

Kaikōura: Return of the birds

Site background

Ecology
Kaikōura is a small seaside town that is bustling with marine life and coastal birds. Many endangered or declining birds such as the banded dotterel and black-billed gull nest and feed along the Kaikōura coastline. The Kaikōura peninsula was once home to many native bush birds that lived in the extensive mixed broadleaf forests but due to the clearing of vegetation by both Maori and Europeans for farming native bush birds are a rare sight.

Tourism
The whales that feed on the edge of the Hikurangi Trench are the main tourist attraction in Kaikōura the town relies heavily on this. With few other attractions and its location on SH1 Kaikōura is a 1 day destination for many tourists meaning the town misses out on the revenue of multi-night tourists.

Culture
With the rebuild after the Kaikōura earthquake, tourism is expected to increase however, this often has negative impacts on culture and place with commercialisation and placeless activities.

Vision
This project will build on the diverse environment of Kaikōura to transform the peninsula into a sanctuary for coastal and bush birds. This sanctuary will provide tourists with a range of activities to engage with the natural environment and culture of Kaikōura.

Goals and objectives

- To create a sanctuary for birds
- To create a predator free peninsula
- To revegetate the peninsula with native food providing trees

- Create activities and design elements related specifically to place
- To use local materials
- To let geology, culture and ecology inform design
- To create unique experiences

Key Drivers

- Accessibility
- Sustainability

Assumptions

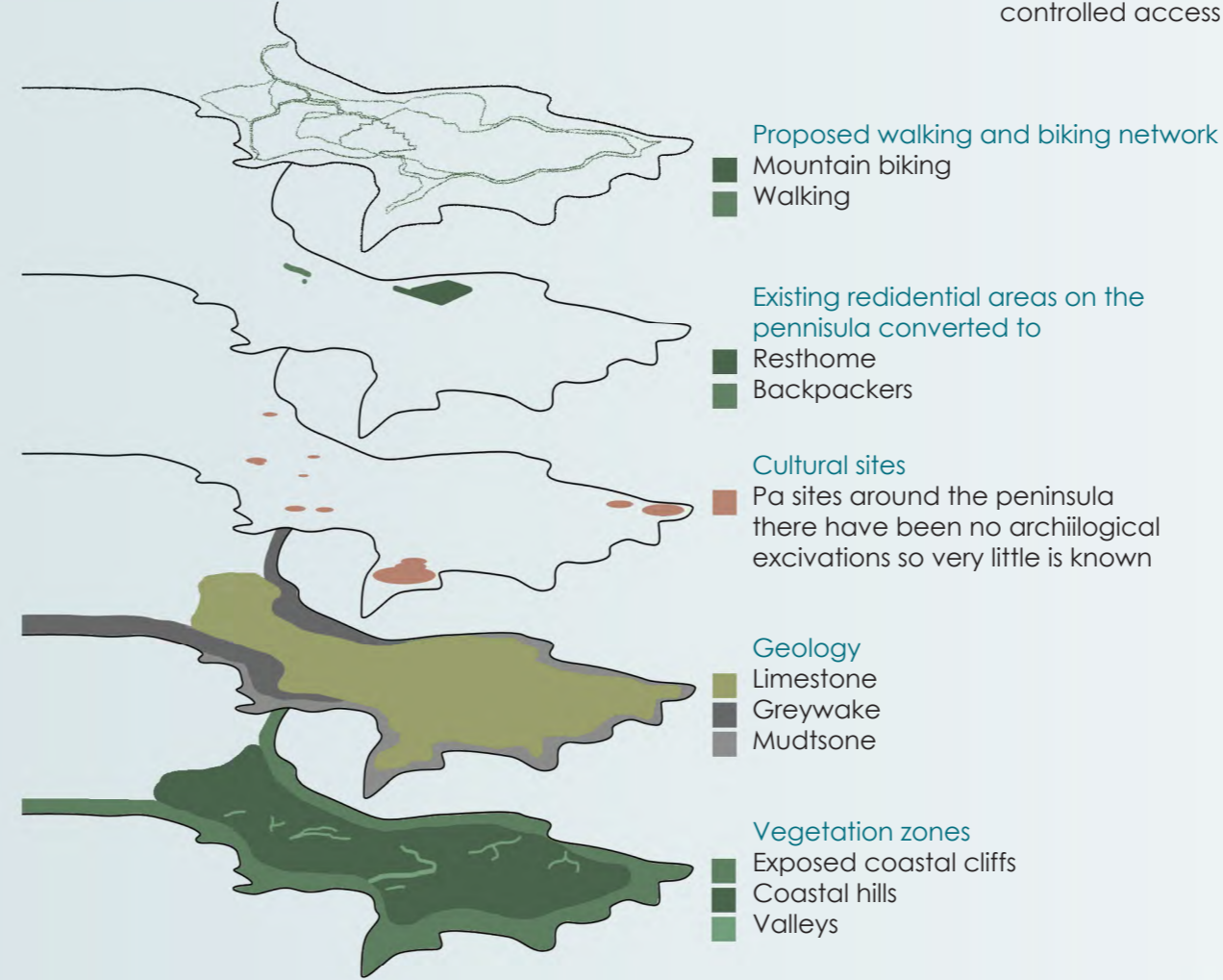
- Predator proof fence success
- Community is on board
- Battery storage and solar efficiency will be improved

Birds that will be reintroduced to the Kaikōura peninsula



Meurk and halls (2006) Patch theory
It is 10km between the peninsula and source habitat so one large patch is required half way along with the addition of smaller patches

Case studies of other bird sanctuaries in New Zealand and how they have used predator proof fences



Native Birds

Native vegetation

Renewable energy

Pests

Walking biking tracks

Land fill use

Tourists experience

Tourism economy

20km of Ebike compatible tracks

15km of mountain biking tracks

12km of Accessible walking tracks

10km of walking tracks

10 Bird hides

5 Viewing platforms

15 Bee hives

304 Hectares Pollinated

Plant Nursery
200,000 plants grown per year
Ecosourced seeds
20 Residents employed

Revegetation
27.6Ha planted per year
Total of 2 million Trees planted and 304Ha revegetated

Solar power
300KW hours per year

15% 60% 24%

Key Interventions

Cats
To allow the diverse range of birds to establish and flourish in the area predation needs to be significantly reduced. As cats are the number one predator for birds, there will be a local policy implemented that will ban all cats from the town. This will be a staged approach with all cats being neutered and no new cats introduced by 2020. With an average lifespan of 15 years and very few exceeding 20, by 2040 an area with a radius of 5 km from the peninsula will be cat free. The fence will utilise the peninsulas form using the coastline as a predator-proof barrier requiring less fencing this is modelled off Cape Sanctuary.

Predator proof fence
With cats eliminated as the most agile predator, the predator-proof fence only needs to be 1.2m in height. There will be designs along the fence that comply with predator-proof regulations to make the fence more attractive. There will be one vehicle access point and several pedestrian gates using the latest technology to ensure no predators can pass.

Revegetation
304 Ha of the peninsula will be revegetated to provide habitat for the birds. This will be based on a mixture of vegetation that historically grew on the site as well as plants that are adapted to the current site conditions and provide food and habitat for the birds. The farmland adjacent to Lyell Creek will be returned to a wetland providing a diverse range of habitats for the birds as well as flood mitigation. A network of patches and corridors will be integrated within the existing farming matrix to provide routes for birds to travel from source habitats to the peninsula. Based on Meurk and Hall's theory, this will create stepping stones for larger birds and corridors for smaller bush birds.

Core habitat
A core habitat will be established on the peninsula. This area will have limited human interaction to reduce disturbances to specialist species, particularly ground feeding and low canopy dwelling birds as well as reducing the impact of vegetation on the forest floor. This is also important for when Kiwi are introduced.

Translocation
Translocation will be required to establish an initial population of smaller bird species such as the Rifleman which will be unable to make the journey until the corridors become well established. In 50 years once the vegetation has matured, the peninsula will meet the habitat requirements for Kiwi. Once this is achieved a small breeding population will be introduced to the core habitat area of the peninsula.

Voluntourism/ Community engagement
The peninsula and surrounding networks will be revegetated by a mixture of voluntourists, community groups, business and schools. This will engage people with the project and connect them to the place.

Recycling station
The recycling station will be refurbished to make it an attractive, pleasant and clean place to go. Additional recycling facilities will be added to convert plastic collected from the town and ocean into wet suits, fishing line, buoys and kayaks. The size of the rubbish centre will also be reduced as the town migrates to a more sustainable mindset.

