

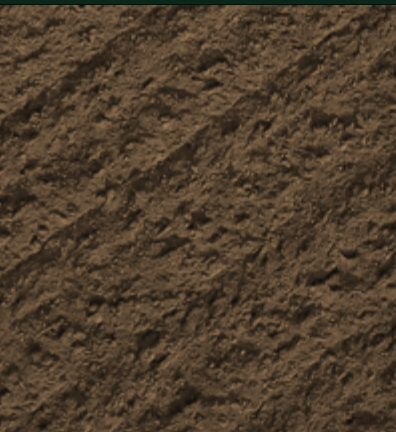


UNIVERSITY OF LEEDS



# SMART AGRI-SYSTEMS

WHOLE SYSTEMS SOLUTIONS FOR SMARTER  
AND SUSTAINABLE FARMING FUTURES



# What Smart Agri-Systems can offer

**We aim to help farms and companies, large and small, develop their competitive advantage and increase their business value. We will work with industry partners to assess the challenge they face and develop a research project to provide a solution, drawing on the necessary expertise and technology from across the University. We can also identify and source external funding to support the project.**

Our partners can benefit from use of the University of Leeds Research Farm as a testbed. The farm is being developed with advanced monitoring and sensing technology, data capture and Internet of Agri-Things for use by a wide range of commercially relevant and cutting edge agricultural, ecological, Earth and environmental research. Alternatively, we can bring the research to a location of your choice – we will work closely with our partners on a case-by-case basis to develop the best solution for the challenge posed.

## The University of Leeds Research Farm

Situated between Leeds and York at an elevation of between 40-72m, the University of Leeds Research Farm is used for agricultural, ecological, Earth and environmental research. The 317 ha farm operates commercially, is predominantly arable but includes pasture used for sheep grazing, and agro-forestry. The farm is also home to the Centre for Innovation Excellence in Livestock (CIEL)'s leading national pig centre, a £10M investment featuring both indoor and outdoor production facilities.

The farm has shallow (<50cm), well-drained, calcareous, fine loamy soils lying above a dolstone aquifer. The climate has relatively low annual rainfall of 674mm, due to its position in the rain shadow of the Pennines, and relatively mild winters and cool summers, ranging from 3.5°C in January to a mean high in August of 15.6°C.

**“To ensure resilience in the agri-food sector going forwards, it is key that institutes such as the Global Food & Environment Institute are underpinned by real world research and insights from facilities such as the University of Leeds Research Farm. Vertically integrating this knowledge into industry practice is fundamental to drive forward productivity and value creation in food of high nutritional value whilst positively impacting social and natural capital.”**

James Hopwood,  
Nomad Foods  
(Birds Eye & Findus)



## Improving future resilience

**Two projects, led by the University of Leeds and funded through Government research programmes, are developing evidence and data to model and improve resilience of two different farming systems.**

The £2.1 million PigSustain project is drawing on a multi-systems approach to predict the future resilience of the UK pig industry. An on-farm, automated and continuous monitoring system – trialled at the University of Leeds Research Farm – will provide early warning and assessment of pig health and welfare to predict outputs.

Current and historic data on pig production will be analysed in relation to changes in climate, intensification, market stability and consumer demand. The resulting model will be used to assess the economic resilience and global competitiveness of the UK pig industry in the face of current and future challenges.

AFRICAP will establish special agricultural zones across sub-Saharan Africa where farming practices and the impacts of weather, climate and supply chains can be assessed to develop more sustainable and productive agricultural systems. The focus is particularly on smallholders, who make up 80 per cent of farms across the continent.

Jointly led by the pan-African Food, Agriculture and Natural Resources Policy Analysis Network, the £9.2 million project's aim is to combine on-farm monitoring, with laboratory research and policy analysis to develop a pathway for agricultural development in Africa.

