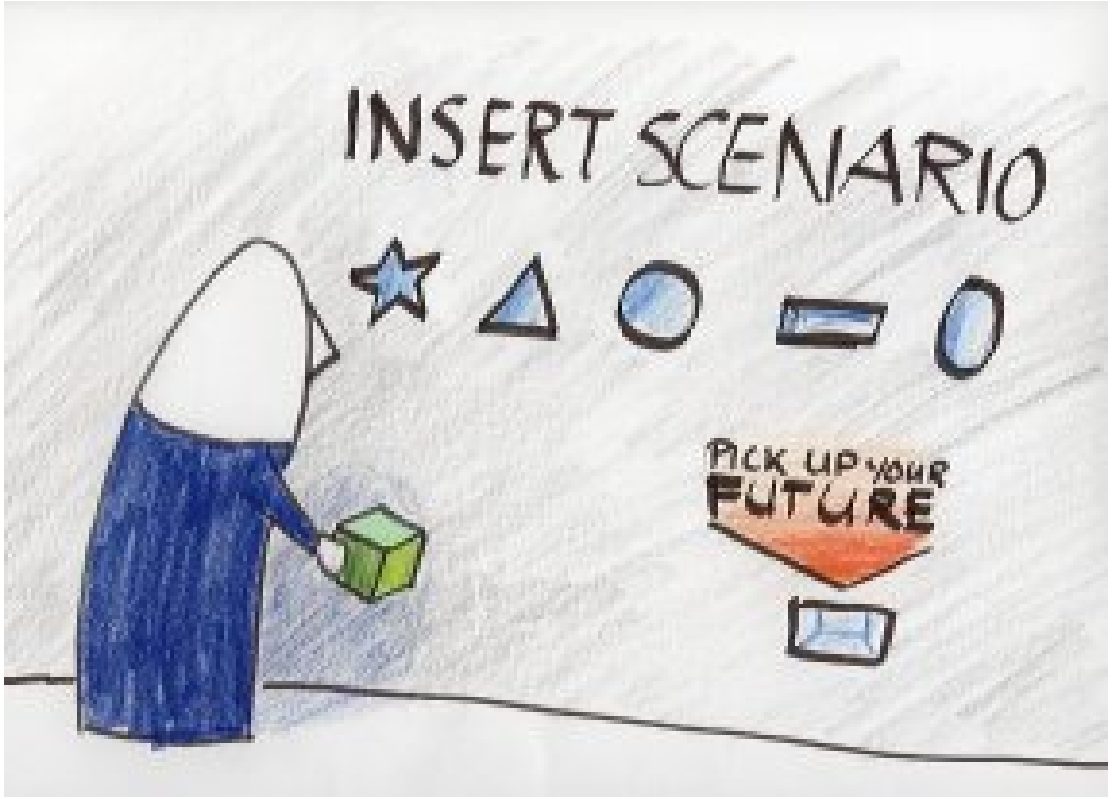
Qualitative (and quantitative) scenarios

Methods for regional development



Kasper Kok - Wageningen University

UNEP expert meeting REDD scenarios
20-21 September 2011

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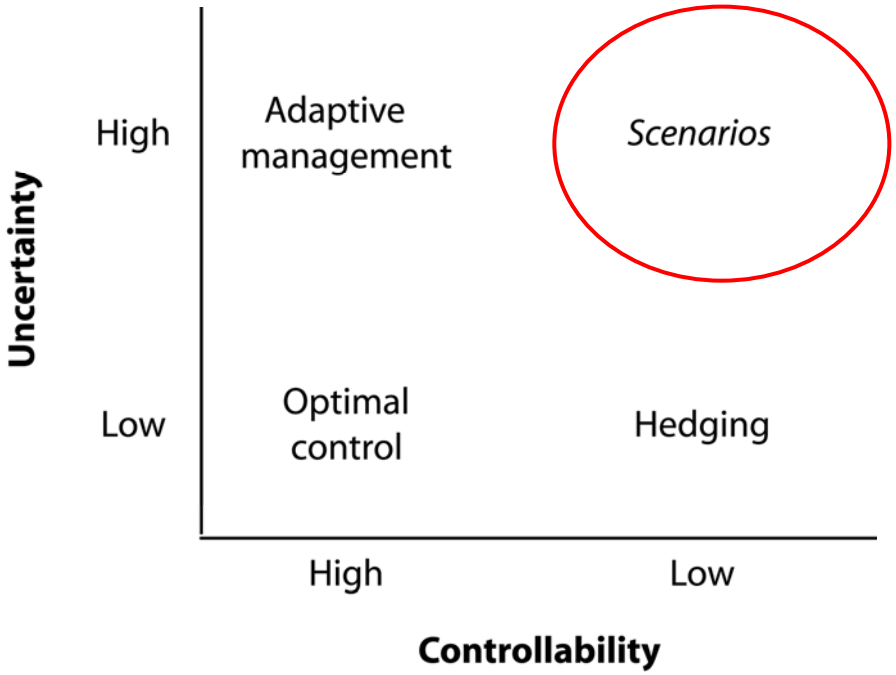
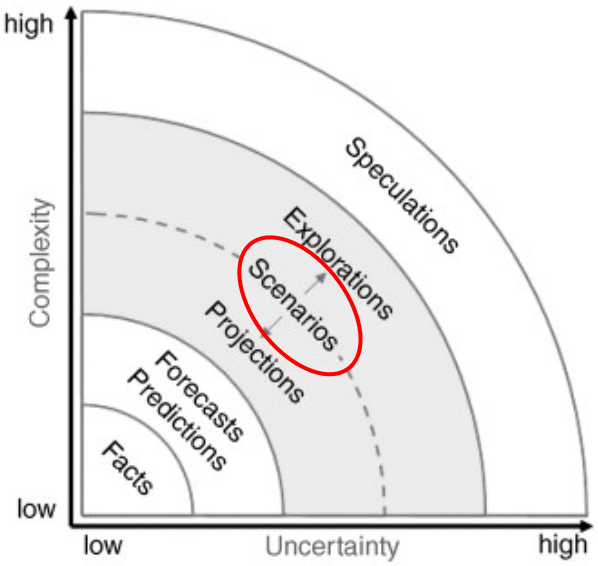
Content

- Methods.
  - Scenarios
  - Some words on the SAS approach
- Examples:
  - Millennium Ecosystem Assessment – multi-scale
  - Scenes – FCMs and SAS
  - CLIMSAVE - SAS
- Conclusions:
  - use of methods in context of REDD

Scenarios – when to use?





	Low uncertainty	High uncertainty
High causality	Predictive	Explorative
Low causality	Projective	Speculative

Scenarios – when to use?

Scenarios are (perhaps) the best tool when:

- Uncertainty is high, and

- Controllability is low, or
- Complexity is high, or
- Causality is high

Note: climate change is highly uncertain; REDD is highly complex; (global) implementation is difficult to control

Scenarios - types

A Project goal - exploration vs decision support:

I. Inclusion of norms? : descriptive vs normative

II. Vantage point: forecasting vs backcasting

III. Subject: issue-based, area-based, institution-based

IV. Time scale: long term vs short term

V. Spatial scale: global/supranational vs national/local

B Process design – intuitive vs formal:

VI. Data: qualitative vs quantitative

VII. Method of data collection: participatory vs desk research

VIII. Resources: extensive vs limited

IX. Institutional conditions: open vs constrained

C Scenario content - complex vs simple:

X. Temporal nature: trend vs snapshot

XI. Variables: heterogeneous vs homogenous

XII. Dynamics: peripheral vs trend

XIII. Level of deviation: alternative vs conventional

XIV. Level of integration: high vs low

Scenarios - types

A Project goal - exploration vs decision support:

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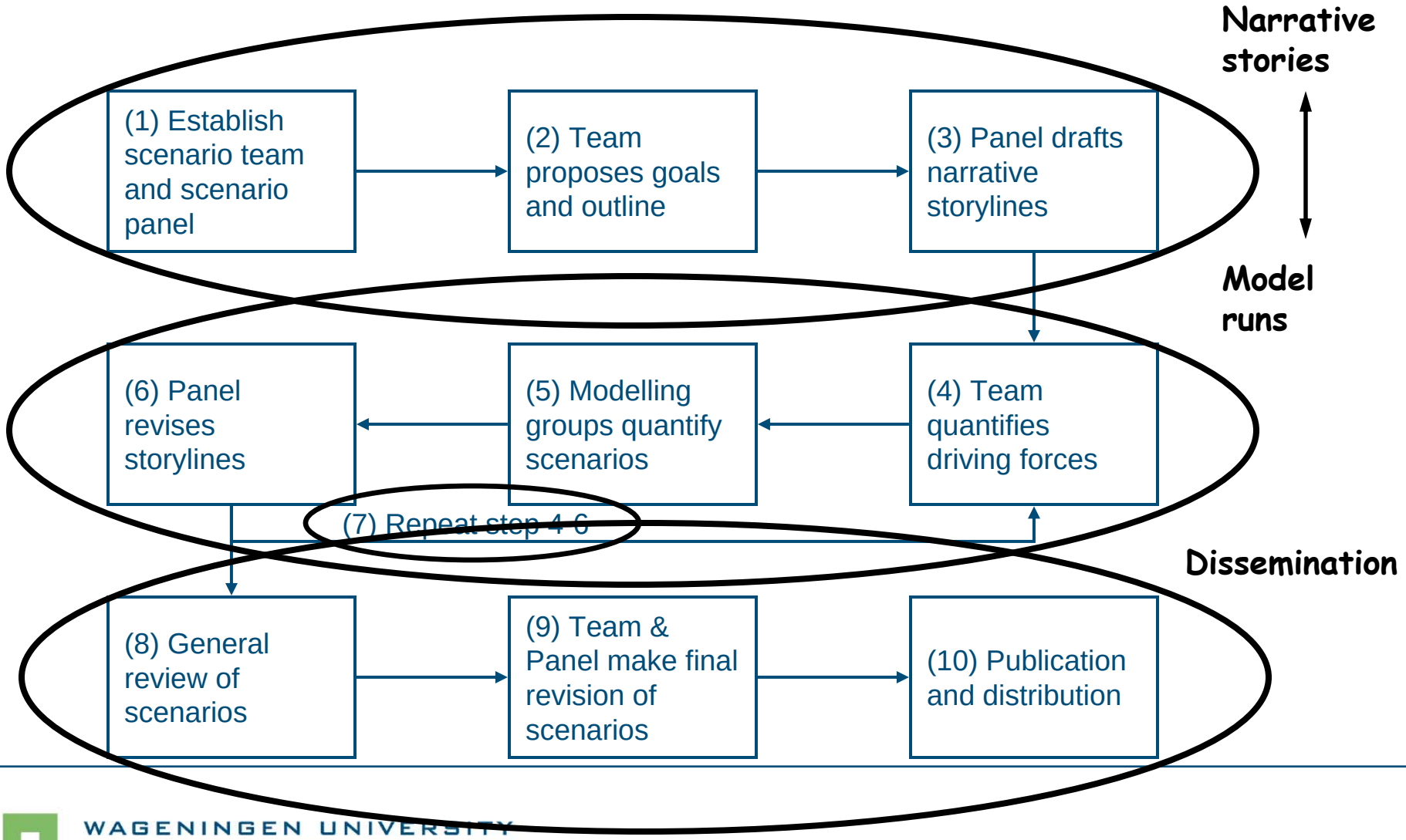
Story And Simulation approach

