



seamless

## SEAMLESS-IF

**An integrated framework to assess  
agricultural and environmental  
policy scenarios**

Olivier Therond and Martin van Ittersum



# Outline

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- SEAMLESS objectives and development process
- Procedures for scenario development and indicator selection
- Integrated modeling framework
- Conclusion
- The SEAMLESS association

# Integrated assessment in EU

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- Increasing interest for IA in Member States
- Regulation for Sustainability IA are common
- Different approaches and methods for IA
- Need for science based methods : modelling

Backlund et al., 2009

# Integrated assessment in EC

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- Since 2003 a formal IA for all regulatory proposals (Com, 2002)
- The integrated assessment shall address "*the full effects of a policy proposal including estimates of its economic, environmental, and social impacts*"
- A systematic guideline for IA : an assessment leader, possibility to engage consultants with own methods (modelling)
- Transparency of modelling is very important

Backlund et al., 2009

# SEAMLESS

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

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SEAMLESS-IF aims at setting up integrated assessment of agricultural and environmental policies and of agro-technical innovations

A participatory development process involving potential users(DGs, National, regional)

➔ credibility, salience and legitimacy of the approach and tools



# SEAMLESS-IF : the challenge

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a generic and flexible IAM framework  
to translate policy questions  
defined in interaction with policy makers  
into scenarios assessed through  
economic, environmental, social and institutional  
indicators at field, farm, region and EU scales

# SEAMLESS project

30 partners  
ca. 100 researchers  
from a variety of  
disciplines



# Knowledge integration

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When integrating knowledge from different disciplines often misunderstandings about the meaning of the different concepts :

- concepts with an ambiguous meaning
- same concepts with different meanings
- different concepts with the same meaning
- ...



# Knowledge integration in SEAMLESS

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Definition of a common language : a common ontology i.e. a specification of concepts and of their relationships

→ a joint conceptualization

Ontology development through iterative interactions between scientists from natural, social and engineering sciences

## Scenario ontology in SEAMLESS (1)

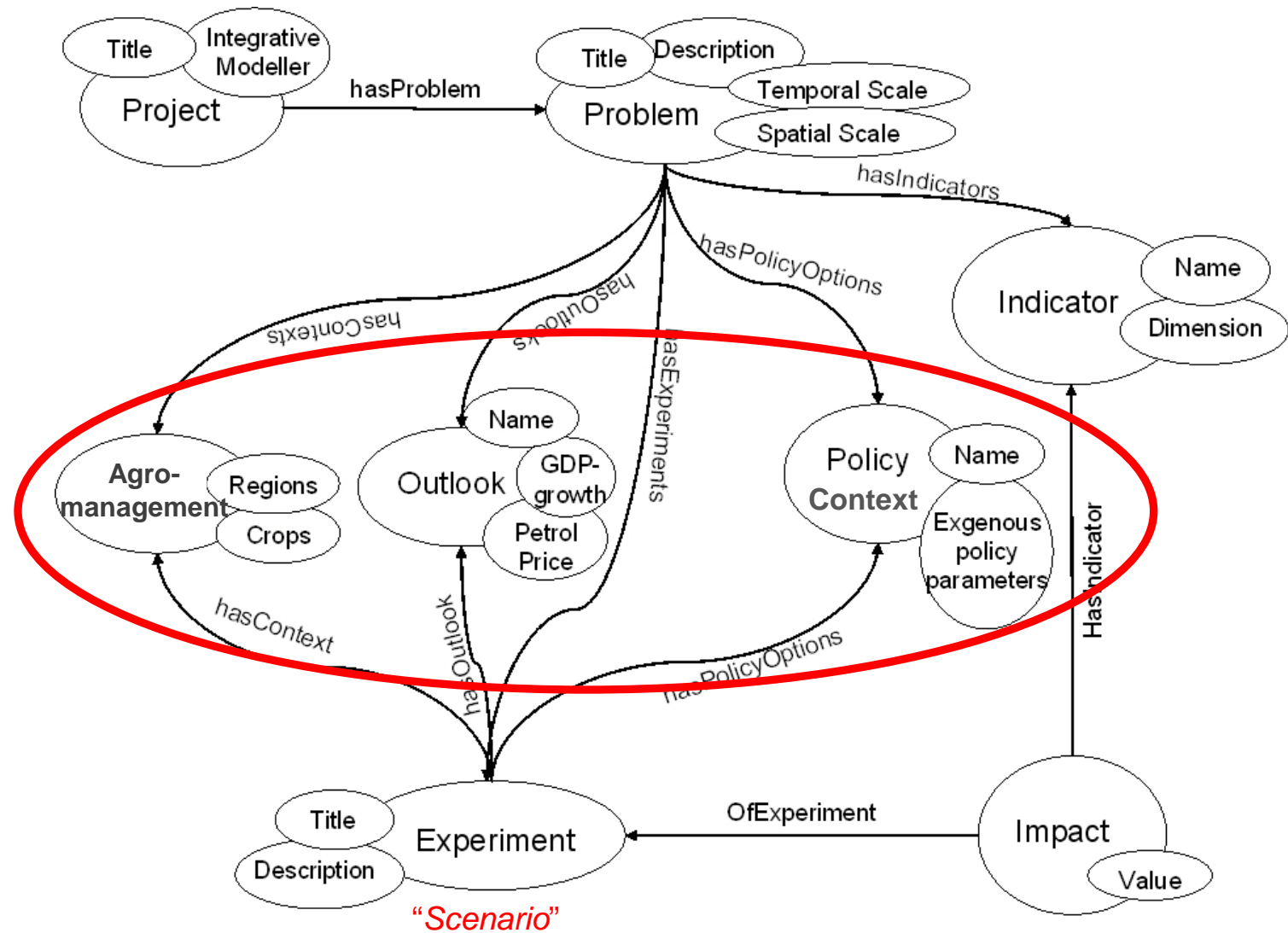
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Scenario an ambiguous and sensitive concept

How to define scenario in SEAMLESS-IF:

What are relevant aspects for  
designing scenarios for SEAMLESS?

