

Hyperspectral Imaging and Data Science

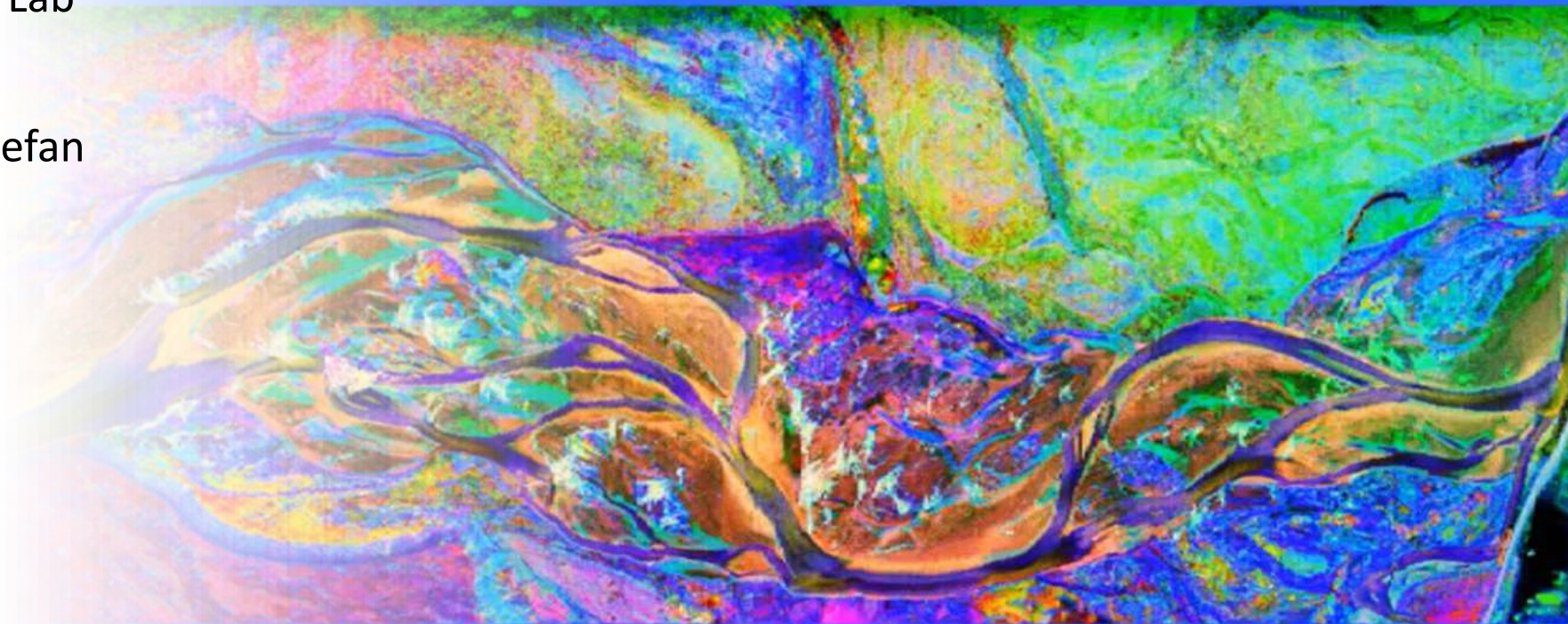
By

Nitin Bhatia

Massey AgriFood Digital Lab

With

Eduardo Sandoval and Stefan
Carter

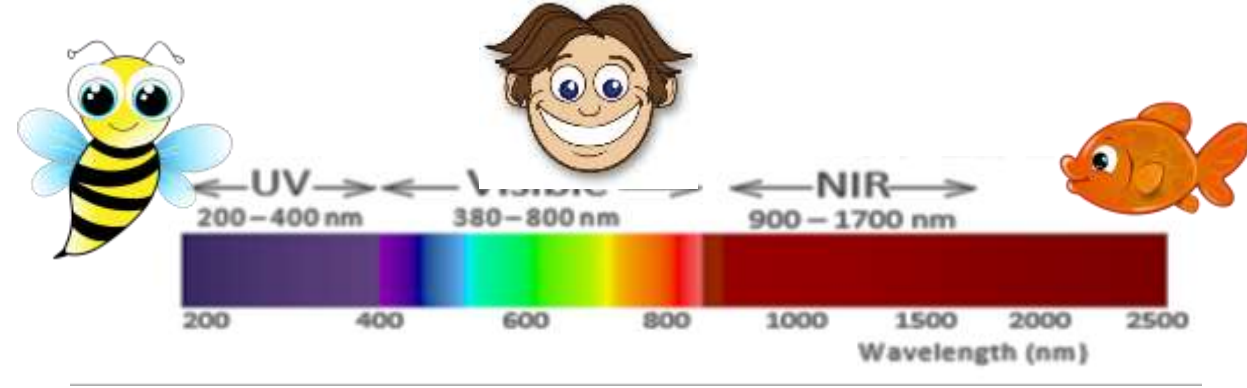


What is

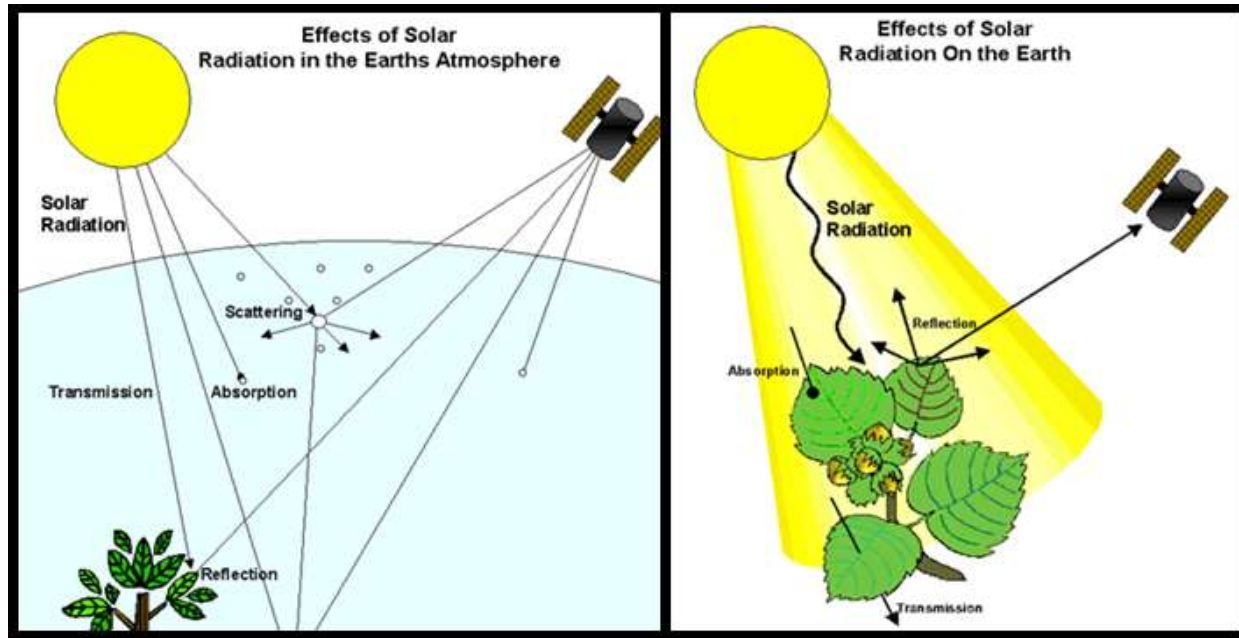
Hyperspectral Remote
sensing?

Hyperspectral Remote sensing

- Spectral data – reflected light
- Sensors beyond RGB spectrum
- Multi spectral sensors extended our capability of collecting information
- Imaging spectroscopy.



