

SAFE: a framework for assessing sustainability levels in agricultural systems

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Introduction Evaluating the sustainability of agricultural systems is a major challenge for scientists, policy makers and farmers. Numerous sets of indicators have recently been designed, both at national and international levels. However, most of these initiatives focus only on environmental aspects of sustainability, indicators are often selected arbitrarily and usually do not fit in a consistent, comprehensive and universally applicable framework. This paper presents an original framework for integrating the information contained by indicators into a single quantitative measure of agricultural sustainability in order to facilitate comparison and diagnosis.

Methodology For each of the three sustainability pillars (environmental, economic and social), SAFE defines hierarchical levels - principles, criteria, indicators and reference values - reflecting the multiple functions that an agricultural system should maintain or enhance in order to be sustainable (Table 1). An exhaustive list of indicators was built and submitted to experts (scientists, policy makers and farmers) for evaluation by the Delphi method (Okoli & Pawlowski, 2004) and against a specific set of criteria (Table 2). Multivariate analysis determined a core set of indicators per criterion. Selected indicators were calculated at different scales (parcel, farm and landscape) and converted to a reference value. Fuzzy evaluation (Cornelissen *et al.*, 2001) allowed the rescaling of indicator values on a continuous scale of sustainability values: S_i [0-1]. Finally, S_i was integrated at the criterion level (weighted average of S_i), at the principle level (average of S_c), at the pillar level (average of S_{pi}) and at the sustainability level (average of S_{pr}). The SAFE framework was tested on four experimental farms.

Table 1 Hierarchical framework

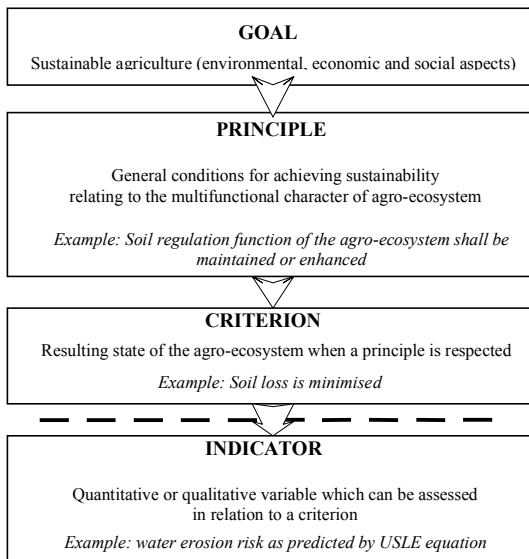


Table 2 Criteria for indicator selection

1. **Discriminating power in time and space**
→ Ability to discriminate between changes due to external factors and management, in space and time
2. **Analytical soundness**
→ “Is the indicator scientifically valid?”
3. **Measurability / Cost and time consumption**
→ “Is the use of the indicator justified in terms of cost and time consumption?”
4. **Transparency**
→ “How understandable is the indicator?”
5. **Policy relevance**
→ “Does the indicator help in monitoring policy measures effects and in identifying areas where policy action is needed?”
6. **Transferability**
→ “Does the indicator relate to general practices of major farm types?”
7. **Relevance to sustainability criteria**
→ “Is the indicator a relevant measuring tool for the sustainability criterion/criteria it is related to?”

Results and conclusions The SAFE framework (“P/C/I” hierarchy) provided a consistent approach for evaluating the sustainability of agricultural systems as a whole (holistic approach) and at different scales. The framework is filled with indicators selected on a scientifically sound basis and SAFE integrates progressively the information of selected indicators in a single quantitative measure of sustainability (S).

References

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