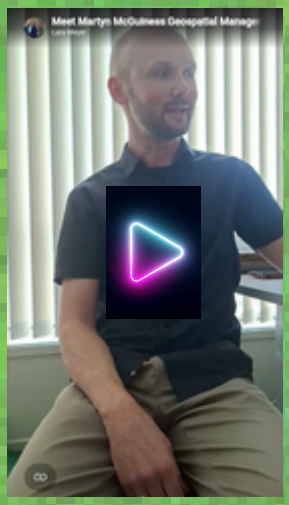
Building a Digital Forest: How GIS Powers Modern Forestry

Geographic Information Systems (GIS) are central to how Ernslaw One manages its forestry operations across Aotearoa New Zealand.
In this case study, we explore how geospatial technology supports planning, decision-making, and environmental management at scale.
Martyn McGuiness, Geospatial Manager at Ernslaw One, based in Gisborne, leads a team of five data analysts who capture, manage, and analyse spatial data across the company's forest estate.
His team supports a complex national operation spanning more than 120,000 hectares of land across Gisborne, the Southern North Island, Marlborough, and Otago.

Meet Martyn McGuinness Geospatial Manager



What is GIS? Scan the QR code to view the Powerpoint

What Does GIS Do?

- **Builds a "digital twin" of the forest**
- **Uses 150+ datasets**
- **Contains 500,000+ data points**
- **Links spatial information including:**
- **Boundaries**
- **Hazards**
- **Watercourses**
- **Tree data**
- **Replaces paper maps with layered digital mapping**
- **Accessible in both office and field environments**

How Does GIS Help?
Improves coordination between:
Field staff
Environmental planners
Harvest teams
Supports decision-making for forest management and operations

Data is shared across:
Desktop systems
Mobile devices
Web platforms

Field teams can:
Access maps on site
Record observations
Send information directly from the field

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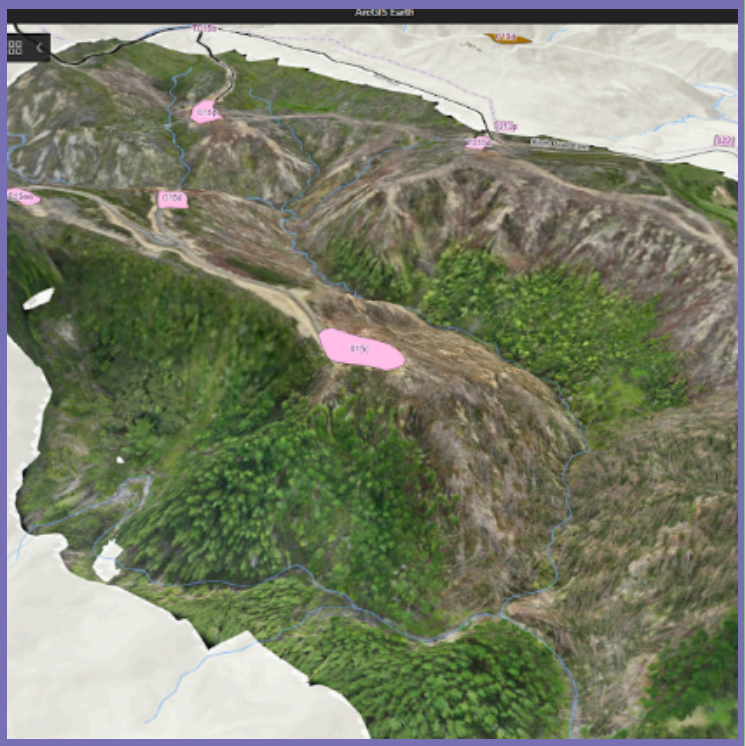
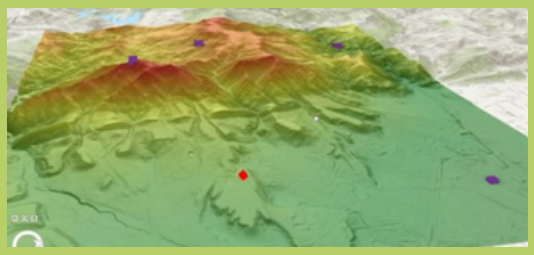
By transforming thousands of data points into clear visual information, GIS helps foresters make decisions based on evidence rather than estimates.



