Limestone ecosystems

Values, threats, conservation and restoration

Conservation week

Oamaru

Department of Conservation
Te Papa Atawhai

New Zealand Government

DOC Science Advisor

Rare ecosystems

Naturally Rare & Threatened Ecosystems

Common attributes of NRTEs

Bog pine, Wilderness Scientific Reserve, Southland

- > 70 rare/uncommon ecosystems
- 45 Threatened
- High levels of biodiversity & many threatened species
- 0.5% of NZ's land area (~134,000 ha)
- Difficulty in mapping
- Specific threats or specific effects of common threats
- Numerous knowledge gaps
- Poorly protected (legally)

Naturally Rare & Threatened Ecosystems

Coastal turf, Long point, Catlins

Grouping	Ecosystem	Ranking
Inland & Alpine	Eastern lowland limestone erosion pavements	1
	Eastern South Island dryland inland outwash gravels	4
	Mackenzie Basin inland sand dunes	7
	Eastern lowland cliffs, scarps and tors of calcareous rocks	8
	Inland saline (salt pans)	9
	Frost flats & hollows (and dolines)	11
Wetland	Gumlands	3
	Ephemeral wetlands (alluvial terraces)	2
	Cold water springs	12
Coastal	Seabird guano deposits	5
	Shell barrier beaches (chenier plains)	6
	Coastal turfs	10

Naturally Rare & Threatened Ecosystems

Heliohebe raoulii, Weka Pass

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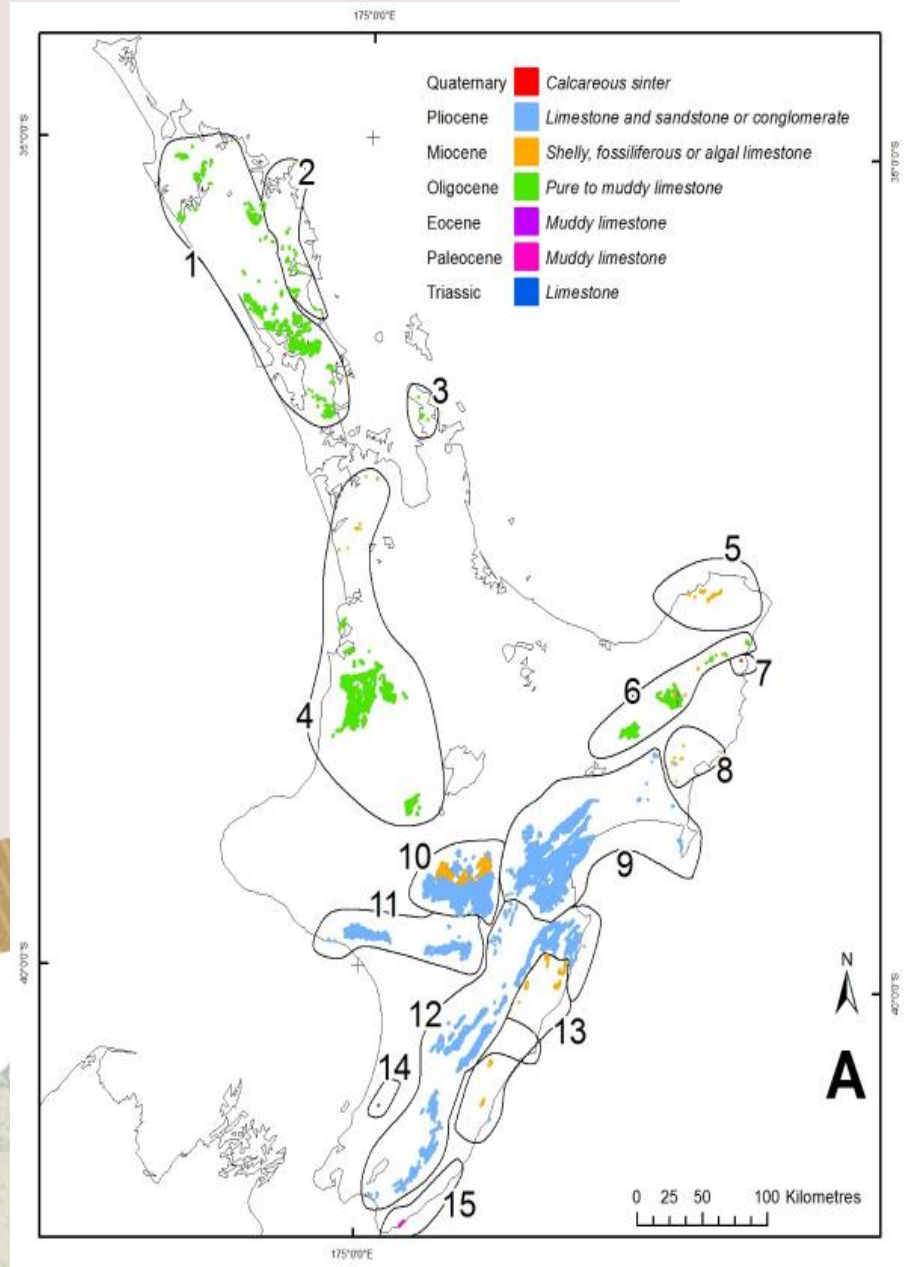
Limestone ecosystem research and management

