PRELUDE

PRospective Environmental analysis of Land Use Development in Europe

Thomas Henrichs
European Environment Agency

European Environment Agency

Outline of presentation

- About us

- What are (environmental) scenarios?

- What is PRELUDE - Why, How, Who?

- Key outcome 1 - the 'process'

- Key outcome 2 - the 'product'

- What lessons did we learn?

European Environment Agency

About us

The European Environment Agency:

- is established by EEC regulation

- is an independent information provider

- is an analyst and assessor

- is building bridges between science and policy

- is dependent upon strong networks to carry out its work

- aims to deliver timely, target, relevant and reliable information

... to support policy processes and inform the public

European Environment Agency
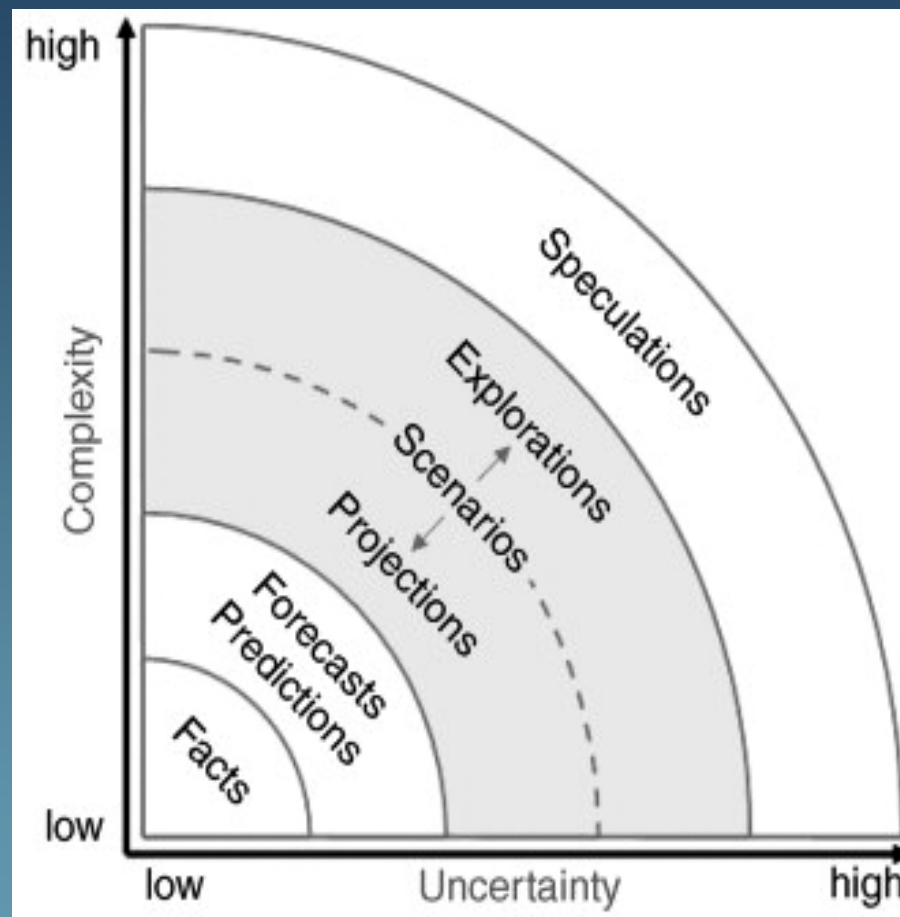
What are scenarios?

Main aim:
A structured conversation about an uncertain and complex future.

Definition:
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.

Source: Millennium Ecosystem Assessment, 2005

Source: Zurek and Henrichs, 2008

European Environment Agency

The PRELUDE project

PRospective **E**nvironmental analysis of **L**and **U**se **D**evelopment in **E**urope

Why …

- Land use change has major environmental impacts
- … and is subject to a range of policy interventions

Who …

- In-house project group and advisory panel
- … external stakeholder panel & support groups

How …

- Story-and-Simulation development of scenarios
- … for spatial assessment of policy interventions
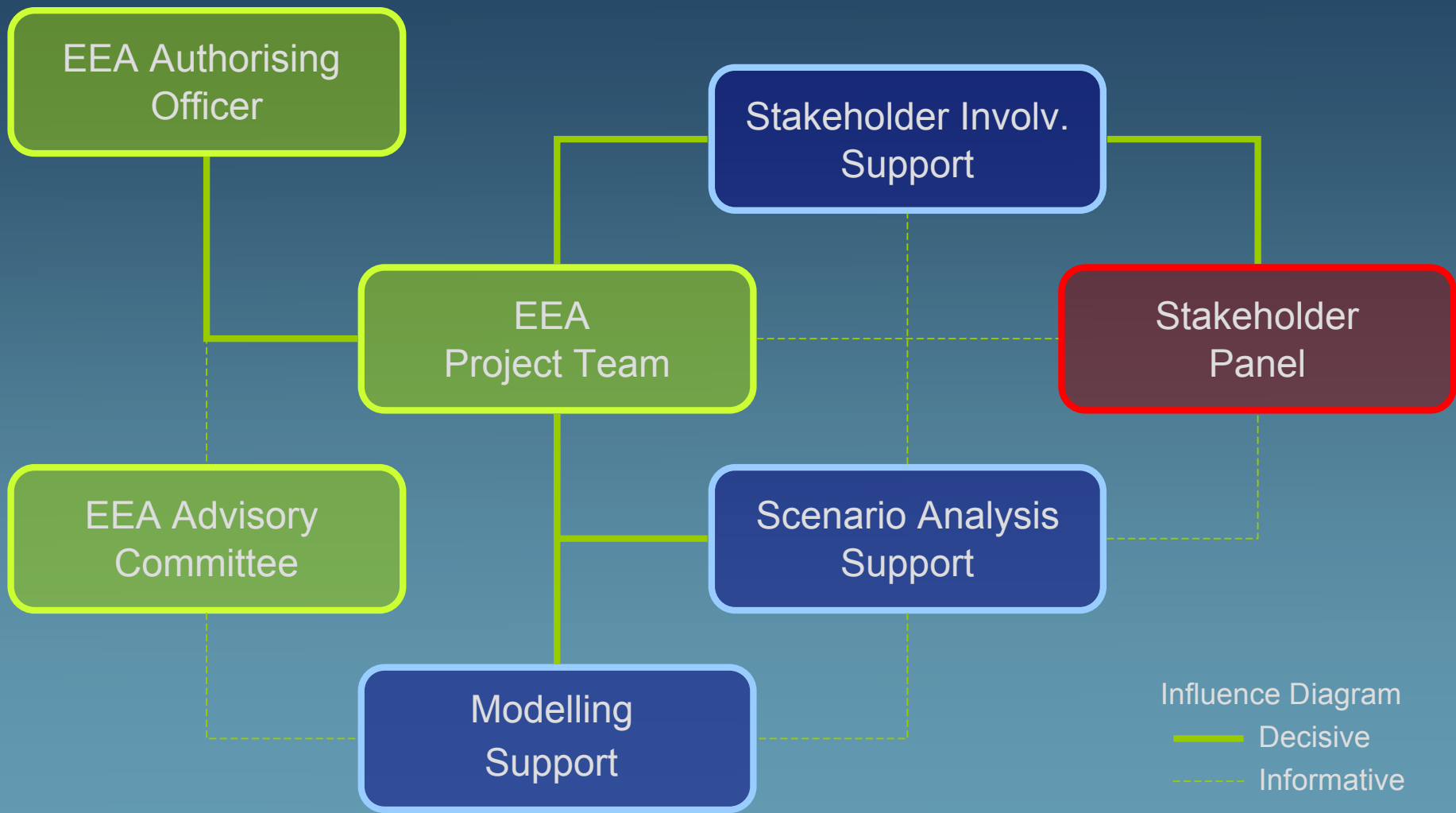
The PRELUDE project - Why?

