Erik Steen Jensen

Research on sustainable production

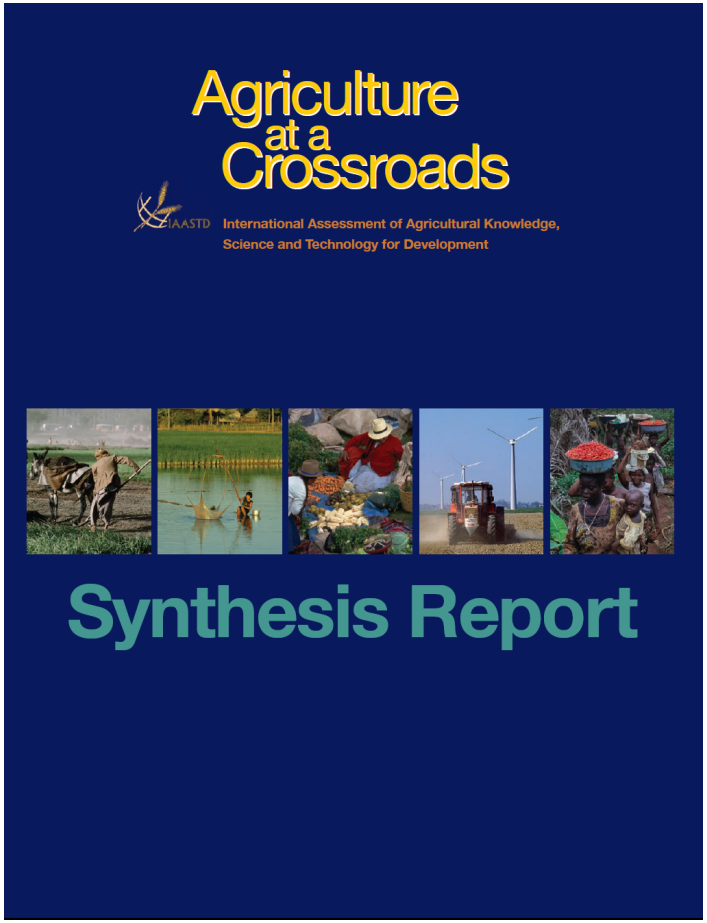
Systems perspectives and principles for sustainable development

EPOK seminar on Research for Sustainable Organic Farming, Stockholm, 9. December 2015

Analyze requirements for sustainable development
Use principles in formulation of aim and hypotheses
Research in a systems perspective

How to increase agricultural productivity in a sustainable manner?

- Increased diversity of farming systems
- Multifunctionality of crops and systems
- Improved nutrient, energy and water use
- Supporting agroecological systems



Agriculture at a Crossroads. Key recommendations from the International Assessment of Agricultural Knowledge, Science and Technology for Development – Johannesburg, April 2009

