Sustainable food production and diets for a green Europe

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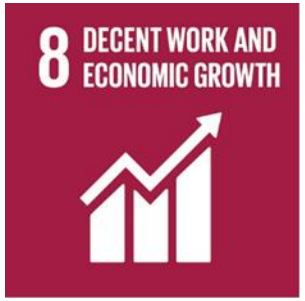
Presentation plan

1. Definition of sustainable development (Brundtland)
2. Sustainable development goals
3. Definition of sustainable diets (FAO)
4. Impact of food production on ecosystems & biodiversity
5. Economical fairness & affordability of healthy diet
6. Nutritional adequacy of diets
7. Organic food production as a model of sustainability.
8. Conclusions.

Sustainable development: Brundtland definition

A development which fulfils the needs of the present generations without endangering future generations possibilities for fulfilling their needs.

„Our Common Future", also known as the Brundtland Report, from the United Nations World Commission on Environment and Development (WCED) was published in 1987.



A final document 'The 2030 Agenda for Sustainable Development' was adopted at the UN Sustainable Development Summit September 25–27, 2015 in New York

The FAO definition of sustainable diets states that

"Sustainable Diets are those diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimizing natural and human resources."

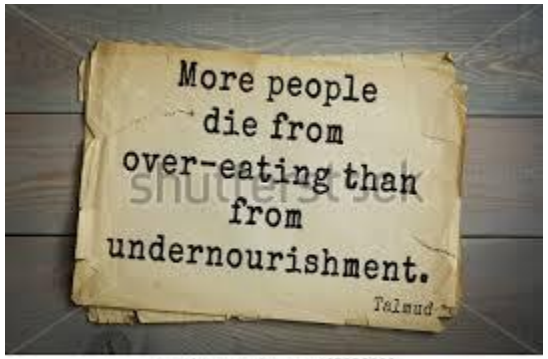
FAO, 2012

The main problems about current food systems

- Unbalanced diets! The paradox in nutrition:
- Ca. 925 million people who are undernourished around the world, the majority in Africa and Asia.

- AND 1,4 billion are overweight

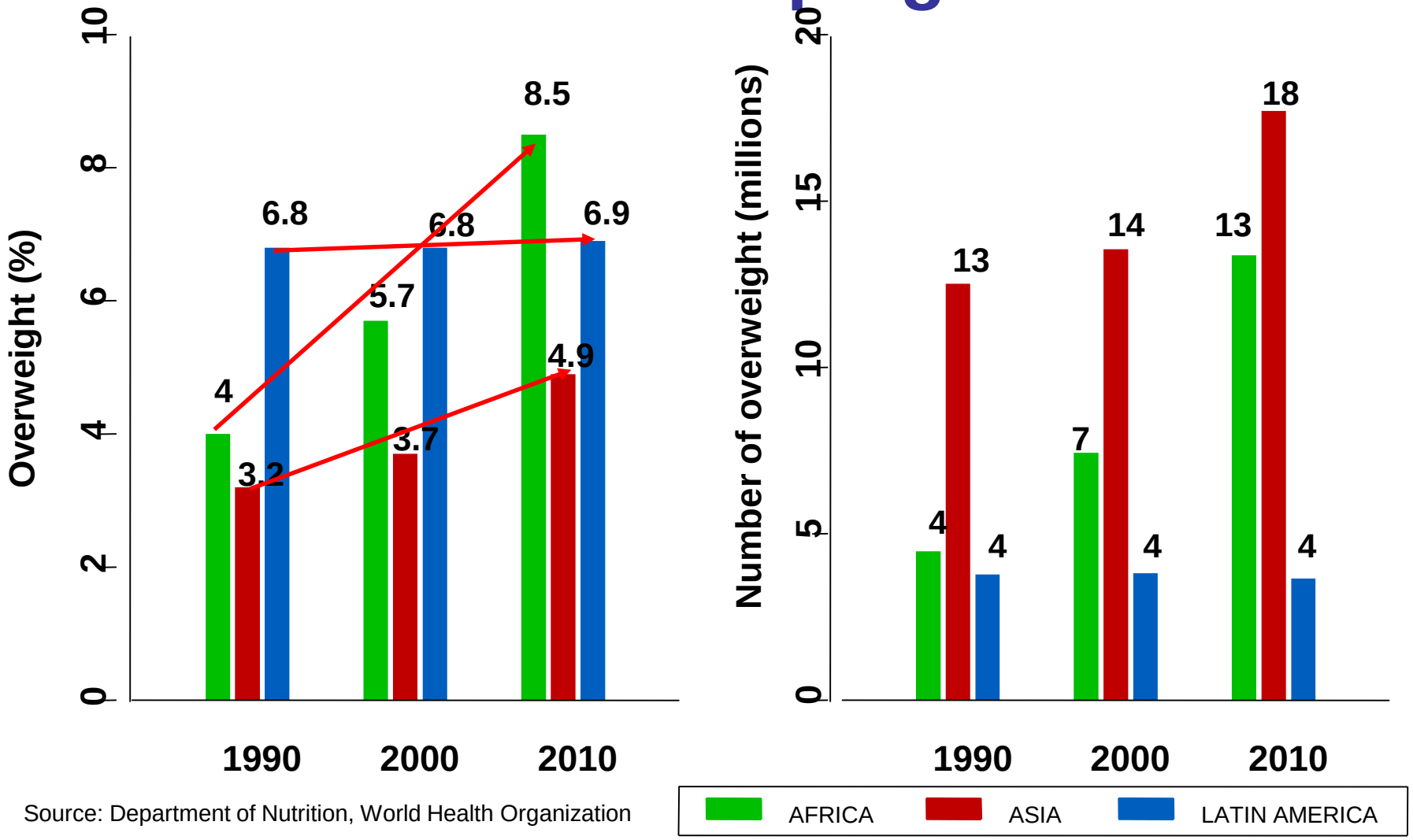
Dietary transition from traditional diets to diets high in processed foods, calories, meat, protein, fat, refined sugars



Where do the hungry live?

