Några pågående SLU-projekt om handburna sensorer, drönare och satelliter

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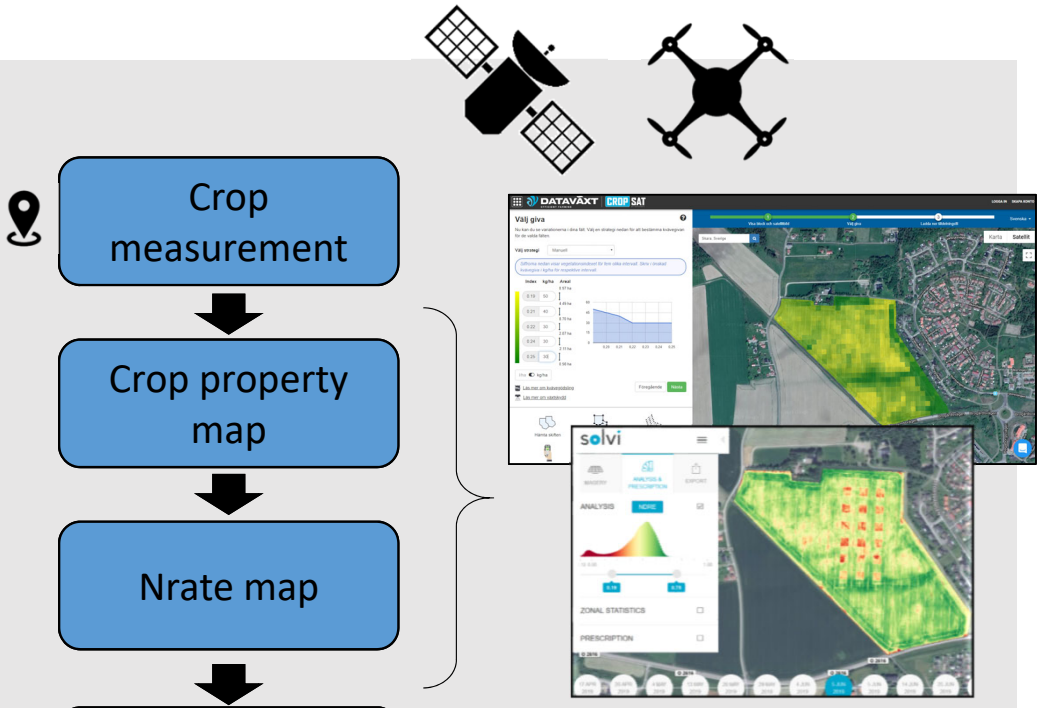
Institutionen för mark och mijö, Sveriges lantbruksuniversitet
Precisionsodling och pedometri

Crop status

- **Relative crop status:**
  Vegetation index
  (Söderström et al., 2017; Tihonov, 2018)
- **Absolute crop status:**
  N uptake from satellite (kg/ha)
  Protein concentration (%)
  (Wolters et al., 2019; Börjesson et al. 2019)
- **Absolute N rate:**
  Optimal N rate (kg / ha) (in oilseed rape)
  (Engström et al. 2017)

Examples of work at SLU & partners
→ in practical use in agri DSS



CropSAT.com
Solvi.nu

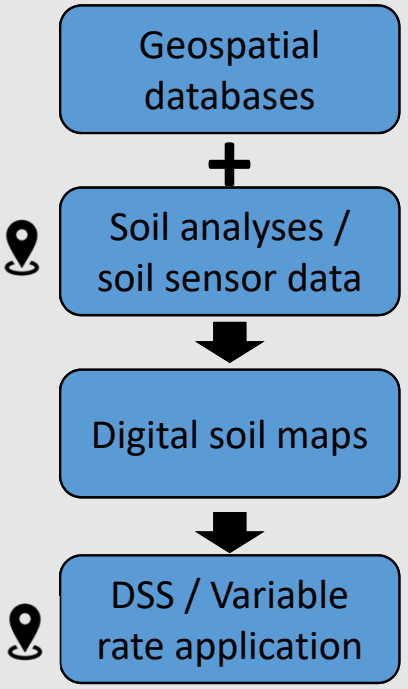
Soil status

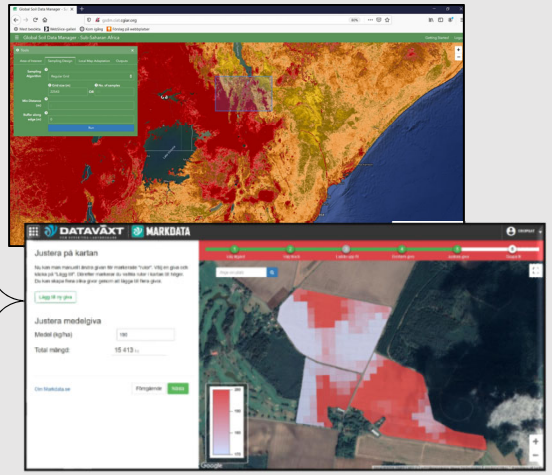
Jordart / lerhalt i åkermark:
Digitala åkermarkskartan (DSMS)
(Piikki & Söderström 2019)

Buffertkapacitet & Mål-pH:
Används för beräkning av kalkbehov, lager i DSMS
(Piikki et al 2017)

Nedskalning av globala geodatabaser:
Enklare och bättre användning av ”big data”
(Söderström et al 2017, Nijbroek et al 2019)

Examples of work at SLU & partners → in practical use in agri DSS





gsdm.ciat.cgiar.com
Markdata.se

Laboratory for intelligent agricultural decision support systems (LADS)

LAST CHANGED: 04 OCTOBER 2019

A programme for strengthening and further develop digital decision support systems to face new information demand for sustainable and efficient agricultural production. LADS' research is carried out in close collaboration with authorities, industry and farmers.

Several decision support systems and geospatial datasets for precision agriculture have been and are being developed during recent years through successful collaboration between SLU and different players such as Hushållningssällskapet, DataVäxt AB, Lantmännen, Agroväst Livsmedel AB, Greppa Näringen och Jordbruksverket, Sveriges Geologiska Undersökning, Västra Götalandsregionen, Solvi AB and others.

www.slu.se/LADS

Prediktioner av kväveupptag i höstvete m h a satellitdata
– Sandra Wolters

Target–N och test av schackbrädesförsök
– Kristin Piikki

Prediktera mikronärings- och andra spårelement i jord med PXRF
– Karl Adler

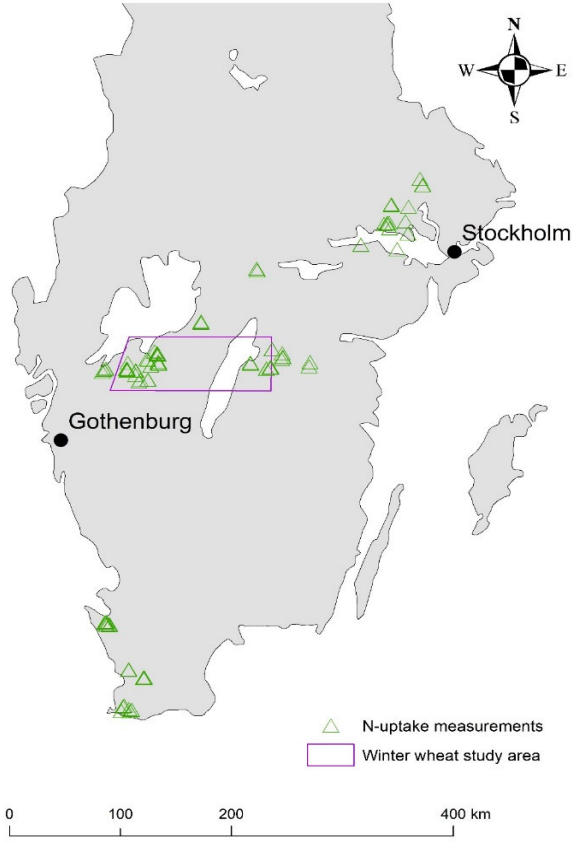
Nitrogen uptake predictions for a decision support system

The process of translating satellite data to nitrogen uptake maps

2020-01-09, Uddevalla

Wolters S., Söderström M., Piikki K., Stenberg M., Reese, H.