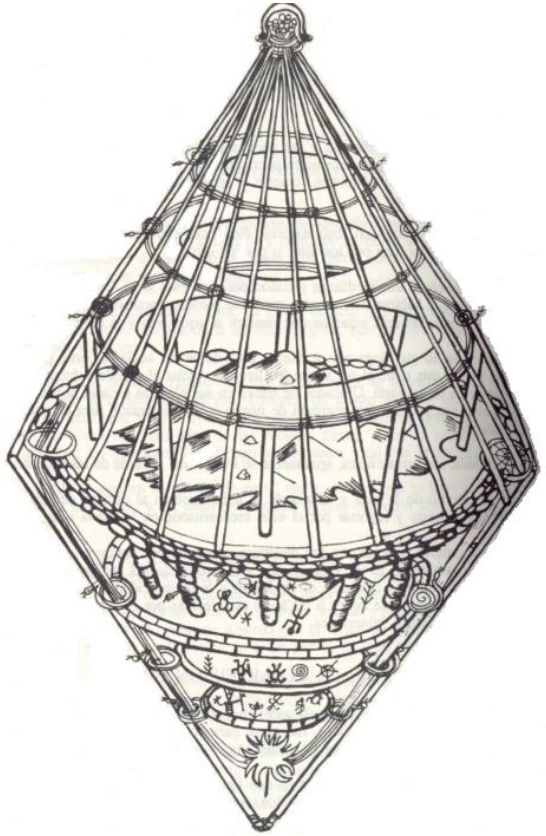


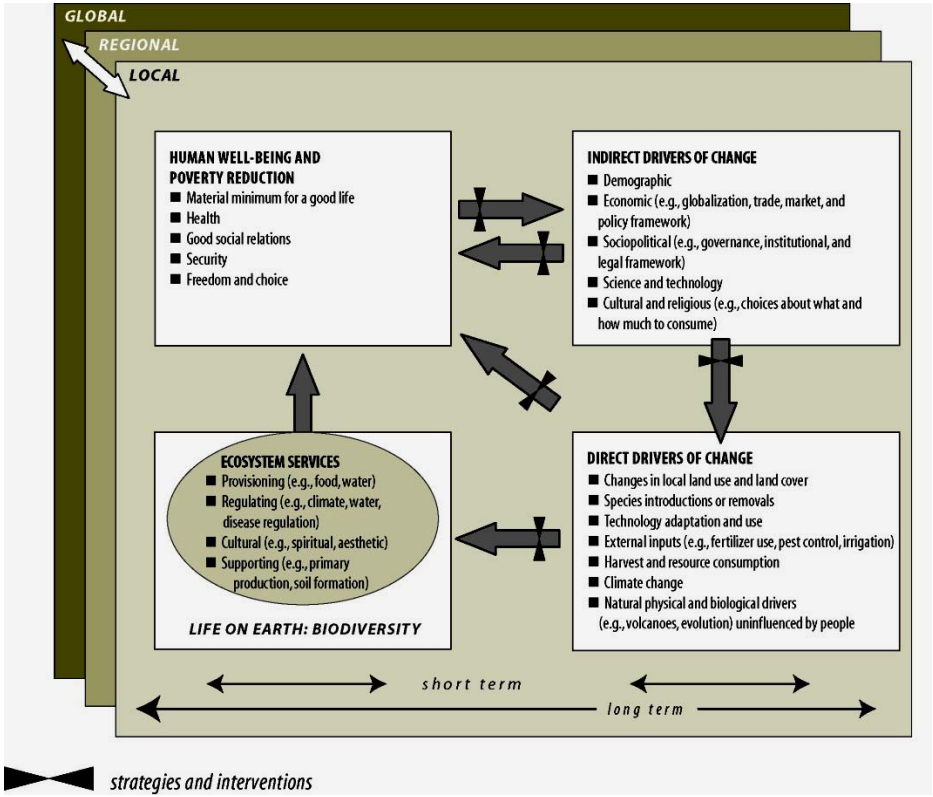
Scenarios – a toolbox of methods

	Qualitative	Semi-quantitative	Quantitative
Present		Fuzzy Cognitive Maps Causal Loop Diagrams Bayesian Belief Networks	Data
Long-term future	Storylines Collages Visions		(spatial) Models
Short-term actions	Backcasting Strategies Robust actions	Fuzzy Cognitive Maps	Indicators

Example 1: **The Millennium Ecosystem Assessment**

(multi-scale scenario development)





Millennium Ecosystem Assessment

- **Aim:** 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 working groups were assessing global conditions, scenarios and responses

Conditions Working Group

- What is the current condition and historical trends of ecosystems and their services?
- What have been the consequences of changes in ecosystems for human well-being?

Scenarios Working Group

- Given plausible changes in primary drivers: what will be the consequences for ecosystems, their services, and human well-being?

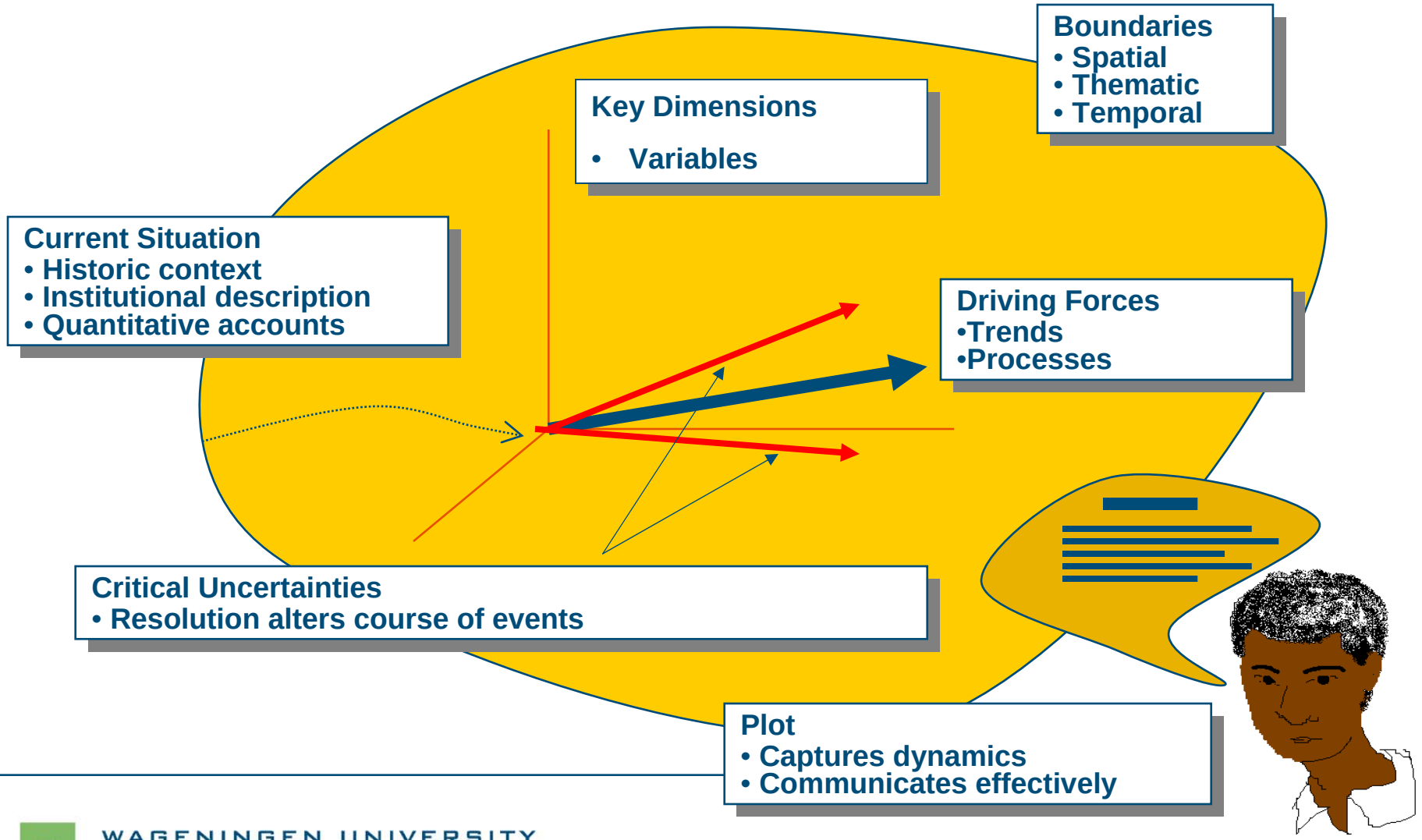
Responses Working Group

- What can we do about it?

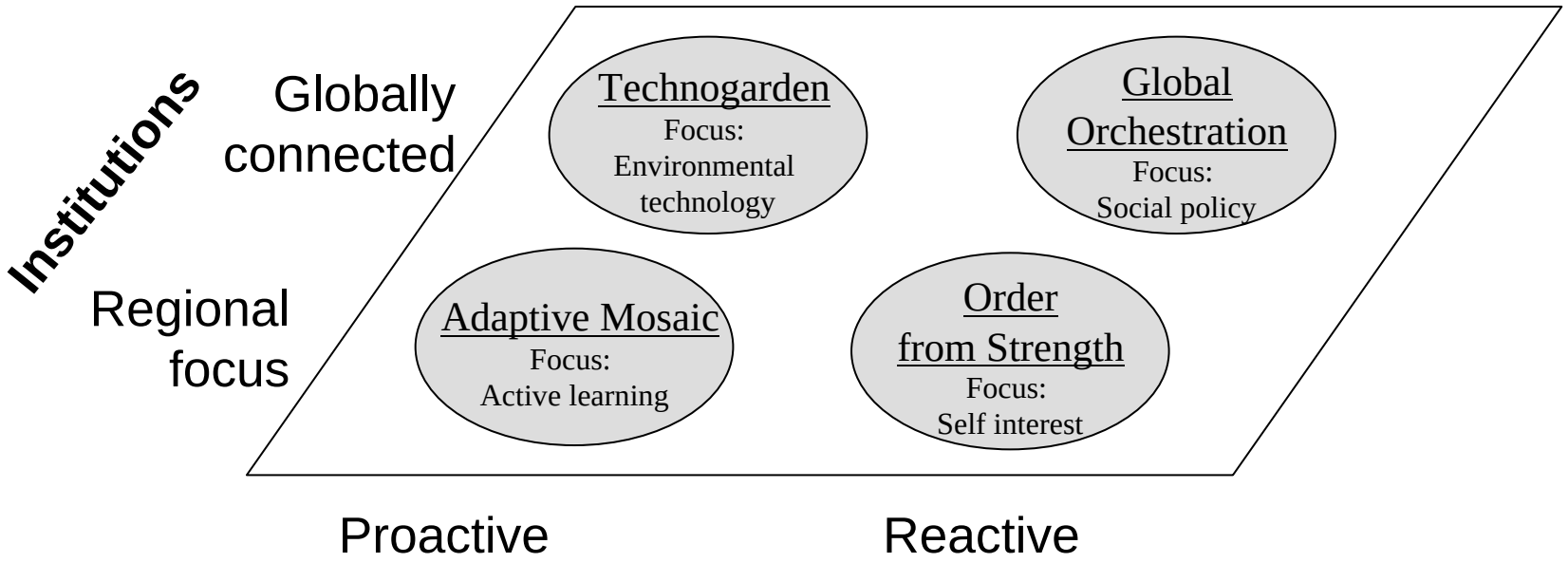
Sub-Global Working Group: all of the above. . .

. . .at sub-global scales

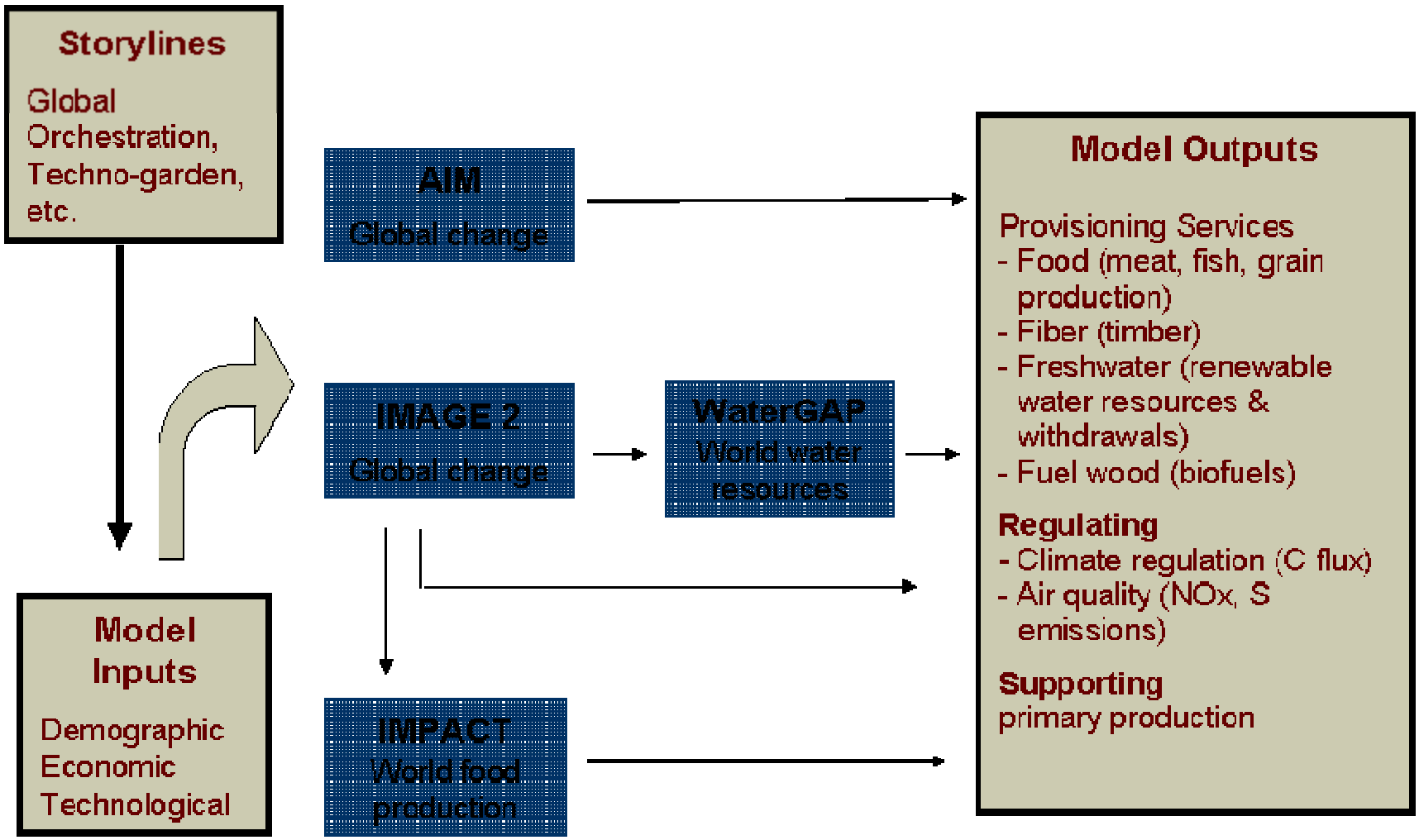
Scenario anatomy (storylines)