Burlingame, FAO, 2013

Overweight prevalence and number affected in developing countries



Source: Department of Nutrition, World Health Organization

Burlingame, FAO, 2013

Impacts of our current food system on environment

- the full supply food chain contributes 19–29% of global GHG emissions / year
- agriculture makes the greater contribution: 14-24% (of these animals are responsible for 31% and fertilizers for 38%)
- soil erosion
- surface and groundwater contamination
- increased pest resistance
- change in land use
- deforestation
- **loss of biodiversity**. 12 plant species accounted for 75% of global food supply;
- 15 mammal and bird species accounted for 90% of animal agriculture

Kahl 2015

Loss of varieties in agriculture

- In 20th century agriculture lost 75% of its varieties worldwide
- Since 1949 China lost more than 90% of varieties in agriculture
- Since 1900 rice varieties in India have been reduced from 30.000 to 12
- Since 1900 we went from20.000 apple cultivars on the market to 15

Kahl 2015

Extent of genetic uniformity in rice

Country	Number of varieties grown		
	Past	Present	Remark
Bangladesh	5,000	23	
Japan	1,302	-	>70% of area cultivated under three varieties
Rep. of Korea	4,227	12	
Philippines	-	13	
Sri Lanka	2,000	100	
Taiwan Province of China	1,679	50	> 82% of area cultivated under three varieties
Thailand	16,185	37	50% of area cultivated under two varieties

Source: Paroda, 1999

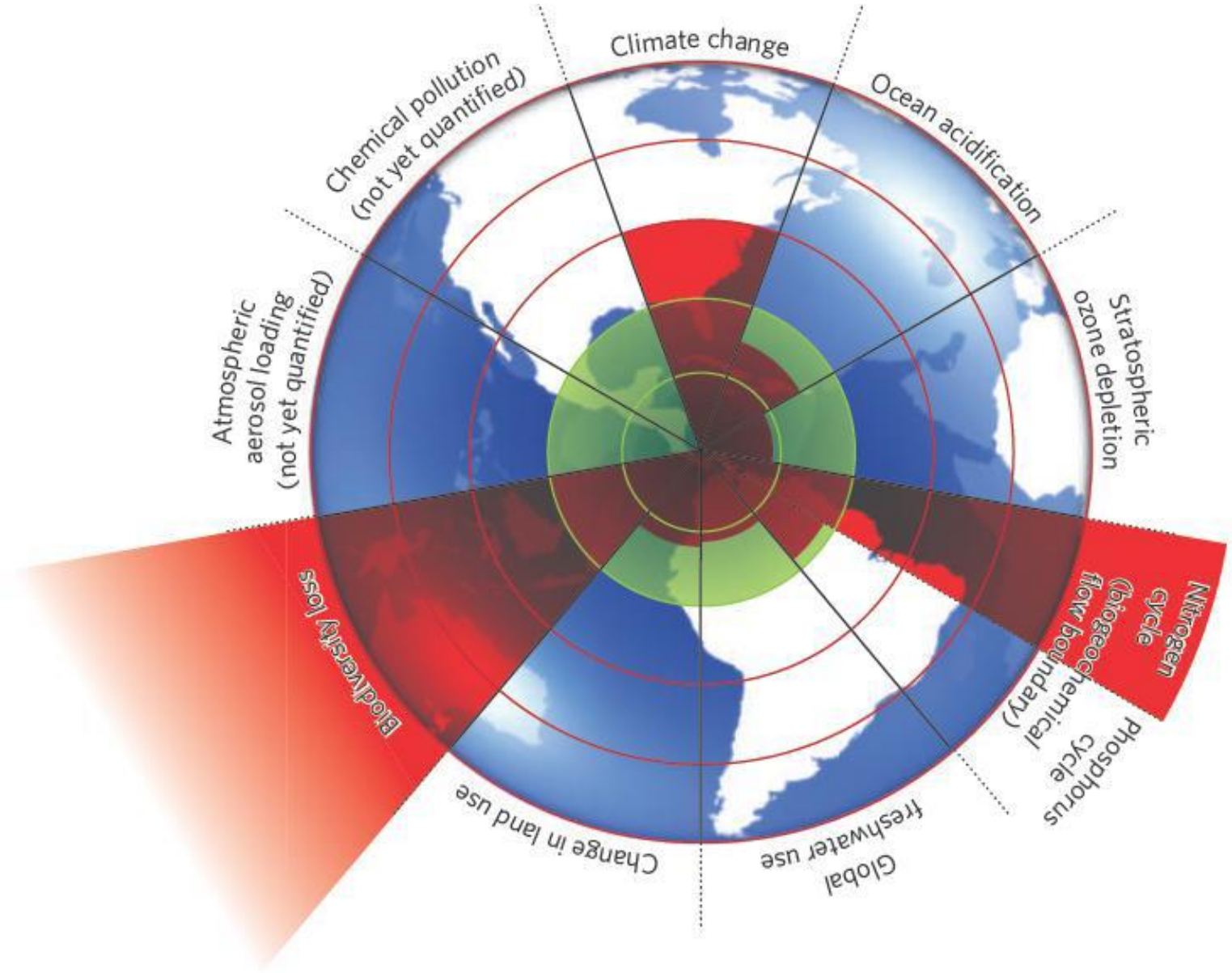
Bananas and vitamin A

<5 µg carotenes

<8500 µg carotenes

Burlingame, FAO, 2013

Impact on ecosystems & biodiversity



Rockström et al 2009, Nature

Biodiversity and nutrition

Burlingame, FAO, 2013

- Dietary energy supply *can* be satisfied without diversity
- Micronutrient supply *cannot* be satisfied without diversity

