Counting Carbon:
Measurement Reporting Verification

Stuart Green

ABSA

MRV

- Measurement: the size of the impact
- Reporting: identifying the source of the impact
- Verification: evidence so that the impact will be trusted

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Assessing Carbon Storage *change* on Farms:

RESULTS BASED

Site Specific

Establish a baseline and repeat measurement after 5, 10 or 15 years.

Typical of some carbon credits- voluntary market approach.

ACTION BASED

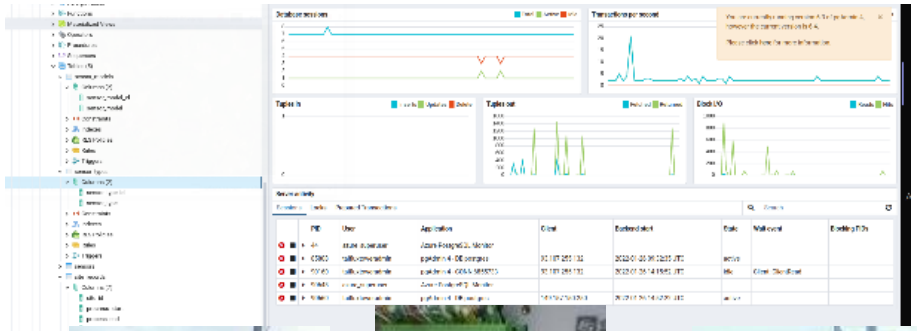
Identify actions that will increase carbon storage (e.g. winter cover)

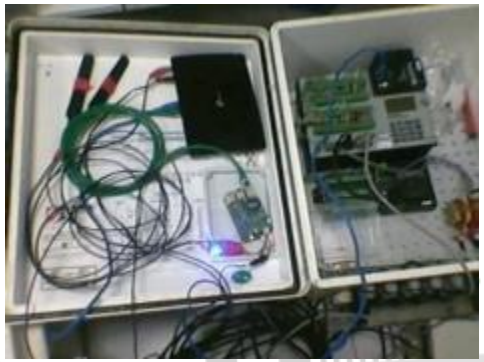
Use MRV Technologies to demonstrate action is being undertaken

Approach likely for Policy Lead Carbon Farming

Sensor Hub IoT

MEASURING





Terrain-AI

T-AI IoT Server

Storage

Sensor Database

Discovery

Sensor Data Catalogue

Ingestion/Indexing

Sensor MetaData & Data Ingestion

RasPi Sensor Hub

3G/4G

Airband

SigFox

Other

- Raspberry Pi
- Robust/IP44/IP66
- Power Mgt
- Remote Control
- Remote Login
- Configurable/Adaptable/Scalable

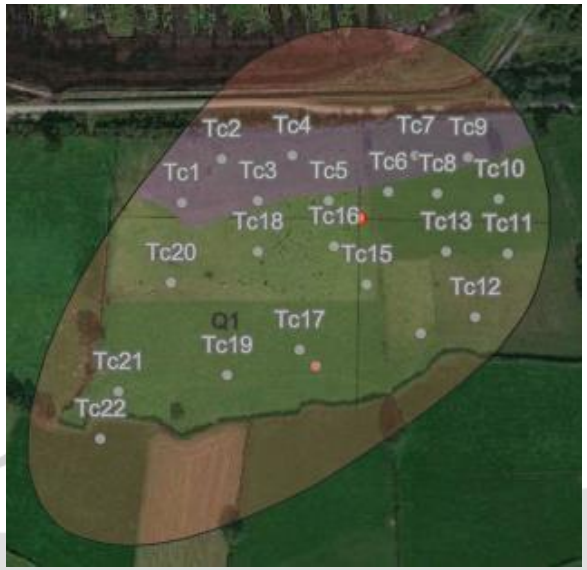
Data Logging Manager

- Campbell/LICOR
- Parsing
- Remove Redundancy
- Prioritisation

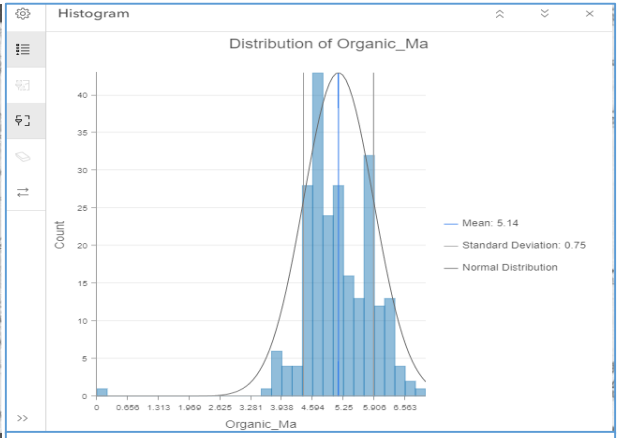
USB | RS-232 | Ethernet | WiFi | Bluetooth | Other