Organic farming (OF) as momentum for sustainable development of food systems

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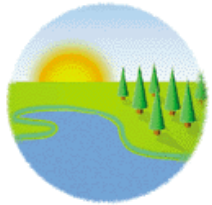
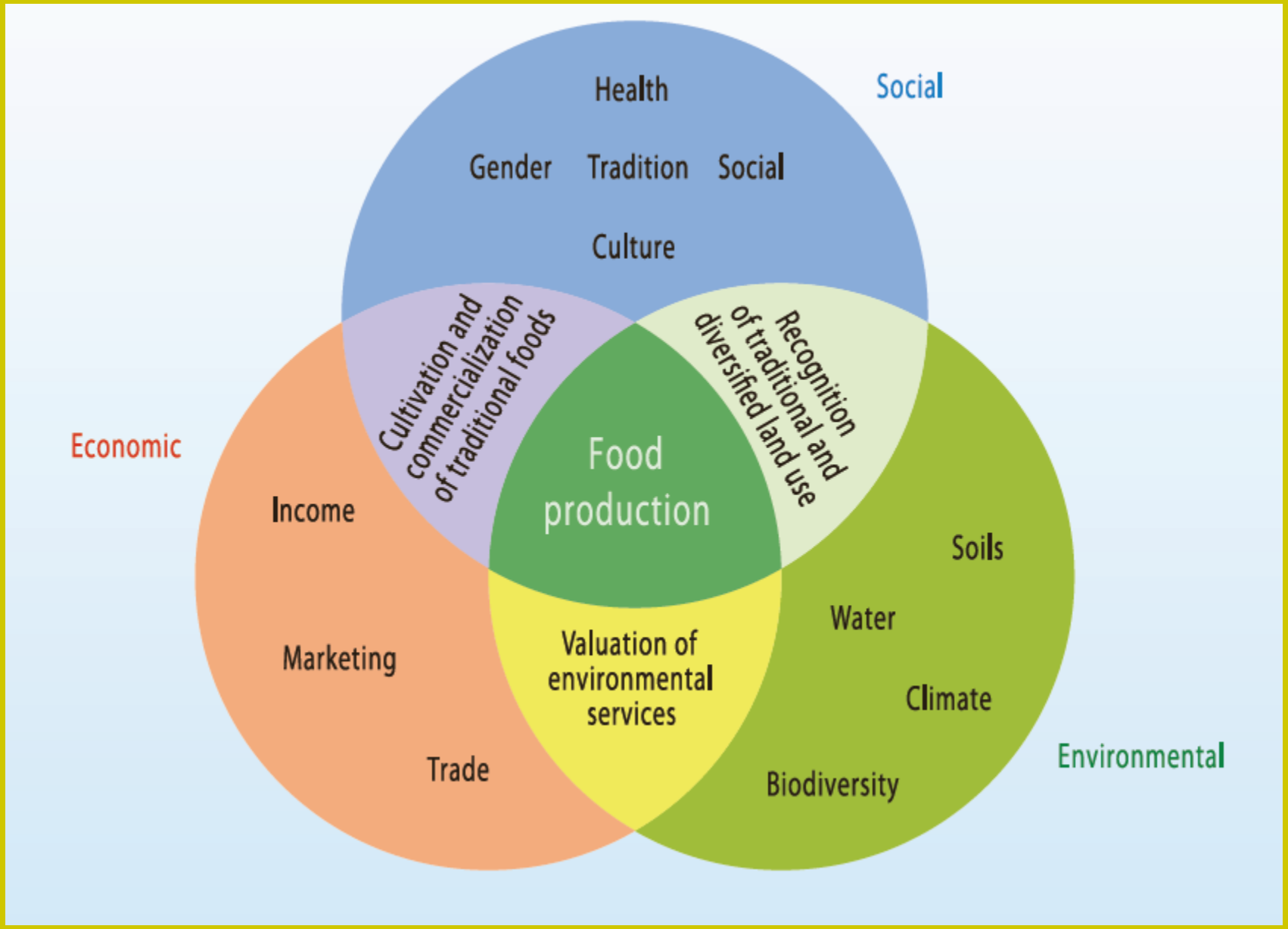
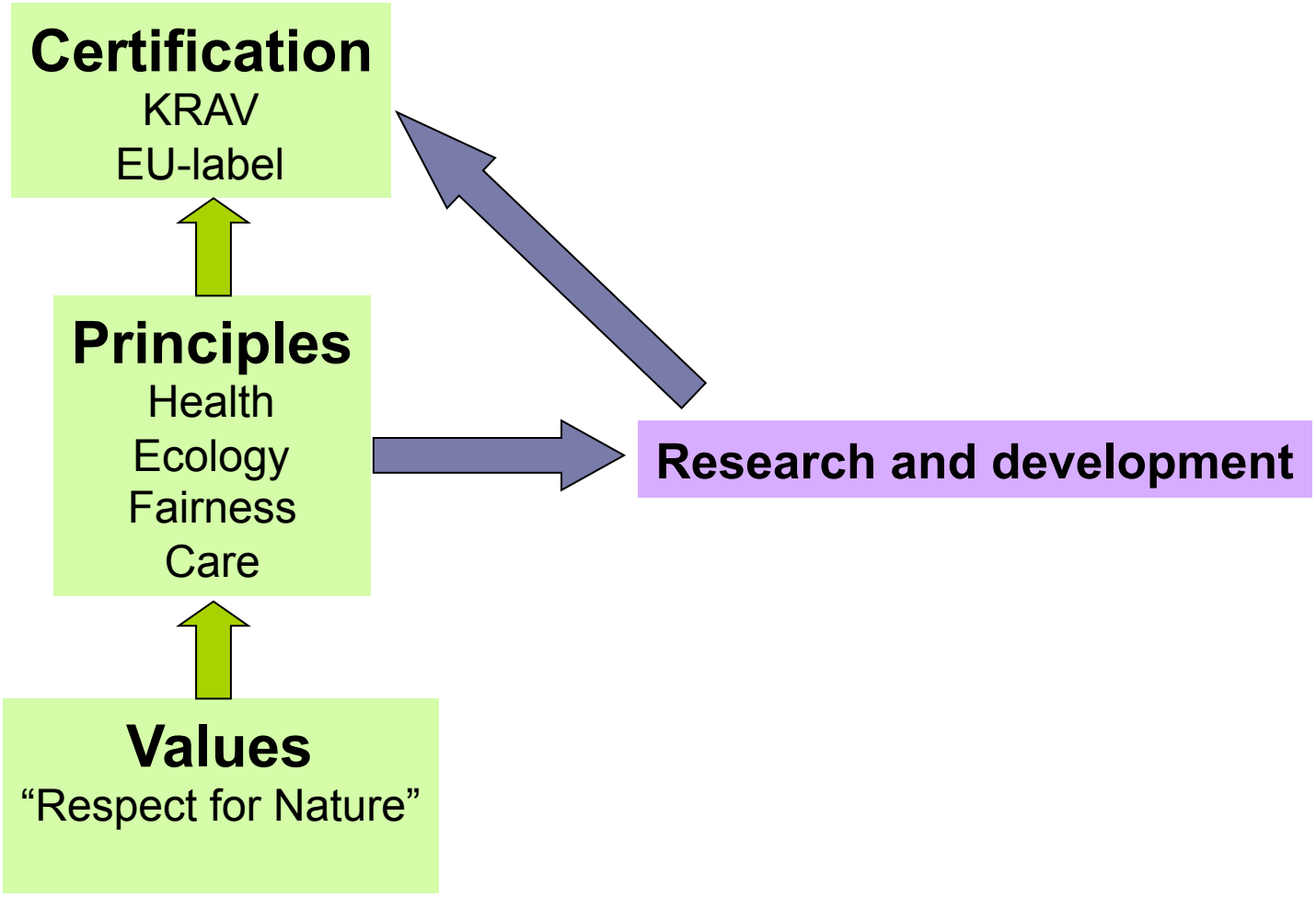


