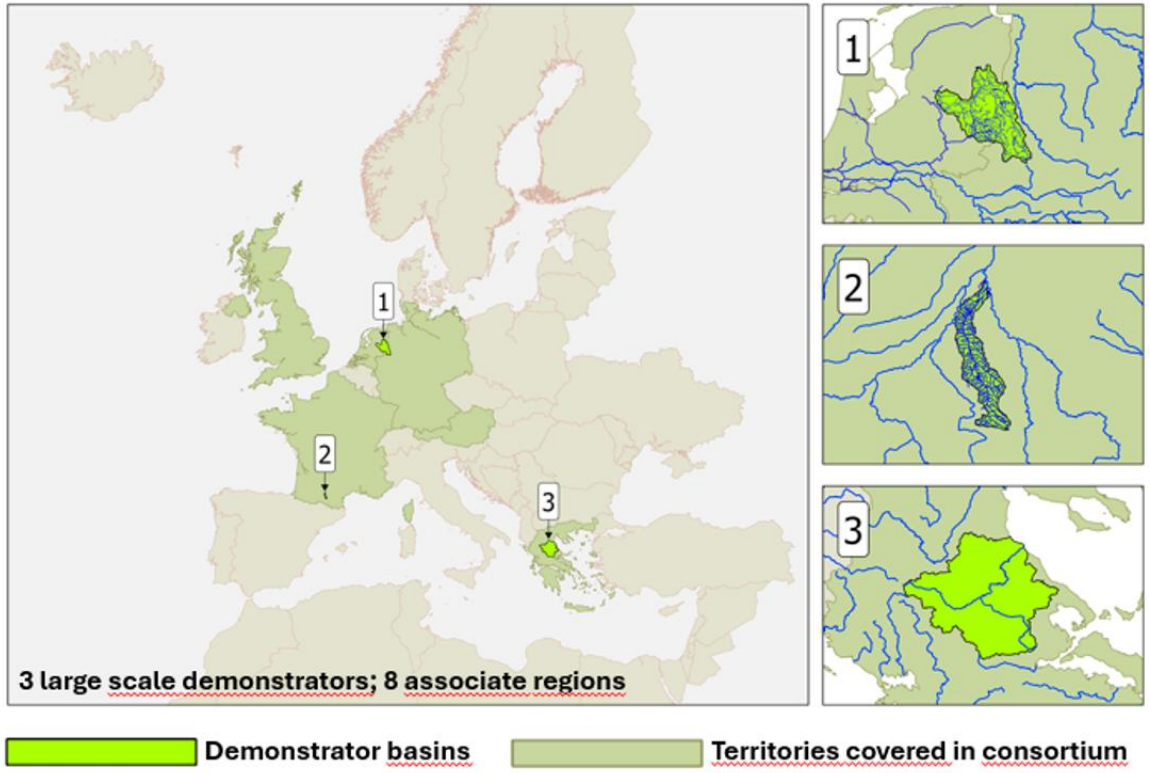
Socio-economic Evaluation of of Nature-based Solutions for for Water Retention

(SpongeWorks)

Why Sponge measures?

SpongeWorks Overview



1 **Vecht (the Netherlands – Germany):** cross-border lowland

2 **Lèze (France):** hilly agricultural catchment

3 **Pinios (Greece):** intensive agriculture, severe drought

The challenge

- Floods & droughts
- Soil erosion
- Water pollution
- Groundwater depletion
- Biodiversity loss
- Soil carbon loss

Sponge measures help landscapes absorb, store and slowly release water – tackling several at once.

SpongeWorks

- Implements sponge measures in demo basins
- Models hydrological & biophysical effects
- Upscales sponge strategies to landscape level

Our role: socio-economic team

- Values costs and benefits of sponge measures
- Identifies combinations that maximise net socio-economic benefits

What do we evaluate?

Cost and Benefit items

Cost-Benefit-Analysis for NbS goes beyond conventional market-based evaluation to include non-market co-benefits as well

Costs

Investment cost

One-off establishment: construction, planting, equipment, engineering and implementation.

O&M cost

Recurring labor, maintenance, materials replacement, monitoring and management.

