NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION

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Tēnā koutou

**NZAA SUBMISSION ON THE DRAFT NATIONAL ADAPTATION PLAN**

*Submitter details*

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The New Zealand Archaeological Association (NZAA) welcomes this opportunity to provide feedback on the draft National Adaption Plan (NAP). We are looking forward to engaging with the Ministry of Environment on matters that enhance the management and protection of Aotearoa / New Zealand's cultural heritage.

Our submission is structured in three parts: an introduction to the NZAA and cultural heritage context, current climate change impacts on archaeological sites and feedback on the National Adaptation Plan draft.

The key points of our submission are summarised below.

1. We are advocating for the protection and appreciation of Aotearoa / New Zealand's archaeological sites. Importantly recognising the value of the archaeological record to understand human history. A strength of the archaeological discipline is through the study of our material past, which can fill gaps or provide a deeper understanding of our traditional, oral, or recorded histories. However, archaeological sites are vulnerable and non-renewable which must be proactively protected and conserved from the effects of climate change.
2. Recognition of the diversity of New Zealand's archaeological sites and the value they hold to Tangata whenua and the wider community.
3. ArchSite's contribution as a data repository for New Zealand's archaeological information, essential to the management and protection of archaeological sites.
4. Requirement for greater coordination, guidance and funding on a national level to understand and address the impacts of climate change on archaeological and cultural heritage sites.

## The New Zealand Archaeological Association

The New Zealand Archaeological Association (NZAA) is the national organisation for archaeology with a membership spanning professionals, amateurs, students, organisations, businesses, and institutions involved or interested in Aotearoa / New Zealand's archaeology and history. Our objectives are to promote and foster research into the archaeology and history of Aotearoa/ New Zealand. Above all we encourage the protection of archaeological sites. We do this in a range of ways, one of which is by engaging with government and local authorities for the recognition and protection of Aotearoa's cultural heritage. An important part of our kaupapa is the management of ArchSite, the national

database of recorded archaeological sites. This web-based service is essential to the management and protection of archaeological sites. To date, it contains information about more than 73,600 recorded archaeological sites, most of which are Māori in origin (Figure 2). There are many more unrecorded archaeological sites in Aotearoa.

Archaeological sites and features contain unique and irreplaceable evidence of the human history of Aotearoa / New Zealand. Archaeological research studies all periods of Aotearoa's history, from the first visits by Polynesian voyagers, to the exploration and settlement of Aotearoa by Māori, representing the last significant land mass to be colonised, the emergence of a distinct Māori culture and society from East Polynesia, megafaunal extinctions and human adaptations to new and changing environments and climates, through to the development of modern cities and industries by a diverse range of people and cultures. Archaeology provides details about aspects of people's daily lives, such as what people ate, the tools they used and how their houses were constructed. These details are not always captured by traditional, oral, or recorded histories but are vital for understanding past environments, economies, and lifestyles. The archaeology and history of New Zealander's is significant on national and international levels.

## The NZAA's position on Climate Change and Cultural Heritage

The NZAA and archaeological community has for some time been concerned about the vulnerability of archaeological sites, primarily caused by the exacerbation of coastal erosion and inundation through rising sea levels which have been exasperating the severity of storm events (e.g., Campbell 2009 and Walton 2007). Work to understand these impacts has focused on coastal survey, monitoring, assessment, and research undertaken by various practitioners and organisations on local or regional scales (e.g., Bennett et al. 2018, Bickler 2013, Brookes 2008 and 2012, Egerton 2009, Hil 2016, McCoy 2018, Tait 2019, and Ramsay 2014). However, there is no coordinated national approach to understand and address the effects of climate change on cultural resources. NZAA also supports attempts to manage and reduce the rate of loss of heritage and information. Inaction and reactive responses will result in the loss of significant heritage sites and places, cascading into the loss of potential for deepening the understanding of our past.

In 2021 the NZAA developed a Climate Change and Cultural Heritage Strategic Plan to focus our response and encourage immediate action. Key to this document is the following mission statement, which draws on relevant climate change and cultural heritage literature and practice.

> **The NZAA is committed to encouraging and undertaking research to understand the implications of and methods to proactively address the impacts of climate change on cultural heritage resources. The NZAA will work with Tangata whenua and the heritage sector to build greater cooperation and collaboration to respond to climate change and minimise the loss of archaeological sites and information. The NZAA will also advocate for the recognition and protection of cultural heritage across New Zealand and the contribution of cultural heritage resources to address climate change.**

Building on the strategic plan, our submission on the National Adaption Plan aims to enact the above statement and to aid in the coordination and focus of climate action, response and improve wider awareness and appreciation of cultural heritage.

## Cultural heritage, well-being, and resilience

***Kia whakatōmuri te haere whakamua: 'I walk backwards into the future with my eyes fixed on my past'***

The NZAA supports objectives to understand and minimise the impacts of climate change on cultural heritage places, particularly archaeological sites. NZAA's priority is to advocate for the protection and conservation of Aotearoa / New Zealand's heritage for current and future generations. We recognise that the unique and diverse heritage across the country contributes to one's overall well-being by reinforcing our sense of place and identity and providing a legacy for future generations. We must ensure that the cultural diversity of New Zealand is reflected in our archaeological and heritage sites, to provide equitable access to culture for future generations (Potts 2021: 36). Adaptation responses must provide for the unique and diverse cultural heritage of all ethnic groups (i.e., Māori European, Chinese, Pacifica) and supply mechanisms to capture current and changing societal and community values.

Cultural heritage and cultural diversity are also a source of resiliency, which can anchor communities through climate change adaptation and following natural disasters. The archaeological record is filled with examples of past human adaptation to changing climates and new environmental conditions. Coupled with climate modelling, ecological reconstructions and mātauranga Māori (indigenous knowledge), archaeology can provide researchers with viable, sustainable, and resilient adaptation responses to current and future climate risks, while recognising and celebrating the past (Figure 1). This relationship is acknowledged in Article 7.5 of the Paris Agreement, which acknowledges that adaptation action should be ''…based on and guided by the best available science and, as appropriate, traditional knowledge, knowledge of indigenous peoples and local knowledge systems…'.

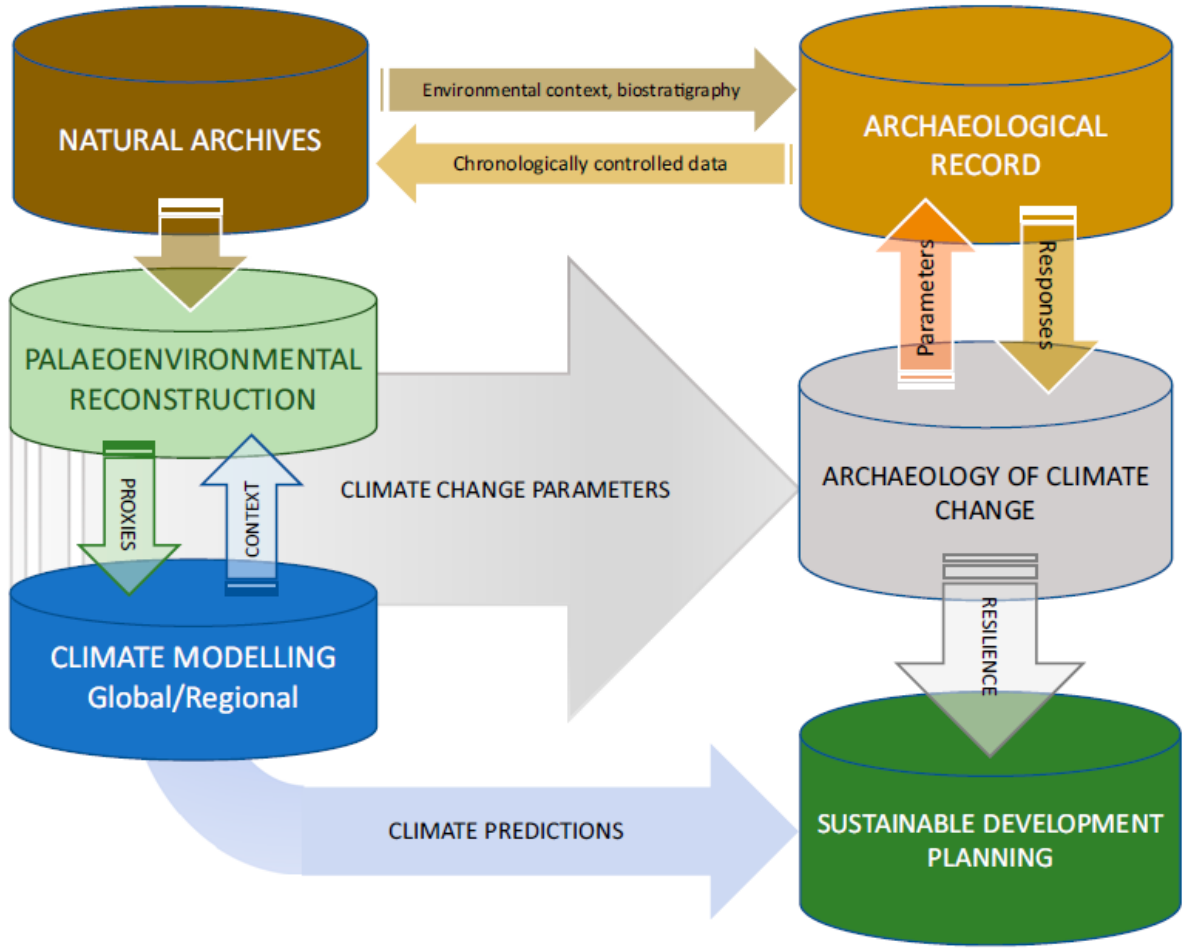



**Figure 1: Diagram showing the workflow between the archaeological record and natural sciences to contribute to sustainable development planning. From Burke et al. (2021: 5).**

## The impact of climate change impacts on archaeological sites in Aotearoa

Climatic changes are creating new and exacerbating existing threats and vulnerabilities. While cultural heritage resources have always been subject to environmental factors, the variation and recombination of these forces are increasing the diversity and intensity of impacts on cultural resources.