Two levels of satellite data and Yara N-sensor measurements in winter wheat 2017 & 2018



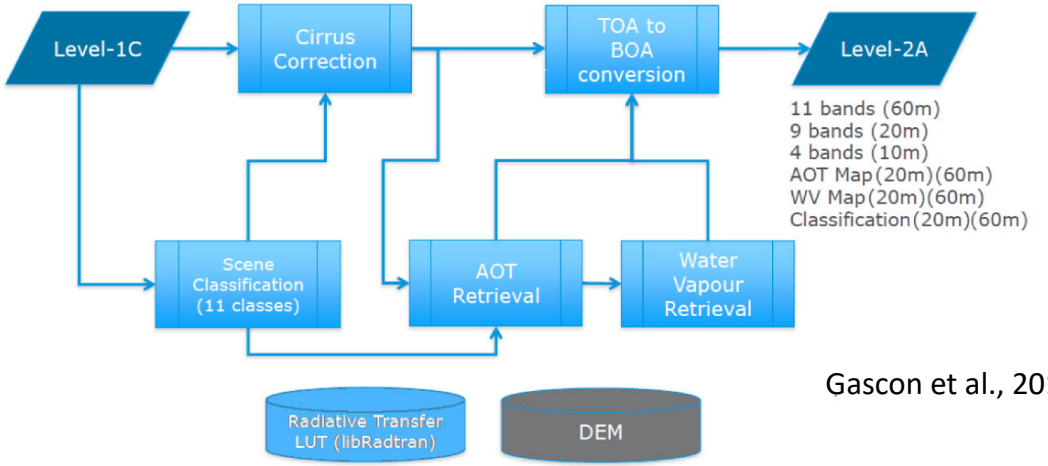
Thanks to the Swedish Board of Agriculture for the georeferenced data on N-uptake obtained by handheld sensor measurements.

Image: Johanna Wetterlind, SLU

Adding L2A and why?