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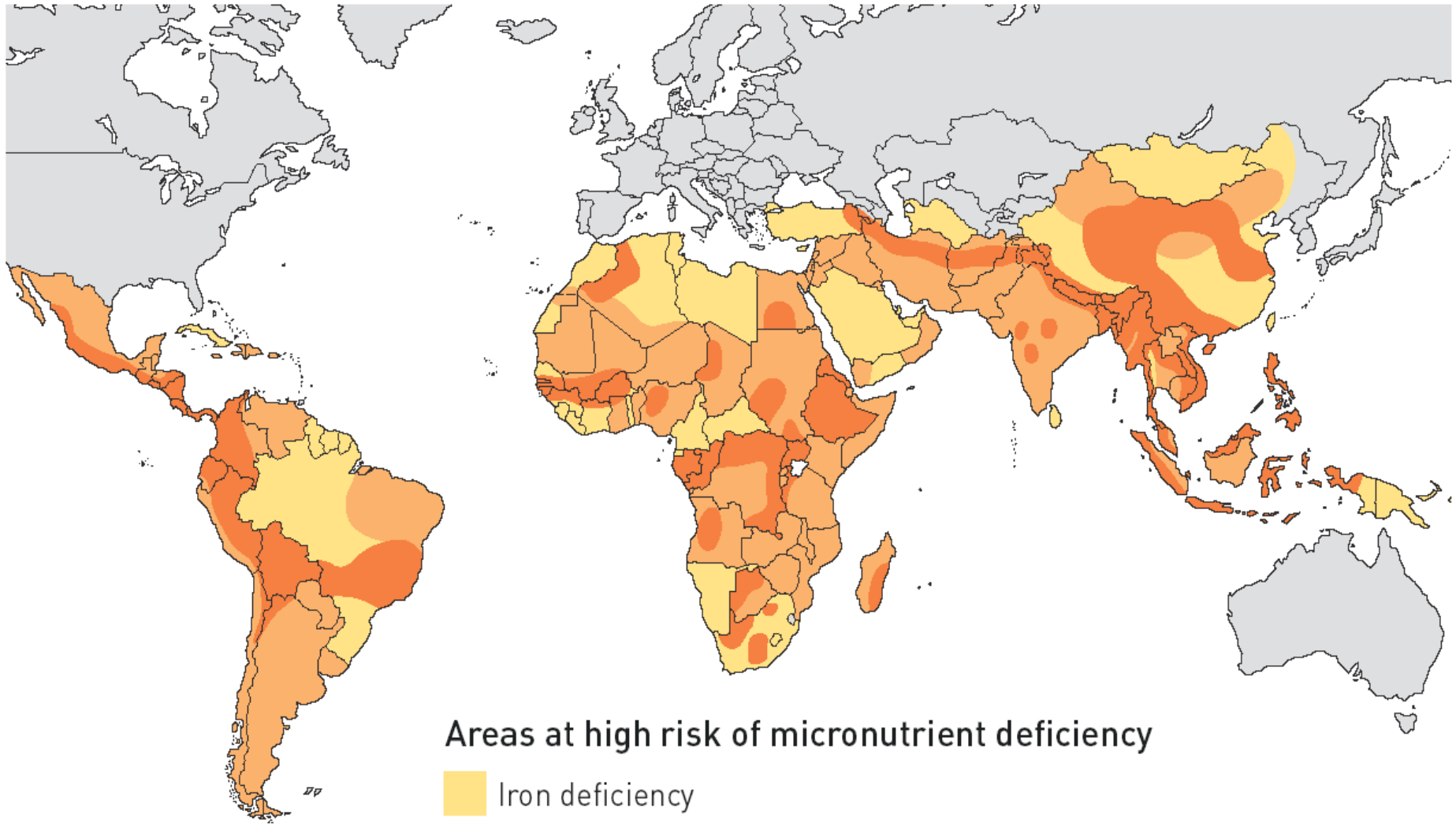
"Agricultural biodiversity is a matter of life and death for us.... We cannot separate agrobiodiversity from food security."

—Zambian delegate to the Conference of Parties, Convention on Biological Diversity, May 1998

Prevalence of micronutrient deficiencies in developing countries



Source: USAID

The loss of biodiversity is caused mainly by:

- population growth, especially in the most biodiversity-rich areas (such as tropical areas);
- destruction and fragmentation of natural habitats (**deforestation**, urbanization, development);
- intensive agriculture; pollution and global climate change;
- introduction of invasive species;
- **destruction of rainforests,** for example, has accelerated dramatically, with dire consequences for biodiversity as these ecosystems host more than half the world's land species;
- ten million hectares of rainforest are cleared or degraded every year – the equivalent of a football field being cleared every two seconds.

Roccatello 2016
Slow Food Foundation for Biodiversity

Deforestation

Amazon – cutting of tropical forest

In 1988 about 10% of the surface area of the Amazon has been deforested. Today this area has doubled to about 19%; This 80% is located in Brazil. The area of the Amazon, which has been deforested, generally estimated at about 762.979 km2 (Nobre, 2014). This is an area larger than the size of the two countries, such as Japan or Germany.

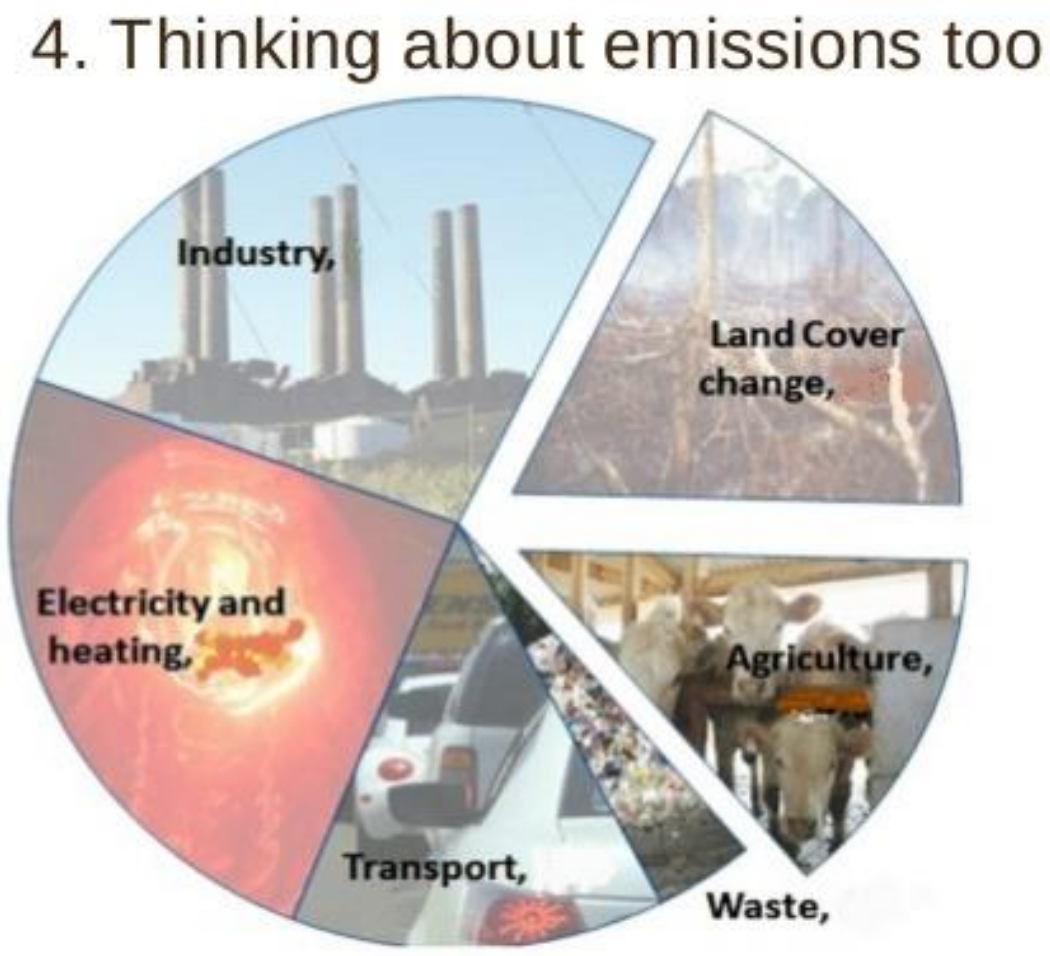
Minister for the Environment Jose Sarney Filho announced a 29 percent increase in deforestation rates in 2016 compared to the previous year in the Brazilian Amazon. That is the equivalent to 7,989 square kilometers (4,964 square miles), or an area bigger than Connecticut.