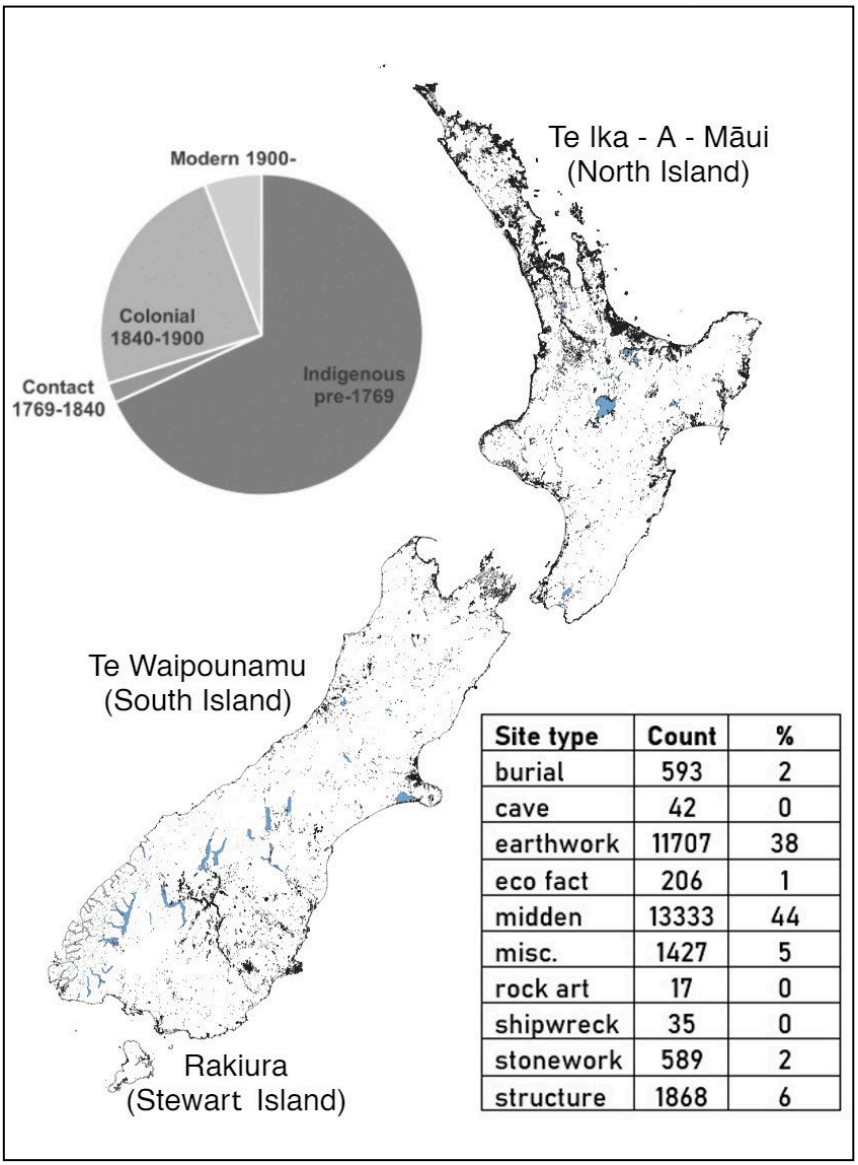
For archaeological and cultural heritage sites in Aotearoa, sea level rise (SLR) and the associated effects of storm surge, inundation and erosion currently pose the most significant risk to the ongoing protection of archaeological sites. Majority of archaeological sites in New Zealand, are located in close proximity to the coast due to the nature of past (and current) Māori and European settlements and dependency on coastal access and resources. This is particularly evident in the number and density of Māori archaeological sites in coastal environments, and therefore the unique heritage of Tangata whenua is especially vulnerable.

Research undertaken by Jones (2022) has found that of the 73,000 plus archaeological sites recorded in ArchSite, 9054 of these are within the coastal zone (i.e., within 1km of the shoreline and with an elevation of 0-25m above sea level). Of all archaeological sites within the coastal zone, 60% are within 100 m of the 'water's edge (Figure 2). This is particularly evident for middens, earthwork sites (e.g.,

pā, pit and terraces) and burials and highlights the potential vulnerability of these types of sites to coastal hazards and SLR.

These maps also highlight gaps in our archaeological record held in ArchSite[1]. Variability in the archaeological data can occur due to survey coverage and data quality (e.g., accuracy, locational information, and time between visits). Although ArchSite holds records over much of the country there are still areas with limited archaeological survey and these gaps can inhibit our understanding of suitable adaptation responses to improve the resiliency and adaptive capacity of sites and places, particularly in coastal environments. There is also a significant number of archaeological sites recorded in environments with limited coastal infrastructure or communities due to their rural or remote locations. We must acknowledge that the risk to these sites may be overlooked in regional or local studies when prioritising adaptation responses due to the low perceived risk to assets. Further, that adaptation of these environments due to low risk to infrastructure and coastal populations in the medium to long-term (e.g., 10, 20 or 50years), could have a significant impact on archaeological and cultural heritage due to exposure and vulnerability to hazards in the present day. Finally, without programmes of regular condition monitoring and standardised recording of climate impacts on archaeological sites, comparison of results and understanding of coastal change is limited.

[1] https://nzarchaeology.org/archsite




| Site type | Count | % |
|---|---|---|
| burial | 593 | 2 |
| cave | 42 | 0 |
| earthwork | 11707 | 38 |
| eco fact | 206 | 1 |
| midden | 13333 | 44 |
| misc. | 1427 | 5 |
| rock art | 17 | 0 |
| shipwreck | 35 | 0 |
| stonework | 589 | 2 |
| structure | 1868 | 6 |

**Figure 2: Distribution of known archaeological sites in black as of May 2020 – approximately 73400 sites. Note the concentration of locations along rivers, estuaries, coastal margins, islands, and lakes. The figure is taken from Jones et al. 2022 article submitted and adapted, which is under review in the Journal of Coastal and Island Archaeology.**

Further analysis of the coastal geomorphological conditions using NIWA's Coastal Sensitivity Index shows that 72% of coastal archaeological sites are on landforms that are vulnerable to SLR-driven erosion and inundation. About half of these sites are either on foredune barrier beaches or foredune barrier plains, 14% are on beaches, and 9% on beach ridge barriers. Mapping the distribution of archaeological sites with vulnerable environments indicates that priority should be given to at risk sites in Northland, and other areas in the North Island around Taranaki, Auckland, the Coromandel, and northern Hawkes Bay, and in the South Island around Tasman and parts of Otago and Canterbury (Figure 3). Regional level assessments within these areas can help to identify needs concerning documenting, preservation, and protection of coastal archaeology.

