LUCCi Land Use and Climate Change Interactions in Central Vietnam

Land and water resources development scenarios in the VGT B river basin, Vietnam

Project duration: July 2010 – June 2015

LUCCi Coordination:

- Institute for Technology and Resources Management in the Tropics and Subtropics, ITT, at the Cologne University of Applied Sciences
- Vietnam Academy for Water Resources, Center for Training and International Cooperation (VAWR)

Main German research partners :

- Department for Remote Sensing, Friedrich-Schiller-University of Jena
- Department of Geoinformatics, Hydrology and Modelling, Friedrich-Schiller-University of Jena
- Institute of Environmental Engineering and Ecology, Ruhr University Bochum
- Institute for Meteorology and Climate Research, Atmospheric Environmental Research, (KIT)
- Secretariat for the International Hydrological Programme (IHP) of UNESCO and the Hydrology and Water Resources Programme (HWRP) of WMO at the Federal Institute of Hydrology, Koblenz

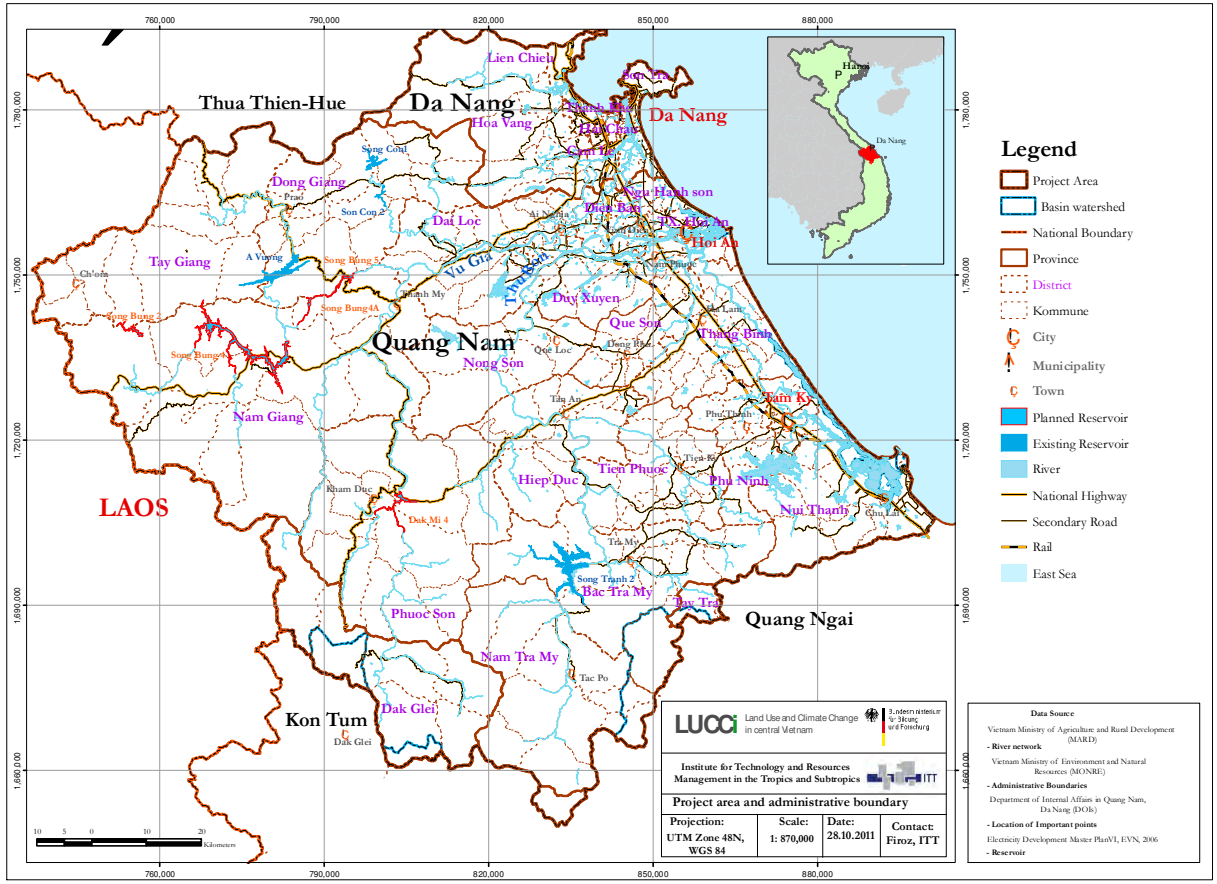
Main Vietnamese research partners

- Hue University of Agriculture and Forestry (HUE)
- IMHEN (MONRE)
- Ministry of Agriculture and Rural Development REDD (MARD)

International partner institutions

- International Rice Research Institute, IRRI, CGIAR (Philippines)
- UN REDD
- UNDP Disaster Risk Management Programme (MARD)

-Project Region-



- Vu Gia-Thu Bon River Basin
- whole Quang Nam Province
- whole Da Nang Province
- Size: around 12,000 km^2
- Population: 1,873,500 inhabitants (urban: 36.5%)

Project Region: Vu Gia Thu Bon River Basin

- Rainfall: 2000 – 4000 mm p.a (wet season: 60-80%)
- Topography: up to >2000 m in the mountainous area, large flood plain
- Agricultural landuse: 220,040 ha (paddy rice 61%)

Overall goal:

Provide a sound future land and water use management framework that considers socio-economic development, population growth and expected impacts of climate change on land and water resources…for the VGTB river Basin