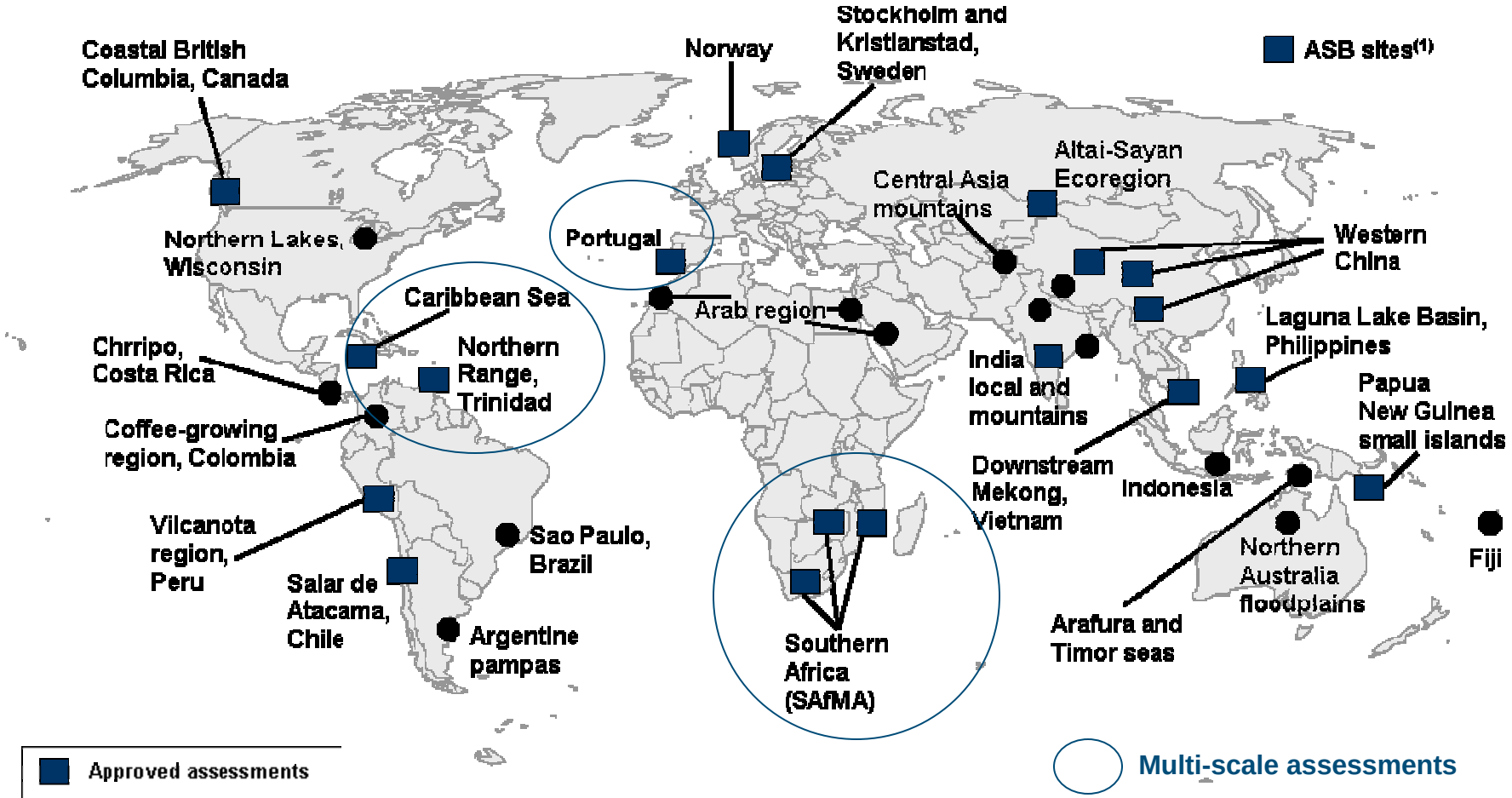
Four global stories



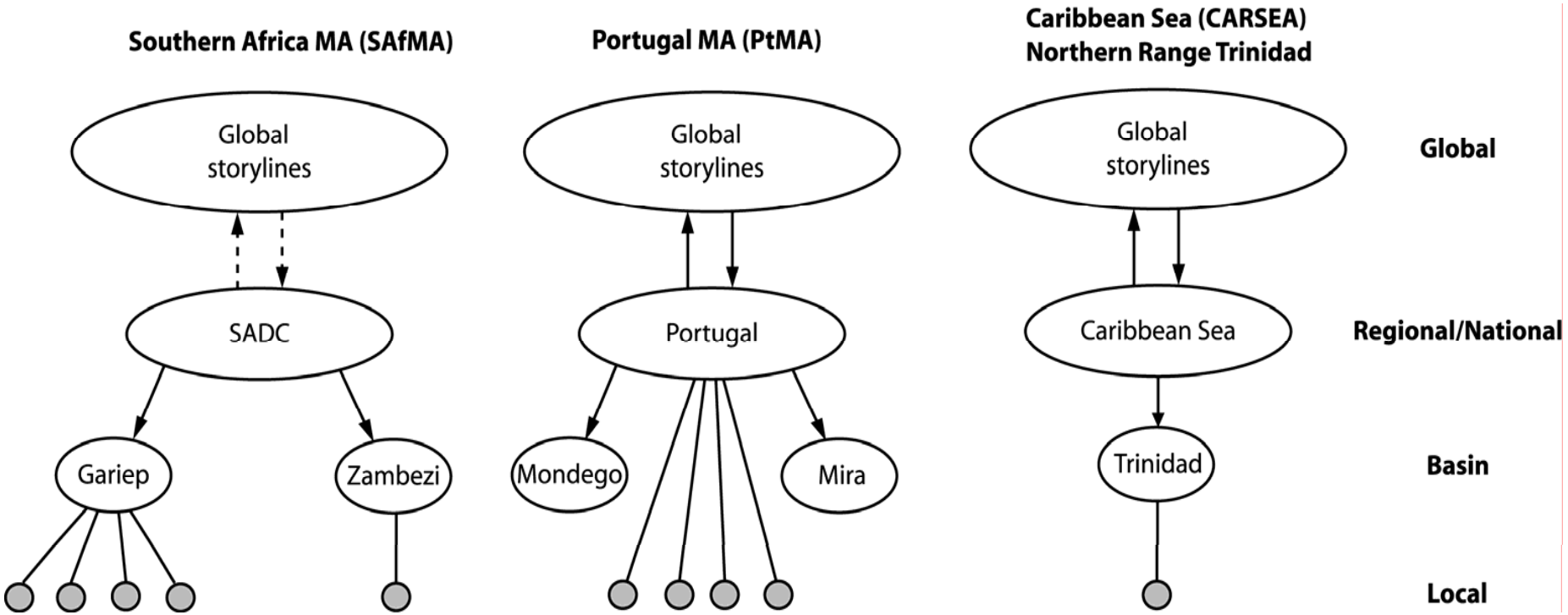
Approach to quantifying the scenarios



Locations of Sub Global Assessments (SGAs). (17 Approved and 16 Associated SGAs)

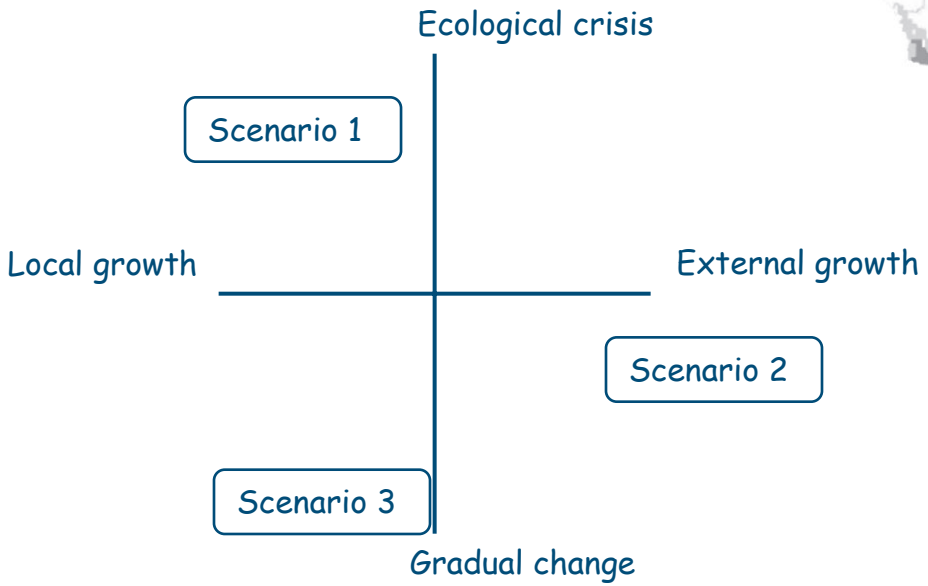


Examples of different multi-scale designs



Examples of scenarios

Wisconsin



SAfMA

Communicating scenarios

Salar de Atacama, Chile

Vilcanota, Peru

SAfMA

Ecosystem services addressed

Ecosystem Service	Sub-global Assessment
Biodiversity	SAfMA, Caribbean Sea, Portugal, Bajo Chirripo, India Local
Water quality and quantity	Goulburn-Broken Catchment, Wisconsin, SAfMA, Portugal,
Soil protection	Portugal
Landscape aesthetics	Wisconsin, Portugal, San Pedro de Atacama
Recreation/Tourism	San Pedro de Atacama, Caribbean Sea

Conclusions from MA

- MA was the first global assessment to explore the SAS approach in all its detail
- MA additionally extensively tackled the multi-scale issue
- MA was very successful in developing stories; models; and multi-scale results
- The MA still stands out as one of the best examples

Further reading

Lebel, L., Thongbai, P., Kok, K. et al. 2006. Sub-global scenarios. Pp. 229-259 in: Capistrano, D., Samper, C.K., Lee, M.J., Rauseppe-Hearne, C. (Eds.), Ecosystems and Human Well-being (Volume 4): **Multiscale assessments**. Findings of the sub-global assessments working group of the Millennium Ecosystem Assessment, Island Press, Washington.

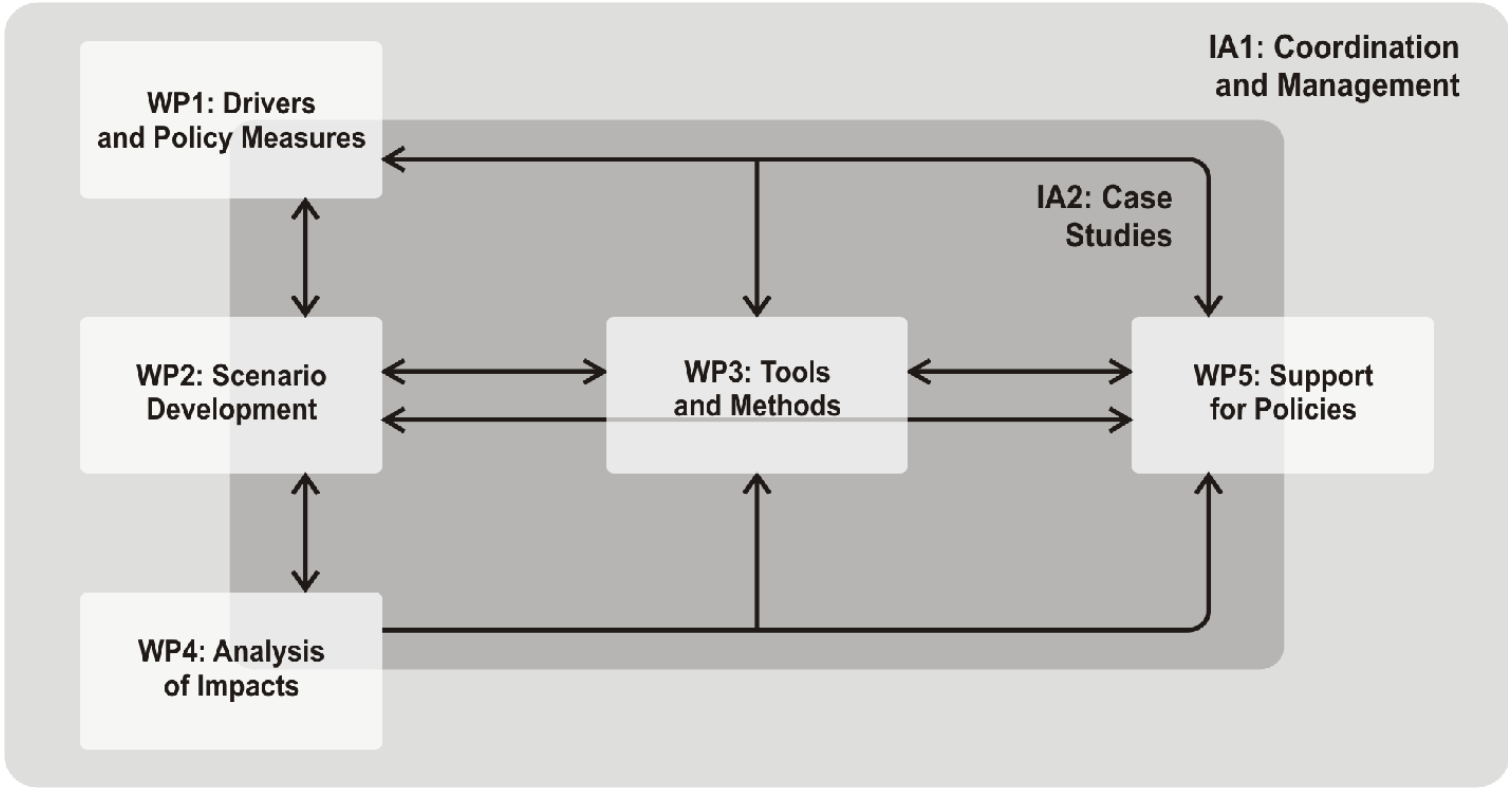
Henrichs, T., Zurek, M., Eickhout, B., Kok, K., Raudsepp-Hearne, C., Ribeiro, T., Van Vuuren, D., Volkery, A. 2010. **Scenario Development and Analysis for Forward-looking Ecosystem Assessments**. Chapter 5 in: UNEP, Ecosystems and Human Well-being: A Manual for Assessment Practitioners. Island Press, Washington.