How does agriculture influence climate change?

- The primary sources of greenhouse gases in agriculture are the production of nitrogen based fertilizers
- The combustion of fossil fuels as coal, gasoline,diesel fuel and natural gas
- Waste management
- Massive overuse of fertilizers!!!
- More than 50 % of all fertilizers applied to the soils ends up in the atmosphere or in local waterways
- The second biggest direct emitters are animals; digesting fodder they produce & emit large amount of methane, a potent greenhouse gas.

https://www.slideshare.net/pranshail/agriculture-amp-climate-change

Contribution of food systems to gas emissions



Food systems contributes 10,000 to17,000 Mt CO_2 eq

19-29% global GHGs

80-86% of this comes from agriculture, but with wide regional variation

Vermeulen et al. 2012

What is Fair Trade?

- Fair Trade is a trading, technical and social partnership based on dialogue, transparency and respect.
- It benefits struggling producers and workers as well as their families in developing countries.
- Promotes equity in commercial relationships and adheres to the process of sustainable development.

Economical fairness & affordability of healthy diet

Practical application of eco-functional intensification by crop diversification

Diversified cropping systems benefit from ecological principles such as:

- **competition,**
- **facilitation,**
- **niche complementarity,**
- **symbiosis,**
- **chemical ecology. etc.**

Steen Jensen 2013

Economical fairness & affordability of healthy diet

An example - diversified food production system by a small scale farmers in Uganda

Mrs. Ssemuddu Regina´s farm outside Kampala – 5 acres

- Matooke
- Cassava and Sweet potato
- Beans and Groundnuts
- Maize
- Green vegetables (onion, cabbage, tomato, eggplant, chili)
- Fruits (mango, jackfruit)
- Tree crops (avocado, chili, coffee)
- Vanilla
- Feed and manure crop: Russian confle, elephant grass.

Steen Jensen 2013

Healthy diets – connect sustainability and health

- Healthy diet concept of the World Health Organization (WHO)
- FAO/ WHO ICN2 2014/2, Rome declaration on nutrition
- Health diet concept:

„Food systems, including all components of production, processing and distribution should be sustainable, resilient and effcient in providing more diverse foods in an equitable manner, with due attention to assessing environment and health impacts”

Special recommendations:

- For sustainable food systems promoting healthy diets
- Actions for nutrition education and information.