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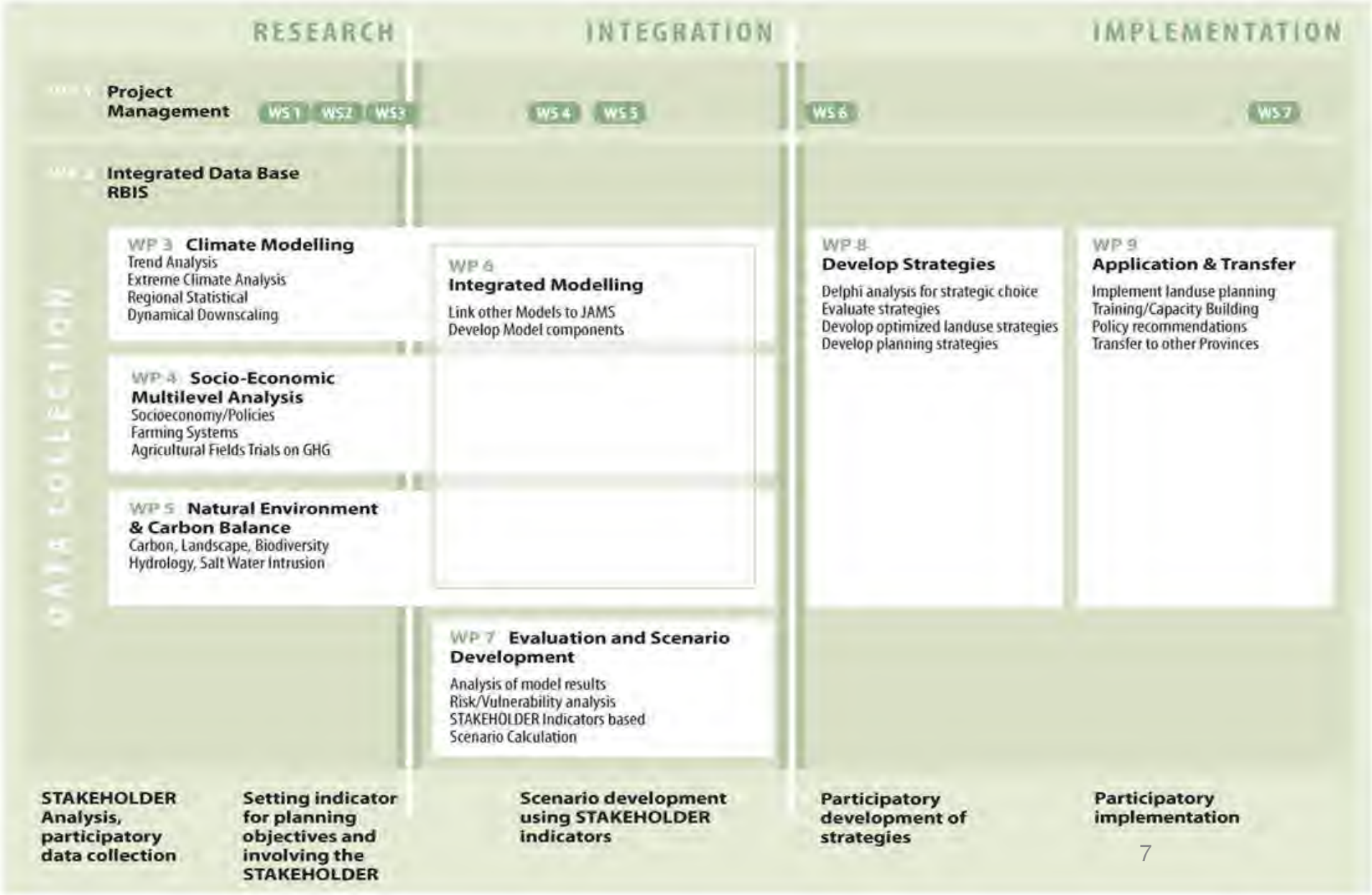
Project Structure



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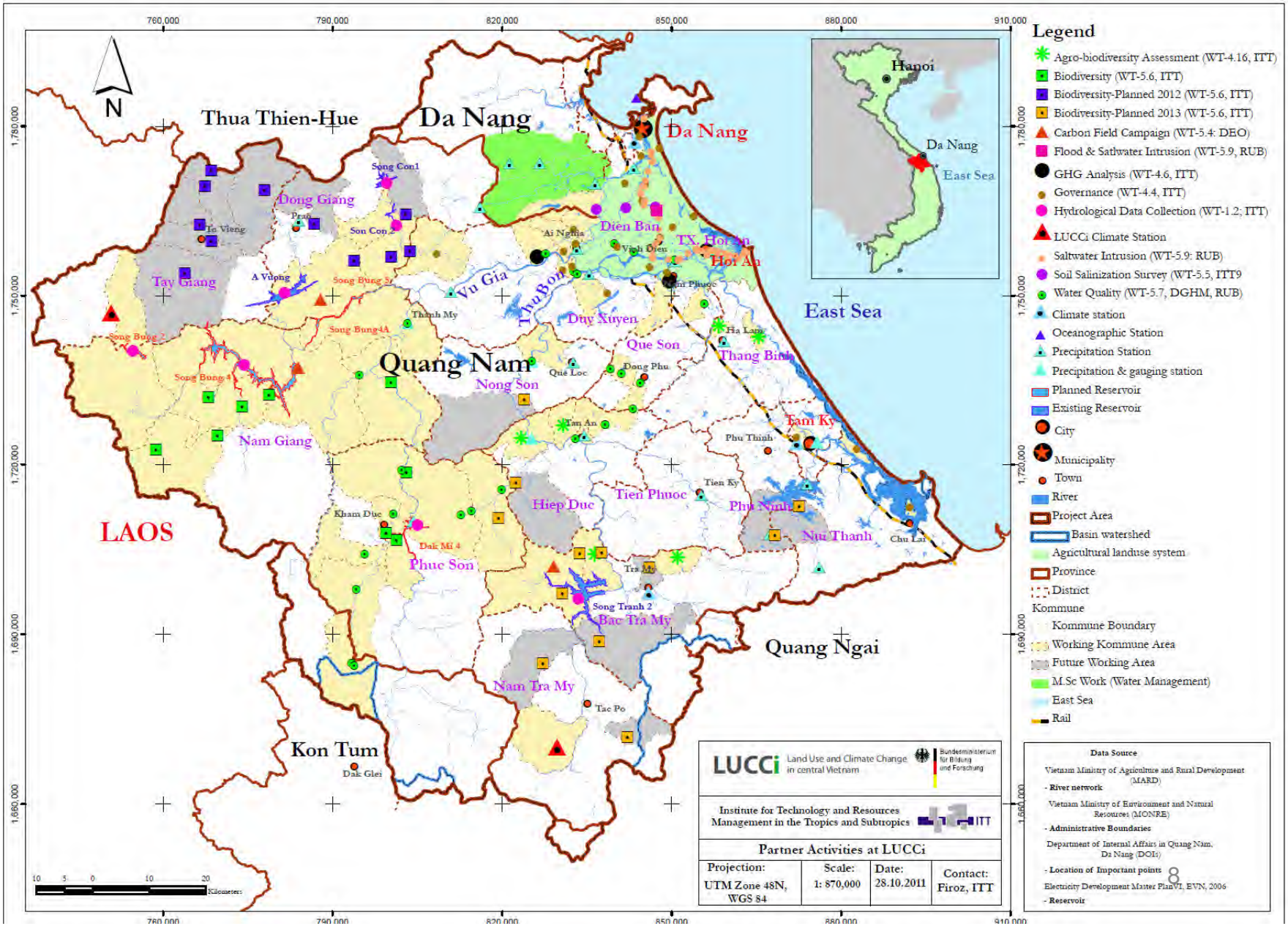
Phase I research activities



