Big data in Agriculture

How can we use the collected data on farm level now and what about the future

Director Digital Crops, Jesper Riber Nielsen

January 2024

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Agenda

- Platform overview and the adoption
- Data sources
- A look at these data and how we process and create AI model on top
- How SEGES Innovation want to create more value with data
- 7 Examples on how we create value based on data
- What is in the horizon

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The Crop platform

FarmTracking
- The fieldworker

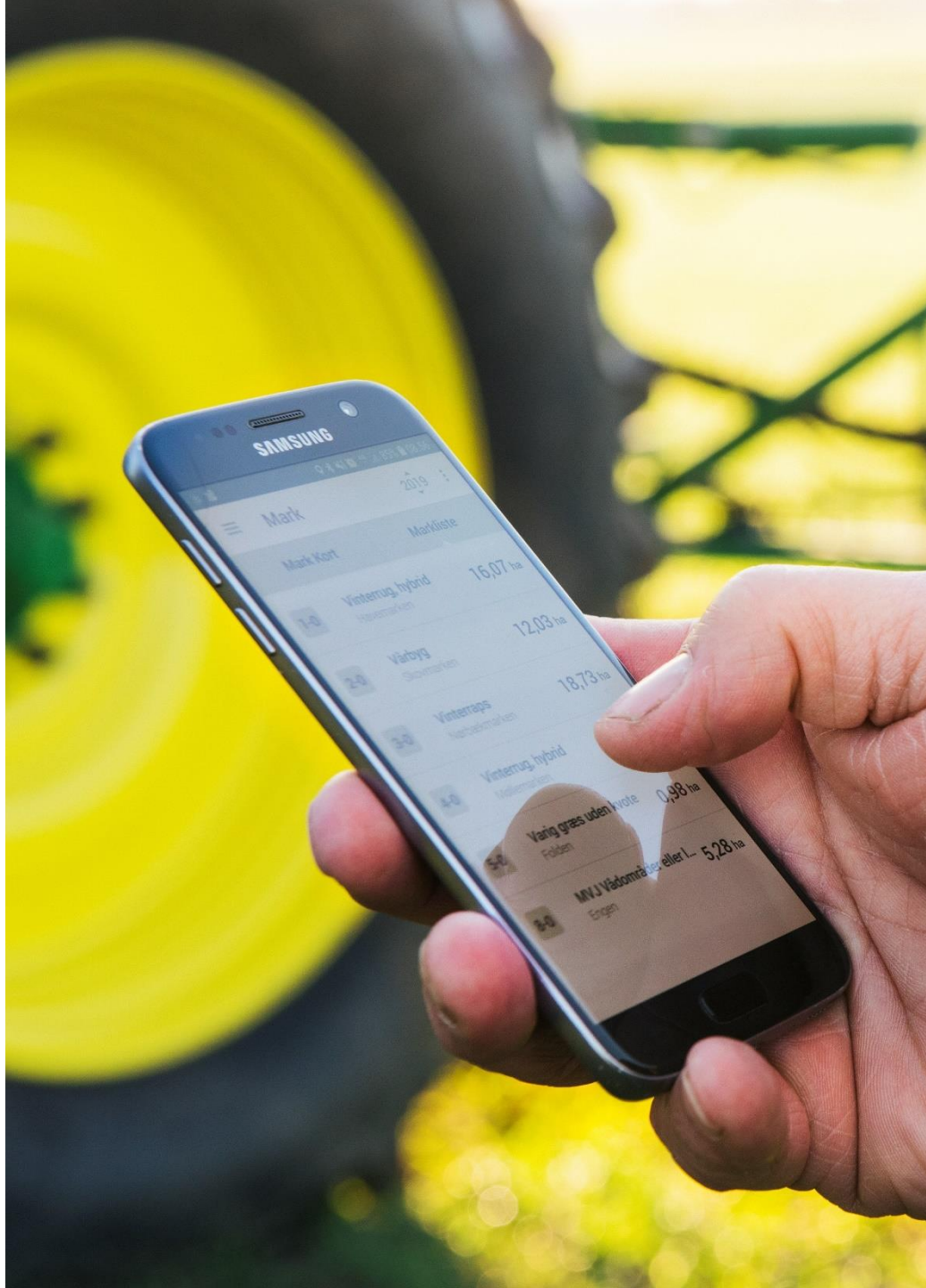
CropManager
- The farm manager and the owner

Mark Online
- The plant advisers
- The advanced farmer

KemiTjek

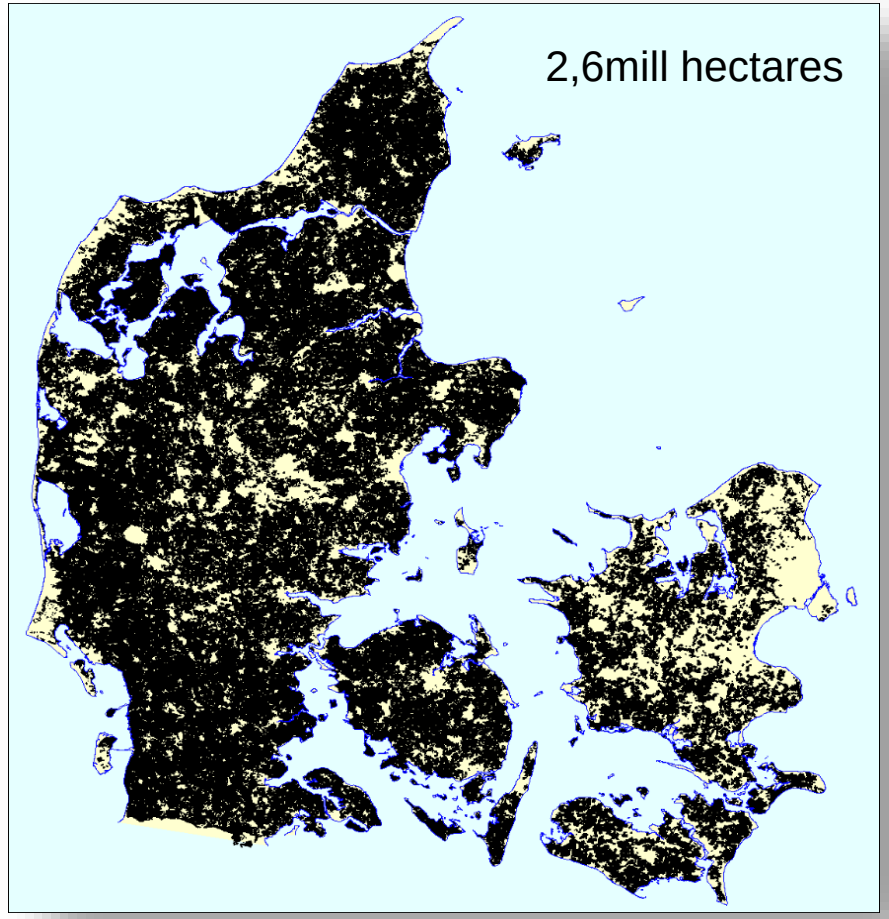
FarmTime

Biogas Online



Adoption in Denmark

- FarmTracking application coverage 1,65 mill Hectares
  - 5000 daily and 10000 monthly users
  - Documentation
- Precision farming is moving forward with 300.000 hectares
  - Accelerated by the precision farming legislation
- Crop advisers use Mark Online covering 2,1 mill. Hectares
  - 500 Advisors use the platform daily to help the farmer apply for EU subsidies and report to public authorities
  - Field, crop and fertilizer planning