**“It is great to see Leeds adopting an interdisciplinary approach to address the challenge faced by agriculture of needing more sustainable and productive agricultural systems.”**

Richard Heathcote, R&J Sustainability Consulting Ltd

# About Smart Agri-Systems

**Smart Agri-Systems at the University of Leeds provides innovative, multi-discipline, systems-based solutions to help industry navigate the complex future challenges for sustainable development of global food production.**

Farmers and agribusinesses face multiple competing demands: to increase efficiency and productivity, ensure food is safe and nutritious, adapt to climate change, maintain high environmental and animal welfare standards and manage fluctuating prices and trading patterns. Meeting these challenges, while still running a profitable and sustainable business, requires complex decision-making, drawing on evidence from the whole supply chain.

Smart Agri-Systems offers an integrated, solutions-focused approach to tackling multi-faceted challenges across the food system: from the farm, through the supply chain, to the consumer. On the farm, sensors – either fixed, or on drones and robotic crawlers – can monitor soil temperature and humidity, map crop growth and density, assess ground water composition, and track the weather, with data streamed at high speed and analysed using complex algorithms to assess and project crop performance.

For livestock production, genomics data can be combined with real-time sensor outputs on environmental conditions, growth rates, feed consumption, behaviour and health to project performance at scale: from an individual animal up to a whole farm.

Beyond the farm, Smart Agri-Systems combines data and expertise on supply chains and logistics, consumer behaviour, health outcomes, environmental monitoring, international law, trade and business to provide sustainable whole system solutions, from field to fork.

The University is positioning itself as a leader in defining future agri-energy systems required to decarbonise UK and global food production. The University Farm is being developed as a testbed for trialling innovative solutions for rural and peri-urban energy systems enabled by Smart technology.

## Technology and innovation

To support its goal of sustainably enhancing UK agriculture, the Government is providing up to £90 million funding for academics and industry to work together to develop new technology and innovation in the agricultural sector, focusing on artificial intelligence, robotics and precision agriculture.

The broad range of expertise at the University of Leeds allows us to apply a powerful unifying systems approach to tackle challenges in national and international agricultural production. Through Smart Agri-Systems, commercial agricultural practitioners can work with teams of experienced researchers to develop solutions for a smarter, enhanced, integrated and sustainable future for farming.

**Research expertise in Smart Agri-Systems at the University of Leeds includes:**

- Farm production: livestock production, health and welfare, optimisation of crop growth, productivity and pathogen resilience, precision nutrition
- Technology: artificial intelligence, robots, sensors, imaging, machine learning, automatic control, 5G telematics and data transmission, high-speed computing, big data analysis, mathematical modelling
- Environment: environmental monitoring, climate change, Earth observation, waste management, water quality and pollution, soil health, sustainability, energy, biofuels
- Business and People: systems approaches, consumer analysis, supply chain modelling, decision-making, agricultural policy, trade and governance, social change, communication of reform, workforce development

