Tyndall Centre for Climate Change Research 21 years

OPEN CLIMATE IMPACTS MODELLING FRAMEWORK

Open Climate Impacts Modelling Framework (OpenCLIM)

Wrapping-up SPERARE online conference

“Russia and the UK on the road to COP26”

March 10, 2021

UEA University of East Anglia | Newcastle University | University of BRISTOL | CEH Centre for Ecology & Hydrology NATURAL ENVIRONMENT RESEARCH COUNCIL | DAFNI Data & Analytics Facility for National Infrastructure | Science & Technology Facilities Council | SAYERS AND PARTNERS

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OpenCLIM Project

- Funded by UK Climate Resilience Programme
- 28 month project to develop the next generation of national climate change risk assessment – UK has a mandated five-yearly cycle in the Climate Change Act (2008)
- Our vision is *"to enhance the UK's climate change risk capability through development and implementation of an advanced open modelling framework, and to nurture a community of developers and users to ensure its long term sustainability"*
- We see this as a foundation for ongoing efforts in this area

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OpenCLIM Project

Key Issues

- About linking models into an integrated framework rather than developing new model components including:
  - The integrated model framework,
  - The model coupling, and
  - Representation of adaptation in addition to impacts under no adaptation
- Developing a community model so that new capabilities can be added by others as they develop – an open model framework
- Use STFC's DAFNI (Data & Analytics Facility for National Infrastructure) platform for software integration and a robust legacy

OpenCLIM Project Consortium

- Tyndall Centre for Climate Change Research
  - University of East Anglia (UEA)
  - Newcastle University (NCL)
- Bristol University
- Centre for Ecology and Hydrology (CEH)
- Science and Technology Facilities Council (STFC)
- Paul Sayers and Associates

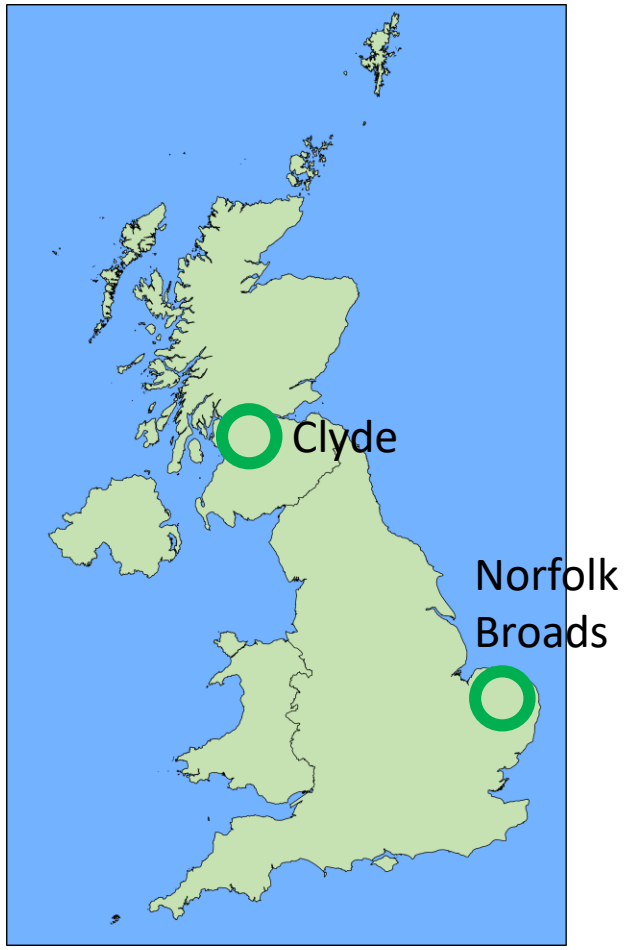
Study Sites and Stakeholder Engagement

England and Wales (4 Dec 2020)