## Scenario ontology in SEAMLESS (2)



# Scenario development procedure

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A participatory procedure with

- Policy Experts : bring the questions
- Integrative Modellers (scientists and modellers) : set up the IA within SEAMLESS-IF

# Procedure to build and assess scenarios

## Phase 1

Pre-modelling

### Problem framing

Translation of policy and technological scenarios and

Parameters  
Models  
Indicators

Policies  
Impacts

Policy  
Experts

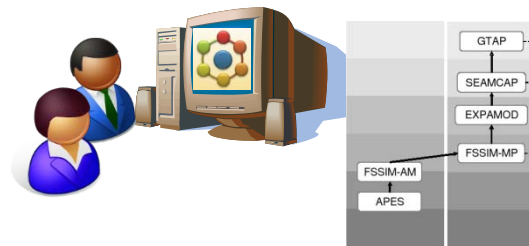
Integrative  
Modelers

## Phase 2

Modelling

### Simulations

Implementation of parameters and quantification of indicators with the modeling chain



## Phase 3

Post-modelling

### Results analysis

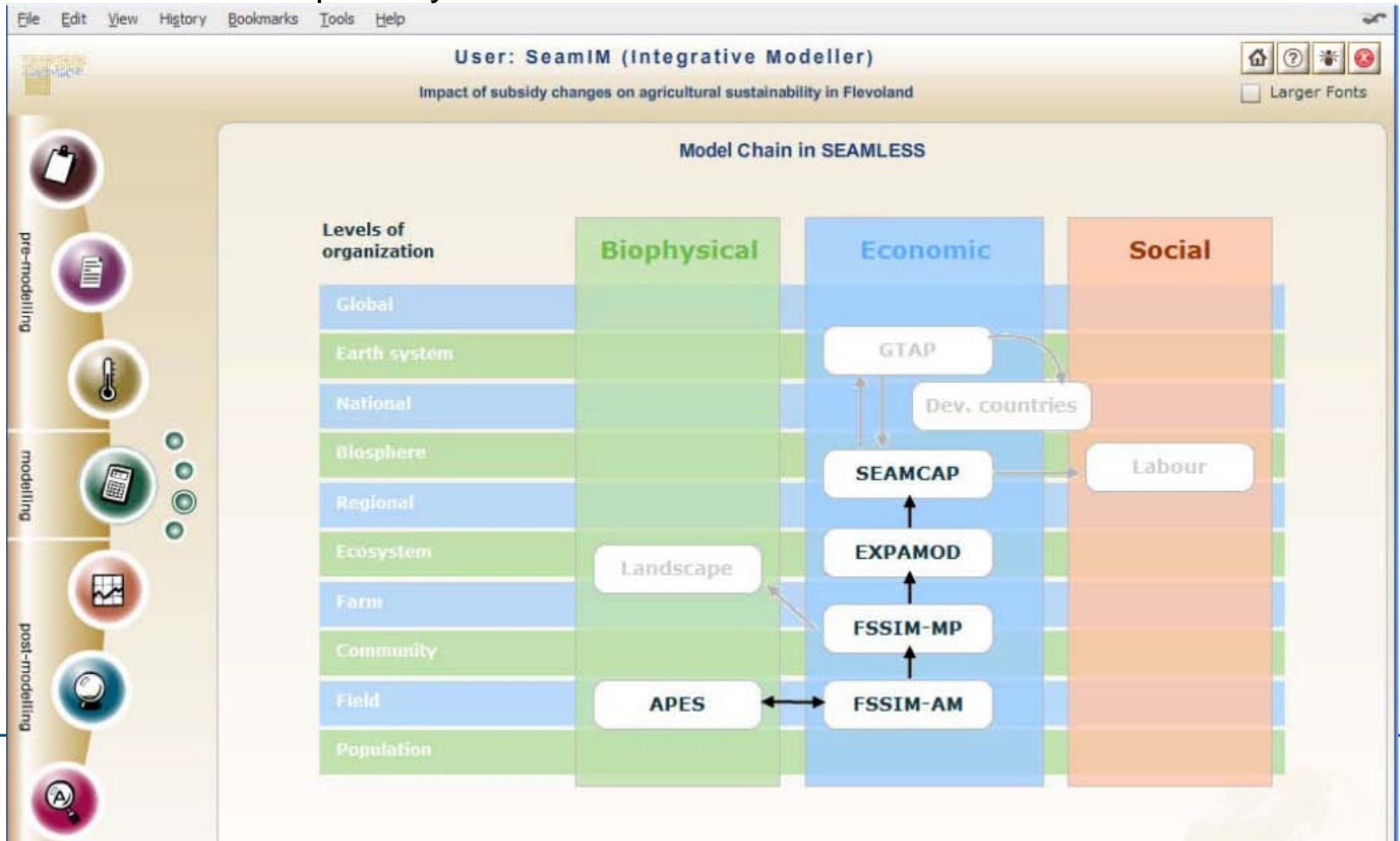
Visualisation, transparency and analysis of results