ESA Copernicus programme, earth.esa.int

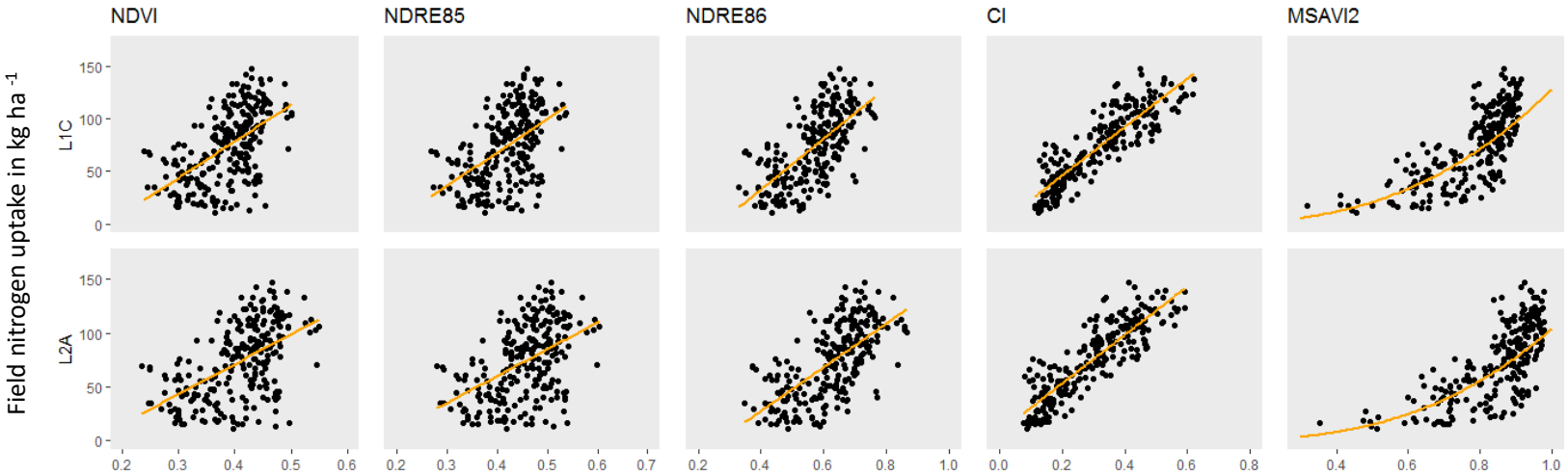
2017-05-27, 33VVF



Gascon et al., 2017

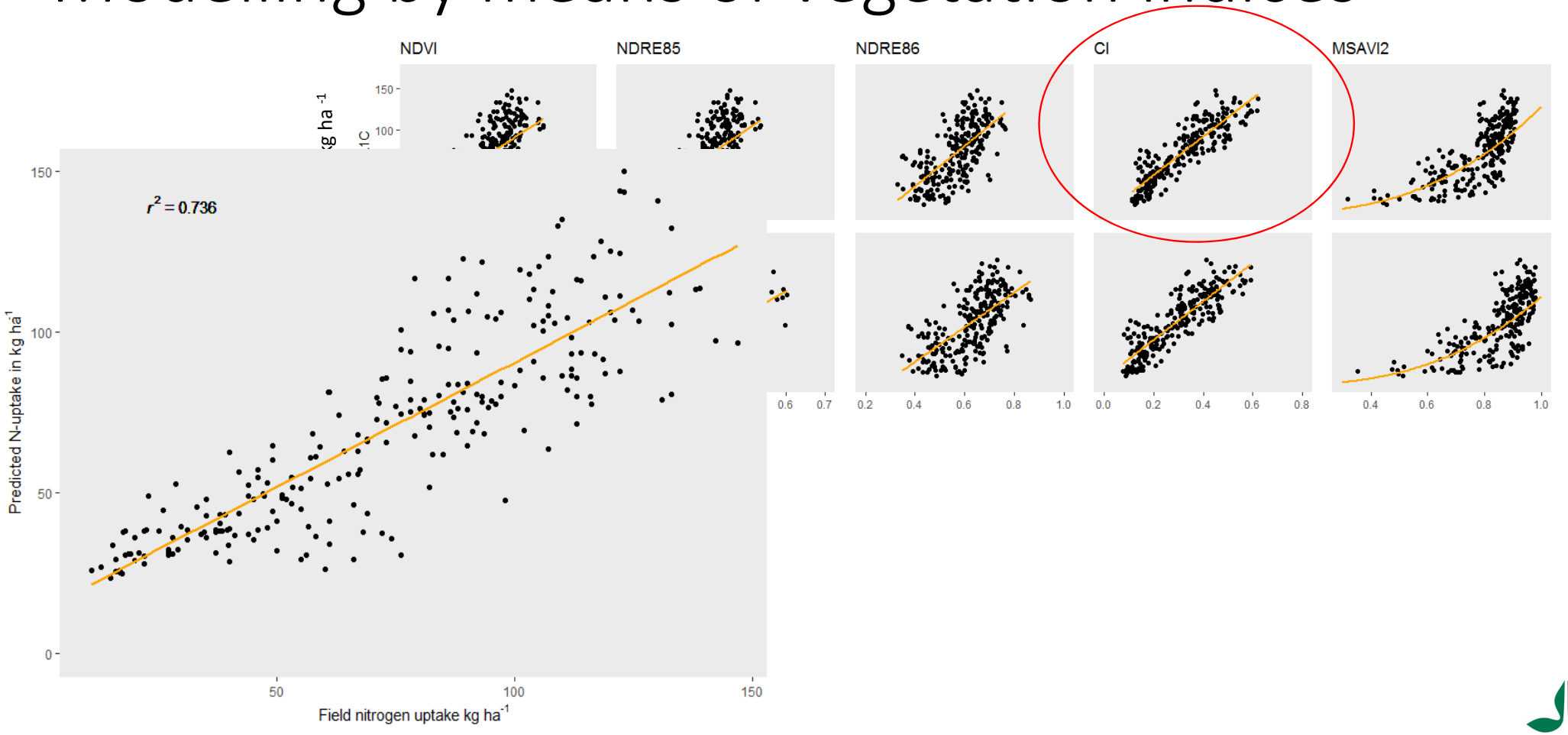
SLU

Modelling by means of vegetation indices



SLU

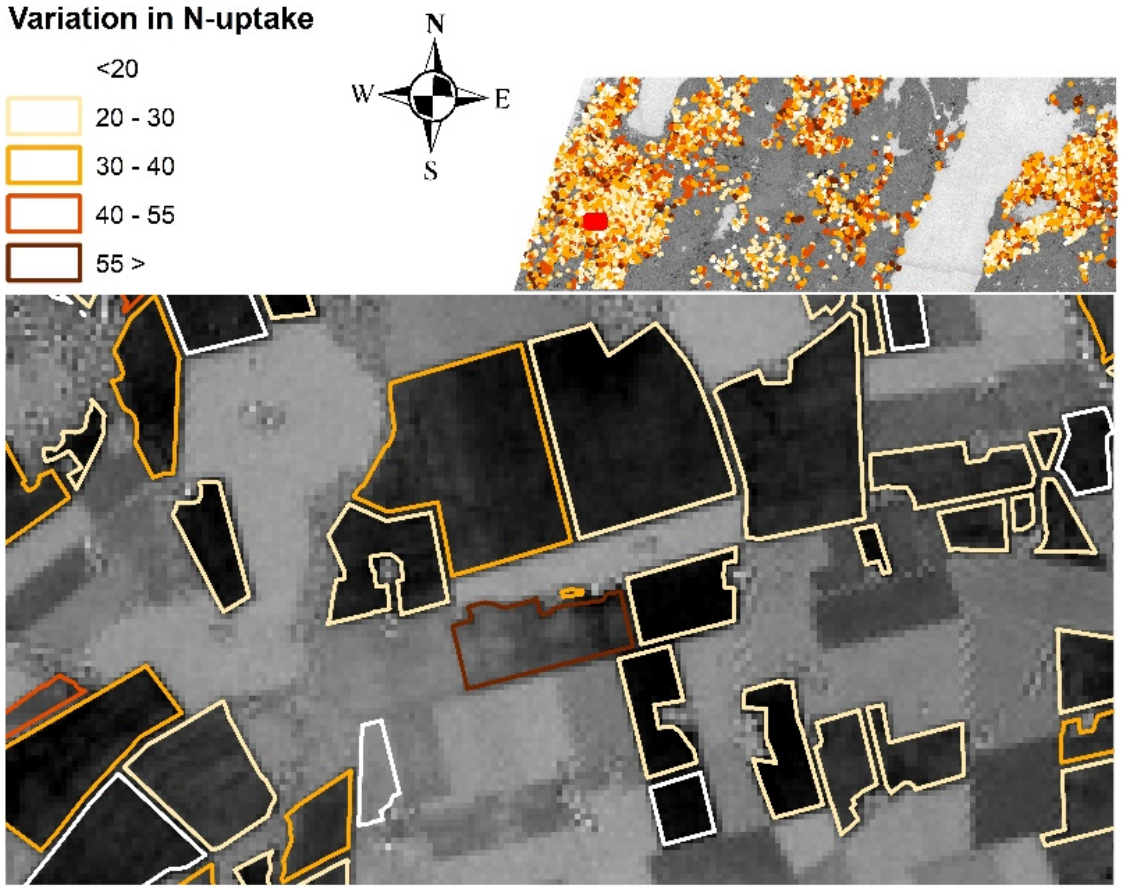
Modelling by means of vegetation indices



SLU

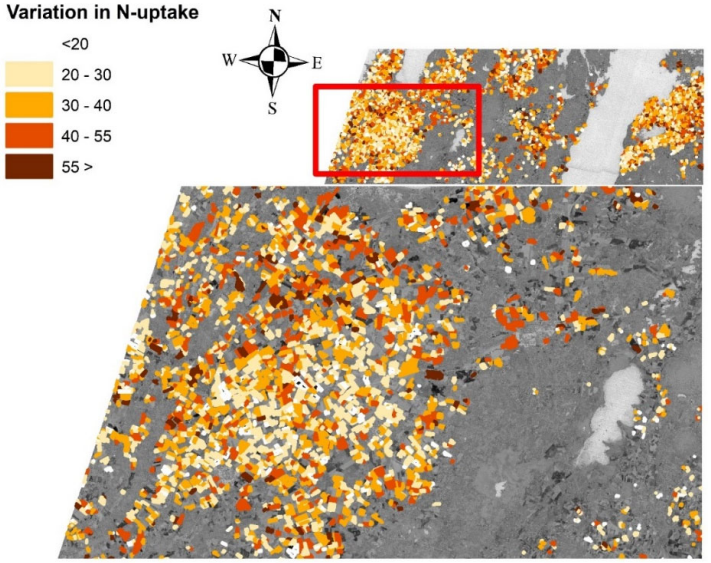
Example: Model applied in all winter wheat fields ”from Vara to Linköping”, 27 May 2017 ≈DC32-37

Variation within and between fields

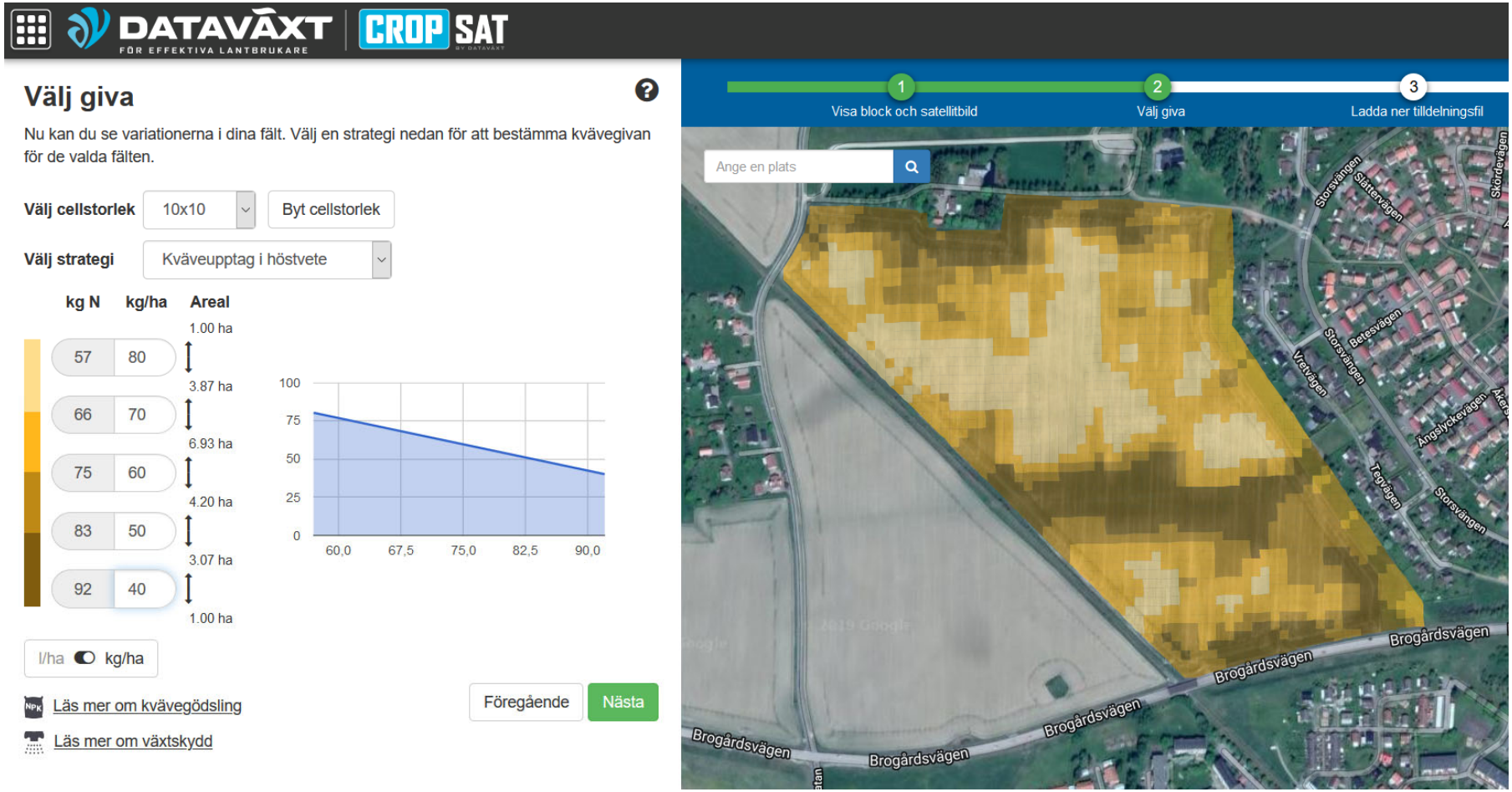


Modelled variation in N-uptake within fields

	Small <10	Medium 10 <> 30	Large >30
Mean (kg/ha)	30	36	41
σ (kg/ha)	12	12	13



CropSAT today



Target–N
och
test av schackbrädesförsök

Två pågående projekt med syfte att ta fram underlag för optimal kvävegödsling

EONR = Economically Optimal Nitrogen Rate

Target-N

Droneborne measurements
in two field trial series – 3-yrs project 2019-2021
Multiple cultivars of winter wheat and spring barley