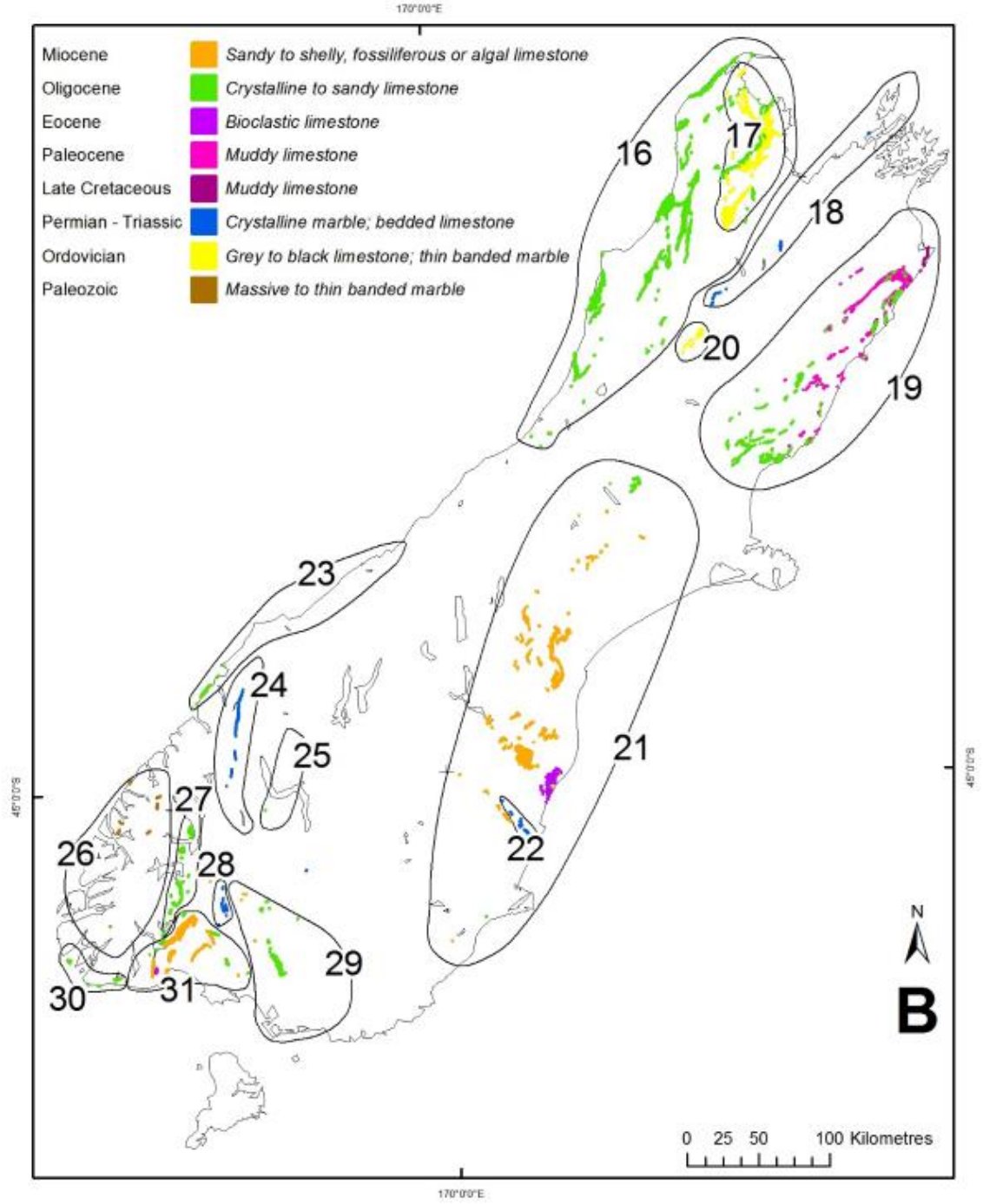
Waitaki Valley

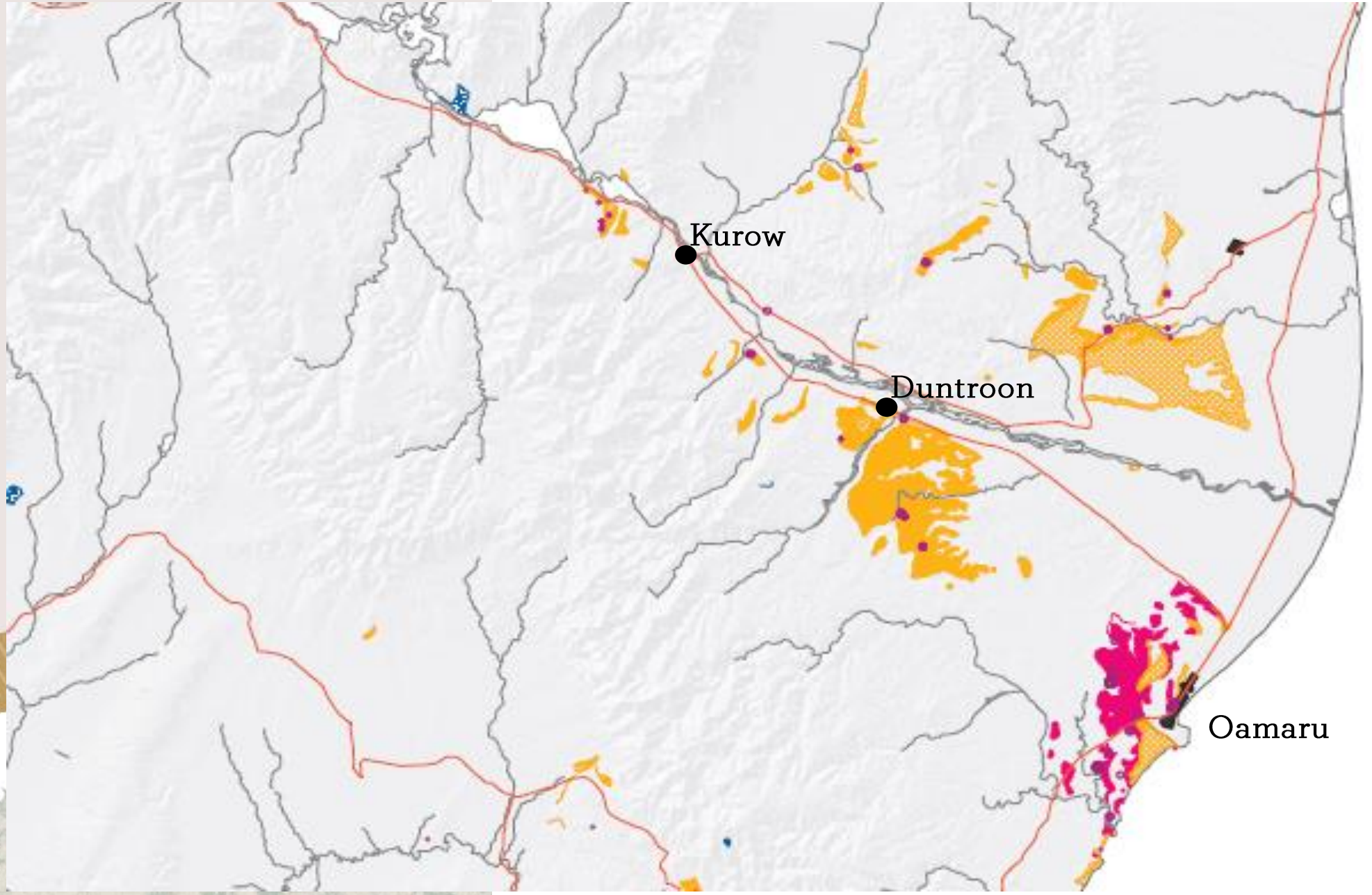
1. **Who?**
   - DOC
   - Te Rūnaka o Moeraki
   - QEII Trust
   - Volunteers
   - University of Otago
   - Private landowners
   - Anyone else keen?
2. **Where?**
   - DOC reserves
   - QEII covenants
   - Private properties
3. **What?**
   - Rare plants
   - Pests/weeds
   - Reforestation
   - Fauna

Gentianella calcis (Nationally Critical)
Only found in the Waitaki

Limestone across New Zealand

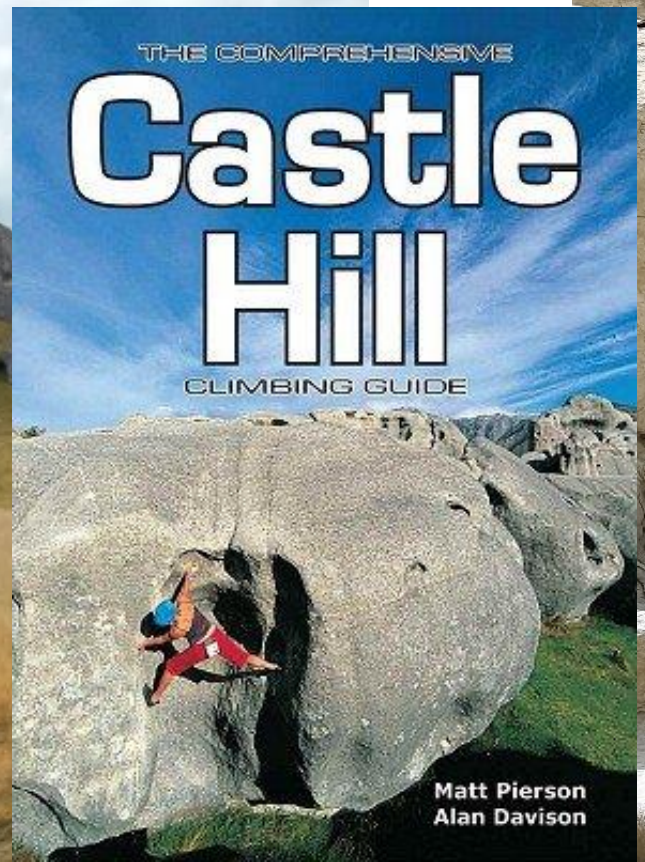





Kurow
Duntroon
Oamaru

Limestone values

Landscape, tourism, recreation…



Limestone values

Resource

Limestone values

Cultural, historical, paleontological

Waitaki Whitestone Geopark

unesco Global Geopark

13 Waipata (Earthquakes)

-44:52:27.575
170:37:24.545

Otekaike Limestone and Kokoamu Greensand, separated from Ototara Limestone by a regional intra-Oligocene unconformity, form large slumped blocks due to mass movement. *In situ* Baleen whale bones.

Protection: Significant Natural Feature

International Scientific Importance

MAP

Geology	✓
Culture	✓
Nature	✓
Education	✓
Vista	

14 Anatini

-44:54:05.482
170:39:15.496

Easily accessible and one of few natural limestone arches in New Zealand, Anatini has baleen whale bones on display nearby as part of Vanished World trail.