Alcamo, J., D. van Vuuren, C. Ringler, J. Alder, E. Bennett, D. Lodge, T. Masui, T. Morita, M. Rosegrant, O. Sala, K. Schulze and M. Zurek, 2005: **Methodology for developing the MA scenarios**. Ecosystems and Human Well-Being: Scenarios: Findings of the Scenarios Working Group (Millennium Ecosystem Assessment Series), S.R. Carpenter, P.L. Pingali, E.M. Bennett and M.B. Zurek, Eds., Island Press, Washington, D.C., 145-172.

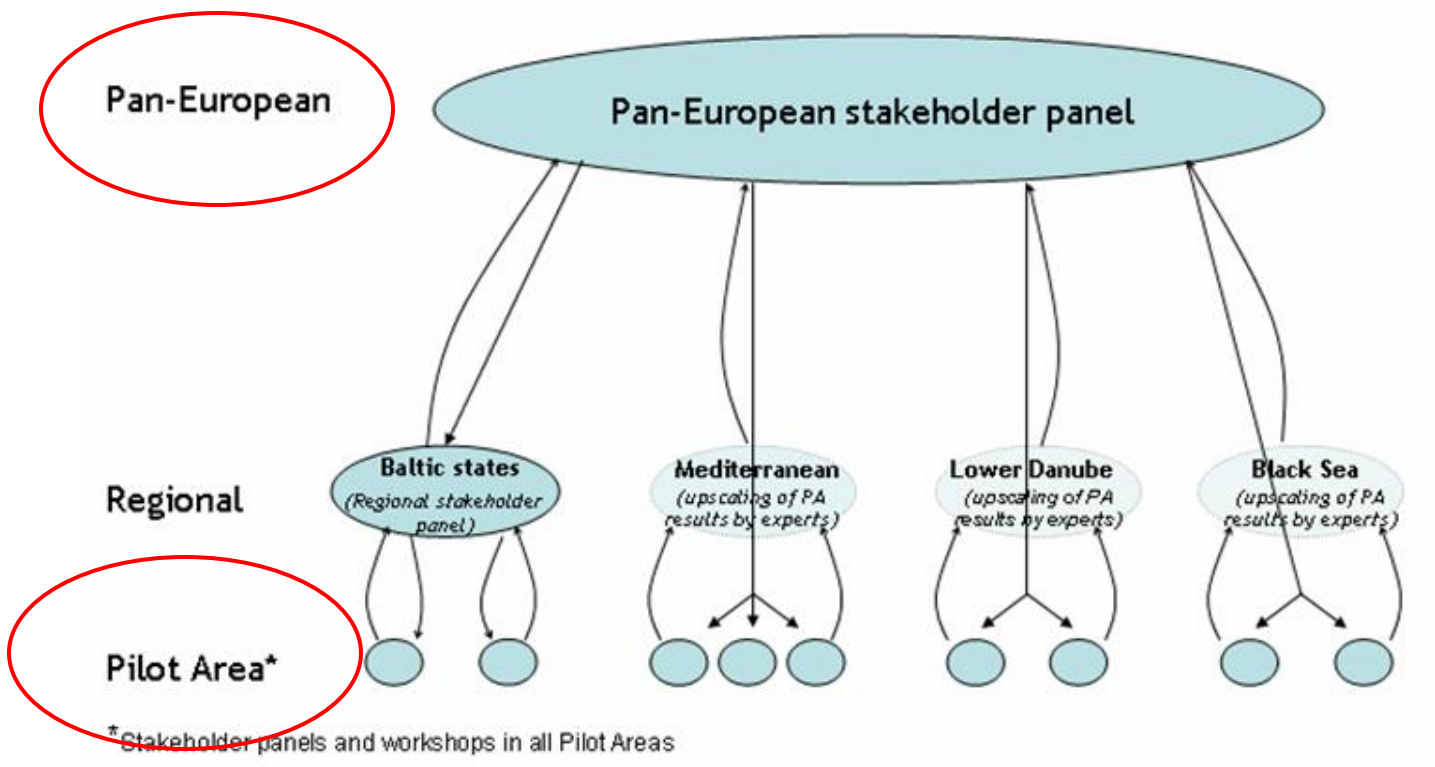
Example 2:

SCENES: Envisioning the Future of Water in Europe

Project set-up



Multi-scale scenario development



Scenario characteristics

Common:

- Participatory with stakeholder workshops
- Co-production of knowledge

Pan-European (PEP):

- Story-And-Simulation
- Main products: stories and model results/indicators

Pilot Areas

- Conceptual modelling
- Main products: FCMs and stories

PEP - Scenario method

Explorative scenarios:

Based on fast-track scenarios for Europe (GEO-4)
Four storylines 2005-2050 in three periods
Focusing on the socio-economic, institutional and cultural system
Input for WaterGap model
Part of the Story-And-Simulation approach

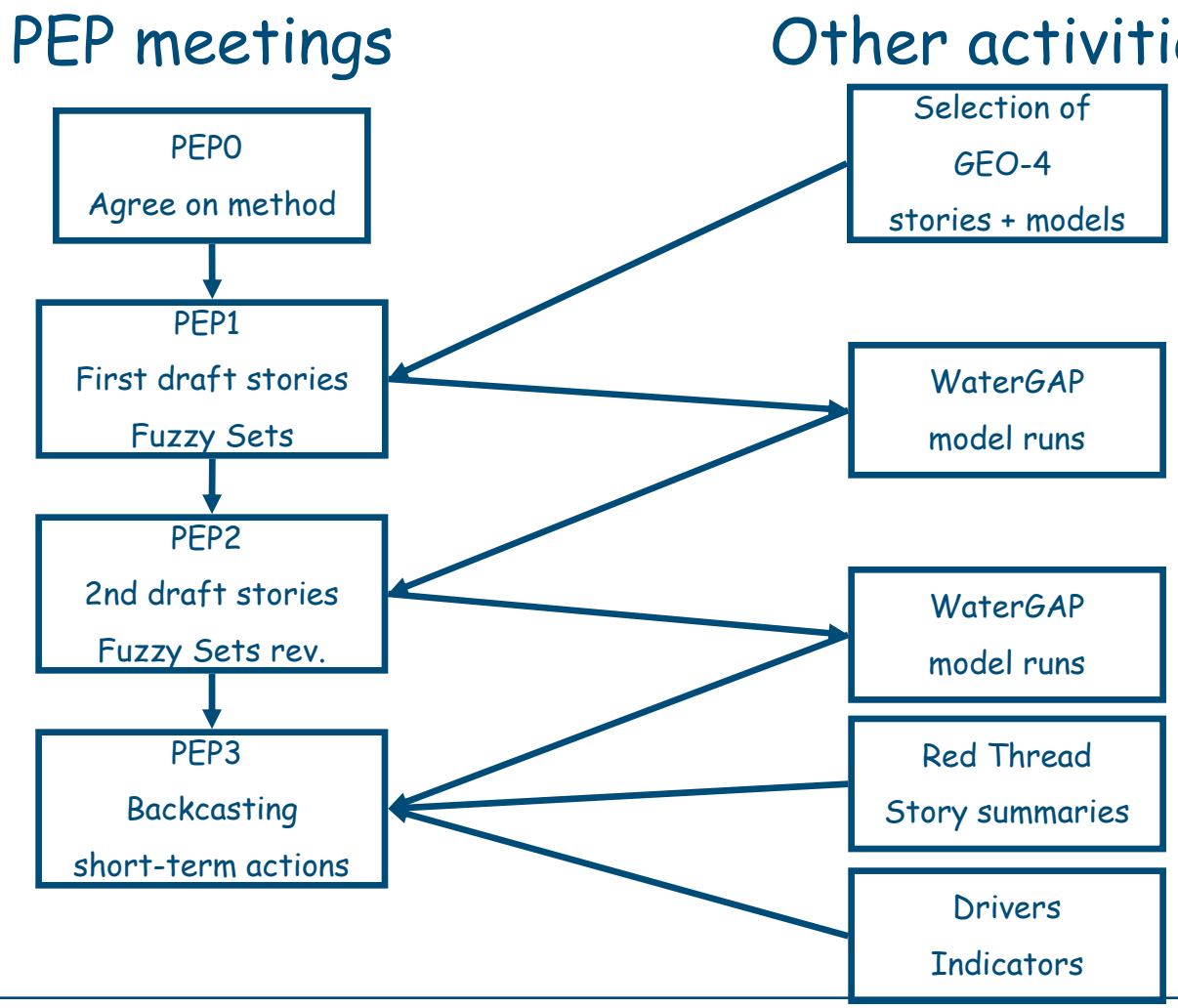
Backcasting scenarios:

Linked to explorative scenarios
Four backcasts 2050-2005 (timelines)
Focusing on short-term (policy) actions

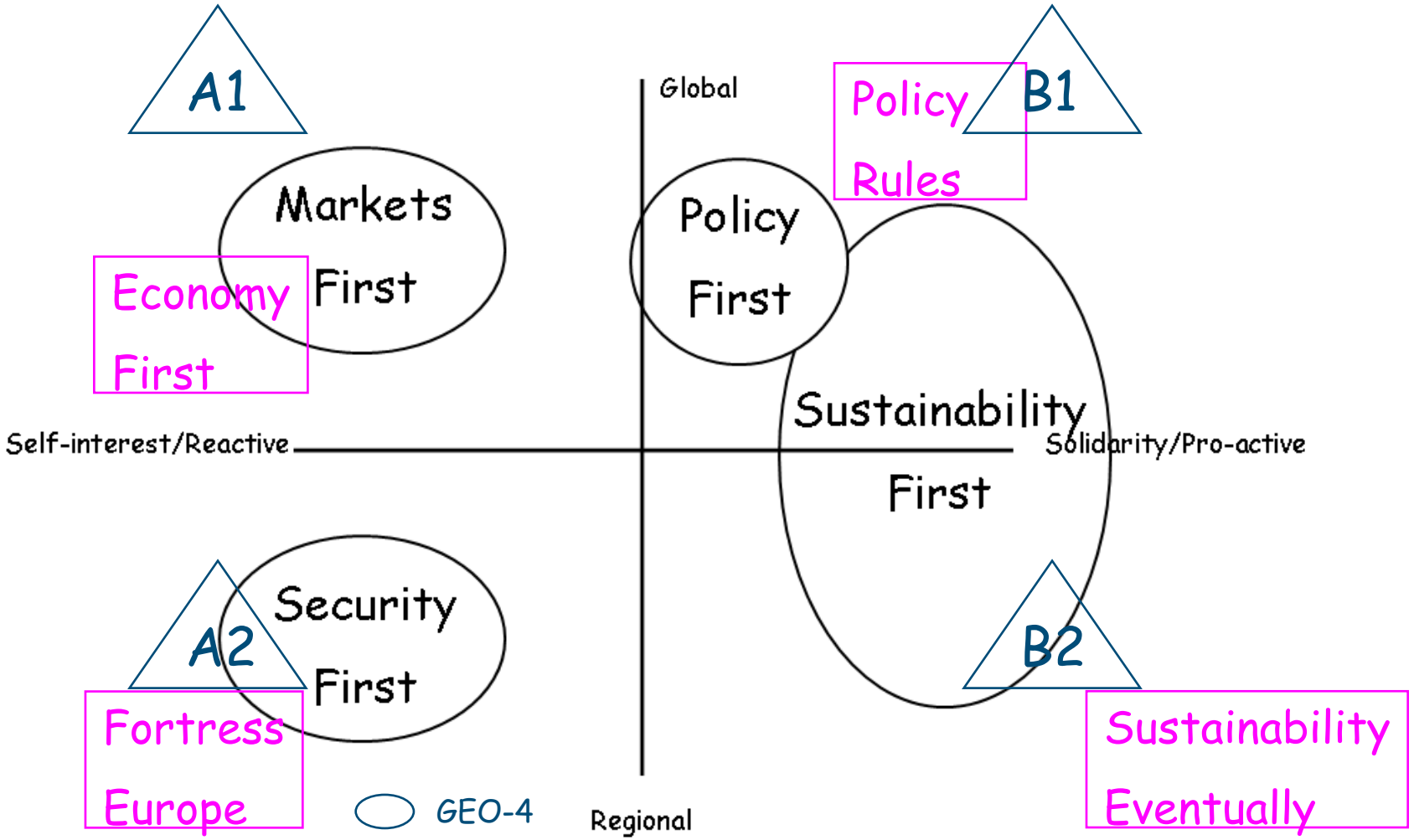
Combination:

Robust strategies and actions
Input for policy recommendations

PEP scenarios – flow of information



Resulting scenario families



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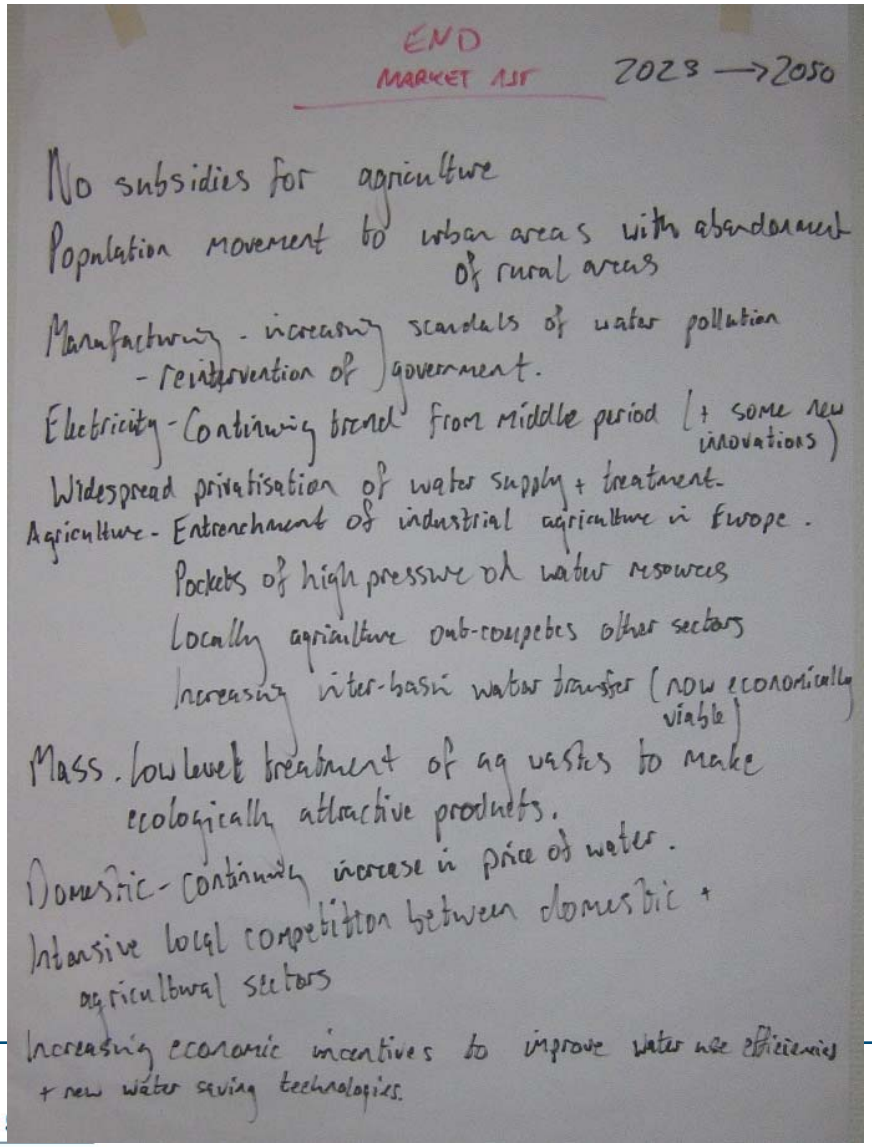
Results - Stories



END
MARKET 1st 2023 → 2050

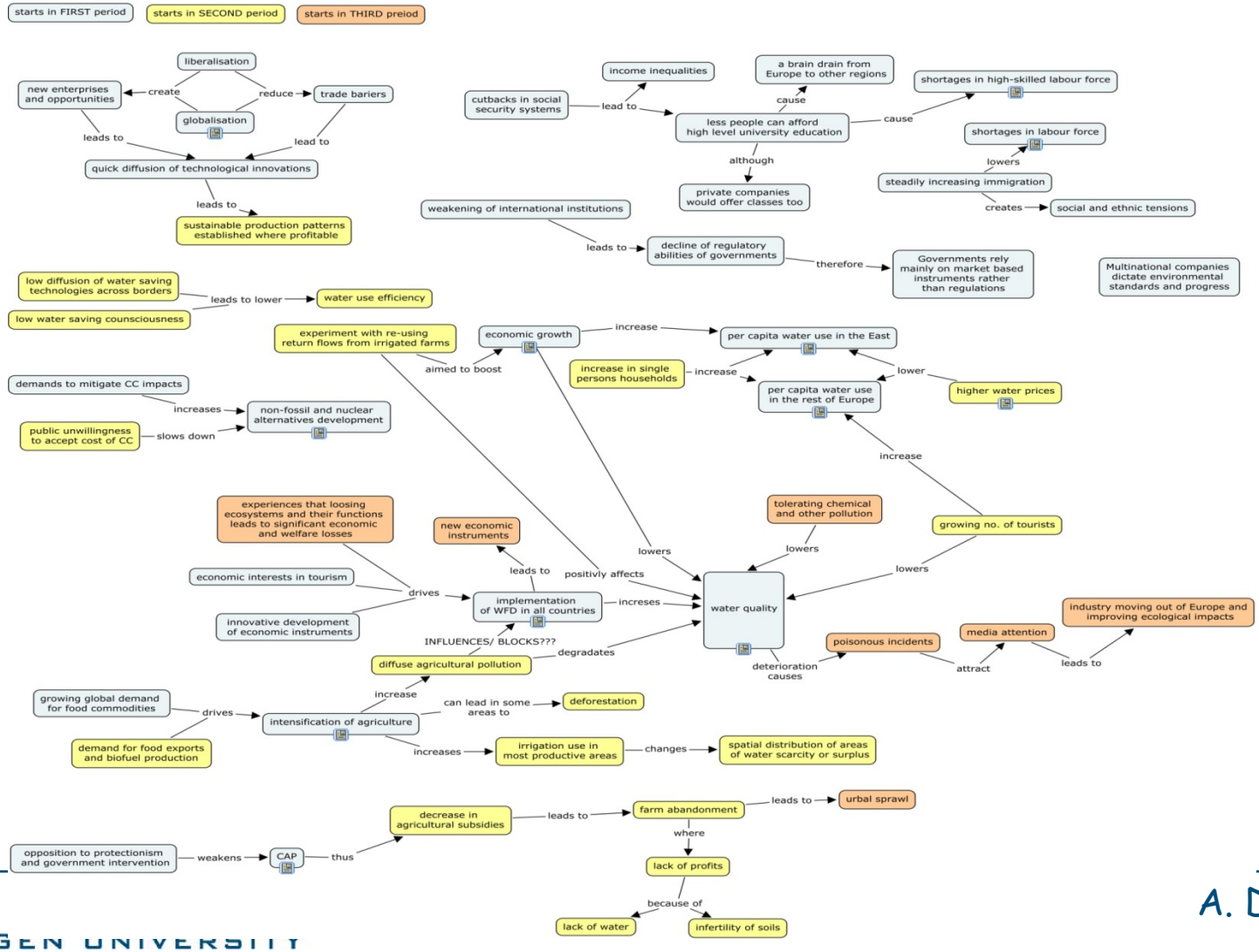
No subsidies for agriculture
Population movement to urban areas with abandonment of rural areas
Manufacturing - increasing scandals of water pollution
- reintervention of government.
Electricity - Continuing trend from middle period (+ some new innovations)
Widespread privatisation of water supply + treatment.
Agriculture - Entrenchment of industrial agriculture in Europe.
Pockets of high pressure on water resources
Locally agriculture out-competes other sectors
Increasing inter-basin water transfer (now economically viable)
Mass. low level treatment of ag wastes to make ecologically attractive products.
Domestic - continuing increase in price of water.
Intensive local competition between domestic + agricultural sectors
Increasing economic incentives to improve water use efficiencies + new water saving technologies.

Results - Stories

"After years of agricultural intensification and declining extensive agriculture, the population moves from rural to urban areas causing urban sprawl. One result is the *fragmentation of agricultural land and natural areas near urban centres. The impact of these changes is very diverse across Europe."*

(taken from Markets First; 2025-2050)

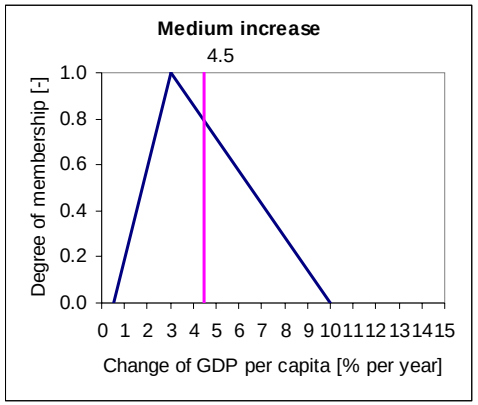
Results – Conceptual models



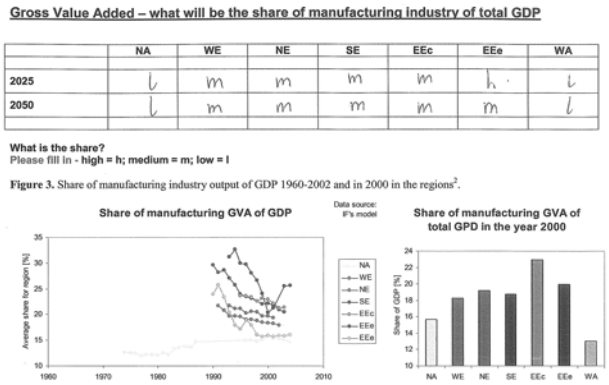
A. Dubel

Results – Quantified parameters

Region	Markets First	
	2005-2025	2025-2050
WE	Medium increase	Low increase
CE	Medium increase	Low increase
EE	Medium increase	Medium to high increase



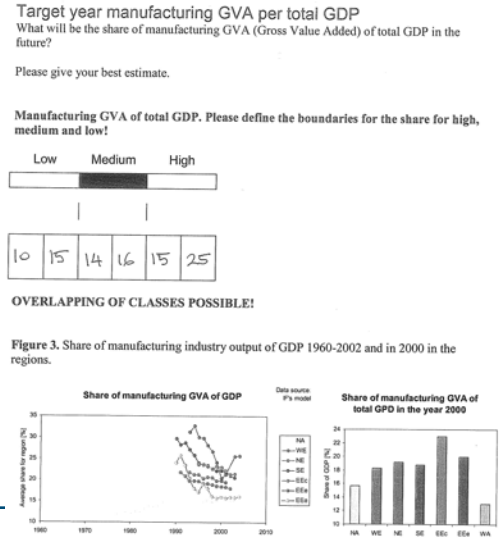
Region	Markets First	
	2005-2025	2025-2050
WE	+ 4.5	+ 2.3
CE	+ 4.5	+ 2.3
EE	+ 4.5	+ 2.3 -4.5


Gross Value Added – what will be the share of manufacturing industry of total GDP

	NA	WE	NE	SE	EEc	EEe	WA
2025	l	m	m	m	m	h	l
2050	l	m	m	m	m	m	l

What is the share?
Please fill in - high = h; medium = m; low = l

Figure 3. Share of manufacturing industry output of GDP 1960-2002 and in 2000 in the regions[2].


Target year manufacturing GVA per total GDP

What will be the share of manufacturing GVA (Gross Value Added) of total GDP in the future?

Please give your best estimate.

Manufacturing GVA of total GDP. Please define the boundaries for the share for high, medium and low!

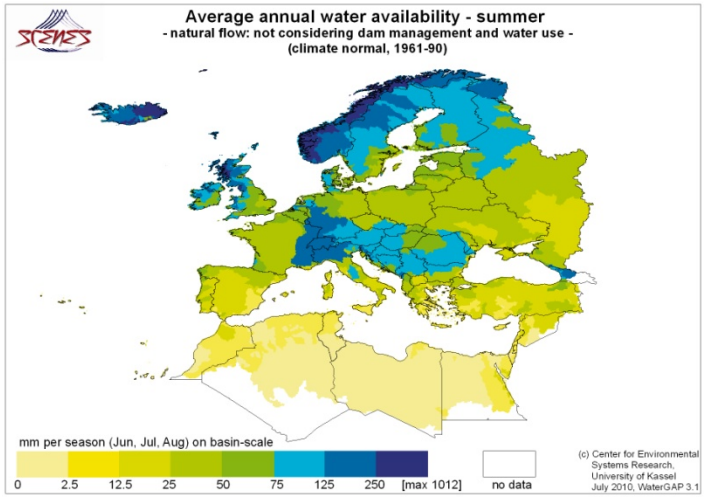
Low Medium High

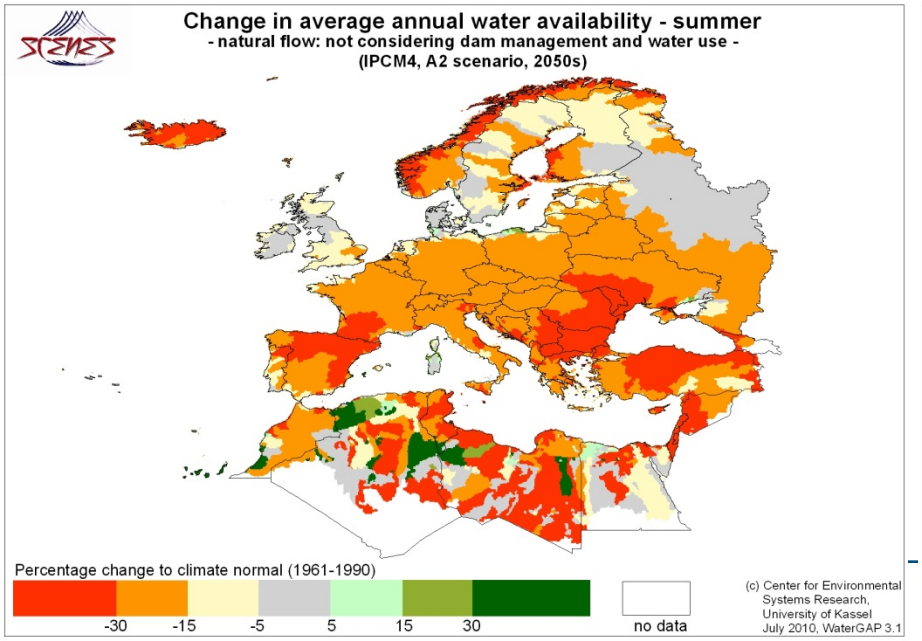
10	15	14	16	15	25

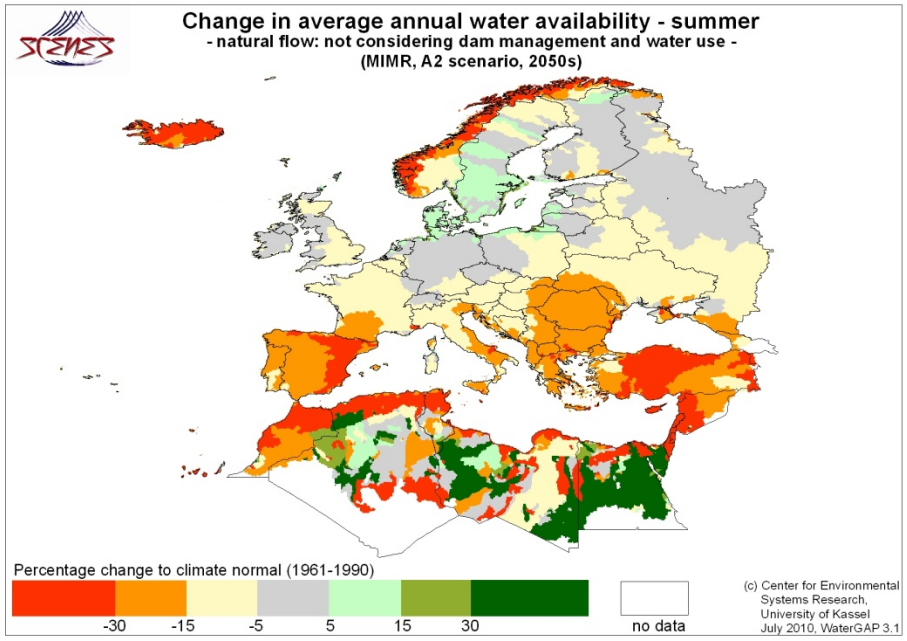
OVERLAPPING OF CLASSES POSSIBLE!

