Setting up a land use scenario and linking it with biodiversity

Part II: Introduction to scenarios and scenario building

Scenario Planning Session
The Arctic Biodiversity Congress:
Trondheim, Norway, December 2-4, 2014

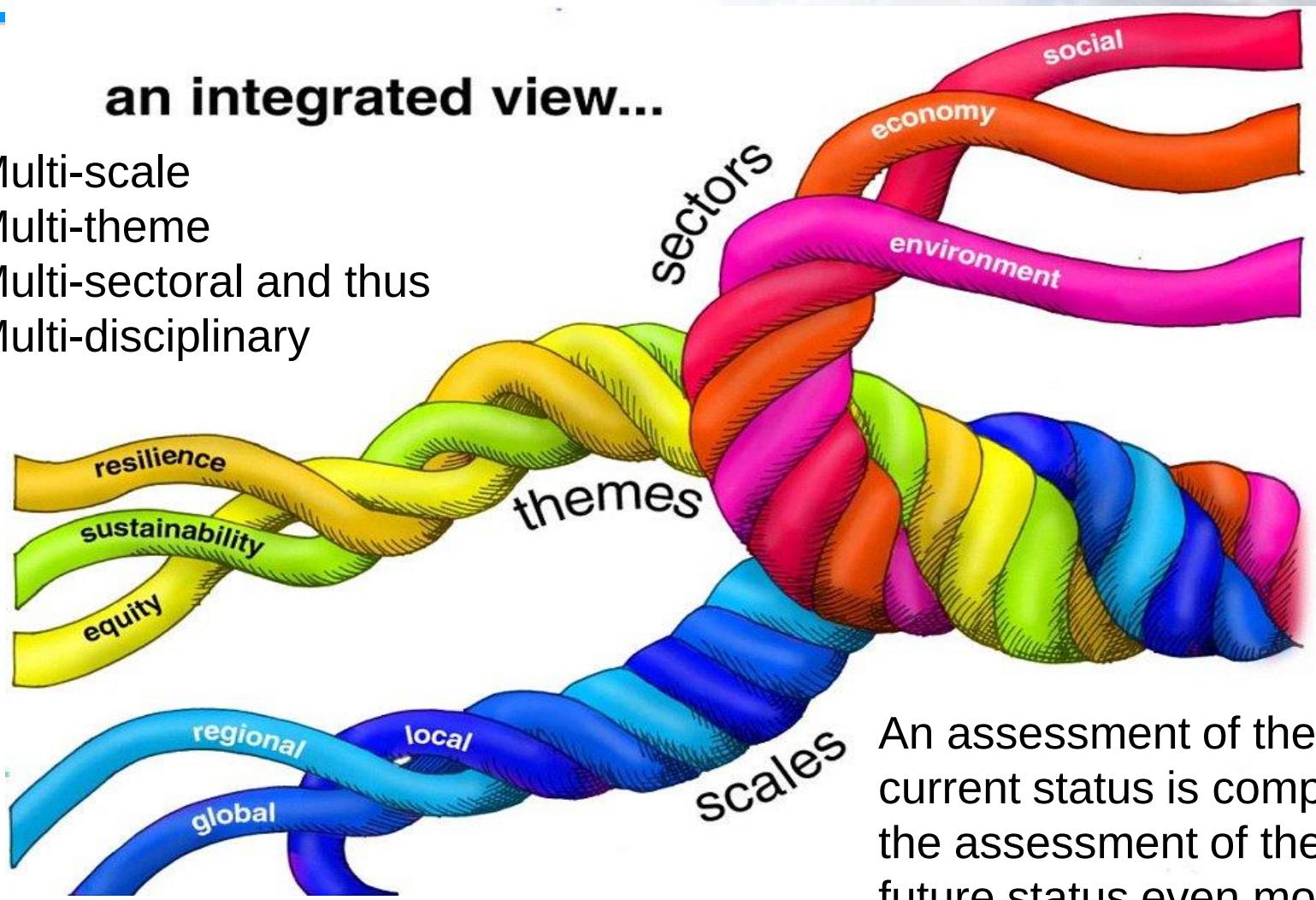
By Wilbert van Rooij

Plansup, The Netherlands

In collaboration with the Netherlands Environmental Assessment Agency and Statistics Norway

Environmental science – a complex issue

- Multi-scale
- Multi-theme
- Multi-sectoral and thus
- Multi-disciplinary



An assessment of the current status is complex, the assessment of the future status even more

What is a scenario?

Scenarios are **credible**, challenging, and **relevant** stories about how the future might unfold that can be told in both words and numbers.

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

Scenarios are not **forecasts**, **projections**, or **predictions**.

Scenarios – overview

Scenarios:

- Have the ability to address **complex** issues in an **integrated** manner.
- Have the ability to deal with **surprises**, **system changes**, bifurcations.
- Are an excellent tool for **communication**
- Possibilities for **participation** are large.

