TEAGASC RESEARCH INSIGHTS
LEADING RESEARCH FOR TOMORROW'S AGRI-FOOD SYSTEMS

Management-scale mapping

Rob O'Hara, VistaMilk

VistaMilk

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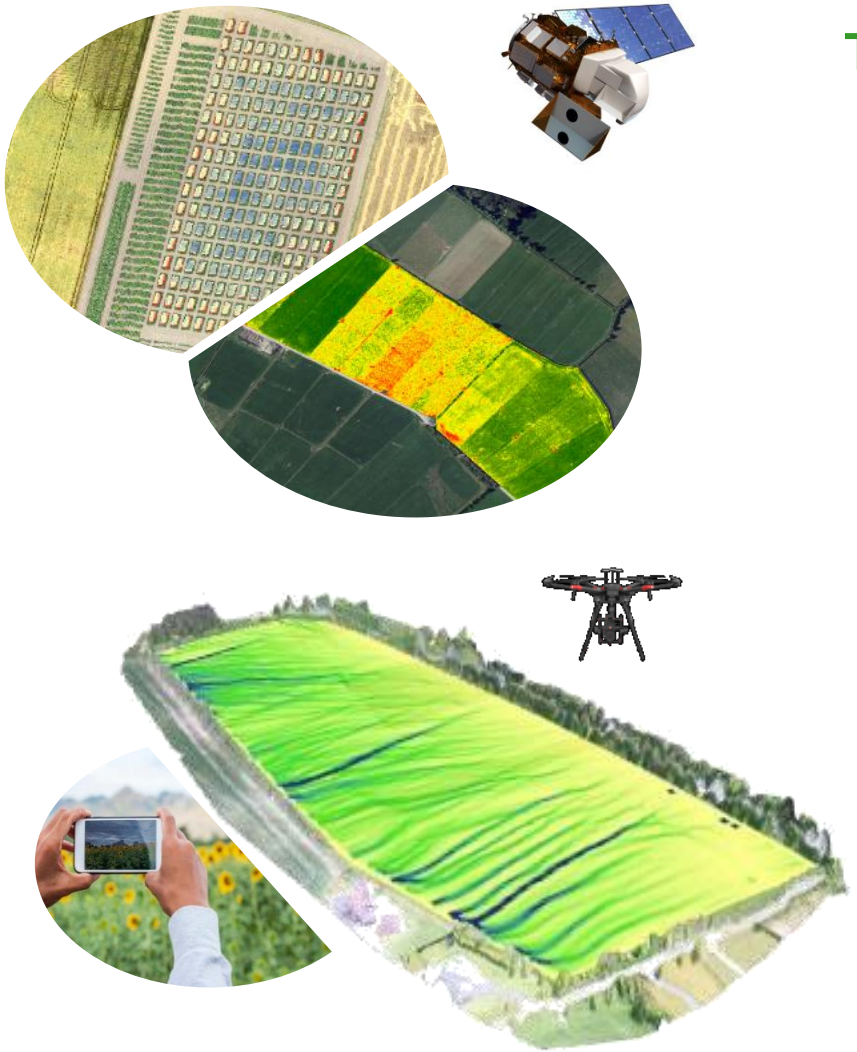

Targeted, on-demand data

Greater availability of high quality EO data from a variety of sources.

New opportunities to deliver actionable data to farmers.

Teagasc at the forefront of precision mapping using novel mapping methods

- Biomass estimation
- Pests/ disease mapping
- Nutrient management
- 3-D modelling
- Habitat mapping
- GHG estimation
- Forestry cover

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Precision mapping

Multi-sensor/ multi-scale mapping
Variety of platforms & payloads

- RGB/ Multispectral/ Hyperspectral
- Thermal
- LiDAR/ RADAR
- Geophysical/ specialist equipment