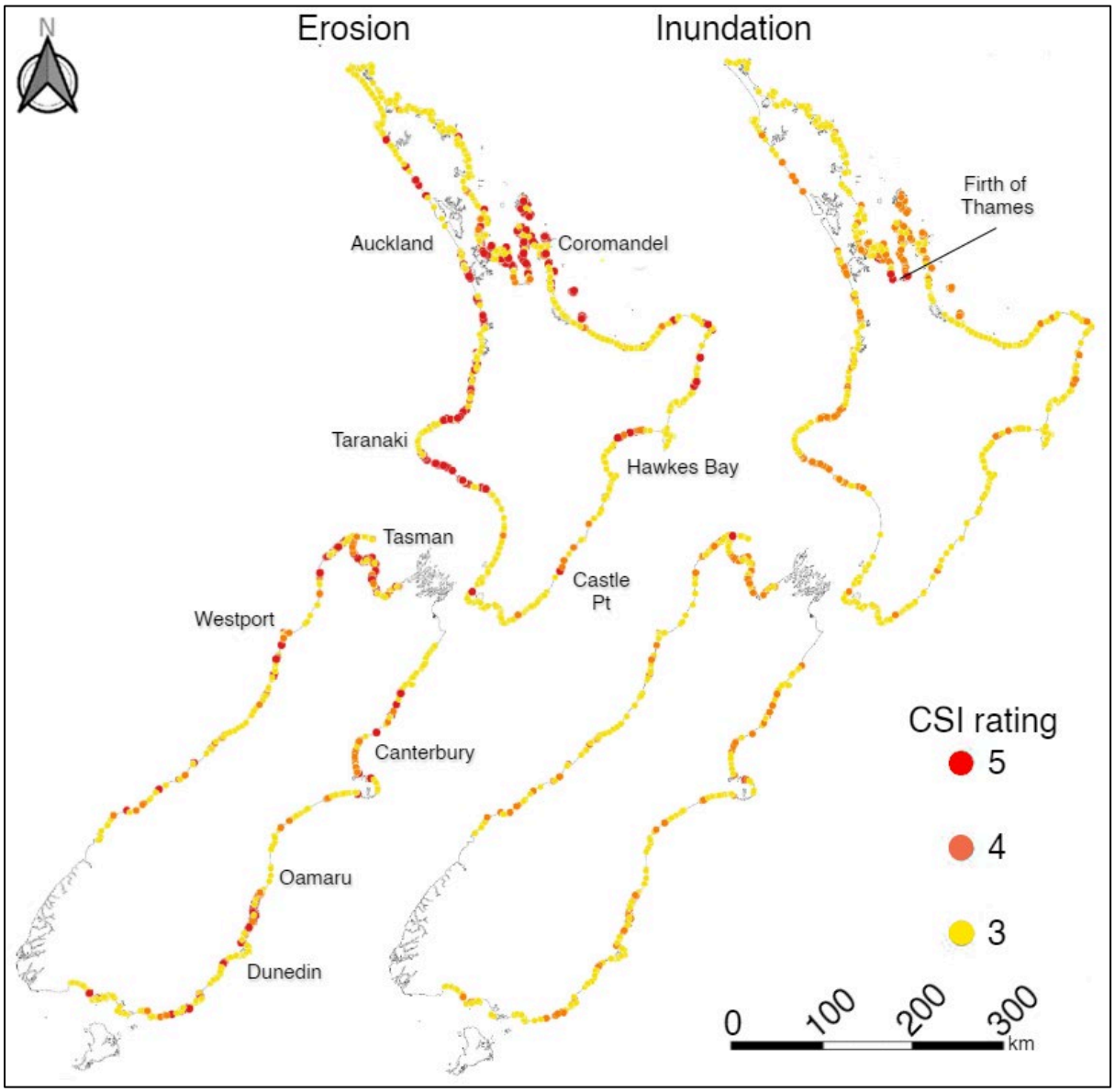



**Figure 3: Coastal distribution of archaeological sites with CSI erosion and inundation landform sensitivity values of 3 or higher. Figure is taken from Jones et al. 2022 article submitted and adapted which is under review in the Journal of Coastal and Island Archaeology.**

This introduction to the impacts of coastal hazards on archaeological sites is only scratching the surface of the wider range of hazards that need to be understood and addressed for cultural heritage (see supplementary information). Further hazards which threaten inland communities, and the condition and integrity of archaeological sites include drought, increased precipitation, fluvial and pluvial flooding, changing plant distributions, risk of wildfires and land instability. National and local scale research is required to fully understand the risk to cultural heritage. Global summaries have been provided at a high level by the International Council of Monuments and Sites (ICOMOS) (2019), who have published a list of climate factors and mechanisms of impact on heritage materials, sites and landscapes while recognising climate drivers can act in combination with each other, or with other social and environmental impacts (such as land use, pollution, and tourism). An example is provided below in Figure 4.

| Climate Change Impacts | Moveable Heritage (including Museums & Collections) | Archaeological Resources (including underwater archaeology) | Buildings & Structures | Cultural Landscapes (including submerged cultural, landscapes and Historic Urban Landscapes, parks and gardens) | Associated & Traditional Communities | Intangible Cultural Heritage |
|---|---|---|---|---|---|---|
| Increased Precipitation and more intense Rainfall Events | ***Facilities***<br>• Potential leaks in collection storage areas and potential wetting of museum objects<br>• Increased cracking associated with ground heave and subsidence; destabilization of buildings and pipes; basements or underground storage sites at increased risk of flooding<br>• Staff at health risk from mould and toxic pollution from flooding<br>• Damage to utilities, generators and electrical systems Staff at increased risk of exposure to unhealthy mould<br>***Collections***<br>• Increased risk of mould, especially organic collections<br>• Increased rusting/ corrosion of metals<br>• Humidity damage to paintings<br>• Warping and cracking damage to wood<br>• Humidity damage to archival, paper, book and photo collections | • Site erosion from overflow and new Flood channels<br>• Soil (and sediment underwater) destabilization/shifting (ground heave, landslide, subsidence)<br>• Damage to unexcavated artefact and site integrity from direct force of water<br>• Erosion and run-off damage at riverine and estuarine sites<br>• Increased sedimentation at estuarine and coastal underwater sites<br>• Risk of damage to sites from interventions to re-channel Floodwaters<br>• Flash flood run-off to the marine environment may increase tidal currents, increasing risk of underwater site degradation | • Swelling/distortion of wooden building materials and architecture features due to wetness and damp<br>• Increased risk of rot and fungal/insect attack<br>• Historic building drainage systems unable to cope with downpours<br>• Erosion of supporting ground around structure<br>• Sewage backup and overflow leading to saturation and related Flooding, contamination and damage<br>• Increased hail damage to roofs, windows and decorative elements<br>• Overflowing gutters and drains back-flowing into buildings, leaking roofs and chimneys<br>• Accelerated decay of masonry units and mortars due to increased extremes of wetting and drying<br>• Cracks in building infrastructure and associated destabilization of buildings and pipes due to ground heave and subsidence/shrink swell soils<br>• Severe damage and loss of historic structures made of adobe and other earthen structures<br>• Change in rainfall patterns could affect cyclical traditions of maintaining earth buildings<br>• Spalling, weathering of wood, brick and stone materials due to salt infiltration during drying<br>• Corrosion of external masonry from agricultural runoff<br>• Increased pressure to relocate or elevate structures, and/or surrounding structures<br>• Landslides causing loss of buildings on slopes or burial and damage of structures under rocks, mud and debris<br>• Adaptive capacity of buildings to serve as shelters in vulnerable zones | • Increased tree-fall due to waterlogging<br>• Limited ability to plant in waterlogged soil<br>• Loss of historical Integrity with improved drainage systems<br>• Decline/disappearance of some vegetation species<br>• Decreased soil fertility from erosion, waterlogging, leaching<br>• Loss of landscape features<br>• Increased susceptibility to destructive fungi and other pathogens that are enhanced by wet environments<br>• Erosion of earthworks and damage to terraces or other landscape features due to landslides and erosion<br>• Disruption or delay of traditional Maintenance practices (e.g. burning)<br>• Destruction of Historic Urban Landscapes due to erosion, soil movement, plantation stress, Flooding in historical precincts<br>• Waterlogging of historic gardens and orchards<br>• Loss of various types of towns, especially those built in earthen materials<br>• Not possible to maintain beaches in current form<br>• Loss of specimen plantings in designed landscapes, parks and gardens | • Loss of life, homes and critical infrastructure<br>• Displacement of inhabitants and communities<br>• Altered harvest times and more frequent crop spoil and losses, due to changes in precipitation patterns | ***Local Knowledge, Practices and Rituals***<br>• Indirect impacts to ceremonial cycles and religious practices involving weather control<br>• Increasing difficulty in predicting storms<br>• Delays in planting cycles, shifting whole agricultural calendar<br>• Impact on participative activities such as festivals<br>• Adaptation of functions in buildings to serve as shelters in vulnerable zones<br>• Loss of traditional language/words specific to elements and interactions in the natural and cultural environments |

**Figure 4: Extract from "Future of Our Pasts" (ICOMOS 2019) Table 6 "Correlating Climate Change to Cultural Heritage".**

Prioritising responses to these threats will change over time based on previous adaption and mitigation efforts coupled with increasing understanding of each threats flow on implication for cultural heritage resources.

## Cultural heritage vulnerability assessments – a tool to inform adaptation

"*Responding to climate change is about adjusting to risks, either in reaction to or in anticipation of a changing climate. Understanding the impact of climate change on natural and physical systems, human communities and cultural heritage is essential in evaluating and managing not only the risks to cultural heritage and its adaptive capacity, but also the positive role cultural heritage can play as a source of resilience for ecosystems, cities, neighbourhoods, sites, and cultural landscapes*" (ICOMOS 2019: 65).

As highlighted above, how we adapt requires a holistic and integrated approach across sectors to ensure sustainable and resilient climate adaptation pathways (Figure 1). This is demonstrated by the interrelatedness and interdependency between natural and cultural resources, where a response in one sector can have positive or negative impacts on the other. For example, riparian planting to improve or conserve freshwater ways may negatively impact archaeological sites through unintended

land disturbance and damage to archaeological evidence. Re-establishing this connection and partnership across disciplines is critical to finding suitable adaptation solutions and avoiding negative impacts on cultural heritage through maladaptive actions. Overall, we must achieve a more meaningful and consistent partnership with Tangata whenua to achieve greater outcomes for Māori and integration of mātauranga Māori into the archaeological discipline and western science.

A tested and widely used approach to achieve positive adaption outcomes for cultural heritage is illustrated below (Figure 5) (NPS 2016). This method combines climate projections, climate change impacts and vulnerability assessments to create a baseline inventory. From here, prioritisation of action is established in conjunction with a site's significance (based on cultural and archaeological/heritage value) and overall vulnerability which determines viable adaptation responses.

However, in the New Zealand context, how we adapt cultural heritage resources to minimise risk while maintaining and conserving the values which contribute to their significance is not well understood. There is a limited pool of case studies with ongoing monitoring of response's the effectiveness of a response and there is no standard way to document impacts, loss, and responses for archaeological resources to enable comparisons between sites and across regions. Guidance on how to prioritise action and resource and source funding is required within Aotearoa / New Zealand to support landowners, local authorities, archaeological community and Tangata whenua to protect vulnerable sites and places.

An important aspect to consider is the legislative and cost related to archaeological mitigation. The archaeological community are aware of the pressures and cost of salvage excavation to document archaeological information. The added pressure of less time and resources exasperated by climate change will foster a dire situation. Documentation of this loss before the destruction of an archaeological site from climate change impacts (e.g., coastal erosion) will be costly and time consuming. Where this responsibility lies, particularly for funding and repositories of data and material from salvage excavations, is not clear, and additional mechanisms are required to ensure adequate standards and consistency of in archaeological recording and monitoring to enable a proper analysis of material if, for example, if analysis cannot be completed for a significant period due to the number of eroding sites.

