Some considerations about multicriteria evaluation of farm sustainability

Raphaëlle Botreau
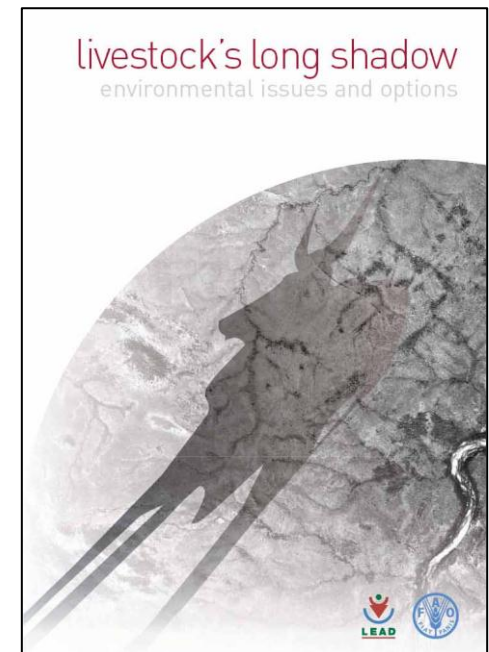
INRA, UMR1213 Herbivores, France

Raphaëlle Botreau

INRA, UMR1213 Herbivores, France

Context:
"livestock farming systems" and "sustainability"?

○ More and more **questions** arise about sustainability of farming systems …

- from **environmental** point of view
  - With a clear impact on global **GHG emissions**…
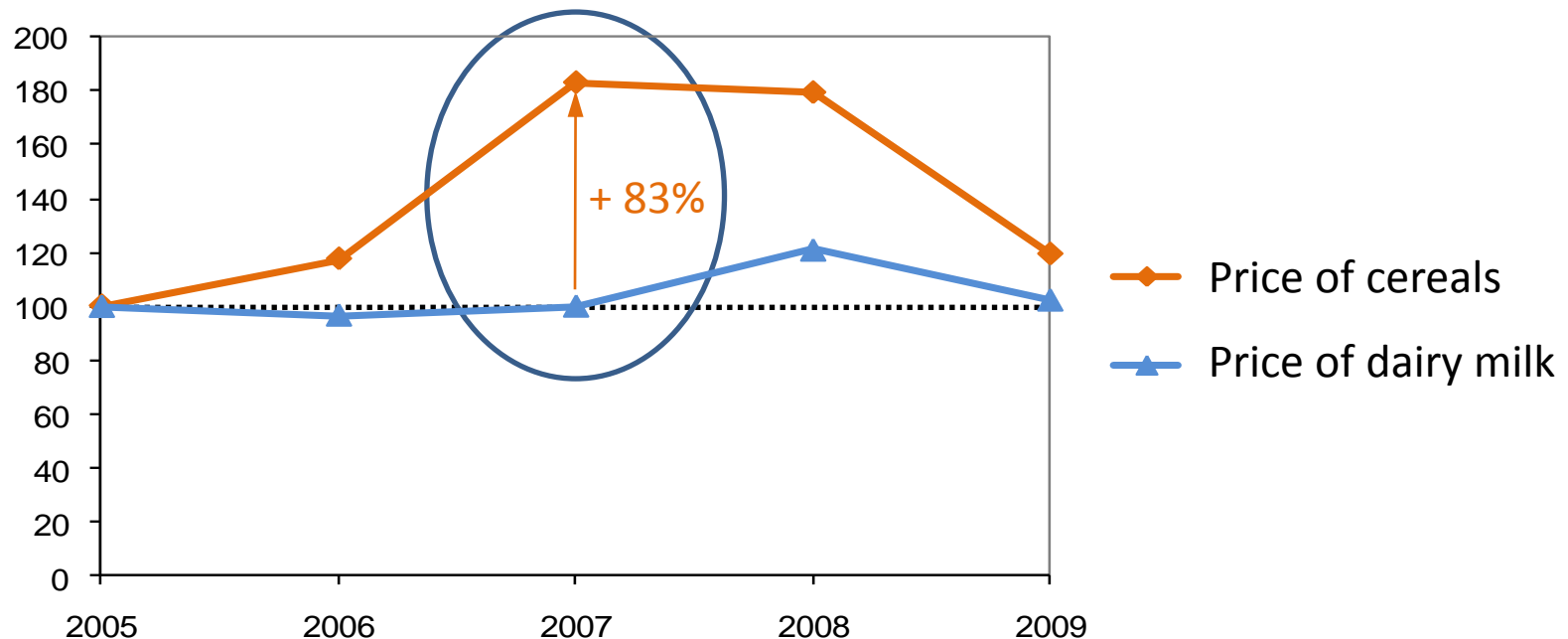 - or on N leaching causing **eutrophication**…