Modern GIS technology can detect and map individual trees across entire forests.
Foresters can accurately count trees, measure their growth, assess forest health, and analyse data at a level that previous generations could only imagine.
The information available to future foresters will be more comprehensive and accurate than ever before.

Modern GIS creates detailed three-dimensional representations of the landscape.



"You can really see the shape of the land," says Martyn. "Slopes become immediately obvious and different colours can highlight areas that are too steep for forestry operations."

These visualisations help harvest managers make important decisions about how to work safely and efficiently in challenging terrain. They can identify where harvesting equipment should be positioned, where logs should be processed, and how operations can be managed across the landscape.



Web GIS, Mobile GIS and Desktop GIS



"GIS is all about understanding landscapes and turning information into something people can use," explains Martyn.

The role of GIS in forestry has changed dramatically over the years. In the past, foresters would map the planted areas and record only basic information about a forest block.
They knew the boundaries, the species that had been planted, the age of the trees, and when they were likely to be harvested.

Much of the planning was based on estimates gathered from small sample plots scattered throughout the forest. Today, the amount of information available is extraordinary.

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Maps themselves have also evolved. Traditional maps were two-dimensional, but modern GIS creates detailed three-dimensional representations of the landscape. These 3D maps allow foresters to visualise terrain in ways that were previously impossible.

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The data collected in the forest doesn't simply remain in a database. It is brought together into dashboards, spreadsheets, maps, and graphs that help forestry teams understand what is happening across their forests.

"We can see exactly where crews have been working and how different areas are performing," Martyn explains.

Drone technology has further expanded the capabilities of GIS. Foresters now use Unmanned Aerial Vehicles (UAVs) to capture high-resolution images of forests and landscapes. These images are imported into GIS platforms, allowing teams to view and assess sites from almost anywhere.

How Geography, Science and Mathematics Power GIS in Forestry

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Geography in GIS

Geography is the foundation of GIS.

It helps foresters understand where things are and why they are there.

Science in GIS

Tree growth rates, species performance, and survival rates.
Soil types, moisture levels, and nutrient availability.
Ecosystem health and biodiversity patterns.
Environmental impacts of harvesting and land use.
Change over time (growth cycles, regeneration, disturbance).

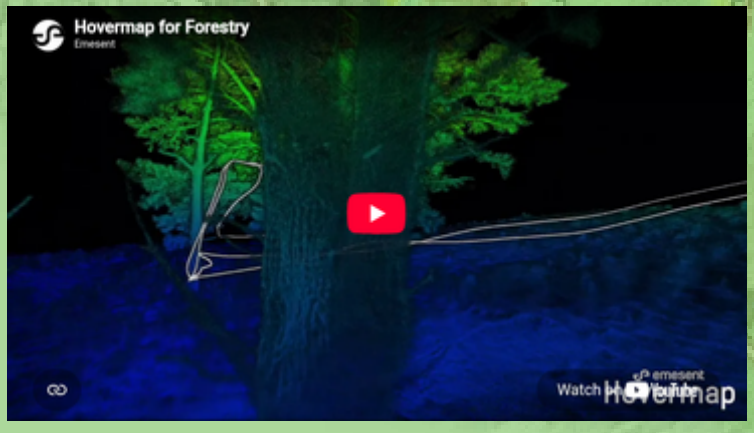
Mathematics in GIS

Calculating tree height, volume, and biomass.
Measuring slope, distance, area, and elevation.
Using coordinates (x, y, z) to map exact tree positions in 3D space.
Statistical analysis of survival rates and growth patterns.
Modelling and predicting future forest growth and yield.

For students who enjoy Geography, science, technology, and problem-solving, GIS offers an exciting career pathway that combines all four.

As Martyn puts it,
"We're collecting more information than ever before. GIS allows us to turn that information into something meaningful so people can make better decisions. That's where the real value lies."

How Technology Maps our Forests





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The Wood Industry Development and Education (WIDE) Trust is a charitable trust established in 2018 with the mission to support development and education in the forestry and wood industry sectors through the provision of grants and scholarships to New Zealand students and institutions.

FOREST GROWERS LEVY TRUST (FGLT)

The Forest Growers' Levy Trust collects the commodity levy paid on harvested wood material from forest growers and acts as the custodian of those funds. The Trust ensures the levy is invested in research, development, biosecurity, promotion and other industry-good activities that benefit New Zealand's plantation forest sector.