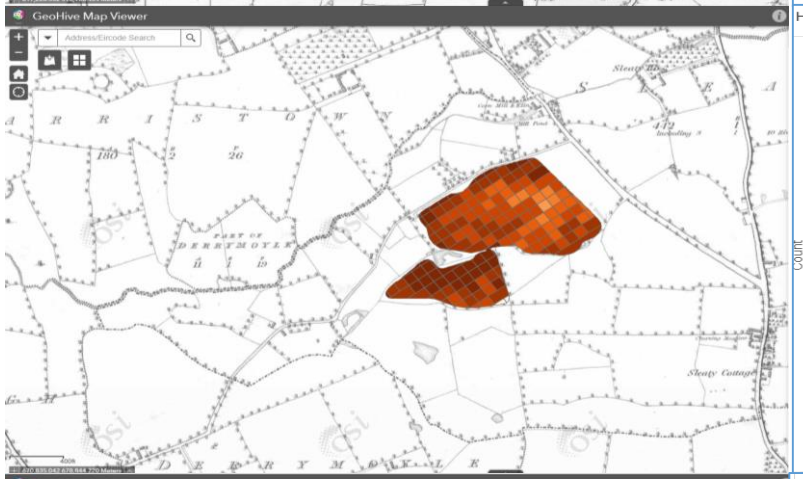
T-AI Field Sensors

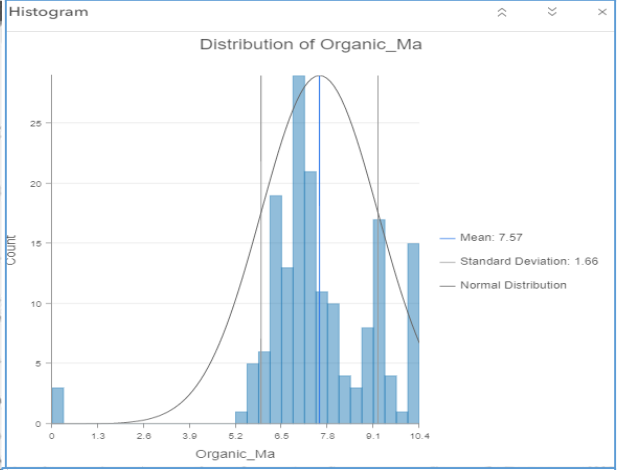
MEASURING

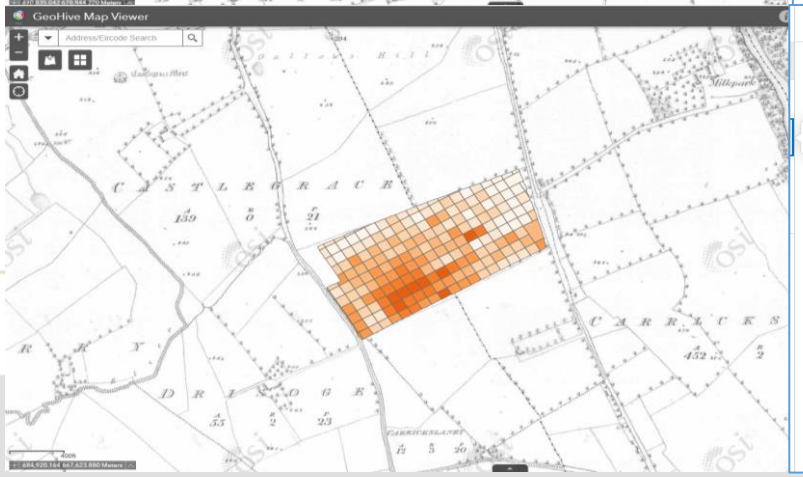

Tc2
Tc4
Tc7
Tc9
Tc1
Tc3
Tc5
Tc6
Tc8
Tc10
Tc18
Tc16
Tc13
Tc11
Tc20
Tc15
Tc12
Q1
Tc17
Tc19
Tc21
Tc22

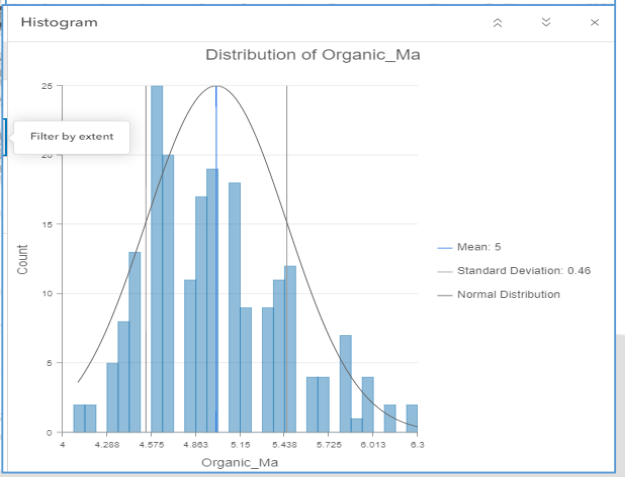

GeoHive Map Viewer
Address/Eircode Search


Histogram
Distribution of Organic_Ma
Count
Organic_Ma
Mean: 5.14
Standard Deviation: 0.75
Normal Distribution

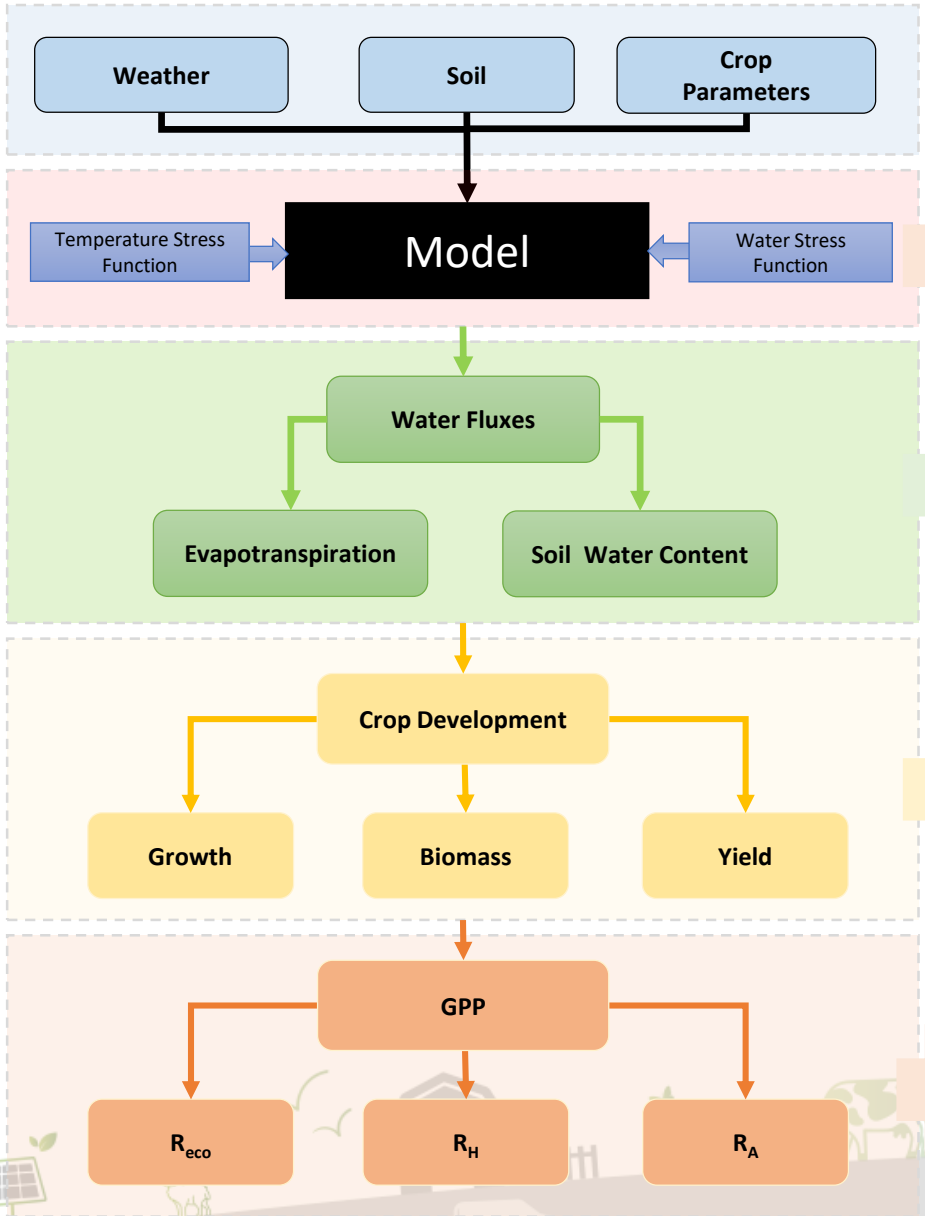

GeoHive Map Viewer
Address/Eircode Search

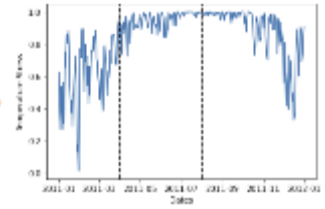

Histogram
Distribution of Organic_Ma
Count
Organic_Ma
Mean: 7.57
Standard Deviation: 1.66
Normal Distribution

