

# StatEO

5-7 May 2026 | ESA-ESRIN | Frascati (Rome), Italy



## Integrating Earth observation and statistics across the agricultural policy cycle

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<sup>1</sup>Katja Berger, <sup>2</sup>Miriam Machwitz, <sup>1</sup>Larissa Torney, <sup>1</sup>Ekin Celikkan, <sup>1</sup>Alison Beamish, <sup>1</sup>Robert Behling, <sup>3</sup>Alexandra Bell, <sup>4,5</sup>Zoltan Szantoi, <sup>2</sup>Christian Bossung, <sup>2</sup>Tom Galle, <sup>1</sup>Martin Herold

<sup>1</sup>GFZ Helmholtz Centre for Geosciences, Germany

<sup>2</sup>Luxembourg Institute of Science and Technology (LIST), Luxembourg

<sup>3</sup>German Aerospace Center (DLR), Germany

<sup>4</sup>Directorate of Earth Observation Programmes, European Space Agency (ESA), Italy

<sup>5</sup>Stellenbosch University (SU), South Africa

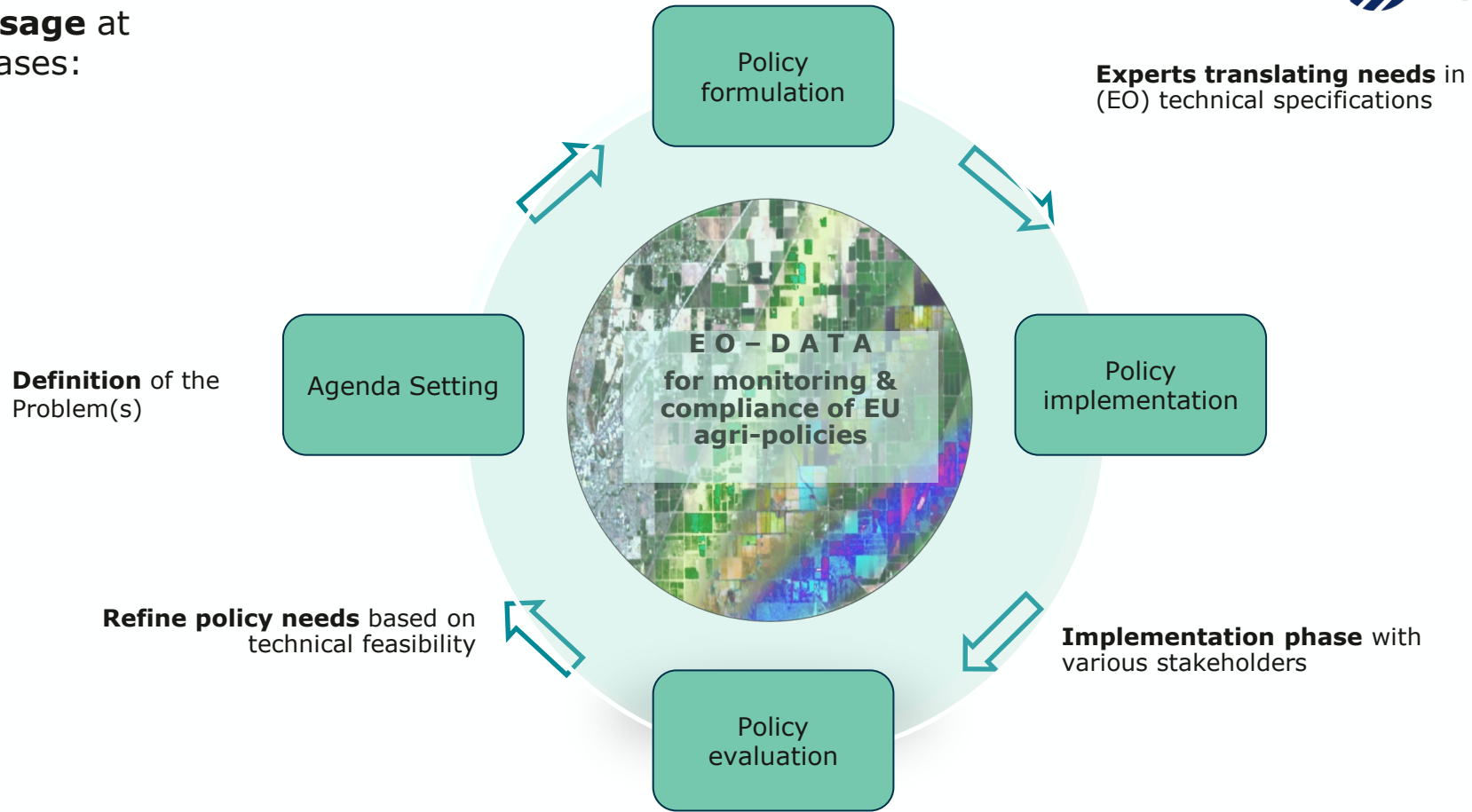
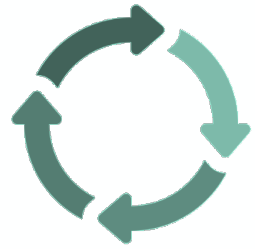
**Thematic sessions** - Agriculture II on the 06/May/2026, 10:00am - 11:30am.





