Sponge Scapes

Evidence and Solutions for improving **SPONGE** Functioning at Land**SCAPE** Scale in European Catchments for increased Resilience of Communities against Hydrometeorological Extreme Events

How to select an appropriate model?

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UK Research and Innovation

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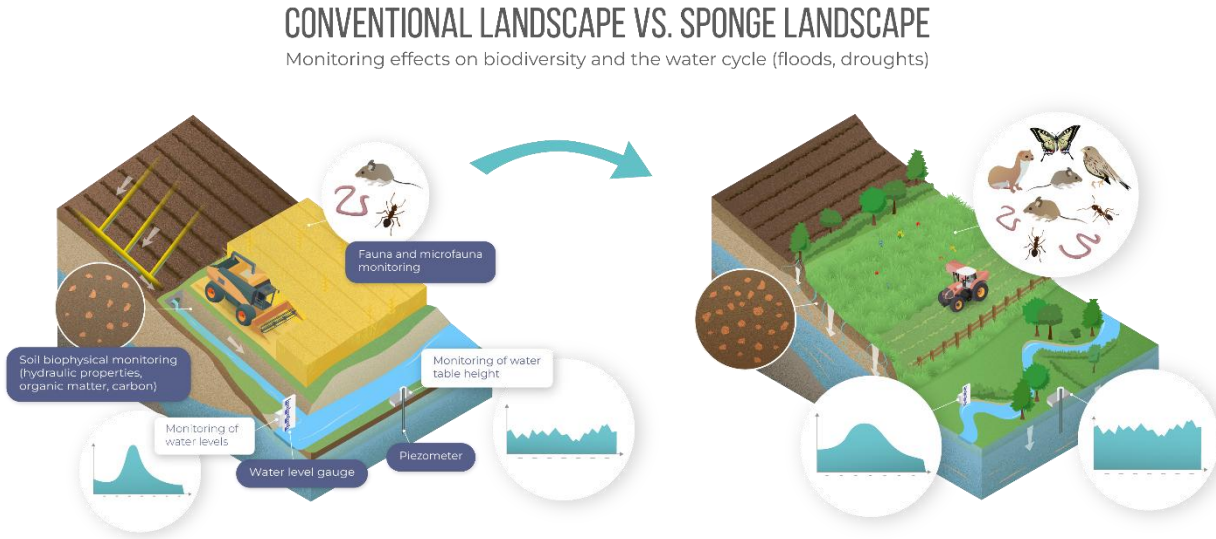
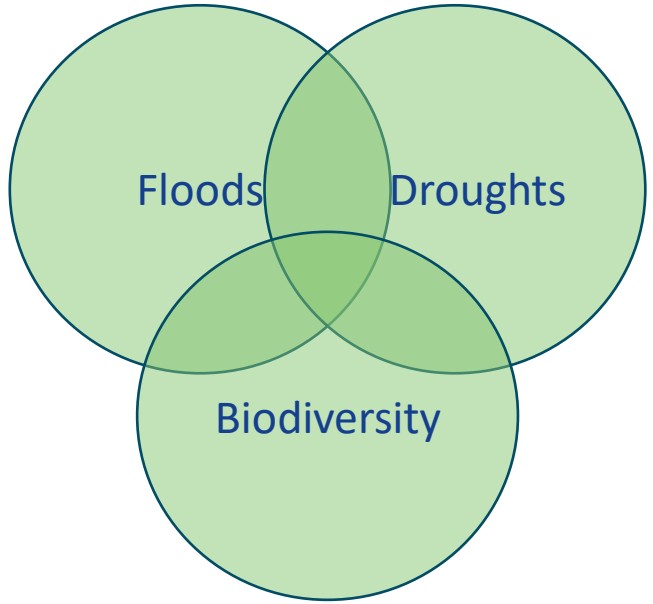
Refresher: Sponge measures

- **Preserve, enhance, or restore the water retention capacity of a landscape by**
  - Intercepting and slowing,
  - Storing and slowly releasing water

- **Can be scaled, replicated and combined to form "sponge landscapes" to mitigate floods and droughts, and provide co-benefits on a landscape scale**

