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[Home](#) → [Research projects](#) → SAGE

RESEARCH PROJECT

SAGE

In progress 01/01/2026 → Unknown

Sustainable Agrivoltaic Grazing Ecosystem: Agroecological Synergies through Ruminant Integration for Enhanced Environmental and Economic Benefits



Contact our coordinator

**Franziska Koch**

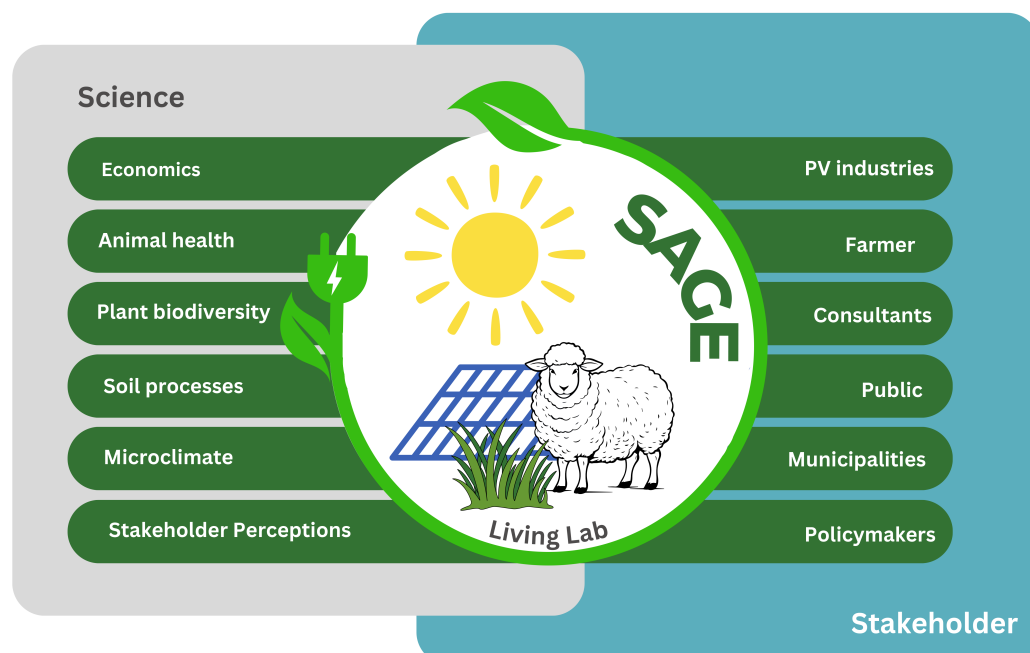
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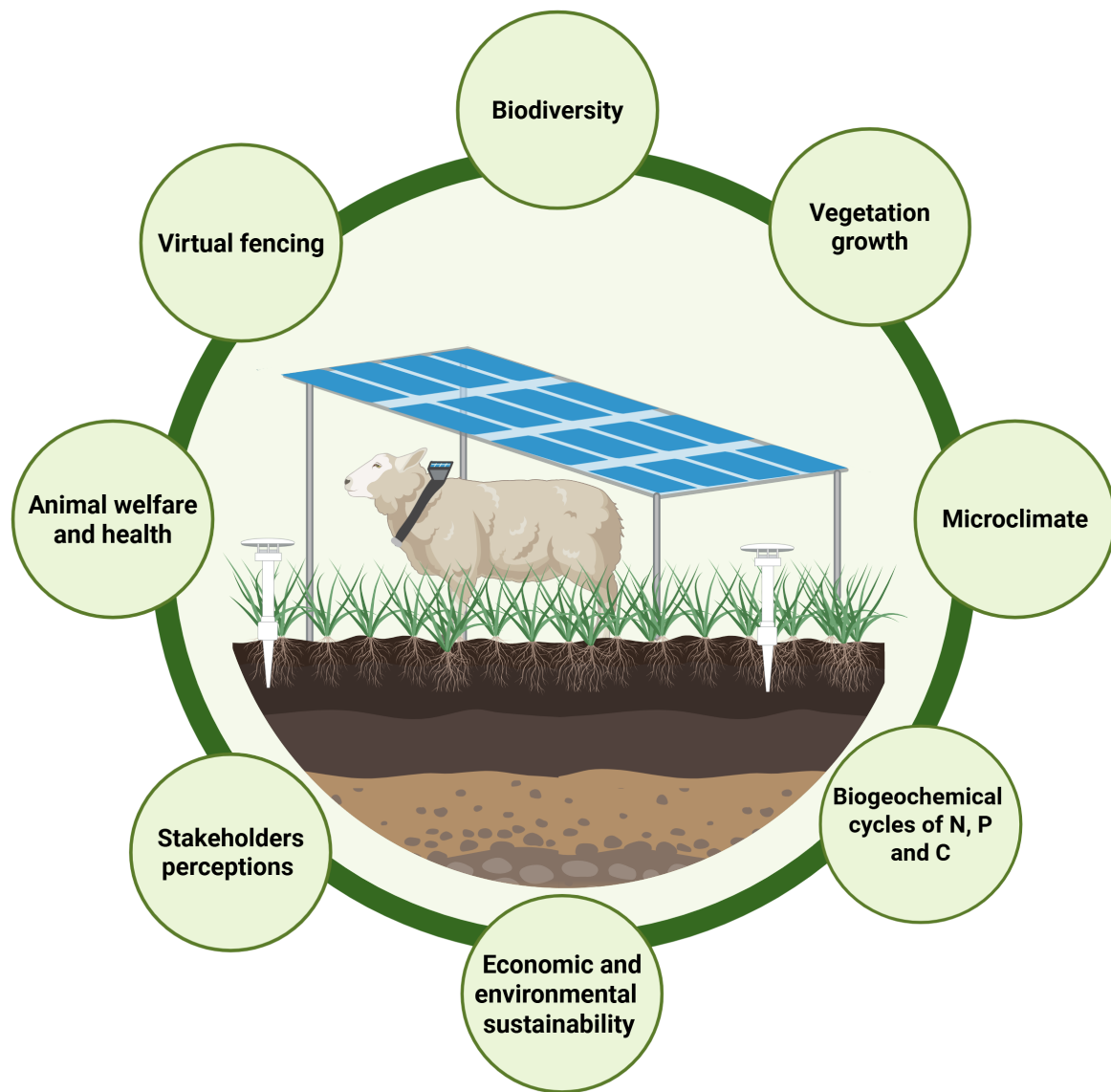
Summary

