

Research Seminars

**System Analyses for Sustainable Agricultural Production and Livelihoods of Smallholders:
Complementary Approaches and Case studies in Southwestern Burkina Faso**

14 and 16 February 2017, ICARDA Office, Amman, Jordan

Principles of Sustainable Intensification: A View from System Science and Transdisciplinarity

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RESEARCH
PROGRAM ON
Dryland Systems



ICARDA
Science for Better Livelihoods in Dry Areas

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Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich



Sustainable intensification (SI) in recent literature

As goals (but not realized by the authors) (Garnet et al. 2013, Godfray and Garnett 2014)

- “Intensified” as increased food yield
- Improved environmental sustainability (natural resource bases/capital)
- Provide basis for improved human nutrition adequacy (quality foods, diverse diets)
- Pillar for rural economies and development

Premises

- Unavoidable given needs to feed growing population and huge land conversion “cost”
- Should not specify a priory whether conventional, high-tech, organic, or conservational agriculture
- Bio-physical and social contexts are important for looking at options

Sustainable intensification (SI) in recent literature

Important missing still:

In goals

- System resilience as a goal
- Social justice (including equity) as a goal
- Not developed base on new knowledge in sustainability science

In premises

- The law of nature: material and energy conservation, e.g. withdraw =< growth, or the essential role of natural capitals
- System constructs for SI?

In indicator sets

- Different studies proposed very different indicator sets of SI regarding numbers of indicators given the concept ill-defined
- Poorly articulation of indicators vs. scale

- **Poorly**
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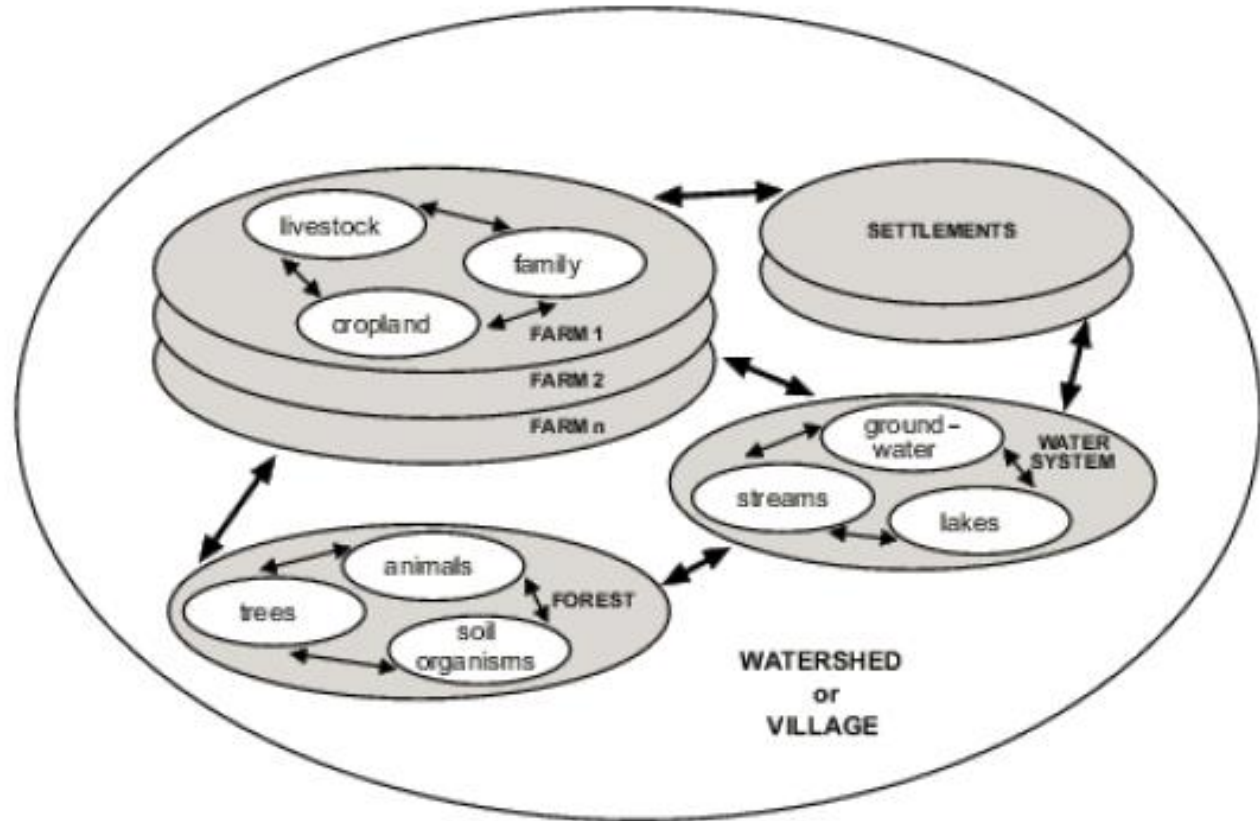
Basic/Key Gap