Scenarios: Socio-Economic change

- Changes macro-economic growth
- Changes in population, demography and labour force
- Changes in labour force (education)
- Changes in consumer behaviour (tastes \ preferences)
- Changes in technology
- Changes in trade

Scenarios: Land-use change

In general:

- Changes in population and economy
- Changes in human diet: more or less meat and milk, fruit & veg; processed foods; staple foods,...
- Changes in agricultural trade assumptions (incl. food speculation)
- Changes in food requirements for animals (more or less residues, more or less grass)
- Changes in feed efficiency per animal

Typical for arctic:

- Change in subsistence systems
- Climate change: Restrictions existing land use versus new opportunities
- Pressures on existing land: e.g. new settlements and roads as a result of increased mining and new shipping routes

Example scenario for Global assessment 1:

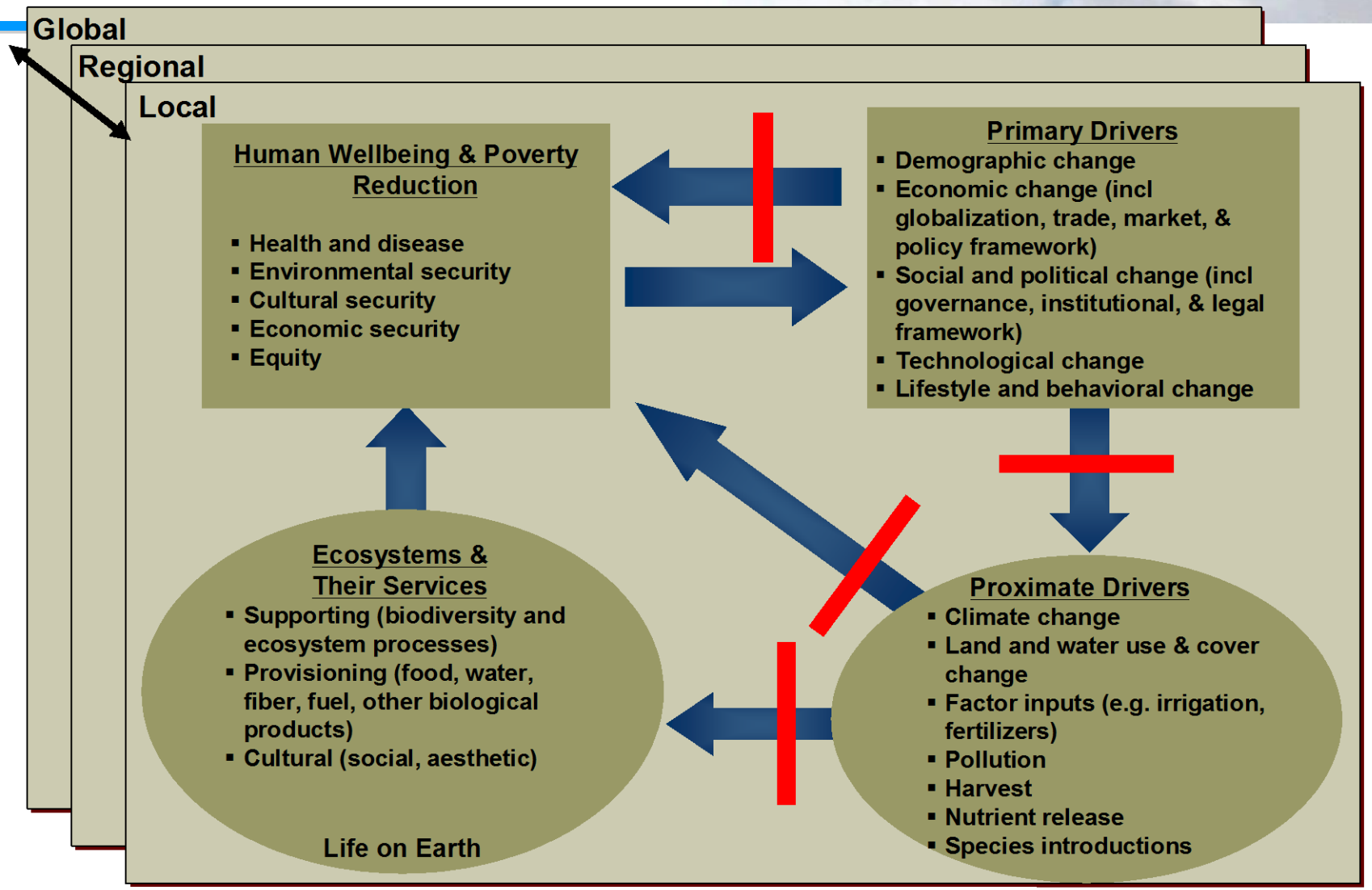
The Millennium Ecosystem Assessment
(full Storyline-And-Simulation approach)

Millennium Ecosystem Assessment

An international scientific assessment of the consequences of ecosystem changes for human well-being:

- **Modeled on the IPCC**
- **Providing information requested by:**
  - *Convention on Biological Diversity (CBD)*
  - *Convention to Combat Desertification (CCD)*
  - *Ramsar Convention on Wetlands*
  - *Convention on Migratory Species (CMS)*
  - *other partners including the private sector and civil society*
- **With the goals of:**
  - *stimulating and guiding action*
  - *building capacity*