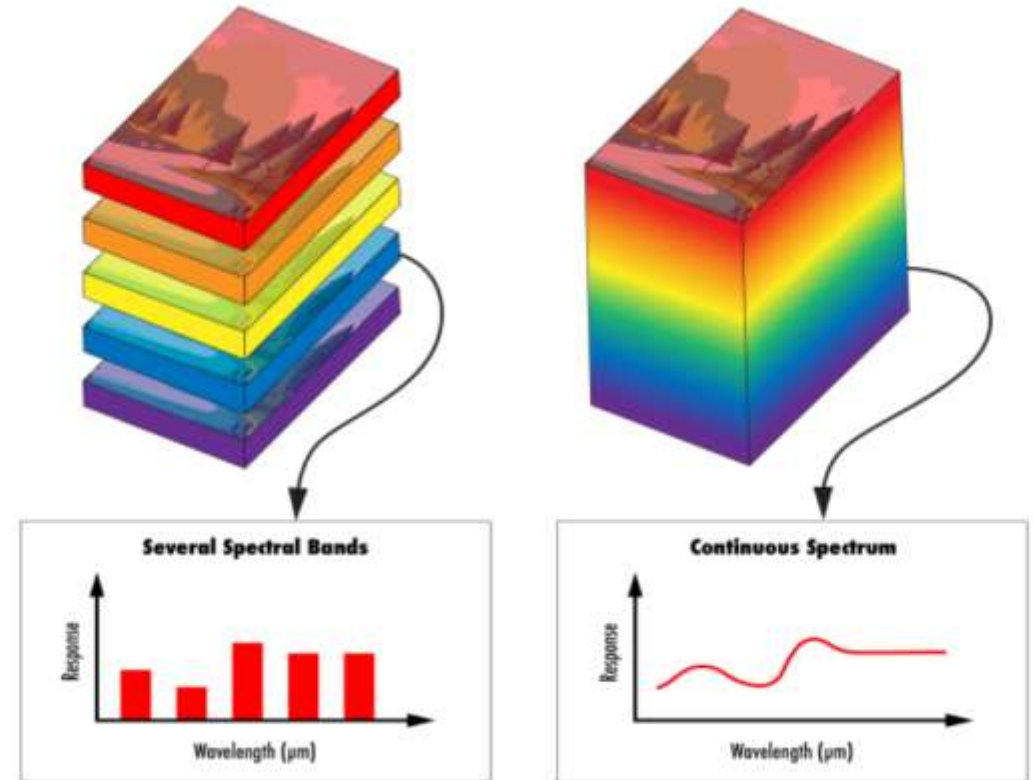
Hyperspectral Remote



Multispectral

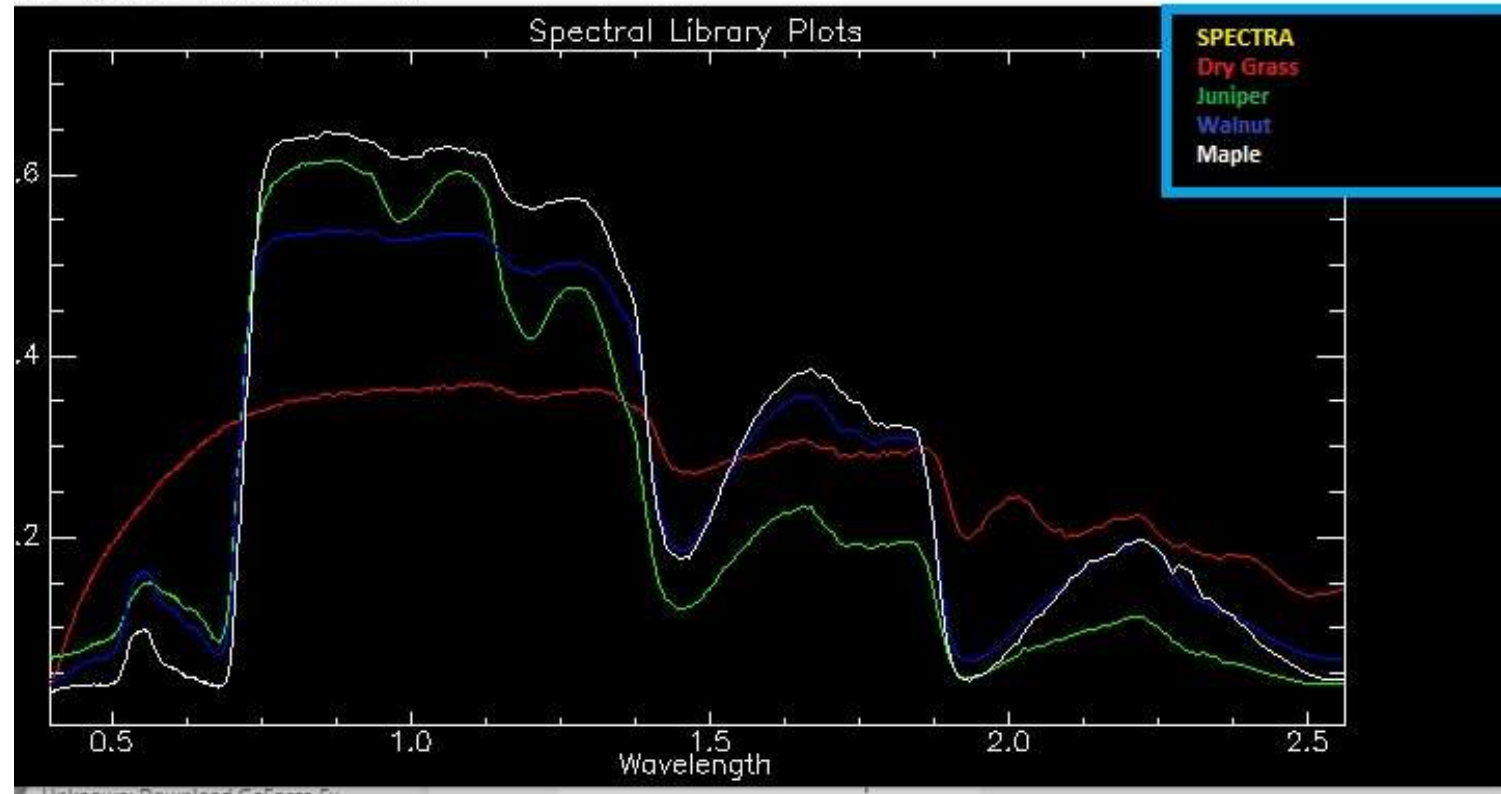
vs.

Hyperspectral



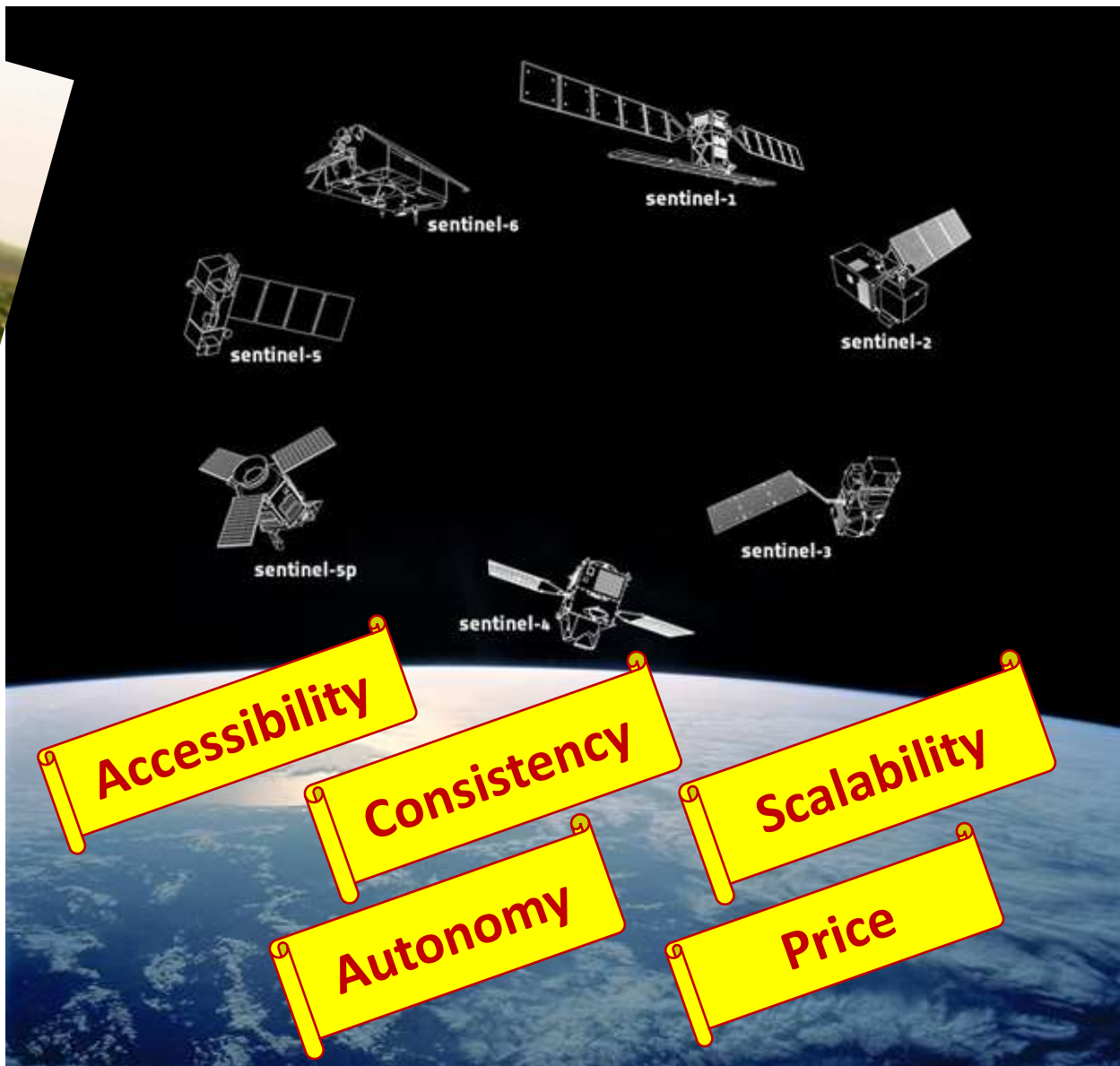


Edit Options Plot_Function Help



Spectra of dry grass, vegetation etc.

Drones VS Airborne Vs Satellite platforms



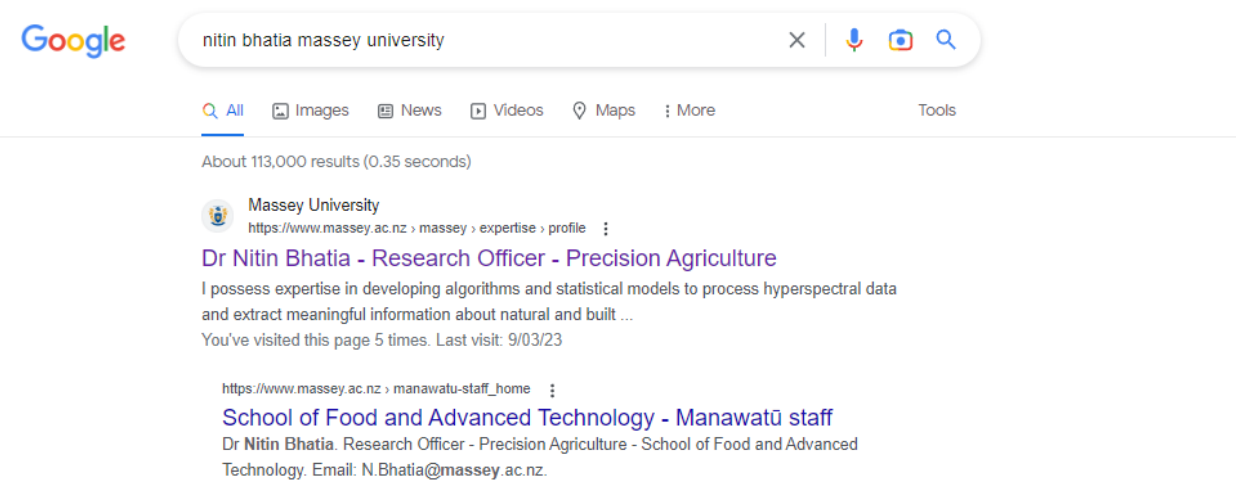
Precision

Quality Imaging

Atmospheric interference

But what you would Google and can not read in books is...