Protection: Significant Natural Feature

National Scientific Importance

MAP

Geology	✓
Culture	
Nature	✓
Education	✓
Vista	

15 Elephant Rocks

-44:53:36.131
170:39:22.355

Set in a stunning rural vista these elephant shaped outcrops formed by chemical and wind erosion of Otekaike Limestone, which originated as a fossil rich marine sand 25 million years ago.

Protection: Significant Natural Feature

Regional Scientific Importance

MAP

Geology	✓
Culture	✓
Nature	
Education	✓
Vista	✓

Limestone Ecological values

Pachycladon fasciarium (Nationally Critical)

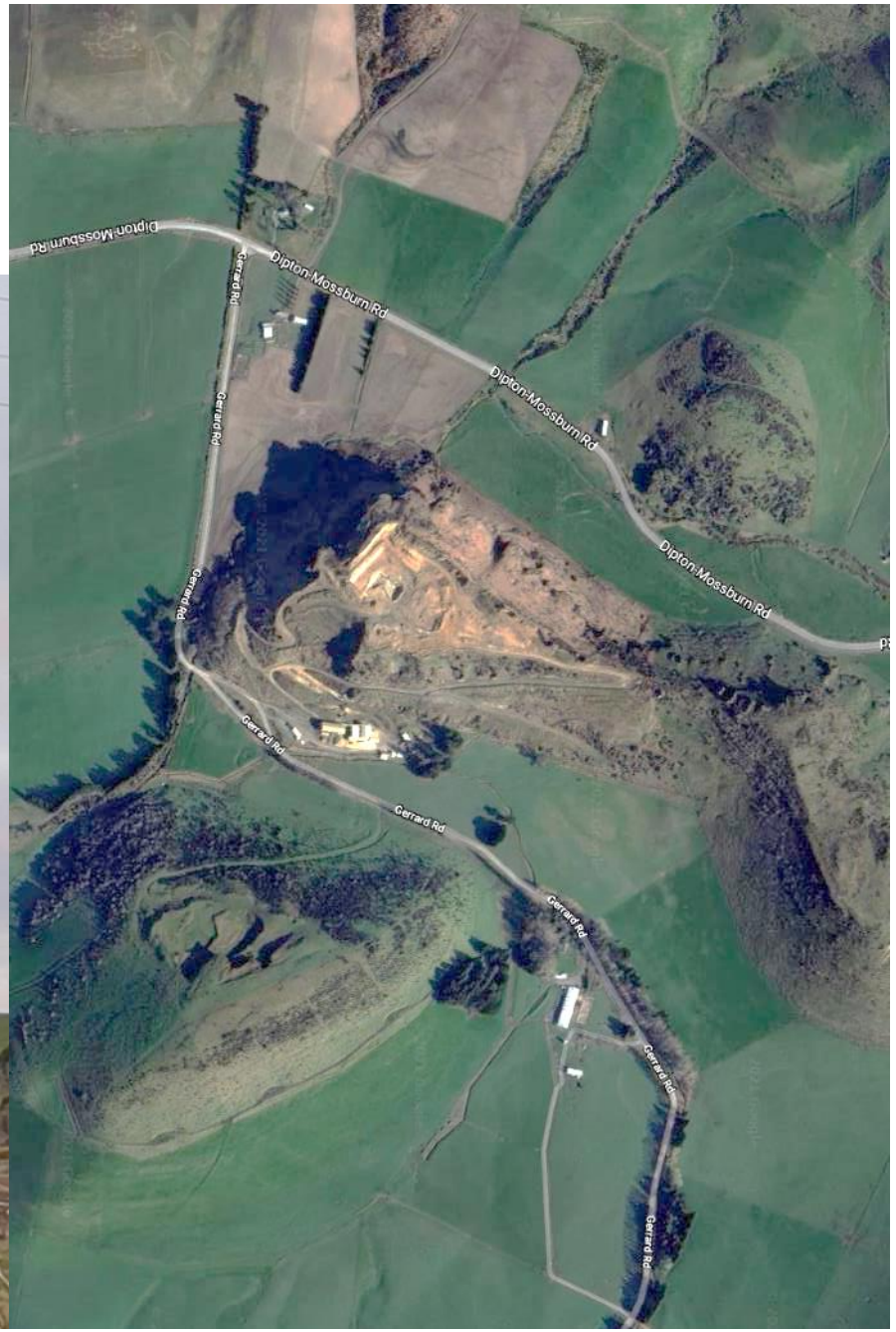
Calcicolous Plants

- 152 species in 2018
- 61 unnamed
- 95% endemic or regionally restricted
- 73% have a total distribution <10ha
- Half are Data Deficient or Threatened
- 1/3 are Nationally Critical

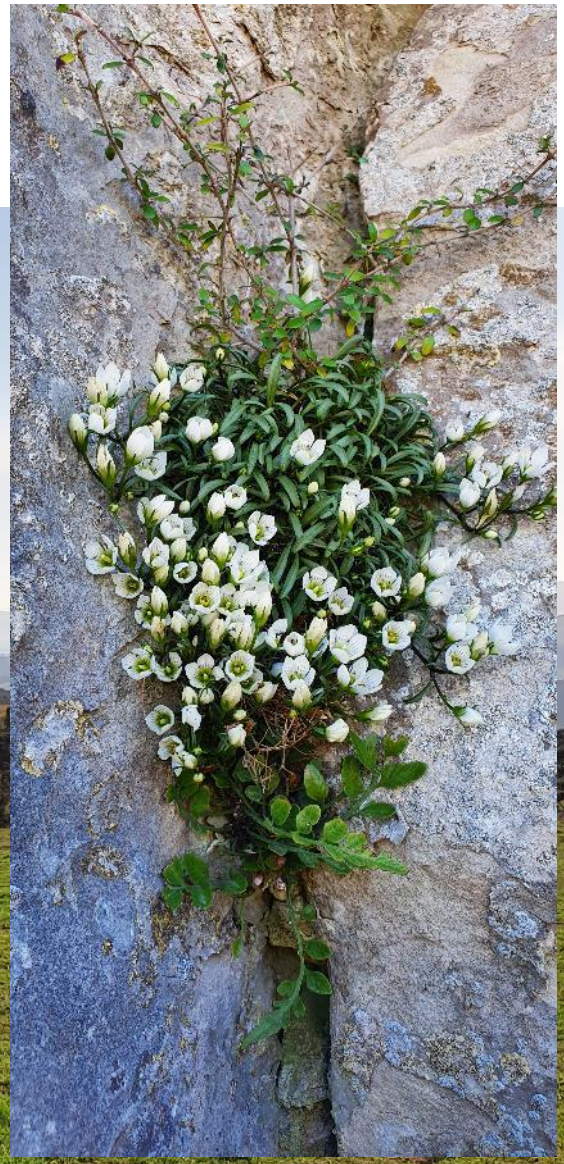
Black-eyed Gecko (Mokopirirakau kahutarae, Nationally Vulnerable)

Cardamine magnifica endemic to Castle Hill Basin in Canterbury

Threats to limestone ecosystems: historically high economic values and lack of legal protection