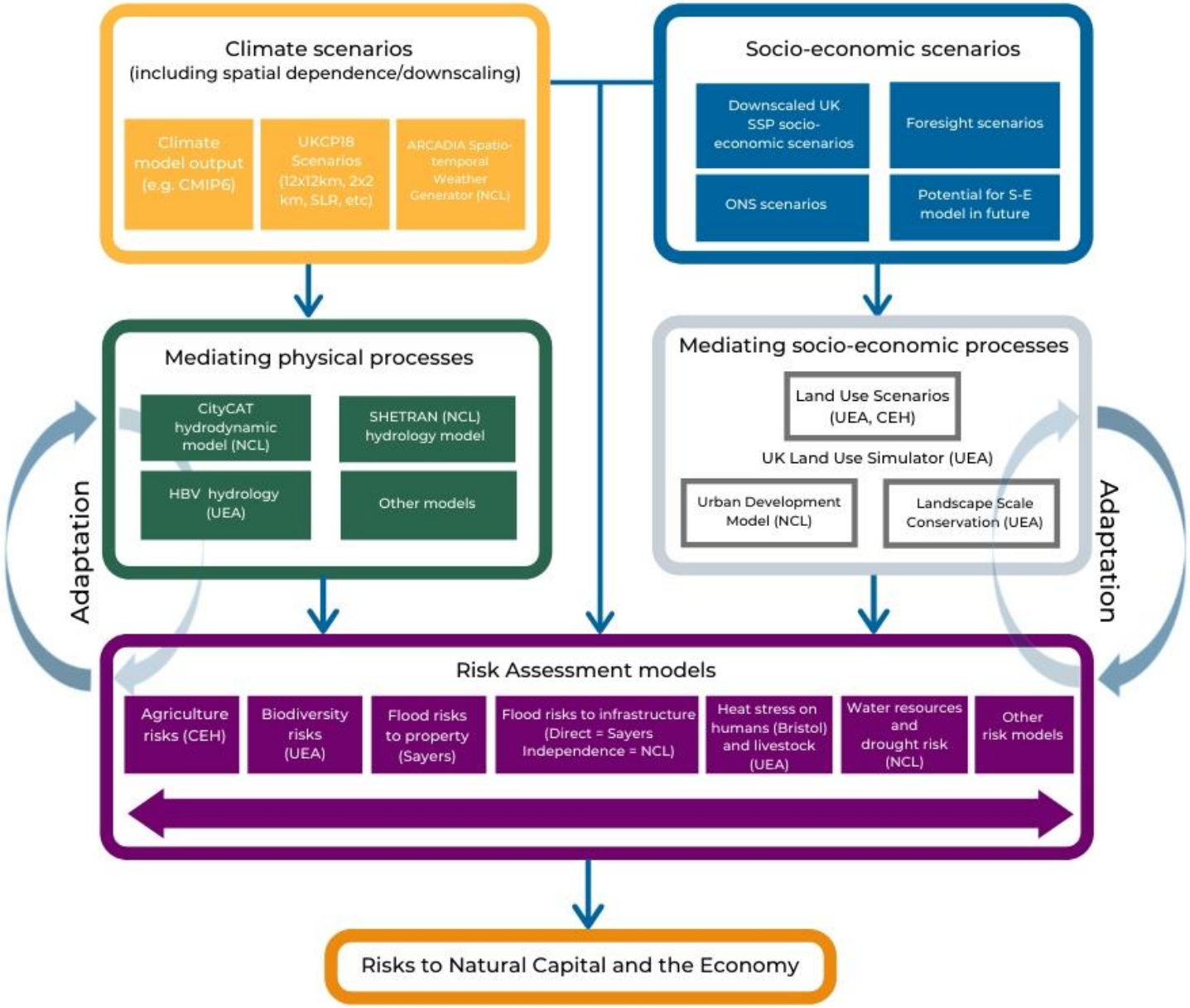
Scotland and Northern Ireland (15 Dec 2020)

Norfolk Broads (11 Feb 2021)

Clyde Catchment (proposed April 2021)