# Earth Observation in the policy cycle

Simplified **policy wheel** -  
integrating **EO data usage** at  
the different policy phases:





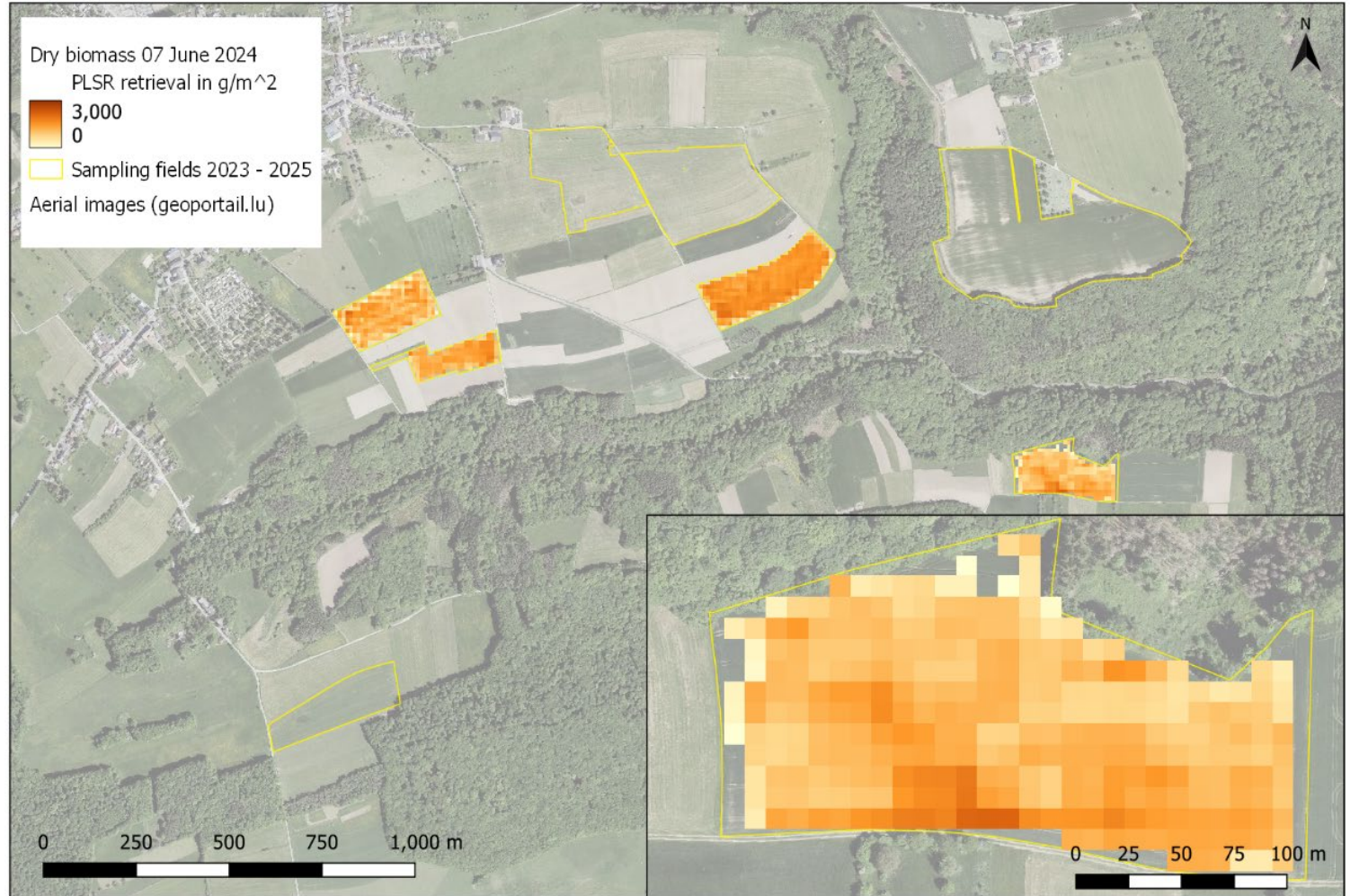
# Agenda setting: Understanding nitrogen leaching



