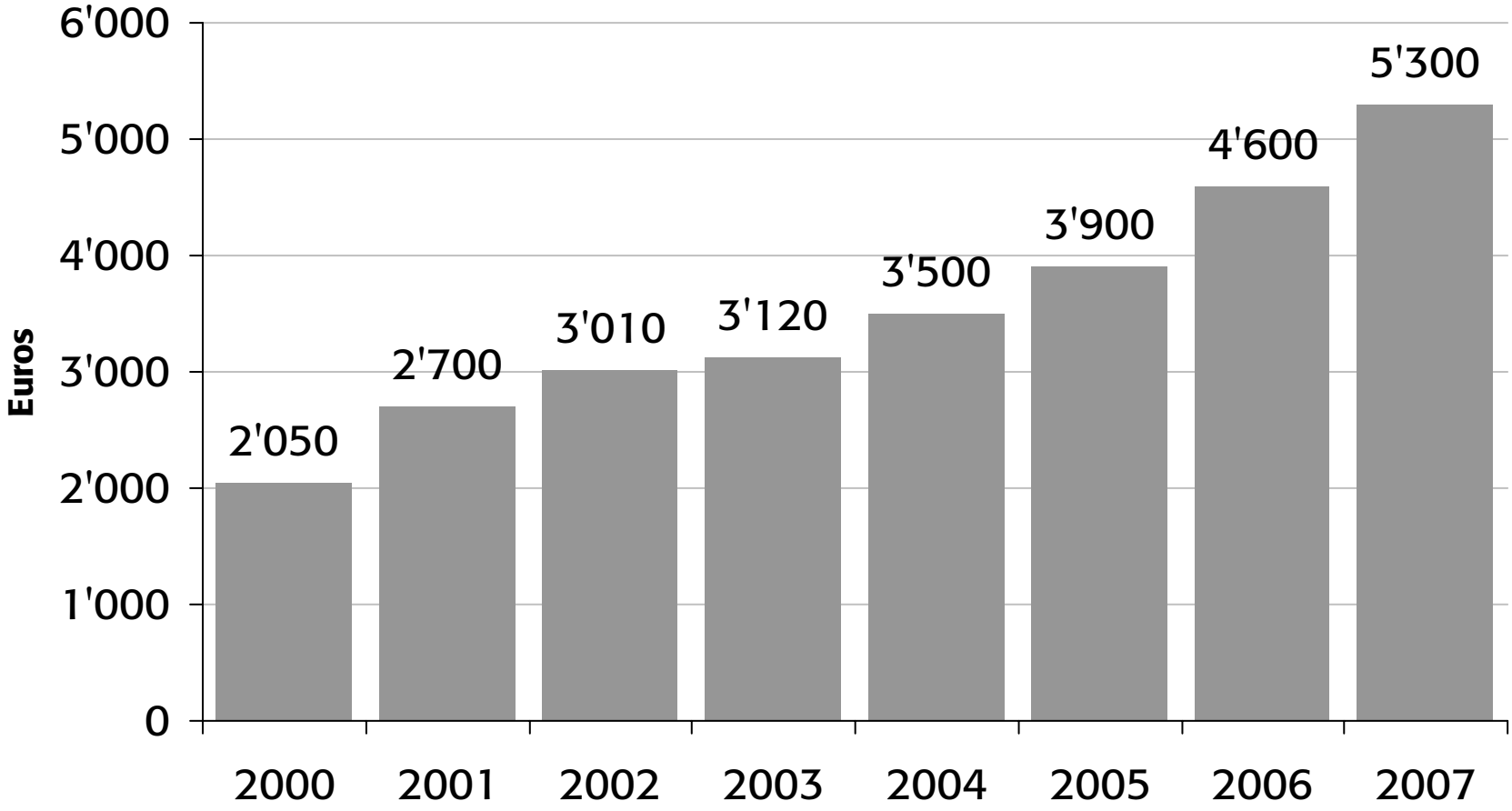
Organic Monitor

Growth of the European market for organic food (in US Dollars)



