

POST-ISLAND FUTURES: SEEDING TERRITORY FOR TUVALU'S FLUID ATOLLS

by Elizabeth Yarina
B.S., Architecture, University of Michigan, 2010

Submitted to the Department of Architecture and Department of Urban Studies in Partial
Fulfillment of the Requirements for the Degrees

of

Master of Architecture and
Master in City Planning

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ABSTRACT

The atoll nation of Tuvalu lies only a few meters above the seas of the equatorial Pacific, and is at high risk for inundation and storm surges due to climate change. However, in spite of the media narrative of “sinking” Tuvalu, when understood in broader contexts of time and space, the existence of atolls is highly temporal and dynamic, based on sediment hydrodynamics and coral reef production. The designation of Tuvalu as a ‘nation’ is also a narrow temporal framing, of colonial origin. The inhabitants of Tuvalu’s atolls were historically highly mobile peoples, moving from island to island in response to resource or social concerns. Tuvaluans today continue to be mobile peoples, migrating between atolls and globally, but this movement is now limited by global territorial sanctions. Climate change creates the risk of uncertain territory and uncertain identity for Tuvaluans; the submergence of the islands below mean sea level threatens rights to their territorial waters (EEZ) as well as their nationhood status as they lose the space to practice their cultural identity.

The modern nation-state views its contents (population and geography) as relatively static. The inherently fluid nature of these components in Tuvalu, further amplified by climate change, problematizes the hard lines of territory and state drawn sharply in the contemporary era. When both ground and people are acknowledged as fluid entities, how might we re-imagine the spatial and social form of the Tuvaluan nation? How can Tuvalu continue to exert territorial claims when both the subject and object of nationhood are in flux? And how can Tuvalu’s spatially oriented cultural identity be maintained as its population becomes increasingly mobile?

Instead of ceding territory to the rising waters of climate change, this thesis posits ‘seeding’ territory as an alternative. The project explores the propagation of the architectural ‘seed’ as a way to ‘grow’ territory in the context of migratory populations and unstable geographies. The seeds consider territory both in the sense of transnational legislation (per the UN Law of the Seas) but also in the cultural sense of Tuvaluans, as a collective space of shared resources and identity. The seeds generate physical territory and facilitate social networks and identities. The design of these seeds is then conceptually tested in future social and environmental scenarios both for both the in- and ex- situ nation.

Thesis Supervisor: Miho Mazereeuw

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To the department and the Institute for providing travel funds and support, including the MIT Public Service Center, the Emerson Travel grant, the MIT Urban Risk Lab and a Lloyd and Nadine Rodwin International Travel Fellowship.

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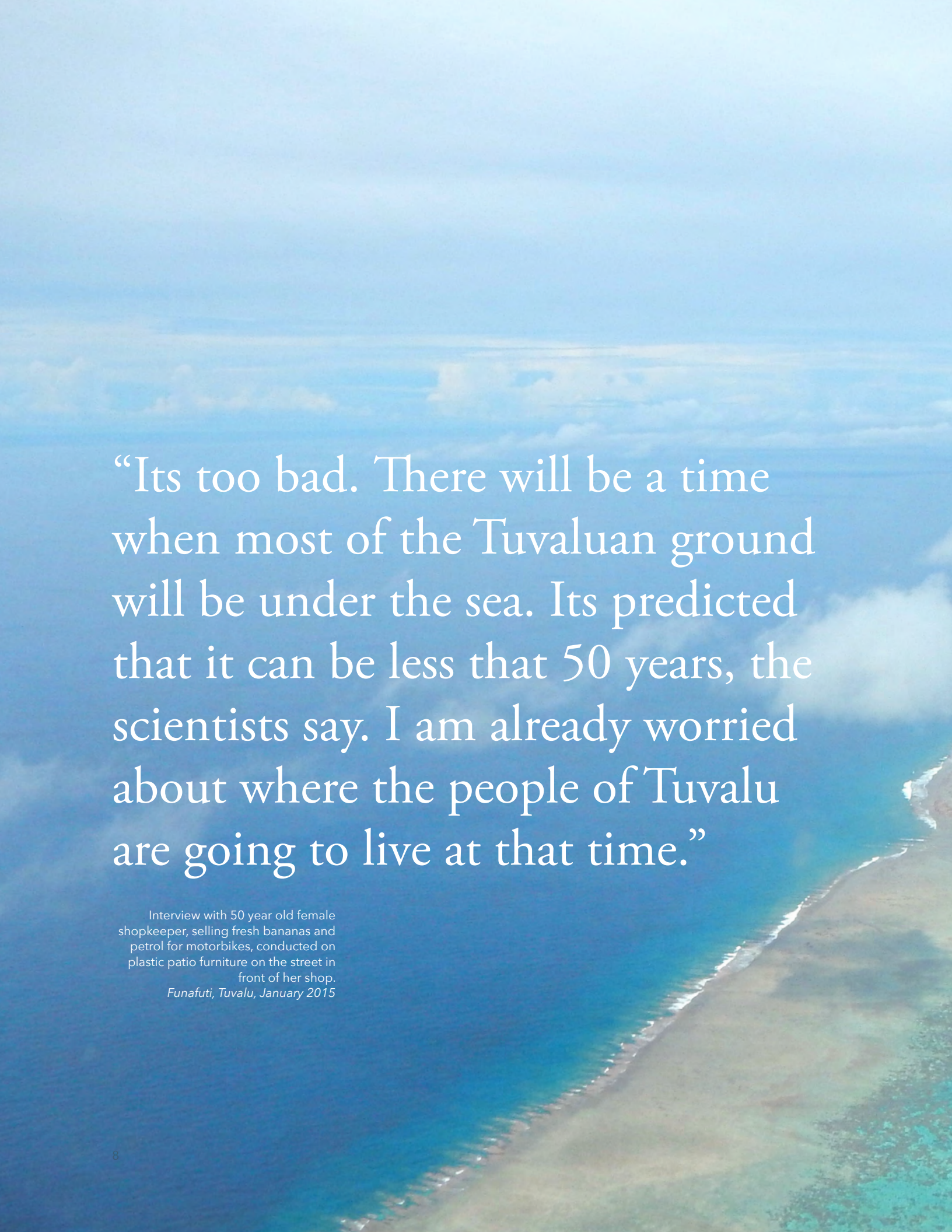
To my undergraduate faculty, who taught me that anything was possible through design; Anya Sirota, for telling me that a thesis should be a aspirational model for how you want to practice, & Jen Maigret, for her long-lasting support and guidance.

And finally, thank you to Richard and my family and friends, for reminding me that there is a world outside of thesis, and supporting me through it all.



Government *maneapa* in Funafuti, in this photo doubling as the waiting area for the twice-weekly flight out of Tuvalu. This open-air structure is also where Tuvaluan parliament is held.



An aerial photograph of a tropical coastline. The water is a vibrant turquoise color, transitioning to a deeper blue further out. A narrow, light-colored sandy beach runs along the edge of the water. The land beyond the beach is a mix of green and brown, suggesting vegetation and some cleared areas. The sky is a pale, hazy blue with some light clouds.

“Its too bad. There will be a time when most of the Tuvaluan ground will be under the sea. Its predicted that it can be less that 50 years, the scientists say. I am already worried about where the people of Tuvalu are going to live at that time.”

Interview with 50 year old female shopkeeper, selling fresh bananas and petrol for motorbikes, conducted on plastic patio furniture on the street in front of her shop.
Funafuti, Tuvalu, January 2015

Sandbar and small islets forming the Western edge of Funafuti atoll. The entire nation of Tuvalu is around 2 meters above sea level.



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INTRODUCTION

PROBLEM STATEMENT

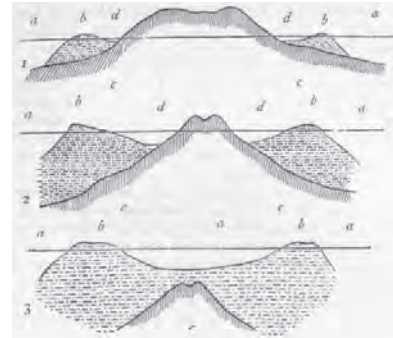
Atoll dwellers are acutely aware of the impacts of global climate change; most atolls rise only a few meters above sea level, and are incredibly susceptible to the rising sea levels, increasingly intense storms, and unpredictable rainfall patterns associated with a changing climate. Their island communities and small water supplies are at high risk for tsunamis, inundation, and eventual submersion. In 2002, Tuvalu (one of four countries which reside entirely on low-lying atolls) sued the U.S. for its support of big oil and extensive greenhouse gas emissions which have contributed to their current state of risk.¹

Tuvalu is the world's third smallest nation in population, at 10,837,² and fourth smallest in physical territory, at 26 square kilometers. However, the liquid territory of Tuvalu is much larger; its Exclusive Economic Zone (EEZ) spans 900,000 square kilometers of ocean. Much of the climatological and social risk that Tuvalu faces in the coming years are closely tied with its specific and unique geography.

The Tuvaluan archipelago is composed of 5 true atolls, 3 raised limestone islets, and one pseudo-atoll,³ most of which are under two meters above mean sea level (MSL). Limited areas of sand and rubble overwash reach three to five meters above MSL. The most recent IPCC projections put sea level rise at up to 6' (2 meters)⁴ by the end of this century. At this rate, the majority of the landmass of Tuvalu's islands would be submerged, and what is left would be incredibly vulnerable to storms and wave action, to the point where all 9 atolls are likely to become uninhabitable without significant intervention.

Tuvalu's atolls each retain a distinct sense of cultural identity, or 'islandness.' Each island has one or two villages, with total populations ranging from 30 people on Niulakita to more than 6,000 in the capital settlement on Funafuti. Tuvalu maintains a community-oriented culture grounded strongly in religion and local traditions. While wage economies and modern amenities are growing in prevalence, particularly in the capital, on the outer islands subsistence or semi-subsistence lifestyles remain commonplace. In addition to risks towards the physical land of the nation, increased out-migration and future displacement accelerated by sea level rise also poses risks to the nation's unique cultural identity and traditional practices.

Historically, residents of Oceania moved freely by boat between various islands as social or environmental conditions made their homes uninhabitable⁵. However, contemporary concepts of territorial ownership mean that increasingly these would-be climate refugees are negotiating



Atoll Formation Diagram, Charles Darwin. Source: Wired.com

1. Reuters. "Tiny Tuvalu Sues United States Over Rising Sea Level." 29 July 2002. <www.tuvalu.islands.com/news/archived/2002/2002-08-29.htm>

2. "Tuvalu: Millennium Development Goal Acceleration Framework - Improving Quality of Education". Ministry of Education and Sports, and Ministry of Finance and Economic Development from the Government of Tuvalu; and the United Nations System in the Pacific Islands. April 2013. Retrieved 13 October 2013.

3. Thaman, Fihaki & Fong. *Plants of Tuvalu: Lakau mo Mouku o Tuvalu*. Suva, Fiji; The University of the South Pacific, 2012.

4. Intergovernmental Panel on Climate Change. "5th IPCC Assessment Report: Climate Change 2013: The Physical Science Basis."

5. Connell, John. "Population, Migration, And Problems Of Atoll Development In The South Pacific" *The Journal of Pacific Studies*, Vol. 9 No. 2. 1986.

access to high ground in other nations entirely. Some atoll dwellers have already left, seeking security from the sea in New Zealand, Australia, or Fiji; however issues of illegal status, poverty, and lack of community all suggest that simply dispersing the population to high grounds is an insufficient solution. Other atoll nations have explored purchasing large swathes of land to accommodate mass migration, or even the construction of new islands all together.

What is the role of spatial design in mediating the post-island future of vulnerable atoll nations such as Tuvalu? As weather and climate patterns shift, issues of lost habitable land and forced migration will become a growing global issue, and Tuvalu is on the front line of this impending shift towards the re-organization of human habitation. I propose that by developing models by which Tuvaluan peoples, culture, and ways of life can continue to exist beyond ‘natural’⁶ the lifespan of their atolls we can launch a conversation about the role of design in territorial politics and uncertain futures.

RESEARCH QUESTIONS

Tuvalu is one of the world’s smallest nations in terms of both population and land area. Its expansive oceanic territory relies on an inter-governmental legal instrument that bases the EEZ on the existence of habitable islands, which Tuvalu risks losing in the not-so-distant future.

This thesis explores the post-island future(s) of Tuvalu, a nation composed of 9 low-lying coral atolls in the Pacific Ocean. Coral atolls, narrow sandbars only a few meters above sea level, are at the front line of sea level rise, storm surge, and water supply depletion. With the loss of habitable land, and potentially territorial waters, the question of nationhood itself is thrown into question for those four countries who reside entirely on low-lying atolls⁷. This thesis explores the role design and spatial disciplines can play in what is typically conceived as a political problem. As a both written and design project, the thesis explores existing strategies exist to deal with the post-island futures of Tuvalu (or other atoll nations), and what spatial design research can add to this conversation.

In this context, the research questions posed by this thesis explore how Tuvaluans can increase agency over their own future in spite of the uncertainty of unstable ground and fluid populations. This fluidity is further problematized by the hard lines of territory drawn by the contemporary nation state. In light of these issues, the following research questions emerge:

6. Natural is a difficult term, particularly in this context. Here it is used to mean without intervening in atoll hydrodynamic processes, but still in light of climate change factors.

7. Barnett, Jon. “Global warming and the security of atoll-countries.” Christchurch : Macmillan Brown Centre for Pacific Studies, University of Canterbury, c2004

See also discussion pages 70-75.



TUVALU COUNTRY PROFILE

Population 11,206
GDP \$37,517,000
Life expectancy 62 (M), 65 (F)
Median Age 23
Labor Force 58%
Urban Population 60%
Land Area 26 sq km
Oceanic Territory 900,000 sq km

Government: Parliamentary Democracy
Language: Tuvaluan, English
Independence (UK): 1978
Religion: Protestant (98%)
Health expenditures: 19.7% of GDP
Obesity Rate: 39.6%
Currency: Australian Dollar
Primary economies: Fish license sales, remittances, aid.

Data source: CIA World Factbook, Tuvalu Central Statistics Division

When both ground and people are acknowledged as fluid entities, how can the spatial and social form of the Tuvaluan nation be re-imagined?

How can Tuvalu continue to exert territorial claims when both the subject and object of nationhood are in flux?

How can Tuvalu's spatially oriented cultural identity be maintained as its population becomes increasingly mobile?

The thesis explores these questions in two phases. The first phase frames the existing geopolitical and theoretical context of the proposal through site analysis, interviews, literature review, and writing. The subsequent design phase devises strategies, applied over time, that combine design and policy in order to facilitate the survival of Tuvalu as its islands risk becoming uninhabitable. More broadly, this phase demonstrates how design can contribute to the future of the post-island atoll states of the South Pacific, where the hard line of political territories meets fluid boundaries of climate and migration.

Design can and should play a role in curating the uncertain future of Tuvalu. Existing policy proposals and physical strategies can be reconsidered and improved upon through the lens of projective design. For the atoll nation of Tuvalu, a range of design strategies are necessary to deal with the spectrum of climate projections/timelines, policy solutions, and cultural specificities inherent to the nation's post-island future(s). In the model of Mathur/da Cunha, this project calls for "the designer as the creator of starting points, of anchors for the staging of social and ecological processes over time⁸." This thesis rejects the notion of a single, one-off design solution for complex and unpredictable problems associated with climate change, and instead proposes integrating this uncertainty into the design process. Designing for unstable futures requires a range of flexible, multi-pronged strategies that integrate multiple time-scales.

A triad of possible futures and associated policies have emerged in response to the impending demise of Tuvalu's islands: the *diaspora*, dispersed among many nations, the *enclave*, with negotiated autonomy within an existing nation, or as a *constructed island* or archipelago at or near its current location. These three policy futures provide an initial framework for the design proposals. Along with design, it is necessary that these strategies are informed by Tuvalu's existing resources. Given its context as a poor nation surrounded by expansive ocean, in the negotiation or construction of higher ground for Tuvalu the elements of its underutilized fishing resources, access to its Exclusive Econom-

8. Interview with Anardha Mathur and Dilip da Cunha, Places Journal

ic Zone, and relationships with wealthy carbon-giant nations are key points of leverage.

ON 'POST-ISLANDS'

The term 'post-island,' as applied in the title of this thesis, is not simply a reference to the possibility the the Tuvaluan archipelago might become submerged as a result of climate change. Rather, the term is intended to mean in multiple ways. Namely, it addresses Tuvalu's position in a globalized and mobilized world, where Tuvaluans are increasingly becoming global citizens. With this in mind, it is pertinent to see Tuvalu not as an island (or set of islands) but as part of larger networks of information, society, ecology, economy, and culture. As a title, this term asks that Tuvalu not be conceived simply as a 'sinking nation,' and that possible futures consider Tuvalu beyond its geographic context.

DISCIPLINARY POSITIONING

Climate-changed futures for the atoll nation of Tuvalu include the possible loss of inhabitable land, cultural practice, or even nationhood itself. This thesis explores how nationhood can persist in the context of unstable ground and fluid populations, through insertion of architectural seeds which grow territorial impacts. These seeds, both conceptual and through their application, give Tuvaluans agency over the future of their nation.

A main agenda of this thesis is to expand the role of design as it relates to complex territorial and political problems. The thesis posits that design and designers should play an expanded role in strategizing complex problems such as climate change-related migration, territorial claiming, and identity politics.

This thesis will be meaningful for multiple groups. For the design and planning community, it will provide a model for integrating design and policy to generate a range of designed strategies for climate-risk zones, as opposed to the singular design object or master plan. Additionally, it will serve to further disciplinary discourse surrounding climate change adaptation to include possibilities of assisted migration,⁹ dealing with the complex resettlement patterns which climate change will inevitably require.¹⁰⁰ For those immediately affected by risk of inundation and evacuation, especially atoll-dwellers and Tuvaluans, it will provide visionary approaches that accommodate a spectrum of future timelines. These designs can serve as a starting point for real conversations about future physical strategies associated with their present and future post-island state.

9. Ste-Marie, Catherine, et al. "Assisted Migration: Introduction To A Multifaceted Concept." *Forestry Chronicle* 87.6 (2011): 724-730. Environment Index. Web. 30 Oct. 2014.

10. Valsson, Trausti. *How the World Will Change with Global Warming*. Iceland University Press: Reykjavik (2006).

RESEARCH

METHODS

MAPPING: multiscalar maps of Tuvalu's social/environmental context

LONG HISTORIES: long-span historical analysis based on primary source historical accounts, geological research data, and oral accounts

FIELD VISITS: first person experiential data collection in Tuvalu and New Zealand: photography, sketches, informal conversations

INTERVIEWING: semi-structured interviews with Tuvaluans in Funafuti and Tuvaluan migrants in New Zealand regarding their views of Tuvalu's future

SCIENCE/POLICY ANALYSIS: review and visualization of contemporary data on climate change science and territory/migration policy

FINDINGS

UNSTABLE GROUND: In spite of the media narrative of "sinking" Tuvalu, when understood in broader contexts of time and space the existence of atolls is highly temporal and dynamic, based on sediment hydrodynamics and coral reef production.

FLUID POPULATIONS: The designation of Tuvalu as a 'nation' is a recent construction, of colonial origin. The inhabitants of Tuvalu's atolls were historically highly mobile peoples, moving from island to island in response to resource or social concerns. Tuvaluans today continue to be mobile peoples, migrating between atolls and globally, but this movement is now limited by global territorial sanctions.

TERRITORIAL RISK: Climate change creates the risk of uncertain territory for Tuvaluans; the submergence of the islands below mean sea level threatens rights to their territorial waters (EEZ) as well as their nationhood status.

PROBLEMS

LIQUIDIZING TERRITORY: The nation-state views its contents (its population and its geography) as relatively static. The inherently fluid nature of these components in Tuvalu, further amplified by climate change, problematizes the hard lines of territory and state drawn sharply in the contemporary era. **When both ground and people are acknowledged as fluid entities, how do we reimagine the spatial and social form of the Tuvaluan nation? How can Tuvalu continue to exert territorial claims when both the subject and object of nationhood are in flux?**

SOCIOCULTURAL LOSS: Alongside risks associated with climate change (cyclones, SLR, food/water security) Tuvaluans are being squeezed out of Tuvalu by globalizing economic and societal pressures. Tuvaluan culture is highly tied to its local small-scaled communities and specific geography, and risks being dissolved into the distributed diaspora. **How can this spatially oriented cultural identity be maintained as Tuvalu's population becomes increasingly mobile?**

ECONOMIC LOSS: Subsistence livelihoods and Tuvalu's small national income achieved from the sales of fishing rights will disappear if rights to the EEZ are lost with atoll submergence. Tuvalu already currently can not capitalize on its massive fish stocks due to lack of capacity and sells fishing rights to developed nations for pennies on the dollar. **How can this lucrative resource, which is projected to potentially even expand with climate change, be harvested even as Tuvalu's rights to their EEZ are threatened?**

ASSUMPTIONS

SINKING ISLANDS: Tuvalu will disappear underneath the sea with climate change and will cease to exist as a nation

DISAPPEARING NATION: Tuvaluans will cease to exist as a peoples following the loss of their physical territory

DESIGN

STRATEGIES

FUTURES

SEEDING TERRITORY: This thesis posits the propagation of the architectural 'seed' as a way to 'grow' territory in the context of fluid population and geography. The seeds consider territory in the sense as it is presently framed in a global legal sense by the UN Law of the Seas (inhabited ground above high tide) but also in the cultural sense of Tuvaluans, as a collective space of shared resources and identity.

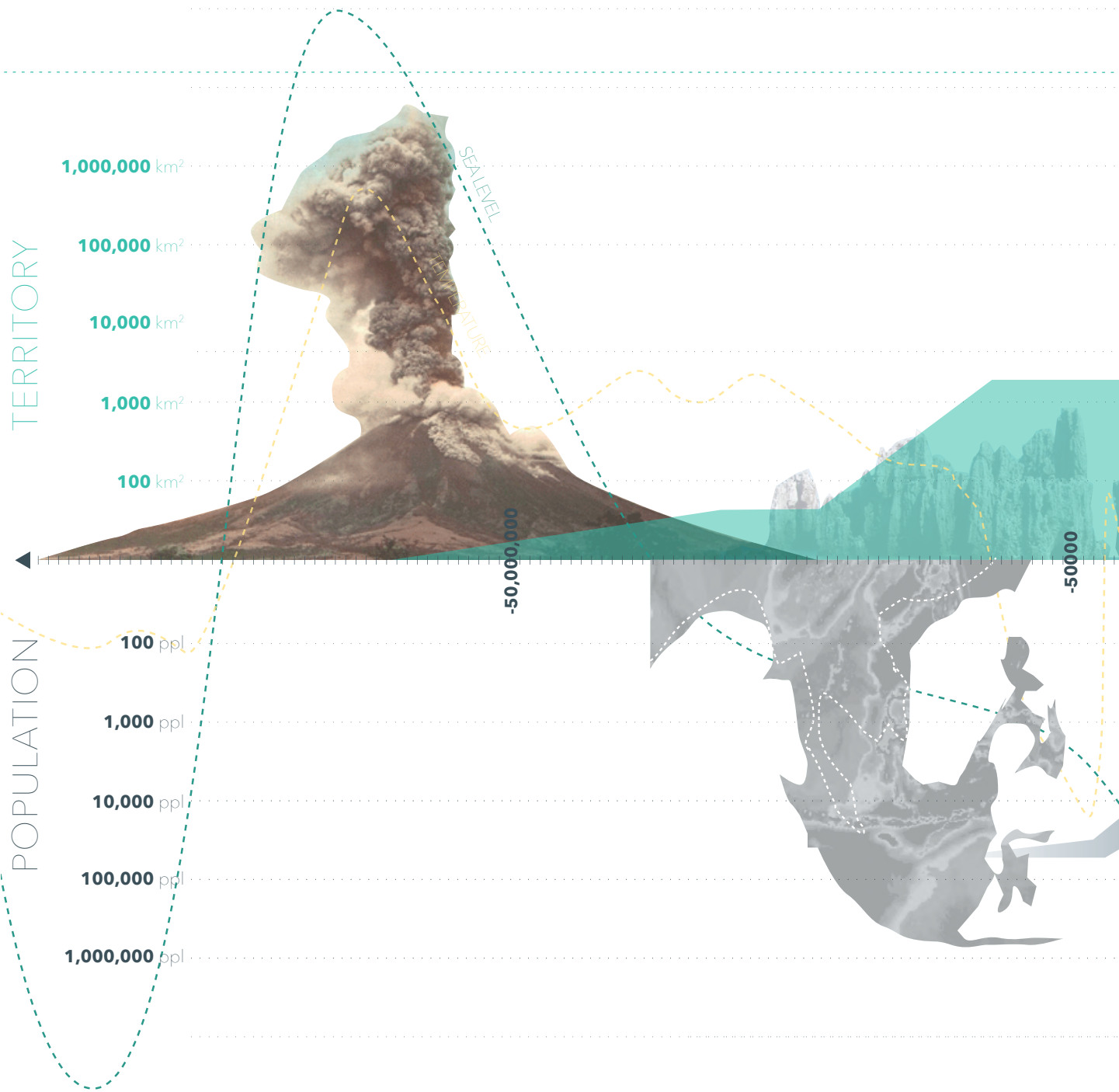
LAND SEEDS: Creation of physical territory (ground) via a hijacking of the atoll-formation process: the 'seeds' are frames for coral reef growth which over time curates and intensifies the sedimentation/deposition process which builds coral atolls

COLLECTIVITY SEEDS: Creation of new forms of collective space (*maneapa*) in the context of Tuvalu's changing physical status. Collectivity seeds include both the makings for deployable *maneapa* in the context of fluid populations and stabilizing *maneapa* as a basis for the formation of communities atop unstable geographies.

[In the context of climate change, multiple futures are simultaneously possible. In order to determine the effectiveness of these seeds in fluid/uncertain future contexts, they must be tested within multiple possible future conditions and time frames to test how they will grow and evolve in different contexts]

ICE SHEET COLLAPSE: Rapid sea level rise outpaces the adaptation capacity of coral reefs, fully submerging Tuvalu in a matter of years

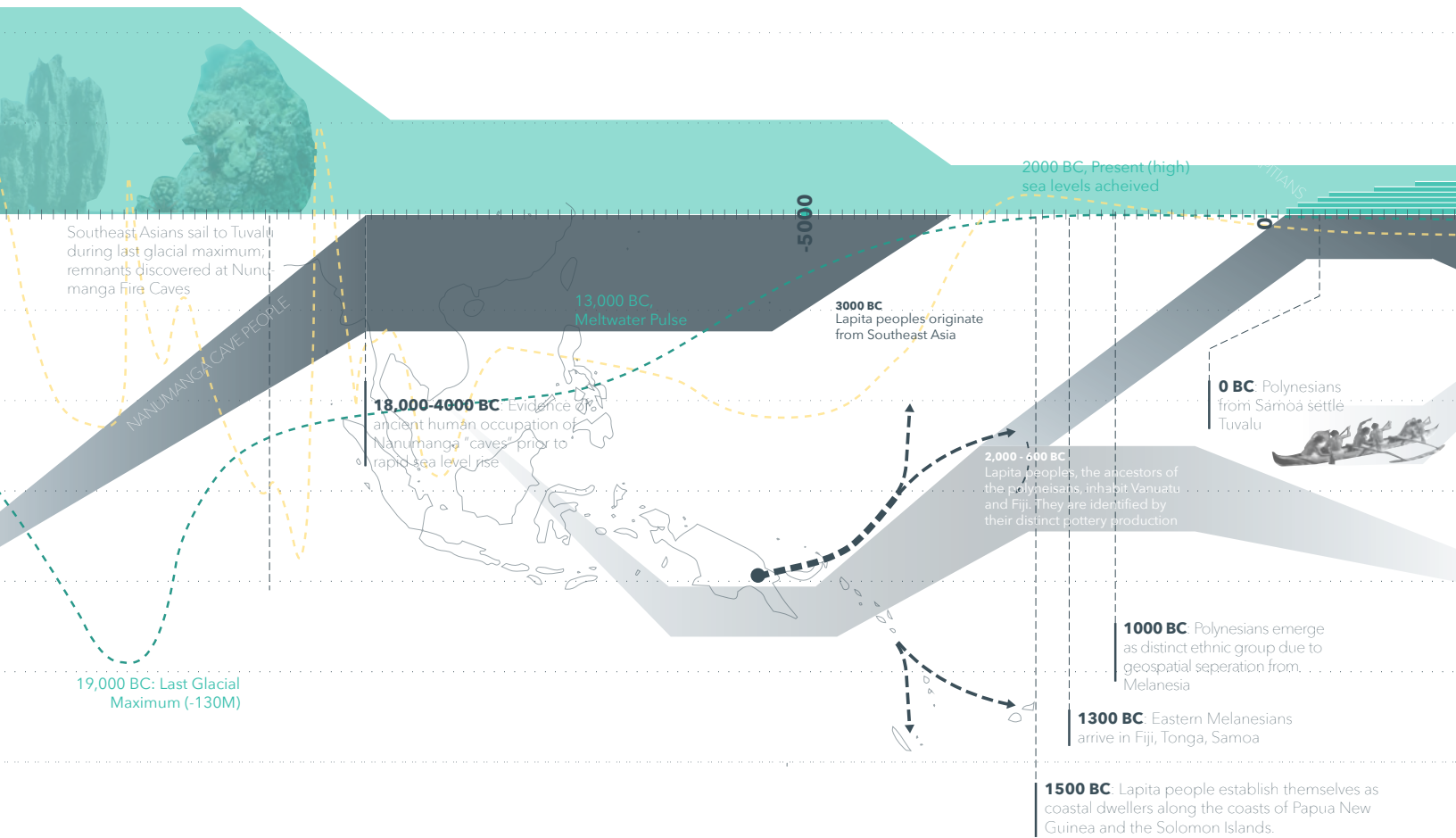
CLIMATE CHANGE AS USUAL: Incremental, consistent sea level rise is met by rising coral reefs; However, atoll land masses become increasingly unstable

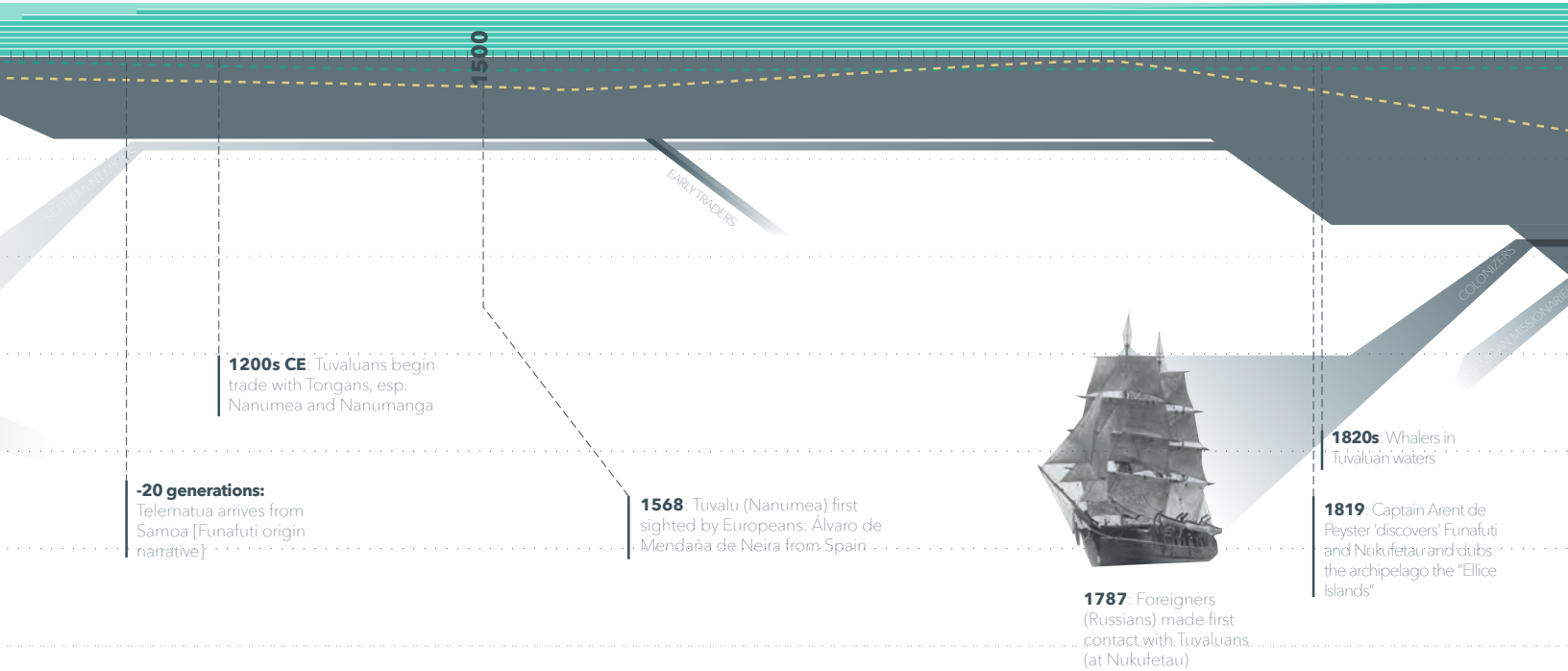


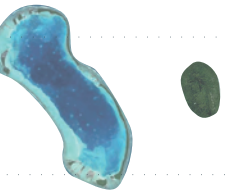
TIMELINE:

Fluid Populations / Fluid Territories

This timeline illustrates a deep history of Tuvalu which indexes historical events against changes in territory (blue, above) and population (grey, below) for the emergent nation.