→ Spatial pattern of biomass estimated from Sentinel-2 imagery using hybrid estimation methods (RTM and machine learning)



Cereal fields 2024



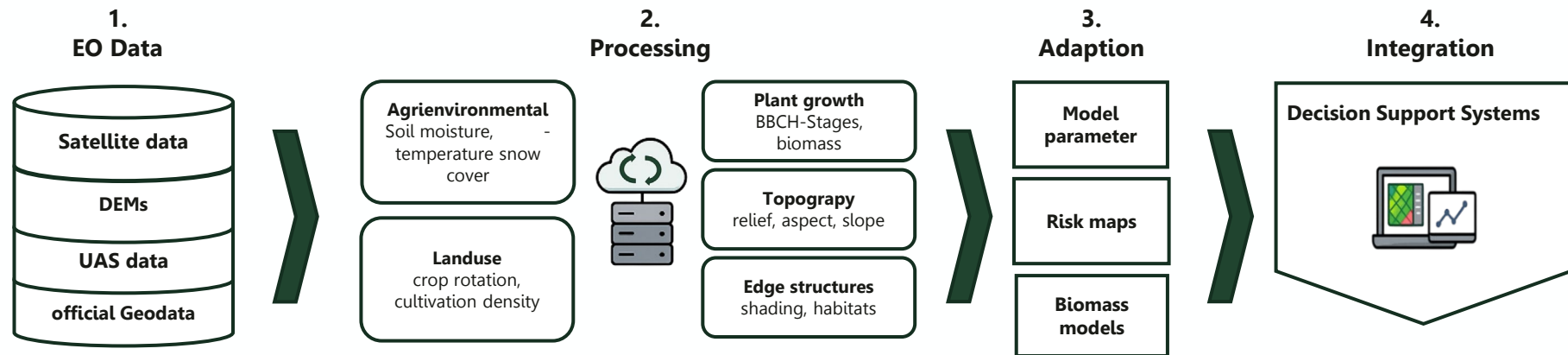
# Policy implementation: Decision Support Systems

Integration of EO-Data in **Decision Support Systems** for crop protection

- Improve forecast quality of crop disease models
- Increase usability of the web service. Retrieve default parameter from EO -> to **reduce use of plant protection products:**