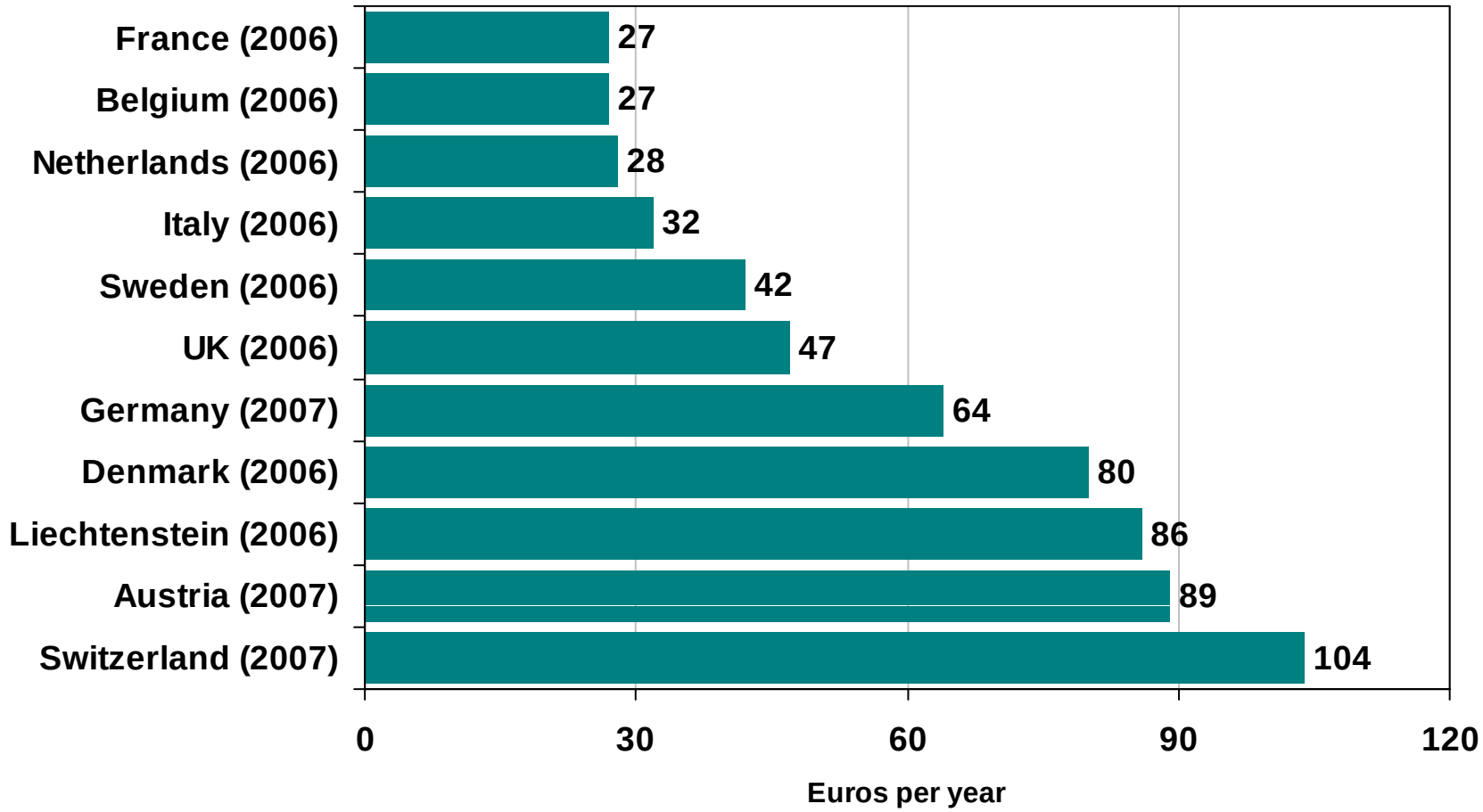
Source: Organic Monitor (Sahota 2005-2008)

Growth of the German market for organic food (in Euros)