High values and occurrence on private land



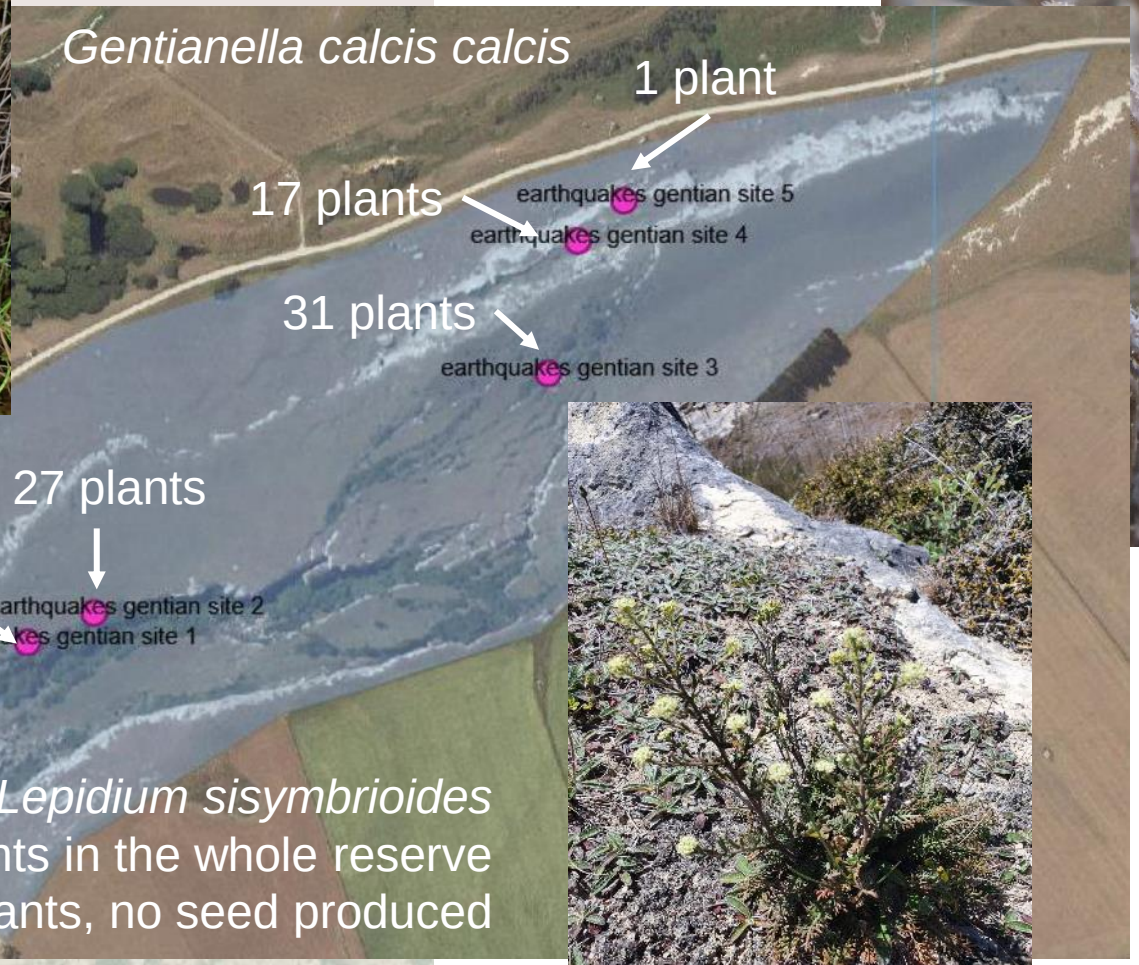
Difficult to locate, monitor and manage

Terrain, habitat and crypticism…

Australopyrum calcis subsp. *Optatum habitat*

Diseases, inbreeding and stochastic events

Small population size effects



Last but not least… Not exactly spectacular!

Pachycladon exile NC W ☼ ★

Limestone Cress

- Found in only one location; previously widespread
- NZ's sixth most endangered species
- Less than 50 individual plants remaining
- Small, slender herb up to 100 mm tall
- Favours dry, exposed habitats
- 3-10 white flowers on a long stem in Oct-Nov
- Dependent on regular weed management
- Prone to fungal diseases and insect damage

Carmichaelia hollowayi NC W ☼ ★

Waitaki Dwarf (Holloways) Broom

- Known from three Waitaki limestone sites
- A member of the legume (pea) family
- Can fix nitrogen from the air into the soil
- Grows up to 0.5 m tall and 1-2 m across
- Sprawling growth form with leafless stems
- Clusters of pink/purple/white flowers, Nov-Dec
- Small seed pods in Jan-May containing 1-3 seeds

Gentianella calcis subspecies *calcis*

Awahokomo Gentian NC W ☼ ★

- Found at three Waitaki limestone sites
- A small plant with long, narrow leaves
- Beautiful white flowers from March-June
- Explosive seed pods; dispersal by wind or water
- Partially dies back over winter
- Found only on limestone bluffs in cracks, crevices or thin, stony soils

Lepidium sisymbrioides NC ☼ ★

- A member of the Brassica family; a cress
- *Lepidium* means 'scale-shaped pods'
- Small plant, 10-15 cm tall, with tall flower stems
- Delicate bronze-coloured foliage
- Tiny white flowers in Sept-Nov
- Deep roots (up to 2 m) to anchor plant
- Seeds can attach to animals for dispersal
- At three sites in Waitaki; also in Central Otago

Chaerophyllum basicola NC ☼ ★

- A member of the parsley family
- Grows in thin soils overlying limestone bedrock
- Tiny cream flowers in Nov-Jan
- Plants may die after flowering
- Wind-dispersed seeds
- Grey-green to blue-grey leathery leaves
- At one site in Waitaki; also in Southland

Key:

- NC Threatened – 'Nationally Critical'
- W Found only in the Waitaki River valley
- ☼ Grows on bare or sparsely vegetated sites
- ★ All populations at serious risk of decline

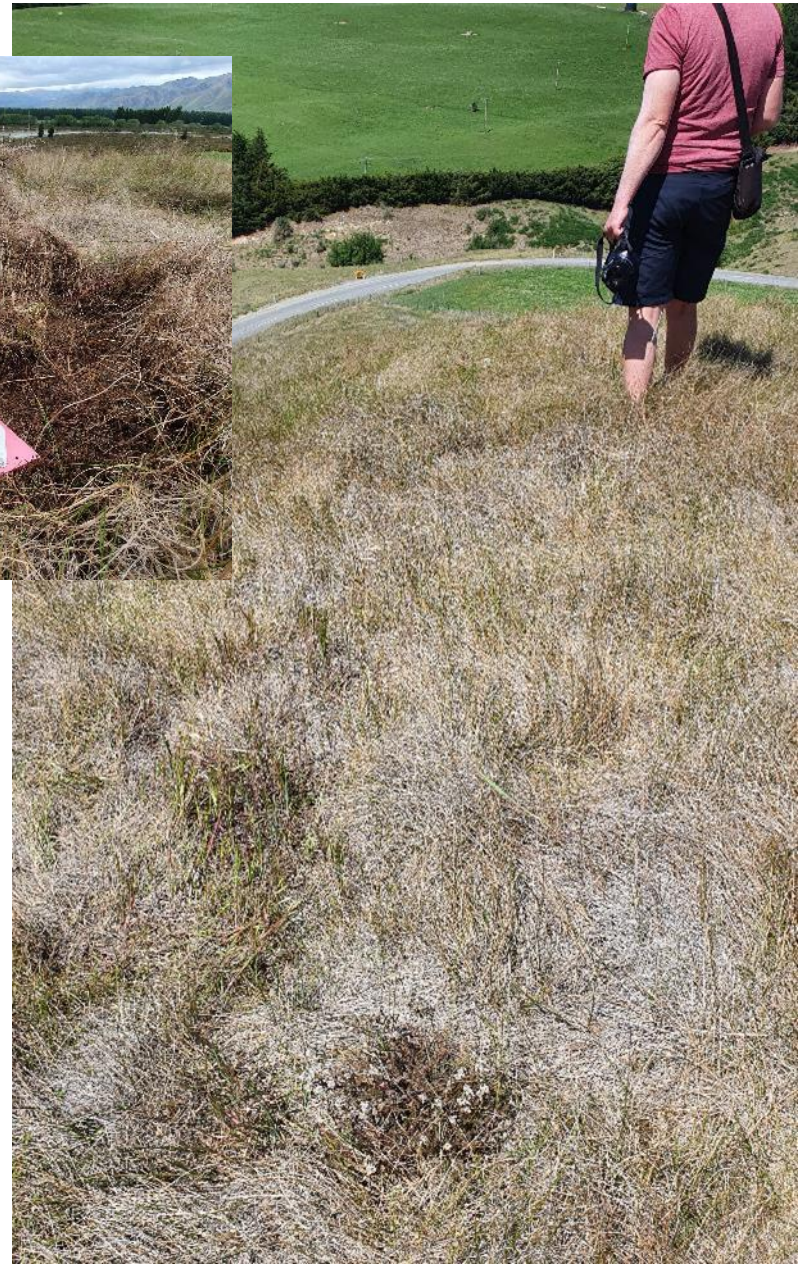
Cardamine bilobata NC W ☼ ★

- From the Brassica family; a cress/mustard
- Grows on shallow limestone soils and pavements
- Limited to one limestone site
- Leathery leaves, red-brown to green colour
- White flowers, Sept-Dec, in groups of 4-20
- Reliant on weed control for space
- Seeds in long pods; explosive seed dispersal
- From the Greek *kárdamon*, a spice plant

What are we doing?

