

The use of indicators to assess the sustainability of farming systems

Definition & challenges

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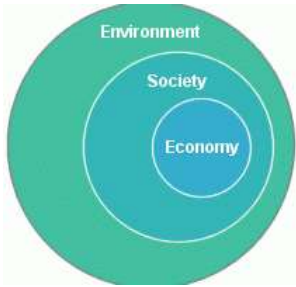
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Why assessing sustainability is complex?



Assess sustainability with indicators

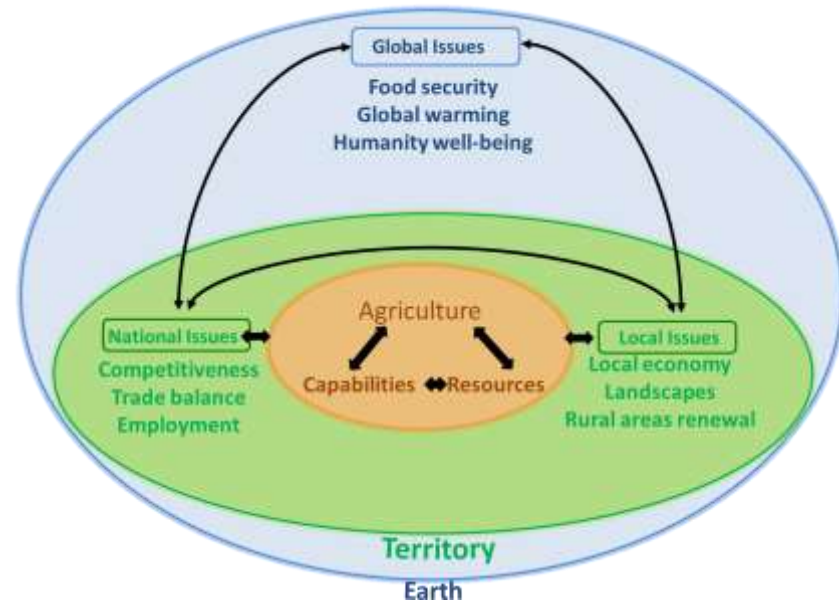
Different visions of sustainable development



Not a predetermined list of actions to follow
Not a final stagnant stage
But a continuous process

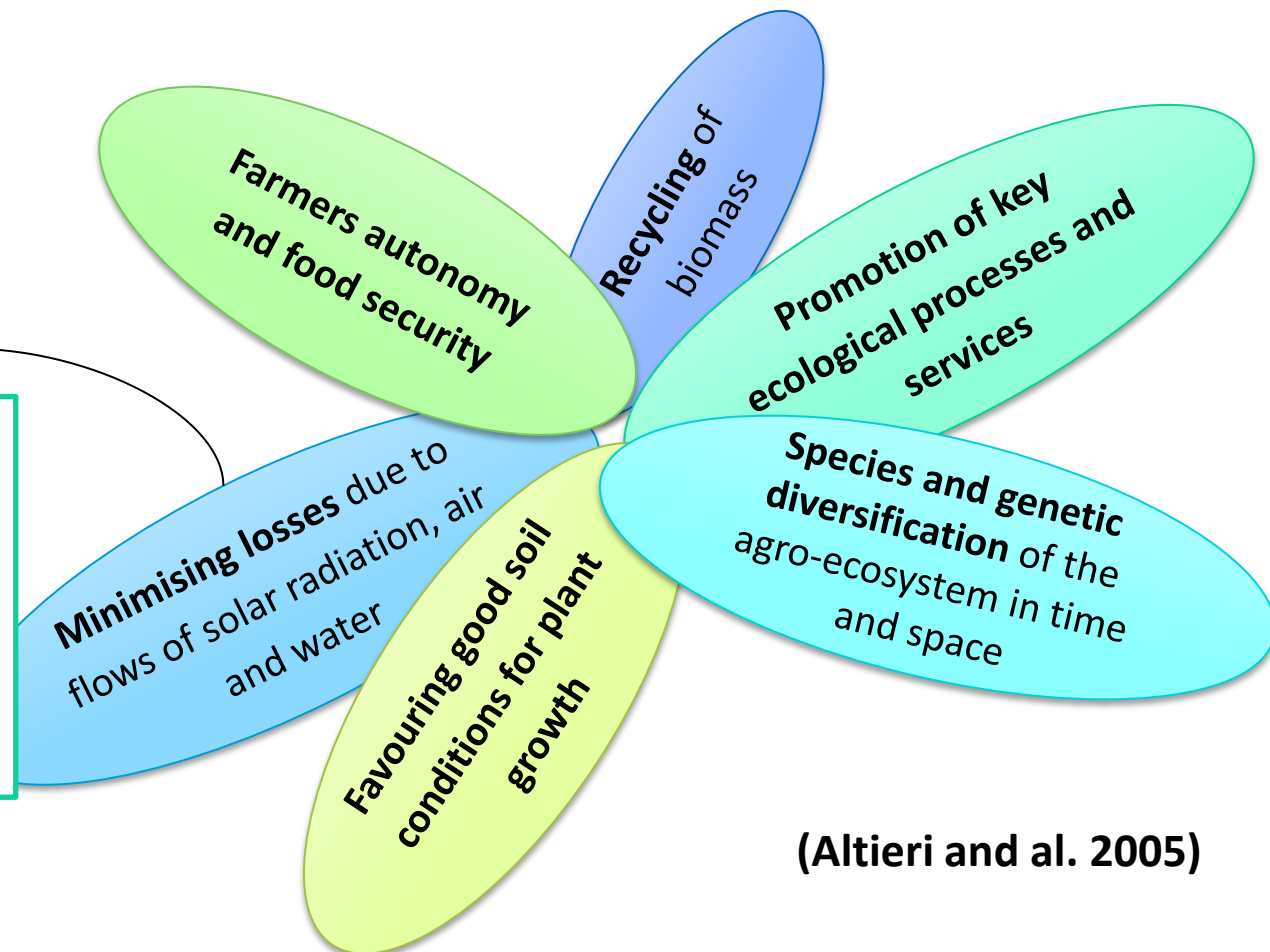
Plenty of processes to assess not easily comparable

