CARBON SEQUESTERED BY NATIVE RESTORATION PLANTINGS, SOUTHERN PORT HILLS AND QUAIL ISLAND, CANTERBURY, NEW ZEALAND

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Session: Conservation and restoration

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INTRODUCTION

Restoration plantings are typically planned with a multi-goal framework. Carbon sequestration is one of these, but we know little about how plantings in different locations of Canterbury can achieve this goal. This study investigated the above-ground biomass (AGB) held at five native restoration sites on the southern Port Hills and Quail Island.

AIM

To better understand the carbon content of different restoration sites the following aims were prescribed:

1. How much CO2 equivalent carbon is stored in restoration plantings of different ages and sites?
2. 2. As potential future canopy dominants, how much CO2 equivalent carbon is stored by planted tōtara (*Podocarpus totara)*?

To address these questions this research focused on 15- to 59-year-old restoration plantings on the southern Port Hills and Quail Island.

RESULTS

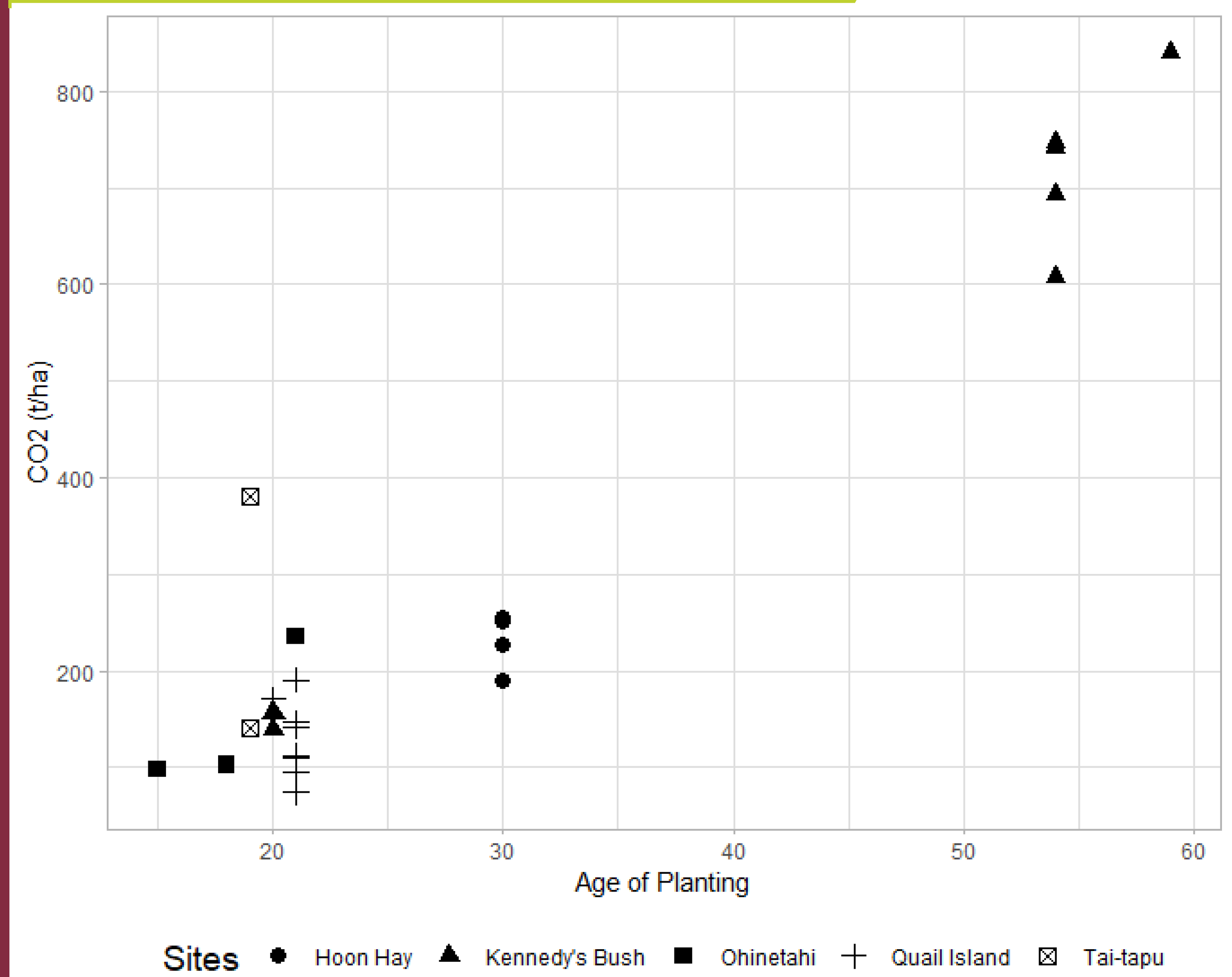

Figure 1: Total CO2 equivalent of all 25 measured plots and their age of planting.

For the 25 plots of mixed species, linear models were used to test whether environmental variables and species composition could explain variation in the amount of CO2 equivalent carbon at a plot level. To further investigate the relationship between the environmental variables and CO2 equivalent carbon, a mixed-effects model was used.

We found no correlation between carbon content and environmental data (Table 1), except for year of planting (Figure 1).

CO2 equivalent carbon in tōtara ranged from 1.07 kg per tree for a nineteen-year-old individual to 896.94 kg per tree for a thirty-year-old individual. Highest carbon content was reached in plantings on the edges of the restoration forests (Figure 2).