# Graphical User Interface – GUI (1)

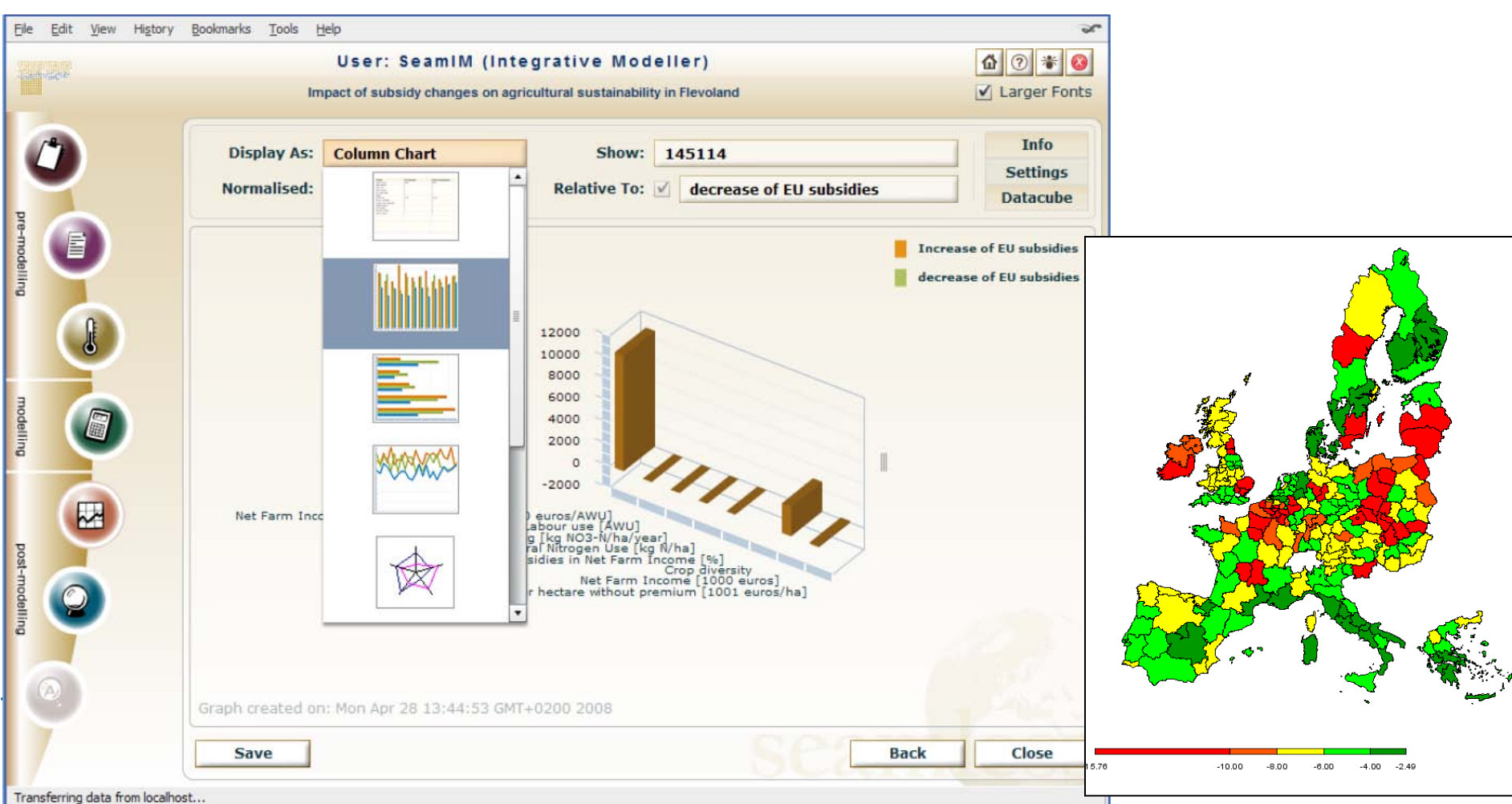
An IA-oriented GUI :

- To support Integrative modellers and policy Experts
- To ensure transparency of simulation results



## Graphical User Interface – GUI (2)

Possibility to present simulation results through a variety of graphical features including maps



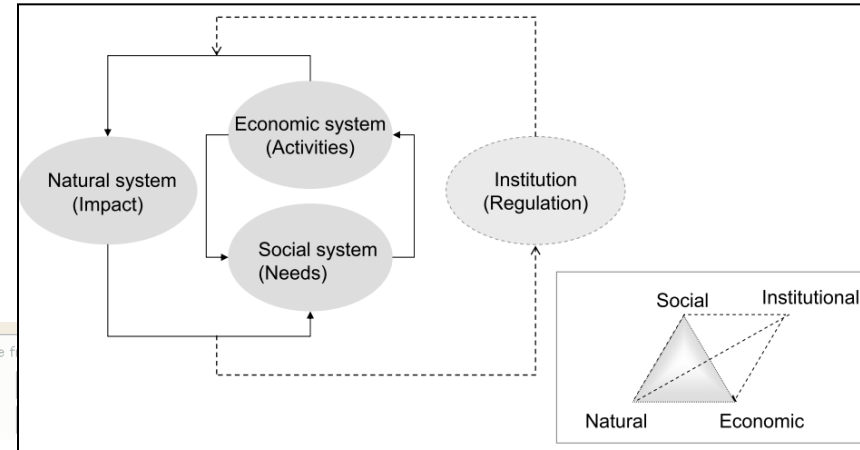
# Selection of indicators

List of available indicators :

- 80 environmental,
- 140 economic
- 11 social

Scientific sound indicators expected by policy makers

Indicators can be added on demand



These filters will, when enabled, be applied to the indicators available for selection:

☐ Show only available indicators calculated by the model:

☐ Show only available indicators calculated with spatial extent:

Available Indicators (matching all enabled filters):

Select	Name	Unit	Spatial Resolution	Status
<input checked="" type="checkbox"/>	Farm income	1000 €	AEnZ	✓
<input checked="" type="checkbox"/>	Average farm income at NUTS2 level	1000 €	Farmtype	✓
<input checked="" type="checkbox"/>	Total nitrogen use per farm	kg/ha	AEnZ	✓
<input checked="" type="checkbox"/>	Percent of area with high leaching	%	Farmtype	✓
<input checked="" type="checkbox"/>	Soil organic matter change per farm	%	AEnZ	✓
<input checked="" type="checkbox"/>	Soil erosion per farm	t/ha/y	AEnZ	✓
<input checked="" type="checkbox"/>	Water use for irrigation	mm/y	AEnZ	✓
<input checked="" type="checkbox"/>	Mean subsidies received by farms at regional level	1000 €	Farmtype	✓
<input checked="" type="checkbox"/>	Total public support for farms at regional level	Mn €	Farmtype	✓
<input checked="" type="checkbox"/>	Total value of farm production at NUTS2 level	1000 €	Farmtype	✓
<input checked="" type="checkbox"/>	Total costs	1000 €	AEnZ	✓
<input checked="" type="checkbox"/>	Value of farm production	1000 €	AEnZ	✓
<input checked="" type="checkbox"/>	Subsidies	1000 €	AEnZ	✓
<input checked="" type="checkbox"/>	Share of subsidies in farm income	%	AEnZ	✓
<input checked="" type="checkbox"/>	Crop diversity	unitless	AEnZ	✓
<input checked="" type="checkbox"/>	Nitrate leaching per farm	kg/ha/y	AEnZ	✓
<input checked="" type="checkbox"/>	Total labour use at regional level	1000 h	Farmtype	✓
<input checked="" type="checkbox"/>	Premium per activity	€/ha		✓
<input checked="" type="checkbox"/>	Yield	t/ha		✓
<input checked="" type="checkbox"/>	Pmp term	€/ha or €/head		✓
<input checked="" type="checkbox"/>	Total farm area	ha		✓
<input checked="" type="checkbox"/>	PAD	%		✓
<input checked="" type="checkbox"/>	Gross margin	€/ha or €/head		✓
<input checked="" type="checkbox"/>	Activity level	ha or heads		✓
<input checked="" type="checkbox"/>	Farm income per hectare at farm level	€/ha	Farmtype	✓