Many : conflicting criteria
measurement units
scales of analysis



Assess agroecology with indicators

How to select indicators of success ? How to deal with trade-off between indicators?
How to jointly interpret indicators? What is the relevant scale of assessment?



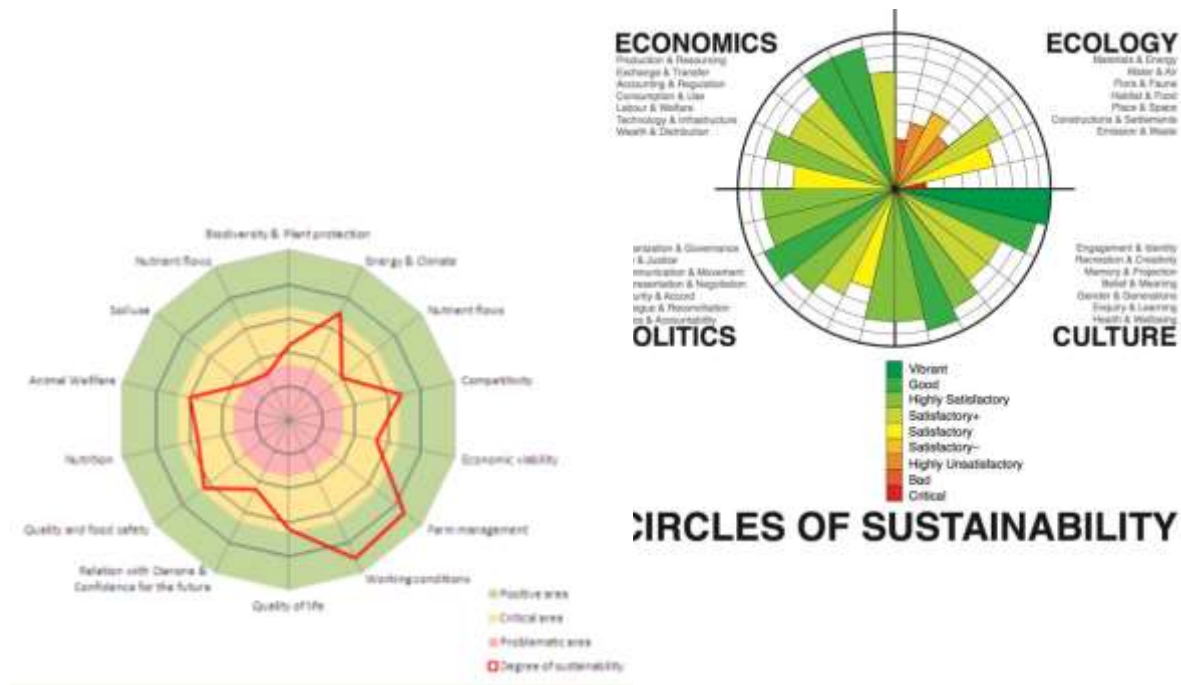
Criterion : Optimization of the use of solar radiation

Possible indicators:

- % solar radiation captured by crops/year on the total solar radiation available
- grain yield per unit of solar radiation captured by the crop

(Altieri and al. 2005)

What is an indicator?