1842: Darwin develops atoll formation theory

1883: Cyclone recorded by George Westbrook

1894: Severe Cyclone

BRITISH PROTECTORATE

1892-1916:

Tuvalu part of British protectorate under British Western Pacific Territories

BRITISH COLONY

1916 - 1974:

Tuvalu + Kiribati = Gilbert and Ellice Islands Colony

1900

1950

1860s: Coconut oil trading begins

1894: Resident Commissioner issues laws based on pastors' laws.

1886: Anglo-German agreement places Tuvalu within British influence (the West Pacific).

1863: Blackbirders kidnapped 54% of adult males on Funafuti and 79% on Nukulaelae (about 400 people) as slaves

1865: Samoan missionaries begin "systematic Christianization" of the Tuvaluan islands

BLACKBIRDED TUVALUANS

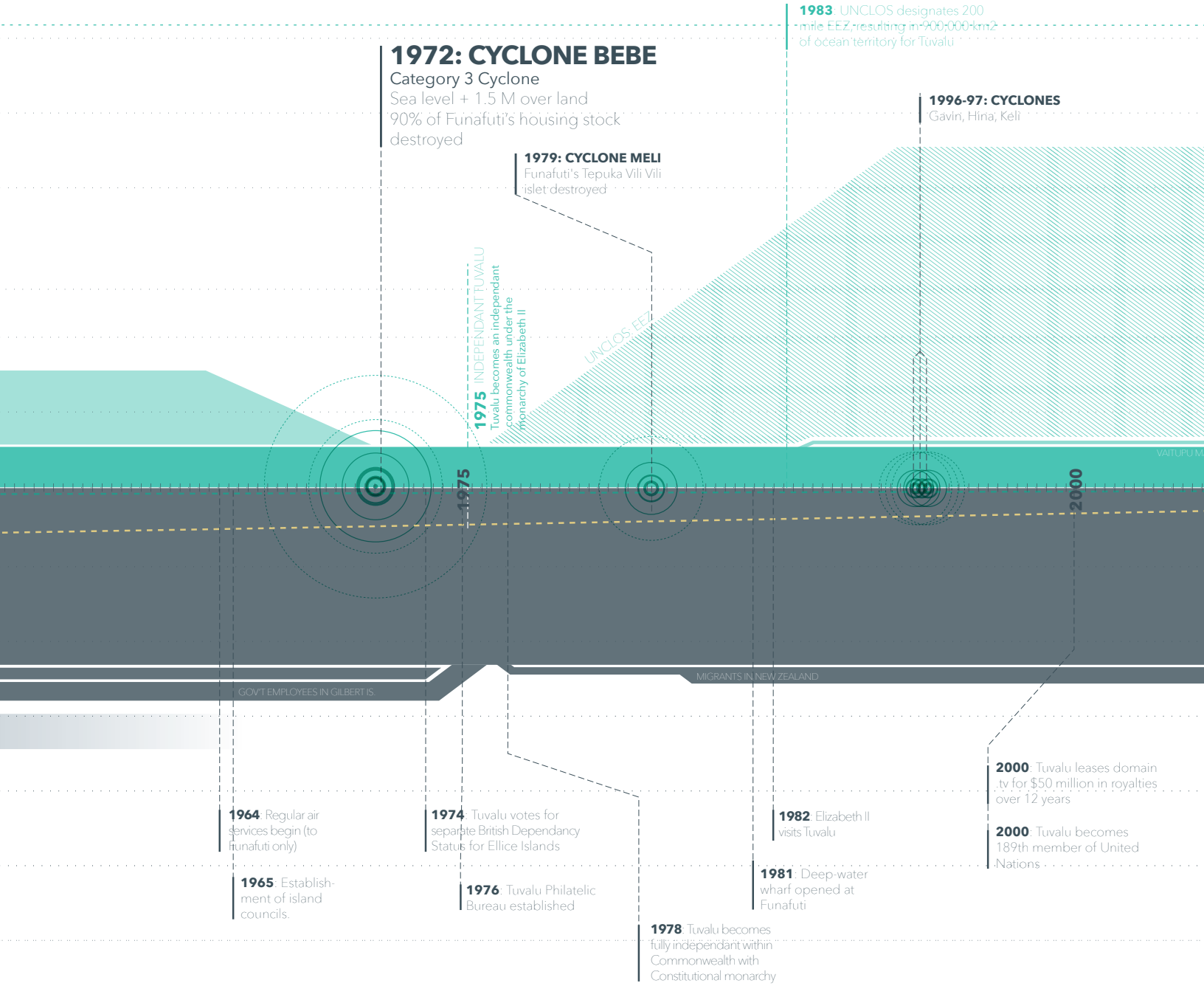
1941-1945
Asia-Pacific War

The Pacific theater of WWII

1924: D.G. Kennedy Opens school in Vaitupu

1947: Vaitupians begin settlement of Kioa island in Fiji.

1943: Funafuti village destroyed by Japanese bombers



2005

2010

2015

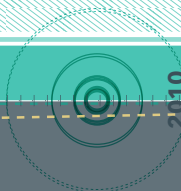
2007: Ambassador Pita calls sea level rise an: "an infringement on our fundamental rights to nationality and statehood as constituted under the Universal Declaration of Human Rights"

2011: Vaitupu islanders in Auckland purchase a structure to use as a community hall [maneapa]

2015: CYCLONE PAM
45% of Tuvalu's population displaced, severe flooding on outer islands despite being over 500 miles from the storm

2011-12: DROUGHT

National State of Emergency
Water rationing in Funafuti and Nukulaelae



MIGRANTS IN AUSTRALIA

2012: Duke and Duchess of Cambridge visit Tuvalu on South Pacific tour

2011-12 drought
State of Emergency

2015: Cyclone Pam:
State of Emergency

2013: Prime Minister Enele Sopoaga declares that relocation "should never be an option"

2002: Tuvalu launches lawsuits against US and Australia due to their implication in sea level rise.

2002: New Zealand implements PAC scheme allowing 75 Tuvalu migrants annually



ATOLL LOGICS

THEORETICAL
CONTEXT

The scale of the atoll nation of Tuvalu allows this research to address issues from the local to the national scale with minimal abstraction.¹⁴ Issues facing many coastal nations around the world—human displacement and migration, rising waters, unstable shorelines, and territorial conflicts—are magnified and superimposed within this micro-nation. While this makes for an excellent case regarding the implications of design on territorial issues resulting from climate change, it also makes Tuvalu unique in many ways. This requires a distinct theoretical context, as framed in the following subsections.

NISSOLOGY: ISLAND STUDIES

Nissology, “defined as the study of islands and islandness,”¹⁶ is an interdisciplinary field exploring the characteristics of islands in their own terms. While islands are interesting phenomenon in and of themselves, their study also serves to inform understanding of the world itself as an archipelago, a fragmented system “where given geographical patterns of lands and seas remains on major factor controlling global processes.”¹⁶ While Tuvalu is an island nation in most imaginable senses of the terms, continental zones facing geographical, social, or economic isolation can share island qualities and learn from island studies.

The study of islands has long fascinated scientists and anthropologists because islands serve as a “closed system” useful for studying processes in isolation, as a microcosm or even a utopia. While this has been the origin of much island research, more recently nissology has shifted to a study of the “archipelagraphy” of islands, characterized by “mobilities, and multiplicities associated with island-island movements,” and “how island movements adapt, transfigure and transform their inheritances into original form.”¹⁷ Thus, islands are studied in terms of not only their smallness and isolation, but the fluidity of their populations in time and space. This paradigm shift aligns with the cartographic studies and design proposals of this thesis which demonstrate the importance of transformation and movement in the ongoing defining of Tuvalu and Oceania.

It is also worth acknowledging that although the populations and land areas of islands such as Tuvalu are tiny, their oceanic territories are massive; “If one takes into account the Exclusive Economic Zone surrounding islands states and territories, their occupation of the earth’s surface is considerable.”¹⁸ The study of island sites, in the context of climate change in particular, is important then not only for their connectivity to the rest of the world, but also for the massive ocean territories they

14. Minimal relative to most nations, with populations in the millions; abstraction is of course still required.

15. Depraetere, Christian. “The challenge of nissology: a global outlook on the world archipelago. Part I: Scene setting the world archipelago.” *Island Studies Journal* 3.1 (2008): 3-16.

16. *Ibid.*

17. Pugh, Jonathan. “Island movements: thinking with the archipelago.” *Island Studies Journal* 8.1 (2013): 9-24.

18. McCall, Grant. “Nissology: A proposal for consideration.” 63 (1994): 93-106.

manage, which also face huge transformations in response to climate change.

The term “post-island” utilized by this thesis then not only considers a possible future where Tuvalu’s atolls become submerged, but also its increasing (though deeply historical) participation in the global space of flows. It also asks one to consider Tuvalu not as a series of atoll-islands, but as a system of land and seas



Honourable Enele Sosene Sopoaga, Prime Minister of Tuvalu, at the 20th Conference of Parties to the UN Framework Convention on Climate Change, December 2014, Lima, Peru. Source: SPREP.org

RE-POLITICIZING CLIMATE CHANGE

Tuvalu has come to serve as a global symbol for the risks climate change will pose to humanity. Like other small island states (termed SIDS or Small Islands Developing States in development literature), it faces not only disasters and resource problems, but the potential loss of any habitable land and with it, the status of nationhood. While at this point no Tuvaluans have been forced to migrate directly due to climate change problems,¹⁹ it is a growing concern, and interview subjects expressed in particular the need for providing security and opportunities for their children abroad.²⁰ Additionally, Tuvaluans have taken advantage of the climate refugee narrative as leverage in international proceedings on regulation associated with climate change mitigation. The following statements were made by Tuvalu’s Prime Minister Enele Sosene Sopoaga at UN climate change events:

19. Shen, Shawn, and François Gemenne. “Contrasted views on environmental change and migration: the case of Tuvaluan migration to New Zealand.” *International Migration* 49.s1 (2011): e224-e242.

20. Interviews in Funafuti, Tuvalu, January 2015. Refer to the appendix for additional information on interview methodology and data.

21. Statement Presented by Prime Minister of Tuvalu, Honourable Enele Sosene Sopoaga at the 20th Conference of Parties to the UN Framework Convention on Climate Change, December 2014, Lima, Peru

22. Statement Presented by Prime Minister of Tuvalu, Honourable Enele Sosene Sopoaga, The 69th Session of the United Nations General Assembly UN CLIMATE SUMMIT, 23 September 2014, New York

“I am here at this important meeting as the highest representative of the people of Tuvalu. I carry a huge burden and responsibility. I carry their hopes that there will be a future for Tuvalu. This is an enormous burden to carry. It keeps me awake at night. No national leader in the history of humanity has ever faced this question. Will we survive or will we disappear under the sea? I ask you all to think what it is like to be in my shoes. Stop and pause for a moment. If you were faced with the threat of the disappearance of your nation, what would you do? I ask you to pause and ask yourself, what would you do?”²¹

“Secretary-General, it is now time to be serious. It is now time to invest in the future of this planet and to divest ourselves from the need to pollute our atmosphere. At the end of the day, we must recognise that there is a limit to what the world can sustain. We live in the same world, and it does not matter who wins in the negotiations, we must work together to save the world. Let’s make the Paris protocol, an agreement that will change our world and save Tuvalu. For if we save Tuvalu, we will save the world”²²

Prime Minister Sopoaga thus plays upon the morality of the world in order to change climate-change causing activities, but also plays on the narrative of the ‘canary in the coal-mine’, where the death of Tuvalu foretells further global destruction at the hands of climate change.²³ Low-lying island nations such as Kiribati and the Maldives have constructed similar narratives to call for action on climate change on the global stage.

The statements made by Prime Minister Sopoaga also call to mind what Eric Swyngedouw has referred to as the ‘oliganthropocene’ or “the age of a few humans (and even fewer women)” in order to call attention to the fact that “the majority of humans living on this planet are not the agents of change, but the victims of change”²⁴ This is made particularly visible in the case of Tuvalu. During my 2015 visit, the island was in the process of adding solar panels to homes and public buildings in an effort to survive on 100% renewable energy. While this is an effective symbolic gesture, Tuvalu’s energy consumption would be dwarfed by a single neighborhood in Boston.

In fact, this kind of symbolic gesture, in the vein of hybrid cars or recycling, could be traced back to the fetishization²⁵ of climate, or the reduction of climate change to the media soundbite instead of the complex, ever-evolving science and set of conditions that it contains. Tuvalu has become part of the climate change ‘apocalyptic imaginary’, a drowned and displaced nation, when in fact how the effects of greenhouse gases will play out on global timescales is highly uncertain. This uncertainty arises from the inability of models to exactly replicate the complexity of the earth’s atmospheric systems, and the rapidly evolving nature of climate change science and policy. The degree of sea level rise in Tuvalu in the next century depends on many factors, including the decided uncertainty of how the world will change its environment-impacting activities.²⁶

The media fetishization of climate, the commodification of carbon dioxide, and in particular Tuvalu as a drowning ‘victim’ of sea level rise, has led to the de-politicization of climate change in the public sphere. In a de-politicized, or post-political context,

“Difficulties and problems, such as re-ordering the climate or re-shaping the environment that are generally staged and accepted as problematic need to be dealt with through compromise, managerial and technical arrangement, and the production of consensus.”²⁷

This eliminates broader conversations about what climate change means in favor of managerial, technocratic processes. Radical alternative fu-

23. . . . Gemenne, Francois. “Anthropocene and its Victims.” Lecture at Harvard University Kennedy School, 24 April 2015.

24. .Ibid.

25. The term ‘fetishization’ in this thesis is used in the sense of Marx’s ‘Capital’, in that climate change garners meaning as a thing-in-itself as opposed to being understood as a set of complex processes with environmental and human implications.

26. See the chapter ‘Futures: Designing for Uncertainty’ for a more detailed discussion on the uncertainty of climate change projections.

27. Swyngedouw, Erik. “Depoliticized environments: the end of nature, climate change and the post-political condition.” *Royal Institute of Philosophy Supplement* 69 (2011): 253-274.

tures, such as those that the design discipline might offer, are eliminated from the conversation.

The exploration of alternative futures through design is one method of re-politicizing climate change, and unpacking what it might mean to be displaced by environmental conditions caused by another, more powerful nation-state. The design proposals encompassed in this thesis provide an alternative to the consensus-based mitigation and adaptation processes prescribed by the dominating political environment, and instead provide a rethinking of changing systems as something that could be intervened in strategically by locally self-determining actors.

MOBILITY/INDETERMINACY

Migration resulting from climate change also suffers from a fetishized imagery. Climate refugees, are shown in the media slogging their belongings through waist deep water or marching across barren deserts. This representation eliminates the agency of the individual from the conversation; the climate happens to them, and they have no choice but to leave. Over time, some discourse on climate change induced migration has evolved from a focus on the climate refugee to ‘migration as adaptation’, a process in which the individual or nation has agency in their mobility, and it becomes a part of the climate change adaptation process. While there may be some risks in shifting the focus to adaptation, in that it is shifted somewhat away from mitigation,²⁹ it is also necessary in the oliganthropocentric framework which Tuvalu and other small island states exist. The mobility made necessary for survival in atoll geographies, combined with the uncertainties associated with climate change, thrusts the future of Tuvalu as a nation, geography, and community into a state of future indeterminacy. Indeterminacy is defined here as making present decisions in response to a condition of multiple simultaneous ‘futuribles,’²⁹ instead of occupying one specific projection of the future. Destabilized by currents, waves, and cyclones, Tuvaluan futures are both *temporal* (in that stability and place are temporary), and *indeterminate* (in that when and where the future will occur is unknown).

28. Gemenne, Francois. “Anthropocene and its Victims.” Lecture at Harvard University Kennedy School, 24 April 2015.

29. The term ‘futuribles’ here is used in the sense of Bertrand de Jouvenal’s *Art of Conjecture*, as a future which is “a possible descendant from the present state of affairs.”

Migration plays a prominent role in the discourse surrounding Tuvalu’s uncertain climate-changed future. Like many other communities in sensitive environments, projected changes in climate will likely make these places uninhabitable within the coming decades without intervention, or existing conflicts or scarcities will become exacerbated in such a way that migration is intensified. In addition to low lying coastal

regions, this is also true for arid climates facing increased desertification, and Arctic climates which depend on permafrost or pack ice.

These environmental changes, if they come to fruition to the extents which have been projected (or beyond), are likely to cause a massive reorganization of settlements on our planet. As some areas' ability to support habitation diminishes, others will become more desirable for settlement.³⁰ However, the exact locations of where and how this changing habitability will occur is indeterminate, as the exact impacts of greenhouse gases on the environment is highly uncertain.³¹ These climate refugees—or, intentionally resettled environmentally induced migrants—are estimated to be in the range of 150 million by the year 2050.³² However, as migration theorist Russell King has noted:

“It is one of the ironies of globalisation that while goods, capital, knowledge, entrepreneurship and the media are free to flow across borders, labour, that other crucial factor of production is not. In fact, on the whole people are less free to migrate now than they were 100 years ago.”³³

If these trends continue, future vulnerable populations will be faced with the tragic irony of not being able to stay, but not being able to leave. This adds further complexity to Tuvalu's uncertain future.

For atoll dwellers, inhabiting delicate sandbars perched atop coral reefs, mobility is integral to survival. At this low elevation land masses are not permanent, and their inhabitants must embrace the idea that the future is uncertain; and may even occur someplace else. Atoll futures are determined by external environmental forces; these geographies are highly susceptible to wind, wave, currents, and coral health, and can be easily submerged or even washed away by a single storm. For inhabitants facing these unpredictable risks, control is relinquished over knowing their own futures. If and when a destabilizing event does occur, (which could be tomorrow or in several generations), atoll dwellers must find new islands to inhabit. This mobilized, impermanent conception of futures is characterized by indeterminacy. While some aspects can be known (food supplies will change, storms will come, water reserves will run dry eventually) they are outside the hands of atoll denizens. Life is contingent upon uncontrolled factors. In many ways, this uncertainty also plays a role in the lives and future conceptions of those of us living on high ground; natural disasters are a possibility anywhere. But the stable West is unlikely to anticipate that because of such events, homes or cities are only temporary. Existing on the cusp of inhabitability, indeterminate futures (in yet to be determined locations) are not a possibility for atoll dwellers, but a given.

30. Valsson, Trausti. *How the World Will Change with Global Warming*. Iceland University Press: Reykjavik (2006).

31. See the chapter 'Futures: Designing for Uncertainty' for a more detailed discussion on the uncertainty of climate change projections.

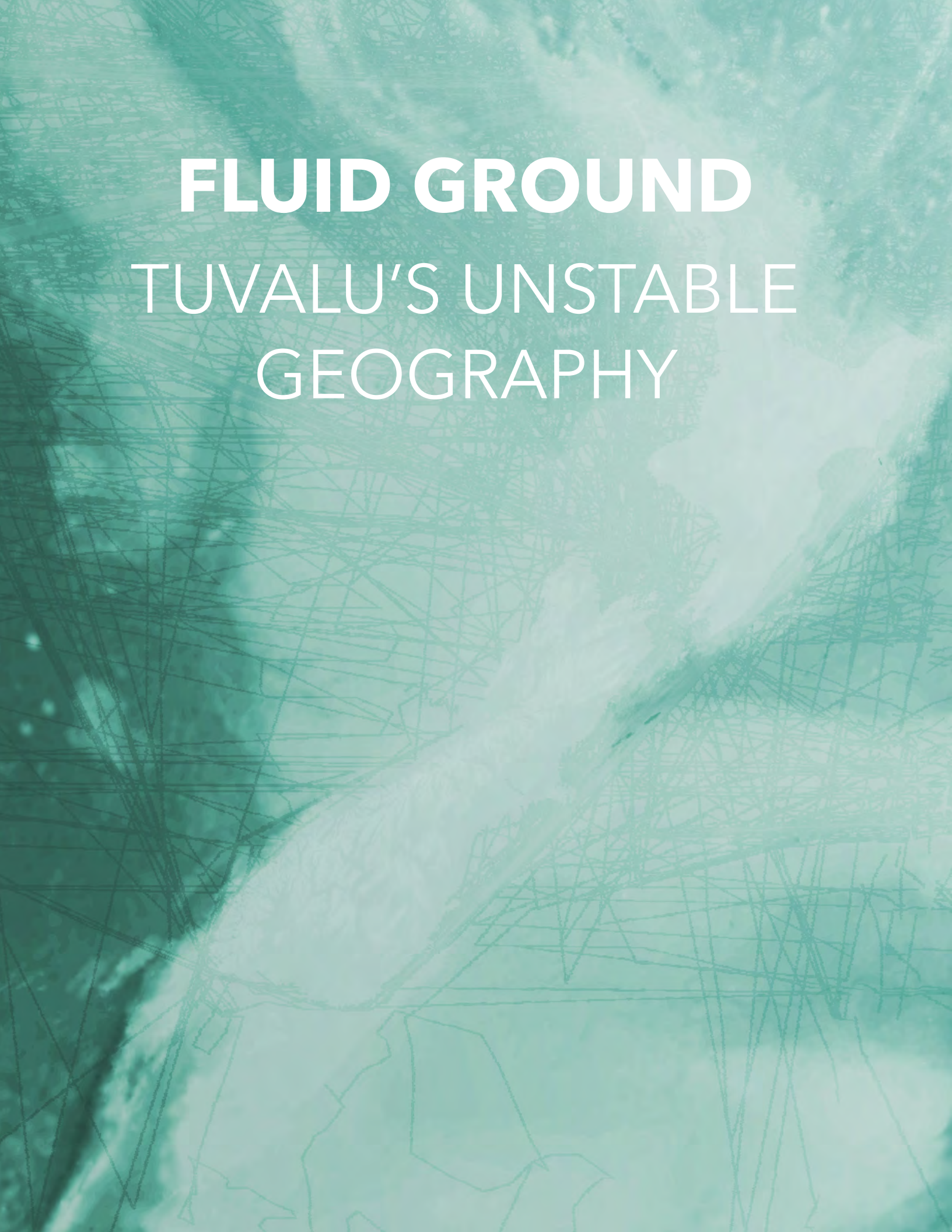
32. Myers, Norman. "Environmental refugees in a globally warmed world." *Bioscience* (1993): 752-761.

33. King, Russell. "Theories and Typologies of Migration." *Willy Brandt Series of Working Papers in International Migration and Ethnic Relations*. Malmö University: 2012.

The arrival of Westerners (from stable lands well above sea level) to Polynesian and Micronesian atoll-states brought new models of futurability to atoll dwellers; namely, concepts of technological progress and religious determinism. While these two Western models are sometimes in opposition, they both represent a future controlled by known forces, with a predetermined direction. These deterministic modes of thought disrupted Tuvaluan conceptions of indeterminate futures, and replaced them with stable concepts which didn't sit well on sandy soils.

This thesis examines historic and present models of Polynesian futurability in the context of the island nation of Tuvalu. In an atoll nation whose future indeterminacy has been further amplified by climate change, indeterminate and mobile futures have new—and urgent—significance for Tuvaluans.

Instead of imposed Westernized model of future thinking, this thesis posits that designs for Tuvalu's futures can and should embrace indeterminacy, encompassing tactics and strategies for a broad range of possible future conditions. The one-off designer solution is rejected here in favor of systems that can evolve and adapt to the dynamic conditions of Tuvaluan atolls and identities.



FLUID GROUND

TUVALU'S UNSTABLE GEOGRAPHY

Change is the very nature of existence. Identities, geographies, and governments are all evolving systems. Existing at the very edge of the warm, tropical Pacific Ocean, this is particularly true for Tuvalu. The coral atolls which compose Tuvalu are fluid systems, relating dynamically to ocean hydrodynamics and coral biology, and evolving in response to changes in sea level, ocean currents, or storm events. For Tuvalu's increasingly developed atolls—particularly the capital settlement at Funafuti—inhabitation of this unstable ground may become prohibitively difficult as climate change accelerates these processes.

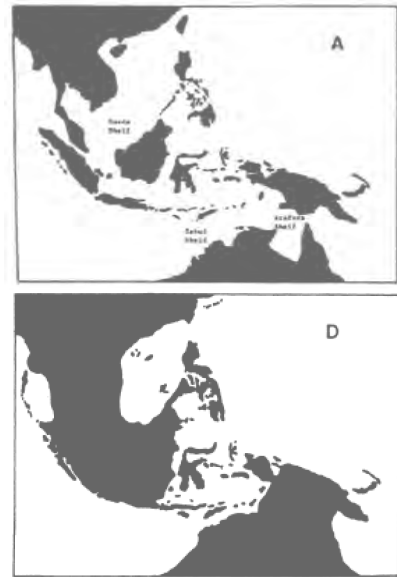
GEOLOGICAL CONTEXT: FLUID GROUND

GEOLOGICAL HISTORY OF TUVALU'S ATOLLS

The Pacific Ocean was formed following the breakup of super-continent Pangea, as early continents spread apart around 750 million years ago. Tuvalu is sited near the Western edge of the Pacific Plate, in a subduction zone as the Pacific plate moves northwest under the Australian plate near Fiji. The volcanic islands that underlay Tuvalu's atoll archipelago may have emerged as a result of this subduction, or as the thin lithospheric plate tracked across hotspots in the earth's mantle.³⁵

The formation of atolls and other coral island types (technically, Tuvalu is composed of atolls, raised coral islands, and pseudo-atolls) was largely established by Charles Darwin in his 1842 "Theory of Atoll Formation." This theory, generally accepted today, states that coral reefs formed on the rim of subsiding volcanic craters grow upwards towards sea level.³⁶ Atolls such as Funafuti are surrounded by a fringing limestone reef upon which rubble and sediment is deposited during storms, forming the highest land masses on an atoll islet. For raised coral islands, such as Niutao, experienced later uplift that caused central lagoons to be elevated above sea level. In all, Tuvalu is composed of 5 true atolls, 3 raised limestone islets, and one pseudo-atoll, Vaitupu, which is in the process of uplift and retains a nearly enclosed lagoon. Because of this geology, most of Tuvalu is under 2 meters above sea level, with limited areas over 3 meters above mean sea level (MSL).

Darwin's theory was tested on Funafuti in 1896 by the Royal Society of London, where boreholes up to 340 meters deep established that the structural base of the island was, in fact, composed of coral. Further testing in Eniwetok atoll, Marshall Islands in 1952 discovered the volcanic layer of that island at a depth of 1290 meters.³⁷



Sea Level Change in Southeast Asia, Present and 6,000 years BP
Source: Gibbons, John RH, and Fergus GAU Clunie. "Sea level changes and pacific prehistory"

35. Neall, Vincent E., and Steven A. Trewick. "The age and origin of the Pacific islands: a geological overview." *Philosophical Transactions of the Royal Society B: Biological Sciences* 363.1508 (2008): 3293-3308.

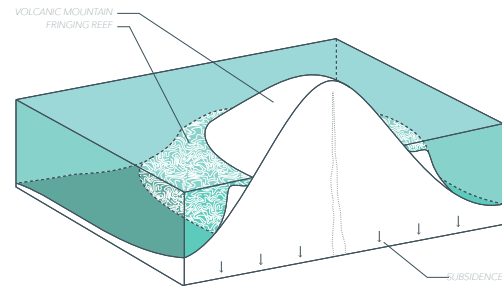
36. Woodroffe, Colin D. "Reef-island topography and the vulnerability of atolls to sea-level rise." *Global and Planetary Change* 62.1 (2008): 77-96.

37. Faaniu, Simati, and Hugh Laracy. *Tuvalu: a history*. University of the South Pacific; Suva, Fiji 1983.

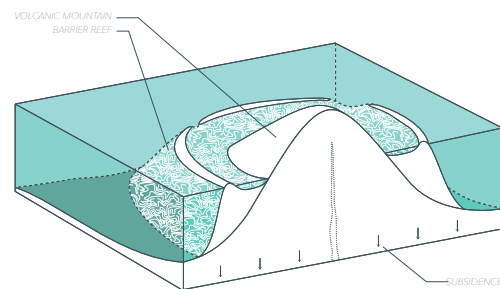
38. Gibbons, John RH, and Fergus GAU Clunie. "Sea level changes and pacific prehistory: New insight into early human settlement of Oceania." *The Journal of Pacific History* 21.2 (1986): 58-82.

