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Enabling carbon farming:
a robust, affordable and scalable method

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Potential of carbon farming

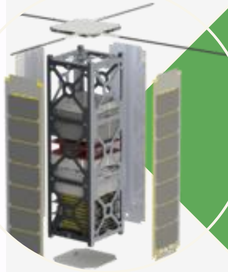
1. Agricultural soils have lost significant amounts of carbon (Quine et al. 1997; Van Oost et al. 2007; Sanderman et al. 2017).
2. Enhancing soil carbon:
   - water retention ↑
   - biodiversity ↑
   - resilience to droughts ↑

   (Guillaume et al. 2022).

3. Can mitigate climate change by sequestering carbon (IPCC, 2021)

Challenges in Carbon Farming:

Wet-chemistry is too costly for farm-level projects



Satellite alternatives are scalable, but always **measuring indirectly**

Additionality (the action that increases the carbon stock) must be shown and doumented

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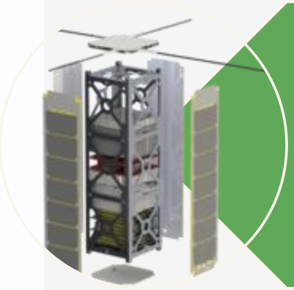
Challenges & solutions Carbon Farming:

Wet-chemistry is too costly for farm-level projects

→ **Near InfraRed Scanners** which leverage existing measurements



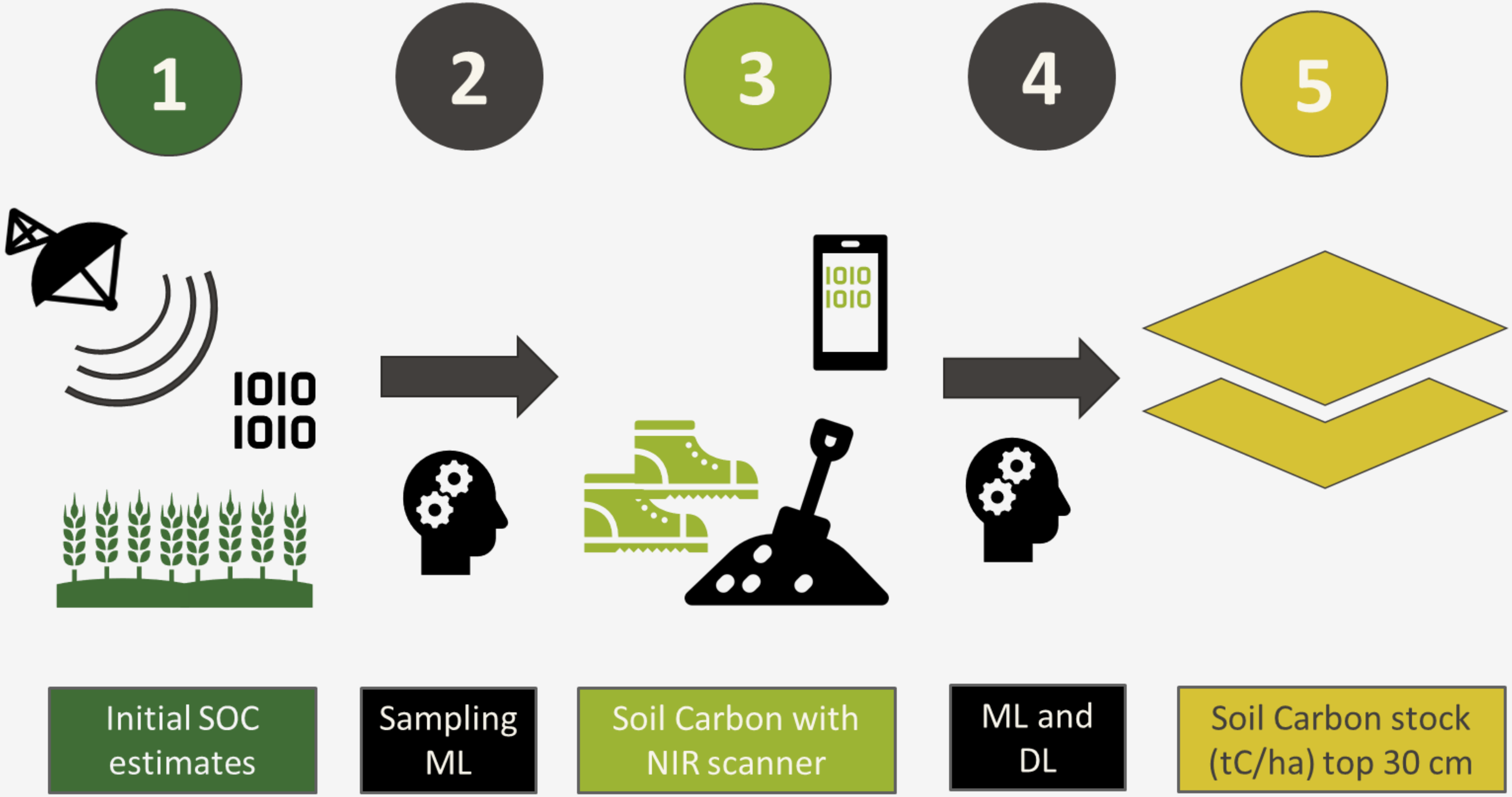
Satellite alternatives are scalable, but always **measuring indirectly**