SI is truly a sustainability concept, as in its name, but its elaboration process in research (Concept → Approach/Framework → Performance Indicators → Methods) has not clearly been driven from the current knowledge of system sustainability

Sustainable intensification: Sustainability of what?

Global

Regions

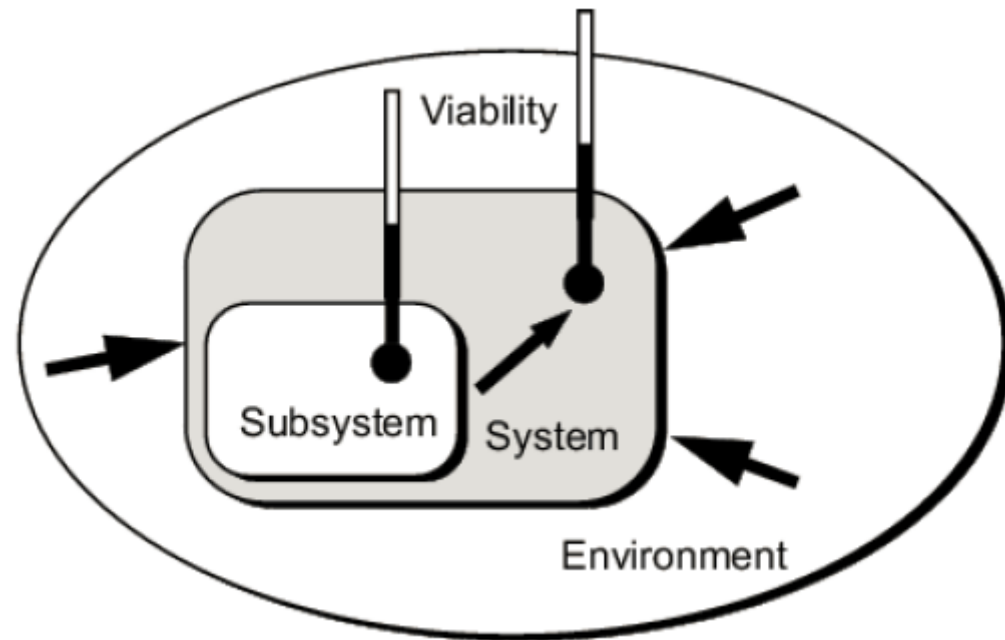


- Multiple system boundaries (systems of sub-systems) needed to be considered
- What should be the minimal system boundary needed for SI?

What determines System Sustainability?

Sustainability of a system is determined by:

- its characteristic system structure & functions
- AND**
- the characteristic properties of its particular environment and of the other systems in this environment



Bossel (2000, 2007)

System Orientors as the Basis Aspects of Systems Sustainability

- **EXISTTENCE:** Is the intensified system able to exist in its socio-ecological environment?
- **EFFECTIVENESS:** Is the intensified system deal well with the resource scarcity (water, nutrient, energy)?
- **FREEDOM OF ACTION:** Does the intensified system have the freedom and ability to respond to environmental variety (including shock and stress)?
- **SECURITY/MANAGED RISK:** Is the intensified system safe, and stable despite a variable and unpredictable socio-ecological environment?
- **ADAPTABILITY:** Can the intensified system adapt to new challenges from its changing environment?
- **CO-EXISTENCE:** Is the intensified system compatible with others interacting systems?

The use of these principles for guiding the development of SI indicators will be discussed on seminars on Feb 16 2017