Developing a management tool to adapt to climate change
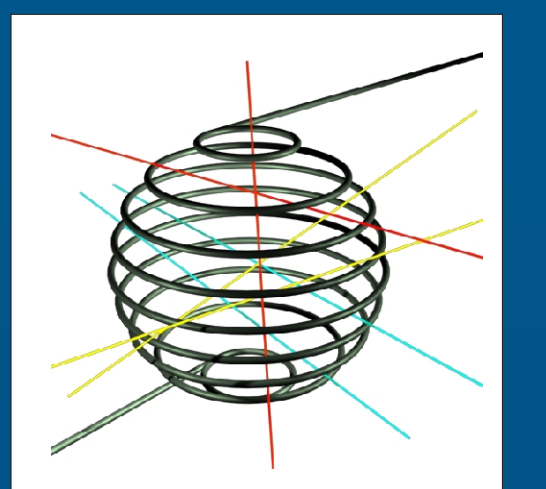## ADAPT - Towards an integrated decision tool for adaptation measures

case study: floods

Introduction

Climate change issues, like floods, are complex and uncertain. As a consequence, they are often hard to handle by policymakers. Nevertheless, an adaptation policy is needed to avoid detrimental effects.

The **Adapt** project aims to **develop an efficient management tool to assist the policymaker** in developing adaptation policy to climate change. Therefore, an analysis of adaptation measures related to flooding will be drawn up. Based on data from two case study areas, the Dender and the Ourthe rivers, the following steps will be carried out:

- evaluating the impact of global change induced flooding on the river basins: hydrological analysis of expected floods based on climate scenarios.

- evaluating secondary impacts of global change-induced flooding: analysis of the economic, social and ecological impacts of floods.

- determining adaptation measures: adaptation measures against floods can be preventive, source-oriented, effect-oriented or curative.

- evaluating the adaptation measures: analysis and evaluation of the economic, social and ecological impacts of adaptation measures.