...about us



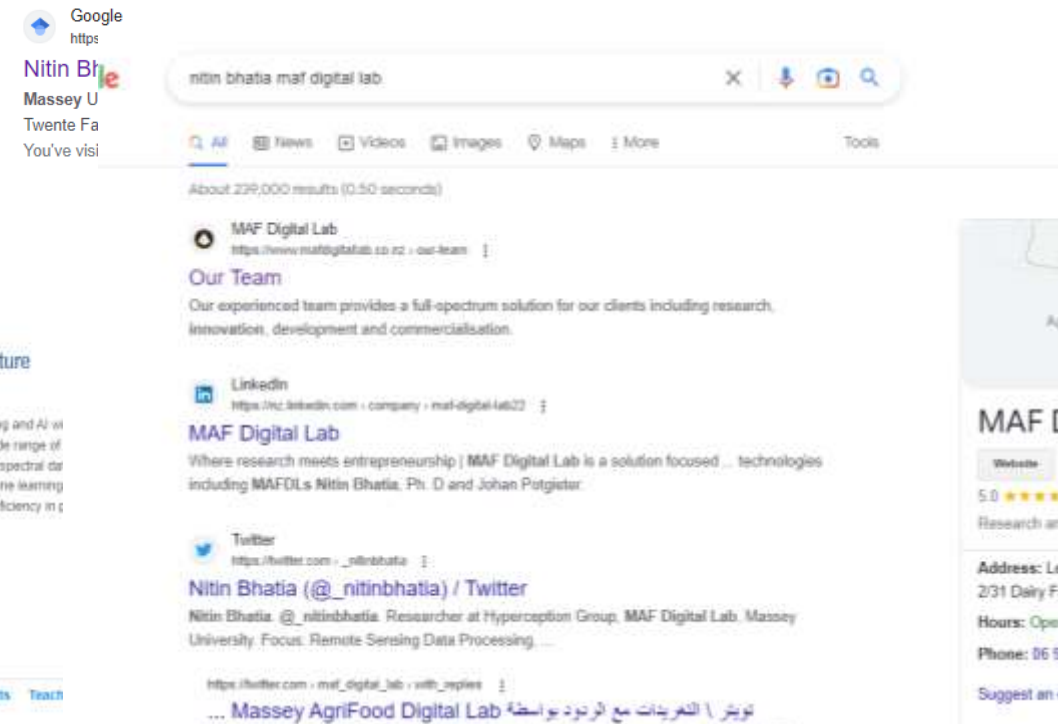
Dr Nitin Bhatia PhD
Research Officer - Precision Agriculture

School of Food and Advanced Technology

My research includes hyperspectral remote sensing and AI w/ ML from sensors that capture information across a wide range of algorithms and statistical models to process hyperspectral data environments. With extensive knowledge of machine learning complex data sets. Strong analytical skills and proficiency in Python. [More about me...](#)

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Palmerston North, Wanganui-Manawatu, New Zealand · Researcher · Massey University
Researcher, Massey Agritech Partnership Research Centre, School of Food and Advanced Technology, Massey University · Report · Report · Activity · Experience.



About us

The background of the slide features a photograph of three men standing on a paved path in a park-like setting during autumn. The trees have yellow and orange leaves, and the ground is covered with fallen leaves. The men are smiling and looking towards the camera. The man on the left is wearing glasses and a striped sweater. The man in the middle is wearing a plaid shirt. The man on the right is wearing a dark cap and a dark jacket.

Hyperspectral/multispectral remote sensing

- Airborne: challenges in hill country
- Lab sensor
- Drone sensors

Data science and computer vision

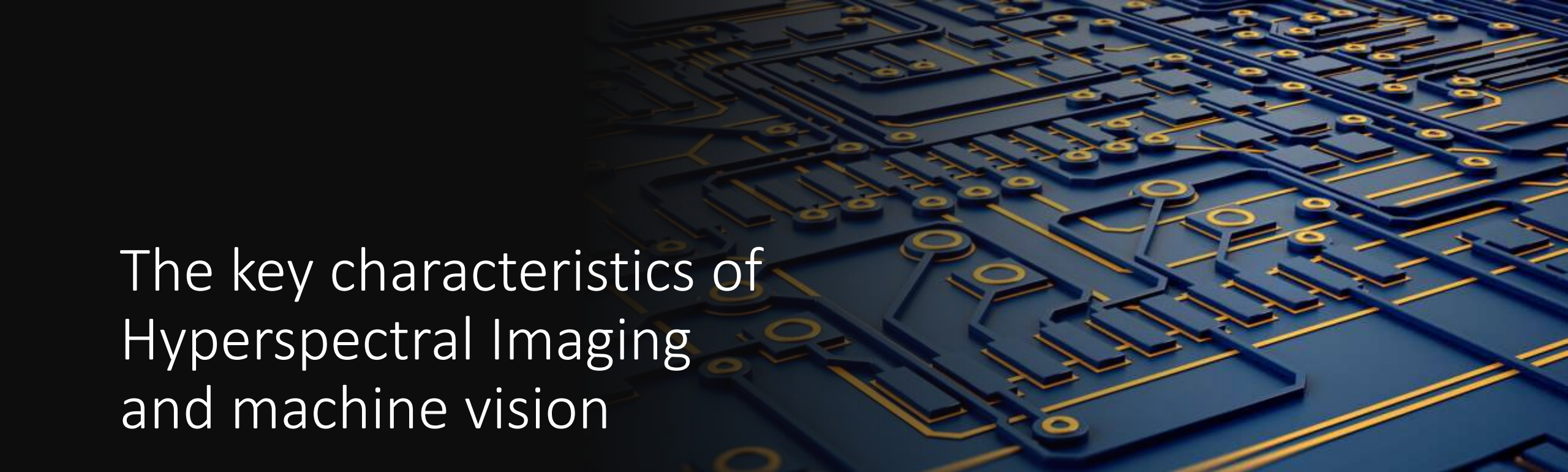
- Data mining and transforming data to information and knowledge

Applications

- Invasive species identification
- Vegetation mapping
- Soil nutrients
- Seed scanning
- GHG emission
- Post harvest fruits/vegetable scanning