Faster processing/ visualisation/ delivery

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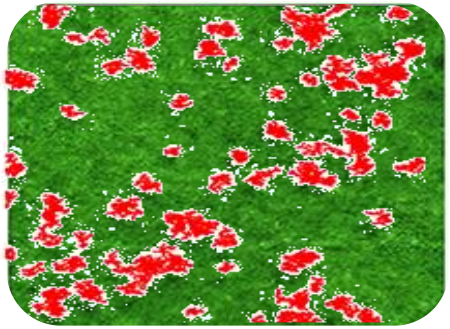
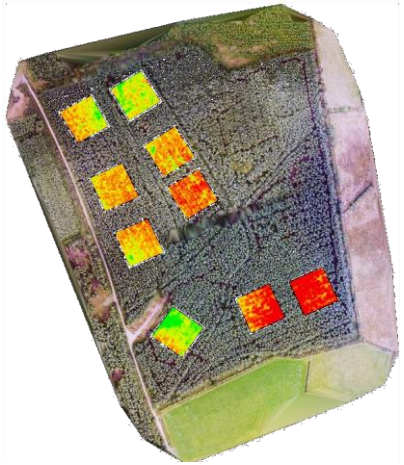
Teagasc precision mapping

DrainMap



Juliette Maire used drones to improve GHG estimation on farms.



Ted Wilson uses drones to assess forest stands for continuous cover forestry.

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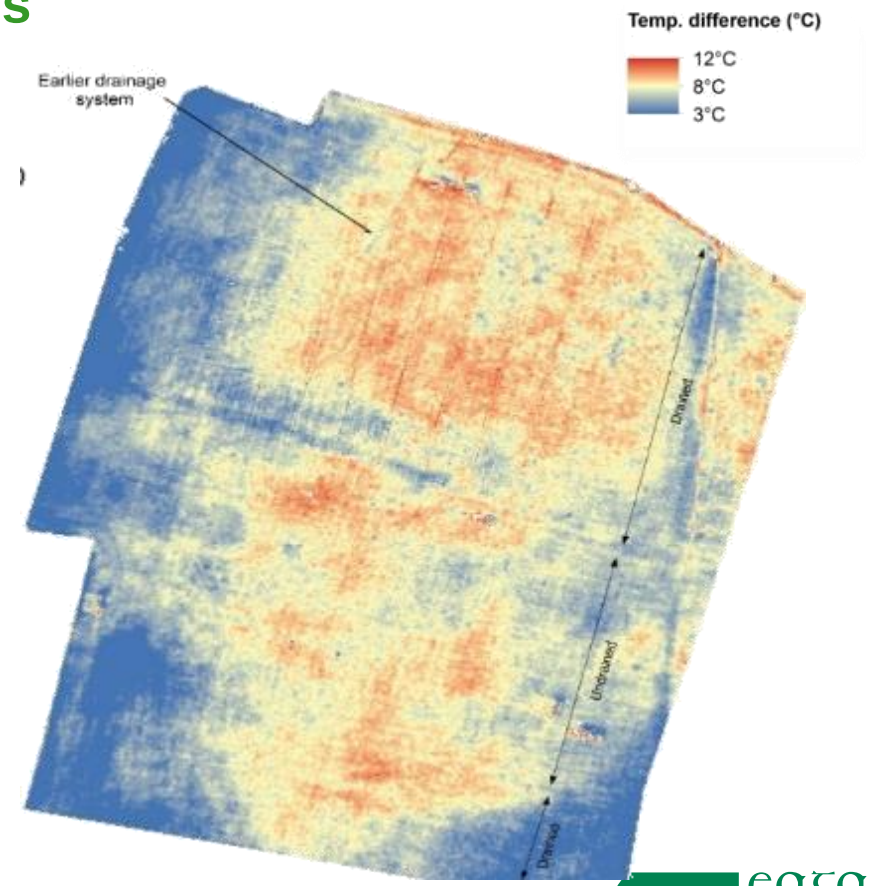
Applications: Finding buried drains

Typically poor information on drain location. Thermal cameras can locate buried drains by identifying spatial & temporal heat anomalies at surface. 64% of known drains identified during the study.