39. Ibid.

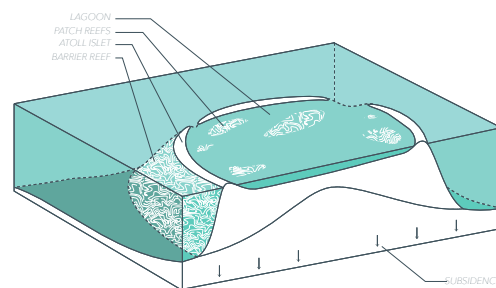
During glacial maxima, historical periods where earth's ice sheets reached their maximum extents, reefs towered above sea level and the land area of the Pacific was greatly increased. Much larger extents of present day islands were exposed and now-sunken islands emerging above sea level. The Last Glacial Maximum (LGM) occurred from 26,500 to 19,000 years ago, and sea level was 130 meters below its present-day position. The most recent glacial melt occurred from around 18,000 to 4,000 before present, with a change in sea level of around 1 meter per century. Our current, more stable sea level dates from about 4,000 years ago.³⁸ During the glacial maximum, the lagoons of atolls or between barrier reefs and volcanic islands would have been dry limestone. During the meltwater period, at around -60 meters, these would have begun to become swampy and silted, until eventually resultant lagoonal forests became fully submerged.³⁹



NATURAL REEF CORAL: FRINGING



NATURAL REEF CORAL: BARRIER



NATURAL REEF CORAL: ATOLL

Atoll Formation Series

Atolls are formed by coral reefs as they form on the rim of subsiding volcanic cones. First, a barrier reef is formed, but eventually, the volcanic island disappears entirely leaving only the fringing reef, now a free-standing atoll. The following spreads graphically illustrate this process.



glacial maximum

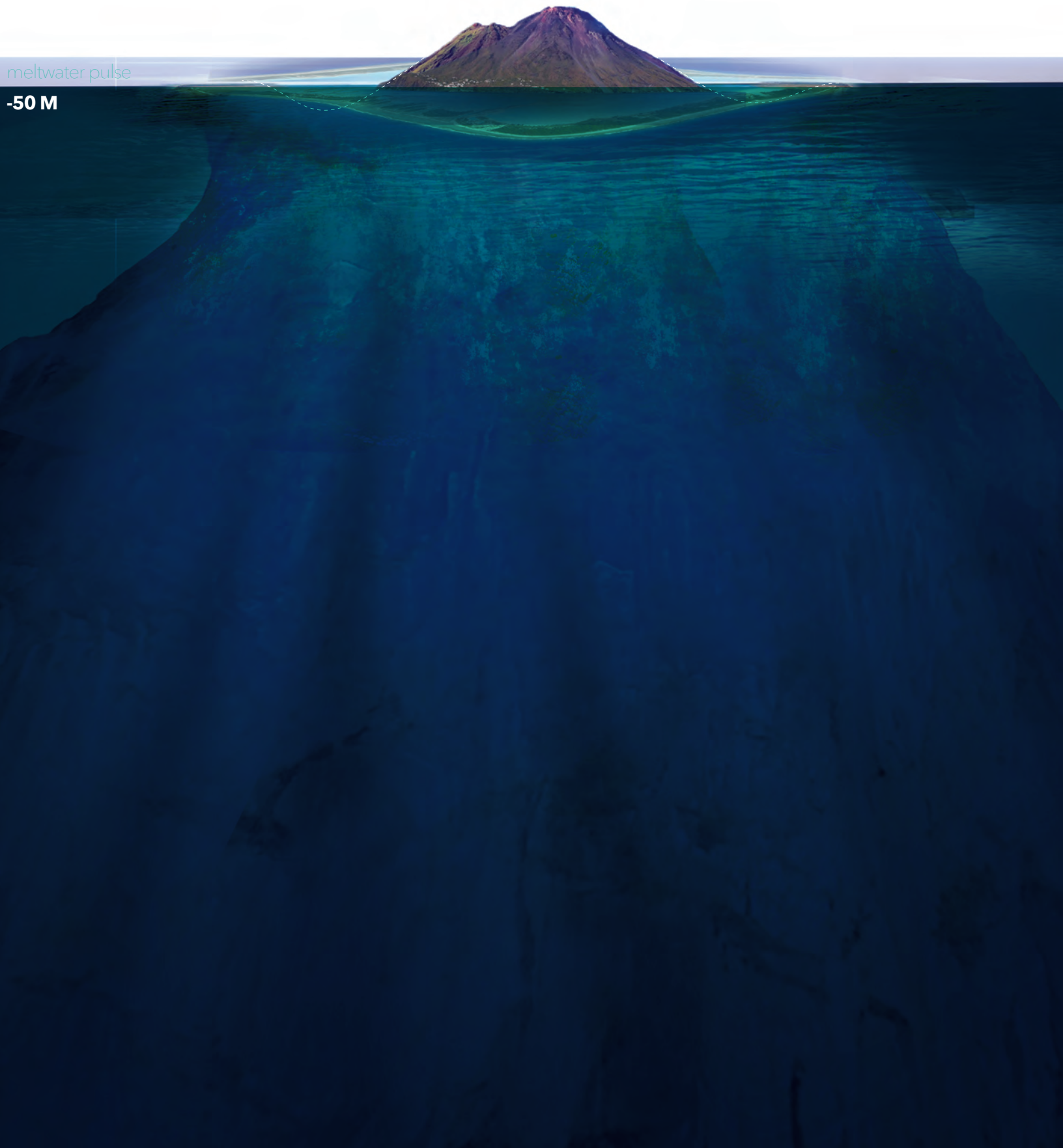
-100 M

VERNACULAR ORIGINS

These scientific narratives vary greatly from the origins of Tuvalu described by oral history. These origin stories vary from island to island, but most revolve around the story of the Eel and the Founder. In this story, Te Pusi and Te Ali (the Eel and the Flounder) get into a dispute, and the eel curses the flounder to become "wide and flat", forming the sandy, flat land masses of the Tuvaluan atolls. The eel, burying his head in the sand, becomes the tall and narrow coconut trees. A rock the eel throws into the air becomes the sky, and then he throws the remainder to become the rest of Tuvalu's 8 islands.

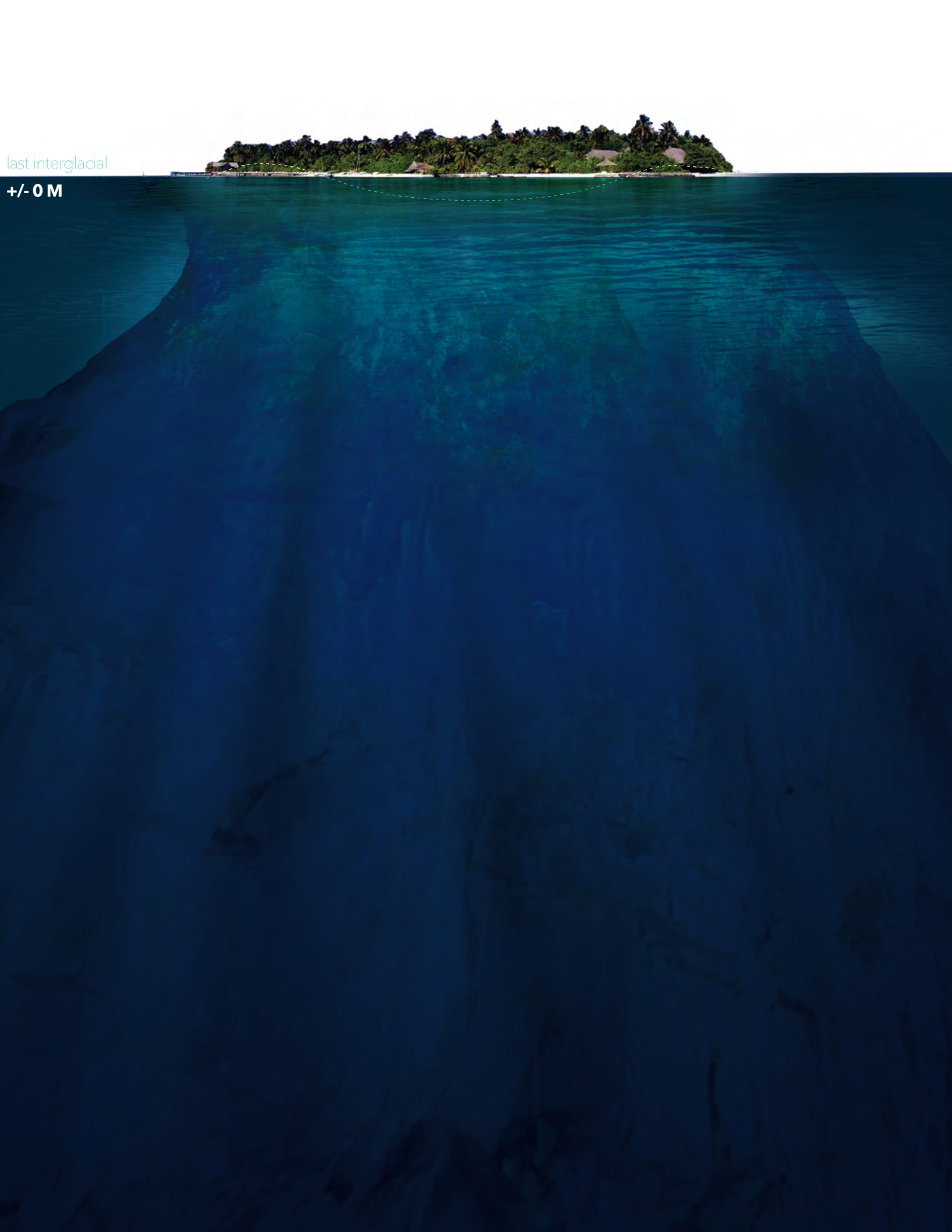
meltwater pulse

-50 M



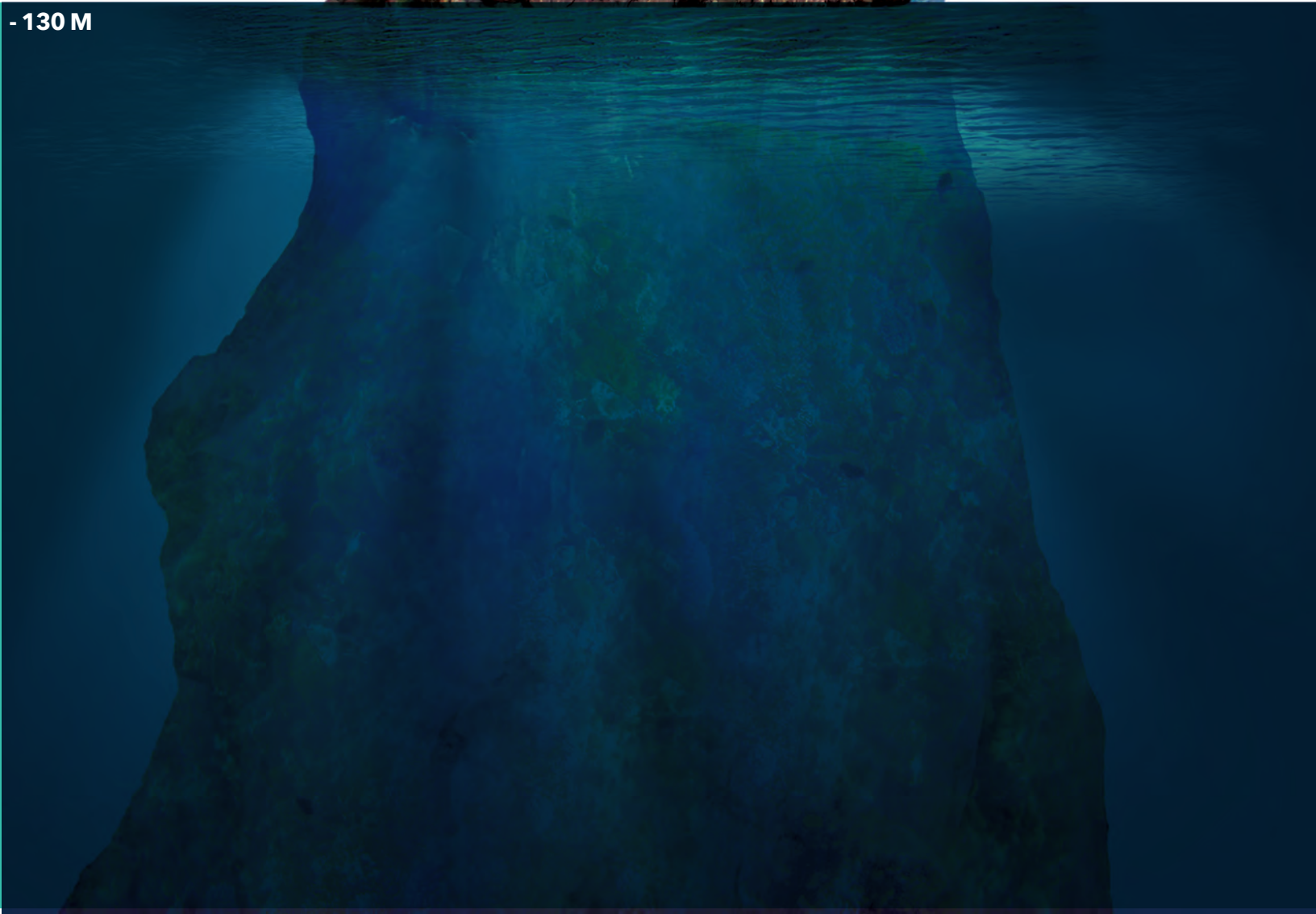
last interglacial

+/- 0 M

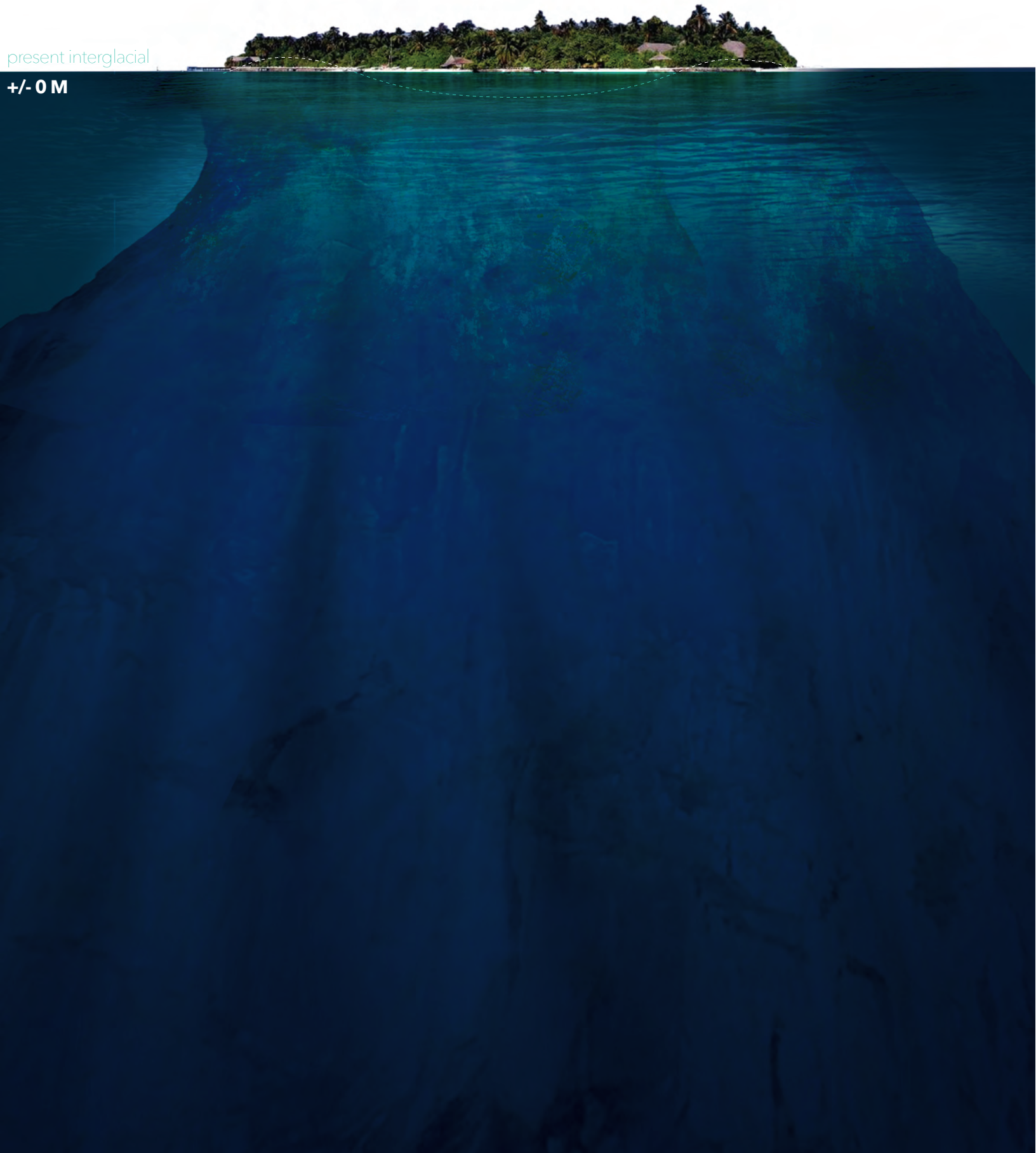


glacial maximum

- 130 M



present interglacial
+/- 0 M



100 year SLR

+ 1 M





glacier melt

+50M

As is discussed above, the relationship between atoll geography and the sea is dynamic. Atolls have been shown to adapt to sea level rise during previous increases, collecting additional sediment as coral reefs grow upwards toward the sunlight.

Atolls such as Funafuti are surrounded by a fringing limestone reef upon which rubble and sediment is deposited during storms, and these deposits form the highest land masses on an atoll islet.⁴⁰ Their ongoing survival (as land masses) depends on the availability of sediment from surrounding healthy corals in order to replace eroded land materials, and a rate of sea level rise sufficiently slow that surrounding corals can keep pace, in order to produce the necessary sediment through their natural life cycles. From a geomorphological perspective, storm events are important in replenishing sediment and building up land mass. However, storms can also ‘overwash’ an atoll, crossing the entire land-mass and taking sediment, fauna, and built structures along with it.⁴¹ This dynamic nature of atoll systems will likely be amplified and made more unpredictable by climate change.

Recent research on atoll hydrodynamics, particularly that arising from Arthur Webb and Paul Kench at the University of Auckland, has emphasized this dynamic nature of coral islands:

“Importantly, the results suggest that reef islands are geomorphically resilient landforms that thus far have predominantly remained stable or grown in area over the last 20– 60yr. Given this positive trend, reef islands may not disappear from atoll rims and other coral reefs in the near-future as speculated. However, islands will undergo continued geomorphic change. Based on the evidence presented in this study it can be expected that the pace of geomorphic change may increase with future accelerated sea level rise.”⁴²

Their study of 27 Pacific atoll islands over the last 19-61 years using historic satellite photos found that in spite of sea level rise, the majority of islands either retained their existing area (43%) or grew (43%). However, in spite of this “geomorphological resilience”, Yamano et. al. cautions that atoll’s “human inhabitants are still highly vulnerable to elevated sea levels.”⁴³ For example, a storm event that deposits large amounts of additional sediment on an atoll may also result in waves that knock down housing and flooding which decimates crops and contaminates drinking water supplies. Thus, while land may continue to exist, inhabitation will become increasingly difficult.

40. Thaman, Fihaki & Fong. *Plants of Tuvalu: Lakau mo Mouku o Tuvalu*. Suva, Fiji; The University of the South Pacific, 2012.

41. Woodroffe, Colin D. “Reef-island topography and the vulnerability of atolls to sea-level rise.” *Global and Planetary Change* 62.1 (2008): 77-96.

42. Webb, Arthur P., and Paul S. Kench. “The dynamic response of reef islands to sea-level rise: evidence from multi-decadal analysis of island change in the Central Pacific.” *Global and Planetary Change* 72.3 (2010): 234-246.

43. Yamano, Hiroya, et al. “Atoll island vulnerability to flooding and inundation revealed by historical reconstruction: Fongafale Islet, Funafuti Atoll, Tuvalu.” *Global and Planetary Change* 57.3 (2007): 407-416.

Many hydrodynamic processes contribute to the fluidity of atoll geomorphology. For example, current-based or hydrodynamic action through the channels (or inlets) between islets surrounding a lagoon can lead to either erosion or sedimentation depending on intensity and substrate. Wave action is also important in atoll geomorphology: waves cross from the ocean side towards or into the lagoon forms the storm ridge, the highest point in most atoll islets. Waves can also overwash an islet entirely, resulting in erosion or even the complete washing away of an islet. Anthropogenic alteration of coastlines by digging and removing coastal materials for construction can increase the height of waves. Atolls islets also migrate over time, particularly in a windward direction or inward toward lagoons.⁴⁴ Atolls with small, shallow lagoons (around 30m) have a tendency to infill over time, while larger atolls with deeper lagoons (around 60m) have a tendency to erode away.

CURATING COASTLINES: INTERVENING IN LITTORAL PROCESSES

The conceptual framework of rising seas / sinking atolls leads to the 'fortification' method of adaptation. Not only expensive, hard infrastructure such as sea walls contributes to beach erosion, disrupts coastal ecology, and perhaps most significantly, disrupts the ability of atolls to adjust on their to rising sea levels in the systems discussed above.⁴⁵

Understanding the geomorphological complexity of atoll dynamics is part of the de-fetishization of climate change. By unpacking what a 'sinking' atoll really is, opportunities emerge for responding to or even intervening in atoll formation processes. New conversations are emerging on how one might collaborate with or curate these existing processes, notably the Tautai Foundation, an NGO focused on "focused on building healthy human-environment partnerships."⁴⁶ Tautai calls for increased understanding of the environmental and atmospheric systems that impact Tuvalu in order to intervene strategically into the production and distribution of island-forming sediment. Thus, environmental systems become a part of the adaptation process, and not an enemy to be combated. For this thesis's design proposals sited within Tuvalu, atoll hydrodynamics becomes a leverage point for defining new relationships with atoll geographies.⁴⁷

44. Webb, Arthur P., and Paul S. Kench. "The dynamic response of reef islands to sea-level rise: evidence from multi-decadal analysis of island change in the Central Pacific." *Global and Planetary Change* 72.3 (2010): 234-246.

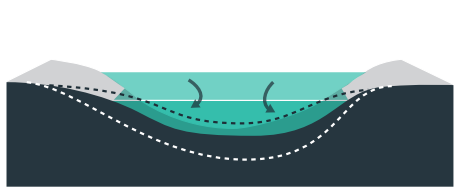
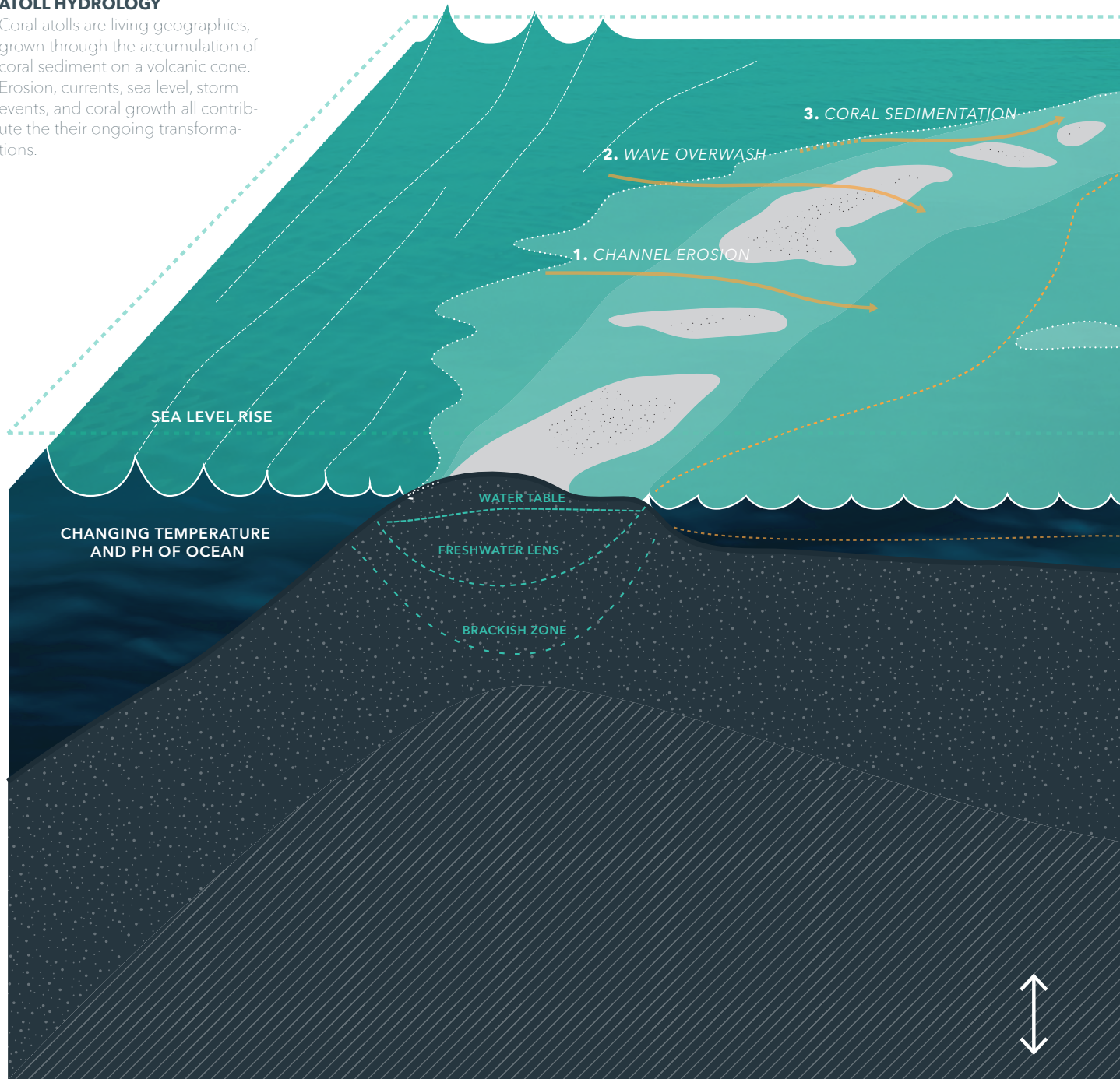
45. Donner, Simon D., and Sophie Webber. "Obstacles to climate change adaptation decisions: a case study of sea-level rise and coastal protection measures in Kiribati." *Sustainability science* 9.3 (2014): 331-345.

46. Tautai Foundation. www.tautai.com, 2016.

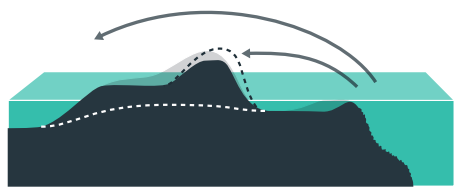
47. See page 48 and proposals for land and territory seeds, page 186 - 188

ATOLL HYDROLOGY

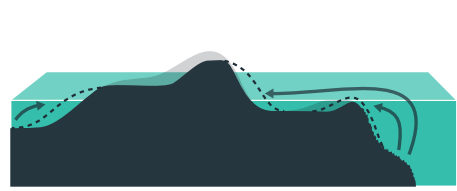
Coral atolls are living geographies, grown through the accumulation of coral sediment on a volcanic cone. Erosion, currents, sea level, storm events, and coral growth all contribute to their ongoing transformations.