Model EONR variation between fields and years

Funding: Swedish Foundation for Agricultural Research, SLF

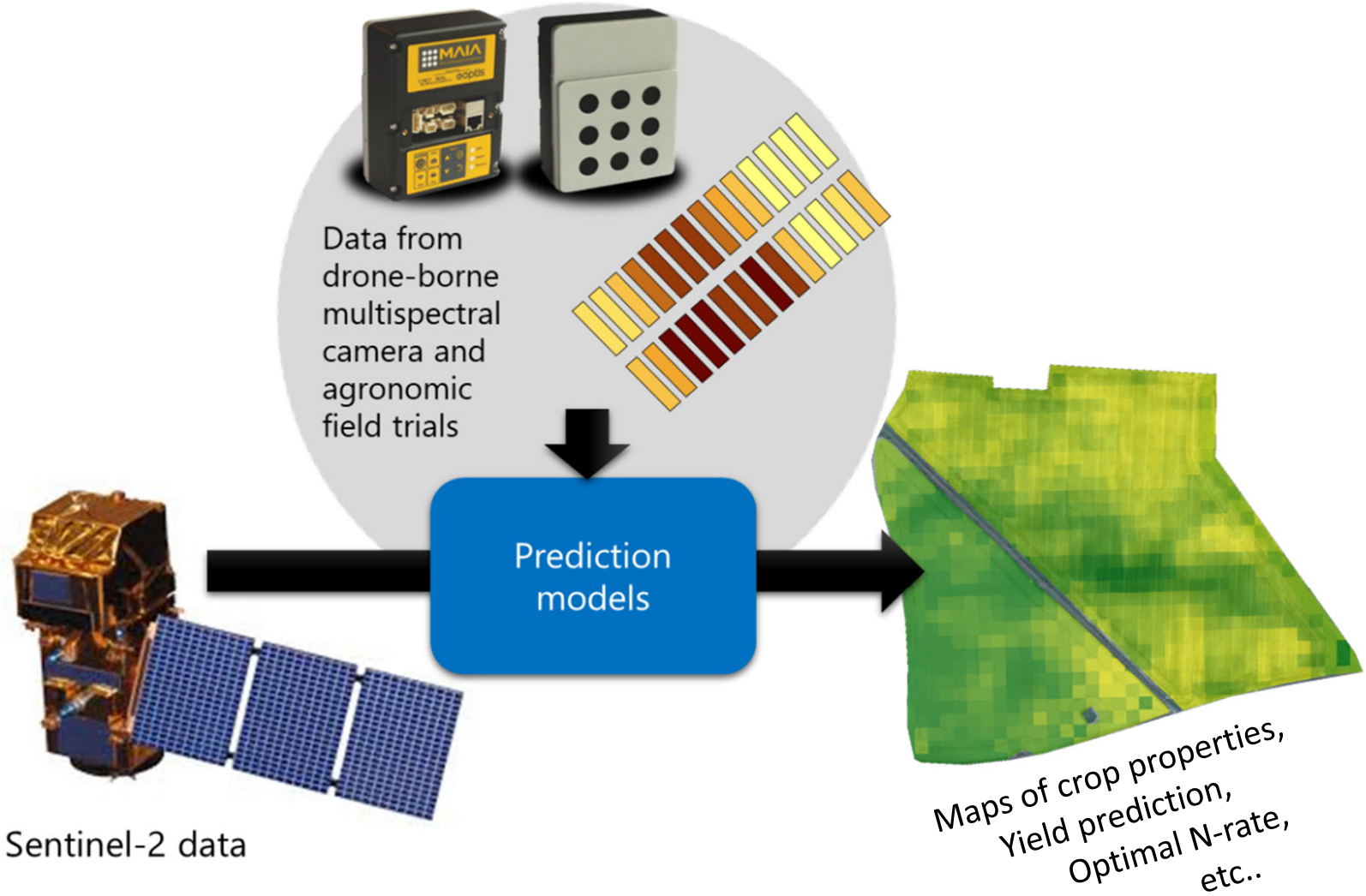
Chessboard

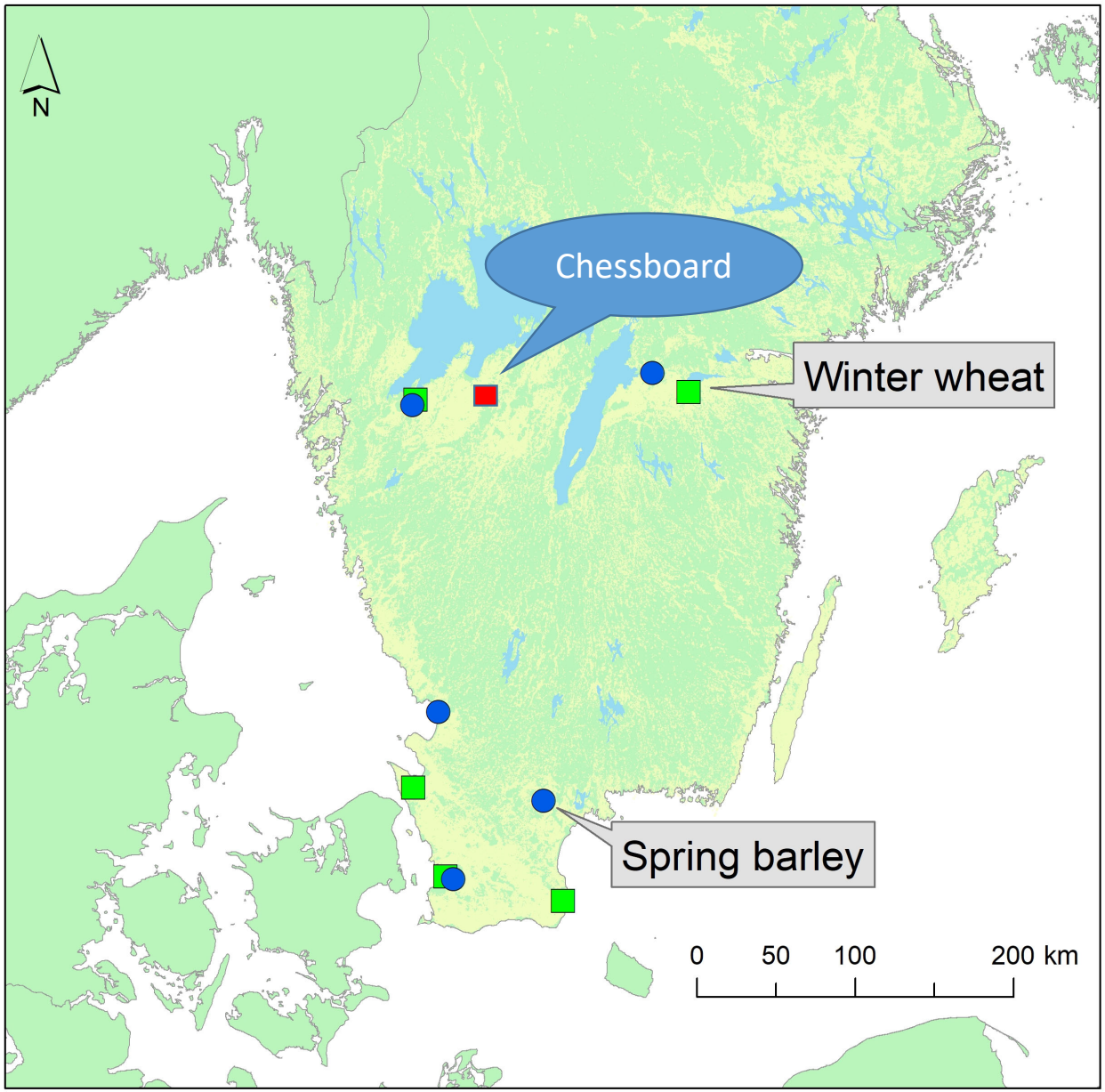
Droneborne measurements
in a pilot chessboard trial
One cultivar of winter wheat

Model EONR variation within one field in one year

Funding: SLU

L7-150c Tommarp, 2019.
Drone mosaic overlaid with Sentinel-2 10 m × 10 m grid


Data from drone-borne multispectral camera and agronomic field trials
Prediction models
Sentinel-2 data
Maps of crop properties, Yield prediction, Optimal N-rate, etc..