Allred et al. 2018
https://doi.org/10.3390/agriculture8110167



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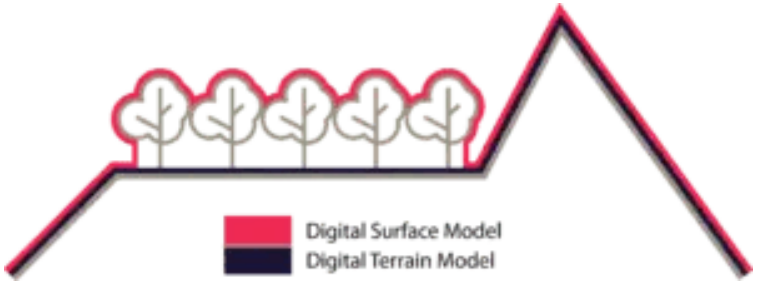
Applications: Estimating P loss

Agricultural Catchments Programme.
Ian Thomas *et al*. 2016.
doi.org/10.1016/j.scitotenv.2016.02.183

Runoff can be accurately modelled with high resolution (but expensive) LiDAR data.

Structure-from-Motion photogrammetry is a cheaper, less accurate method that can only measure the surface (canopy) height.

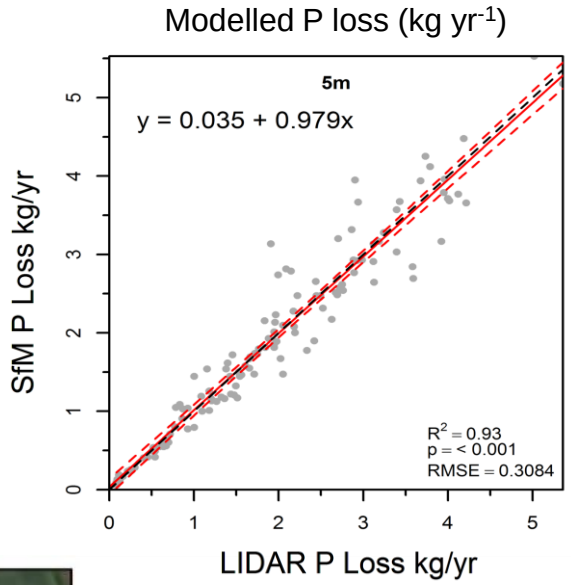


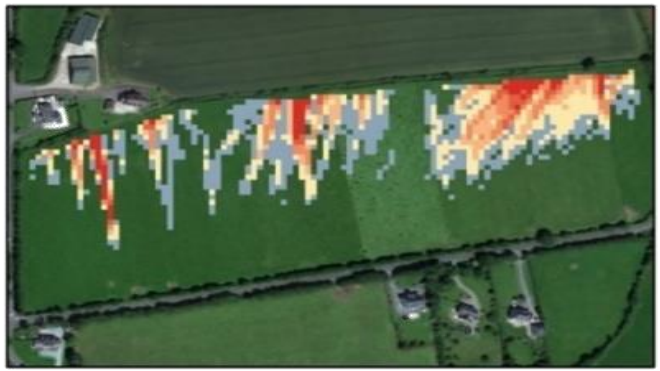
Applications: Estimating P loss

Consumer grade drones created accurate 3-D surface models of intensively managed grassland.

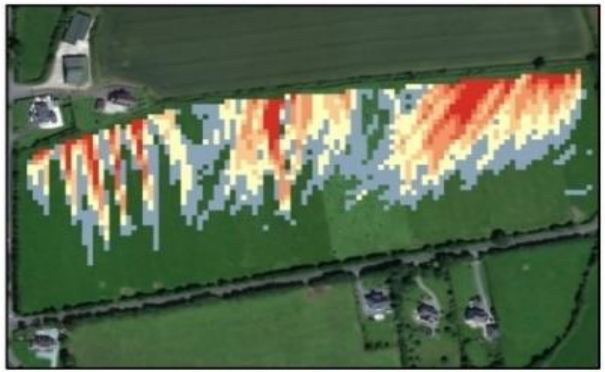
Could be used to target remedial measures that interrupt runoff/P loss within fields.

Closets correlation between LiDAR & photogrammetry was 5 m resolution. At higher resolution, sward height increased error.