Figure 3. Share of manufacturing industry output of GDP 1960-2002 and in 2000 in the regions.

Results – Model output

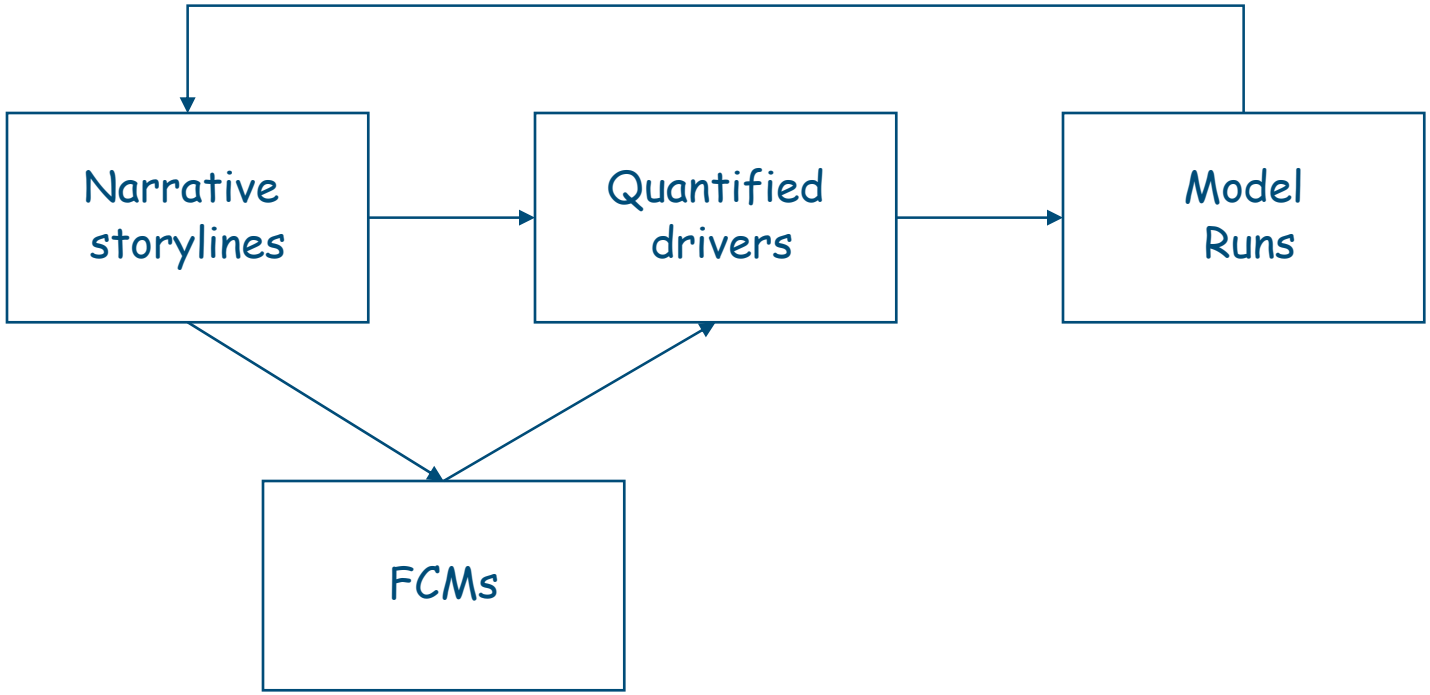






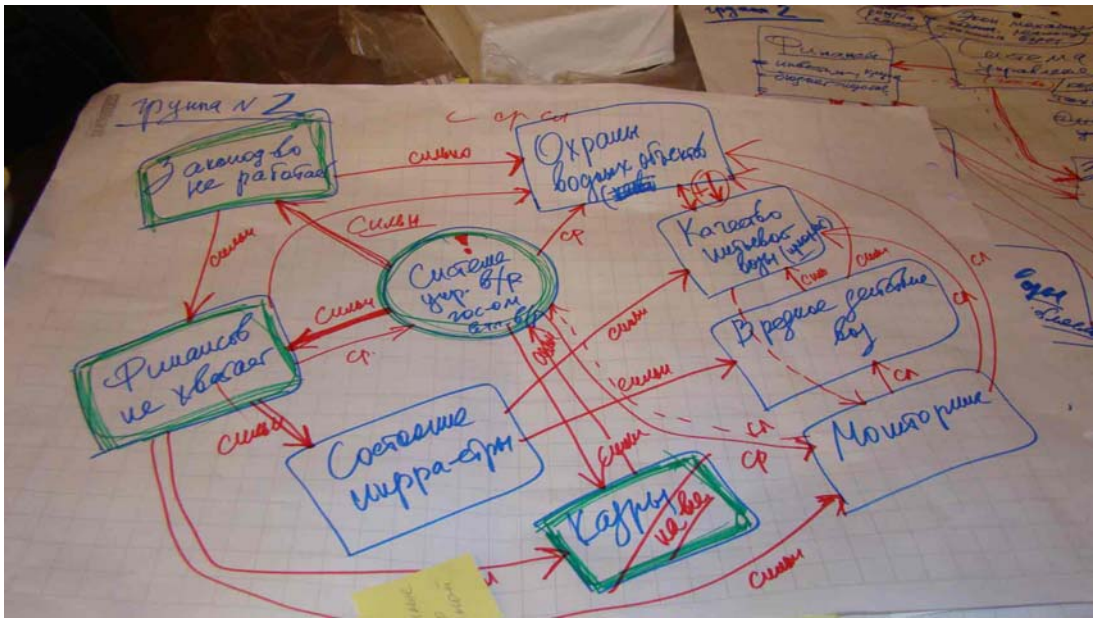
Pilot area scenarios

The role of Fuzzy Cognitive Maps



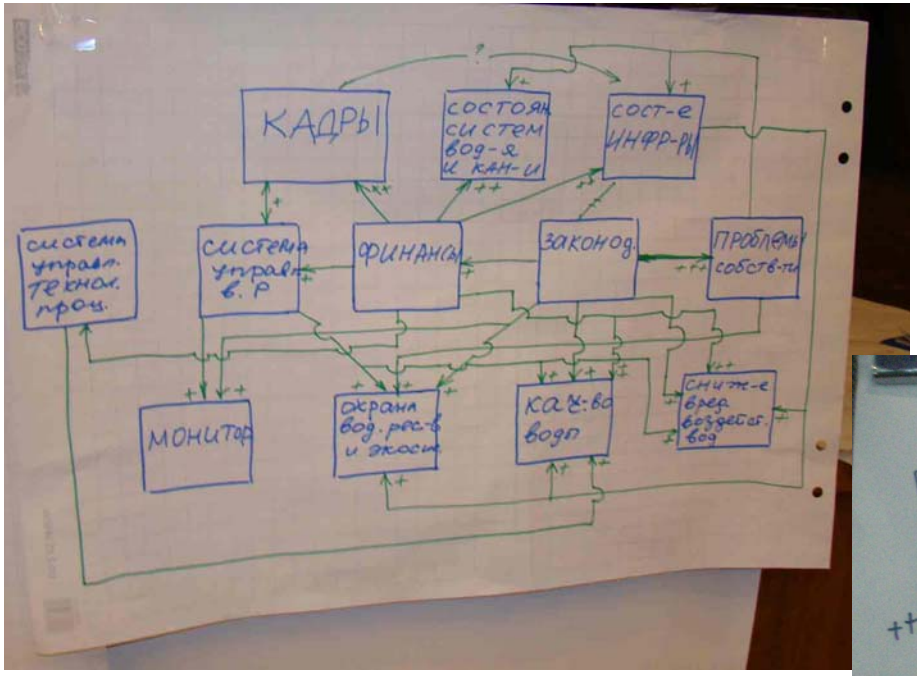
Participatory FCMs – creative process

Guadiana - Spain



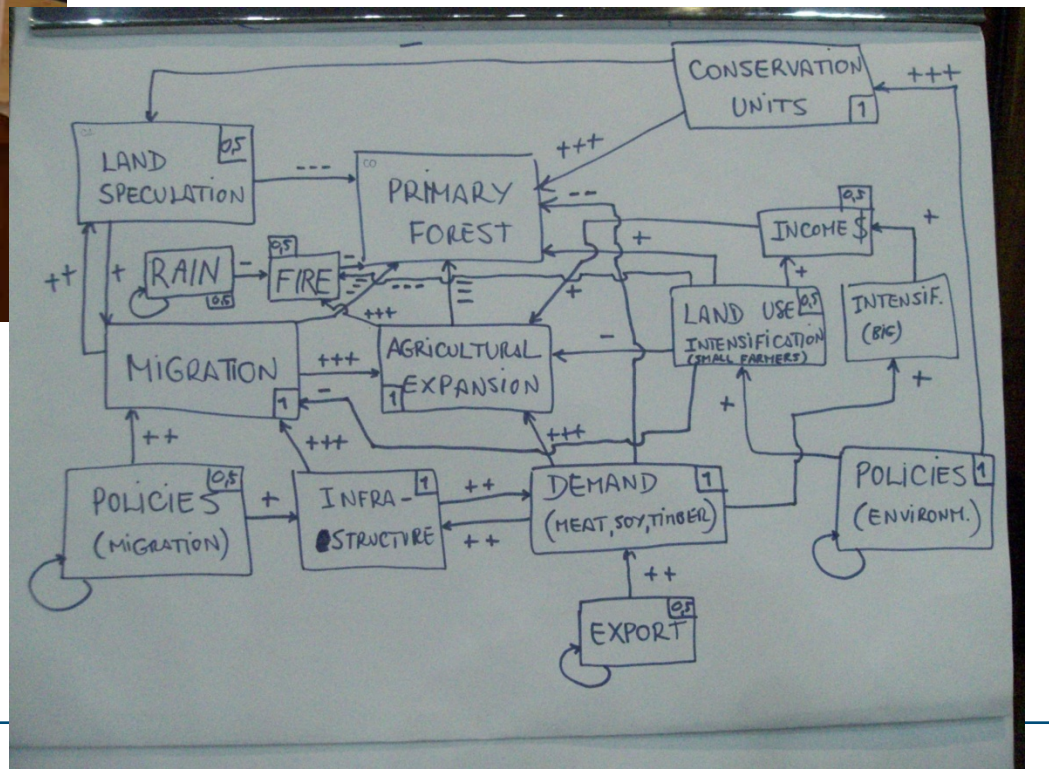
Crimea - Ukraine

Participatory FCMs – structured consensus

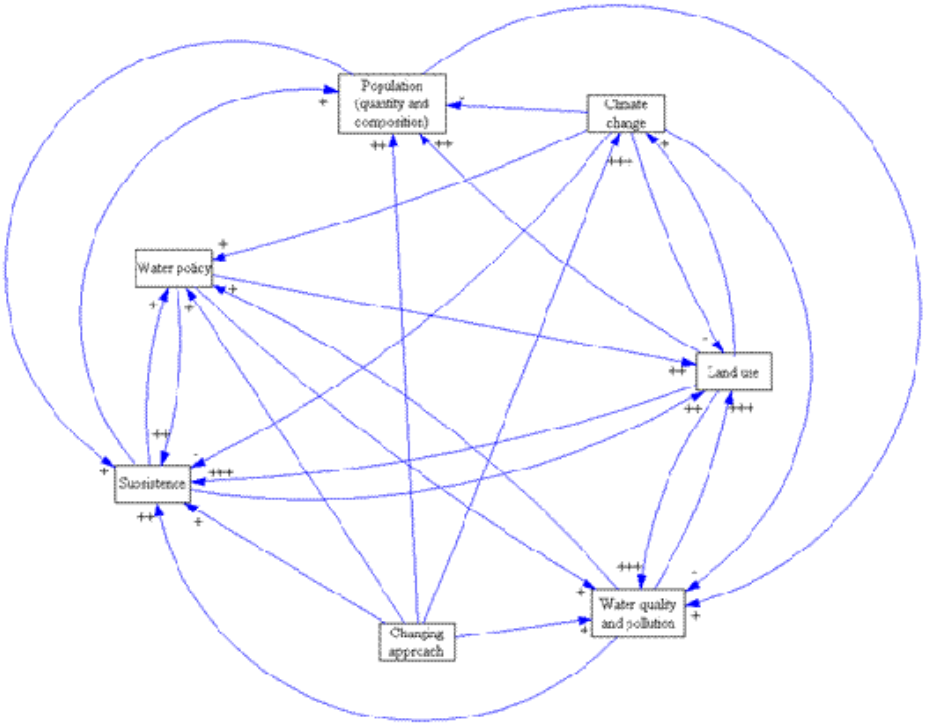


Crimea - Ukraine

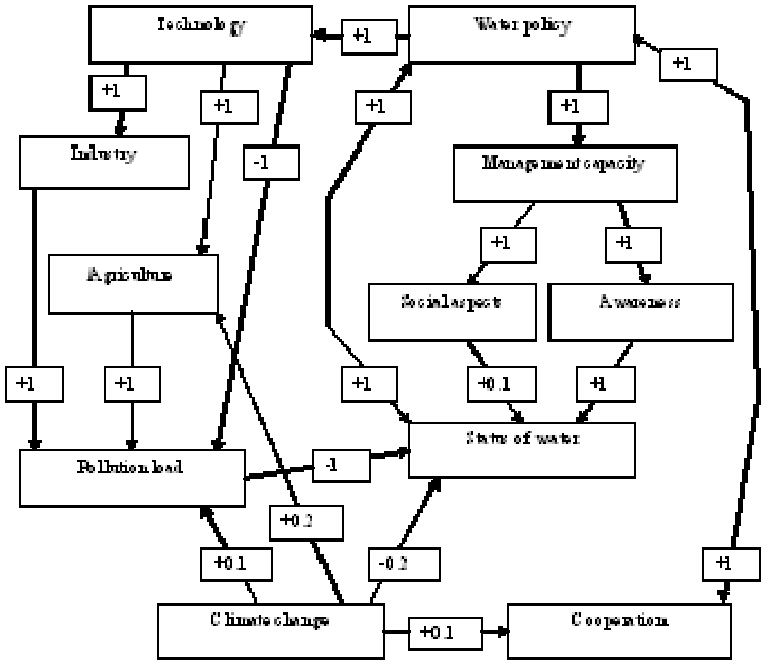
Manaus - Brazil



Participatory FCMs – group model building

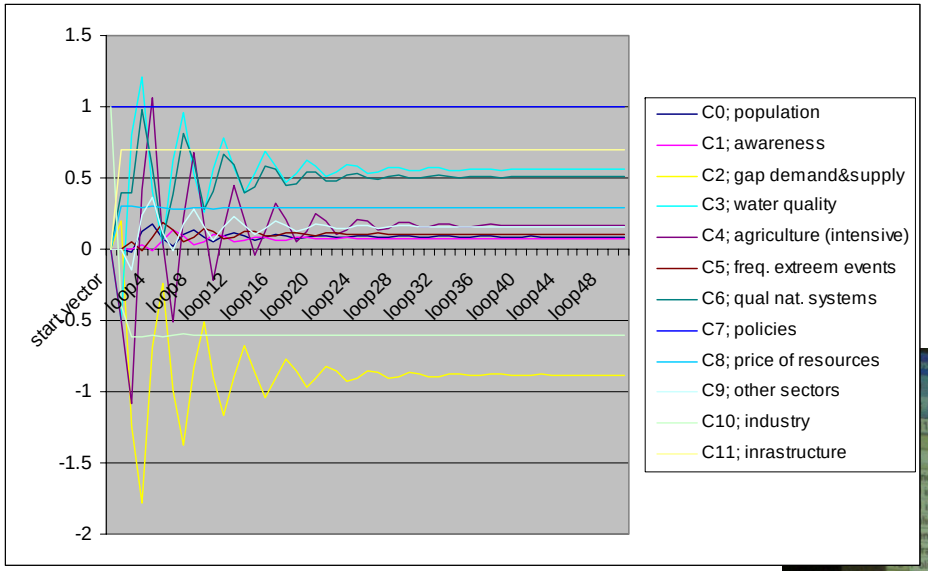


Lower Tisza - Hungary



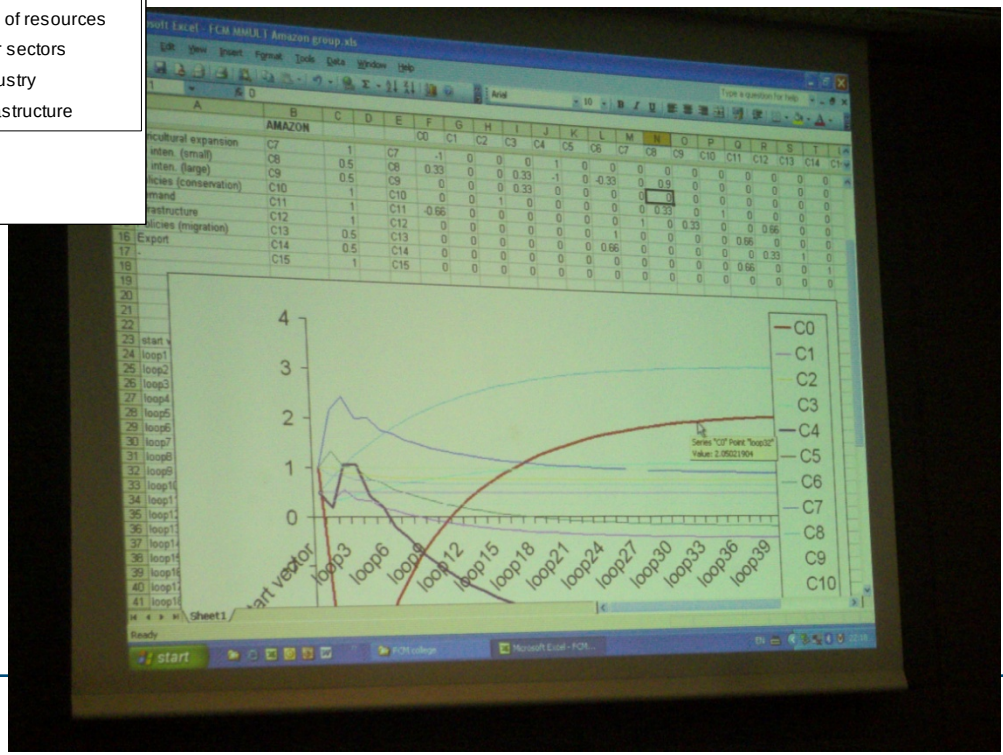
Lake Peipsi - Estonia

Participatory FCMs – dynamic output



Crimea - Ukraine

Manaus - Brazil



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Fuzzy Cognitive Maps – summary

Advantages ("QUICK"):

- *Easy to develop and apply*. The approach is highly intuitive, it can quickly be explained and applied to any new situation.
- *High level of integration*.
- *Forces users to be explicit* and facilitates a concrete discussion.

Disadvantages ("DIRTY"):

- *Relationships are only semi-quantified*. It is difficult to interpret the output in absolute terms.