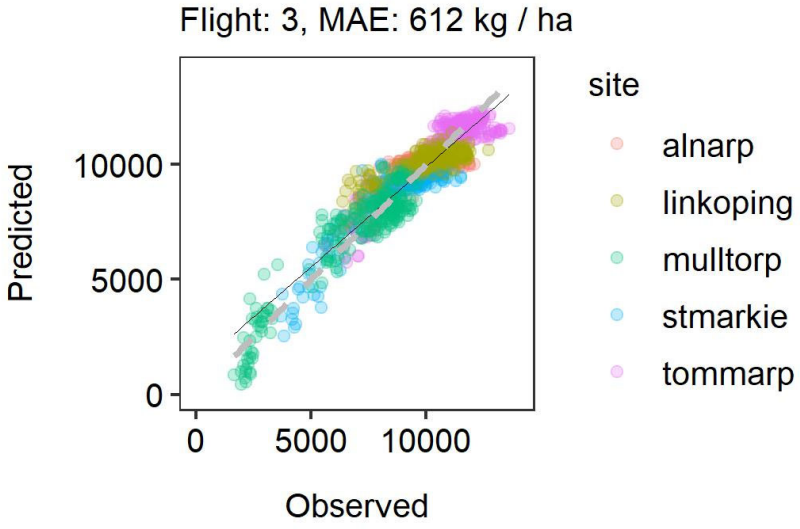


2019 trials
Winter wheat: L7-150 / 150c
Spring barley: L7-426

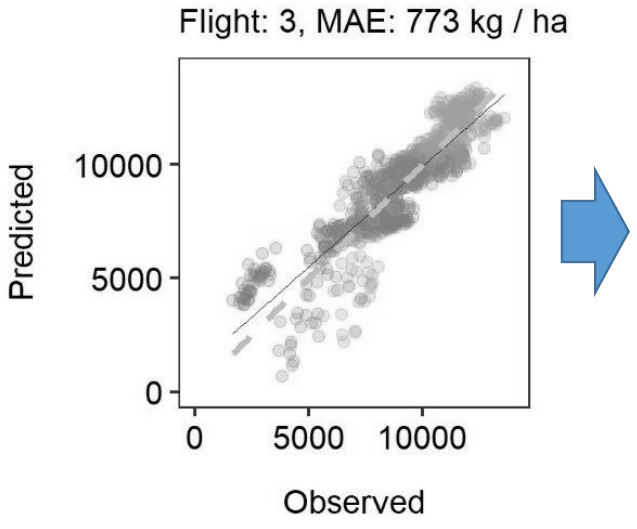
Continues 2020 & 2021

Predictions of yield (kg / ha) –leave one site out

Average yield from user + drone data

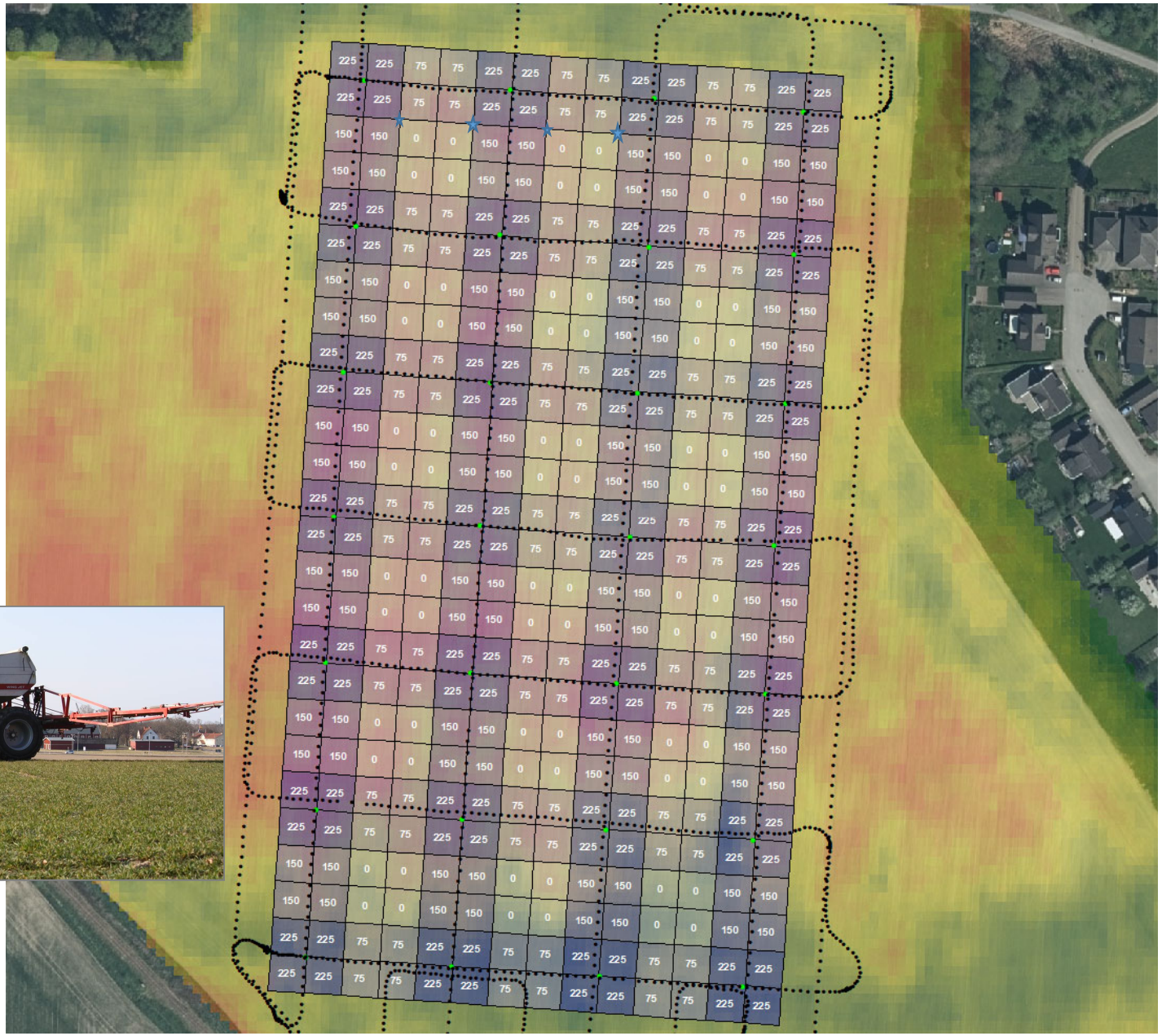


Average yield from user + Sentinel-2 data



Söderström et al., 2019

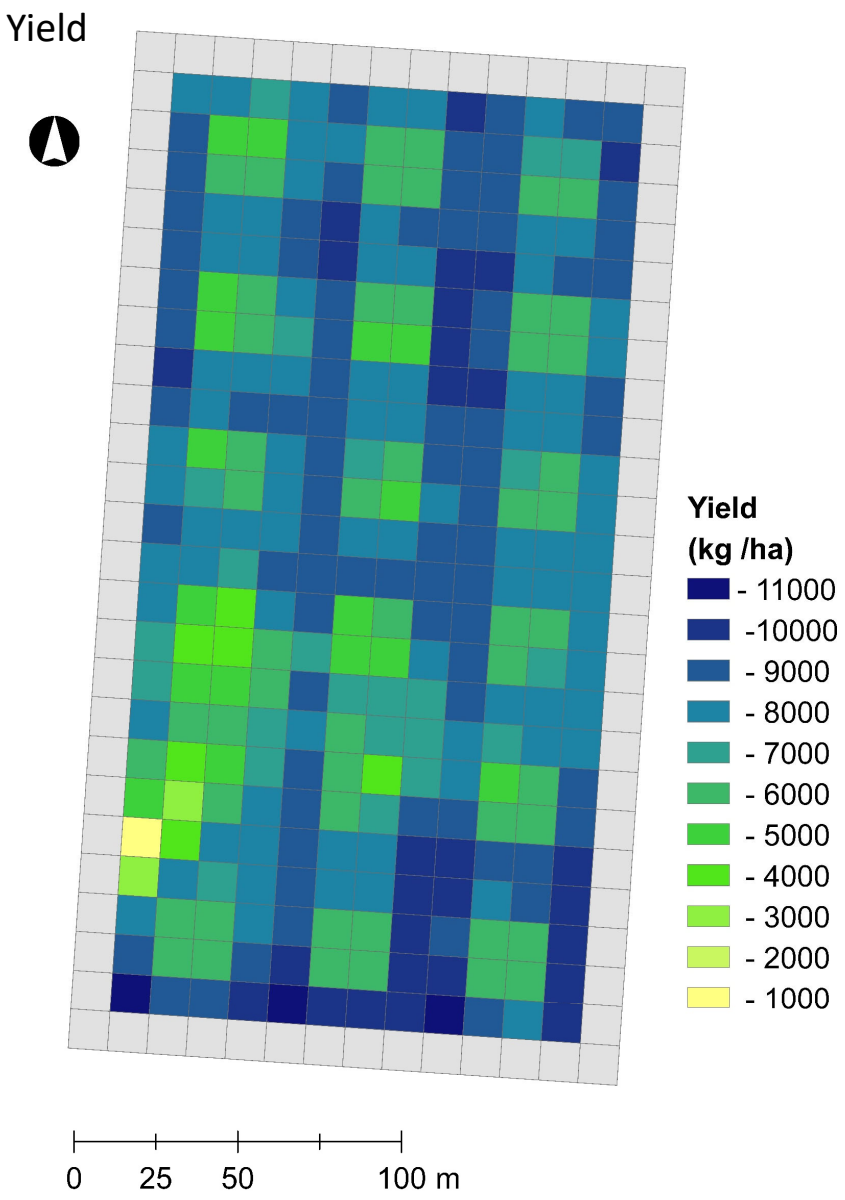
Chess-board trial