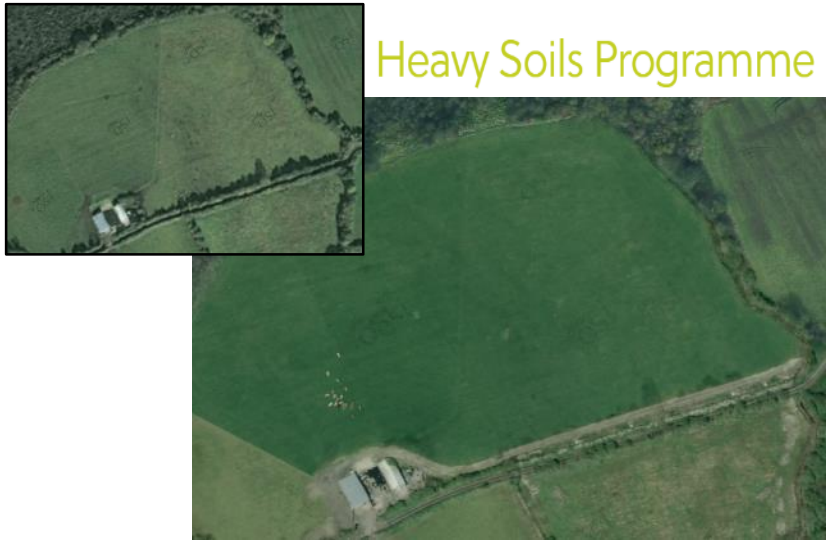
LIDAR

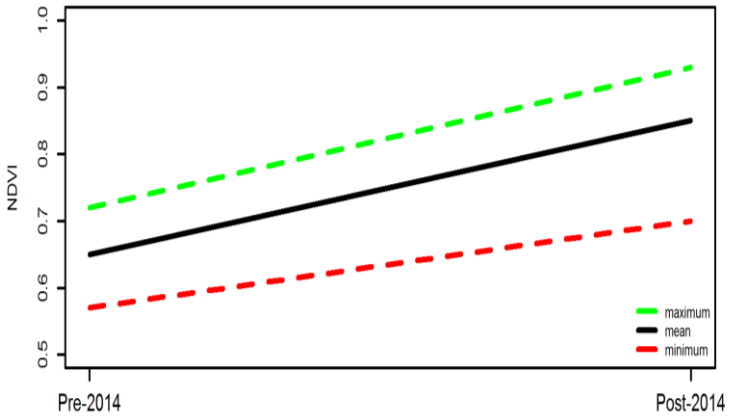


Photogrammetry

Applications: Monitoring growth

Multi-temporal analysis of satellite imagery showed higher NDVI values (proxy for biomass) following drainage. Random Forest classifications showed a year-on-year increase in drained area from 25% (2011) to 68% (2016). Efficient method to monitor drain function at field scale over time.