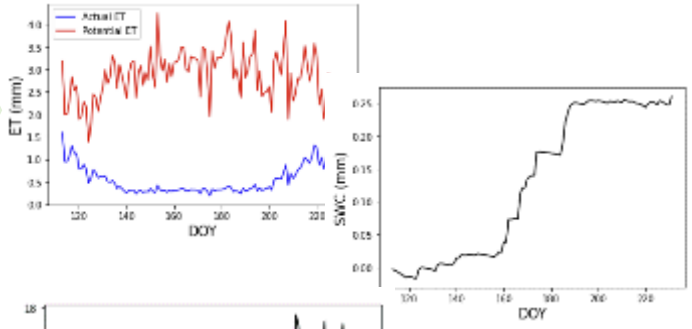

GeoHive Map Viewer
Address/Eircode Search

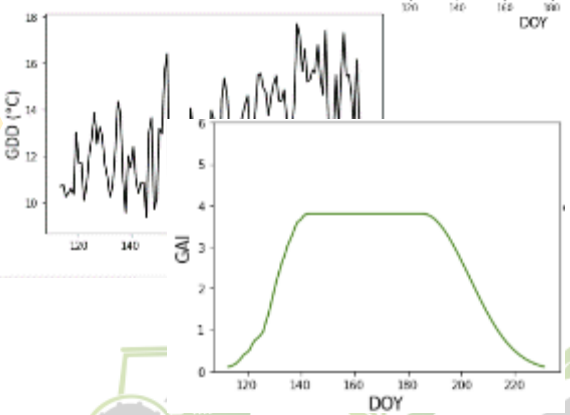

Histogram
Distribution of Organic_Ma
Filter by extent
Count
Organic_Ma
Mean: 5
Standard Deviation: 0.46
Normal Distribution

MEASURING/MODELS









Aerial & Drone Survey

MEASURING

Aerial Survey data

Drone

Terrain-AI

Emission & Air Quality : CO_2, CH_4
& PM 1, 2.5, 4 & 10 DR2000 Gas Sniffer

100MHz, 150MHz & 500MHz GPR

Sample Drone Multispectral NDVI captured over Castledockrell Farm

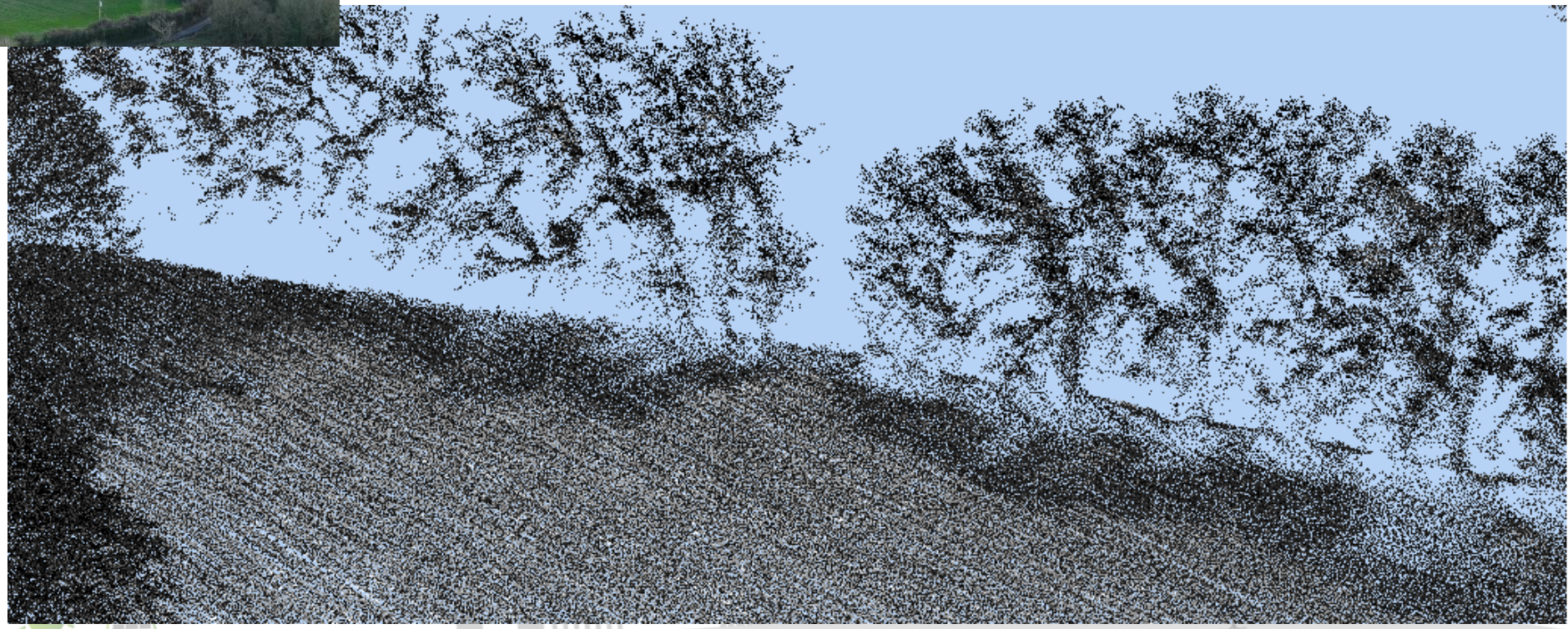
4th Aug 2021

13th Aug 2021

18th Aug 2021

MEASURING

LIDAR



SIGNPOST
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MEASURING

MEASURING

FARM CARBON

- **Mean above ground carbon stock 58 tC.ha-1**
- **Mean below ground carbon 10 tC.ha-1**

Irregular less intensively managed hedgerows contained significantly higher amounts of aboveground biomass compared to intensively managed hedgerows.

