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"Towards multi-functional agro-ecosystems
promoting climate resilient futures"

UKUDLA: Data-driven innovation for sustainable and resilient food systems in Africa

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Abstract

UKUDLA, the African German Centre for Sustainable and Resilient Food Systems and Applied Agricultural and Food Data Science, addresses a central challenge of agri-food research: transforming food systems toward greater sustainability, resilience, and equity while strengthening the evidence base for action. Based in Southern Africa, the centre brings together food systems research and applied data science in an interdisciplinary framework linking ecosystems, agricultural production, food environments, value chains, governance, and human capacity development. Three research clusters provide an integrated framework for understanding how environmental, social, institutional, technological nutritional dimensions of food systems interact and shape sustainability and resilience.

UKUDLA's innovative contribution lies in linking food systems research with data-driven methods to generate actionable evidence across scales. For different farming systems this includes remote sensing, geospatial analysis, and sensor-based monitoring to assess resource management efficiency, crop and livestock health parameters, and climate-related risks. These approaches support the analysis of production systems under increasing pressure from
drought, land degradation, and variable rainfall. With regard to policy and governance, data science can strengthen evidence-based decision-making through policy analytics, network analysis, and participatory digital platforms that capture stakeholder perspectives and institutional dynamics. These tools can help identify governance bottlenecks, evaluate policy trade-offs, and improve coordination across actors and sectors. For post-harvest processes, food quality and nutrition, data-driven approaches such as image analysis, traceability systems, and predictive modelling can improve monitoring of food losses, quality deterioration, and nutritional outcomes along value chains.

A defining feature of UKUDLA is its commitment to research, capacity building, and knowledge transfer. The centre aims to equip students, early-career researchers, and practitioners with the methodological skills needed to work at the interface of agricultural and

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food systems research and data science. This includes training in data collection, integration, analysis, visualisation, and interpretation, as well as transdisciplinary collaboration and stakeholder engagement.

By fostering collaboration between African and German partners, UKUDLA contributes to the co-production of knowledge for sustainable and resilient food systems. The centre positions data science not as a standalone technical field, but as a strategic instrument for improving food system performance, informing policy, and supporting equitable and context-sensitive transformation.

Keywords: Agricultural resilience, data science, food systems, research & training network, southern Africa