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Data Sources

Satellite images

Soil samples

Applications

Weather data

Slurry samples

Other software providers

FODERTEKNIK

COW CONNECT

grainit

Farm Storage Management

Machine data connections

NFTS

Drones

Trimble

NEW HOLLAND AGRICULTURE

agrirouter

CASE IH

MF

CLAAS

bogballe

JOHN DEERE

FENDT

KRONE

VALTRA

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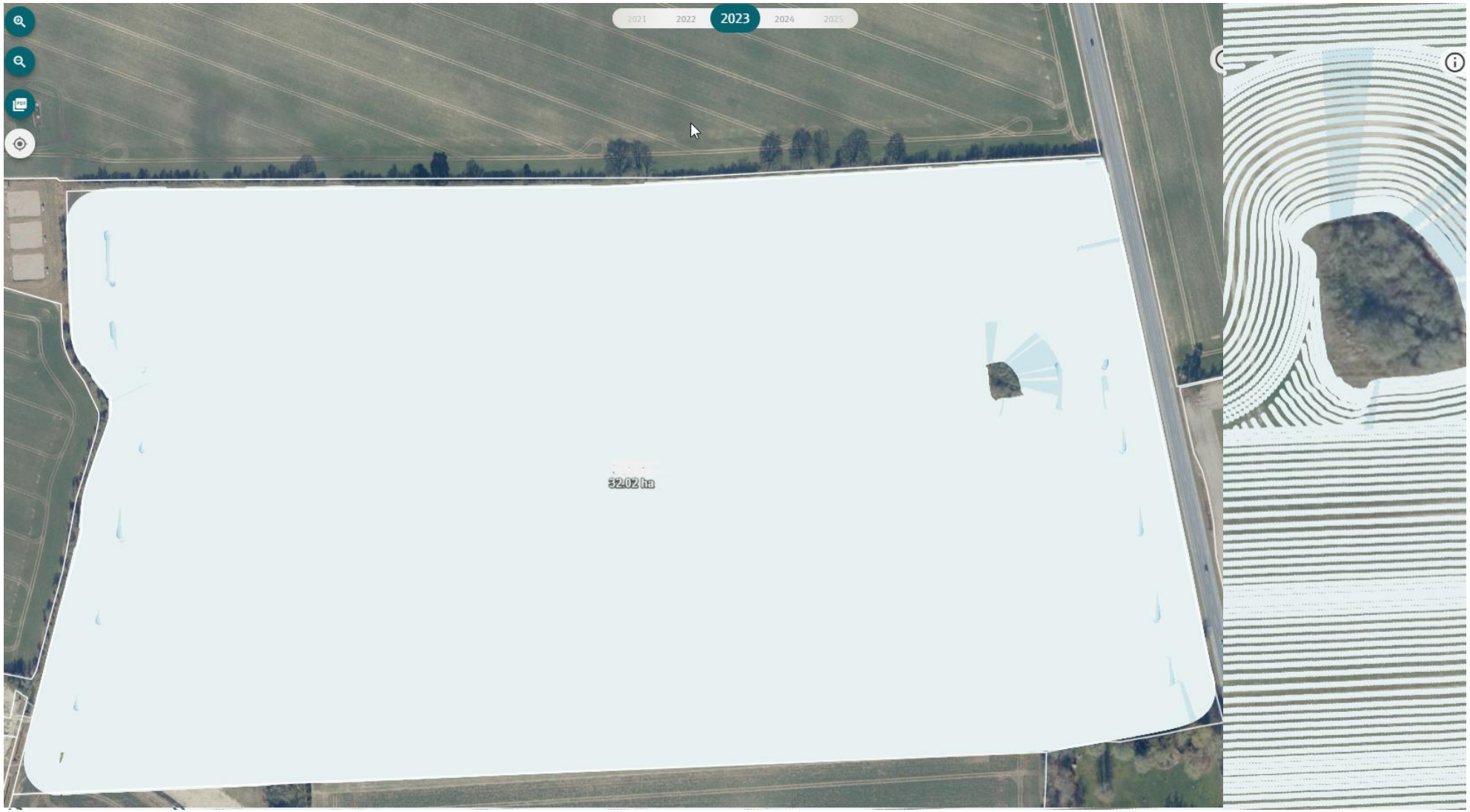
Data, Data and more data



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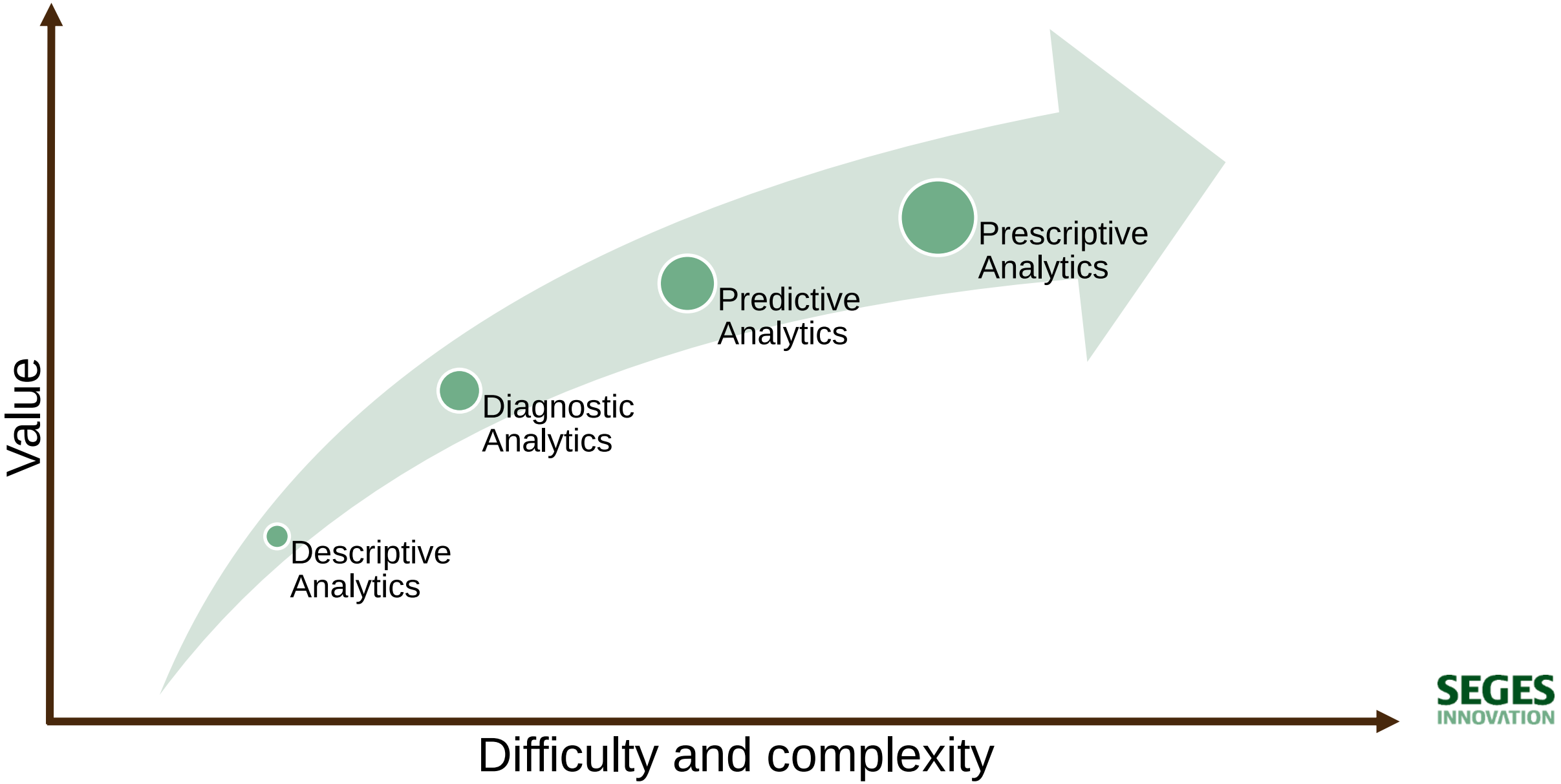
Microsoft

SEGES

Driving sustainable transformation in agriculture using AI and a new data science vision

How data should provide value



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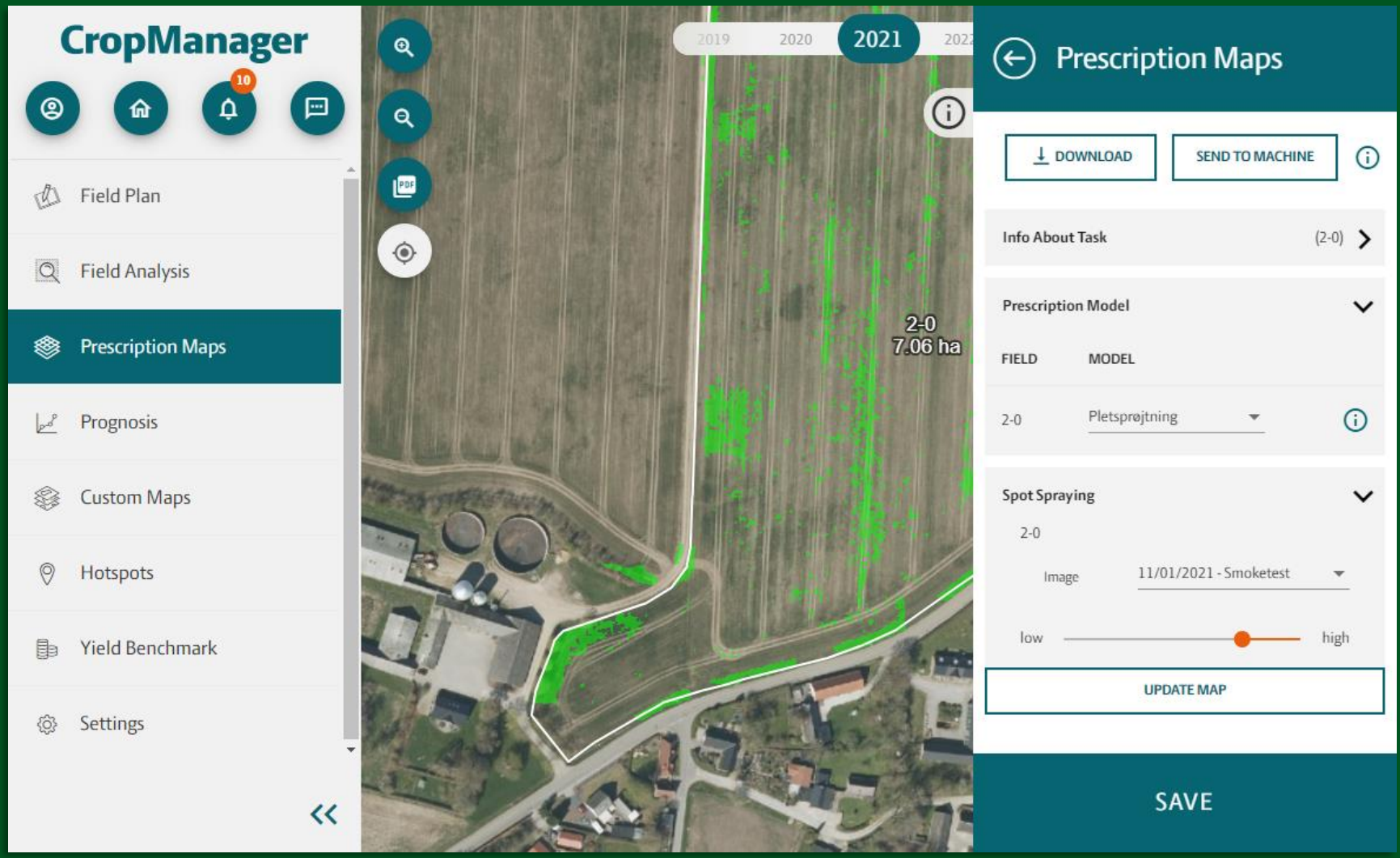
EXAMPLE 1:

Drone data



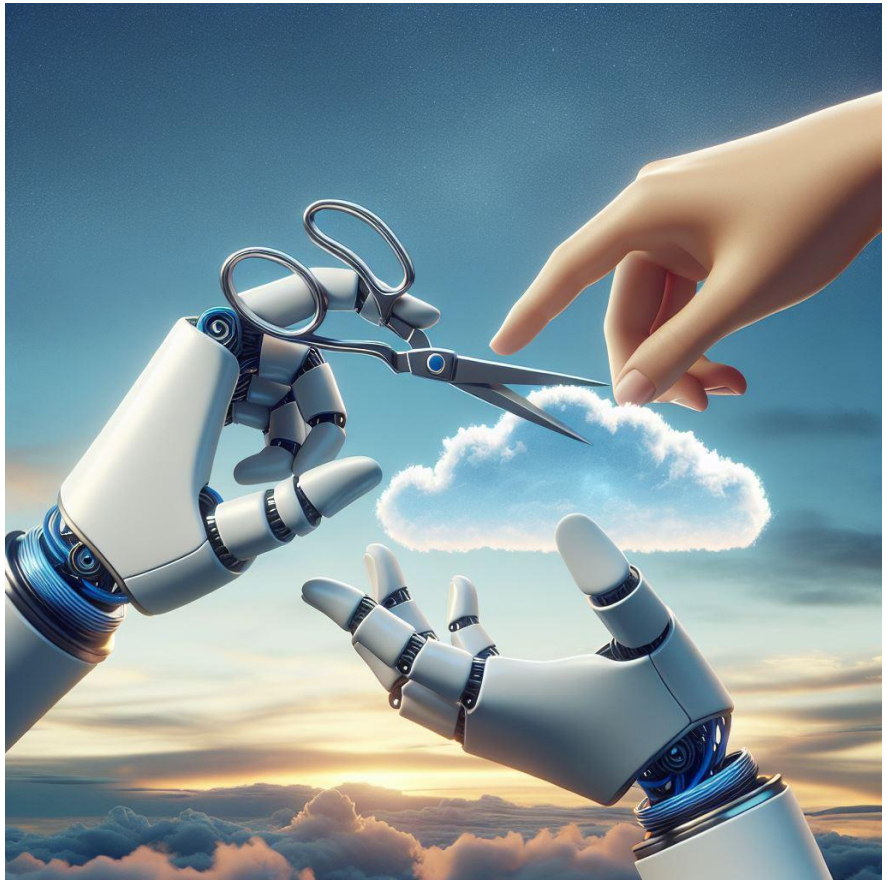
User flies a drone

User uploads images in CropManager

CropManager stiches images together and calculates a weed map

User makes final adjustments and sends data to machinery

Example 2: Cloud removal



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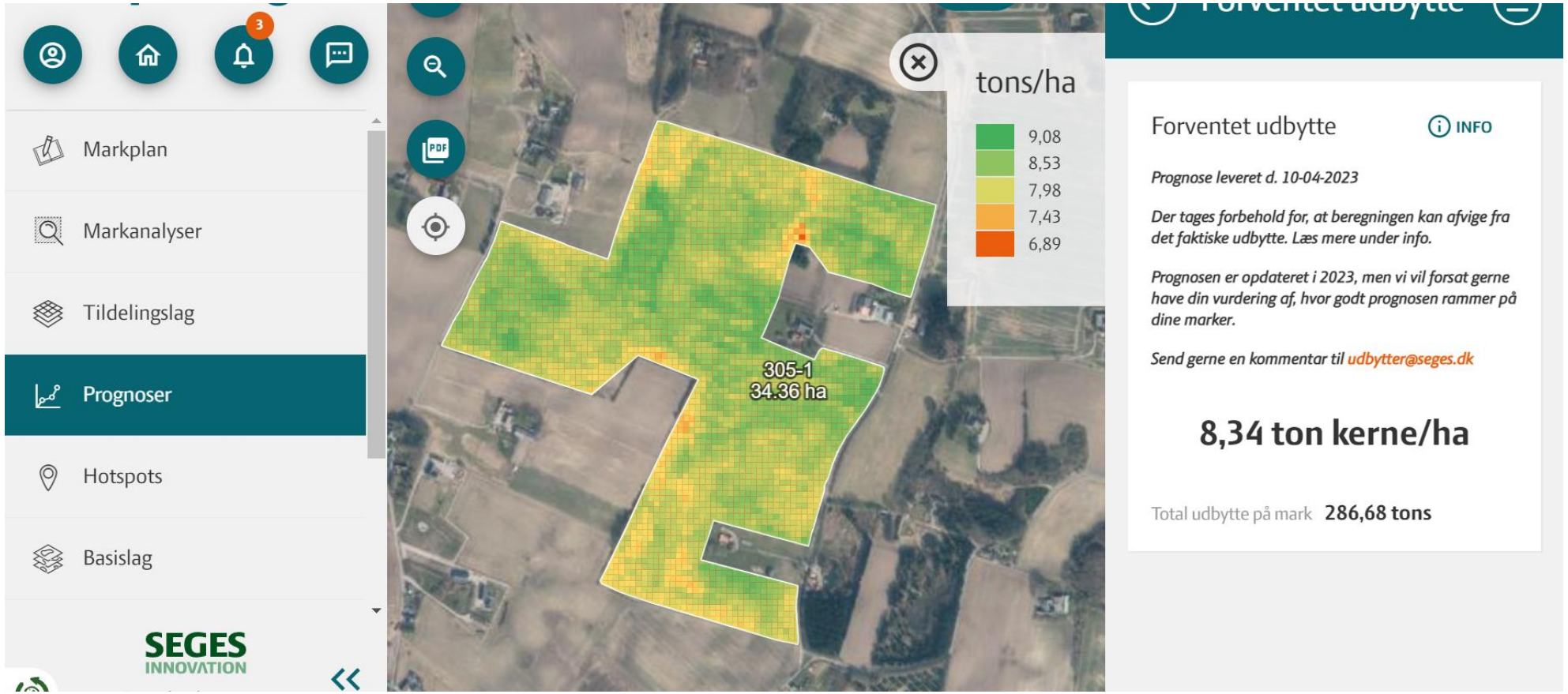
Example 3: Yield prediction