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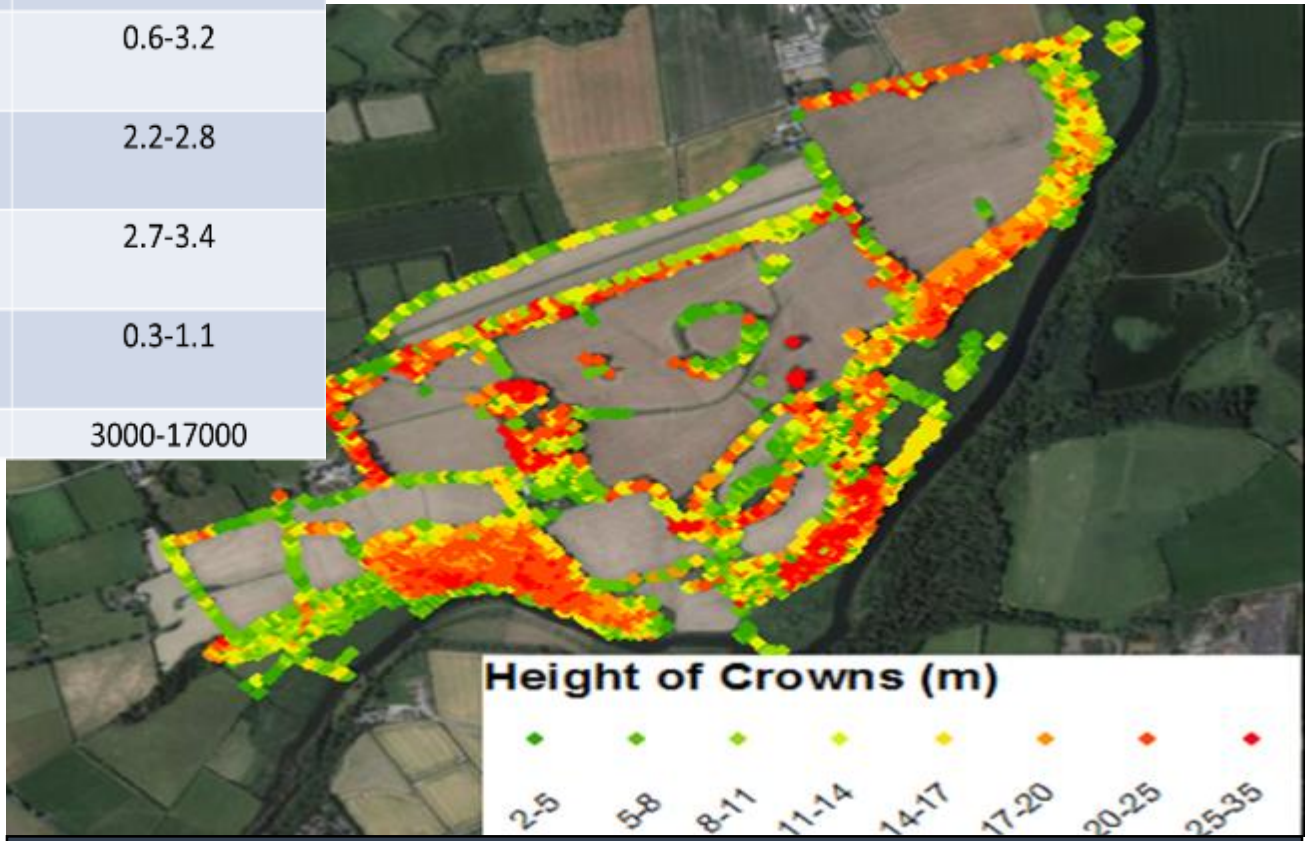
Reporting

	Estimate	Lower/Upper limit to estimate
Above Ground Hedgerow Sequestration Rate (tCO^2/ha/yr)	1.6	0.5-2.7
Total Hedgerow Sequestration Rate (tCO^2/ha/yr)	1.9	0.6-3.2
Above Ground Scrub Sequestration Rate (tCO^2/ha/yr)	2.6	2.2-2.8
Total Scrub Sequestration Rate (tCO^2/ha/yr)	3.1	2.7-3.4
National Hedge & Scrub Annual Sequestration (t CO^2)	0.7 Million	0.3-1.1
Annual net-net removal (t CO^2)	9200	3000-17000