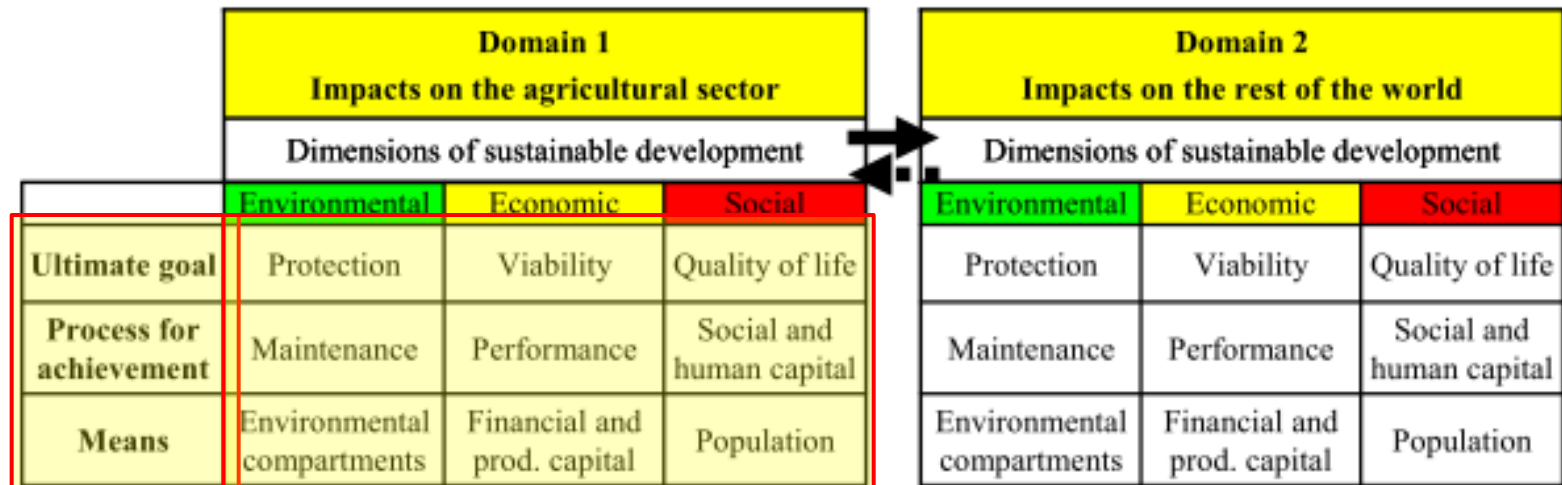
Select all   Deselect all   (Or use the checkbox in the Select column to choose per indicator.)

Choose view: **Goal Oriented Framework**   Indicator Library



# The indicator framework

## The Goal-Oriented Framework (GOF)



# The indicator framework in the GUI

The screenshot displays the GOF (Goal Oriented Framework) GUI, which is organized into a hierarchical structure for selecting indicators. The interface is divided into three main sections: **Spatial Extent**, **Domain**, and **Indicator Framework**.

**Spatial Extent:** A dropdown menu is set to **Farmtype**.

**Domain:** A dropdown menu is set to **Effect of agriculture on itself**. Below it, a list of domains is visible: **Effect of agriculture on itself**, **Effect of agriculture on the rest of the world**, and **Effect of agriculture on the environment**.

**Indicator Framework:** The framework is organized into three main categories: **Ultimate goal**, **Processes for achievement**, and **Means**. Each category contains a grid of indicators, with a progress bar at the bottom of each grid.

- Ultimate goal:** Contains three main indicators: **Protection of human health and ...** (2 / 13), **Viability** (3 / 10), and **Effect of agriculture on itself** (0 / 0).
- Processes for achievement:** Contains three main indicators: **Protection of human health and ...** (2 / 13), **Performance** (4 / 40), and **Human capital** (2 / 2).
- Means:** Contains three main indicators: **Protection of human health and ...** (2 / 19), **Other production means** (0 / 1), and **Human capital** (0 / 0).

At the bottom of the GUI, there is a **Choose view:** section with two options: **Goal Oriented Framework** (selected) and **Indicator Library**. To the right, there are **Save** and **Discard** buttons.

