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System for Environmental and Agricultural Modelling; Linking European Science and Society

What is SEAMLESS?

European agriculture and rural areas face rapid changes in response to agreements to liberalize international trade, the introduction of novel agro-technologies, climate change and other drivers. Efficient agricultural and environmental policies are needed to support sustainability of European agriculture. Assessing the strengths and weaknesses of new policies and innovations prior to their introduction, i.e., ex-ante integrated assessment, is vital to target policy development for sustainable development.

SEAMLESS (www.seamless-ip.org) is an Integrated project within the 6th EU Framework Research programme and develops a computerized, Integrated Framework (SEAMLESS-IF) to analyze agricultural and environmental policy options and questions. SEAMLESS-IF enables assessment of indicators that capture the key economic, environmental and social issues of the questions at stake. The framework tool uses innovative software architecture which allows seamless model linkage (SEAMLESS and other models) across the full range of scales. This has resulted in new research on a wide range of scientific issues.

Scientific approach

SEAMLESS-IF is a generic framework achieved through a modular set-up with stand-alone knowledge components linked through an advanced software infrastructure. SEAMLESS-IF forms a profound basis to assess topical agri-environmental issues, such as biofuels, climate change and upcoming CAP reforms including elimination of milk quota. The three main outputs of the project, i.e. the so-called triple I of SEAMLESS, are: (1) Integrated framework for impact assessment; (2) Infrastructure of software enabling model linkage; and (3) Individual stand-alone knowledge components (models, data bases and indicators).

Integrated framework for Impact Assessment

Infrastructure software   Individual components

Triple I concept of SEAMLESS with the three main outputs
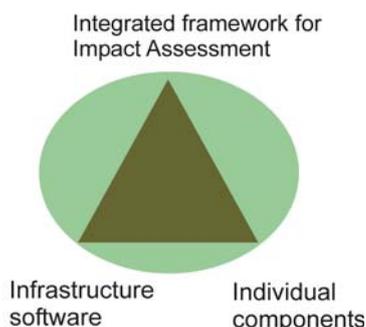
Research highlights

The main research topics in SEAMLESS are briefly described below.

a. Method for integrated assessment through linking standalone components: SEAMLESS-IF allows integrated assessments of agricultural systems at multiple scales (from field, farm, region to EU and global) and provides capabilities for analysis for environmental, economic, social and institutional aspects of agricultural systems.
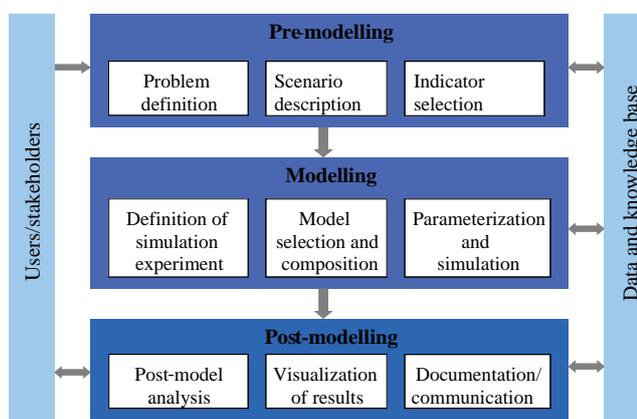
Integrated assessment procedure using SEAMLESS-IF, with pre-modelling, modelling and post-modelling phase

b. Stand-alone components: including a pan-European data base, indicator systems and a range of models: (1) APES is a modular simulation model for calculating agricultural production and its externalities; (2) FSSIM is a farm model for quantifying the integrated agricultural, environmental and socio-economic aspects of farming systems, partly using the output from APES; (3) EXPAMOD is used for up-scaling the outcomes from FSSIM to the European scale; (4) CAPRI (existing model but adapted to SEAMLESS-IF) is a comparative static equilibrium model providing information on price-supply relationships, solved by iterating supply (from EXPAMOD) and market modules, and applied to the agricultural sector of the European Union; (5) Models that simulate landscape change and its visualization, global markets, and change in agricultural employment in the EU.

