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Potential to reduce losses and increase SOC stocks under grazed grasslands – New Zealand perspective

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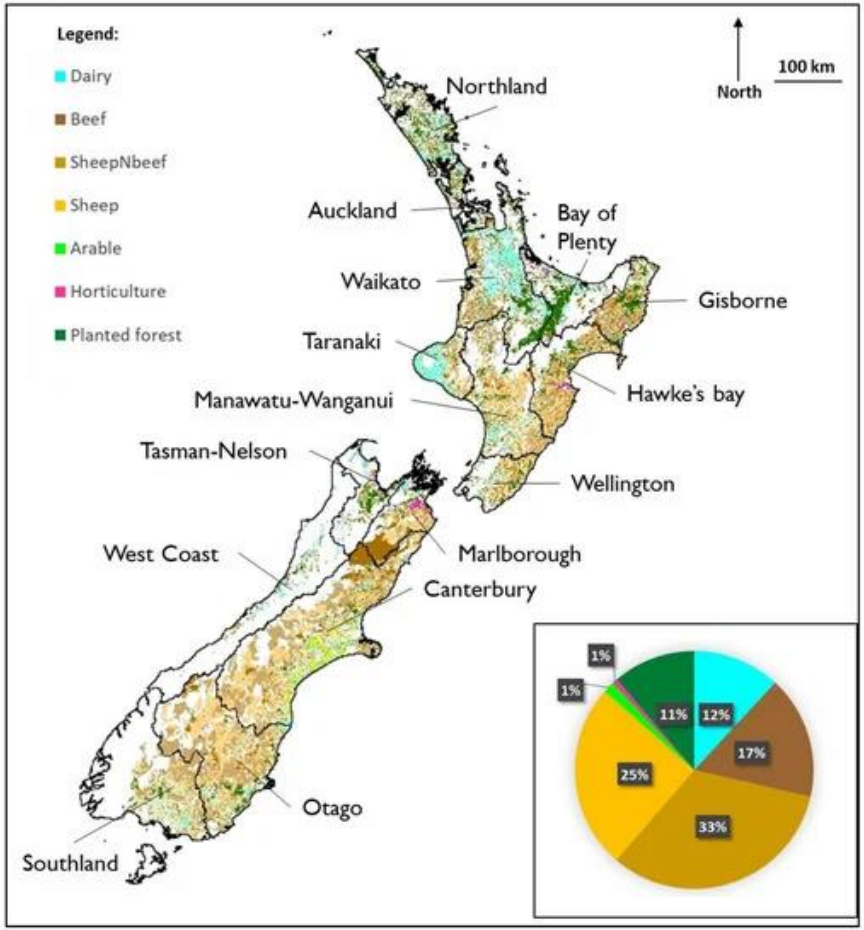
New Zealand

- 53% of land under agriculture
- Permanent pasture dominant land use
- Emissions profile driven by agriculture
- SOC and biomass of interest for GHG mitigation potential



Vannier et al. 2022. Land, 11, 2334

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National SOC stocks

Moderate to high SOC stocks

- Average of 100 tC/ha in top 30 cm
- Grassland soils have largest stocks
- Soil order important

