Integrated socio-environmental modelling of policy scenarios

Supporting evidence-based decision-making for Scotland's rural environment

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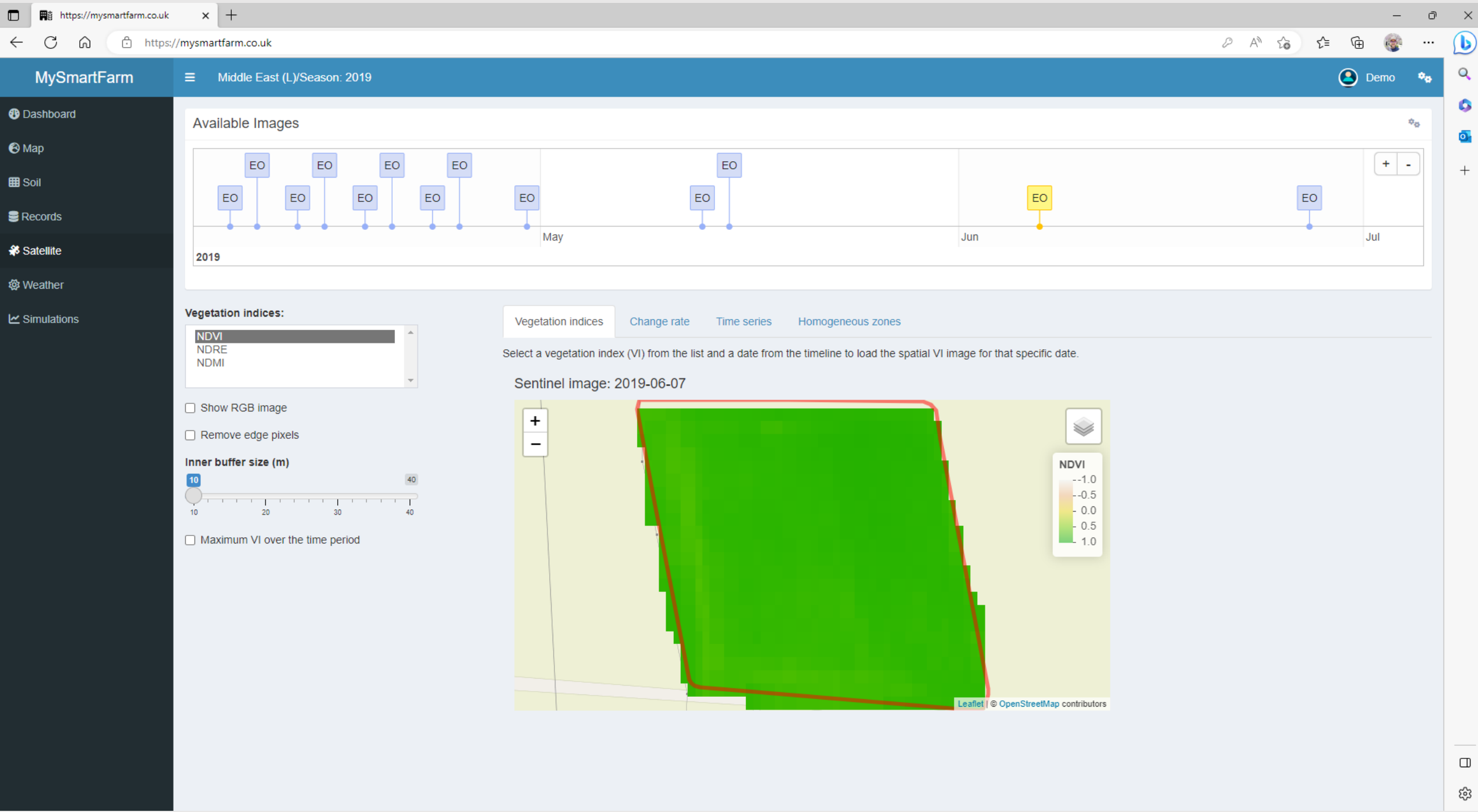
Aim

This project aims to leverage the power of computer modelling to provide decision-makers with evidence-based, decision-support tools for matters relating to rural social-environmental systems in Scotland. It will use an agile research project management approach and stakeholder participation to ensure the tools are transparent, of practical value, and capable of being responsive to evolving stakeholder needs. Ultimately, the project aims to develop a comprehensive monitoring framework for Scotland's soils, a high-resolution spatial model to assess the impacts of climate change on land-based activities, and an agent-based agriculture model to simulate policy-to-fork scenarios.

Drivers

Computer modelling has an increasing role to play in helping to navigate the landscapes of complex social-environmental decision-making processes and offer decision-makers integrated, consistent guidance based on formalizations of evidence. Such computer modelling needs to be accountable and transparent, especially when the consequences of such decisions have impacts on businesses and citizens. Modelling and data analysis in this project is driven by:

- The need to monitor the health of Scotland's soils in support of production of land-derived goods, biodiversity, regulation of water and nutrient flows, and carbon sequestration;
- Biophysical and societal pressures on arable land systems and the threats and opportunities from climate change;
- Changes in frameworks for supporting production systems, changes in international trade agreements, and technological innovations particularly in the circular economy.

Figure 1 – Screenshot from the MySmartFarm app which has been developed as part of the project :
MySmartFarm is a crop modelling platform for assessing water use and estimating crop yields at the field scale as a function of the soil-plant-atmosphere dynamics. It is intended as a practical tool for farmers, offering near contemporaneous insights into a variety of variables. You can try the app yourself at: https://mysmartfarm.co.uk.

Figure 2 – Other outputs from the first year of the project
These include the RIVERTOOL application shown above, plus a number of papers, posters, and other prototyped tools.

Objectives

WP0: Agile Management. To ensure the project's timely and continuous delivery of value to the scientific, policy and stakeholder communities (led by GP).

WP1: Digital Environment. To co-construct guidance for integrative and reproducible modelling and to prototype and iteratively co-develop digital infrastructure to provide a digital environment for policy-led large-scale modelling of Scotland's rural human-environmental system based on international best practices and innovative uses of existing and novel data sources (led by KM).

WP2: Soil Monitoring Framework. To evaluate and present options for a soil monitoring framework that takes into account the variety of Scottish soils, is applicable across a wide range of land uses, and becomes part of Underpinning National Capacity (led by NB).

WP3: Rural Landscape Potential for Multiple Benefits. To develop models that improve the sustainable delivery of multiple benefits from land, accounting for spatial constraints on suitability and land change impacts (led by MR & AG).

WP4: Governance Scenarios. To undertake large-scale modelling to explore scenarios pertaining to government influence on the rural social-environmental system, and the impact this has on waste with particular focus on Scotland's food system 'from policy to fork' (led by BM).

WP5: Mediated Modelling. To provide a service to WPs 1-4 by prototyping and refining a set of mediated modelling protocols that can facilitate efficient, low-input stakeholder involvement in rapid-response, policy-led, large-scale modelling (led by MH).

Next steps

The second year of the project will build on the foundations already laid. For example, we will be:

- Writing of a paper on agile project management that will consider the lessons learnt during the project thus far (WP0);
- Projecting barley yields over time and space under different climate change scenarios (WP3);
- Simulating the effect of proposed Common Agricultural Policy replacement measures (WP4);
- And much more!

Further information
For more information and to keep track of project progress, visit:
https://large-scale-modelling.hutton.ac.uk

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