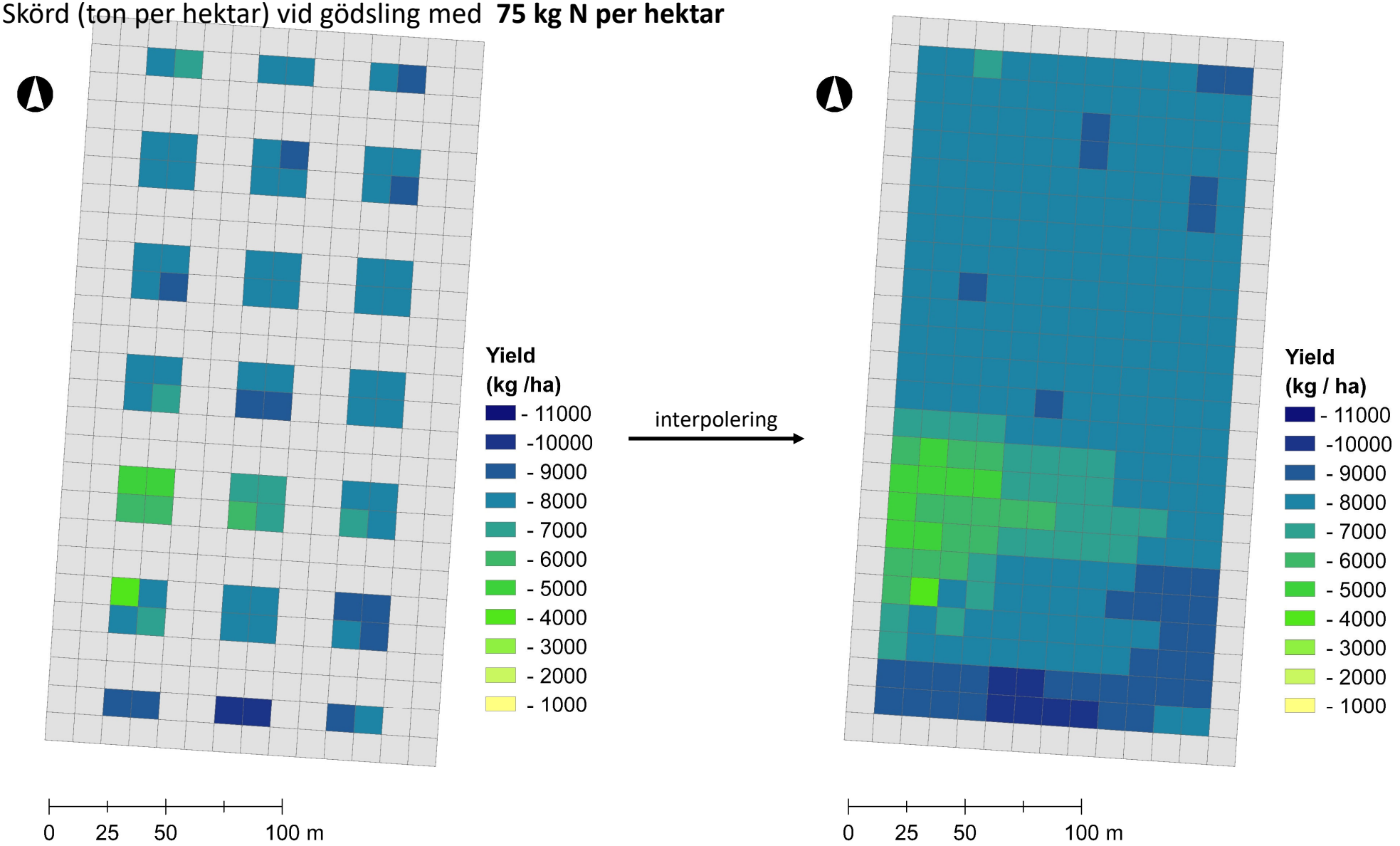
Winter wheat
cv. Ellvis

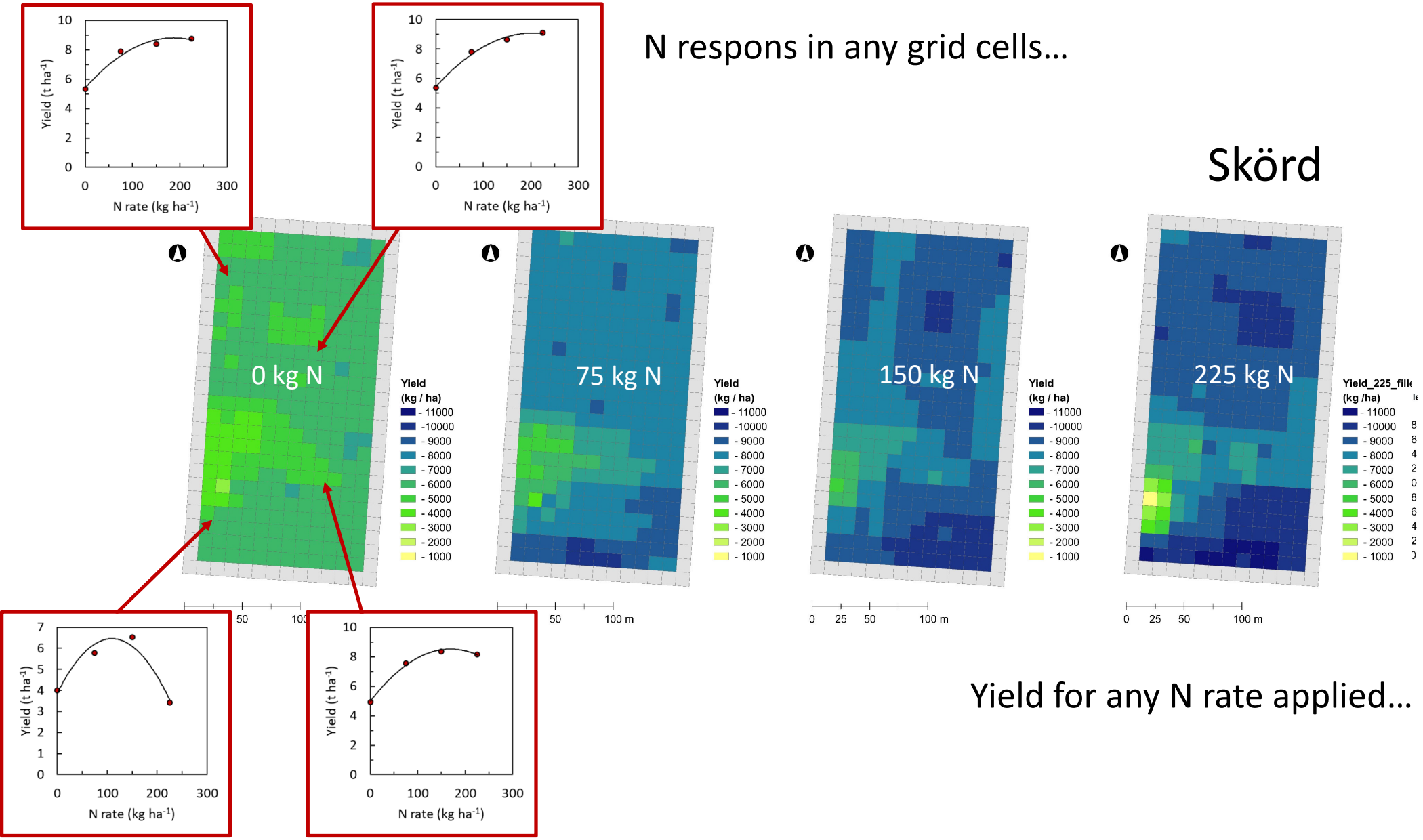
Manure applied:
45 kg N ha^{-1}

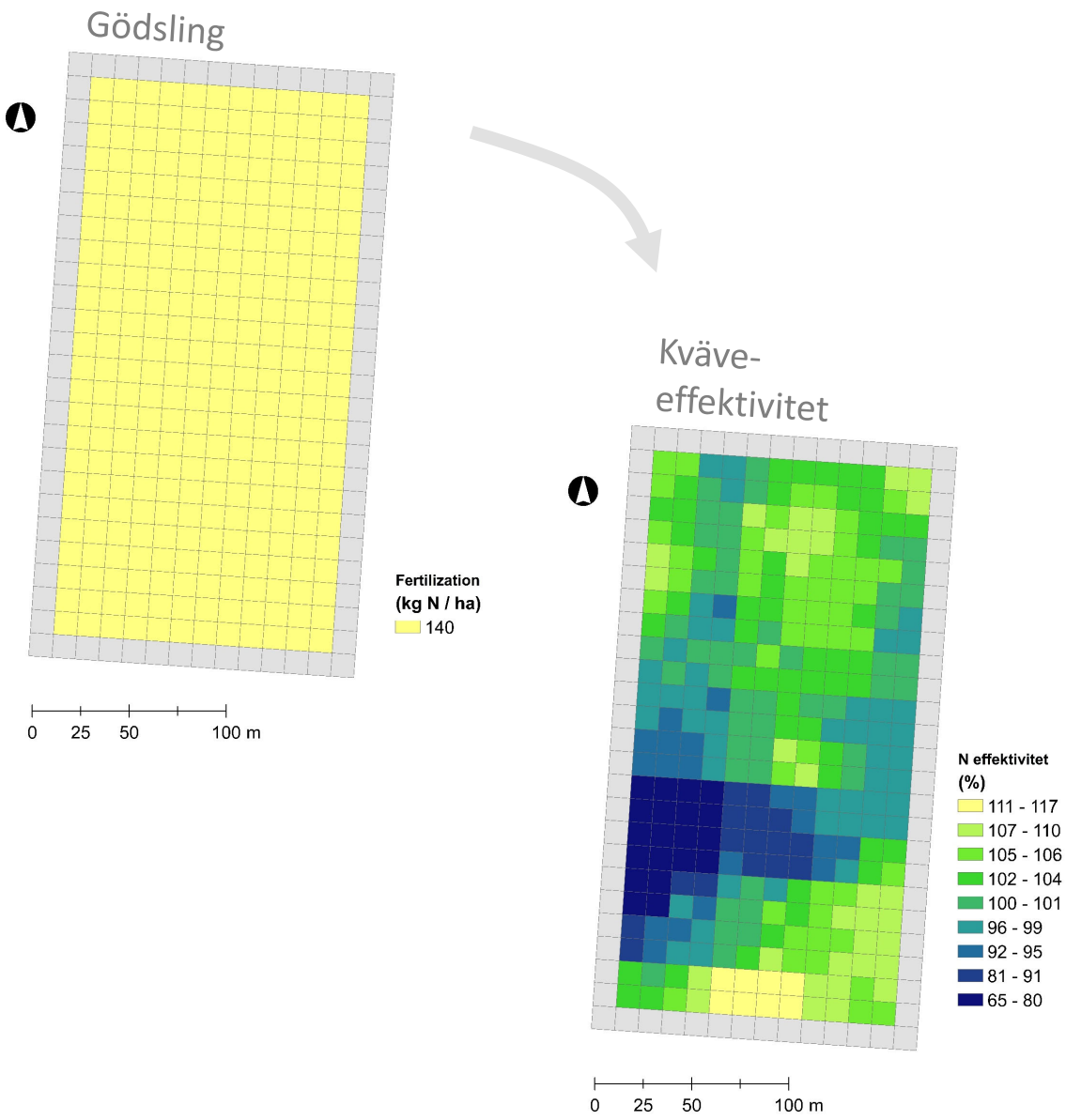

Sampo
ROSENLEW
2010


Yield
Yield
(kg /ha)
- 11000
-10000
- 9000
- 8000
- 7000
- 6000
- 5000
- 4000
- 3000
- 2000
- 1000
0
25
50
100 m

Skörd (ton per hektar) vid gödsling med **75 kg N per hektar**



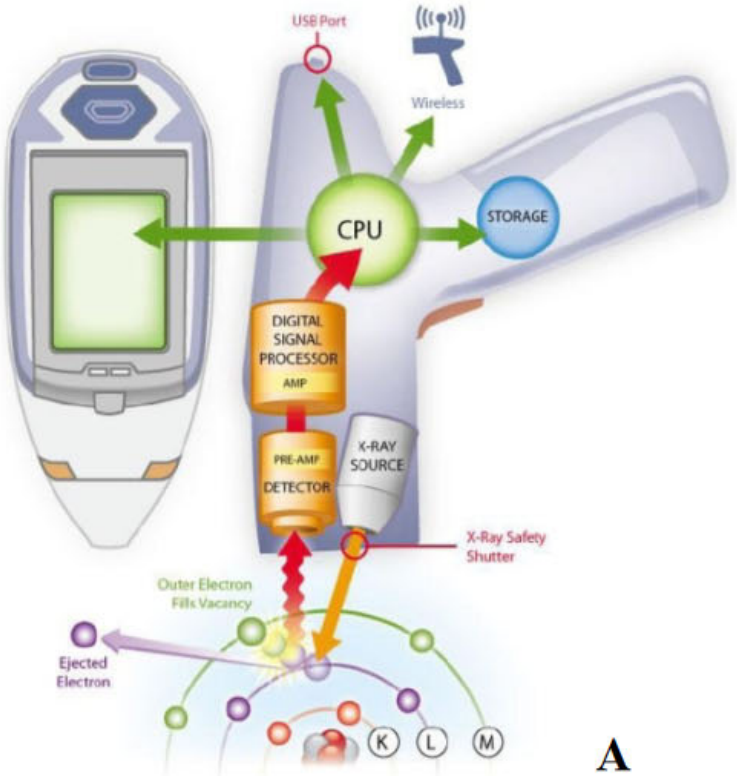

N respons in any grid cells…
Skörd
Yield (t ha-1)