PRELUDE

Project objectives:

To explore plausible long-term developments (to the 2030s) in land use and their effects on the environment.

To develop land use scenarios that provide a context against which the potential of (environmental) policy initiatives can be judged.
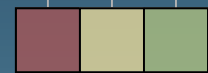
European Environment Agency

The PRELUDE project - Who?

PRELUDE

EEA Authorising Officer

Stakeholder Involv. Support

EEA Project Team

Stakeholder Panel

EEA Advisory Committee

Scenario Analysis Support

Modelling Support

Influence Diagram
—— Decisive
------ Informative

European Environment Agency

The PRELUDE project - How?

EEA

Experts

Stakeholder Panel

Quant. Scen.

Qual. Scen

☺ Land Use
☺ Biodiv.
…

Modelling & Scenario Analysis Groups

European Environment Agency

The process
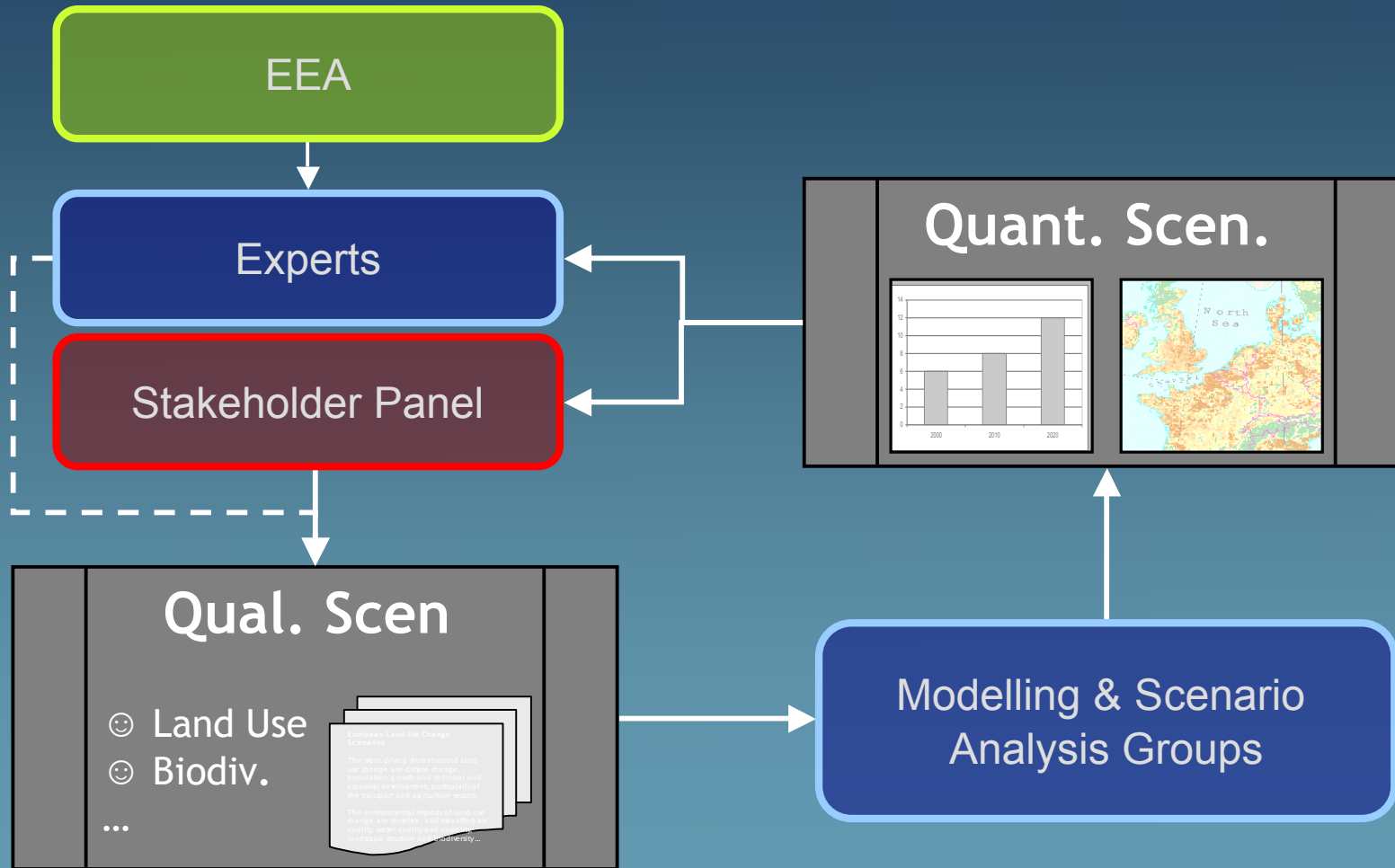
## Phase 1 - Scoping (2002/2003)

- Several preparatory expert meetings

Phase 2 - Scenario development & analysis (2004/2005)

- 1st stakeholder meeting (key uncertainties, driving forces, scenario logics, …)
- -- Initial European-level quantification
- 2nd stakeholder meeting (check & revise quantification, revise narratives, …)
- -- Refined European-level quantification & regional-level quantification
- 3rd stakeholder meeting (final review, …)

Phase 3 - Scenario outreach (2005/2006)

- Interactive multimedia tool, background report
- Active stakeholder outreach at various high-level fora (PRELUDE 2 Action)
- Input to discussions at informal EU Council of Ministers (Envi. & Agri.)
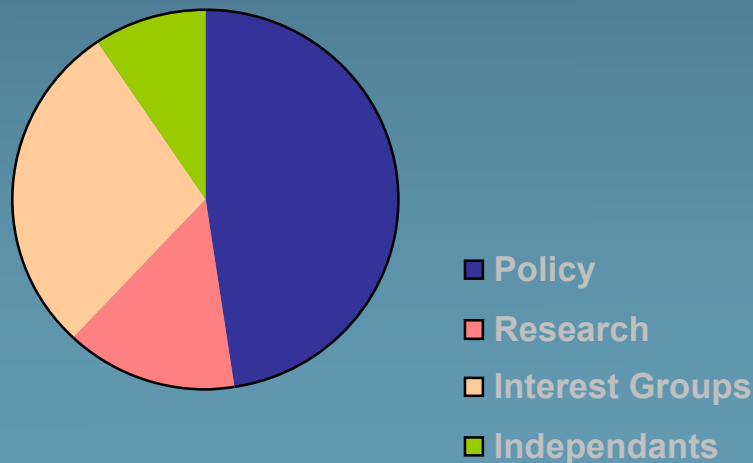
European Environment Agency
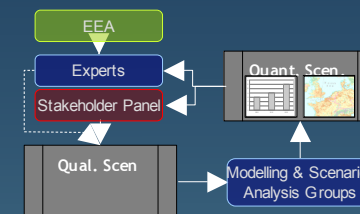
The process:
stakeholder panel

PRELUDE

A selected group of more than
20 senior stakeholders invited
to co-develop scenarios with us.