Definition

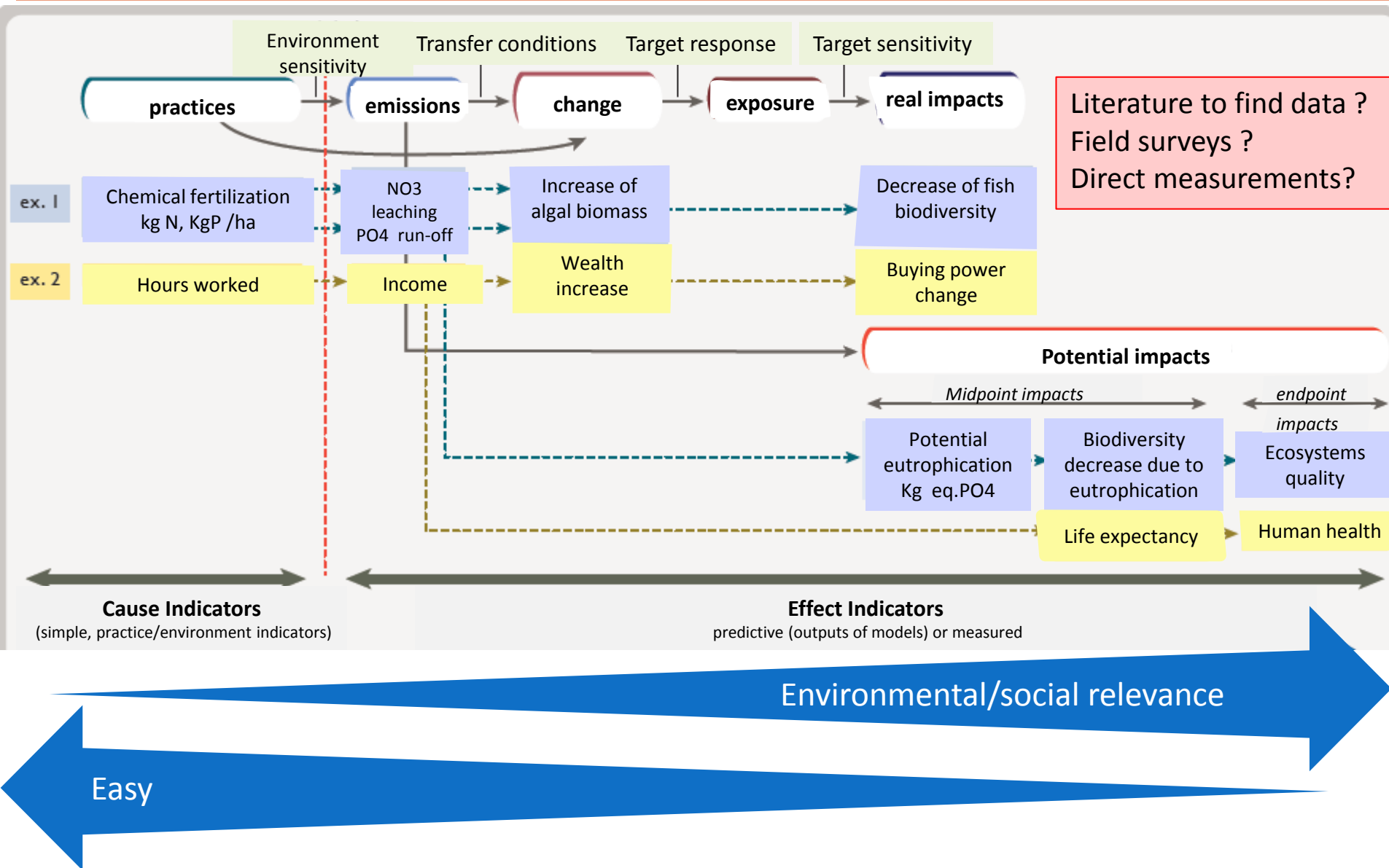
Indicators simplify a complex reality

- They aggregate relevant variables to report on a phenomenon which can not be directly assessed
- They give a meaning to simple data :

Have a body temperature of 39°C means = you are sick

→ It's an indicator only because you compare it with the healthy T° of 37°C

Different types of indicators



Qualities of a good indicator

- **Scientific relevancy**

Transparency about the choices made (method, type of data, hypothesis, etc.)