Solar panels
All facilities and activities on the peninsula will run off renewable energy predominantly solar energy. The sustainable practices used on the peninsula will act as a benchmark for how the Kaikōura township develops with homes and businesses converting to renewable energy sources.

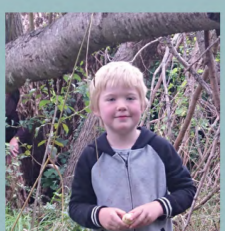
Township and beyond
As the peninsula is revegetated so too will the surrounding township. Residents will be inspired to plant more natives in their own gardens so eventually Tui, Silvereyes and Kereru will be prevalent amongst the seabirds in the town. This will continue out into the landscape with streams and lakes like Lake Rotorua being revegetated to support wetland birds.

Retirement village
A retirement village will be retrofitted into the existing settlement on the peninsula. This will enable elderly who have lived their life in Kaikōura, on the ocean or in the mountains to live their twilight years in a sanctuary full of wildlife. All profits from the rest home will help fund conservation efforts on the peninsula and surrounding areas.

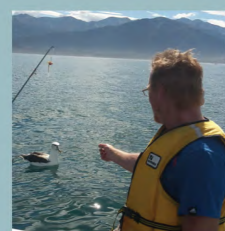
Shareholders
The land will be brought in a joint partnership between Ngai Tahu and the New Zealand government, making it public land with the shareholders doing everything in the best interest of the flora and fauna. Local businesses will benefit from the tourism generated by the peninsula.

Legend

- MTB tracks
- Playground
- Recycling center
- Accessible tracks
- Birdwatching
- Resthome
- Existing dolphin watch
- Existing whale watch
- Snorkling
- Steeper walking tracks
- Cafe
- Pa
- Core habitat
- Birds



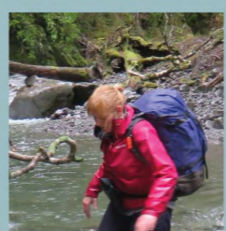
Cameon is on a short holiday with his family. He loves watching the birds fly past him and running off to find logs to look under for bugs. He normally doesn't like long walks very much as he gets board. But he loved walking around the peninsula with his family because there was lots of things to do on they way like the Kiwi hopt! He really wants to come back again so that he can see how big the seedling he planted has gotten.



Paul is a keen fisherman that has spent his life around kaikōura. He loves to get stuck in and help out and has attended every planting day on the peninsula so far. He loves native birds and would one day like to hear them in his back yard. He also likes to help out in the plant nursery and hopes that one day he will get to live out his life here.



James is a ornithologist from Scotland and has come to study the success of breeding populations in solely revegetated forests. He has timed his visit so that he could also take part in the natural seed sourcing workshop being held at Ohanga. His favorite part of the day is the walk from the lodge to the research lab where the sound of the seabirds and waves echo up the valley and join the chorus of native bush birds.



Pamela loves to go tramping but since her knee injury there are not many walks she can do that are not in the city, so she made a special trip to kaikōura. She spent the day walking through the native forest on a forgiving track she decided to take some seedlings with her and plant them as she walked around. After a long enjoyable day she stopped at the Ohanga cafe for a coffee. Feeling a little sore after the walk she was glad to find an Ebike to ride back to the town centre.



Design intent

Kaifakifanga will underpin the philosophy of the sanctuary with both the land being looked after but people too. A retirement village will be retrofitted into the sanctuary to give the elderly the end to life they deserve and people of all mobility will be catered for through a range of track gradients and transport options, these pathways will also be used to tell the cultural narrative of the landscape. The large scale revegetation of the peninsula will create a diverse ecological environment for many bush birds which will form the basis of educational activities.