**The GOF allows a balanced selection of indicators for the sustainability assessment of policy options and agro-technical innovations**

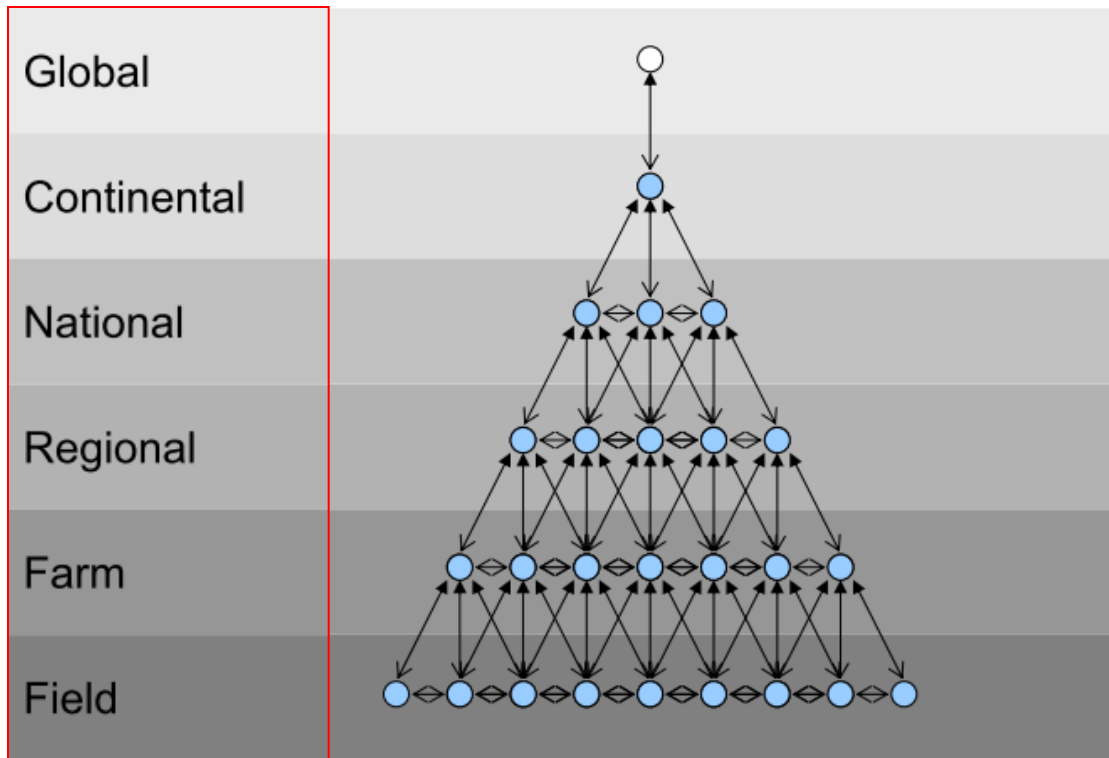
# The integrated modelling framework

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Integrated modelling a way to integrate biophysical, institutional, social and economic aspects of complex environmental systems

Hierarchy Theory to organise investigation of systems operating on different spatio-temporal scales and of their relationships

# The Hierarchy Theory

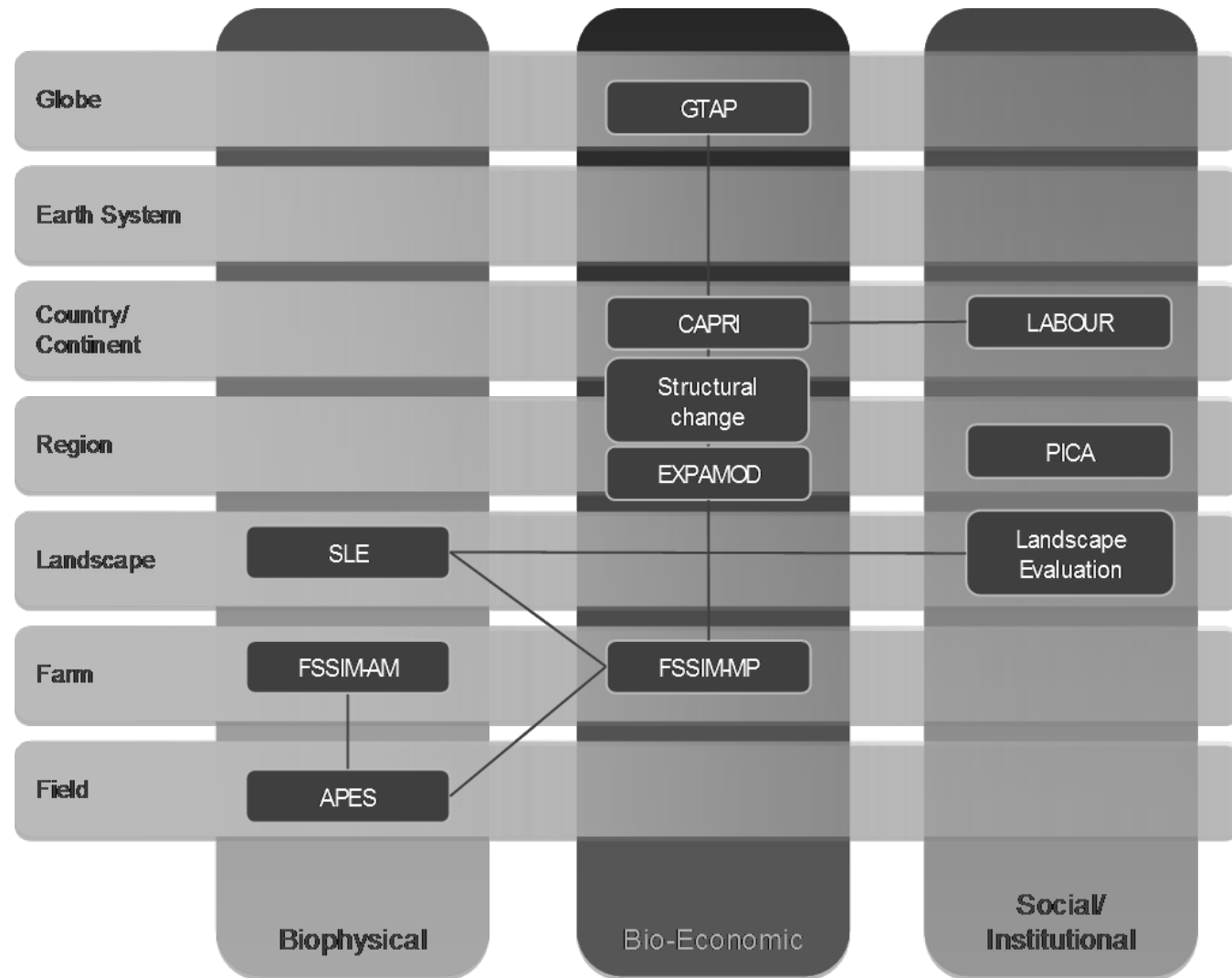


Agricultural systems have been represented as sub-systems of a hierarchical system