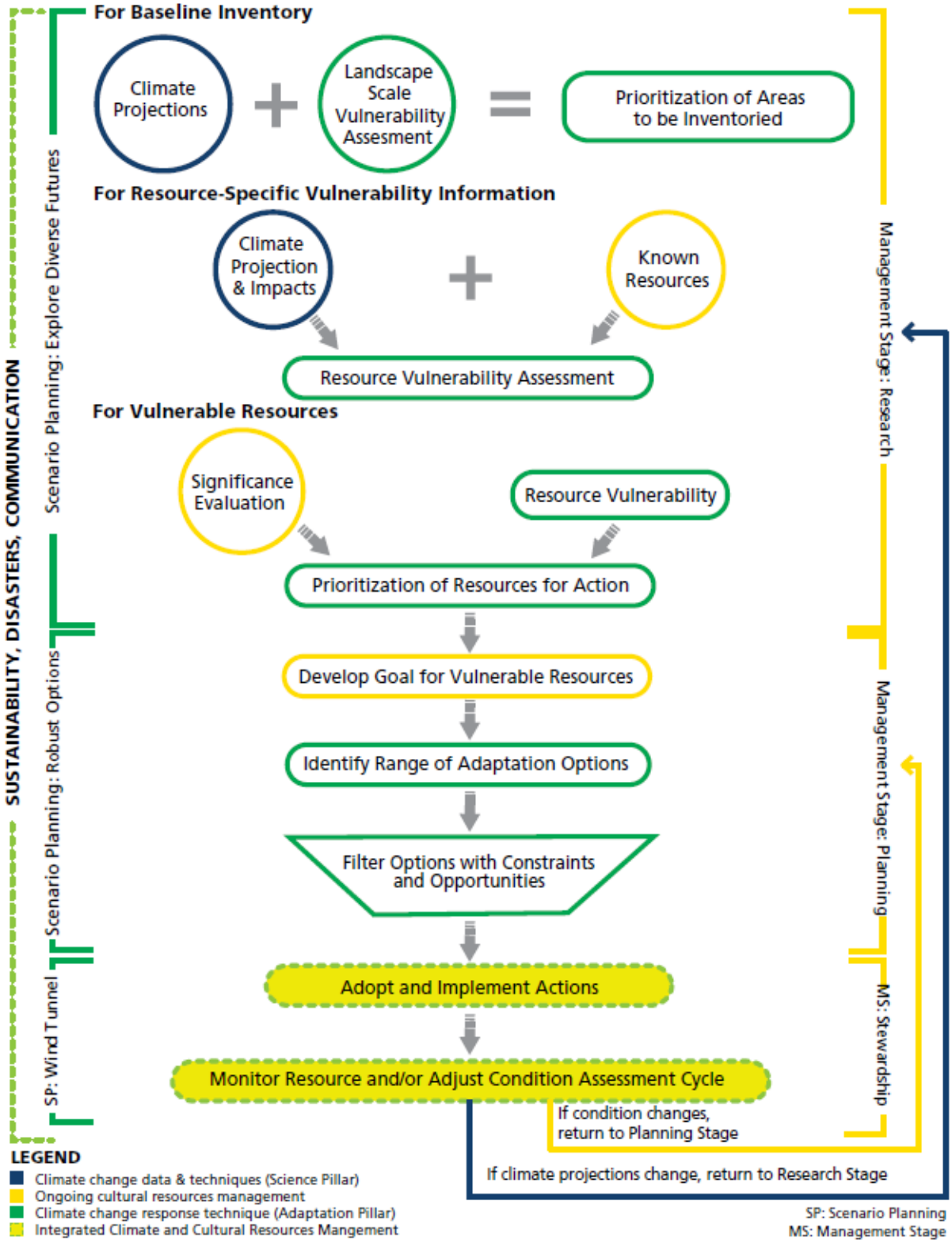



**Figure 5:** ***Cultural Resources Management- Climate Change Integration Flow Chart.*** **This chart outlines major touchpoints between climate change and research, planning, and stewardship stages of cultural resources management. (Extracted for NPS 2016: 27).**

Feedback on the draft National Adaptation Plan

Considering the above background and summary highlighting the intersection of climate change and cultural heritage, the draft NAP *Outcome Area and Objectives:* ***Homes, Buildings, and Places*** is of most relevance to the New Zealand Archaeological Association. However, we acknowledge there must be great cross-pollination of action and collaboration between outcome areas.

Regarding those cultural heritage outcomes proposed actions are a good first step to understanding and minimising the impacts of climate change on cultural heritage. However, the NAP should reference and draw from progress already made across the archaeological discipline and significant gaps in data, resources, and funding to achieve meaningful action.

The NZAA have identified key areas that should be amended or addressed in the draft NAP. These are summarised below:

1. The NAP must recognise the significant value archaeology provides to understand human history. Archaeological sites are vulnerable and non-renewable which must be proactively protected and conserved from the effects of climate change.

2. We must recognise the diversity of Aotearoa's cultural heritage and the value of these sites held by Tangata whenua and the wider community. However, the NAP does not address the significant impact that climate change poses on archaeological sites and conflates Māori cultural heritage and archaeology. While the two are often overlapping and mutually supportive, they are separate entities', and this distinction should be made.

3. Many archaeological are of Māori origin and are risk from the pressures of climate change and Māori will be disproportionately affected by this damage and loss. Māori heritage including archaeological site are vital for community well-being and resilience for current and future generations.

4. The impacts of climate change will affect cultural heritage of importance to all New Zealander's, and we must endeavour to protect heritage that reflects the diversity New Zealand society.

5. This can be addressed by broadening the definition of cultural heritage provided in Appendix 1 of the NAP. The definition recently provided through the RMA reform submission defines cultural heritage as:
   (a) means those aspects of the environment that contribute to an understanding and appreciation of New Zealand's history and cultures, deriving from any of the following qualities and values:
   (b) includes—
      I. historic sites, structures, features, places, and areas; and landscapes; and
      II. archaeological sites; and
      III. sites and cultural landscapes of significance to Māori, including wāhi tapu; and
      IV. values and surroundings associated with those sites and places and areas

6. That climate change impacts need to be understood at national, regional, and local scales to effectivity understand and minimise the risk to cultural heritage, natural environment, communities, homes, and infrastructure. The scalability at a local level allows for greater input

of local environmental knowledge, mātauranga Māori and understanding of hazard impacts on individual cultural heritage sites or landscapes.

- For example, the requirement for more accessible and high-resolution climate modelling, geomorphological and topographical data to improve estimates and mapping of environments prone to erosion, inundation, land instability and flooding to correlate with archaeological and cultural mapping to provide a scientific foundation for considering adaptation options. Future analyses are further needed to deliver local-scale outputs that will have value to stakeholders, community, iwi/hapu, and coastal planners.

7. The New Zealand Archaeological Association can assist in delivering the NAP goal to "provide data, information and guidance to enable everyone to assess and reduce their own climate risks". ArchSite is the national database of recorded archaeological sites. This platform can support 'the portal' to ensure archaeological information is accessible to relevant parties and built upon to highlight climate change risk to cultural heritage and responses nationwide.
    - There are also many more currently unrecorded archaeological sites across Aotearoa. Archaeological potential and gaps in our survey coverage need to be addressed to fully understand the impacts of climate change on archaeology and ensure adaptation responses are flexible to changing insights on the archaeological record.
    - A baseline of archaeological condition and threat, with regular monitoring and standardised recording of climate impacts, is required to offer a comparison of results and understanding of coastal change across time.
    - The 'portal' should also include best practice examples, sharing of success stories, networking, and requirements for cultural and archaeological inductions.

8. Greater national guidance or response is required on the following:
    - Standards on adequate documentation, management, and protection of cultural heritage, specifically archaeology in the face of climate change. Including guidance on storage and curation of archaeological material.
    - A framework for assessing exposure and vulnerability of a range of cultural heritage types, including archaeology, Māori cultural heritage, buildings, landscapes, plantings, and collections to the impacts of climate change. These could be completed at a site and landscape-level approach.
    - How do we provide adaptation options which appropriately and sustainably protect and conserve Māori cultural heritage and archaeological sites?
    - Hazards outside of the coastal zone are also prioritised. For example, addressing impacts of inland heritage flooding recently experienced on the West Coast and land instability and erosion impacting significant pā sites across the Awhitu peninsula.
    - Guidance to local government, the archaeological community and Tangata whenua on how to prioritise resources and action to address the significant number of archaeological sites at risk of climate change hazards.
    - Guidance on how to improve collaborative outcomes for Māori and archaeology. For example, the collection and dissemination of radiocarbon dates to contribute to archaeological and cultural understandings of a landscape.
    - Targeted and dedicated budgets to fund research, archaeological survey, and investigation. Funding should be prioritised for projects which have a strong partnership between archaeologists and iwi/hapū kaitiaki.
    - Greater recognition and protection of cultural heritage in climate action plans, national policy, strategies, legislation, and other relevant locales.

- Development of a "short-circuit approach" to site protection and adaptation. It is acknowledged that there are sites which are already vulnerable and experiencing loss and damage from the impacts of climate change. An at-risk list is required now, recognising the time and resource required to complete national inventory of exposure and vulnerability for cultural heritage.
    - Achieved in collaboration with regional/local experts (i.e., NZAA regional file keepers, archaeologists (HNZPT and consultant), universities/research institutes, iwi/hapu and TLAs). Identify ~10 sites per region, undertake initial site visits and regular follow up monitoring visits (i.e., 2-3 times a year). Prioritise some sites (1-2 per region) to have detailed recording, rescue archaeology or other proactive response.

NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION

NAP Key submission questions: Homes, Buildings and Places

| Section | Question | NZAA Response |
|---|---|---|
| **Homes, buildings, and places** | 19. Do you agree with the outcome and objectives in this chapter?<br>*Homes, buildings, and places are resilient to the changing climate, allowing people and communities to thrive.*<br>*Homes and buildings are climate-resilient and meet social and cultural needs (objective HBP1).*<br>*New and existing places are planned and managed to minimise risks to communities from climate change (objective HBP2).*<br>*Māori connections to whenua and places of cultural value are strengthened through partnerships (objective HBP3).*<br>*Threats to cultural heritage arising from climate change are understood and impacts minimised (objective HBP4).* | |
| **Homes, buildings, and places** | 20. What else should guide the central government's actions to increase the resilience of our homes, buildings, and places? | • More robust definition of cultural heritage (see comments above)<br>• Recognition of cultural diversity |
| **Homes, buildings, and places** | 21. Do you agree with the actions set out in this chapter? | • Greater focus and national direction and standards for the protection and identification of at-risk archaeological sites, an – the irreplaceable source of information about the past. |
| **Homes, buildings, and places** | 22. Are there other actions the central government should consider to:<br>a) better promote the use of mātauranga Māori and Māori urban design principles to support the adaptation of homes, buildings and places? | • Relationship between the natural environment and cultural heritage – link to nature-based adaptation solutions and resiliencies. Natural and cultural heritage impacts are interrelated – outcome in natural -flow-on effects on cultural heritage. For example, overfishing in the gulf, removal of predator species, impact kelp forest, impact on dispersing wave energy, increase erosion on coastal archaeology.<br>• Flexible, adaptive pathways – identification of unrecorded archaeological sites. |

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|---|---|---|
| | b) ensure these actions support adaptation measures targeted to different places and respond to local social, cultural, economic and environmental characteristics?<br>c)understand and minimise the impacts to cultural heritage arising from climate change? | • Kaitiakitanga – Māori outcomes are achieved – melding with archaeological practice.<br>  ○ Kaitiaki and archaeological partnership<br>  ○ What we can learn from mana whenua – collaborative approach and sharing of knowledge and understanding.<br>  ○ Resilience and past – adaptation<br>• Archaeology is well-positioned to contribute to climate research – deep-time data, baselines, and adaptation to past climatic events.<br>• Learn from the past to adapt to future<br>• Well-being as an outcome. Connection to whenua, archaeological data coupled with mātauranga Māori, support ancestral stories<br>• Local-scale initiatives |
| **Homes, buildings, and places** | 23. Do you think that there is a role for the government in supporting actions to make existing homes and/or buildings more resilient to future climate hazards?<br>If yes, what type of support would be effective?<br>*Existing buildings can include housing, communal residential (hotels, retirement village), communal non-residential (church, public swimming pools), commercial (library, offices, restaurant), and industrial (factory, warehouse).* | |
| **Homes, buildings, and places** | 24. From the proposed actions for buildings, what groups are likely to be most impacted and what actions or policies could help reduce these impacts? | |
| **Homes, buildings, and places** | 25. What are some of the current barriers you have observed or experienced to increasing buildings' resilience to climate change impacts? | |

## NAP Appendix 2: Climate risks this first plan addresses

H5 Risks to Māori social, cultural, spiritual, and economic well-being from loss and degradation of lands and waters, as well as cultural assets such as marae, due to ongoing sea-level rise, changes in rainfall and drought.
H6 Risks to Māori social, cultural, spiritual, and economic well-being from loss of species and biodiversity due to greater climate variability and ongoing sea-level rise.
H8 Risks to Māori and European cultural heritage sites due to ongoing sea-level rise, extreme weather events and increasing fire weather.

## Commentary on actions identified in the Draft NAP

| Objective | Title | Lead agency | Relevant portfolio | NCCRA risks addressed | Status | Timeframe | Implementation progress is expected by August 2024 | NZAA Comments |
|---|---|---|---|---|---|---|---|---|
| **HBP3 and HBP4** | **Support kaitiaki communities to adapt and conserve taonga/ cultural assets** | MCH | Culture and Heritage | H5 | c | Years 1–6 (2022–28) | Working with iwi/Māori and relevant agencies, completed a high-level understanding of existing activities/ support for planning and adapting and of potential gaps (2022–23).<br>Begun working with relevant partners on how we might improve support and access to information on cultural assets to help kaitiaki to self-determine adaptation pathways (2023–24). | Well-being as an outcome. Connection to whenua, archaeological data coupled with mātauranga Māori, support ancestral stories.<br>ancestral land connection<br><br>Cultural assets should be reworded to all cultural features with cultural landscape. |
| **HBP3** | **Partner with Māori landowners to increase the resilience of Māori-owned land, homes and cultural sites** | HUD | Māori Housing | B2, H5, H8, G4, G5 | p | Years 3–4 (2024–26) | Not applicable– action to be delivered after August 2024. | Reword Māori land to traditional ancestral land. |
| **HBP4** | **Research how cultural heritage contributes to community well-being and climate change adaptation** | MCH | Culture and Heritage | H8 | p | Years 1–4 (2022–26) | Initial' literature 'review' on the current state of knowledge completed. Includes identification of key stakeholders and existing research programmes. | 'Ben's research?<br><br>• Well-being outcome<br>• archaeologies forms part of community coastal monitoring programs<br>• Monitoring of urupa |

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| | | | | | | | Gaps and potential partnerships identified and research strategy under development. | • archaeologies contribution to climate science, conservation. Provide a link to the past, past environments etc<br>• Stories related to places can be linked to archaeological sites |
| **HBP4** | **Produce guidance for disaster risk management for cultural heritage** | MCH | Culture and Heritage | H8 | p | Years 2–5 (2023–27) | Current knowledge of disaster risk management in relation to cultural heritage captured and key stakeholders identified and engaged with. | • Research into understanding climate change-related impacts on archaeological sites<br>• Draw from international example / best practice |
| **HBP4** | **Develop a framework for assessing exposure and vulnerability of cultural assets/taonga to climate change** | MCH | Culture and Heritage | H8 | p | Years 1–3 (2022–25) | Relevant partners (including iwi/Māori and relevant agencies across the national adaptation plan) were identified.<br>Research on how we identify taonga/cultural heritage at risk from climate change at national and local levels was completed.<br>With partners, a draft framework was developed for engagement with wider interest groups/stakeholders. | Cultural vulnerability assessments<br><br>Monitoring of Urupa can be tied in with other archaeological sites on the coast e.g., pa, midden etc.<br>Steps are missing in the process. |

Case Studies and more information

| Date | Location | Source | Description | Stakeholders |
|---|---|---|---|---|
| 21 Feb 2022 - Ongoing | Pouwhenua Bream Bay, One tree point, Whangarei, Te Tai Tokerau Northland | Site visit<br><br>https://resiliencechallenge.nz/student-profile-ben-jones/ | Recording of midden in danger of coastal erosion. Monitored by hapū. | Patuharakeke, Department of Conservation, Whangarei District Council |
| 2003 / Ongoing | Southland | Southland Coastal Heritage Inventory Project (SCHIP)<br><br>https://www.otago.ac.nz/spar/research/otago719305.html | Project provides an assessment of threats and management options for coastal archaeological sites at risk to climate change effects. | SPAR, Department of Conservation, Environment Southland, Te Ao Marama, and Heritage New Zealand |
| 2020 | | Heritage Under Water at Risk: Challenges, Threats, and Solutions Edited by Albert Hafner – Hakan Öniz – Lucy Semaan – Christopher J. Underwood Published by the International Council on Monuments and Sites (ICOMOS) International Committee on the Underwater Cultural Heritage (ICUCH)<br><br>https://openarchive.icomos.org/id/eprint/2488/ | Underwater Cultural Heritage in Aotearoa New Zealand: Challenges and Opportunities<br><br>Matthew Carter And Kurt Bennett, Aotearoa New Zealand | |
| 2022 - ongoing | Nationwide | https://www.royalsociety.org.nz/what-we-do/funds-and-opportunities/marsden/awarded-grants/marsden-fund-highlights/2021-marsden-fund-highlights/using-marine-shells-to-accurately-locate-early-maori-settlers-in-time/ | Radiocarbon dating of the remains of marine shellfish to align environmental records, archaeological excavations, and Māori histories to inform environmental adaptation, socio-political development, material culture changes, or social connectivity. This research will provide insights into how quickly human societies in | University of Waikato, Marsden Fund (Royal Society), Otago Museum, Auckland War Memorial Museum, independent researcher, University of Kiel, Germany |

| | | | | |
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| | | | Aotearoa dealt with environmental differences and adapted to long-term climate deterioration and will provide more scientific and contextual information to enhance Māori communities' knowledge of wāhi tupuna (ancestral places). | |
| 2020 - ongoing | The Noises, Hauraki Gulf Marine Park / Tīkapa Moana / Te Moananui-ā-Toi | https://www.thenoises.nz/<br><br>https://www.thenoises.nz/research/#archaeological-work | Ongoing monitoring and salvage excavations of a midden at significant risk to the impacts of climate change. Providing valuable baseline ecological data for holistic project focused on ecological restoration and conservation of the Noises Islands, involving archaeologists, natural scientists, mana whenua, landowners, and the wider community. Community led project mentioned in the government's Sea Change Plan. | Auckland War Memorial Museum, Ngāi Tai ki Tāmaki (Mana whenua), Neureuter family (landowners) |
| 2016-2019 | | Omaio ki Tua Coastal Heritage Project<br><br>https://www.nzherald.co.nz/hawkes-bay-today/news/university-and-hawkes-bay-iwi-partner-up/QF7OEKWXCK54BGYA23KE5NRF24/?c_id=1503462&objectid=11848422n | Carried out by Southern Pacific Archaeological Research in partnership with Ngati Kahungunu and Kairakau Land Trust, Hawkes Bay. Coastal archaeology and cultural heritage management framework to address threats from climate change, modules included field-based training and workshops for marae-based organisations. | Southern Pacific Archaeological Research, Ngati Kahungunu and Kairakau Land Trust, Hawkes Bay |
| 2022 | | https://www.youtube.com/watch?v=Y7zOr2NdYss&ab_channel=NewZealandArchaeologyAssociation | Ari Carrington is a Kaikiaki Monitor and Resource Management Co-ordinator for the Patuharakeke Taiao unit that is part of the Patuharakeke Te Iwi Trust Board. Ari shares his specialist skills in capturing | Patuharakeke Te Iwi Trust Board and New Zealand Archaeological Association |