Urgency: species management

- Monitoring, surveying
- seed collection
- Hand weeding
- Baby-sitting…



Provide legal protection and basic management

Wai o Toura and Waipata reserves

Otago Daily Times

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Friday, **1 November 2013**

Winning the battle against boxthorn pest

By online editor

Business » Farming

- Fencing and grazing retirement
- Woody weeds removal (gorse, broom, boxthorn, pine, cotoneaster)

New issues…

Pasture and swarding grasses

Stuck between a rock and a hard place

Need for a holistic approach

Next steps?

Long term: ecosystem restoration

- We first need to set goals and identify issues
- Then what to do…
- Finally, how to do it!

Raise awareness

Work **with** all stakeholders

- Latitude magazine article
- Geopark flyer and interpretation panel
- RNZ – our changing world
- NZES2022 Dunedin

Living on the Ledge

Rare Plants of Waitaki Limestone Outcrops

Waitaki Dwarf Broom, *Carmichaelia hollowayi*

WAITAKI WHITESTONE ASPIRING GLOBAL GEOPARK AOTEAROA NEW ZEALAND

INTRODUCTION

Limestone outcrops are a significant geological feature of the Waitaki region. Famous for their fossilised marine creatures and Māori rock art, limestone sites are also refugia for some of New Zealand's most critically endangered plants.

The Waitaki River valley is home to many locally endemic plant species. Endemic means they are found nowhere else in the world. Limestone cliffs, crevices and ledges offer unique habitats for small, low-growing plants to take hold.

Each limestone outcrop is like an island, isolated from other outcrops. The limestone substrate is high in minerals such as calcium and does not hold water for long, therefore it is often dry. Rock outcrops are very exposed to the elements so are prone to weathering and erosion.

Life isn't easy for plants on a limestone ledge. They face many challenges and will need the help of conservation experts and our local community to ensure their long-term survival.

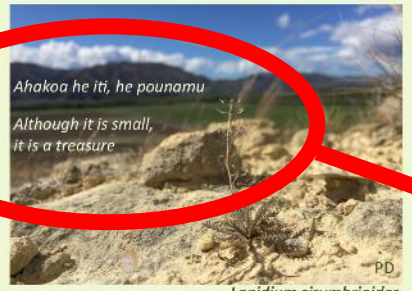
CHALLENGES FOR LIMESTONE PLANTS

- Very small population sizes
- Significant habitat loss
- Browsing by introduced pests (rabbits, hares, possums, etc.) and stock
- Invasion by weeds causing competition for space on rock outcrops
- Failure to set seeds or reproduce
- Exposure to extreme weather and wind
- High rate of habitat erosion
- Isolated from similar sites
- Difficult sites to manage due to topography, private land, etc.

HOW THESE PLANTS ARE BEING HELPED

Protection from animal browsing:
- Rabbit-proof fencing
- Pest animal control at significant sites
- Stock kept out of limestone outcrops
- Cages placed over most vulnerable plants

Reduction of invasive weeds:
- Maintain weeded areas around rarest plants
- Removal of woody weeds (gorse, broom, etc.)



Lepidium sisymbrioides

Replanting native trees and shrubs:
- Local seeds sourced for propagation
- Local community involvement

Increasing the number of rare plants:
- Collect their seeds
- Propagate seeds in nurseries
- Translocate back to natural site

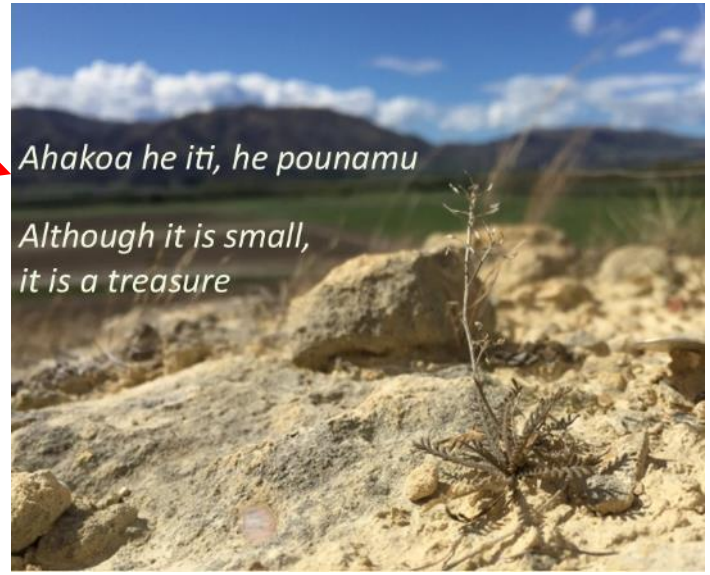
Monitoring and managing:
- Survey sites to understand plant distribution
- Increase public awareness and engage with private land owners

Text: Petrina Duncan **Photography:** Peter Heenan (PH), O2 Landscapes (O2), Petrina Duncan (PD)

Defending Limestone Castles

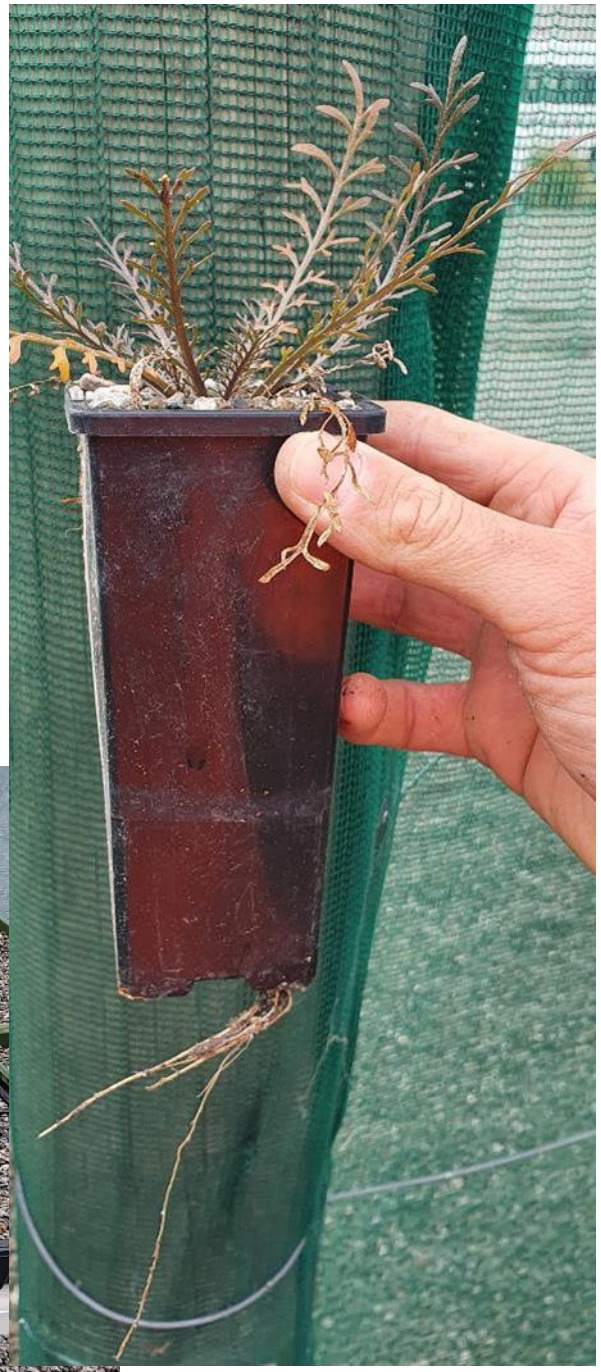
Neglected by a lack of resources, public interest and advocacy for their protection, limestone outcrops in the Waitaki Valley and across South Canterbury are home to a suite of endemic plants, including some of New Zealand's most endangered species.