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Changes in SOC stocks

Land use change between 1990 and 2016

8.45 % of national land area

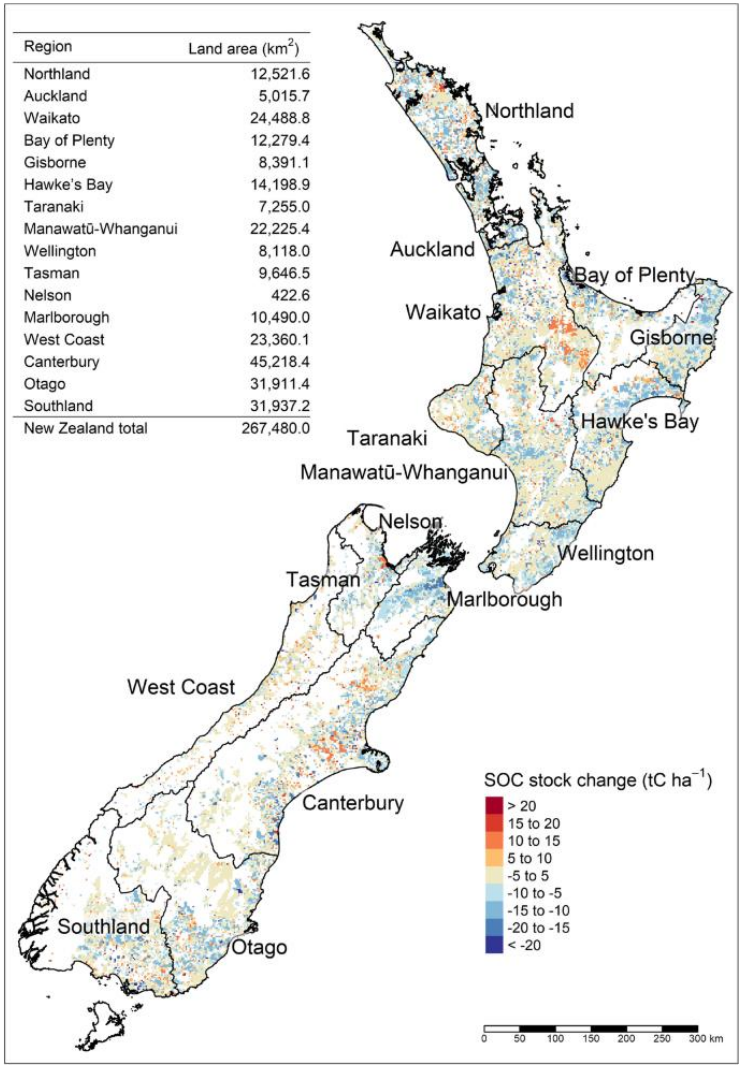
Net loss of 3.3 tC/ha

What can we do to gain SOC?

No management effects

Whitehead et al. (2021). https://doi.org/10.1007/s10113-021-01837-4

Region	Land area (km^2)
Northland	12,521.6
Auckland	5,015.7
Waikato	24,488.8
Bay of Plenty	12,279.4
Gisborne	8,391.1
Hawke's Bay	14,198.9
Taranaki	7,255.0
Manawatū-Whanganui	22,225.4
Wellington	8,118.0
Tasman	9,646.5
Nelson	422.6
Marlborough	10,490.0
West Coast	23,360.1
Canterbury	45,218.4
Otago	31,911.4
Southland	31,937.2
New Zealand total	267,480.0



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Soil Use and Management | WILEY

RESEARCH ARTICLE

Evaluation of the potential for nine established and emerging interventions to reduce soil carbon losses and increase stocks in grazing systems: A case study for Aotearoa New Zealand

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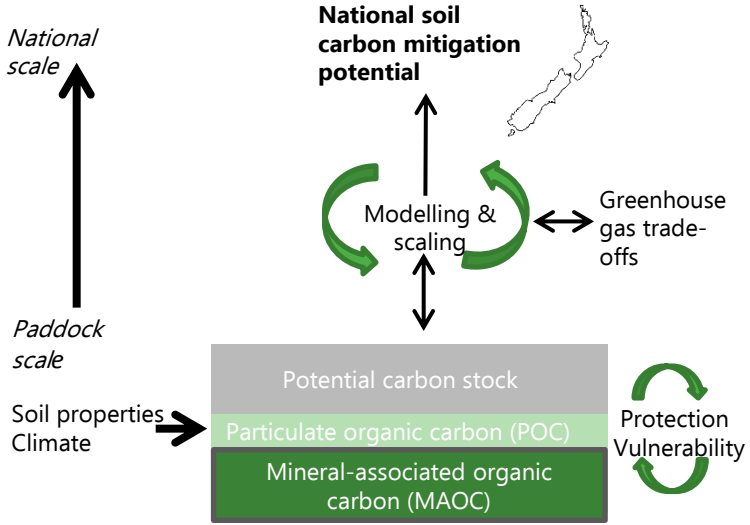