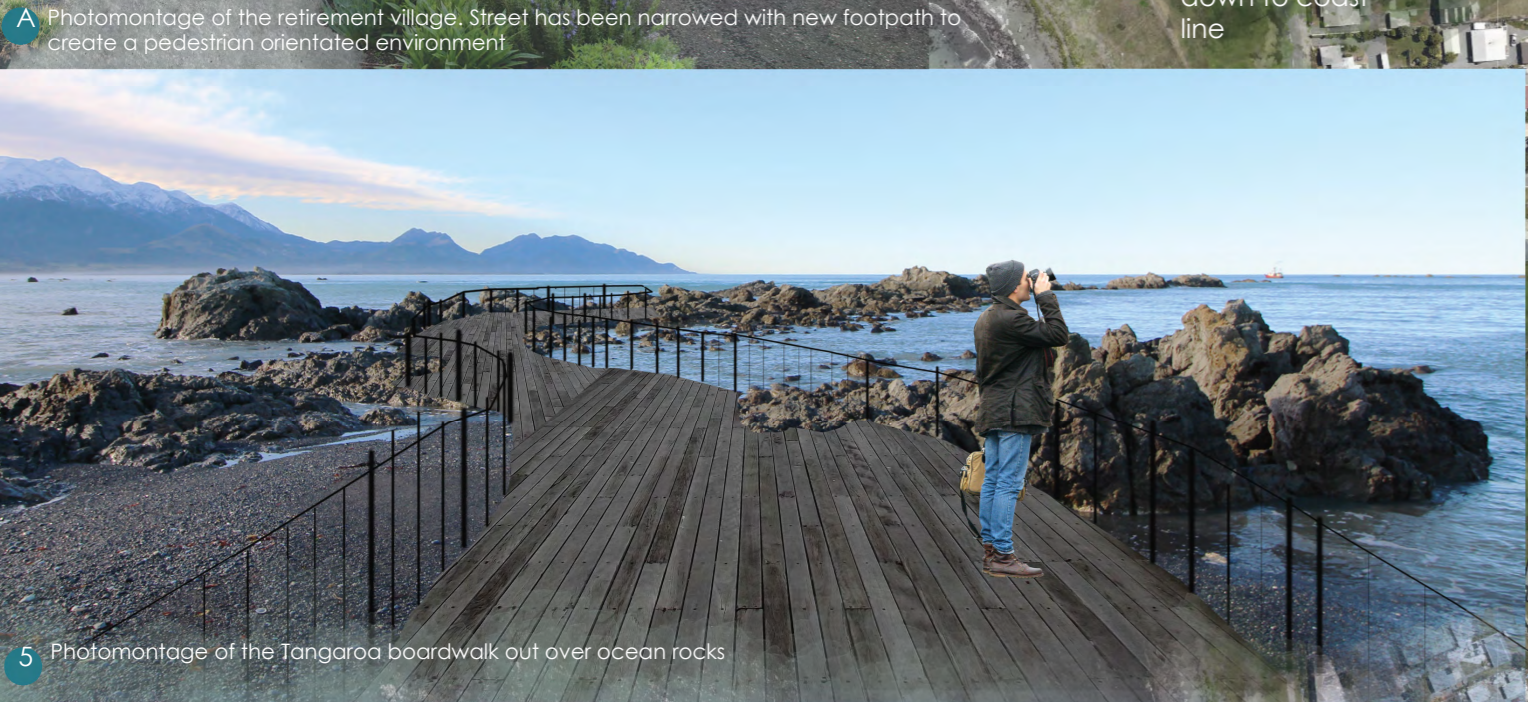


Existing vegetation on the Kaikōura peninsula



Key Interventions

- 1 Plant nursery**
The plant nursery will provide plants for revegetating the peninsula. It is located along the main pathway so people can watch the plants as they grow. They can also walk through the nursery where they will find information panels on the plants. Plants will be paid for through fundraising and grants with planting being done on a volunteer basis. Plants can be picked up by locals and planted in designated zones.
- 2 Bees**
Beehives will be placed around the peninsula to ensure the highest chance of cross-pollination and plant growth. Fifteen hives will be placed around the peninsula to ensure native pollinators are not outcompeted and that there is enough pollen for each colony. Excess honey is collected for use in the cafe but left for the bees when they enter hibernation in winter. The bees will also provide a food source for some birds.
- 3 Birdwatching**
Bird hides are scattered around the coast and throughout the forest to give bird watchers a place to sit and record as well as providing shelter and educational points for other users. An Artificial intelligence wildlife interface will be developed that can identify birds and mammals that the camera is pointed at giving the user information on the bird based in its tracking tags.
- 4 Peninsula to coast**
Patches of trees and plants will extend from the top of the peninsula down along the coast to protect people from the sun as well as providing nesting materials and sheltered habitat for coastal birds without obscuring residents' views of the ocean.
- 5 Tangaroa boardwalk**
This boardwalk extends out along a row of exposed ocean rocks which jut through the boardwalk. Seashells and ocean grasses are suspended in epoxy decking timbers, and rope nets are strung along the edge of the boardwalk, creating a growing environment for ocean plants. These will be exposed with changing tides. Waves forced through pipes will echo the sound of Tangaroa.
- 6 Cultural trail**
This pathway will connect South Bay to Kaikōura. It will extend down beside the Marae across the main road to the ocean, providing a physical link between the Marae and ocean which is severed by the road. The path will also loop around the peninsula connecting Pa sites. Local Maori artists will be employed to create artworks of the stories uncovered from the archaeological excavations that will be undertaken on the Pa to learn more about their history.
- 7 Walking tracks**
The walking tracks will pass through a range of ecological environments from enclosed valleys and wetlands with small winding paths through open regenerating clearings to exposed cliff faces and hillslopes with views across the ocean.
- 8 Accessible**
There will be an increased number of accessible walking tracks to enable anyone to walk around the peninsula. Tracks with gentle gradients and hard surfaces will enable people in wheelchairs or with prams to enjoy the experience. There will be models of E-bikes that are compatible with wheelchairs or infant seats. Wayfinding points and interpretive panels are bilingual.
- 9 E-bikes - hire**
E-bikes are available for hire around the peninsula and township. These will encourage those not walking to bike between Kaikōura and South Bay with a short trip of 10min this will reduce the number of cars traveling between locations. E-bikes can also be used on the easy biking tracks so people can enjoy the ride around the peninsula or between activities. The bikes are parked at solar charge stations along main pathways.
- 10 MTB tracks**
MTB tracks range in difficulty from hard to downhill fanatics to easy for all ages and abilities. The terrain varies through different environments and provides different scenery with small narrow tracks based on balance deep within the forest to wider trails along the coast looking out over the ocean. Mountain bikes are available for hire from the Ohanga.
- 11 Piwaka tower**
A multi-level bird hide lookout will be constructed on the highest point of the peninsula. It will provide 360-degree views of the ocean coastline and Seaward Kaikōura. The structure takes inspiration from birds' feathers and how wings fold in flight. The structure has an exoskeleton with lots of nooks and crannies for birds and insects to nest in and epiphytes to grow up.
- 12 Treetop walk**
The existing stand of pine trees next to the Ohanga will be used to support a low and high ropes course. As large native trees mature the course can be extended into the native canopy. This will provide people with an experience of being amongst the canopy with native birds.



A Photomontage of the retirement village. Street has been narrowed with new footpath to create a pedestrian orientated environment.



B Photomontage of the Tangaroa boardwalk out over ocean rocks.



C Photomontage showing the cultural trail extending from the Pa to the ocean connecting Tangaroa and Tangaroa.



D Photomontage showing the main pathway through the plant nursery with native vegetation establishing around it.

Design intent

The varied vegetation will provide different experiences for users as they pass through a range of habitats and plant communities with play elements along the journey. These Paths also enable access to previously inaccessible Pa where mana and Tikanga have been restored. Close quarter interaction with native bird species is enabled by the large aviary as well as rehabilitation of injured birds.



Key Interventions

- 1 Node sculptures**
There are sculptures at nodal points which will serve as way finding points on the tracks around the peninsula. These will be designed by local artists and be based on ecological or scientific themes.
- 2 Research lodge**
There is a research lodge on the peninsula that will be used by universities and researchers while they study birds or processes on and around the peninsula. The accommodation in this facility can also be booked by schools and used to house volunteers during planting or maintenance events.
- 3 Spontaneous education**
Around the peninsula there are numerous small and fun educational activities scattered along the tracks such as the Gecko climbing wall, dragonfly count, Weka balance logs and Kiwi hop. These provide spontaneous spots of activity for children.
- 4 Kiwi hatchery**
This will serve as a hatchery for the south island chicks bread here will eventually be released into the core habitat area once it has matured. Once kiwi have settled into the sanctuary knight walks will be held for kiwi spotting.
- 5 Tikanga**
The Pa around the peninsula will be Partially revegetated with rongoa species while keeping urPa and sight lines clear as they traditionally were. Through Archaeological excavations, the story of each Pa will be revealed and communicated by local artists. The return of the birds to the peninsula and removal of stock from the sacred sites will help restore mana. Water is a requirement for Tikanga on Pa sites, so using a locally sourced greywacke boulder water will be piped up and spread out over the surface like a mauri stone. This can then be used for cleansing. Low growing ground covers will be planted on the Pa fortification ditches to reveal their form and reduce mowing which will degrade the form over time.
- 6 Dropped items**
This is the story of the lives lost in the attacks of Te Rauparaha when he sent his tribe south. The items scattered up the hillside are items that were used by Ngai Tahu at the time and would have been dropped as they fled from their attackers.
- 7 Aviary**
There is a large aviary that can be accessed by the public to view the native birds in close proximity. Education programs with schools are run here where they can learn about native species and how injured birds are cared for. The kiwi hatchery will also be set up here.
- 8 Swing bridge**
This will provide a direct route from the hub to the Piwaka tower, the swing bridge will extend over a deep valley where people will be suspended over kahikatea trees and have views out to the ocean.
- 9 Clearings**
Clearings or low native plants are strategically placed along the peninsula to provide views out to the ocean so people get the experience of walking through enclosed forest then coming out into a clearing with views of the ocean, Kaikōura or down into a valley. These clearings are also important habitats for the Kingfisher who will wait atop a branch and swoop down into the clearing to catch his prey
- 10 Hill Slides**
A slightly larger version or using a sheep sack to slide down a steep hill these slides built into the hill will provide people with the exhilarating experience of weaving in and out of native vegetation.

Legend

- FFL - Finished floor level
- TJ - Top of jump
- BJ - Bottom of jump
- MB - Middle of bridge
- EB - End of bridge
- TB - Top of boardwalk
- BR - bottom of ramp
- TN - Top of netting
- Contours (m)
- Proposed spot height (m)



4 Pa entrance with sculptural water supply and rongoa planting



Mountain Biking track with obstacles

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Detail Plan 1.100

Jessica Shafford
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Design intent

To create a hub of activity for all activities on the peninsula. As an attraction it will encourage people to walk and bike through the sanctuary rather than drive around.