- *Time is ill-defined*. Factors included in the system do not usually all operate at the same temporal scale. FCM does not adequately deal with these time-mismatches.
- *Being concrete requires expert opinions*. Especially when developing a FCM from scratch requires a high level of understanding of all participants.

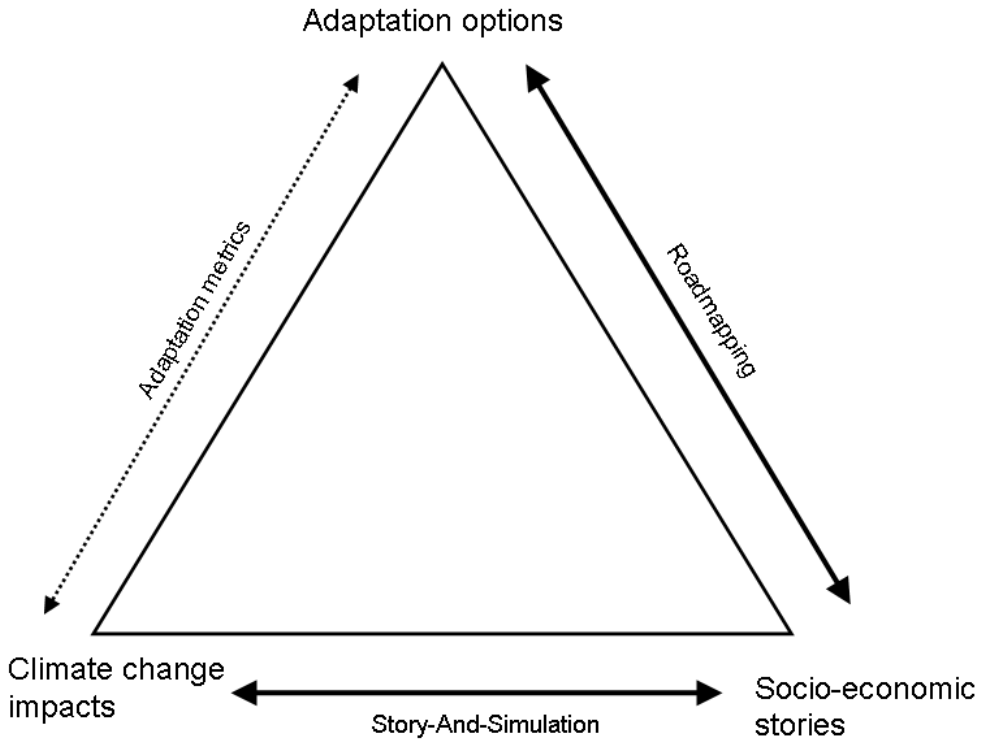
Conclusions from Scenes

- Scenes was an important test-case of the SAS approach
- In terms of scenario development, Scenes was successful on almost all accounts
- It showed that it was possible to increase the number of iterations, and increase consistency between models and stories
- It furthermore showed the importance of additional tools to strengthen the link between qual and quan: Fuzzy Sets and a number of Conceptual Modelling techniques

Example 3:

CLIMSAVE – adaptation to climate change

Scenario development framework



Scenario development framework

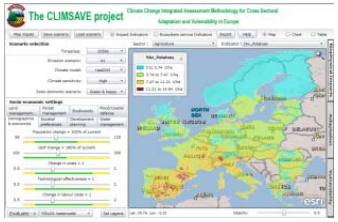
Similar to SCENES:

- Participatory with stakeholder workshops
- SAS approach with stories and models

Novel aspects:

- Development of online Integrated Assessment Platform
- More focus on normative (adaptation) options and robust strategies