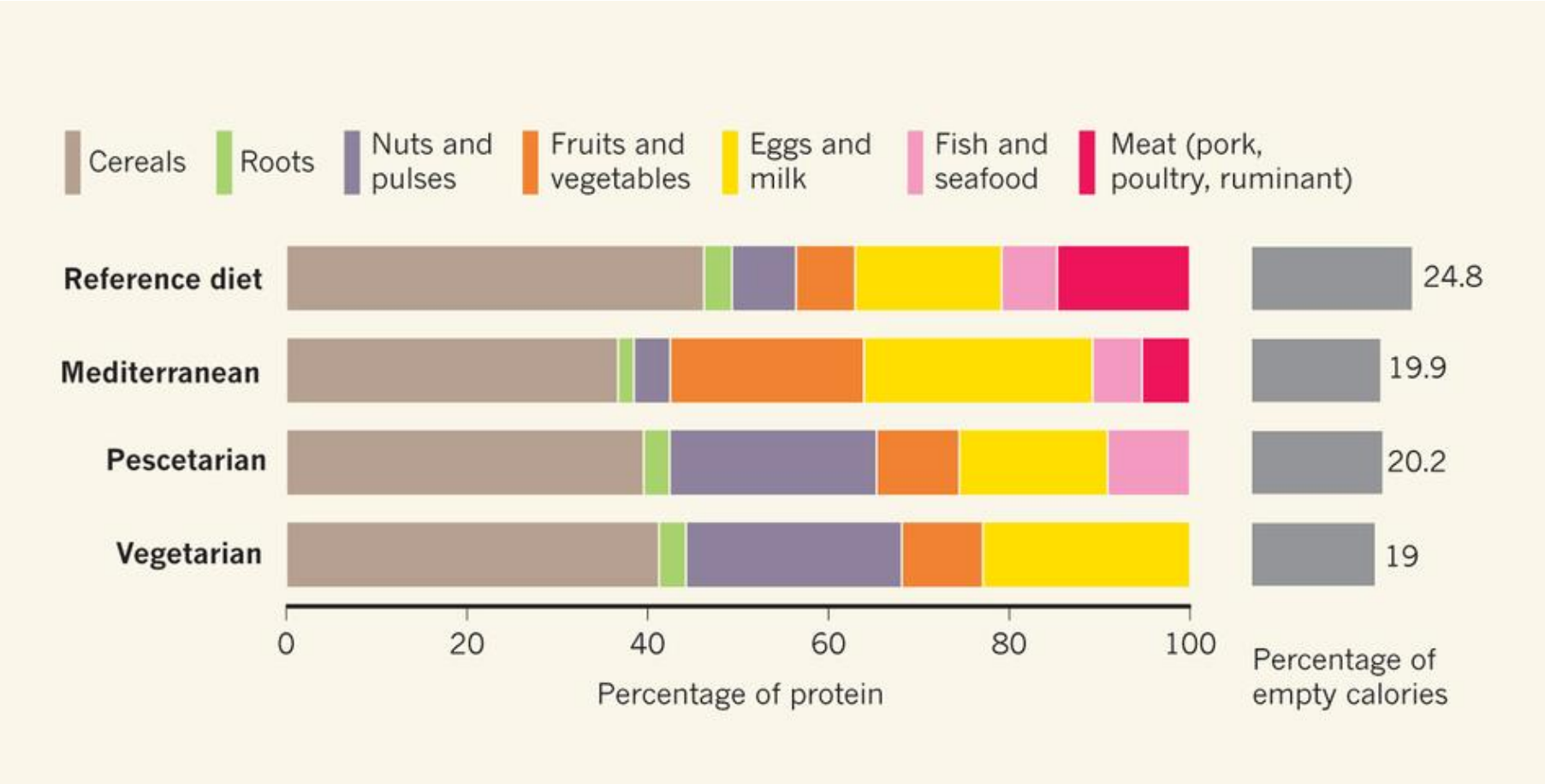
Kahl 2015

Sustainable healthy diets

- **Diversity – a wide variety of foods eaten.**
- **Balance achieved between energy intake and energy needs.**
- **Based around: minimally processed tubers and whole grains; legumes; fruits and vegetables – particularly those that are field grown, "robust" (less prone to spoilage) and less requiring of rapid and more energy intensive transport modes.**
- **Meat, if eaten, in moderate quantities – and all animal parts consumed.**
- **Dairy products or alternatives (e.g. fortified milk substitutes and other foods rich in calcium and micronutrients) eaten in moderation.**
- **Unsalted seeds and nuts.**
- **Small quantities of fish and aquatic products sourced from certified fisheries.**
- **Very limited consumption of foods high in fat, sugar or salt and low in micronutrients e.g. crisps, confectionery, sugary drinks.**
- **Oils and fats with a beneficial Omega 3:6 ratio such as rapeseed and olive oil.**
- **Tap water in preference to other beverages – particularly soft drinks.**

FAO guidelines 2016

Stehfest E. 2014: Diet: Food choices for health and planet. Nature. 515, 501–502. doi:10.1038/nature13943



Mediterranean Diet Pyramid

Another approach: The New Nordic Diet

- More calories from plant foods and fewer from meat
- More foods from the sea and lakes
- More foods from the wild countryside compared with the current average Danish diet
- Food: >70% from organic production

- Sustainability
- Nordic
- Identity
- Health
- Gastronomy

Mithril 2013, Kahl 2015


How to produce more with
less
environmental impact?

Organic agriculture

- Organic agriculture is a production system that sustains the health of soils, ecosystems and people;

- It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects;

- Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved.

IFOAM 2011

Principles in organic farming

Recycling

- Recycling of nutrient and use of renewable resources. Versatility of production.

Precaution

- Known and well-functioning technologies are better than risky technologies. It is better to prevent damage than to depend on our ability to cure the damage.

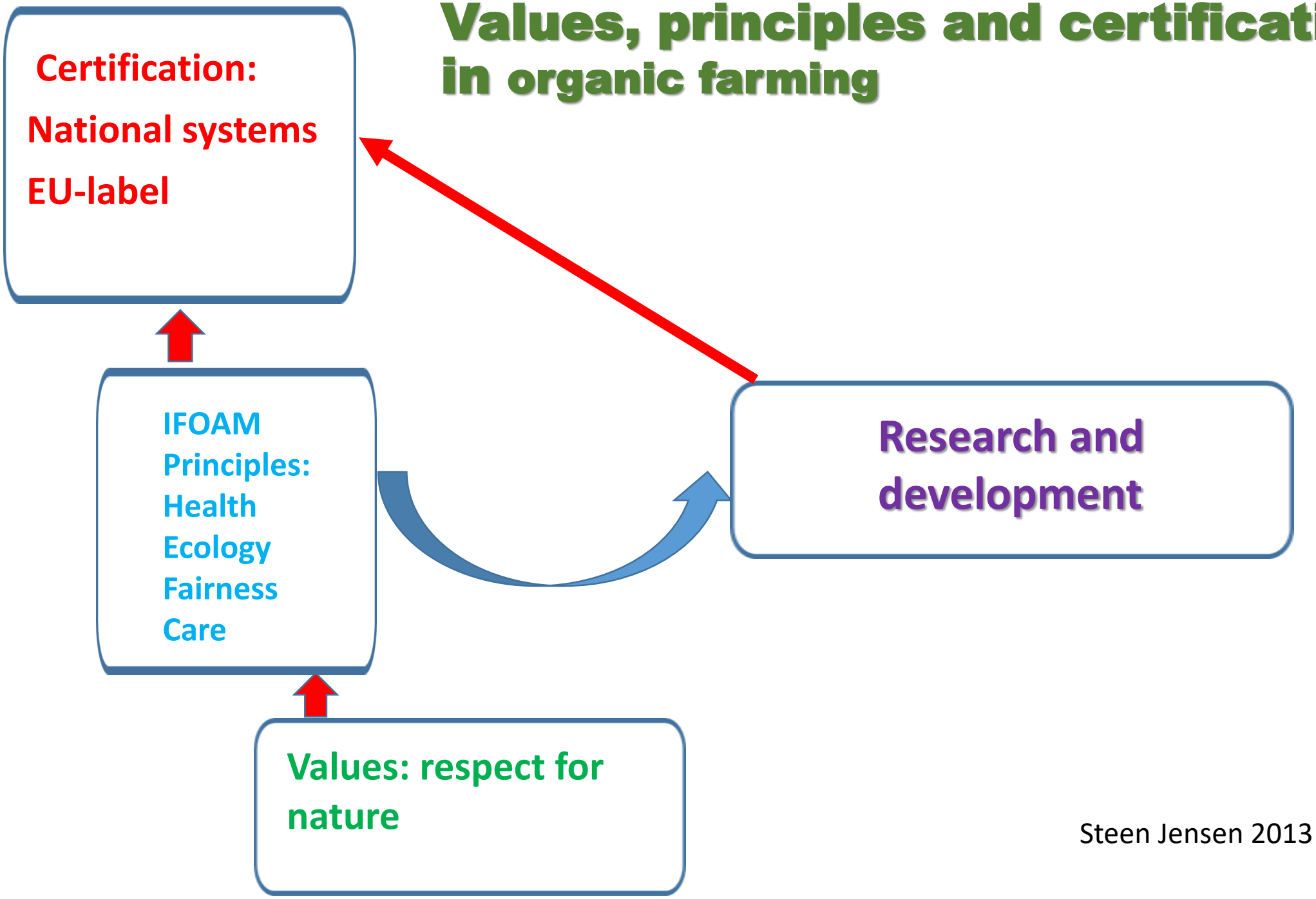
Nearness

- Transparency and co-operation in food production can be improved by nearness.