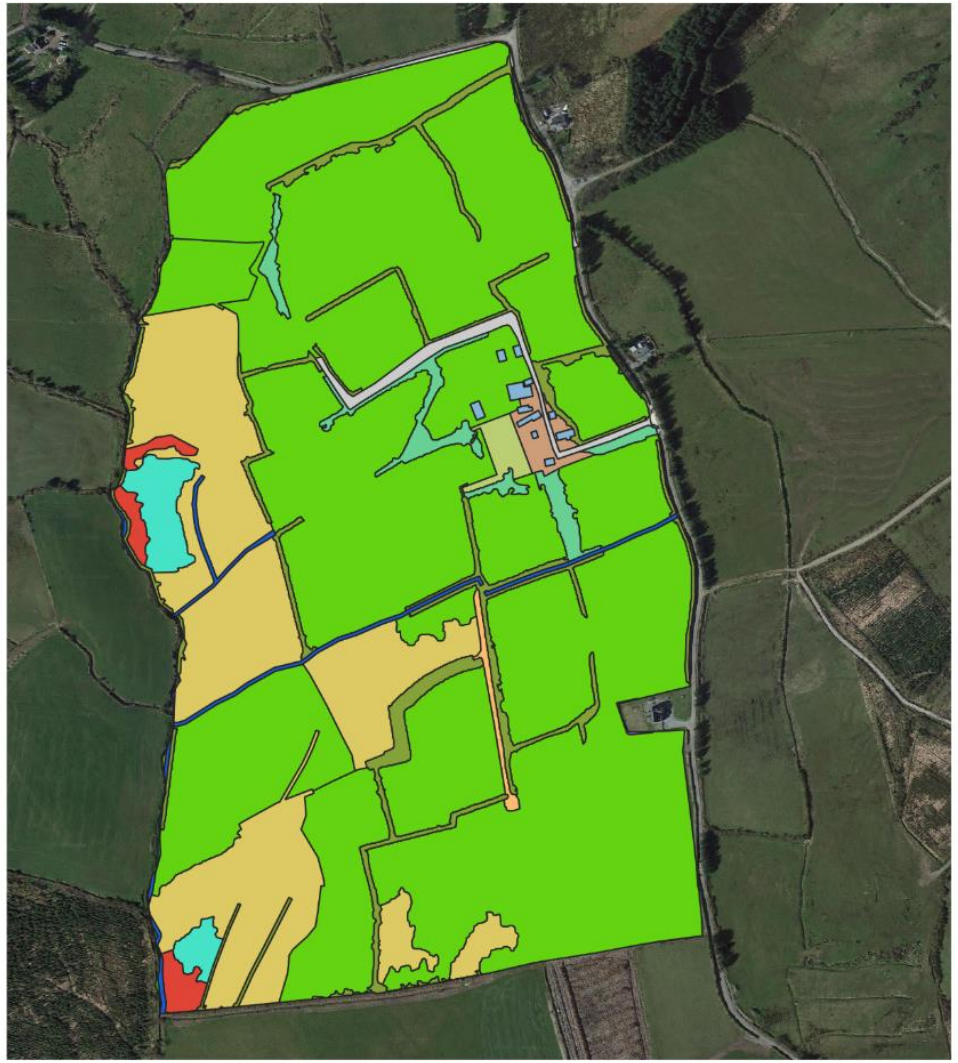


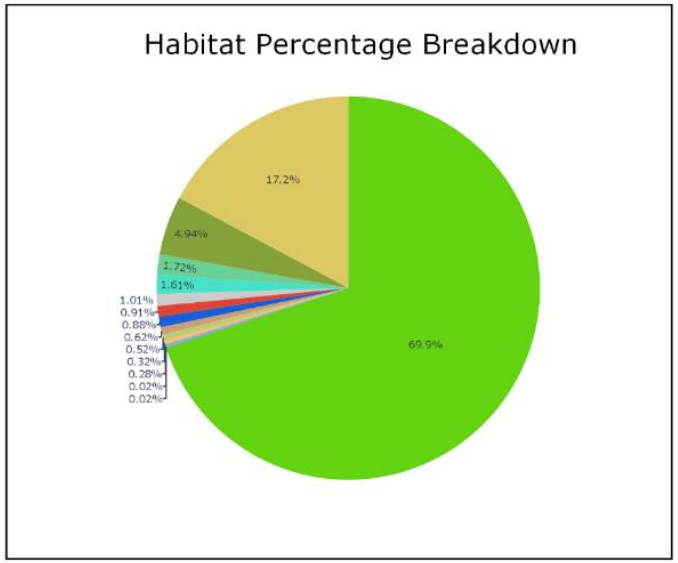
I applied the methodology on the Devenish owned Dowth Estate- estimating carbon holdings.

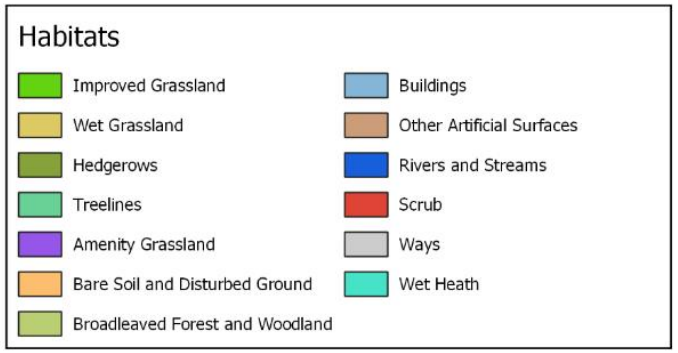
Reporting

Suckler Beef Habitat Map