Attractive landscape due to new EC regulations?
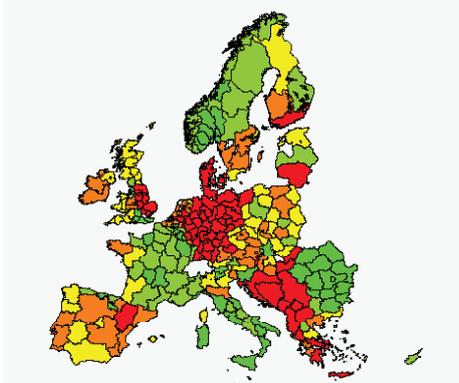
Relative change (%) of beef production across EU-25 regions as a result of the policiy scenario (compared to the baseline scenario) (Source: Univ. of Bonn)

Is reduction of groundwater use for agriculture in Southern Europe possible?
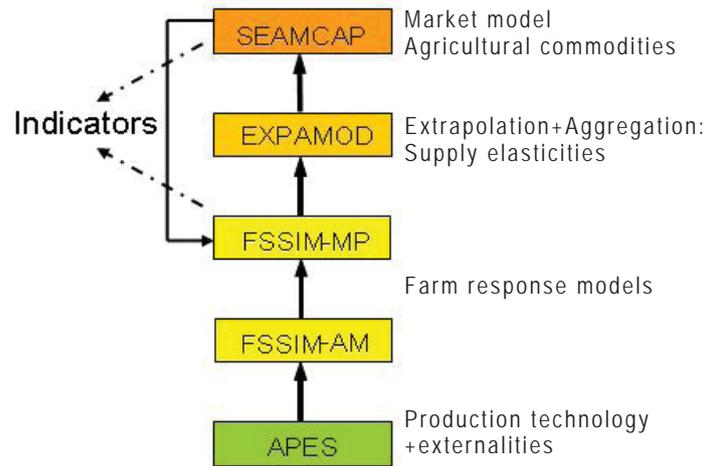
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Research highlights continued

c. **Software infrastructure:** SeamFrame, the software architecture for SEAMLESS-IF, consists of the modelling environment, the project manager, the processing environment and the domain manager. SeamFrame allows the linkage of stand-alone models and data bases such that they can be used in integrated assessments, and also the linkage of end-user applications (e.g. graphical user interface, tool for delivering output). SeamFrame uses an ontology to structure knowledge from different domains as well as semantic meta-information about components of SEAMLESS-IF.

d. **Scaling methods:** Analyses with SEAMLESS-IF can be done at the full range of scales and with varying time horizons, whilst focusing on the most important issues emerging at each scale. SEAMLESS-IF may, for example, be applied for analysing the consequences of the Water and Nitrate Directive for, respectively, representative arable and dairy farms in France, for regions in France, and for the EU as a whole, with respect to nitrate leaching, water use, farm income and agricultural employment. To allow this we develop methods for scaling information from field to farm and farm to region and market level.

e. **Methods to assess social and institutional indicators:** An example of a method is the Procedure for Institutional Compatibility Assessment (PICA) which has been developed for making ex-ante assessments of the institutional feasibility of policies. In other words, PICA assesses the probable effectiveness of a policy option in a given institutional environment.

More information

For more information about the science in the SEAMLESS project and publications, to view the information video, or to download latest prototypes, visit **www.seamless-ip.org**

Indicators

SEAMCAP — Market model Agricultural commodities

EXPAMOD — Extrapolation+Aggregation: Supply elasticities

FSSIM-MP — Farm response models

FSSIM-AM

APES — Production technology +externalities

Backbone model chain of SEAMLESS-IF for field, farm and market level analysis (from the bottom to the top)

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