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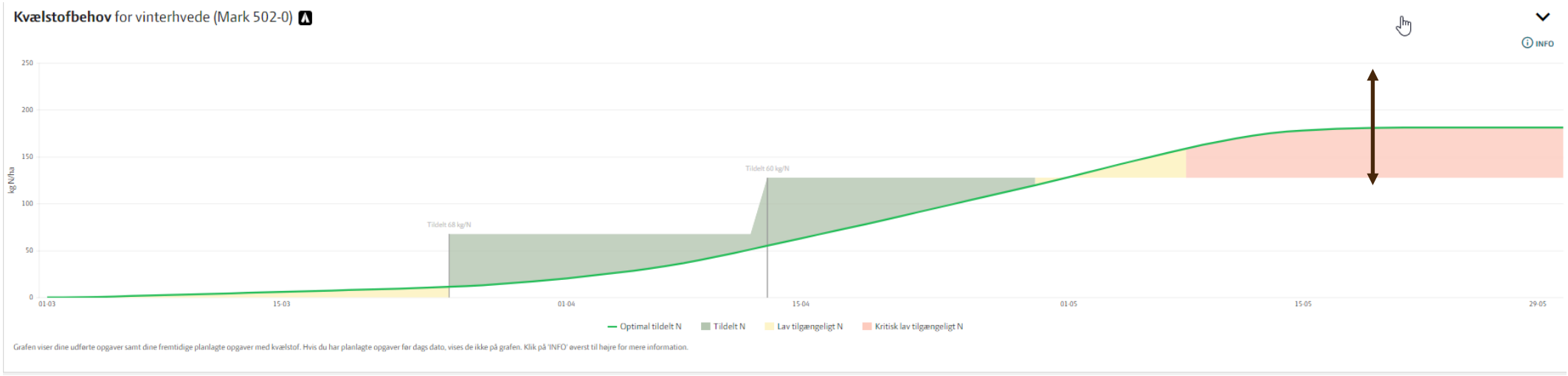
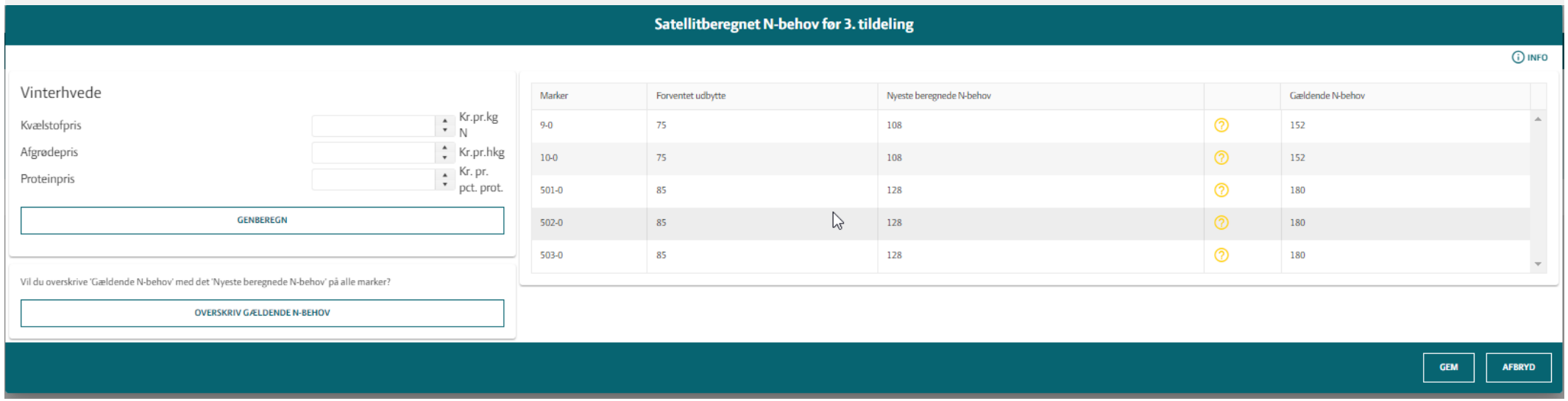
Example 4: Dynamic fertilizer tool





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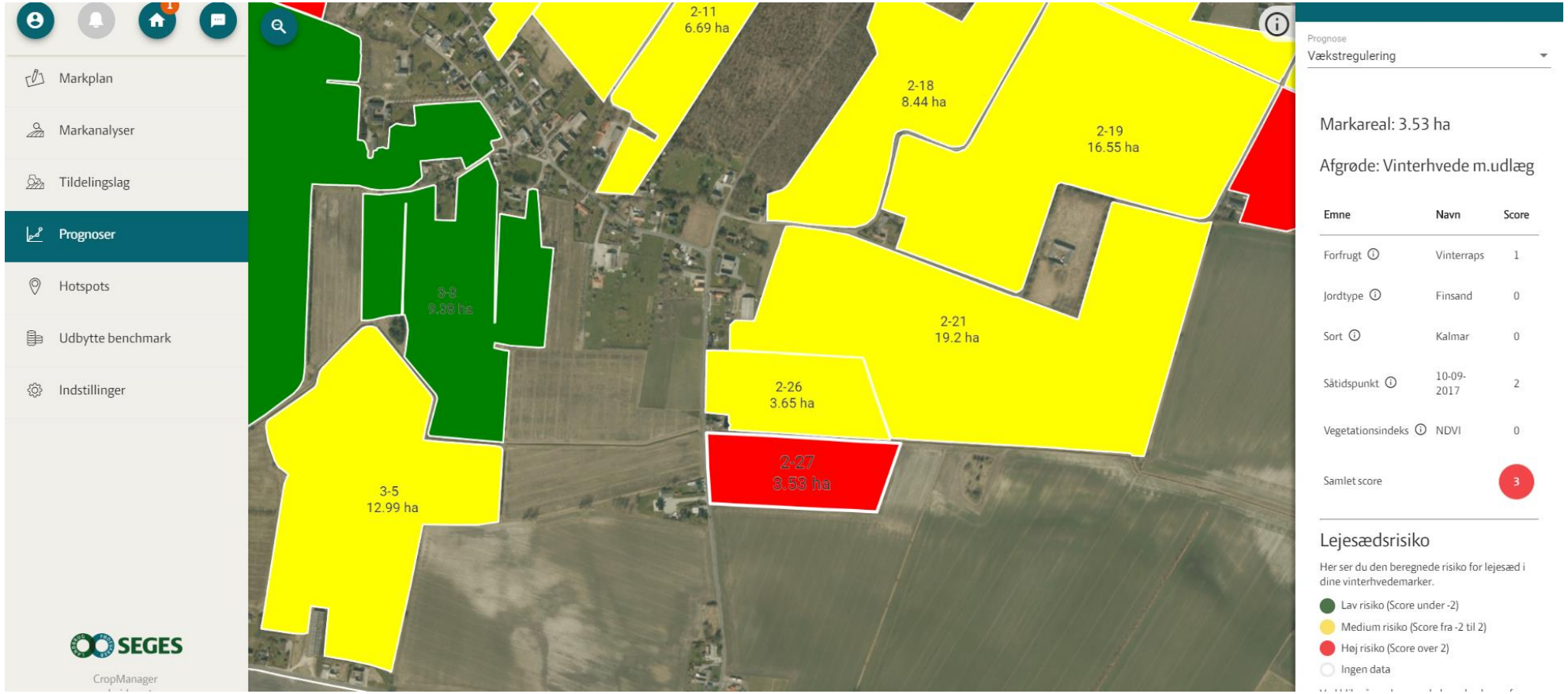
Example 5: Risk of lodging



