Ecological experience in Aotearoa's deathscapes.

By

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Abstract

Death is a land-use issue and therefore a landscape issue. This design-led research explores reshaping the way we experience death through our engagement with it ecologically and socially.

Globally and in Aotearoa, exponential population growth and death has increased pressures of urbanisation on cemeteries and the lands’ capacity for burial. Aotearoa’s young colonial history means the majority of our dead lie in a mono-functional, socially and ecologically vacant lawn-cemetery typology from Europe. These prevailing cemeteries hide death by sanitising the visceral qualities of landscapes above ground, whilst poisoning them below.

Karori Cemetery in Wellington will reach full capacity in less than five years, with others in New Zealand following close behind. This research will explore Te Ahumairangi in the Wellington Town Belt as the site of a new forested public space cemetery. Existing landscape conditions have the potential to be interwoven with alternative burial methods that can allow for a greater frequency of burial in an urban environment constrained for burial space.

The thesis proposes that reinterpretation is needed in making Aotearoa’s South Pacific deathscapes unique. The end-of-life methods of natural burial, aquamation and cremation can be explored for their potential to address capacity pressures, pollutants and the negative impacts of lawnscape cemeteries on the landscape. It explores how designing the process of these burial methods in the landscape has the potential to alter experiential, ecological, social and sacred richness of death spaces.

The research sheds light on these considerations, findings and underexplored relationships, through a type of ecological-experience fieldwork to counter current practice. The uncovered range of potentials in landscapes of death can be tapped to catalyse the discipline of landscape architecture and cemetery planning into action.

Preface

With a topic as religiously and culturally entwined as death, it is important to preface this research as being undertaken through the refractions of my own culture, upbringing and understanding.

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and confidence in my studies*

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Chapter One - Introduction

“a great, dry grass desert with uniform rows of standardized graves seem like a grim card-game of Patience left incomplete. There is no shelter from the sun, no trees lean over the graves to shade them, no slopes in the landscape to lift one’s eyes to the sky, or deflect from the endless monotony of what is less a place of consolation and more like a killing field, or a sports field hastily dug up for mass burials after some terrible atrocity.”³

Proposition

The matter of death is one profoundly involved in the human condition, being that it is the one certain outcome for all of us. This certainty should see more importance placed on the design of spaces for the dead. This design-led research explores reshaping the way we experience death through our engagement with it ecologically and socially. Landscape architecture can bring people closer to the most human of landscapes, where the landscape is comprised of human remains. In doing so, we may approach a less rigidly perceived boundary between the binary of living person and vacant lifeless shell. An ecological perspective sees death and life as greatly intertwined, not mutually exclusive. The dominant practice of burial has separated itself from ecology and perpetuates our perceived exclusion from the cycles of decay, birth and growth.

Death is a land-use issue and therefore a landscape issue. Globally and in Aotearoa, exponential population growth has increased pressures of urbanisation on cemeteries and the lands’ capacity for burial. Karori Cemetery in Wellington will reach full capacity in less than five years, with many others following close behind. This has prompted a current investigation by Wellington City Council into new burial sites in the capital.¹ The majority of our dead lie in a mono-functional cemetery typology from Europe which is often socially and ecologically vacant. These prevailing cemeteries hide death by sanitising the visceral qualities of landscapes above ground, whilst poisoning them below.

Auckland Cemeteries Manager, Catherine Moore states the current practice of cemetery siting as: “within a thirty-minute drive of most Aucklanders; a large site (rather than a series of smaller ones); located on public transport routes, near a main highway; flat-gently sloping gradient; well-draining soil with minimum groundwater impact; and land zoned outside of the rural-urban boundary.”² The precedence of functional and economic considerations is restrictive and precisely what landscape architecture should challenge. If we continue to push our dead out to fringe rural areas where traditionally favoured land for burial is still found, we risk further disconnecting the experience of death and our ancestors from society. These rural cemeteries eventually see modern secular urbanisation encroach around them, but by this time those buried there have largely been forgotten. Yet, spaces for the dead have a culture-forming ritual function visible in the importance of urupā in contemporary Māori culture.

The social, ecological and experiential considerations in cemeteries should have priority over functional economics. Cemeteries founded on these considerations might become celebrated landscapes that are economically viable through their popularity. This research proposes an alternative site selection criteria for Wellington: use government owned reserves (no purchase cost, lower burial prices, most are already used for recreation); ability to accommodate alternative burial (allows for steeper and forested land); within walking distance of Central Business District (close to daily life and sociality); and a site with native afforestation aspirations (burial can fund and enhance ecology). These criteria have the potential for cemeteries to alter experience of daily life and death within the urban realm.

The thesis proposes that reinterpretation is needed in making Aotearoa’s South Pacific deathscapes unique. There is no manual on the design of cemeteries and there doesn’t appear to be a strong exploration in the modern world of how indigenous understandings, experiential, sacred, ecological and social aspects are engaged with in cemetery design. Fieldwork becomes important as a way to create concrete understandings of how these are produced. End-of-life methods of natural burial, aquamation and cremation have the potential to entwine these aspects together to create a richness and diversity in the ecology and sociality of cemetery landscapes. Whilst allowing for a greater frequency and space for burial in a constrained urban environment. The research will explore Te Ahumairangi in the Wellington Town Belt as the site of a new forested public space cemetery. The focus is to explore the design potential of an inescapable phenomenon and its relationship to people in a way that will nurture the land’s native ecology.

Research Question

How landscapes of burial could become re-entwined with human culture and ecology?

¹Wellington City Council. “Cemeteries Management Plan Review”.

²Braunius, McManus and Elliot, *Death and Dying in New Zealand*, 74.

³Worpole, *Last Landscapes*, 56.

The Ephemeral Pond

“According to tradition, karaka were brought by people on voyaging canoes, distributed by people living in coastal areas, and planted on tracks as a food resource, or to identify tapu places, burial grounds or caves.”⁴

The Parapet

Tree Ferns

Parataniwha Gully

Motivation

My childhood home in the Waitākere Ranges is surrounded by a large radius of native forest reserve. This damp rainforest stretches fifteen kilometres toward the west coast through an undulating landscape marked by large dams and streams that supply Auckland with a quarter of its drinking water. I would explore this rainforest around my home, and I knew most areas closer to home like the back of my hand. There was an area which managed to elude me until later in life, then a local man had asked if I knew about the caves a mere two-hundred metres from our house. To most people it would seem impossible not to have stumbled upon this earlier. But everything about the landscape keeps you away and covered in dense forest, it is not easily found. With vague directions, I set out into the dense jungle.

A two-hundred year old puriri tree sits opposite our driveway, passing this down into the forest I reach an ephemeral pond which I used to play at as a child. It was summer and the hollow had dried to a patch of bright green moss. Past this, an overgrown and little used track winds down a steep ridge through tree ferns. I leave the track through a grove of kauri rickers and ponga that act as a sort of gateway.

Scrambling down a slippery bank I find myself in a strange high sided gully, running perpendicular to the main ridge rather than parallel. The landform is a narrow terrace cut by an ephemeral stream flowing near the horizontal along it. Tall ponga, nikau, scrambling ferns, epiphytes and parataniwha carpet the ground. Huge puriri, karaka and kahikatea begin to dominate and darken the understory. The large karaka are uncommon in this forest and were my first sign that this area had significance. The second was being met by intense yellow irises and the deep black pupils of a ruru in filtered daylight staring back at me. Its presence and fixation on me would later become eerie. Further along this gully, what looks like a large clay sinkhole falls two metres underground, another irregularity. A large series of jagged stones jut high above head forming the cliff below and the wall of the gully, like a castle parapet. This exposed geology is much unlike the surrounding clay and absence of rock with which I am familiar. These parapets have huge trees perched atop them, large aerial roots of rata and akapuka snake down to meet the ground. The small ‘caves’ I was looking for are revealed. Sunken in a ditch behind this parapet of stone, gigantic boulders fallen from above, form very narrow openings or ‘caves’ underneath.

What I had encountered

Afterward, these strange irregularities begged research. I learned that I had encountered an old rua koiwi (resting place of bones). Suddenly this place became populated in my mind, I could imagine how the first people to discover this would have seen the potential of the landscape here to conceal and protect their dead. The old karaka trees are nga uru karaka, groves planted as food sources or to mark areas of significance. The nocturnal ruru I had locked eyes with, belongs to the spirit world in the Māori worldview. Their haunting cry and watchful nature are linked with tapu, guardianship, forewarning and grief. The large clay hole is not recorded but may have been a rua (midden). The ‘caves’ were probably formed by excavating underneath the boulders to create small openings in which bones could be hidden. Although the bones were relocated some time ago⁵, for respect and secrecy of the deceased photographs and maps of the burial caves themselves are not included in this research. In tikanga Māori, a deceased person’s mauri (life force) can become captured or damaged by the process of photography or replication, diminishing a person’s mana.

It was here, just over a steep ridge from where I lived, that the interconnectedness of death and life in the forest began to emerge for me. I developed a fascination with forested burial grounds and began to question our current way of burial.

⁴Haami, *Pūtea whakairo: Māori and the written word*, 33.
⁵Hayward and Diamond, *Prehistoric Archaeological Sites of the Waitākere Ranges and West Auckland*.

Aims and objectives

The research aims to design a multi-functional urban cemetery that accommodates alternative burial methods to allow for a greater capacity of burial in land constrained spaces. This public space would undergo metamorphosis with the interment of our ancestors to enrich the experiential, ecological, social and sacred richness of death spaces.

To achieve this an exploration of Māori conceptions of ecology and death could provide a framework for a uniquely South Pacific relationship to death and the landscape. An understanding of current cemetery practice and its separation from ecology is needed and study of how the bodily experience creates the social and sacred in relation to landscape elements. The research will investigate natural burial, aquamation and cremation as processes that can nurture life and be intertwined with the landscape. Overall, the research focusses on how Aoteroa’s burial landscapes can express the interconnectedness of human culture and ecology.

Scope

The research hopes to facilitate a practice for the design of Aotearoa’s memorial spaces. The ambition is not to produce restrictive guidelines for cemetery design. Rather it is by design, an experiment that aims to bring awareness to potentials inherent in landscapes of burial through fieldwork. Attention is placed on making alternative burial work in the context of a Te Ahumairangi, a single hill in Wellington’s Town Belt. The particular landscape conditions are all singular in their combination. If a broader scope and timeframe were possible the research would investigate the potential of multiple smaller cemetery sites linked throughout the Town Belt. The data readily available is limited for Te Ahumairangi, personal observations and fieldwork were used to map most areas of interest such as geology, hydrology, human use, etc. Terrestrial LiDAR was tentatively used to aid design of forested space, large data sets and the learning curve in processing the data limited its scope to a small area within the site. It could prove to be extremely useful in forested cemetery space design.

Methodology

The methodology for this research aims to fill gaps I have observed in theses and literature that focus on cemeteries. It experiments with a wide range of elements inherent in landscape, that are often overlooked in cemetery design. An investigation into the existing practice of current and traditional cemeteries; historic Māori burial and conceptions of ecology; alternative methods of returning the body to land; and how the body creates experience of the social and sacred in relation to landscape elements is undertaken in a literature review.

Fieldwork is the main driver of the research and attempts to explore a range of underexplored realms in the design and existing conditions of cemeteries and ecologies. A range of Aotearoa’s cemeteries are explored to find potential design strategies and drivers for burial in Te Ahumairangi. Waikumete, Karori, Makara and Bolton Street Cemetery are analysed through methods of photography, mapping and section studies. These local case studies were found to be more important than remote international studies. The ability to bodily experience cemeteries and arrive at personal conclusions and discoveries of what is most interesting was invaluable.

Studies of how burial interacts with steep topography are undertaken to understand the possibilities for how currently disregarded land for cemeteries could be utilised to provide alternatives to current restrictive cemetery siting requirements. It also proposes the experience of cemeteries could be directed and intensified with topography.

Geology is mapped through personal observation and is explored for the potential it has in marking the place of the dead, how it determines suitable depths for burial and the way burial disturbs soil layers that leads to changes in floristic compositions. A study is made into how graves might be dug without the use of large machinery on Te Ahumairangi.

The entire perimeter of Te Ahumairangi’s 38 hectares was walked and documented to understand accessibility, how it connects to and is perceived by the city. The interior was walked numerous times to gain knowledge of where new paths or removal of others could benefit clarity, ease of route and experience of the hill. Carparking and alternative means of access on the steep terrain are explored for the viability of a cemetery in the Town Belt.

A series of local ecology studies surrounding and including Te Ahumairangi are undertaken through drawing and photography to explore the spatiality and bodily experience of native and exotic forest species. This ecology fieldwork is used as framework for understanding what native species are absent from the regenerating site and can be reimplemented to alter the experience of Te Ahumairangi through natural burial planting, alongside those species which occur on site. Speculations are made on how an influx of nutrient from bodily decomposition might affect the growth of forest. Cultivation of native plants traditionally used for basketry and weaving are suggested for the construction of natural burial caskets, to help create a self-sustaining cemetery. Current practice only tentatively engages with forested space, due to the complexity of representing and designing growing material. Under-canopy documentation methods will be used to help represent the complexity and aid in the design of Te Ahumairangi’s forested space.

Chapter Two - Review of Thinking in Practice

Explore Māori conceptions of ecology and death to provide a framework for a uniquely South Pacific relationship to death and the landscape.

The first Polynesian voyagers to Aotearoa brought concepts like *rāhui*, *tapu* and *whenua* ashore. Over time they developed a relationship to land formed around nature’s rhythms. European ships brought the forward ticking time of the pocket-watch and thus a change to the perception of time as cyclical rhythms of nature. The present and future still drives the ‘productive’ economics of European life, with a fundamental notion of ‘time is money’. Māori spiritual connection to whenua became suppressed as it relied on the past and the notion of utu, that which happens in the future and past is reciprocally connected.⁶ For the European, the experience of those in the past appears to offer relatively little in the economy of the present, this is visible in the current neglect for the elderly and cemeteries. By contrast, the importance of urupa in contemporary Māori culture maintains the link between ancestors, descendants and the community.⁷ Cemeteries are potent cultural landscapes that reveal how the past produces the present, and are also where the two mingle. Utu can reimagine ways of returning to the earth, where our ancestors can contribute in passing, to the public space of the future. In turn, these spaces might foster greater respect for the elderly and deceased.

Aotearoa has come to understand our native landscape as a collection of primeval life with which we have not evolved. This is a hangover from a legislated separation between culture and nature that sees people as visitors to an unpopulated, primordial land. Scenery preservation was brought under law in 1892 and helped to save Aotearoa’s rapidly disappearing forest from vanishing further under a veil of grass and grazing animals. But it created two types of landscape: one in which the urge was to advance society, and the other in which the urge was to exclude it. There was no ‘middle landscape’ in which the urge was to progress people living with the land’s indigenous life.⁸ This also removed a framework for dying with the indigenous, our cemeteries separate the dead from the natural cycles of the land’s native ecology. Park suggests the Waitākere Ranges are closer to this ‘middle landscape’, a forested domain of human residence where the environment is intertwined with culture. A different relationship with land, a shared ecosystem. It was near my home in the Waitākere Ranges where I encountered a rua-koiwi (resting place of bones) in the dense forest. Death as part of the indigenous landscape, it provoked this research exploration into human burial and its integration with nature. But today, Aotearoa is a country that might be averse to the notion of burying the dead in our ‘pristine’ forests.

A shift in reading nature as disjunct boundary lines of protected objects to knowing it as a highly connected nourishing terrain that gives life and receives death. The conservation estate has purged Māori customary rights and care, making whenua - the interconnectedness of people and nature, a marginal concept. Māori established an umbilical connection to the land by placing the placenta within it, entangled in this connection is tangata whenua (people of and from the land). The dual meaning of whenua is both land and afterbirth. Whenua appeals to ecology in its most fundamental principle, that everything is connected. The responsibility to the other life with which we share the land, flows from that interconnectedness. The linguistic roots of whenua are shared across the Pacific and early traces found in the Indian ocean.⁹ All are conceptualisations of identity in which the relationship between people and land is vital, a feedback process from centuries of the social system experiencing the and co-evolving to the ecosystem’s limits.