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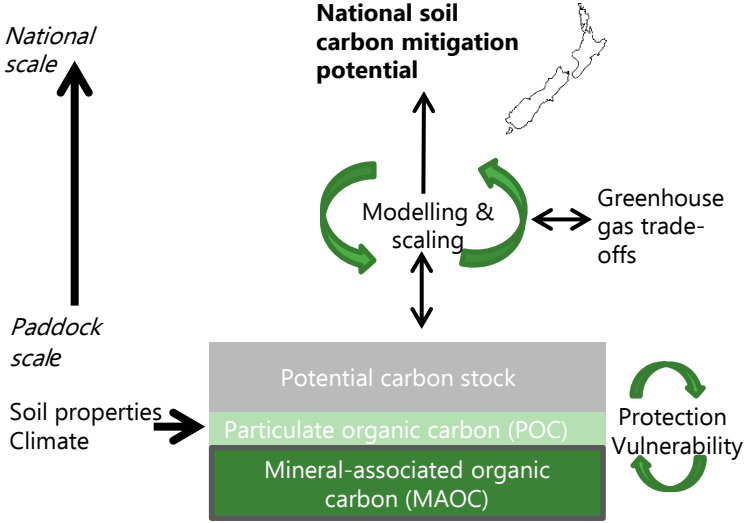
Whitehead et al (2024) *Soil Use and Management* doi:10.1071/SR23177



Interventions for new mitigation opportunities

Carbon inputs
Deep rooting & mixed species swards
Forage crops
Grazing management

Carbon protection
Organic soil management
Full inversion tillage
Clay mineral addition
Enhanced rock weathering

Integrated systems
Integration of trees

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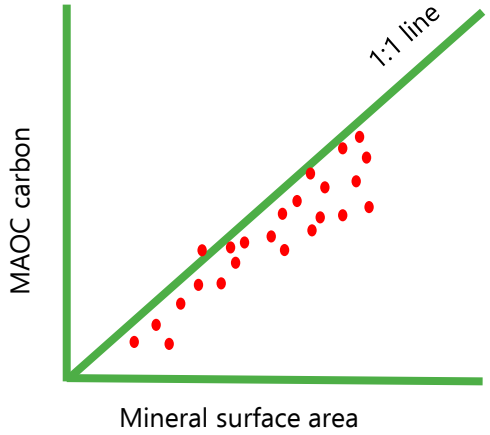
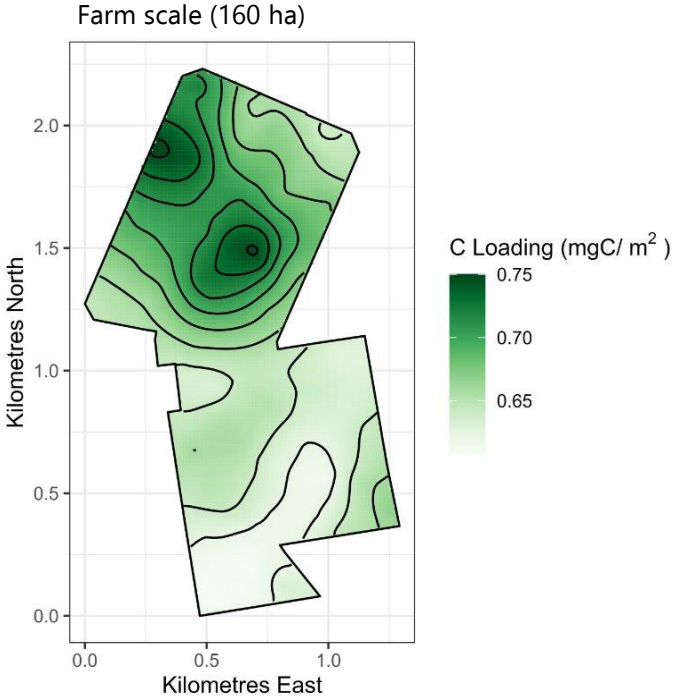
Carbon loading (MAOC/MSA)