THE SIGNPOST PROGRAMME







0 75 150 m

Hedgerow Carbon Stock = 143tC

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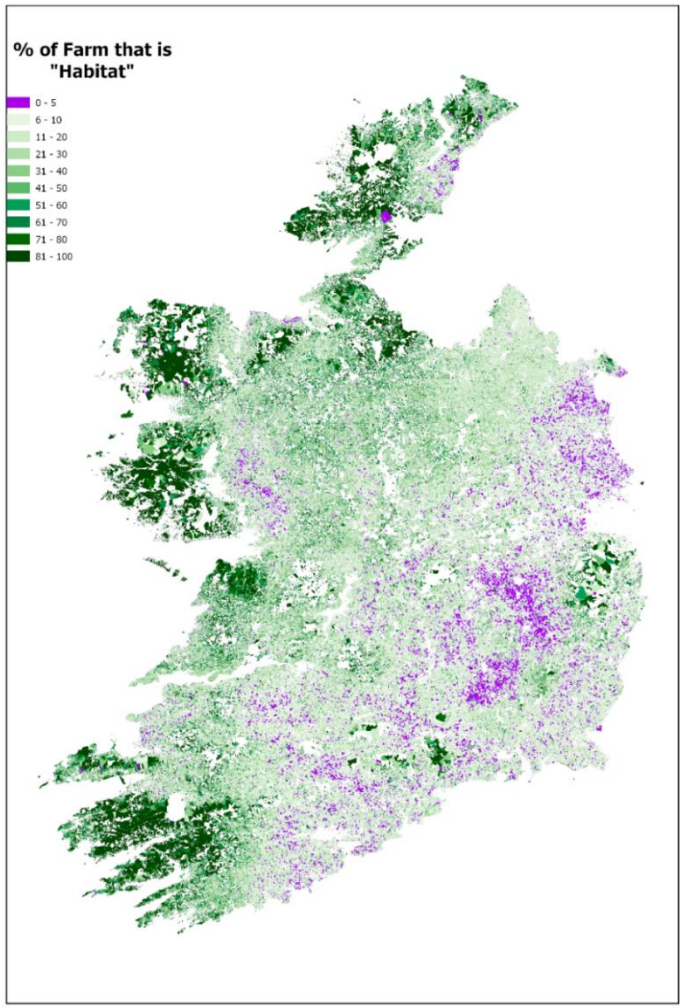
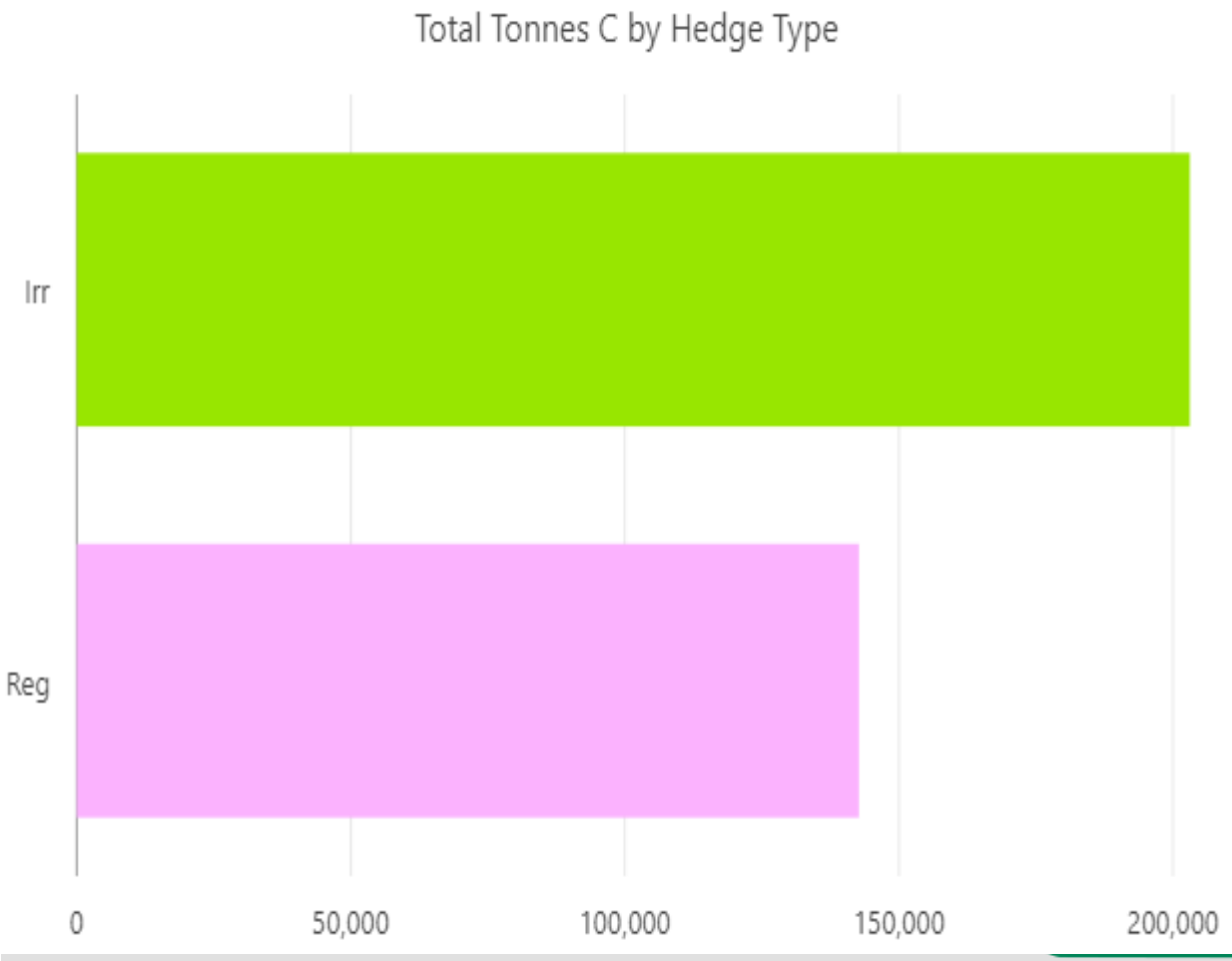
Habitat and Hedgerows