Modern alternative burials use trees to mark the place of the dead, early Māori burial shares the importance of trees and uru in marking significant spaces. Kahikatea in the Māori landscape is a symbol of birth and death. The placenta is as the land and the umbilical cord, iho is the strength of a tree trunk. Iho were sometimes buried in a tapu place, often in conjunction with kahikatea. At Tauwhare and across Aotearoa, high up in clustered epiphytes in kahikatea the bones of ancestors were placed. Māori sensed that trees had individual souls but also held those of ghosts, demons and gods before Christianity forcibly displaced them.¹⁰ “Every unusual place, or spectacle, whether remarkably beautiful or ghastly, imprints a touch or apprehension of some latent invisible power.”¹¹ Jackson accounts of indigenous Lithuanian’s sacred groves and their belief that harming the trees was a sacrilegious act. To aid his rule of Lithuania, converted Catholic King Władysław II Jagiełło of Poland felled their sacred trees to example the superstition of the inhabitants. Met with no divine retribution, the indigenous people began to believe the Kings authority and Christian religion. Oddly the Polish pagan born Jagiełło, grew up in a country with its own history of sacred pagan groves. The Białowieża Forest in Poland, one the largest and last remnants of ancient forest on the entire European Plain was owned and named after him, and he treasured his time in this forest.¹² Lithuania is close to the furthest on Earth you can get from Aotearoa, but tapu was treated the same by early missionaries converting Māori to Christianity. At Tauwhare, this situation was echoed by missionary Cort Schnackenberg and his attempt at burning the burial kahikatea to rid Māori of their ‘superstitious’ fear of tapu.¹³ “In some incomprehensible way (to Māori) the Pakeha seemed to be able to ignore the tapu restrictions of the Māori atua without fear of retribution”.¹⁴

Our cemeteries have been removed from the interconnectedness of human culture and ecology. Utu, whenua and tapu have all had a history of suppression and erosion, yet they appear useful in reimaging a connection to landscape, death and life. What would it mean for death to become part of the forested landscape again and what would these burial grounds do for Aotearoa’s way of perceiving and conceptualising death and life? A landscape which nourishes life and which we nourish, through death.

Fig 1.

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⁶ Awatere, *Māori Sovereignty*, 30.
⁷ Deed, *Unearthly Landscapes*, 190.
⁸ Park, *Essays on Landscape and Whenua*, 202.
⁹ Park, 240.
¹⁰ Park, *Ngā Uruora*, 168-169.
¹¹ Jackson, *The Works of Thomas Jackson*, 171.
¹² Hunt, “Dead Wood.”
¹³ Park, *Ngā Uruora*, 167.
¹⁴ Riley, *Māori Healing and Herbal*, 10.

Current cemetery practice and its separation from ecology.

Current cemetery practice relies on word and symbol to convey memorial and often perpetuates a range of cliches. Forest Lawn Memorial Park is often described as a funereal theme park or the Disneyland of Death.¹⁵ Historically, incentive was needed to urge a larger portion of society to visit a funerary landscape, at Forest Lawn the answer was art and sculpture. Contrary to its name, there is no forest in a natural sense, instead it is an expansive lawn and home to the largest replica collection of Michelangelo sculptures in the New World.¹⁶ Aldous Huxley’s literary character, Jeremy Pordage accounts of his visit there:

“statues of Peter Pan and the Infant Jesus, its groups of alabaster babies playing with bronze rabbits, its lily pool and an apparatus labelled The Fountain of Rainbow Music, from which there spouted simultaneously water, coloured lights and the inescapable strains of the Perpetual Wurlitzer... Statues wherever you turned your eyes. Hundreds of them, bought wholesale.. from some monumental masonry concern in Carrara or Pietrasanta. All nudes, all female, all exuberantly nubile. The sort of statues one would expect to see in the reception room of a high-class brothel in Rio de Janeiro.”¹⁷

The designer of Forest Lawn, Hubert Eaton set three slogans which seem to have been adopted by the majority of cemetery designers since. They are: depict life, not death; build a safe repository for our beloved dead and a place for the living to reverently enjoy; and spend one dollar in construction today to save one cent in care tomorrow.¹⁸ The efficiency focused mind of Eaton was the first to conceive of plaques recessed below the lawn. This allowed faster maintenance by mechanical mowers and the added benefit of giving superiority to the flowing lawn and plethora of sculpture. However, in keeping with his first slogan it suppressed the presence of the dead. This suppression of death and sadness is often perpetuated in cemeteries. The preoccupation with the relentless pursuit of happiness, is evident in the joyous wurlitzers, rainbow fountains and the Peter Pans of Forest Lawn. It parallels pharmaceutical remedies that are promoted as a means of escaping any emotion other than joy. Modern landscape architecture can simply become part of the drive for eternal bliss.¹⁹ Before he became manager of what would become Forest Lawn, Eaton viewed the native chaparral ecology sprouting from old graves as depressing. He dreamt of the picturesque cemetery he would design with tall trees, wide lawns and playful fountains.

“In the same way that middle class desire dreamed up suburbia, a place where everyone has their own patch of lawn to fortify their bungalows against real wilderness, carpets of sod would be unrolled and laid across the hills, smothering the chaparral in an act of botanical colonialism.”²⁰

From an ecological point of view, this preoccupation with joy has led to vast innovation in herbaceous perennials, bulbous plants, annuals and brightly flowered species. Old varieties are preserved, new ones bred, with this process creating a profusion of options each year. However, the varieties of woody plants and trees have stagnated for years and display very little development. Cemeteries and current trends of natural burial are complicit in the focus on meadows, flowers and grasses and have taken attention away from the opportunities that forest trees and native ecosystems can provide in memorial space. Woody plants are the elements that shape the fundamental basis of spatiality and habitat in the landscape.²¹ Eaton’s economic concerns took precedence over the ecological, sense of sacred and celebrated the joy of life by hiding death. Landscape architecture should offer an alternative focus in bringing social and ecological aspects to the forefront of cemetery design.

Fig 2.

¹⁵ Diakiw, “Disneyland of Death.”
¹⁶ Wolschke-Bulmahn, *Places of Commemoration*, 87.
¹⁷ Huxley, *After Many a Summer*, 115.
¹⁸ Wolschke-Bulmahn, *Places of Commemoration*, 87.
¹⁹ Bowring, *Melancholy and the Landscape*, 5.
²⁰ Diakiw, “Disneyland of Death.”
²¹ Girot, *Topology*, 154.

Natural burial, aquamation and cremation in the landscape.

Decomposition

Bodily burial has a range of polluting practices aimed at halting and supressing decay, however as decomposition is integral part of ecosystems this leads to a range of negative environmental effects. Formaldehyde used in embalming solution and coffins to slow decay, leaches out and poisons the soil; concrete vaults separate the bodies nutrients from the land; and fossil fuels for mowers and leaf-blowers are used in the maintenance of sanitised grounds.²² Embalming and burial deep underground means it takes fifty years for tissue to break down. By eighty years in a coffin, bones begin to crack and deteriorate, leaving nothing but the brittle mineral frame behind. A century in, bones will have turned to dust leaving only teeth and inorganic material.²³ Graves are generally dug six-feet-under from a historic fear of reanimation and beliefs around disease and hygiene. However, no significant health risk is posed from a corpse, even above ground.²⁴ Natural burial is a growing trend which aims to revegetate areas through burial. Instead of a memorial headstone, the experience of ecology becomes a symbolic legacy of the deceased. It requires shallow burial in the more biologically active layer of the soil, restricts the use of formaldehyde and uses natural material caskets. In the right conditions the body breaks down within a decade. Bodily decomposition with natural burial over large areas could vastly alter soil composition and available nutrients in the landscape. In Cameroon, sacred village groves are often associated with burial and many hold the skulls of royal ancestors. Botanical studies have shown that these burial activities over a long period, affect the floristic composition and appearance of these sites. They are often the result of unintentional actions or management practices that interact with the spontaneous growth of vegetation.²⁵ Planting trees on graves could be more captivating with the experience of the living in mind, many current natural burial areas such as Makara Cemetery are revegetating first and waiting decades before the forest can be navigated by the public. This limits families and the public from experiencing the resting place of their loved ones, designing the placement and species of trees first can allow these spaces to be accessible from day one. Natural burial offers the opportunity to design a forested public space that undergoes ecological metamorphosis with the interment of our ancestors. It offers a potential to create novel ecology with which we are unfamiliar, as exempld by Cameroon forests grow differently in the context our buried ancestors.

Infiltration

Aquamation or alkaline hydrolysis is a way to transform organic matter into inert components. It uses water, an alkaline solution, high temperatures and pressure over the course of a few hours to produce a sterile, slightly alkaline water. The bones that remain are very brittle and can be powdered and put in an urn like cremation. Aquamation leaves a considerable volume of benign water that proves an ethical problem for its widespread adoption as a viable end of life choice. To most it seems wrong to discharge this water which seems to hold some ‘essence’ of the deceased into the wastewater system. Yet, embalming which drains a large portion of a cadaver’s blood is treated in this way.²⁶ Another option is to irrigate land, but the mechanical and utilitarian aspect of such a system also seems to lack empathy. What might a respectful journey of liquid remains look like? The experience of aquamation invites exploration, an increase of water in the landscape might be experienced in its coolness, moisture, sound and the ecology it turns verdant through water exchange.

Combustion

Cremation is the most popular end of life choice in Aotearoa, owing to a cheaper cost and less demanding space requirements. The negative aspects of cremation include carbon-emissions, reduced air quality, and the energy required.²⁷ Bio-urns are a relatively new offering that are half filled with ashes and soil, that a seed or seedling is planted in. The compostable urns are buried in the landscape, through collective urn burial an individual can become part of larger memorial forest. Due to the much smaller area occupied by an urn that a body, they can be buried almost anywhere. Their size means: underlying geology is not so restrictive; they can be buried on much steeper slopes; use a fraction of the space bodily burial does; and clears less vegetation in forest burial. Bio-urns provide the potential for reforesting slopes and changing our experience of vegetation and topography in cemeteries.

Fig 3.

²² Braunius, McManus and Elliot. *Death and Dying in New Zealand*, 80.
²³ Shira and Echevarria. “What Happens To The Human Body After 100 Years Inside A Coffin”.
²⁴ Fisher and Reed. “Risks Posed By Dead Bodies After Disasters”.
²⁵ Woudstra and Roth, *A History of Groves*, 123-126.
²⁶ Braunius, McManus and Elliot. *Death and Dying in New Zealand*, 94-95.
²⁷ Braunius, McManus and Elliot. 74.

Bodily experience creating the social and sacred in relation to landscape elements.

The focus on economic and utilitarian aspects in cemetery design has eroded sacredness in burial space. This functional precedence in cemeteries is transparent to most and this visible intention alone might act in removing the experience of these cemeteries from a sense of the sacred. A modern attitude shared by emerging landscape architects rescued some cemetery landscapes from a supporting role to architecture or as decorative scenery. Landscape instead came to express emotional and evocative importance, where the idea of the sacred no longer relied on the symbolic language of buildings.

Topography and the sacred

Kongenshus Mindepark in Demark designed by Carl Sorensen commemorates the early of efforts of farmers who reclaimed the heathland to feed the nation during the Danish resistance whilst also celebrating the heathland ecology. The design moved almost no earth, instead the topography of the narrow glacially carved valley was utilised to direct experience through the memorial space. As one passes the rows of large stones, the body through past experience connects to the sacred associations stone dolmens of prehistoric burial hold in the collective memory of Danish.²⁸ The tall slopes of heath block out the surroundings and draws experience down the valley and into the sky above.

In Serres’ Five Senses, he explores the ‘audible’ and argues that noise is what defines the social. He suggests that of bodily senses, our perception of noise is what unites space and creates a single phenomenon perceptible to all. Pinara is an ancient burial cliff, the vertical graves are like “ten thousand dead eyes watching over the ruins of the old city on the hill below... Death keeping watch over life.”²⁹ On the other side of the city lies an old Greek theatre. The whole landscape becomes involved as an amphitheatre in which the city is the stage, amplified by the echoes of the funereal cliff-face.

“The lively city is directed at what is being broadcast in the background from a thousand shadowy mouths, tombs that blacken the tall, sombre cliff. The lingering moan of the dead still audible in the circus two thousand years after the death of the city.”³⁰

Collectively, people listen to the transmissions of their dead. From the theatre it appears a spectacle of death, but as one listens, they see it is a matter of hearing, a sound stage created by the body in space and its relationship to soaring geology and the dead. Sonic vibrations resonate throughout the space, infolding the sociality of the city with death.

Fig 4.

Fig 5.

Vegetation and the Sacred

Skogskyrkogarden engages the individual and group through experience of the forest. The forest existed before Asplund and Lewerentz, proposed their design. The sense of place is based on the sacred significance of this pine forest and rejects the cliché of the traditionally picturesque cemetery. The dark mass of pine represents the original matrix of the place, and the designed voids reflects culture. The main processional path leads the eye toward the sky and directs human understanding toward its integration with natural and celestial realms. A sense of resurrection for the living.³¹ Similarly in traditional Korean belief systems, the village grove separated and distinguished the sacred and profane but was also where the two worlds met. Koreans understand the daily profane in terms of ‘horizontal space’, an experience of time passing. Transcendent experiences like birth and death are related to ‘vertical space’ or the sacred, in which the earth is linked to the sky and humans to Heaven. These experiences of vertical space are centred on these village groves.³² Ancient trees “confer a sense of continuity on the changing settlement around it”.³³ Trees and landscapes condense and mingle time, they are reflections of the past, are experienced in the present and suggest a future.

Aotearoa’s focus in the past century has been and remains on conservation and revegetation as a consequence of widespread deforestation. Areas are revegetated based on regional lists of suitable species or performative aspects such as nitrogen uptakes for riparian projects. While this is important, it has led to a severely underexplored realm in the experiential qualities that native forest species possess. Unlike the relatively flat and dual-layered pine forest of Skogskyrkogarden, our native forests are often dense, multi-layered and undulating temperate rainforests. In landscape design, many people negatively view our native species as a series of muted brownny-green tones.³⁴ Despite negativity toward New Zealand’s ‘colourless’ appearance of flora, most experience awe in the presence of cathedral-like kauri at Waipoua or the way forest species like rimu, totara and kahikatea structure space. Trees direct human movement and experience through the height of branches, size of trunks and canopy, density of spacing, opacity, colour, roughness, scent and a range of other aspects in their space making. This cannot be understood separately from topography, geology and other components of landscapes either. The combination of these factors is underexplored, and much is desired in how Aotearora’s landscape elements create differences in bodily relations and space making in any context. If gentle tonality and shifts in monochromatic flora provide restful repetition³⁵ and our native trees are capable of structuring reverent spaces, then Aotearoa has vast potential to create incredible forested cemeteries.

Fig 6.

²⁸ Luciani and Boschiero, *Kongenshus Mindepark Mindepark : The International Carlo Scarpa Prize for Gardens*, 87.
²⁹ Serres, Sankey, and Cowley, *The Five Senses: A Philosophy of Mingled Bodies*, 108-109.
³⁰ Serres, Sankey, and Cowley, 110.
³¹ Wolschke-Bulmahn, *Places of Commemoration*, 102.
³² Woudstra and Roth, *A History of Groves*, 151.
³³ Lynch, *What Time Is This Place?* 111
³⁴ Wassilieff. “Horticultural Use Of Native Plants”
³⁵ Bowring, *Melancholy and the Landscape*, 157.

Reflection

The certainty of death should see more importance placed on the design of spaces for the dead. Yet, our cemeteries have been removed from the interconnectedness of human culture and ecology. Economic and functional concerns have taken precedence in cemeteries over the ecological, social, sense of sacred and experience. If current practice continues in the face of mounting pressures of urbanisation, we will continue to see socially and ecologically vacant concrete fields of death spreading into the disconnected rural realm. This literature mobilises the design-led research to explore reshaping the way we experience death. Utu, whenua and tapu present themselves as useful drivers in reimagining our connection to landscape, death and life. Landscape architecture should challenge current practice and explore alternative burial methods as a mode of freeing cemeteries from the restrictive criteria of current siting. No studies were found that investigated the role of vegetation, topography, hydrology and geology in Aotearoa’s memorial context. Personal fieldwork into how these realms affect bodily experience can catalyse design opportunities in Wellington’s deathscapes. A methodology is proposed for entwining all these aspects together to form an experimental practice for landscape architecture, that taps into the vast potential our landscape offers for the richness of cemetery design.

Dying in Aotearoa
Map of Cemeteries

Cycles of Opportunities

Chapter Three - Māori Customs and Death in an Ecological Sense

Te Ara Wairua

The Pathway of the Spirits

In Māori belief, a persons spirit departs Aotearoa at Te Rerenga Wairua (Cape Reinga) to return to the ancestral homeland of Hawaiiki-a-nui. This means all spirits must journey north.

This spirit journey north influenced aspects of daily life for living Māori, such as the doors of pataka (food storehouses) being oriented north. This was so spirits travelling from the south would not be able to enter and make the food tapu.

Here a spirit map created by the author, uses triangulation of all the trig points in the North Island. In this way it shows the concentration of spirit energy pathways across North Island maunga. Wellington, Hawkes Bay, East Cape and Taupo being particularly concentrated areas.

Once western travelling spirits reach Ahipara they follow a series of prescribed areas on west coast which must be passed by the spirits. Likewise, there is an eastern journey for east coast spirits once they reach Karikari Peninsula.

Landmarks of the Spirits

(13) Haumu at the head of the beach, where spirits from both coasts converge. (14) Maringinoa (weeping spirits) is where the spirit would look back and farewell their people.

(15) The spirits then descend into the valley of Waingurunguru (murmuring-waters). Very still and swampy, where a stream flows slowly, if at all. A faint droning is said to be heard, coming from everywhere and nowhere.