- **Monitoring of implemented measures is necessary to understand impact**

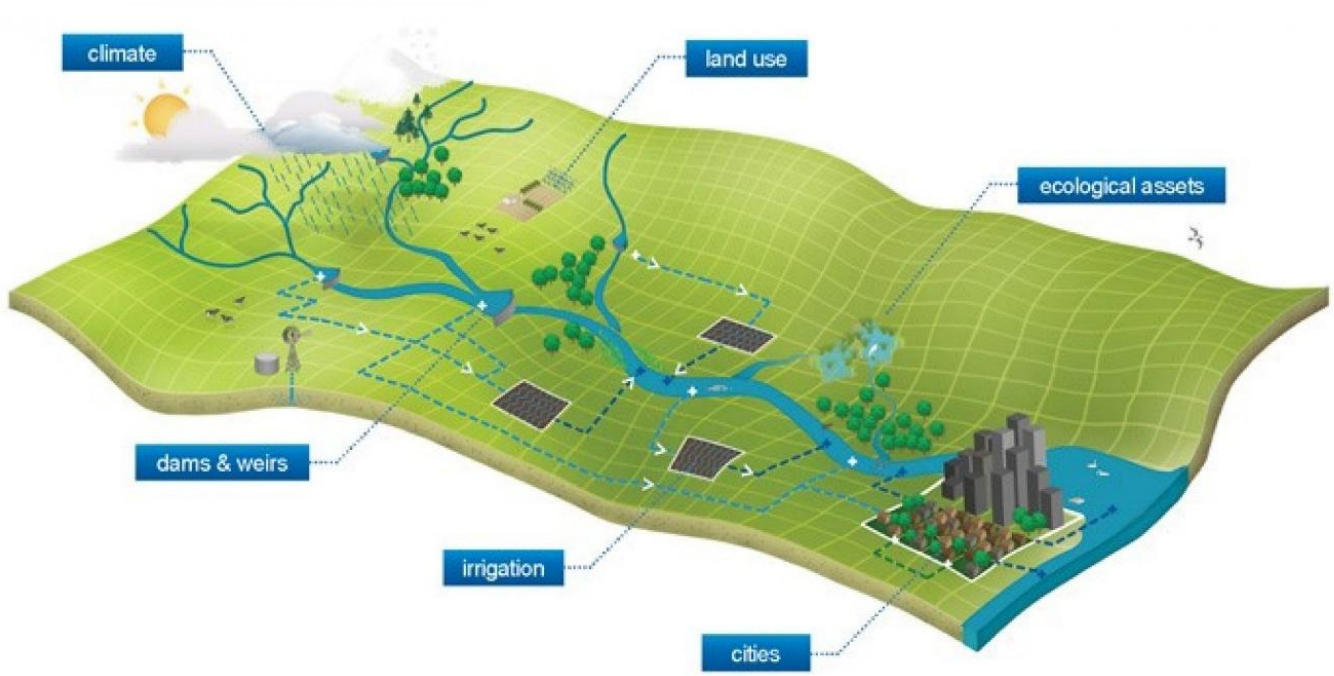




What about predicting the effects *before* implementation?

Contents

- Why is model selection important?
- Disentangling model suitability
- Demonstration of model selection guide
- Take home messages