OpenCLIM Structure

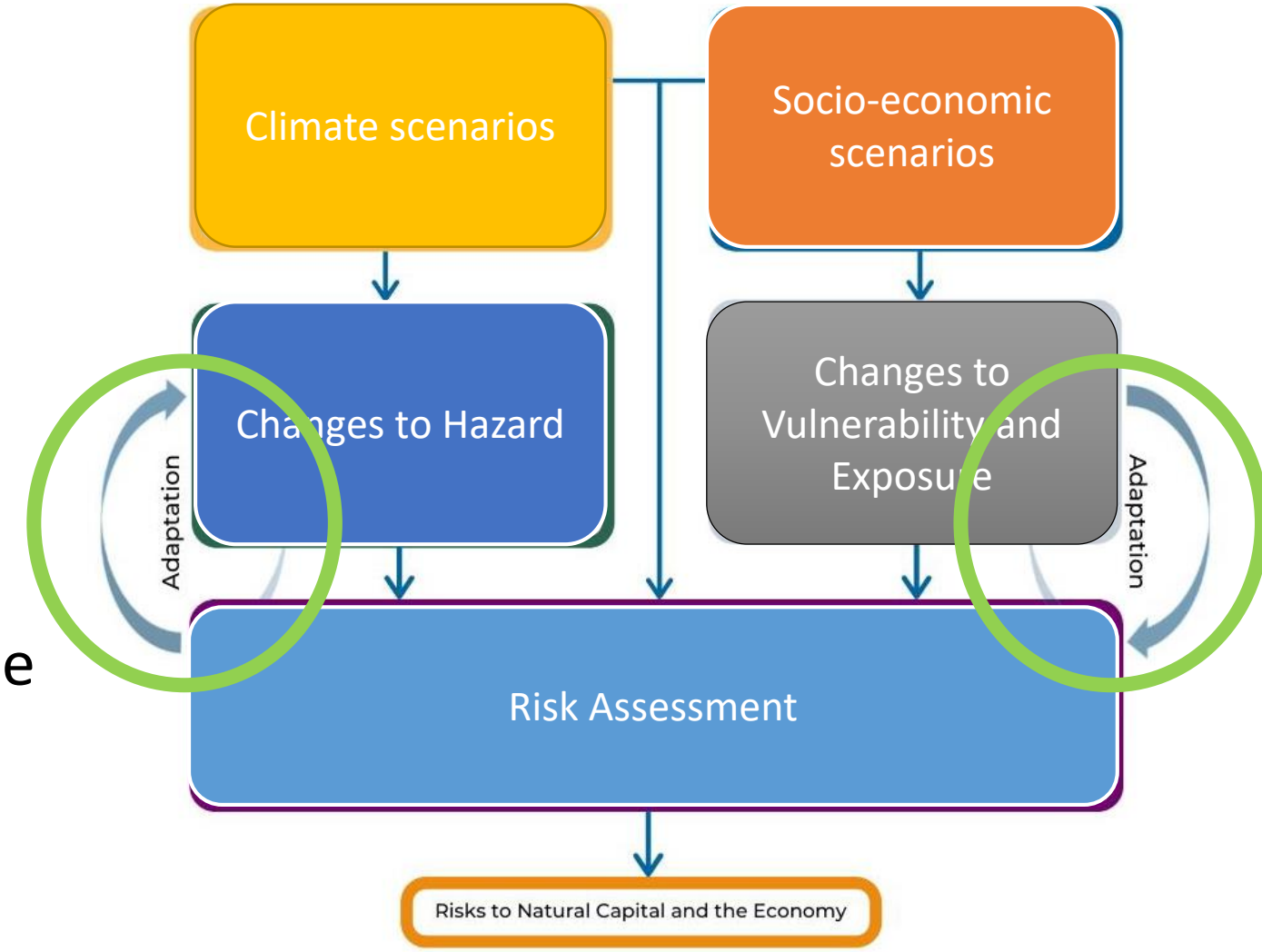


Climate and Socio-Economic Processes

- Includes land use/Urban development changes vulnerability/exposure profile
- Spatial allocation of people, infrastructure, and assets

Aim:

- To provide a process to map the impacts of socio-economic change alongside climate change



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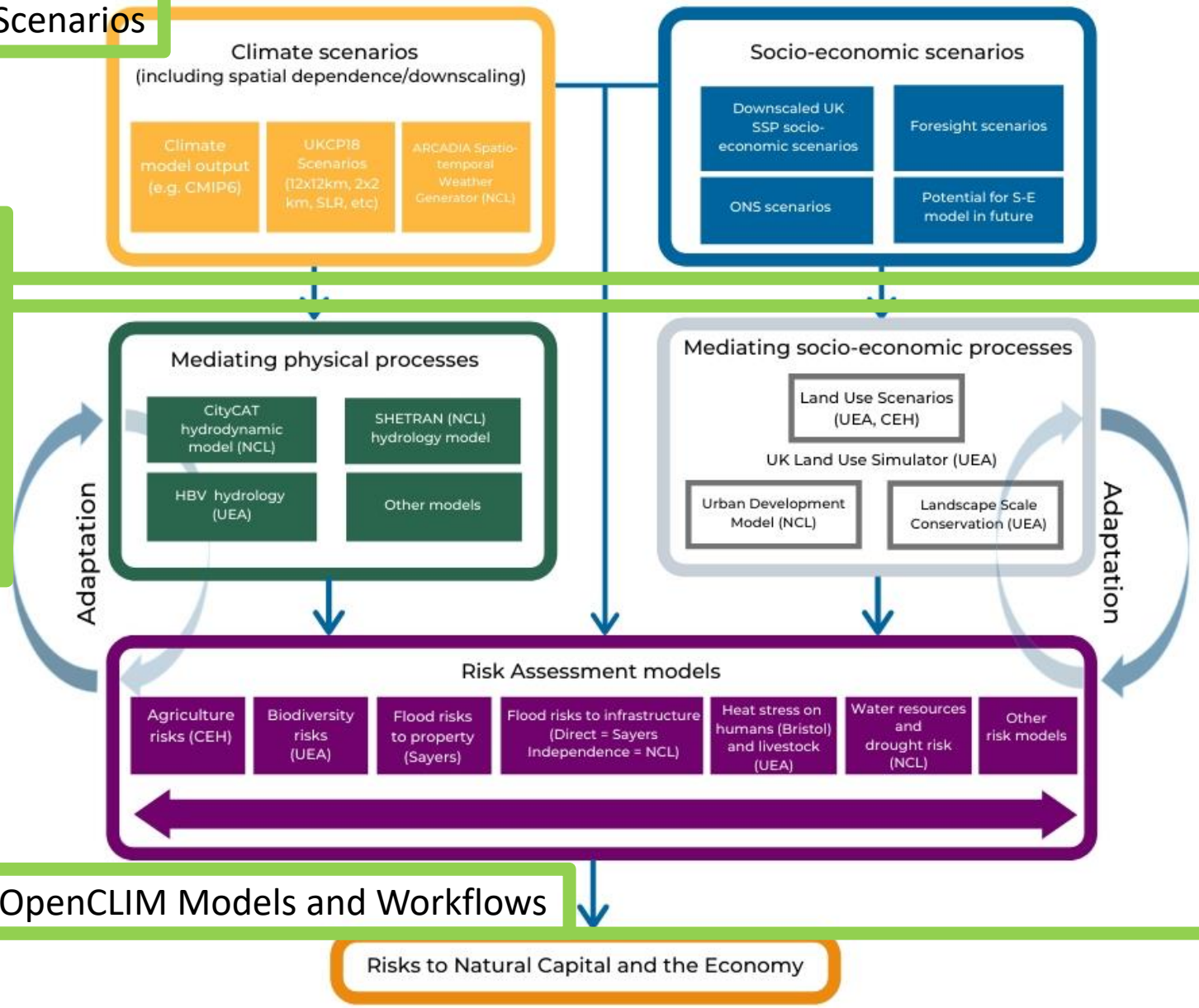
OpenCLIM Structure