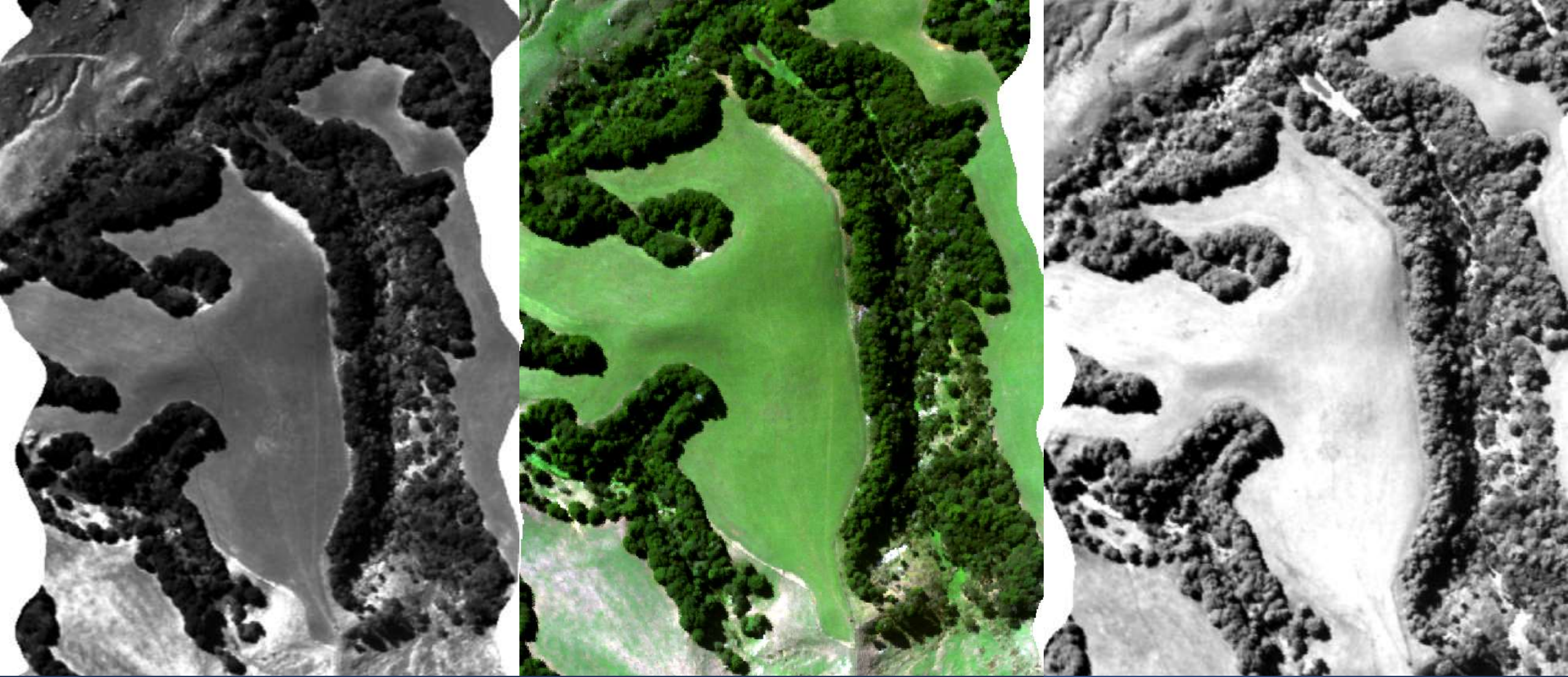
Future projects

- GHG emission through hyperspectral Airborne/Satellite borne remote sensing



The key characteristics of
Hyperspectral Imaging
and machine vision





Distinguishing features

Pasture and soil in different wavelengths

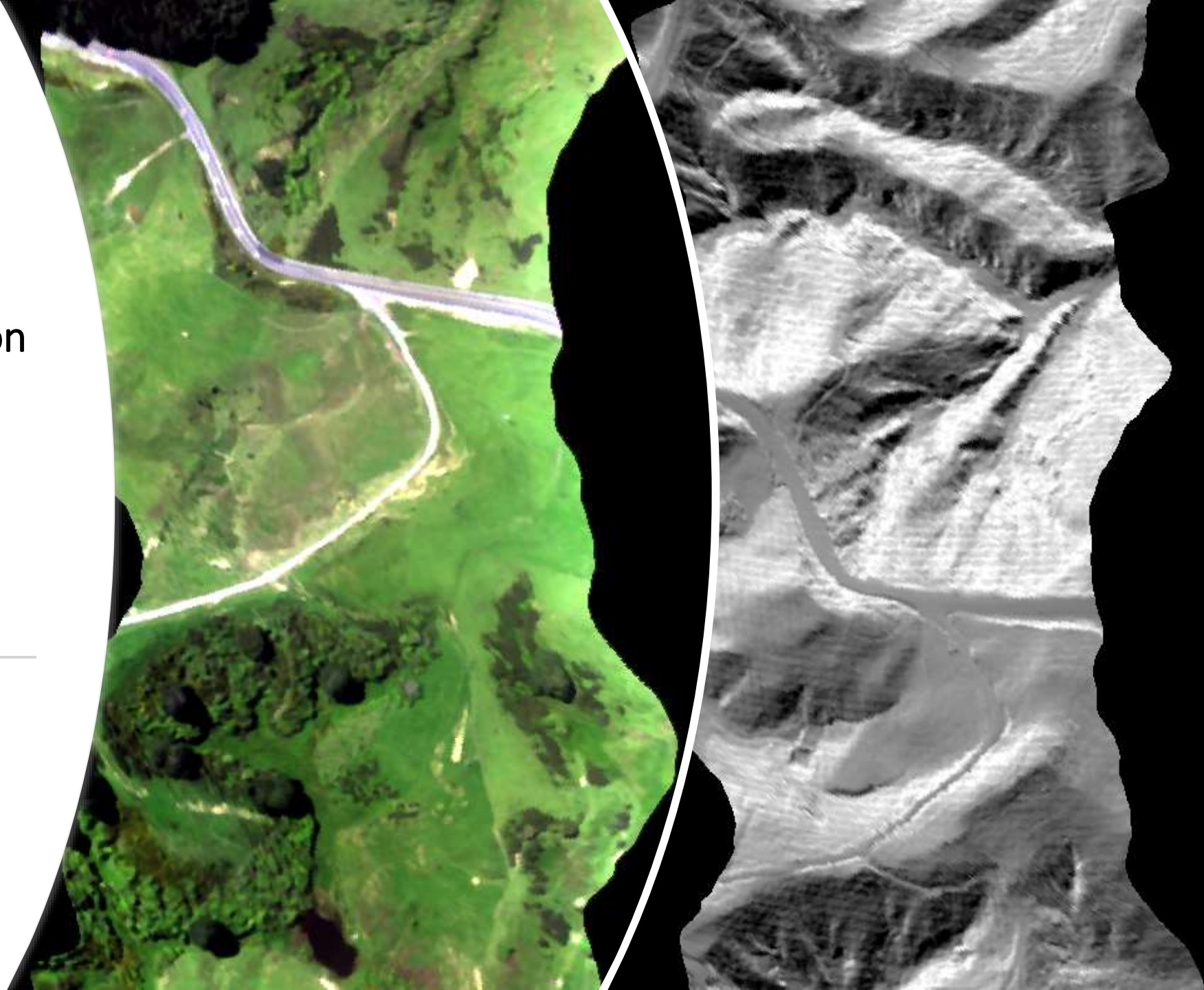


Distinguishing
features
poplar tree and
pasture in different
wavelengths



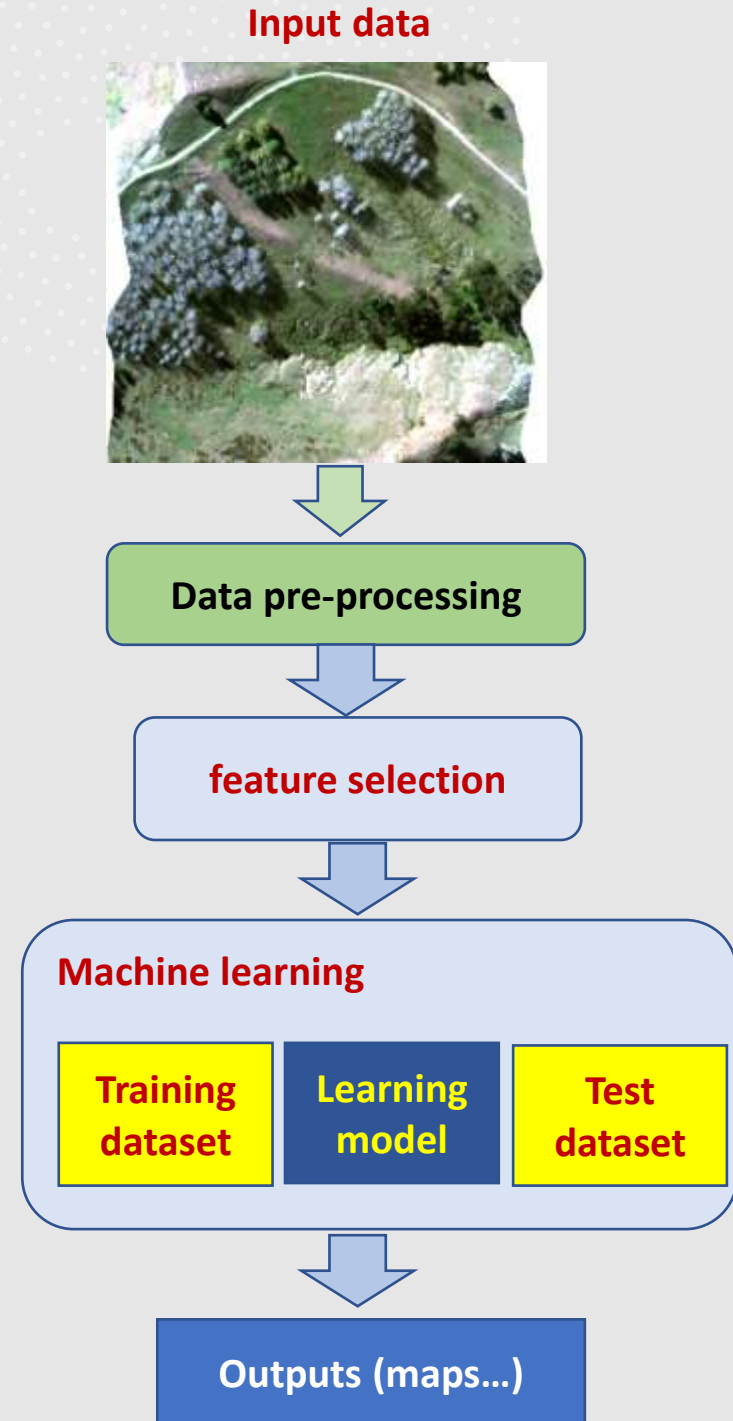
Slope
Aspect
Viewing and illumination
geometry

