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SEEDS Workshop

Use of soil land surface data in precision agriculture

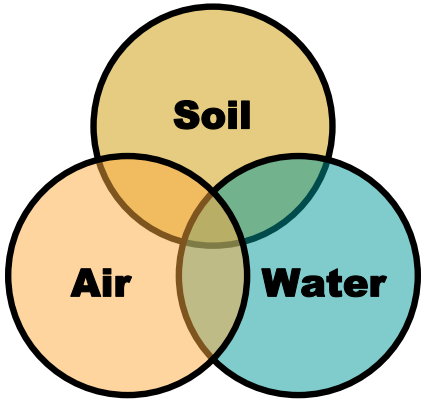
Dr Suzanne Higgins

23 March 2022

afbini.gov.uk

Main Science Question

- How can we manage land sustainably while minimising nutrient losses to the environment?
- Soil nutrient management needs to be more efficient
- Apply only the nutrients we need and where we need them



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Managing Soil Nutrients

- Farm scale studies: Farm type, farm intensity, soil type. N, P, K, S, pH
- Field scale: Precision management of nutrients at sub-field scale

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Impact

- Revisions to fertiliser recommendations included in policy e.g. Nitrates Action Programme
- Improvement in water quality & air quality
- Meeting WFD & GHG emission targets
- Benefits for health and quality of life
- Savings for farmers . Avoiding unnecessary fertiliser

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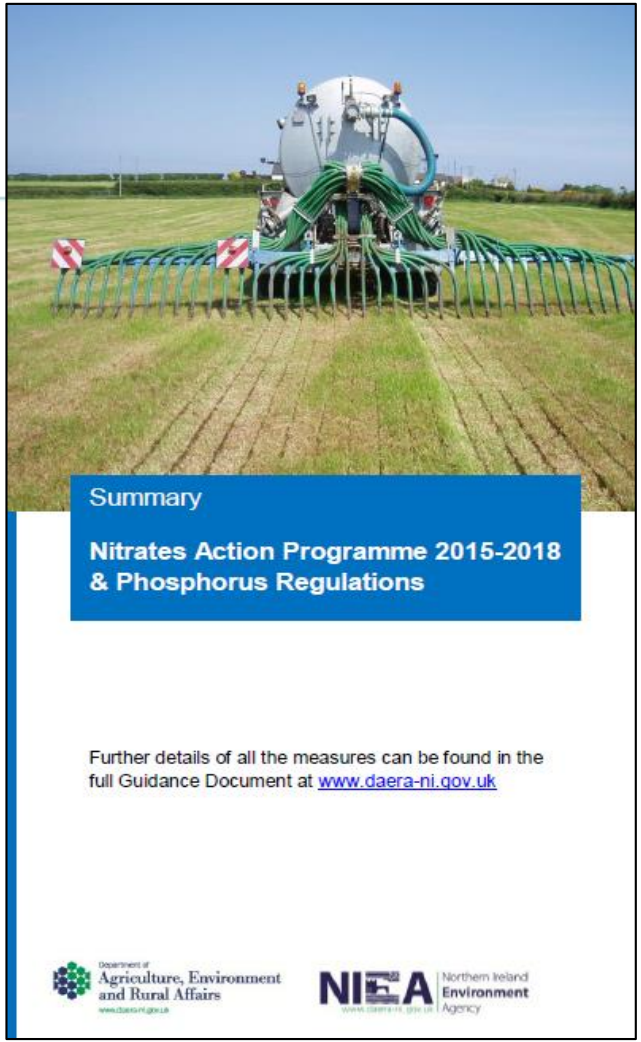
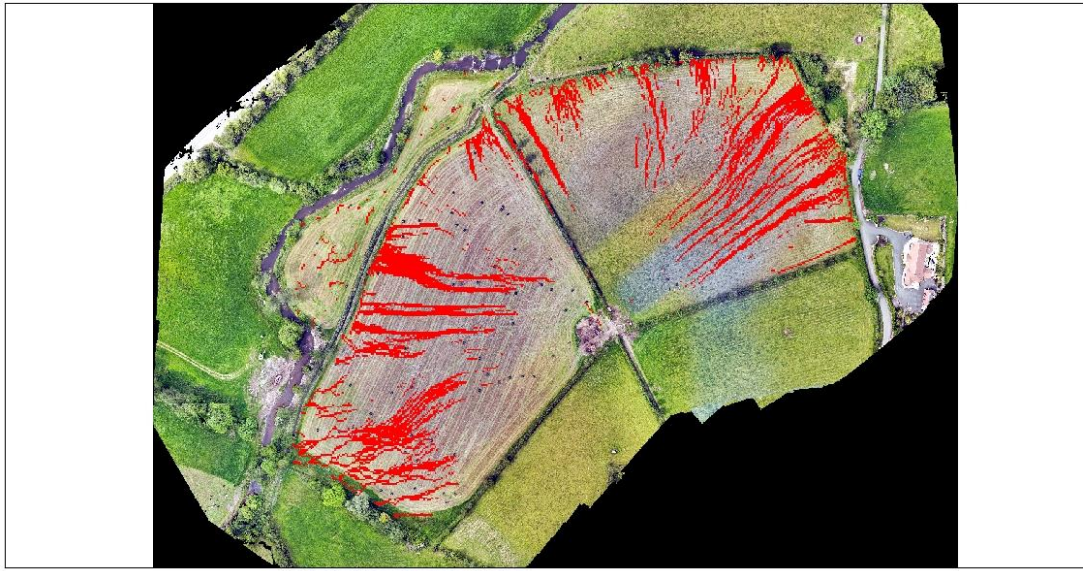