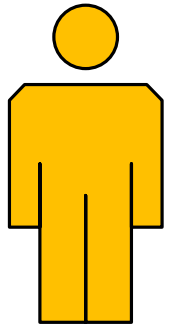
1. OpenCLIM Framework

2. Scenarios



4. OpenCLIM Models and Workflows

3. Stakeholder Engagement



5: OpenCLIM Roadmap
6: OpenCLIM database
7: Adaptation inventory and database
8: DAFNI and accessing results

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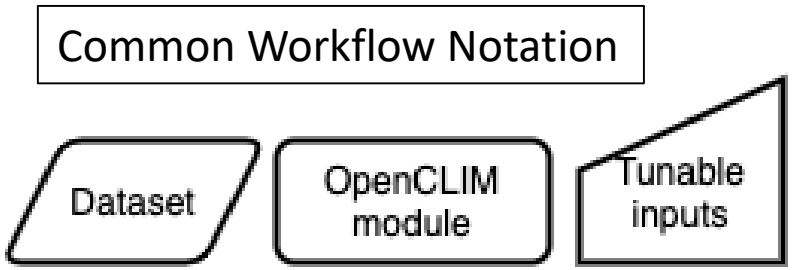
Workflows

- Workflows are an assembly of appropriate models and data that allow users to create complex system-of-systems simulations and make the results of these workflows available to share with other users.
- In OpenCLIM we are currently exploring six workflows combining all the models available to the project to be implemented on DAFNI.
  1. Biodiversity/land cover
  2. Urban development
  3. Agriculture
  4. Heat stress
  5. Inland flooding
  6. Drought and Water supply



- These workflows are NOT independent and there are developing linkages.

Agriculture: Models

Aims to develop:

i) national maps of crop suitability under UKCP18;

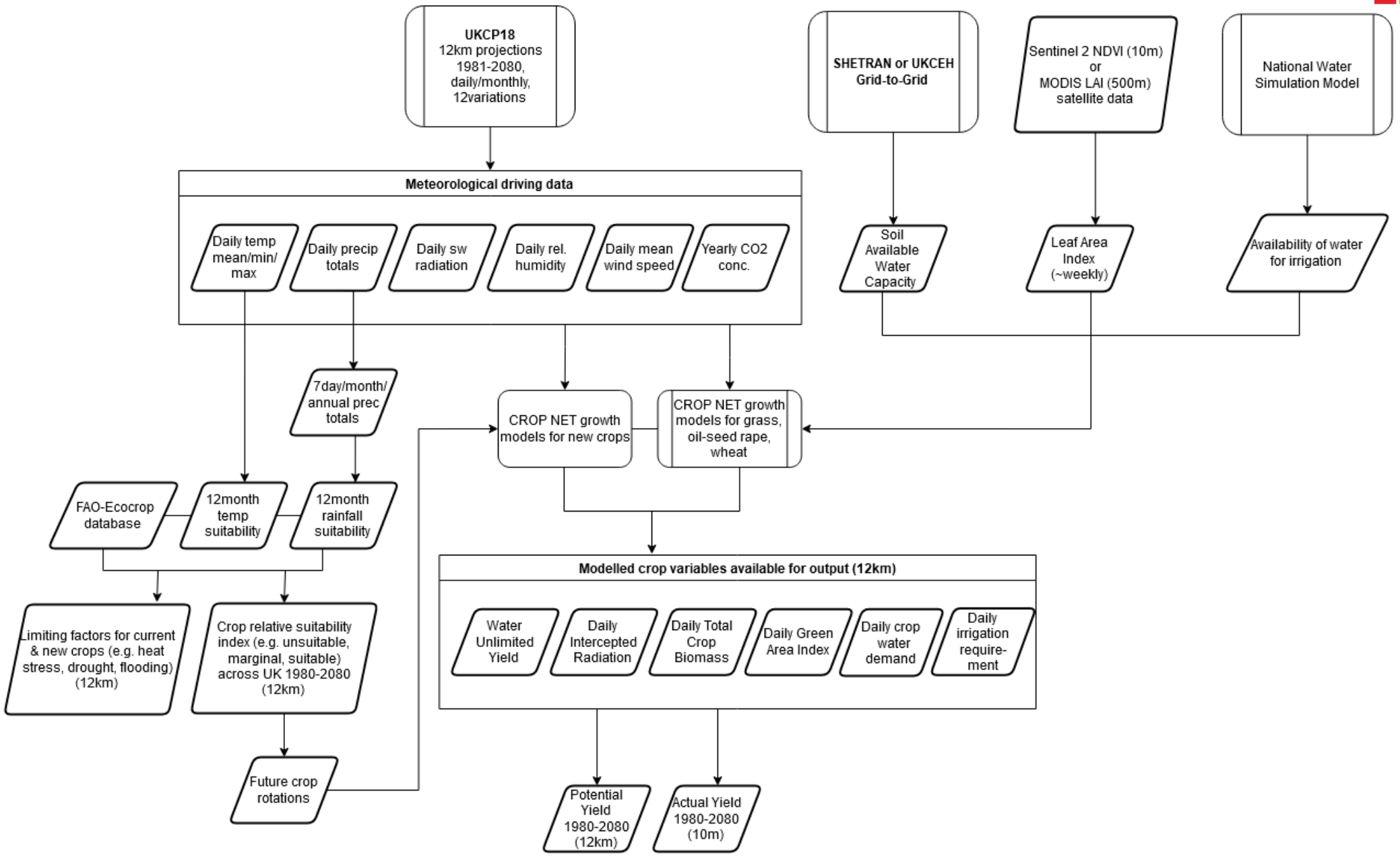
ii) spatially explicitly yield predictions under UKCP18 for selected crops; and