Group composition:

- ■ Policy
- ■ Research
- ■ Interest Groups
- ■ Independants

POLICY
EU-level authorities
National-level authorities
International Organisation

RESEARCH/SCIENCE
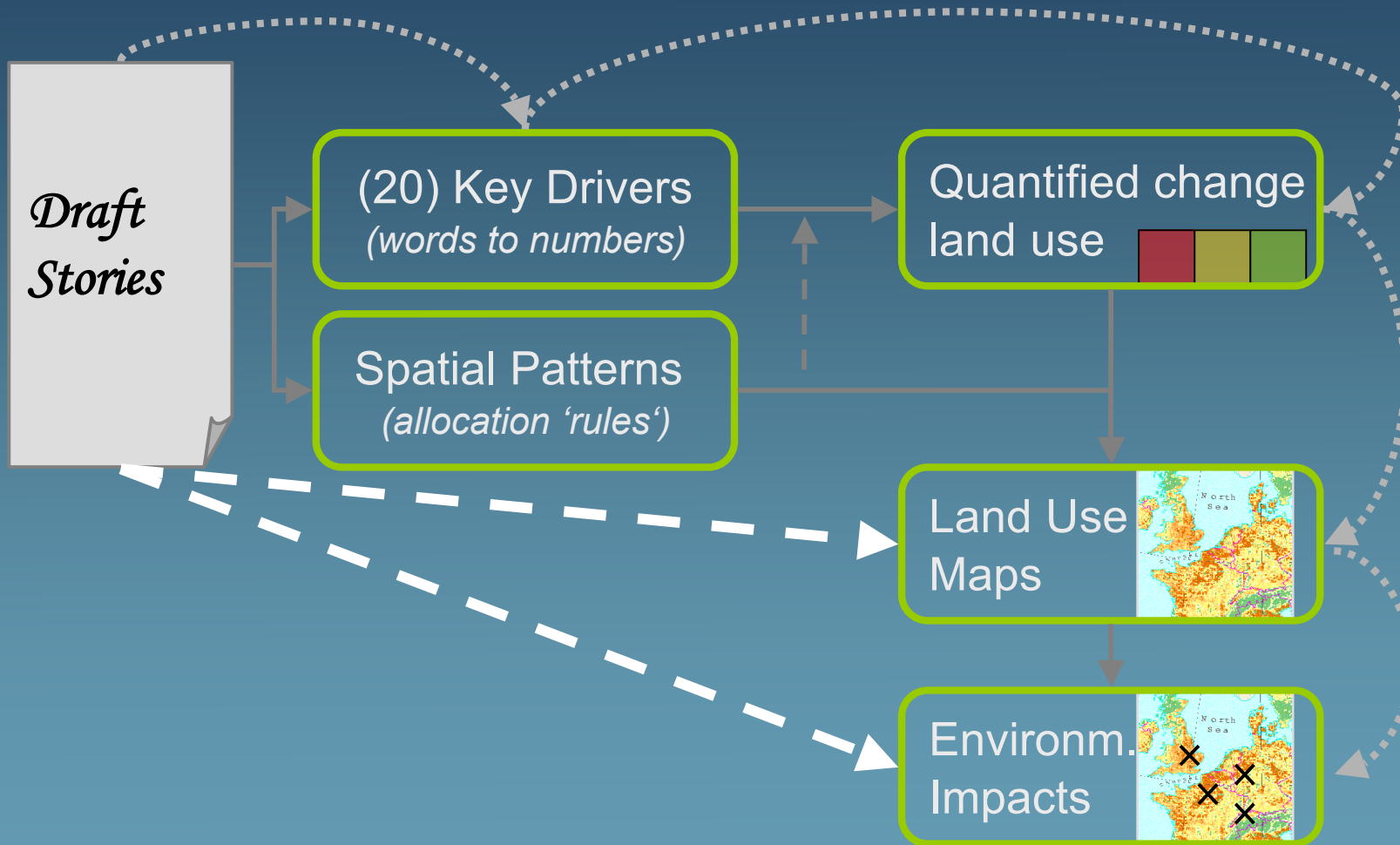Natural Sciences
Social Sciences
Information Technology

INTEREST GROUPS
Business/Industry
Agriculture/Forestry
NGOs: Nature, Culture, …

INDEPENDANTS

European Environment Agency

The process:
how to quantify the scenarios?

PRELUDE

Draft Stories

(20) Key Drivers
(words to numbers)

Spatial Patterns
(allocation 'rules')

Quantified change land use

Land Use Maps

Environm. Impacts

European Environment Agency

The process:
how to quantify the scenarios?

PRELUDE

KEY DRIVERS STAKEHOLDERS DISCUSSED

- Population growth
- Aging society
- Immigration
- Internal migration
- Economic growth
- International trade
- Daily mobility
- Technological growth
- Agricultural intensity
- Self-sufficiency
- Health concern
- Social equity
- Quality of life
- Environmental awareness
- Human behaviour
- Renewable energy
- Climate Change
- Subsidiarity
- Policy intervention
- Settlement density

Some drivers match well,

some can only be partially approximated,

some are not covered by the available models.

KEY DRIVERS IN MODELS USED

- Change in Population
- Internal migration (east - west)
- Internal migration (rural - urban)
- Change in GDP
- Change in demand for agricultural goods
- Self Sufficiency ratio
- Atmospheric CO_2 concentration
- Climate Change (Temp / Precipitation)
- Change in crop yields
- Biofuels (and area used for)
- Change in forest area
- Quantity, usage, types of protected area
- New use for surplus land or unmanaged areas
- ...

European Environment Agency

The product

A set of five scenarios …

| GREAT ESCAPE | evolved society | CLUSTERED NETWORKS | Lettuce surprise u | BIG CRISIS |
| Europe of Contrasts | Europe of Harmony | Europe of Structure | Europe of Innovation | Europe of Cohesion |

… and for each of these scenarios:

• A storyline

• An illustrative 'teaser' (i.e. a cartoon)

• A set of explicit qualitative and quantitative assumptions

• A quantification of corresponding land use changes across Europe

• A more detailed quantification of land use changes in seleted regions

• An indicative analysis of resulting environmental changes

… as well as a comparative assessment across all five scenarios.

GREAT ESCAPE
Europe of Contrasts

In **'Great Escape'** the international market rules. Government intervention is low. Relatively poor immigrants move to the urban city centres. Societal tension builds up. The contrast between rich gated communities in the countryside and urban ghettos becomes extreme.

Agriculture intensifies but total agricultural area diminishes. European oversupply is diminished by net export. Many grasslands are abandoned or converted into arable.

The impacts on the environment of this scenario are generally negative. Improved soil and water quality in abandoned areas cannot compensate for the agricultural intensification elsewhere. Many nature reserves and extensive farm-land areas with high nature value are lost.