Context:
"livestock farming systems" and "sustainability"?

○ More and more **questions** arise about sustainability of farming systems ...

- from **environmental** point of view
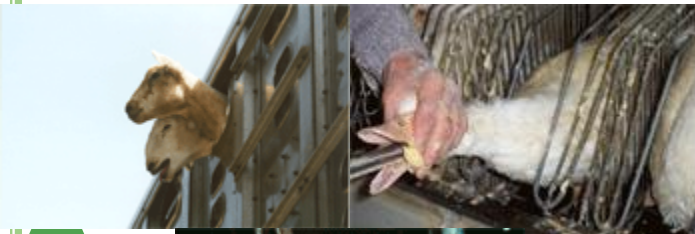- from **economic** point of view

    *How to face **price volatility**?*

    E.g. Evolution 2005-2009 of price indices of agricultural in France (source: Eurostat)

Context: "livestock farming systems" and "sustainability"?

○ More and more **questions** arise about sustainability of farming systems …

- from **environmental** point of view
- from **economic** point of view
- from **social** point of view
  - ○ **Sanitary** crisis
  - ○ Animal **welfare**
  - ○ **Workload**
  - ○ …

4

Context:
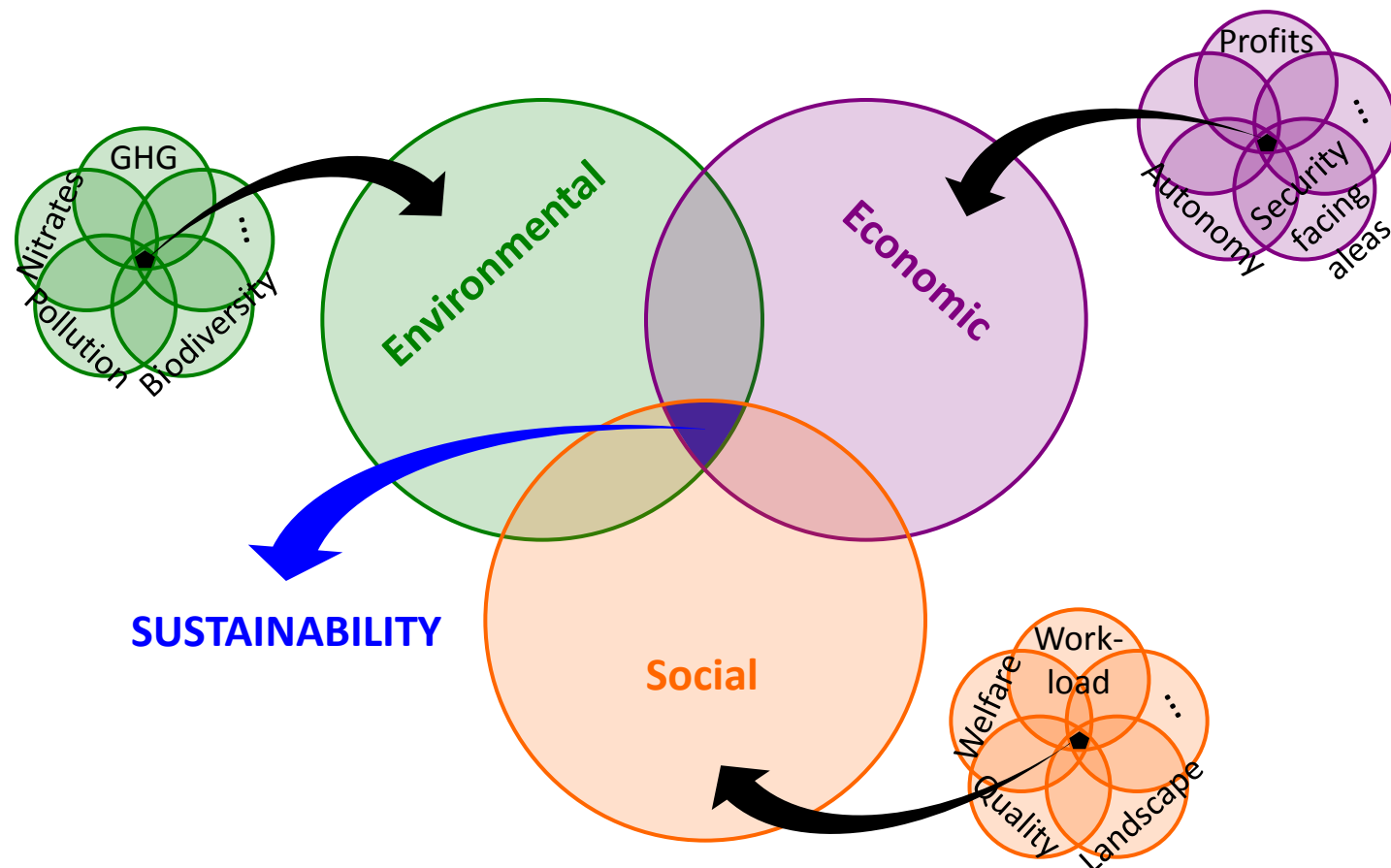## "livestock farming systems" and "sustainability"?