The inescapable interconnectednes of agricultures different roles and functions

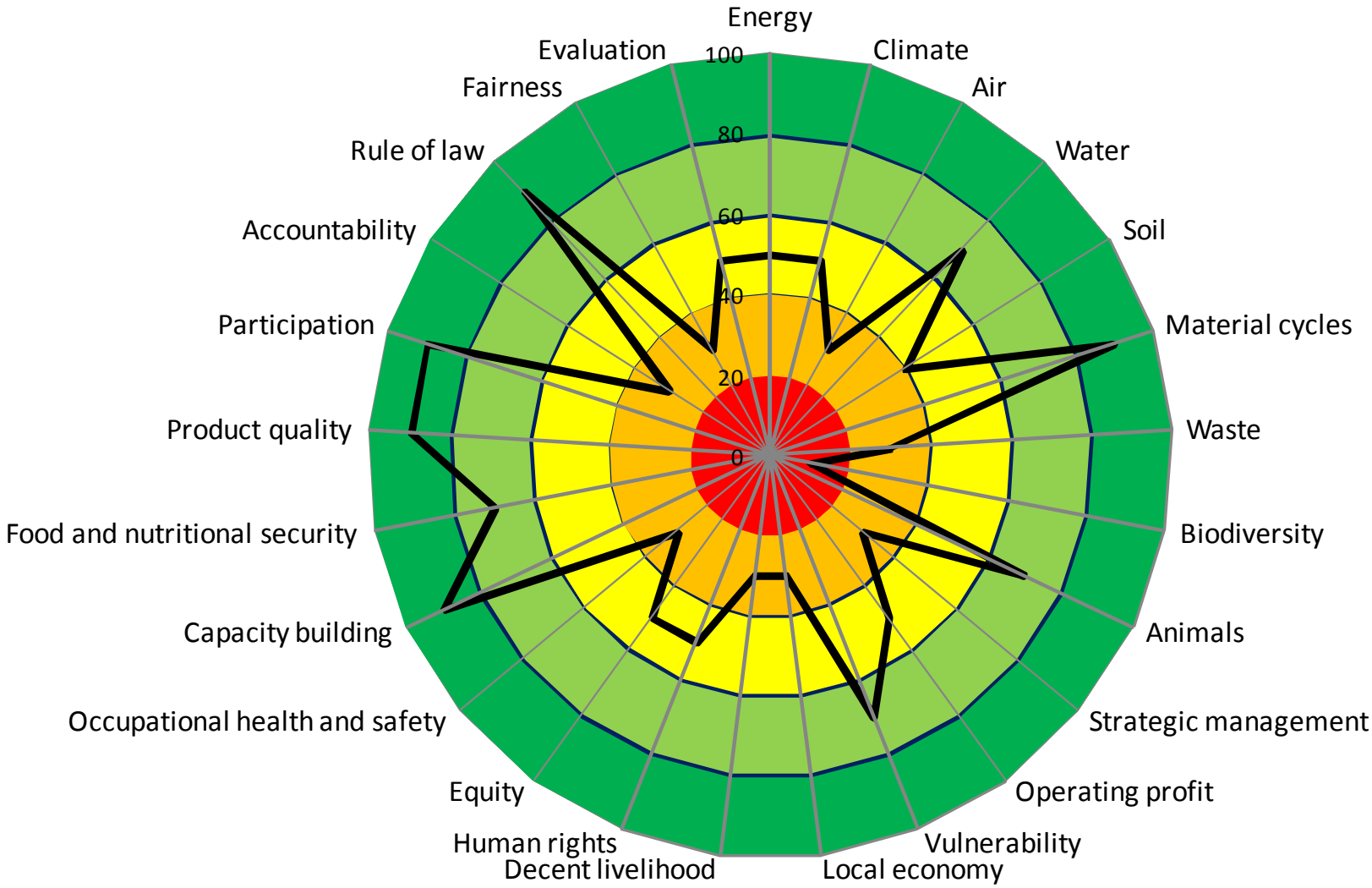


Agriculture at a Crossroads, 2009

Values, principles and certification in organic farming



Sustainability Assessment of food and agricultural systems (SAFA)



FAO, 2013

Daly´s principles for strong sustainability

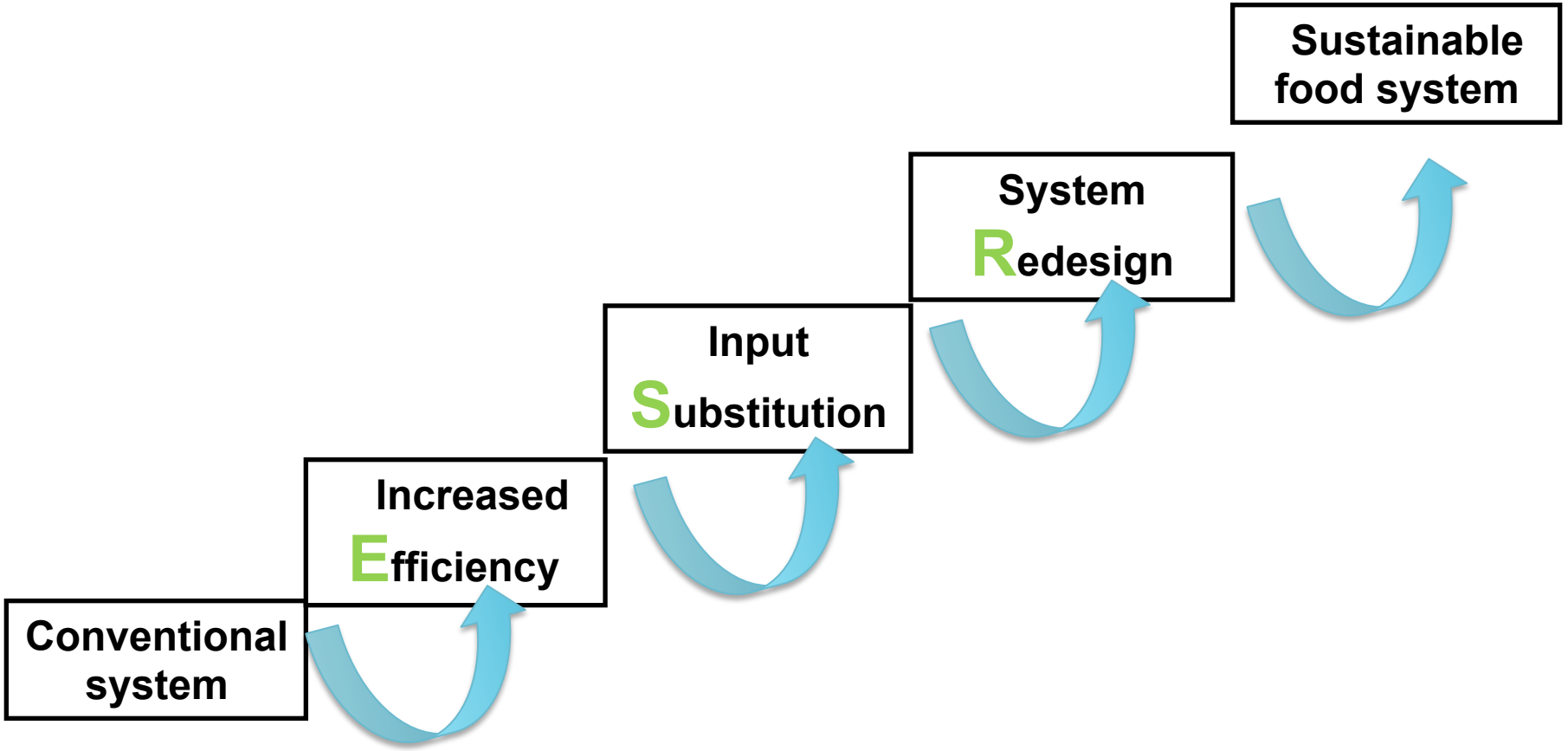
Renewable resources must be harvested at or below the growth rate for some predetermined level of resource stock