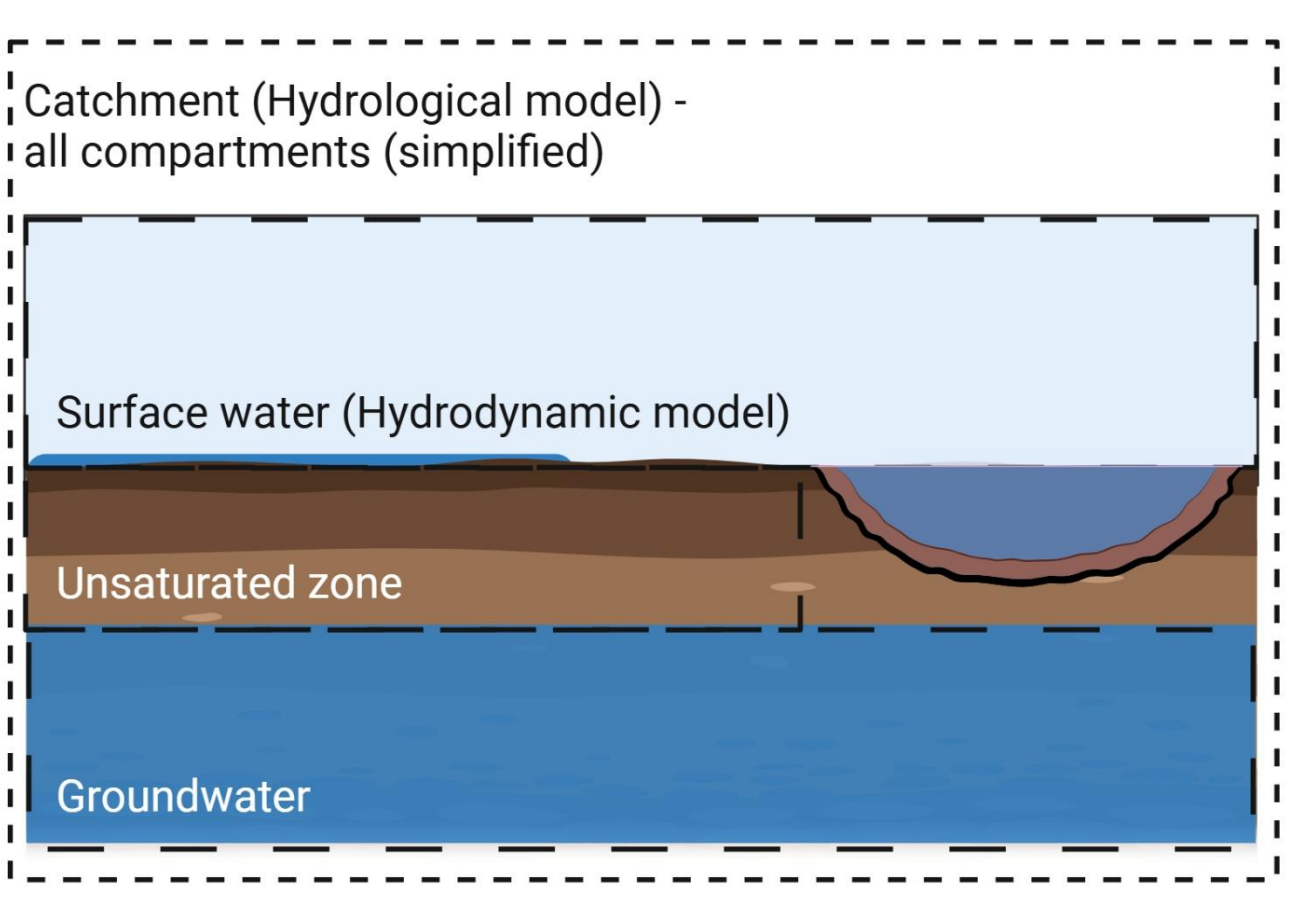


Why is model selection important?

Why is model selection important? – Model specialization

There is no perfect model

- **Hydrodynamic model**
  - 1D (open channels)
  - 2D (rainfall-runoff/floodplain)
- **Unsaturated zone model (physics based)**
  - 1D (point)
  - 2D (distributed)
- **Groundwater model**
- **Hydrological model**
  - Rainfall-runoff (distributed, semi-distributed, lumped)
  - Water balance (conceptual)
- **Other: statistical/empirical**



How to disentangle model suitability? – Our approach

- **Step 1: Model mapping exercize → identify important factors and considerations**