○ More and more **questions** arise about sustainability of farming systems...

- from **environmental** point of view
- from **economic** point of view
- from **social** point of view

⇨ More and more demands arise about sustainability **evaluation** of farming system, for several purposes:

- From certification scheme to diagnostic tool

5

Sustainability: a multidimensional concept
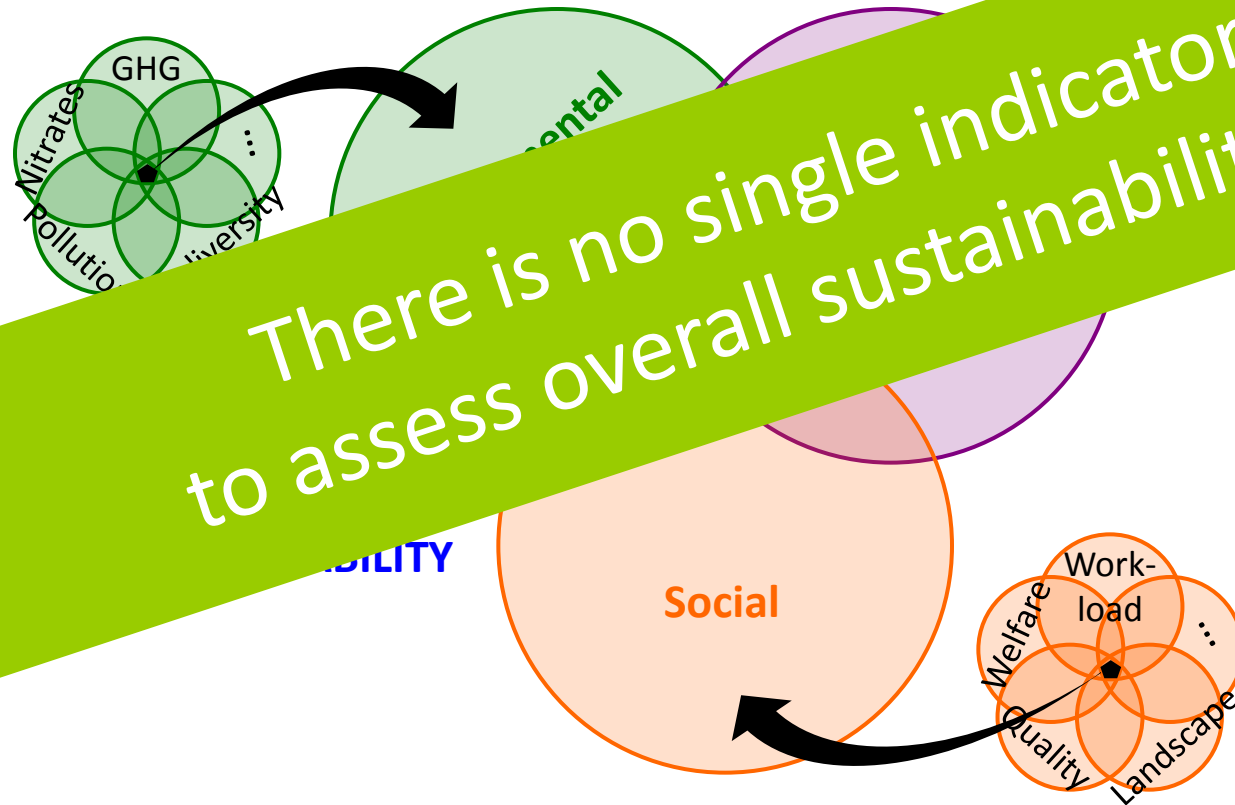
⇨ SUSTAINABILITY = a multidimensional concept

