A methodological framework for integrated assessment of land use policies and sustainable development in developing countries

Pytrik Reidsma, Hannes König, Ingrid Nesheim, Irina Bezlepkina, Marijke Kuiper, Martin van Ittersum, Frank Ewert, Karen Tscherning, Stefan Sieber, Katharina Helming, Floor Brouwer

WUR, ZALF, SUM, LEI

www.lupis.eu
LUPIS project

- Land Use Policies and Sustainable Development in Developing Countries
- EU FP6 Project
- 16 Institutions, 13 Countries
- Feb 2007 – July 2010

- Scientific Co-ordination
  Landbouw Economisch Instituut (LEI), Netherlands
Key objectives

- Improve knowledge of the impact
  - that different land use issues/policies
  - will have on the sustainable development
  - of developing countries

- Develop integrated assessment tools
  - for application by scientists
  - in a selected number of developing countries

- Building blocks
  - Tools developed in SENSOR and SEAMLESS
  - Developed in European context
  - Test applicability in developing countries
  - Adjust where necessary
SEAMLESS and SENSOR

Tourism  Conservation  Nature  Agriculture  Forestry  Transport  Energy

Global  
Continental  
National  
Regional  
Farm  
Field

Source: LUPIS DoW
Methodological framework

Pre-modelling:
Problem analysis

Modelling:
Assessing impact of policy on indicators

Post-modelling:
Assessing impact of policy on SD

Users/stakeholders

Data
Land Use Policies and Sustainable Development in Developing Countries

Pre-modelling

- Problem definition
- Land use related problem

Modelling: Assessing impact of policy on indicators

Post-modelling: Assessing impact of policy on SD

Problem definition

Selection of assessment tools

Apply models and knowledge rules

Indicator integration and formation

SD evaluation

Visualisation/documentation/communication

Users/stakeholders

Data

- Tables
- Graphs
- Spider-diagrams
- Maps
- Text

Sustainability Choice Space

Land use related problem

Models

- Knowledge rules
- Response functions

Adaptation/Development

Parameterization

Simulation

Translation case study to assessment tools: DPSIR

SENSOR

SEAMLESS

other tools

Trade-off analysis

Institutional analysis

Brasil:

Road construction / pavement BR-163

China:

Water pollution in Taihu Lake Basin
Pre-modelling

Problem definition
Land use related problem

Case study definition
Spatial scale
Land use sectors
Resolution

Case study definition
Problem analysis

Brasil:
Amazonas regions (Mato Grosso, Pará)
Regional scale, 1.780 km road lengths
Forestry, agriculture, nature conservation

China:
Taihu Lake Basin
Regional scale, 36.500 km²
Agriculture, water


Grid cell
Regions
Agro-ecological zones
Farm types
**Pre-modelling**

- **Problem definition**
- **Land use related problem**

**Case study definition**
- **Spatial scale**
- **Land use sectors**
- **Resolution**

**Indicator selection**
- **SD targets**
- **Land Use Functions**
- **Indicators**

**Problem analysis**

**Indicator selection (pre-modelling)**

**SD targets**

**Land Use Functions**

**Indicators**

**SD evaluation (post-modelling)**

**Brasil:**

- **ECO**
  - > economic growth
  - > commodity production

- **SOC**
  - > public health
  - > equitable income distribution
  - > net income

- **ENV**
  - > deforestation
  - > ecosystem functioning
  - > agro-ecological practices

- **INST**
  - > law enforcement
  - > corruption

**Diagram elements:**
- ECO: Economic
- ENV: Environmental
- SOC: Social
- INST: Institutional
- SD: Sustainable Development

**Legend:**
- Red: Corruption
- Green: Law enforcement
- Yellow: Economic growth
- Black: Others

**Processes:**
- **1. SD targets**
- **2. Land Use Functions**
- **3. Indicators**
- **4. Indicator assessment (modelling)**
- **5. SD evaluation (post-modelling)**
- **6. Land Use Functions**
- **7. SD targets**

**Regions:**
- Region Farm
- Region Farm...
Pre-modelling

Scenarios are developed for
a) the target year 2015 to assess ‘short term’ policy effects, and
b) for the target year 2025 to assess impacts on SD
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**Pre-modelling: Problem analysis**
- Problem definition
- Case study definition
- Indicator selection
- Scenario description