Land opportunity cost

Net returns forgone from the best feasible alternative land use.

Benefits

Carbon sequestration

Additional carbon stored in vegetation and soils.

Flood & drought regulation

Avoided expected damage from improved water regulation.

Air & water quality

Reduced pollution damages and treatment needs.

Recreation & biodiversity

Use and non-use values from improved ecosystems and access.

Agricultural production

Higher, more resilient yields from better water and soil.

Why co-benefits matter

Co-benefits are large enough to change the outcome of a cost-benefit analysis

CO-BENEFITS VS. COST

≈ €3 : €1

Value of ecosystem services from 85 nature-based solutions in the Alps, per euro invested

González-García et al. 2025, Cell Reports Sustainability

€2–10 back per €1

invested in climate adaptation

Global Commission on Adaptation 2019

FLOODS & DROUGHTS

€822 bn

EU losses from climate extremes, 1980–2024; 47% from floods

EEA 2025

WATER QUALITY

€70–320 bn

Yearly damage from nitrogen pollution in Europe

European Nitrogen Assessment 2011

SOIL EROSION

€1.25 bn

Yearly farm productivity lost to soil erosion in the EU

Panagos et al. 2018

CARBON

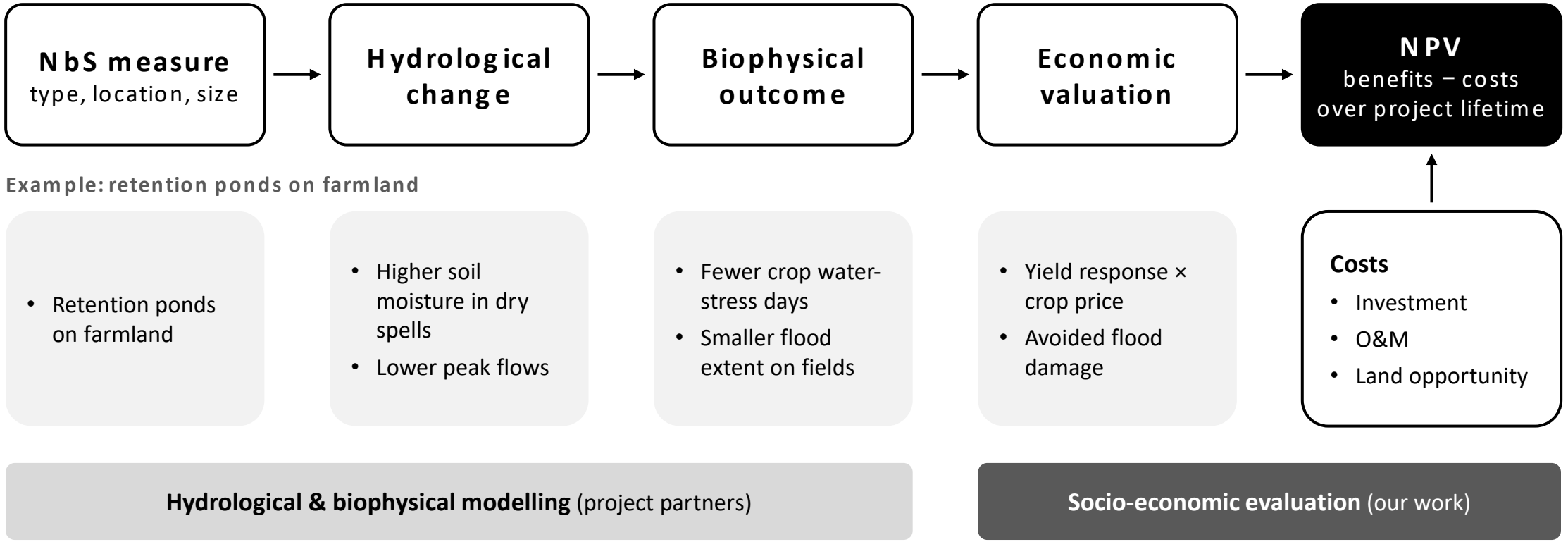
37%

Share of cost-effective CO_2 cuts to 2030 that nature can deliver

Griscom et al. 2017, PNAS

How do we evaluate it?