Expected Products

- River Basin Information System (RBIS)
- River Basin Status Report (maps + figures analyzing key challenges)
- Integrated Modeling and Decision Support System (DSS VGTB)
- Scenarios :
  - Regional Climate Change
  - GHG emission estimates and carbon stock changes
  - Flood, drought and salt water intrusion
- Assessment reports on alternative land and water management strategies

Phase II

“Integration and Scenario Development”

Procedure

Phase I: Develop a Basic System understanding (2010-2011)
→ Status conference + round tables march 2012

Suggest a system model and build szenario families (2012-2013)
→ Stakeholder round tables (water and land) march 2013

Run szenarios, alternative strategies
→ Status conference II: presentation and consolidation of scenarios (2014)

Szenario Basics

Szenarios are…

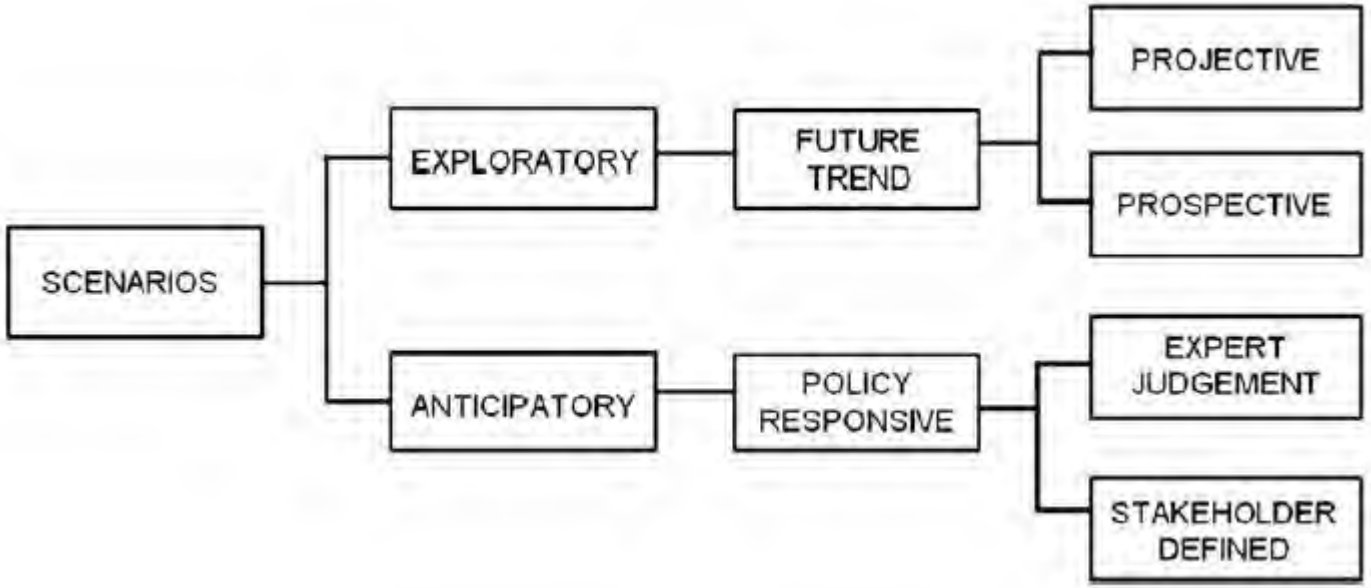
…carefully constructed snapshots of the future

…help to focus thinking on the most important factors driving change in any particular field.

…considering the complex interactions between these factors, we can improve our understanding of how change works, and what we can do to guide it

…Scenarios do not predict the future, but help us to decide what to do now in order to shape it

Scenario types



Mahmoud et al 2009

"A scenario is a coherent, internally consistent and plausible description of a possible future state of a system. It is not a forecast;
rather, each scenario is one alternative image of how the future can unfold."

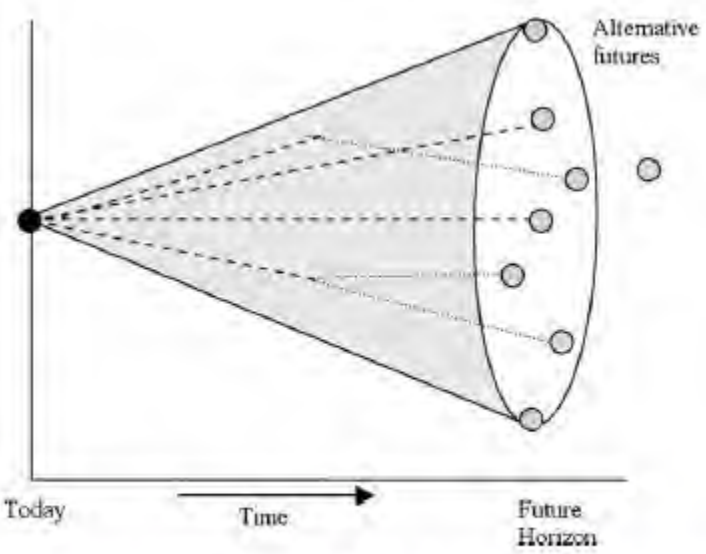


Fig. 1. Conceptual diagram of a scenario funnel. Adapted from Timpe and Scheepers (2003).