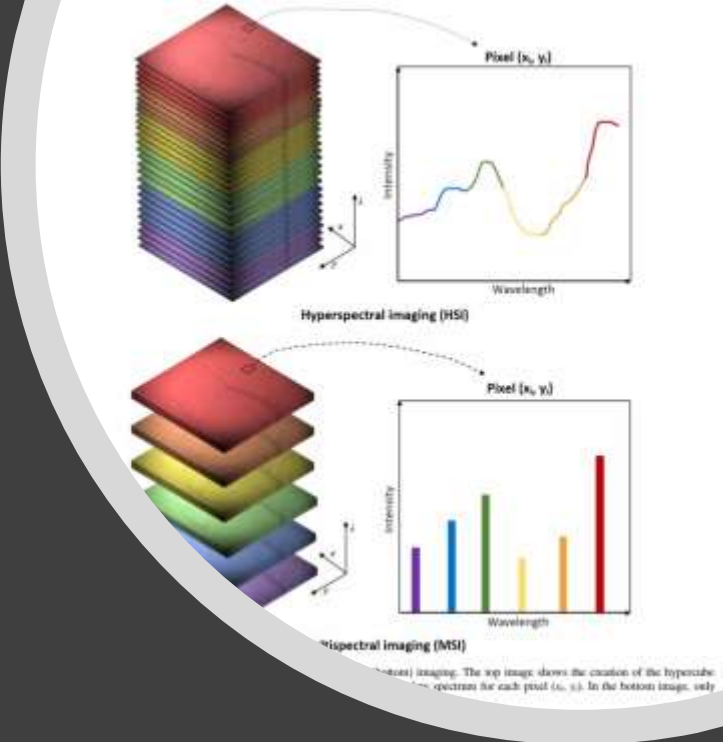
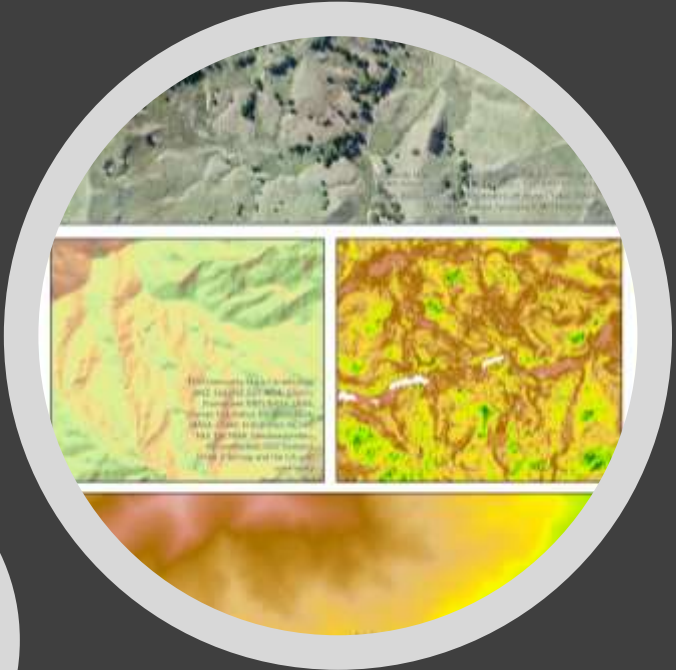
Challenges in hill
country



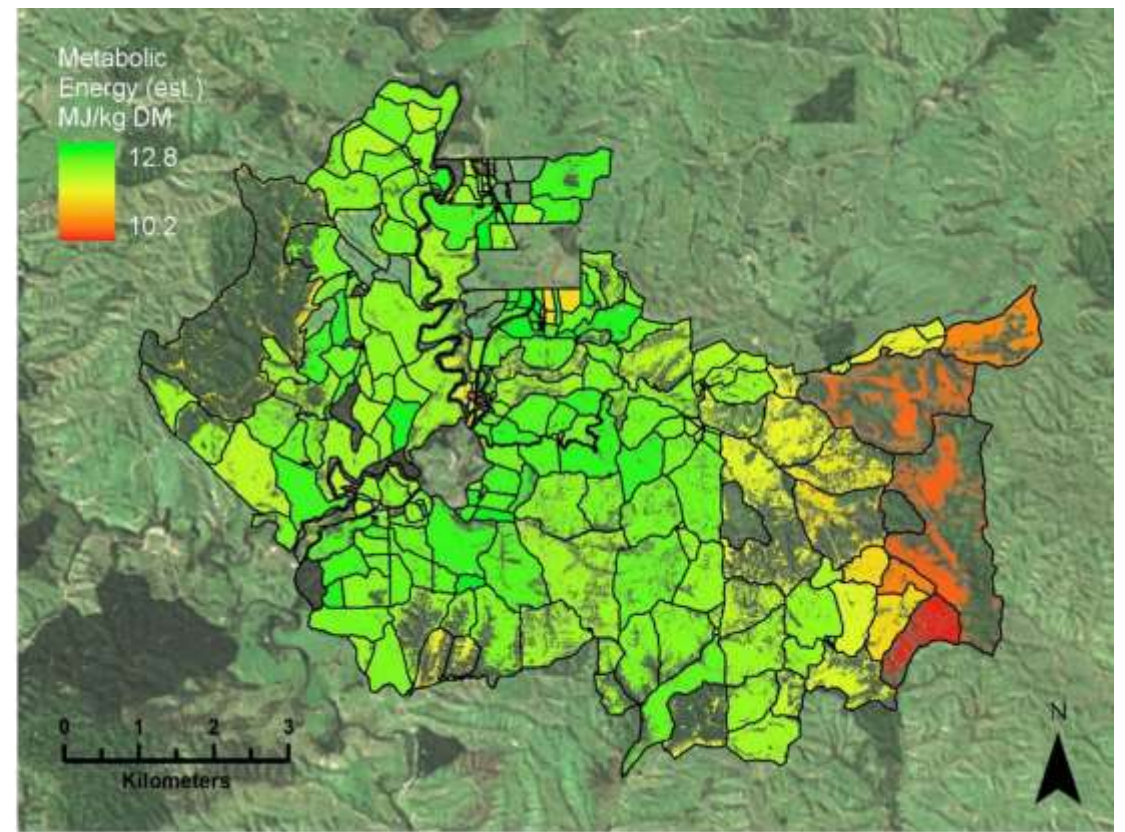
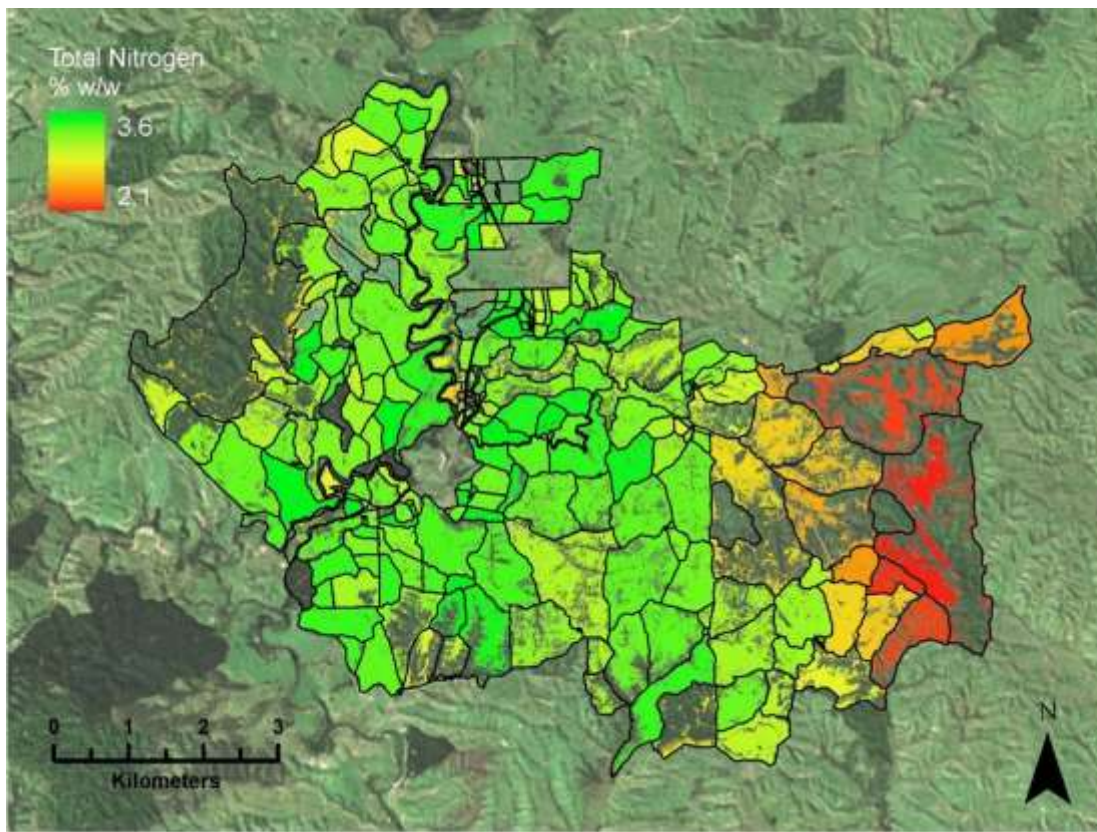
This information feeds into machine learning algorithms

Machine vision is a field of artificial intelligence (AI) that enables computers and systems to derive meaningful information from digital images.





Hyperspectral Imaging and AI Capabilities



Cheaper, but still highly accurate, fine-scale data is required to achieve Aotearoa-NZ's aspiration to build an accurate and reliable GHG emission inventory for its mitigation strategies. Specifically, in the context of pasture quality (as measured through nitrogen (N%) and metabolic energy (ME)) is affected by farm type and region, season, the impact of grazing management (e.g., grazing interval), and the interactions with pasture species, season, land slope and other drivers; and hard to realize through a mathematical model.