- **Step 2: Questionnaire → Standardization, comparability**

→ 21 modelling tools, both standalone and coupled

- **Step 3: Development of model selection guide**

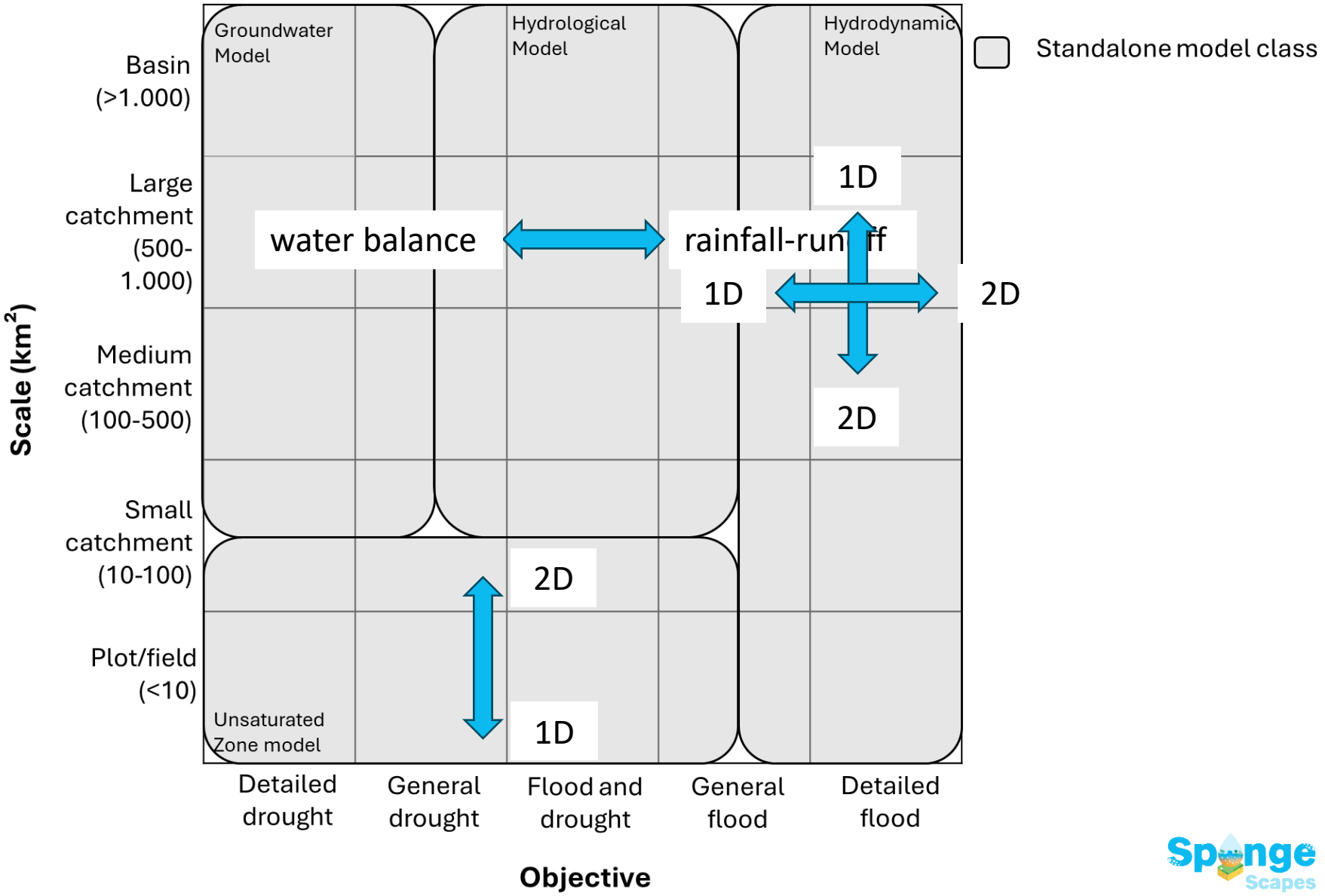
→ Formulation of 8 basic criteria

→ Assigning ratings for each criterion

Disentangling model suitability – Scale and Objectives

Suitability criteria:

- Scale/Objectives
- Level of detail
- Topography
- Complex geographic conditions
- Measures
- Co-benefits
- Additional considerations