Principles later developed to the ecology, health, fairness and care principles by IFOAM.

”The IFOAM principles of organic agriculture have become a global reference for sustainability in agriculture and food systems, due to evidence based on research and adaptive management” (2009)

Values, principles and certification in organic farming



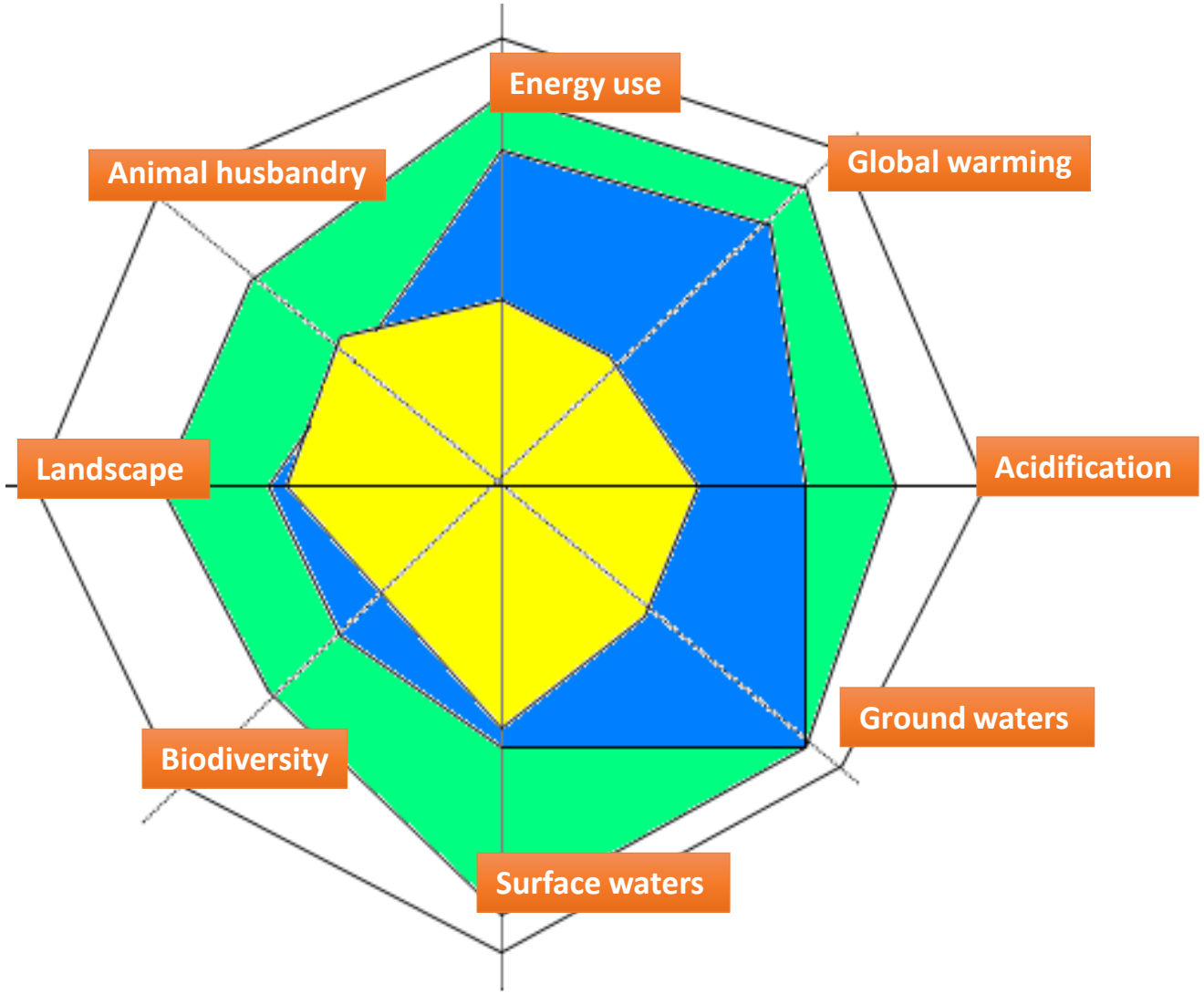
Steen Jensen 2013

Impact on ecosystems & biodiversity

Diagram of the impact of the three management systems: intensive, extensive and organic on selected indicators of environmental quality in Allgäu (Germany)

Outside net
= 100% positive

Middle of net = 0% positive



LEGEND:

- organic
- extensive
- intensive

Haas et al., 2001

Impact of the organic food system on biodiversity

- **Organic shows 30% higher biodiversity, when compared to non-organic** (Bengtsson et al. 2005, Gabriel et al. 2013, Tuck et al. 2014)

Why organic performs better?

- No herbicide and chemically-synthesized pesticides
- Less and pure organic fertilization
- Fewer cattle per m2
- More diversed crop rotation
- Conservation tillage
- More diversed farming structure (Pfiffner&Balmer 2011).