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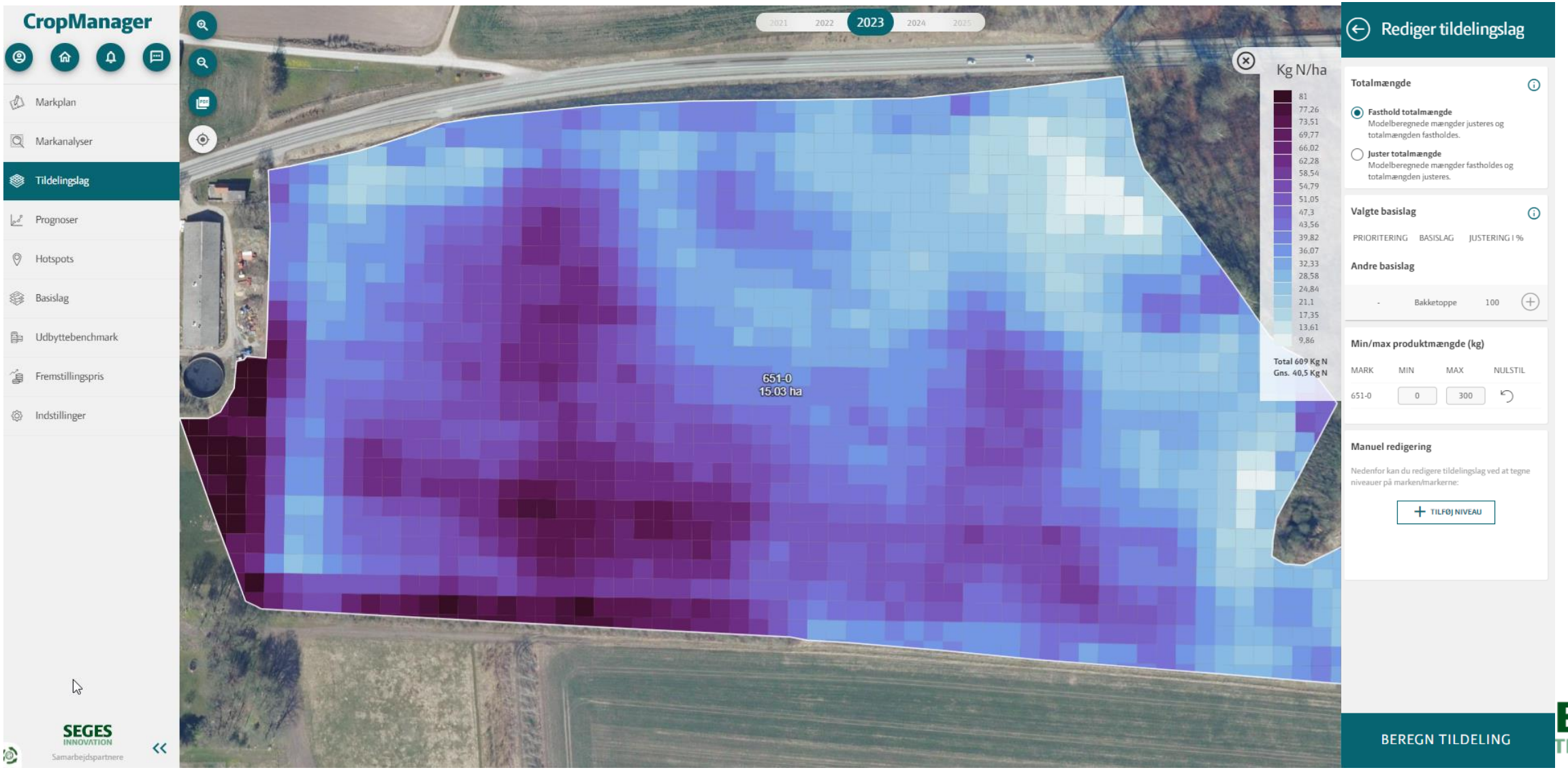
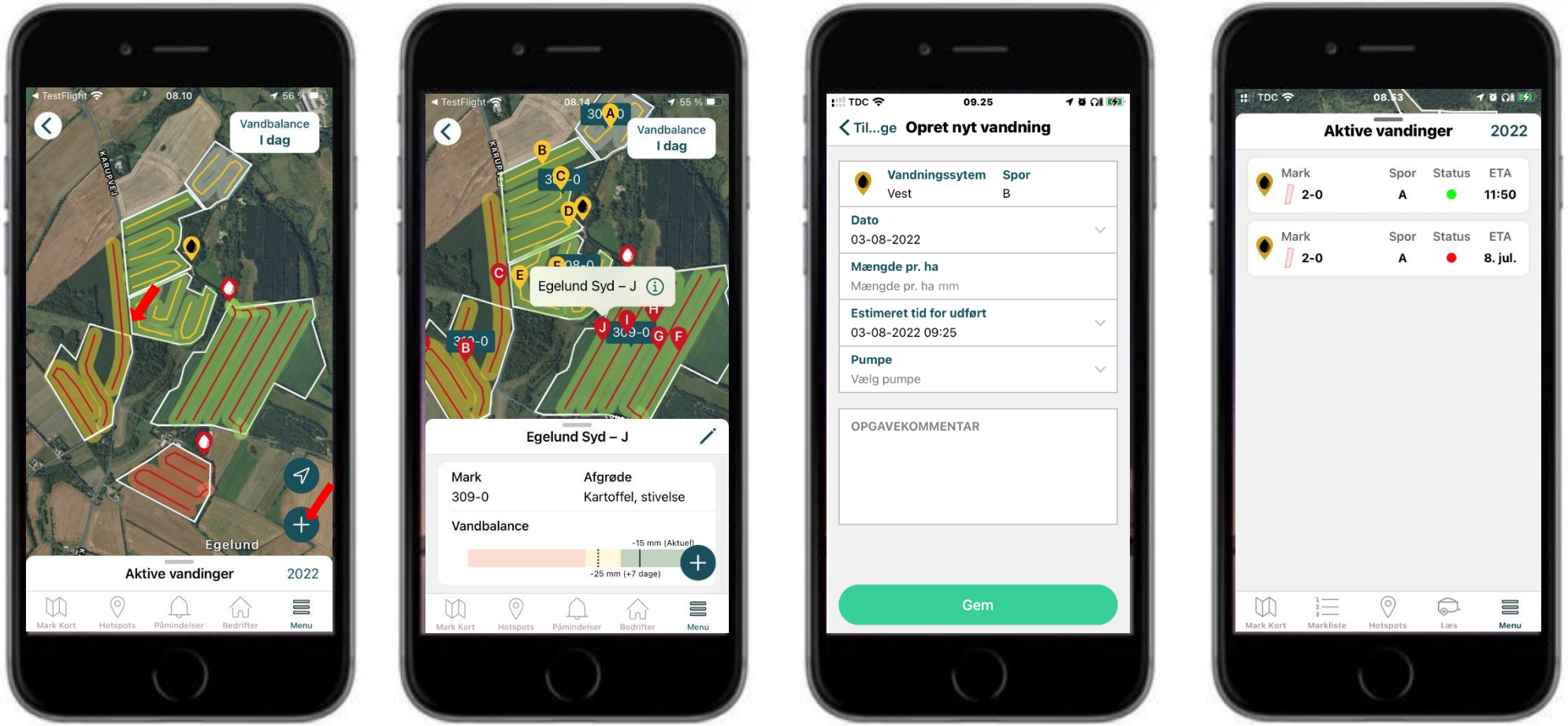
Example 6: Barley st. 30-32



Example 7: Irrigation module in FarmTracking



What is in the horizon

AI assisted fertilizer usage

Soil variation
Crop and variety
Weather condition
Sustainable resource usage

Alarms and recommendations

Diseases monitoring
Irrigation recommendation

AI assisted field planning

Legislations
Crop rotation
Sales options and prices
Sustainable land usage

Operational planning

Optimal utilization of machinery
Harvest optimization
Sprayer operation based on weather and necessity

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Thanks

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Can access to more data change the way we think about the science and practice of crop protection?

Paul Neve, Professor, Plant & Environmental Sciences, University of Copenhagen

The Crop Protection Challenge

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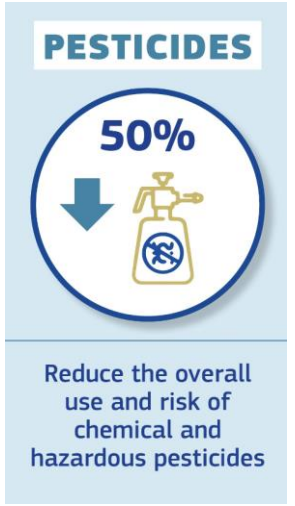

#EUFarm2Fork #EUGreenDeal

Modern, intensive agriculture is heavily reliant on synthetic pesticides, which, whilst often highly effective also have negative consequences:

- Evolution of resistance
- Environmental pollution
- Human health (user and consumer exposure)
- Non-target impacts (pollinators, biodiversity loss)

Reducing pesticide reliance requires holistic agroecological (complex) solutions.

‘Big data’ can be an enabler for this transition

Big data in healthcare

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- Personalized medicine
- Preventative medicine
- Evidence-based medicine
- Early detection
- Population health management
- Risk management

www.cybersnowden.com

Alopecurus myosuroides (Rævehale, blackgrass).

Cultural blackgrass management – a risky business

Ploughing	Delayed autumn sowing	Competitive cultivars	Spring crops	Sowing rate	Grass ley / fallow break	
69%	31%	22%	88%	26%	70%	Mean efficacy
-82 to 96%	-64 to 97%	8 to 45%	78 to 96%	7 to 63%		Variation

Lutman et al., 2013

Big data in agriculture

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GiSC™ GROWER INFORMATION SERVICES COOPERATIVE

"Traditional, **replicated field-experiment agronomy is too time-consuming and expensive** to provide an effective approach for identifying optimal practices"

"the key is to **take advantage of the farmer innovation** that occurs across the millions of fields planted to crops each year. In essence, **each of these fields is an "experiment"** that receives a specific set of crop and soil management practices"

"At issue is how to cost-effectively and efficiently **identify which combination of practices works best** for a given combination of crop, soil type, and climate"

Agrimetrics

THE AGRIFOOD DATA MARKETPLACE

The Blackgrass Resistance Initiative

Black-Grass Resistance Initiative

Newcastle University



Rob Edwards Alina Goldberg-Cavalleri Nawaporn Onkokesung

- **Molecular mechanisms & biochemistry**

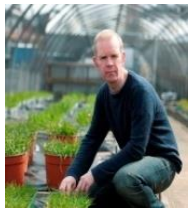
ZSL LIVING CONSERVATION


Ken Norris Alexa Varah

- **Economic & environmental impacts**

ROTHAMSTED RESEARCH





Lieselot Nguyen Laura Crook Richard Hull



Paul Neve David Comont Andrea Dixon

Claudia Lowe

- **Ecology, evolution, population genetics & epidemiology**

The University Of Sheffield.