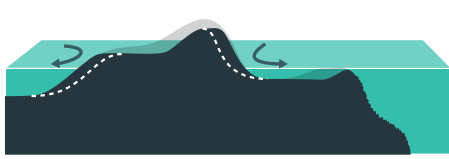
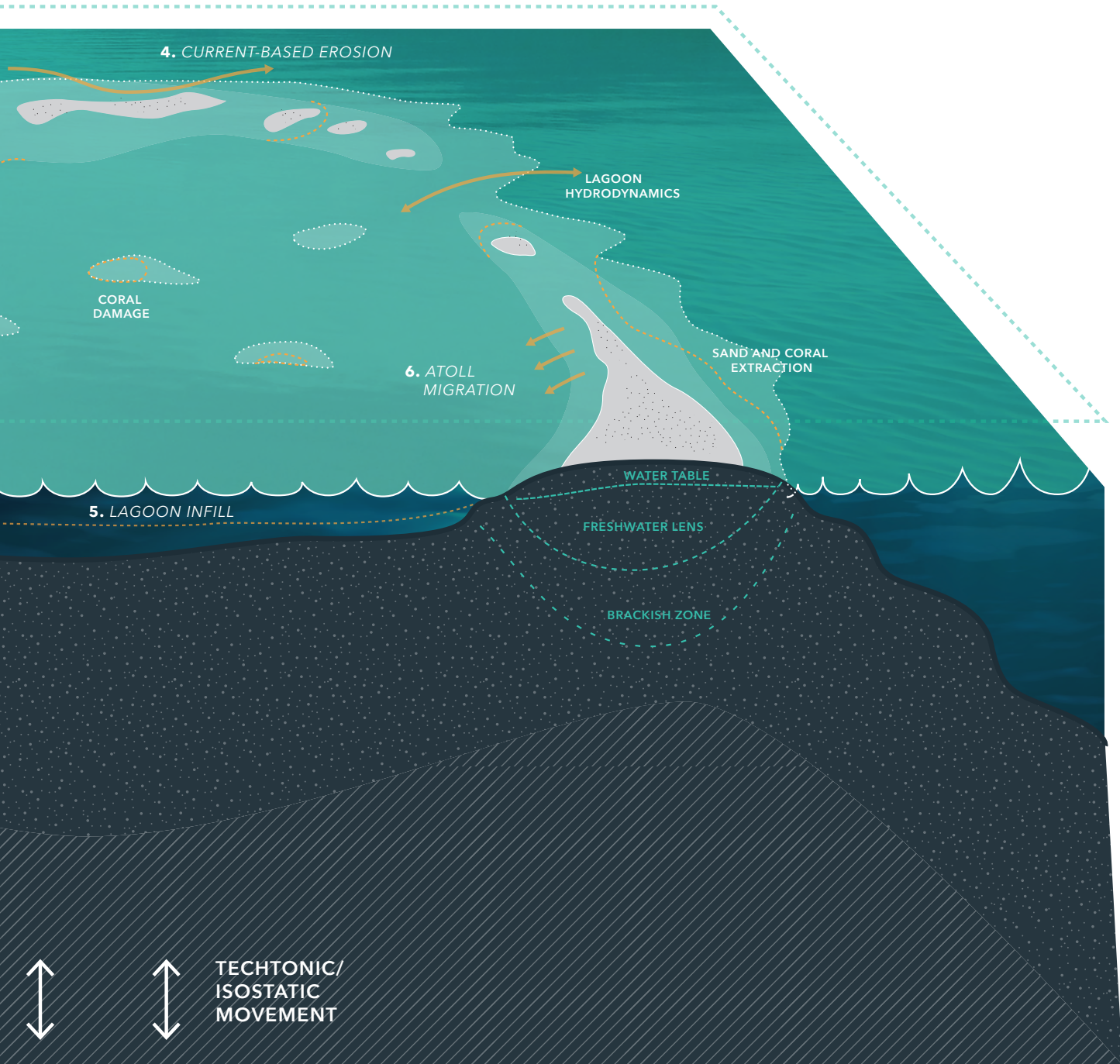
1. CHANNEL EROSION



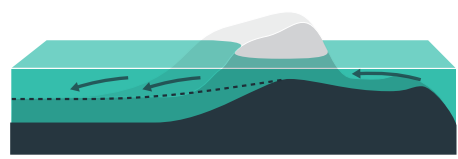
2. WAVE OVERWASH



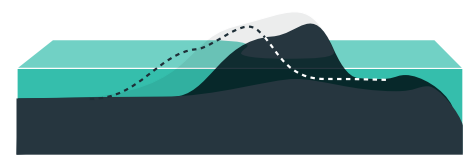
3. CORAL SEDIMENTATION



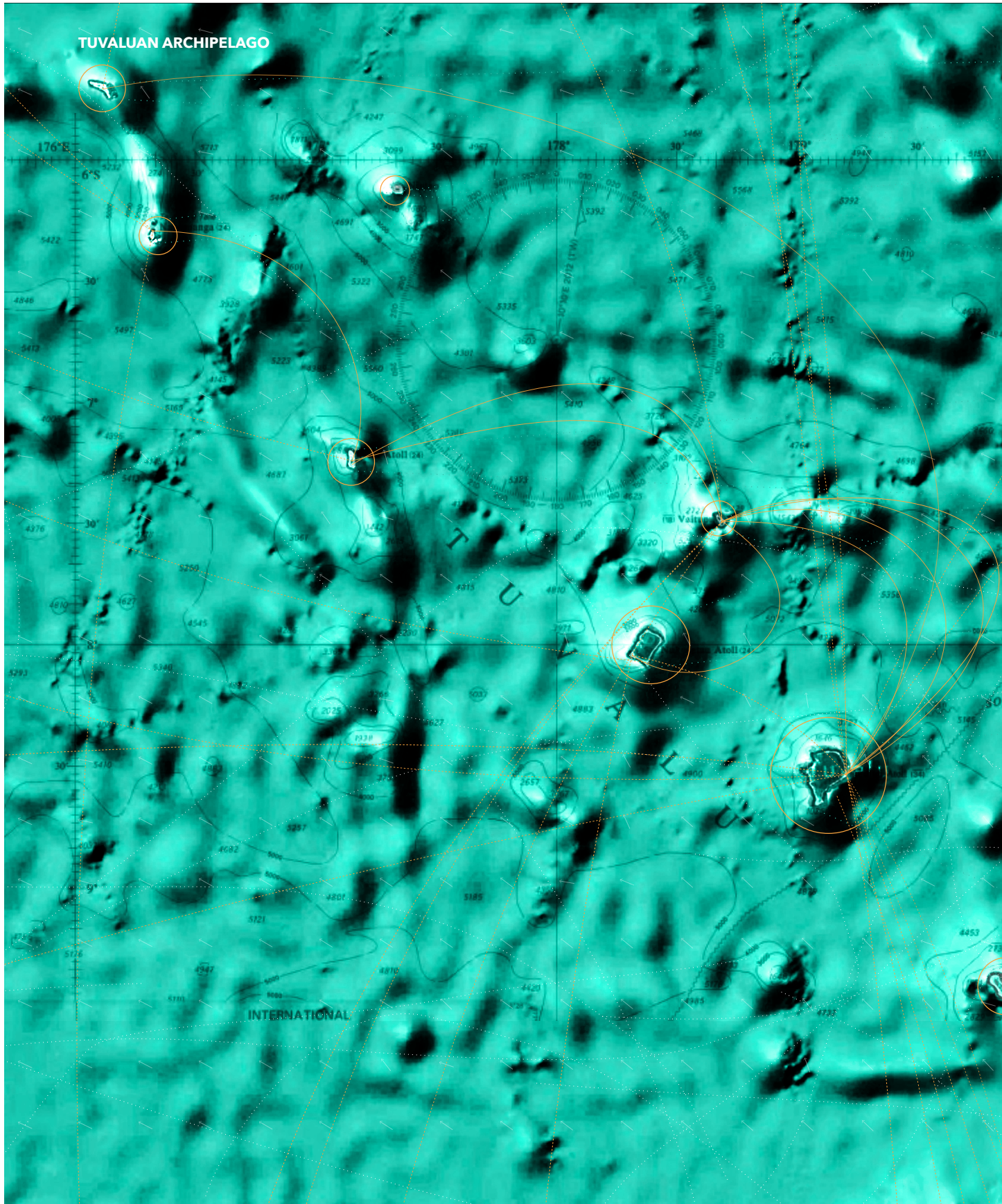
4. CURRENT-BASED EROSION

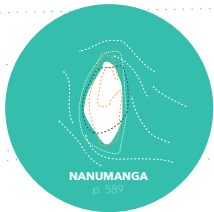
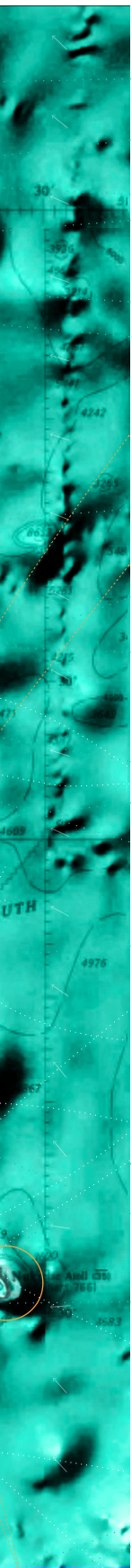


5. LAGOON INFILL



6. ATOLL MIGRATION





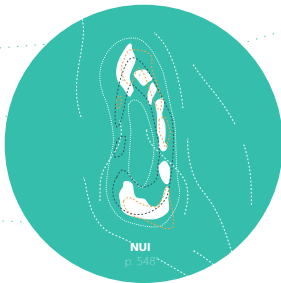
NANUMANGA

p. 552



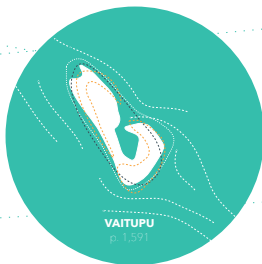
NIUTAO

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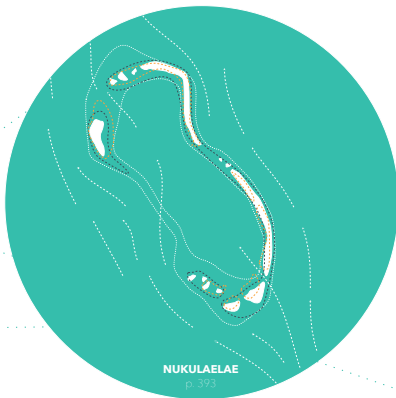
NUI

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VAITUPU

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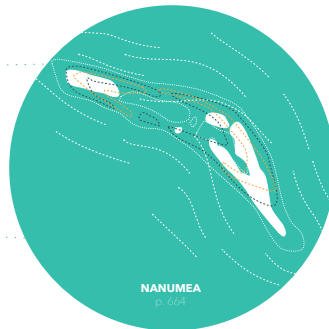
NUKULAE LAE

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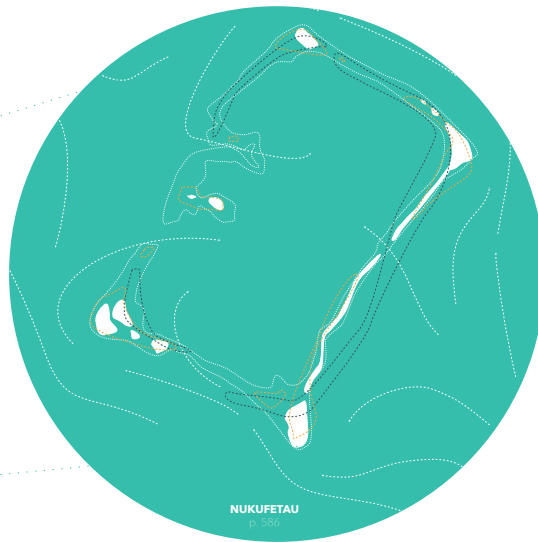
NIULAKITA

p. 35



NANUMEA

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NUKUFETAU

p. 586



FUNAFUTI

p. 6194

GROUND RISK: PHYSICAL + TERRITORIAL LOSS

SHORT TERM PHYSICAL RISKS

While the international media focuses on (relatively) long term risks for Tuvalu associated with climate change and sea level rise, many Tuvaluans are more concerned with environmental risks that currently affect their daily lives, including physical degradation, king tides, pollution, and food and water security. Additionally, these issues also increase the nation's vulnerability to sea level rise and catastrophic storm events associated with and amplified by climate change.

Funafuti is Tuvalu's capital, with the primary settlement on Fongfale islet. The atoll is 2.8 square kilometers of land surrounding a large lagoon. It is composed of 33 atolls, 2 of which are inhabited.⁵¹ The islets are very narrow, Fongfale ranging from 175' wide at high tide on the narrowest settled point, to just under half a mile in the most densely settled town center. It runs 7.5 linear miles. Burrow pits⁵² and the airstrip make 1/3 of this area un-developable. These physical modifications contribute to the overcrowding of the capital, and the burrow pits in particular also contribute to some of the environmental risks described below. The water filling these pits is brackish, and they contribute to the salinization of the water table. Pits on the reef table on the ocean side of the islets also contribute to increased wave action, because increased water depth allows for greater wave heights.⁵³ Thus, these already vulnerable atolls are put at further risks by human-induced changes to the physical and social landscape of the islands.

During my January 2015 visit to Funafuti, Tuvalu, the impacts of rising water levels were made particularly apparent by the arrival of the *king tides*, a solar/lunar phenomenon which results in the highest tides of the monthly tidal cycle, amplified by the tradewinds of the rainy season and the alignment of the sun and moon. Tuvaluans often cited the increasing levels of the king tides as evidence of climate change and sea level rise.

51. Funafale atoll is a rural islet, with only 8 adults residing there according to one interview subject. However, it is a popular picnic site and several interview subjects mentioned it as their favorite place in Tuvalu.

52. These brackish ponds were formed by the cut and fill efforts of American occupying forces during WWII in order to create land for the airstrip.

53. Interview with Alejandra Ortiz, MIT/WHOI Joint Program: Doctorate in Marine Geology & Geophysics 2015

54. Interviews, Funafuti, Tuvalu. January 2015.

“On the island itself, where we used to have places that didn't used to be flooded before, now we notice that during King Tides season, from October through to March of each year, its a lot of flooding around Funafuti island”⁵⁴

Fresh water supplies are also made vulnerable by sea level rise, as well as by pollution, overtapping and increasing built area. Atolls do not have rivers or streams, and the only freshwater is a delicate lens formed by rainwater infiltration which floats on the denser saltwater beneath it. As

the sea level rises, more and more freshwater is displaced by saltwater. Flooding during storm surges causes further saltwater contamination. At the same time, increasing built area and rainwater collection prevents the infiltration of rainwater to refresh the lens. Over-extraction for growing populations further amplifies saltwater contamination. Pollution also contaminates the water supply, particularly due to insufficient sanitary systems; pit toilets may leak directly into groundwater, resulting in dangerous levels of contamination. The groundwater of Funafuti is so contaminated that it is only used for cleaning pig pens and flushing toilets.

Saltwater intrusion is a major concern for vegetation and agriculture. Increasing salinity restricts the types of plants that can grow, and is particularly problematic for the cultivation of taro, a staple crop for Tuvaluans. Taro is cultivated in carefully mulched pits in the center of the islets, and cannot survive in a saline environment. As noted by interview subjects, “local farmers are more or less giving up on cultivating of local taro pits because of salinity in the soils.”⁵⁵ Salinization combined with a lack of land for agriculture in Funafuti means that particularly in the capital reliance is growing on imported food products.

The convergence of pollution, salinization, and lack of supply means that the only safe drinking water in the settlement at Funafuti is rainwater, which requires extensive land area to store, and a small, inconsistent, and energy-intensive supply of desalinated water. Nearly all homes in the capital have one or more rainwater tanks with a typical capacity of between 3 and 4 cubic meters. Water running off the tin roofs of modern or semi-modern dwellings is stored there for domestic uses. Reliance on consistent rain for restocking puts islanders in a vulnerable situation, and the water tanks take up valuable real estate in the capital.

While climate change has brought (and will bring) severe physical risks associated with storms, lack of precipitation is also crippling for Tuvalu. Unpredictable weather means that not only are storms more intense, but droughts also become more frequent and extreme. During my January 2015 visit, the effects of the 2011-2012 drought were still prominent in peoples minds. This drought, lasting nearly a full year, resulted in the declaration of a national State of Emergency and severe rationing of drinking water. As Tuvaluans typically rely on rainwater for drinking and domestic water use, during this time they were forced to rely on a desalination plant provided by Australian aid, and freshwater flown in from New Zealand. On Funafuti and Nukulaelae, freshwater was limited to two buckets per family per day. As one Funafuti resident recalled: “You see people swimming in the sea because we don’t even have



Water tanks outside a home on Funafuti. Rainwater is the primary source of water for drinking, washing, and bathing in Funafuti as well as some outer atolls which have damaged freshwater lenses. In Funafuti, these tanks encroach on valuable real estate, and homes increasingly utilize 2 or more tanks.

55. Interviews in Funafuti, Tuvalu, January 2015

the water to take a shower or a bath.”⁵⁶ During this time, agricultural crops also failed due to lack of fresh water, and due to lack of rainwater infiltration to refill the freshwater lens below the islands, saltwater contamination was amplified.

Pollution and waste, byproducts of both overcrowding and rapid modernization, is another primary concern for Tuvaluans, particularly on Funafuti. There is little room for waste disposal, and the shift from biodegradable waste to plastics and other non-degradable products hasn't seen a corresponding shift in the way waste is dealt with. Thus, much waste winds up in the lagoon and ocean, which in addition to contaminating water supplies (as discussed above) also damages local ecologies. In Funafuti, garbage that is collected by the Solid Waste Department is interned at a dump on the Northern end of Fongafale islet, but its capacity is limited, and the capital is already suffering from a lack of land in general. In my interviews, an employee of the Waste Department worried about what would happen if waste issues are not resolved soon:

“If we don't take care of what we have now, it will be a lot of trouble for our future generations, maybe our future generations will be sleeping with waste next to them...”⁵⁷

The government is already considering exporting waste as an option. Recycling is not currently implemented due to lack of capacity, but the Waste Department is discussing how it might be possible in the future.

Sanitary waste is also an issue; although most homes now have toilets, septic tanks are unreliable and the sea is still used as a sewage basin. Explosive population growth on Funafuti has further amplified these issues. Additionally, the farming of pigs on the island's scarce land leads to polluted runoff flowing into the sea. Biological waste in the lagoon and ocean has led to algal blooms, which damage corals by decreasing the dissolved oxygen content of the water. The blooms also damage fish stocks and pose risks to human health through contaminated fish or direct infection.⁵⁸

The explosive population growth of Funafuti has overwhelmed the ecosystem on Fongafale islet. Clearing of land for housing has removed flora which helps with water infiltration and erosion prevention, as well as potential food supply. Many of those I spoke to mentioned seeing changes in the health of corals and local ecosystems:

“I think its all from all the waste from the land taken out by seawater, and its polluting the reef, the corals. Thats why when you go snorkeling, especially here, most of the corals are dying out.”⁵⁸

TUVALU'S CLIMATE

Tuvalu has a tropical maritime climate, with temperatures ranging typically from 25 - 31°C. The archipelago has two seasons; a 'cool' season from March to October (due to Southeast tradewinds), and a warm and rainy November through February (with winds from the West and North). Because the island chain spans nearly four hundred linear miles, this climate varies between islands, with those in the furthest South experiencing more storms, cooler temperatures, and less overall precipitation. However, these 'seasons' are becoming less consistent, based on the experiences of local Tuvaluans; cyclones recently are happening during the dry season. As one interviewee noted: “The climate, or the weather patterns, they do not respect our regular way of life anymore.”

56. Ibid.

57. Interviews on Funafuti, Tuvalu, January 2015.

58. De Ramon N'Yeurt, Antoine and Viliamu Iese. “Assessment of a Seaweed Bloom Issue on Funafuti Atoll and Associated Solutions; Conducting Awareness Sessions for the Local Communities.” University of the South Pacific, 14 November 2013.

59. Interviews on Funafuti, Tuvalu, January 2015.

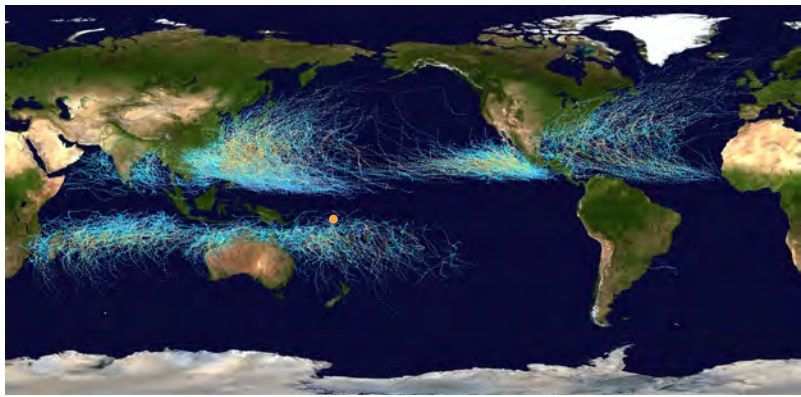
The visibility of these changes, relative to the more hypothetical threat of climate change, results in opinions such as these:

“With human activities we may actually be doing more harm to our environment than sea level rise itself.”⁶⁰

As is discussed above, these environmental concerns are closely tied to climate change vulnerability, and mediating some of these immediate pollution and degradation issues may better prepare Tuvalu to cope with increasing future climate change risks.

CYCLONE VULNERABILITY

Cyclones have long been a concern for Tuvalu. Oral and early Europeans histories suggest many cyclones have struck Tuvalu over past centuries, some quite severe. Tuvalu’s atolls are located between 5° and 10° South, which places it at the edge of the risk zone for cyclones. (The region directly adjacent to the equator is not sus-



ceptible to cyclone formation, as the map at right shows). However, two major factors increase Tuvalu’s vulnerability to cyclones. New housing stock, constructed in a Western model, has little resilience to storm events⁶¹ and the high density of the capital settlement means that little vegetation is available to buffer storms or prevent erosion. And perhaps most significantly, climate change is projected to intensify both the frequency and intensity of cyclones, resulting in even more catastrophic damage. While design is unlikely to prevent cyclones from occurring, improved design of architecture and settlements can mitigate the risk that these events create.

The vulnerability of Tuvalu to storm events, even relatively minor ones, was sadly exemplified by Hurricane Pam, which devastated Vanuatu in March of 2015, and also did devastating damage to Tuvalu through a sea swell which generated severe flooding throughout the outer islands, even though the hurricane passed hundreds of miles from the nation. Half of Tuvalu’s residents were displaced by this event, and the Prime Minister declared a State of National Emergency.⁶² If the damage caused by a hurricane 500 miles away is this severe, it is clear that a direct hit by a cyclone would be truly disastrous.

Pacific Cyclone Tracks. Note that the equatorial region between 5°N and 5°S is free of cyclone tracks. Tuvalu is highlighted in orange. *Image Source: Wikimedia Commons.*

60. Ibid.

61. See section on traditional architecture, pages 100-102

62. Khaleej Times. “Tuvalu ‘severely’ impacted by Cyclone Pam: Report.” 15 March 2015.





Flooding associated with King Tides,
Funafuti airstrip, January 2015.

Opposite: Algal bloom on the ocean
side of Fongafale, adjacent to pig pens.



Flooding associated with King Tides,
Funafuti airstrip, January 2015.

“On the island itself, where we used to have places that didn’t used to be flooded before, now we notice that during King Tides season, from October through to March of each year, its a lot of flooding around Funafuti island”

Interview with 65 year old retired seaman and volunteer for the ship union at his two bedroom home.
Funafuti, Tuvalu, January 2015





Causeway, showing both ocean and lagoon, Funafuti Atoll.

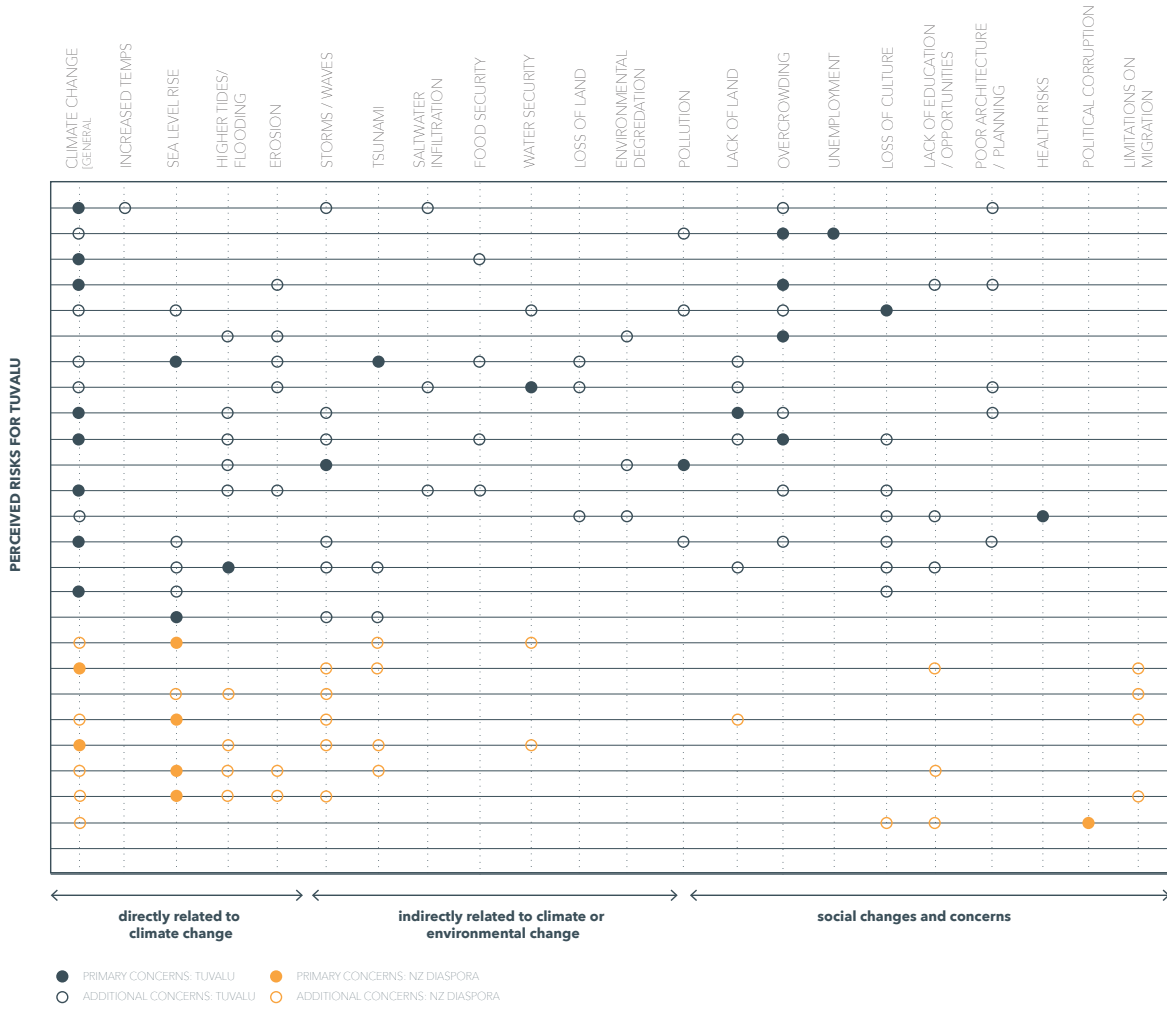




Ocean, Funafuti Atoll.



BELIEF IN CLIMATE CHANGE



INTERVIEW DATA: Climate Change and Risk Perceptions. Based on responses from 16 interview subjects in Funafuti, Tuvalu, January 2015 and an additional 9 interviews in New Zealand, June 2015.

While Tuvalu's equatorial location mean that cyclones are relatively infrequent, the nation has been intermittently struck, either indirectly or directly, with devastating results. Prior to Pam, Cyclone Bebe in 1972 was the most significant weather event in Tuvalu's recent history. Bebe crashed through the capital island of Funafuti, which already at that time was the population center of the archipelago. Five were killed by the event in the capital, and another two sailors at sea. 90% of Funafuti's housing was destroyed. Using overseas aid funding, a new village was built with extremely low quality housing stock, structures which increase the risk of destruction in future storm events.⁶³ This event was poignant in the memory of Tuvaluans interviewed, who recalled "waves of ceiling height" "coming across the lagoon." For this small community, the losses created by this hurricane were truly catastrophic. The force of the wind and waves were so strong that a new islet was formed, and an 8 kilometer rubble rampart was created along Fongfale islet.⁶⁴ Funafuti islanders continue to commemorate the event through a holiday on October 21st annually.

One reason for the particularly startling flattening of the housing stock of Funafuti during the Bebe event could have to do with the type of housing constructed there. Funafuti village had been previously flattened in 1943 when the atoll was used as a strategic air base by American forces during World War II. Houses were rebuilt using foreign aid in a "western" style which was not well adapted to the climate or extreme storm events. As one resident noted:

"When the cyclone comes, [for traditional homes] they'll just take off the roof, put it down, use the leeward side as the entrance, for shelter, and then they wait for, say, 2 days, the cyclone goes, and they go back and put in on top and they are back to business as usual. But now the corrugated iron roof, if it flies away, you have no money to pay for a new one."

Prior cyclones are not well documented, but European visitors noted severe hurricanes in 1883 and 1894, and hurricanes in 1954 and 1962 overwashed the entire island of Funafuti. More recently, a series of hurricanes in the season of 1996 to 1997 are, for Tuvaluans, associated with inconsistencies in weather patterns in recent decades; "because now of climate change, there is a changing pattern, atmospheric conditions, not respecting our traditional Tuvaluan calendar." IPCC projections show that while climate change may make some extreme weather events such as cyclones less frequent, they will become more intense, and more unpredictable.⁶⁴ As history shows, a single hurricane event has the potential to knock out the housing of the entire nation.

63. Resture, Jane (5 October 2009). *Hurricane Bebe 1972: Tuvalu and the Hurricanes: 'The Hurricane in Funafuti, Tuvalu'* by Pasefika Falani (Pacific Frank).

64. Maragos, James E., Graham BK Baines, and Peter J. Beveridge. "Tropical cyclone Bebe creates a new land formation on Funafuti Atoll." *Science* 181.4105 (1973): 1161-1164.

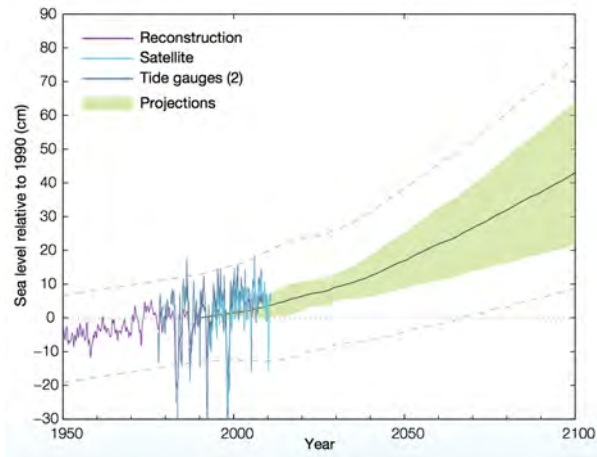
New land formations established (or destroyed) during storm events are part of the natural geomorphological process of atolls. Large waves associated with storms can be essential in atoll formation.

65. Intergovernmental Panel on Climate Change. "5th IPCC Assessment Report: Climate Change 2013: The Physical Science Basis."

Opposite: Informal housing associated with rural-urban migration on Funafuti. The housing is sited on a narrow strip of land between the burrow pits. Illegal waste dumping surrounds the structures, and the adjacent burrow pit seems to be subject to an algal bloom.

CLIMATE CHANGE PROJECTIONS

In general, this project seeks to unpack the uncertainty and broad ranges of climate change projections. However, it is useful to consider the projections as possible future scenarios, with the understanding that what comes to pass may be more severe, less severe, or an entirely different future condition.



Sea Level Rise: Observations and projections. Image source: © Pacific Climate Change Science

The IPCC projects a ‘likely range’ of sea level rise of between .25 and 1 meter by the year 2100, based on a combination of thermal expansion and ice melt. However, this estimate does not include the possibility of a rapid collapse of the Antarctic ice sheet, which would more than double that estimate.⁶⁶ Sea level rise does not occur at an equal rate around the globe, and since 1993 sea level rise in Tuvalu has occurred at a rate of 5mm per year, around double the global average.⁶⁷ At the highest end, sea level rise of 2 meters in the next 85 years (in the case of rapid ice sheet collapse) could more or less inundate the entire nation,

particularly if coral reefs aren’t able to adapt due to coral bleaching or the rapid pace of sea level rise.⁶⁹

In addition to risks of sea level rise and storm surges, temperature increases associated with climate change pose conflated risks for Tuvalu and Oceania. The IPCC projects a temperature increase of 3.7 to 4.8°C by 2100,⁷⁰ which will affect the habitability of the region for both humans and other species. Corals are surely the most important living organism for the ongoing existence of atolls, as they create the sediment necessary for preserving coral island landmasses, and survive at only a narrow range of temperatures not exceeding 29 °C. The average water temperature in Tuvalu is already 29 °C, and increases of even a few degrees will be devastating for coral reefs. Ocean acidification, the changing of ocean chemistry due to increased dissolved oxygen content under higher temperatures, further threatens coral stocks and other marine ecosystems. Even under conservative climate change scenarios, coral cover will be depleted at least 50% by 2100, with a 90% or greater decrease under the IPCC’s high-end scenarios.⁷¹ The impacts of the collapse of corals on atoll stability is not well understood, meaning its effects are likely to be unpredictable and even volatile; see the following section for details.

For humans, the increase in temperatures caused by climate change will cause additional strain. While homes were historically naturally ventilated, “modern” wood frame or cement block homes require air condi-

66. DeConto, Robert M., and David Pollard. “Contribution of Antarctica to past and future sea-level rise.” *Nature* 531.7596 (2016): 591-597.