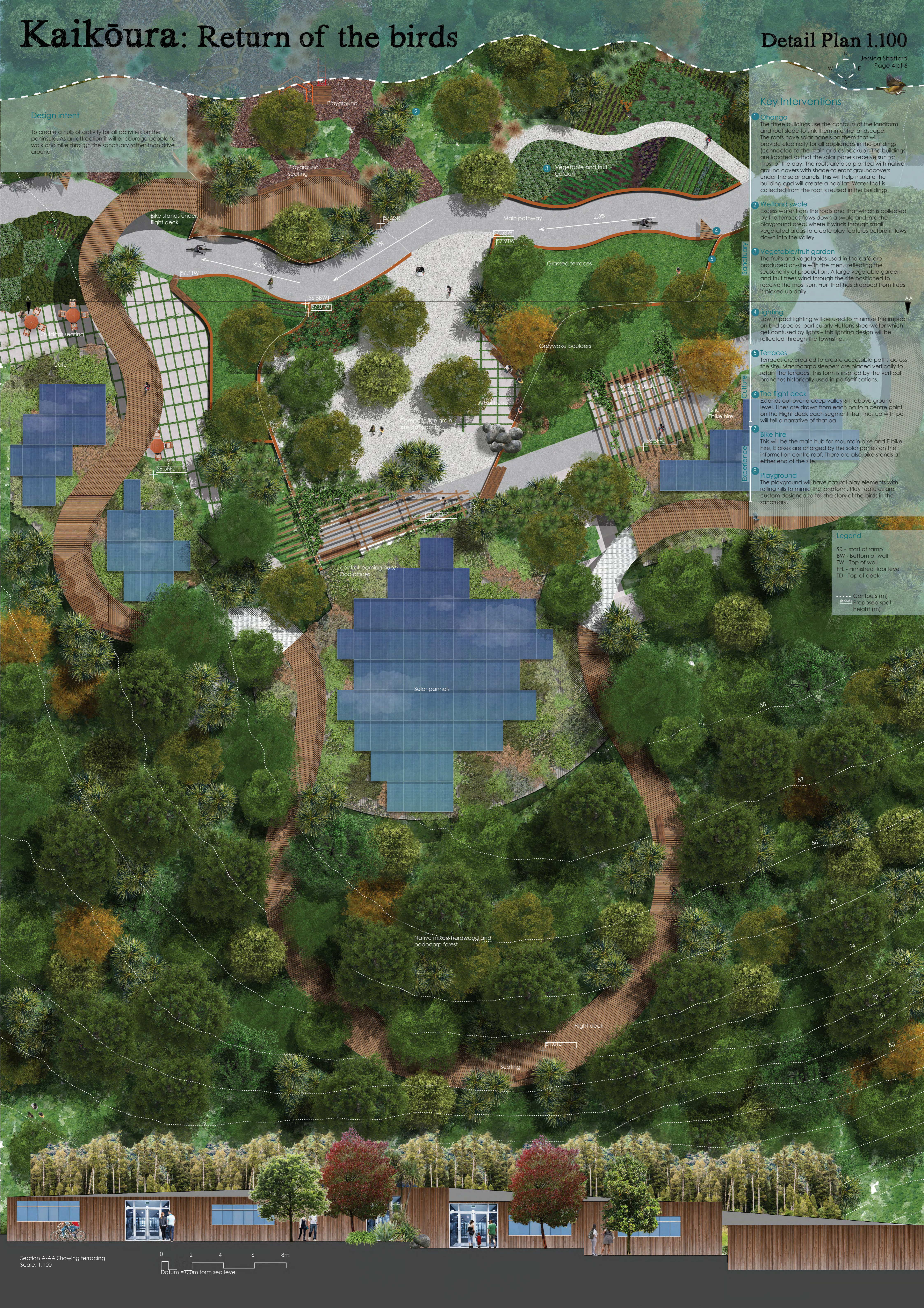
Key Interventions

- Change**
The three buildings use the contours of the landform and roof slope to sink them into the landscape. The roofs have solar panels on them that will provide electricity for all appliances in the buildings (connected to the main grid as backup). The buildings are located so that the solar panels receive sun for most of the day. The roofs are also planted with native ground covers with shade-tolerant groundcovers under the solar panels. This will help insulate the building and will create a habitat. Water that is collected from the roof is reused in the buildings.
- Wetland swale**
Excess water from the roofs and that which is collected by the terraces flows down a swale and into the playground area, where it winds through small vegetated areas to create play features before it flows down into the valley.
- Vegetable/fruit garden**
The fruits and vegetables used in the café are produced on-site with the menu reflecting the seasonality of production. A large vegetable garden and fruit trees wind through the site positioned to receive the most sun. Fruit that has dropped from trees is picked up daily.
- Lighting**
Low impact lighting will be used to minimise the impact on bird species, particularly Huttons shearwater which get confused by lights – this lighting design will be reflected through the township.
- Terraces**
Terraces are created to create accessible paths across the site. *Macrocampa* sleepers are placed vertically to retain the terraces. This form is inspired by the vertical branches historically used in pa fortifications.
- The flight deck**
Extends out over a deep valley 6m above ground level. Lines are drawn from each pa to a centre point on the flight deck each segment that lines up with pa will tell a narrative of that pa.
- Bike hire**
This will be the main hub for mountain bike and E bike hire. E bikes are charged by the solar panels on the information centre roof. There are also bike stands at either end of the site.
- Playground**
The playground will have natural play elements with rolling hills to mimic the landform. Play features are custom designed to tell the story of the birds in the sanctuary.

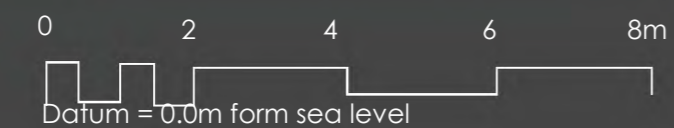
Legend

- SR – start of ramp
- BW – Bottom of wall
- TW – Top of wall
- FFL – Finished floor level
- TD – Top of deck

- Contours (m)
- Proposed spot height (m)



Section A-AA Showing terracing
Scale: 1:100



Kaikōura: Return of the birds

Locally sourced materials will be used as much as possible to reflect the character of place and its location within the geological environment.



Map of pa sites from Ohanga



Archway entrance down path



Native windfall trees

Native timber used on the peninsula will be harvested from wind fallen trees in native forests around Kaikōura following best practice not to disturb other flora and fauna.



Limestone chip

Lime stone chip of varying grades is used around the peninsula for pathways and design features. This is a locally sourced material and will provide contrast to the landscape while showcasing the geology of Kaikōura



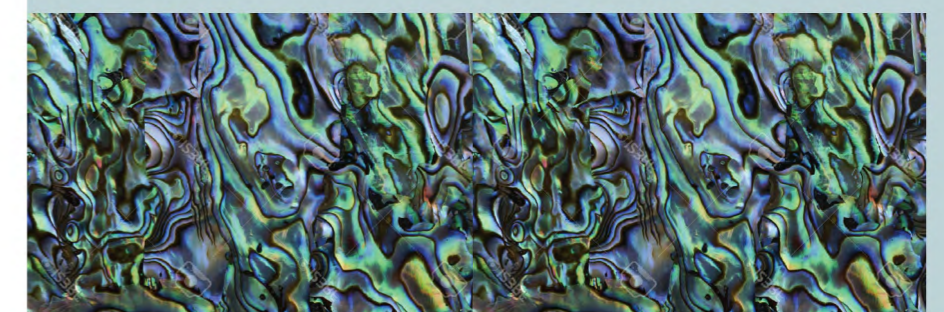
Sandblasted limestone concrete

This is to incorporate limestone where a more durable surface is required, this is used as a design feature set amongst Grey concrete for contrast



Hapuku boulders

These are used as a design feature and are locally sourced from the hapuku river and reflect the coastal processes that occur along the coast they also create a play element for children.



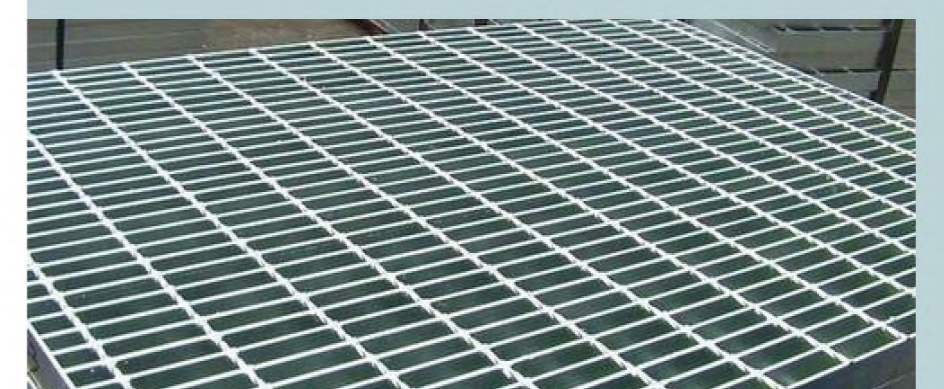
Paua shell

This is used selectively throughout the site for unique small details. The material is an attractive colour and is locally sourced from the beaches around Kaikōura



Seashell exposed aggregate

Paths are constructed with exposed aggregate with seashells mixed in as a unique design feature reflecting the coastal location of Kaikōura.



Steel grating

This is used on the flight deck where there are gaps so vegetation can grow through and people can see the vegetation below. Thick grade is used to prevent vibrations and keeping exterior sounds to a minimum on the flight deck so people can hear the birds and ocean.



Pave-lock

This is used where loose aggregates are used on main areas to prevent the stones from spreading into the vegetation and providing a more accessible path



The Flight Deck

The mixture of balustrade heights breaks up the form of the deck blending it into the environment. These are made of native timbers.

By using the point of the Ohanga lines are drawn to the edge of each pa site this has informed lines that run through the flight deck and each one is marked by a carving done by the local whakairo artist. A piece of Paua stone is also inset into the handrail. The segments that are in line with a pa will have a related narrative inscribed into the handrail. Elsewhere small bird footprints are burned into the timber.



Archways

These are designed to mimic the bird wing in flight they act as a feature to guide people down the main pathway they also provide soft light at night so they do not disturb wild life but allow people to find their way. Lights are powered by solar panels on the top side of the wing. The base is constructed of concrete to anchor it to the ground and provide contrast to the light tapering timber wing tip.

This feature is also used through out the sanctuary to display information panels



E bike station with sheltered seating

Inspired by the sternum bone of a bird that is oversized so that the wing muscles can fuse to it. This forms a weather structure for people to shelter under in sun or rain. The roof has solar panels and charges bikes that are stored.