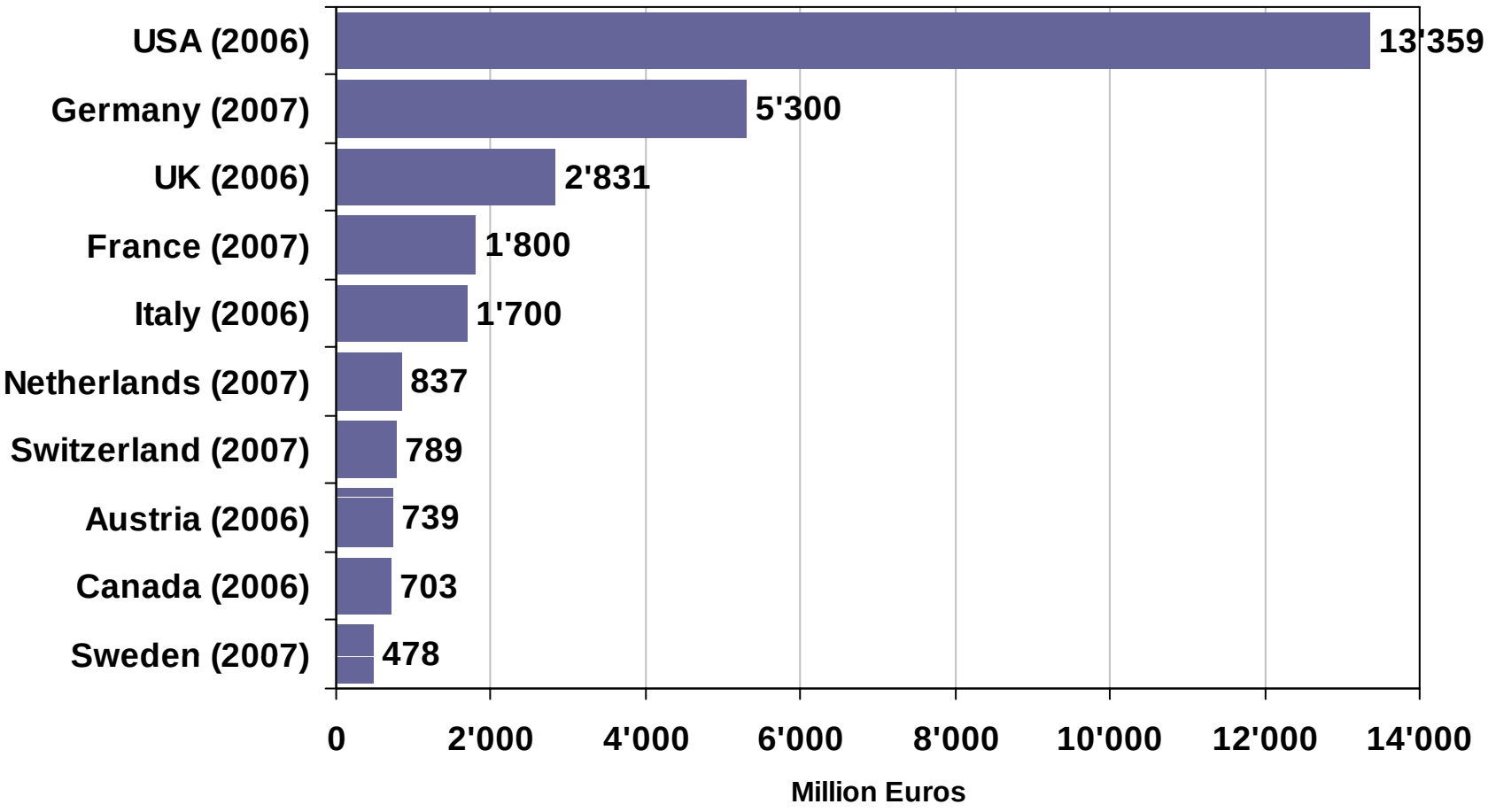
Source: Hamm, University of Kassel, Germany

Per capita consumption of organic products 2000/2007 (based on retail sales); the ten leading countries in Europe