Caves - Rua Koiwi

Huge cliff faces were accessed above by makeshift ladders or by climbing forest giants and bridging from the branches to inter bones into caves perched high above the ground.

Tomo - Toma

In limestone country, sinkholes known as tomo were used to hide bones.

Freshwater springs - Waipuna

Freshwater springs, lagoons or pools were also used and bodies were weighted and sunk to the bottom.

Burial in Limestone Country

Māori Burial

Burial grounds are termed urupa. In-ground burial seemed to be less common historically, when it was employed it was usually within the confines of a village.

A cave or chasm where bodies or bones of the dead were placed is called a toma, whara, and rua koiwi. If the dead were buried, or otherwise disposed of outside the limits of the fortified village, then secret disposal was generally necessary.

The tapu nature of these bones often meant great lengths were taken to hide them. The creativity in the hiding areas of bones shows a great understanding of the environment in which Māori have forged over a thousand years of settling this land. They were often reflected by their locality and ecology.

Tree Hollows - Uru Koiwi

In forested lands, like that of Te Urewera, bones were stored in the hollow trunks of species like pukatea. This often involved climb tall trees to deposit them.

Swamp Burial - Wairepo

Sometimes the dead, would be gently tamped into the soft mud of swamps.

Astelia Epiphytes - Wharawhara

Clumps of Astelia epiphytes high up in trees provided a leafy domain for bones.

**Burial in
Swamp and Forest Lands**

Fig 7. Adapted from Pankhurst

Lagoons - Muriwai

Like burial in freshwater springs, lagoons were also used and bodies were weighted and sunk to the bottom.

Dune Burial - Tāhuahua

Dune burial was very common on the coast, the ease of burying in the sand, probably contributed to this. Bones are still found today, after erosive events on the coast.

Sea - Moana

Bodies were also taken out to sea, and provided a watery grave.

Rock Outcrops - Toka tū moana

Crevices in rocky outcrops and sea-caves, also provided small niches for the bones of the deceased.

Burial on the Coast

Fig 8. Adapted from Pankhurst

Alternate Burial Methods

LANDSCAPES OF BURIAL

The designed ecology of cemeteries often focusses on grasslands. However, this is not appropriate in the context of New Zealand where the flora never evolved into grassland or prairie meadowlands. These ecological models which are popular in international cemeteries are often imported here, with detriment to the ecosystem of New Zealand.

Traditional Lawn Cemeteries

These have remained the dominant trend in burial for centuries. Historically, grazing animals were often used to maintain the height of the grass to a two-dimensional plane. Today, they are maintained by large lawnmowers and for further efficiency many headstones are now flat and sunken below the lawn level.

The graves were generally dug “six feet under”, partially from fear of reanimation of the dead and beliefs around disease and hygiene. This deep layer of the soil is often very inert and the body can take a century to fully perish. The popularity of grandiose caskets meant the graves were generally wider, which uses more land. However, the depth can allow further burial atop of the last for other members of the family.

Natural/Green/Eco Burial Cemeteries

Natural burial is becoming an increasingly popular option for many. The landscape is seeded or allowed to regenerate in meadow grasses and flowers. The renewed appreciation for the aesthetics of meadows is seeing this method quickly replicated in cemeteries around the world. The ecology occurs up to knee-height with a few scattered trees.

The graves are dug to a depth of fifty centimetres to a metre. This leaves the body in the most biologically active layer of the soil, where the body and casket are recycled by the environment much faster than traditional means. Depending on the tenure of the grave plot, an endless amount of further interments may be possible.

Forested Cemeteries

Burial in the forest has largely been ignored. The few examples of such are generally from countries where the natural growth of the understory is limited. In New Zealand, the forest is dense and multi-layered. The flora occupies every available gap in three-dimensions.

The research explores how burial can become entwined with New Zealand's ecology. The graves will utilise the same dimensions as natural burial and native plant material will be explored in casket construction.

Alternative Burial
Methods

BODY	INPUTS	PROCESS	OUTPUTS	PROCESS	PRODUCT	IN LANDSCAPE
<div>NATURAL BURIAL <i>Earth - Decomposition</i></div>	<div>Natural material casket →</div>	<div> No embalming Made from native plants</div>		<div>Grave dug </div>	<div>Body decomposes faster in the more biologically active layer of soil </div>	<div> Area specific tree species planted Tree growth, marker for the dead</div>
<div>CREMATION <i>Fire - Combustion</i></div>	<div>285 kWh natural gas →</div>	<div> 600C for 120mins Body burned</div>	<div>Hg - Mercury + 240kg CO2 ↑ Metals released into atmosphere</div>	<div> Area specific species seed</div>	<div>Hole dug </div>	<div> Tree growth, marker for the dead</div>
<div>AQUAMATION <i>Water - Infiltration</i></div>	<div>300L H2O (Water) + NaOH (Lye) →</div>	<div>Heated water dissolution 160C for 180mins 90 kWh electricity</div>	<div>Bones remain + 350L Alkaline H2O Water Drained</div>	<div>$\text{Ca}_5(\text{OH})(\text{PO}_4)_3$ = Bone Powder + Water Urn =</div>	<div>Metals reclaimed, fillings, joints </div>	<div> Irrigation or infiltration into streams</div>

Selected Case Studies:

Discoveries

- Alternative Burial
- The Challenges of Topography
- Manipulation of Geology through Burial
- Architecture in Watery Landscapes
- Spontaneous Flora
- Spatiality, Arrangement and Experience of Vegetation

Local Cemeteries

1. Whenua Tapu Cemetery

2. Hongoeka Urupa

3. Plimmerton Urupa

4. St Alban's Cemetery

5. Urupa (Puaha St)

6. Urupa (Mataiwhetu St)

7. Urupa (Te Arataura St)

8. Porirua Cemetery

9. Johnsonville Cemetery

10. Makara Cemetery

11. Karori Cemetery

12. Bolton St Cemetery

13. Mount St Cemetery

After investigating regional cemeteries and urupa from Wellington to Porirua, three were selected for their relevance, site conditions and discovered design potential. Makara, Karori and Bolton St Cemetery.

MAKARA CEMETERY

*Discoveries
- Natural Burial*

Natural Burial Area of Makara Cemetery

Freshly Turned - Year One

Wooden Gravemarkers

Mulched and Planted - Year Five

Juvenile Forest - Year Ten

Makara Cemetery is Wellington City's only natural burial site. Makara Cemetery hopes to see the natural burial areas grow into a memorial forest park with walkways. By the twentieth year of growth this might be possible, but currently the bush is thick and unnavigable. While the long-term ambition is admirable, there are twenty years in which the family of the deceased cannot visit the grave without causing damage to the regenerating bush. Another solution might be using existing areas of exotic or regenerating forest to bury in, so people can visit graves and enjoy a forested experience.

The Challenges of Topography

Karori Cemetery is the second largest cemetery in Aoteroa, behind Waikumete Cemetery. It is the resting place of over 80,000 people and was established in 1891 to provide more burial space after Bolton St Cemetery ran out.

These photos show a particular area in the centre of Karori Cemetery where Wellington's challenging topography was dealt with in a creative, yet economic way.

This steep hill has sinuous rows of concrete graves running along contour. The graves themselves are angled from the horizontal so that they roughly match the contour of the hill. Conceivably, this was not a design decision and rather an economic one which meant less time and material cost than if the concrete graves were made horizontal. The staggered graves face downhill of their orientation, looking down on you when rounding the corner. The prominence of the hill gives the deceased a powerful presence. The topography and graves come together to confront you. Here the deceased and the landscape start to blend. This example is promising for the possibilities of burial on slope. Karori Cemetery Management Plan also notes that the less demanding depth requirements of natural burial are particularly useful in difficult terrain.

The Challenges of Topography

The Spatiality, Arrangement and Experience of Vegetation

Macrocarpa, with their thin pointy branches reach out and encapsulate you.

They begin to darken a direct you through a tunnel of light. As you make your way downhill, the graves become progressively more overgrown.

The forest shifts toward Eucalyptus, their trunks are rough and black. Above head height, they begin to branch. These drastically contrasting, smooth and white skeletal branches create a lightness in the canopy.

The public burial section two, opened in 1903 and the vegetation likely dates to the 1938 or 1948 planting. Many of the trees now 70-80 years old prove a management issue, their falling branches and roots damage the graves.

These Eucalyptus viminalis were planted because of concerns around the starkness of the previously unvegetated cemetery. They proved to be one of the most resilient species of many that were trialed, in their ability to cope with the lack of moisture and toxified soil from years of herbicide use and embalming leachates.

The Spatiality, Arrangement and Experience of Vegetation

The importance a single tree has in structuring space is evident here. The canopy reaches over 20 metres in diameter, its relative lack of leaves allows an incredible amount of light into the space below. It also acts as an anchor for the the graves surrounding it. Those that are sheltered by its branches are brought into a relationship with the tree. The flaky bark peels off in long strips onto the graves and as it decays, smaller vegetation begins to grow in the detritus. Left unchecked for another 100 years, a forest would grow from the graves.

These photographs show this process already beginning. The simple white crosses, help to mark the place of the dead within what is already becoming harder to tell as cemetery.

Figures 9. Overlaid

Disregard for the Dead

Bolton St Cemetery was Wellington City's first burial ground and opened in 1840. It was full by 1892. By 1960 Wellington was in need of better access into the city. There was a lot of controversy in the route of Wellington's motorway. The cemetery was in the way and from 1968 until 1978 construction was underway. It saw 3,700 burials exhumed, which now lie in a large sealed vault under the bisected eastern half of the cemetery.

There was a promise to build a linking piazza (fig.9), but this never eventuated and a narrow footbridge over the motorway was constructed instead. The overall damage to the cemetery was considerable and marked a turning point on Wellington's attitude to conservation questions.

The bisected cemetery today, showing the footbridge connecting the halves. Thousands of Wellingtonian's drive over the old resting place of 4000 people a day. Te Ahumairangi in background.

Spontaneous Flora

Amaryllis

Autumn

Autumn marks the end of summer and as the temperature cools, Amaryllis emerges on long naked stalks and erupt into a show of pink blooms. They are a South African species and like many of our cemeteries, they thrive in the harsh conditions.

Some of the graves are gardened, mulch is spread and flowering perennials are planted.

Hydrangea burst into shades of red, white and purple down in the shady gullies.

Amaryllis

Hydrangea

Japanese Anemone

Yellow Sparaxis

Spring

Spring brings warmth from the cold winter, here a range of other South African bulbous species have taken hold. Prolific in their reproduction, Sparaxis line many of the paths in the North Western section.

Watsonia

Arum Lily

Daffodil

Maroon Sparaxis

Tricolour Sparaxis

REGIONAL CEMETERY STUDY

Pomaderris kumeraho

Schoenus tendo
Gleichenia dicarpa
Dracophyllum sinclairii
Leptospermum scoparium

Gumland Ecology

Waikumete Cemetery was a large native gumland ecology before its conversion into a cemetery. The surface was molded into pathways, rows and burial plots. Gumlands are a soil and ecology associated with kauri forest, kauri gum is preserved in the soil conditions and hence - gumland. The soil is generally sodden in winter and baked dry in summer. This results in very difficult growing conditions and as a consequence plants that are low-fertility tolerant, thrive. There are small areas of this gumland left.

The Manipulation of Geology through Burial

The process of digging graves here has led to the soils becoming even more infertile. The small amount of fertility left in the top layer of clay was disturbed and mixed with the lower leached clays. When the soil was placed back atop the deceased, very few species of plants were able to grow. Burial over such a large area, led to the entire landscapes fertility being altered. Now South African flora, highly adapted to these conditions grow throughout the cemetery (next page).

Gumland Ecology - Burnt

Graves dug into leached soils

Soil layers mixed

More infertile top layer after burial

1. *Babiana angustifolia*

2. *Centranthus ruber*

3. *Coreopsis lanceolata*

4. *Daucus carota*

5. *Dichelachne crinita*

6. *Ixia polystachya*

7. *Lathyrus latifolius*

8. *Leucanthemum vulgare*

9. *Leucojum aestivum*

10. *Pauridia capensis*

11. *Sparaxis bulbifera*

12. *Tritonia crocata*

Spontaneous Flora

Waikumete Cemtery is a stunning seasonal display of largely South African flowering plants. They were planted on graves throughout the century as a token to the deceased, like one would with cut flowers. Over time as the plants have flowered, seeded or grown as a rhizome, the cemetery has morphed into a large wildflower meadow. Part of the cemetery is designated a wildflower sanctuary and management is in place to keep control of more aggressive species like *Watsonia*. It also provides habitat for *Dichelachne crinita* and *D. inaequiglumis* which are two uncommon species of native grasses.

The phenology diagram below shows when the different species of flowers occur in the year, as well as height, structure and colour. Waikumete is an example of mourning loved ones, changing the ecology of a cemetery through their grief. It provides an understanding of how the small actions of many, can contribute to the wider. What might be brought the forested landscape by mourners?

13. *Watsonia borbonica*

International Cemeteries

Kongenshus Mindepark

The Challenges of Topography
Year - 1953
City - Jutland, Denmark
Landscape Architect - Carl Theodor Sørensen

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Fig 10.

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Kongenshus Mindepark commemorates the early of efforts of farmers who reclaimed the heathland to feed the nation during the Danish resistance whilst also celebrating the heathland ecology. The design distills sacred associations of prehistoric Danish stone dolmens, the landscapes of heath and connection to the Ice Age glacial landscapes of Denmark. The large boulders are both symbolic of the glacial movements that shift them and the cultural manipulation of them in marking the dead.

The design moved almost no earth, instead the topography of the narrow glacially carved valley was utilised to direct experience through the memorial space. As one passes the rows of large stones, the tall slopes of sesonally mauve heath, block out the surroundings and draws experience down the valley and into the sky above.

Sørensen was not challenged by topography and instead used its power to create a celebrated memorial landscape.

Fig 10.

Skogskyrkogården

Spatiality, Arrangement and Experience of the Forest

Year - 1917

City - Stockholm, Sweden

Landscape Architect - Sigurd Lewerentz

Architect - Gunnar Asplund

Fig 11.

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Skogskyrkogården is particularly relevant to the research as it is a cemetery that was created within an existing forest.

The dark mass of pine trees represents the original matrix of the place. Asplund and Lewerentz designed voids within the forest to allow for burial, and let light into the forest for the experience of the living. These voids represent one of the earliest types of cultural landscape architecture, the forest glade or clearing.

The sense of place is based on the sacred significance of this pine forest and rejects the cliché of the traditionally picturesque cemetery. The main processional path leads the eye toward the sky and directs human understanding toward its integration with natural and celestial realms. A sense of resurrection for the living. Skogskyrkogården engages the individual and group through experience of the forest.

Similar ambitions are useful when creating a natural burial landscape within a forest. Their method of using photography and drawing for studying the potential of forest graves. A similar methodology will be tested in this research.

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Fig 12.

Middle Village Cemetery

and the Curious Case of the Mulberries

Year - Established 1879

City - New York, U.S.A.

Designer and intention not the focus

Spontaneous Flora

Middle Village Cemetery is located in Queens, New York. There is a curious phenomena that occurs at this cemetery, brought to my attention by Eric Oglander. Upon a walk through certain areas in the cemetery, one might come to notice the somewhat regular scattering of mulberry trees. As a member of the *Morus* genus it produces elongated blackberry-like fruit. The trees appear throughout the cemetery in descending heights, they also tend to be growing right out of the headstones. They are too close to the headstones to have been planted and occur too far away to grow from berries to blown off larger trees. The culprits for this strange relationship between graves and trees, are birds. Up in the older trees, they feast on fruit and then fly off to roost on the warm headstones. After digesting, they deposit their meal. Over time, this has lead to a thicket of mulberries sprouting from the graves and left longer, would eventually turn to forest.

This example is an important reminder of the spontaneity brought by fauna and flora to the cemetery. How might animals form relationships with our cemetery landscapes and create novelty through their actions? By engaging with the interconnectedness of life-forms in the landscape, we can provide the right conditions for them to flourish. In turn, this shapes our experience of cemeteries and allows our dead to interact with the present and future.

Fig 13.

1.

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further details.

2.

3.

4.

5.

Chapter Four - Site Selection:

Current Practice Criteria
1. Land zoned outside of the rural-urban boundary.
2. Flat-gently sloping gradient; well-draining soil with minimum groundwater impact.
3. 30 minute drive of most residents.
4. Located on public transport routes, near a main highway.

My Site Criteria
1. Use government owned reserves (no purchase cost, lower burial prices, most are already used for recreation).
2. Ability to accommodate alternative burial (allows for steeper and forested land).
3. Within walking distance of Central Business District (close to daily life and sociality).
4. A site with native afforestation aspirations (burial can fund and enhance ecology).

Site Selection

Town Belt Management Plan

Fig. 14

Most reserves in the Town Belt have large areas of actively managed exotic forest such as Mount Victoria. Mt Albert Park and Te Ahumairangi have a long-term ambition of native afforestation.