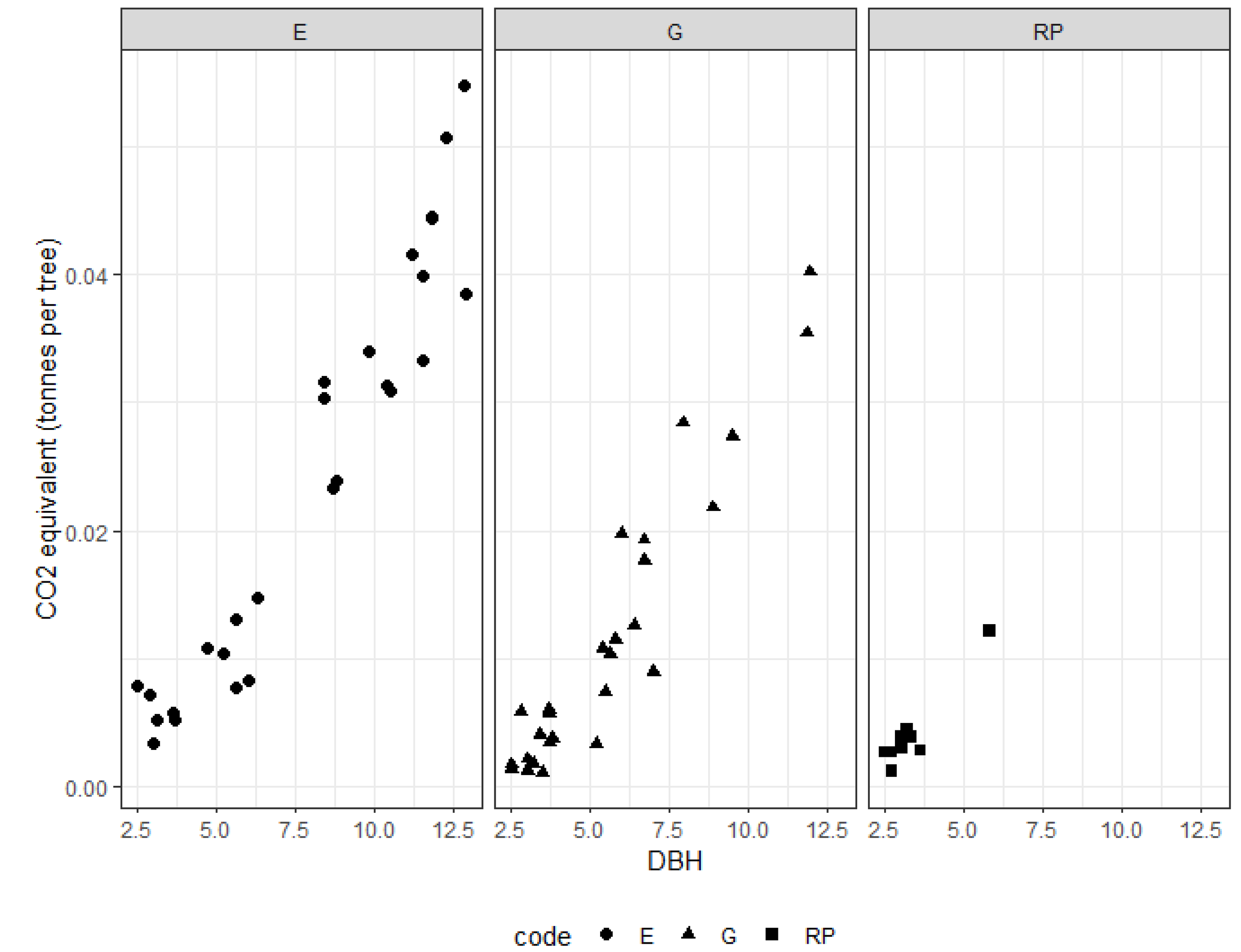

Figure 2: CO2 equivalent by the dbh under different growth conditions for planted tōtara: restoration plantings (RP), edge (E), and gorse (G).

Year of planting (n=number of plots)	Total CO_2 (t/ha)	Elevation (m.a.s.l.) Mean and Standard Deviation	Aspect	Physiography	Slope Mean and Standard Deviation
1999-2005 (n=16)	152.7441667	138.625 +/- 33.5	N=100% / S=0%	Face=75% / Ridge=12.5% / Terrace=6.25% / Valley=6.25%	29.625 +/- 3.2
1990 (n=4)	231.1283	438 +/- 10.2	N=75% / S=25%	Face=100%	17.75 +/- 5.8
1961-1966 (n=5)	725.9193333	472.2 +/- 7.8	N=50% / S=50%	Face=100%	47.8 +/- 6

Table 1: Environmental variables and CO2 equivalent carbon for sites with a close year of planting.

METHODOLOGY

- Carbon in plots was calculated from measurements of tree height, dbh & diameter 10cm above ground, using a shrub(1) or a tree(2) equation.
- Environmental variables described plot characteristics. These included physiography, aspect, latitude, longitude, species, slope, slope shape and presence of mammalian pests.
- 105 tōtara trees were measured in sites where ungulate numbers were controlled. Trees were found growing within restoration plantings amongst other tree species, on the edges of plantings and amongst gorse.

CONCLUSIONS

No specific environmental conditions or species compositions affected carbon contents in restoration plantings. However, carbon contents increase with age.

Tōtara might perform well as a carbon sequestration booster during the first 30 years of planting. To achieve this, tōtara should be planted in areas where ungulates are excluded or reduced. Tōtara will achieve higher carbon contents on edges of a forest (3)(4).

REFERENCES

1. Beets P, Kimberley M, Oliver G, Pearce S. The Application of Stem Analysis Methods to Estimate Carbon Sequestration in Arboreal Shrubs from a Single Measurement of Field Plots. Forests. 2014;5(5):919-35.
2. Beets PN, Kimberley MO, Oliver GR, Pearce SH, Graham JD, Brandon A. Allometric Equations for Estimating Carbon Stocks in Natural Forest in New Zealand. Forests. 2012;3(3):818-39.
3. Forbes AS, Norton DA, Carswell FE. Artificial canopy gaps accelerate restoration within an exotic Pinus radiata plantation. Restoration ecology. 2016;24(3):336-45.
4. Tulod AM, Norton DA. Regeneration of native woody species following artificial gap formation in an early-successional forest in New Zealand. Ecological management & restoration. 2020;21(3):229-36.

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