Key drivers:

• International trade (globalisation)
• Decreasing solidarity
• Reduced policy intervention

STORYLINE

PLAY TEASER

🔊 AUDIO ON

European Environment Agency

PRospective Environmental analysis of Land Use Development in Europe

EXIT

PRospective Environmental analysis of Land Use Development in Europe

GREAT ESCAPE
Europe of Contrasts

evolved society
Europe of Harmony

CLUSTERED NETWORKS
Europe of Structure

Lettuce surprise u
Europe of Innovation

BIG CRISIS
Europe of Cohesion

LIBRARY

Disclaimer

European Environment Agency

evolved society
Europe of Harmony

In **'Evolved Society'** climate change and energy scarcity trigger environmental awareness and strong policy interventions. Revival of the countryside is high on the agenda and supported by financial incentives. People move away from the most densely populated (lowland) areas and settle in more rural and safe areas.

Farming is high-tech and increasingly organic. In areas that are prone to repeated flooding, cropland is reduced considerably. Grassland shows a moderate decrease, but less so than in the other scenarios.

This scenario has mildly positive environmental impacts. Land use changes are not dramatic. The agricultural area remains approximately the same while farming intensity decreases. Extensive farmland with high nature value is relatively well conserved.

Key drivers:

• Energy scarcity (shift to renewables)
• Growing environmental awareness
• Policy intervention (rural development)

STORYLINE

PLAY TEASER

AUDIO ON

EXIT

:PRELUDE

GREAT ESCAPE
Europe of Contrasts

evolved society
Europe of Harmony

CLUSTERED NETWORKS
Europe of Structure

Lettuce surprise u
Europe of Innovation

BIG CRISIS
Europe of Cohesion

LIBRARY

Disclaimer

European Environment Agency

CLUSTERED NETWORKS
Europe of Structure

In **'Clustered Networks'** society adapts to the growing demands of an ageing population. Agriculture marginalises. Spatial planning encourages migration away from polluted urban areas. New cities with a service economy are created, benefiting from efficient traffic solutions, a relatively cheap labour force and investment premia.

Urbanisation is concentrated. Large-scale land abandonment occurs. Incentives for rural development focus on 'green belts' around the urban centres.

This scenario leads to increased differences between urban areas and the countryside. Soil, water and air quality benefit from receding agriculture and the development of green belts around the cities. Natural habitats develop in the wider countryside, but at the detriment of high nature value farmland.

Key drivers:

• Population dynamics (ageing)
• International trade (marginalising agricultural sector)
• Policy intervention (spatial planning)

STORYLINE

PLAY TEASER

AUDIO OFF

EXIT

GREAT ESCAPE
Europe of Contrasts

evolved society
Europe of Harmony

CLUSTERED NETWORKS
Europe of Structure

Lettuce surprise U
Europe of Innovation

BIG CRISIS
Europe of Cohesion

LIBRARY

Disclaimer

European Environment Agency

Lettuce surprise U
Europe of Innovation

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)

STORYLINE

PLAY TEASER

AUDIO ON

EXIT

⋮ PRELUDE

GREAT ESCAPE
Europe of Contrasts

evolved society
Europe of Harmony

CLUSTERED NETWORKS
Europe of Structure

Lettuce surprise u
Europe of Innovation

BIG CRISIS
Europe of Cohesion

LIBRARY

BIG CRISIS
Europe of Cohesion

In **'Big Crisis'** environmental disasters change the political climate in favour of centralised government. New policies focus on sustainable and regionally balanced development. Public transport is strongly promoted.

Land use changes are limited. The population in current urban core areas decreases slightly. Overall, the urban area changes little. Cropland and grassland decrease moderately.

The initial environmental pressures are relieved. Soil, water and air quality benefit from agricultural extensification and limited land abandonment. The loss of high nature value farmland remains relatively small.

Key drivers:

• Growing environmental awareness
• Growing solidarity
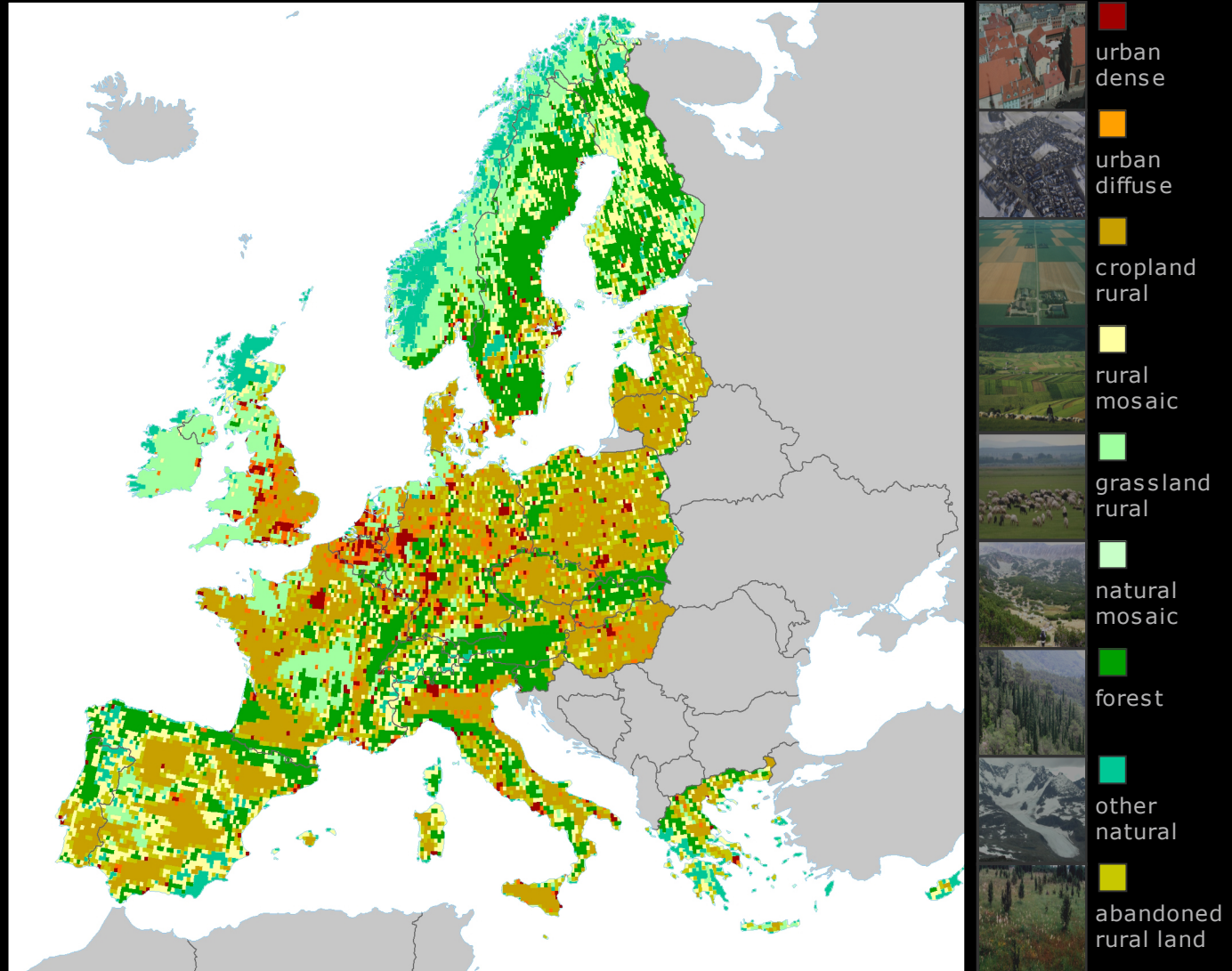• Policy intervention (centralisation)
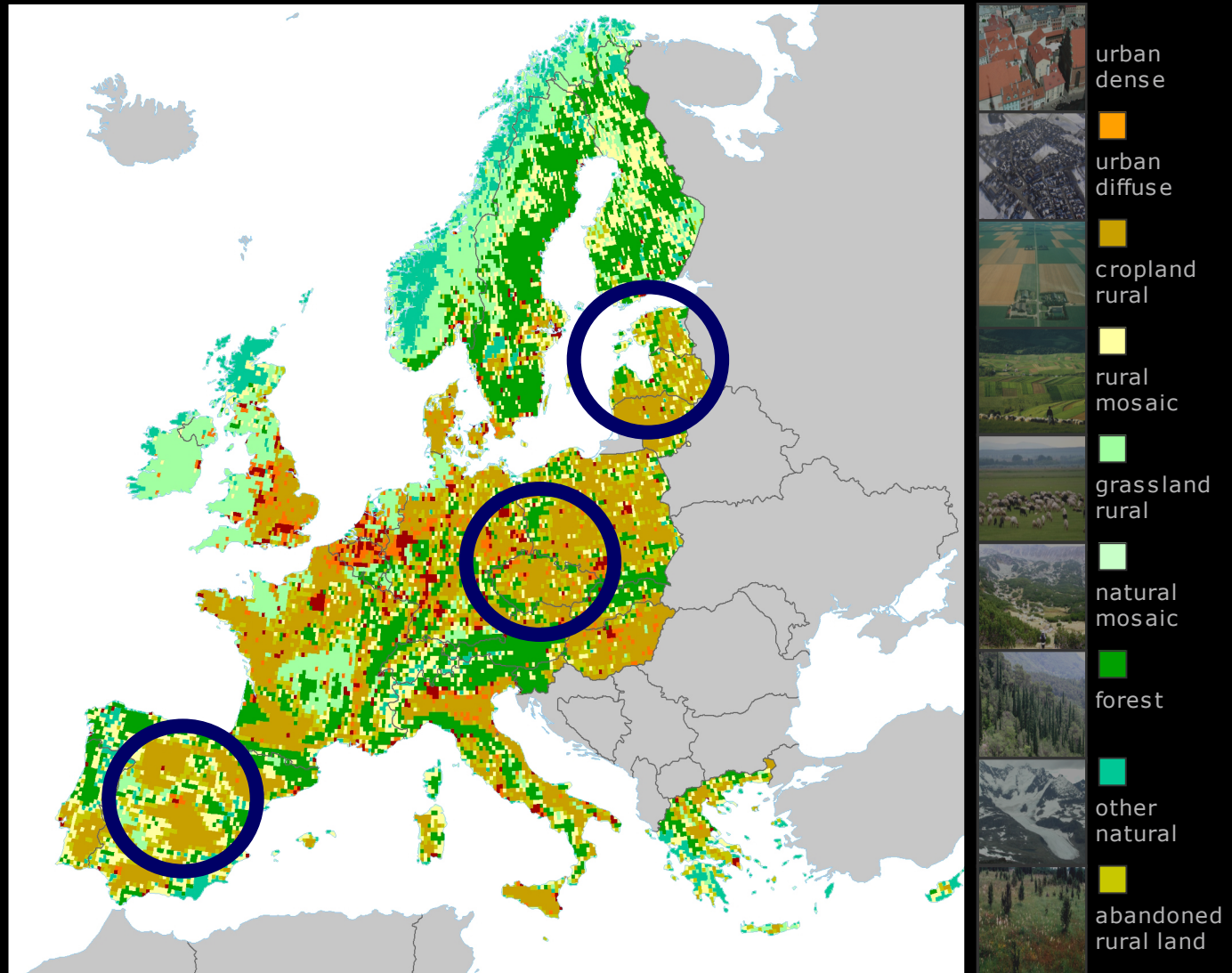
STORYLINE

PLAY TEASER

🔊 AUDIO ON

Disclaimer

European Environment Agency

EXIT

The product:
status in 2005 - European-level quantification

- **urban dense**
- **urban diffuse**
- **cropland rural**
- **rural mosaic**
- **grassland rural**
- **natural mosaic**
- **forest**
- **other natural**
- **abandoned rural land**

The product:
status in 2005 - European-level quantification

urban
dense

urban
diffuse

cropland
rural

rural
mosaic

grassland
rural

natural
mosaic

forest

other
natural

abandoned
rural land

The product:
5 scenarios for 2035 - European-level quantification

- **urban dense**
- **urban diffuse**
- **cropland rural**
- **rural mosaic**
- **grassland rural**
- **natural mosaic**
- **forest**
- **other natural**
- **abandoned rural land**