- cost-benefit analysis and multi-criteria analysis: methods to select the most preferred adaptation measure or package of adaptation measures.
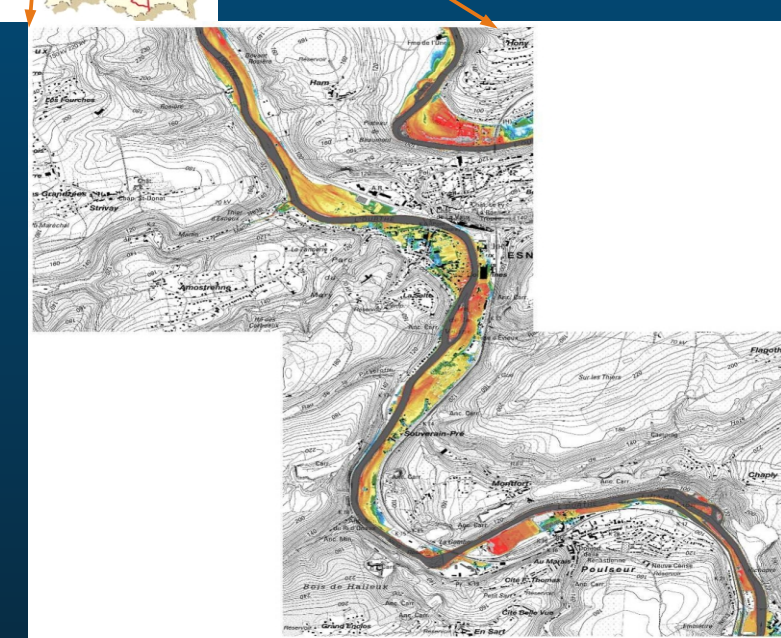
conceptual framework
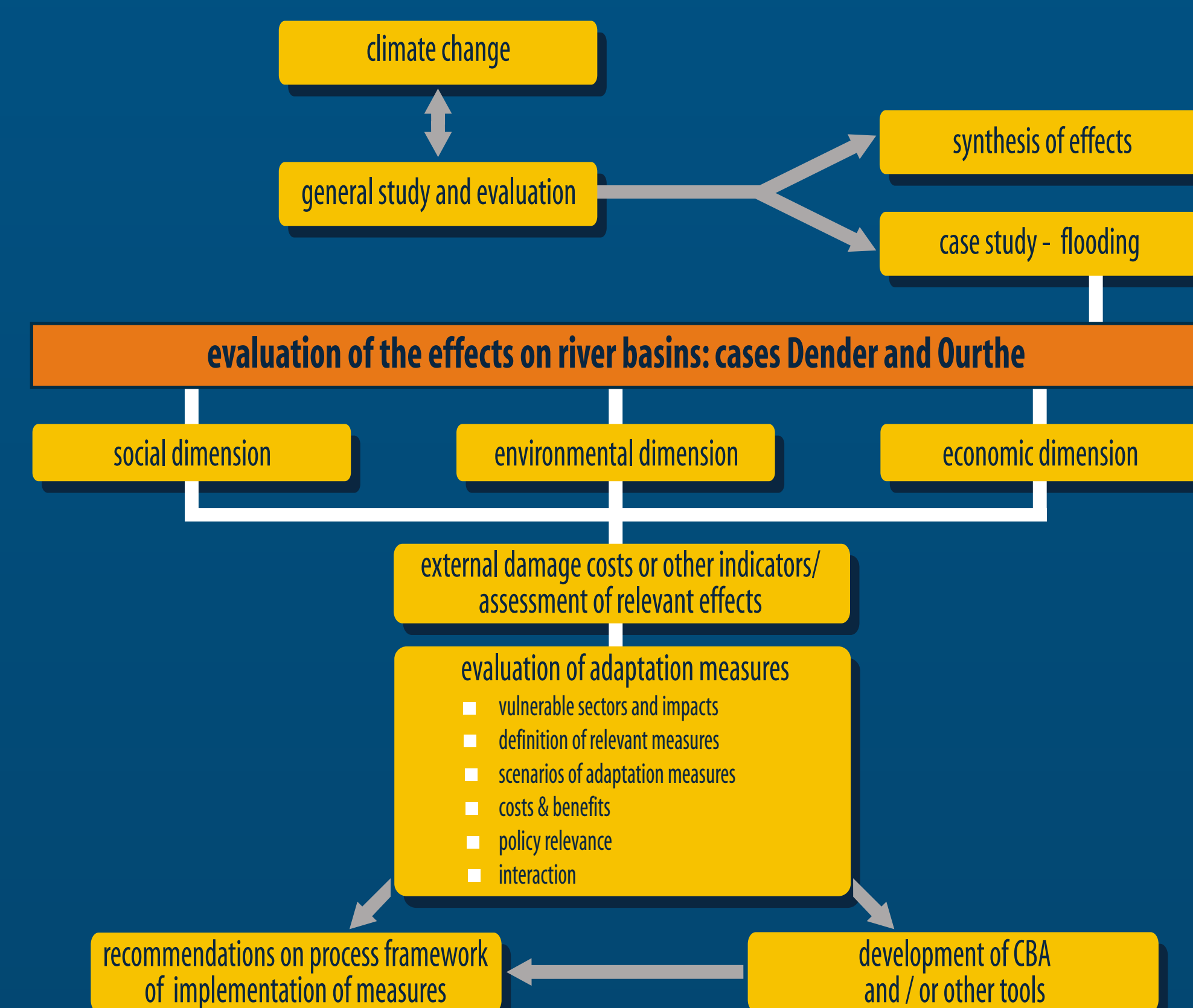
Methodology