WORDS **Annie Studholme**



Preserve the unique biodiversity

Looking after the plants until we restore the ecosystem



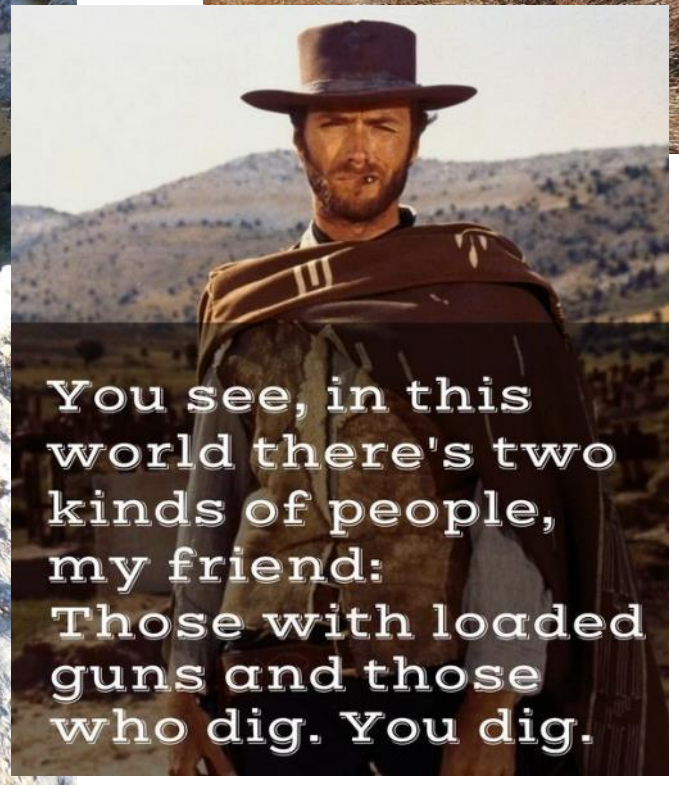
Key step

Pre-translocation hardening

Translocation

But where?

