UK National Climate Crop Modelling Capability (UKNCCC)

Farm-scale decision support platforms

Enabling two-way data exchange, crop monitoring and simulation

Call to action:

Advance UK capability in farm-scale decision intelligence by integrating multi-source data streams with predictive crop and soil models. Prioritize automation of analytics and visualization tools to enable real-time monitoring of productivity, resource efficiency, and climate resilience at the field level.

Why we need farm-scale decision support platforms in UKNCCC:

Farm- and field-scale Decision Support Systems (DSS) are essential tools for helping farmers make both real-time tactical and long-term strategic decisions. Their value includes:

- Climate Services: DSS support the delivery of climate-smart practices for both mitigation and adaptation
- Data for Modelling: Data collected (e.g. crop observations, soil moisture) can improve model calibration, enhancing simulations of crop and grass growth under future climate scenarios using unique soil-climate combinations
- Smart Investment: Platforms like OurSmartFarm were developed to harness this potential and support data-driven farm management
- Supply Chain Insights: DSS can inform production forecasting, supporting supply chain resilience
- Reducing Waste: By improving productivity and reducing losses, DSS contribute to food security and waste reduction at the start of the food system

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Benefits:

Enables real-time, data-driven decisions for both tactical and strategic farm management	Improves model calibration by integrating diverse data (e.g., crop, soil, weather), enhancing future scenario simulations	Strengthens supply chain resilience through better production forecasting
Reduces waste and boosts food security by increasing productivity and minimizing losses	Facilitates collaboration between farmers and scientists, improving decision quality while respecting data privacy	Delivers location-specific climate services for strategic planning and risk assessment

Alignment with policy:

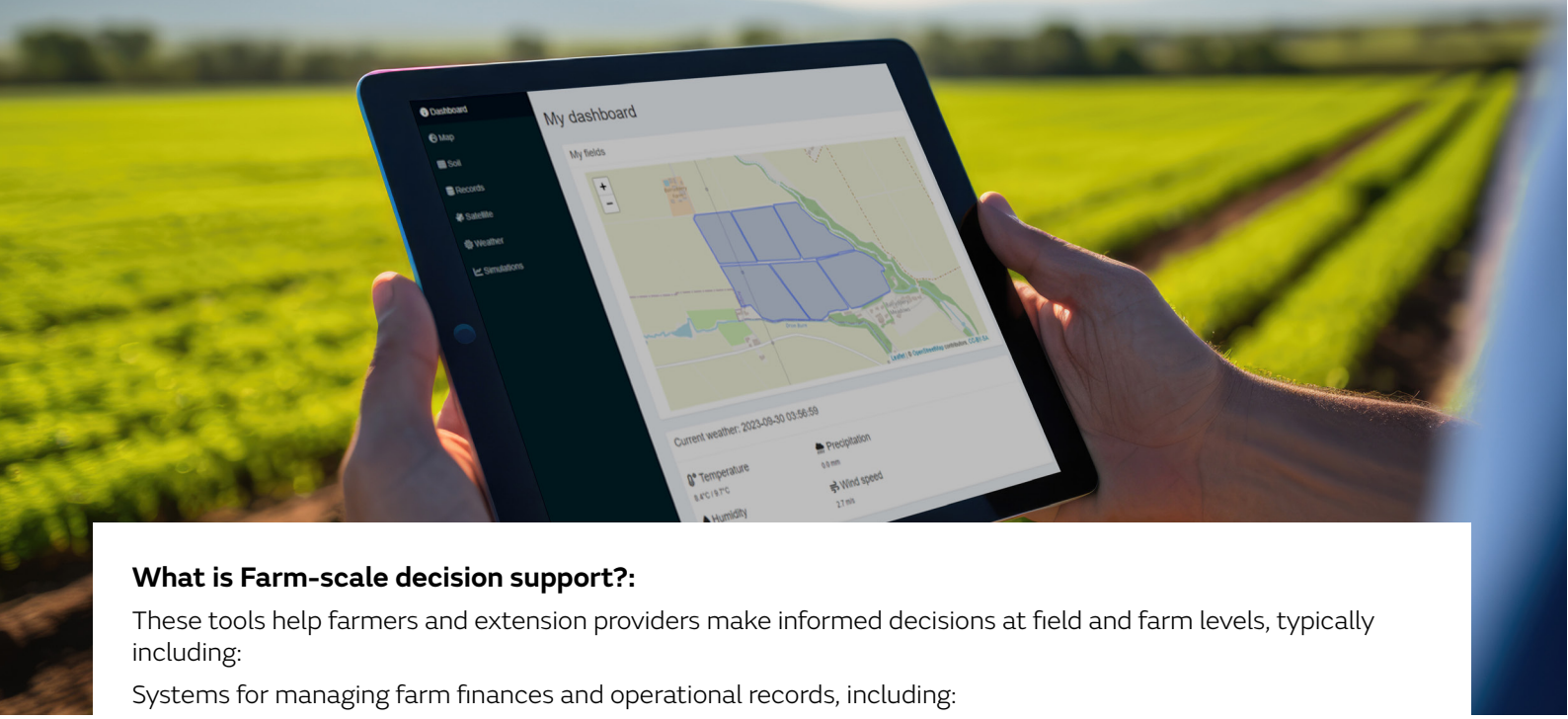
This aligns with UK government priorities, including the Environmental Land Management schemes and Sustainable Farming Incentive by enabling data-driven soil health, nutrient management, and integrated pest control. Its precision agriculture features reflect the Farming Innovation Programme's digital transformation goals, while optimised input use supports Net Zero Growth Plan targets for emission reduction. Weather data integration and crop phenology modelling enhance resilience per National Adaptation Plan 3 (NAP3) while sustainable production aligns with the 25-Year Farming Roadmap.