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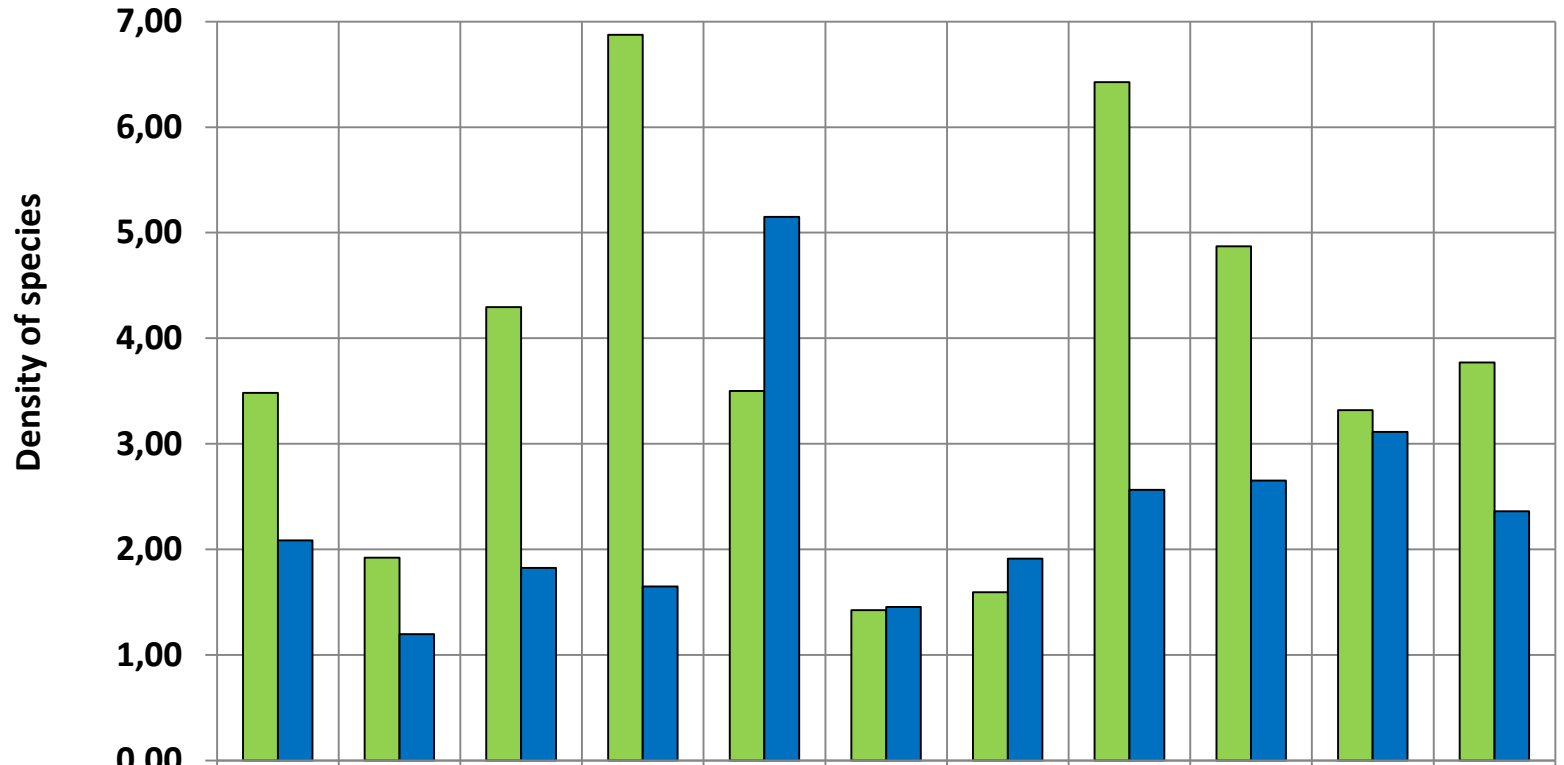
Summary of the effects of organic farming on individual taxon, in comparison to conventional

Taxon	Positive	Negative	Mixed/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

(Note: total in table > number of studies in review since it includes multi-taxon studies).

Hole et al. 2005
Does organic farming benefit biodiversity? Biological Conservation 122 113–130

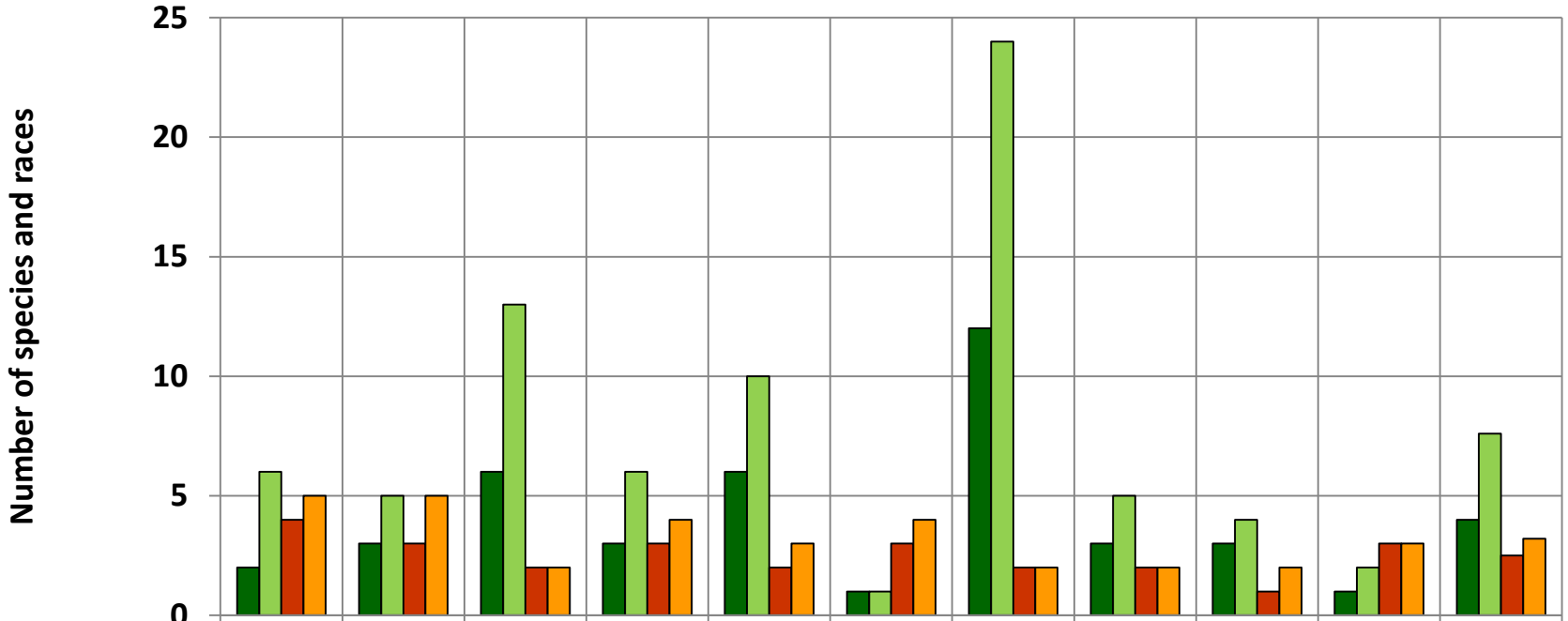
Density of plant species cultivated in organic and conventional farms



