Can trees solve climate change?

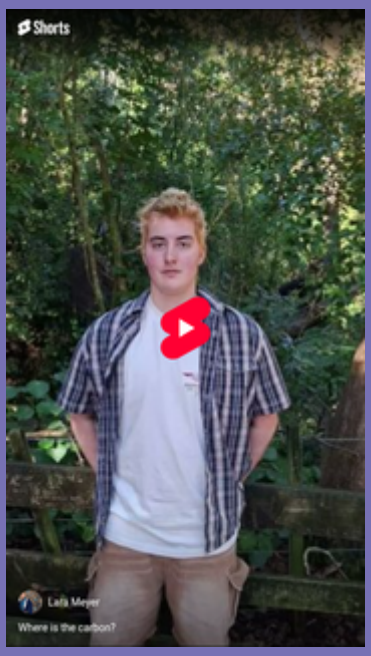
"Forestry can help buy us time, but it isn't a complete solution." Max Brinkhurst

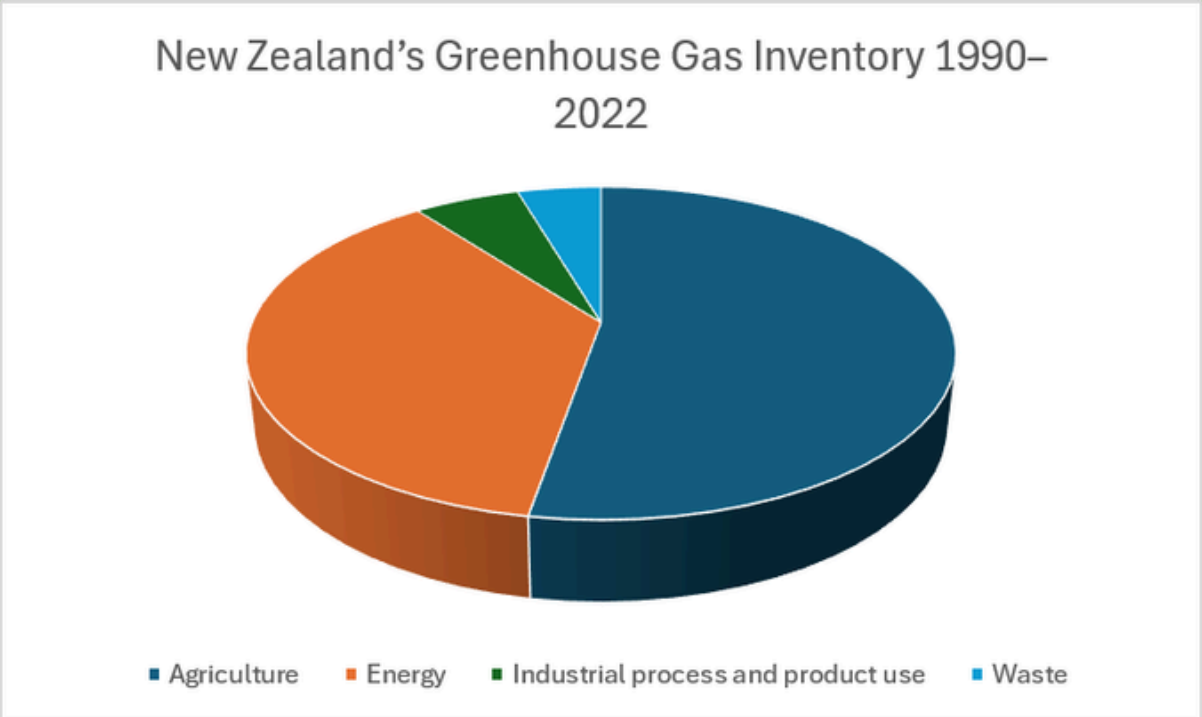
Meet Max Brinkhurst a forestry scientist working at Rata Forest Management .



Max uses data, mapping and ecological knowledge to understand how forests can contribute to climate change mitigation through New Zealand's Emissions Trading Scheme

Looking ahead, Max sees a future where forestry embraces diversity, with native species, plantation forests and research working together to create more resilient and sustainable landscapes.





Did you know?

Agriculture produces more than half of New Zealand's greenhouse gas emissions, but forests are our biggest natural solution for removing carbon dioxide from the atmosphere. Without our forests, New Zealand's net emissions would be much higher.