→ Combine **satellite** with field-based measurements

Additionality (the action that increases the carbon stock) must be shown and doumented

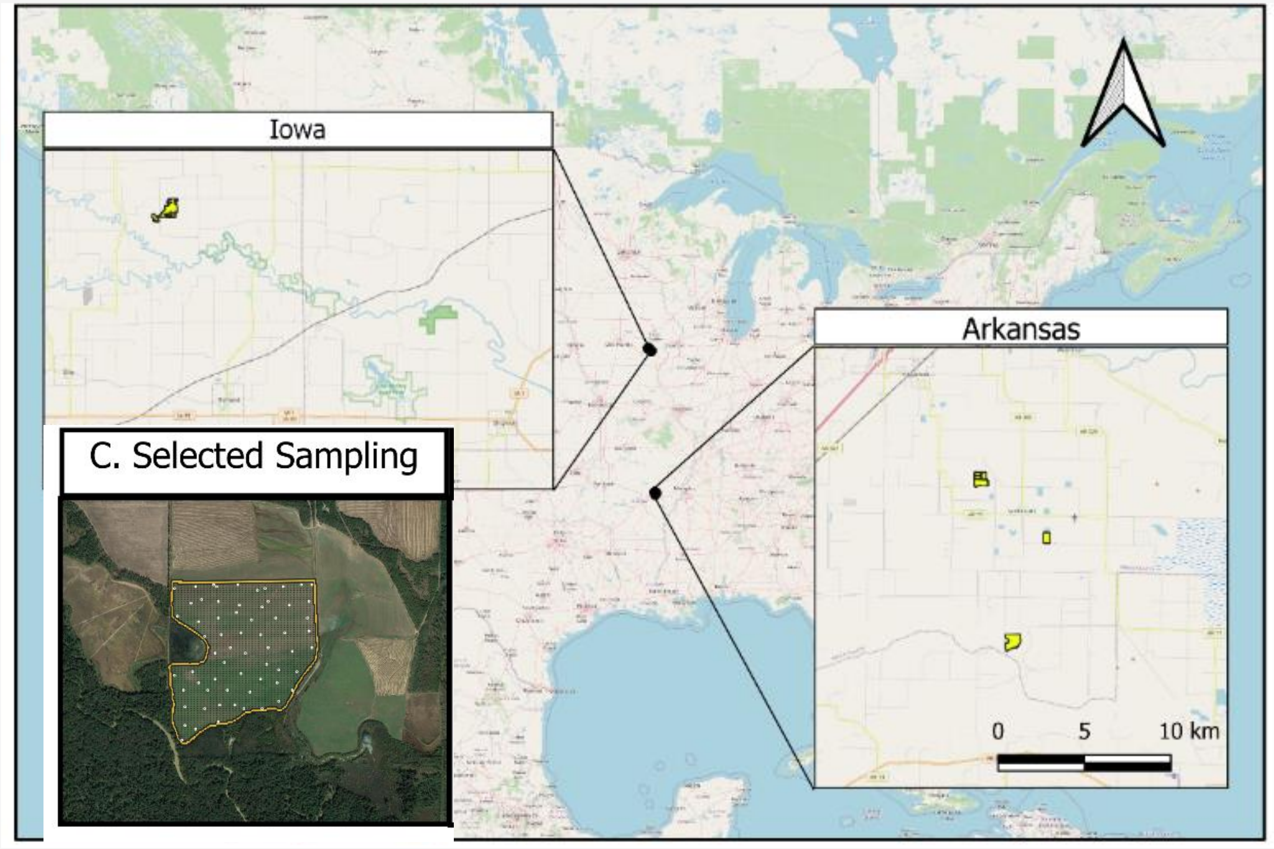
→ Robust data quality and collection aligned with carbon credit protocols

