Scenario development for impact assessment and land use change

Mark Rounsevell
School of Geosciences
University of Edinburgh, UK

Thomas Henrichs
National Environmental Research Institute
University of Aarhus, Denmark
What is the rationale of this session?

To discuss different methods and concepts applicable to the development of land use scenarios;

To explore the relevance of these scenarios for and role in supporting decision-making processes;

To focus on experiences, lessons learnt and pitfalls identified when developing scenarios to support decision-making.
Assessing future land use change and impacts

The way we address ‘futures’ in complex systems depends on:

(a) how well we understand a system’s *complexity / causalities*;

(b) how *uncertain* we are about future developments of key drivers.

What are scenarios?

Scenarios are plausible and often simplified descriptions of how the future may develop, based on a coherent and internally consistent set of assumptions about key driving forces and relationships.

(Millennium Ecosystem Assessment, 2005)

Note that scenarios are neither predictions nor forecasts!
Important qualities of scenario processes

**Credibility** (i.e. are the scenarios scientifically sound?)
- especially in ‘research and science’

**Saliency** (i.e. are the scenarios relevant to information needs?)
- especially in ‘education and capacity building’

**Legitimacy** (i.e. who developed the scenarios, and how?)
- especially in ‘strategic planning and decision support’

*aiming for creativity, rigour, internal coherence, and plausibility.*

Types of scenarios

Predictive scenarios – extrapolation of current trends and processes, business-as-usual and reference scenarios;

Exploratory scenarios – constructing alternative, plausible futures, as trends or shocks;

Normative scenarios – describing desired futures and the events that can lead to such futures;
Pan-European land use scenarios
(roughly chronological)

- Grounds for Choices – exploratory
- ATEAM – exploratory, IPCC-based
- ACCELERATES – exploratory, IPCC-based
- EURURALIS – exploratory, IPCC-based
- PRELUDE – exploratory, combined participatory and quantitative approach
- ESPON – reference scenario, explores policy variants
- ALARM/ECOCHANGE – explores ‘shock scenarios’
- SCENAR2020 – reference scenario, policy variants
- SENSOR – reference scenario,
- FARO – visions, expectations
- PLUREL – explores ‘shock scenarios’, IPCC-based
- ...

And many more regional examples in this session ...
Land use scenarios in science and research

Example from ATEAM:

Quantification of change in cropland area (for food production) by 2080 compared to baseline (%) for the 4 SRES storylines and HADCM3

Source: Schröter et al. (2005). Ecosystem service supply and vulnerability to global change in Europe. Science, 310 (5752), 1333-1337
Land use scenarios in science and research

...  

Uncertainty across similar scenarios, change in European cropland areas for a range of studies

Global studies = 1, 2 (Image), 3, 4, 5

Regional studies = 6 (Ateam), 7 (Eururalis)

Source: Busch, G. (2007). Future European agricultural landscapes - What can we learn from existing quantitative land use scenario studies? Agri, Ecosys. & Env.
Land use scenarios to help capacity building

Example:
PRELUDE

In ‘Lettuce Surprise U’ technological innovation is triggered by a food security crisis. People lose trust in central government. The political system decentralises and the demand for environmentally friendly food production increases. New crop varieties are developed that enable higher yields with lower inputs.

Migration is limited and urbanisation largely follows the current pattern. Due to increased productivity the cropland area decreases. Grassland decreases also, but at a slower rate. Agriculture in the core production areas is high-tech, clean and relatively small-scale.

This is the most environmentally friendly of the scenarios. Reduction of agricultural area and inputs leads to a general increase of biodiversity, soil, water and air quality. Land abandonment does affect high nature value farmland, but less so than in other scenarios.

Key drivers:
- Technological innovation
- Growing environmental awareness
- Reduced policy intervention (decentralisation)

Source: www.eea.europa.eu/prelude
Land use scenarios as decision support approach

Example: Eururalis 2

Click [here](https://www.eururalis.eu) to go to the page where you can download and install the software application on your computer, using Java Web Start.
Challenges for scenario development: credibility

Addressing the subjectivity of scenario developers and stakeholders (biases, prejudices, expectations and ideology);

Quantifying incertitude in scenario assumptions (differences in uncertainty between drivers and scenarios, probabilities);

Reducing uncertainty within models (calibration on the past - validation for the future?, level of abstraction, data).
Challenges for scenario development: saliency

Building on participatory approaches to ensure relevance to the policy context and stakeholder perspectives;

Capturing imagination, e.g. by exploring also ‘surprises’

Presenting and communicating scenarios in an accessible manner.

Transposing existing scenarios between scales, issues and contexts - respond to changes in the focal issue by context.
Challenges for scenario development: legitimacy

Using participatory approaches can help to facilitate stakeholder buy-in and acceptance;

Designing scenario processes to be useful to policy makers from the outset (participation, mandates, focal questions …);

Ensuring transparency of the scenario process and its political context (motivation, who did it/funded it)
Key questions for this session

Can scenarios be equally credible, salient and legitimate? Do we want them to be?

How can we enhance the usefulness of land use scenarios in decision making contexts?

What can existing and new scenario methods contribute to this? What needs to be and can be improved?
We are looking forward to an interesting session

Thank you
The Panel and their role here

- Dale Rothman – social scientist; participatory approaches to scenario development
- Bas Eickhout – environmental scientist; land use modelling
- Hedwig van Delden - regional land use modelling
Key questions for this session

Can scenarios be equally credible, salient and legitimate? Do we want them to be?

How can we enhance the usefulness of land use scenarios in decision making contexts?

What can existing and new scenario methods contribute to this? What needs to be and can be improved?