Timber is sculpted and fused to the sculpture like muscle fibers to create a unique form.



Hapuku rocks roll down retaining wall similar to the processes they undergo during river transportation

Small amphitheater

Can be used by tour groups and outdoor workshops held by the education center as well as providing casual seating or a space for musicians on Sunday afternoons. The seating is flush with the retaining walls and uses their form to create the space. Wind fallen native hardwoods. Large paver's made with limestone and seashells are set with gaps for ground covers to grow in. They are used to define the space and provide water infiltration.



Native timber used for retaining walls
Wind well from surrounding forests must be a hardwood

Limestone chip

Paua shell

H4 treated Retaining wall substructure

Retaining wall

The structure is built with pinus radiata that was milled from the small plantations on the peninsula attached to this is the facade of native hardwoods sourced as windfall from surrounding forests. The slabs of timber are stood vertically and have varying heights to reflect the old pa fortifications. Limestone chip is used at the base to provide a linear mowing strip and provide contrast against the timber.

The maximum height of the retaining walls are 900mm to fit within building code standards for fall heights.



Pergola birds nests

The pergola have inbuilt birds nests which are covered in leafy vines to encourage birds to settle into the ohanga

Kaikōura: Return of the birds

Planting Strategy

Jessica Shatford
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Design intent

The revegetation strategy will return the peninsula to the state it was before European and Maori settlement. It is impossible to replicate a natural forest system so the goal is to make a start and nature will do the rest through natural selection and wind or avian dispersal of seeds.

Vegetation

Vegetation selected is based on what flora would have existed on the peninsula before and during Maori settlement as well as vegetation that will thrive in current site conditions and ensure a year-round supply of food for birds. The two main forest types in the area are mixed native hardwood podocarp forests and manuka dominated forests. These two types will be planted on the peninsula along with the exposed coastal cliffs system to create a varied habitat for birds and experiences for people.

A nursery will be set up to grow the plants on the peninsula to ensure they are well adapted to the climate and to reduce transportation distances. Seeds will be eco-sourced from surrounding native forests. Public workshops will be held so that the community can get involved in collecting seeds.

Management

Newly planted seedlings will need to be looked after to ensure the highest survival rate. For the first two years plants will require watering (once a month during summer) and weed management until they have established. To make this a more manageable task for the small town planting is spread out over a number of years to ensure all plants over the large area are cared for and the community are not overwhelmed.

Naturally regenerating

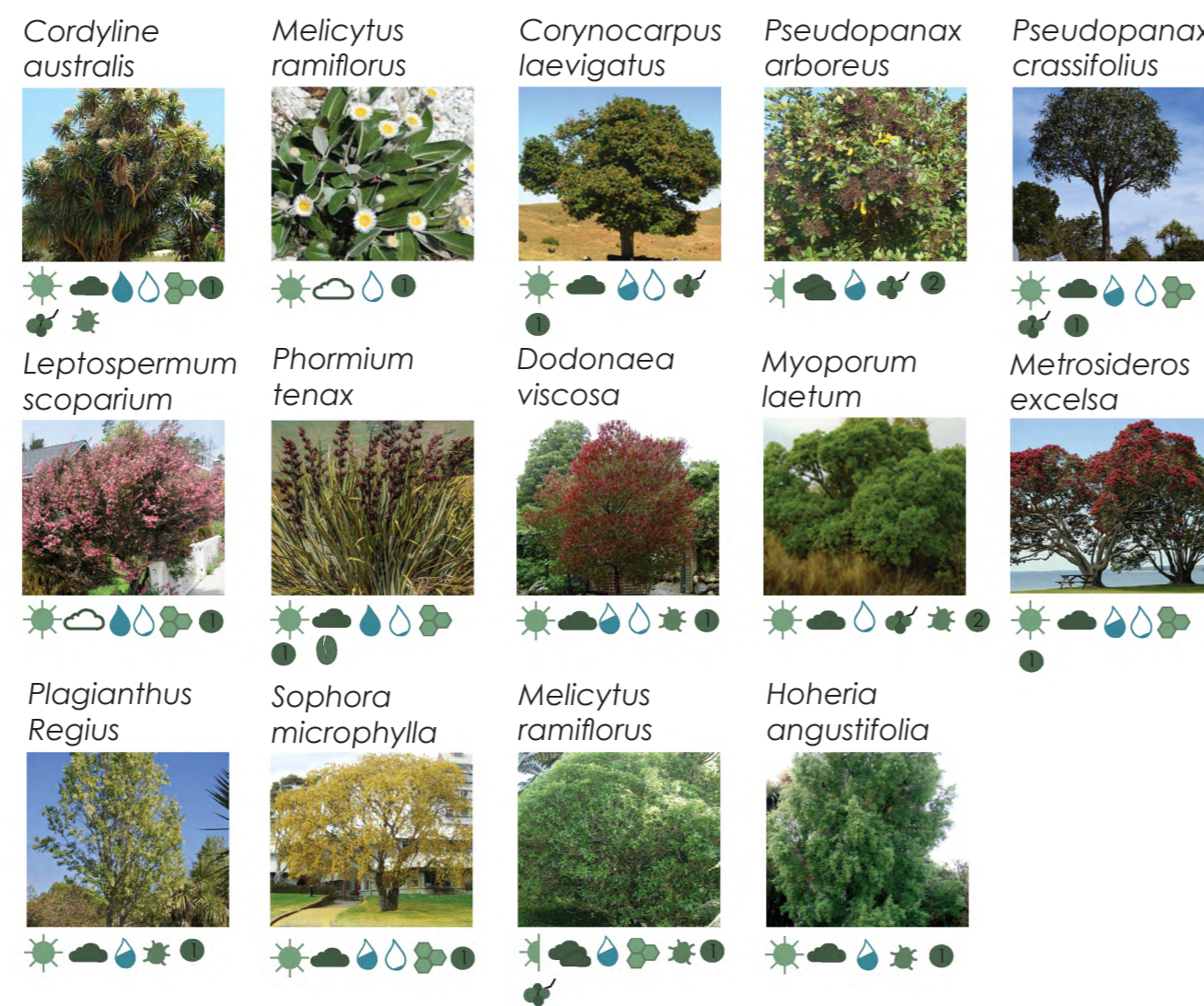
Pockets of the peninsula will be left unplanted so that it becomes planted through natural regeneration. Walking tracks run through some of these pockets so people can watch nature slowly colonise the site. In areas designed to be kept open to create varied user experiences naturally regenerating seedlings will be selectively collected and planted in similar ecological locations.

Wetlands

Across the peninsula, there are several hollows that hold water in winter and remain damp in summer. These will be excavated to create small wetlands. These will provide a water source for birds as well as habitat for a large number of invertebrates which birds can feed on.