GeoProg



**GFZ** Helmholtz Centre for Geosciences

**ZEPP**  
KOMPETENZENTRUM  
FÜR ZERLEGENDE PRODUKTION

**FERN LAB**  
HELMHOLTZ  
PRONOSE  
LAB

**isip** **JKI**  
Julius Kühn-Institut  
für integrierte  
Pflanzenschutzforschung

**heliopas.ai** **THÜNEN**

**DE national**  
National Action Plan  
on Sustainable Use  
of Plant Protection  
Products (NAP) -  
Germany (BMEL)

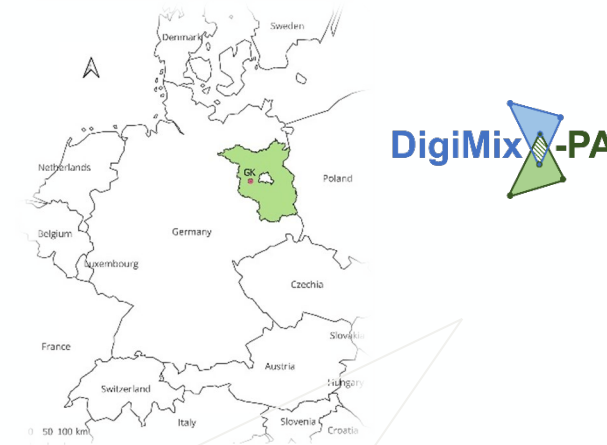
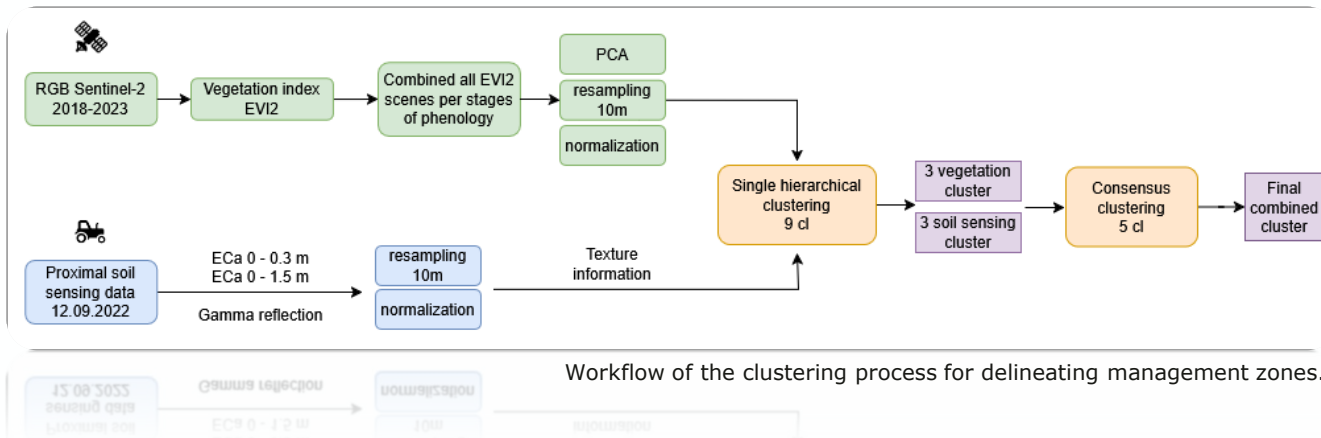
**DE national** National Action Plan on Sustainable Use of Plant Protection Products (NAP) - Germany (BMEL) [nap-pflanzenschutz.de](http://nap-pflanzenschutz.de) Implements Directive 2009/128/EC via §4 Pflanzenschutzgesetz; targets 30% environmental risk reduction by 2023; promotes IPM, demonstration farms, and aims to align with the Farm to Fork 50% reduction goal by 2030

**Pesticides** Directive 2009/128/EC - Sustainable use of pesticides (SUD) [eur-lex: dir/2009/128](http://eur-lex.europa.eu/uri/dir/2009/128) Member states must adopt national action plans; promotes integrated pest management (IPM) and non-chemical alternatives

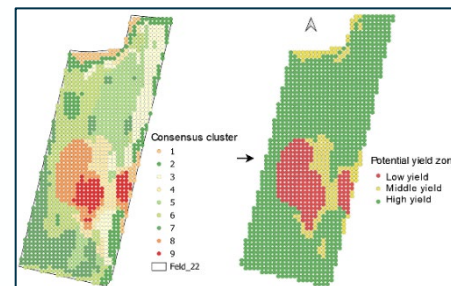


# Evaluation: Delineation of management zones

.. To assess the effectiveness of policy actions and show how EO improves evidence-based evaluation:



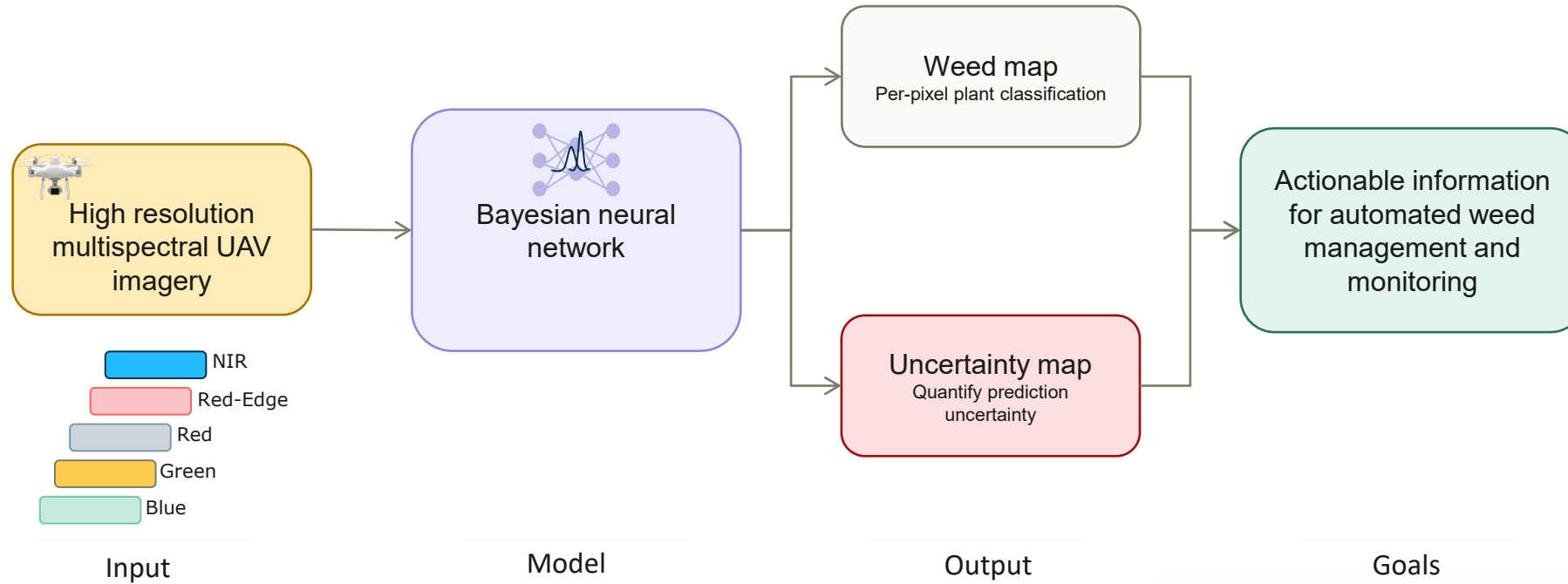
- **Soil nutrient availability** has a stronger effect on yield than applied fertilizer nitrogen
- **Convert potential low-yield zones** into small forests or flower strips?
- **Evaluation-driven land-use adjustment** to improve biodiversity, ecosystem services, and environmental performance.



Biodiversity	Regulation (EU) 2021/2115 – CAP Strategic Plans 2023–2027	reg/2021/2115	One of ten CAP objectives focuses on restoring biodiversity; eco-schemes and "green architecture" require biodiversity-friendly farming practices
Biodiversity	Regulation (EU) 2024/1991 – Nature Restoration Law	reg/2024/1991	20% of EU land to be restored by 2030; member states must improve farmland bird populations and pollinator diversity; in force since August 2024

# Evaluation: Identification of weeds

EO-based weed maps to evaluate the effectiveness of current weed-management practices (e.g., where herbicides are over- or under-applied) and quantify spatial weed pressure.