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|---|---|---|---|---|
| | | | traditional practices tied to coastal archaeological sites that are at risk from climate change as well as digging deeper into elements of Mātauranga Māori tied to these places. "Midden is like a library of information". | |

NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION

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## Supplementary information

### Climate change impacts to archaeological sites in Aotearoa

The release of the findings of New Zealand's first National Climate Change Risk Assessment (NCCRA) by the Ministry for the Environment (MfE) provides the most recent risk assessment of how New Zealand may be affected by climate change-related hazards (MfE 2020, Bodeker et al. 2022). Rising sea-level, severe weather events, shifting patterns of precipitation, increased flooding, and more land instability and erosion are all in New 'Zealand's future and is now recognised by the New Zealand Government as a Climate Emergency.

Largely absent from almost all discussions regarding the climate emergency are the effects on cultural heritage and on archaeological sites, specifically. Although archaeology and cultural heritage are mentioned, most government reports focus on natural heritage. However, the peoples of Aotearoa/New Zealand understand and interpret this natural heritage through cultural engagement, and our landscapes are expressions of our shared and unique historical and cultural heritage.

#### Coastal threats

Climate change will exacerbate existing coastal erosion and inundation. Archaeological sites are vulnerable to coastal hazards impacted by physical drivers such as sea-level rise (SLR). The gradual change in sea level is of less concern compared to the changes in the physical drivers influencing coastal hazards. The drivers of most relevance are:

1. Larger tidal ranges, especially in shallow harbours, river mouths and estuaries
2. Higher storm surges and changes in storm tide levels
3. Wave dynamics on coastal sites

These changes will cause an impact on coastal archaeological sites due to:

- Increased coastal inundation
- Increased coastal erosion
- Salinisation of surface freshwater and groundwater
- Tsunami inundation
- Reduced effectiveness of coastal defence constructions.

#### Sea level Rise

Coastal hazards threaten properties, infrastructure and cultural sites around Aotearoa's coastline and sea-level rise (SLR) will escalate this problem. SLR and changing wave patterns will reshape Aotearoa New Zealand's coast over the next century and beyond [Lawrence et al 2018]. SLR will elevate the level that is inundated by spring tides and will likely be accompanied by more frequent storm surges, especially in shallow harbours, river mouths and estuaries [Bell et al, 2017, Mullan et al 2016, Wratt et al 2004]. Storm surges has had and will have an impact on Aotearoa's coastline (Cagical et. a; 2019). It is widely expected that rates of coastal erosion and inundation (coastal flooding) will accelerate under SLR, although there will be considerable local-scale variability due to complicating factors, such as the effects of local sediment supply to shorelines [Mullan et al 2016, Rouse et al 2017]. Assets in the coastal zone are at risk to erosion and inundation, including infrastructure, housing, and archaeological sites. The potential loss of coastal archaeological sites in Aotearoa is of concern as these sites are both of high scientific and cultural value [Whangapirita et al 2003, Philips and Allen, 2010, Carmichael et al. 2018]. In particular, some Māori archaeological sites contain wāhi tapu: places that are sacred to Māori in the traditional, spiritual, religious, ritual, or mythological sense [HNZ, 2014].

At present it is unclear how archaeological sites will be affected by future coastal erosion and inundation. National-scale archaeological and environmental datasets to provide a first-pass overview of archaeological heritage at risk in Aotearoa / New Zealand. Two key national-scale datasets are utilised: (1) a Coastal Sensitivity Index (CSI) developed by the National Institute of Water and Atmospheric Research and (2) Archsite, Aotearoa's archaeological site database. The integrated datasets produce insights into the sensitivity of coastal archaeology to SLR and associated hazards, which is vital to plan for the loss of coastal archaeological sites (no. 9054). The predominant coastal archaeological sites around Aotearoa are midden (44%) and earthworks (38%). In total, about half of coastal archaeological sites are within 100m of the shoreline. Only about 2% of sites are burials, but the impacts of loss of these 445 burial sites are significantly higher than for other site types due to the presence of koiwi tangata (human remains). 60% of coastal burial sites are located within 100m of the shoreline.

Coastal erosion is a particularly important threat to archaeology as it would permanently remove sites, whereas the risk of site removal by coastal flooding inundation is lower. 72% of coastal archaeological sites are located on landforms that are sensitive to SLR driven erosion: ~29% of archaeological sites are located on foredune barrier beaches, 23% on foredune barrier plains, 14% on beaches, and 9% on beach ridge barriers. Attention is drawn to the scale of coastal archaeology in Aotearoa that needs adequate documentation, preservation, and protection in the face of SLR. Robust coastal erosion and inundation datasets are needed to more deeply understand potential SLR-driven impacts on coastal archaeology and provide a scientific foundation for considering adaptation options. SLR is a subset of the climate change impact but begins to fill in the picture of the scale of the problem. SLR poses to archaeological sites globally. Each country, for example, has a unique archaeological record with a different quantity and type of coastal archaeology (Bickler et al. 2013, Brooks et. al. 2018, Dawson et. al 2020, Daire et. al 2012, Fenger-Neilsen et. al 2020, Flatman, 2019, Hil, 2020, Mattei et.al 2019, McCoy 2018, Murphy et. al 2009, Ramsay, 2014, Reeder-Myers, 2015, Westley et.al. 2011, Walton, 2007, Tait, 2019, Law 2021).

Coastal archaeological risk is a function of the susceptibility of coastal areas to inundation and erosion processes [Anfuso et al. 2021, Mattei et. al 2021], and the capacity of those areas to adapt to new climatic conditions, such as SLR. Dawson et. al [2020] states that archaeological site vulnerability "is determined by its exposure (the scale of the potential impact of a climatic event) and its sensitivity (or degree to which it could be affected by that exposure" (p8281). They suggest a four-step process (Figure 1) to address the archaeological impacts related to SLR: 1) prepare an inventory of existing archaeological site data (location, type, date), 2) update the inventory by surveying the coastal margin to identify new sites, and check the state of existing sites, 3) determine archaeological site vulnerability based on the data from 1 and 2 and 4) provide strategies and recommendations to minimise risk.

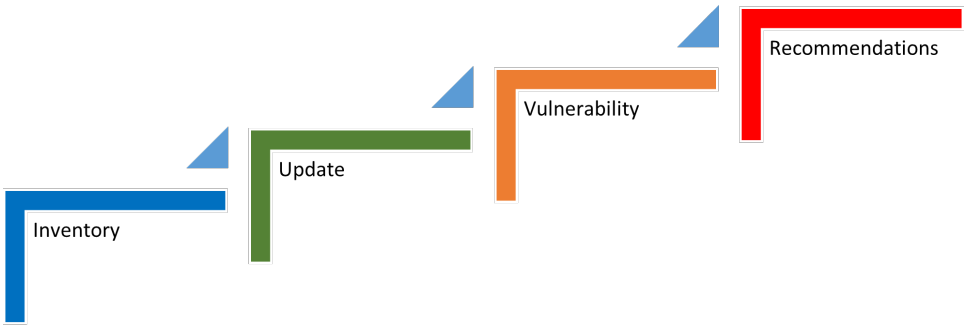



**Figure 1: Dawson's et. al four-step process for archaeological risk assessment**

Aotearoa's coastal zone contains a high number (9054) of archaeological sites. This trend is particularly evident for midden and burials and highlights the potential vulnerability of these types of sites to coastal hazards and SLR. Of all archaeological sites within 1 km of the shoreline, 60% are within 100 m of the water's edge. The dominant coastal archaeological sites are middens (44%) and earthworks (48%). Only 2% of sites are burials, but these 445 highly important locations will be key for adaptation planning due to the presence of koiwi tangata (human remains). 60% of coastal burial sites are within 100 m of the shoreline.