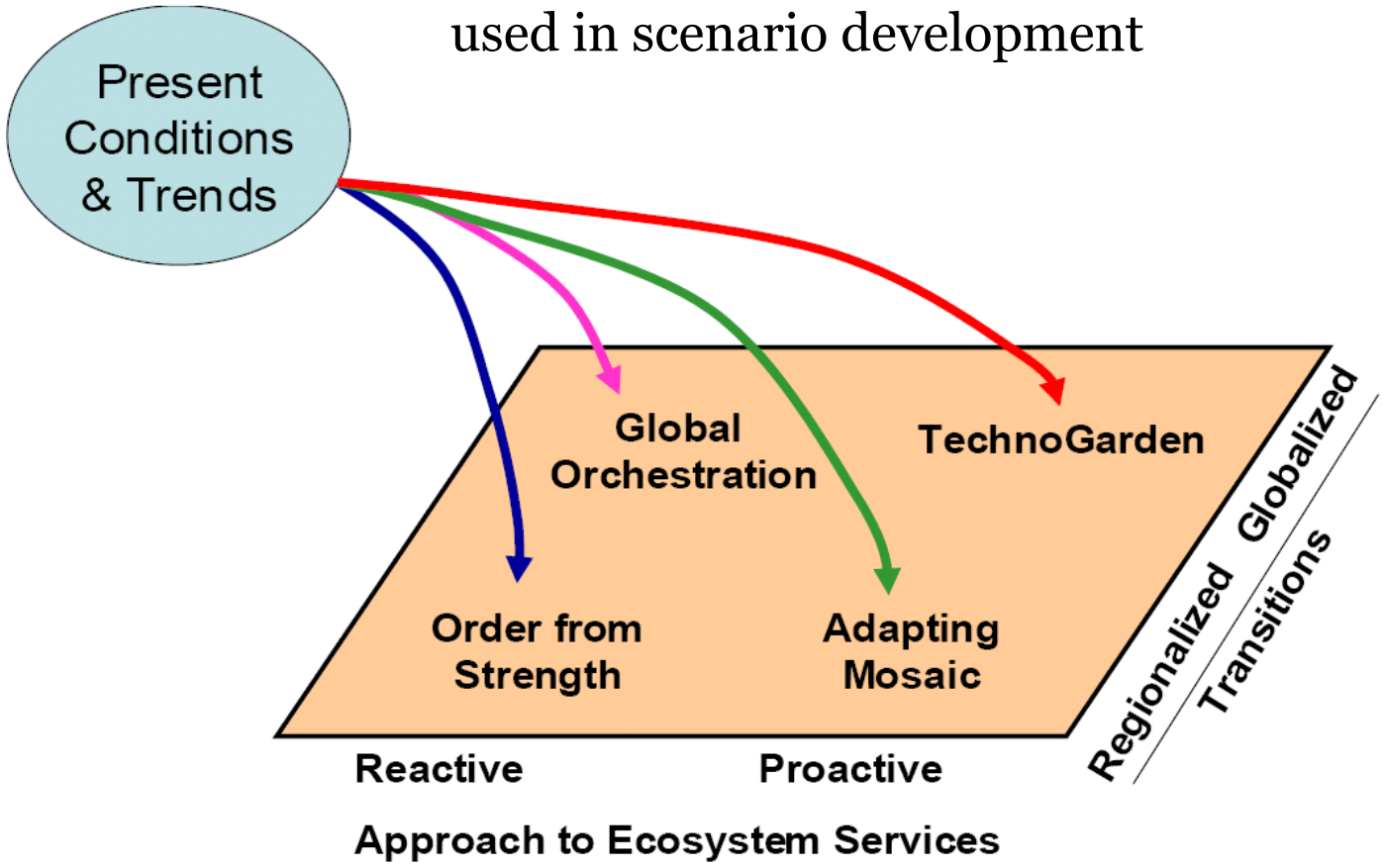
MA Conceptual Framework



MA Scenarios

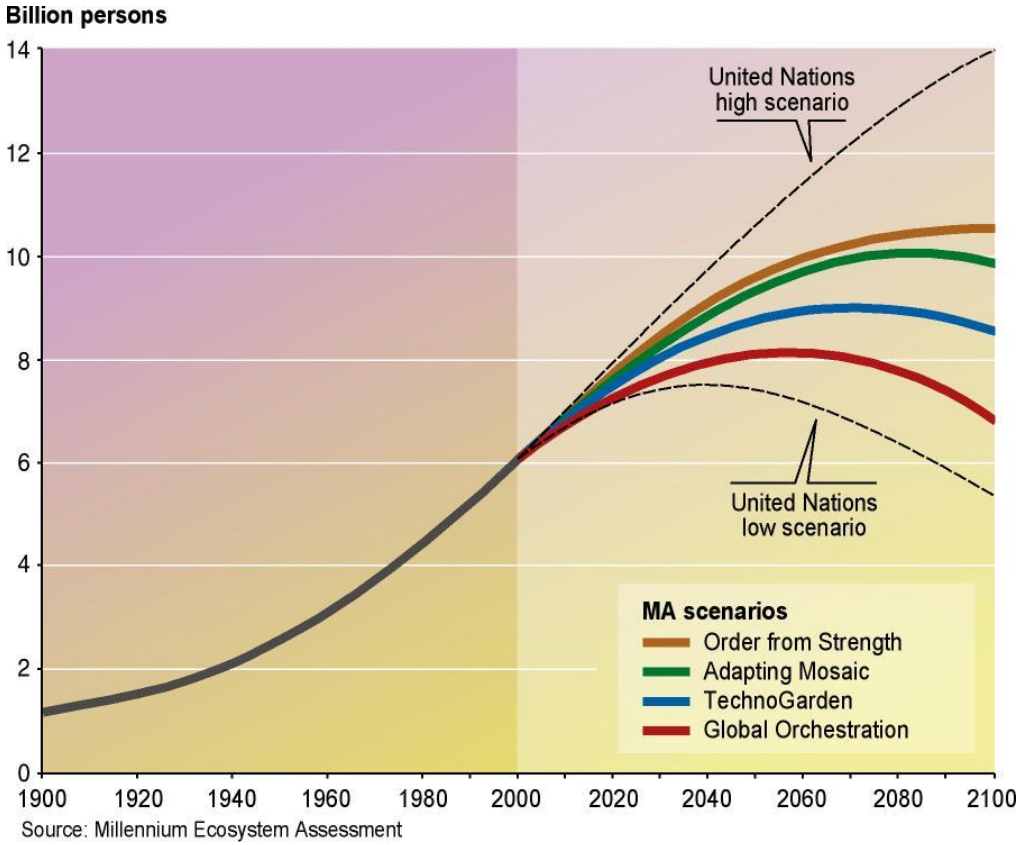
Not predictions – scenarios are plausible futures