Based upon Mahmoud et al 2009

Scenario development

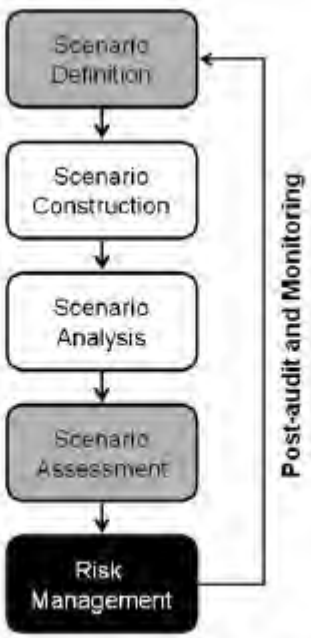
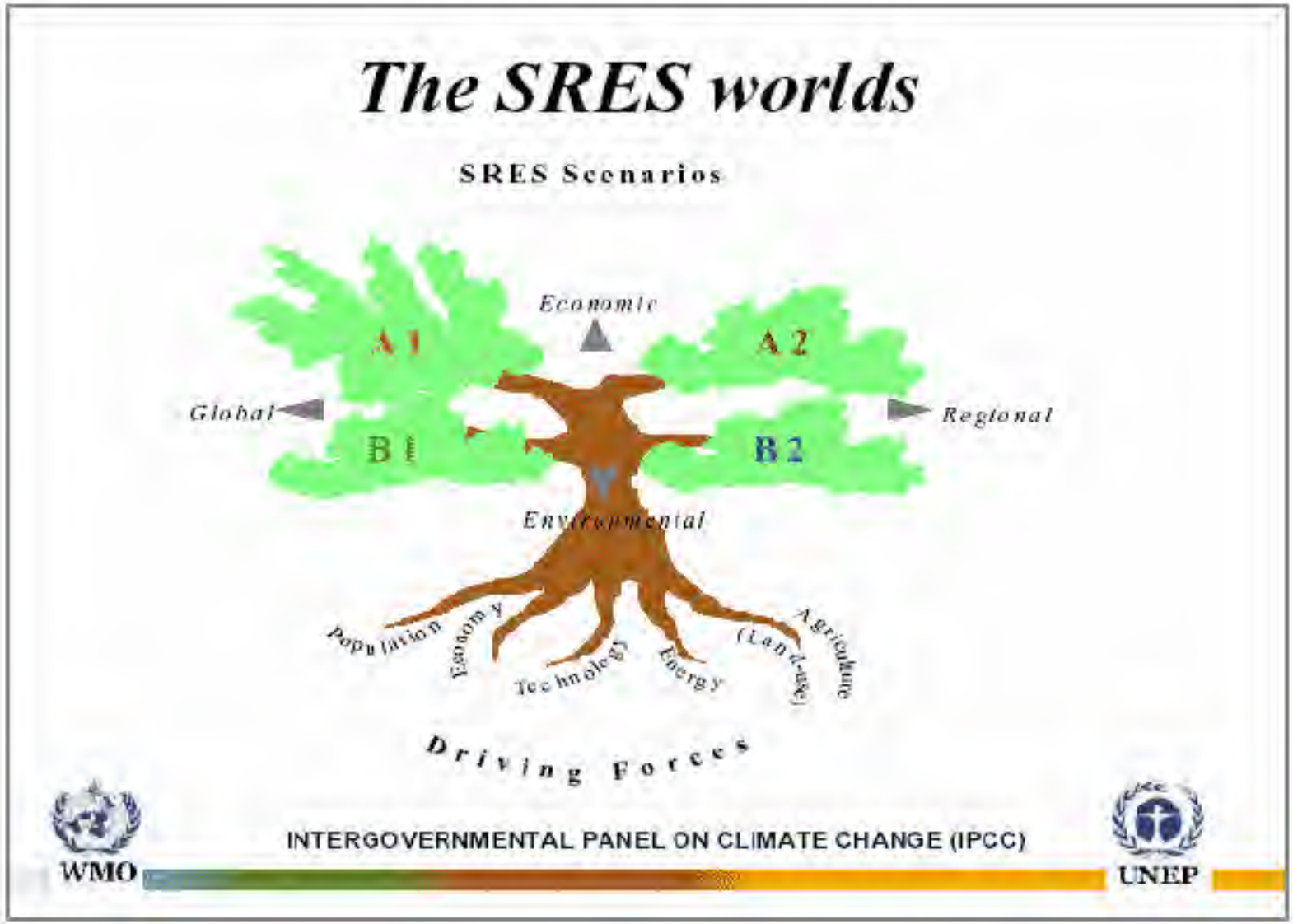


Fig. 4. The five progressive phases of scenario development.

Mahmoud et al 2009

1. Spatial and temporal extend of scenarios, system boundaries and elements, purpose
2. system conceptualization, model development, data collection causal relationships, critical uncertainties, key assumptions, important variables and situations, relevant spatial and temporal timescales for decision making process
3. Causal relationships, critical uncertainties, key assumptions, important variables and situations, relevant spatial and temporal timescales for decision making process
4. Consequences of interactions, statistical and other analytical techniques
5. Identifying risks, rewards, mitigations opportunities and tradeoffs


The SRES worlds
SRES Scenarios
Economic
A1
A2
Global
Regional
B1
B2
Environmental
Population
Economy
Technology
Energy
Agriculture
(Land-use)
Driving Forces
INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC)
WMO
UNEP

Approach in Lucci

Stepwise approach

- Describe the system and elements
- Analyse interactions (cause-effect relationships)
- What are important factors for development in the future (in the scope of Lucci)?
- What are important drivers and pressures?
- What are likely or plausible assumptions for the trend of drivers and pressures?