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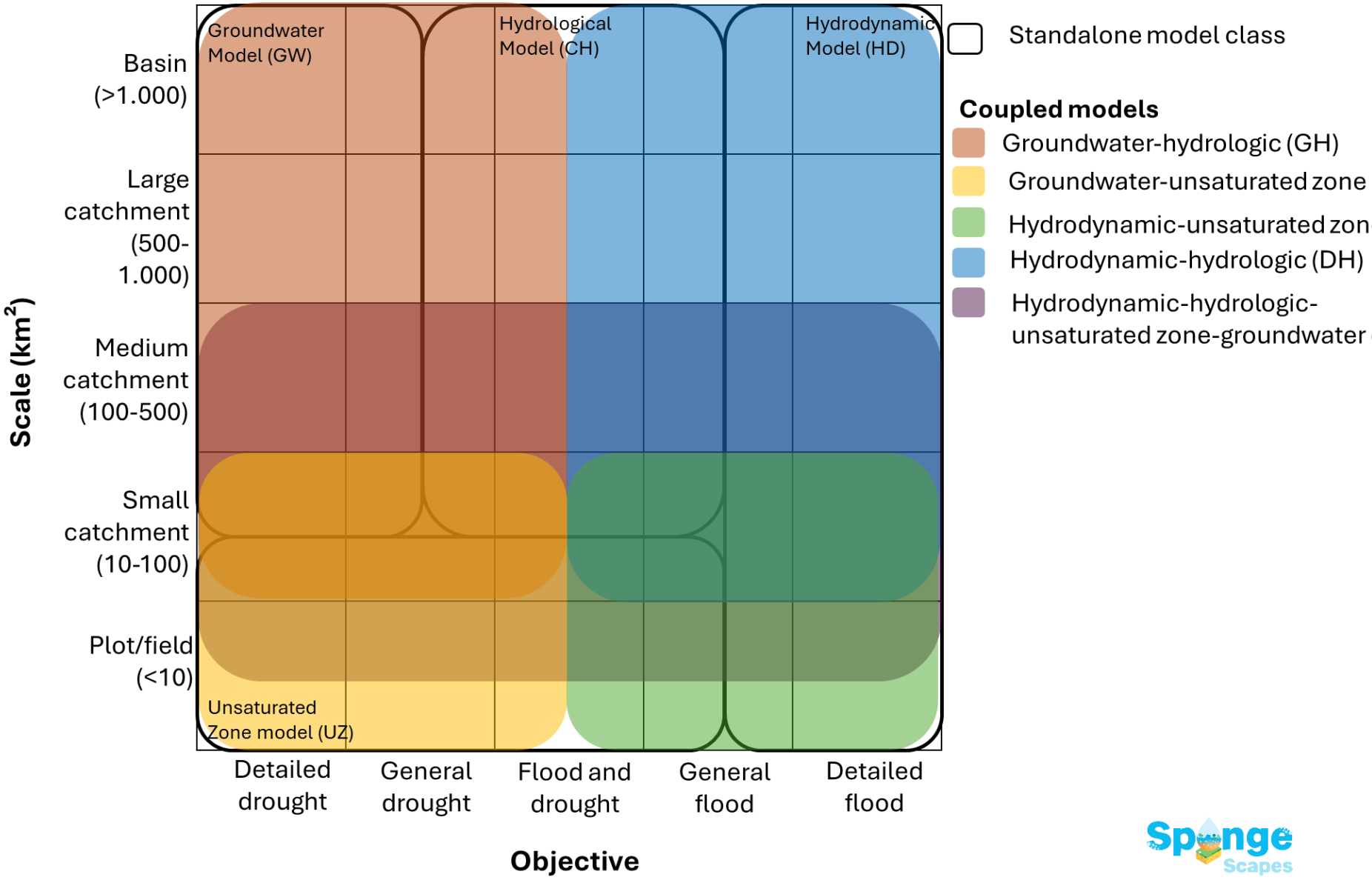
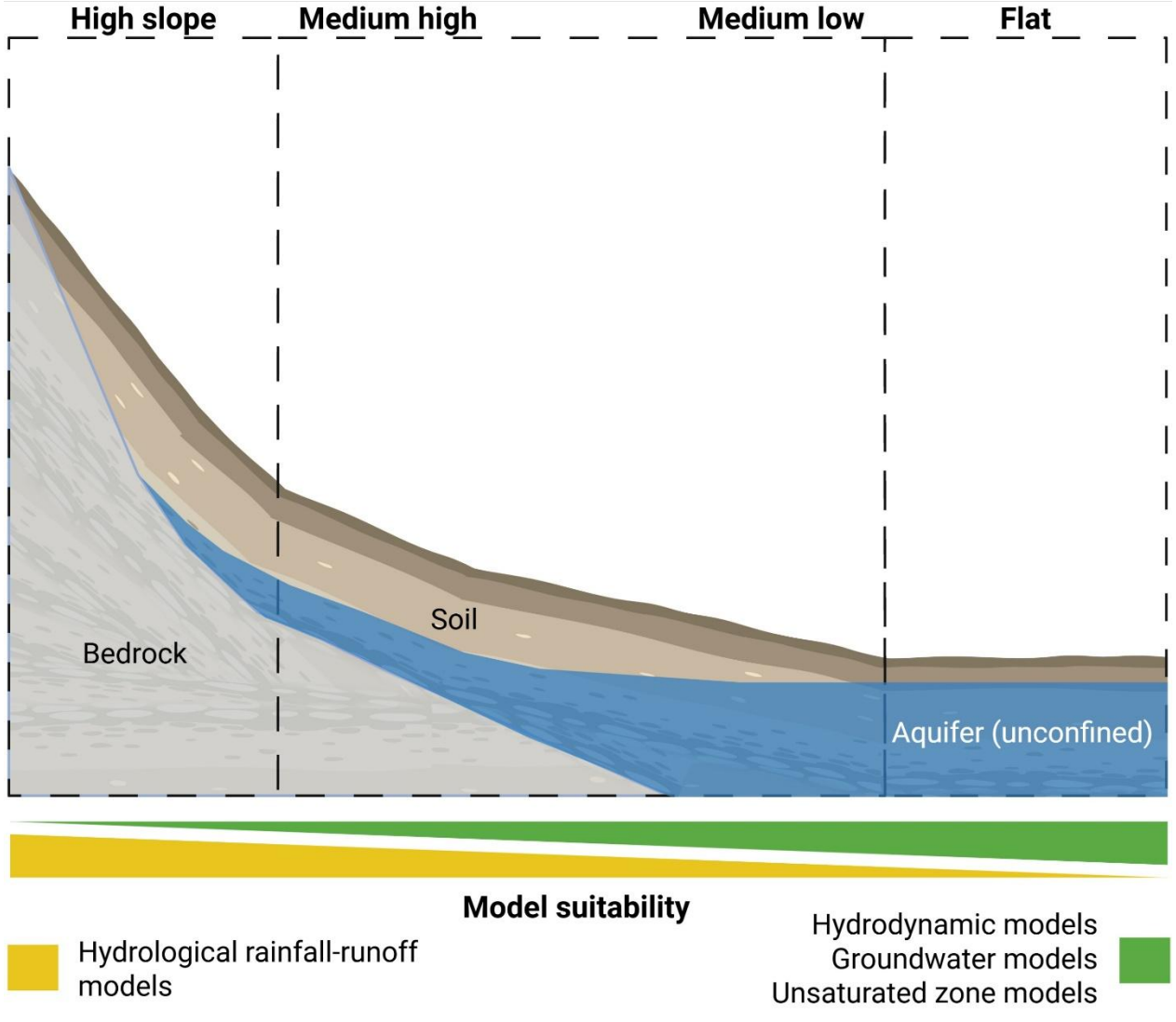