The product:
5 scenarios for 2035 - European-level quantification

evolved society
Europe of Harmony

- urban dense
- urban diffuse
- cropland rural
- rural mosaic
- grassland rural
- natural mosaic
- forest
- other natural
- abandoned rural land
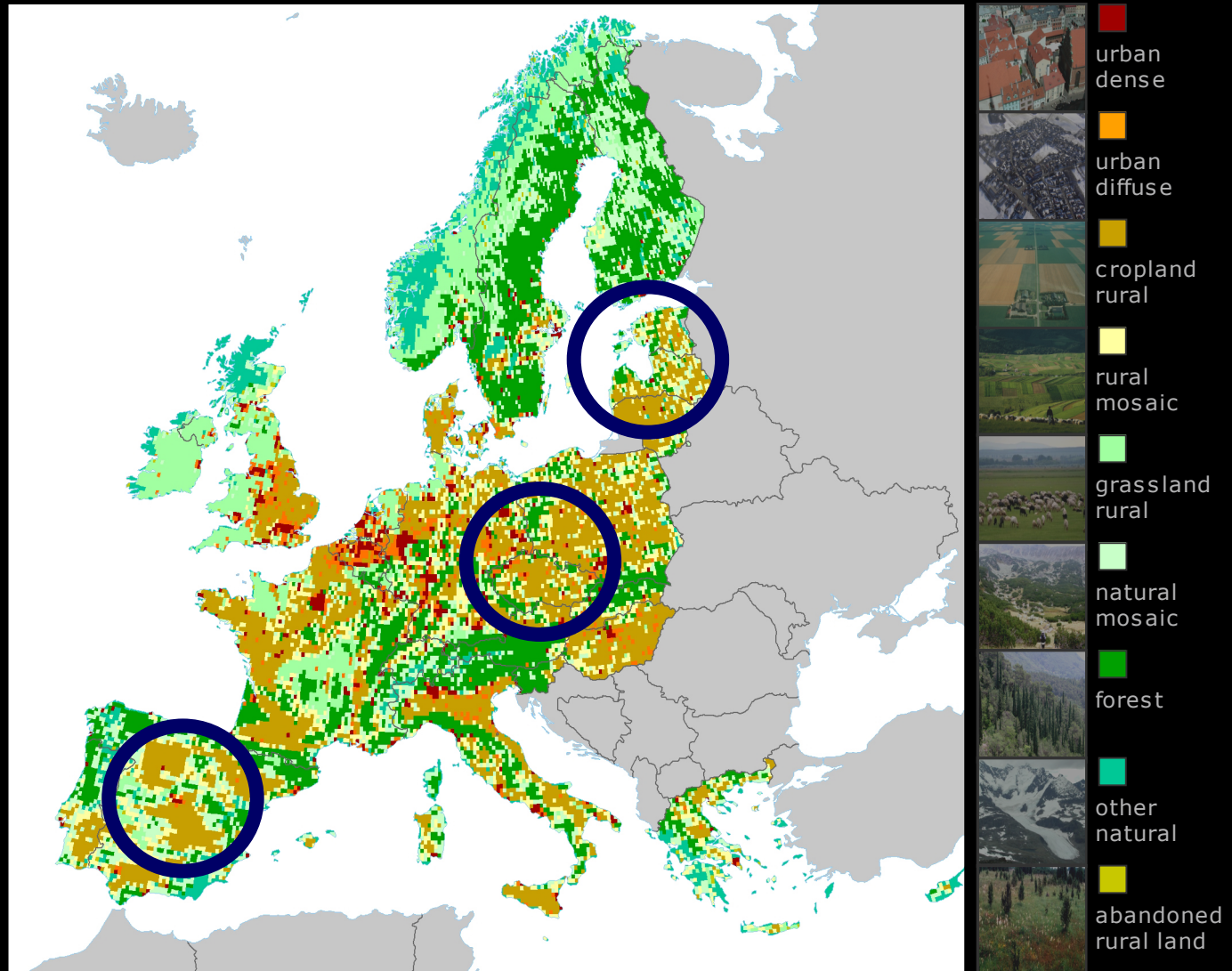
The product:
5 scenarios for 2035 - European-level quantification

CLUSTERED NETWORKS
Europe of Structure
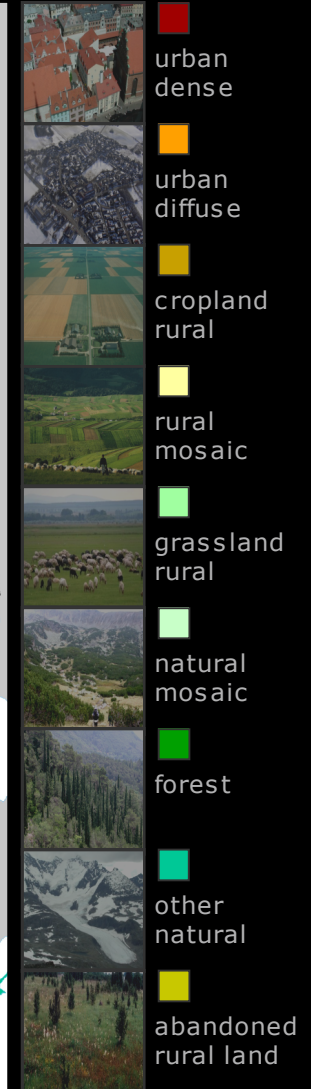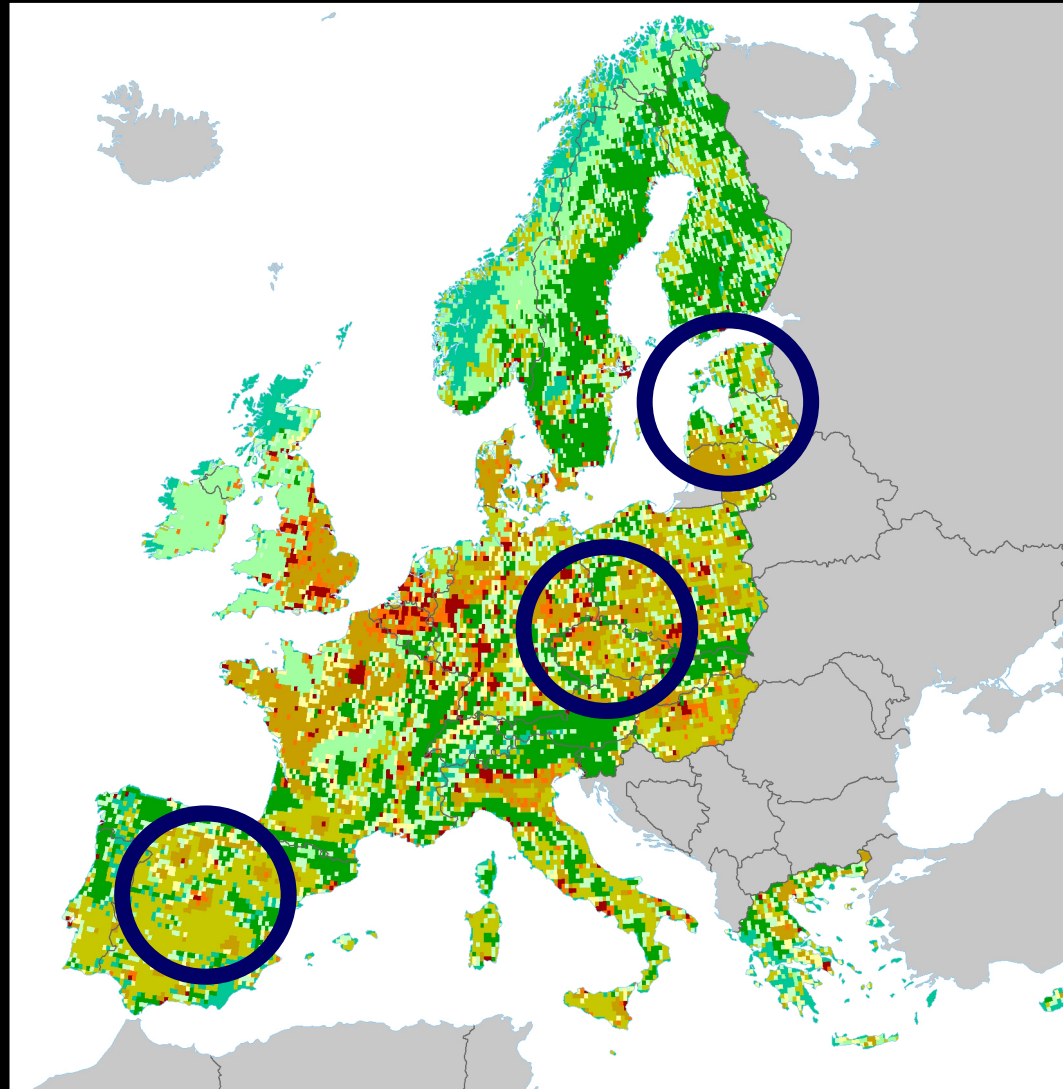
- urban dense
- urban diffuse
- cropland rural
- rural mosaic
- grassland rural
- natural mosaic
- forest
- other natural
- abandoned rural land