Ewert et al, 2009

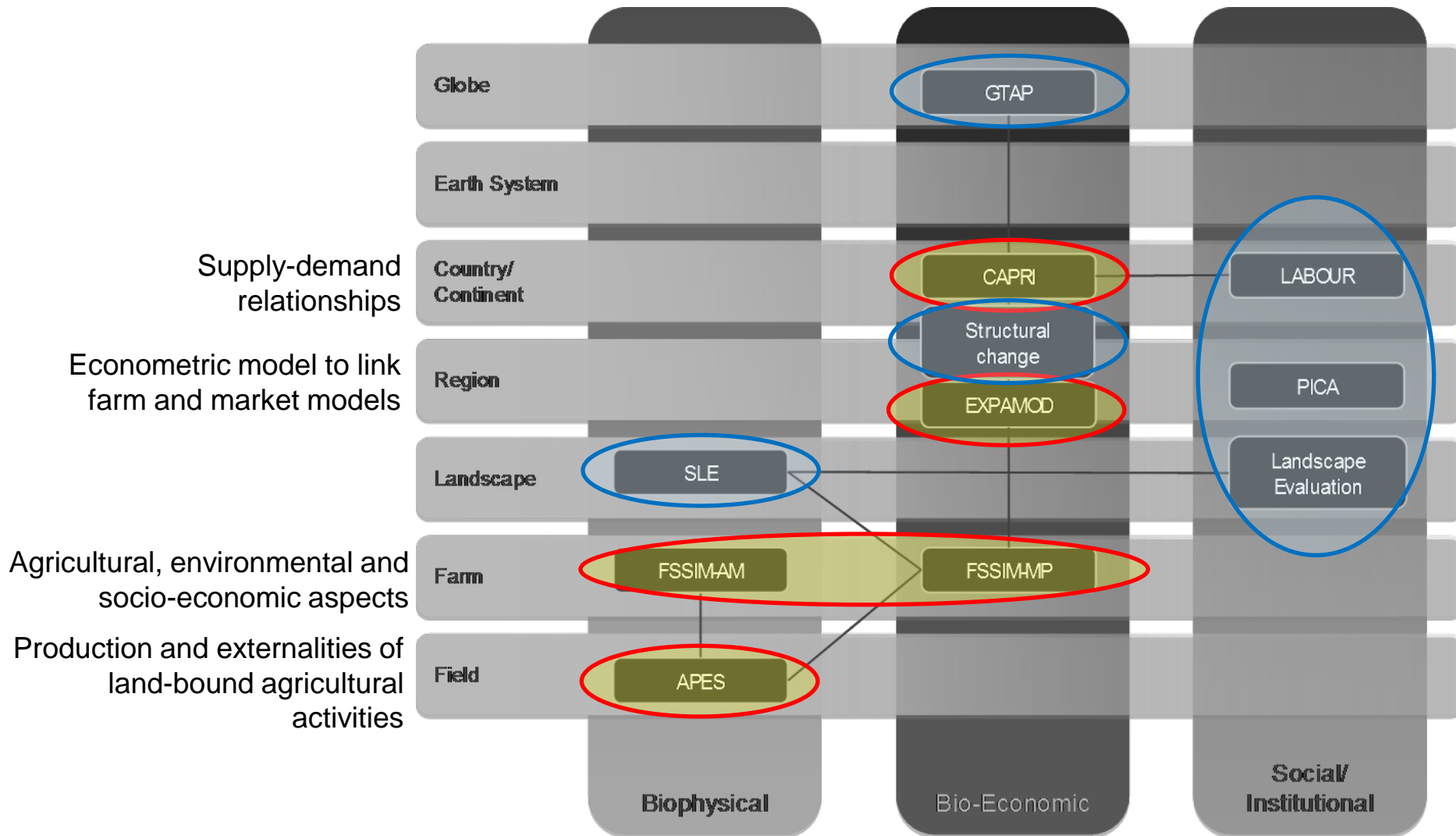
# The integrated modelling framework

In SEAMLESS-IF agricultural sub-systems are modelled as separate model components that represent different system levels and disciplinary domains