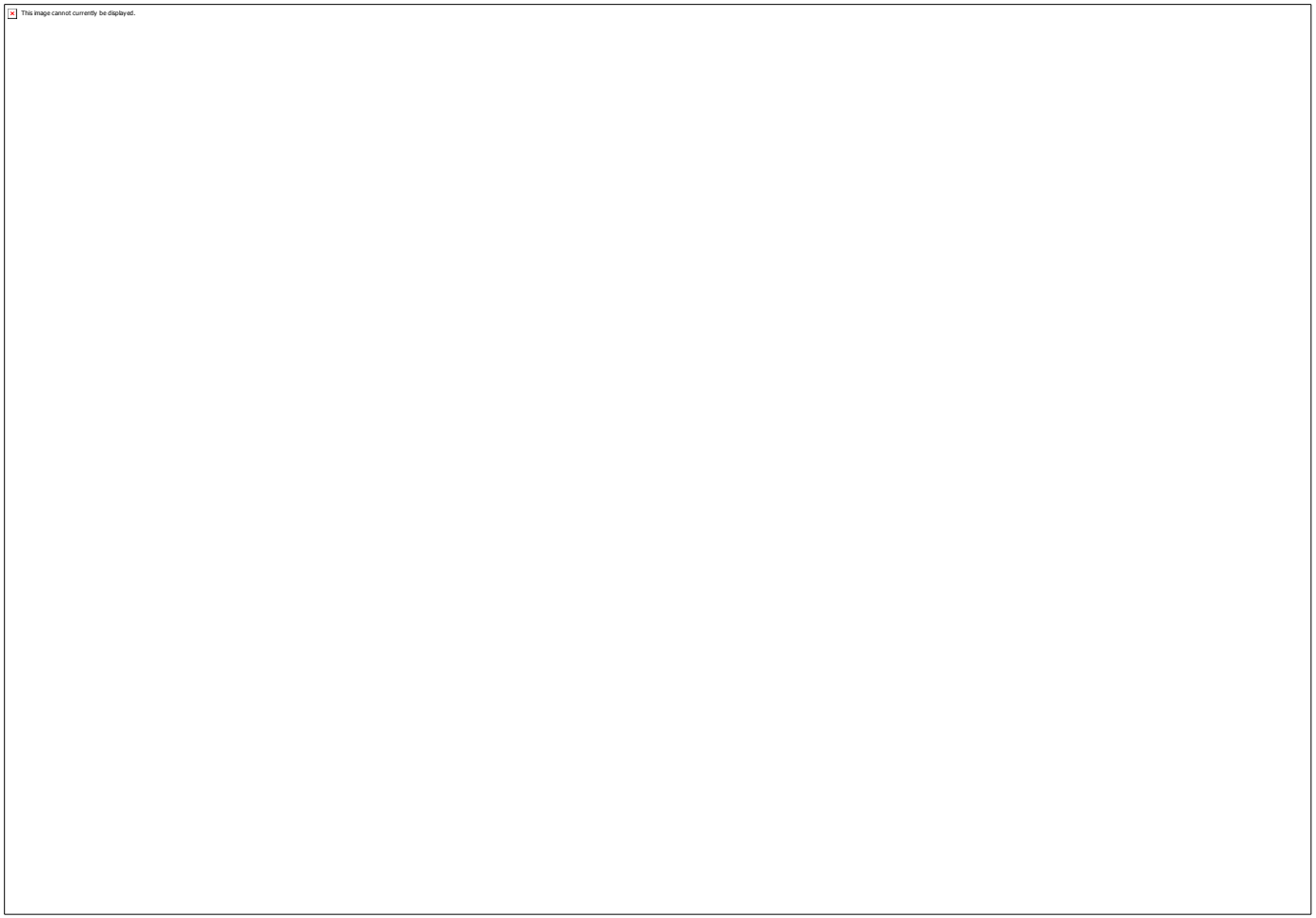
Shared Vision modeling

Involve stakeholders from the beginning in the research
…as stakeholder interests are essential
…without their involvement model results will not be „accepted“
…(potential) conflicts between different stakeholders need to be known / found out and included in model development

Figure 2.5. Stakeholders involved in river basin planning and management, each having different goals and information needs (*Engineering News Record*, 20 September 1993, with permission).

Challenges in the basin (initial stakeholder workshops)

- Hydropower development
- Deforestation and defragmentation
- Salt water intrusion
- Flood risk
- Drought risk
- Institutional diversity and ongoing reforms
- Increasing demands for food, water and energy
- Green house gas emissions of rice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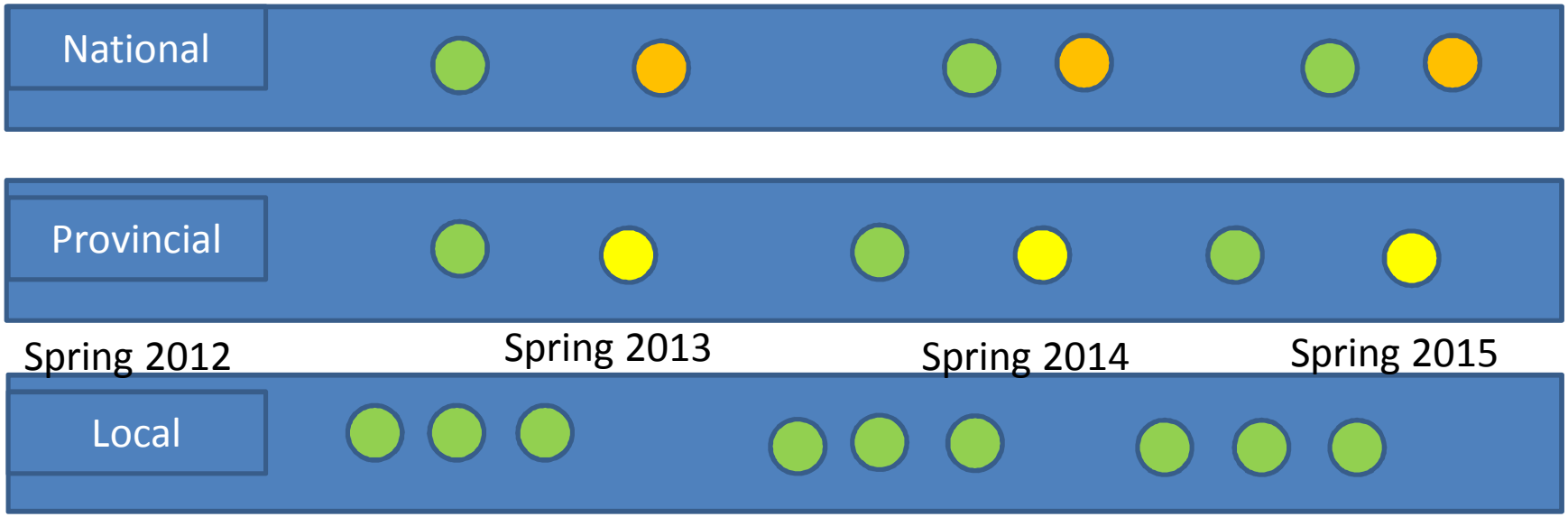
Stakeholder platforms



- National consultation workshops 2013+2014; common presentation of stakeholders and researchers in Hanoi 2015
- Stakeholder workshops to discuss research findings, knowledge gaps, strategies
- Research Groups: joint field campaigns and dialogue of stakeholders with local and international researchers

Start of Phase II

2012

Modeling and quantifying Interactions

- Climate Change - Hydrology
- Hydrology – Salt Water Intrusion/Flood level
- Salt Water Intrusion – Agricultural Production
- Flood Risk - Agricultural Damage
- Land Use change - Carbon Stocks/GHG Emissions
- Agricultural Practice – Agro-biodiversity
- Environmental Policy – upstream land use