Rob Freckleton **Dylan Childs** Helen Hicks Shaun Coutts

- **Evolutionary ecology, monitoring, modelling & epidemiology**

UNIVERSITY of York

THE UNIVERSITY OF EDINBURGH

Louise Jones

- **Epigenetics**

Jarrod Hadfield

- **Quantitative genetics**

A Blackgrass Farm network

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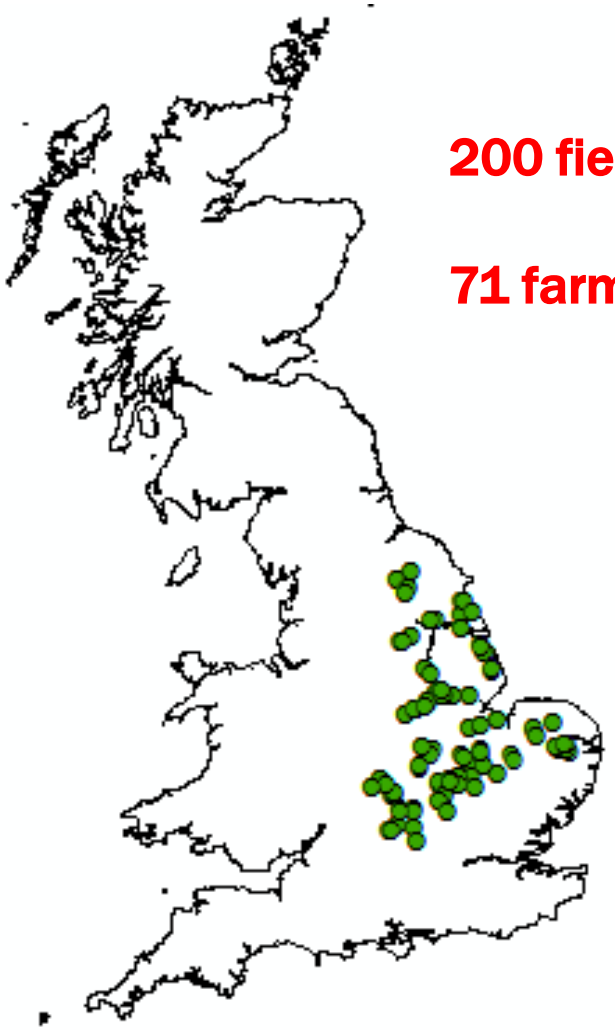

200 fields

71 farms

- Field maps (population dynamics)
- Resistance characterization (whole plant, molecular)
- Field management data (farmer records)
- Economic data (yields, costs, profit)
- Environmental data (soils, weather, landscape etc.)

Epidemiology of resistance: every field as a case study.

Mapping blackgrass abundance

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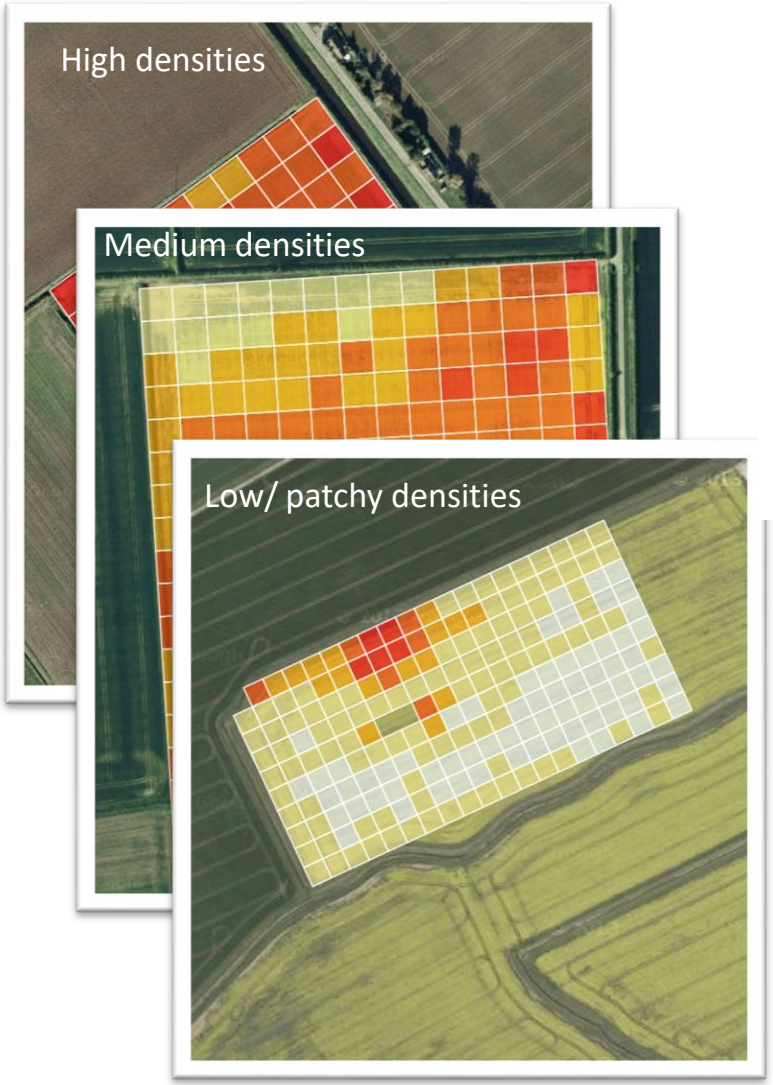
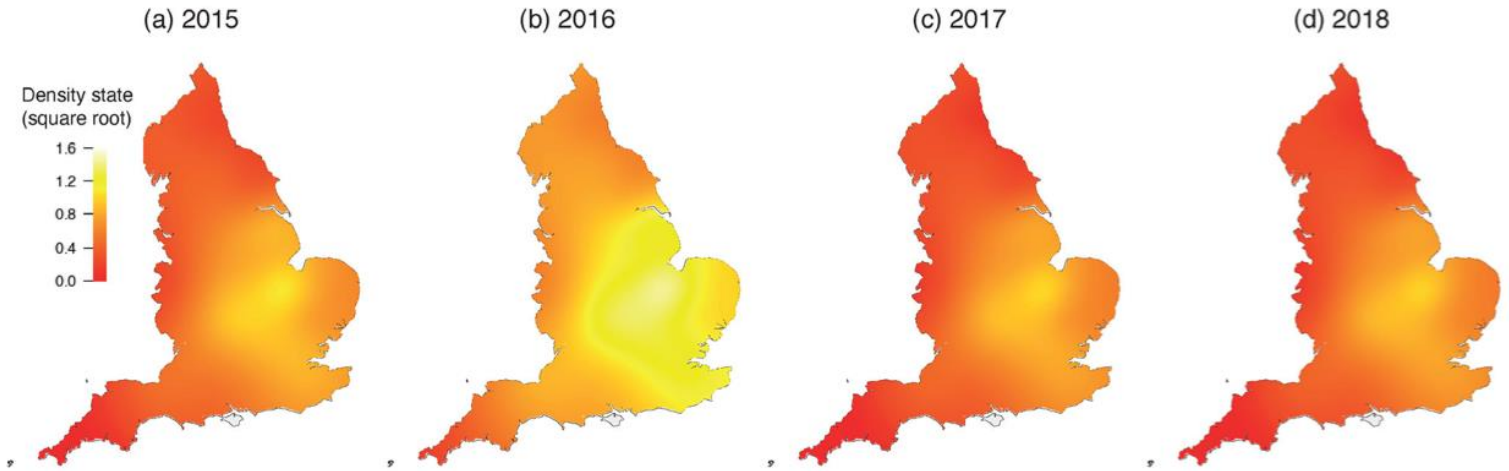
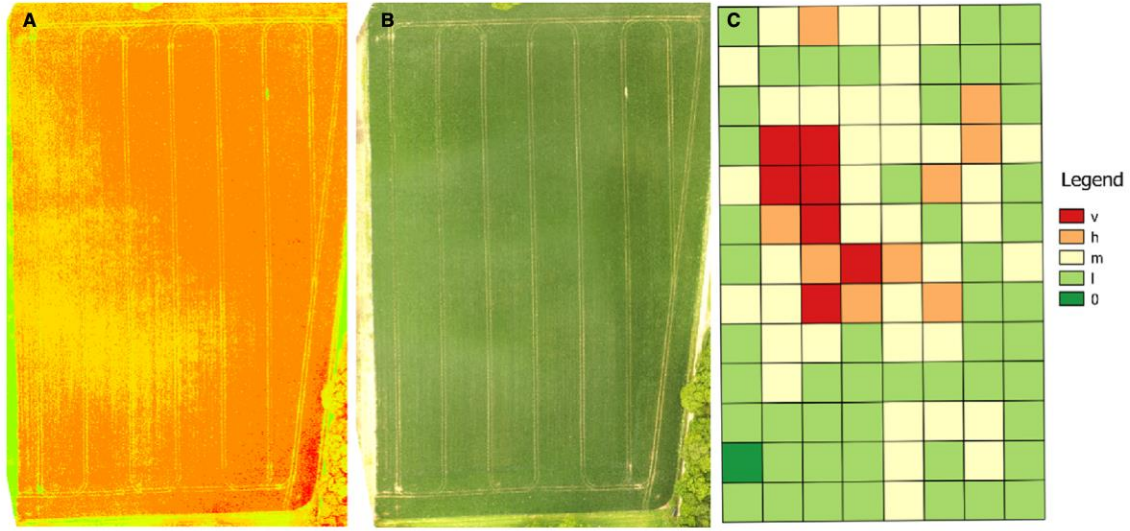


Field maps (ground-truth)