The product:
5 scenarios for 2035 - European-level quantification

Legend:
- urban dense
- urban diffuse
- cropland rural
- rural mosaic
- grassland rural
- natural mosaic
- forest
- other natural
- abandoned rural land

The product:
5 scenarios for 2035 - European-level quantification

Color	Legend
red	urban dense
orange	urban diffuse
dark yellow	cropland rural
light yellow	rural mosaic
light green	grassland rural
pale green	natural mosaic
dark green	forest
teal	other natural
yellow-green	abandoned rural land
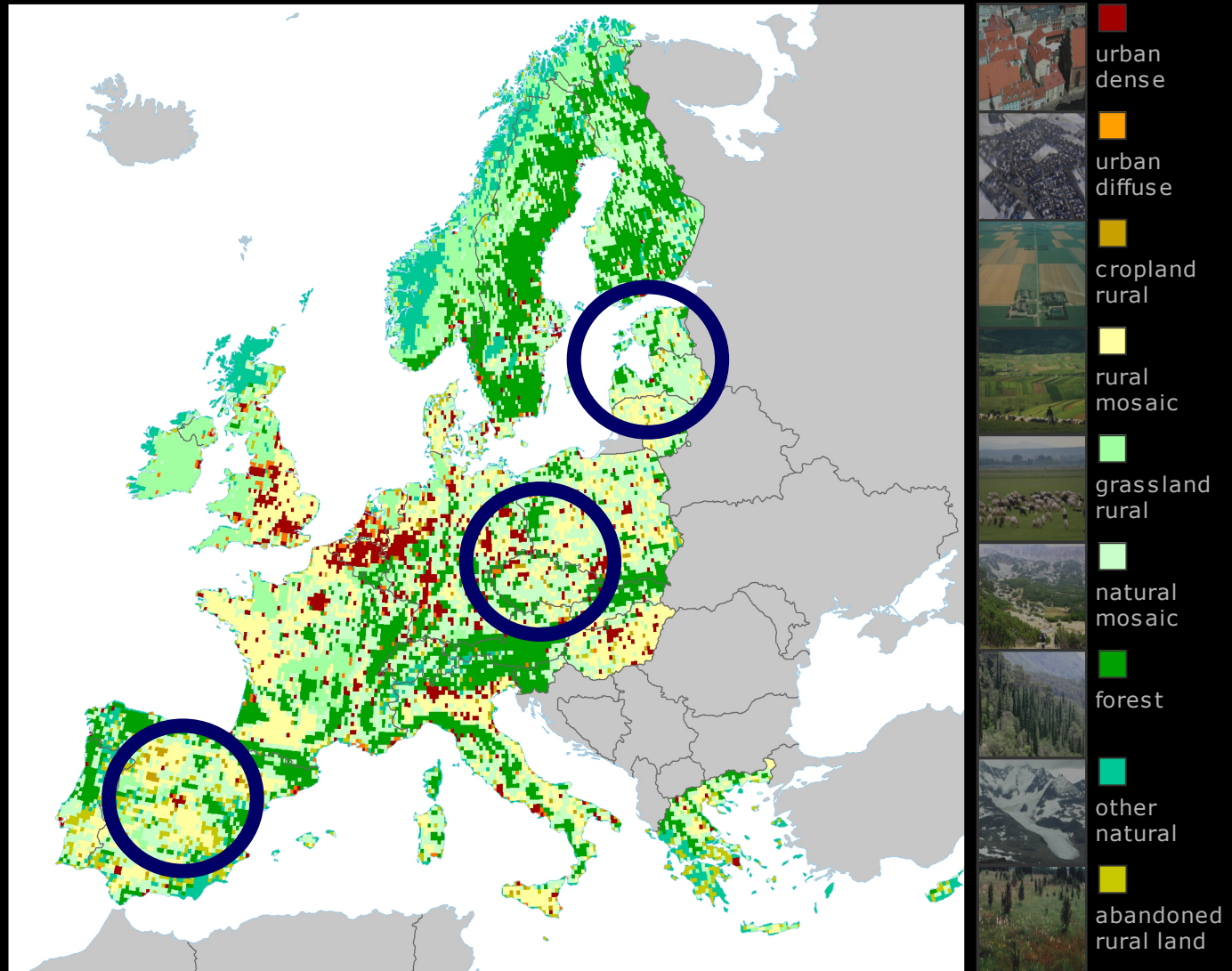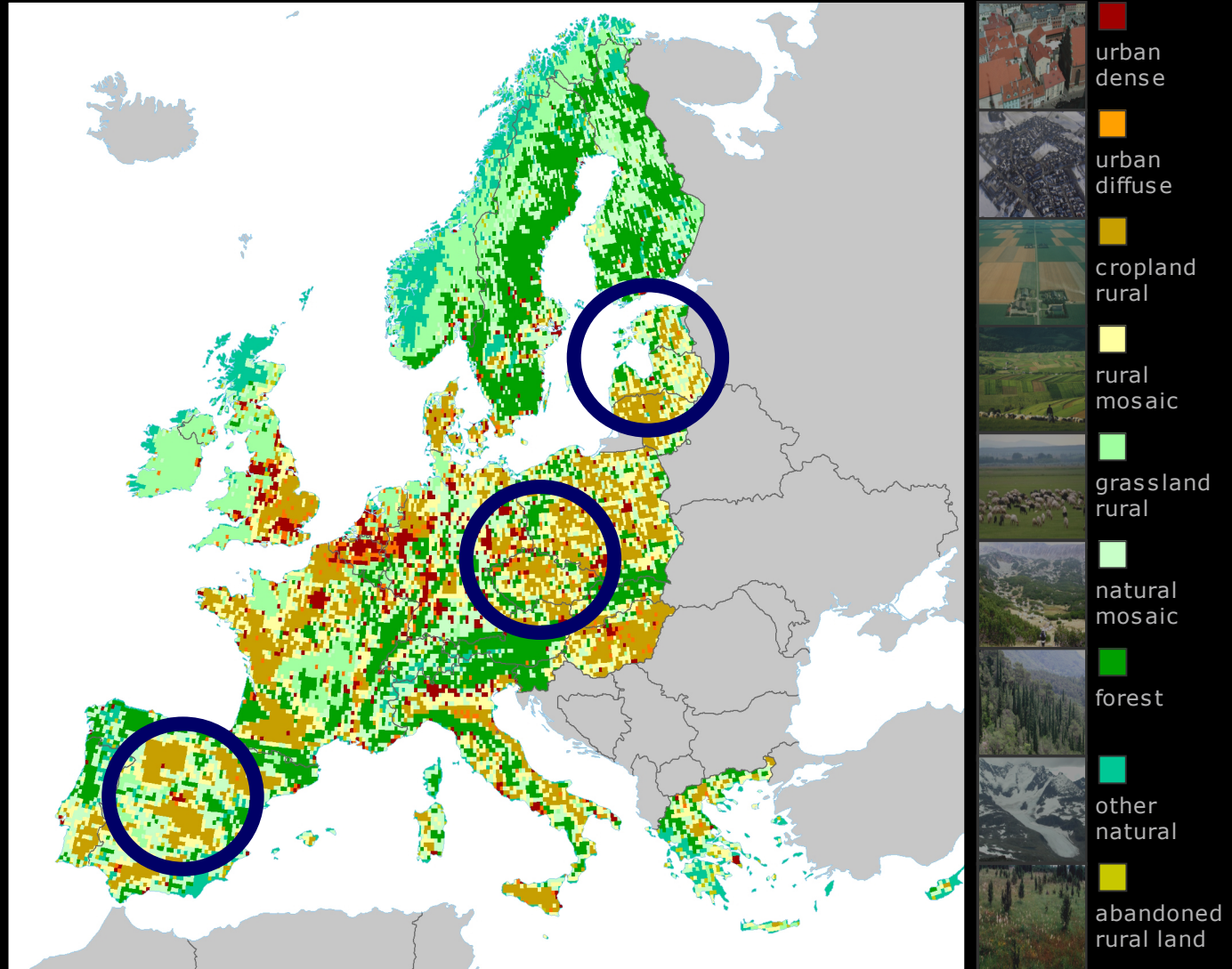
The product:
5 scenarios for 2035 - European-level quantification