Source: Survey of Aberystwyth University, Agromilagro Research, FiBL, ZMP

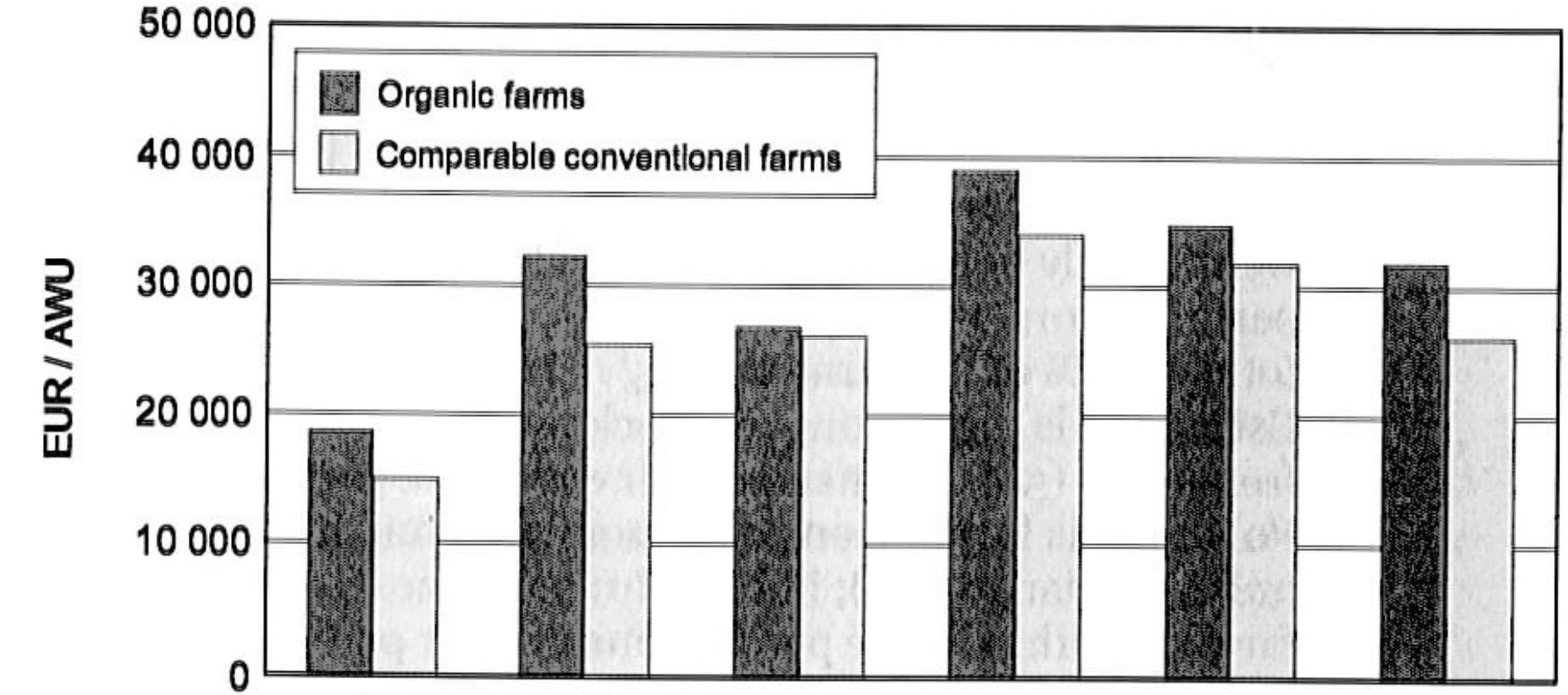
Retail sales with organic products 2007, the ten leading countries



Source: Survey of Aberystwyth University, Agromilagro Research, FiBL, ZMP

Profitability of organic farms

Farm Net Value Added per Agricultural Work Unit



	AT	CH	DE	DK	IT	UK
Number of farms	317	244	224	199	751	115
% OF > CCF 1)	63%	72%	53%	63%	n.a.	61%