	1	2	3	4	5	6	7	8	9	10	Śre-dnia
Ekologiczne	3,48	1,92	4,29	6,88	3,50	1,42	1,60	6,42	4,87	3,32	3,77
Konwencjonalne	2,09	1,20	1,83	1,65	5,15	1,45	1,91	2,56	2,65	3,11	2,36

Dowbecka & Rembiałkowska 2013

The number of races and species of animals on organic (E) and conventional (K) farms



	1	2	3	4	5	6	7	8	9	10	Śre-dnia
Gatunki (E)	2	3	6	3	6	1	12	3	3	1	4
Rasy (E)	6	5	13	6	10	1	24	5	4	2	7,6
Gatunki (K)	4	3	2	3	2	3	2	2	1	3	2,5
Rasy (K)	5	5	2	4	3	4	2	2	2	3	3,2

Dowbecka & Rembiałkowska 2013

Comparison of Organic vs. Conventional Foods:

Meta-analysis as a research tool

Dominika Średnicka-Tober & Ewa Rembiałkowska

Warsaw University of Life Sciences, Faculty of Human Nutrition and Consumer Sciences

Meta-analysis last paper

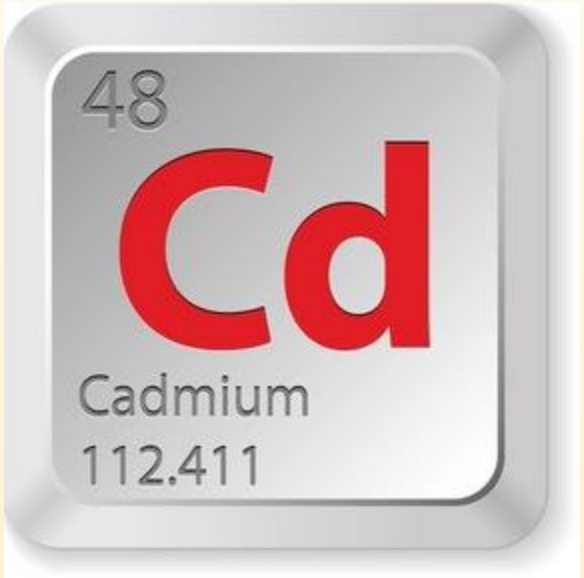
- **Barański, M.,** Średnicka-Tober, D., Volakakis, N., Seal, Ch., Sanderson, R., Stewart, G.B., Benbrook, Ch., Biavati, B., Markellou, E., Giotis, Ch., Gromadzka-Ostrowska, J., Rembiałkowska, E., Skwarło-Sońta, K., Tahvonen, R., Janovska, D., Niggli, U., Nicot, Ph., Leifert, C. **2014.** Higher antioxidant and lower cadmium concentrations and lower incidence of pesticide residues in organically grown crops: a systematic literature review and meta-analyses, **British Journal of Nutrition**, 112, 794–811

Meta-analysis results

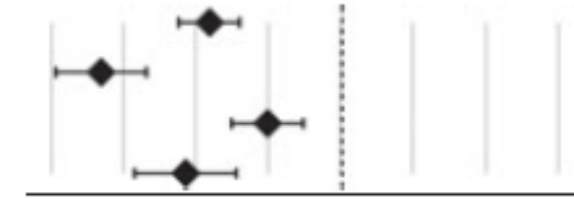
Higher concentrations of polyphenols in organic plant foods

Many of these compounds have previously been linked to a reduced risk of chronic diseases, including cardiovascular disease, neurodegenerative diseases and certain cancers

Lower cadmium concentrations in organically grown crops (48 % less)



Four times higher frequency of occurence of pesticide residues in conventional crops



Products†	*n*	*P**	Percentage of positive samples: ORG Mean	ORG 95 % CI	CONV Mean	CONV 95 % CI
All	66	<0·001	10·55	6·74, 14·36	46·35	37·96, 54·75
Fruits	22	<0·001	11·45	4·92, 17·99	74·60	64·65, 84·55
Vegetables	36	<0·001	10·25	4·77, 15·73	31·95	21·72, 42·18
Compound foods‡	6	<0·001	12·59	1·52, 23·65	44·64	24·81, 64·48

ORG vs. CONV milk & dairy and meat products

- 250 publications

Most important results: beneficial fatty acid composition of organic milk and meat (more PUFAs, more n-3 fatty acids: ALA, EPA, DHA, higher n-3/n-6 fatty acids ratio) compared to the conventional milk & meat

Profiles of Organic Food Consumers in a Large Sample of French Adults: Results from the Nutrient-Sante´Cohort Study

Kesse-Guyot et al., 2013

Results

In conclusion, the presented survey of this very large cohort indicated that consumers of organic foods have:

- **a higher level of education,**
- **a dietary pattern better fitting food-based recommendations and micronutrient/fiber recommended intakes,**
- **a sustainable diet concept.**

Organic consumers are:

- **less overweight and less obese compared to conventional consumers.**

DIET FOR A GREEN PLANET

- Tasty, attractive and healthy. If the Diet for a Green Planet is to have a broad impact, factors such as taste, smell, visual presentation and packaging etc. need to be addressed.
- Organically produced. Food should be organically produced according to EU (or stricter) requirements.
- 20% meat. The animals are needed on the farm, but the number of animals should not exceed the farm's capacity to grow its own fodder. The majority of meat consumed should come from ruminants. Dairy products are not included in the 20%.
- Locally produced. Locally produced food can be defined as food produced and consumed within a specific area where the sender is evident. The bigger the metropolitan region, the bigger the catchment area that can be called "local ".
- Seasonal. Seasonal food is fresh, healthy and genuine. It is food that at any one moment or period is at its best and available on the local market
- Reduced waste. Reducing waste contributes to a more healthy climate and environment. The food waste that is generated anyway should go to animal fodder or biogas production.

Hertwig 2016

BERAS International
Building Ecological Recycling Agriculture and Societies

Conclusions

- The current predominating food systems and dietary patterns have a negative impact on the environment, food quality and human health
- There is an urgent need for the increased sustainability of the food production systems across the whole world
- There are several models of healthy & sustainable diets, e.g. Mediterranean Diet, New Nordic Diet, pescetarian & vegetarian diets
- Organic food system provides a significant improvement of the sustainability parameters, therefore it can be recognized as a promising model for other food systems.


Thanks for your attention