As non-renewable resources are depleted, renewable substitutes must be developed to maintain the flow of services

Pollution emissions should be limited to the assimilative capacity of the environment

Daly, H. E. (1990) Ecological Economics. 2, 1-6

ESR principle by Hill



Hill, S.B. 1998. Redesigning agroecosystems for environmental sustainability. Systems Research and Behavioral Science 15, 391-402

The ESR approach for transition to a sustainable agriculture

Table 2. Comparison of three approaches to sustainable agriculture

Unsustainable	Shallow sustainability		Deep sustainability
Conventional	Efficiency	Substitution	Redesign
Examples			
Factory farm	Low-input and resource-efficient agriculture	Eco-agriculture	Permaculture, natural and ecological farming
Approaches			
High-power	Conservation	Conservation	Low-power
Physico-chemical (soluble fertiliser, pesticides, biotechnology)	Physical/chemical/biological (slow release band)	Biological and natural materials	Bio-ecological, *in situ*
Imported input-intensive	Efficient use	Alternative inputs	Knowledge/skill-intensive
Narrow-focus, farm as factory (linear design and management)	Efficient factory	Softer factory	Broad focus, farm as ecosystem (integrated design and management)
Problems as enemies to eliminate and control directly with products and devices	Efficient control (monitor pest, integrated pest management)	Biocontrols	Prevention, selective and ecological controls (pests as indicators)
Goals			
Maximise production (neglects maintenance)	Maintain production while improving maintenance	Improved maintenance	Optimise production (emphasises maintenance)
Create demand, manipulate wants			Meet real needs

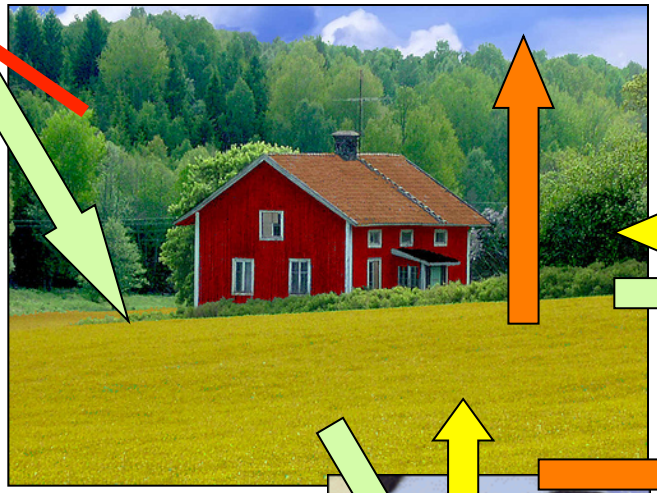
Hill, S.B. 1998. Redesigning agroecosystems for environmental sustainability. Systems Research and Behavioral Science 15, 391-402

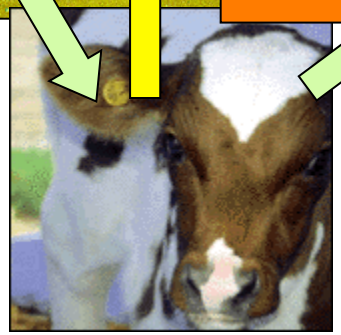
Principles in organic farming (DARCOF 2000)

- **Recycling** Recycling of nutrient and use of renewable resources. Multifunctionality of production systems.
- **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.

Danish Centre for Research in Organic farming (DARCOF) 2000

Principle: Recycling





Organic farming principles (IFOAM, 2005)

Ecology

Organic Agriculture should be based on living ecological systems and cycles, work with them, emulate them and help sustain them.

Health

Organic Agriculture should sustain and enhance the health of soil, plant, animal, human and planet as one and indivisible.

Fairness

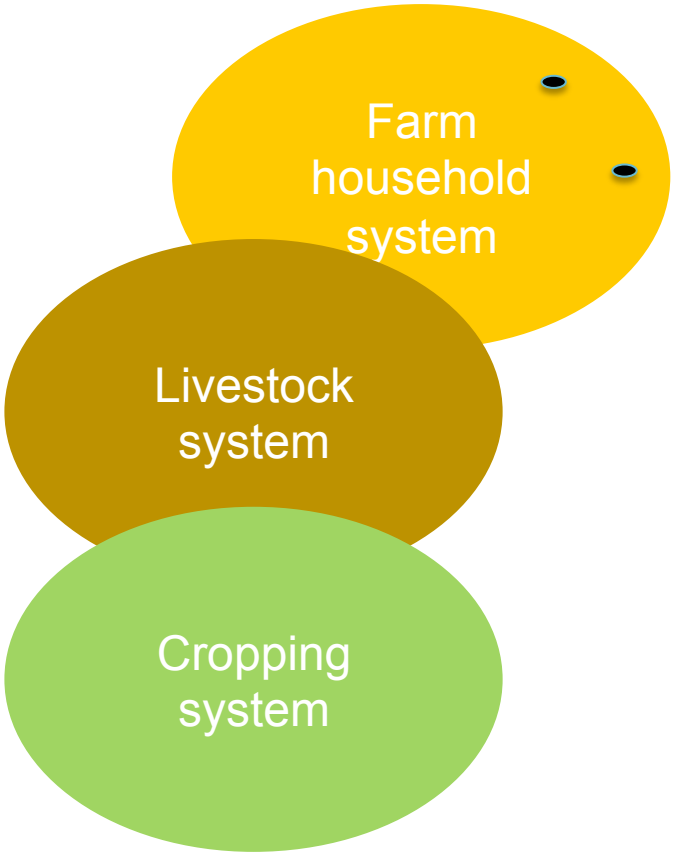
Organic Agriculture should build on relationships that ensure fairness with regard to the common environment and life opportunities