Priority Actions and Recommendations for UKNCCC:

These tools help farmers and extension providers make informed decisions at field and farm levels, typically including:

There is significant potential to scale and enhance farm DSS through greater **collaboration, data integration**, and **climate service alignment**:

- Fostering Collaboration → Bringing together DSS developers, farmers, extension services, and researchers can unlock the wider value of farm-collected data for public good and supply chain resilience
- Farmer–Science Partnerships → Improved data exchange can enhance model outputs for decision-making. While data ownership remains with farmers, anonymised use for model calibration avoids privacy concerns and General Data Protection Regulation (GDPR) issues
- Location-Specific Climate Services → DSS can integrate localised climate projections and risk assessments to support strategic planning. For example, the James Hutton Institute's 1km-scale visualisation tool offers insights into agrometeorological indicators and climate extremes
- Farmer Engagement → DSS platforms can serve as tools for dialogue - helping identify farmer needs and co-develop solutions
- Enhanced Forecasting → Linking DSS with weather forecasts enables insights into irrigation needs, disease risks, and fire danger
- Virtual Crop Trials → DSS environments offer a low-risk space to experiment with new crop types before field deployment



What is Farm-scale decision support?:

These tools help farmers and extension providers make informed decisions at field and farm levels, typically including:

Systems for managing farm finances and operational records, including:

- **Management Records:** Soil analysis results, crop performance data
- **Financial Tracking:** Costs and revenues used to calculate margins
- **Field Visualisation:** Satellite imagery for remote monitoring of crop growth spatial variability
- **Crop Management & Nutrition:** Supports decisions on cultivation timing and fertiliser application rates
- **Crop Protection:** Risk forecasting to guide pesticide, herbicide, and fungicide use – often linked to on-farm or local weather stations to identify optimal operational windows

Precision Agriculture: Smarter, Targeted Farm Management:

Precision agriculture enables targeted interventions by using field-level data to optimise inputs, improve efficiency, and support sustainability. This is achieved through:

- **Remote Sensing & Environmental Monitoring:** Satellite imagery and on-farm sensors (e.g. soil moisture sensors) are linked to telemetry units that upload data to the cloud
- This data, made accessible via mobile devices and dashboards, provides real-time insights from sensors, weather stations, and more
- **Mapping Tools:** Integrate remote sensing with field-level management data to visualise variability and guide actions
- **Modelling Tools:** Include crop phenology models, irrigation planning, and platforms like OurSmartFarm - a Decision Support System (DSS) developed by the James Hutton Institute. With features including Field mapping, topography, weather integration and field records

UK Centre for Ecology & Hydrology

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