- Measurable properties
- Assess potential SOC capacity





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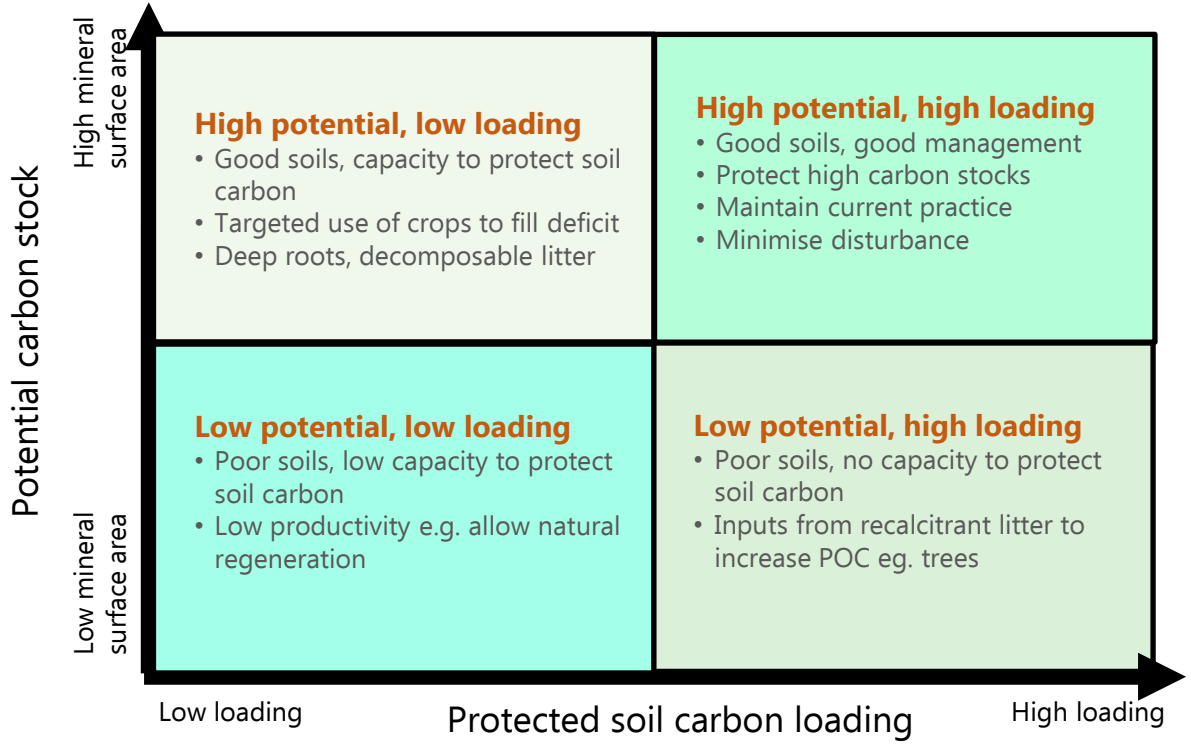

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Increasing carbon inputs

Deep rooting & mixed species swards
Forage crops
Grazing management

Increasing carbon protection

Organic soil management
Full inversion tillage
Clay mineral addition
Enhanced rock weathering

Adopting integrated systems

Integration of trees

Technical potential	Fit with current practices	Time to delivery	Capture in inventory	Co-benefits	Potential national impact	Confidence	Research needs
Existing lab and field findings	Ease of incorporating into current practices	Ready to adopt or new technology to be tested	How to capture adoption	Greenhouse emissions reduction, productivity etc	Impact on national agricultural greenhouse emissions from realistic adoption over 20 years	Confidence based on evidence and uncertainty	Research needed to reduce uncertainty