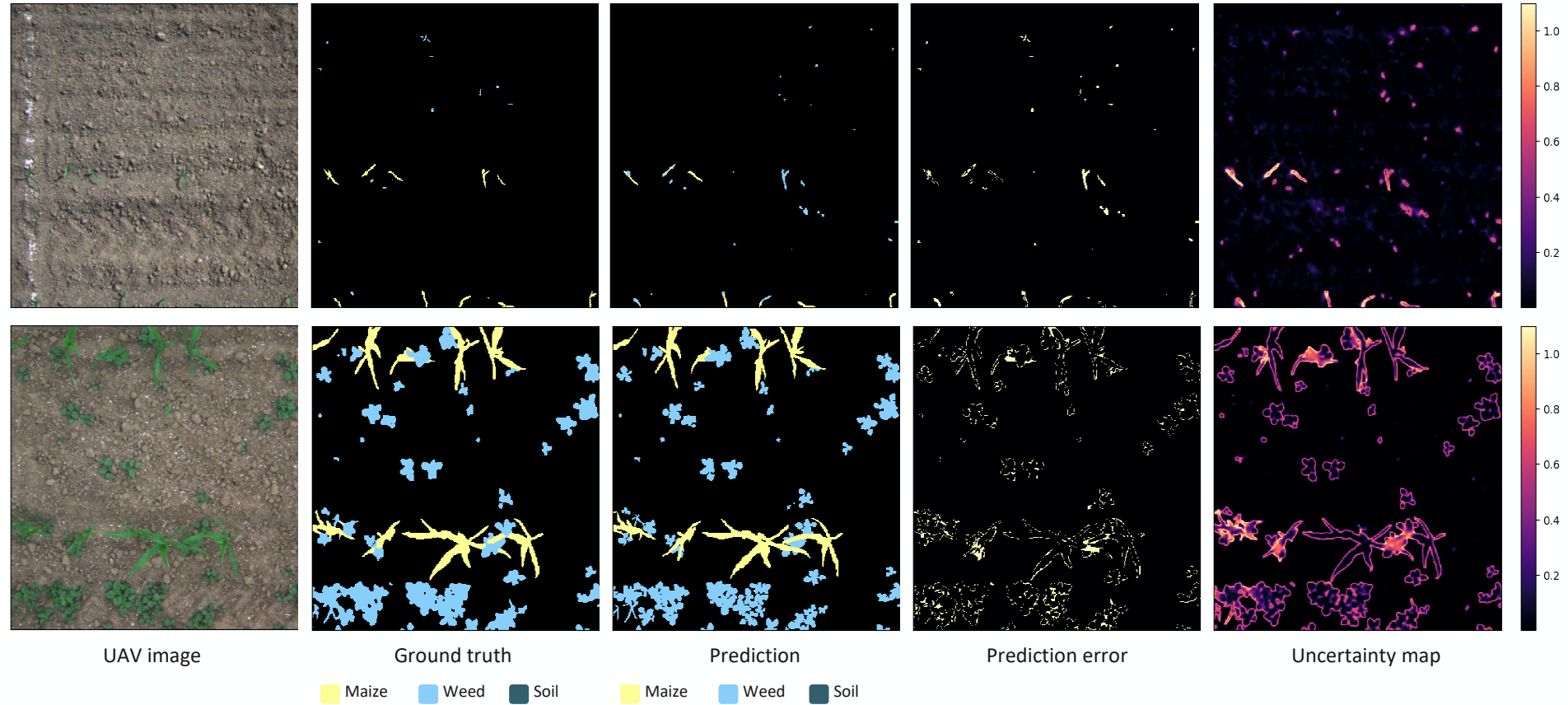


→ Framework for Bayesian deep learning for weed identification from UAV imagery

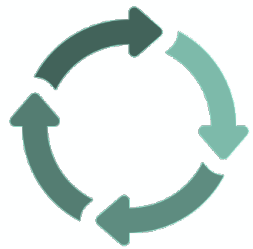
Pesticides	Directive 2009/128/EC – Sustainable use of pesticides (SUD)	dir./2009/128	Member states must adopt national action plans; promotes integrated pest management (IPM) and non-chemical alternatives
Pesticides	Regulation (EC) 1107/2009 – Authorisation of plant protection products	reg./2009/1107	Active substances may only be approved if residues cause no harm to human health or the environment

# Evaluation: Identification of weeds

→ Framework for Bayesian deep learning for weed identification from UAV imagery - Qualitative Examples



Celikkan, E., Kunzmann, T., Yeskaliyev, Y., Itzerott, S., Klein, N., & Herold, M. (2025). **WeedsGalore: A Multispectral and Multitemporal UAV-Based Dataset for Crop and Weed Segmentation in Agricultural Maize Fields**. In *Proceedings of the Winter Conference on Applications of Computer Vision (WACV)* (pp. 4767-4777).



- **Earth Observation** enables **reliable, spatially explicit agricultural statistics** that support **multiple stages of the policy cycle**, from agenda setting to evaluation.
- Our case studies **demonstrate how EO-derived indicators can be integrated with statistical methods** and decision-support systems to inform nutrient management, biodiversity-sensitive land-use, and pesticide-reduction targets under EU agricultural policy **frameworks**.
- **EO** is currently used most intensively in the *first (agenda setting) and fourth (evaluation) stages*, where data help identify problems and assess outcomes, **while stages 2 (policy formulation) and 3 (implementation) remain relatively** underrepresented in EO-based applications.
- We encourage **embedding EO more systematically into policy design and operational implementation**



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**Thank you for your attention - We welcome questions, feedback, and collaboration!**

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Policy Cycle

[www.gfz.de](http://www.gfz.de) [katja.berger@gfz.de](mailto:katja.berger@gfz.de)

*Integrating Earth Observation and Statistics across the agricultural policy cycle, K. Berger et al.*