Scientific Validation (design and outputs)

Repeatability in different contexts (time and space)

Sensitivity to change

- **Feasibility**

Easy to document and interpret (easy access to data)

Simple to calculate

Be appropriate to the abilities of the users

- **Usefulness**

Meet the needs of users

Able to be reported easily to the targeted audience

Some challenges to overcome...

- ✓ Define the perimeter of your assessment
- ✓ Deal with different kinds of variables
- ✓ Conclude about the sustainability when you have conflicting indicators from different dimensions of sustainability (economic, social, environmental)
- ✓ Scale up indicators (from the field to the planet)

Challenges of the assessment

1) Define the perimeter of the assessment

What are your objectives ?

*Ex: Compare 2 cropping systems
Design a new system*



What is the perimeter of your assessment?

System boundary

What processes?

What flows?

What spatial/organizational/time scales?

♦ N_2O

♦ CO_2

♦ Skills, knowledge

♦ Income

♦ Employment

♦ Farm

♦ Fields

♦ Territory

♦ Value chain

What impacts, criteria?

Climate change

Resiliency

Food security

Protect soil erosion


Ecosystem services

Challenges of the assessment

2) Deal with different kinds of variables

Quantitative- continuous variables	T
<ul style="list-style-type: none">• Farm area• Yields• ...	R
Quantitative- discrete variables	A
<ul style="list-style-type: none">• Herd size• Number of employees• ...	N
Qualitative- discrete variables	S
<ul style="list-style-type: none">• Presence (Yes/No) of hedges• How a farmer likes his job from 1 to 10• Level of soil erosion (from null to significant)• ...	F
	O
	R
	M
	A
	T
	I
	O
	N