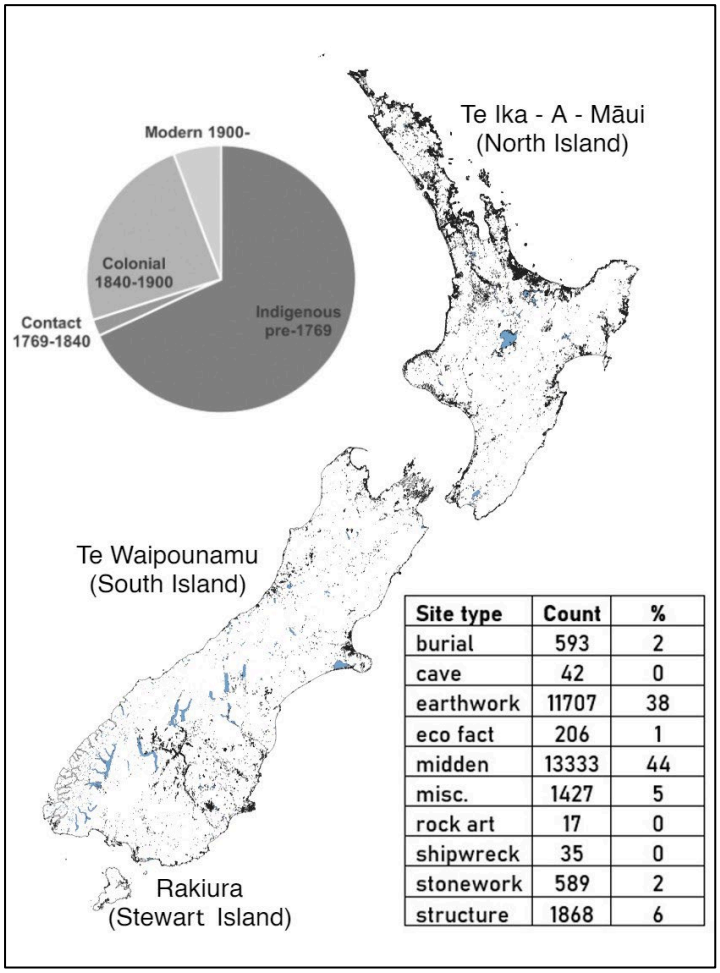
Two large-scale archaeological risk studies have been conducted within Aotearoa [McCoy, 2018, Tait, 2019]. Tait [2019] identified archaeological sites in the coastal zone within Department of Conservation (DOC) land at risk to inundation. This analysis determined a potential coastal inundation risk 'zone' (PCIRZ) where DOC assets (archaeological sites) intersecting the PCIRZ were considered to be at potential risk to current and future inundation, with 420 archaeological sites identified as of 2019. McCoy's [2018] assessment was derived using elevation data from a 25 m resolution Digital Elevation Model (DEM) and considered archaeological sites at risk of partial and/or complete inundation given projected global SLR. The estimate suggests 14% (9430 sites) of all known archaeological sites are within 5 m of current sea level and 1.6% (1096) are within 1 m of the current sea level.

Tait and McCoy's [2019, 2018] work provide valuable first attempts to estimate archaeological site vulnerability with Aotearoa's coastal zone. Neither work considers risk associated with coastal erosion, and neither considers the morphodynamic character of the coast, including the variability of different types of coastal landforms around the country. Coastal erosion appears to be a particularly serious threat to archaeology, in comparison with inundation, because erosion would permanently remove sites, erasing all contextual information that is important for archaeological preservation and investigation. Using the CSI 72% of coastal archaeological sites are on landforms that are vulnerable to SLR-driven erosion. About half of these sites are either on foredune barrier beaches or foredune barrier plains, 14% are on beaches, and 9% on beach ridge barriers. Spatial mapping of archaeological sites in at risk areas indicates site of regional focus in the North Island around Taranaki, Auckland, the Coromandel, and northern Hawkes Bay, and in the South Island around Tasman and parts of Otago and Canterbury. Regional level assessments within these sites can help to identify needs concerning documenting, preservation, and protection of coastal archaeology.

Further improvements in assessing coastal archaeological risk in Aotearoa will also require improved geomorphological datasets. Datasets to not only assess coastal archaeological risk, rather inland, hinterland and other areas which hold archaeological material. For erosion and SLR risk argued to be the most pressing risk national coastal erosion datasets are required. Higher resolution topographic data are also required to improve estimates of inundation sensitivity in Aotearoa [Rouse et al 2017, Nigel et al 2012, Pethink & Crooks et al, 2000]. Several significant improvements in the availability of national scale datasets for Aotearoa are being provided as a result of large research projects, including nationwide relative sea-level forecasts, wave climate forecasts, historic shoreline analyses, and national coastal LiDAR. The next phase of coastal archaeological risk analyses could utilise these data sources to significantly build upon the first-pass stock take provided in this submission. The work in this submission highlights issues of concern and indicates potential focus areas. Future analyses are further needed to deliver local-scale outputs that will have value to stakeholders, community, hapu and coastal planners.

**Vegetation and Dune Restoration**

Another hazard deriving from changes to the climate is changing plant distributions (Cassar 2005, Hilton et al. 2018). As temperatures increase, vegetation and indeed whole ecosystems are likely to change. Changes in vegetation result in changes to the degree of root damage and other biological activity impacting on subsurface archaeological features. Human responses in terms of changing coastal settlement patterns and additional coastal defences will clearly also affect archaeological sites.




| Site type | Count | % |
|---|---|---|
| burial | 593 | 2 |
| cave | 42 | 0 |
| earthwork | 11707 | 38 |
| eco fact | 206 | 1 |
| midden | 13333 | 44 |
| misc. | 1427 | 5 |
| rock art | 17 | 0 |
| shipwreck | 35 | 0 |
| stonework | 589 | 2 |
| structure | 1868 | 6 |

**Figure 2: Distribution of known archaeological sites in black as of May 2020 – approximately 73400 sites. Note the concentration of locations along rivers, estuaries, coastal margins, islands, and**

**lakes. Figure taken from Jones et al 2022 article submitted and adapted which is under review in the Journal of Coastal and Island Archaeology.**

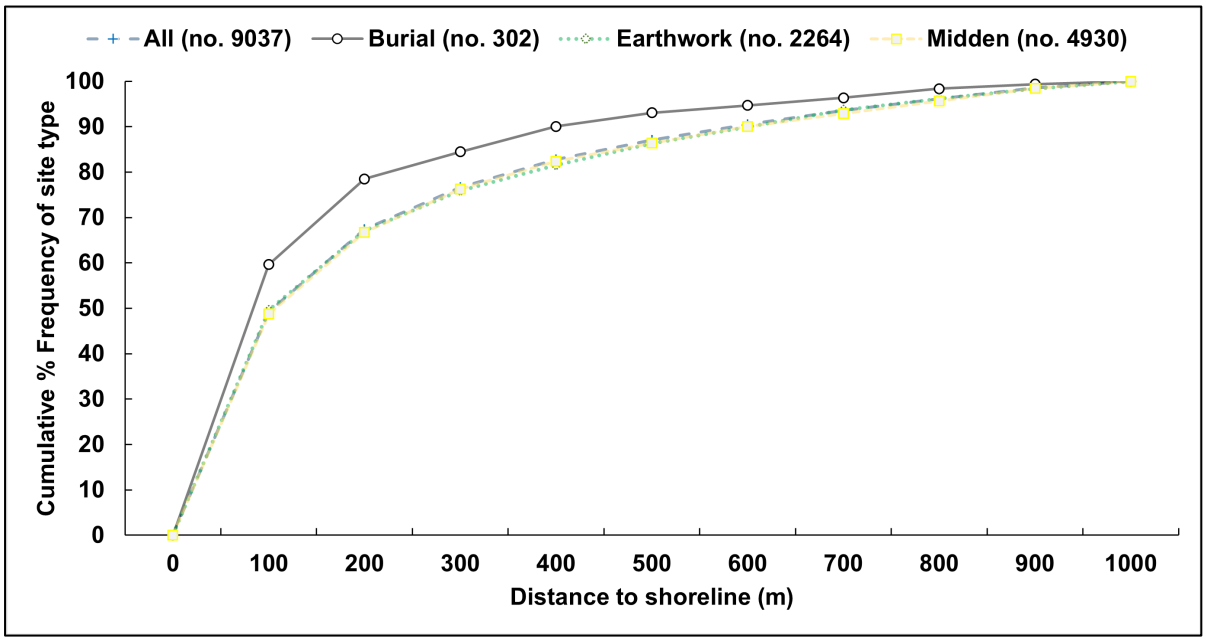



**Figure 3: Cumulative % frequency graph of archaeological site types of burial, midden, earthwork, and all within 1000m of the shoreline. Figure taken from Jones et al 2022 article submitted and adapted which is under review in the Journal of Coastal and Island Archaeology.**

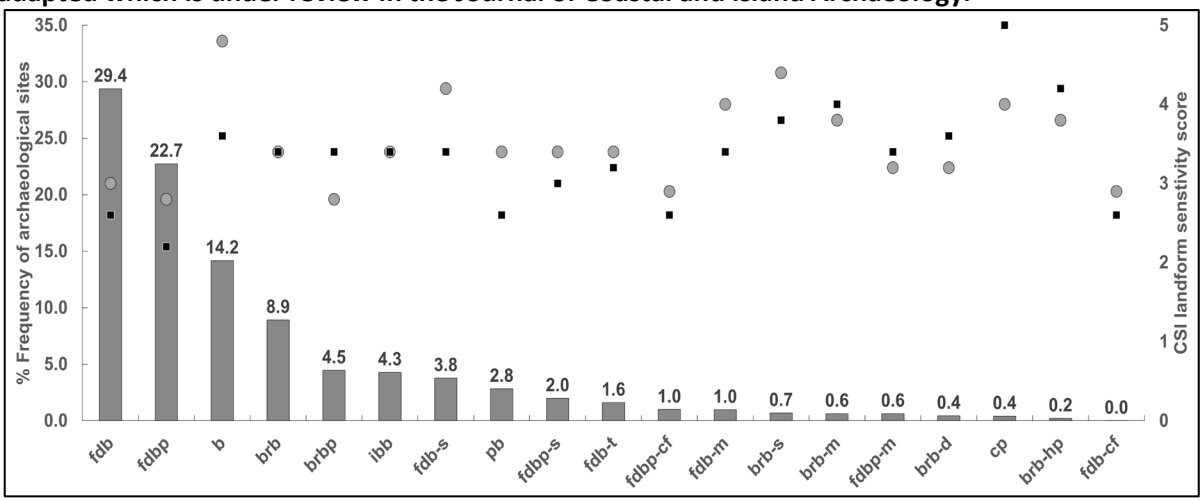



**Figure 4: Percentage of archaeological sites on coastal landforms showing sensitivity to SLR coastal erosion (grey circles) and inundation (black squares). Categories: beach (b), beach ridge barrier (brb), beach ridge barrier delta (brb-d), beach ridge barrier hapua (brb-hp), beach ridge barrier modified (brb-m), beach ridge barrier plain (brbp), beach ridge barrier spit (brb-s), beach ridge barrier – tombolo, chenier plain (cp), foredune barrier (fdb), cuspate foredune (fdb-cf). foredune barrier modified (fdb-m), foredune barrier plain (fdbp), plain cuspate foredune (fdbp-cf), foredune barrier modified (fdb-m), foredune barrier plain spit (fdbp-s), foredune barrier spit (fdb-s), foredune barrier tombolo (fdb-t), incipient barrier beach (ibb), platform beach (pb). Jones et al 2022 article submitted and adapted which is under review in the Journal of Coastal and Island Archaeology.**