…and Further Research Questions

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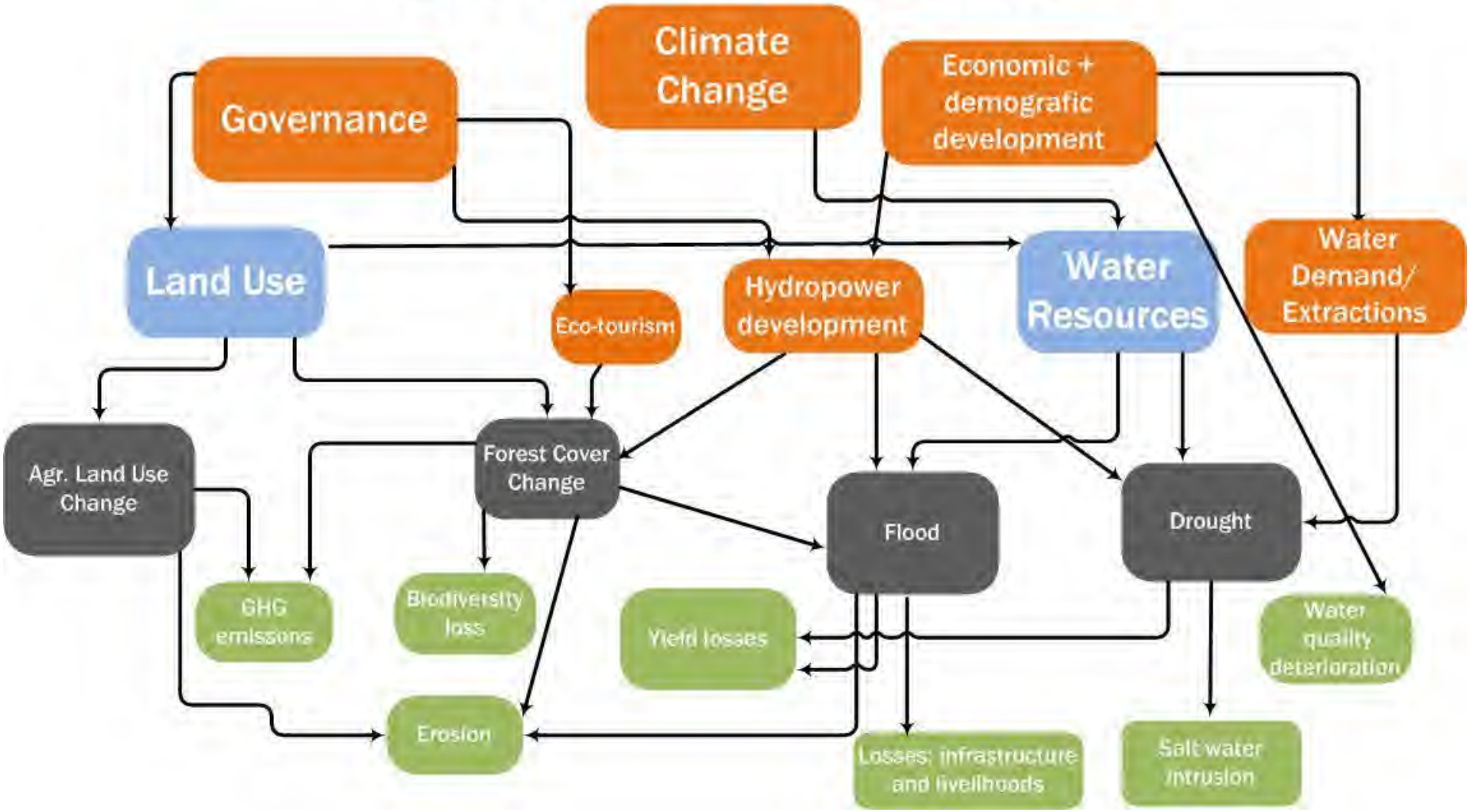