Mt Albert Park is the second best option based on the site criteria. But, it lies 3km from Cuba St and would be deemed to far to walk for many.

Te Ahumairangi is four times as large as Mt Albert Park and could provide a large enough area for ongoing burial. It is a 15 minute walk from the CBD and 30 minutes from Cuba St. It provides a green backdrop to much of the city and a cemetery here has the potential to change the way the city relates to the Town Belt. It currently acts as a topographical barrier to the western suburbs, but the design of the cemetery has potential to create better access between the city and suburbs.

Site Analysis:

History

1885

Fig. 15
Watercolour view from Tinakori Hill.

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Fig 16.

1839
Charles Heaphy first viewed Tinakori Hill, the slopes and summit were “densely timbered... the rata being conspicuous”. Native gardens were present at the base of the hill (1,2). By the end of the 1870s the bush had gone and been replaced by pasture grasses.

1866
Northern end of Lambton Quay. Photographed from a vessel in the inner harbour. Forest toward the top still remains.

Fig 17.

1880
Sir Julius Vogel's addition to Premier House. Which turned the prime ministers residence into a two-storeyed structure. Pasture has taken hold on most of the hill. Farmland fences visible behind.

Fig 18.

1894
View over Thorndon from the Bolton Street Cemetery looking towards the Tinakori Hill. Regeneration starting to occur on farmland.

Fig 19.

1912
Fig 20.
Wellington from the Tinakori Hills

Te Ahumairangi - 1938
After thirty years of deforestation and grazing, planting work began in the 1880s on the mostly bare hill. Conifer plantations were established around the northern end of Tinakori Hill including the oaks in Queen's Park which are now of great size. At the southern end of Tinakori hill, pine and macrocarpa were heavily planted. Other exotic species were trialled such as: gums, wattles, sweet chestnut and sycamore. Native species like pohutukawa, karo and griselinia were used extensively. Many of the paths still functional today are visible without the canopy.

Te Ahumairangi - 1941
An interesting mixture of native species growing on the central slopes of Tinakori Hill probably dates from this time. This planting includes: rimu, black beech, black-red beech, kawaka, tanekaha, mangao, and karaka. The major conifer plantings were completed between 1920 and 1940. Pohutukawa was often planted at the edge of plantations, and blocks of gums were grown on the lower slopes of Tinakori Hill.

Te Ahumairangi - 1945

This year saw earlier preparations for WWII still in place. At Anderson Park in the Botanic Gardens (bottom left) a large United States military camp was instated. On Te Ahumairangi a range of bunkers were built at the north and south ends using the height as a vantage point over the harbour. Only one bunker remains at the southern end.

Te Ahumairangi - 1959

Post-war more housing was needed and Cecil, Euston and Pembroke Roads are can be seen in construction. This would later open up the western slopes for subdivision. The conifer plantations are now beginning to dominate much of the landscape.

Some subdivision and new housing is visible and the Orangi-kaupapa road is being built around an old Māori pa site and would later have houses built.

Te Ahumairangi - 2017

The landscape of Te Ahumairangi has slowly been regenerating. The pines still remain 100 years since their planting. Significant portions of pine fell over in the 2004 storm and their future as limited as they become even more susceptible to windfall. Urbanisation has steadily encroached and SH1 has bisected Tinakori and Thorndon, severing easy pedestrian access to Te Ahumairangi.

HISTORY

Mining

Kohatu Quarry

The Kohatu quarry is off the Huntingdon Street track. George Thomas who owned the land built a track from Orangi- Kaupapa Road to the quarry which enabled road metal to be removed from the site, initially by horse and cart and later by tramway which is still visible today.

In 1908, he sold the quarry to Kohatu Quarrying Company. Following the death of the quarry foreman in an explosion in 1912 and the difficult war years, the Kohatu Company approached the Council in 1919 also offering to sell their land including the quarry.

Grant Rd Lower Quarry

The Grant Road quarry was Council managed and dates back to 1889 as a road metal supply. The enormous scar has grown over. It is located behind the Wellington's Potter Association. The geology of the hill is comprised of greywacke.

Grant Rd Upper Quarry

An increasing demand for new sources of quality metal led to prospecting above the existing quarry. The Council found 'a valuable source of supply' and installed wooden chutes and a cable-car system to carry the quarried rock down to Grant Road.

Upper Quarry Tunnel

The 35 metre long tunnel at this old quarry remains an enigma and may have been part of other gold prospecting efforts. Today it is home to glow-worms and cave weta.

Gold Prospecting

A range of small excavations were made on the reserve near the Glamorgan St entrance.

Human Vectors

Pedestrian Catchments

- <5 mintues
- 5 -10 mintues
- 10-15 mintues
- 15-20 mintues
- 20-25 mintues
- 25-30 mintues
- 30-35 mintues
- 35-40 mintues

A study of the surrounding context was undertaken using Taranaki St, Salamanca Rd, Upland Rd, Curtis St, Wilton Rd and Churchill Dr as a boundary. This captures the likely vectors from Te Aro, Kelburn, Northland, Wadestown and Thorndon.

The times were based on walking speed and the closest entrance to Te Ahumairangi at any given point in the surrounding suburbs.

Western Wadestown and the lower slopes of Northland suffer from the lack of a close entrance, despite their close proximity to the reserve.

Properties that Border

A map was constructed to understand where private land borders public land. It shows the public porosity and accessibility of Te Ahumairangi's perimeter.

It also shows that Tinakori and Wadestown have the highest density of residents surrounding, which tend to have a greater social influence on the reserve.

Human Vectors
Routes Taken and Desires

Tourists
Age: 25-65
Desires: Mild walking, a memento, panoramic photographs.
Requirements: Toilets, Nature, Seating

Walkers/Runners
Age: 20-50
Desires: To exercise, to complete a loop.
Requirements: Nature, Loop Track

Cycling Commuters
Age: 30-45
Desires: Can take a slightly longer and exciting route to work in Thordon or CBD
Requirements: Well-graded and dry track

Dog Walkers
Age: 30-60
Desires: Expansive grass, to throw objects for their furry friends.
Requirements: Fresh water, Grass, A place to put dog poo.

Foragers
Age: 20-50
Desires: Mushrooms and other wild edibles, quiet, privacy, to go off track.
Requirements: Pine or Deciduous Forest

Te Araroa Trail Hikers
Age: 25-50
Desires: After walking half the length of the country at this point, to get to the ferry, Botanical Gardens, or civilization.
Requirements: Trail Markers, Nature

Park-ups
Age: 18-30
Desires: To drink alcohol in the car, with a view, with loud music.
Requirements: Nature, Night-time access, Carparks.

Walking Commuters
Age: 25-55
Desires: Quick route to work in Thordon or CBD, wants to arrive clean.
Requirements: Well-graded track, Direct route, Sense of Safety

Picnickers
Age: 30-55
Desires: Expansive grass, Panoramic Views, Quiet
Requirements: Grass, Tables, Seating, Nature, Toilets

Tennis Players
Age: 25-60
Desires: Shelter from the wind and a short walk.
Requirements: Tennis Court

Mountain Bikers
Age: 18-45
Desires: Adrenaline, to build their own tracks
Requirements: Nature, Steep gradients

Council Workers
Age: 25-50
Desires: Moves in a grid-like fashion, trap-line monitoring, can drive places others can't. A place to have smoko.
Requirements: Nature, Keys to the gates, Seating

Entrance Experiences

WELD ST

Weld St entrance forms the start of the Northern Walkway track and Te Araroa Trail. Toetoe spring from the regenerating hillsides of gorse.

MOORHOUSE ST

Moorhouse entrance, winds through the upper part of Te Waipaekaka stream. A damp mixed native and exotic forest, drops orange leaves along the track in Autumn. It emerges on a steep grassy slope with views out to Wellington Harbour and looks down on grove of cabbage trees.

WADESTOWN RD NORTH

The northern Wadestown Rd entrance is steep and gouged out by access vehicles. It is marked by a kowhai, crossing the road will bring one to an entrance to Queens Park.

UPPER QUEEN'S PARK

The north-western Queens Park entry is obscured and only revealed on inspection of the giant pine tree marking it. The track is overgrown and snakes past a waterfall and through deciduous oaks.

LOWER QUEEN'S PARK

Lower Queens Park is wall of green, seen from Grant Road. Underneath the canopy very old pohutukawa wrestle above head.

GOLDIE'S BRAE

Goldie's Brae was once a Victorian strolling park, today it seems empty. Large oaks and natives punctuate the small lawn.

Entrance Experiences

GLAMORGAN ST

Glamorgan entrance is one of my favourites, carpets of Hound’s tongue fern and the frequent presence of screeching Kaka make for a dramatic entry.

CECIL RD

A long flight of wooden steps make their way up the hill. The plantings of native beech are not often seen in Wellington City.

MONMOUTH WAY

Monmouth entrance is a strange sort of entry, owing to its odd sense of public and private. What is and appears as private driveway actually has access at the top. This damp valley is full of supplejack and kawakawa.

HUNTINGDON ST

Huntingdon entrance takes one along the old tramway used to remove stone from the Kohatu Quarry. The width and flatness of this path is uncharacteristic of Te Ahumairangi.

SOUTHERN CAR ACCESS

The Northland vehicle entrance to Te Ahumairangi runs between a sharp rocky cutting and a dark valley. The road is in poor condition and is very steep. Huge macrocarpa from early plantings arch over the road.

WATERWORKS

The waterworks are remnants of the days when the water reservoir at the Weld St carpark was used to supply Wellington City with drinking water.

Landform

Landform Structure

Geometries of Te Ahumairangi and how they structure experience and vegetation.

Ridgetop

The ridgetop is currently utilised for recreation and is popular for its views over the city and western suburbs. It extends for just over 1km. The ridgetop is maintained as grass, plants are exposed and buffeted by strong wind.

Ridgelines

There are 12 major ridgelines that structure the experience of Te Ahumairangi. Pathways utilise the ridges as connectors between the ridgetop and northern walkway. They provide filtered views through pine forest out to the city. They are drier which is reflected in the vegetation.

Valleys

There are 10 major valleys that structure the experience of Te Ahumairangi. They are damper, darker and tend to be rocky. They provide a more intimate sense of space. Mahoe, kawakawa and ferns carpet the valleys.

Steep Faces

There are 9 roughly triangular steep faces. They all face the city and are important in how the wider city perceives Te Ahumairangi. Their verticality against the city means they are mostly what is seen of the hill.

Slope Map

Key

The only particularly flat areas are those modified by humans. The ridgetop has been graded as a rough road in the past and in the south the flat areas show where military buildings once lay. The other flat area of note is to the east and was a Māori kainga.

In terms of burial, 0-40% could accommodate bodily burial and 40-60% would be able to accommodate urn burial, 60-80% slopes are likely too difficult to bury in.

Geological Map

- Key
- Greywacke Mudstone
 - Greywacke Mudstone-loam
 - Greywacke Scree
 - Greywacke Boulders
 - Exposed Rock
 - Greywacke Cliffs

Geological studies of Te Ahumairangi do not exist. A series of geological samples were collected through fieldwork to help understand the distributions of geology across the site.

As a generalisation, greywacke tends to fall into the valleys whereas mudstone comprises many of the drier ridgelines.

This study is very useful in understanding the types and depths of burial that are better suited to particular areas of geology.

Geological Study

Soft Mudstone

Soft Mudstone Scree

Mudstone Soil

Hard Greywacke

Fractured Greywacke

Greywacke Scree

Hydrology

Historic Streams and Kāinga

A series of catchments were created to provide clarity throughout the document to which area of the large site is being referred to. Understanding which areas are hydrologically linked is important in how aquamation and burial interacts with water on site.

Saturation Gradient

Groundhog is plugin for grasshopper and rhino, that allows for modelling of saturation gradients that occur along water paths. In this map white represents the driest areas and dark-blue the wettest. This is used to provide constraints for wide scale plant distribution later based on water-tolerances.

The software allows for other visualisation methods such as representative bars of varying height. The percentage of water loss based on porosity of soil type is offered also. For Te Ahumairangi's greywacke soils this is roughly 12% and so this was set as the parameter. There is a general trend toward the wettest areas being those about three quarters along valleys on the downhill.

Flora

Historic Flora

A pollen analysis was undertaken by Matthew Campbell and Mark Horrocks in a 2009 archaeological study of Pipitea Street.

This area is very close to Te Ahumairangi and would likely contain the pollen of plants on the hill and resemble a similar floristic composition.

Interestingly beech pollen was found, which may attributed to further away sources like Eastbourne. But it may reflect a cooler time period where beech may have occupied Te Ahumairangi.

Fig 22.

Historic Vegetation

Wellington’s western peninsula was once a tall podocarp/broadleaf forest. Rimu and rata were the dominant emergents, soaring above a dense canopy of tawa, titoki and hinau. Northern rata start their life high up in rimu branches as a seed, and climb down to the forest floor before swallowing its host in a tangle of roots. Wellington’s forests was once draped with perching astelia lilies, scented orchids and epiphytic ferns.

The understorey was comprised of treeferns and vines weaving their way up to the light in the canopy. The forest floor was a carpet of moss, ferns, sedges and grasses atop decaying plant matter.

These emergent and canopy species are notably absent or rare in the Town Belt after a many human induced changes. Most of what occurs on Te Ahumairangi is still in early ecological succession and is mainly species from (fig. 23) understorey and under.

Fig 23.

Current Vegetation

Te Ahumairangi has had a century of floristic changes, like much of the town belt, exotic conifers, pines and deciduous trees were planted. Today, conifers still dominate on Tinakori Hill and range in age from 60 to 120 years old. The tallest stands reach 25m in height. The damp gullies and lower slopes of Te Ahumairangi under dense conifer canopy, host shade-tolerant native species like mahoe, rangiora, karamu, fivefinger, shining spleenwort and hound’s tongue fern .

Two large storms in 2004 saw mature pine plantations fall in the Town belt, especially on Te Ahumairangi. Some of the remaining isolated trees were cleared and for the first time in the memory of most people, part of the Town Belt was bare.

In 2005, thousands of northern rata seedlings were planted on Tinakori Hill, as an attempt to re-establish rata which were noted by early settlers. If the native forest is to be self-sustaining, then large plantings of rimu, hinau, tawa, titoki, miro, matai, totara, kahikatea, pukatea, fuchsia, kohekohe and nikau is needed.

Vegetation Composition

- Habitat Key*
- Pinus radiata forest
 - Coniferous forest
 - Exotic and native forest
 - Native forest
 - Regenerating native forest
 - Exotic scrub
 - Maintained grassland

This vegetation study based on a personal and more recent observation than other mappings. Native forest is primarily comprised of Mahoe and broadleaf vegetation. Regenerating natives are a diverse mix of mahoe, wineberry, rangiora and other. Coniferous forest are remnants of Cryptomeria and Macrocarpa plantings. Exotic scrub is primarily gorse and broom. Sections of grassland are maintained for recreation along the ridgeline. There is a tendency for pine forest to be absent in the valleys, the combination of geology and water seems to have led to the earlier death of pine. A noticeable diagonal line in the distribution of vegetation owes to a historic boundary line that was planted with macrocarpa as a windbreak. This study is useful for understanding, the existing vegetation of the site and how this might change through burial and management over time. Although pine forest is marked as a singular, there is an incredible diversity of flora below. The following photographic study shows the variation under pine and macrocarpa.

Asplenium bulbiferum under Pine and Sycamore

In, damp pine forest, shining spleenwort flourishes. It brings reflectivity into the understory and is somewhat epiphytic as shown.

Pine and Sycamore

Much of the southern Tinakori end slopes are comprised of *Acer palmatum* (sycamore). It turns this part of the hillside red and gold in autumn.

Microsorium pustulatum under Pines

Native hound's tongue fern has an affinity for pine forest. On these drier slopes it creates a verdant green carpet. These are the only parts of the forest vegetatively restricted from knee to canopy.

These mahoe and kawakawa slopes seem to hold the character of Te Ahumairangi. They might have the most potential in the current native ecology for creating a memorial experience. The light they bring into the forest and relative ease of human movement through could be important in Wellington's burialscares.

Fauna

INATURALIST TO
MAPPING WORKFLOW

Where no comprehensive animal-life reports are available, citizen science allows for fast understanding of distributions and species of fauna. At Te Ahumairangi it would otherwise take months or years to collect as much data.

This data is used to create a maps and reports of the species of interest on site. Then by grouping these organisms into defined habitats and understanding of the overlap of species can be found and their relationship to burial in the landscape can be speculated upon.

The explore section of Inaturalist, gives places of interest or a bounding box can be created.

With 7500 observations at Te Ahumairangi there is a lot of data.

Filters set to include 'wild', 'research grade' and organisms of interest.

Export Observations

1 Create a Query

Create an observation query just like you would elsewhere on the site. You can also cut and paste an observations URL from another part of the site. Your query should return no more than 200,000 observations.