The case study analysis of the two main Belgian river basins, the Scheldt and the Meuse basins, will allow to develop, test and improve the methodology for the management tool.
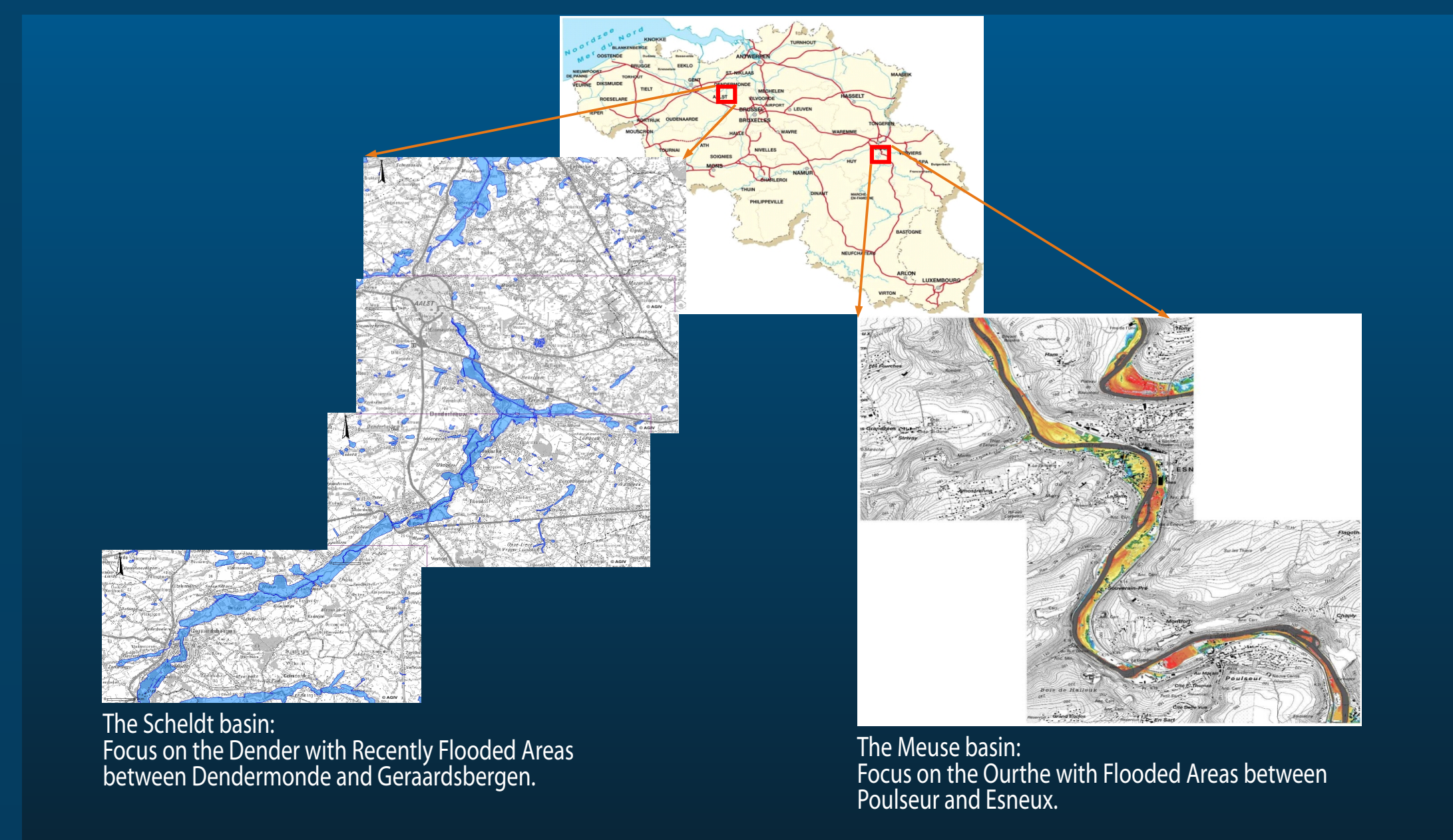
The Scheldt basin:
Focus on the Dender with Recently Flooded Areas between Dendermonde and Geraardsbergen.
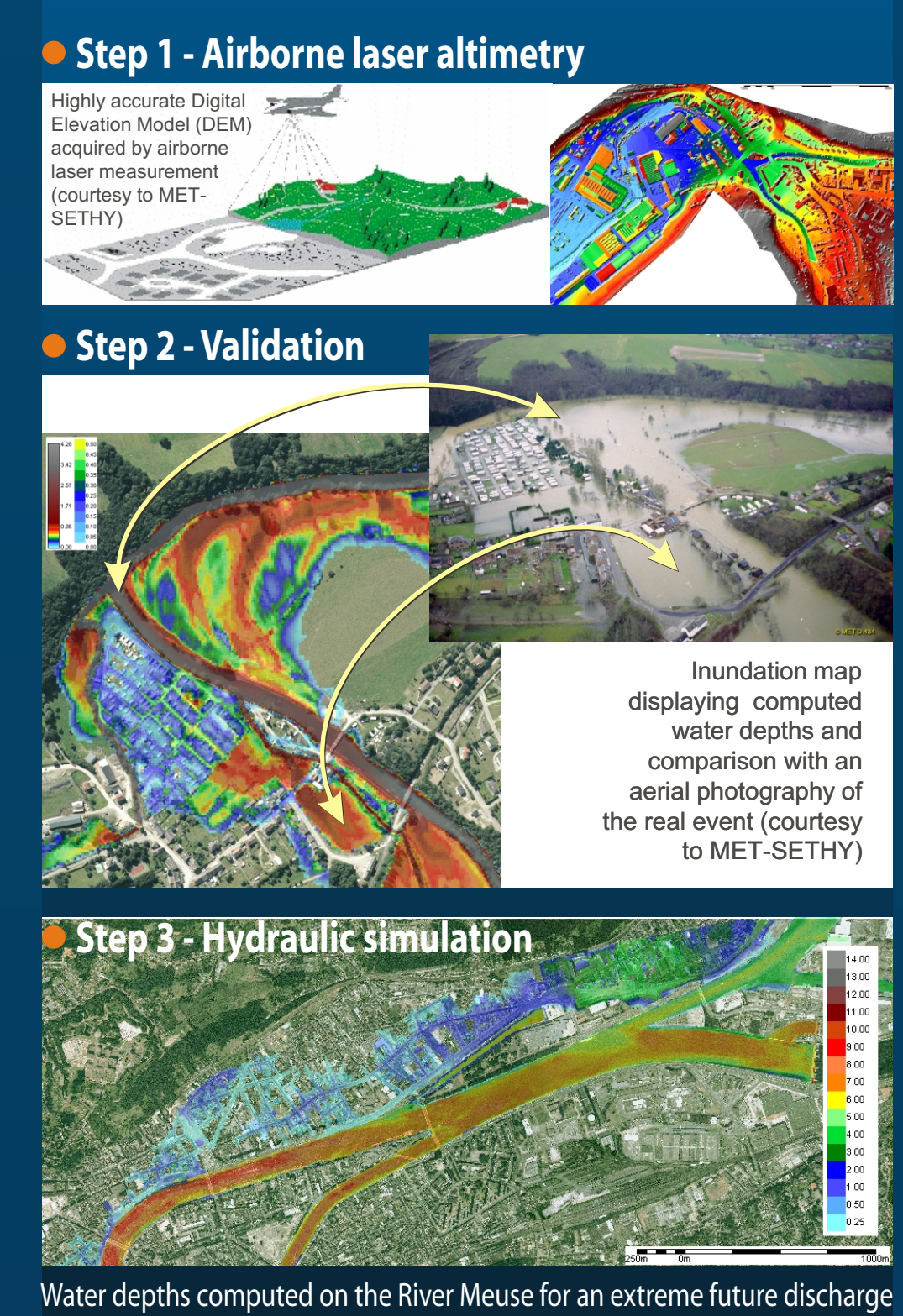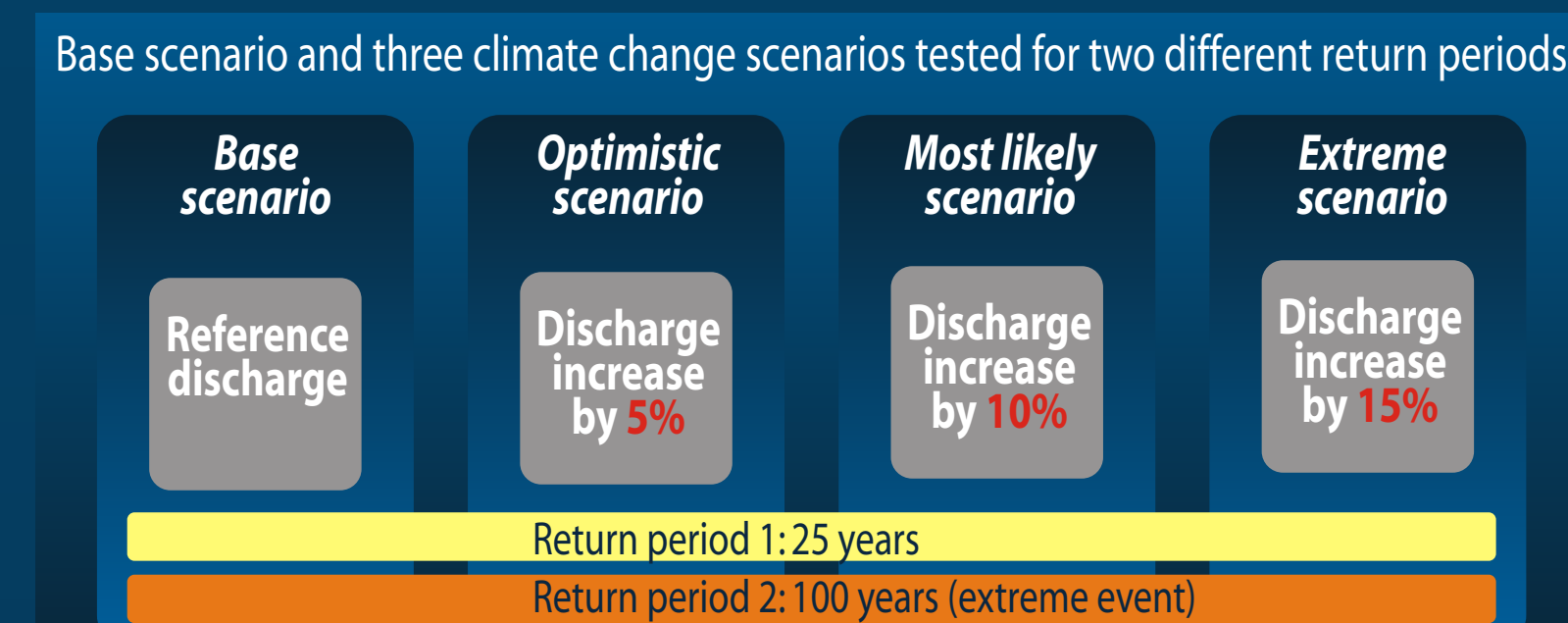
The Meuse basin:
Focus on the Ourthe with Flooded Areas between Poulseur and Esneux.