N

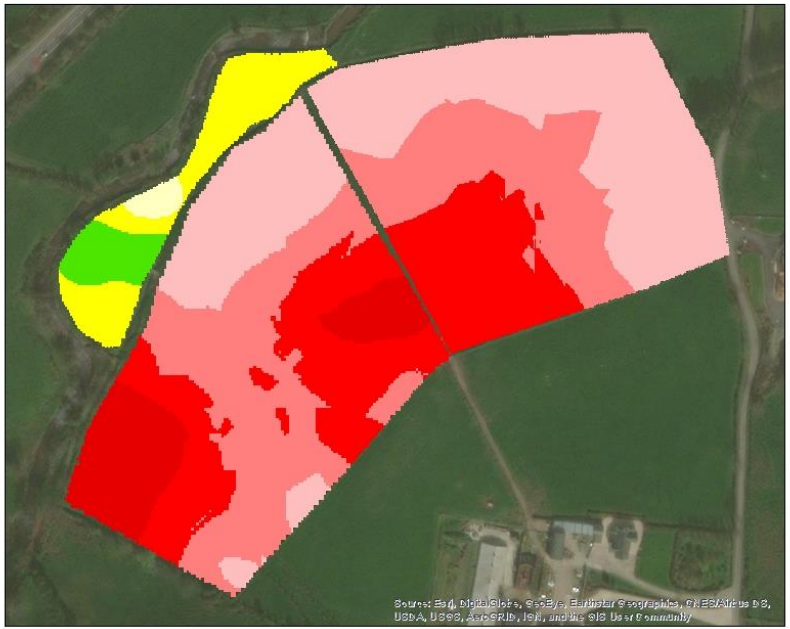
Scale: 1:1,600

Kilometer
0 0.03 0.06 0.12 0.18 0.24

Legend

Modelled Runoff Channels

Hayes, E. Higgins, S. Geris, J. Mullan, D. 2021



Scale: 1:2,000

Kilometers
0 0.015 0.035 0.07 0.105 0.14

N

Legend

Soil P Index

- Index 0
- Index 1
- Index 2
- Index 3
- Index 4
- Index 5
- Index 6

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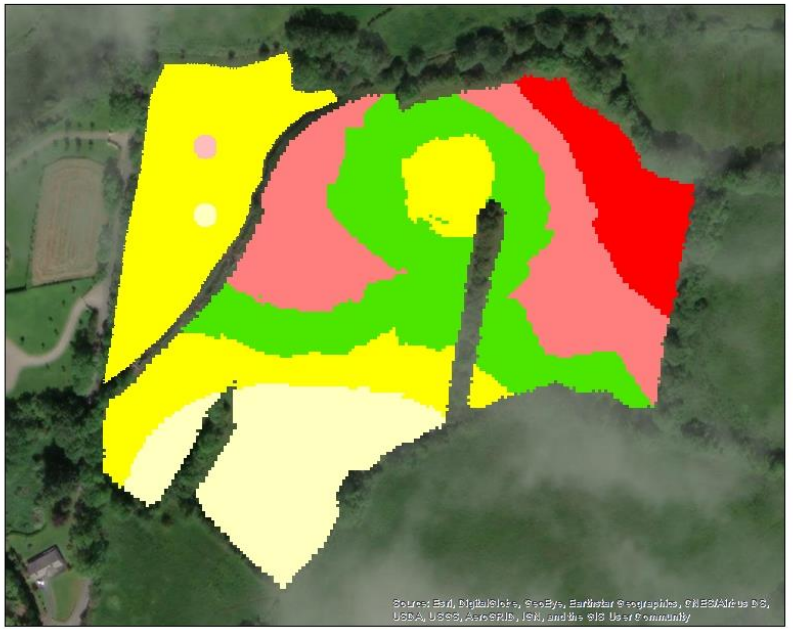
Scale: 1:2,800

Kilometers

0 0.02 0.04 0.055 0.11 0.165 0.22

N



Scale: 1:1,900

Kilometers

0 0.01 0.02 0.035 0.07 0.105 0.14

N

Legend

Soil P Index

- Index 0
- Index 1
- Index 2
- Index 3
- Index 4

Targeted soil nutrient management