Care

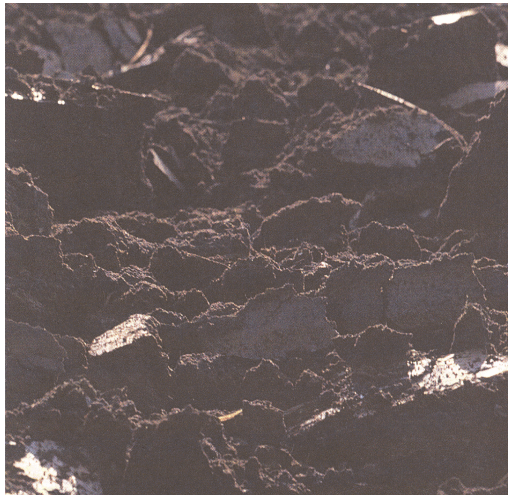
Organic Agriculture should be managed in a precautionary and responsible manner to protect the health and well-being of current and future generations and the environment

”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” (ICROFS, 2009)

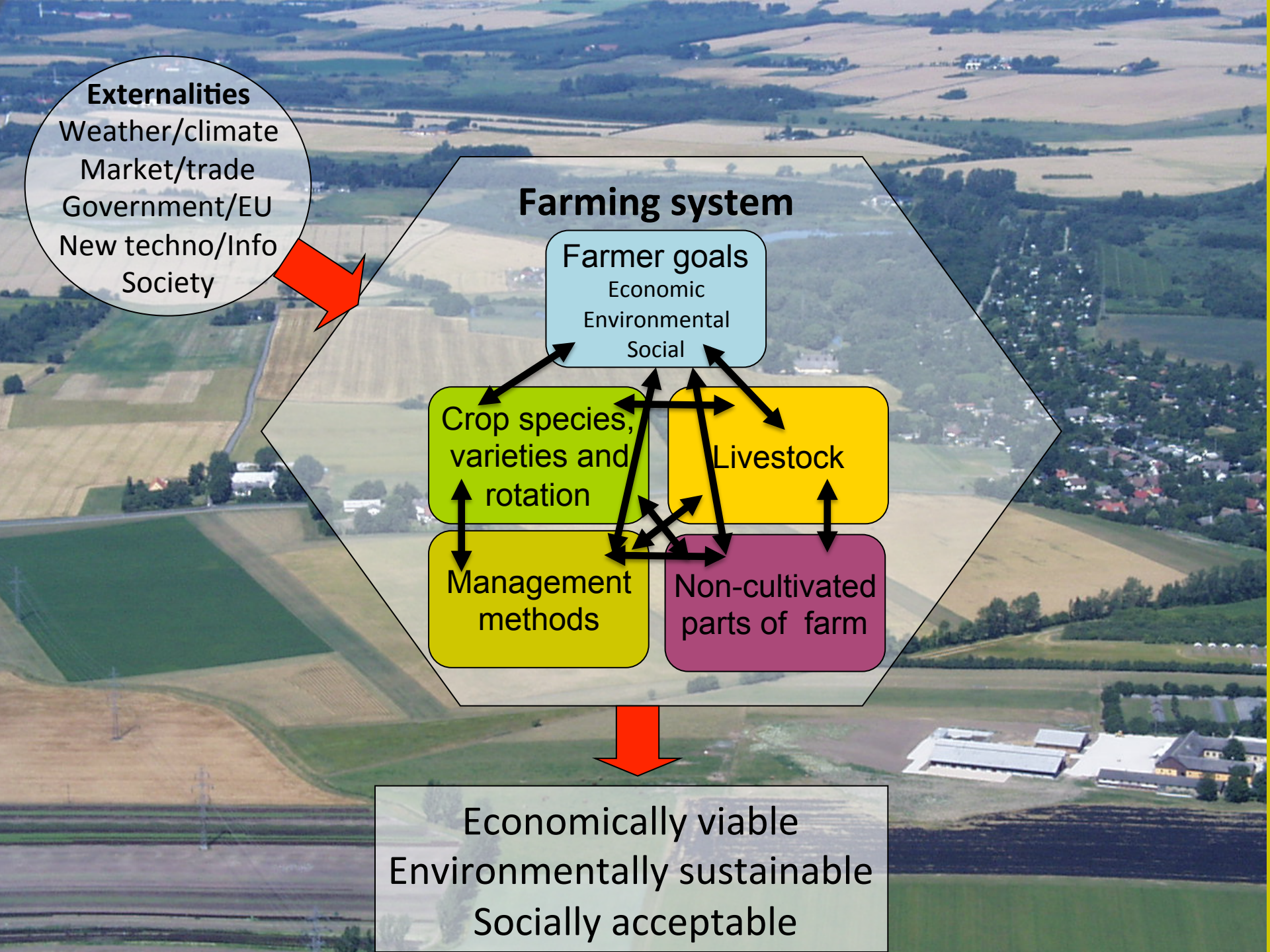
Why “ORGANIC” farming

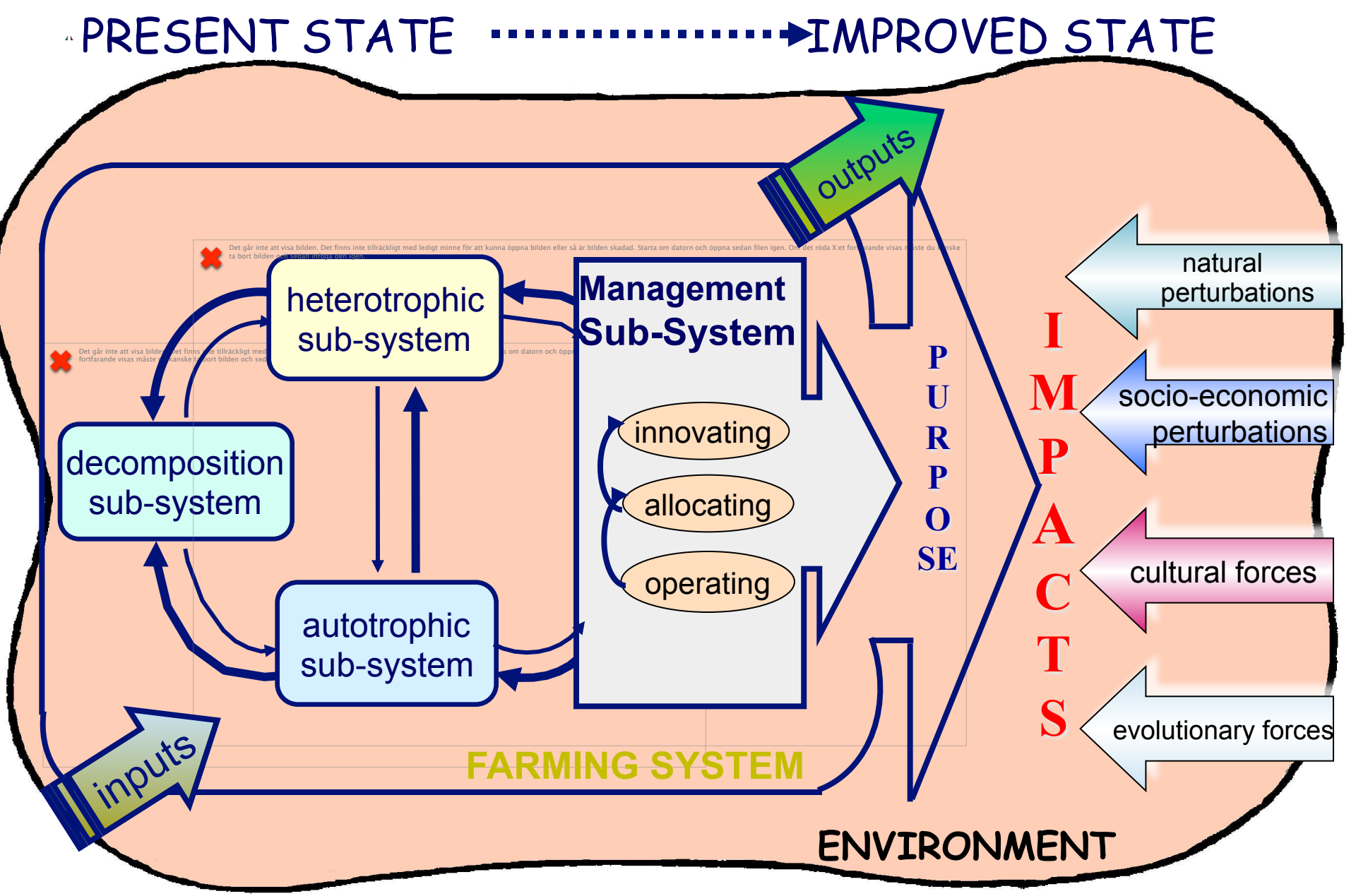


Organic = Organism?



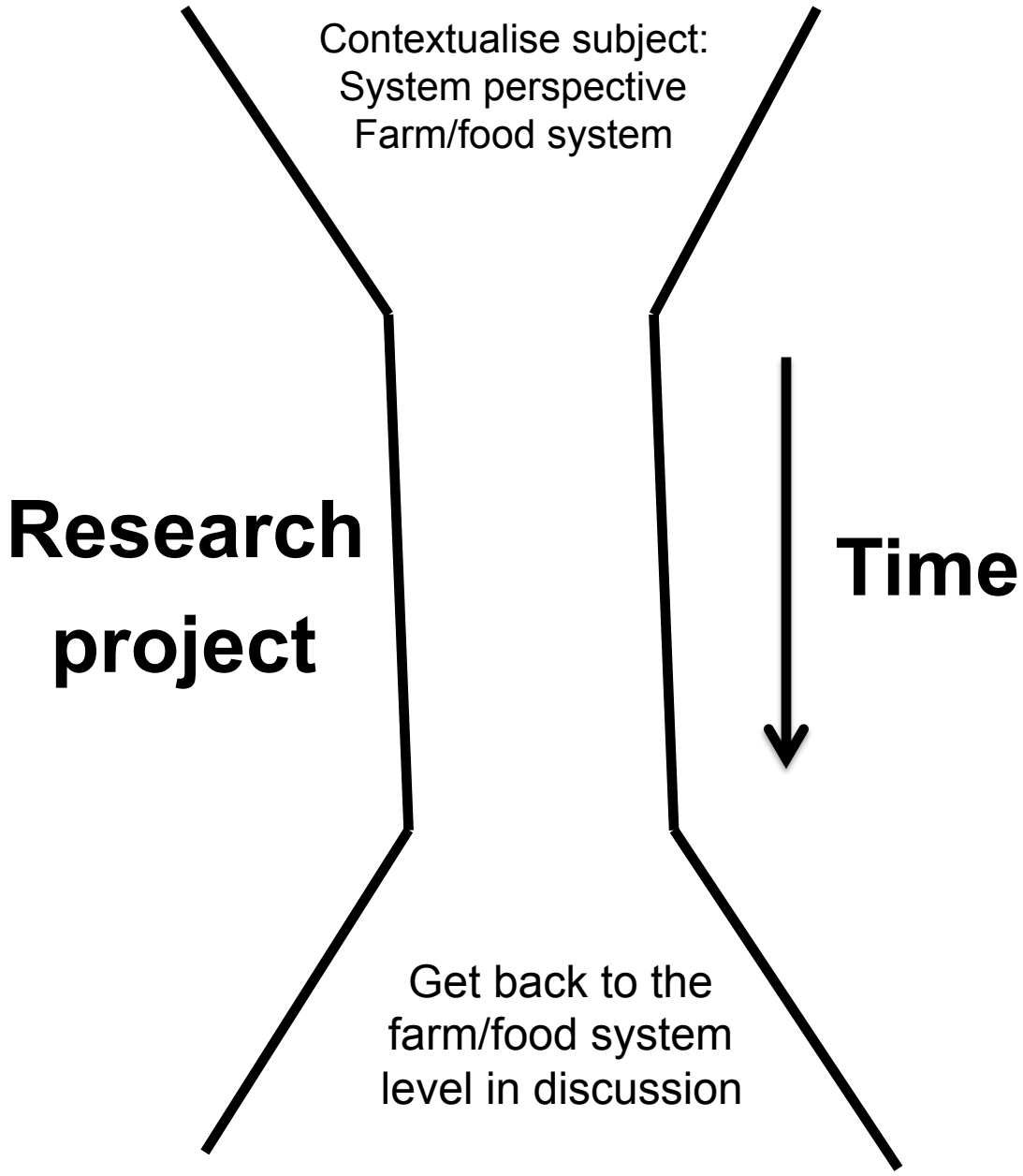
Organic = Soil organic matter?