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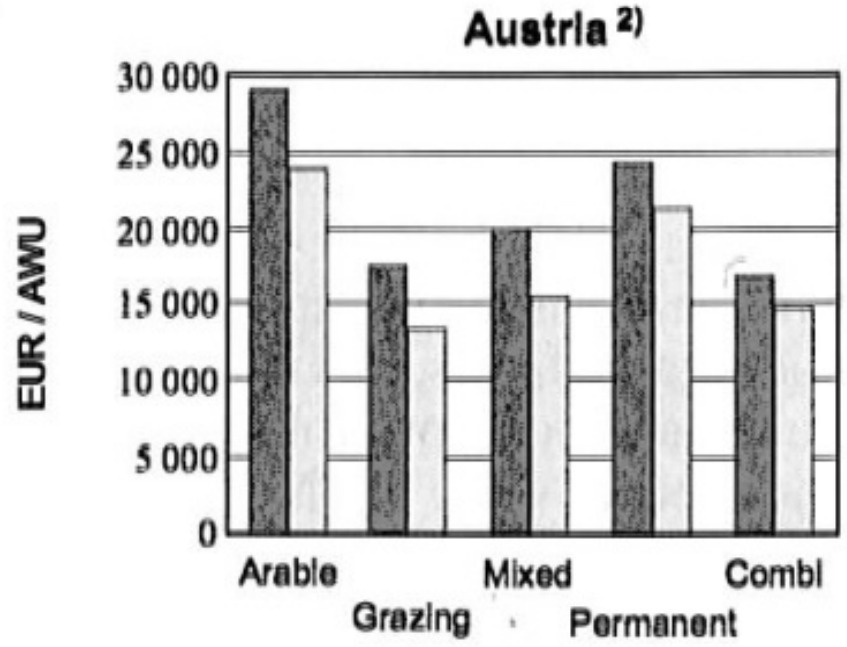
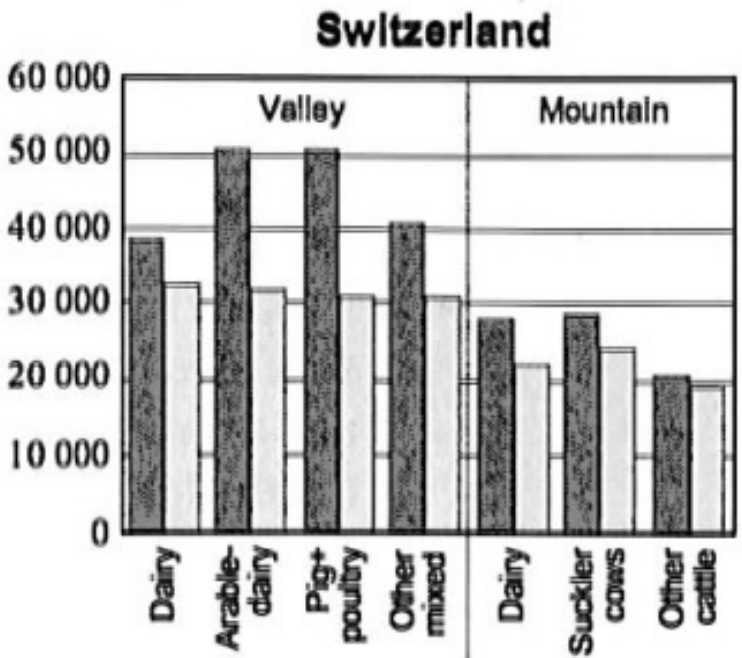
Profitability of organic farms

Farm Net Value Added per Agricultural Work Unit, 2001



	Arable	Mixed	Combi
Number of farms	23	184	13	12	82
% of OF > CCF 1)	52%	68%	69%	50%	55%



	Dairy	Arable-dairy	Pig+ poultry	Other mixed	Dairy	Suckler cows	Other cattle
	13	8	6	13	104	10	7
	62%	88%	83%	92%	74%	60%	57%