67. Pacific Climate Change Science. “Current and Future Climate of Tuvalu.” *International Climate Change Adaptation Initiative*. 2011.

68. Ibid.

69. See page 69

70. Bell, Johann; Johnson, Johanna & Hobday, Alistair [ed.] *Vulnerability of Tropical Pacific Fisheries and Aquaculture to Climate Change*. Secretariat of the Pacific Community. November 2011.



tioning to maintain a comfortable temperature. The cost of A/C units prevents many households from acquiring them, and for these families the rising temperatures will likely cause comfort and health issues. As more and more families acquire air conditioners, and as these units are turned up to higher volumes, strain will be put on the islands minimal power infrastructure. Indirectly, increased temperatures also amplify vector borne disease risk⁷¹. For the densely populated atoll of Funafuti, an epidemic could quickly knock the population to its knees.

ATOLL VULNERABILITY

As is discussed above,⁷² healthy corals are critical to typical processes of atoll regeneration. Part of what makes atolls and coral islands so susceptible to sea level rise and storm events is the very nature of their geomorphology. Reef island types such as compose Tuvalu are accumulations of sand and rubble on top of the barrier reef surrounding a subsided volcanic island.⁷³ These islands are dynamic systems, undergoing a constant process of erosion and addition. Atolls such as Funafuti are surrounded by a fringing limestone reef upon which rubble and sediment is deposited during storms, and these deposits form the highest land masses on an atoll islet.⁷⁴ Their ongoing survival (as land masses) depends on the availability of sediment from surrounding healthy corals in order to replace eroded land materials, and a rate of sea level rise sufficiently slow that surrounding corals can keep pace, in order to produce the necessary sediment through their natural life cycles. From a geomorphological perspective, storm events are important in replenishing sediment and building up land mass. However, storms can also ‘overwash’ an atoll, crossing the entire landmass and taking sediment, fauna, and built structures along with it.⁷⁵ This dynamic nature of atoll systems will likely be amplified by sea level rise and storm surge events, as interview subjects have noted:

“People see that their land used to be closer to the ocean, and so they been claiming that their land inside, the didn’t know that the land is being eaten away by the sea.”

Without sufficient intervention, this increasing instability will make an already tenuous existence on a narrow Pacific sandbar likely impossible. Furthermore, while evolution and transformation is inherent to the life cycles of atolls, increasing sea surface temperatures make the coral reefs on which they rely vulnerable; as Barnett has warned, “It is not sea-level rise per se, but rather projected increases in sea-surface temperature

71. Tilling, A.J. & E Fihaki. *Tuvalu National Biodiversity Strategy And Action Plan; Fourth National Report To The Convention On Biological Diversity*. 17th of November, 2009.

72. See page 37, and 46-49

73. Webb, Arthur P, and Paul S. Kench. “The dynamic response of reef islands to sea-level rise: evidence from multi-decadal analysis of island change in the Central Pacific.” *Global and Planetary Change* 72.3 (2010): 234-246.

74. Thaman, Fihaki & Fong. *Plants of Tuvalu: Lakau mo Mouku o Tuvalu*. Suva, Fiji; The University of the South Pacific, 2012.

75. Woodroffe, Colin D. “Reef-island topography and the vulnerability of atolls to sea-level rise.” *Global and Planetary Change* 62.1 (2008): 77-96.

(SST) that poses the greatest long-term risk to atoll morphology.”⁷⁶ Coral reefs thrive in water temperatures of 23°–29°Celsius, and water temperatures in and around Tuvalu are already in the range of 29.° Thus, just a small increase in sea surface temperature creates the risk of massive die-off in Tuvaluan reefs.

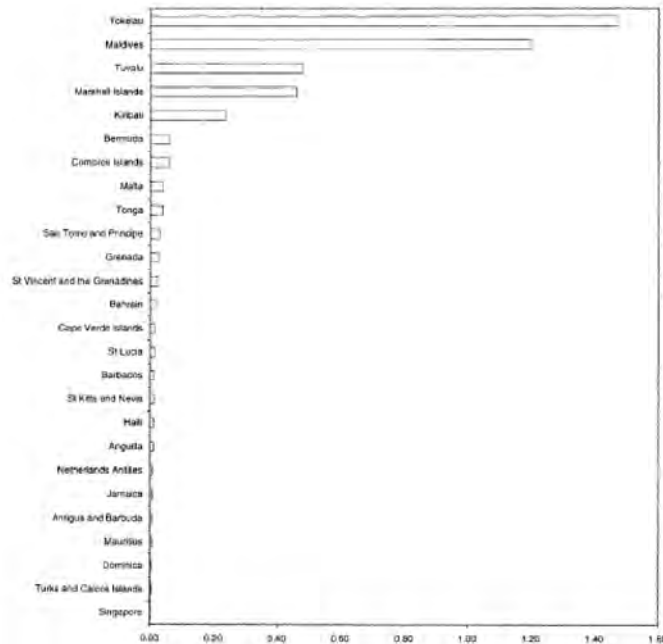
Historically, atolls adapted to sea level rise as surrounding coral grow upwards towards the light. However, mass mortality of corals associated with increasing sea surface temperatures and coral bleaching will eliminate the innate ability of atolls to adapt to changes in sea surface levels. Coral death associated with pollution, for example surrounding the capital settlement at Funafuti, further inhibits this capacity.

This inherent ability of atolls to adapt to sea level rise is one of the points leveraged by the proposals in this thesis.⁷⁷ Emergent technologies such as new coral strains known as super-corals, as well as assisted reef-building through electrification, may be able to help coral reefs withstand some of these environmental stresses. However, this may only be possible if the pace of sea level rise is sufficiently slow, and the increase in sea surface temperature is kept to a minimum.

CURRENT RISK PERCEPTIONS

In recent years Tuvaluans have become highly aware of climate change related risks, due to their nation’s prominent role in the global call for emissions reductions, and through local awareness and adaptation programs. A number of development organizations are active in tiny Tuvalu including NZ Aid, AU Aid, the UNDP, and GEF. Nearly all of the projects undertaken by these groups affiliate their work with climate change narratives.

All of the subjects interviewed believed in some degree of climate change risk, although for some their concern regarding full immersion was tempered by what has been termed the “Noah Narrative.”⁷⁸ Arising from the nation’s extremely high belief in Christianity (99% of Tuvaluans identify as Christian)⁷⁹, the Noah Narrative deems that Tuvalu will not be inundated because, according to the Bible, the flood has already come during the time of Noah. As one interviewee in Funafuti noted:



Sea level rise vulnerability index. Source: Barnett, Jon, and W. Neil Adger. “Climate dangers and atoll countries.”

76. Barnett, Jon, and W. Neil Adger. “Climate dangers and atoll countries.” *Climatic change* 61.3 (2003): 321-337.

77. See seed proposals, page 186-188. To adapt to different scenarios of sea level rise, the thesis proposes intervening in the process of atoll formation, combining these emergent reef-building technologies with existing strategies for coastal engineering.

78. Dahlström, Jonas. “In the Eye of the Storm – Risk Perception and Perceived Adaptive Capacity among Civil Society Leaders in Tuvalu.” Masters Thesis in Development Studies, Department of Government, Uppsala University.

79. Tuvalu Central Statistics Division

“In Noah’s time... He punished all these people. I think it won’t happen again. That’s my belief.”

Even for those Tuvaluans who saw climate change risks as real, there was always a sense of removal; interviewees tended to refer to risks for others rather than risk associated with their own lives. While they believe in climate change as a national issue, it is difficult to internalize the meaning of this risk into conceptions of their personal history and future in Tuvalu. For example:

“Some people are threatened by the problem of sea level rise, so its better now to move to find a better place to stay, in order to get a better place for their children.”

For this Tuvaluan, climate change risk existed, but for someone else, in some future time. Others have gone so far as to begin asking what climate change risk means for Tuvalu as an entirety:

“Its too bad. There will be a time when most of the Tuvaluan ground will be under the sea. Its predicted that it can be less that 50 years, the scientists say. I am already worried about where the people of Tuvalu are going to live at that time.”

This Tuvaluan recognizes that climate change places a overarching risk on Tuvalu’s inhabitation, and perhaps even its nationhood status. These voices also acknowledge the very real possibility of mass migration out of Tuvalu, an issue this thesis attempts to explore with the Auckland proposals.⁸⁰

EEZ: RISK + OPPORTUNITY

This risk to the physical ground of Tuvalu is made more complex by the dependence of national oceanic territory on the ground’s continued existence above sea level. The United Nations Conference on the Law of the Seas (UNCLOS)⁸¹ stipulates a 200 nautical mile Exclusive Economic Zone (EEZ) offset of the shoreline of coastal nations. This allows nations such as Tuvalu rights to explore for and use marine resources including power production from wind or water, oil reserves, and most importantly for Tuvalu, fish stocks. It does not allow any rights to the surface of the sea or above; ships from other nations can pass through an EEZ freely. For Tuvalu, the EEZ amounts to about 900,000 square kilometers of territory; more than 30,000 times as much as Tuvalu’s ground area (26 km²).

80. See proposals for Culture seeds and Economy Seeds pages 188-191, which attempt to claim territory and agency for displaced Tuvaluans through mechanisms of shared cultural space and new Tuvaluan fishing export economies.

81. The EEZ was adopted during the Third United Nations Conference on the Law of the Sea (1982). UNCLOS is an international agreement on oceanic rights and regulations.

In addition to the EEZ, nations also have rights to *territorial waters* extending a maximum of 12 miles off the coastline. While nations only have sovereign rights to *marine resources* within an EEZ, they have full sovereignty over territorial waters. This extends to both the seabed below the ocean's surface, and airspace above. Nations also have full sovereignty over any *internal waters*, including the lagoon's on Tuvalu's atolls. Beyond territorial waters, nations also have an additional 12 kilometers (24km offset from the coastal baseline) to a *contiguous zone* which gives states limited control for preventing or punishing legal infringements within the territorial waters. Somewhat confusingly, the term 'territorial waters' can be used to stand in for all of the waters a nation has jurisdiction over, including the EEZ, contiguous zone, territorial waters, and internal waters. The ocean beyond the EEZ is the *high seas* and is not associated with any nation.

In the case where two EEZs (or contiguous zones, or territorial waters) would overlap, a *maritime boundary* is delineated by finding the mid-point between the two zones. The coastal *baseline* from which these different oceanic territorial typologies are measured is typically the low-water line along the oceanic coast. However, some bays, ports, or river mouths that are considered internal waters may also be considered part of the baseline. In order to be considered, an "island" must be "a naturally formed area of land, surrounded by water, which is above water at high tide" and not be a rock, "which cannot sustain human habitation or economic life of their own."⁸² Areas which are fully submerged at high tide ("low-tide elevations") are also not considered in UNCLOS's definition. This part of the legislation is particularly difficult in light of the extensive inundation king tides are already causing in Tuvalu.

As mentioned, oceanic territories are usually measured from a baseline established by the low-water line. When islets or even entire atolls no longer emerge from the seas at low tide, these baselines will disappear. As the existence of a baseline is a necessary condition for claiming oceanic territory, their submersion may eliminate a state's claims for these waters. While some have suggested that submerged islands may form a special (but not yet defined) category, we can imagine the likelihood of remaining dry nations attempting to claim that territory in cases of prior maritime boundaries resulting from overlaps. And if all of the islands making up a nation are submerged, nations may potentially lose their status of statehoods, since they no longer have sovereignty over land or seas.⁸³

MARINE DELIMITATION

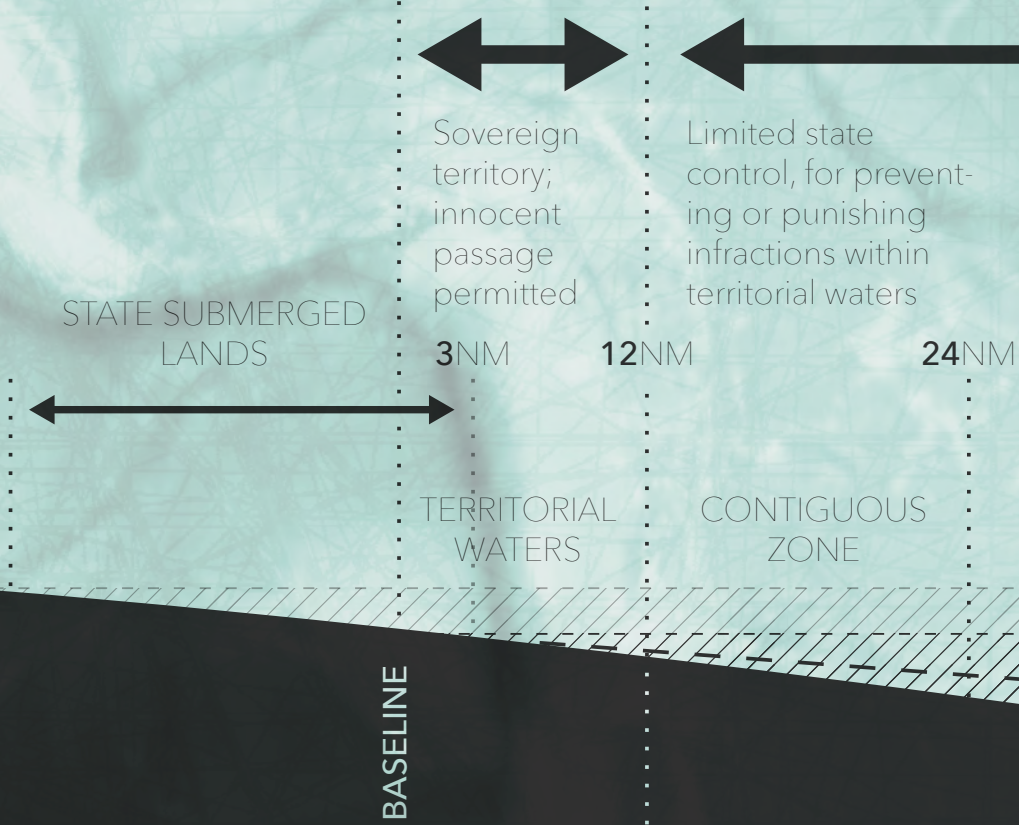
Marine delimitation is the process of establishing (inter)national boundaries in oceanic space. Unlike boundary delimitation on solid ground, which can be more easily marked with a fence or inscribed on a map relative to other stable features, in the ocean these limits are abstract constructs, existing only as geographic coordinate points and vectors. Oceanic territory delimitation is calculated relative to established baselines, typically sited at the low tide mark. See diagram on following page for the extents and determination of oceanic territories.

82. UNCLOS, in Article 121 (Regime of Islands).

83. Hayashi, Moritaka. *Islands' Sea Areas: Effects of a Rising Sea Level* », Review of Island Studies, 2013, p.2.

Territorial control extends from airspace above, through territorial waters, and to seabed below.

TERRITORIAL SEA



EXCLUSIVE ECONOMIC ZONE

[CLAIMABLE]

HIGH SEAS

States retain special rights over the EEZ, regarding exploration and particularly marine resources: energy production, fish stocks, mineral resources. However, these zones can still be traversed above sea level as international waters

Nations witha continental shelf extending more than 200 NM can apply for extended EEZs up to 300 NM

200NM

200NM

EXCLUSIVE ECONOMIC ZONE

MEAN HIGH TIDE
MEAN LOW TIDE

SLOPE

RISE

ABYSSAL PLAIN

SOUTH CHINA SEAS

The South China Seas have long been the sites of contested territorial claims, centering around the Paracels and the Spratly island chains. Multiple nations stake claim to overlapping zones along these archipelagos, including China, Taiwan, Vietnam, the Philippines, and Malaysia. As early as 1947 China issued a map claiming these zones, which fall into the 200 nautical mile UNCLOS EEZ designation of the other listed nations. The issue came to a head last year when satellite photos revealed that China was reclaiming land and building military bases on the archipelago which is primarily formed of sunken islands.

While China's actions have been met unfavorably on an international stage, and it has been chastised by the UN, their actions suggest that building or growing islands may be a possible mechanism for claiming and expanding oceanic territory. If they are able to be recognized as sovereign owners of these contested, constructed islands they will be able to claim substantial additional territory from adjacent nations through EEZ UNCLOS regulations. In addition to the military bases they are developing, this will also provide them with rights to oceanic resources such as fisheries or sea bed minerals.

Thus, through the UNCLOS legislation, loss of inhabitable ground above sea level negates rights to oceanic territory. If the islands become fully submerged, Tuvalu will also lose access to its 200 nautical mile radius exclusive economic zone (EEZ) which provides much of the nation's income through the licensing of tuna fishing. This disaster presents very obvious economic and social risks, but also the destruction of an entire culture and national identity. This includes losing access to coastal livelihoods that are closely tied to cultural identities, and also fish stocks that serve as Tuvalu's biggest potential economic asset. Tuvalu's dominant commercial fish stock is tuna, a resource worth four billion dollars in the Pacific region. Tuvalu has an abundance of tuna, particularly skipjack tuna, and climate change is actually anticipated to increase that volume as more tuna shift eastward into Tuvalu's EEZ. While this resource is valued at over 22 million dollars, Tuvalu accesses only a small amount of that cash through licensing fees.⁸⁴ Tuna is currently Tuvalu's most notable resource, and with the loss of access to this shared amenity along with shared ground, little would remain to tie the nation together.⁸⁵

Modern concepts of nationhood have been applied by Western outsiders upon what was once a loosely affiliated archipelago of independent island communities. Now, when they are facing a future of uninhabitable land, the territorial lines drawn by outside power structures bind them to these 'sinking' islands. The modern, Western world constructed the concept of sovereignty for Tuvalu, and within the same framework Tuvaluans face having that sovereignty wrested from them.

Transnational territorial regulations such as UNCLOS are problematic in that their rules are static, but the world is not. Beyond the shifts triggered by geopolitics, geography itself is dynamic. Geographies such as coral atolls are forming and eroding, continental plates rise and subside, and *the sea is not level*. Seen in the longer *duree*⁸⁶, our very earth itself is in motion, resisting the hard lines we attempt to draw across its surface. Geo-policy's inability to deal with this geographic fluidity is exemplified by China's construction of new islands and territorial claims in the South China Seas, to the outcry of the international community. China's attempt to strongarm its way through UNCLOS's loopholes shows the potential for re-framing these regulations for dynamic geographies, although it also presents the possibility that this is only possible with the might of a world superpower such as the PRC behind it.

Also problematic in the UNCLOS agreement is a lack of acknowledgment of the Anthropocene, an era where humans are an undeniable

84. Bell, Johann; Johnson, Johanna & Hobday, Alistair [ed.] *Vulnerability of Tropical Pacific Fisheries and Aquaculture to Climate Change*. Secretariat of the Pacific Community. November 2011

85. See the subsection 'Fluid Cultural Geographies' for more detailed information on Tuvalu's fisheries, page 94 & 96 as well as the proposal for 'economy seeds' on page 264 - 281

86. See page 175

player in our global environment. As noted above, UNCLOS states “island” must be “a naturally formed area of land...”⁸⁷ Many have used this language to disprove China’s claims in the South China Seas. China is attempting to claim ownership of drowned islands by building them up with sand and infrastructure. However, if we acknowledge that humans



are the cause of climate change and sea level rise, is a drowned atoll *a naturally formed area of land* that has been *unnaturally destroyed*? And what level of human coercion on oceanic geomorphological processes crosses the line from *natural* to *unnatural*? Ultimately, if Tuvalu constructs her own islands, would Tuvaluan oceanic territorial rights be retained or even expanded? To date, international maritime and territorial law has not reached a consensus on this issue, and political scientists have recommended that international Laws of the Seas regulations be revised in light of emergent complexities associated with sea level rise and cyborg geographies.⁸⁸ However, as the South China Seas case suggests, taking physical action now may be one way to shape how these future policies play out.

Building new islands in the South China Seas. Image Source: Asia Maritime Transparency Initiative

While the complexities of territorial politics certainly creates another set of problems for Tuvalu on top of the direct risks they face from climate change, overpopulation, and uneven development, a close reading of UNCLOS policy in this way also creates opportunities for the tiny nation. It creates the possibility of selective intervention, growing up islands at important EEZ baseline points in order to maintain existing oceanic territory, or even “growing” new islands to expand territory by selectively intervening in atoll formation processes. One of Tuvalu’s greatest assets is its sovereignty, and the rights that sovereignty brings on an international stage, including territorial waters. As such, leveraging this sovereignty strategically may be one of the strongest forms of currency for atoll nations in light of climate-vulnerable futures. This strategy of hacking geopolitical and geomorphological systems is explored in the designs proposed by this thesis, in the sections on *seeding ground*⁸⁹ and *seeding territory*.⁹⁰

87. UNCLOS, in Article 121 (Regime of Islands).

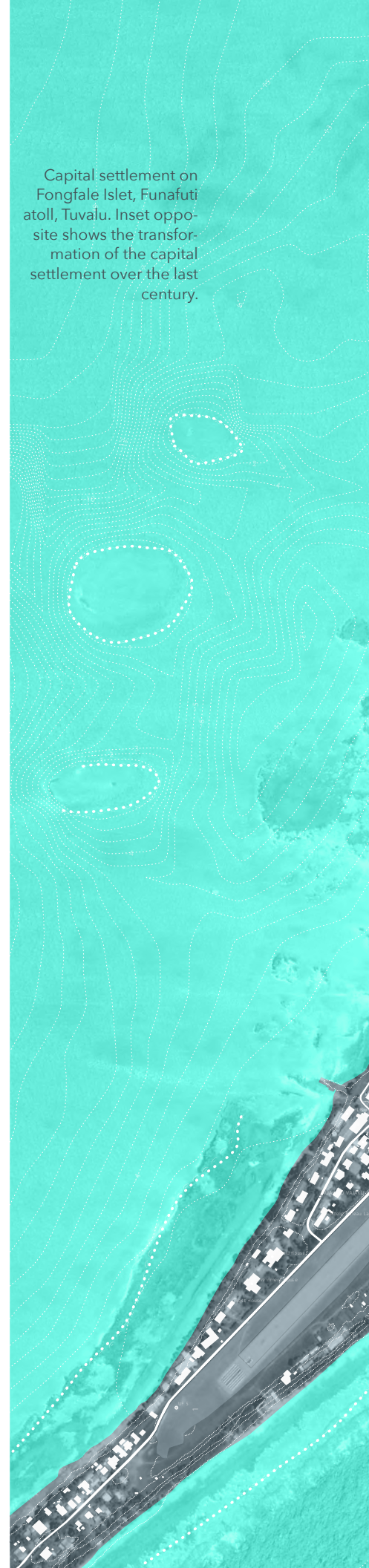
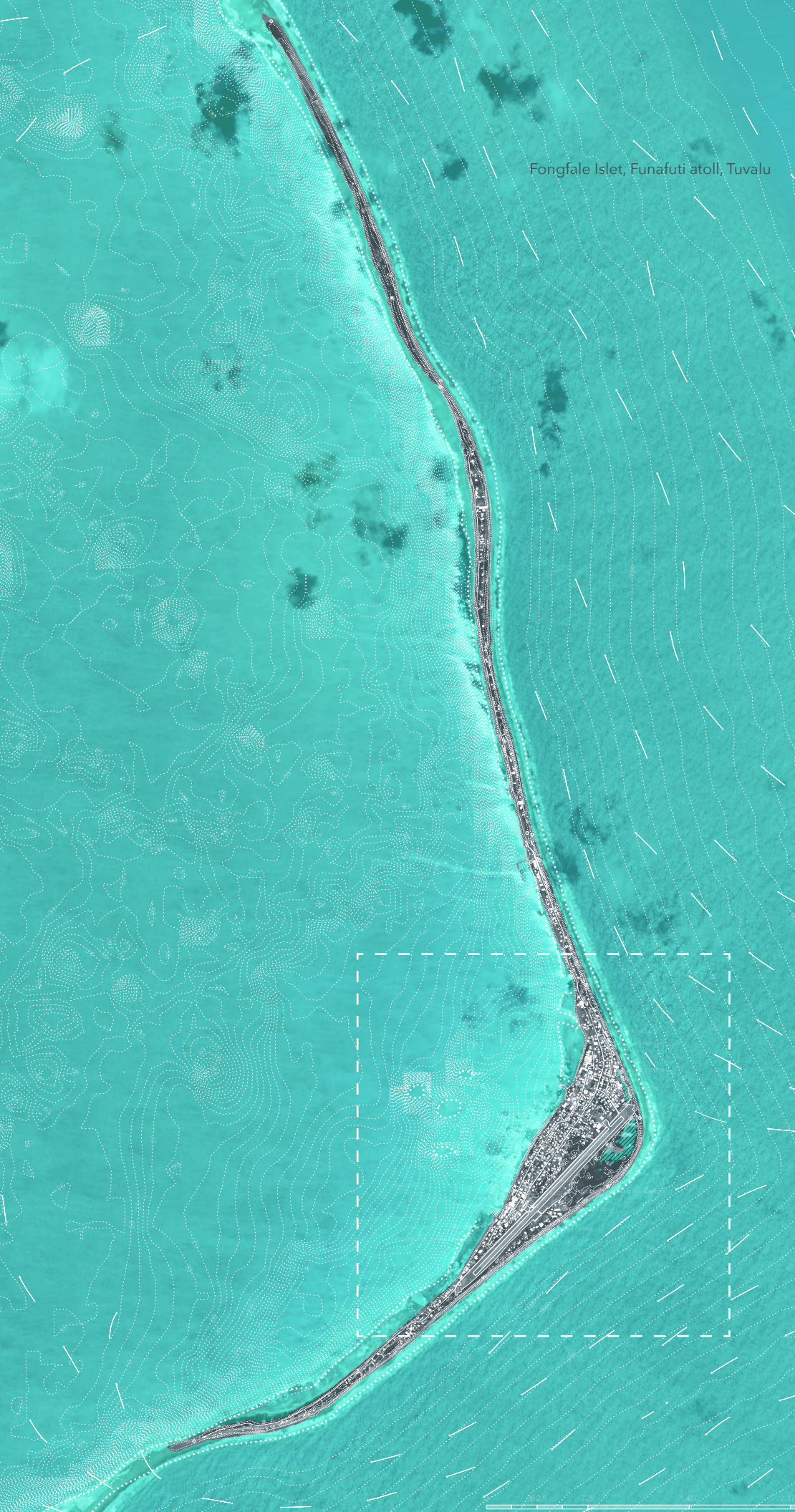
88. Tsaltas, Grigoris, Tilemachos Bourtzis, and Gerasimos Makis Rodotheatos. “Artificial islands and structures as a means of safeguarding state sovereignty against sea level rise. A law of the sea perspective.” *6th ABLOS Conference “Contentious Issues in UNCLOS-Surely Not. 2010.*

89. See 200 - 215

90. See 246 - 253

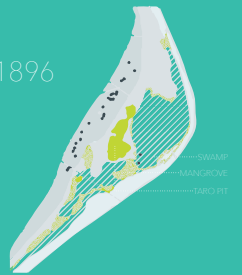
Fongfale Islet, Funafuti atoll, Tuvalu

Capital settlement on Fongfale Islet, Funafuti atoll, Tuvalu. Inset opposite shows the transformation of the capital settlement over the last century.





1896



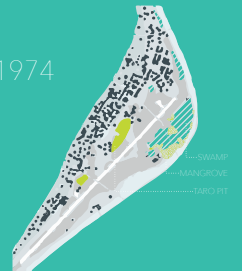
1941



1943



1974



1984



2004





FLUID PEOPLES
TUVALU'S MOBILE
DIASPORA

Inhabiting the unstable geography described in the prior section means that Tuvaluans must operate as a fluid population: mobile, adaptable, and archipelagic. Historically, mobility was a part of surviving on unstable atoll geographies, and the risk of sea level rise may repeat this necessity. In state of change further catalyzed by a warming climate, population dispersal dilutes Tuvaluan agency over the population's futures; however, it also creates the opportunity for a more fluidly defined nation-state.

HUMAN CONTEXT: FLUID POPULATIONS

HISTORIC TUVALUAN MIGRATIONS

The social history of Tuvalu is not one of permanence and stability, but rather an ongoing tale of mobile oceanic voyagers; their identities are as fluid as the atolls they inhabit. The story of Tuvaluan mobility begins long before the naming, or even discovery, of Tuvalu. Polynesia was settled by the Lapitians around 4,000 years ago, who made their way from New Guinea across the islands of the region. Their exact origins are disputed, and their key identification is tied to distinctively marked pottery they left behind. Settlement did not occur in a single wave, but rather these early peoples migrated frequently, as is evidenced by the “extreme racial heterogeneity”⁹² of Polynesians. It should be noted that Lapitians originated and largely dispersed across mountainous volcanic islands with rich soils, which vary greatly from the flat, sandy atolls of Tuvalu on which some eventually settled.

The general trajectory of the Lapitians was from Melanesia to New Caledonia, the site of a large pottery deposit, around 5,000 years ago. From there they reached Fiji via Vanuatu, which would become an important Lapitian hub. Tuvalu is thought to have been settled around 2000 years ago by Tongan and Samoan Lapitians likely traveling on the South Equatorial surface current, by way of Uvea and Tokelau. Much of historic migration is tracked through the development of language; the Tuvaluan language is a Polynesian variant with strong Samoan influences, however Tongan influences in language and place names are stronger in the northern island.⁸² While the language is shared across the archipelago, dialects vary from island to island, representing a degree of isolation and individualism on each of the atolls. One exception is the island of Nui, which has strong Micronesian influences due to frequent encounters with the I-Kiribati warriors to the North.⁸³ The people of Nui also have distinct physical features that align them more closely with Micronesian heritage. The concept of a collective of unique island-states is represented in the word ‘Tuvalu’ which means ‘eight

91. Gibbons, John RH, and Fergus GAU Clunie. “Sea level changes and pacific prehistory: New insight into early human settlement of Oceania.” *The Journal of Pacific History* 21.2 (1986): 58-82.

92. Faaniu, Simati, and Hugh Laracy. *Tuvalu: a history*. University of the South Pacific; Suva, Fiji 1983.

93. Koch, Gerd. *The Material Culture of Tuvalu*. Museum für Völkerkunde Berlin, 1961.

stand together.’ Representing the 8 originally settled atolls, this name identifies the importance of the unique identities of each island. Each atoll community has distinct, though related, traditions associated with song and dance, ceremonial events, and crafts.

NANUMANGA CAVE PEOPLE

In the 1980s, a New Zealand team discovered an underwater cave on the reef mount of Nanumanga atoll in Tuvalu. The discovery was initiated by a local legend which spoke of “a large house under the sea.” The cave showed evidence of a fire, suggesting that the atolls had been inhabited earlier than previously thought, likely by a different group of peoples. According to sea level reconstruction data, the caves had not been above sea level in between 6,000 and 8,000 years, and were submerged by the Meltwater Pulse that began around 8,000 years ago. In contrast, the Tuvaluan archipelago is thought to have been originally settled around 2,000 years ago.