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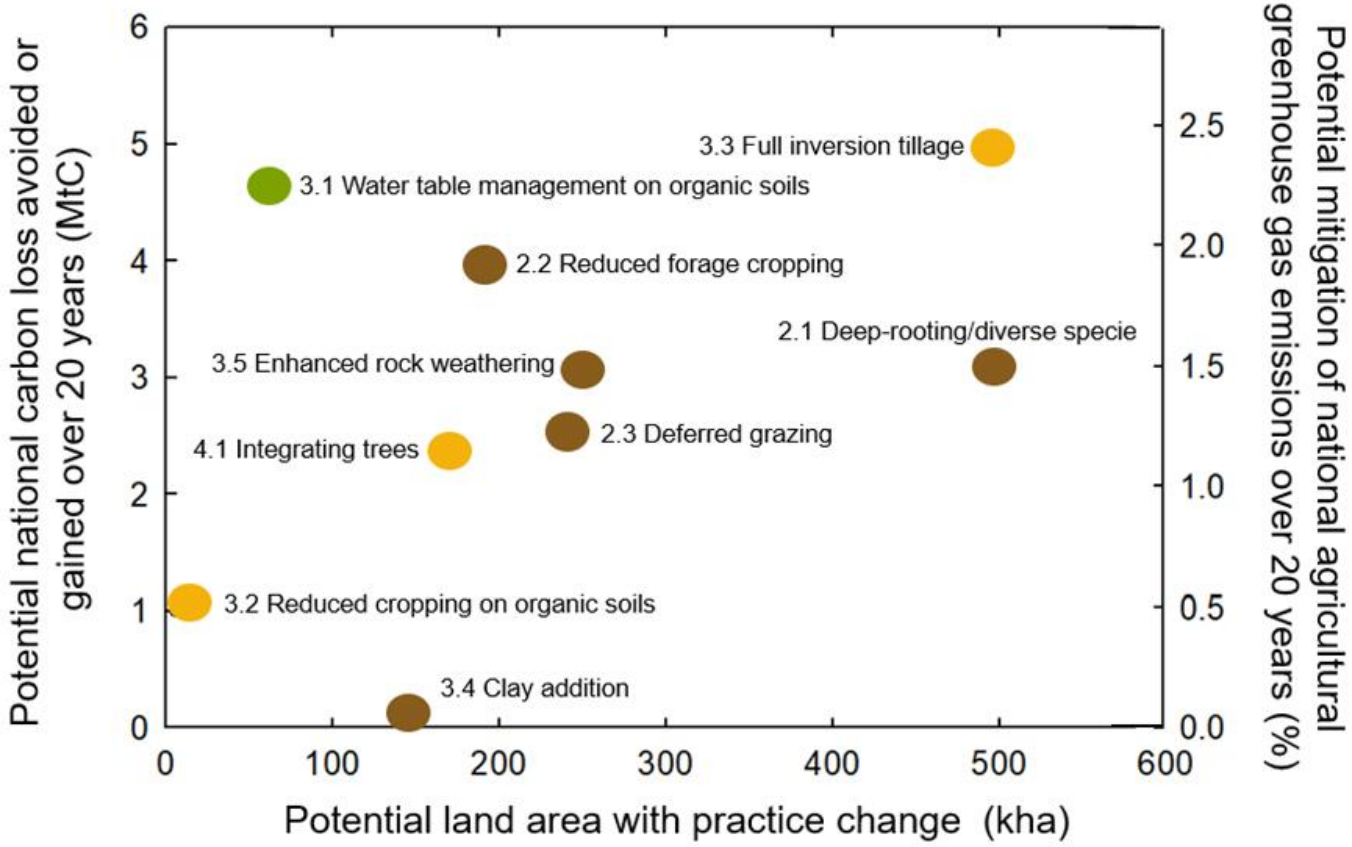

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Barriers & incentives

New Zealand soils have moderate to high SOC stocks
- Maintaining current SOC stocks is critical

No one intervention has large impact
- Impact best achieved through multiple interventions

Limited data on management practices that increase SOC stocks
- Low confidence

No incentives for SOC sequestration
- No clear link between SOC content and production benefits
- High variability in SOC stocks and slow rates of change
- No accepted soil carbon accounting scheme

Planting trees currently only accepted option for C sequestration
- Sequestration in biomass accepted
- Large land area available to integrate trees
- Establishment costs
- Trade-off with milk/meat production

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