Both quantitative models and qualitative analysis used in scenario development



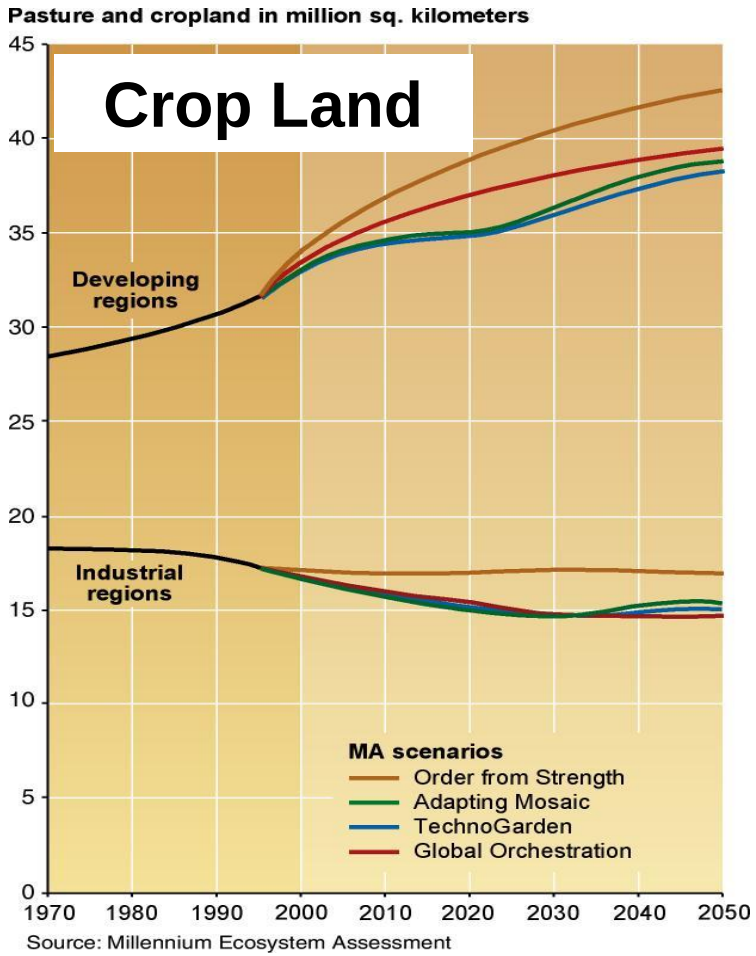
Changes in indirect drivers

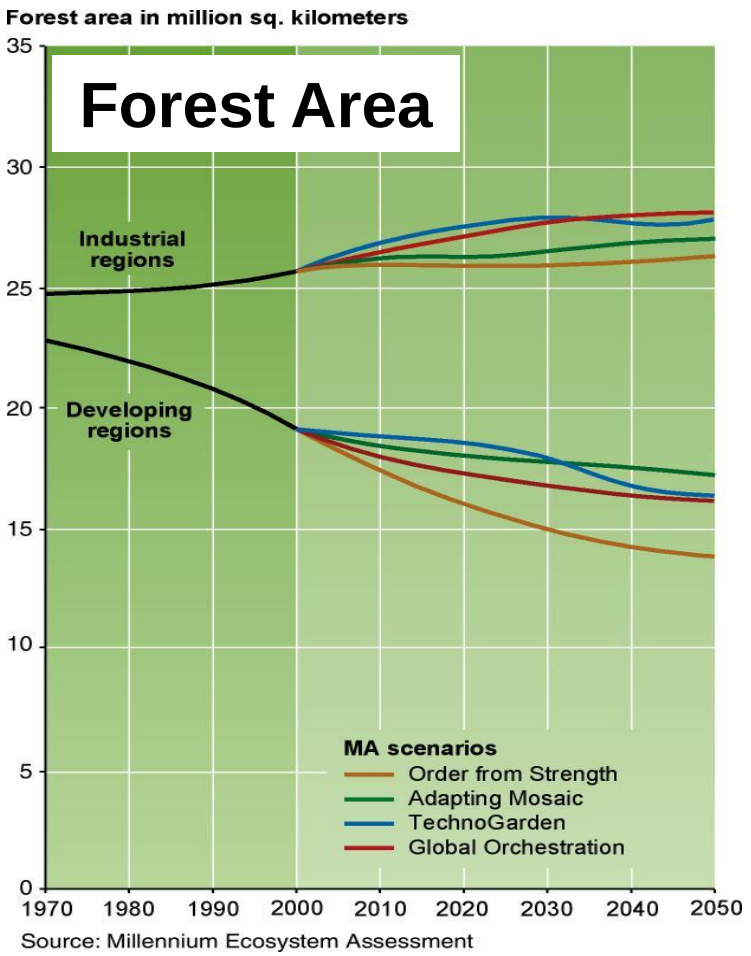
- In MA Scenarios:
  - Population projected to grow to 8–10 billion in 2050
  - Per capita income projected to increase two- to fourfold