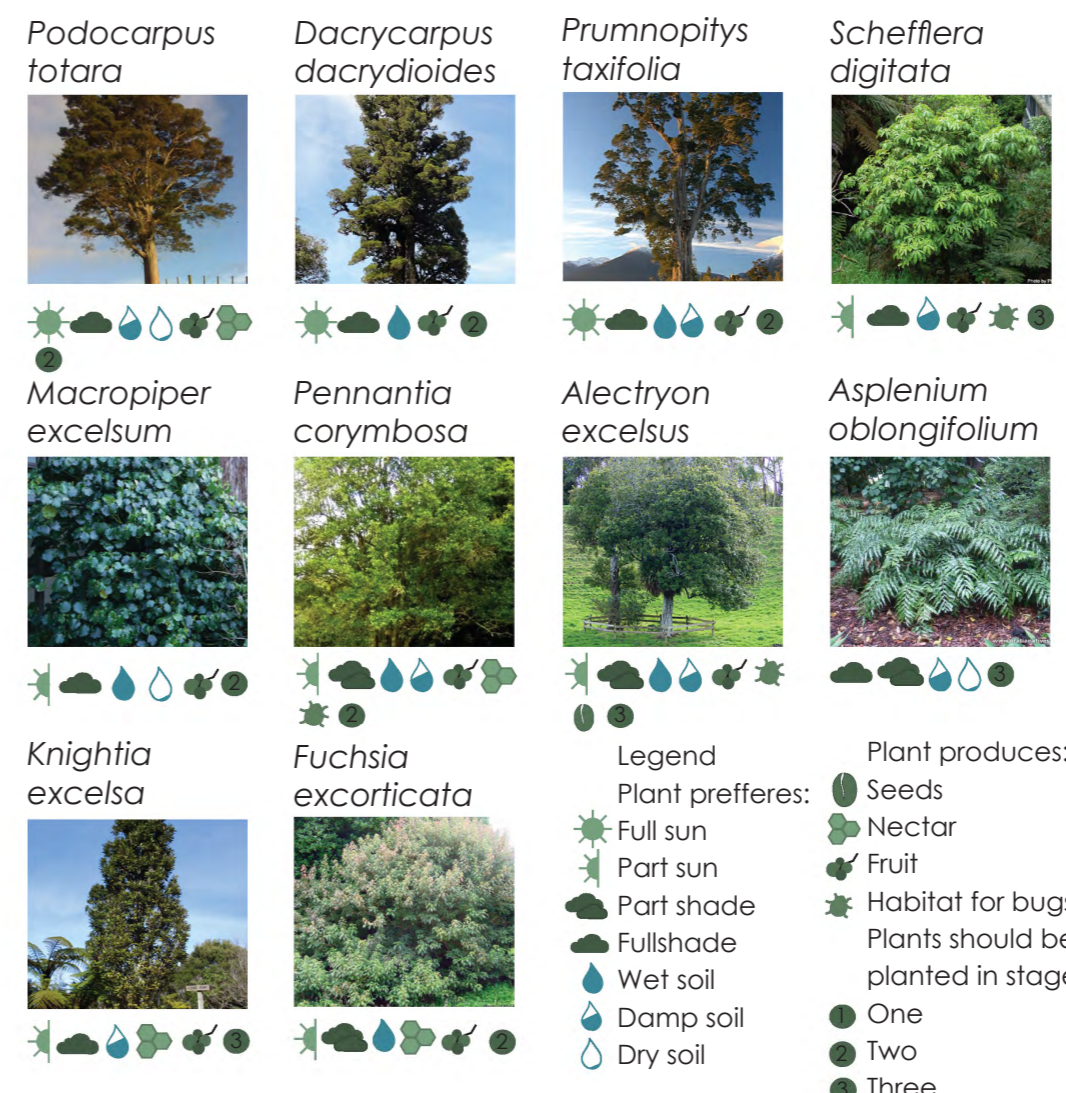
Coastal species

Can be planted throughout the peninsula, particularly around the perimeter of the peninsula. Most of these species are well adapted to the hot and dry environment along coastlines, but some will require more shelter so will be planted in the second phase



Valley species

Can be planted in the valleys and in the centre of the peninsula where they are protected by other trees. These are second and third phase plants that will need a nurse crop to establish in the current environment.



Legend
Plant prefers:
● Seeds
● Nectar
● Fruit
● Part shade
● Fullshade
● Wet soil
● Damp soil
● Dry soil

Plant produces:
● One
● Two
● Three



Location of valleys and wet areas

Rongoa

These plants will provide an important source for people providing medicinal remedies or traditional uses as well as customary practices. Located close to the Turangahake marae they will be able to be readily collected. Rongoa plants can also be used to heal the land as well as providing food sources for birds.

Wetland

Species such as carex secta and juncas will be planted in the wetland areas.

Horizontal revegetation strategy

Planting utilizes existing paddock fences to keep stock out of revegetated areas. Stock will be kept on the peninsula and number will slowly reduce as more paddocks are revegetated. Stock is kept on the peninsula to manage grass and prevent weeds settling in so less maintenance is required before planting.



Existing vegetation
There is some recent revegetation around the edge of the peninsula as well as some native and exotic patches.



1. Nurse crop
In the first two years a nurse crop of hardy species will be established in strategic areas that are exposed.



2. Valley and wetland
This will be planted over 2 years. Valleys have higher moisture levels and are sheltered so a range of plants can be initially planted.



3. Coastal
Coastal cliffs and peninsula top edge will be planted to stabilise erosive limestone cliffs. This will also provide a buffer to the core from strong coastal winds.



4. Southern sides
The areas on the southern side of slopes and existing hedge lines will be planted. These locations will be more shaded from the sun and drying winds.



5. Infill planting
These areas will be planted throughout the revegetation period with a mixture of species.



6. Natural regeneration
These areas will not be planted and will be left to naturally regenerate.



Canopy layer

The canopy layer will provide shelter and shade for the plants in layers below protecting them from the strong winds that travel across the peninsula. This layer will also provide habitat for birds and will typically produce the larger fruits taken by kereru.

Sub canopy layer

Important habitat for nesting

Shrub layer

This will form an important habitat for many birds allowing them to nest and forage for insects.

Ground layer

This is where all the organic matter from the trees above will collect providing nutrients and protection for tree roots as well as providing a habitat for many insects which are a food source for insectivorous and omnivorous birds.

Vertical revegetation strategy



0-2 years Colonizing plants are planted



8-12 years nurse crop has established enough for more sensitive plants to be planted underneath such as kahikatea



18-25 years Canopy cover has been achieved and conditions are suitable for shade loving groundcovers to be planted



50+ years podocarp forest is starting to mature natural succession and regeneration occurs and little human intervention is required

Bird species

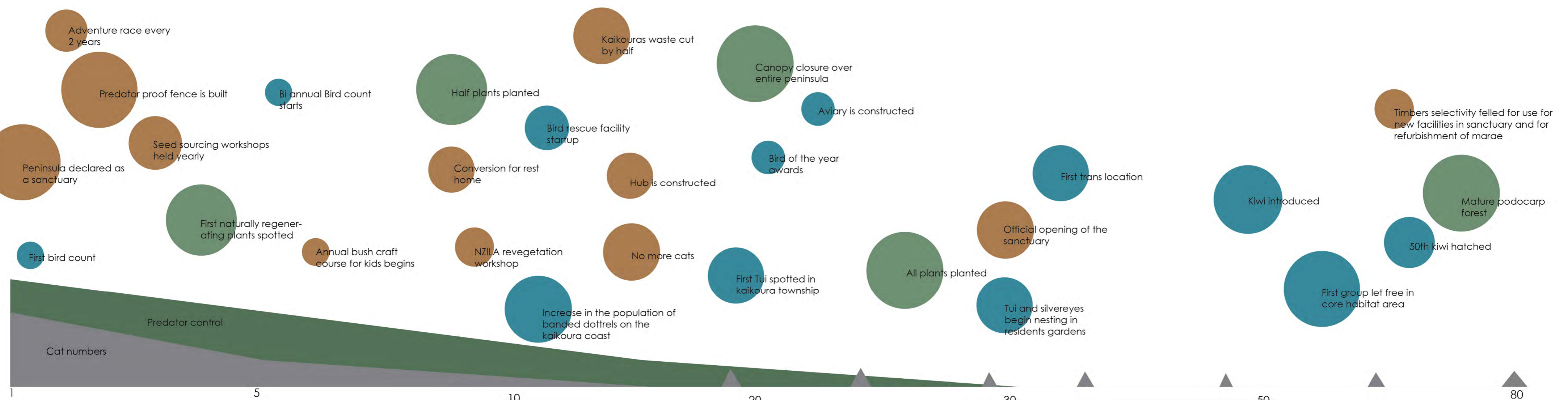
<p>Tui Status: Not threatened, extinct on peninsula Habitat: Forest bird but common in some residential areas. Nest in trees 3-15m Food: Nectar - Pohutukawa, kowhai and native fuchsia. Fruit - Mahoe and Totara as well as insects often by gleaning and hawking in Totara and Manuka Breeding: Nov to Jan</p> <p>South Island Robin Status: Declining Habitat: Prefers dense forests with leaf litter for foraging Food: Earthworms, spiders, stick insects, cicadas, snails, slugs, beetles and small fruits. Obtained by gleaning and foraging. Breeding: Oct to Jan</p>	<p>Tamtit Status: Not threatened, extinct on peninsula Habitat: Forest and shrubland nests in sheltered canopy's or under rocks Food: Spiders, beetles, flies and occasionally small fruit. Breeding: Aug to Feb</p> <p>Grey wabler Status: Not threatened Habitat: Range of habitats Food: beetles, spiders and caterpillars Breeding: Aug to Jan</p> <p>Brown creeper Status: Not threatened Habitat: Common wide range of native forest Food: Insect larvae and small fruits Breeding: Sept to Feb</p>	<p>Kereru Status: Not threatened, Extinct on peninsula Habitat: Native forest, home range 16ha Food: Large fruits - karaka and Mahoe some foliage and flowers. important for dispersing podocarp seeds Breeding: Nov to Mar</p> <p>Bellbirds Status: Not threatened Habitat: Native remnants and regrowth, nest in dense cover 1-12m high Food: Nectar from Pohutukawa, Kowhai, native fuchsia and flax. Invertebrates and fruits. Breeding: Sept to Jan</p> <p>Kingfisher Status: Not threatened, some sightings on peninsula Habitat: Open forest and farmland nests in holes in trees Food: Worms, Spiders, crabs, small fish and skinks. Breeding: Oct to Jan</p>	<p>Rifleman Status: Not threatened Habitat: Mature podocarp forests. Nests in holes in trees from ground to 6m Food: Beetles, spiders, caterpillars. Eat fruit in autumn Breeding: Sept to Jan</p> <p>Silvereye Status: Not threatened, uncommon on peninsula Habitat: Common in a range of habitats with tree cover. Food: Beetles, spiders, small fruits and nectar Breeding: Sept to Feb</p> <p>Brown Kiwi Status: Nationally vulnerable Habitat: Native forest Food: Worms, beetles, spiders Breeding: July to Jan</p>
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	J	F	M	A	M	J	J	A	S	O	N	D
Cordyline australis												
Corynocarpus laevigatus												
Leptospermum scoparium												
Phormium tenax												
Fuchsia excorticata												
Dacrydium dacrydioides												
Melicytus ramiflorus												

