SIAT
Sustainability Impact Assessment Tool

Methodology
and Functionality of Prototype II

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Leibniz-Centre for Agricultural Landscape Research e.V., Wageningen University and Research Centre, Green world research - amongst others
Structure

- Rationale
- Methodology
- Development
- Prototype II
- Acknowledgements
Rationale

Project aim – Focus for SIAT

To deliver ex-ante Impact Assessment Tools (SIAT) to support decision making on policies related to multifunctional land use in Europe and in targeted third countries (since Dec. 2006)

IA- Guidelines (EC 2005)

1 Identifying the policy problem
2 Defining the objective
3 Developing the main policy options
4 Analysing the impacts
5 Comparing the options
6 Outlining policy monitoring and evaluation
Methodology

Approach – SIAT Implementation

Sustainability Impact Assessment of multifunctional land use
Methods – Complementary Application

- Evolutionary rapid development & operational prototyping (Guida 1999)
- Requirement analysis by stakeholder involvement (Wiegers 2003).

(1) Reviewing and benchmarking of existing knowledge
(2) Adjustment of basic requirements
(3) Develop a simplistic Prototype
(4) Group discussions with end users
(5) Targeted input by expert interviews
(6) Final negotiation with regard to given capacities
## Prototype II

### Classification – Novel Model Challenges

<table>
<thead>
<tr>
<th>Definition</th>
<th>Comparative static Meta-Model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Trade offs across 6 sectors</td>
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<tr>
<td></td>
<td>SIA, policy impacts / valuation</td>
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<tr>
<td>Methods</td>
<td>Response protocols &amp; knowledge rules</td>
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<tr>
<td></td>
<td>Stakeholder-validation</td>
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<td></td>
<td>Server-based application</td>
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<td></td>
<td>Flexibility (OpenMI)</td>
</tr>
<tr>
<td>Results</td>
<td>Approx. 30 indicators, NUTX-level</td>
</tr>
<tr>
<td></td>
<td>Indicators, LUF, Thresholds</td>
</tr>
<tr>
<td></td>
<td>Transparency, Traceability</td>
</tr>
</tbody>
</table>
Prototype II

Response Protocol – Functionality

Modelling framework

- Feasible (YN)
- Wood demand
- Forest land claim
- Areas
- GDP
- Land price and use

EFISCEN

NEMESIS with B&B, TIM, SICK

CLUE-S

CAPRI

Interim results (land use)

Indicator value

Policy variable

Interim result

www.sensor-ip.org
Prototype II

System Integration – State of the Art

**End User Tool**

Current integration state:
- complete system integration
- (to display full storyline)
- graphical re-design
- new GUI

**Knowledge base**

Current integration state:
- 105 fact sheets
- Respective long versions
- 10 causal chains
- 1 policy case, 3 instr. (+1 in process)
Integrating concepts

- EU Impact Assessment guidelines
- Multi functionality
- Sustainable development
- Response protocols
- Thresholds
- Transparency

- How to integrate?
Tool releases

- Proto1: integration conceptualisation
  - Method: throw away
  - No quality assurance
  - Stand alone
  - Sample data
  - Sample model
  - Single user database

- Proto2: operationalisation
  - Evolutionary development
  - Quality assurance started
  - Web based
  - Real data
  - connected (response) models (OpenMI)
  - Database server
Sustainability Impact Assessment Tool

Environmental, social and economic effects of multifunctional land use in European regions

Impact assessment

Define a land use related policy and see its pan-European impacts in 2025 for numerous indicators over a total of 9 sectors: agriculture, forestry, nature conservation, energy, transport and tourism.

Your land use related policy affects: (1) the use of land; (2) impact indicators for the economic, environment and social dimensions; (3) assess multifunctional land use effects by verifying impact indicators on the basis of sustainability thresholds and targets.

Sustainability Impact Assessment Tool (Siat) is a product of the Sensor consortium. Sensor directly responds to the European sustainability objectives as applied to land use and regional development. It is based on the Impact Assessment Guidelines (June 2005) of the European Commission.