From NbS measures to monetary value

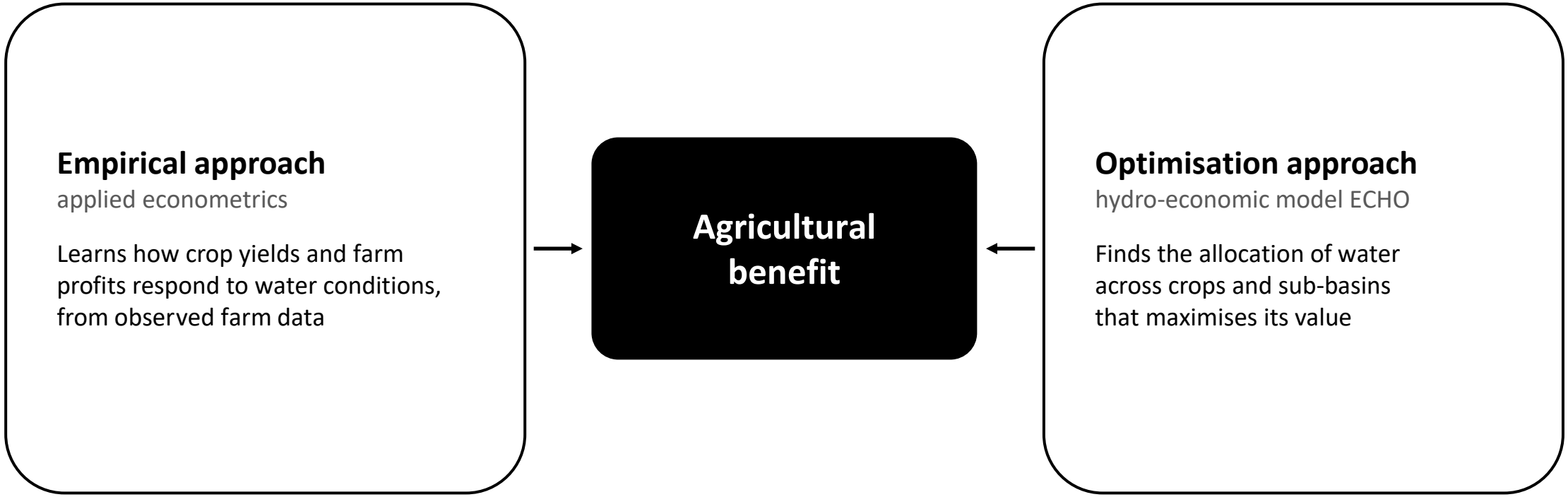


Benefit evaluation: one shared logic

Benefit	What NbS changes	×	Who / what is affected	×	Value per unit
Flood / drought	Lower flood & drought hazard	×	Exposed assets & their vulnerability	×	Damage cost per event
Air / water quality	Lower pollutant concentration	×	Exposed population (dose–response)	×	Health or treatment cost per case
Carbon	More carbon stored in vegetation & soil	×	Area under NbS land use	×	Social cost of carbon
Recreation	Better site quality (water, green/blue access)	×	Number of visits	×	Value per visit (travel cost)
Agriculture	Higher, more stable crop yield	×	Planted area	×	Crop price