Research partners

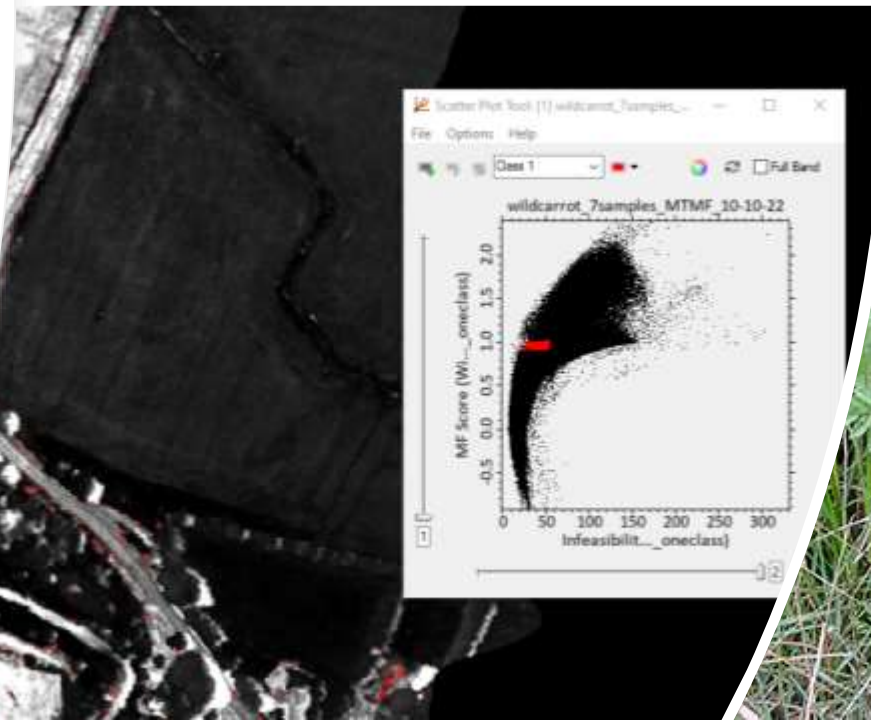
Ministry for Primary Industries
Manatū Ahu Matua



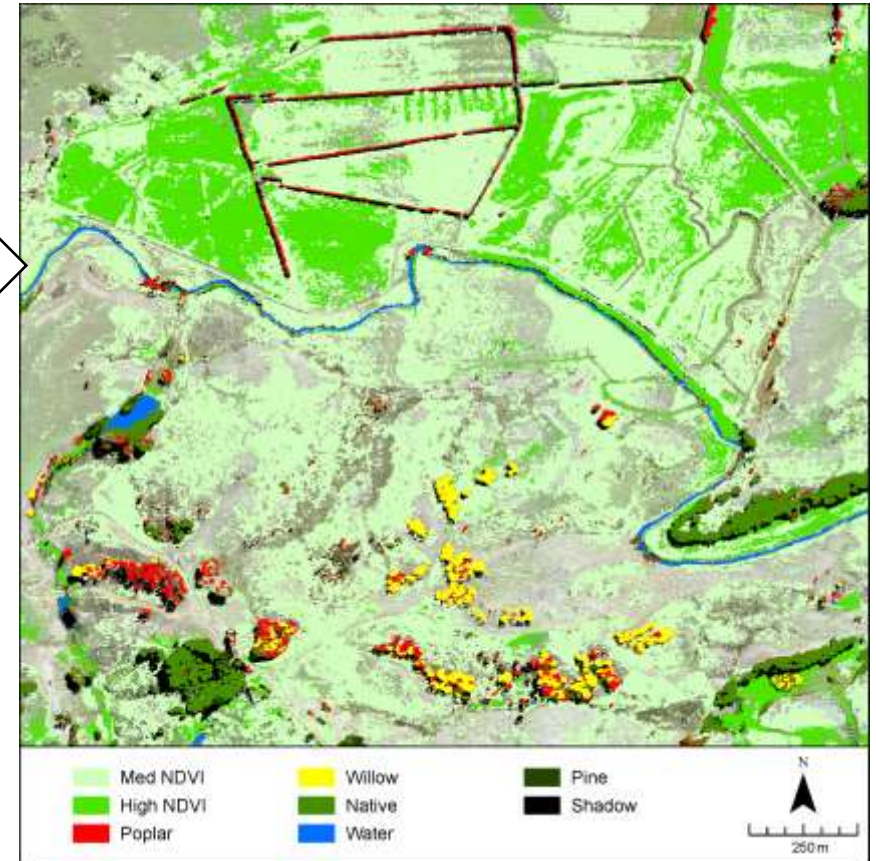
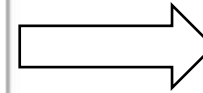
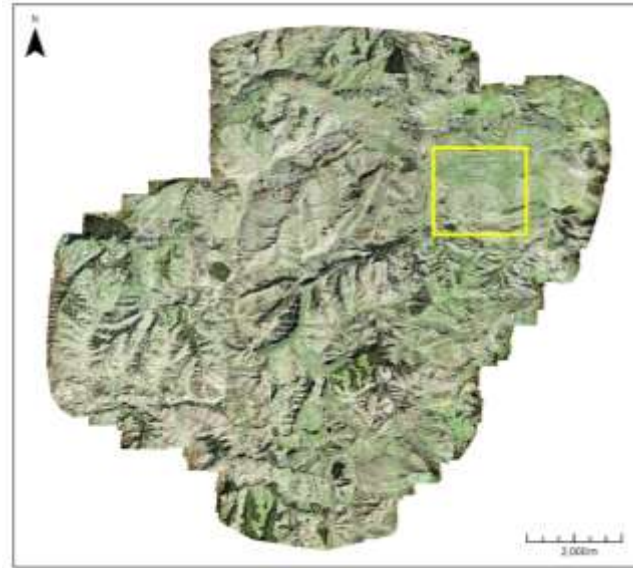
ravensdown 



Wild carrot
detection
(invasive
species)