Hayes, E. Higgins, S. Geris, J. Mullan, D. 2021

GPS technology on tractors

- Many new tractors are now fitted with GNSS technology.
- This will help increase the precision of nutrient management

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Precision slurry and fertiliser applications

- This technology is part of the CIEL precision grassland platform at AFBI Hillsborough

- Potential benefits of new technology for farmers, and for minimising the environmental impact of agriculture

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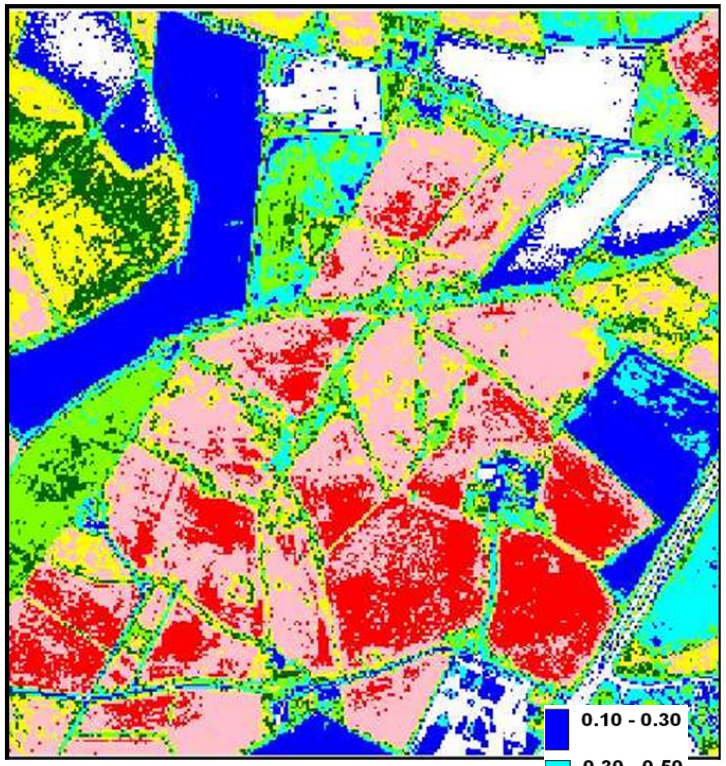

(a) IKONOS 4m true colour orthoimagery. (b) NDVI calculated from IKONOS 4m multispectral imagery.