Background

Read about methods on driving forces and scenarios, the modeling - and the indicator framework, and how they were tested in selected regions like mountains, coastal zones, islands and post-industrialized zones across Europe.

The majority of socioeconomic data of the EU is based on the NUTS system which divides Europe in a number of administrative units. The socioeconomic information is relatively spatially fixed to the NUTS boundaries and in contrast to the majority of biophysical datasets. The regionalisation "NuSo" combines and relates different datasets enabling to use both socioeconomic and biophysical data for the same spatial entities.

Land use functions are private and public goods and services provided by different land uses, that summarizes the most relevant economic, environmental and societal aspects of a region.
How to define a simulation?

1. Choose simulation
   Select or create a new simulation to view its future impacts. All simulations are based on the "business as usual" baseline.

2. Choose policy case
   Select a policy case to get a list of related policy instruments. A policy case has an implicit policy objective. Press the information button ‘?’ behind the policy case for a fact sheet describing the policy case.

3. Specify policy
   Define your policy by setting policy instrument values and press ‘GO’ to get a general overview of the impacts of your policy.

Impacts are determined by:
- determining land use changes as effect of the policy;
- translating land use changes into impact indicators (environmental, social and economical);
- assessing multi-functionality issues.

You may view any of the impacts directly by pressing the corresponding buttons ‘land use changes’, ‘impact indicators’, or ‘sustainability valuation’ above.
Sustainability Impact Assessment of multifunctional land use
Sustainability Impact Assessment of multifunctional land use

Define policy
1. Choose simulation
   - New simulation

2. Choose policy case
   - 2012 Financial reform of the CAP

3. Specify policy
   - Direct support
     - 0
   - Market support
     - Market support
   - Re-invest in Research and Development
     - Re-invest

Land use changes

Impact indicators

Sustainability valuation

Forest [km²] at scale. NuisX (relative to business as usual)
Sustainability Impact Assessment of multifunctional land use through the tool.

Impact Indicators at scale: NutsX (relative to business as usual)

- NOx emissions
- Farmland birds
- Dead wood

Impact indicators for different regions:
- Ustecky kraj
- Karlovarsky kraj
- Deven
- Ilfov
- Pardubicky kraj
- Liberecky kraj

Dead wood:
- Devon 493.5
### Land use changes

<table>
<thead>
<tr>
<th>Spatial entity</th>
<th>NOx emissions</th>
<th>Farmland birds</th>
<th>Dead wood</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ustecky kraj</td>
<td>1956.0</td>
<td>499.0</td>
<td>979.0</td>
</tr>
<tr>
<td>Karlovarsky kraj</td>
<td>1907.0</td>
<td>479.75</td>
<td>953.5</td>
</tr>
<tr>
<td>Devon</td>
<td>567.0</td>
<td>246.75</td>
<td>493.5</td>
</tr>
<tr>
<td>Iflov</td>
<td>NaN</td>
<td>NaN</td>
<td>NaN</td>
</tr>
<tr>
<td>Pardubicky kraj</td>
<td>1520.0</td>
<td>390.0</td>
<td>760.0</td>
</tr>
<tr>
<td>Liberecky kraj</td>
<td>1669.0</td>
<td>417.25</td>
<td>834.5</td>
</tr>
<tr>
<td>Salaj</td>
<td>1126.0</td>
<td>281.5</td>
<td>563.0</td>
</tr>
<tr>
<td>Toljov apskirit</td>
<td>1419.0</td>
<td>354.5</td>
<td>709.0</td>
</tr>
<tr>
<td>Hampshire and Isle of Wight</td>
<td>NaN</td>
<td>NaN</td>
<td>NaN</td>
</tr>
<tr>
<td>Vlinaus apskirit</td>
<td>4221.0</td>
<td>1055.25</td>
<td>2110.5</td>
</tr>
<tr>
<td>Plzensky kraj</td>
<td>3386.0</td>
<td>841.5</td>
<td>1683.0</td>
</tr>
<tr>
<td>Jihocesky kraj</td>
<td>4295.0</td>
<td>1073.75</td>
<td>2147.5</td>
</tr>
</tbody>
</table>

Sustainability Impact Assessment of multifunctional land use.
Sustainability Impact Assessment of multifunctional land use.