Large scale scanning





Research partners

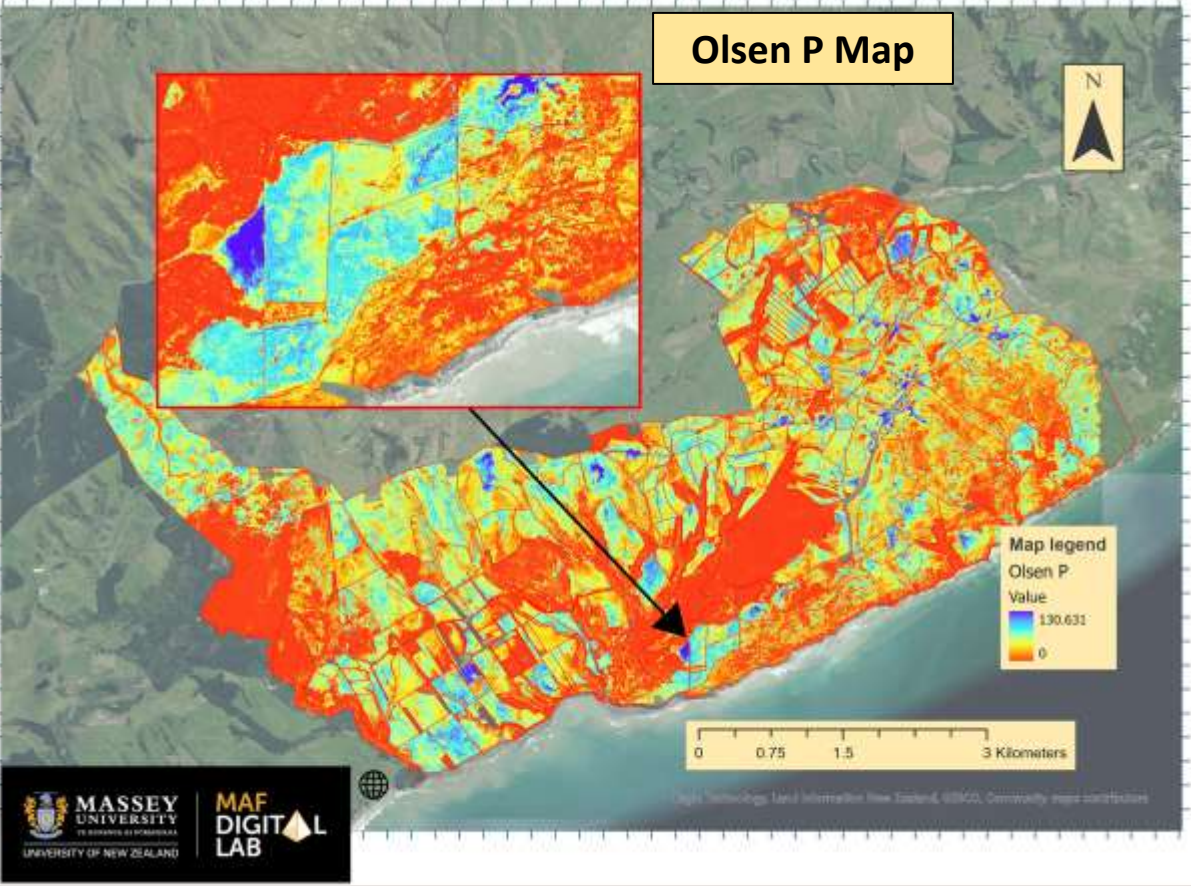




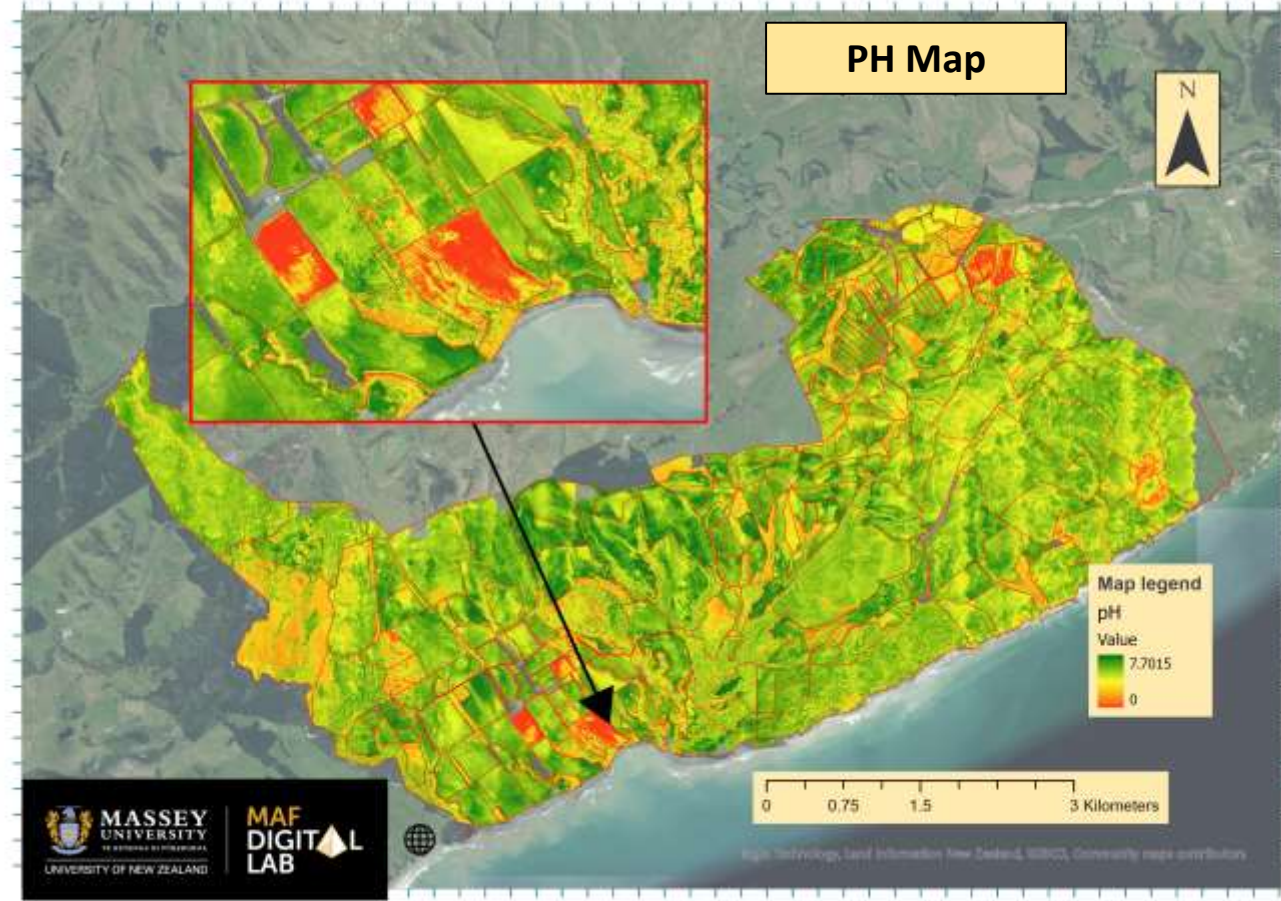
ravensdown 



Olsen P Map



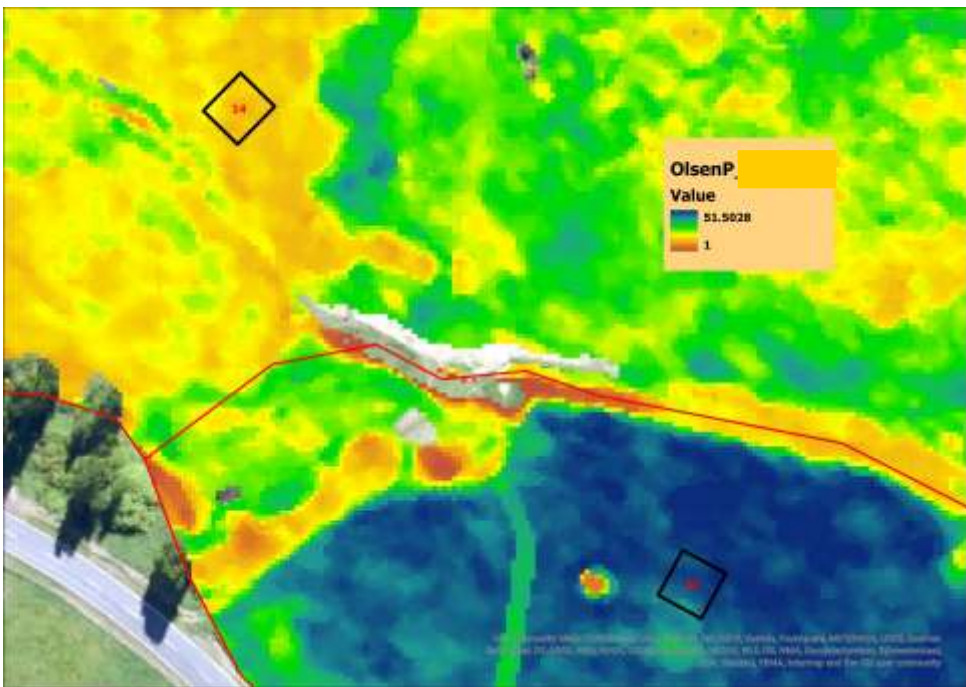
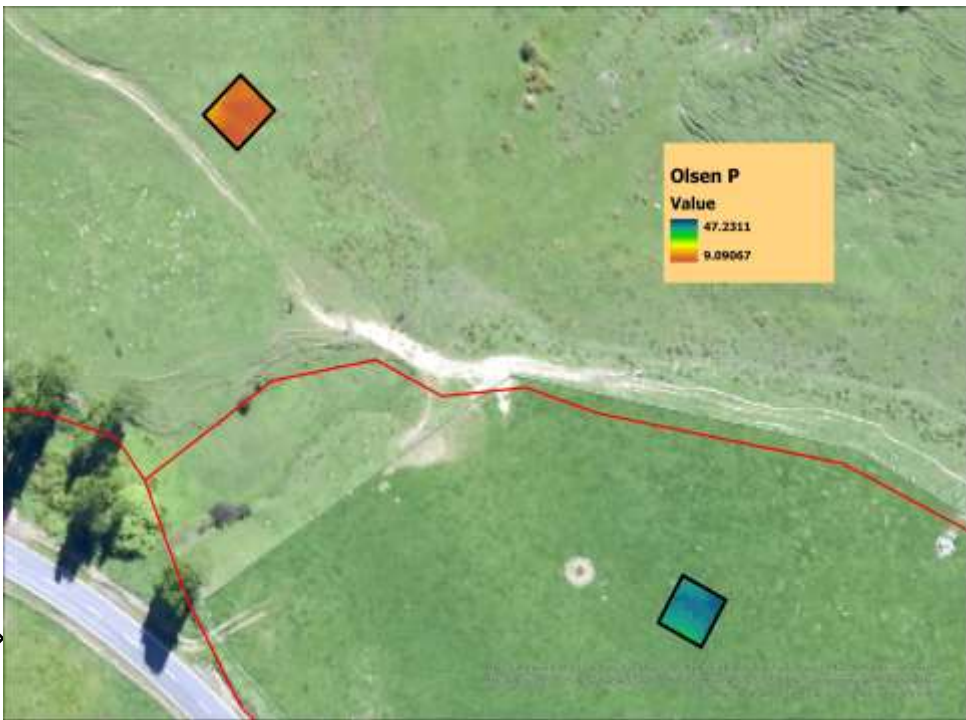
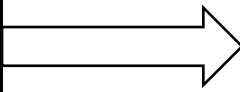
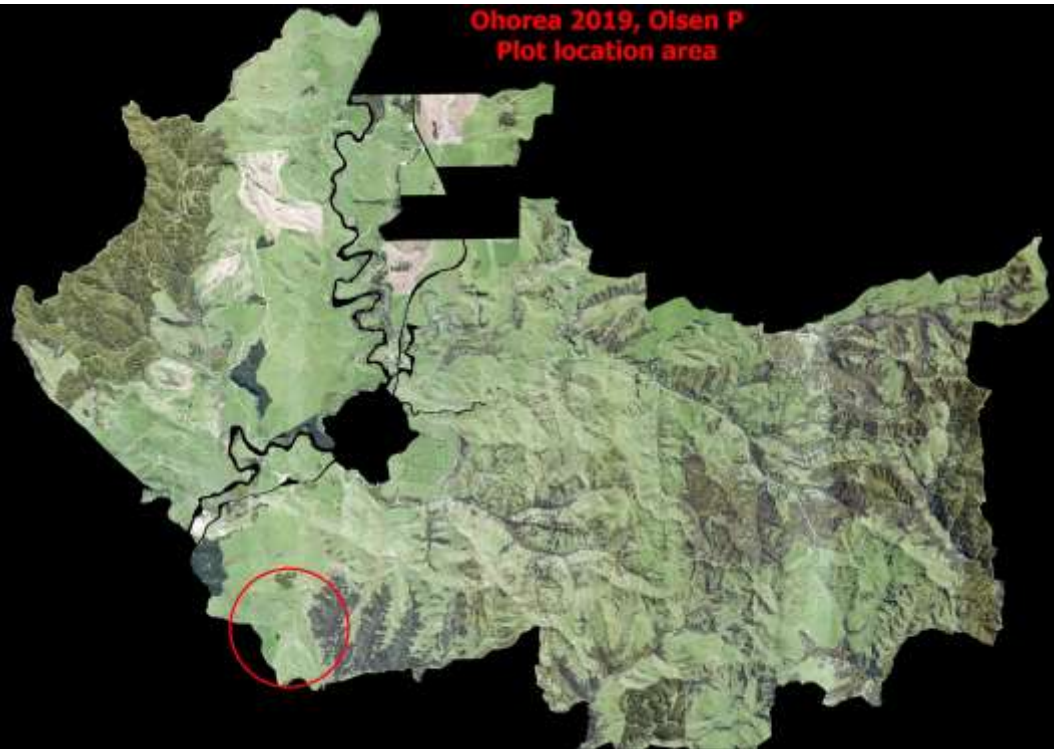
PH Map