Whose dimensions are also **multidimensional**!

Sustainability: a multidimensional concept

⇨ SUSTAINABILITY = a multidimensional concept
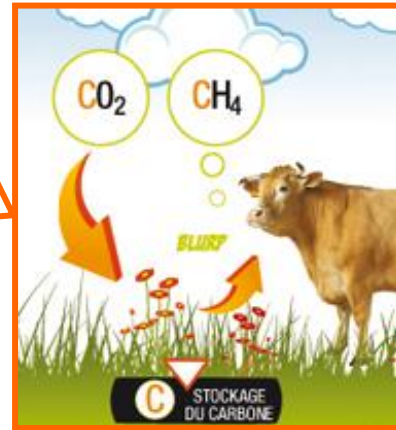
Whose dimensions are also **multidimensional**!

GHG

Nitrates

Pollution

...

Diversity

ental

Social

Work-load

Welfare

Quality

Landscape

...

There is no single indicator
to assess overall sustainability!!!

Why a multicriteria evaluation?

o Even if **links** may exist between these dimensions…

E.g. encouraging grazing of dairy cows
on **permanent pastures**

may favour:
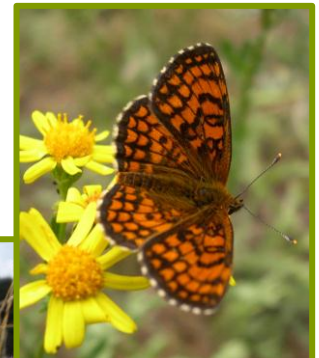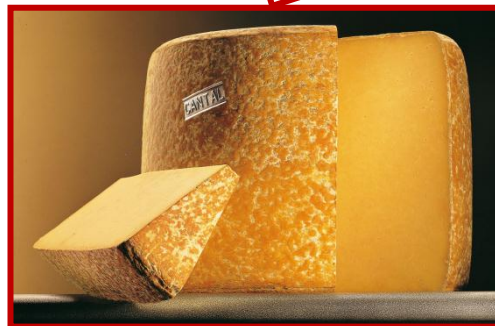
C- sequestration
[e.g. Soussana et al., 2007]

Biodiversity
[e.g. Farruggia et al., 2008]

Milk quality
[e.g. Coulon et al., 2005]

R. Botreau

Why a multicriteria evaluation?