Explaining the Emissions Trading Scheme

The Emissions Trading Scheme was set up as a tool to help New Zealand meet its international climate targets.

The basic idea is that businesses produce emissions, and forests help offset those emissions by removing carbon dioxide from the atmosphere.

In forestry, trees store carbon as they grow. Forest owners can earn New Zealand Units, or NZUs, which represent one tonne of carbon dioxide removed from the atmosphere.

Those units can then be bought and sold.

Choosing the right land use

When we look at land, we consider things like slope, erosion risk and land capability. New Zealand uses Land Use Capability (LUC) classes from 1 to 8.

LUC 1 is highly productive land, such as land suitable for horticulture and intensive agriculture.
LUC 6 is marginal for farming.
LUC 8 is very steep or fragile land that is generally better suited to permanent native vegetation.
The challenge is choosing the right use for the right land.
Some land is better for food production.
Some land is better protected by trees.
After Cyclone Gabrielle, we saw large areas of unstable land that needed permanent vegetation to help protect the soil."

Land-use change

We've definitely seen more interest in planting trees.
Some farmers are planting small forests on steep gullies or erosion-prone areas while keeping their best land in pasture.

Others are planting larger forests where forestry provides a better long-term return.
The government has limited how much farmland can be converted into exotic forest and registered in the ETS.

Each year 15 000 hectares of Land Class 6 can be registered. Land Class 6 is generally less suitable for arable farming.

Measuring carbon

Carbon measurement depends on the size of the forest. For forests under 100 hectares, foresters can use carbon lookup tables. These tables estimate the amount of carbon stored based on:

- the tree species
- the age of the trees
- the location of the forest

For forests larger than 100 hectares, more detailed measurements are required.

We create sample plots throughout the forest, use GPS to find those plots, count the trees, measure stems and use that information to estimate the carbon stored across the whole forest

DISCOVER FORESTRY NEW ZEALAND

HOW FORESTS ARE MEASURED TO CALCULATE CARBON

A combination of fieldwork, technology and data analysis

Forests remove carbon dioxide (CO_2) from the atmosphere and store it in trees and soils.

1 TREES ARE MEASURED IN SAMPLE PLOTS



Foresters set up sample plots at different places throughout the forest to get a representative picture of the whole area.

2 GPS RECORDS THE LOCATION



The location of each plot is recorded using GPS so it can be found again in the future.

3 FORESTERS MEASURE TREE DIAMETERS AND HEIGHTS



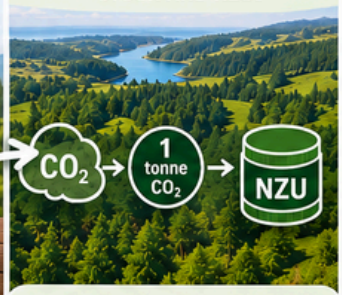
At each plot, foresters count the trees and measure key information like diameter (at breast height) and height.

4 COMPUTER MODELS ESTIMATE CARBON STORAGE



The measurements are entered into computer models that estimate how much carbon is stored in the forest.

5 RESULTS DETERMINE THE FOREST'S CARBON STOCK AND NZUs



The estimated total carbon is converted to tonnes of carbon dioxide (CO_2). Each tonne equals one New Zealand Unit (NZU).

Accurate measurement means forests can play their part in a low-carbon future.

WHERE IS CARBON STORED?

- In trunks, branches and leaves
- In roots underground
- In forest soils

RĀTĀ FOREST MANAGEMENT

Fieldwork, Technology and Data

1. Forest inventory data are collected through permanent sample plots , surveys, and LiDAR calibration.

- **Stand ID / compartment ID**
- **Species (e.g., radiata pine, native species)**
- **Age (years since planting)**
- **Stocking rate (trees/ha)**
- **Diameter at breast height (DBH)**
- **Tree height (mean / dominant height)**
- **Basal area**
- **Mortality rates**
- **Site index (productivity measure)**

These data sets become the "base layer" for carbon estimates

2. Carbon stock calculation spreadsheets. These convert forest growth into carbon units.

Typical spreadsheet outputs:

- **Above-ground biomass (t/ha)**
- **Below-ground biomass (roots)**
- **Total carbon stock (tC/ha)**
- **CO_2 equivalent (tCO_2e)**
- **Annual carbon sequestration rate**
- **Carbon change over time (year-by-year growth curves)**

These are built from tree measurements
Look up tables
Standard Carbon Fractions

3. Growth & yield models (the "engine" behind spreadsheets)

- 3-PG (Physiological Principles Predicting Growth) – widely used for radiata pine
- Forest estate simulation models (growth + harvest + replanting)
- Yield tables (pre-calculated productivity curves)
- Stand growth simulators (forecasting volume and biomass over decades)

Outputs feed directly into carbon forecasts.