Research partners



Soil Olsen P map through airborne hyperspectral imaging



Lab measurements



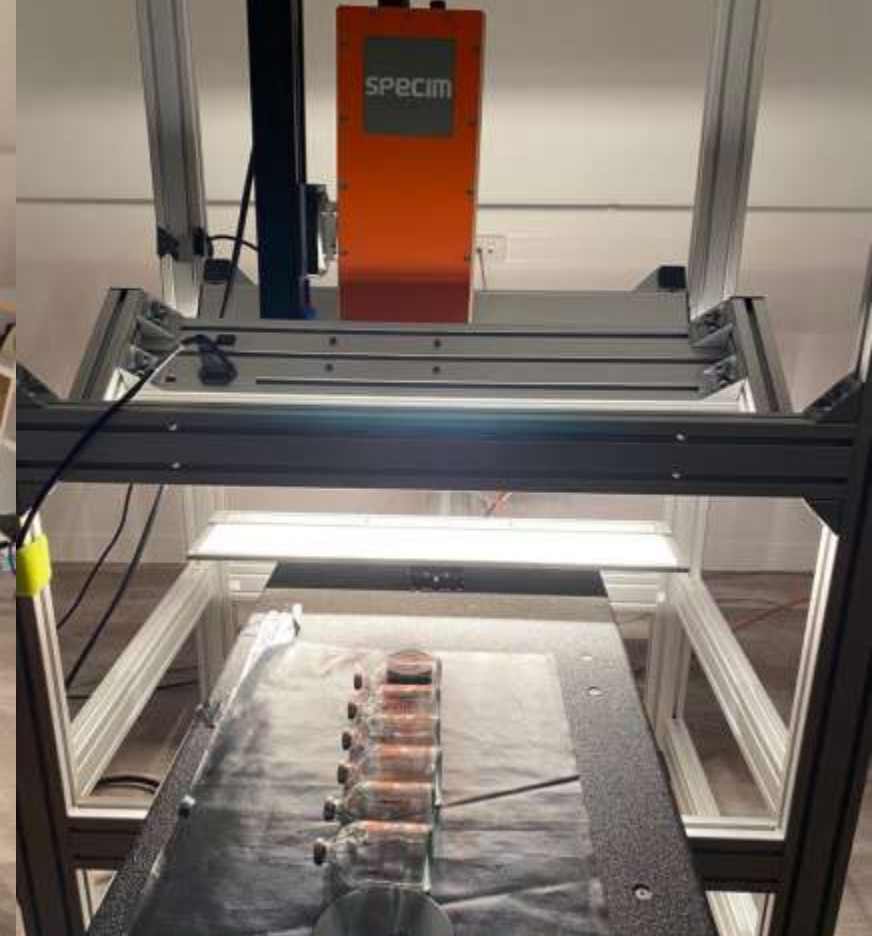
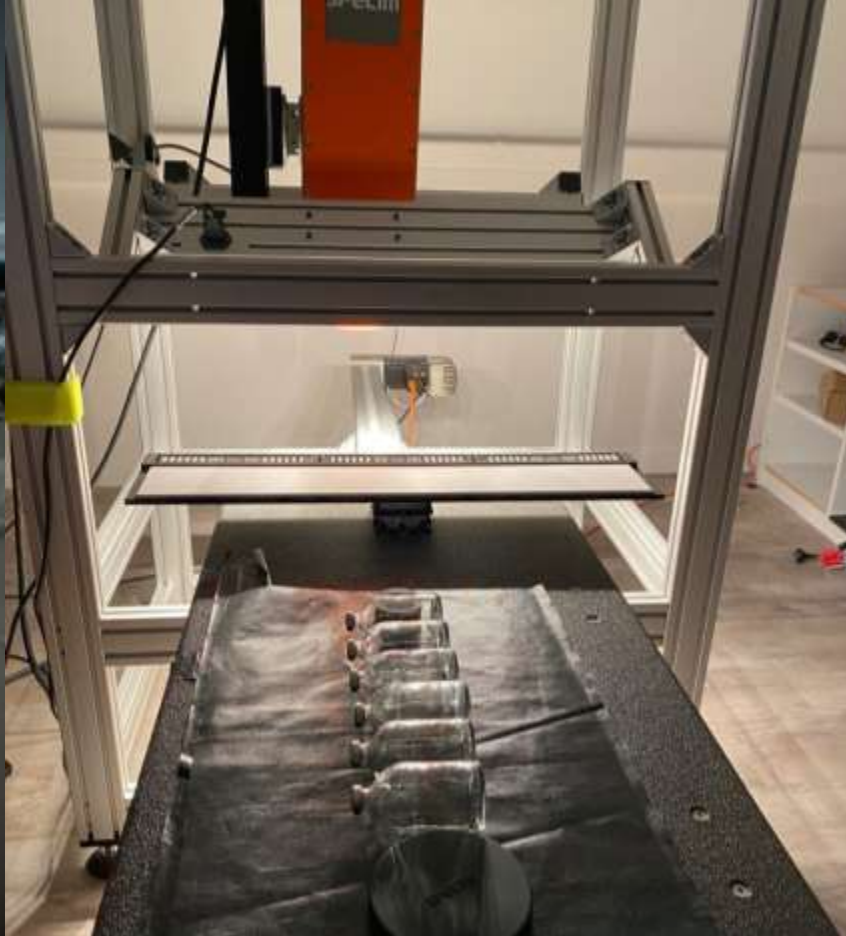
specim

A photograph of a laboratory instrument, likely a spectrophotometer or similar measurement device. The device has a grey front panel with a grid of small, square wells or sample holders. The word "specim" is printed on the left side of the panel. The device is mounted on a metal frame.



Small scale scanning



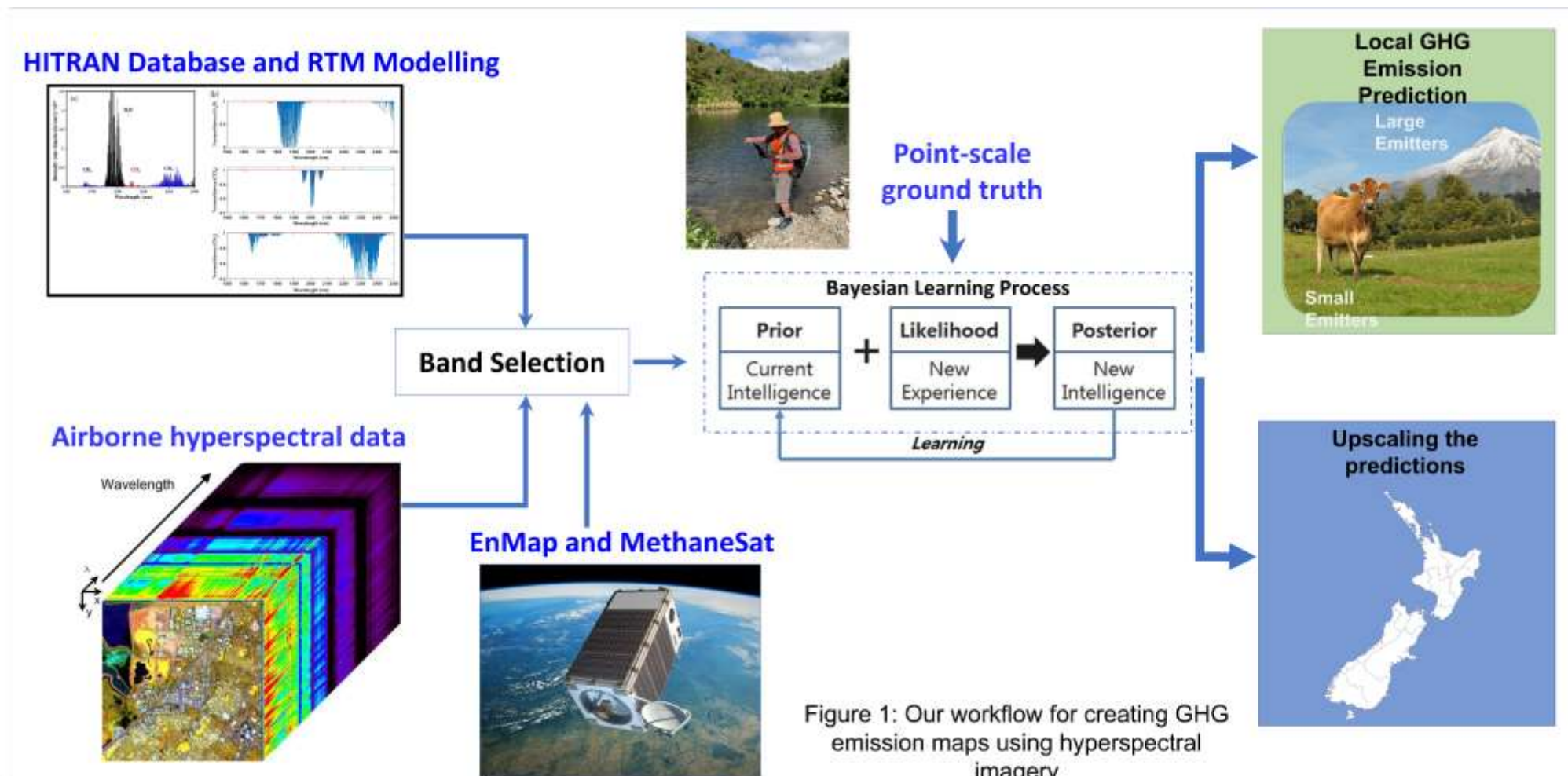


Methane, Nitrous Oxide, and Carbon Dioxide Scanning

Lab measurements:
for example,
avocado scanning



Future projects: GHG emission at fine-scale



Future projects

Pest detection



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- Thank you for your attention
 - We would love to hear about your works and collaborate with you

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