2 Preview

1 - 30 of 2057

Photos / Sounds	Species / Taxon Name	Observer	Date observed	Place	1 ID
	Discobola dohrni	wild_wind	February 11, 2021	Northland, Wellington 6012, New Zealand (Google, OSM)	Research Grade
	Common Tiger Beetle	wild_wind	February 11, 2021	Northland, Wellington 6012, New Zealand (Google, OSM)	Research Grade

3 Choose columns

Choose the columns you want to export

4 Create Export

Under the filters tab, is a download feature.

Longitude, latitude are needed for positioning later, scientific and common names for understanding the species. The data is downloaded as .csv file which can be opened with excel.

Using ArcGis, the longitude and latitude data are taken from the .csv, and points are plotted on a map. The symbology layer gives options to group species by colour.

FUNGI
DECAY

Fungi’s role in the ecosystem is to recycle nutrients, they accelerate decay in vegetative matter. As decomposers in the forest they may play an important role in natural burial cemeteries. They also create experience at the macro-scale. Ranging in colours from bright red to blue and in texture from transparent jelly to hard and woody. They visually affect the experience of the forest and might flourish with the process of burial.

<p><i>Armillaria novae-zelandiae</i> Honey Mushroom</p> <p>Habitat Stumps, Logs, Trees.</p>	<p><i>Ascocoryne sarcoides</i> Purple Jellydisc</p> <p>Habitat Tawa Beech and Pine.</p>	<p><i>Auricularia cornea</i> Ear Fungus</p> <p>Habitat Mahoe, Tawa, Kohekohe, Kawakawa.</p>	<p><i>Baeomyces heteromorphus</i></p> <p>Habitat Exposed Soils, Clay Banks.</p>	<p><i>Bisporella citrina</i> Lemon discs</p> <p>Habitat Beech, Griselinia, Kanuka/ Maunuka, Kamahi.</p>	<p><i>Campanella tristis</i></p> <p>Habitat Coastal Forest Species.</p>
<p><i>Conchomyces bursiformis</i></p> <p>Habitat Tawa, Beech, Kahikatea, Pine.</p>	<p><i>Cyclocybe parasitica</i></p> <p>Habitat Tawa, kohekohe, Lacebark, Pukatea, Mahoe, Putaputaweta, Karaka.</p>	<p><i>Dibaeis arcuata</i></p> <p>Habitat Exposed Soils, Clay Banks.</p>	<p><i>Heimiomyces velutipes</i></p> <p>Habitat Tawa.</p>	<p><i>Hypholoma brunneum</i></p> <p>Habitat Beech.</p>	<p><i>Ilodictyon cibarium</i> White Basket Fungus</p> <p>Habitat Pine, Kanuka, Mamaku.</p>
<p><i>Leratiomyces erythrocephalus</i> Scarlet Pouch</p> <p>Habitat Tawa, kohekohe, Nikau, Mahoe, Rimu, Ponga, Pine.</p>	<p><i>Myxarium nucleatum</i> Crystal Brain Fungus</p> <p>Habitat Titoki, Kamahi, Kohekohe, Karaka, Beech.</p>	<p><i>Oudemansiella australis</i> Porcelain Slimecap</p> <p>Habitat Kohekohe, Mahoe, Mapou, Beech, Kowhai.</p>	<p><i>Paurocotylis pila</i></p> <p>Habitat Rimu, Kanuka/Manuka, Beech, Kahikatea, Totara.</p>	<p><i>Pholiota subflammans</i></p> <p>Habitat Beech, Pine.</p>	<p><i>Podocyptha petalodes</i> Wine Glass Fungus</p> <p>Habitat Pine, Kanuka, Pukatea, Mahoe.</p>
<p><i>Podospirula pusio</i> Pagoda Fungus</p> <p>Habitat Pine, Manuka, Beech, Tawa.</p>	<p><i>Pseudohydnum gelatinosum</i> Toothed Jelly Fungus</p> <p>Habitat Pine, Manuka, Beech, Totara, Macrocarpa.</p>	<p><i>Psilocybe werarora</i></p> <p>Habitat Tawa, Beech, Maunuka, Ponga, Mamaku, Kawakawa.</p>	<p><i>Schizophyllum commune</i> Splitgill Mushroom</p> <p>Habitat Pine, Kowhai, Ngaio, Tawa, Maire.</p>	<p><i>Stereocaulon ramulosum</i></p> <p>Habitat Disturbed Ground, Rock.</p>	<p><i>Stereum versicolor</i> False Turkey-tail</p> <p>Habitat Tawa, Kohekohe, Rewarewa, Manuka, Kahikatea, Beech.</p>
<p><i>Tympanella galanthina</i></p> <p>Habitat Tawa, Manuka, Mamaku, Beech.</p>	<p>Habitat Key</p> <ul style="list-style-type: none">Decaying WoodRocksDry BanksDamp Banks and CavesStanding WaterShrublandForest				

MOTHS AND BUTTERFLIES POLLINATORS

Moths and butterflies play important roles in the pollination of plants and in the wider ecosystem they are food for birds.

Many of these members of the Lepidoptera insect order have specific relationships with plants like the flax notcher, kawakawa looper, clematis triangle and many others.

The planting of thousands of native species in tandem with natural burial would likely increase the populations of these insects, in turn benefiting birds. Increased sightings of them might help to heighten the sense of the interconnectedness of living and dying, in a cemetery context.

Habitat Key

- Decaying Wood
- Rocks
- Dry Banks
- Damp Banks and Caves
- Standing Water
- Shrubland
- Forest

<p><i>Adoxia vulgaris</i> Olearia Moth</p> <p>Habitat <i>Brachyglottis</i> and <i>Olearia</i> leaves.</p>	<p><i>Aenetus virescens</i> Puriri Moth</p> <p>Habitat Bores into <i>Putaputaweta</i>, Beech, <i>Hoheria</i>, <i>Maire</i>, <i>Griselinia</i>.</p>	<p><i>Austramathes purpurea</i> Mahoe Moth</p> <p>Habitat <i>Mahoe</i> leaves.</p>	<p><i>Austrocitaria similata</i> Dark Coprosma Moth</p> <p>Habitat <i>Coprosma robusta</i>, <i>C. rotundifolia</i>.</p>	<p><i>Chersadaula ochrogastra</i> Stone Moth</p> <p>Habitat <i>Under</i> stones.</p>	<p><i>Cleora scriptaria</i> Kawakawa Looper</p> <p>Habitat <i>Titoki</i>, <i>Wineberry</i>, <i>Akeake</i>, <i>Fivefinger</i>, <i>Kawakawa</i> leaves.</p>
<p><i>Deana hybrealis</i> Clematis Triangle</p> <p>Habitat <i>Clematis</i> leaves.</p>	<p><i>Declana floccosa</i> Forest Semilooper</p> <p>Habitat <i>Pine</i> and <i>Muehlenbeckia</i> leaves.</p>	<p><i>Epalxiphora axenana</i> Kohekohe Moth</p> <p>Habitat <i>Kawakawa</i>, <i>Kohekohe</i>, <i>Griselinia</i> and <i>Toro</i> leaves.</p>	<p><i>Epiphryne undosata</i> Hebe Moth</p> <p>Habitat <i>Hebe salicifolia</i> flowers.</p>	<p><i>Feredayia graminosa</i> Mahoe-stripper Moth</p> <p>Habitat <i>Mahoe</i> leaves.</p>	<p><i>Glaucias amyoti</i> Australasian Shield Bug</p> <p>Habitat <i>Coprosma</i>, <i>Griselinia</i> and <i>Ngaio</i> leaves.</p>
<p><i>Glaucocharis auriscriptella</i> Moss Moth</p> <p>Habitat Feeds on mosses.</p>	<p><i>Glyphipterix tungella</i> Day Sedge Moth</p> <p>Habitat Sedges in open habitats.</p>	<p><i>Gymnobathra sarcocantha</i> Rangiora Moth</p> <p>Habitat <i>Rangiora</i> leaves.</p>	<p><i>Heterocrossa eriphylla</i> Beech Feeder Moth</p> <p>Habitat Open wounds on Beech.</p>	<p><i>Hierodoris atychioides</i> Gregarious tineid</p> <p>Habitat <i>Pine</i>, <i>Rimu</i>, <i>Matai</i>, <i>Kahikatea</i>, <i>Macrocarpa</i>, <i>Kanuka</i>/<i>Manuka</i>.</p>	<p><i>Ichneutica steropastis</i> Flax Notcher Moth</p> <p>Habitat <i>Flax</i> leaves.</p>
<p><i>Izatha convulsella</i> Rimu Moth</p> <p>Habitat <i>Rimu</i>, lichens on <i>Rimu</i>.</p>	<p><i>Izatha epiphanes</i> Fuchsia Moth</p> <p>Habitat <i>Fuchsia</i> and <i>Coprosma</i> dead wood.</p>	<p><i>Izatha huttonii</i> Wineberry Moth</p> <p>Habitat <i>Wineberry</i> and <i>Karamu</i> dead wood.</p>	<p><i>Leucinodes cordalis</i> Poroporo Fruit Borer</p> <p>Habitat <i>Poroporo</i> fruit.</p>	<p><i>Liothula omnivora</i> Common Bag Moth</p> <p>Habitat <i>Pine</i> and native species leaves.</p>	<p><i>Pseudocoremia fenerata</i> Conifer Moth</p> <p>Habitat <i>Pine</i>, <i>Rimu</i>, <i>Miro</i> and <i>Totara</i> leaves.</p>
<p><i>Pseudocoremia leucelaea</i> Forest Looper</p> <p>Habitat <i>Pine</i>, <i>Rimu</i>, <i>Miro</i> and <i>Totara</i> leaves.</p>	<p><i>Pseudocoremia suavis</i> Common Forest Looper</p> <p>Habitat <i>Pine</i>, <i>Rimu</i>, <i>Miro</i> and <i>Totara</i>, <i>Beech</i>, <i>Kanuka</i> leaves.</p>	<p><i>Scoparia ustimacula</i></p> <p>Habitat <i>Hydrocotyle</i> leaves.</p>	<p><i>Stigmella cypracma</i> Rangiora Moth</p> <p>Habitat <i>Rangiora</i> leaves.</p>	<p><i>Vanessa gonerilla</i> Red Admiral</p> <p>Habitat <i>Ongaonga</i> (nettle) leaves.</p>	<p><i>Vanessa itea</i> Yellow Admiral</p> <p>Habitat <i>Ongaonga</i> (nettle) leaves.</p>

INSECTS
GRAZERS

These insects are more like grazers in the ecosystem. Some help breakdown wood others keep smaller insects in balance.

Many of these are ‘vocal’ and their sounds shape the human acoustic realm. Cicadas, dragonflies and grasshoppers all emit noise and signal changes in seasons.

Glowworms emit light on the other hand and create fascinating night-time experiences. Burial methods may be able to provide more habitat for a range of these species.

<div>Arachnocampa luminosa Native Glowworm</div> <div>Habitat Damp, Humid, Caves or Banks.</div>	<div>Argosarchus horridus Native Giant Stick Insect</div> <div>Habitat Bush Lawyer, Myrtles, Hoheria.</div>	<div>Austrolestes colenonis Blue Damsel</div> <div>Habitat Ponds 1m deep, Wetland plants.</div>	<div>Hemideina crassidens Wellington Tree Weta</div> <div>Habitat Holes in living Manuka/ Kanuka, Ngaio, Kohekohe, Mahoe.</div>	<div>Kikihia scutellaris Lesser Bronze Cicada</div> <div>Habitat Burrows to 40cm below ground.</div>	<div>Mitophyllus irroratus Native Stag Beetle</div> <div>Habitat Decaying karaka, shit-shrub, mahoe, kaikomako, pigeonwood, kamuka, tarata.</div>
<div>Neocicindela parryi Parry's Tiger Beetle</div> <div>Habitat Dry Clay Banks.</div>	<div>Neocicindela tuberculata Common Tiger Beetle</div> <div>Habitat Dry Clay Banks.</div>	<div>Oncacanthus vittatus Forest Shield Bug</div> <div>Habitat Grasslike plants with small seeds.</div>	<div>Orthodera novaezealandiae New Zealand Mantis</div> <div>Habitat Open Shrubland, Manuka/ Kanuka, Eats moths/flies.</div>	<div>Pachyrhamma edwardsii Cave Weta</div> <div>Habitat Caves, Cool, Humid.</div>	<div>Phaulacridium marginale Native Grasshopper</div> <div>Habitat Grasses, Weedy Species.</div>
<div>Pison spinolae Native Mason Wasp</div> <div>Habitat Mud-Sandy Banks.</div>	<div>Platypus apicalis Beech Borer</div> <div>Habitat Decaying Pine and Beech Wood.</div>	<div>Pleiopectron hudsoni Tokoro/Cave Weta</div> <div>Habitat Leaf litter, soil, decaying wood.</div>	<div>Prionoplus reticularis Huhu Beetle</div> <div>Habitat Bark of Fallen Wood.</div>	<div>Scolopterus tetracanthus Four-spined weevil</div> <div>Habitat Flowers of Nikau, Hoheria, Schefflera.</div>	<div>Stethaspis suturalis Tanguru Chafer</div> <div>Habitat Tree roots, Manuka, Olearia.</div>
<div>Uropetala carovei Carov's Giant Dragonfly</div> <div>Habitat Damp Gully Banks.</div>					

- Habitat Key**
- Decaying Wood
 - Rocks
 - Dry Banks
 - Damp Banks and Caves
 - Standing Water
 - Shrubland
 - Forest

BIRDS
DISPERSAL

Birds are the most visible and widely loved animals. Their songs and interactions are a favourite experience of many. There isn’t a large diversity of native birds at Te Ahumairangi, but increasing mature native plants and trapping would bring more.

As the top of the food-chain (not including introduced mammals) in New Zealand, they benefit from the health and populations of all prey or food sources. Burial methods could increase those which in turn will benefit birds.

MOLLUSCS
GRAZERS

There are just two recorded native molluscs from Te Ahumairangi. *Potamopyrgus oppidanus* is particularly unique because its only habitat is a small stream on Te Ahumairangi. It is critically threatened and options for its protection should be explored.

<div><i>Anthornis melanura</i> Bellbird Habitat Nests in forks of trees under dense cover, from near ground level to >5m. Feeds on nectar, fruit and insects</div>	<div><i>Circus approximans</i> Swamp Harrier Habitat Large nests on ground, low bushes, long grass, scrub or wetland. Carnivorous.</div>	<div><i>Gerygone igata</i> Grey Warbler Habitat Typically found in woody vegetation, in mid to high levels of the canopy. Nests in manuka, kanuka and <i>Coprosma</i> sp. Insectivorous.</div>	<div><i>Hemiphaga novaeseelandiae</i> Kereru Habitat Podocarp-broadleaf forest, beech forest, pine forest with streams. Leaves of kowhai, large drupes, flowers and buds.</div>	<div><i>Nestor meridionalis</i> North Island Kaka Habitat Hollows in podocarps, beech, 5m off ground, omnivorous.</div>	<div><i>Ninox novaeseelandiae</i> Morepork / Ruru Habitat Dark hideaways, tops of tree ferns, holes in trees and banks. Large insects, small birds, moths.</div>
<div><i>Prothemadera novaeseelandiae</i> Tui Habitat Lowland broadleaf forest, predominantly nectar feeders. High canopy nests. Kowhai and flax are favourite.</div>	<div><i>Rhipidura fuliginosa</i> Habitat Small nest in forested areas. Eat small invertebrates, such as moths, flies, beetles and spiders.</div>	<div><i>Zosterops lateralis</i> New Zealand Silvereye Habitat Forests, scrubland and wetlands. Nests in vegetation 8 metres above ground. Omnivorous.</div>
<div><i>Potamopyrgus antipodarum</i> Native Mudsnaill Habitat Damp areas leaf litter, algae, sediments.</div>	<div><i>Potamopyrgus oppidanus</i> Tinakori Mudsnaill Habitat Damp shaded areas in undisturbed leaf litter, stones and woody detritus.</div>				

- Habitat Key**
- Decaying Wood
 - Rocks
 - Dry Banks
 - Damp Banks and Caves
 - Standing Water
 - Shrubland
 - Forest

Chapter Five - Regional Landscapes

Fieldwork

ECOLOGIES SURROUNDING
TE AHUMAIRANGI

Visits

An ambition of visiting twenty-one different reserves was set to understand the surrounding ecological context. In total the fieldwork, amounted to walking 60km (roughly the distance from Wellington to Otaki) and nearly 24 hours of non-stop walking.

Two thirds of the outlined reserves were visited and I decided I had enough material to work with. Some areas I had already been to and did not necessitate another visit. Another two areas not within the original bounds of investigation but were significant include Paekakariki Escarpment and Te Kopahou Reserve.

Reason

While Te Ahumairangi does have a range of native forest species, much of the site is regenerating from a century of farming and exotic plantations. Lots of species that will grow here given time, are absent. It was also important to understand how as the forest ages, different spatialities will occur.