Hydraulic modelling

what areas are confronted with flood risks caused by climate change?

The hydraulic model WOLF 2D is used in the ADAPT project to simulate the water depths and flow velocities during flood events.

The simulations are based on high resolution topographic data (laser DEM, 1 point/m²).

The model WOLF 2D has been developed at the University of Liege and has been extensively validated by comparison of simulated results with real flood extents observed during past events.

Step 1 - Airborne laser altimetry

Highly accurate Digital Elevation Model (DEM) acquired by airborne laser measurement (courtesy to MET-SETHY)

Step 2 - Validation

Inundation map displaying computed water depths and comparison with an aerial photography of the real event (courtesy to MET-SETHY)

Step 3 - Hydraulic simulation

Water depths computed on the River Meuse for an extreme future discharge

Base scenario and three climate change scenarios tested for two different return periods

Base scenario	Optimistic scenario	Most likely scenario	Extreme scenario
Reference discharge	Discharge increase by 5%	Discharge increase by 10%	Discharge increase by 15%

Return period 1: 25 years
Return period 2: 100 years (extreme event)

What impacts are caused by floods?

Economic impacts

Two economic techniques, which are based on the assessment of the use value by the revealed preference approach, are used to assess the flood damages in the context of this project:

Market prices which are based on the price of the losses in terms of market prices;

Hedonic pricing, which depends on the analysis of existing markets where environmental factors, have an influence on price. This approach attempts to identify how much of a price differential is due to a particular environmental difference.