○ Even if **links** may exist between these dimensions…

-- Example –

… they have **different impacts** on **sustainability** and must be considered and **interpreted independently**, and then to be **aggregated**

○ In addition, **compensations** between these dimensions are probably **to be limited**
(e.g. to be good on economy is not sufficient if you impair the environment…)

⇨ Thus **multicriteria evaluations** of sustainability are to be designed, *implying to keep in mind several theoretical and practical considerations…*

R. Botreau

The multicriteria evaluation process

1. Define the **object** to be assessed: Farm? Territory? Farming system? ⇨ define the boundaries of the "system" to be evaluated

2. Precise the **objective(s)** of the assessment: Why evaluate? What do you want to do with that evaluation?

3. Identify the « **specifications** » deriving from the objective: ⇨ list the constraints to be considered (e.g. feasibility, duration…)

4. Define the sustainability **criteria** i.e. define what you mean by "sustainability"

5. Choose / develop **indicators** to check the conformity of the "system" with the criteria

6. Construct the **evaluation model**: Interpret & aggregate the indicators and criteria ⇨ *choose the method(s) most adapted to the situation*

Economy

Environment

Society

10
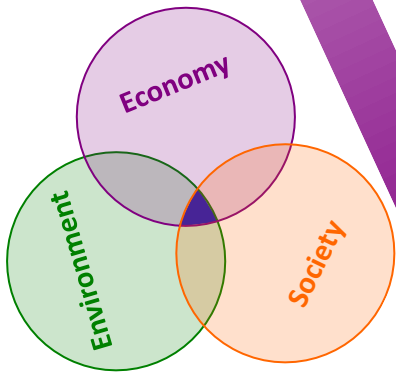
1. Define the object to be assessed

○ **Spatial** scale:

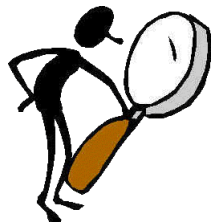Is the evaluation to be done at **unit**, **farm** or **territory level**?
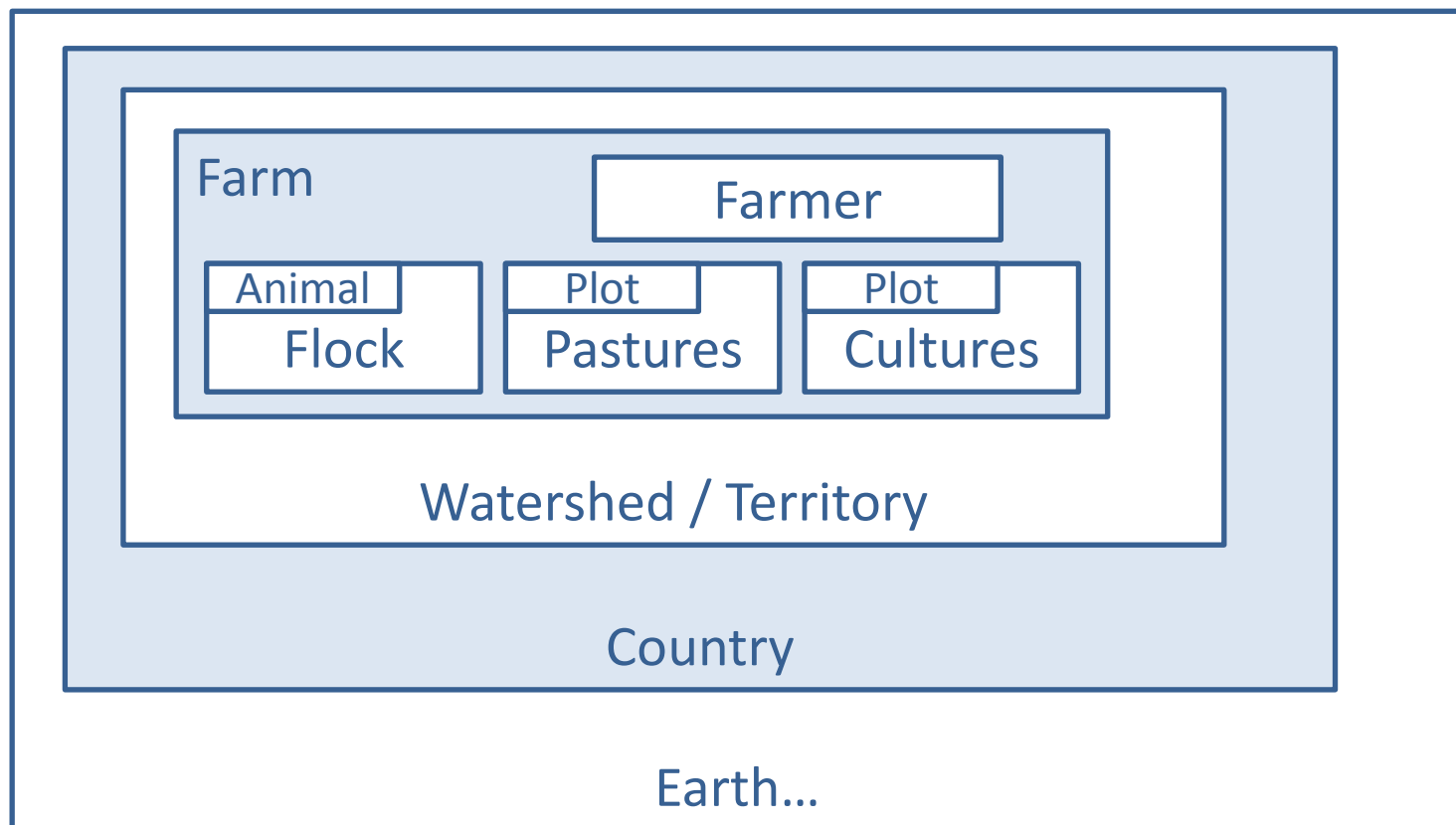
2. Precise the objective(s) of the assessment