4. GIS & spatial datasets are used to map and manage carbon across land blocks.

Typical layers:

- Stand boundaries (GIS polygons)
- Planting year by compartment
- Soil type and slope
- Land-use history (pre-1990 vs post-1989 for ETS rules)
- Harvest blocks and rotation cycles
- Carbon density maps (tCO_2e per hectare)

Tools commonly used:

- ArcGIS / QGIS
- Satellite imagery
- LiDAR-derived canopy height models

NZ ETS / regulatory reporting spreadsheets

In New Zealand, companies participating in carbon forestry under the ETS often maintain:

- Carbon accounting schedules (annual emissions returns)
- Harvest liabilities tracking sheets
- Carbon unit allocation summaries (NZU units)
- "Stock change" reconciliation tables:
  - Opening carbon stock
  - Growth gains
  - Harvest emissions
  - Net position

Carbon Tables can be viewed here.

- https://www.legislation.govt.nz/secondary-legislation/pco-drafted/2022/266/en/latest/#LMS709973

Operational planning Spreadsheets are used to connect carbon with business decisions:

- Harvest scheduling (when carbon liabilities occur)
- Rotation age optimisation (carbon vs timber revenue)
- Cashflow models (carbon credit income vs harvest costs)
- Replanting schedules
- Fire risk and carbon loss scenarios



LiDAR gives foresters a 3D picture of the forest.
By combining this with measurements taken from trees on the ground, computers can estimate tree growth, carbon storage and forest health across thousands of hectares. LiDar helps managers make better decisions

A forestry company flies LiDAR over a plantation and creates a canopy height map.

Managers can identify which blocks are approaching harvest age without physically measuring every tree.

- **LiDAR captures canopy structure.**
- **Sample plots measure actual trees.**
- **Models estimate biomass across the entire forest.**

A forestry company may repeat LiDAR flights every 2–5 years.

LiDAR does not replace people measuring trees but it improves accuracy.

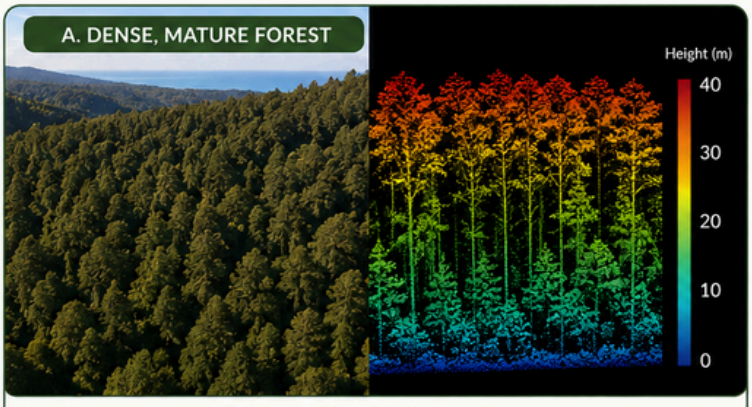
THINK LIKE A FORESTER!

Look at the two forests below.

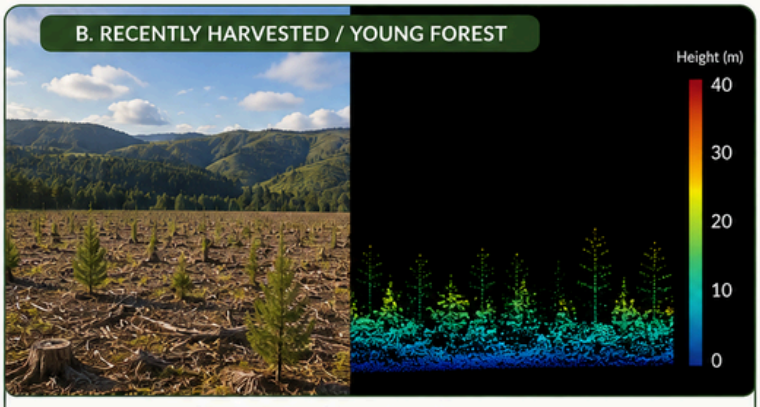
Which forest stores more carbon?