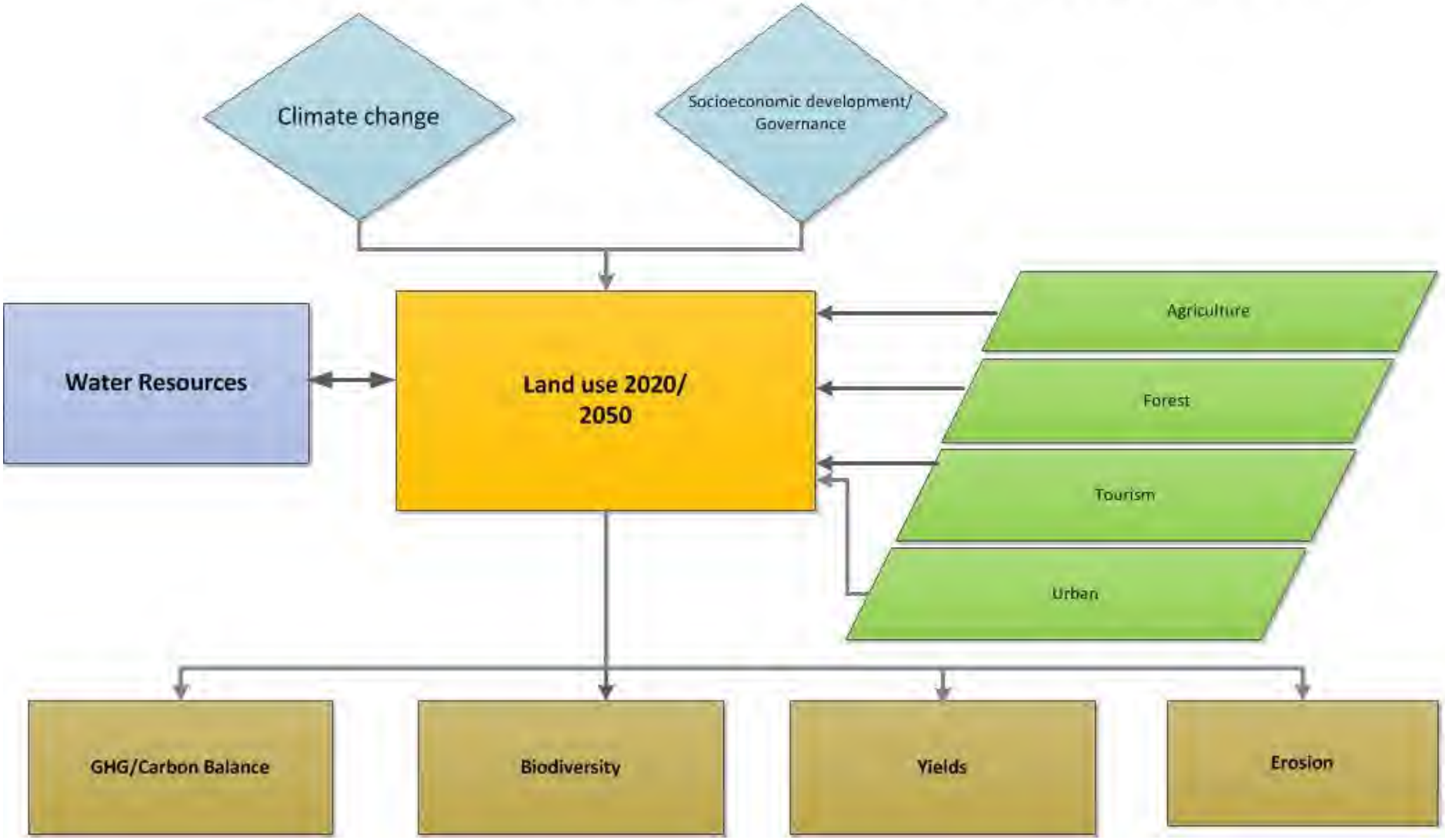
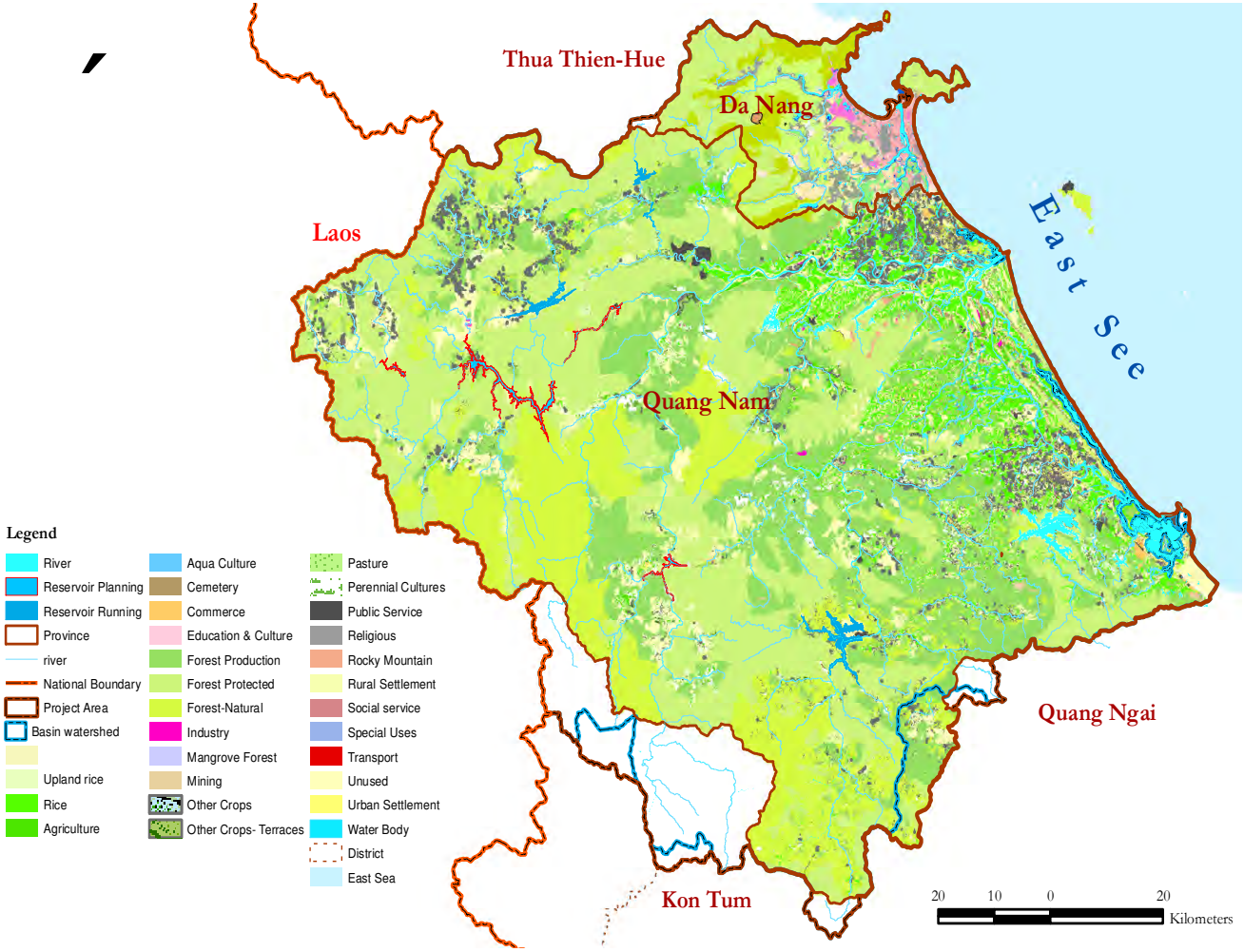
LUCCi – system overview