Banded dotterel
Status: Nationally vulnerable.
Breeding population along Kaikoura coastline
Habitat: Coastline
Food: Crustaceans, worms, spiders.
Breeding: Aug - Nov

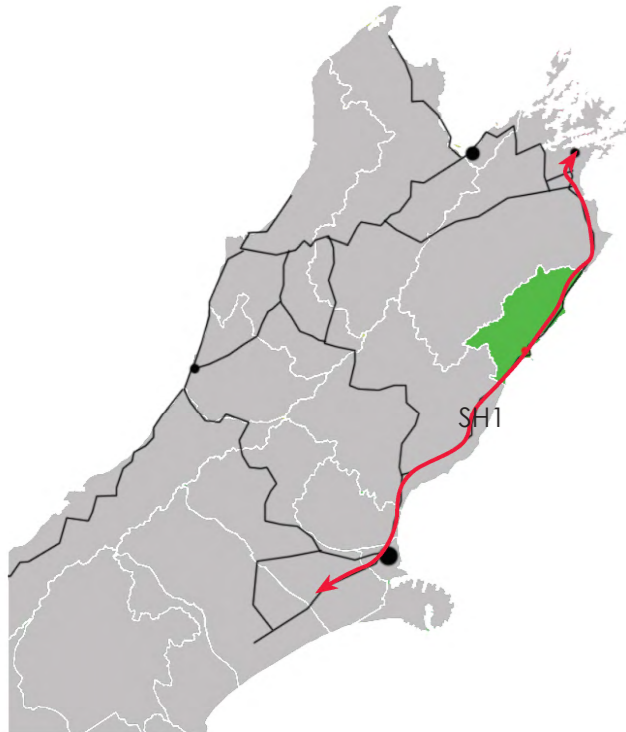
Black billed gull
Status: Nationally critical.
Breeding population around Kaikoura
Habitat: inland riverbeds
Food: Invertebrates from rivers and pasture
Breeding: Aug - Dec

Yellow eyed penguins
Status:
Habitat:
Food:
Breeding:



Restoring Kaikoura

Map 1. Context (NTS)



Context

Kaikoura is a small coastal town on the East coast of the south island. Its commonly known for its seafood and marine life. The district plan outlines the Peninsula as a significant and outstanding landscape this is also the kaikoura peninsula tourism zone due to the unique views it affords. This is also the base of most tourism activities in kaikoura.

Problem

While the coast of kaikoura is home to many coastal bird species and marine life the kaikoura peninsula and plains have been stripped bare of the vegetation and wild life that used to exist there to make way for extensive pastoral farmland, because of this Kaikoura focuses its tourism on its marine life with its dolphin and whale watch being the largest attractions. The lack of diversity in attractions means that visitors do not stay long with most visitors staying only 1 night or not staying at all (Simmons, Horn & Fairweather, 1998). this means that local businesses miss out on extended business.

Goal

To restore the vegetation on the peninsula to support omnivorous bush birds and create a diverse range of adventure activities.

Sub-Goal

To attract omnivorous bush birds to the Kaikoura peninsula

To provide a range of adventure activities on the Kaikoura peninsula



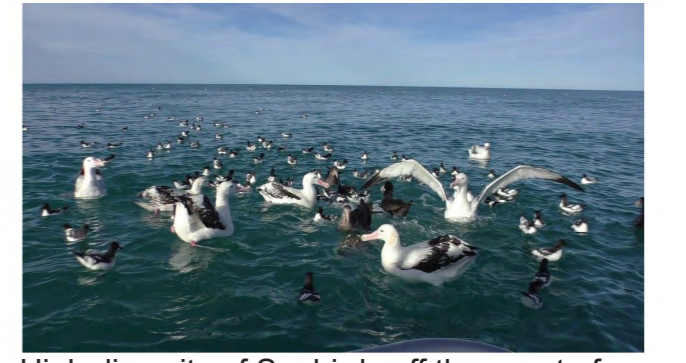
View from peninsula walkway showing extensive farmland and small exotic tree patches. (Shafford, 2019)



View from peninsula lookout showing extensive farmland and small exotic tree patches. (Shafford, 2019)



Seasonal ponding area

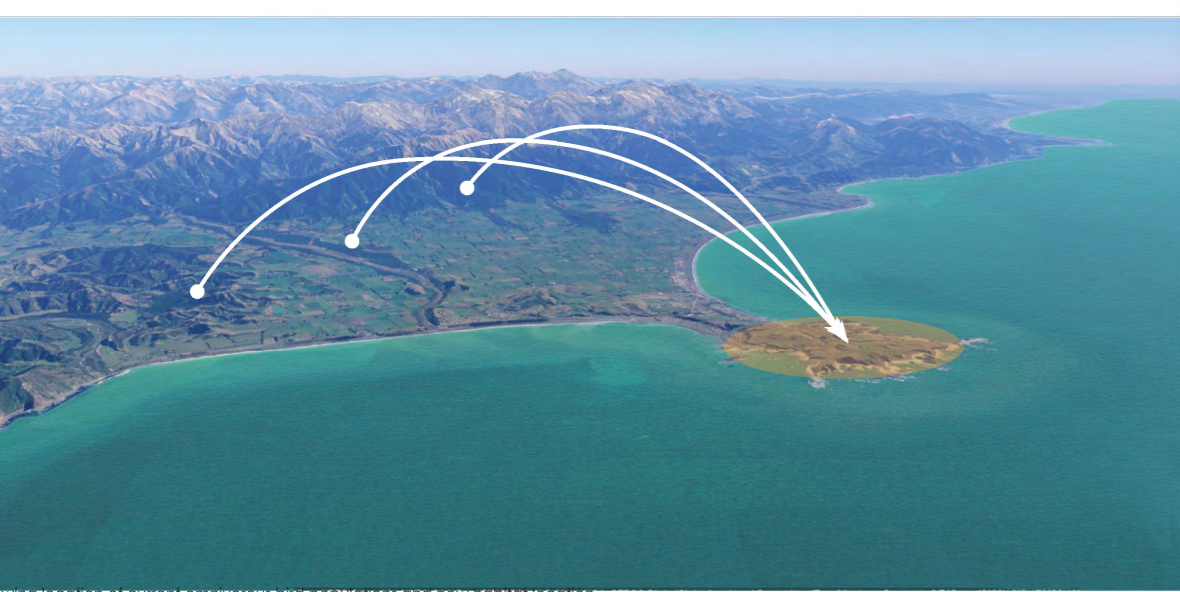


High diversity of Seabirds off the coast of Kaikoura (from Patwardhan, 2018)

Omnivorous Bush Birds



Omnivorous bush birds are able to fly 10km between patches the kaikoura peninsula is within 10KM of 3know areas with a source population yet these birds are not present in kaikoura this is because there is a lack of quality habitat on the peninsula.