Externalities
Weather/climate
Market/trade
Government/EU
New techno/Info
Society
Farming system
Farmer goals
Economic
Environmental
Social
Crop species, varieties and rotation
Livestock
Management methods
Non-cultivated parts of farm
Economically viable
Environmentally sustainable
Socially acceptable



A Model of Farming as a Human Activity System

From Roger Packham, University of Western Sidney


Contextualise subject:
System perspective
Farm/food system
Research project
Time
Get back to the farm/food system level in discussion

Conclusions - Research for sustainable development of organic farming

There is no “the” sustainable solution, since sustainable development is value-based

Discuss sustainable development with colleagues, other actors and stakeholders – take care to separate values and professional issues in discussion

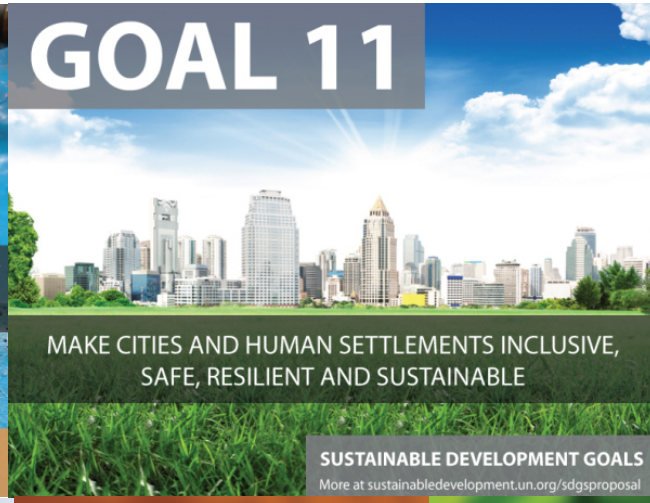
Use multi-criteria sustainability assessment and make priorities for sustainable development within the system

Apply the principles of organic farming to the challenges and define objectives and research hypotheses

Develop the research in a systems perspective

SLU

SUSTAINABLE DEVELOPMENT GOALS



http://www.un.org/sustainabledevelopment/sustainable-development-goals/

Thank you

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Swedish University of Agricultural Sciences

Thank you for your attention

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Explicit values in organic farming?

Nature is a whole which we have a moral duty to care about.

Man is an integral part of Nature

Nature is such a complex entity that we do no fully comprehend the consequences on Nature of our actions.

Organic farming (IFOAM)

Organic agriculture is a production system that:

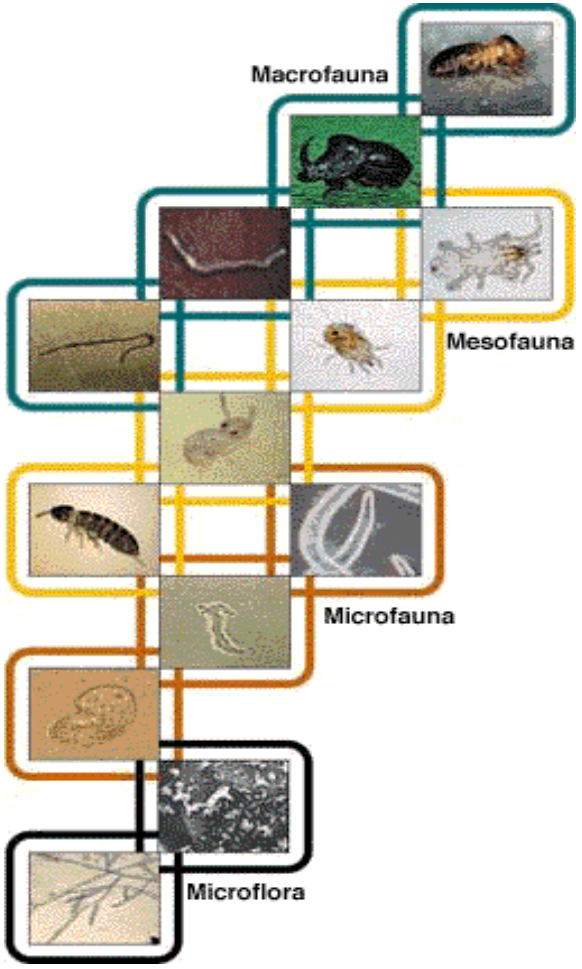
- sustains the health of soils, ecosystems and people
- relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects
- combines tradition, innovation and science to benefit the shared environment, and
- promote fair relationships and a good quality of life for all involved

Ecology

This principle roots organic agriculture within living ecological systems. It states that production is to be based on ecological processes, and recycling. Nourishment and well-being are achieved through the ecology of the specific production environment. For example, in the case of crops this is the living soil; for animals it is the farm ecosystem; for fish and marine organisms, the aquatic environment.