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Improvements in Satellite Imagery

Early Problems: Extensive cloud cover during key monitoring periods

- Limited the number of images available during the growing season
- low repeat cycle (14 days)
- low resolution (4m)
- relative expense of the data

Recent Advances: Shorter revisit time so ability to provide more images and cover phonological events

- Multiple wavelengths so greater ability to distinguish between species.
- Higher resolution

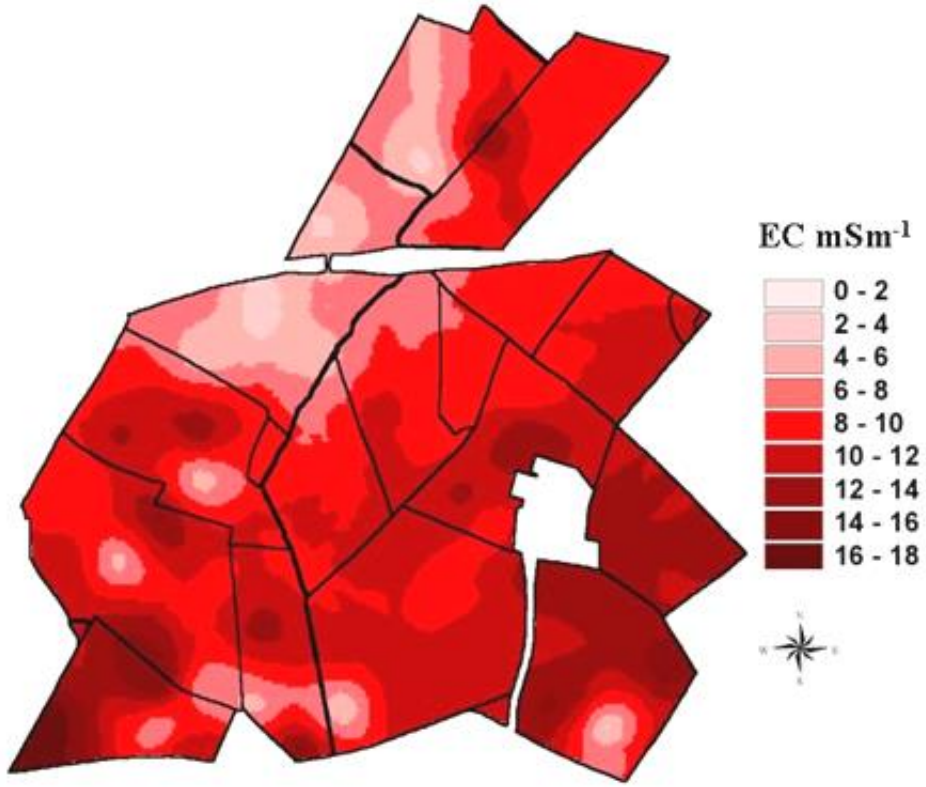
Requirements for Different Soil Properties

- Continuous monitoring, in-situ sensors, real-time data e.g. soil temperature & moisture, nutrients
- Proximal sensors – ground based platforms. Carbon, soil texture
- Remote sensing and aerial systems – mapping of crop yields & landscape features