How could LiDAR help foresters estimate this without measuring every tree?

Did you know?
Forests remove carbon dioxide from the air as the trees grow and store it in their trunks, branches, leaves and roots.



Tall trees with a closed canopy.
Lots of wood = lots of stored carbon.



Shorter trees with an open canopy.
Less wood = less stored carbon (for now).

YOUR TURN

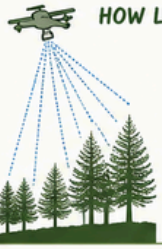
Which forest do you think stores more carbon? _____

Why? _____

What information helps you decide? _____

_____

HOW LiDAR HELPS FORESTERS



LiDAR (Light Detection and Ranging) uses laser pulses from the air to measure millions of points on the forest – the tops of trees, branches and the ground. Foresters use this 3D data to estimate tree height, volume and biomass – and work out how much carbon is stored in the forest – without measuring every tree.



LiDAR surveys are flown across New Zealand in planes or helicopters.

DISCOVER FORESTRY NEW ZEALAND



FORESTRY, CARBON & THE EMISSIONS TRADING SCHEME

rātā
RATA FOREST MANAGEMENT

Insights from Max Brinkhurst – Rata Forest Management

Forestry is one of the few things that can REMOVE carbon from the air.

THE BIG IDEA

"Forests capture carbon as they grow. Through the Emissions Trading Scheme (ETS), landowners can earn carbon credits for that carbon – but it's not just about making money. It's about planting the right trees, in the right places, for the long term."

WHO IS MAX?

Max Brinkhurst is a forestry scientist with Rata Forest Management. He works with landowners across Aotearoa New Zealand to grow forests, manage carbon, and make smart decisions for the future.

WHAT IS THE ETS?

The Emissions Trading Scheme (ETS) is New Zealand's way of pricing greenhouse gas emissions.

- Businesses that emit carbon must buy NZ Units.
- Landowners can earn NZ Units by growing forests that store carbon.
- These units can be sold to help reduce emissions elsewhere.

KEY TAKEAWAYS FROM MAX

FORESTS GROW, CARBON GROWS
Trees absorb CO_2 as they grow and store it in their trunks, branches, leaves and roots.

AOTEAROA, UNIQUE OPPORTUNITY
New Zealand's climate and land make it ideal for forestry. We have the chance to lead in sustainable forest management and carbon farming.

THE ETS CREATES INCENTIVES
The ETS rewards landowners for growing forests. It turns good environmental choices into real financial value.

LONG-TERM THINKING
Forestry is a long game. Decisions made today (what trees, where, how we manage) affect carbon outcomes for decades.

BALANCING PEOPLE, PROFIT & PLANET
Good forestry balances economic returns with environmental care and social values.

WORDS TO KNOW

CARBON SEQUESTRATION:
The process of capturing and storing carbon from the atmosphere.

NZ UNIT:
The currency of the ETS. One NZ Unit = one tonne of CO_2 stored or avoided.

PERMANENCE:
Carbon stored in forests needs to stay stored for the long term.

PLANTATION FOREST:
Forests grown by people, typically in even-aged plantations for timber production and carbon storage.

THINK & DISCUSS

1. What are the benefits of forests capturing carbon?
2. Why do you think the ETS only works if forests are managed over the long term?
3. How might the ETS influence decisions about land use in New Zealand?
4. What are some challenges or risks involved in using forests for carbon storage?
5. How does forestry contribute to a sustainable future – environmentally, socially and economically?
6. If you owned a piece of land, what factors would you consider before planting a forest for carbon?



"Forestry is part of the solution. It's about using the land wisely, looking after the environment, and making decisions that last."

TEACHER TIP
Use Max's insights to spark inquiry! These ideas connect to science, geography, economics, civics and sustainability.

OUR FORESTS. OUR FUTURE. OUR CHOICE.

HEALTHY FORESTS. STRONG COMMUNITIES. A BETTER FUTURE FOR AOTEAROA.

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Email us for more information at discover@discoverforestry.co.nz.

WIDE TRUST

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.