Agriculture: two approaches

Agriculture is our main benefit, so we evaluate it from two complementary angles



Empirical approach

1 Water change
flood, drought &
irrigation water quality

→

2 Yield response
learned from farm
surveys, crop by crop

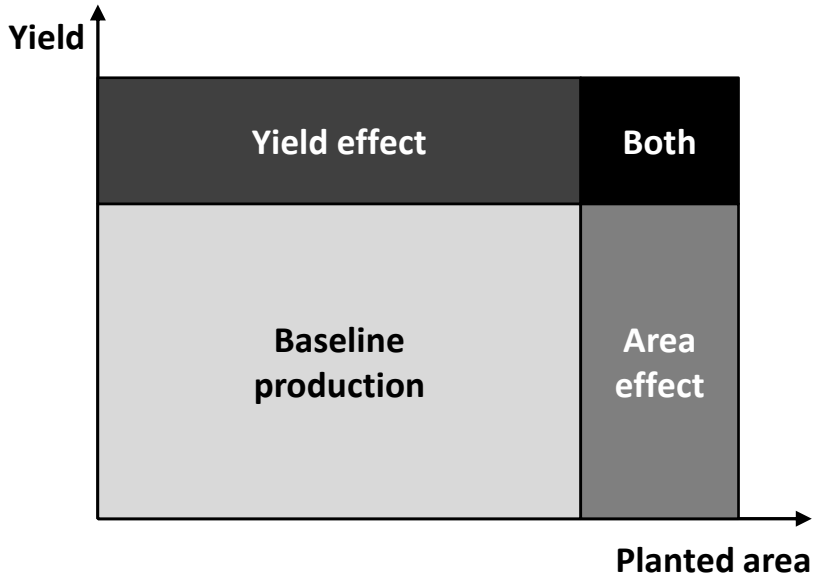
→

3 Production
Change in yields &
planted area

→

4 Monetary value
at projected
crop prices

3 Where does change in production come from



Yield effect
higher yields on existing fields

Area effect
land that becomes farmable

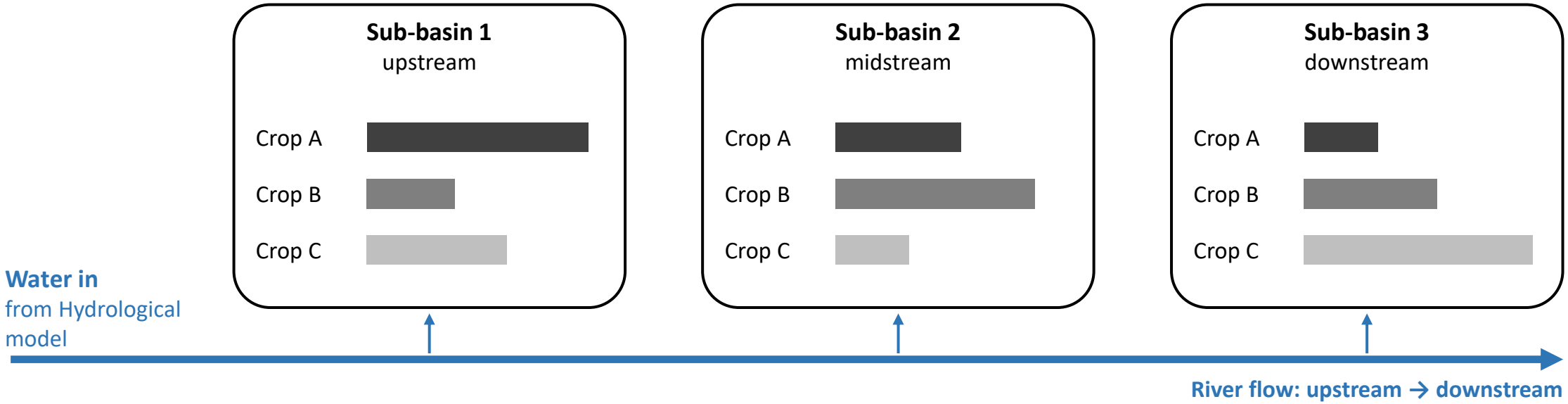
Both
higher yields on that new land

4 What the change in production is worth

Local projects
- Valued at projected crop prices
- Prices stay unchanged

National scale-up
- More supply lowers crop prices
- A simple market model adjusts for this

Optimisation approach (ECHO)



Question

How to share limited water across crops and sub-basins?