GREAT ESCAPE
Europe of Contrasts

evolved society
Europe of Harmony

CLUSTERED NETWORKS
Europe of Structure

Lettuce surprise u
Europe of Innovation

BIG CRISIS
Europe of Cohesion
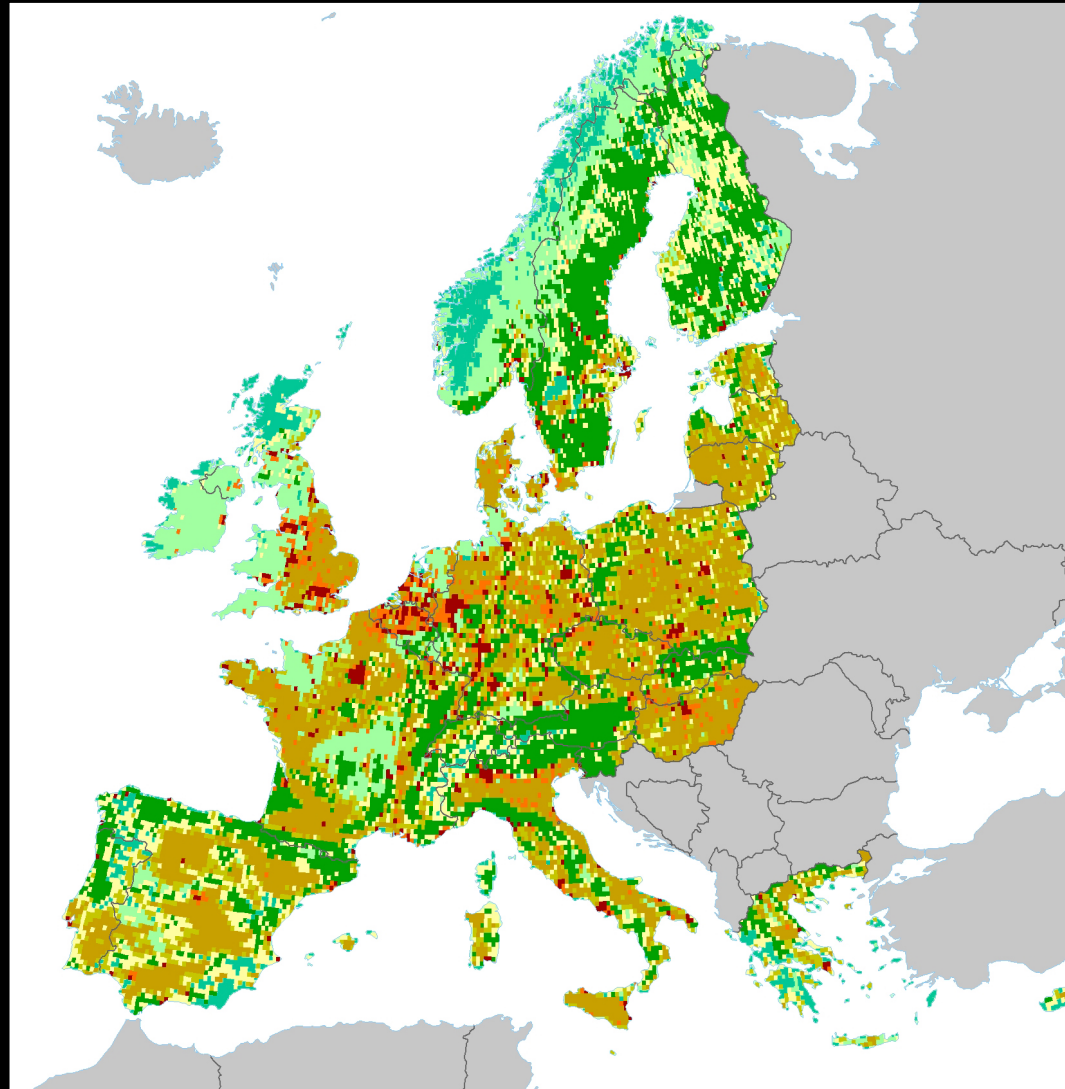
urban dense
urban diffuse
cropland rural
rural mosaic
grassland rural
natural mosaic
forest
other natural
abandoned rural land

What lessons did we learn?

About the process

- Full responsibility for drafting the storylines was given to the participants, they developed trust in the process and ownership of the product.

- External facilitation of the process underlined that there was no 'hidden agenda' - the participants engaged in an open and lively debate.

- Process brought together into a new dialogue a diverse group of stakeholders.

- Quantification of scenarios proved not to be straightforward, would have benefited from an additional iteration between qual. and quan. scenarios.

- But even so the exercise was time- and resource-intensive process.

European Environment Agency

What lessons did we learn?

PRELUDE

About the product

- Credibility: use of state-of-the-art models ensured general plausibility; yet, inconsistencies between qualitative assumptions and quantifications remained (partly due to lack of iterations, partly due models used, partly by design ...).

- Relevance: participatory scenario process encouraged 'out-of-the-box' (and 'out-of-the-model') thinking; bringing different perceptions into the discussion created an integrated long-term perspective on the issue of land use change.

- Legitimacy: strong ownership by participants facilitated strategic follow-up activities; the scenarios reflect contrasting views, which helped create a common platform for different policy communities to explore ideas.

European Environment Agency

A few more things I'd just like to mention …

PRELUDE

- PRELUDE is available online: www.eea.europa.eu/prelude

- The process and the outcomes of PRELUDE have been described in a dedicated technical report:
  EEA 2007. Land-use scenarios for Europe: qualitative and quantitative analysis on a European scale. EEA Technical Report 9/2007.

- Scientific aspects have been described in dedicated research papers *e.g.*
  Volkery et al. 2007.'Your vision or my model? … ' Sys Pract. & Act. Res. 21

- General guidance on scenario exercises in environmental context:
  MA / UNEP 2010. 'A Manual for Assessment Practitioners' (Chapter 5)
  Alcamo 2008. 'Environmental futures' (Chapters 2 and 6)

… Thank you

European Environment Agency