Ittersum, 2009

# The integrated modelling framework



Ittersum, 2009

## SCENA



## SCENA

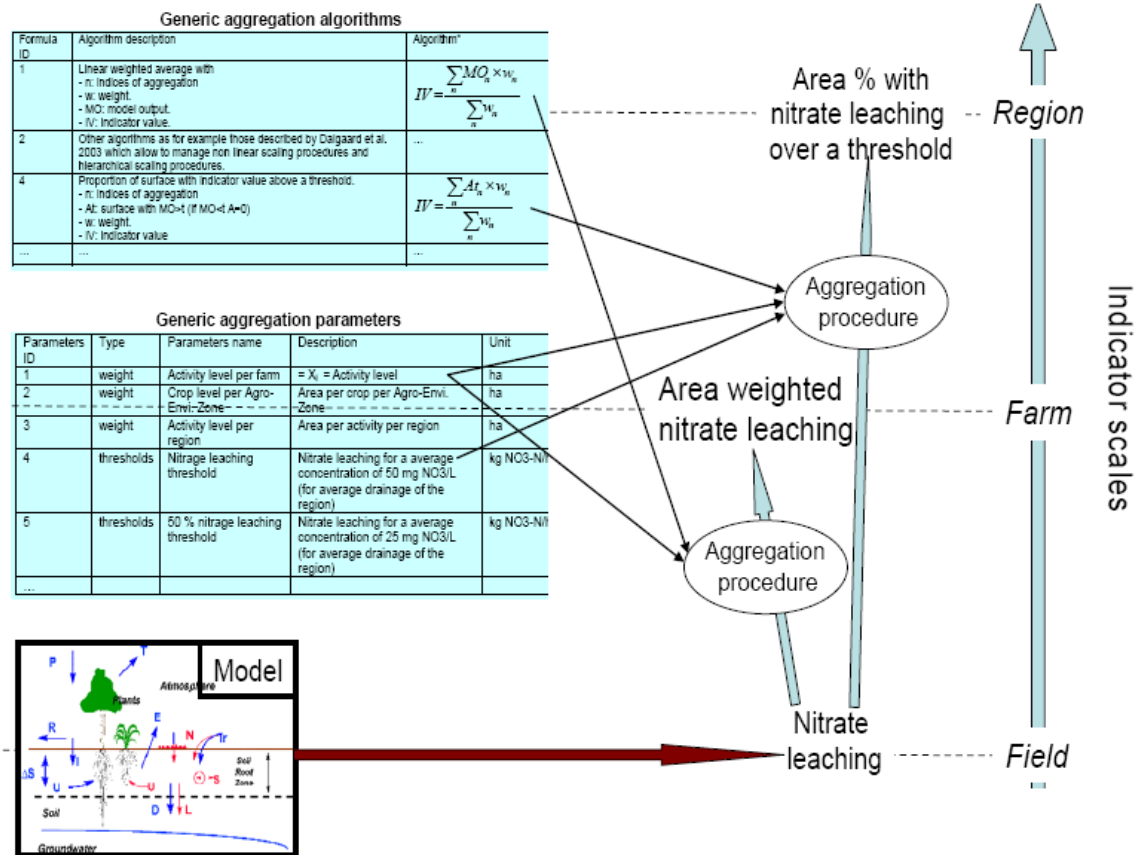
## SCENA

## SCENA

# Scaling in SEAMLESS-IF (2)

A library of generic procedures for upscaling information from levels of models to levels at which policy-makers expect indicators

## Example of Nitrate leaching



Therond et al, 2009

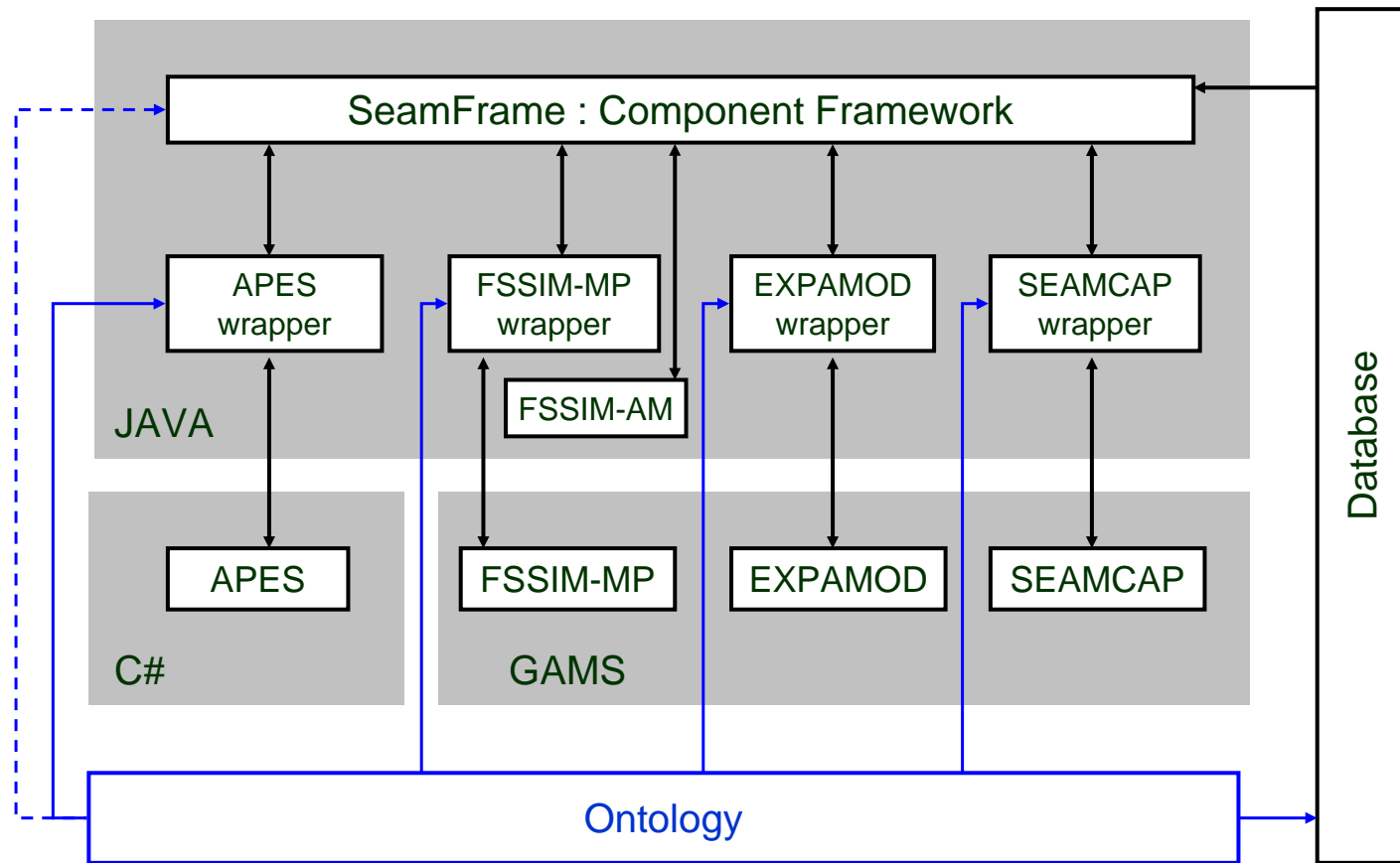




# Software framework in SEAMLESS-IF

Based on the OpenMI interface and Environment

(Gijsbers et al., 2003; Wien et al., 2010)




## Conclusion

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- High flexibility of SEAMLESS-IF to set up integrated assessment of a wide range of policy questions regarding environment and agriculture
- Complexity of the modelling chain → knowledge divided over specialists of the different components

# SEAMLESS association

<http://www.seamlessassociation.org/>



SEAMLESS

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## The SEAMLESS Association


The SEAMLESS Association can be seen as a continuation of [the EU SEAMLESS project](#) (See [SEAMLESS in a nutshell](#)), which developed an Integrated Framework for Integrated Assessments based on linkage of individual components (models, data, indicators) that enables analyses of the environmental, economic and social contributions of a multi-functional agriculture and the effects of a broad range of issues (e.g. climate change, new policies, innovation).