Soil Carbon STock pRotocol – The SoilCASTOR



Van der Voort, Verweij et al, submitted

The case study: USA Iowa and Arkansas Steps 1&2



1. Collect all (satellite) data available for regions
2. Run sampling algorithm (cLHS)
   - Sampling captures maximum variability
   - Efficient sampling design

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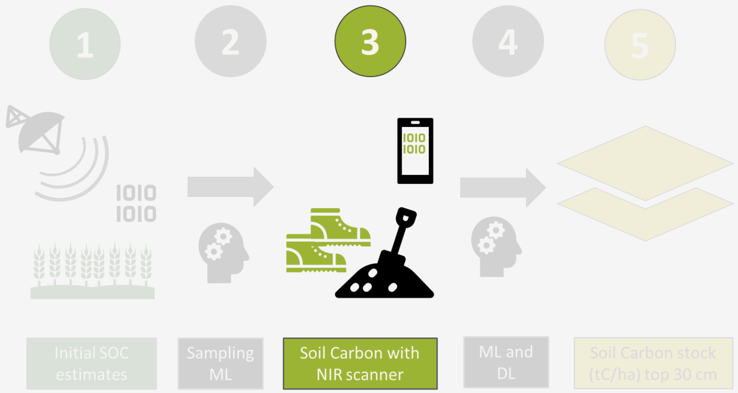
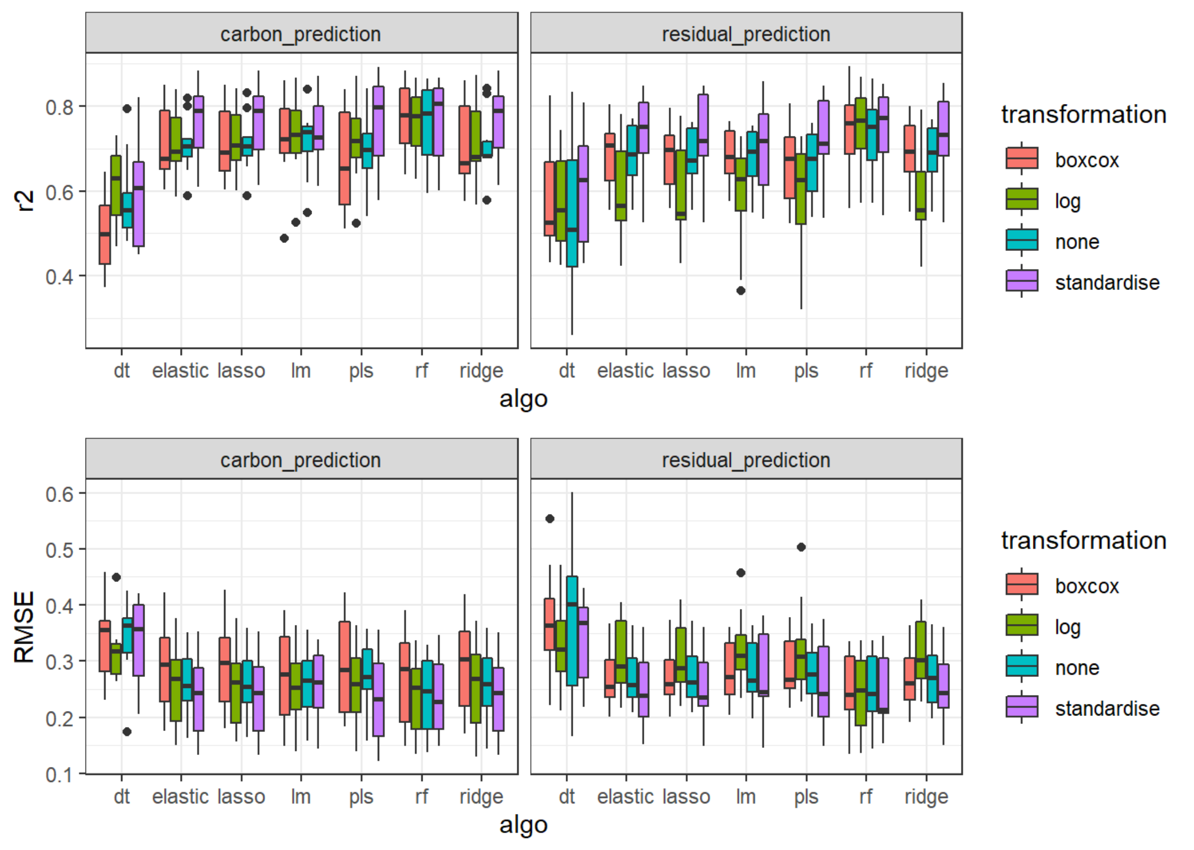
The case study: USA Iowa and Arkansas Step 3