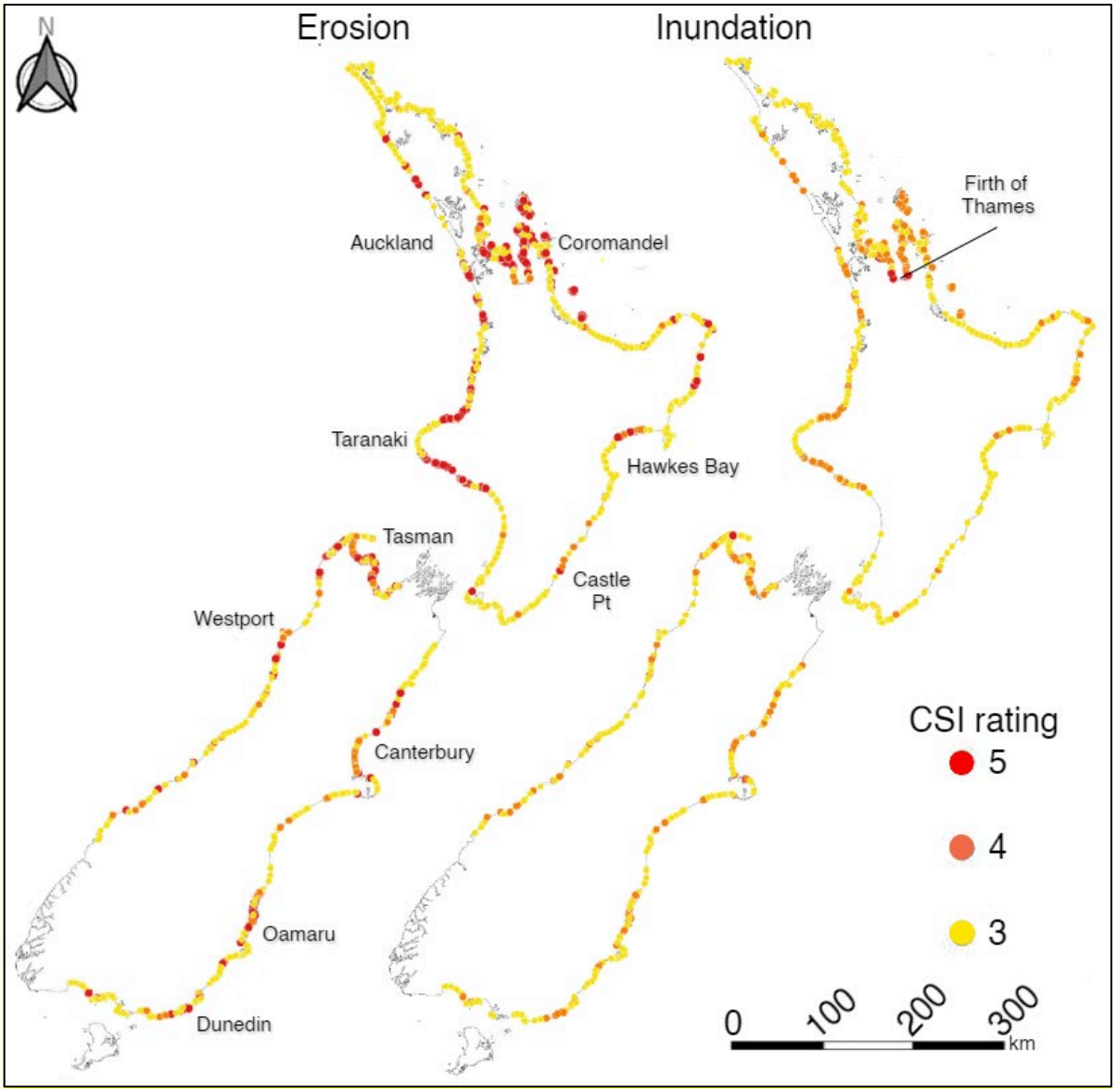



**Figure 5: Coastal distribution of archaeological sites with CSI erosion and inundation landform sensitivity values of 3 or higher. Figure taken from Jones et al 2022 article submitted and adapted which is under review in the Journal of Coastal and Island Archaeology.**

**Non-Coastal hazards exacerbated by climate change**

**Flooding (Rivers and waterways)**

Heritage sites located along rivers, like those along the coast, are subject to significant hazards especially flooding and erosion. Historically, archaeological sites have been located near waterways as these were major inland travel paths for both Māori and settler communities. The flood hazard identifies 'land which, on the information currently available, is susceptible to flooding either due to rivers or streams overflowing their banks, inundation from the sea during high tides or storm surges, or to water ponding during extended periods of wet weather (Whangarei District Plan 2007: ch.56: 1). Not all of the flood hazard zones, therefore, relate to coastal hazards. Flooding is not necessarily destructive of archaeological remains; its effect depends on the nature of the site as well as how the flooding occurs. Midden sites will often survive inundation if they are well sealed but because movements of soil often accompany a flood, flooding results in damage. This suggests that large 'flood 'zones' are less of a threat than areas associated with rivers and streams where the water flow is more

of an issue before, during and after a flood. Removal of riverbanks which hold archaeological material is off particular concern. Some early European sites with fragile structural remains, and sites that include metal components, will be vulnerable to flood damage.

**Land Stability**

Ground instability hazard zones generally cover different landforms than the coastal margins and flood zones, particularly in being higher in elevation, although there are overlaps with the other hazard types. The instability also varies in severity. Midden sites and pits/terrace complexes were most vulnerable to ground instability. Pa sites are vulnerable to this hazard t. Like flooding, however, ground instability can affect a diverse range of site types. These include less common site types, particularly relating to the historic period. Many of these rare types have only a few examples recorded and so any effects on these sites could be significant.

**Liquefaction/Fault Lines**

Heritage sites on inland areas with land stability issues have also proved to be vulnerable to significant damage. Following the 2010-2011 Christchurch and 2014 Kaikoura Earthquakes, hundreds of heritage structures and sites were damaged or destroyed.
Value
Many New Zealanders are surprised by the presence of archaeological sites in the local landscape, having the perception that as a young nation, there will not be much for archaeologists to find. There is, however, a diversity of sites representing the history of New Zealanders over the past few hundred years. The sites also represent the destinations of many peoples who have crossed the Pacific Ocean over the last millennia, making the story one that connects populations across the globe.
The value of these places is that they are both the physical expression of local and regional identity for those living in Aotearoa/New Zealand. They contain information relating to the history of New Zealand. Sites are a valuable asset not only for the community, but for visitors from elsewhere. There remains a pressing need to extract what information we can from sites that are rapidly disappearing. The information contained in these sites can considerably enhance our understanding of the past. For example, coastal middens may contain environmental, dating and settlement information that may be crucial to our understanding of the pre-European settlement sequence, the effects of settlement on the natural environment and the processes of cultural transformation involved in the development of Māori society from East Polynesian origins (Walter et al. 2017). Archaeological research can also shed light on past climatic changes or seismic events such as rising sea levels, flooding, tsunamis and earthquakes, and the effects of these on settlement patterns and food resources, improving our understanding of naturally occurring events and processes, and the extent to which future events may be natural or human induced occurrences (see e.g., McFadgen 2007, Goff et al. 2010, Smith and James-Lee 2010, Smith 2011). Reliable reconstruction of the past, however, depends on examination of a range of archaeological sites of different periods across different environments and landscapes within the district (and nationally), and must inevitably focus on the areas of earliest and densest settlement, which are predominantly within the coastal areas and shown by the submission are under threat.

**Summary of climate change impacts on archaeological sites in Aotearoa**

Climate change effects will have a definitive impact on Aotearoa's archaeological record (Bickler et al. 2013). Currently, the major threats to archaeological sites in coastal areas are erosion, flooding and ground instability, and some sites are at risk from more than one of these threats. Climate change will exacerbate existing coastal hazards and increase the likelihood and severity of impacts on archaeological sites

The types of sites that are most likely to be affected are coastal midden and small habitation sites relating to Māori occupation. These could be affected by all of the major hazards identified, but particularly coastal erosion. Land stability issues and flooding are likely to affect a greater range of sites, including larger sites such as pa and sites relating to early European settlement. It is not possible to quantify the risk to sites from increased land instability resulting from global climate change, but it is noted that any increase in extreme weather events would not be confined to coastal areas. Action is needed now to protect or retrieve the information from significant sites under threat in coastal areas before the sites disappear completely.