N rate (kg ha-1)
0 kg N
75 kg N
150 kg N
225 kg N
Yield
(kg / ha)
- 11000
-10000
- 9000
- 8000
- 7000
- 6000
- 5000
- 4000
- 3000
- 2000
- 1000
Yield_225_fill
(kg /ha)
0 25 50 100 m
Yield for any N rate applied…



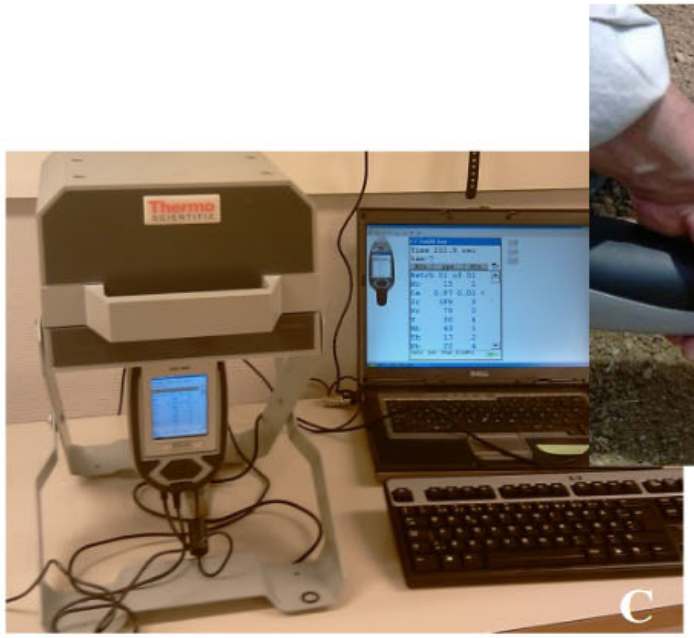
Simulera effekter av gödslingsscenarier på:

- *Skörd*
- *Proteinhalt*
- *Kväveffektivitet*
- *Ekonomiskt resultat*

Prediktera Cu, Zn och Cd i jord med PXRF (Portabel röntgenfluorescens)