Text Key

- Visited
- Visited Before
- Did Not Visit

Map Key

- Reserves
- Te Ahumairangi
- Mature Nikau Sites

Surrounding Sites

- 1. Botanic Gardens
- 2. Zealandia
- 3. Wrights Hill
- 4. Albermarle Reserve
- 5. Johnston Hill
- 6. Otari Wilton's Bush
- 7. Huntleigh Park
- 8. Orleans Reserve
- 9. Heke Reserve
- 10. Trelissick Park
- 11. Cummings Park
- 12. Mt Kaukau
- 13. Odell Reserve
- 14. Seton Nossiter Park
- 15. Tyers Stream Reserve
- 16. Belmont Park
- 17. Gilberts Bush
- 18. Kaiwharawhara Park
- 19. Cashmere Park
- 20. Te Ara Paparangi
- 21. Homebush Park

Pariwhero Loop Track

D: 9.3km
T: 3h15m

Johnston Hill

D: 1.8km
T: 1h

***Wrights Hill
Deliverance Track***

D: 4.3km
T: 1h30m

Otari Skyline Track

D: 4.5km
T: 1h45m

Huntleigh Park

D: 1.5km
T: 1h

Trelissick Park

D: 4.1 km
T: 1h10m

Paekakariki Escarpment Track

D: 9.8km
T: 3h20m

Experience and Findings

A range of threatened species including Cook Strait kowhai, leafless Clematis, leafless lawyer and a range of scrub communities useful in the design of Te Ahumairangi’s ridgeline.

Experience and Findings

Twisted groves of Tawa trees along the main ridgeline.

Experience and Findings

Old growth Mahoe forest.

Experience and Findings

Clusters of remnant rimu and kohekohe. Healthy populations of rewarewa.

Experience and Findings

Large kahikatea, matai and totara podocarp forest, with a rich fern understory.

Experience and Findings

Old karaka groves and broadleaf forest.

Experience and Findings

Old karaka groves, kohekohe, ngaio and kawakawa forest on scree slopes.

Belmont Trig - Korokoro Track

D: 16km
T: 5h15m

Albemarle Reserve

D: 0.7km
T: 20m

Heke Reserve

D: 0.4km
T: 15m

***Odell Reserve
Piwakawaka Track***

D: 2km
T: 30m

***Orleans
Pukatea Walk***

D: 0.7km
T: 20m

Cummings Park

D: 0.4 km
T: 15m

Mount Kaukau Loop

D: 4.2km
T: 1h20m

Experience and Findings

Podocarp forests with high proportion of Nikau. Beautiful shrubland communities comprised of hupiro, horopito, raukaua, griselinia, astelia and more. Useful in the design of Te Ahumairangi’s ridgeline.

Experience and Findings

A tributary of Te Ahumairangi. Regenerating mahoe, ponga and tree fuchsia.

Experience and Findings

A few very old ngaio.

Experience and Findings

Largely dominated by exotic sycamore, areas of coprosma grandiflora are regenerating underneath.

Experience and Findings

A few large kahikatea, nikau, pukatea and tree fuchsia. Kohekohe and kawakawa forest.

Experience and Findings

One very old totara and interesting planted specimens like Nestegis lanceolata.

Experience and Findings

Raukaua edgerleyi and raukaua anomalus with some beech trees.

Spatiality and experience in the forest

Generalised Tree Arrangements

A series of tree arrangements were created to understand different vegetated space abstractly.

While these give a typology of forest types the remain unconnected to real landscapes. A study of some particular landscapes found in the regional fieldwork are undertaken. To explore vegetation in its relation to experience, topography and geology.

Johnston Hill Twisted Tawa

The northwest-southeast orientation of the ridgeline, leaves tawa trees open to the strong winds. The main leading trunks snap, causing the trees to develop twisted candelabra-like forms, as secondary leaders grow out.

This copse of tawa illustrates how individual trees could act as markers for the dead in a greater collective. The growth forms are highly unique and recognisable, further to this the visitor has to duck or bow (somewhat reverentially) to move beneath the low limbs. After initial viewing of the intricate branches the eye is drawn up the multitude of small branches, toward the lightness of the canopy and sky.

To achieve this effect, tawa would need to be planted in tandem with the deceased, along windy ridgelines.

Transect

Species present in transect

- Ah = *Astelia hastata*
- Wharawhara
- Bd = *Blechnum discolor*
- Crown fern
- Bt = *Beilschmiedia tawa*
- Tawa
- Cd = *Cyathea dealbata*
- Ponga
- Mr = *Melicytus ramiflorus*
- Mahoe
- Pe = *Piper excelsum*
- Kawakawa
- Rs = *Ripogonum scandens*
- Supplejack

Wright's Hill Mahoe

A winding, south facing gully where mahoe have grown huge from the available moisture. Their roots act as steps along most of the pathway. Mahoe forest in Wellington tends to have a relatively open understory which makes traversing this forest type relatively easy.

Mahoe form here in what might be termed a dingle or depression. As a marker for burial, the visitor would be able to see the multitude of life their loved one supports. Mahoe's smooth bark often lends itself to colonisation by mosses, then by ferns which turns the trunks a verdant green and lastly, perching epiphytes. Frequent visits by birds and other wildlife to these small ecosystems may help us to see death as less final.

Species present in transect

- Ao = *Asplenium oblongifolium*
Shining spleenwort
- Mr = *Melicytus ramiflorus*
Mahoe
- Ms = *Microsorium scandens*
Fragrant fern
- Pe = *Piper excelsum*
Kawakawa

Transect

Otari's Kohekohe

Otari has some relatively well established kohekohe forest, with some ancient specimens. Kawakawa is the dominant sub-canopy plant and glows green as sunlight filters down the small gullies.

Kawakawa brings a lightness to darker gullies that might otherwise appear gloomy. Kohekohe are most spectacular in winter, when flowers emerge straight out of their trunks. An important nectar source for tui and a strong vanilla scent from the flowers allows these markers for the deceased to interact with the aroma of the present and future.

Species present in transect

- Ab = *Asplenium bulbiferum*
- Hen and chicken fern
- Gl = *Geniostoma ligustrifolium*
- Hangehange
- Pe = *Piper excelsum*
- Kawakawa
- Rs = *Ripogonum scandens*
- Supplejack

Transect

Huntleigh Park's Kohekohe and Supplejack

A wide south facing hillside carries on up to the outer town belt. Supplejack creates a wiry landscape beneath the canopy.

Within kohekohe forest such as this, there would be potential to sustainably harvest supplejack canes. This vine has historically found use in basketry and is a sturdy material. The vines could be used to create caskets for the deceased (similar to willow caskets) and they can be returned to the earth in the landscape from which they came.

Species present in transect

- Ds = *Dysoxylum spectabile*
Kohekohe
- Gl = *Geniostoma ligustrifolium*
Hangehange
- Rs = *Ripogonum scandens*
Supplejack

***Paekakariki Escarpment
Kohekohe and Kawakawa***

Areas of scree slopes on the Paekakariki escarpment share similar characteristics to those on Te Ahumairangi.

Of particular interest, is the way in which scree that continues to roll downhill, accumulates at the base of vegetation blocking its path. Forming small cairns, similar to stone mounds which humans have used to mark resting places for millennia.

With burial in scree on Te Ahumairangi, the burial process would naturally form small mounds from the displacement of soil, these mounds may continue to accumulate with time.

Species present in transect

Pe = *Piper excelsum*
Kawakawa

Transect

Mount Kaukau

The gullies of Mt Kaukau are lush and damp. Pukatea are large valley trees with heavily buttressed roots that give them stability in wet ground.

These trees hold large amounts of water. As aquamation (bodily dissolution) is of interest, swamp trees would be capable of uptaking liquified remains. In this way, the essence of a person becomes distributed throughout a forest. Similar to the way the cremated ashes may be on the breeze, aquamated remains are amongst the trees.

Species present in transect

- Ab = *Asplenium bulbiferum*
Hen and chicken fern
- Fb = *Freycinetia banksii*
Kiekie
- Gl = *Geniostoma ligustrifolium*
Hangehange
- Ln = *Laurelia novae-zealandiae*
Pukatea
- Ms = *Microsorium scandens*
Fragrant fern

Transect

Variabilities in understorey - Ways of covering the ground and graves

Kawakawa - Bushing with sunlight

Kawakawa - Reaching to sunlight

Kawakawa - Inadequate sunlight

Supplejack- Scrambling

Blechnum - Near vertical

Hen and Chicken + Karetu - In clearing

Kiokio - Higher altitude

Hen and Chicken - In kohekohe thicket

Native Passionfruit -Thick in old forest

Filmy Fern - Damp area

Blechnum filiforme - Scrambling over scree

Fragrant Fern - Scrambling over stones

Blechnum fluviatile - In kohekohe forest

Blechnum fluviatile - In kohekohe forest

Blechnum fluviatile - w/ karaka seedlings

Hounds tongue fern - Under pine

Ridgelines

- 1. *Alectryon excelsus*
Titoki
- 2. *Beilschmiedia tawa*
Tawa
- 3. *Dacrydium cupressinum*
Rimu
- 4. *Eleaocarpus dentatus*
Hinau
- 5. *Fuscospora truncata*
Hard Beech
- 6. *Knightia excelsa*
Rewarewa
- 7. *Lophomyrtus bullata*
Ramarama
- 8. *Metrosideros robusta*
Northern Rata
- 9. *Nestegis cunninghamii*
Black Maire
- 10. *Pennantia corymbosa*
Kaikomako
- 11. *Pittosporum eugenoides*
Lemonwood
- 12. *Prumnopitys taxifolia*
Matai
- 13. *Pseudopanax arboreus*
Five-finger
- 14. *Raukaua edgerleyi*
Raukawa

Valleys

- 1. *Cyathea medullaris*
Mamaku
- 2. *Dacrycarpus dacrydioides*
Kahikatea
- 3. *Dysoxylum spectabile*
Kohekohe
- 4. *Freycinetia banksii*
Kiekie
- 5. *Fuschia excorticata*
Kotukutuku
- 6. *Laurelia novae-zelandiae*
Pukatea
- 7. *Melicope ternata*
Wharangi
- 8. *Melicytus ramiflorus*
Mahoe
- 9. *Piper excelsum*
Kawakawa
- 10. *Podocarpus totara*
Totara
- 11. *Rhopalostylis sapida*
Nikau
- 12. *Ripogonum scandens*
Supplejack
- 13. *Schefflera digitata*
Pate

Plant Palette

These regional studies and photographs of plants help understand the experience of and landscape requirements of certain species. These are then used to create a wide scale planting plan for natural burial graves.

Chapter Six

Design Investigation

Forests of Death

DESIGN PHASE 1

Sets up the logic for the development of a site masterplan. This diagram explains the key ideas explored in this phase of design development and how they tie into the initial research.

PARAMETRIC PLANTING

List of Species

Species Name	Indigenous Name	Time to Maturity	Spacing Radius	Initial Crown Radius	Mature Crown Radius	Crown Variance	Initial Trunk Radius	Mature Trunk Radius	Initial Height	Mature Height	Display R	Display G	Display B
DRY													
<i>Metrosideros robusta</i>	Rata	100	1000	400	4000	50	70	2000	300	40000	178	34	34
<i>Pseudopanax arboreus</i>	Whauwhaupaku	20	600	400	2000	30	60	100	500	5000	189	183	107
<i>Pennatia corymbosa</i>	Kaikomako	50	600	400	2000	40	50	500	300	0	128	128	0
<i>Beilschmiedia tawa</i>	Tawa	90	800	500	2500	50	100	2000	500	35000	218	165	32
<i>Prumnopitys taxifolia</i>	Matai	80	800	500	2600	30	90	1300	600	26000	240	128	114
<i>Fuscopora truncata</i>	Hard Beech	60	700	400	2500	50	60	1200	500	30000	144	238	144
<i>Knightia excelsa</i>	Rewarewa	50	700	400	2100	40	50	700	600	0	141	220	130
MODERATELY DRY													
<i>Pittosporum eugenoides</i>	Tarata	30	600	300	2000	50	50	300	0	0	255	215	0
<i>Dacrydium cupressinum</i>	Rimu	70	800	500	2500	50	100	1500	500	35000	34	139	34
<i>Elaeocarpus dentatus</i>	Hinau	70	700	400	1500	50	90	1000	400	20000	240	230	140
<i>Raukawa edgerleyi</i>	Raukawa	50	650	400	1500	50	50	400	0	0	140	200	40
<i>Alectryon excelsus</i>	Titoki	30	700	500	3000	50	75	500	400	15000	128	128	40
<i>Nestegis cunninghamii</i>	Black Maire	60	600	400	2500	50	60	1000	0	0	120	120	50
<i>Lophomyrtus bullata</i>	Ramarama	20	300	300	1000	50	30	50	0	0	126	126	30
MODERATELY DAMP													
<i>Ripogonum scandens</i>	Supplejack	20	20	10	20	5	10	20	100	5000	107	142	35
<i>Podocarpus totara</i>	Totara	100	800	800	4000	33	110	2000	500	22000	85	107	47
<i>Dysoxylum spectabile</i>	Kohekohe	50	700	500	2000	40	70	1000	600	15000	154	205	50
<i>Meliczytys ramiflorus</i>	Mahoe	30	700	500	2000	20	70	600	500	10000	173	255	47
<i>Melicope ternata</i>	Wharangi	40	500	400	2000	30	50	200	0	0	170	250	40
<i>Piper excelsum</i>	Kawakawa	15	300	200	1500	20	10	50	0	0	150	235	45
DAMP													
<i>Rhopalostylis sapida</i>	Nikau	25	750	500	3000	15	75	200	500	12500	46	139	87
<i>Dacrycarpus dacrydioides</i>	Kahikatea	60	1000	400	3000	50	80	1800	600	50000	102	205	175
<i>Laurelia novae-zelandiae</i>	Pukatea	80	800	400	2500	40	80	1500	500	30000	60	179	170
<i>Fuchsia excorticata</i>	Kotukutuku	60	700	400	2400	30	70	1500	500	15000	0	100	0
<i>Cyathea medullaris</i>	Mamaku	30	200	500	3000	40	100	300	0	0	0	115	5
<i>Freycinetia banksii</i>	Kiekie	40	900	300	1000	5	10	20	100	5000	0	120	10
<i>Schefflera digitata</i>	Pate	25	300	200	1500	50	10	200	0	0	0	90	0

These species are chosen from the regional ecologies field work. Their relative absence from Te Ahumairangi and potential in creating experience are drivers for their selection.

PARAMETRIC PLANTING

Grasshopper - Groundhog Definition

PARAMETRIC PLANTING

Moisture regime

Attributing species based on a moisture regime derived from topography. Dampest areas are attributed to most moisture loving species etc, four categories created. Dry, Moderately Dry, Moderately Damp, Damp. Using flows component, the flow paths themselves are used to find highest density of points. The points then are attributed to moisture level. Red = Dry, Dark Blue = Damp. The points are then used to create boundary lines to define the area to be planted.

PARAMETRIC PLANTING
Vegetation Masterplan

*Close up of species at 100 years
maturity*

Here the 27 species of native plants drawn from regional ecology studies are distributed across the site based on moisture gradients and slope. Thousands of trees are represented here and each could also represent the resting place of someone. Plants like Fuchsia, Pukatea and Kahikatea occupy the dampest areas and the driest by Kamahi and Totara. Species are represented in colour by moisture tolerance. Blue = Dampest, Red = Driest. Trunks and canopy are represented to give a better understanding of the spaces created below canopy. Spacings and randomness can all be altered, which could be used to create variation in density of forest. Semi-random grouping could create groves of the same species in areas where this might heighten a certain experience. Parametric planting provides a projected future and maturation rate and distribution of species.

NATIVE PLANTS FOR CASKETS

A range of native plants that are suitable for the conditions and are already existing or should be at Te Ahumairangi will be cultivated in areas of the cemetery for use in casket making.

In Europe and America, willow canes are often utilised for the purpose of making natural burial caskets. Native flax caskets are available in New Zealand, but there are many other species worth exploring.

1. Harakeke - *Phormium tenax*
Fig 31.

1. Traditional Use
Harakeke is synonymous with weaving. Wahakura are traditional baby basinetts woven from flax.

Potential Use
By upscaling wahakura a casket can be made. From cradle to grave.

2. Houhere - *Hoheria sextylosa*
Fig 32.

2. Traditional Use
The fine lace-like inner bark has been used as trim for hats, baskets and as a type of cloth.

Potential Use
The delicate paper could be used as a veil over the deceased in open caskets.

3. Kareao - *Ripogonum scandens*
Fig 33.

3. Traditional Use
A very strong vine used in basketry, fencing, tool handles and fishing traps.

Potential Use
Kareao vine could make strong woven inner frames for caskets, which could be further woven with other plants.