Source: Gibbons, John RH, and Fergus GAU Clunie. “Sea level changes and pacific prehistory: New insight into early human settlement of Oceania” *The Journal of Pacific History* 21.2 (1986): 58-82.

Tuvalu was connected to an Oceanic world tied together by trade and war. Trade and contact with Tongans began in the 13th century, particularly with Nanumea and Nanumanga atolls⁸⁴ which have more easily navigable surrounding reefs. Early trade with Fiji is also evidenced by Lapitian pottery shards on Nanumea, Nanumanga, and Vaitupu. This mobility was not only part of their livelihoods, but necessary for survival:

“In historic times atoll dwellers were extremely mobile and far from insular; men and women moved readily between islands in search of new land, disease-free sites, wives, trade goods, and so on. In this way some islands were populated, depopulated, and later repopulated. Mobility itself was responsible for demographic survival; without mobility, adaptation and change were impossible.”⁹⁶

The Tuvaluan community is very much defined by its movement from one place to another, from the time of its original settlement, and this historical narrative delineates the importance of mobility in Tuvaluan survival. Through a series of unpredictable and chance events—conflicts, voyages, alliances, relationships—Tuvalu came to be established as the approximate nation-state-collective it is today.

ORIGINS: TRANSIENT SETTLEMENT MYTHS

While the histories described above are primarily constructed via linguistic and material trajectories, the mythology of the individual islands demonstrates a similar indeterminate and mobile logic of island settlement, which is deeply integrated into the cultural ethos of Tuvaluans. In Tuvaluan myth, the archipelago was created by super-human forces. These origin stories vary from island to island, but many are based on Te Pusi and Te Ali (the Eel and the Flounder). In this story, the Eel and the Flounder get into a dispute, and the Eel curses the Flounder to become “wide and flat”, forming the sandy, flat land masses of the Tuvaluan atolls. The Eel, burying his head in the sand, becomes the tall and narrow coconut trees. A rock the Eel throws into the air becomes the sky, and then he throws the remainder to become the rest of Tuvalu’s 8 islands. Thus, it is not by a grand schema of the gods that Tuvalu’s islands are created, but rather by an accidental tussle of extra-human forces. The Eel tosses a rock into the air, and it happens that it’s scat-

94. Thaman, Fihaki & Fong. *Plants of Tuvalu: Lakau mo Mouku o Tuvalu*. Suva, Fiji; The University of the South Pacific, 2012.

95. Connell, John. “Population, Migration, and Problems of Atoll Development in the South Pacific.”

tered pieces form the archipelago; not even the spirit world can create a planned Tuvaluan future.

Island origin myths differ from settlement myths, which convey how the island's ancestors came to arrive there. While island origins are always defined by the actions of the gods (unplanned as they may be), settlement myths tell of how man came to discover and inhabit the islands. In these histories, which also vary between island and clan, the ancestors have always arrived from someplace else; usually Samoa or Tonga. In this way, Tuvaluan futures do not exhibit a modern trajectory of starting from one vantage and yearning towards another; rather, the inhabitation of the archipelago is part of a cyclical narrative of shifting and settling, always beginning someplace in the middle.

This shifting cycle of migration and settlement parallels the structure of traditional Tuvaluan songs and dance. In their musical traditions, songs are repetitive loops, building to a point of crescendo, marked by thumps of a drum, claps, and shouts, until the song dissolves, and the cycle begins again. Where it will end is undetermined; the cycle goes on until the performers are ready to break.

The islands of Vaitupu and Funafuti share the settlement narrative of Telematua and his wives, Futi and Tupu, the namesakes for the two islands. Telematua arrived in Tuvalu by canoe, first settling in Funafuti. The family first colonized Funafale islet on Funafuti atoll, and later shifted to Fongfale islet, which is the location of the present town and government center. Telematua then left Funafuti atoll “searching for a land of greater fertility and where fresh water was more plentiful, [and] discovered Vaitupu.”⁹⁶ Having already left Samoa in search of new ground, Telematua again strikes out to open water, hoping to happen upon a more desirable island. Although many Vaitupu and Funafuti people trace their ancestral lineage to Telematua, his arrival into the historical narrative does not represent thence-forward stability. Telematua later “set out another journey.. this time to Tonga”⁹⁷ where he acquires another wife to bring back to Vaitupu.

Prior to the arrival of the white man, island histories are riddled with contact from other island societies: raiders from Tonga, voyagers from Kiribati, and settlers from across the Pacific. The moment of Telematua's arrival in Tuvalu thus becomes an arbitrary starting point; it is simply the moment when we happen upon the scene of a long history of Polynesian mobility. Like a weaving where each additional weft unravels the one at the beginning, there is no origin of the Tuvaluan peoples,

96. Faaniu, Simati, and Hugh Laracy. *Tuvalu: a history*. University of the South Pacific; Suva, Fiji 1983.

97. *Ibid.*



HOUSING TYPOLOGIES

Existing housing types on Tuvalu; vernacular and 'modern' models and materials

but simply moments captured in the rhythm of movement and rest within the repetition of cultural time.

That Tuvaluans arrived from the high, volcanic islands of Samoa and Tonga—both in mythology and historical genealogy—also establishes an ongoing dialogue between unstable atolls and stable high islands. Those high islanders who ultimately settled Tuvalu left a land of security to inhabit one of uncertainty. Inhabitants at the edge of Samoan/Tongan society broke adrift, landing for a time on the fluid sandbars of Tuvalu. While the definition of indeterminate mobility can be easily expanded to high islands as well, which deal with their own temporal-events (cyclones, tsunamis, volcanic eruptions), we might also gather that these particular high island voyagers exhibit a certain kind of mobile desire. In an Oceanic version of the grass is always greener (the coconut trees are always taller) these particular islanders exhibit a desire to seek out alternative futures.

98. See page 80-81 and also information on fluid atoll hydrodynamics, page 46

As discussed above,⁹⁸ the indeterminacy of atoll inhabitation is characterized by the multiple and simultaneous possible futures which exist at any given moment. Tuvaluans, then, are founded by a people who not only acknowledged the existence of these possible futures, but sought them out actively. When Telematua left Samoa, he did not know that he would find Tuvalu. And when he left Funafuti atoll, he did not know that he would find Vaitupu. Rather, he recognized the possibility of a future with better soils or clearer waters, and set out in his canoe to find them.

COLONIZATION: MOBILITY, INTERRUPTED

When Europeans then first encounter the Tuvaluans, they are not, then, discovering an isolated peoples, but simply happening in on an ongoing cross-oceanic dialogue. Their arrival modified the mobile lifestyles of Tuvaluans, preventing some forms of fluid existence but introducing others.

The first recorded sighting of Tuvalu by Europeans was the 1598 sighting by the Spaniard Mendana, who happened upon the atoll of Nui. However, it was some time until the islands were set foot on by the Western



FENUA [HOUSE]
MIXED CONSTRUCTION, NEW MIGRANT HOUSING



FENUA [HOUSE]
WESTERN MATERIALS, SELF-BUILT



FENUA [HOUSE]
WESTERN MATERIALS, AID-BUILT

world. It wasn't until the 19th century that contact was established. In 1819 Captain Arent de Peyster 'discovered' Funafuti and Nukufetau and dubbed the archipelago the "Ellice Islands" after the owner of the ship's cargo. Subsequently, in 1841, Charles Wilkes and the US Exploring Expedition stopped at 3 Tuvaluan atolls during their Pacific Voyage.⁹⁹

Through the rest of the decade, Western impacts grew rapidly, and Tuvaluan society was transformed. 'Blackbirding' was one of the first examples of mobility without agency for Tuvaluans. Blackbirding was the South Pacific version of the slave trade, where Australian and European sailors captured large populations of Oceanic islanders as slaves to be traded in the West. For a tiny nation like Tuvalu, these activities were particularly devastating; in 1863 Blackbirders kidnapped 54% of the adult males on Funafuti and 79% of the men on Nukulaelae as slaves¹⁰⁰ (about 400 men in total) to work on guano mines in Peru.¹⁰¹ This process that occurred throughout the 1850s-1870, disrupting the social and economic life of Tuvalu deeply. Blackbirding has contributed to the further dispersal of Tuvaluans throughout the globe; descendants of these slaves still live in Hawaii, Fiji, and Samoa¹⁰²

Two years later in 1865 Samoan missionaries began the "systematic Christianization" of the Tuvaluan islands. The introduction of Christianity undermined traditional social and political structures based around complex relationships between chiefs/nobles and commoners.¹⁰³ It also modified the space of Tuvaluan futures, shifting from the chance logics of traditional beliefs to a narrative of predetermined Christian futures. These missionaries were incredibly successful; today 99% of Tuvaluans belong to the Christian church.¹⁰⁴ Pastors became powerful figures in the community, and established a new set of frameworks and guidelines for how society should operate. One rule disallowed travel from one island in the archipelago to another; abruptly, Tuvaluan society went from one of undetermined mobility to one of predetermined (and externally determined) stability. Hamlets were restructured into gridded villages under the guidance of the pastors, and land ownership left the hands of collective clans, in favor of Western private ownership models. From the beginning, these stable/determinate concepts conflicted with the fluid/indeterminate logics of atolls

99. Thaman, Fihaki & Fong. *Plants of Tuvalu: Lakau mo Mouku o Tuvalu*. Suva, Fiji; The University of the South Pacific, 2012.

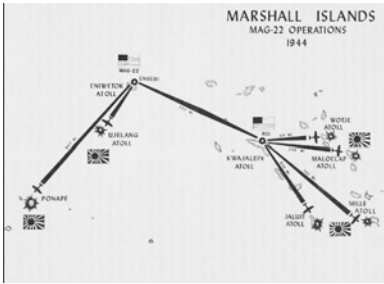
100. McQuarrie, Peter. *Strategic Atolls: Tuvalu and the Second World War*. Macmillan Brown Center for Pacific Studies, University of Canterbury, Christchurch, New Zealand, 1993.

101. Thaman, Fihaki & Fong. *Plants of Tuvalu: Lakau mo Mouku o Tuvalu*. Suva, Fiji; The University of the South Pacific, 2012.

102. Ibid.

103. Koch, Klaus-Friedrich. *Logs in the Current of the Sea: Neli Lifuka's Story of Kioa and the Vaitupu Colonists*. Cambridge, Ma; The Press of the Landgdon Associates, 1978.

104. Tuvalu Central Statistics Division



Occupation and strategic placement of Tuvalu during WWII.
 Source: www.tuvaluislands.com

and atoll dwellers; a seaside land owner would find that every year, meters of beach would be eroded away from his property, only to be re-deposited on a different part of the island. Stable concepts are eroded by the fluidity of the atoll.

Colonization shortly followed the dramatic impacts of blackbirding and Christianization. The islands have been under the British sphere of influence since 1877,¹⁰⁶ in 1896 they were officially colonized as a British Protectorate, and in 1915¹⁰⁷ became a Crown Colony. They were colonized not because of a desire by Tuvaluans or I-Kiribati for protection, but for their strategic influence in the region as bases and landing points in the Pacific. As a matter of convenience, Kiribati and Tuvalu (formerly the Gilbert and Ellice Islands), were managed jointly and eventually merged into a single colony. Colonists reinforced many of the determinist logics introduced by Christian pastors, although their higher power was the King and the colonial hierarchy instead of an Almighty God. They also introduced another kind of determinism: progress. Early trade of steel tools and fishhooks had been introduced prior to colonization, but became integral by the permanent residence of colonial powers on the islands. The British introduced the idea of “development,” promoting modern technology and infrastructures. The occupation of three Tuvaluan atolls by US Marines during World War II amplified these concepts of western progress as air bases were developed and a cash economy was established.

At the beginning of WWII, Tuvalu was caught as no-man’s land between Japanese and Allied territories in the Pacific, and thus was seen as an important strategic location by the Allied Forces. The nation was occupied by US Marine forces on Funafuti, Nanumea, and Nukufetau as “anchored aircraft carriers”, serving as a launching point for the US Central Pacific Offensive. Occupation of these three islands resulted in significant displacement of people to outer islets, and up to 1/3 of land area was razed for military installations.¹⁰⁸ There were seven bombing missions against Funafuti airbase beginning in March 1943, resulting in further evacuation of Fongfale to Funafala islet. The Japanese bombing missions, alongside military ‘improvements’, destroyed the entire fabric of Funafuti village. This resulted in a re-formulation of building types and a re-spatialization of village fabric, from a close-knit cluster of traditional homes before the war to a spatially dispersed patchwork of housing and adjacent cultivation along the newly constructed linear road, incorporating the former military structures. Planning was poor, and Allied assistance in rebuilding was insufficient:

106. Thaman, Fihaki & Fong. *Plants of Tuvalu: Lakau mo Mouku o Tuvalu*. Suva, Fiji; The University of the South Pacific, 2012.

107. Koch, Gerd. *The Material Culture of Tuvalu*. Museum für Volkerkunde Berlin, 1961.

108. McQuarrie, Peter. *Strategic Atolls: Tuvalu and the Second World War*. Macmillan Brown Center for Pacific Studies, University of Canterbury, Christchurch, New Zealand, 1993.

“With the passing of a few years, the village took on a distinctly shantytown appearance, with rusted corrugated iron roofs and decaying timber—quite a contrast to the ordered rows of thatched houses which had existed previously.”¹⁰⁹

Occupation also environmentally degraded the occupied islands, leaving behind contaminated and compacted land, ruins of military machinery, and damage to agricultural and ecological systems. Even today, the impact of the events of WWII remain visible, and the structure of Funafuti today is strongly influenced by the reconfiguration during WWII.¹¹⁰

THE KIOA CASE: MOBILITY MEETS MODERNITY

It was a combination of this new concept of progress, and the historic models of mobility, that allowed for the islanders of Vaitupu atoll in Tuvalu to imagine that, following World War II, they could compensate for their island’s uncertain ongoing habitability by framing for themselves an alternative future. Their contact with newly globalized world, brought expectations for security and progress beyond what their meager island could offer. Vaitupians used 3,000 pounds saved from working for the Americans during wartime occupation to purchase land in Fiji in 1946 for cultivation and settlement. Nearly all of Vaitupians contributed, and a large group migrated over the period of 1946-54, at which point Fijian authorities began to more closely regulate immigration.¹¹¹

The concept of a planned resettlement did not emerge from the Tuvaluans themselves. Following World War II, Tuvaluans had gathered significant wealth working in Oceanic war operations and selling native handicrafts to embedded soldiers. A former European schoolteacher, D.C. Kennedy, proposed the purchase of an island in Fiji to Vaitupu’s magistrate as a way to “get something from [their] hard work that would last forever.”¹¹² While this Pacific migration might appear to be a movement in line with historic indeterminate mobility, its initiation is perhaps more closely aligned with European colonization projects. The idea that the purchase of Kioa would “last forever” imagines a singular, determined future of stable land ownership. Fiji is composed of mountainous, volcanic islands, and a Fijian island is likely to far outlast the geologic lifespan of an atoll.

When Vaitupu’s magistrate Neli Lifuka brought the proposal of purchasing Kioa through collective donations of war-created wealth to the people of Kioa, young men working abroad overwhelmingly agreed to

109. Ibid.

110. Ibid.



Main settlement, Funafuti Atoll, Tuvalu.
Source: Google Earth Pro

111. Koch, Klaus-Friedrich. *Logs in the Current of the Sea: Neli Lifuka's Story of Kioa and the Vaitupu Colonists*. Cambridge, Ma; The Press of the Landgdon Assoiates, 1978.

112. Ibid.

the plan, and some even volunteered to contribute beyond the requested sum. However, in Neli's recollection of the proposed purchase with the council of elders on Vaitupu, some were more skeptical:

“We had a big meeting in the maneapa to decide what to do with our money. Some of the old men wanted to use the money to have something to show like a hospital. That's the native way of thinking. The people want to see their money right away. They don't think of the future.”¹¹³³

Who can we say is truly thinking of the future in this context? The young men, who are excited to have a white man purchase a volcanic island for them, a future elsewhere, sight unseen? Or the old men, who wish to use the money to improve the tangible, immediate future?

Like Telematua in his eventual discovery of Vaitupu, the young men are “searching for a land of greater fertility and where fresh water was more plentiful.” These boys, working in Ocean Island, Christmas Island, Tarawa, Canton, Palmyra, have already begun to inhabit a multiplicity of futures much in the way of their mobile forebears. For them, the future could be anywhere. Instead of launching a canoe into deep waters, they trust in the vessel of D.C. Kennedy to safely bring them to another shore. Intent on discovering stability and permanence elsewhere, for these young men historic indeterminacy and Westernized stability have collided in their vision of new island futures. The elders, penned in by colonial land tenure laws, cannot envision multiple, simultaneous futures. Rather, they inhabit a singular future on Vaitupu, tweaked towards progress through the addition of new medical infrastructure.

Neli was eventually successful in persuading the council of elders, and the rest of the Vaitupu community, and placed the purchase into Kennedy's hands. On June 16th, 1946, Neli received the following telegraph from D.C. Kennedy: “I have bought an island in the Fiji group, named Kioa.”¹¹⁴ Through this act, imagined futures convened with reality, and preparations to inhabit it began.

This foray into a new world brought with it complications. The island of Kioa is 7 square miles, over 3 times the size of Vaitupu. Like all of Tuvalu's islands, Vaitupu is a low-lying coral atoll, rising only a couple of meters above sea level. In contrast, Kioa is a mountainous volcanic island. Vaitupians were unfamiliar with the geological and ecological systems of this new landscape, and had to rely upon Fijian neighbors for agricultural assistance. However, they found the land poor for cultivating many of their familiar foods (primarily taro and coconut), and the settlement suffered a famine in 1948-9 due to low fish stocks around Kioa. The settlement also experienced political problems. Their

113. Koch, Klaus-Friedrich. *Logs in the Current of the Sea: Neli Lifuka's Story of Kioa and the Vaitupu Colonists*. Cambridge, Ma; The Press of the Landgdon Associates, 1978.

114. *Ibid.*

new territory lacked both the imposed western-style governance of the British colonists, and the islanders had also lost touch with traditional social and governance hierarchies. This resulted in political fragmentation; “The Kioa people had become like the drifting coconuts they had to gather from the sea to supplement their meager produce.”¹¹⁵

The earliest settlers, a group of 30 who arrived in 1947, faced a difficult life establishing the new settlement, and Vaitupuans, hearing this news, were hesitant to follow. The following song commemorates the arrival of the first settlers on Kioa:

“On the twenty-sixth of October, forty-seven,
At two in the afternoon of a Sunday,
We arrived at the bay of Kioa.
I cast my eyes to the mountain heights
For which I longed when in Vaitupu.
What now that I am here?
Oh, I feel a sorrow seeing Paka,
The leader of our group of travellers.

On solid ground where I have set my feet
But no one comes to welcome me.
Trees alone are standing there before me,
And birds are singing.
Come and assemble to offer thanks.
Ready the cargo to be taken,
To the shelter crudely made.

The voice of command has been heard:
Be ready now for a soldierly life.
In walking toward the mountains top,
Unused to this kind of trail,
Breath comes in short gasps.
Old men, be encouraged!
The Six Chiefs and the Old Men
Remember us.”¹¹⁶

The author of this song describes the rift between imagining and inhabiting their alternative future on this Fijian island. “Casting my eyes to the mountain heights” he asks, “What now that I am here?” The permanence and firmness of this place collapses the indeterminacy of multiple, simultaneous futures into a single place. As with Telematua’s voyages, the arrival in each new island is followed by a yearning for something else. Instead of the unstable ground of the atoll, which brings with it

115. Ibid.

116. Kioa settlement song by Asuelu Fakamua, translated into English by Fou Tofinga and edited by Klaus-Friedrich Koch. Sourced from “Logs in the Sea” by Klaus-Friedrich Koch.

an inherent temporality, the author discovers “stable ground” with foreign geographic features. For these Tuvaluans, when an indeterminate future becomes a stable reality, replete with “crudely made” shelter and a “solidierly life,” they look backwards, instead of forwards, to the “Six Chiefs” and “Old Men” from their home atoll.

It is also the stable boundaries of property ownership, introduced by Europeans, which tie the new-Kioans to their Vaitupu past. Prior to Western intervention, the land and seas of the Tuvaluan archipelago operated under collective clan ownership structures, governed by an *aliki* (chief). Hamlets were organized around a central communal space, and the surrounding landscape was co-managed by the clan with each individual performing specific tasks; cultivating taro, gathering coconuts, or harvesting seafood. Christian pastors first designated the gridding of villages, and colonists further promoted the subdivision and privatization of the landscape. Thus, the new arrivals on Kioa were tied to the plots they owned on Vaitupu, even as they began to establish a new life in Kioa. When the Kioans attempted to establish a collective ownership model for their new settlement, the European D.C. Kennedy, and later Fijian authorities (under the purview of the British Crown) saw to it that the entirety of Kioa was subdivided into individually owned plots.¹¹⁷⁷ The ownership of land entangles the Kioan-Tuvaluans to this particular piece of land, ultimately delineating their singular future in Kioa, ever looking back towards Tuvalu.

Nearly seventy years later, Kioans are still yearning for their ‘home’ atoll, although they are now Fijian citizens, and nearly all of the community was born on Fijian soils. Their Tuvaluan-ness even becomes a part of their branding, as evidenced by the island’s home page:

“The Tuvaluans brought with them only their culture, religion, and lifestyle - which have been preserved and are still in tact today. Kioa Island is a Polynesian community in the midst of a Melanesian country. Visiting Kioa will feel like you have left Fiji and traveled approximately 1000 kilometers north to the islands of Tuvalu.”

The post-Tuvaluans of Kioa have ultimately established their identities looking backwards towards Tuvalu, instead of forwards to multiple possible futures. Perhaps, having completed the long, round trip journey from stable islands to unstable atolls and back, they have returned to a determinate vision of future space. Without the risks of instability that atolls face, there is much less indeterminacy against which to position themselves. The future of Kioa, at least in geological terms will look much like today, so within that vacated future spaces occupies a vision of the

117. Koch, Klaus-Friedrich. *Logs in the Current of the Sea: Neli Lifuka's Story of Kioa and the Vaitupu Colonists*. Cambridge, Ma; The Press of the Landgdon Assoiates, 1978.

past. Having set out to find a stable future, and now successfully inhabiting it, the Kioan-Tuvaluans have both fulfilled their historic search for a place with fresh water and high ground, and also negated their traditional models of futurability by eliminating indeterminacy from the equation.

POST-WAR MIGRATIONS

In addition to the Kioa case, the colonial period generally saw an increase of specific forms of mobility. For educated Tuvaluans, government positions brought them to the capital of the Gilbert and Ellice Islands, Tarawa, of Kiribati. However, the dominant form of mobility was for labor, in association with colonial plantation and extraction practices. From colonization to the period of Independence, roughly 800,000 Pacific Islanders and Asians worked under indentured contracts on sites across the Pacific. This included gold mining and plantations in Fiji and PNG, and phosphate mining on Ocean Island and Nauru.¹¹⁸⁸ Tuvaluans were more frequently recruited for the latter, providing one of the nation's early sources of wage incomes and remittances. Of the 26 Tuvaluans I interviewed for this research, 10 were born on or had lived at some point in Kiribati or Nauru.

The process of Tuvaluan independence from British rule began in the 1960s, with the writing of independent constitutions for the two nations of Tuvalu and Kiribati (then, the Ellice Islands and the Gilbert Islands).¹¹⁹ Tuvalu became officially separated from Kiribati in 1974 and officially took on the traditional name of Tuvalu. In 1978 Independence was completed, but it was not until the year 2000 that Tuvalu became a full member of the United Nations. Tuvalu's seat in the United Nations is one of their most powerful assets. As an internationally recognized sovereign nation, Tuvaluan maintains a seat in the UN General Assembly, along with a vote which is as powerful as any other nation's according the UN's democratic 'one nation, one vote' policy. This position gives Tuvalu a powerful voice on an international stage, even though it is one of the world's smallest nations in terms of economy, land area, and GDP. It is this sovereignty that gives the nation access to its huge oceanic territory.

FLUID CULTURAL GEOGRAPHIES

The word for culture in Tuvaluan is *anganu*, which is a composite of the word *anga*, or 'action' and *nu*, or 'island.'¹²⁰ Thus, Tuvaluan culture is closely tied to the geography of the place, and associated behaviors or traditions. Their lives are closely tied to the coconut tree, the coral

118. Shlomowitz, Ralph, and Doug Munro. "The Ocean Island (Banaba) and Nauru labour trade 1900-1940." *Journal de la Société des Océanistes* 94.1 (1992): 103-117.

119. Macdonald, Barrie. *Cinderellas of the empire: towards a history of Kiribati and Tuvalu*. USP, Fiji, 2001.

120. Interviews, Funafuti, Tuvalu. January 2015.

reefs, and an abundance of fish. From the time of the arrival of the first settlers, the sea is an inherent part of being Tuvaluan:

“Traditionally we have been a people who are affiliated with the water in many ways. Our lives, we have been people have been able to harvest from the sea, and I think the fisherman, if he were to go to a large place, it would be very hard for him, to relate to that place.”¹²¹

Traditional Tuvaluan villages operated on the basis of strict hierarchy determined by birth and age. Communities were typically led by the *aliki*, or chiefs, who were determined by ancestry and “were seen to be the shadow of an even mightier and more powerful being whose domain was the whole universe.”¹⁰⁸ Some islands instead had an *ulu*, or king. They were served directly by the *tao aliki*, or assistant chiefs (literally “talking chiefs”), who served as administrators and mediators to the general public. Below the *tao aliki* were the elders, or male heads of each clan. The council of elders were highly respected and had the power to regulate some of the decisions of the *aliki*. Warriors and other men and women, new settlers, and slaves filled the remaining rungs on the social ladder. Within this structure, a person’s place in society was clear, and each family had a specific *pologa*, or task. This operated much like a guild structure, with specific specialties designated and protected by law. *Pologa* were defined as either land-based (such as pulaka farming or coconut production) or water-based (such as fishing for specific types of seafoods). The design and construction of buildings and settlements was also a *pologa*, and each island had a master builder or *tufuga fai fale*.¹²³ This social hierarchy was disrupted first by the arrival of European traders and their introduction of commerce, and further modified by the arrival of Samoan missionaries, who eventually superseded the power of the *aliki*.¹²⁴

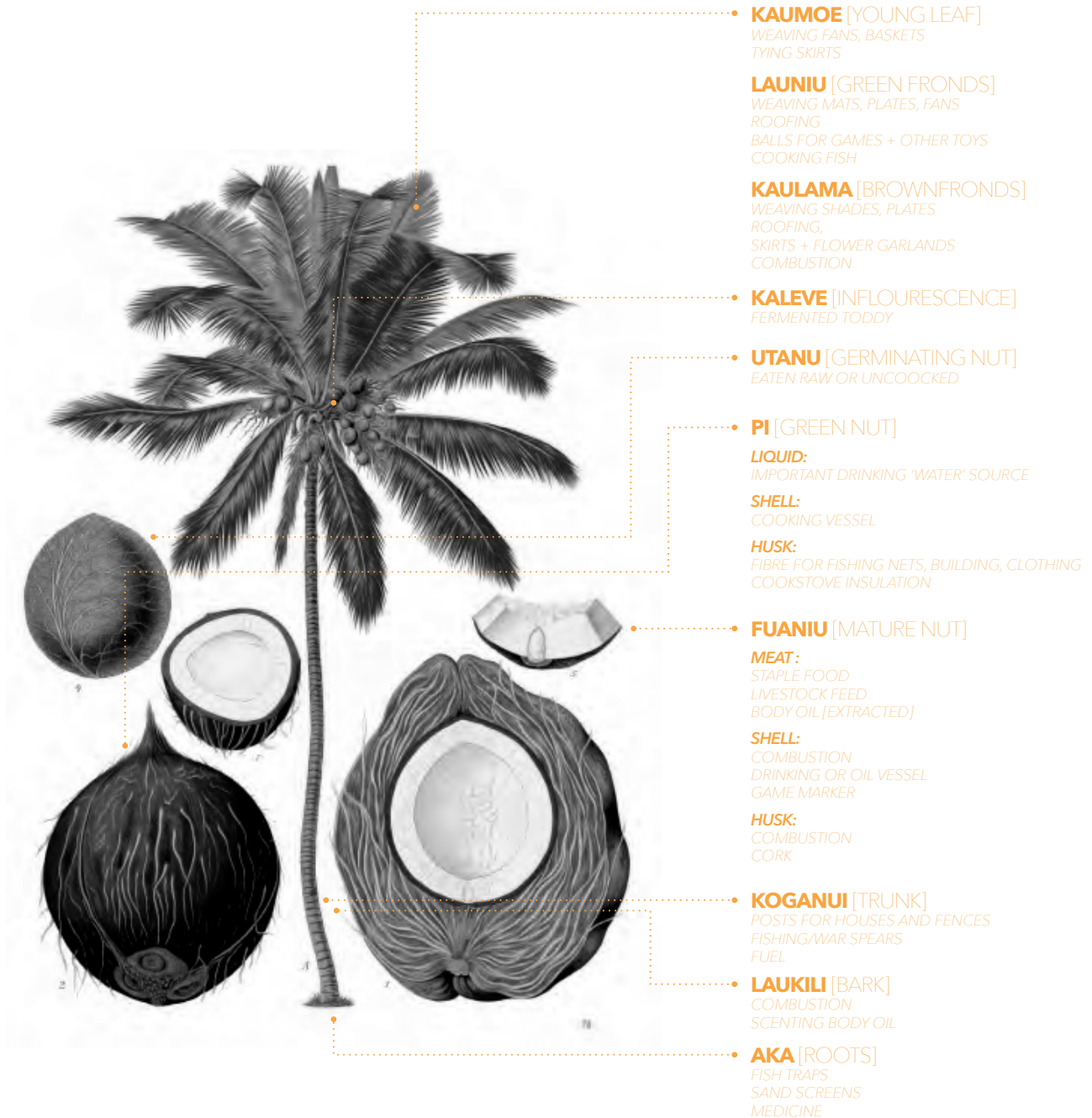
Historically, the population of Tuvalu never rose above 3,000, or around 300 persons per island/village. Thus, smallness is an inherent aspect to traditional Tuvaluan communities. Each family was permitted one boy and one girl, and early missionaries noted practices of abortion or infanticide (though these may have actually been misunderstood ritual sacrifices). The current population on Funafuti alone exceeds 6,000, and population is anticipated to continue to expand. In the larger communities of Vaitupu and Funafuti, traditional family-oriented social structures have been replaced by cash economies and significantly Westernized social hierarchies.

123. Niuatui, Lomiata. *Fakai mo Fale a Tuvalu: The Villages and Buildings of Tuvalu*. Bachelors of Architecture Thesis, Papua New Guinea University of Technology, 1990.