Disentangling model suitability – Topography

Suitability criteria:

- Scale/Objectives
- Level of detail
- Topography
- Complex geographic conditions
- Measures
- Co-benefits
- Additional considerations



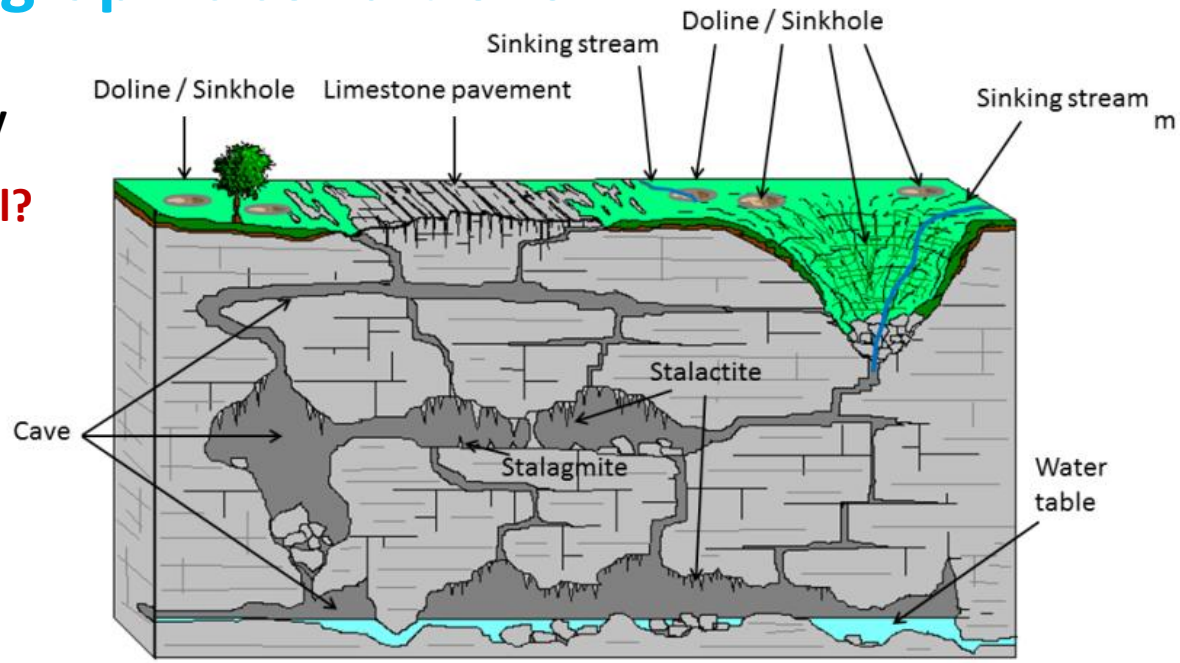
Disentangling model suitability – Geographic conditions

Suitability criteria:

- Scale/Objectives
- Level of detail
- Topography
- **Complex geographic conditions**
- Measures
- Co-benefits
- Additional considerations

Karstic geology

Empirical model?



Modified water system

Hydrodynamic model with suitable functions

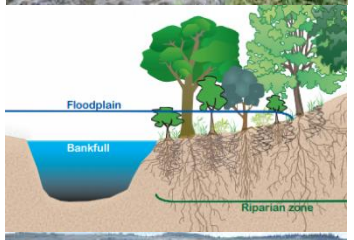
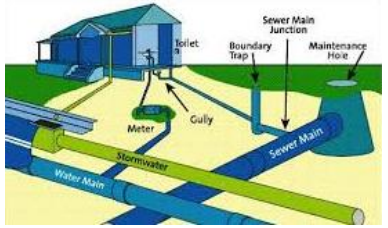
Disentangling model suitability – Measures

Suitability criteria:

- Scale/Objectives
- Level of detail
- Topography
- Complex geographic conditions
- **Measures**
- Co-benefits
- Additional considerations

Type

Location

	Instream	Catchment	Urban
Morphological changes			
Land use changes			
Land management changes			
Operational/ engineered			

Tool-specific suitability

Disentangling model suitability – Co-benefits

Suitability criteria:

- Scale/Objectives
- Level of detail
- Topography
- Complex geographic conditions
- Measures
- Co-benefits
- Additional considerations

Erosion / sediment transport

Hydrodynamic model?

Crop yield

??

Water quality

??

Biodiversity

??

Tool-specific suitability

Disentangling model suitability – Additional considerations

Suitability criteria:

- Scale/Objectives
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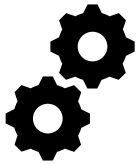
Accessibility/flexibility → Free / open source?



Robustness/intuitiveness → support / documentation?

Flexibility/data scarcity → Global data, number of parameters

Demonstration of model selection guide

- **ModeST_v01**

Take home messages

- Model suitability depends on many different criteria
- No one model can do everything – picking a suitable model is about prioritization
- All models are wrong, some are useful
- Modelling starts with tool selection, but good modelling practice still applies
- The theoretically most suitable may not be applicable in practice
- Trust beats accuracy

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