Modelled national density maps, Hicks et al., 2021

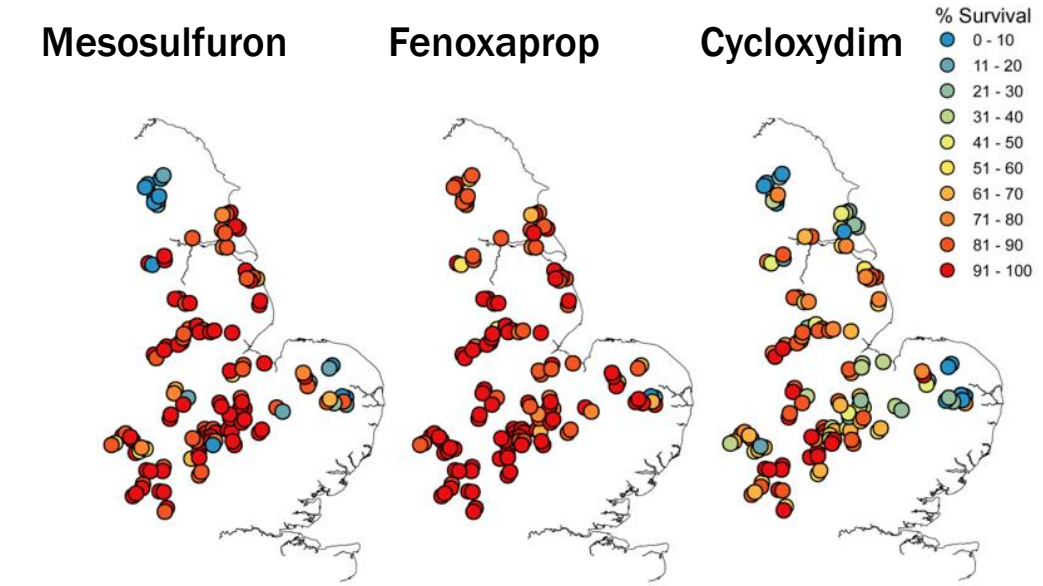


UAV images

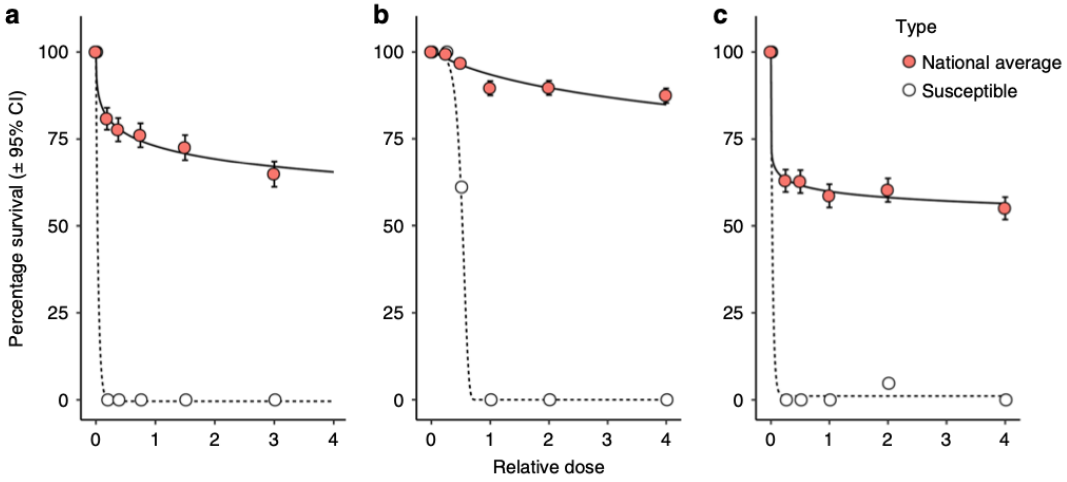
A) R_{mod} (670-750nm)
B) RGB
C) Field map

Lambert et al., 2018

Mapping herbicide resistance

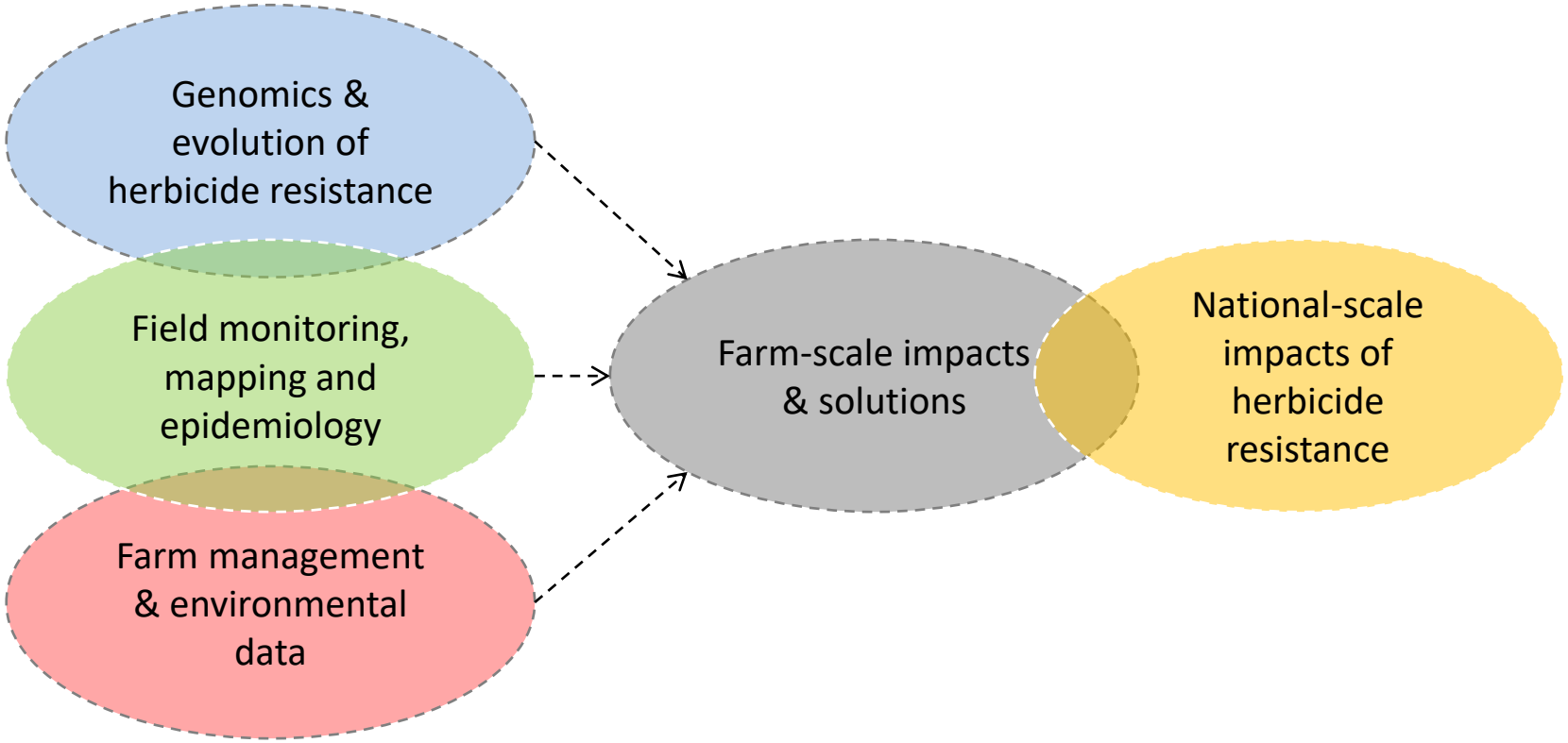


Hicks et al. 2018



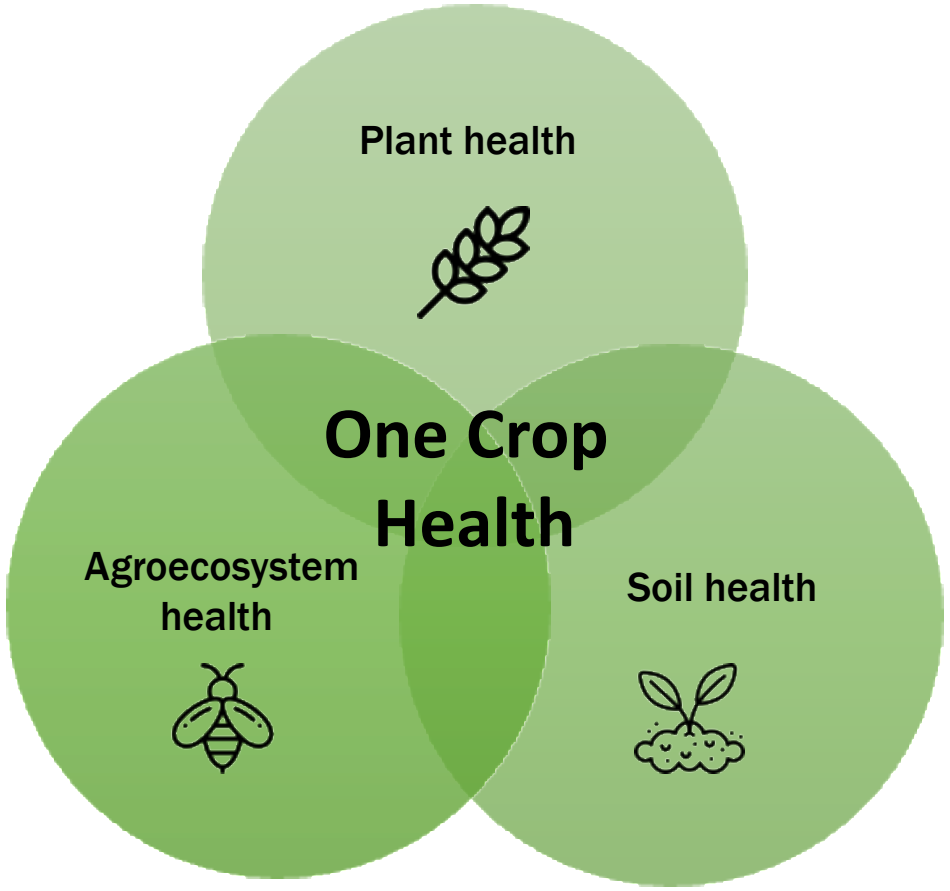
Comont et al. 2020

Blackgrass big data: informing science & practice



- National-scale monitoring
- Drivers of resistance
- Resistance management (what works?)
- Early detection of resistance
- Costs of resistance
- Genomics of resistance