Changes in direct drivers

Changes in crop land and forest area under MA Scenarios





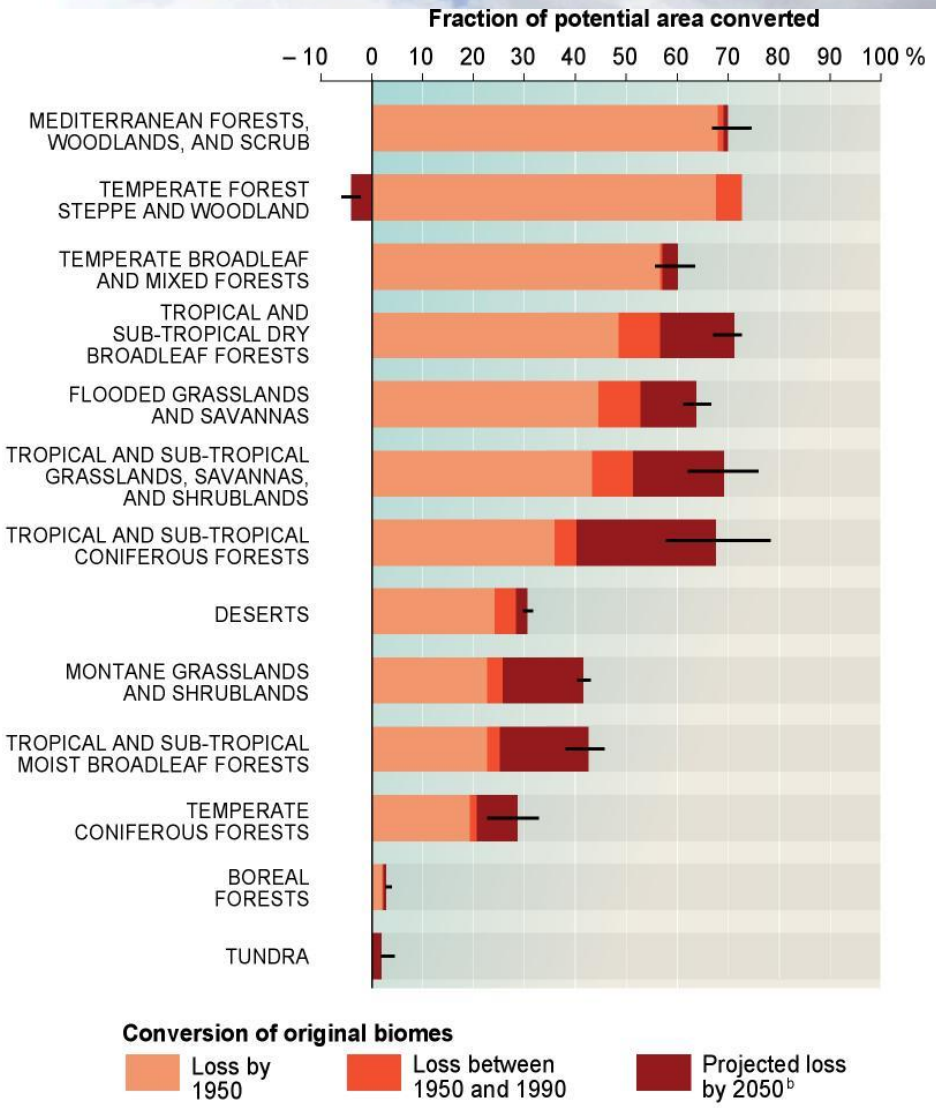
Changes in direct drivers

- Habitat transformation:
  - Further 10–20% of grassland and forestland is projected to be converted by 2050

- Overexploitation, overfishing:
  - Pressures continue to grow in all scenarios

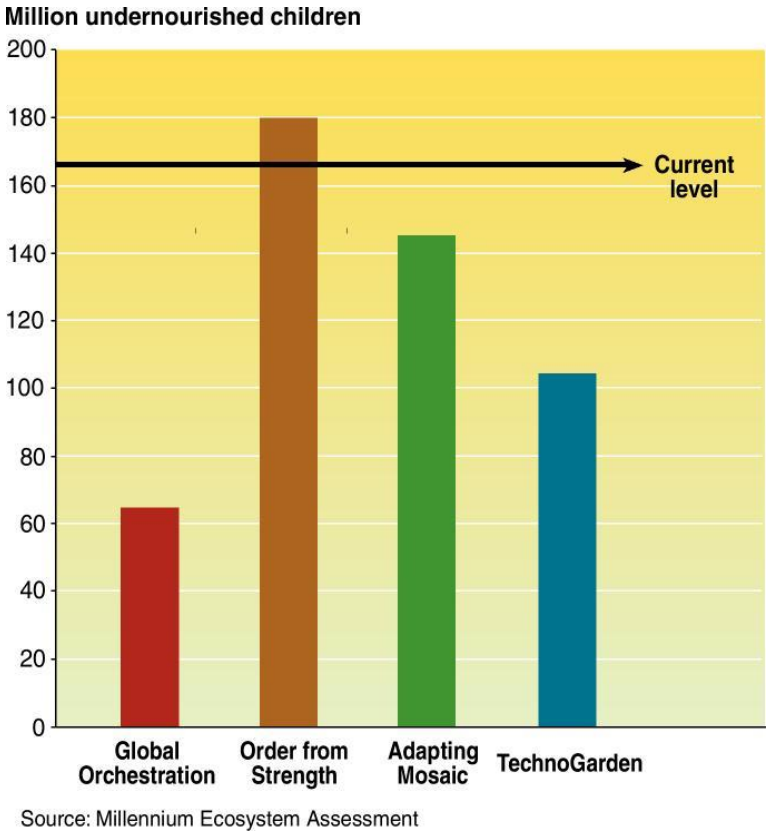
Invasive alien species:

  - Spread continues to increase



Changes in ecosystem services under MA Scenarios

- Demand for food crops is projected to grow by 70–85% by 2050, and water withdrawals by 30-85%
- Food security is not achieved by 2050, and child undernutrition would be difficult to eradicate (and is projected to increase in some regions in some MA scenarios)
- Globally, the equilibrium number of plant species is projected to be reduced by roughly 10–15% as the result of habitat loss over the period of 1970 to 2050 (*low certainty*)



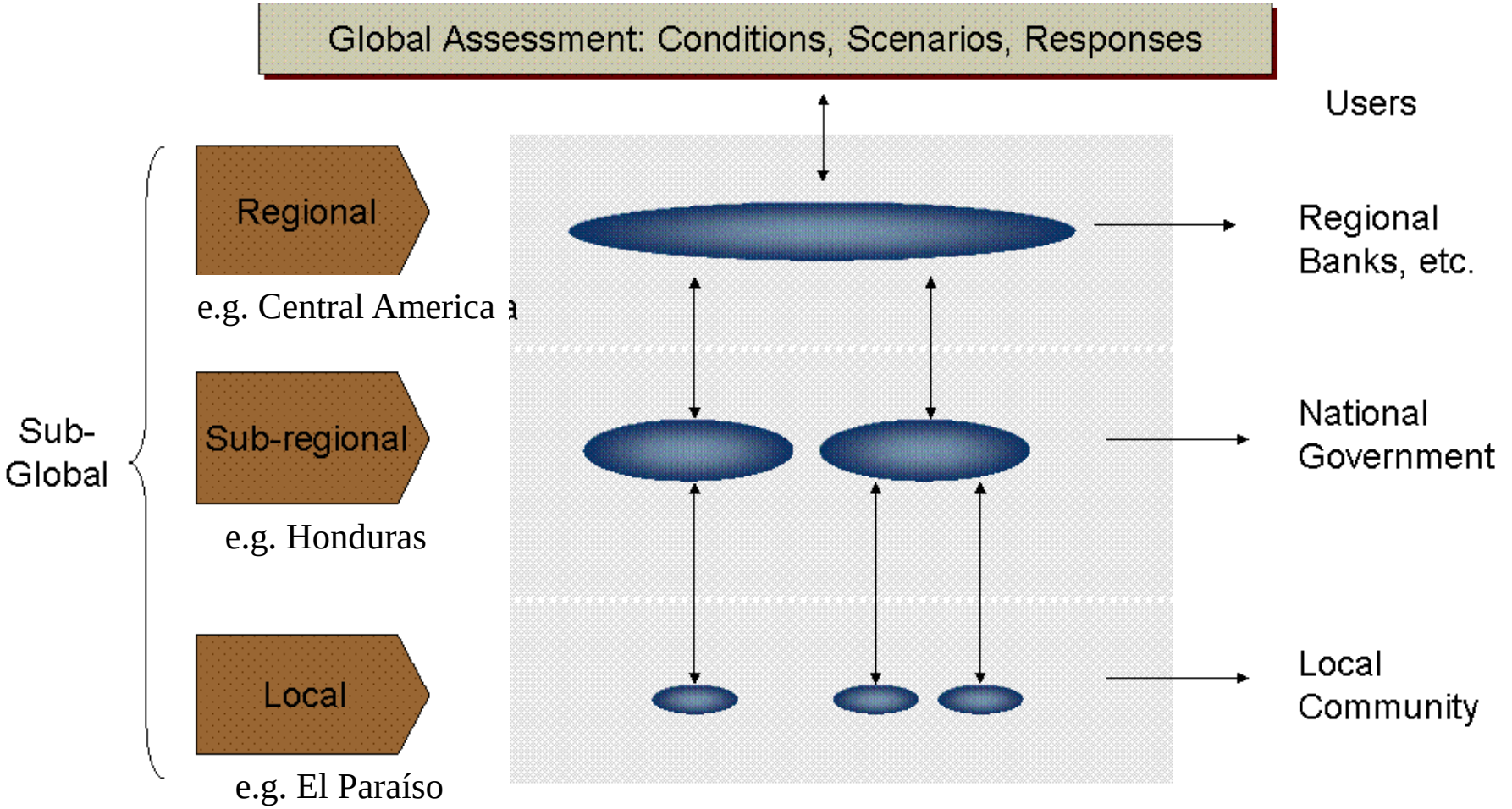
Child undernourishment in 2050 under MA Scenarios