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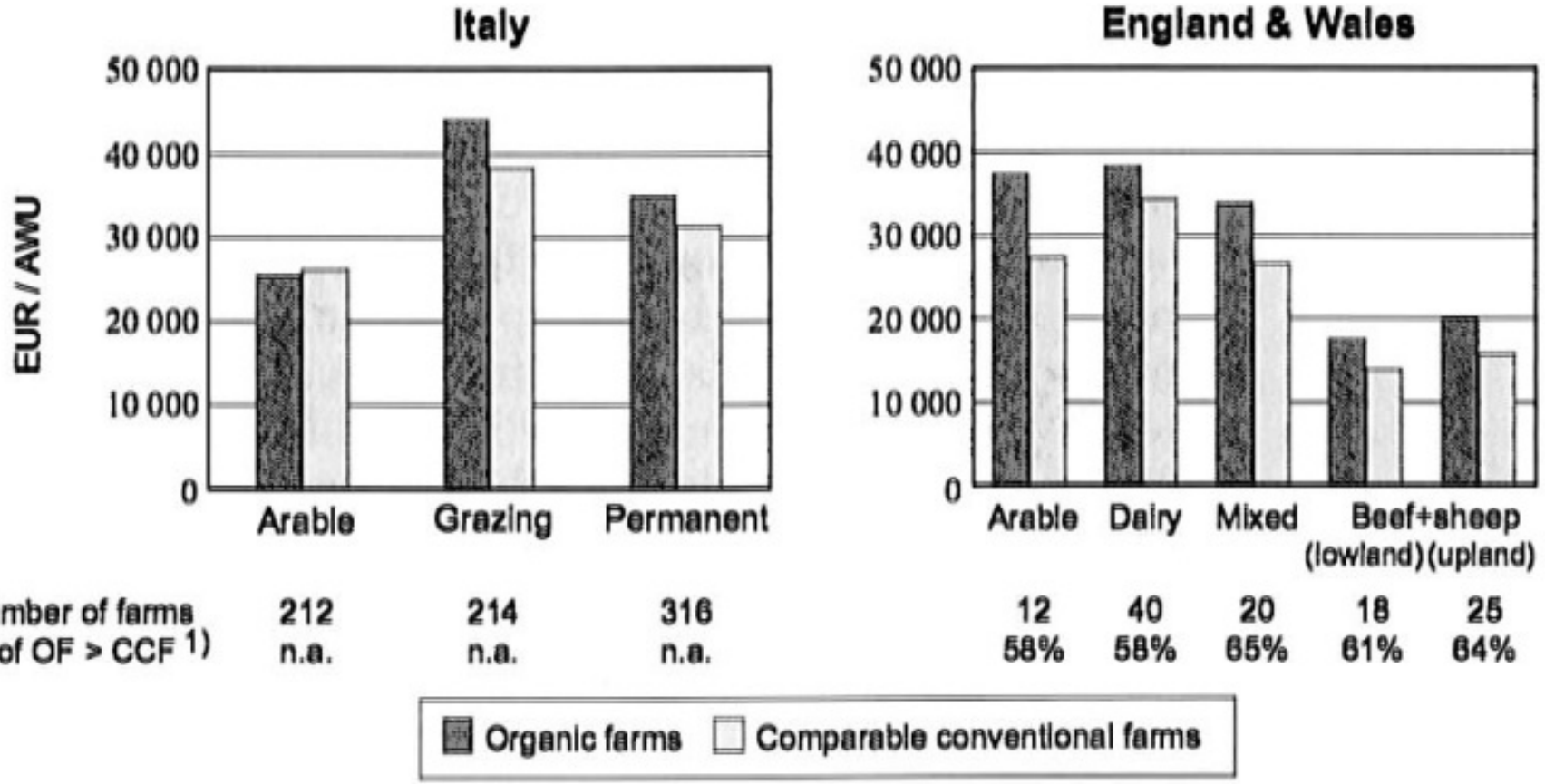
Profitability of organic farms

