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Spatial upscaling of on-farm indicators: Concepts to use a scientific knowledge base to match policymakers' requirements

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Introduction

The SEAMLESS-Integrated Framework (S-IF) aims at assessing *ex-ante* impacts of policy options and agro-technical innovations on the sustainability of agricultural systems and on sustainable development at large (Van Ittersum *et al.*, 2008). This assessment is mainly performed through the use of modelling chains allowing the quantification of a set of sustainability indicators at multiple scales. SEAMLESS-IF models have been designed to simulate behaviour of the key hierarchical agricultural systems (field, farm, region, EU and world). However, despite the wide range of scales covered by these models there can be gaps between the scale at which model outputs are available (i.e. the model scale) and the scale at which policymakers' demand indicators for decision making (i.e. the decision scale). Accordingly, to meet expectations of policymakers there is a need for procedures changing the scale of this information from the model to the decision scale (Dalgaard *et al.*, 2004; Bierkens *et al.*, 2000). This paper presents aggregation concepts and methods that underpin the scaling capacities with respect to the indicator quantification in S-IF.

Methods

Temporal and spatial aggregation of models outputs to calculate indicators in SEAMLESS_IF is realized through the definition of appropriate indicator attributes which are capture in the indicator ontology (Therond *et al.*, 2009). These attributes specify for each indicator the spatial and temporal resolutions which refers to (the scale of) model outputs and the extents referring to the decision scales at which at which indicators are demanded. Once this information is defined the complementary information necessary to manage the aggregation from the indicator resolution to the indicator extent is associated (tagged) to the indicator (aggregation algorithms, aggregation weight...).

Results and discussion

The main characteristics of SEAMLESS-IF are its component structure which allows flexible linkages of independent model components depending on the problem to be addressed. In addition, components can be added that allow the scaling of data to compute indicators from model outputs to scales that are relevant for the decision makers. For the spatial up-scaling of data at the farming system level, information about the spatial allocation of farm types is important and considered in the proposed scaling approach (Figure 1). Of course, different scaling factor are used for different indicators (Figure 2), enabling scaling-up of information on the basis of farm type area for environmental processes, or on the number of farms per farm type for economic information, or even more complex information as indexes for income inequalities. For example, for some environmental issues linked to local impact (water quality, soil erosion, etc.) calculation of a weighted mean by farm size is not relevant, so that specific indicators like percentage of area with high nitrate leaching have to be developed. Approaches and results are presented and discussed for different indicators and conclusions for future work are derived.

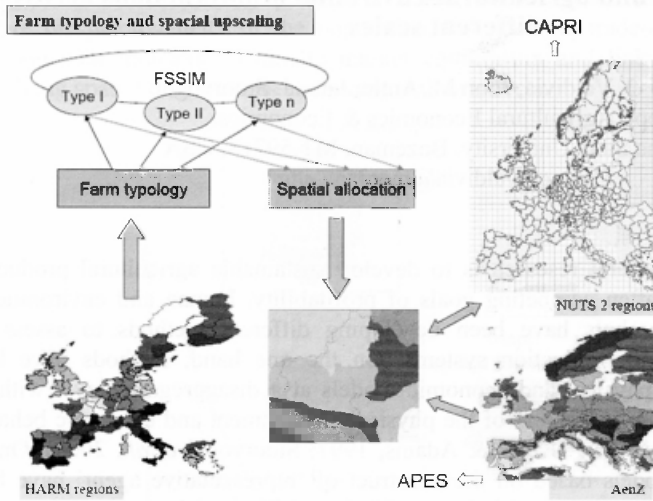


Figure 1. SEAMLESS farm typology and spatial upscaling issues.

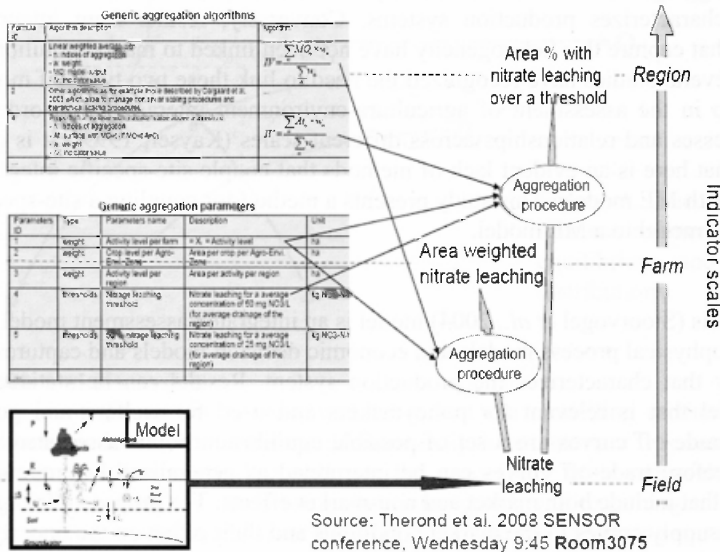


Figure 2. Procedures to scale information for project concerning detailed regions with a spatial extent of problem assessment corresponding to the region.

References

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