LUCCi – Land use change 2020-2050

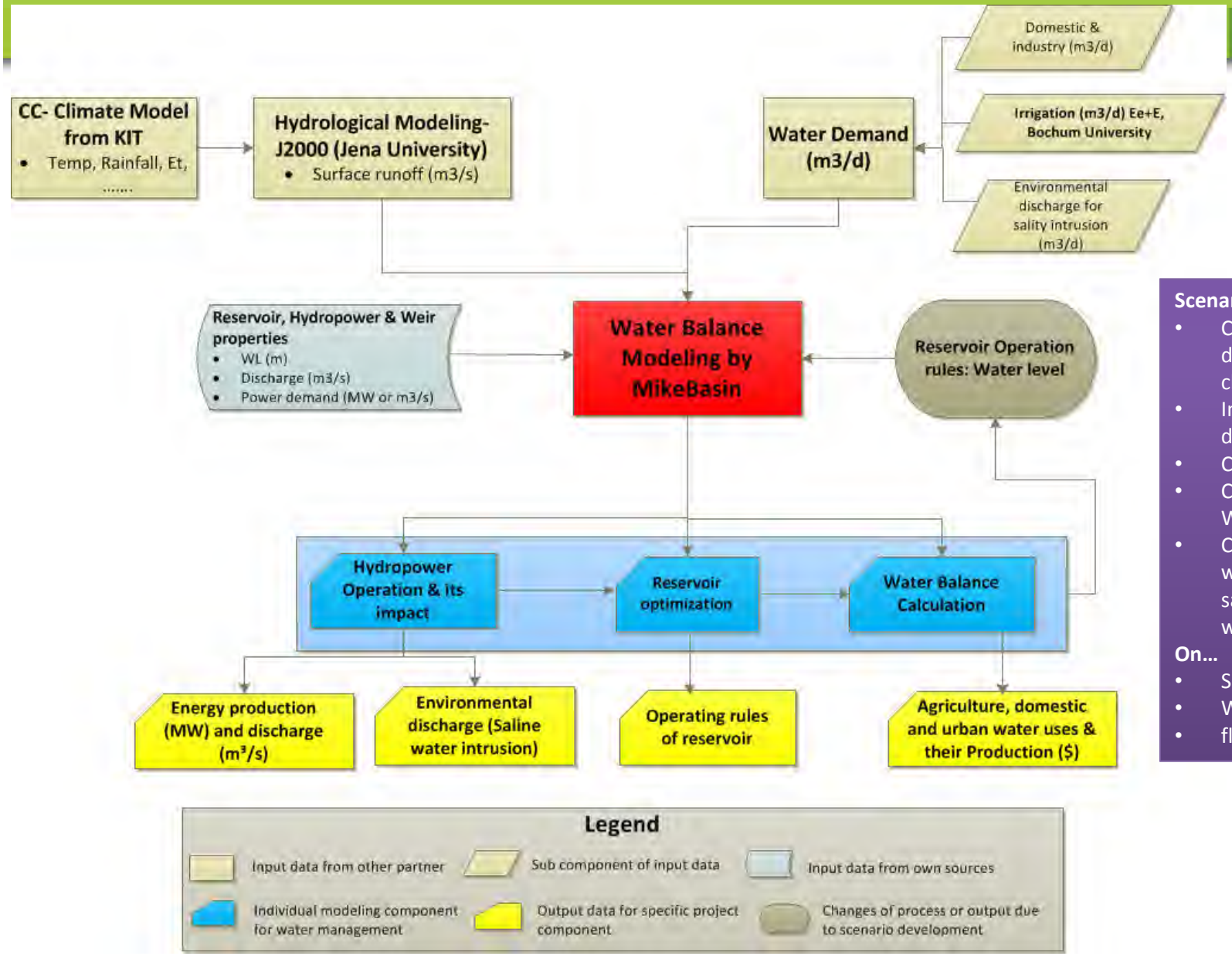


Land use and land cover



Ca. 75 % forest cover, 11% agricultural land use (MONRE, 2010) 5 % settlements

Methodological Framework for Water Management



Scenarios: Impact of…

- Changes of surface runoff due to landuse and climate change (hydrology)
- Increase hydropower development
- Changes of Power Demand
- Changes of Irrigation Water Demand
- Changes of Environmental water demand (e.g. For saline water intrusion/ water quality)

On…

- Salt water intrusion
- Water shortage and yields
- floods

Author: Firoz, 2013

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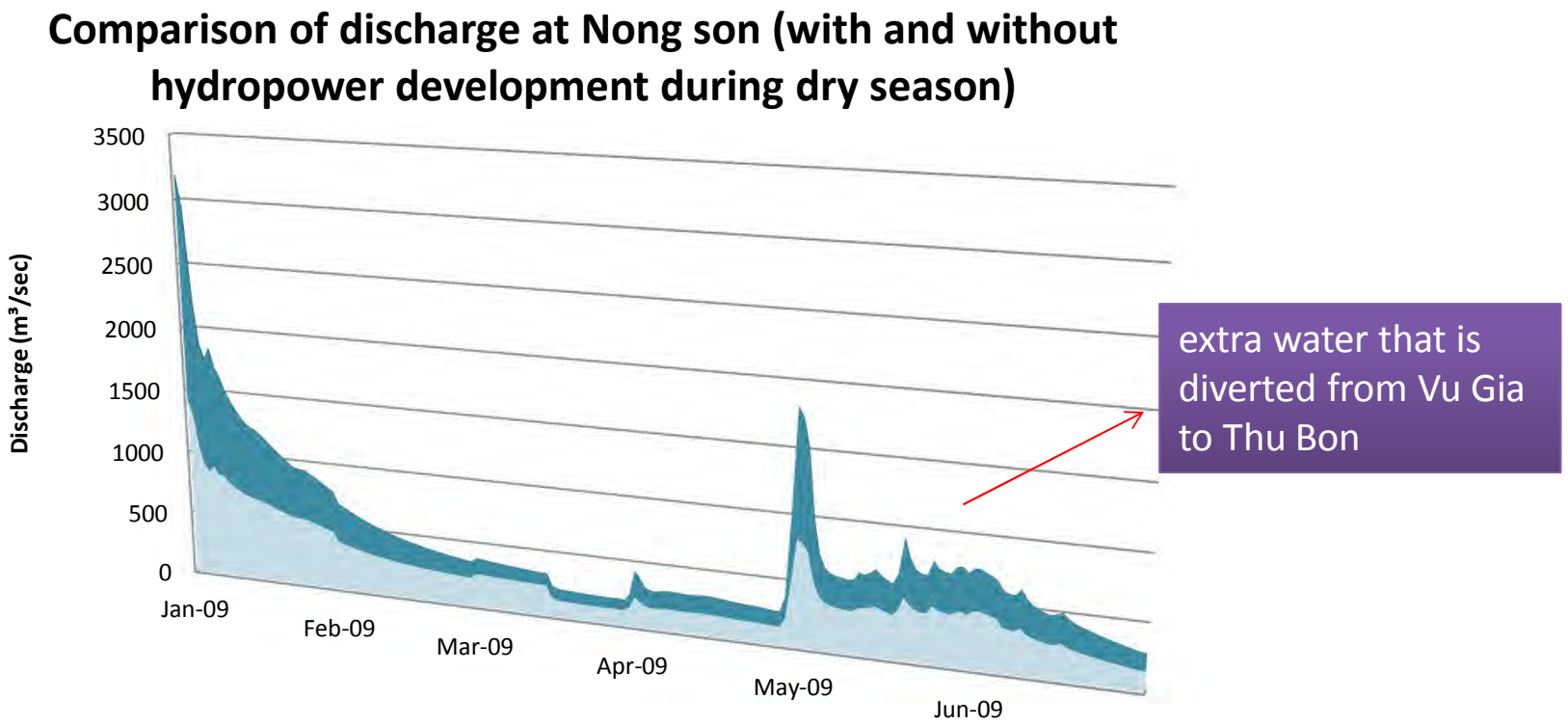
Model Result

Diversion of Dak Mi4 and the resulting impact on the water



Author: Firoz, 2013

Szenario 2020

- construction of 44 small and medium hydropower reservoirs will be built
- 6 major hydropower reservoirs will be built until 2016
- Major landuse changes from forest to plantation, expansion of slash and burn likely.
- Climate Change: Downscaling of A1B ; Sea Level Rise

- Outputs observed: downstream water availability, salt water intrusion, yields, flood risk

Scenario 2020

Water uses:

- Agricultural water uses are not expected to change
- Irrigation becoming more water use efficient due to improvement of irrigation system
- Other water uses might increase as tourism and industry
- Industrial zone in Quang Nam will increase water demand.
- Ground water use is increasing (but very polluted e.g. salinity)
- Hydropower will be further developed

= > Change in water use ratio

=> Increase of overall water demand is likely

Challenges

- Access to data in Vietnam
- Involvement of stakeholders
- Common understanding of terminology
- Different approaches and quantifications in different disciplines

Thank you for your attention