The CLIMSAVE IA Platform



Databases

Urban

Snow cover

Crop yields

Forestry

Pests & diseases

Hydrology

Water availability

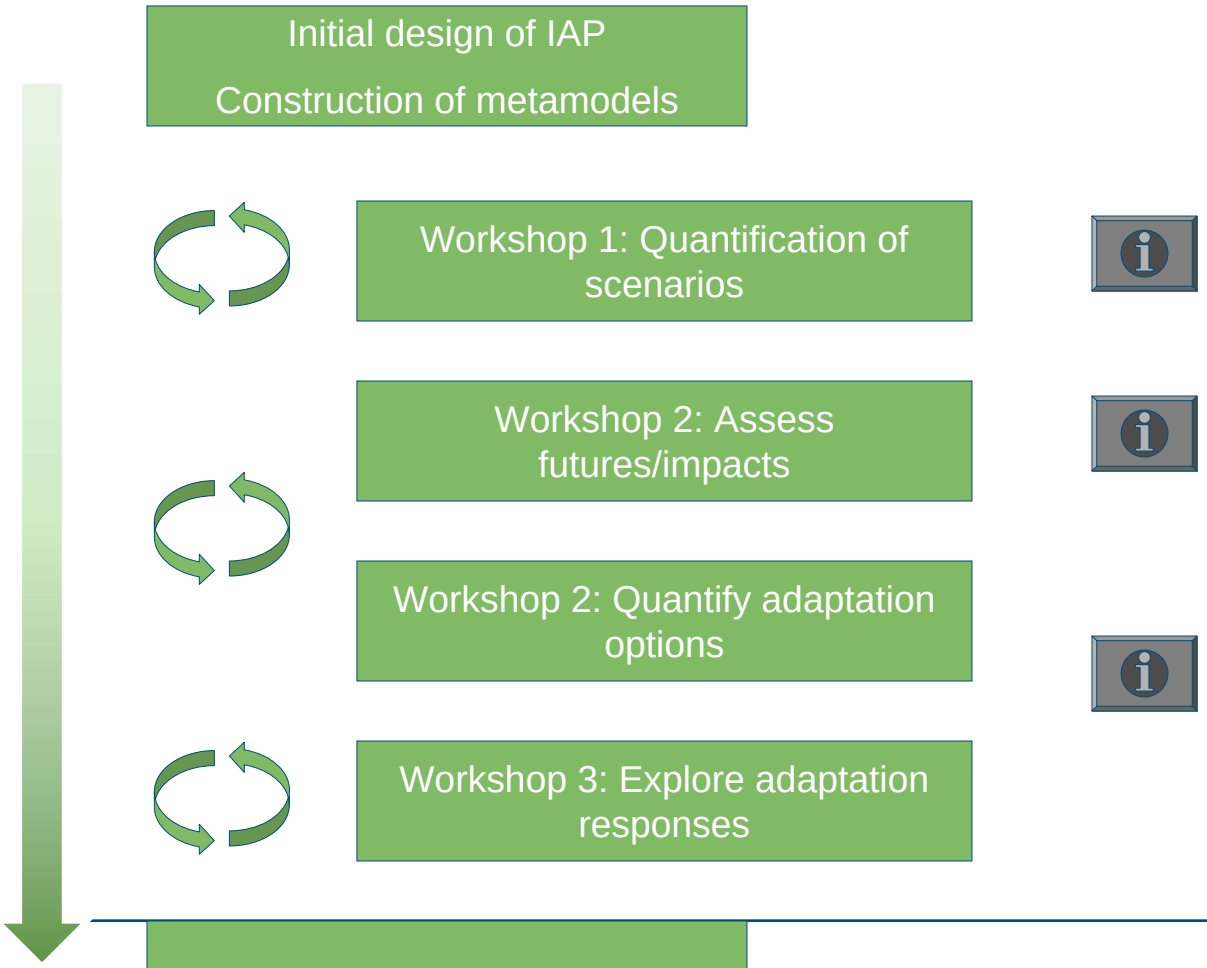
Flooding

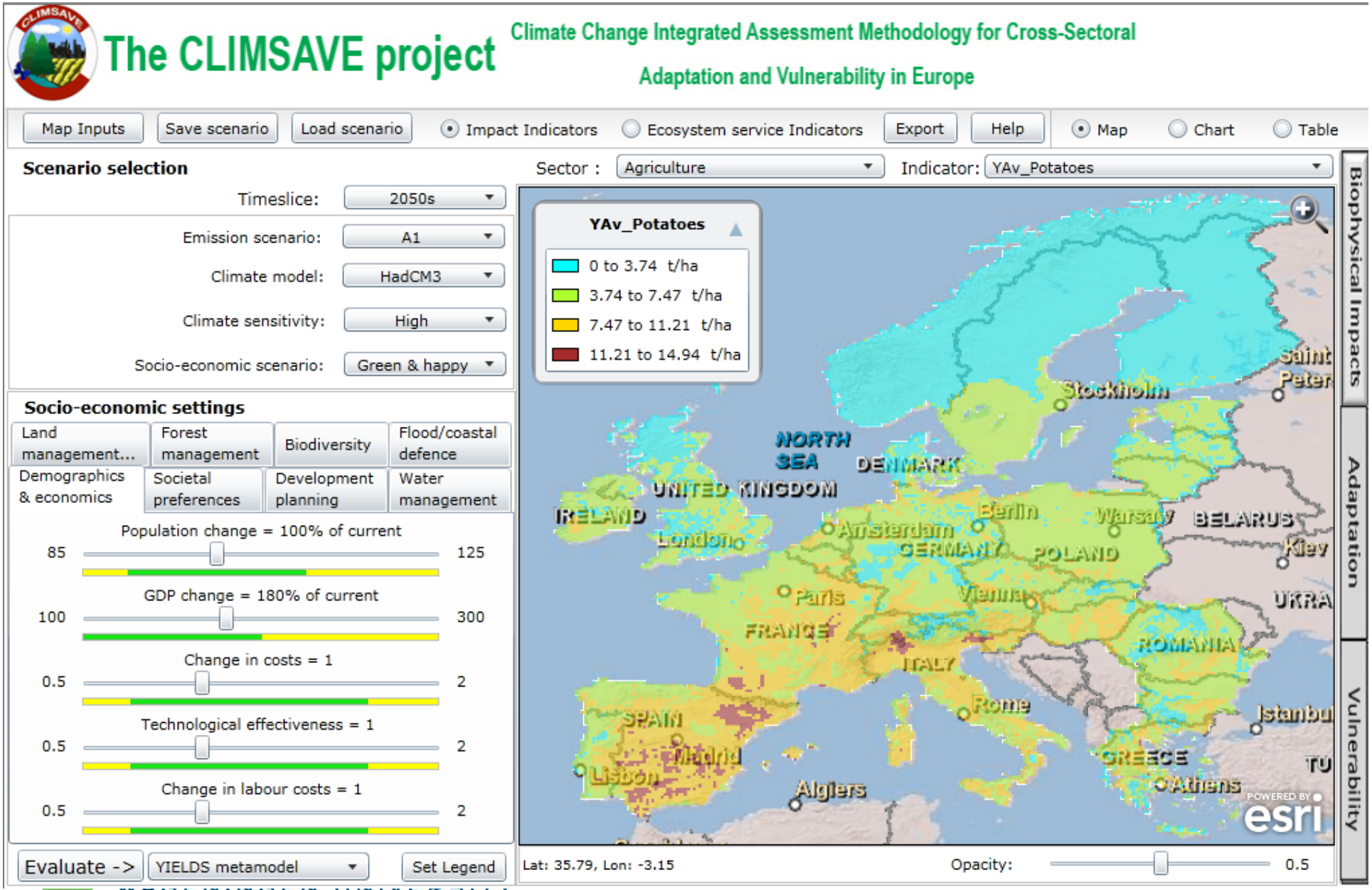
Rural land allocation

Water use

Biodiversity

The IAP development process




The CLIMSAVE project
Climate Change Integrated Assessment Methodology for Cross-Sectoral Adaptation and Vulnerability in Europe
Map Inputs
Save scenario
Load scenario
Impact Indicators
Ecosystem service Indicators
Export
Help
Map
Chart
Table
Scenario selection
Timeslice: 2050s
Emission scenario: A1
Climate model: HadCM3
Climate sensitivity: High
Socio-economic scenario: Green & happy
Socio-economic settings
Land management...
Forest management
Biodiversity
Flood/coastal defence
Demographics & economics
Societal preferences
Development planning
Water management
Population change = 100% of current
85
125
GDP change = 180% of current
100
300
Change in costs = 1
0.5
2
Technological effectiveness = 1
0.5
2
Change in labour costs = 1
0.5
2
Evaluate ->
YIELDS metamodel
Set Legend
Sector : Agriculture
Indicator: YAv_Potatoes
YAv_Potatoes
0 to 3.74 t/ha
3.74 to 7.47 t/ha
7.47 to 11.21 t/ha
11.21 to 14.94 t/ha
NORTH SEA
DENMARK
UNITED KINGDOM
IRELAND
London
Amsterdam
Berlin
Warsaw
BELARUS
GERMANY
POLAND
Paris
Vienna
FRANCE
ROMANIA
ITALY
Rome
SPAIN
Madrid
Lisbon
Algiers
GREECE
Athens
Istanbul
Stockholm
Saint Peter
Kiev
Lat: 35.79, Lon: -3.15
Opacity:
0.5
Biophysical Impacts
Adaptation
Vulnerability
WAGENINGEN UR

The CLIMSAVE project

Climate Change Integrated Assessment Methodology for Cross-Sectoral Adaptation and Vulnerability in Europe

View capital maps | Save / Load scenario | Impact Indicators | Ecosystem service Indicators | Export | Help

Scenario settings

2020s | A2 | HadCM3 | High | Green & happy

Sector / Ecosystem service: Cultural

Indicator: Charismatic species

Responses

Rural planning | Urban planning | Biodiversity planning | Water planning

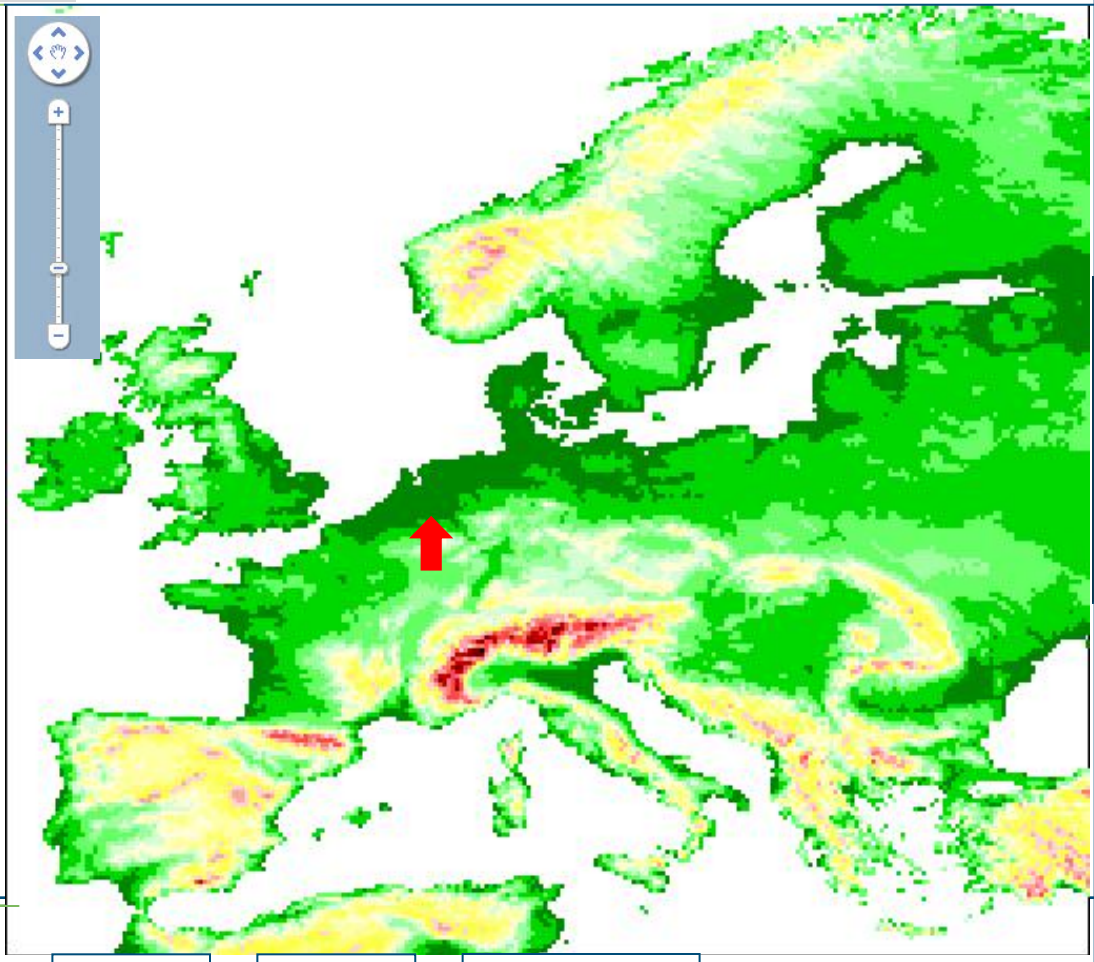
Instructions

- Yield change due to technology (15%) — 0 … 30
- Irrigation efficiency = 0% increase — 0 … 30
- Irrigation price = 280% of current — 0 … 300
- Change in bioenergy production (560 PJ) — 0 … 1000

Capital meter

Very Low … High

Natural
Manufactured
Human
Social
Financial



Biophysical Impacts | Adaptation | Vulnerability

To baseline | Run for 2020s | To 2050s

Lat: 49.8 | Long: +6.8 | Value: 49.8%

Biodiversity | Food | Water | Flooding | Forest | Aggregated indicators

Conclusions from examples

- Scenarios come in many shapes and forms
- The Story-And-Similation approach has emerged as the state-of-the-art and has proven its functionality
- The approach has spurred to development and adoption of a growing number of tools and methods
- Testing continues in a number of projects
- Focus is shifting from the 'classic' SAS to the role of Conceptual Models, Fuzzy Sets, and online platforms.
- In short, SAS has been operationalised

Scenarios – a toolbox of methods

	Qualitative	Semi-quantitative	Quantitative
Present		Fuzzy Cognitive Maps Causal Loop Diagrams Bayesian Belief Networks	Data
Long-term future	Stories Collages Visions	Causal Loop Diagrams	(spatial) Models Online platforms
Short-term actions	Backcasting Strategies Robust actions	Fuzzy Cognitive Maps	Indicators

Scenarios and REDD

1. How could scenarios support the progress of REDD+?

Type of scenario: Existing stories and models

Role:

- Identify links with REDD and mapped uncertainties to steer direction.
- Identify feedbacks and connections of REDD with others aspects (conservation; rural livelihoods; climate)

2. How can scenarios help stakeholders plan a REDD programme?

Type of scenario: qualitative or semi-quantitative; backcasting; national(?)

Role:

- Excellent tool for stakeholder engagement & co-production of knowledge
- Explore socio-economic and institutional steps that are needed for planning REDD programmes

Scenarios and REDD

3. How can scenarios help stakeholders analyse/visualise the benefits and impacts of a REDD program in a country?

Type of scenario: full Story-And-Simulation, preferrably multi-scale, and perhaps linking exploratory and backcasting scenarios

Roles:

Exploratory scenarios structure fundamental uncertainties

Exploratory scenarios can demonstrate the plausible window of deforestation etc.

Backcasting can help making robust decisions in the face of these uncertainties

A mix of qual/quan can help building an integrated picture of future changes including deforestation, degradation and afforestation and its socio-economic and institutional drivers.

Final conclusions

- The issues related to REDD are very complex and therefore inherently and fundamentally uncertain.
- Scenarios are an essential tool to structure uncertainties and facilitate making decision in the light of those uncertainties
- The tools and methods (e.g. SAS) are available, operational, and (partly) tested.
- Scenario development should be a essential part of any effort to set up REDD programmes

Background information

Example 1: www.millenniumassessment.org

Example 2: www.environment.fi/syke/scenes

Example 3: www.climsave.eu

Further reading:

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Questions?