Organic farming, pastoral and wild harvest systems should fit the cycles and ecological balances in nature. These cycles are universal but their operation is site-specific. Organic management must be adapted to local conditions, ecology, culture and scale. Inputs should be reduced by reuse, recycling and efficient management of materials and energy in order to maintain and improve environmental quality and conserve resources.

Organic agriculture should attain ecological balance through the design of farming systems, establishment of habitats and maintenance of genetic and agricultural diversity. Those who produce, process, trade, or consume organic products should protect and benefit the common environment including landscapes, climate, habitats, biodiversity, air and water.



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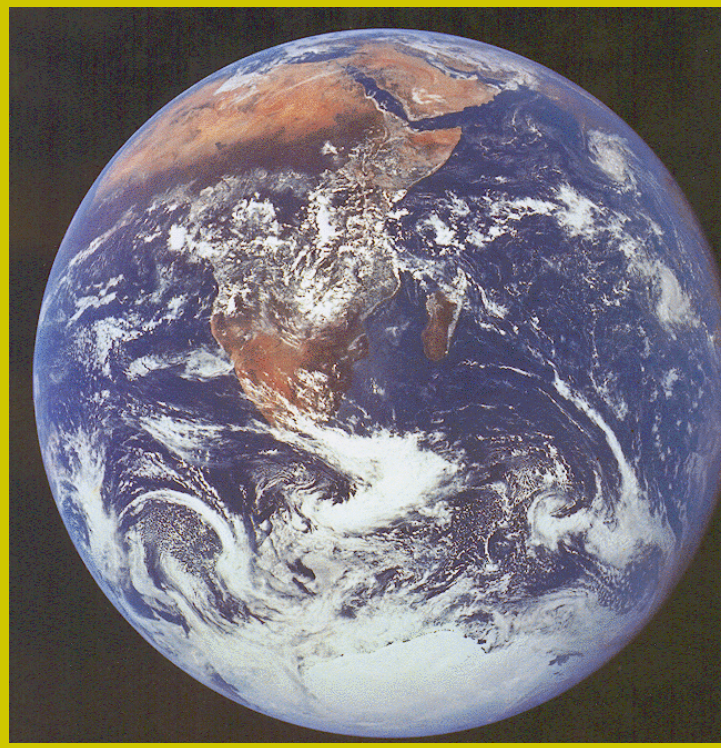
Some challenges for global agriculture

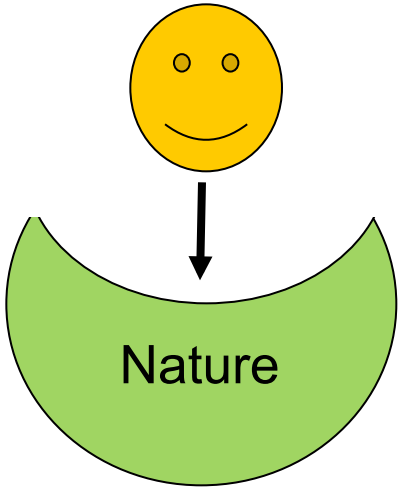
Food security and sovereignty
Climate change – adaption and mitigation
Clean water
Reduced use of pesticides
Healthy and safe quality food
Energy supply
Non-renewable resource supply
Biodiversity
Changing markets – free trade
Rural development



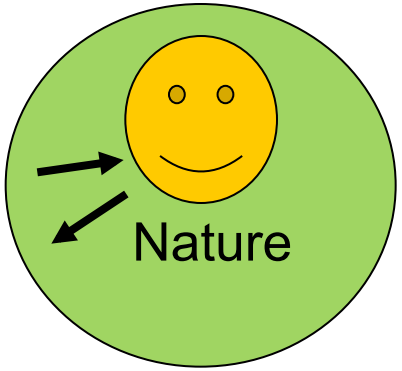
Sustainable development: Brundtland definition

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

Two ways to consider sustainable development



Resource (food) sufficiency



Functional integrity

Thompson, P.B. (1997). In Sørensen, J.T. (ed) *Livestock farming systems - More than food production.* Proc. of the fourth international symposium on livestock farming systems. EAAP Publ. No. 89: 5-15 pp

Resource sufficiency (antropocentric view)

- Emphasis on supply of food, materials, energy etc. for present and future generations using biophysical and technological resources
- If current or foreseeable supplies meet or exceed the amount required in a certain timeframe the practise is sustainable

Thompson, P.B. (1997). In Sørensen, J.T. (ed) *Livestock farming systems - More than food production.* Proc. of the fourth international symposium on livestock farming systems. EAAP Publ. No. 89: 5-15 pp

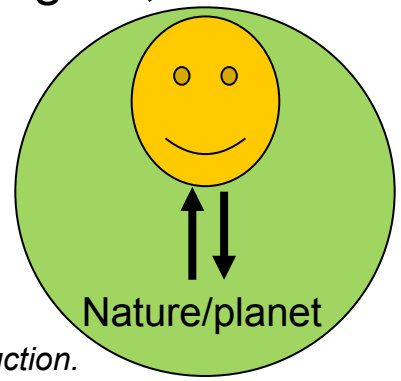
Functional integrity view on sustainable development (ecocentric view)

Assumes systems to have crucial elements that are reproduced over time in a manner or at a rate that is depend on previous system states (e.g. soil fertility, natural enemies, the family..)

Reproduction of critical systems elements may be impaired with a substantial time lag as consequences of change due to an unsustainable practice.

We are not fully aware about the long-term consequences of many practices.

Acknowledging the complex interactions between ecological, economic and social values, a systems view is required.



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