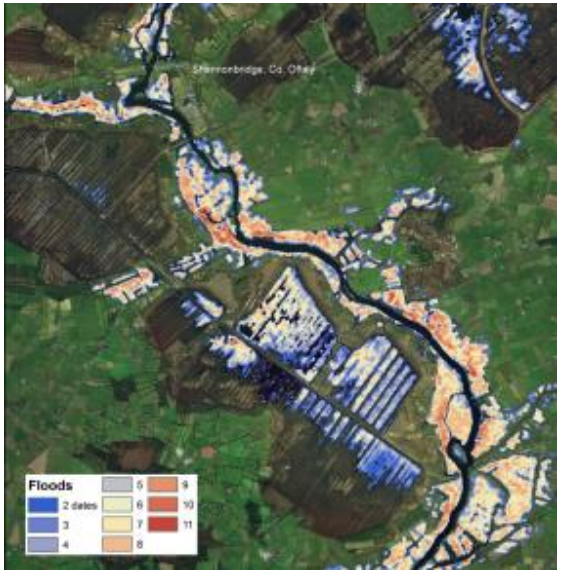




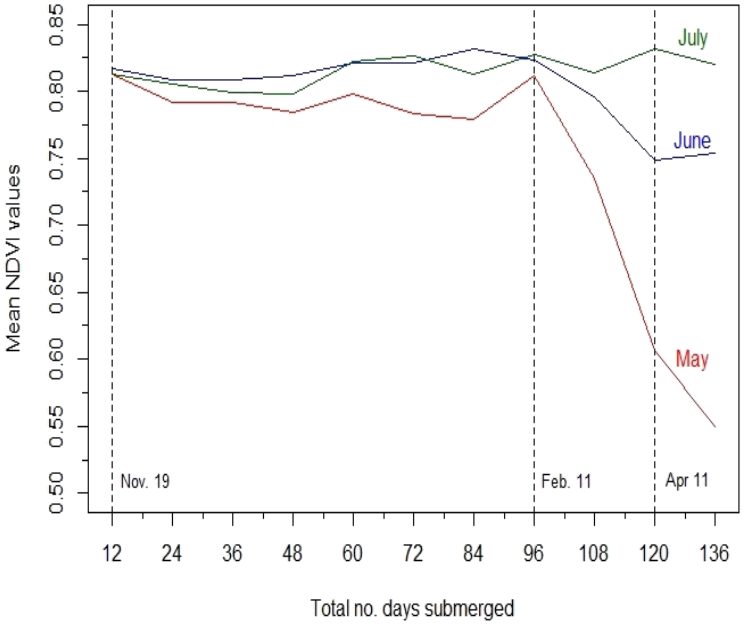
Journal of Applied Remote Sensing

Identifying artificially drained pasture soils using machine learning and Earth observation imagery

Applications: Identifying problems



NDVI vs. persistent saturation



Multi-temporal NDVI imagery combined with RADAR flood maps showed long-term effect of persistent saturation/ flooding on grass growth.

Irish Journal of Agricultural and Food Research

The agricultural impact of the 2015–2016 floods in Ireland as mapped through Sentinel 1 satellite imagery

Applications: land use mapping

Combines ground-level photography with optical & RADAR satellite imagery for improved land use & habitat mapping.

Land use & habitats are difficult to identify with certainty in satellite imagery so require timely, accurate ground truth data.

Eurostat
LUCAS survey 2018

Low input, extensive,
Species/ habitat rich

High input, intensive
Species/ habitat poor

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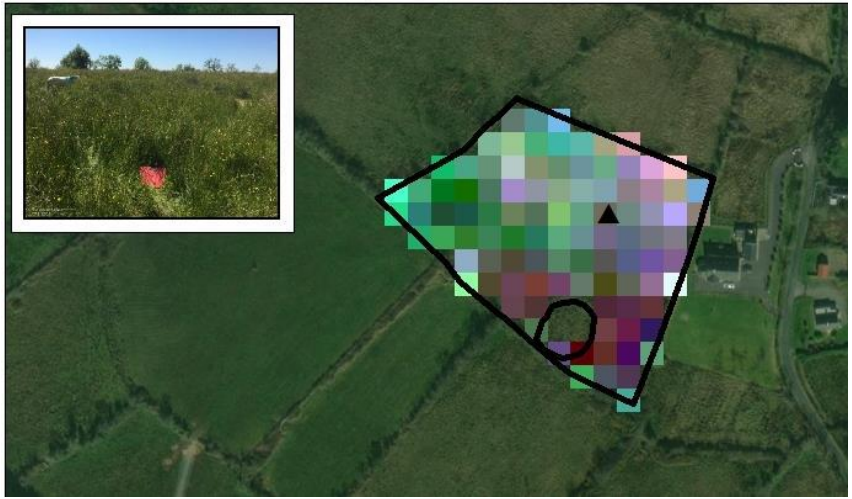
Applications: land use mapping

Smartphone photographs provide training/validation data for machine learning.

Management class: 90% accuracy
Paddock detection: 85% accuracy

Deep Learning to automate labelling of *in-situ* photography (Mohamed Saad, UCD). DL mimics how the human brain processes unlabelled data.



What a smartphone sees versus what the Sentinel 2 satellite sees. Management classes are spectrally similar in satellite images. The information in the photograph is essential to be able to properly train machine learning.

Summary

Barriers to precision mapping being removed.

Range of data now available for precision mapping.

Continued expansion as technology improves.

Commercial sector providing surveys, data & EO analytical services.

Greater role for precision mapping for CAP, environmental & sustainability reporting.

Thank You!