- Ordinal qualitative grades

E.g. : [Good, OK, bad] or 

- Score

E.g. : -100 to +100 or 0 to 10

- Continuous variables

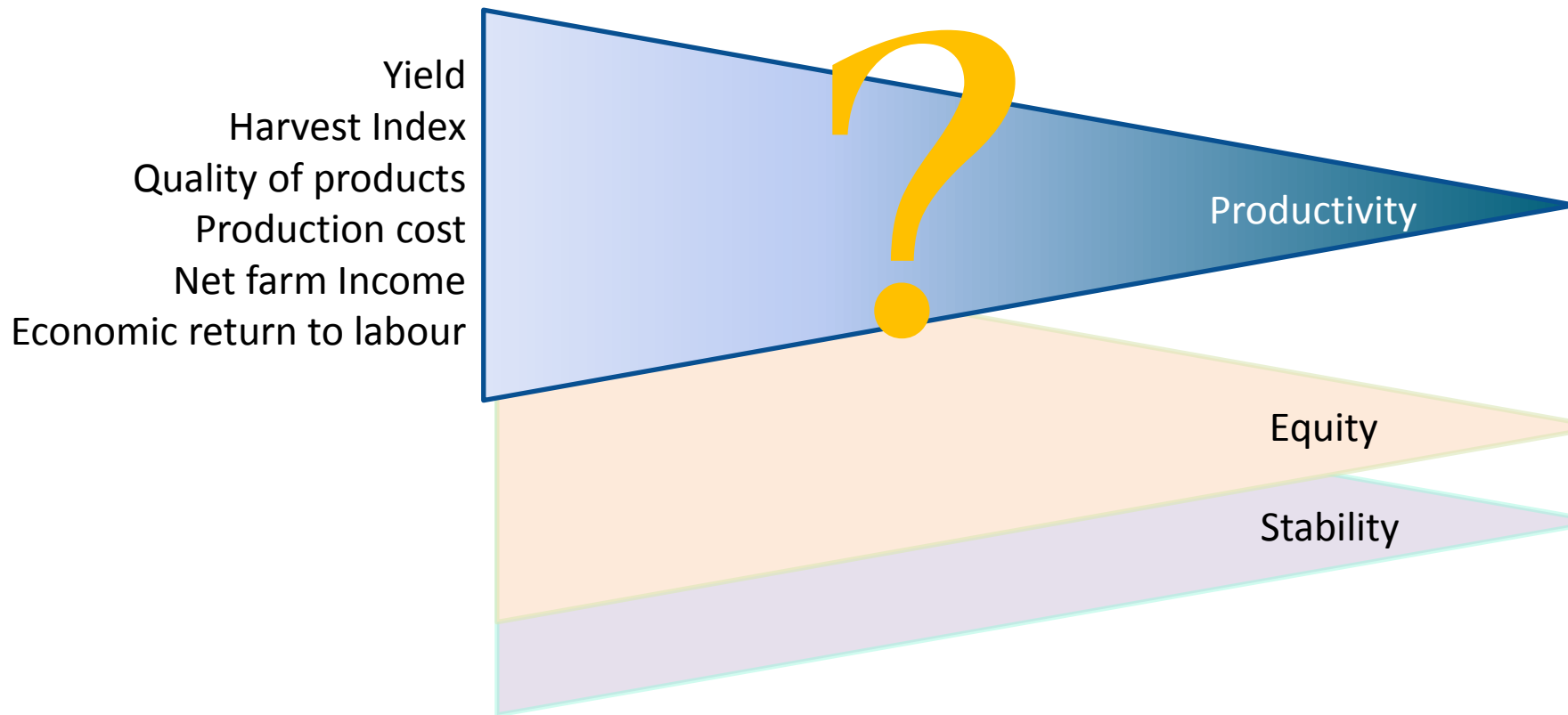
E.g. : standardized variables

Challenges of the assessment

3) How to aggregate indicators?



Add pears with apples

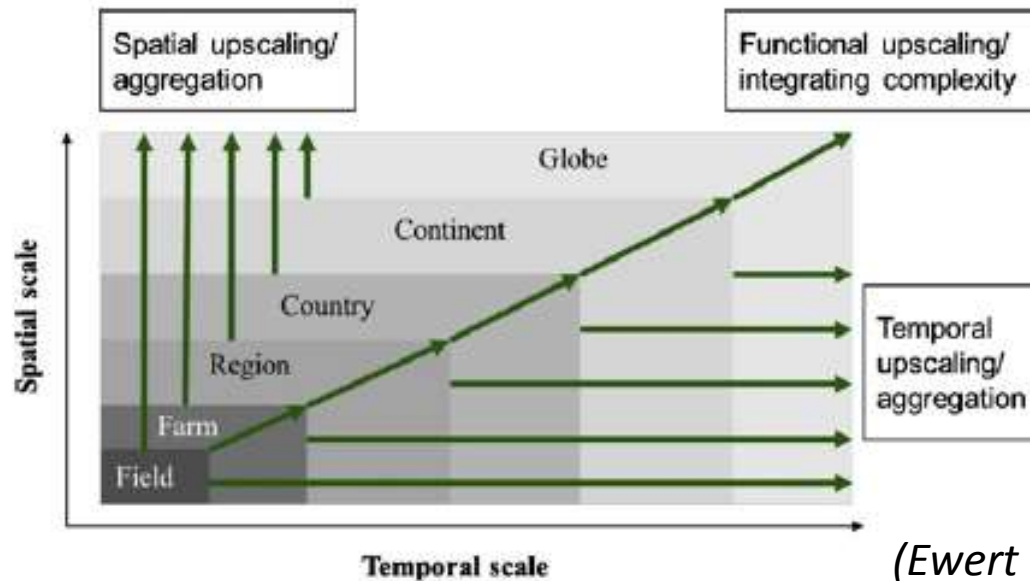


Challenges of the assessment

4) Scale up of indicators

Agricultural systems are complex

→ Covering a range of organizational levels and spatial and temporal scales



(Ewert et al., 2011)

Not necessarily linear relationship between scales!

Effects of interactions between components (compensation, synergy)

The whole impact at the territory scale could be more/less than the sum of individual effects

E.g.: Buffer zone, ecological corridor

To conclude...

Any assessment is subjective!

Results depend on your choices

Interpretation of a complex reality

How to ensure the scientific scope of your evaluation:

Be transparent in your choices

Check the sensitivity and reliability of the method

Make sure to have a consistent framework of analysis