A

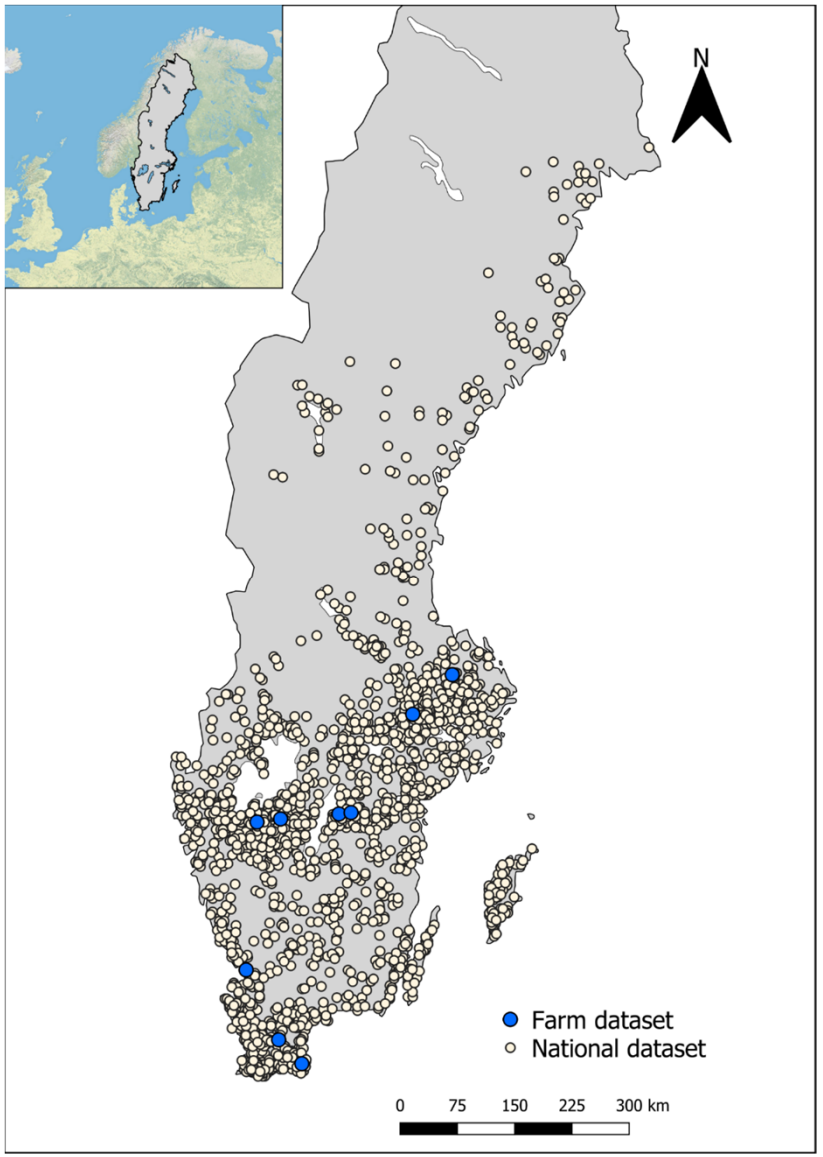


C

B

Jordprover och metod

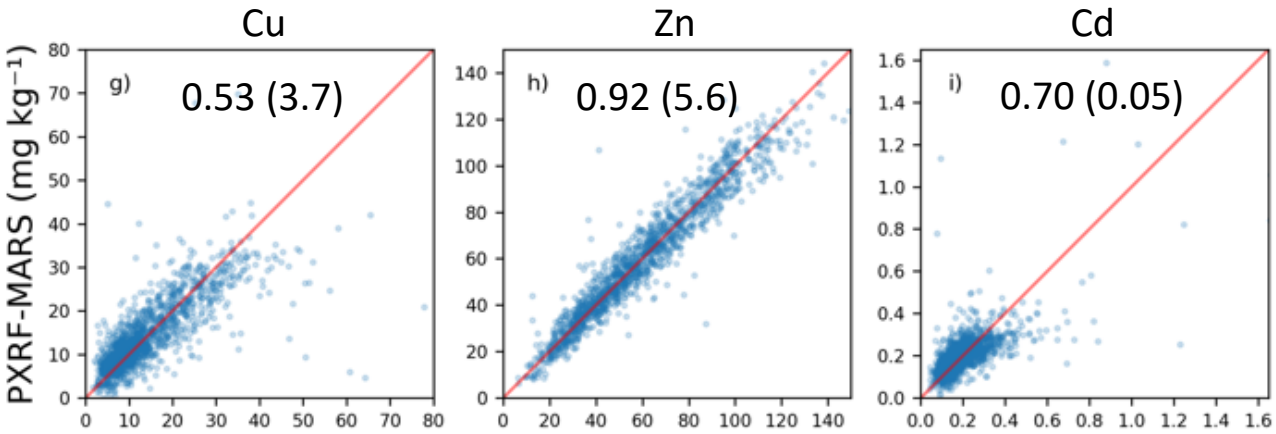
- 1520 nationella prover för att kalibrera och validera prediktionsmodeller
- 179 gårdsprover (9 gårdar) för validering
- 3 olika multivariata modeller testades



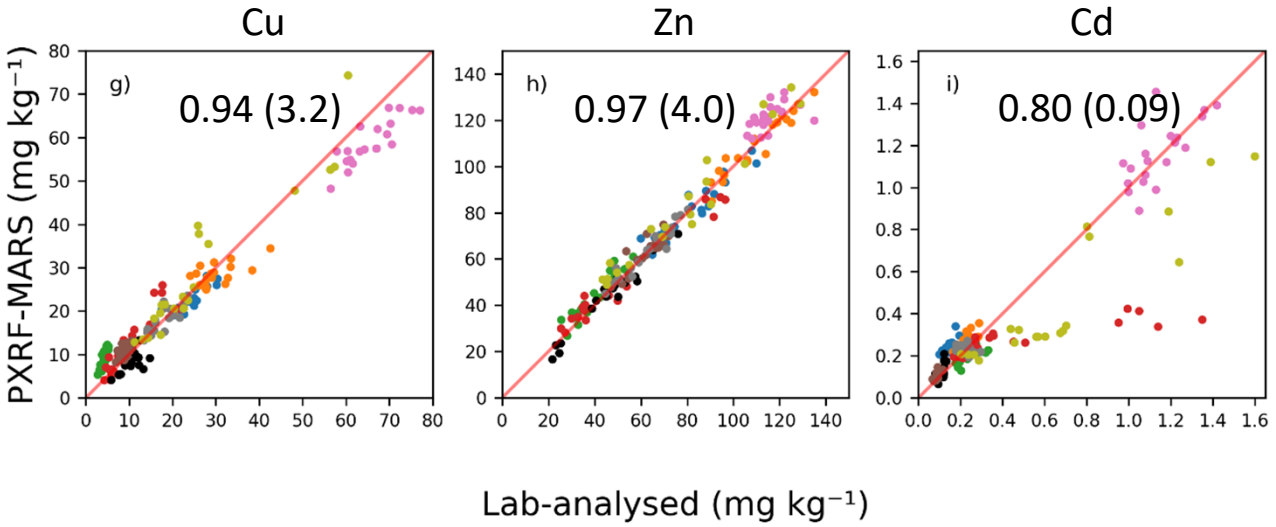
Validering

R^2 (MAE mg/kg)

Nationell korsvalidering



Gårdsvalidering



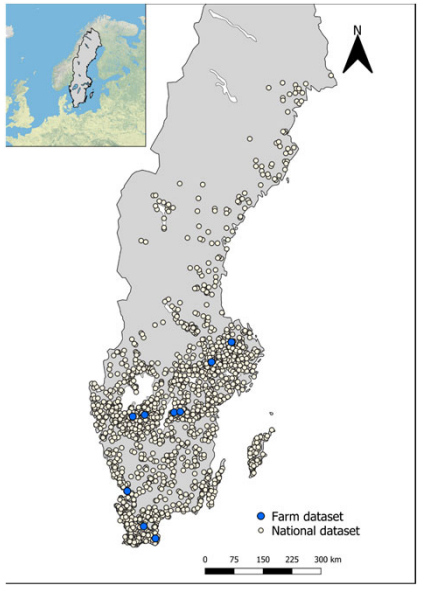
Vad händer härnäst?

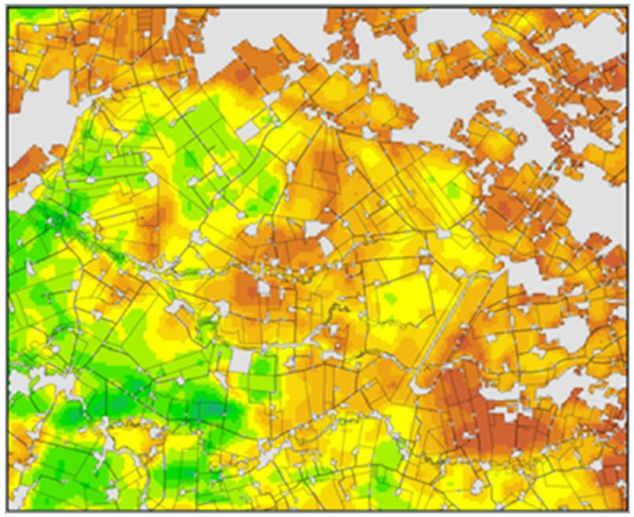
Nu) Prediktionsmodeller är framtagna

2) Applicera dessa på 12 000 prover mätta med PXRF

3) Nationell kartering av Cu, Zn, Cd, Mn och B

4) Tillgängliggöra som lager i DSMS (Digitala åkermarkskartan)





DSMS lerhaltskartan

Slutsatser

- **Stora möjligheter att utveckla underlag för mycket bättre beslutsstöd genom att kombinera data av olika typ m h a datautvinningsmetoder.**
- **Möjlighet att förkorta vägen från forskning → praktiskt användning genom implementering av resultat i lättillgängliga beslutsstödsystem.**
- **Utveckling av robusta metoder för uppskalning av observationer i fältförsök till satellit viktig del.**

More info:

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- Sandra.wolters@slu.se
- Karl.adler@slu.se
- Mats.soderstrom@slu.se

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More projects:

ww.slu.se/LADS

Stiftelsen Lantbruksforskning

SLU

VÄSTRA GÖTALANDSREGIONEN