Approximately a net removal of hedgerows between 1995 and 2015 of between 0.16-0.3% pa



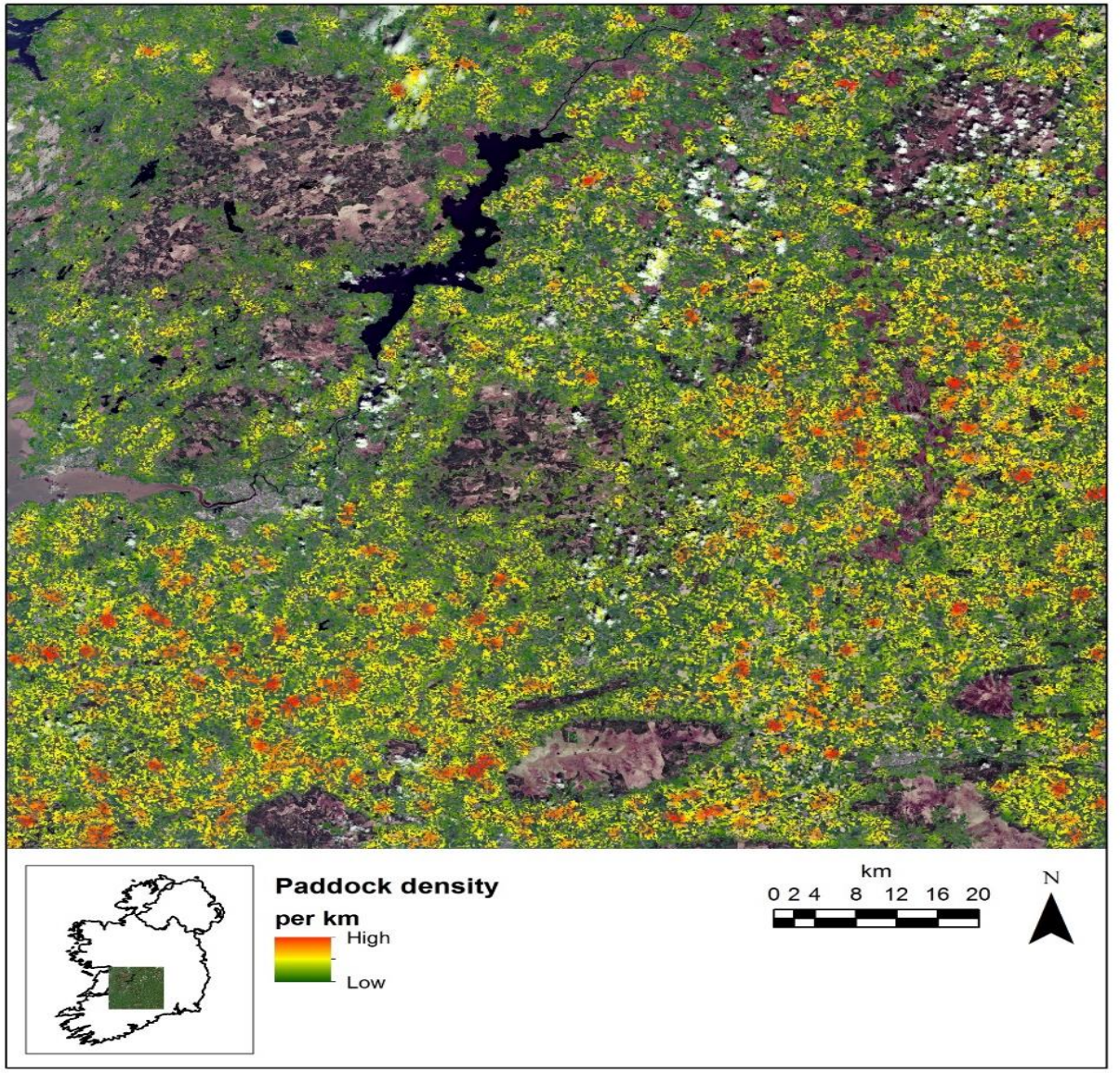
Hedgerow Carbon of County Kildare



Reporting

Verification

How do we prove MACC actions are adopted ?
Grassland Management



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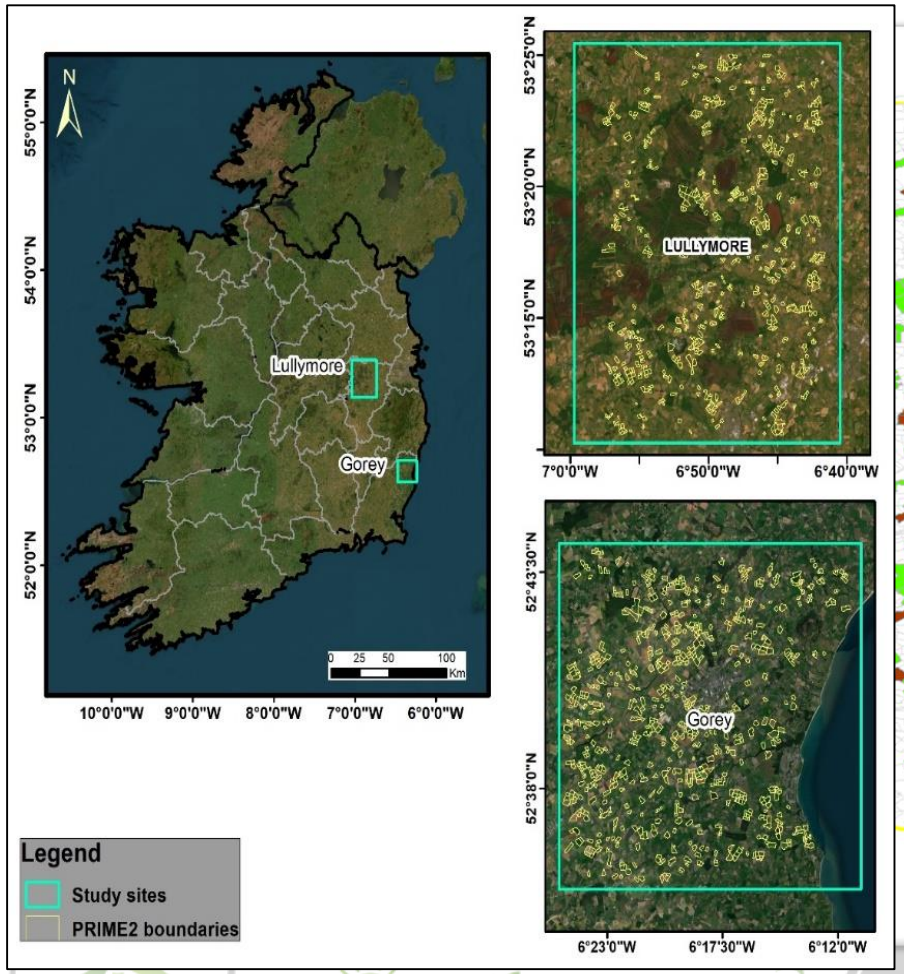
Verification

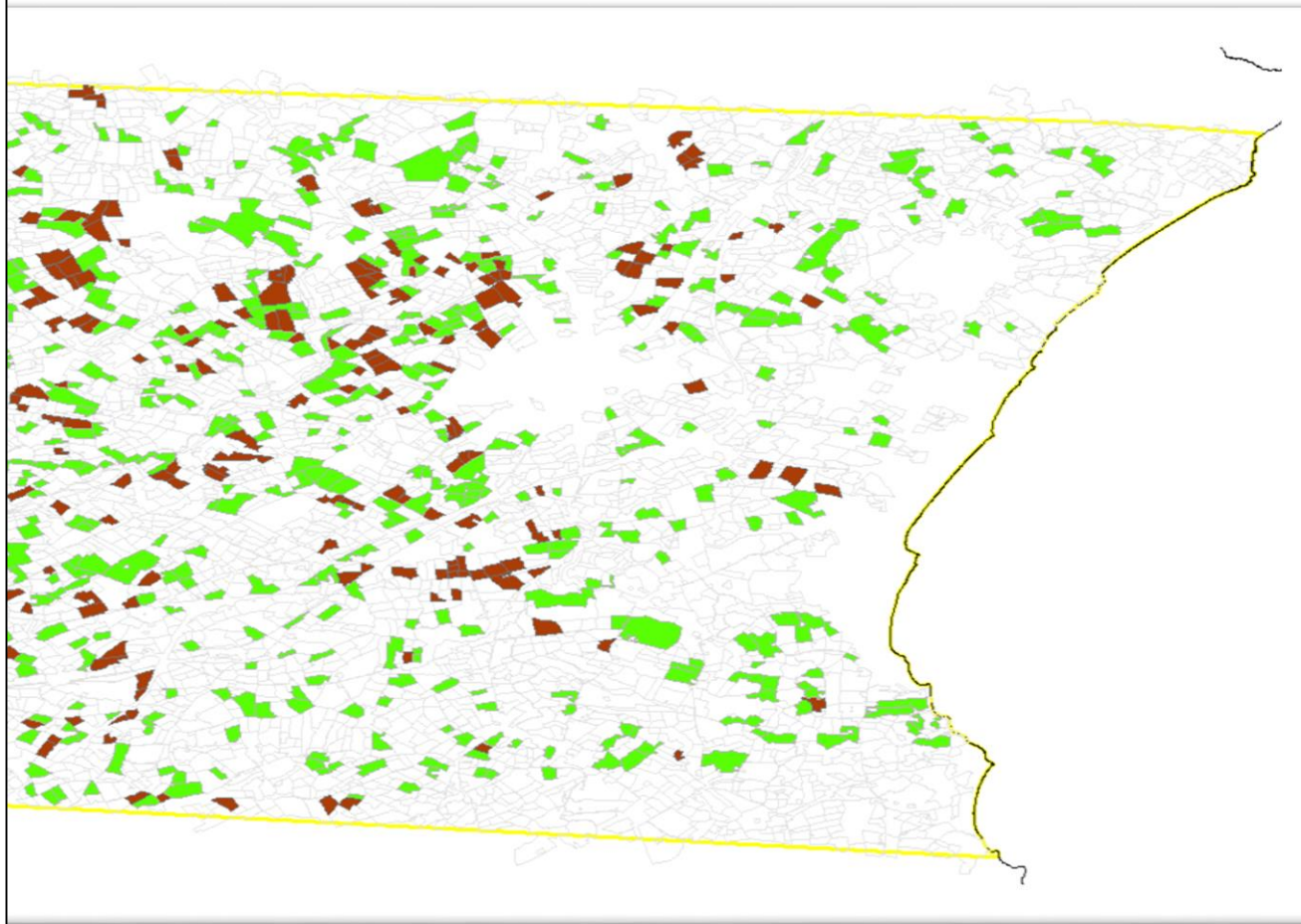
NATIONAL: Permanent Grassland Map

- **Land Use time-series data (Landsat)**
  - Identify ancient permanent grasslands (fields never reseeded)