One Crop Health: Next Generation Crop Protection (2024-2030)



Department of Plant and Environmental Sciences

Paul Neve

Department of Computer Science

Sune Darkner

ROTHAMSTED RESEARCH

Jonathan Storkey

AARHUS UNIVERSITY

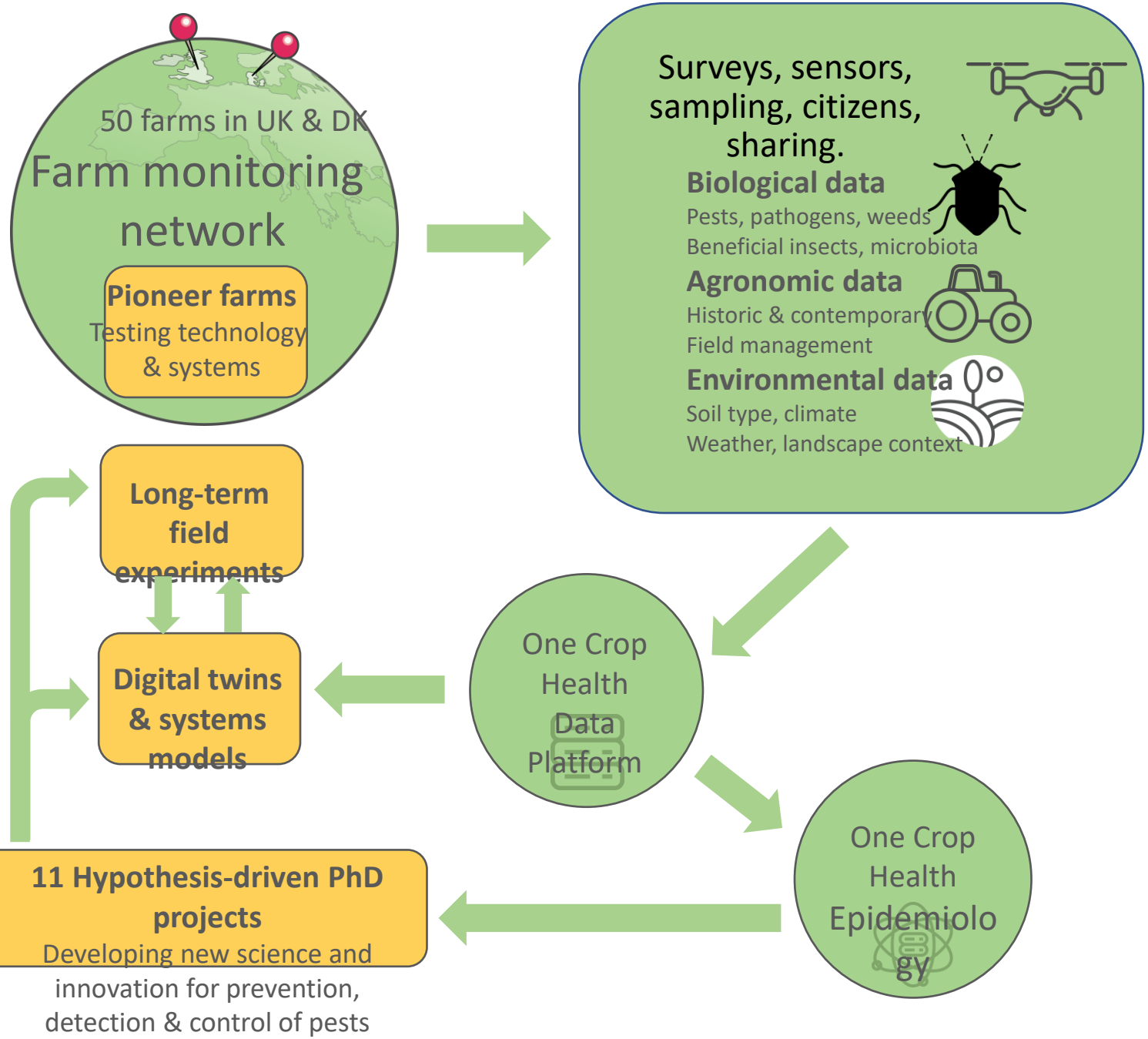
Department of Agroecology

Per Kudsk

A systems approach using agronomy, ecology, biotechnology and data science to reduce reliance on pesticides for pest, weed and disease control.

novo nordisk fonden

One Crop Health



- A comprehensive mapping & modelling of the crop health system.
- An international cohort of PhD students

Answering big questions with ‘big’ data

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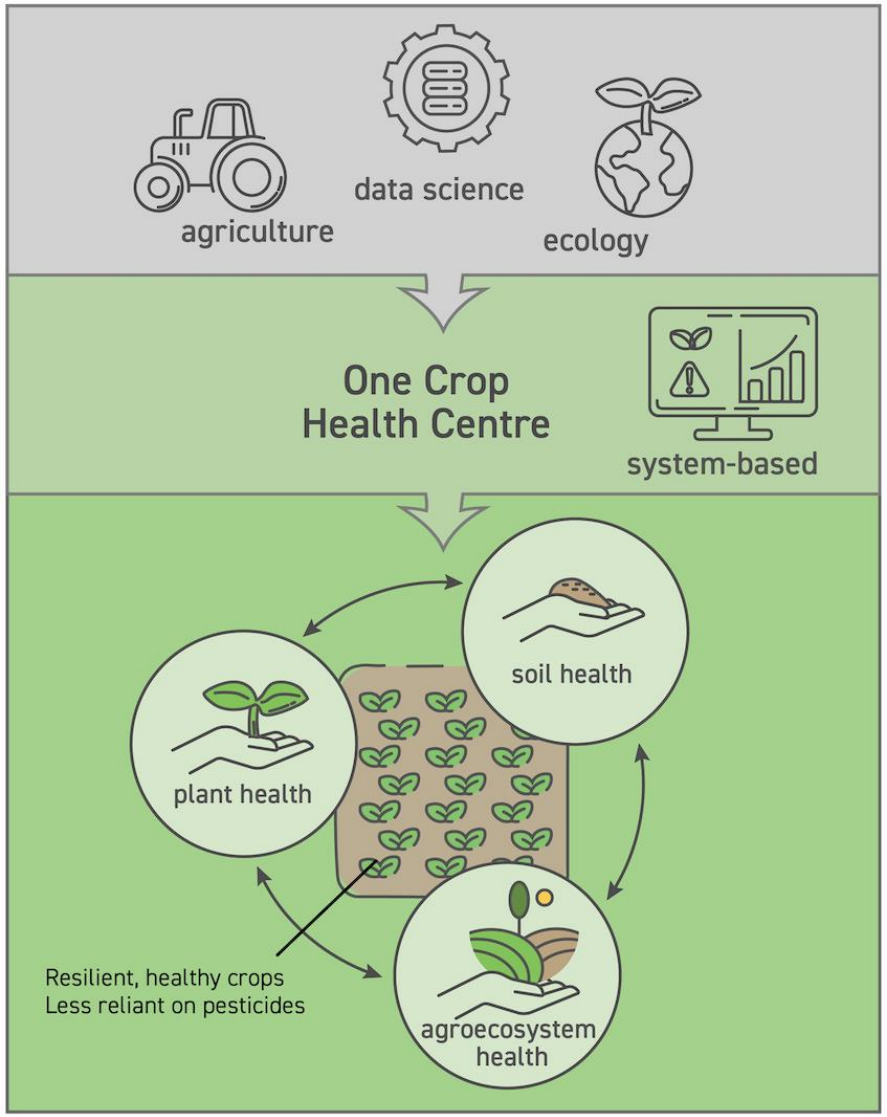

- What drives pest, weed & disease numbers at field to landscape scales?
- Which management practices limit pest, weed & disease populations?
- What are the links between soil, ecosystem and crop health?
- How can big data be used to optimise crop protection?
- How do we reduce pesticide use in future agroecosystems?
- How do we use new technologies to maximise their efficacy and minimise negative environmental impacts?