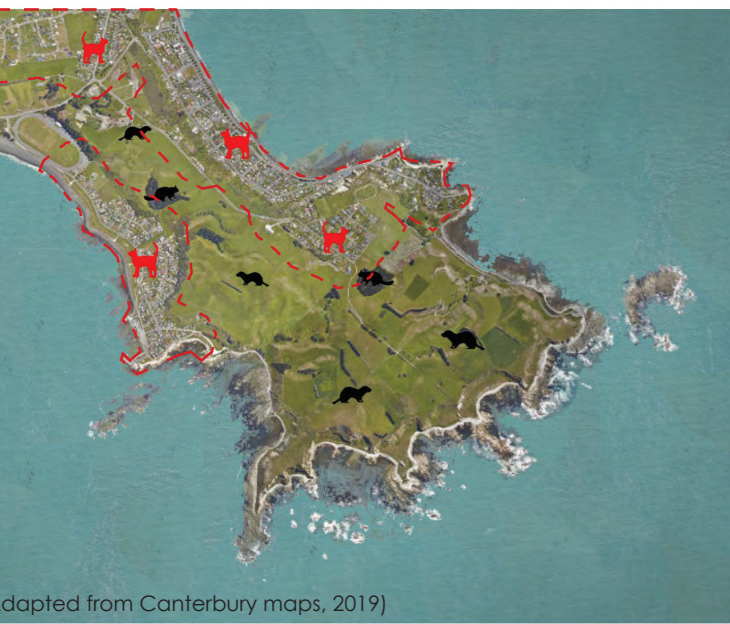
Showing location of current omnivorous bird populations and new habitat location (Adapted from Google earth, 2018)

Sub Goal	Objective	Scale & Map	Inventory
To attract Omnivorous bush birds to the Kaikoura peninsula	To provide food sources for omnivorous bush birds in Kaikoura (nectar and fruit)	1.5000 Map 4	Native patches
	To provide adequate habitat to sustain invertebrate population	1.5000 Map 4, 5	Native patches Exotic patches Wetland areas
	To provide 200ha of vegetation to create a sustainable bird population (Shadbolt, 2018)	1.5000 Map 4, 5 & 7	Non vegetated land suitable for re-vegetation Slope Existing patches and corridors Soils
	To maintain adequate food sources throughout the year	1.500 Map 4	Diversity of native vegetation
	To create stepping stones from existing bird populations (1km spacing)	1.30000 Map 2	Existing stepping stone patches
	To provide nesting habitat (1Ha of quality habitat per pair)	1.5000 Map 4	Quality of existing patches Size of existing patches
	To reduce bird egg and fledging mortality by predators (rats stoats possums)	1.5000 Map 3	Existing predators Range of predators

Map 2. Bird sources and stepping stones 1.30000 (NTS)

As omnivorous bush birds are a generalist species and live in a range of habitats there is no strong determining factor on where vegetation should be placed besides the influences of soil type. So to reduce the amount of soil erosion and allow farming to remain Planting of vegetation for birds is best suited on steep slopes where farming is not suitable and where there is a high risk of soil erosion. These areas are also cooler and damper proving a better environment for growing trees that will provide habitat and food sources for the birds. Valleys also have natural curvilinear boundaries which are preferred by many species[]

Map 3. Predator risk areas 1.5000 (NTS)



Legend

- Domestic cats
- Stoats/Ferrets
- Possums
- Rats

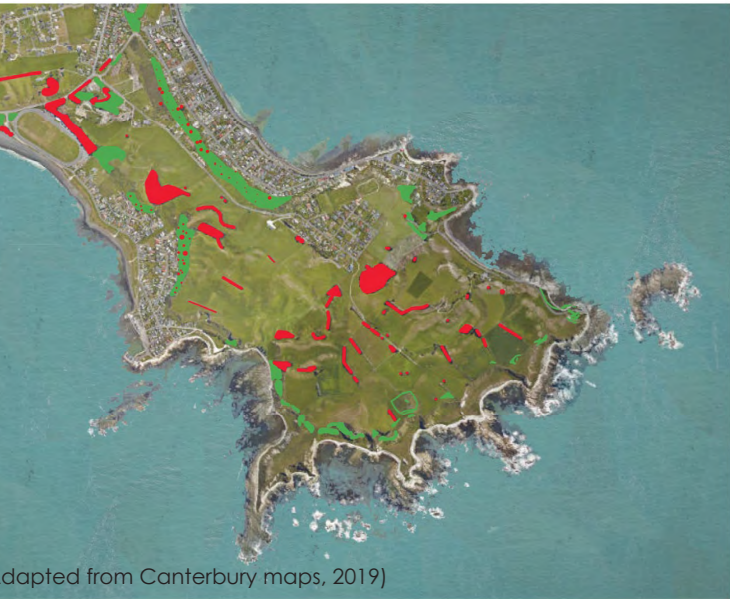
Inventory

- Cats are a household pet and are common in residential areas.
- Cats roam up to 100m from their home and eat birds and hatchlings
- Stoats, ferrets, possums and rats live in farmland and forests and eat bird eggs

Analysis

- In order to ensure bird survival patches for need to be outside of the range of cats to reduce predator risk.
- Predator control will be required in these areas to reduce this

Map 4. Existing vegetation 1.5000 (NTS)



Legend

- Native patches and corridors
- Exotic patches and corridors

Inventory

- Vegetation patches provide habitat for invertebrates
- Small network of patches and corridors
- Native patches provide some food sources
- Small patches of native vegetation are diverse in species composition
- Native patches have diverse structure

Analysis

- Vegetation patches provide habitat for invertebrates
- Not enough habitat area to sustain omnivorous bird population
- Diverse range of species will provide seasonal food sources but not in quantity required
- Small native patches will provide the 10-15% quality habitat cover as suggested by Meurk et al. (2016)

Map 5. Waterways 1.5000 (NTS)



Legend

- Streams
- Seasonal water ponding

Inventory

- Small wetland area on peninsula
- Small un vegetated pond areas
- Extensive stream/ valley network

Analysis

- Pond areas have potential to home a range of invertebrate species
- Streams can provide habitat for invertebrates

Map 6. Slope Steepness 1.5000 (NTS)



Legend

- Slope degrees - Soil erosion risk
- 0-10 Low
- 10-20 Moderate
- 20-30 High

Inventory

- Steep hillside slopes
- Flat terraces

Analysis

- High risk of erosion
- Flat terraces ideal for farming
- Steep hillside less suitable for farming

Map 7. Soils (NTS)



Inventory

- There is moderate to high soil moisture on the peninsula
- Moderately well drained and well drained soil
- Deep depth to hard soil

Analysis

- Moderate to high soil moisture is ideal condition for many large native trees
- Moderately well drained soil will cater to a large range of tree species
- No obstructions to roots penetrating into soil

Map 8. Composite Inventory & Analysis map - Omnivorous Bush Birds 1.5000 (NTS) Vertical



(Adapted from Canterbury maps, 2019)

Legend

- Moist well draining soil
- Domestic cats
- Stoats/Ferrets
- Possums
- Rats
- Native patches and corridors
- Exotic patches and corridors
- 0-10 Low
- 10-20 Moderate
- 20-30 High

Total vegetation area of approximately 24Ha about 50% of this is exotic and does not have the same provisions for omnivorous bird species as native vegetation.

This landscape currently does not meet the requirements of Murk and Hall (2006) for a patch corridor network as the patches are too small and there is not enough of them.

Ideal location for a large patch as the area is mostly made up of steep slopes which are less suitable for farming, there are several streams running through the area which will provide a good habitat for insects, this area is outside of the cat predation zone but pest control will be required.

Map 9. Opportunities map 1.5000 (NTS) Gestalt



(Adapted from Canterbury maps, 2019)

Legend

- Existing exotic corridor
- Existing exotic patch
- Existing Native corridor
- Existing Native patch
- Proposed Native corridor
- Proposed Native patch

Inventory
Two large exotic plantation patches - suitable habitat for generalist omnivorous birds.
Numerous predators - decreased survival rate of any birds in area
Small patches of native vegetation - habitat and food sources
Seasonally wet areas - potential for insect habitat
Existing forest patches have hard edges which are not preferred
Patches are too small to support
Exotic patches do not provide limited food for omnivorous bush birds
Corridors do not connect to patches

Main vegetated patches are adjacent to cat predation zone

Opportunities

- Large patches can be established by joining existing small patches
- Areas of steep slope around valleys can become large patch areas
- Existing corridors can be extended to link patches together

150Ha of the 200 required Ha for sustainable bird populations can be on the peninsula this will provide adequate habitat while allowing some farming area to remain on gentle slopes

Using the theory of large patch benefits to extend existing patches, small patch benefits, corridors & ecologically optimum patch shape (Dramstad, Olson, & Forman, 1996)

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