Farm Net Value Added per Agricultural Work Unit, 2001



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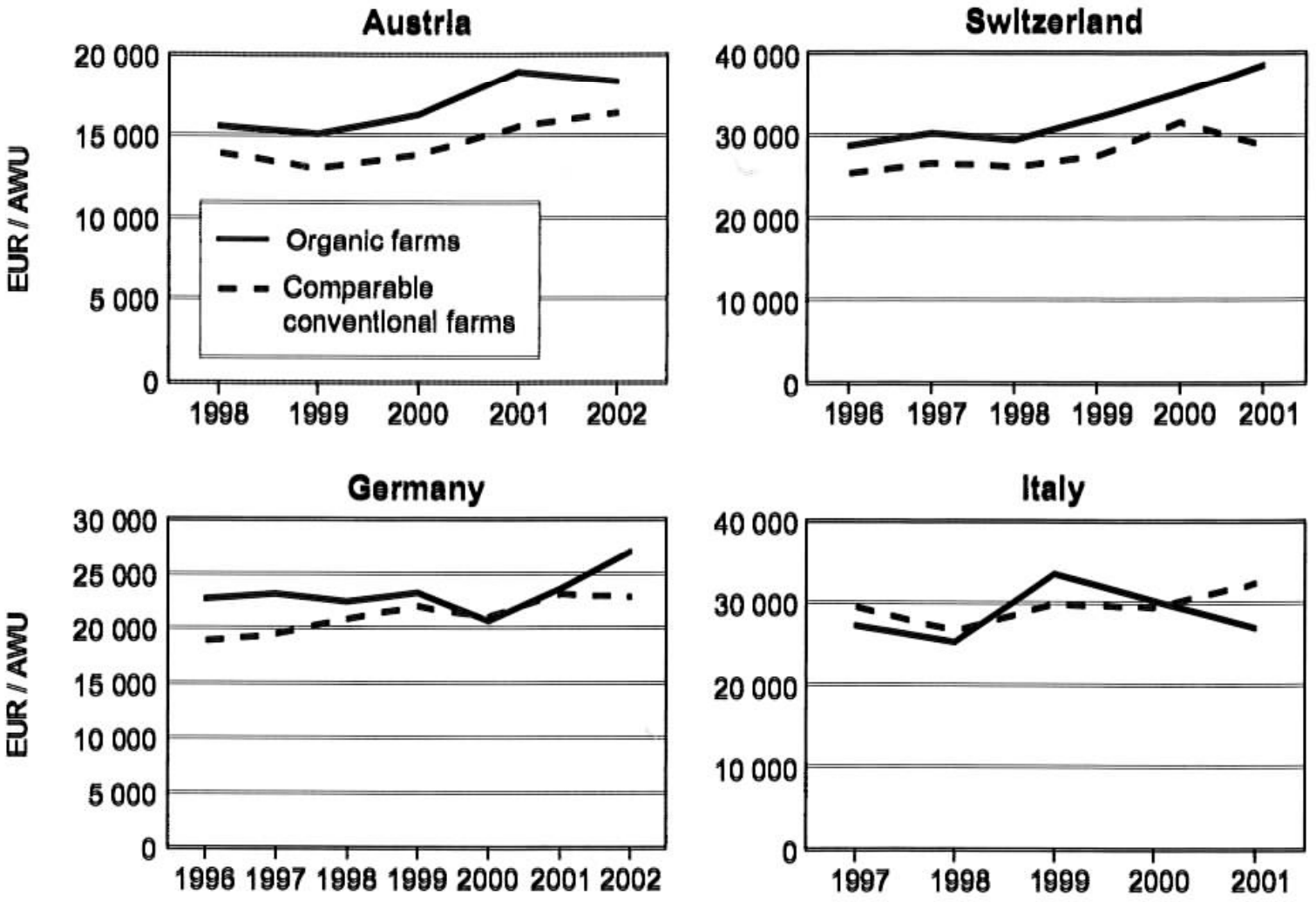

Nieberg, Offermann, Zander, 2007

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Thanks!

Review studies

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- Hole D G, Perkins A J, Wilson J D, Alexander I H, Grice P V and Evans A D, 2005: Does organic farming benefit biodiversity? Biological Conservation 122, 113-130.

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