- **Production of statistics**

  E.g. 20% of cows housed in tied-stalls in France
  25 % of cows are lame *[source MAF]*

  - **Analysis ⇨ Identification of risk factors**

    E.g. Calves reared by calm and gentle farmers
    are less stressed when handled *[Lensink et al 2001]*

- **Diagnostic and advice**

  E.g. self-assessment grid *[Bartholomeu 2001]*
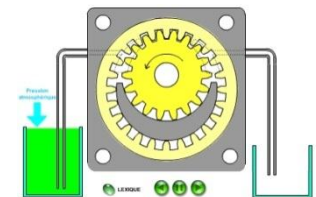
  - **Certification ⇨ Inspection / Control**

    Certification criteria are to be checked on farms

- **New systems' design ⇨ Choice among alternatives**

  Scenarios are compared on a set of indicators

Descriptive

Normative Prescriptive

Mathematical construction:

⇨ **Evaluation tools vary depending on objectives!**

12

3. Identify the « specifications » deriving from the objective

For a given type of objective, **constraints** may be really different!

○ E.g. duration of the inspection & indicators that can be used to assess the sustainability of a farm:

E.g. for a commercial certification

Using a **« simple questionnaire »**
to be filled in with the farmer,
for a **maximal duration of 2h**

$$\neq$$

E.g. for research purpose (systems' design)

Using **many precise measures** like for instance
blood samples on animals
or deep interview with the farmer to assess his workload,
etc...

→ **may takes several days!!!**

4. Define the sustainability criteria

○ Criteria must allow to establish preference judgements

- **relative:** on a given criterion, this farm is **better** or **worse than** this other one

OR

- **absolute:** on a given criterion, this farm is **good** or **bad**, whatever the results of the other farms

R. Botreau

4. Define the sustainability criteria

○ Criteria must allow to establish preference judgements

○ The set of criteria should comply with *[Bouyssou 1990, Roy 1985]* some theoretical and practical requirements:

- The set of criteria must contain all important criteria but no redundant or irrelevant criteria

- One must be able to interpret each criterion separately

- Criteria should not be too numerous

- The set of criteria should be agreed by stakeholders involved in the assessment