124. Faaniu, Simati, and Hugh Larcy. *Tuvalu: a history*. University of the South Pacific; Suva, Fiji 1983.

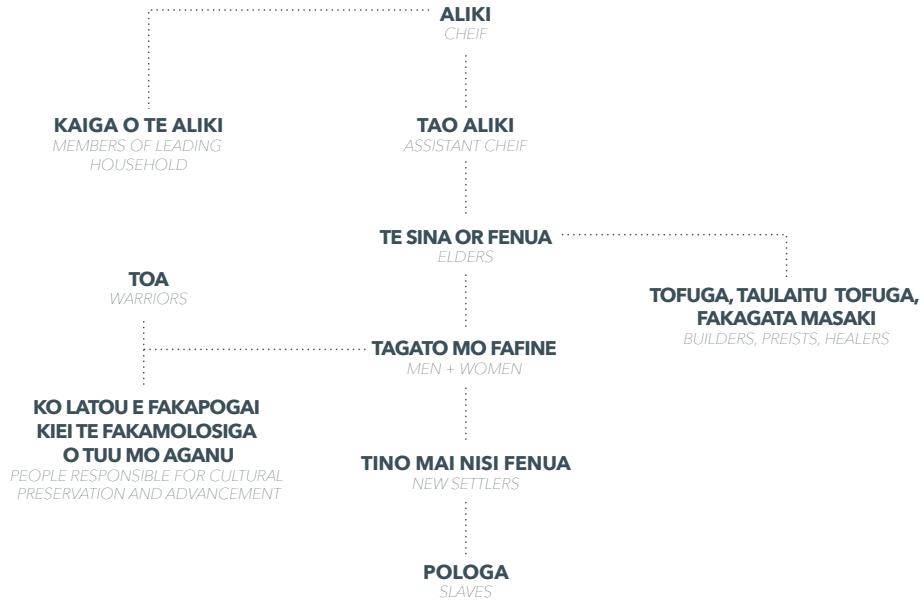
121. *Ibid.*

122. Faaniu, Simati, and Hugh Larcy. *Tuvalu: a history*. University of the South Pacific; Suva, Fiji 1983.



Some uses of the coconut tree in Tuvalu.
Diagram by author. Data adapted from:
*The Material Culture of Tuvalu and Plants
of Tuvalu*

SOCIAL STRUCTURE



VILLAGE STRUCTURE



Local Livelihoods_

Because of a lack of exploitable resources, relative to many other Polynesian nations, Tuvaluan islands remained less affected by the outside world until recent decades. Writing of his time in the outer islands in 1960-61, Gerard Koch noted that “these people are still complete masters of their environment; more of the old way of life is retained on their atolls than on most of the Polynesian islands.” However, upon his return in 1996 he recalls that “Money, which from ancient times had been regarded by the Polynesians as being of little value had acquired greater importance. For many people, ‘business’ has become the important thing in life.”¹²⁵

Even today, many Tuvaluans still practice a subsistence or semi-subsistence lifestyle, particularly on the outer islands; only 1/4 of Tuvalu’s population is incorporated into the formal wage economy.¹²⁶ This subsistence lifestyle historically revolved around fishing, cultivation and gathering. Cultivation is difficult on sandy and often saline soils, so Tuvaluans rely on a limited range of crops: taro, breadfruit, pandanus, bananas, and coconut, alongside proteins derived from the sea. The use of these crops is not restricted to food; for example, “everything has to do with coconut.” The trunk of the coconut tree is used for building structures and is carved down into furniture and fishing spears, fibers are used to make rope, sap is drained to produce alcohol, fronds are used as thatch and in traditional clothing. The fruit itself is used as food or drink through many different phases in its development, extracted oils are used on the skin, and the husk is used as a container and for burning.¹²⁷

These diverse uses of a single tree demonstrate how important local ecology and geography is for the Tuvaluan culture. The limited nature of food sources mean that each one held an important place in the society. However, the ecology of the archipelago is not static; even the coconut tree was imported by the original settlers. In fact, given the nature of their formation, all of the flora and fauna on an atoll are immigrants, arriving by wind, current, wing or boat. However, this influx of species was amplified, first through imported plants during inter-island trade, and further by European contact and colonization. Thus, Tuvaluans have adapted to changing ecosystems, integrating new vegetables such as the thorny yam and Chinese cabbage into their diet and cultivation systems, as well as new forms of existing crops such as ladyfinger bananas.¹²⁸

Opposite, top: Traditional Tuvaluan social structure.

Opposite, bottom: Traditional Tuvalu village structure. *Diagrams by author. Data adapted from: The Material Culture of Tuvalu, and from interviews in Funafuti, January 2015*

127. Koch, Gerd. *The Material Culture of Tuvalu*. Museum fur Volkerkunde Berline, 1961.

128. Thaman, Fihaki & Fong. *Plants of Tuvalu: Lakau mo Mouku o Tuvalu*. Suva, Fiji; The University of the South Pacific, 2012.

125. Koch, Gerd. *Songs of Tuvalu*. Translated from German by Guy Slatter. Institute of Pacific Studies, USP, Suva Fiji; 2000.

126. Thaman, Fihaki & Fong. *Plants of Tuvalu: Lakau mo Mouku o Tuvalu*. Suva, Fiji; The University of the South Pacific, 2012.

Wage Economy_

In spite of these introductions, and typical of atoll nations, Tuvalu has little natural resources with which to produce wealth. The early cash economy of Tuvalu, during British colonization, was based on the trade of copra¹²⁹ and coconut. However, limited land area made this a relatively small scale production. In more recent history income was also generated from domain name .tv and the sale of collectible postage stamps.

Now, most wage earners are employed by the government; of the 3,869 Tuvaluans employed in some capacity, 40% hold government jobs according to the 2007 census. Another 10% are employed as seamen, who contribute \$1-3 million to the economy annually in remittances (based on data from 2000-2007). The public Tuvalu Marine Training Institute on established on Amatuku Motu, Funafuti in 1978 produces more in remittances by seamen than it costs to run.¹³⁰ In Funafuti, 84% of households are supported by wage earners and business owners, while on the outer islands, only half of all households participate in the wage economy, with the rest supported by subsistence lifestyles and remittances. For the 25% of outer islanders supported by remittances, these come from both Funafuti (typically by relatives employed in the Government of Tuvalu) and overseas.¹³¹

Fish remains an important food source for Tuvaluans, and outer islanders in particular rely on fish for their subsistence lifestyles. However, the local fishing industry, primarily tuna and some reef fish, does not contribute to the nation's GDP,¹³² and less than 10% of Tuvaluans rely on the sale of fish or other locally sourced products for income.¹³³

Although local fisheries only catch about 16 tons of tuna per year, valued at USD 36,000, foreign fisheries licensed within Tuvaluan waters were 26,380 tons, valued at USD \$22,600,000. The licensing of foreign fishing within Tuvalu's EEZ is a primary source of government income, valued at USD 3.4 million annually, or 11% of Tuvaluan GDP.¹³⁴ Locals expressed concern that these foreign fisheries were not only exploiting the nation's primary resource at pennies on the dollar, but also concerns about sustainable fishing practices, transmission of invasive species, and illegal non-licensed fishing activities. As Peterson notes, "Pacific island countries have found it tremendously difficult to capture what would appear to be the appropriate level of economic rent from the fishery."¹³⁵ Improved agency for the local fishing industry, and / or improved management of foreign fishing vessels, could provide an important contribution towards Tuvalu's future adaptation, particularly in

131. Tuvalu Central Statistics Division. *Tuvalu Statistics*. <<http://www.spc.int/prism/tuvalu/>>

132. Bell, Johann; Johnson, Johanna & Hobday, Alistair [ed.] *Vulnerability of Tropical Pacific Fisheries and Aquaculture to Climate Change*. Secretariat of the Pacific Community. November 2011.

133. Tuvalu Central Statistics Division. *Tuvalu Statistics*. <<http://www.spc.int/prism/tuvalu/>>

134. Bell, Johann; Johnson, Johanna & Hobday, Alistair [ed.] *Vulnerability of Tropical Pacific Fisheries and Aquaculture to Climate Change*. Secretariat of the Pacific Community. November 2011.

135. Petersen, Elizabeth. "The catch in trading fishing access for foreign aid." *Marine Policy* 27.3 (2003): 219-228.

129. Dried coconut meat used for oil extraction.

130. Connell, John. *Islands at Risk?* Northampton, MA; Edward Elgar Publishing Inc, 2013.

light of predictions that climate change may increase fish stocks within Tuvaluan waters over the next 100 years. While coral-dependent reef fish may decline as temperature increase causes coral bleaching, tuna populations will likely experience significant growth in warming waters. Skipjack tuna in particular is projected to increase 41% under the IPCC's B1 scenario by the year 2100.

Foreign aid and income from the Tuvalu Trust Fund represent Tuvalu's other primary sources of government income. The Tuvalu Trust fund was established at the time of Independence by the UK, Australia, and New Zealand, and was valued at AUD 127.3 million (approx USD 100 million) in 2012.^{136,137} Reliance on foreign aid limits how funds are used, and its agendas may have more to do with the country from which it originates than what is best for Tuvalu. It has been argued that foreign aid from wealthy nations such as Japan is received in exchange for these undervalued access to fisheries; with limited flexibility in terms of how the aid it is used. This in turn limits long term planning for the benefits of the Pacific Island nations.¹³⁸ In general, it is argued that foreign aid is "only partially successful at promoting growth and reducing poverty," partially because it tends to be associated with strategic investment by the donor nations instead of true altruism.¹³⁹ Whether by improved command of fisheries licensing, improved harvest of local fisheries, or other means, it is clear that it is in the best interest of Tuvalu and other dependent island states in the Pacific to develop more independent finance structures.¹⁴⁰

Communal Lifestyle_

Historically, Tuvaluans practiced a communal or collective lifestyle, which helped islanders cope with scarce resources. Work and settlement occurred in family clan groups under chief (*aliki*) leadership alongside a tribal council of elders,¹⁴¹ as described above.

"People have survived because they live together, its a reciprocal type of living.. I give you some coconut and you give me two pigs."¹⁴²

This societal system is evidenced by a lack of materialism; under the process of *falekamolemole* one will part with any possession requested by a fellow clansmen.¹⁴³ Islanders from Funafuti atoll also practice *kaitasi*, or the sharing of properties amongst family members. Instead of dividing parcels over time, the extended family shares rights to the same land.¹⁴⁴

Even in light of modernization, "family relationships, community spirit, and community solidarity still play a considerable role"¹⁴⁵ in Tuvalu-

136. "Agreement Concerning an International Trust Fund for Tuvalu". 2008 Revised Edition CAP 4.22.1. 2008.

137. Kevin Petrini, Marilyn Simmons, Silvia Irawan, Alex Heikens (2012). "Case Study Report: Tuvalu Trust Fund". UNDP.

138. Petersen, Elizabeth. "The catch in trading fishing access for foreign aid." *Marine Policy* 27.3 (2003): 219-228.

139. Alesina, Alberto, and David Dollar. "Who gives foreign aid to whom and why?." *Journal of economic growth* 5.1 (2000): 33-63.

140. The design proposals for Scenario B explore this in further detail; refer to pages 244-287

141. Koch, Gerd. *The Material Culture of Tuvalu*. Museum fur Volkerkunde Berline, 1961.

142. Interviews, Funafuti, Tuvalu, January 2015.

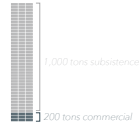
143. Koch, Gerd. *The Material Culture of Tuvalu*. Museum fur Volkerkunde Berline, 1961.

144. Interviews, Funafuti, Tuvalu, January 2015.

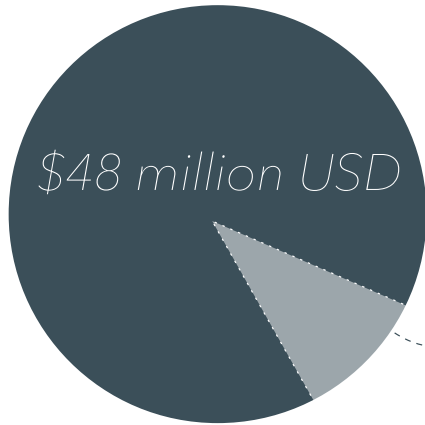
145. Koch, Gerd. *The Material Culture of Tuvalu*. Museum fur Volkerkunde Berline, 1961.



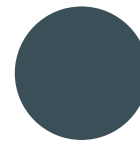
FOREIGN FISHERIES VOLUME 60,000 tons/year [primarily tuna]



TUVALU FISHERIES VOLUME
1,200 tons/year [pelagic and tuna]



FOREIGN CATCH VALUE 48 million USD

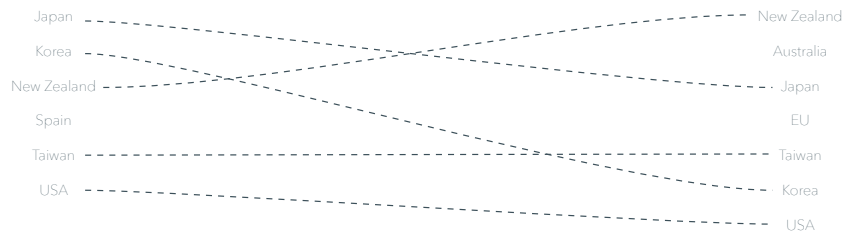


*\$6 million USD
in licensing to Tuvalu*



*\$36,000 USD
commercial catch*

TUVALUAN CATCH VALUE 200,00 USD (80% subsistence)
TUVALUAN LICENSING VALUE 6 million USD (tripled since 2006)



FOREIGN FISHING NATIONS 2008

NATIONS SUPPLYING AID TO TUVALU

Tuvaluan Fisheries data: Tuvalu has ownership of hundreds of millions of dollars of Tuna within its EEZ but harvests little of this value. Instead, it sells cheap fishing licenses in exchange for foreign aid.

an life. Many Tuvaluans interviewed identified ‘communal lifestyles’ as a defining aspect of Tuvaluan society. However, there has been a definitive shift from the collectivist model to a capitalist one, which aligns with concerns about ‘modernization’ discussed in the previous section.

“Before, if a family killed a big, or got enough fish, they distribute it, they share it with their neighbors. But nowadays, when some receives a bunch of fish they won’t share it. They will sell it to the neighbors because they need the money now.”¹⁴⁶

Collectivism is a model which helped Tuvaluans deal with resource scarcity and uncertainty, and aspects of this model may play an important role in shaping an alternative future for Tuvalu. This lifestyle is tied to the unique geography of the place, where smallness has been made necessary by the carrying capacity of the atolls and due to the scale of settlements individual accountability for actions remains significant. This model of collectivism, based on a sharing logic known as *kaitasi*, suggests the possibilities of developing models of alternative Tuvalu-modernities that embed these logics, allowing the nation to accept change while also holding true to important social and cultural legacies.

Islandness_

Fenua, or identification with a particular place or island, is multiscale for Tuvaluans; it is important to the identity of Tuvaluans as related to their particular home island, but also ties them together as a sovereign nation. For example, a Nanumean on Funafuti might identify as “Nanafuti”, while a Tuvaluan residing in the Solomon islands might identify as “Solovalu.”¹⁴⁷ Individuals may identify more strongly with their home islands than with Tuvalu as a nation; “in Tuvalu the spirit of islandism is very strong.”¹⁴⁸ After all, Tuvalu’s national identity was established more by colonial imposition than by the desire of its citizens to identify as a nation-state.

The differences between islands may not be significant to outsiders, but are very important from the perspective of Tuvaluans; as one interviewee noted, “I wouldn’t know about about an outsider coming into Tuvalu if she can find any difference, but we can.” Many of these differences have to do with traditions that have been handed down from generation to generation, and are associated with forms of crafts, building, social practices, and celebrations.¹⁴⁹ As one interviewee, a middle-aged government official on Funafuti noted,

146. Ibid.

147. Stratford, Elaine, Carol Farbotko, and Heather Lazrus. “Tuvalu, sovereignty and climate change: considering Fenua, the archipelago and emigration.” (2013): 67.

148. Interviews, Funafuti, Tuvalu, January 2015.

149. Ibid.

“In Tuvalu the spirit of islandism is very strong.. In terms of each island, each has its own unique identity, accent, when someone talks you know that that person comes from that island. Even the way that they behave... Each island has its own specific and unique traditional knowledge.”¹⁵⁰

The interviewee went on to list specific differences in ways of speaking, styles of dancing and singing, weaving of mats and garlands, construction of canoes, forms of traditional medicine, and traditions associated with wedding ceremonies. In addition to these differences stylized by generations of semi-independent development on each of the islands, today the most visible difference is between the “modernized” or “urban” capital of Funafuti, and the “rural” outer islands.

“On the outer islands, people survive on subsistence farming and fishing. They still have resources. But its limited, its really hard, not like in the past.”¹⁵¹

As has been discussed above, the extreme inaccessibility of these outer islands disconnects them from the developments occurring in Funafuti, with distance from the capital serving as proxy for the level of modernization; nearby atolls such as Vaitupu have the most developed wage economies and infrastructure. While access to new technologies, jobs and communication system is one reason for these changes, another is spatial. As noted in the quote above, Funafuti’s high level of population density make many traditional subsistence practices impossible; space for taro and other subsistence agriculture is severely limited or eliminated, and is further problematized by issues of pollution and saltwater infiltration. Thus, modernization becomes a self-fulfilling prophesy as growing populations can only be supported by imported foodstuffs and building materials.

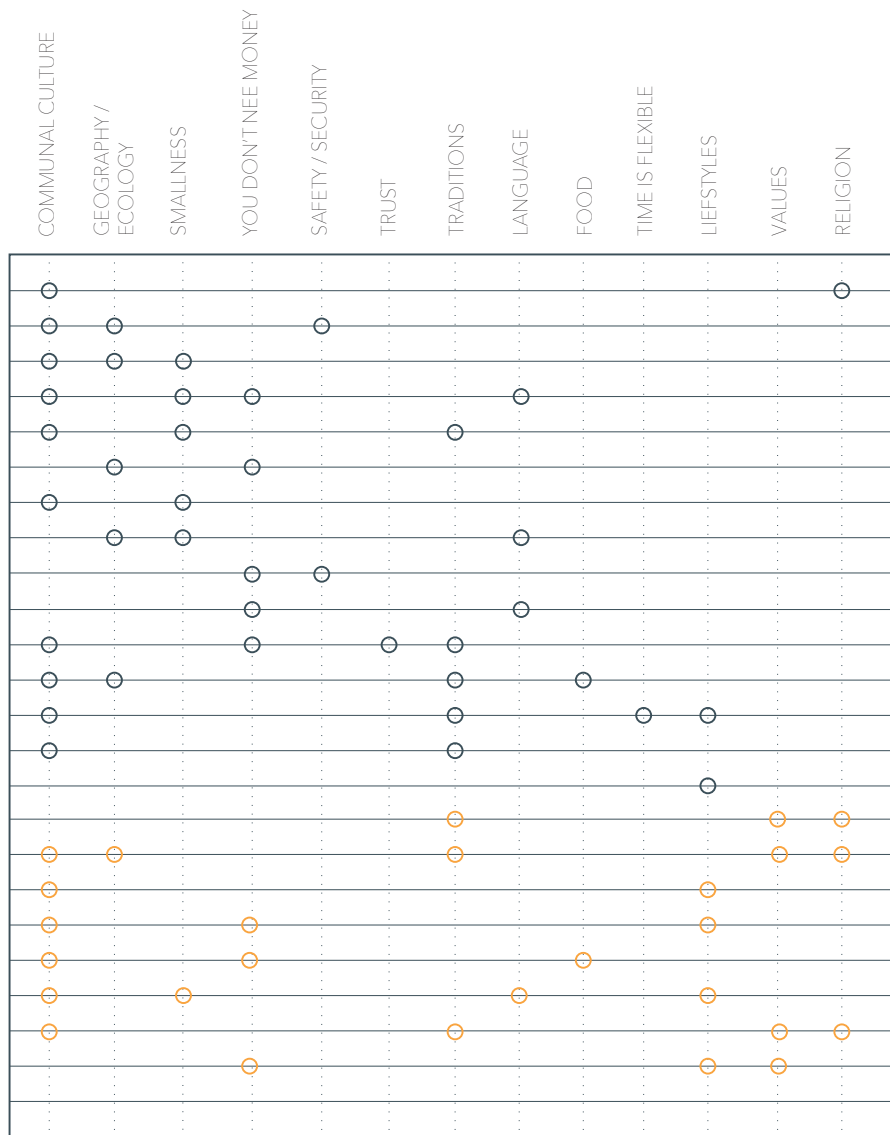
TRANSFORMABLE ARCHITECTURE

Traditional Tuvaluan architecture and settlements were characterized by transformability and mobility that allow for their inhabitants to adapt to the fragile atoll ecosystems they inhabit. The traditional Tuvaluan house is a post and beam construction with a thatched roof and coral-rock foundation, and range in size from 2.5m x 5m to 5m x 10m. Supporting posts are created by the trunk of the coconut or pandanus, and secondary ribs are created using the pandanus branch. Structural work was typically done by men, while women managed the thatching. Thatch is typically made from pandanus leaves, folded over the spine of a coconut leaf and stitched together with coconut twine. Thicker coconut fiber twine is also used to lash together posts and beams. Steep roof

150. Ibid

151. Ibid.

WHAT MAKES TUVALU UNIQUE?



Interview responses to the question "What makes Tuvalu unique?" Responses were similar across interviewees, with most revolving around the small geography and community of the island/archipelago. *Source: Diagram and data produced by author, based on interviews in Funafuti, Tuvalu January 2015.*

slopes allowed for rain to be shed easily, and helped to prevent thatch from rotting or molding. All structures, excepting chicken houses, were built without walls to allow for maximum ventilation; in older styles of houses the eaves reached near to the ground to keep out rain. In newer house styles with higher eaves, mats woven from coconut palms are used to keep out wind and rain. These demountable wall mats allow for buildings to adapt to changing weather conditions. Variations in this general system occur by both use and island.¹⁵² The roofs of traditional houses were also demountable:

“When the cyclone comes, [for traditional homes] they’ll just take off the roof, put it down, use the leeward side as the entrance, for shelter, and then they wait for, say, 2 days, the cyclone goes, and they go back and put in on top and they are back to business as usual. But now the corrugated iron roof, if it flies away, you have no money to pay for a new one.”¹⁵³

152. Koch, Gerd. *The Material Culture of Tuvalu*. Museum für Volkerkunde Berlin, 1961.

153. Interviews, Funafuti, Tuvalu, January 2015.

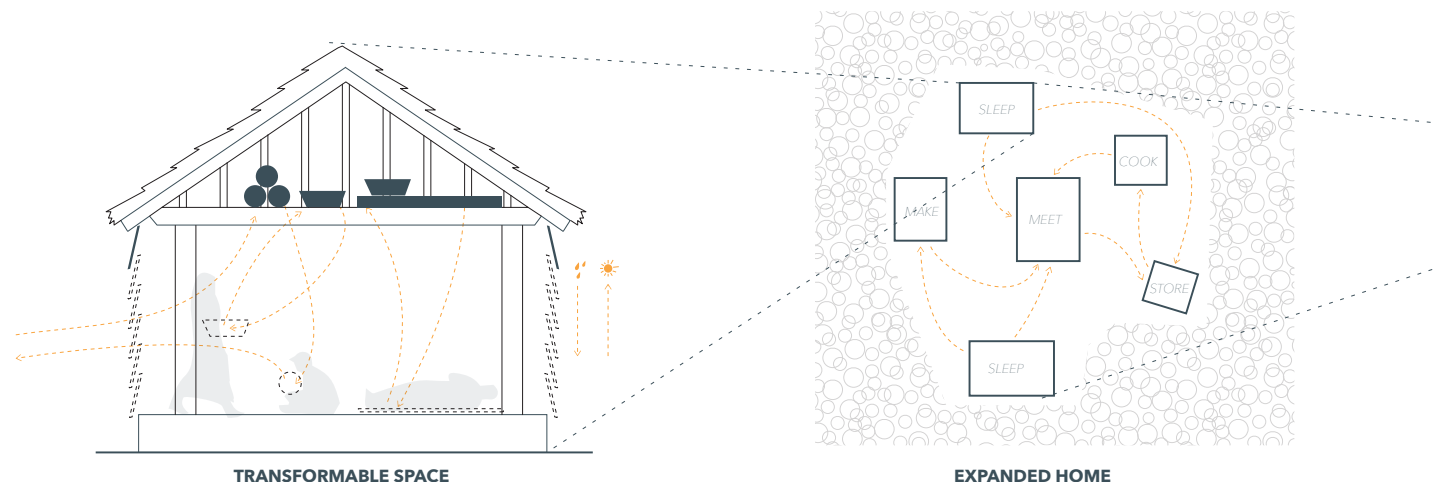
154. Niuatui, Lomiata. *Fakai mo Fale a Tuvalu: The Villages and Buildings of Tuvalu*. Bachelors of Architecture Thesis, Papua New Guinea University of Technology, 1990.

This feature is especially notable in relationship to modern houses with iron roofs that blow off easily in storms and become dangerous projectiles in the process.

Within the buildings furniture was minimal. Sleeping houses (*fale moe*) were typically equipped with mats for sitting and sleeping, and baskets hung from the rafters were used to store food.¹⁵⁴ In this way, each structure was also transformable: the deployment of different objects on the floor surface allowed for the space to be programmatically transformed.

Below: Tuvalu’s mobile models of architecture and settlement.
Source: Drawing by author

Master builders (*tufuga fai fale*) created special and even new building typologies. The *fale poutasi*, a house structure unique to the atoll of Niutao, was supported by a single post at the center, which allowed for



the structure to rotate. Built for significant persons such as the eldest son or daughter, they were rotated by two men in order to allow for maximum cross-ventilation on hot days, adapting the structure to temperature and wind direction.¹⁵⁵

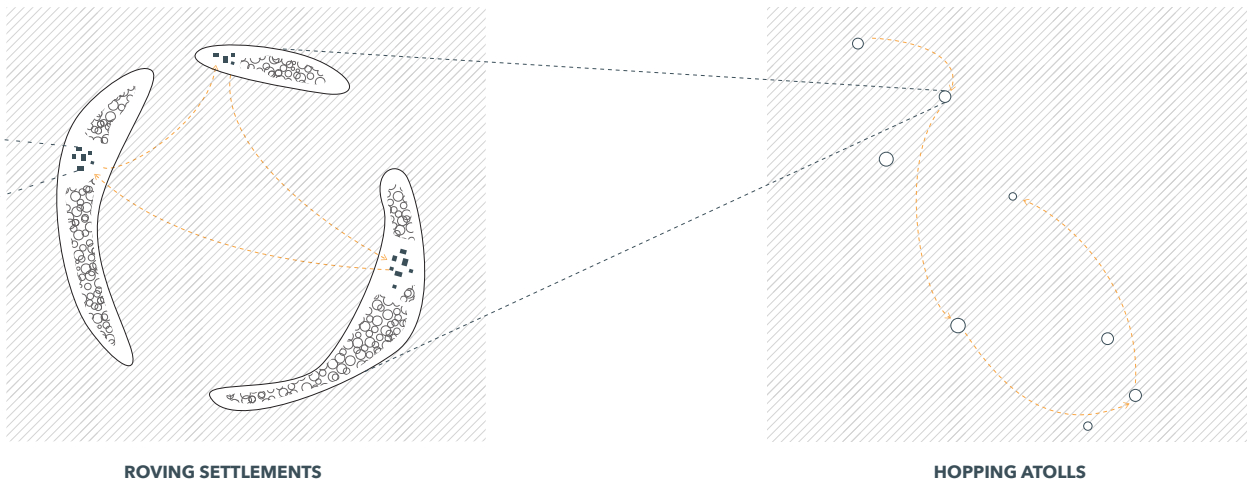
Interviewees generally expressed a preference for the sorts of spaces associated with traditional structures: ventilated spaces, open verandas¹⁵⁶, and wall-less architecture. One resident noted “We are like nomads... We don’t want to be enclosed in something.”¹⁵⁷ However, the transition to ‘modern’ or ‘western’ houses is highly visible, particularly on Funafuti. These are wood frame or CMU structures of one or two stories. The most minimal are single-room buildings with thorough cross-ventilation, and the largest and most luxurious might not be out of place in globalized suburbia. The displeasure with ‘western’ houses can be traced back to their inflexibility; these buildings are not built for their environment, and do not adapt or transform.

Although the cultural status of Western housing plays a large role in its prevalence in Funafuti and all of the atolls, Funafuti in particular also owes its housing and layout to two separate catastrophes: bombing during WWII occupation which flattened the Funafuti settlement in 1942, and Cyclone Bebe in 1972 which destroyed 90% of the atoll’s housing. Following both events, the village was reconstructed by the occupying forces or international aid in low quality wood-framed, tin-roofed housing. It is possible that had Funafuti been constructed in traditional structures with demountable roofs, the damages of Bebe might have been less catastrophic.

155. Koch, Gerd. *The Material Culture of Tuvalu*. Museum für Volkerkunde Berlin, 1961.

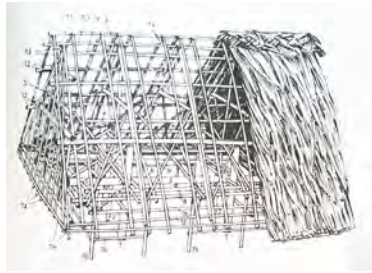
156. Interviews, Funafuti, Tuvalu, January 2015.

157. *Ibid.*





'fale fakatuagata' style of house. Source: Gerd Koch, *Material Culture of Tuvalu*



'Taufatafenua' style of sleeping house. Source: Gerd Koch, *Material Culture of Tuvalu*

159. Koch, Gerd. *The Material Culture of Tuvalu*. Museum für Volkerkunde Berlin, 1961.

158. Interviews, Funafuti, Tuvalu, January 2015.

Advantages of 'modern' housing include the use of the tin roof for rain-water collection, and the ease of purchasing and constructing with imported materials. Traditional methods, in spite of their benefits, take significant time and labor. Also, when housing is provided through international aid, they send tin and plywood, not coconut posts and pandanus thatch. However, these structures have terrible thermal performance, collecting solar energy throughout the day and radiating it out into the already stifling night. Ventilation is typically not designed for and tends to be poor, so the only way to maintain a comfortable temperature is through air conditioning. New buildings lack the environmental adaptability of their predecessors.

In both models construction happens on a semi-informal basis. Historically there were master builders, and presently there are a handful of construction companies, but in general the individual participates in the construction of their home:

“As you mentioned, you are an architect, but here in Tuvalu when you build a house you don't need a special architect or engineer to build a house. You build your own house. Especially in the outer islands.”¹⁵⁸

As the master builder (along with many other traditional practices) has faded as a societal role, there is now little design expertise in the construction of housing that would help reconcile the benefits and problems of these two styles of buildings. Building construction models are in serious need of reconsideration, as many of the interviewees acknowledged.