Soil auger top 30 cm

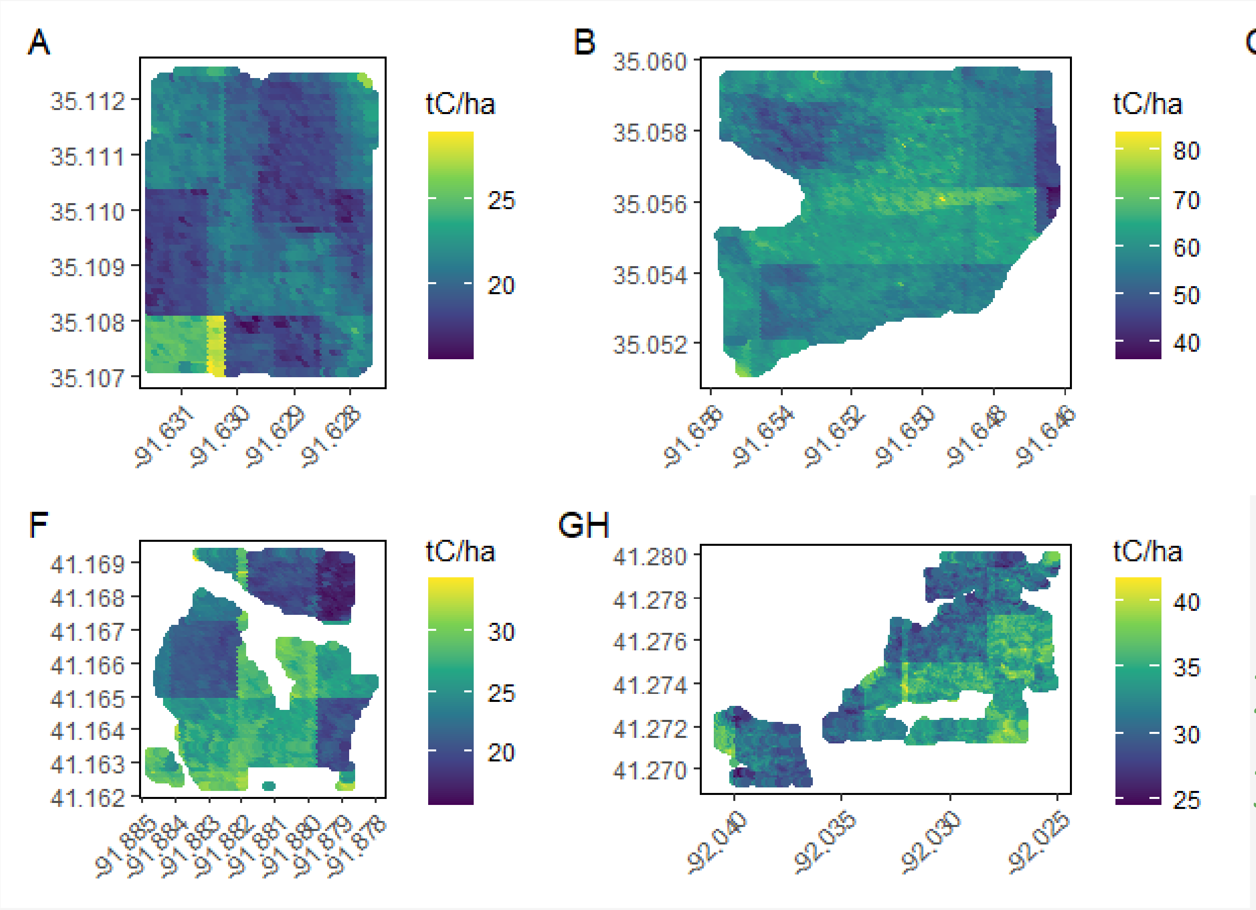
NIR Scanner to measure soil organic carbon in-situ