R. Botreau

4. Define the sustainability criteria
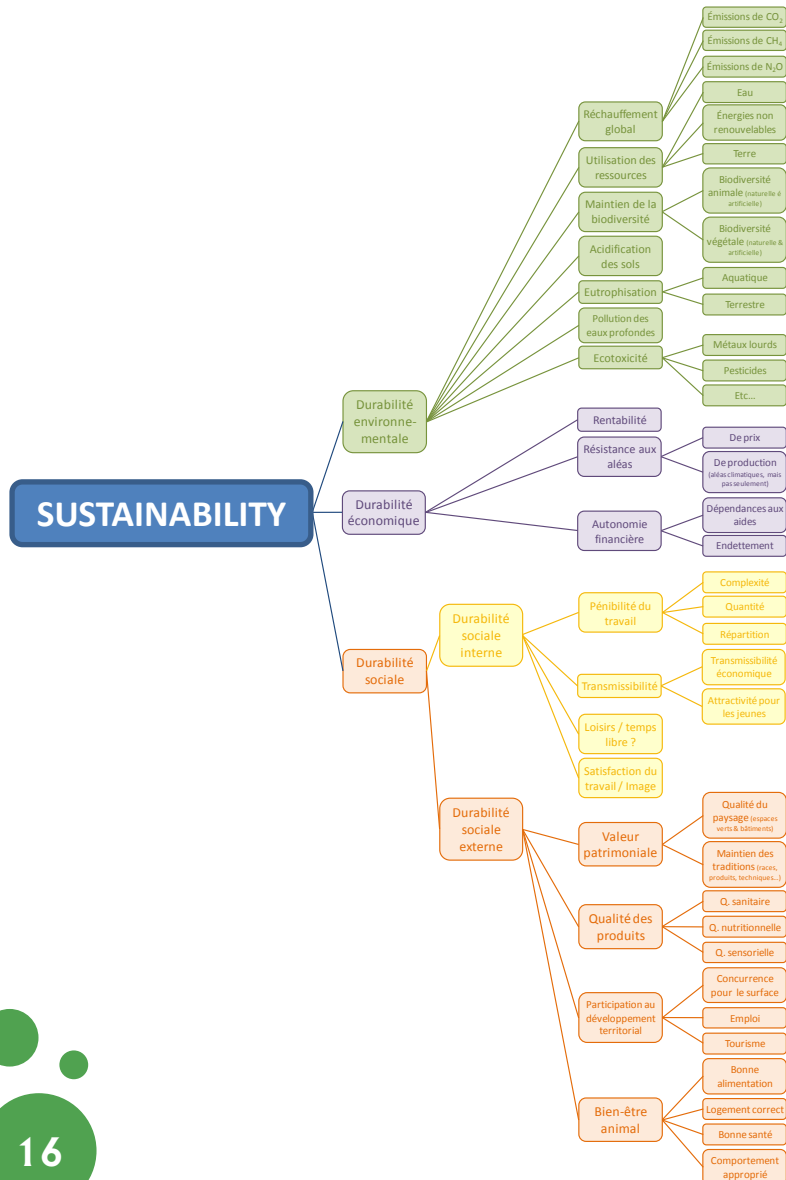
For the assessment,
the list of criteria should be
exhaustive…

… BUT more it is, the longer it is!

5. Choose / develop indicators to check the conformity of the "system" with the criteria

- Once the sustainability **criteria** defined,
  the **indicators** that will allow to evaluate them
  are now to be chosen in order to:

  - cover all the criteria to be checked to assess sustainability

  - be relevant

  - be repeatable (to ensure data reliability)

  - be feasible in the different situations that should be covered
    by the evaluation tool
    (on commercial farm? In routine use? On several species? etc.)

  - be easily **interpretable**

5. Choose / develop indicators to check the conformity of the "system" with the criteria

○ Often, the difficulty is to reach an appropriate compromise between **feasibility** and **relevance** of the indicators

How to measure **biodiversity**???