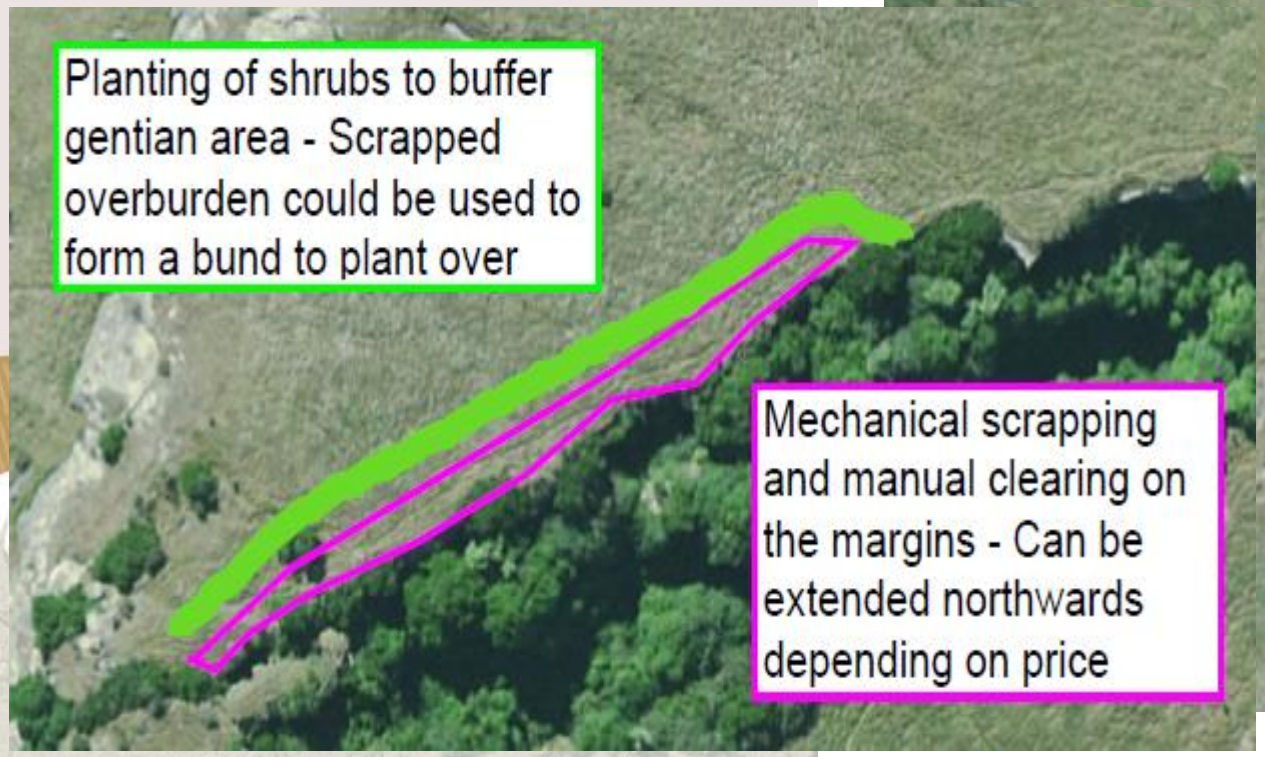
Habitat restoration or (re)creation

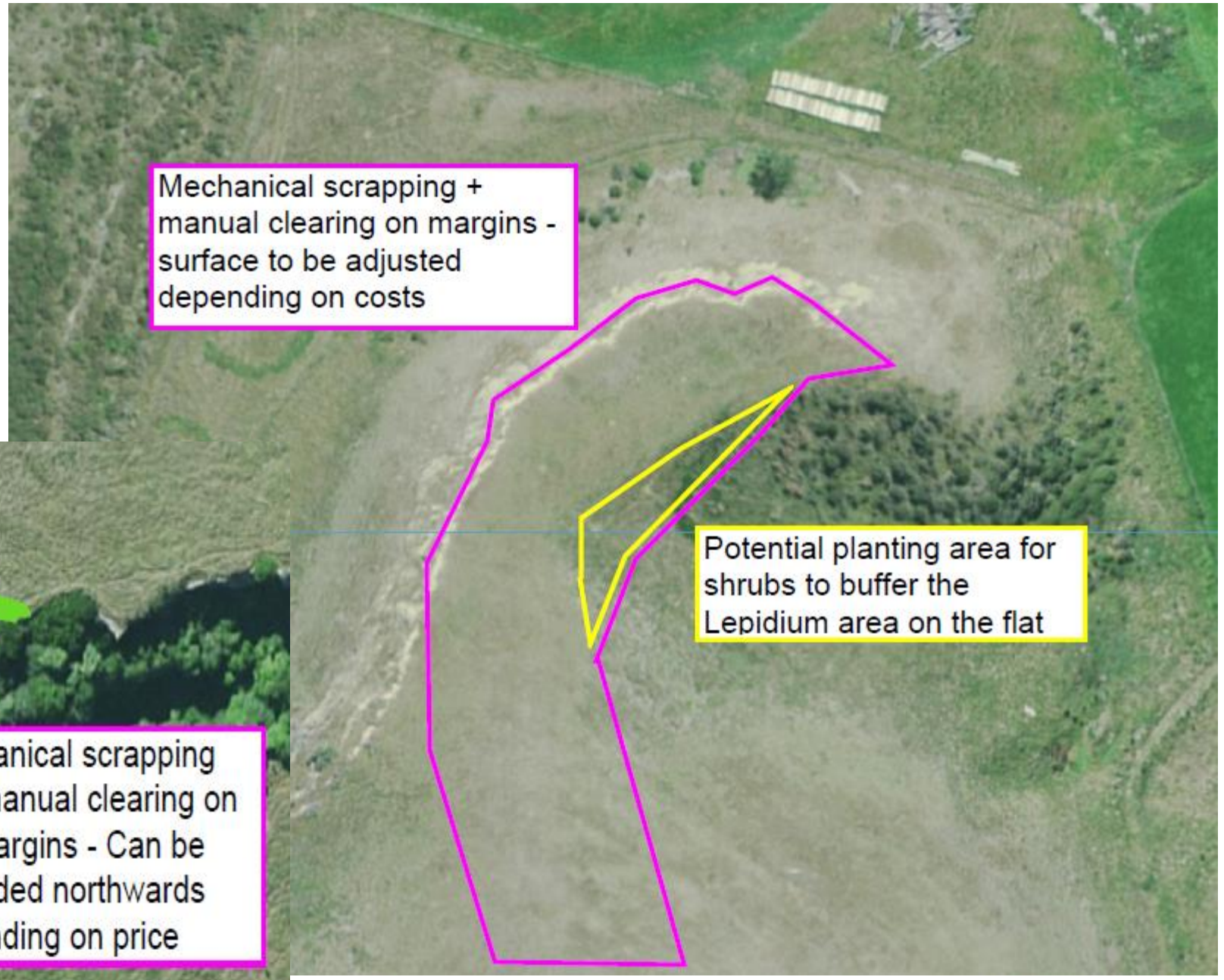


Small-scale trials

Scaling up…

Small scale trials proved the concept but not enough

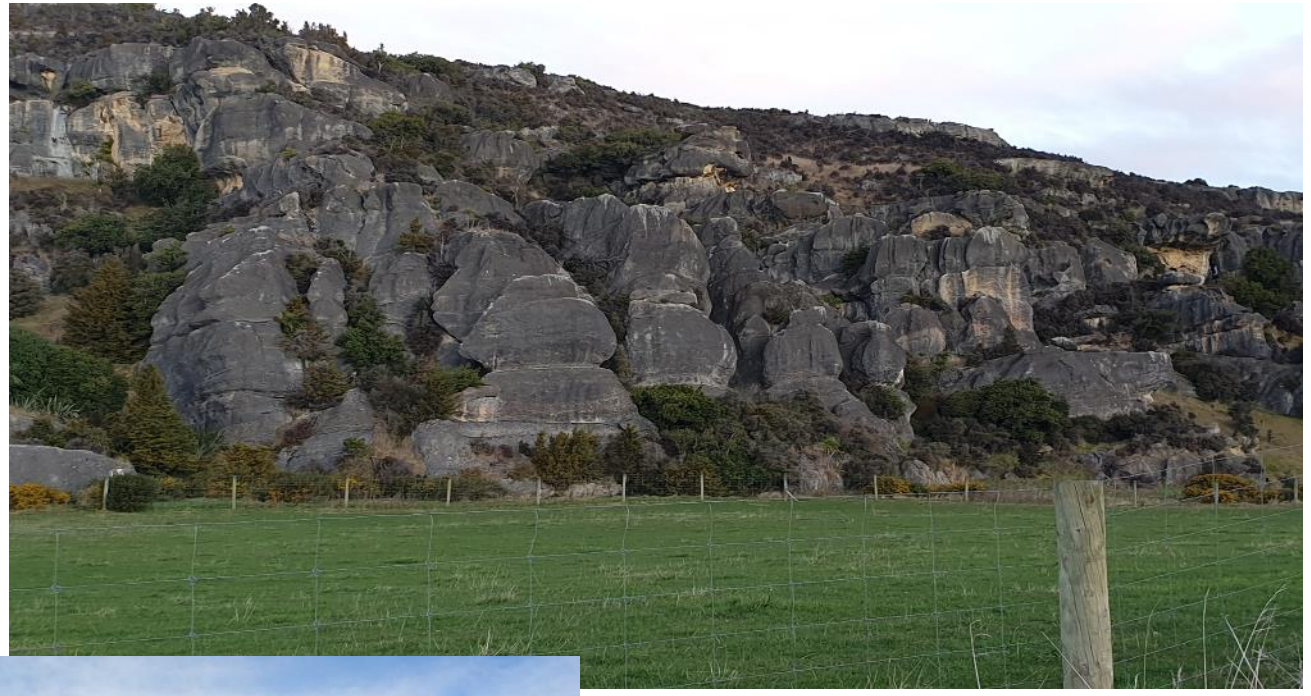


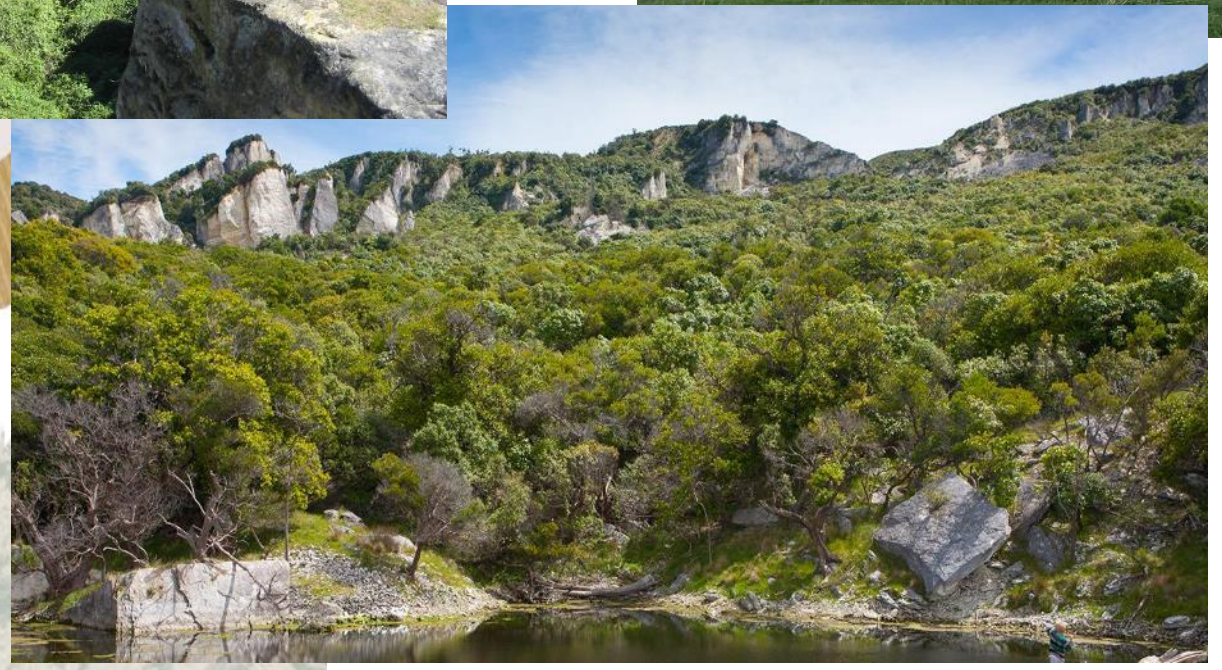


Scaling-up

Forest component

Natural protection for limestone outcrops





Large scale woody vegetation restoration

Wai O Toura - Gards Road Scenic Reserve

Start with a blank canvas…

Large scale forest restoration

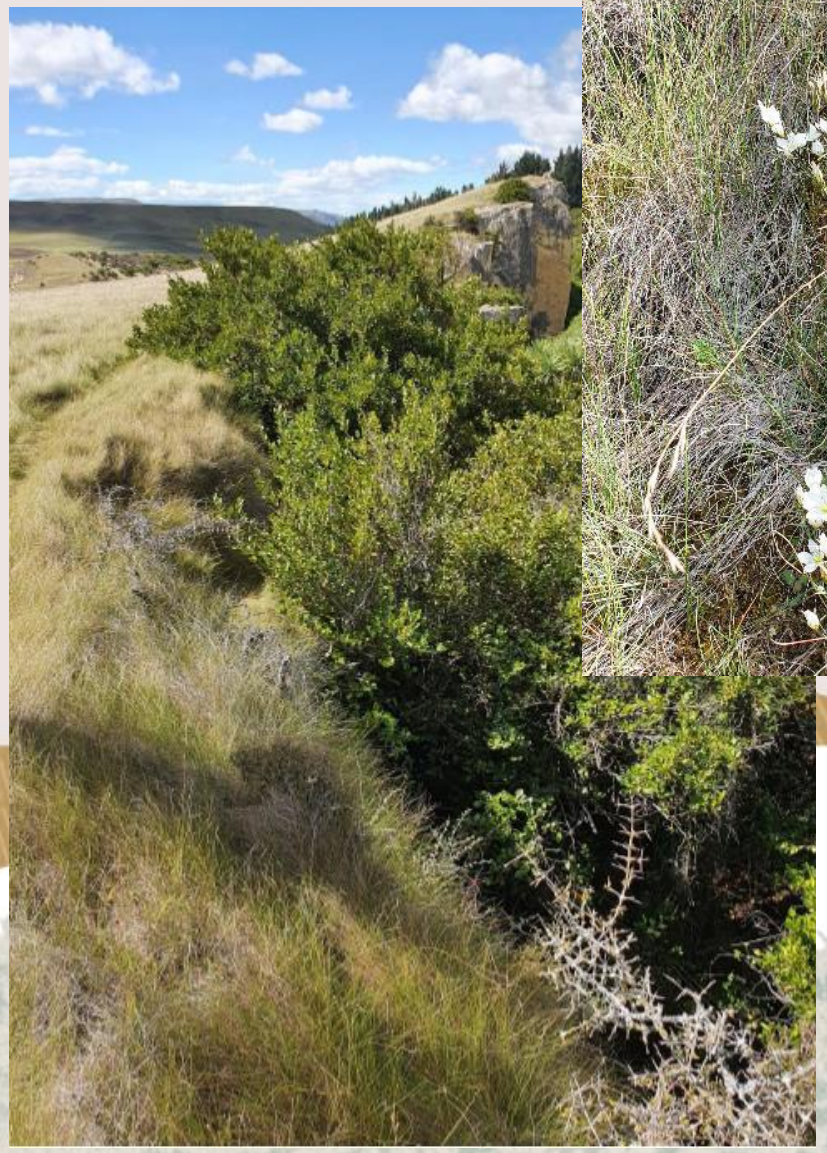
Wai O Toura - Gards Road Scenic Reserve

Forest restoration

Key to ecosystem functioning and resilience

But 15–20-year timescale

Current state of affairs



- Ecosystem-scale restoration and management
- Propagation and translocation of threatened plants to restored habitats
- Large scale woody vegetation restoration: Methods, outcomes and benefits
- Invertebrates in limestone ecosystems: values and roles?
- Lizard fauna in limestone: Effects of rank grass, rodents and predators?