The case study: USA Iowa and Arkansas



1. Ensemble Machine Learning Model
2. Select optimal model and target variable based on r2 and RSME
3. Attain optimal results

The case study: USA Iowa and Arkansas part 3



1. Bulk density from pedotransfer function
2. Carbon stock 10*10 meter resolution
3. In range expected

Outlook

Basis to support carbon farming

Pilots in Kenya, US and EU

Soils with enhanced or restored carbon stocks

Questions?

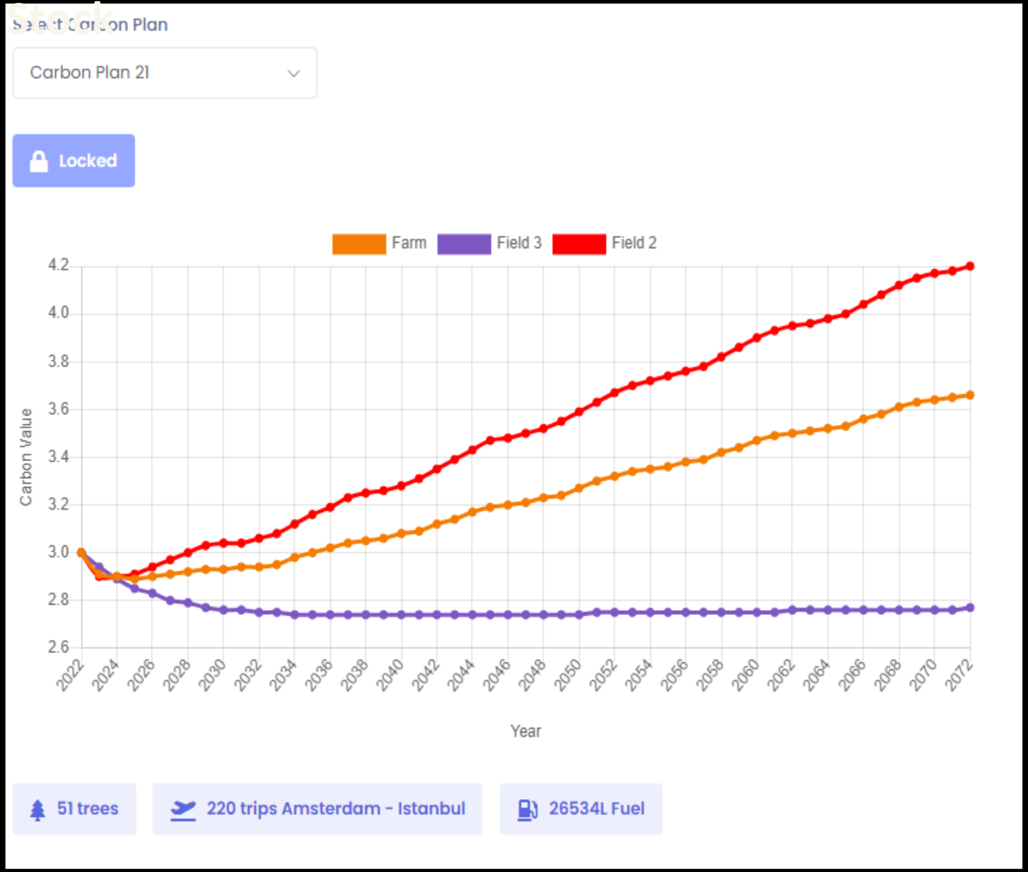
Additional Slides

Alignment with Carbon Credits

(1) Aligns with requirements Carbon Credits (e.g. VCS Verra)

(1) Piloting a Decision Support Tool (DST) (global) to enable famers to take action to increase stocks (additionality)

Pilot Decision Support to augment Soil carbon



Bulk Density options

(1) **Pedotransfer functions:** Based on clay content and SOC (%) from the global soil model SoilGrids.

(2) **NIR Scanner Clay content with Machine learning:** Clay content estimates from the NIR scanner

Other options:

(3) **Lab- based measurement** (highly labour intensive)

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