Resources-based indicators   **Results**-based indicators

E.g. total length of hedges on the farm

Feasibility

Relevance

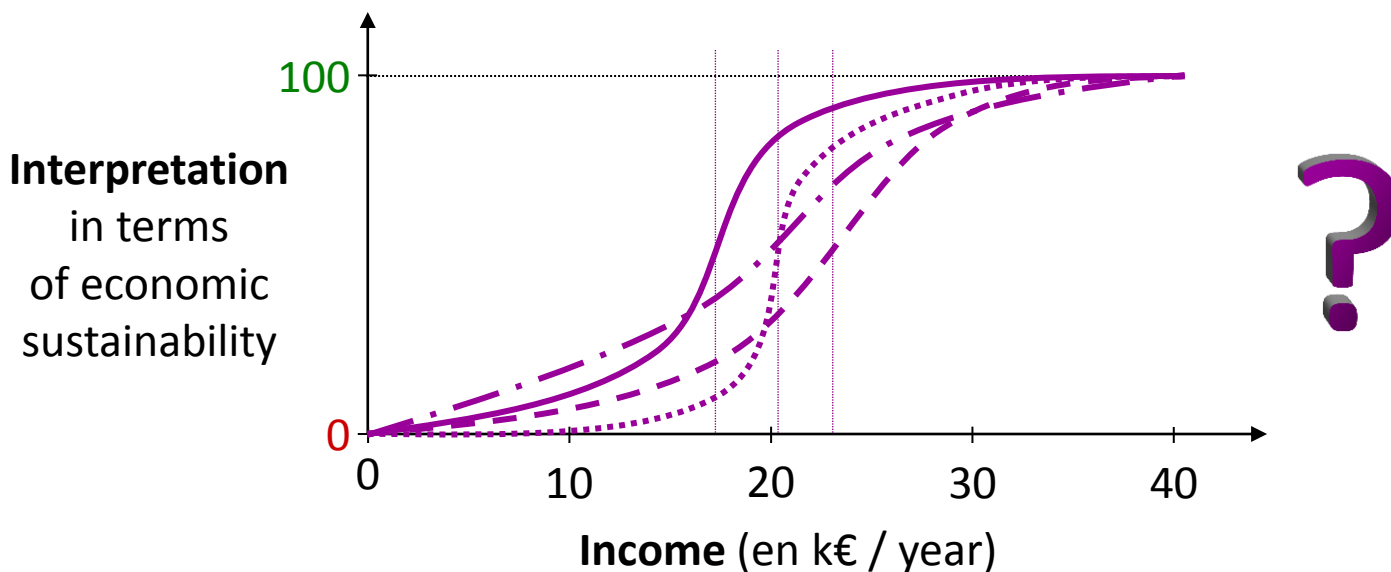E.g. Abundance and richness of plant and animal species

Choice will also depend on the specifications identified!

18

6. Construct the evaluation model

○ First difficulty, interpret indicators in terms of sustainability

E.g. Annual farmer's income

⇨ Evaluation is by definition **subjective**!

6. Construct the evaluation model

○ First difficulty, interpret indicators in terms of sustainability

○ In addition to the necessary interpretation of the indicators, other considerations exist around the aggregation problem:

- Is it **necessary** to aggregate? And if yes, **up to which level**
  (criteria / sustainability pillars / overall assessment)?

- What are the **weights** to be assigned
  to the different indicators and criteria?

- And are **compensations** between bad and good results to be allowed?

⇨ Consulting "experts" to know their *judgement* both on the interpretation and on the rationale they use to aggregate the different elements

⇨ Adapting the *calculation methods* to fit experts' rationale(s)

In all cases, what is to be done = **model experts' opinion**

Conclusions

- All along the evaluation process
  several questions and difficulties are to be addressed

- This list of considerations is **not exhaustive** but points out major difficulties to be faced and **choices to be made** when designing a sustainability evaluation model

- **Two messages** to keep in mind:

A **model** is a simplification of the reality, even for an "evaluation" model ➡ We must accept to make such **simplifications**

Evaluation process necessarily involves **value judgements** ➡ We must accept the **subjectivity** of the evaluation *(it cannot be fully objective!)*

R. Botreau

Thanks for your attention...