Social impacts

The social impact assessment is based on a social impact matrix that lists all potential effects of floods on the individual and the community level. Because of the limited knowledge and the complex and uncertain context, relevant stakeholders are involved by organising focus groups and interviews to assess the likelihood of social impacts in future floods in accordance to the method of participatory integrated assessment.
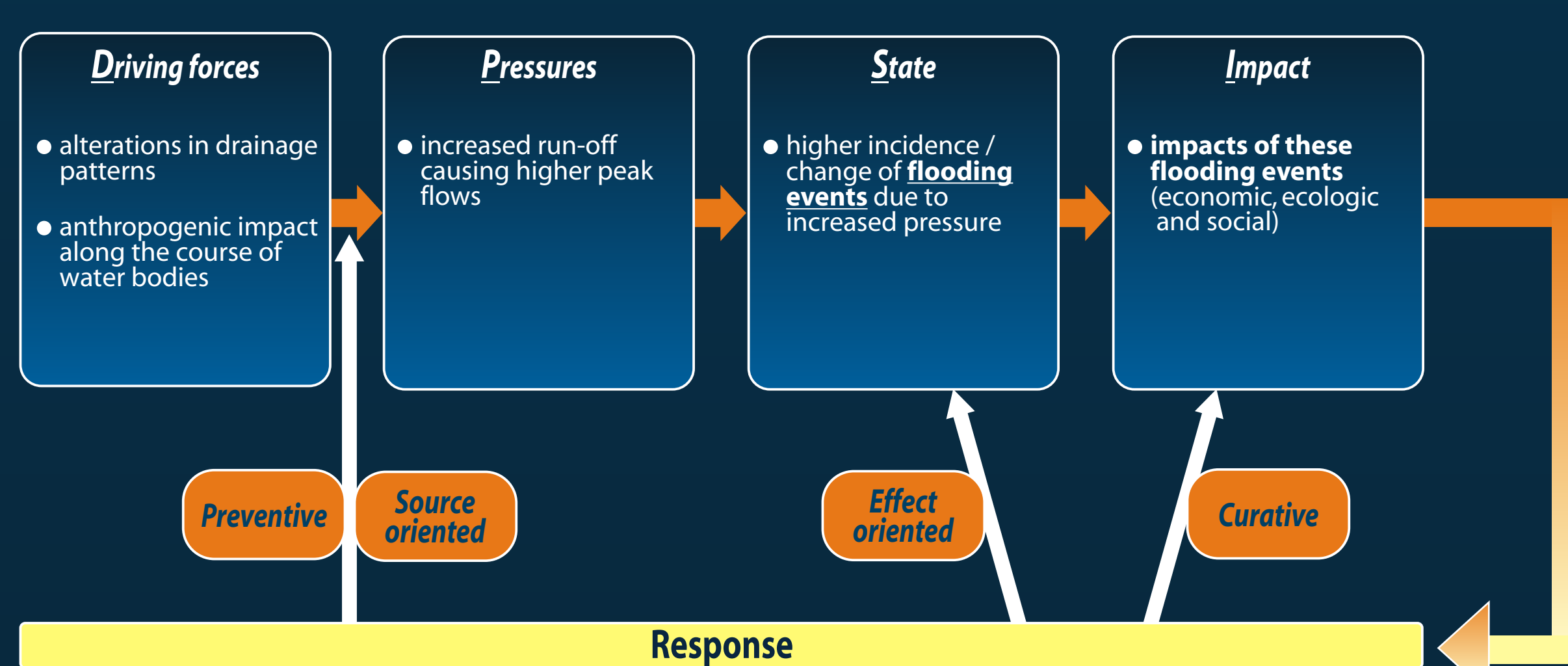The acceptability of adaptation measures will be evaluated by surveys.