iii) climate adaption tools for agriculture

Core models	Key Input	Key Output	Adaptation options
EcoCrop	Daily temperature, precipitation as 7 day or monthly moving average	Crop climatic relative suitability score	Selection of tolerant crops and 'climate smart' crop rotations
Crop_Net	Soil available water capacity, daily temp, precipitation, shortwave radiation, RH, mean wind speed, CO_2 conc., leaf area index	Potential yield, actual yield	• *Agronomy – planting date, inputs* • *Crop breeding* • *Increase soil available water capacity* • *Irrigation*

Additional Models?	Key Input	Key Output	Adaptation options
National Water Simulation Model (Workflow 6)	River flow, irrigation water demand, non-public water demand (abstraction data), public water demand (WRMP planning tables)	Reservoir storage, water restrictions (level 3 and 4), shortfalls in water available for abstraction for different abstractor groups per catchment	Inter basin transfers, New infrastructure / supply side options, Abstraction reform, Re-allocation / prioritisation of abstractor groups
SHETRAN (Workflow 5 and 6)	Lakes, PE, Rainfall, Land Cover, Soil & Geology, DEM	Streamflow, reservoir flows, soil moisture/groundwater moisture	Slow the flow
Heat stress (livestock)?? (Workflow 4)			Livestock housing options

Agriculture: Workflow



Agriculture: Plan & Progress

Crop suitability mapping

1. **Eco-crops database linked to UKCP18 data to produce UK crop suitability maps**
2. Overlay crop suitability with water shortage/water supply maps
3. Consult with stakeholders to identify climate-smart crop rotations
4. Select a limited number of crops for yield modelling

Crop yields

5. Assimilate Sentinel 2 LAI data into Crop-NET model to provide actual yield correction from 1km to 10m;

6. Analysis of extreme climate events on UK crop yields, 1990-2020; 2020-2080

7. Make Crop-NET models work over whole UK to be CCRA compliant

8. Scope linking with SHETRAN and National Water Simulation models

Stakeholders & collaboration

9. Stakeholder meetings

10. Work with stakeholders to refine adaptation strategies

Key linkages = Biodiversity/land cover; Water supply & drought, Floods; (animal) Heat Stress (Workflows 1, (2), 4 and 6)

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