4. Kiekie - *Freycinetia banksii*
Fig 34.

4. Traditional Use
A climbing plant whose water-resitant leaves and aerial roots were used in clothing, mats and rope.

Potential Use
The aerial roots and ability to make rope are useful in lashing and handles for caskets.

5. Pohuehue - *Muehlenbeckia complexa*
Fig 35.

5. Traditional Use
A scrambling plant with fine decorative vines used in basketry.

Potential Use
For decorative inter-weaving with Kareao.

6. Raupo - *Typha orientalis*

Fig 36.

7. Ti Kouka - *Cordyline australis*

Fig 37.

8. Toetoe - *Cortaderia fulvida*

Fig 38.

9. Totara - *Podocarpus totara*

Fig 39.

10. Wharawhara - *Astelia hastata*

Fig 40.

6. Traditional Use

Raupo was highly important in the construction of houses (whare), its prolific nature makes it suited to large harvests.

Potential Use

Woven into a frame of Kareao it would quickly make a casket.

7. Traditional Use

Was used in all aspects of woven items, its fibre when made into rope is stronger than flax.

Potential Use

Rope for lifting and lowering casket into grave.

8. Traditional Use

The straight hollow canes are used in tukutuku panels on walls.

Potential Use

Inter-weaving in caskets.

3. Traditional Use

The flaky bark of totara was used to make a particular type of basket known as Patua.

Potential Use

Strengthening liner in caskets.

3. Traditional Use

An epiphyte used to make snow sandals, mats and baskets.

Potential Use

For decorative inter-weaving with other species for different hues.

BURIAL IN THE FOREST

Challenges are posed in the logistics of burying around trees and in rocky ground.

All tools must be able to be carried to a burial plot by a people on foot, the density of forest prohibits digging graves with large driven machinery. Focus is placed on portable means of grave digging.

Care must be taken to site burial away from the drip-lines of larger trees whose roots pose problems to digging.

Power Tools

Chainsaw

Where larger diameter roots are encountered.

Jackhammer

For very hard ground and lots of rock.

Machine Auger

Useful in speeding the process of digging burial urn holes, the small diameter of the hole can be drilled out quickly.

Hand Tools

Spade

The quintessential tool in the grave diggers arsenal. Used to mark out a grave and dig out most material, but struggles in rocks and roots.

Pick

Useful for loosening soil and breaking rock.

Root Spud

A sharpened flat instrument, used to chop through smaller diameter roots.

Digging Bar

When power and leverage are needed to move or break large rocks.

A Proposed Natural Burial Casket - Framework of Supplejack Sectioned on End to Show Interior

Preliminary Forest Burial Design

Parametric planting is useful for understanding how plants can be distributed through burial in the cemetery. How might these different areas of vegetation be experienced and combined with burial?

Preliminary designs of forest burial focused on differing landforms and vegetation experience in Te Ahumairangi.

It tries to bring together a range of relationships between burial and lifeforms. For example, in the rocky slopes, stones may be piled atop the deceased to mark their place. (Geolocation apps common in natural burial sites would be used in tandem). A top these rocks, hounds tongue fern and a fragrant fern are likely to grow. The stone moth (*Cherasdula sp.*) would benefit from the increase in habitat, insectivorous birds like the fantail - piwakawaka, wound in turn benefit from their increase. Bird guano dropped here can further the growth of ground dwelling plants and a forest species like rimu can be further planted to mark the dead.

Within the aging and decaying pine forest, burial urns could be placed within rotting stumps. Wood loving fungi spores could be integrated with the urns to speed decomposition of the pine, releasing nutrient for native forest to grow.

Here the concept of utu (that which is reciprocally connected between past, present and future) is explored through these burial methods which might facilitate these connections.

Scree slope

Dry Bank

Valley Pines

Urn Burial - Shrubland

Forest Burial Design

Suitable Topography

This particular area is near the Weld St entrance and is currently gorse dominated. The burial of urns with proposed flora atop, would create an ecology similar to that of Belmont Reserve. It would provide a range of habitat for shrubland species and can bring an ecology into relationships through burial.

This can revegetate steep areas owing to the ease of burying a small urn.

Flora Possible Fauna & Fungi

Astelia fragrans
Kaiwharawhara

Clematis forsteri
Forster's Clematis

Coprosma foetidissima
Stinkwood

Coprosma crassifolia
Shrubby Coprosma

Cortaderia fulvida
Toetoe

Griselinia littoralis
Papaumu

Pseudowintera colorata
Horopito

Raukawa anomalous
Raukawa

Glyphipterix tungella
Day Sedge Moth

Orthodera novaezealandiae
New Zealand Mantis

Stethaspis suturalis
Tanguru Chafer

Oncaontias vittatus
Forest Shield Bug

Phaulacridium marginale
Native Grasshopper

Circus approximans
Swamp Harrier

Natural Burial - Hollows

If a small depression were to be left atop graves, it would allow the land to hold water ephemerally. This would benefit a range of fauna like damselflies and the endangered mudsnail. The increase in moisture might provide a niche for species like *Hydrocotyle*, which in turn would increase the presence of *Scoparia* moth as greater amount of food is available.

This is mostly possible on shallow slopes.

Dacrycarpus dacrydioides
Kahikatea

Freycinetia banksii
Kiekie

Fuschia excorticata
Kotukutuku

Melicope ternata
Wharangi

Melicytus ramiflorus
Mahoe

Piper excelsum
Kawakawa

Rhopalostylis sapida
Nikau

Schefflera digitata
Pate

Austrolestes colenisonis
Blue Damselfly

Potamopyrgus antipodarum
Native Mudsnail

Izatha epiphanes
Fuchsia Moth

Hemiphysa novaezealandiae
Kereru

Potamopyrgus oppidanus
Tinakori Mudsnail

Scoparia ustimacula
Hydrocotyle Moth

Natural Burial - Soil Mounds

Soil mounds are created by the displacement of earth by the deceased. Atop these drier micro topographies, hounds tongue fern is likely to colonise. These verdant green mounds could create a unique experience in cemeteries. This would be in the forested valleys of Te Ahumairangi, species like tui might benefit from the winter nectar produced by kohekohe.

The looseness of soil restricts this method to flatter slopes, where the soil is less likely to wash out.

Cyathea medullaris
Mamaku

Dysoxylum spectabile
Kohekohe

Freycinetia banksii
Kiekie

Melicope ternata
Wharangi

Podocarpus totara
Totara

Rhopalostylis sapida
Nikau

Ripogonum scandens
Supplejack

Hemideina crassidens
Wellington Tree Weta

Prothemadera novaeseelandiae
Tui

Stereum versicolor
False Turkey-tail

Kikihia scutellaris
Lesser Bronze Cicada

Pseudocoremia suavis
Common Forest Looper

Zosterops lateralis
New Zealand Silvereye

Natural Burial - Scree Mounds

In scree valleys, stones may be piled atop the deceased to mark their place. Atop these rocks, hounds tongue fern and a fragrant fern are likely to grow. The stone moth (*Cherasdula sp.*) would benefit from the increase in habitat, insectivorous birds like the fantail - piwakawaka, wound in turn benefit from their increase. Mahoe and kawakawa provide food for their respectively named moths. The fluffy *Stereocaulon* fungi would have an increased habitat of disturbed rock.

This method could work on higher slopes as the rock covering prevents erosion. Over time as stone falls down from the ridges, the deceased would become further buried under rock.

Cyathea medullaris
Mamaku

Dysoxylum spectabile
Kohekohe

Freycinetia banksii
Kiekie

Melicope ternata
Wharangi

Melicytus ramiflorus
Mahoe

Piper excelsum
Kawakawa

Schefflera digitata
Pate

Australamathes purpurea
Mahoe Moth

Chersadula ochrogastra
Stone Moth

Feredayia graminosa
Mahoe-stripper Moth

Rhipidura fuliginosa
North Island Fantail

Campanella tristis

Cleora scriptaria
Kawakawa Looper

Pleiopectron hudsoni
Tokoriro / Cave Weta

Stereocaulon ramulosum

Urn Burial - Pine Stumps

Burial urns can fit into the niches of the decaying pine stumps. The rotted wood would be easy to place or drill holes for urns. The spores of wood loving fungi may be mixed into the urn, to break down pine faster. The bright colours and intricate shapes of fungi can mark the dead. Within these forest the call of kaka are already heard.

This can utilise any kind of slope as the burial is within a stump and not the ground. This forest would grow raised off the ground. It may potentially create an easily navigable forest.

- Beilschmiedia tawa*
Tawa
- Dacrydium cupressinum*
Rimu
- Fuscospora truncata*
Hard Beech
- Lophomyrtus bullata*
Ramarama
- Nestegis cunninghamii*
Black Maire
- Pittosporum eugenoides*
Lemonwood
- Prumnopitys taxifolia*
Matai
- Raukahu edgerleyi*
Raukawa

Ascocoryne sarcoides
Purple Jellydisc

Nestor meridionalis
North Island Kaka

Platypus apicalis
Beech Borer

Podoscypha petalodes
Wine Glass Fungus

Podoserpula pusio
Pagoda Fungus

Pseudocoremia fenerata
Conifer Moth

Pseudocoremia leucelaen
Forest Looper

Natural Burial - Brush Piles

Brush pile burial can make use of material cleared from tracks and other burial sites. Within these a range of shelter habitat is provided for fungi and fauna. *Bisporella* fungi might turn these brush graves bright yellow. A series of bright yellow mounds in the forest could create a novel kind of burial. Or the gelatinous *Myxarium*, a translucent mound.

The sides of valleys might be an ideal place for these.

- Beilschmiedia tawa*
Tawa
- Dacrydium cupressinum*
Rimu
- Nestegis cunninghamii*
Black Maire
- Pittosporum eugenoides*
Lemonwood
- Prumnopitys taxifolia*
Matai

Anthornis melanura
Bellbird

Argosarchus horridus
Native Giant Stick Insect

Bisporella citrina
Lemon discs

Myxarium nucleatum
Crystal Brain Fungus

Ileodictyon cibarium
White Basket Fungus

Prionoplus reticularis
Huhu Beetle

Natural Burial - Dry Banks

Natural burial on banks can reshape the land. Within these drier banks on ridges a range of exposed soil opportunist fungi and endangered native insects could find homes. More drought tolerant plants like five-finger and kaikomako would provide berries for the grey warbler.

This can use steeper land and the soil from excavation can be used to widen many of the narrow pathways.

- Knightia excelsa*
Rewarewa
- Lophomyrtus bullata*
Ramarama
- Nestegis cunninghamii*
Black Maire
- Pennantia corymbosa*
Kaikomako
- Pittosporum eugenoides*
Lemonwood
- Prumnopitys taxifolia*
Matai
- Pseudopanax arboreus*
Five-finger
- Raukaua edgerleyi*
Raukawa

Baeomyces heteromorphus

Dibaeis arcuata

Neocicindela parryi
Parry's Tiger Beetle

Neocicindela tuberculata
Common Tiger Beetle

Pison spinolae
Native Mason Wasp

Gerygone igata
Grey Warbler

Natural Burial - Damp Banks

In damp banks, there is an opportunity to increase the habitat of glow-worms throughout Te Ahumairangi. The glowing graves can line pathways and create a habitat for weta, moss moth and Carov's dragonfly. Glow-worms are found no where else in the world and they may provide a role in create a uniquely Aotearoa cemetery.

These would be in valleys were moisture levels are higher.

- Cyathea medullaris*
Mamaku
- Dacrycarpus dacrydioides*
Kahikatea
- Freycinetia banksii*
Kieke
- Laurelia novae-zelandiae*
Pukatea
- Piper excelsum*
Kawakawa
- Ripogonum scandens*
Supplejack
- Schefflera digitata*
Pate

Arachnocampa luminosa
Native Glowworm

Austrocidaria similata
Dark Coprosma Moth

Glaucocharis auriscriptella
Moss Moth

Ninox novaezelandiae
Morepork/Ruru

Pachyrhamma edwardsii
Cave Weta

Uropetala carovei
Carov's Giant Dragonfly

Overall Design

DESIGN PHASE 2

The site masterplan focusses on four key design areas of differing scales.

Masterplan

Burial areas named based on their character or species present.

Vegetation Masterplan

The plant species that were distributed over the entire site in earlier design stages, now it covers just those areas where urn and bodily burial will occur. The family of the deceased would be able to choose from the range of tree species that have been distributed, which would be planted atop the plot of their deceased. When these trees are planted, their location would be geo-referenced so the family can easily find their loved one. Some areas are retained as broad scale plantings such as the zones of Hound’s tongue fern, as this species already forms large carpets, burial will utilise the existing population of ferns and vary the experience through undulating burial mounds.

1. Realm of Potamopyrgus

Rāhui for Potamopyrgus - Large scale

Investigates how attention to fragile ecology may see areas set aside in cemeteries with ecological considerations.

RAHUI FOR POTAMOPYRGUS OPPIDANUS

Enforced by Ongaonga, Matakoura and Shit-shrub.

This content is unavailable. Please consult figure list for further details.

Fig 41. Potamopyrgus oppidanus
Te Ahumairangi Mudsail

Potamopyrgus oppidanus is confined to an area less than a hectare and is only known from this single catchment. Its habitat consists of stony stream beds, and leaf litter. Vegetation clearance for illegal mountain bike tracks has provided a niche for invasive Tradescantia along the stream. Alongside this, fallen macrocarpa have blocked water flow and leaf litter from entering the stream, which the snail eats.

The species is Nationally Critical and continues to decline. Its relatively small area of habitat, can make protecting this species easier.

A native planting design is proposed that becomes increasingly more unpleasant to humans as one ventures closer.

The first line of defense on the brighter and drier ridgeline is Discaria toumatou. Matakoura has been recorded from early accounts of Wellington’s Town Belt. It was heavily sprayed in agricultural areas as its thorniness was an impediment to grazing animals. It is now endangered in Wellington, but recently an unknown population was found at Miramar Peninsula and it is deserving of a wider reintroduction to Wellington. It provides habitat for lizards and nesting birds.

The second line of defense is Coprosma foetidissima colloquially know as shit-shrub on the account of its pungent smell when crushed or cut. Any illegal track clearance would leave the nostrils burning. It provides habitat for the native stag beetle.

Ongaonga is a stinging nettle which is found through Te Ahumairangi. Damp and shady areas lower in the catchment are planted to encapsulate the stream with this stinging native plant. It is also the main food source of the red admiral butterfly-kahukura. The stream edges are replanted with mahoe whose leaves appear to be a favoured food of the mudsnail.

Existing walking tracks which cut across the habitat have been rerouted, now two small areas of boardwalk cross at the top and bottom of the catchment, where the impact of track maintenance and walkers is reduced.

Key

- Current
- Disturbed Riparian Area

Regenerating Native Forest

Coniferous Forest

Large Cupressus macrocarpa

Old kainga

Existing Tracks

Water Catchment
- Proposed
- Mahoe - Melicytus ramiflorus

Ongaonga - Urtica ferox

Shit-shrub - Coprosma foetidissima

Matakoura - Discaria toumatou

Boardwalk

2. Ridgeline Design

A floristic connector route - Wide scale

Investigates the current experience and proposes alterations to recreation and procession along a flower-picking ridgetop route.

Long Section Through the Ridgeline

Current Experience of the Ridgeline

Current Experience of the Ridgeline

The current experience can be summarised as transitional zones of pine forest, grassland and native shrubs. The space expands and compresses between wide grassy plateaus and more narrow parts the ridge. Large areas of grass are unnecessarily kept that way and need a high level of maintenance.

The design will propose a native flowering shrubland that occupies these spaces. The plateaus should be kept open for their views and ability to connect people to the wider context.

Ridgetop Plant Selection

derived from visited ridgetop ecologies in the region

- 1. *Astelia fragrans*
Kaiwharawhara
- 2. *Clematis afoliata*
Leafless Clematis
- 3. *Clematis forsteri*
Forster’s Clematis
- 4. *Coprosma foetidissima*
Stinkwood
- 5. *Coprosma crassifolia*
Shrubby Coprosma
- 6. *Cordyline australis*
Ti Kouka
- 7. *Cortaderia fulvida*
Toetoe
- 8. *Discaria toumatou*
Matakoura
- 9. *Griselinia littoralis*
Papaumu
- 10. *Hebe parviflora*
Tree Hebe
- 11. *Hibiscus trionum*
Puarangi
- 12. *Metrosideros perforata*
Akatea
- 13. *Microsorium pustulatum*
Hound’s Tongue Fern
- 14. *Muehlenbeckia complexa*
Pohuehue
- 15. *Myrsine australis*
Matipo

16. *Phormium cookianum*
Wharariki

17. *Pseudowintera colorata*
Horopito

18. *Raukaua anomalus*
Raukawa

19. *Rubus squarrosus*
Leafless Laywer

20. *Sophora molloyi*
Cook Strait Kowhai

21. *Weinmannia racemosa*
Kamahi

Designing the Ridgeline

Pathway Network
Paths and Decisions

Existing Path Network

Proposed Path Network

Far South Ridgetop

Mid South Ridgetop

Matipo Grove

Exposed Shrubland

View of Western Hills

Panoramic View

Panoramic View

Mid North Ridgetop

Floral Zone

Calming Greens and Textures

North Ridgetop

Horopito Shrubland Burial Zone

Aquatorium - Crematorium - Masterplan

Visitor centre - Large / Intermediate scale

An interconnected series of buildings, transport and waterways addressing access and connectivity within the cemetery.