## Delivering Net Zero

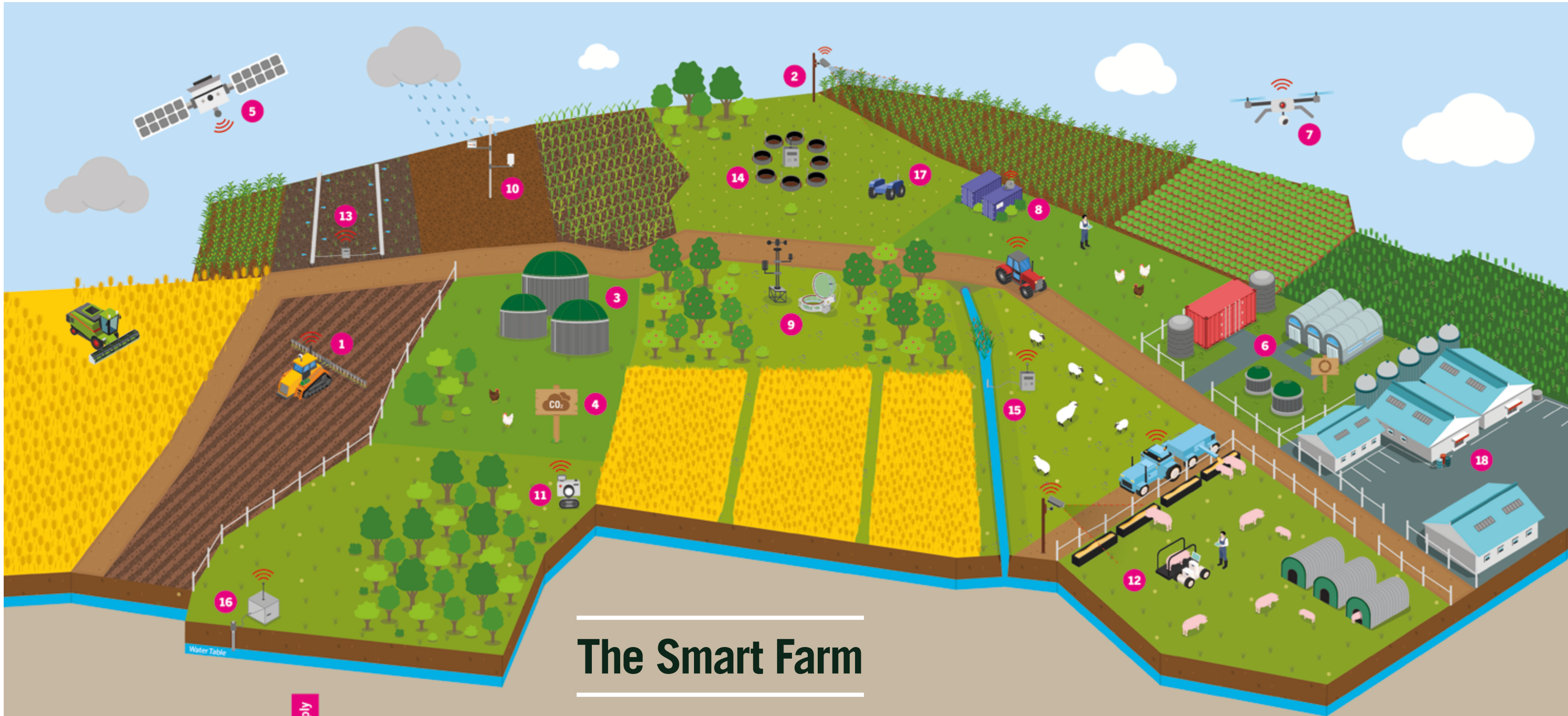
Agriculture accounts for 10% of greenhouse gas (GHG) emissions in the UK and 20% of those globally. The decarbonisation of crop and livestock farming is a major challenge that industry is keen to tackle but practical, evidence-based routes to net zero production must be defined.

The University of Leeds is driving innovation in net zero and regenerative agriculture research from the acquisition of data to underpin robust, universal emissions standards to the development, integration and testing of technologies and practices to identify farming systems that are net zero for emissions and environmentally regenerative.