Goods and services provided by different land uses, summarise most relevant soc, eco, env aspects.
Baseline scenario

The reference or business-as-usual scenario reflects a possible state of affairs in 2025 in the absence of policy changes.

It is calculated by means of assumed trends in a number of important drivers:
  - Population growth and demographic structure (Europe)
  - Labour force participation rates by sex and age group (Europe)
  - World demand
  - Energy prices
  - Expenditure on research & development (Europe)

These drivers are considered as largely outside the control of European policymakers. For the first four drivers, forecasts from reputed institutes have been used: Eurostat for demographic trends, the EU's Economic Policy Committee for participation rates, the OECD for world demand, and the PROMETHEUS model for energy prices. For R&D expenditure, the trend over the period 1991-2004 has been extrapolated. These calculations result in the following figures:

<table>
<thead>
<tr>
<th>Driving forces</th>
<th>year 2005</th>
<th>year 2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population (EU-25, m)</td>
<td>450.5</td>
<td>470.1</td>
</tr>
<tr>
<td>Participation rate (EU)</td>
<td>47.7</td>
<td>46.1</td>
</tr>
<tr>
<td>World GDP excluding oil price (constant €)</td>
<td>31.390</td>
<td>56.708</td>
</tr>
<tr>
<td>Oil price (constant €)</td>
<td>46.8</td>
<td>46.5</td>
</tr>
<tr>
<td>R &amp; D expenditure (in)</td>
<td>201.5</td>
<td>403.2</td>
</tr>
</tbody>
</table>

Specifications of the reference scenarios are:
  - Low growth scenario
  - High growth scenario
The ‘engine’ of SIAT consists of a series of linked models. Firstly, there is the macro-economic model NEMESIS, which translates the five drivers and the policy options into scenarios for macro-economic variables such as gross domestic product, international trade, employment and prices. These figures are provided per sector.

Secondly, there is the land-use model CLUE-s which simulates changes in land use for 1 km² grid cells. This is done on the basis of data for land suitability, claims for land derived from macro-economic data and population projections, as well as policy options. NEMESIS supplies this GDP and projections of land prices.

These two models communicate in turn with models for the different priority sectors in SENSOR:

- CAPRI for the agricultural sector. This model yields data on agricultural production, inputs and environmental quantities such as nitrogen and phosphate output, on the basis of GDP (NEMESIS) and agricultural land areas per NUTS-2 region (CLUE-s).
- EFISCEN for the forestry sector. This model yields wood production as well as data on environmental aspects, based on projections for wood demand per region.
- TIM for transport infrastructure. This model projects the demand for infrastructure based on output from NEMESIS.
- E&B for the tourism sector. This model projects numbers of tourism nights per region for the EU-25, based on NEMESIS data as well as cultural variables reflecting consumer preferences.
- SIEK for the urban sector. This sector was not included in the original SENSOR design, but it is necessary to consider urban land claims in conjunction with the SENSOR sectors. The model is designed to do this in conjunction with NEMESIS and population projections.
What next

- Quality Assurance (e.g. auditing)
- Operational issues (server availability, maintenance)
- Prototype 3 (2009)
  - Compare different policy options
  - Add
    - Policy cases
    - Baselines
    - Indicators
  - Context sensitive fact sheets (e.g. indicators)
  - Include back tracing (e.g. region specific response function)

- Siat architecture: slot 13, Wednesday afternoon
Acknowledgements

Joint product – We thank you so much!

39 institutes
- Sensor consortium: targeted input for SIAT

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- Software architecture, conceptual design
  (Peter Verweij, Johnny te Roller,
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- Knowledge integration
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DEART
- Scaling / Aggregation methods
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