**Modelling: Assessing impact of policy on indicators**
- Selection of assessment tools
- Apply models and knowledge rules

**Post-modelling: Assessing impact of policy on SD**
- Users/stakeholders
- Data

**Land use related problem**
- Spatial scale
- Land use sectors
- Resolution

**Land Use Functions**
- Spatial scale
- Land use sectors
- Resolution

**Indicators**
- SD targets
- Land Use Functions
- Indicators

**Policy options**
- Current situation
- Baseline scenario
- Policy options

**Sustainability Choice Space**
- SD targets
- Current situation
- Baseline scenario
- Policy options

**Trade-off analysis**
- Institutional analysis

**Modelling**
- Translation case study to assessment tools: DPSIR
- SENSOR
- SEAMLESS
- Other tools

**Selection of assessment tools**
- Models
- Knowledge rules
- Response functions

**Apply models and knowledge rules**
- Adaptation/Development
- Parameterization
- Simulation
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**Modelling**

- **D** Drivers
- **P** Policy options
- **S** Social, Environmental, Economic, Institutional indicators
- **I** Sectoral (per scale), Regional (cross-sectoral)
- **R** Policy options

- Models for ex-ante IA
- Intermediate indicator
- Composite indicators, Land Use Functions, Institutional compatibility

**China:**
- Agriculture, industry, domestic sewage
- Increase in N and P
- Food production, water quality, aquatic biodiversity, tourism

Sewage treatment, Fertiliser management
Models for ex-ante IA

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<th>Sectors</th>
<th>Agriculture</th>
<th>Tourism</th>
<th>Water</th>
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<table>
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<tr>
<th>Scales</th>
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<td>national</td>
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<td>CGE/LP/Up-scaling, ...</td>
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<tr>
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<td>Bio-economic model, ...</td>
</tr>
<tr>
<td>field</td>
<td>APES</td>
<td>Crop-soil model, ...</td>
</tr>
</tbody>
</table>

Land use change

SENSOR Adapted

CLUE Non-spatial explicit approach, ...

Knowledge rule (if-then-relations derived by experts)

Selection of models depends on the problem definition, drivers, indicators, data, model availability & skills, time, and regional IA issues

Choice: agriculture, industry, domestic sewage

Increase in N and P

food production
water quality
aquatic biodiversity
tourism

Sewage treatment
Fertiliser management

China:
Land Use Policies and Sustainable Development in Developing Countries

Pre-modelling: Problem analysis

- Problem definition
- Land use related problem

Modelling: Assessing impact of policy on indicators

- Case study definition
- Spatial scale: Land use sectors, Resolution
- Indicator selection: SD targets, Land Use Functions, Indicators

Post-modelling: Assessing impact of policy on SD

- Scenario Description
  - Current situation
  - Baseline scenario
  - Policy options

Users/stakeholders

Data

Post-modelling: Assessing impact of policy on SD

- Translation case study to assessment tools: DPSIR, IFASCR, HARMLESS, other tools
- Selection of assessment tools: Models, Knowledge rules, Response functions
- Appy models and knowledge rules: Adaptable Development Framework, Simulator

- Indicator integration and formation
  - Single indicators
  - Land Use Functions
  - Composite indicators

- SD evaluation
  - Sustainability Choice Space
  - Trade-off analysis
  - Institutional analysis

- Visualisation/documentation/communication
  - Tables, Graphs, Spider-diagrams, Maps, Text
Concluding remarks

- Generic methodological framework
  - applicable in all case studies
  - to assess impact of policies on SD

- SEAMLESS & SENSOR tools
  - testing the transferability
  - not directly applicable in DCs
  - good basis for concepts
  - models need adaptation

- Work in progress
Thank you
Land Use Policies and Sustainable Development in Developing Countries

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  - Resolution
- Indicator selection
  - SD targets
  - Land Use Functions
  - Indicators
- Scenario Description
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Modelling: Assessing impact of policy on indicators
- Translation case study to assessment tools: DPSIR
  - SENSOR
  - SEAMLESS
  - other tools
- Selection of assessment tools
  - Models
  - Knowledge rules
  - Response functions
- Apply models and knowledge rules
  - Adaptation/Development
  - Parameterization
  - Simulation

Post-modelling: Assessing impact of policy on SD
- Indicator integration and formation
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Data