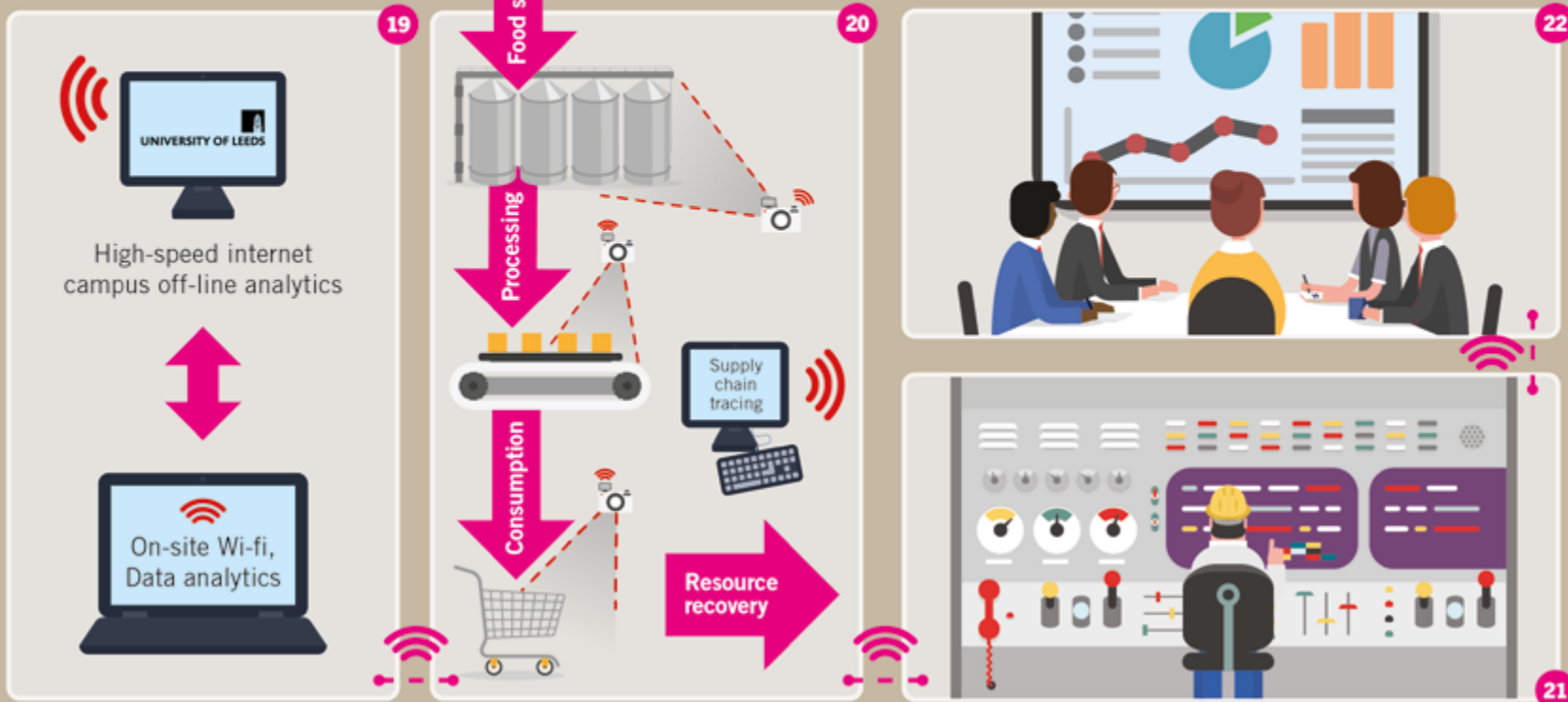
Central to this mission is the University of Leeds Research Farm, with state-of-the-art sensing technology to monitor the range of GHG emissions, soil health and biodiversity and a commercial mixed arable and livestock model permitting exploration of circular economy approaches to improving the sustainability and profitability of production.

These include technologies to valorise waste streams and the integration of novel, renewable agri-energy solutions. By taking a systems approach that considers environmental, commercial, social, and legislative components of future agri-systems, we are mapping sector-specific pathways that will de-risk future investment and allow profitable, climate neutral and regenerative production to be realised.





# The Smart Farm



- 1 Precision application of agrochemicals
- 2 Vegetation Productivity Imaging
- 3 Agri-energy solutions
- 4 Net Zero Agriculture
- 5 Satellite remote sensing data products
- 6 Novel waste amelioration and valorisation systems
- 7 Aerial imaging
- 8 Atmosphere climate observation
- 9 Greenhouse gases & land-atmosphere fluxes
- 10 Meteorological observation
- 11 Land Imaging
- 12 Livestock production sensing systems
- 13 Soil moisture sensor network
- 14 Lysimeter mesocosms
- 15 Drainage flow monitoring
- 16 Groundwater monitoring, flow and transport simulation
- 17 Autonomous Robot
- 18 National Pig Centre
- 19 Internet of things
- 20 Supply chain tracing
- 21 Smart agri-system dashboard
- 22 Adding business value





**Get in touch**

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