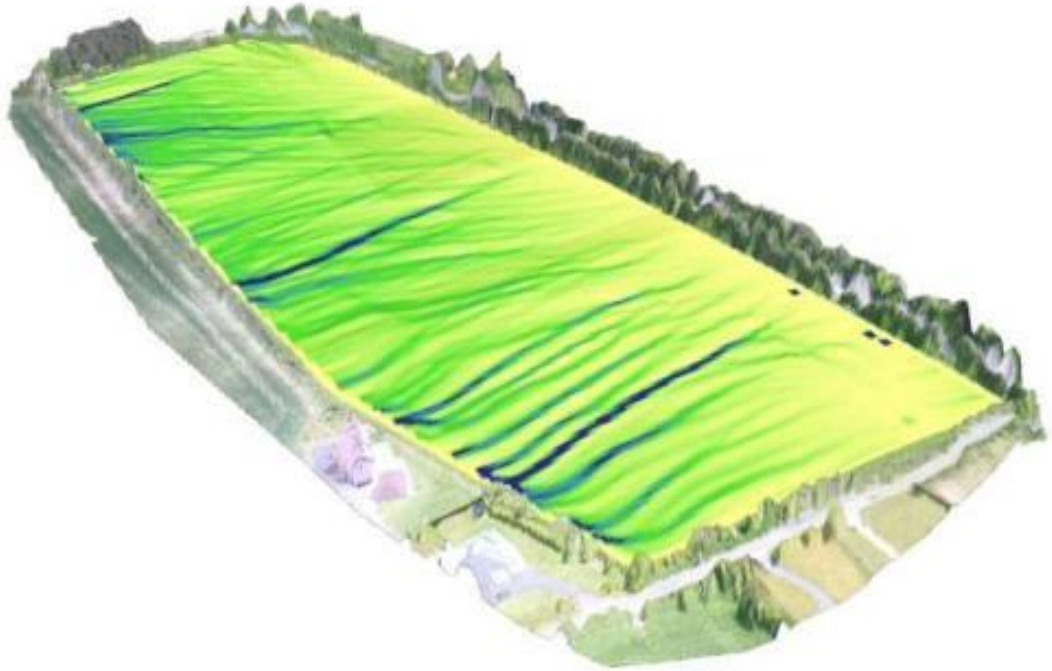
Verification

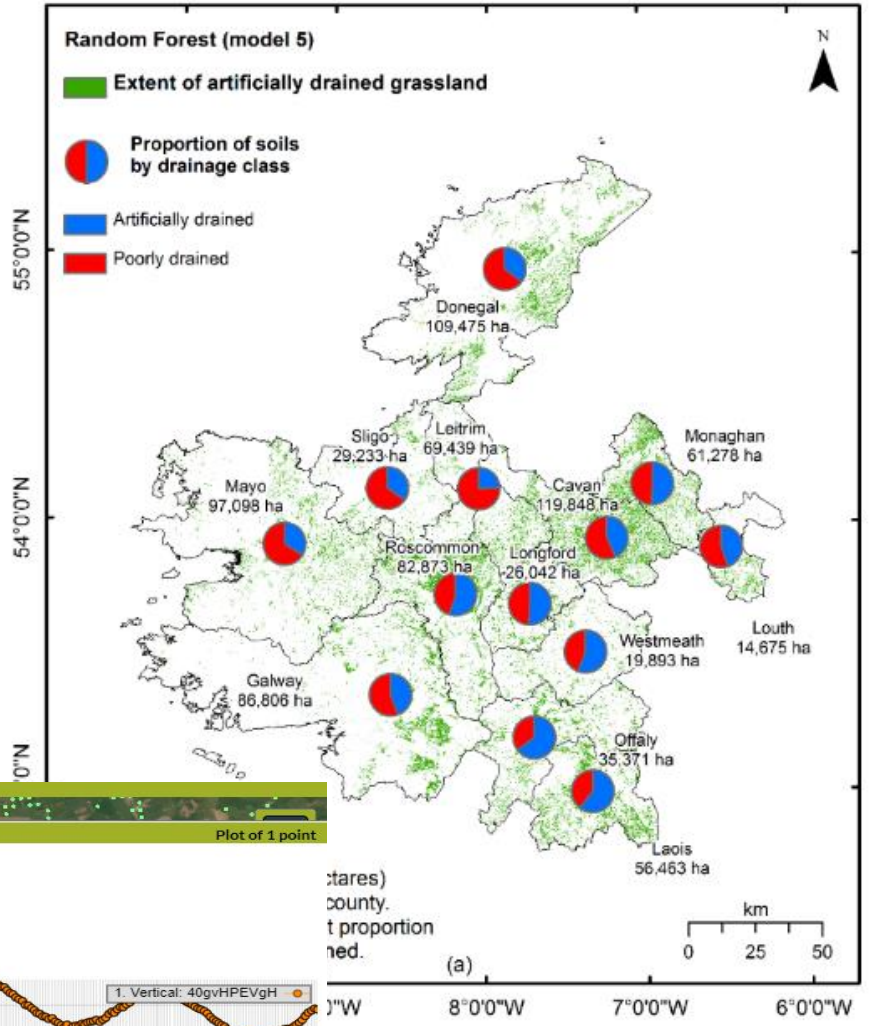
Winter Green Cover – Cover Crops Monitored using SAR- A MACC Option

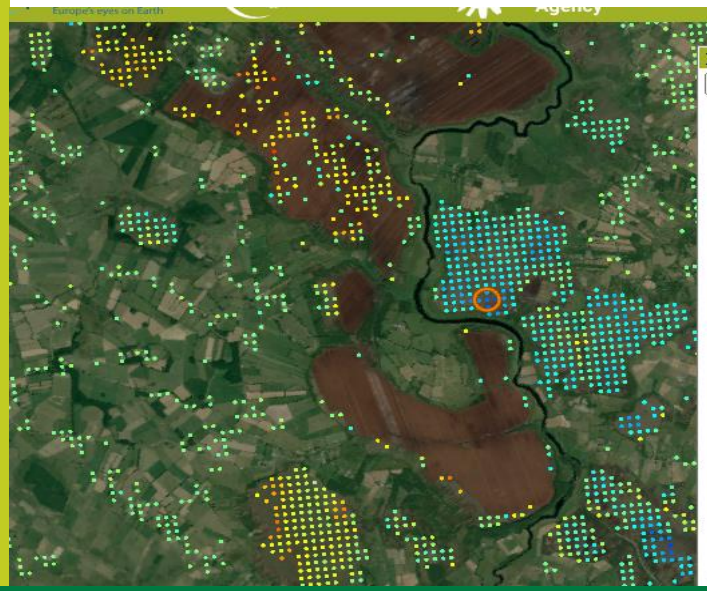




Verification







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Conclusion

- MRV is the key to all forms of carbon farming assessment
- Teagasc is development of these tools to support carbon farming policy
- MRV technology around hedgerows and some land management are ready to be deployed.
- Soil carbon will rely on intensive before and after sampling and improved soil/land use modelling as we saw in the earlier presentations