SAGE (Sustainable Agrivoltaic Grazing Ecosystem) represents an interdisciplinary initiative aiming to combine renewable energy production with extensive grazing systems in agrivoltaics (solar grazing). SAGE seeks to address pressing challenges in land management, biodiversity conservation, energy production, and the application of agroecological principles to achieve a sustainable and resilient system combining agricultural and energy production, by adopting a bottom-up approach and involving local stakeholders through Living Labs.



Work description. Source: Franziska Koch

The overarching goal is to balance solar energy generation, agricultural productivity, biodiversity protection, and animal welfare, while promoting efficient land use and resilience in the face of climate change. By studying the interactions between photovoltaic (PV) systems and natural processes in multiple European countries with different regulatory and climatic conditions on a gradient from North to South, the project investigates the effects on soil health, vegetation growth, microclimate conditions, carbon cycling and biodiversity in grassland ecosystems with grazing ruminants. These insights will help to determine how solar grazing can enhance or maintain ecosystem services while supporting agricultural productivity and thus creating sustainable agrivoltaic systems based on the combination of PV systems with agricultural land-use. Additionally, the project examines the potential of virtual fencing as a tool for managing solar grazing. Virtual fencing technology enables precise control over livestock movements without the need for physical fences, allowing for better protection of sensitive areas and biodiversity while ensuring optimal grazing patterns and continuous animal monitoring. This innovative approach not only supports sustainable livestock production but also aligns with broader goals of environmental conservation. SAGE places significant emphasis on animal health and welfare in PV systems.



Source: Jessica Schwerdtfeger

The project explores critical factors such as heat stress, spatial behaviour, nutrition, and physiological responses of grazing animals in agrivoltaics. Parasite control will also be part of the holistic evaluation of animal welfare data. By using data from virtual fencing collars to monitor animal behaviour and well-being, researchers aim to develop strategies that improve livestock management while ensuring high standards of animal welfare. At the same time, SAGE evaluates the economic feasibility of solar grazing system technology by incorporating stakeholder perspectives. This includes assessing costs, benefits, societal acceptance and potential barriers to adoption. Experimental results and economic analyses will be scaled up to form broader models for transferring agrivoltaic practices to different regions across Europe. By identifying trends and patterns at the micro level, SAGE aims to develop adaptive management strategies tailored to specific regional agricultural and ecological conditions. These strategies will be accompanied by regionspecific guidelines that address local needs while supporting the EU's climate change targets. Policy recommendations derived from the project's findings will aim

to promote sustainable agrivoltaic practices that enhance resilience in agricultural systems while contributing to EU's energy independence.

Top image source: Dina Hamidi

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