Ecological impacts

The heart of the methodology consists of knowledge tables and scoring tables that can assess the impact of floods on ecological sectors like nature, woods,... The knowledge table should take into consideration the flood characteristics (inundation frequency, duration, depth, and period) and also surface water quality. The inundation tables, derived from hydrological models from primary impacts, will provide information about the impact of different flood regimes on vegetation types under the form of scores of not sensitive, tolerant, sensitive, and very sensitive.
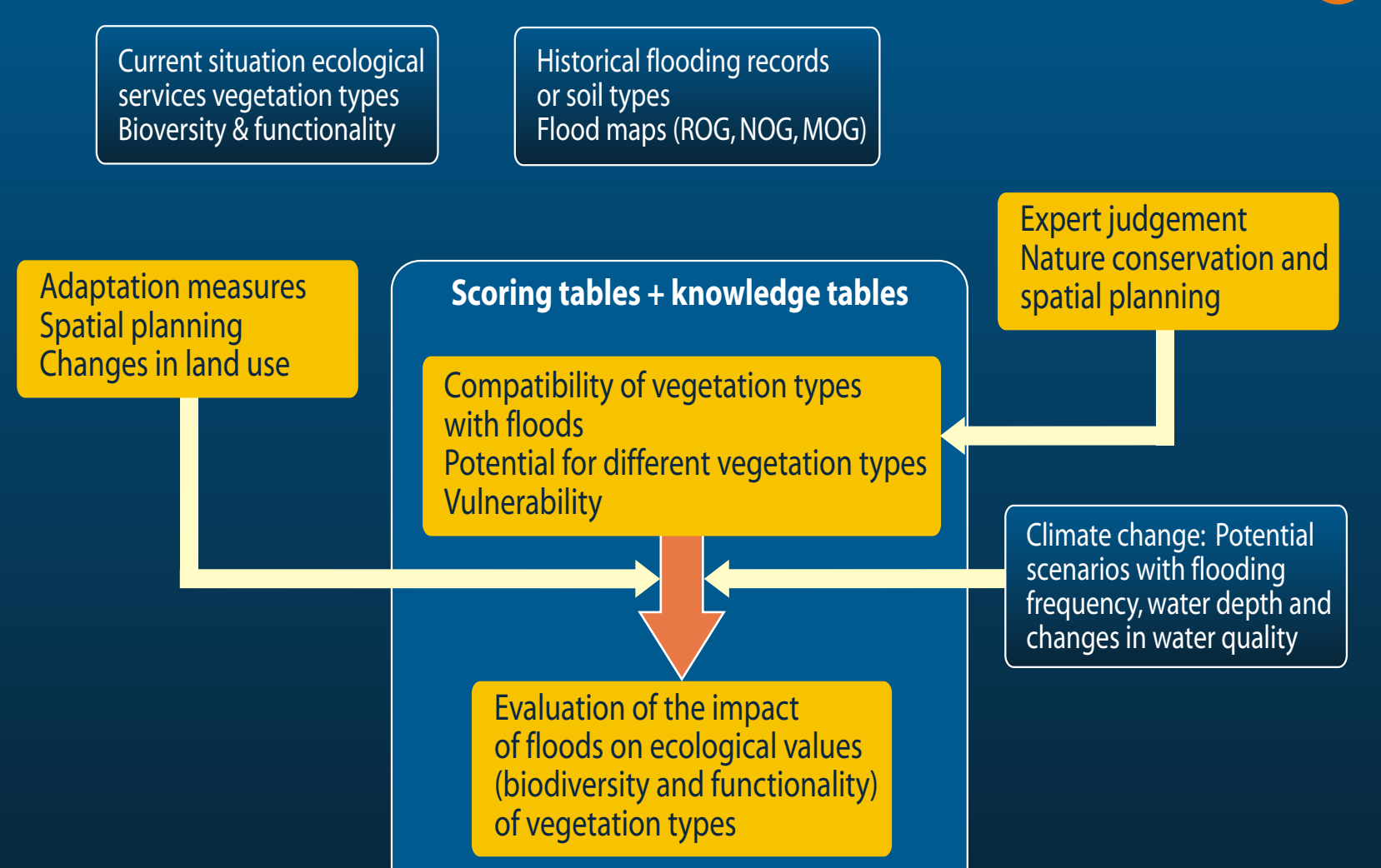
What impacts are caused by adaptation measures?

which adaptation measures are most preferred?

evaluation by means of cost-benefit analysis and multi criteria analysis

Preventive	Source oriented	Effect oriented	Curative
	Research and lessons learned		
Limit the use of flood plains	Controlled flooding areas	Dykes, dams, walls	Emergency response
Enhance retention capacity of soils and floodplains			Flood forecasting and early warning systems
Inform people by risk mapping			Insurance and assisting people during recovery

Website http://www.ulb.ac.be/ceese//ADAPT/Home.html