Framework for assessing the Sustainability of Agricultural Systems: the SAFE concept

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1. Introduction

A large number of national and international institutions has recently put effort in the design of sets of so-called agri-environmental indicators. Most of these initiatives are restricted to the environmental pillar of sustainable agriculture, and indicators are more or less arbitrarily selected. In agriculture, unlike forestry, remarkably few efforts have been made to develop a generic, conceptual framework of Principles,Criteria and Indicators (PC&I) of sustainable agriculture .

2. Objective

To develop a consistent framework of PC&I for evaluating the sustainability of agro-ecosystems, referred to as the SAFE framework.

3. Methodology

SAFE is situated in the evaluation path of sustainable development (fig 1). The SAFE analytical framework defines hierarchical levels to facilitate the formulation of sustainability indicators in a consistent and coherent way (fig 2). After definition of principles and criteria, indicators serve as actual measuring tools of sustainability at three spatial scales (field, farm and landscape). A core set of indicators is selected following elaborated criteria concerning quality and cost/benefit ratio of the proposed indicators. The proposed methodology is tested on four experimental farms (see practical poster).

4. Results

Table 1 lists the principles and criteria defined for the environmental, economic and social pillar of sustainability. Indicators are proposed for each criteria, but are not shown due to limited space.

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Framework for assessing the Sustainability of Agricultural Systems: the SAFE concept - Preliminary Results

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1. Introduction

A methodology (SAFE) was developed for a consistent and holistic sustainability evaluation of agricultural systems. This methodology defines a framework of principles, criteria and indicators that serves as a structured evaluation tool (see theoretical poster).

2. Objective

To test the methodology developed in SAFE. Indicators are selected for the different principles and criteria. These indicators are quantified at three spatial levels using detailed management data and other field data.

3. Methodology

Experimental sites:
Four farms are selected that are situated over different agricultural regions in Belgium. Different regions, land-use practices and soil types are covered by the range of selected farms. Figure 1 shows the geographical situation of the farms in Belgium and a table is inserted which gives an overview of some characteristics of the farms.
Data collection and management:
Data collection is done through field work, interviews and literature research. Data management is performed in dBASE and linked with geographical information system for spatial evaluation and visualization
Indicators, verifiers and calculation:
The following indicators are presented:

- **Pesticide use** (g active substances/ha): entire applied dose of active substances present in herbicides, insecticides, fungicides, growth inhibitors, dressing powder and seed coatings.
- **Occurrence of earthworms** (ton/ha and number of species/parcel)
- **Soil perturbations** (number of treatments): number of passages by tractor with working tools
- **Humus** content in topsoil (%): organic carbon content, determined on mixed soil samples at 0-15cm.
- **Organic matter input** (kg C/ha): organic amendments, plant residues and intercropping.

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- **Direct and indirect fossil energy input** (MJ/ha): direct fossil energy is the energy input in the agricultural system under the form of diesel, electricity and lubricants, indirect fossil energy is the fossil energy required to produce and transport inputs like fertilisers, machines, seed and pesticides.**4. Preliminary results and future work**

Two amoeba figures are inserted for visualization of the results. The amoeba show the indicators for respectively parcels under grassland and arable parcels. There are clear differences between parcels of different farms and crop. Future work will be oriented towards aggregation of indicators which allows sustainability scoring of parcels, farms and landscapes at the level of principles.