Native limestone snails

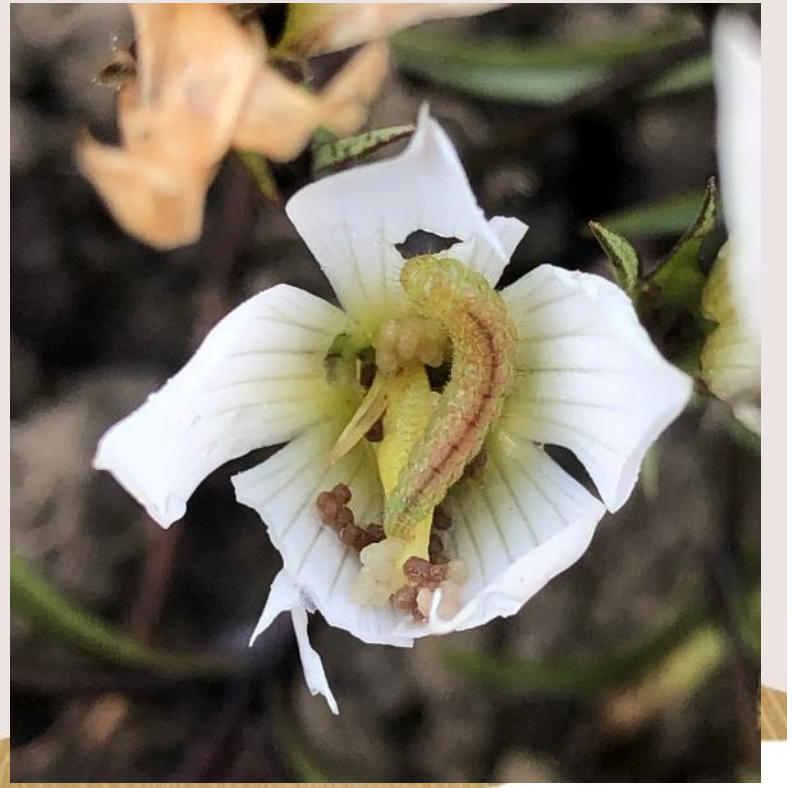
Clear indicator of native forest health and maturity

- Values of remnant native bush as refugia for snails
- Values of snails as indicator taxa in limestone

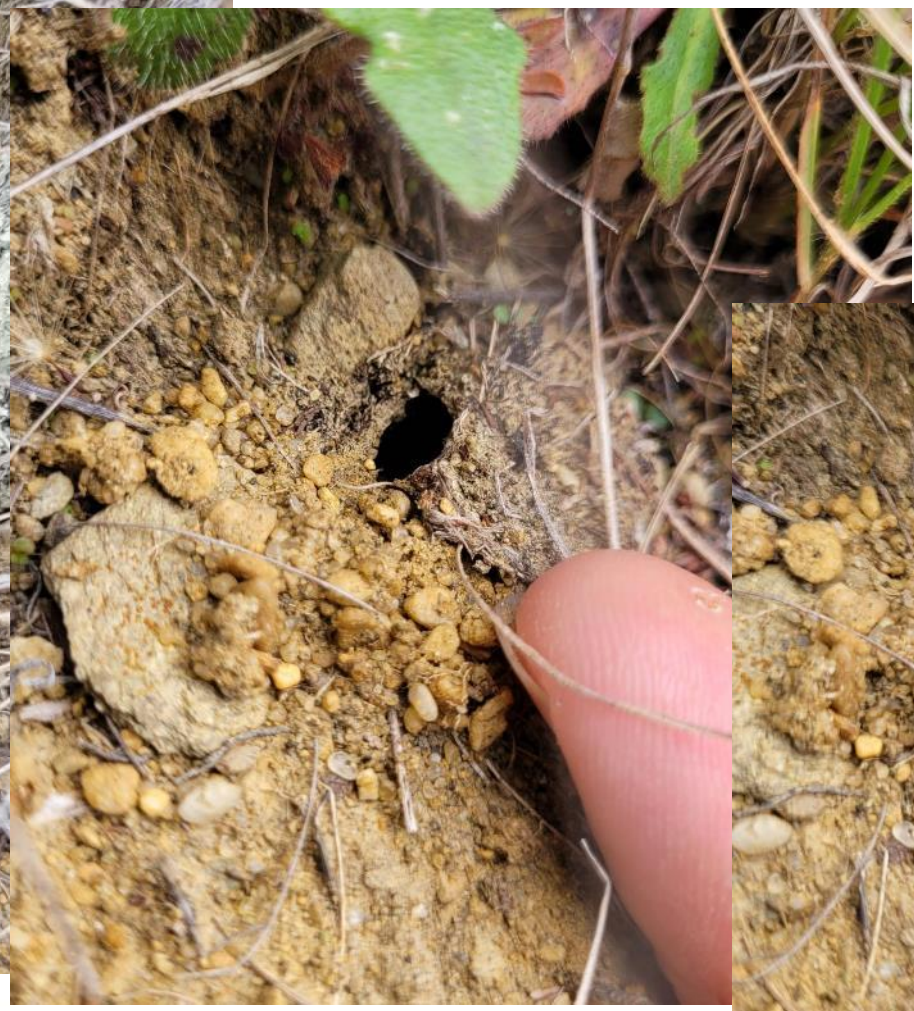
Lizard fauna in limestone ecosystems

- High potential values for lizards, originally and as potential refugia
- Effects of current threats (weeds, rodents and predators)?
- Indicator species when management occurs?
- Potential translocations based on subfossils evidence?

Pollinators and plant predators



Other faunal values



Long road to recovery: Holistic approach to ecosystem management

At the moment, we are babysitting what is left, but that is not a solution long term. If we can turn the tide on the ecosystem as a whole in a more holistic way, then the plants should follow. We are past the manage and protect and more into a recovery and restore approach now. We need to lay out and test the blueprints to the road for recovery. Even if it's a long and winding road...