Mapping soil properties

EJP SOIL
European Joint Programme

- Work with EU partners in EJP Soil



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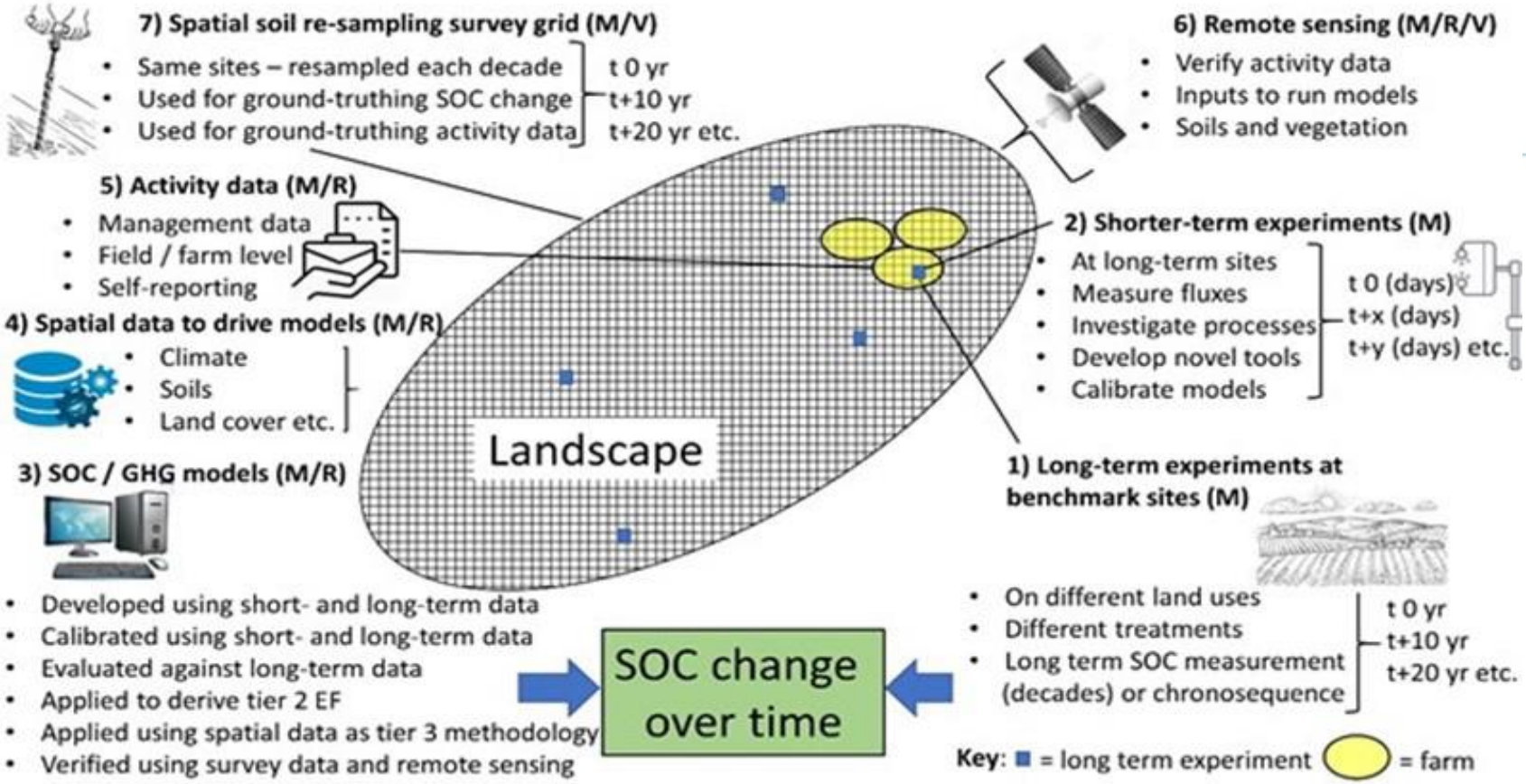

From Smith et al. (2020). Components of a soil measurement / monitoring, reporting and verification framework for soil carbon

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Impact and Future Direction

- Work with EU partners to advance knowledge in precision agriculture.
- Downscaling, upscaling & increasing precision of soil maps

- Continue to contribute to local policy & Decision Support Systems
- Applied research and work with local farmers

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