-

Finding an urban situation for the main buildings, centrally located within Tinakori near the bustle of daily life and can accommodate aquamation.
-

The chosen site is along the Whakahikurwai catchment and valley. This evolves into two buildings linked by a cable-car across the incline of this valley. An aquatorium at the top, where the journey of aquamated remains starts.
-

Along this journey, the aquamated remains nourish plants and are filtered by them throughout swales and a series of ponds in the catchment.
-

The crematorium and visitor centre below looks to solve access issues, through the design of bus stops, cable car and associated stops that allows mobility hindered people access to the resting places of family and friends.
-

Within this visitor entry space, the aquamated remains join with another stream (wairua; both spirit and meeting of streams) in a proposed public wetland-park before continuing the journey to sea, and northward to Te Rerenga o Wairua.

Gulbenkian Garden

Watery Landscapes and Architecture

Year - 1969
City - Lisbon, Portugal
Landscape Architect/s - Gonalo Ribeiro Telles and Ant3nio Viana Barreto
Architect/s - Ruy Jervis d’Athouguia, Pedro Cid and Alberto Pessoa

Fig 24.

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The landscape architects enlarged the existing lake and brought three streams together. This created an interconnection between elements of the park and structure the vegetation and experience into a central focus from which everything is generated.

Fig 25.

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The streams to the east and west increased the depth of the lake and established a stronger bond between architecture and landscape.

By increasing the area of water, the park’s design gained more texture, dynamism and depth. The garden now offered greater complexity and diversity as well as greater ecological variety.

Fig 26.

Fig 27.

This relationship between architecture and watery landscape is particularly useful as a precedent for the design of aquatoria, a building that could involve the watery remains of humans into the landscape instead of flushing this benign liquid into the wastewater system.

Fig 28.

Preliminary Design of the Aquatorium and Cable Car

The initial design centred on using the large premier house (mansion for prime ministers) parcel of land as the rest of the urban realm constrained the needed angle for a cable car.

This cable car would act as an accessibility route for the elderly and anyone wishing to avoid the steep hill. From the multiple cable car stops, mourners could visit the graves of their loved ones along contour-paths. The cable car would also have a separate car that would act as a hearse, allowing a body to be easily transported up the hill to the grave site.

This particular path, needed the cable car to tunneled across large areas and bridged in others.

The other element of the design included several green space bridges that cover the sunken motorway and allow for ease of pedestrian moment across the bisected halves of the city.

This particular choice of site was abandoned as further design revealed greater integration of cable car, public space and access were possible elsewhere.

Section along Cable Car

Flood Prone - Little George St

Fig 29.

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further details.

Two of the larger affected buildings are suggested as high-quality densified housing for the owners of affected properties.

The Potters association is suggested to merge and have residency within the cemetery visitor centre. The crematorium within this can help heat the firing kilns and create a more sustainable cremation process.

The potters may also wish to sell handmade urns for cremated and aquamated remains.

Fig 30.

This historically flood prone area became important in the design of the Aquatorium. The landscape is still in shape of a hollow from where Tiakiwai stream used to run. It's relatively small amount of houses per landmass makes for a more viable option than Premier House land. It also gives a much larger area for water to collect from Aquamation and create an urban wetland park.

Diagram of proposed site

Developing Design of the Aquatorium and Cable Car

Whakahikuwai stream - Before Whakahikuwai stream - After

An increase in water in the landscape bringing a greater diversity of epiphytes and plant life.

The crematorium and visitor centre nestles into the slopes of Te Ahumairangi. The bottom floor glass and perches above the swamp. This is the main atrium, from here the next level is a space for funerals. Above this an open rooftop provides a large space from the propagation in an outdoor native plant nursery. These trees can then be taken on the cable car to plant atop the deceased. A crematorium sits below the relocated potters association. Atop allow this is the cable car, accessible by the central elevator. The cable car no longer tunnels through the hill, instead two small trenches and bridges are all that is needed in construction.

Journey of remains from ridge to basin.

Section through wetland and crematorium

Developed Design of Visitor Centre, Crematorium and Wetland

The design aims to create clearer access from Tinakori Road, to allow people to access the Te Ahumairangi more easily.

From the excavation for the wetland, the topography of the hill is pushed out to encapsulate the building. This also forms the new daylighted edge of Tiakiwai stream which once ran through here.

Aquamated remains that move through Whakahikuwai catchments are directed into a series of terraced wetlands that step down and treat the water before reaching the larger wetland park space. The two streams come into confluence. Wairua - two streams and also meaning spirits.

The main pathway which crosses this wetland breaks away into a board walk crossing small, dry islands and surrounded by kahikatea.

From here members of the public and funeral goers can take the cable car up the steep hill. Making Te Ahumairangi much more accessible to everyone. It also provides means of transporting the deceased up to section where they will be buried.

Masterplan

Kohatu Quarry Lacusium Design

Kohatu Quarry - Detailed scale

Exploring a potential experience of aquamation in the landcape and new tools in the design of cemeteries.

Suggested term for scattering place of liquid remains - Lacusium.

From Latin lacus - pond, pool, lake, also basin, reservoir.

Or in Te Reo, this might be - hāpunapuna o wairua

A pool formed from spirits

The Limits of Traditional Representation

Current landscape design methods rely heavily on Geographical Information System data. For most open space projects and cemetery design, this works reasonably well.

But taking the Kohatu Quarry for example. 1m interval contours allows us to understand topography and therefore infer stream paths. We can see some broad vegetation types like pine, gorse, native forest and a few tree ferns from the aerial photograph, as well as the current path. If a section was drawn we could understand the general spatiality of the topography.

As soon as we encounter forested space, it becomes immensely hard to propose any environmentally sensitive design without being able to see underneath the canopy.

Photography then becomes a useful medium for understanding the spatiality and experience of the forest. But, photography always warps reality through a lens and therefore accurate measurements are very difficult to derive from photographs.

0 12.5 25 50 75 metres

Under Canopy Design Tools

Photography

The obscured entrance

Flooding in the trench

Moving through the trench

Emerging into the quarry

The space becomes compressed

The space opens up into the quarry

Under Canopy Design Tools

Photography

The flooded depression

Mahoe on the upper slopes

Steep sides of the quarry

The ephemeral waterfall

Mossy greywacke and tree fuchsia

Looking back over to the entrance

Preliminary Design of the Quarry

Not be able to see through the canopy in plan, necessitated design through photography. This series of design testing explored access issues to the site and allowing people to navigate without getting stuck in mud.

The design wanted to explore using on site material such as the loose greywacke and working around the existing vegetation.

LiDAR in the Design of Forested Space

Sectioned ground plane of point cloud showing location of scans with the Leica BLK360. The area chosen for terrestrial LiDAR scanning was the Kohatu Quarry. A small part of Te Ahumairangi, that currently requires going off-track and is relatively hidden. Its overgrown, amphitheatre like qualities make it a particularly useful space in the context of a memorial. As all sides of the quarry are exposed rock, it helps form a useful spatial boundary for LiDAR.

Current Landscape Elements of Kohatu Quarry

Ephemeral Waterfall

Quarrying of greywacke has left large faces of rock exposed. The quarry excavated into an pre-existing stream path, now water flows vertically down the quarry rock face.

Mahoe

Mahoe proves itself very capable of occupying rocky terrain, it is currently the dominant species on most of Te Ahumairangi's rock-strewn slopes.

Mamaku

Other than mahoe, mamaku is one of the few species managing to grow atop the rocky quarry floor.

Pond in Depression

This area would have been flattened as a place to sort and load stone. Today it has eroded deeper and catches the run-off from the waterfall.

Narrow Entrance

Here the linear trench stops and opens out into the rounded quarry. Bounded by two large rock faces.

Narrow Path

A linear trench was carved out to allow carts in, this is the only easy way to access the quarry and is relatively hidden from the main track. It is often soft deep mud.

Seeing the Forest for the Trees

Point cloud models can offer a precise view of forested space that can allow for delicate construction within it.

It provides a new way of understanding forested space that photography and survey would not be able to replicate. What can precise measurements and locations of tree species in space, offer design?

Three general realms can be sectioned through and understood in three dimensions.

- 1. Canopy - realm of the leaf
- 2. Sub-canopy - realm of the branch
- 3. Ground - realm of trunk and root

Most often we find the realm of the trunk and ground easier to design with, as we can easily touch, observe and measure it. Above head-height the forest tends to be harder to engage with. It is hard to map every branch. Understanding the forest is a complexity gradient starting at the trunk increasing through branches, twigs and leaves.

Point Cloud Section - Elevation

Lidar models appear on screen “as a pixelated membrane, producing a luminescent ensemble of textures, including details and reliefs, vegetation, and infrastructure... stunningly precise and beautiful in its wafer-thin representation. Landscapes captured in this mode reproduce a pointillistic veil of scintillating electronic point-clouds that look like dew drops minutely covering the entire surface of the land.”³⁶

³⁶Girof, Topology, 81.

The Forest

Realm of the Leaf

Realm of the Branch

Realm of the Trunk and Root

Point Cloud Section - Plan

Realm of the Leaf

Realm of the Branch

Realm of the Trunk and Root

Point Cloud Section - Perspective

Realm of the Leaf

Realm of the Branch

Realm of the Trunk and Root

Elevation Values - Section

Understanding elevation in the forest. Precise heights of the trees can help to understand where shifts in spatiality of forest occur.

For example the trunks of mahoe split into branches at around 1m off the ground. At 4-5m, branches separate out further into smaller branches and twigs. The top of the canopy currently rises to 14m.

Precise Contour

Using AutoCad Civil 3D, a point cloud can be turned into a surface. This surface can then be contoured to any precision of contour (0.25m was chosen). These contours allow for a more precise understanding of microtopography and therefore, how water moves through the landscape. It also allows for remote design methods that are more sensitive to the existing landscape condition.

Digital Stoneworking

Stones from site

Being able to move around the quarry floor in 3-dimensions allows a to-scale inventory of existing stones. This can offer a quick way to visualise how these stones may be used in design. For, example stone paths, walls, or for other construction.

Elevation Values - Plan Section

There was an ambition to involve the waterfall into the design. Using elevation, this analysis looks at the points at which mahoe fork (orange dots) above head as a design driver. A series of shapes were drawn that could convey water and navigate between tree forks above head height. This particular drawn ellipse crossed the most forks possible whilst collecting water. This will make the ellipse appear to be held by the trees when viewed from below.

Site Plan - Final Design

Boardwalk

A board walk is proposed to raise visitors off the boggy ground and away from aquamated remains. It weaves between tree trunks and requires no removal of vegetation or change of terrain. The preciseness of LiDAR allows for a remote design of this. The walkways perching nature, gives a sense of the sacred or tapu to the liquid remains and ground below.

Aquamation Basins

These are proposed stone basins placed near the path and under the line of falling water from the overhead channel. As the water falls it collects and sprinkles in the basin to suggest the interment of liquid remains here. It travels down from the basins and into the main pool before making its way through the wider landscape .

Stone Path

The stone inventory is used to create sections of stone pathways that connect to the existing landscape and merge into the stone aquamation basins.

Ellipse of Water

The ellipse shape becomes an over head steel channel that is built into the rockface and collects and distributes water from the waterfall.

The channel is design to overflow to create a curtain wall of water dripping from the canopy above.

Section aa

A proposed design section through the existing narrow trench entrance. The increase in water from interred aquamated remains in the Lacusium will raise the current water level and flood the trench further.

A boardwalk allows a flat and easier accessibility. The planting of native the swamp fern - *Cyclosorus interruptus* and wetland sedge - *Isolepis prolifera* are proposed species for the swampy trench.

Section bb

A proposed design section through a basin. These basins constructed from on site stone, collect falling water from the overhead channel. A mourner returns their aquamated loved one (in an urn) back to the land.

Section cc

The elliptical channel is on a 1° slope toward the main pool. It is only 5cm deep, so that water collected from the waterfall overflows. Above the aquamation basins, small 2cm diameter holes allow a greater amount of water to fall into the basins.

The channel is held up on steel support poles that have a screw extension, to allow them to react to the growth of trees. A grate on top of the channel prevents leaf fall from blocking the flow.

Partially hidden in the canopy the visual effect will be that of rain produced by the group of trees it encapsulates.

Chapter Seven - Reflection on Research Practice

This research set out to explore how landscapes of burial could become re-entwined with human culture and ecology. With an ambition of designing; an urban cemetery that changes our relationship to death and life, through engagement with the experiential, ecological, social and sacred aspects of Aotearoa’s landscape.

Discoveries and Reflection

There has been a range of functional and economic concerns in the design of cemeteries that has seen them become further distanced from the cultural and ecological realm. A critique of planning and policy through a comparison of site selection criteria, helped steer the research toward new possibilities in cemetery design and planning. A site based research I termed; ecological-experience fieldwork, was used to counter this practice and helped generate new potentials in the way we may relate to Aotearoa’s landscape in the context of death. Fieldwork was important to this research, as there has been very minor engagement or publication on cemetery design in Aotearoa. A selection of Aotearoa’s current cemeteries were investigated for how they have traditionally been designed, whilst discovering a range of underappreciated aspects in cemetery design. Together this fieldwork resulted to 70km of walking and experiencing the landscape and helped form an innate understanding of the vegetation, geology, fauna, hydrology, topography other landscape elements of Te Ahumairangi where data was unavailable.

The relationship between burial and topography became agent in the research, this led into being able to understand the possibility for burial in Wellington’s steep Town Belt and Te Ahumairangi. Topography seems to be the most limiting landscape condition to today’s modern cemetery design. The less restrictive space requirements and lack of necessity for flat land offered by alternative burial methods have the ability to change the cemetery as we know it, urn burial and aquamation may even further the possibilities of what is possible in cemetery landscape design. Studies of topography in this research shaped where differing burial methods could be implemented.

Geology also determined the depth at which body and urn burial was possible and in tandem with topography formed the basis of burial type zones. Old quarries in the site and their geology played an important role in the design phase. Hydrological flows and catchments created a framework for aquamation and streams became an important part of returning this liquid to the land in a respectful way.

A close study of living beings (flora and fauna) appears an endless, but highly rewarding task in cemetery design. The vast range of species explored have many interconnected relationships and structure experience in completely different ways, these connected cycles became one of the main focuses. Flora and fauna studies allowed the dead (past) to interact with life in the future, with these interactions experienced by people and therefore able to alter our culture in the present. Utu, whenua and other traditional understandings were useful for conceptualising how these interactions may form different connections to land and death. A study into native plant use in casket design, allowed for a site specific send-off and creates a closed-system of resource use in a cemetery.

Terrestrial LiDAR was adopted later in the research trajectory and engaged with tentatively at the start, due its large data sets and required software skill. It ended up becoming a major element in the design, after a familiarity with it was formed. It is incredibly precise and allows for a range of design under canopy that would only be possible on site. Further to this, it also shows new potentials in the design of forest spaces. An x-ray like vision into the canopy creates an understanding that does not seem possible with other tools and led to design that reacts to this under-explored world of canopy space.

Further Areas for Research

Terrestrial LiDAR is limited by its surface based data generation and representation. For this reason, it was most useful when it came to the design of an aquamation space, where the main component of the design was surface water. The research was focused within government owned land and digging large holes in reserve land was not an option. Investigation of Ground Penetrating Radar (GPR) was outside the scope of this research but could prove useful in the design of alternative burial cemeteries where an understanding of subsurface geology and soil depth is crucial to the type and method of burial.

A range of traditional Māori understandings were found to be stimulating in the design of cemetery space, but the author acknowledges that closer work with specialists in these fields is incredibly important for Aotearoa’s future cemeteries. This research also acknowledges concerns and laws around ashes being returned to waterways, if aquamation does become legal here this will likely raise similar concerns.

Another layer this research would benefit from is in the realms of land management and care. The exact layout of gravesites was not engaged with as other parts of the research took precedence. Thorough research into plot tenure, shapes and sizes of plots, plot maintenance and marking would benefit further research into alternative burial methods.

Multiple smaller cemetery sites were outside of the set scope, design-led research with a series of linked sites throughout the Town Belt be a beneficial exercise. The Town Belt arcs around and encapsulates the city, if a burial belt were to be implemented a range of new opportunities would arise and lessen the need for large infrastructure and spending around a single site.

A New Practice for Cemetery Design

This research used an experimental practice that intertwines a vast array of potentials in cemetery design. It did not set out to provide guidelines, as current ones are already restrictive. The research hopes to shed light on these considerations, findings and underexplored relationships, that can be tapped to catalyse the discipline of landscape architecture and cemetery planning into action.

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