*The aim of the SEAMLESS Association is twofold:*

1. Maintain and disseminate SEAMLESS-IF and its components to:
  1. overcome fragmentation and poor re-use of modeling efforts concerning agricultural systems in Europe and beyond,
  2. facilitate model linkage for integrated studies,
  3. contribute to better informed process of impact assessment of agricultural and environmental policies,
  4. advance our scientific understanding of agricultural systems and their relation with sustainable development and integrated assessment.
2. Enable and facilitate extension of SEAMLESS-IF and its components and make a synthesis of improvements and extensions.

### Correspondence

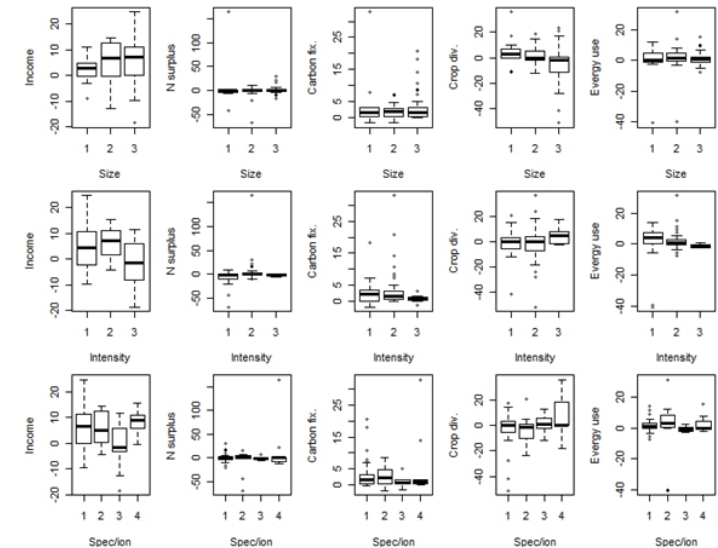
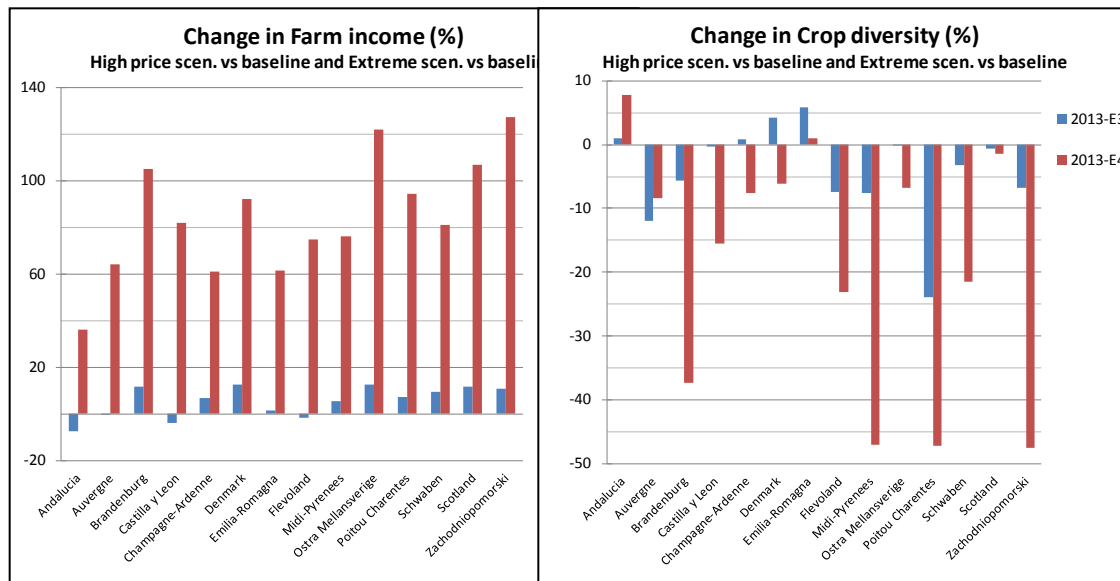
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# Applications of SEAMLESS-IF

Association is setting up new applications of SEAMLESS-IF

E.g. assessment of “***Effects of High prices on Farming systems over Europe***”



Wolf et al, 2011

# SEAMLESS association



<http://www.seamlessassociation.org/>

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Country	Abbreviation	Organisation	Logo
NL	<a href="#">ALTERRA</a>	Alterra B.V.	
FR	<a href="#">CEMAGREF</a>	Cemagref, Centre national du machinisme agricole, du génie rural, des eaux et des forêts	
FR	<a href="#">IAMM</a>	Institute Agronomique Méditerranéen de Montpellier	
CH	<a href="#">IDSIA</a>	Scuola Universitaria Professionale della Svizzera Italiana - Istituto Dalle Molle di Studi sull'Intelligenza Artificiale, IDSIA-SUPSI	
FR	<a href="#">INRA</a>	Institut National de la Recherche Agronomique, INRA	
NL	<a href="#">LEI</a>	Agricultural Economics Institute Landbouw-Economisch Instituut B.V.	
NL	<a href="#">PRI</a>	Plant Research International B.V.	
UK	<a href="#">SAC</a>	Scottish Agricultural College	
DE	<a href="#">UBONN</a>	University of Bonn, Institute for Agricultural Policy	
DK	<a href="#">UoC</a>	Danish Centre for Forest, Landscape and Planning, KLV	
NO	<a href="#">UMB</a>	Norwegian University of Life Sciences	
NL	<a href="#">WU</a>	Wageningen University	