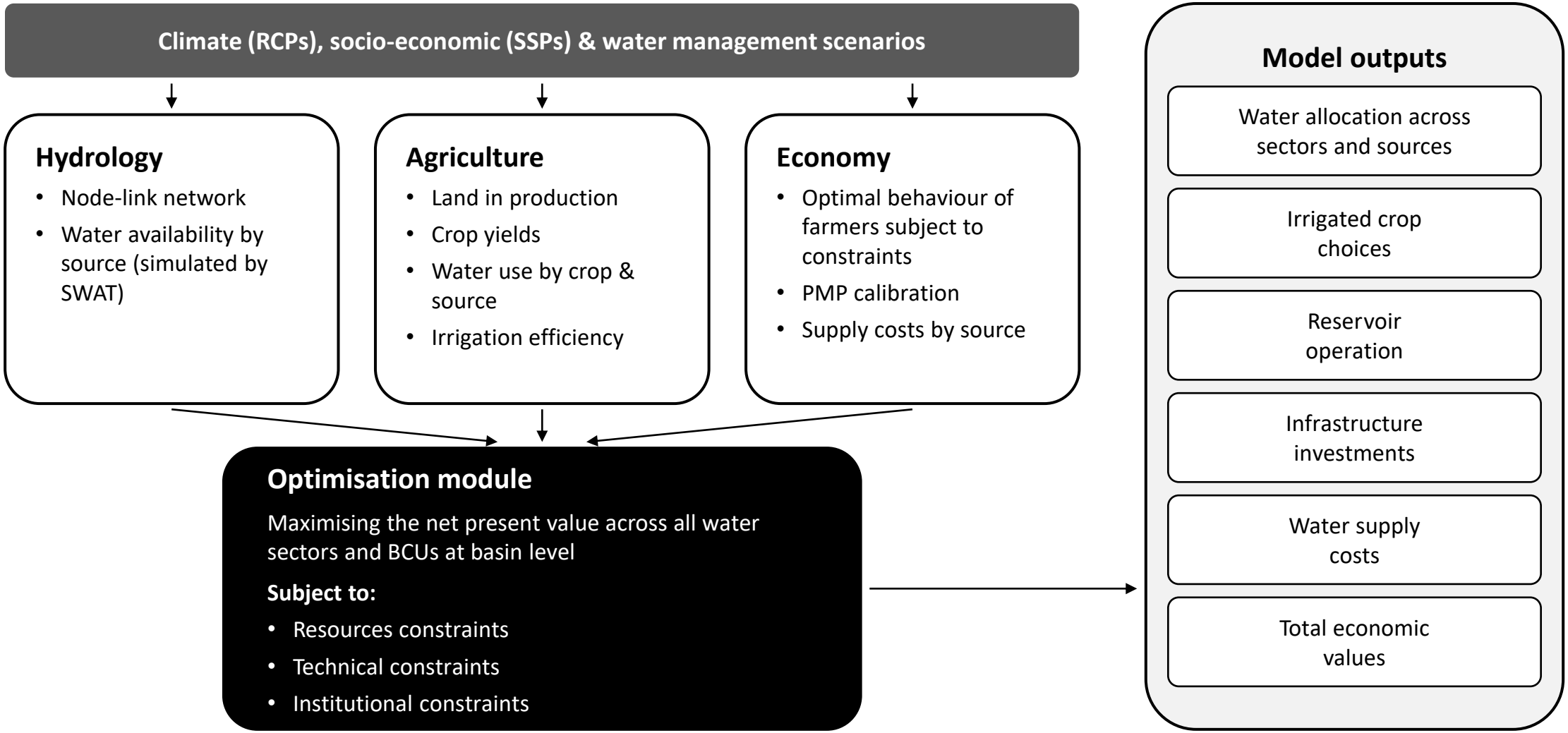
Objective

Maximise the net present value of water for the whole basin

Within constraints

- Water availability & land
- Technical constraints
- Institutional constraints

How the ECHO model works



Adapted from the ECHO model paper: doi.org/10.5194/gmd-18-7987-2025

Which approach, for what purpose?

Pros and Cons

	Empirical (econometrics)	Optimisation (ECHO)
Question	**How do yields respond to water, based on observed farm data?**	**How should limited water be shared across crops and sub-basins?**
Scale	Farms, scaled up to the measure's area	The whole basin, sub-basin by sub-basin
Strengths	• Grounded in observed farm outcomes • Fits directly into the full CBA	• Captures competition for water • Shows upstream–downstream trade-offs
Limitations	• May not hold under new conditions • No reallocation of water	• Data- and model-intensive • Relies on calibrated farmer behaviour
Best for	Valuing a specific measure's effect on farm output	Planning water allocation and comparing strategies at basin level

Thank you very much!