But this was very global

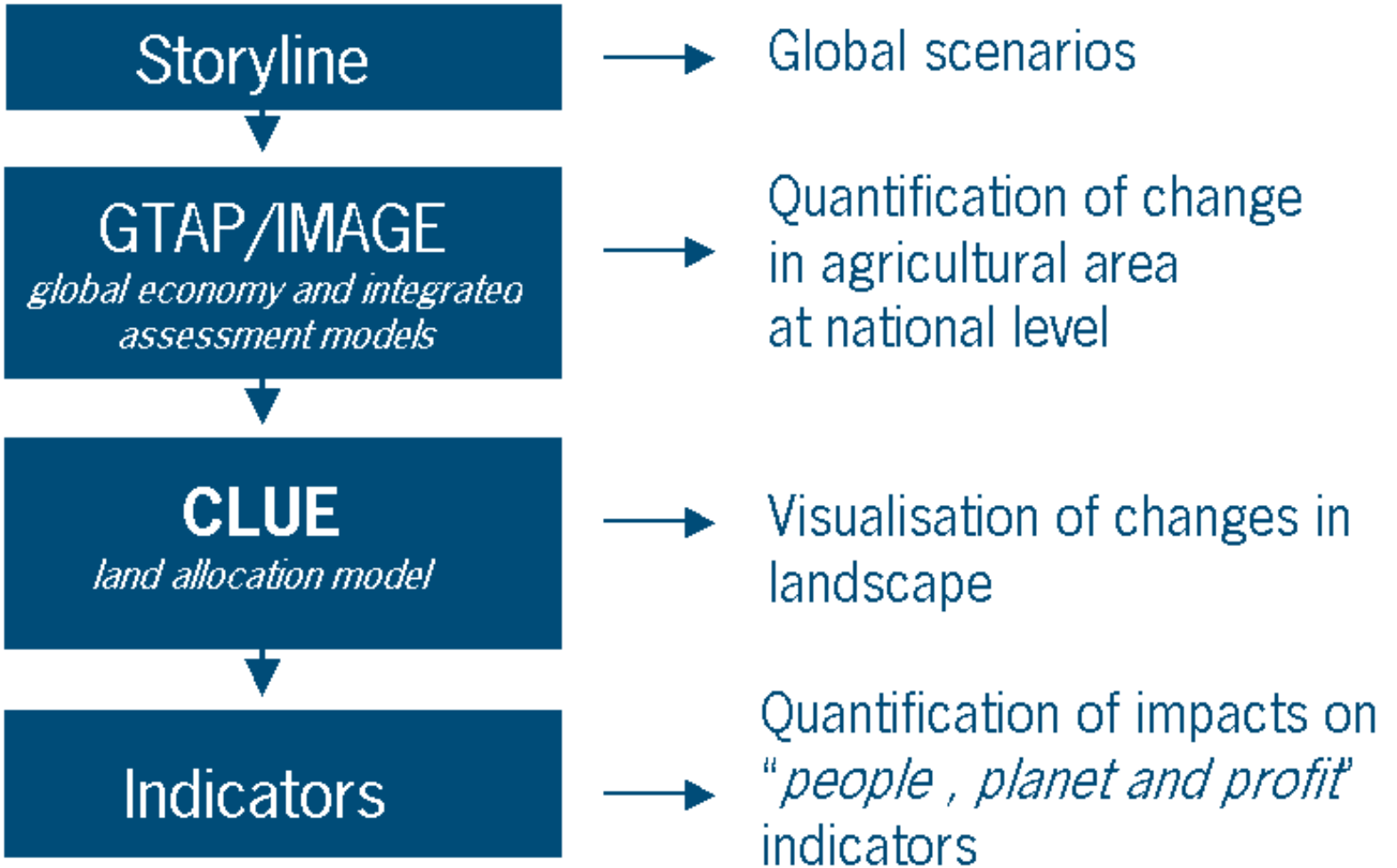
How can this be used for regional or national scenario development?

- Use global model results as a context (what food feed, bio-energy and timber demand is required in your region)
- Use global results as an input where other information is missing
- Use regional and local sources and experts to assess national-specific aspects (socio-economic indicators and land-use change)

The MA is a multi-scale assessment with multiple layers of nesting



Methodology of multi scaled assessment:Eururalis



Effects of climate change on land use scenario

Determine local consequences climate change on main drivers

E.g. on Agriculture:

Change of productivity because of melting permafrost, floods, drought, rain on ice, changes in snow cover; → migration of land use to other areas

However also the reverse as more land will come available for the production of crops and livestock → inward migration

→ extensification vs intensification

Consequences for Biodiversity:

→Habitat change spp

→Increased pressure on natural resources

→Etc

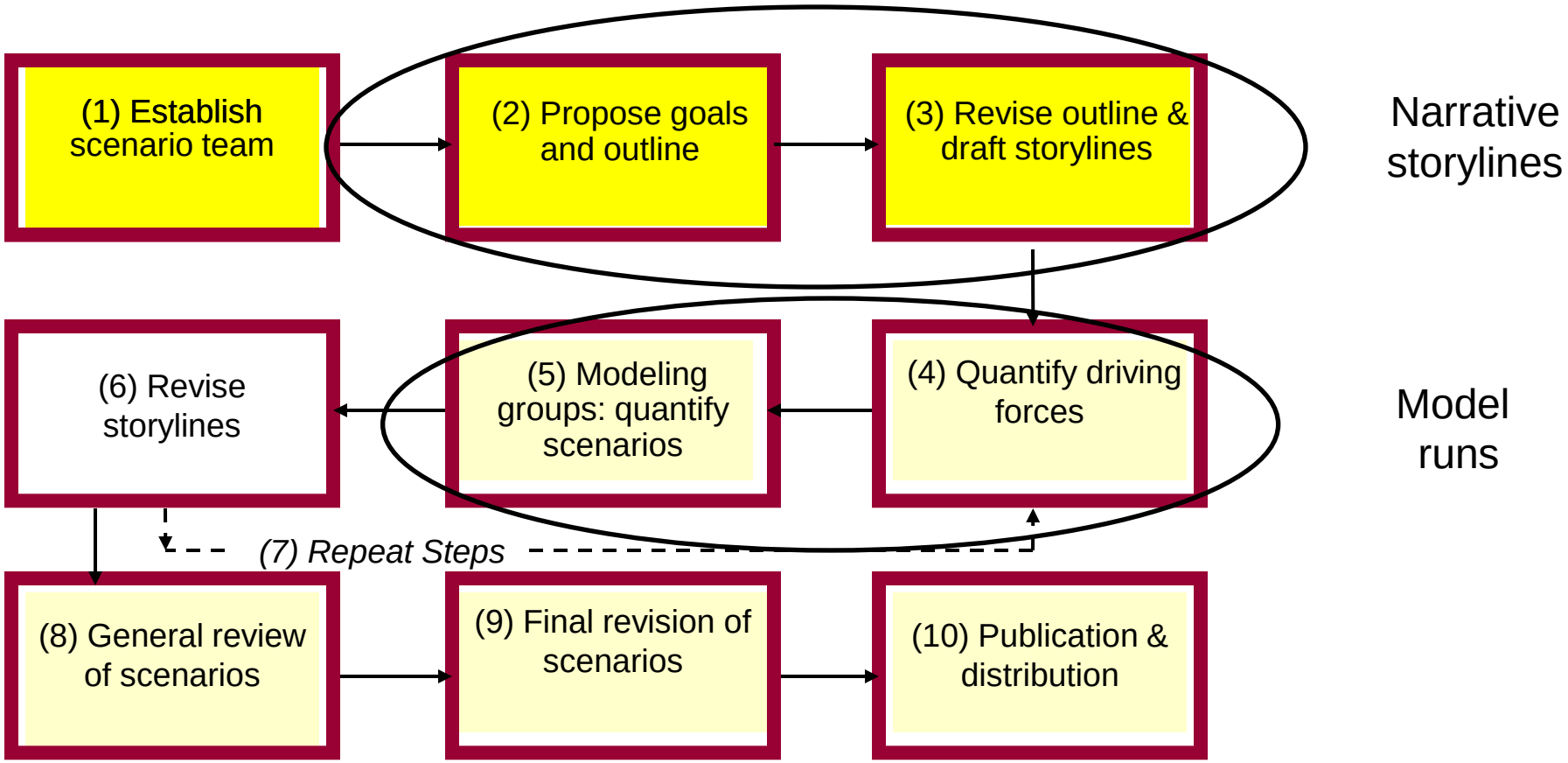
Quick reference scenario building

Scenario exercise

Phase 1 **Phase 2** **Phase 3** **Phase 4**

Source: Ecosystems and human well-being:
A manual for Assessment Practitioners
Neville Ash et all, 2010

Storyline And Simulation approach



Creating the scenarios

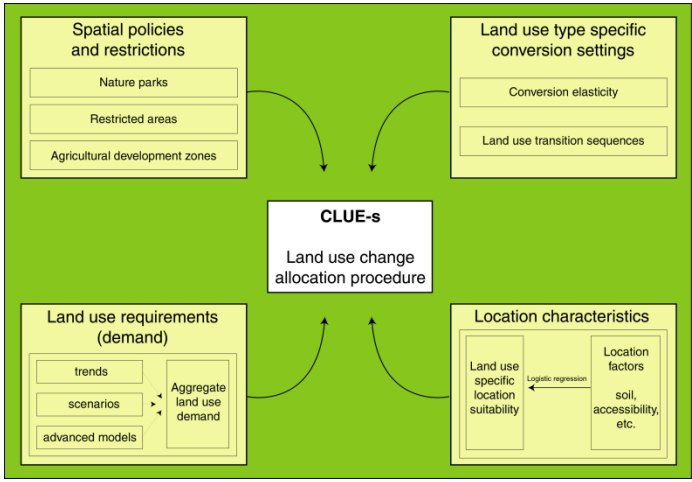
Link with CLUE model

Demand:
How much will be the change (in ha)
of all major land uses?

Spatial policies:
New national parks, restricted areas, agricultural development zones

Location characteristics:
Infrastructure (new roads?) = change in accessibility
Soil (soil degradation?)
Population (migration?)
Etc.

Conversion settings
Transition possibilities from one land use type to another



Bridging gap between numeric and geographical data: Baseline scenario

1: Extract numeric data from available resources:

A: Global: FAO (website), Global Assessments (MA, OECD, GBO, IPCC)

B: National: Development reports (agricultural + forestry department
Outlooks (Vietnam: Agenda 21, MDG report, etc)
Census data from statistical department
Specialists (Socio-Economists. Agronomists, Forestry planners, Environmentalists, etc)

2: Aggregate land use classes based on type and use intensity
So that you can compare spatial and numeric data
and for which you can find future data

3: Create trends, historical and for planned time horizon

4: Compare geographical areas aggregated land use classes of the land use map with the areas derived from non spatial sources

5: Interpret reasons for difference, adjust numeric data and use relative differences for creation of demand table

National scenarios – essential elements

A National scenario could have information on:

Factors:	*Sectors:*	*Actors:*
Economic development	**Agriculture***	Government
Population growth	**Tourism**	Businesses
Consumption pattern	Energy	NGOs
Technology	Water	Farm/Herding
Environmental Policies	**Forestry**	**Subs. hunters**
Scientists	**Protected area**	**Fishermen**
Institutions	**Urban area**	
State of environment	**Subsistence farming**	
	Herding	
(Biodiversity!)	**Mining & oil exploration**	
	(Fisheries)	
	Hunting	

* Share intensive / extensive agr. area

Translating storylines: Quantification

- Quantitative differences in land use areas (demand)
  - Agricultural / livestock / raindeer demand
  - Intensification
  - Reforestation
- Spatial differences (conversion matrix/region file)
  - Parks
  - Restricted areas
- Behavioural differences (suitability maps / elasticities)
  - Subsidies
  - Awareness (new opportunities/ restrictions)
  - Learning
  - Farming system change

Baseline climate scenario + policy options

- Determine different trends in land use change because of implementation of selected policy option(s)

- Analyze national policies / plans with respect to climate adaptation and mitigation

Examples adaptation:

- Production of additional fodder to support existing herding
- Restrictions within hunting licenses (e.g. species type)
- Support to (subsistence-) farmers who want to change land use: Different type of livestock, more additional feeding, e.g. more drought resistant animals
- New settlements: Increasing meat imports to avoid high grazing pressure in sensitive natural areas