MOBILE SETTLEMENTS

Prior to European influence there were no villages but rather small hamlets based on family clans. These consisted of communal houses, a lifted kitchen hut or *baba*, a store house, and a canoe house.¹⁵⁹ These structures were organized around an open space, or *maneapa* (although the term for the community hall). Throughout the course of the day, people moved between structures for different activities: from the sleep shelter, to the kitchen hut, to an eating platform, out into the bush, to the storehouse, etc. Not only were these hamlets loose aggregations that encouraged movement, but the settlements themselves were mobile:

“At times, to allow the coconuts to grow up and to give the fishing grounds a rest, the permanent village is temporarily abandoned, and the whole tribe move to another locality. Several duplicate villages are built about the lagoon, perfect sometimes even to the chapel and court house,

wherein each family owns a residence, and to which they periodically move to enjoy a change of air and scene.”¹⁶⁰

Original hamlets were surrounded by the “bush,” where coconuts, pandanus, and bananas were cultivated and collected. Hamlets were connected by informal footpaths. Pulaka pits were at the center of the atoll land mass, in order to protect them from saline infiltration and overwash. These were much more intensely cultivated, with organic matter built up over time in order to create a nutrient-rich environment for this root vegetable. Beyond, the ocean and lagoon serve as an extension of living space, used for bathing, recreation, and fishing.¹⁶¹ Settlements were sited based on access to fishing grounds, in areas protected from reef waves and wind. This was typically the Western side of the island, protected from the Easterly winds. While this meant that the location was not optimally suited for cooling breezes, the open buildings structure and shading breadfruit trees prevented some of the environmental issues faced by structures today.¹⁶²

The early Samoan pastors encouraged a shift into a village structure, which allowed them to keep a closer watch over the inhabitants.¹⁶³ As settlements densified into villages with European influences, this *maneapa* remained, as did references to traditional social hierarchies (discussed above). Village centers were organized around this open space, with the homes of the *aliki* (chiefs) and their extended family located at the corners. In between lived the men and women of the village, with the *faulekaupule*, or building for the village government, on one side. As the influence of Europeans expanded, many villages were constructed in a gridiron pattern; this is best exemplified by Vaitupu, which has the largest population second to Funafuti but has not experienced Funafuti’s rapid (and disruptive) population influx. As Samoan pastors replaced traditional hamlets with gridded villages, they also encouraged the destruction of existing buildings and rebuilding of Samoan style architecture with raised platforms.¹⁶⁴ Today, each atoll consists of one, or occasionally two, settlements. Technically, Funafuti is composed of 4 separate villages, although the capital settlement has merged into a single linear village the length of the Fongafale islet, and Funafale remains a distinct, much smaller settlement on the atoll’s southernmost islet.

In the capital settlement today, a lack of planning is evident, largely due to the uncontrolled migration and overcrowding discussed in more detail in the following section. There exists little, if any, regulation of the built environment, and though a building code was produced for Tuvalu by the Australian government in 1990 it is not well adapted to local conditions and practices, and it is not followed. Due to this reg-

160. Hedley, Charles, 1896. General account of the Atoll of Funafuti. I. General account. Australian Museum Memoir 3(2): 1–72. [21 December 1896]

161. Interview with Alan, Funafuti, Tuvalu, January 2015.

162. Niuatui, Lomiata. *Fakai mo Fale a Tuvalu: The Villages and Buildings of Tuvalu*. Bachelors of Architecture Thesis, Papua New Guinea University of Technology, 1990.

163. Ibid.

164. Interview with local architect, Funafuti, Tuvalu, January 2015.



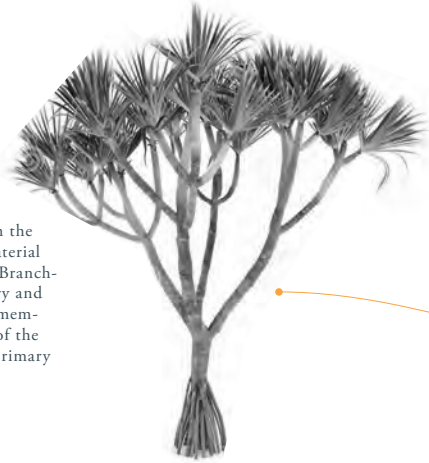


Dispersed settlement at the Northern end of Fongfale Islet, Funafuti. As the capital becomes more dense, these rural edge zones become increasingly settled in spite of their tenuous relationship to rising tides.

Opposite: Vaitupu *maneapa* (community hall), Funafuti atoll. This structure combines traditional thatching and framing with a modern concrete base.

Pandanus fronds form the primary thatching material for Tuvaluan houses. Branches are used for primary and secondary structural members. Forked trunks of the pandanus forms the primary posts or 'king posts'.

PANDANUS TREE

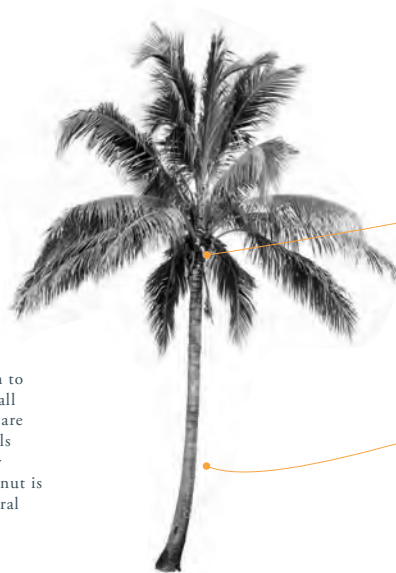


Thatching for the maneapa roof is supplied by the female members of the community. Pandanus fronds are flattened, dried, and folded over the spine of a coconut frond. Coconut fiber is then used to stitch the thatch together. Thatch panels are then layered on to the roof structure. Laying of the final thatch panel is an honor reserved for the *aliki* of the community. Women similarly

THATCHING

Coconut fronds are woven to form sleeping mats and wall coverings. Coconut fibers are used to stitch thatch panels together and lash together structural members. Coconut is sometimes used as structural

COCONUT TREE

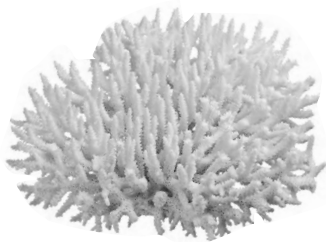


Building posts are often re-used over many generations. The primary posts are cured in the ocean, and are the first part of the maneapa that is built to allow natural settlement into the ground over tie. Natural forks and bends are made integral to the structure, providing supports and truss-like frameworks. Multiple interior posts that result from the large roof spans of the maneapa are integral to the culture; leaders and elders are given the privilege of leaning against posts. Men are typically responsible for preparation of logs and framing of the structure.

FRAMING

Coral rock, which washes ashore on oceanward beaches, is collected to form raised foundations for traditional sleeping houses and maneapa

CORAL ROCK

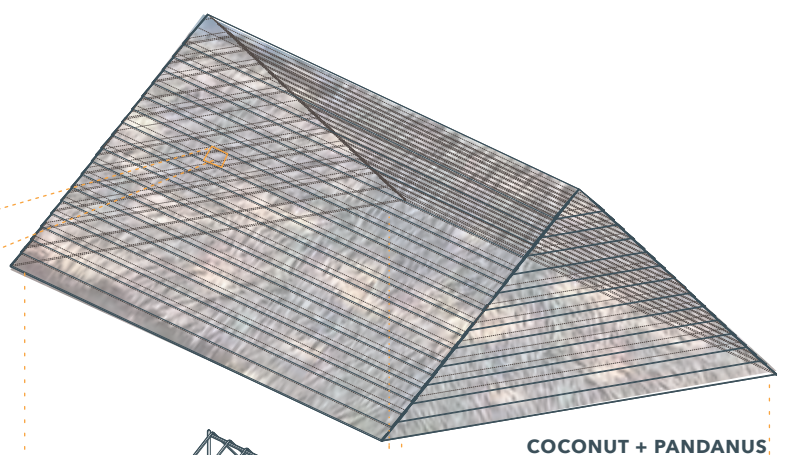
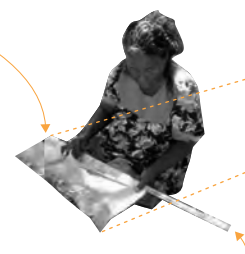


The laying of the foundation occurs after the primary roof structure has completed. This job is also typically completed by men, who lay large and flat coral stones around the perimeter as a foundation wall to a level of .2M below grade. , outside of the primary columns.

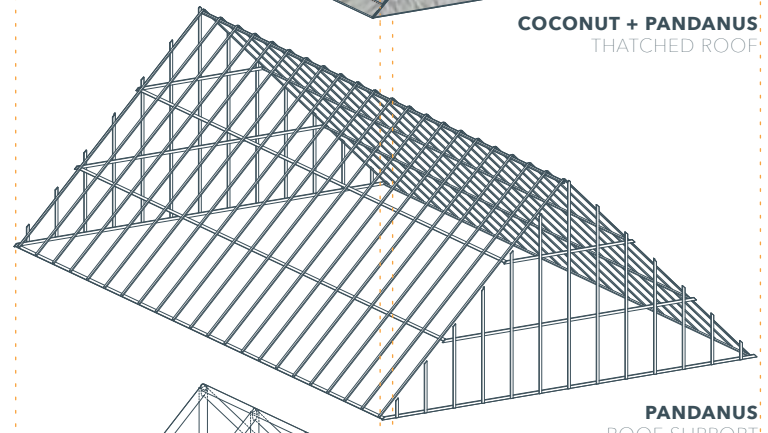
LAYING



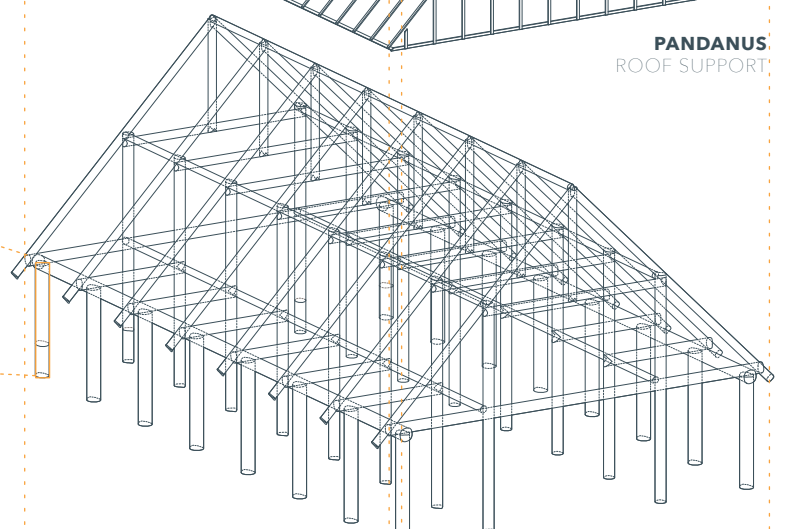
Community construction of the maneapa. Drawing by Author, based on data from Gerd Koch and interviews



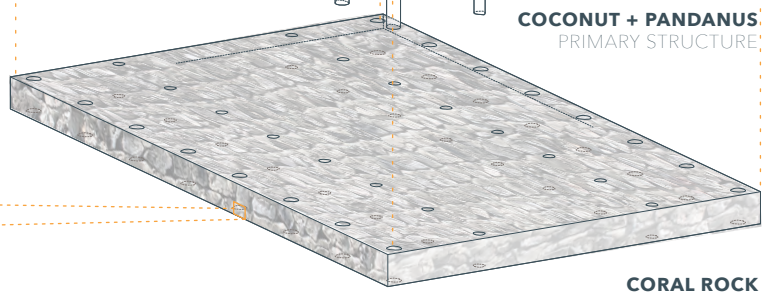
COCONUT + PANDANUS
THATCHED ROOF



PANDANUS
ROOF SUPPORT



COCONUT + PANDANUS
PRIMARY STRUCTURE



CORAL ROCK
RAISED FOUNDATION



ulatory vacuum and migratory pressures, housing structures and water tanks fill nearly all available land. Many homes don't have road access, having been built in the backyard of a brother or cousin. Many Funafuti residents expressed concern over this poor use of the land:

“If we don't manage the space properly, [on] the land that we have, then overcrowding will come to be a bigger problem.”

“If I was to change one thing I think I would just change the way they locate houses. How they make space for houses. Because right now its too crowded in one place. Houses everywhere. Or maybe make, how they store water, you know we store water everywhere, so if we had a building code that make everybody have a water system underground, and the house is on top.”

While improved land use and building code is only one small aspect of future concerns for Tuvalu, advocacy for its improvement is well-supported. However, what kind of settlement guidelines might be enforced is unclear, as both the traditional and colonial models no longer fit the current situation. New forms of settlement which accommodate both traditional knowledge and globalizing identities might be hybrids of both method and material.¹⁶⁵

165. This is an agenda explored by the proposal for 'culture seeds'; see pages 216 - 237

CONTEMPORARY MOBILITY: NEW TUVALUAN FUTURES

Today's Tuvalu remains a mobile culture, but instead of being bound by navigational ability, mobility is restricted by territorial boundaries and immigration requirements. Although they now are able to participate in a global economy (the majority of Tuvaluans have wi-fi access), “on the whole people are less free to migrate now than they were 100 years ago.”¹⁶⁶ While historically migration was seen as an extension of the present, a substitution of a better version of the same landscape, for modern Tuvaluans migration is a form of progress. Migration is a determination of status, of access to employment and education, and an engagement of the outside world. This desire is also evidenced by internal migration; Tuvaluans are flocking from the outer islands which are subsistence oriented in search of jobs and progress in the capital of Funafuti, resulting in massive overcrowding and unemployment. Funafuti's population has grown from less than 1,000 people before independence to more than 6,000 today.¹⁶⁷

166. King, Russell. “Theories and Typologies of Migration.” Willy Brandt Series of Working Papers in International Migration and Ethnic Relations. Malmö University: 2012.

167. Tuvalu Central Statistics Division

Tuvalu has become an international symbol of the risks associated with climate change. At only a few meters above sea level, Tuvalu is extremely vulnerable to rising tides and storm surges; this was made very clear

on March 14th 2015, when Hurricane Pam 500 miles away caused severe flooding on the outer islands, displacing 45% of Tuvalu's inhabitants. Because there is no high ground for Tuvaluans to retreat to, it is not true for Tuvaluan as it might be in other nations that its "people are affected by natural catastrophes, but they could have moved away from the area or taken out insurance."¹⁶⁸ While in the past Tuvaluans might have done just this, now their unstable future framework runs up against the hard political boundaries of the contemporary nation state. Western systems of determinism and subdivided space have entrapped Tuvaluans on a sinking ship.

Now tied to and self-identified with a specific landmass which is inherently unstable, with or without the risks of climate change, Tuvaluans struggle with the binary discourses of migration and mitigation. Westernized worldviews clash with the traditions and geography of Tuvalu. While past leaders have explored resettlement strategies similar to Kioa¹⁶⁹ or pressed adjacent high-island nations for improved immigration policies, the present Prime Minister has attempted to frame stability and permanence as key to the ongoing survival of Tuvaluan lifestyles:

"I am here at this important meeting as the highest representative of the people of Tuvalu. I carry a huge burden and responsibility. I carry their hopes that there will be a future for Tuvalu. This is an enormous burden to carry. It keeps me awake at night. No national leader in the history of humanity has ever faced this question. Will we survive or will we disappear under the sea? I ask you all to think what it is like to be in my shoes. Stop and pause for a moment. If you were faced with the threat of the disappearance of your nation, what would you do? I ask you to pause and ask yourself, what would you do?"¹⁷⁰

Prime Minister Sopoaga asks us to "pause for a moment," calling for a cessation of progress in order to process the conflicting future world views which Tuvalu now inhabits. He requests a certain kind of temporal understanding to be set aside or reexamined, seeking to reconcile past and present models of the future, and seeking to reconcile Tuvaluan future time with other future times. However, he seems to have lost connection to the past futures of his own peoples, early atoll dwellers who constantly asked "will we disappear under the sea?" and responded by mobilizing to find secure ground elsewhere.

Climate change discourse, including that regarding Tuvalu, is organized around the concept of risk, "a form for present descriptions of the future under the viewpoint that one can decide, with regard to risks,

169. See page 85-89

170. Statement Presented by Prime Minister of Tuvalu, Honourable Enele Sosene Sopoaga at the 20th Conference of Parties to the UN Framework Convention on Climate Change, December 2014, Lima, Peru

168. Luhmann, Niklas. "Describing the Future" from *Observations on Modernity*. Stanford: Stanford University Press, 1998.

one or the other alternative.”¹⁷¹ However, they are “in the position of a tourist who is planning a journey with the help of a guidebook that is already out of date.”¹⁷² While past models of migration operated on an indeterminate system, the framework was cyclical in nature; voyage, settle, repeat. There is no ‘guidebook’ for modern migration at a national scale, no existing frameworks upon which to model what this kind of future might be like. Even if one can decide which ‘alternative’ future is right for Tuvalu, the contents of that future remain un-graspable.

So, although Tuvalu has again entered into a state with multiple simultaneous possible futures, their profound newness represents a sharp break with past future ideologies. Tuvaluans are entering into, and already beginning to inhabit, a state of future shock: “Unleashing the forces of novelty, we slam men up against the non-routine, the unpredicted... transience and novelty are an explosive mix.”¹⁷³ Tuvaluans must inevitably break from the past in order to survive; it is no longer possible to stake out a vacant Pacific island. However, within this “explosive mix” of “transience and novelty,” there is perhaps space to determine conceptions of the future which relate to Tuvaluan identities while dealing with the contemporary moment, instead of absorbing Western models of futurability. In the context of future shock, “the individual needs new principles for planning his life,”¹⁷⁴ ones which reconcile Tuvaluan instability with a globalized world.

THE TUVALUAN DIASPORA

In spite of of geopolitical limitations, and the relative impotency of the Tuvaluan passport,¹⁷⁵ Tuvaluans have managed to migrate temporarily or permanently around the region. In 2013, 1,580 Tuvaluan citizens had migrated to New Zealand, 1,046 to Kiribati, and nearly 1,000 more to Australia, Nauru, and the Russian Federation.¹⁷⁶ With Tuvalu’s overall population at just over 11,000, this means a huge proportion have been able to successfully migrate, some temporarily for work or education, and others to settle down permanently. This data does not include people who are ethnically Tuvaluan that have been born or naturalized elsewhere.

Equally dramatic is the rate of internal migration from outer islands to the capital settlement on Funafuti atoll. Over half of all Tuvaluans now reside in Funafuti, having quintupled from under 1,000 at the time of Independence, 40 years ago. As of the 2012 provisional census, 6,194 people resided in Funafuti in under 1 square mile of land area. This puts the population density at 6,700/sq mi, greater than the city of Chicago. If the islets around the Western edge of the atoll conserved for ecological preservation were excluded from the calculation, the density would

171. Luhmann, Niklas. “Describing the Future” from *Observations on Modernity*. Stanford: Stanford University Press, 1998.

172. De Jouvenel, Bertrand. “Introduction” and “Part I” from *The Art of Conjecture*. New York: Basic Books, 1967.

173. Toffler, Alvin. “The Death of Permanence,” “The Scientific Trajectory,” and “Coping with Tomorrow” from *Future Shock*. New York: Random House, 1970

174. *Ibid.*

175. The Tuvaluan passport was recently ranked 56 out of 81, below Botswana, Kenya, and Sierra Leone, in the recently published *Passport Index* (passportindex.org) based on

176. UNICEF. *Migration Profiles*. “Tuvalu,” 2013

be even greater. Outer islands have half again as many households per capita relative to Funafuti meaning that significantly more people live in each home in the overcrowded capital, and many are forced to construct informal housing. During my 2015 visit I observed numerous shanties constructed from scrap materials surrounding the trash-infested burrow pits.

Migration from outer islands to capital settlements is part of a larger phenomenon in the region, a form of rural-urban migration. Following the creation of a centrally managed government during Independence, along with the lifting of colonial-era travel restrictions, resulted in migrations towards the opportunity for wage employment and a growing cash economy. Capital migration “may be compounded by ‘urban bias,’ where financial and technical resources are overwhelmingly concentrated in the urban area.”¹⁷⁷ In addition to causing overcrowding in the capital, it has also resulted in draining the populations of the outer islands, particularly of young men and women. This leaves outer islands populated primarily by children and the elderly. However, children also temporarily migrate to other island for education. All children are provided a primary education on their home island, but those who are accepted into the only secondary school at Motufoua on Vaitupu atoll room and board there during the academic term.

There are many reasons Tuvaluans who migrate beyond their home nation, but most have to do initially with access to work and education, though climate change is increasingly a factor. Since Tuvalu offers no post-secondary education aside from the Tuvalu Maritime Training Institute, anyone interested in a subsequent degree must temporarily migrate. Many attend the University of the South Pacific in Fiji, or travel on scholarship to Australia, New Zealand, Hawaii, Samoa, or Papua New Guinea. Some parents will also take their children abroad for their secondary education if they are not accepted at Motufoa, or if they receive a secondary education scholarship. Often, education abroad is a launching point for more permanent settlement as educational migrants find work, seeking permanent resident status, or marry locally.¹⁷⁸ Work is also often a motive for temporary migration. As discussed above, Tuvalu’s wage economy is minimal, and so those seeking paid employment often must look beyond their small archipelago. In addition to seafaring,¹⁷⁹ another common form of transnational employment is seasonal working schemes with Australia and New Zealand, typically in the agricultural sector.

New Zealand is the dominant migration site for Tuvaluans, as the largest and wealthiest nation in the region (excluding Australia), and also

177. Connell, John. “Population, migration, and problems of atoll development in the South Pacific.” *Pacific Studies* 9.2 (1986): 41-58.

178. Interviews, Tuvalu and New Zealand, January and June 2015.

179. See subsection on ‘Fluid Cultural Geography’, page 89

due to favorable migration policies. The establishment of a Tuvaluan community in Auckland began following Tuvaluan Independence, when there were no regulations blocking Tuvaluans from settling in New Zealand. People who settled during the 1980s and early 1990s were grandfathered in as permanent residents.¹⁸⁰ Today, 27% of Tuvaluans by ethnicity reside in New Zealand.¹⁸¹ Predominantly these Tuvaluans reside in Auckland, New Zealand's largest city and a burgeoning multicultural metropolis at 1.37 million people. However, a growing contingent reside in Wellington, anchored by the recently relocated Tuvaluan High Commission, or are scattered across the rest of the country.

Many of the Tuvaluans I had interviewed had initially arrived in New Zealand as seasonal workers or educational migrants. New Zealand also accepts 75 Tuvaluans by lottery each year as part of the "Pacific Access Category," or PAC program.¹⁸² Tuvaluans who have arrived in New Zealand also attract family members, and migration to join family provides an additional route for legal migration. Many Tuvaluans who have arrived in New Zealand by the above means apply for permanent resident status, and their children are born as New Zealand citizens. In fact, it is quite common for Tuvaluans to give birth to their children while working or studying abroad, to give them the agency of the more powerful passports of Australia, New Zealand, or the US. However, many other temporary migrants remain in New Zealand by overstaying their visas illegally, which makes application for permanent settlement more difficult.¹⁸³

183. Interview with immigration assistant, Auckland NZ, June 2015.

Only one of the 10 people I interviewed in New Zealand, only one identified climate change as their primary reason for migration. After studying in Australia with her husband, she had returned to Tuvalu in 2002. In the 2002/2003 season the King Tides of Funafuti were extremely high, causing widespread flooding throughout the capital, and fearing this was a harbinger of even worse crises to come, she decided to move to Auckland permanently. However, over half of the Tuvaluan's interviewed in New Zealand did cite climate change as one factor in their decision to migrate. This exemplifies another problem of the 'climate refugee' narrative; causality in human decision-making is not always 1:1, and individual or family decisions such as migration typically are based on a multitude of major and not so major factors. This is also apparent in other parts of the world, such as the Sahel region in Africa, where climate change combines with overfarming to create desertification, which contributes to lack of resources and unrest, which all might be factors in the decision to migrate.

180. Interviews by author in Auckland, New Zealand, June 2015.

181. Gerrard, Michael B., and Gregory E. Wannier. *Threatened Island Nations: Legal Implications of Rising Seas and a Changing Climate*. Cambridge University Press, 2013.

182. While some interview subjects saw the PAC program as a great opportunity, others were concerned by its limited size and doubts about the program's fairness: "they check your background, your employment, they call your boss and say 'how was this guy?'" Source: Interview data, Suva, Fiji, 2015.

Among the multiple factors cited for migration to New Zealand in my interviews, providing opportunities for children was one of the most prevalent. In addition to climate risks that may affect future generations, parents or prospective parents also cited access to education, employment, and the broader world:

“Climate change, its one of the points [in our decision to migrate]. And the other point was for education. We are thinking about our son, that's why we wanted to move here.”¹⁸⁴

The multi-factorial nature of migration decision was apparent in a series of recent cases vaunted by the media as “the world’s first climate refugees.”¹⁸⁵ First of all, ‘climate refugee’ is not an official refugee status. The 1951 Refugee convention defines a refugee as someone who “owing to a well-founded fear of being persecuted for reasons of race, religion, nationality, membership of a particular social group or political opinion, is outside the country of his nationality, and is unable to, or owing to such fear, is unwilling to avail himself of the protection of that country.”¹⁸⁶ Climate refugee claims have either been rejected based on the lack of a legal basis for climate refugee status, or have been accepted because the claimant typically identifies climate amongst a slew of other reasons for migration. In the case of one of these ‘first climate refugees,’ a Tuvaluan family seeking residence in Auckland, their petition was accepted because they already had multi-generational familial ties to New Zealand.

As might be expected, perceptions on migration varied between Tuvaluans in Tuvalu and Tuvaluans in New Zealand. Tuvaluans on Funafuti generally expressed strong ties to the local geography and community, and though some saw migration as an eventual necessity, few saw it as a preferred option. In general, those in New Zealand saw migration as eventually the only option for Tuvaluans. These people wished to maintain a strong connection to their homes and island identities (*fenua*), even visiting for short sabbaticals, but ultimately saw their futures elsewhere. This did not preclude retaining and passing along their Tuvaluan heritage. In fact, New Zealand Tuvaluans seemed to be more concerned with teaching their children about Tuvaluan culture than their Funafuti counterparts:

While Auckland and Wellington have Tuvalu’s dominant migrant communities, the diaspora is much broader. Many Tuvaluans use New Zealand as a springboard to establish finances or careers before migrating onwards, particularly to Australia. Other ex-situ communities are tied to historic migrations. While Tuvalu was colonized along with Kiribati

184. Interview with female migrant who moved to New Zealand in 2013 with her husband and child, Auckland New Zealand, June 2015.

185. Nuwer, Rachel. “The World’s First Climate Change Refugees Were Granted Residency in New Zealand,” *Smithsonian.com*, Aug 07, 2014. See also O’Briend, Emma. “An Islander’s Bid to Be the World’s First Climate Refugee.” *BloombergBusiness*, March 30, 2015.

186. United Nations High Commissioner for Refugees (UNHCR). *1951 Convention Relating to the Status of Refugees*.



Tuvaluan migrants in Auckland showcase garments constructed of the traditional *kolose* craft through a dance ceremony, or *fatele*. Image Source: Mangere Arts Center, "Kolese: The Art of Tuvalu Crochet"

under as the Gilbert and Ellice Islands protectorate, many Tuvaluans established lives and intermarried with I-Kiribati. Fiji is also an important site for the diaspora, partially due to its important role as a site for higher education. Additionally, the 566 Kioans¹⁸⁷ and their descendants who were naturalized into Fiji in 2005 retain their Tuvaluan and Vaitupu identities.

Now dispersed across Fiji, they combine with work and education migrants in Suva to form a significant Tuvaluan community there.

While at this point climate change is not a leading driver for migration, future environmental crises, along with growing globalizing tendencies, are likely to catalyze further migration. Tuvaluans in New Zealand noted that following cyclone Pam, more and more Tuvaluans are seeing migration as a future necessity, and the New Zealand diaspora is encouraging this trend:

"I hope that people will try and move away. As we have heard about what happened during Cyclone Pam, we've heard the news and it devastated us all, but it showed me we made the right choice moving away."¹⁸⁸

187. See subsection "The Kioa Case" page 85-89

188. Interview with Tuvaluan migrant, Wellington NZ, June 2015

189. Stratford, Elaine, Carol Farbotko, and Heather Lazrus. "Tuvalu, sovereignty and climate change: considering Fenua, the archipelago and emigration." (2013): 67.

190. See page 94

191. See scenario B, page 244 - 287

192. Simati, Sunema Pie. *The effect of migration on development in Tuvalu: a case study of PAC migrants and their families*. Thesis, Master of Philosophy in Development Studies at Massey University, New Zealand, 2009.

As the diaspora grows, its already significant implications for the nation will become even more significant. For example, migrated Tuvaluans play a strong role in the nation's economy. According to 2000 census data, 47% of Tuvaluan households receive regular remittances from overseas relatives; for 18% of Tuvaluan households this is the main source of income. Overseas remittances continue decades after migration occurs.¹⁶⁶ In combination with development aid, it is clear that Tuvalu's economy is dominated by money coming from outside Tuvalu.¹⁹⁰ The reliance on relatively abundant income from remittances may be a barrier to the development of locally initiated economies. This backdrop provides one logic for the design proposal of 'economy seeds' that help Tuvaluans in Tuvalu establish a fishing economy based on abundant, underutilized local resources.¹⁹¹ This proposed strategy also provides an additional way to tie together the dispersed diaspora: a new shared economy.

Tuvaluan leaders identify migration "as a vital ingredient in the development of Tuvalu."¹⁹² The migrated diaspora retains strong institutional, familial, and island community (*fenua*) ties; "...the physical

separation of Tuvaluans from one another through migration does not limit the richness of the interactions and connections between them.”¹⁶⁹ However, there are barriers to these connections between Tuvaluan and the diaspora and within diasporic communities.

As I learned during my 2015 visit, the migration of islanders from remote, minimally developed Tuvaluan communities to the sprawling metropolises of New Zealand creates both human problems such as long commutes and fragmented communities, and contributes to urban problems such as congestion and sprawl. When Tuvaluans arrive in New Zealand, they often don't know how to drive a car or manage a paycheck. Many of these are socio-spatial problems, which require design and planning to resolve. While in Tuvalu it is easy for the community to gather for regular events and celebrations, the physical dispersion and cash-economy limitations on New Zealand Tuvaluans can make these events feel like a burden:

“Sometimes it feels like the commitment is a bit too much as well, its kind of like pushing you away from Auckland as well, and the commitment comes with money as well. It comes down to funds.”¹⁹⁴

Lack of proper meeting space is also a problem; only one islander community, Vaitupu, has its own dedicated meeting space. Other Tuvaluan communities must rely on expensive rented halls, or meet in one another's homes. Perhaps most significantly, ex-situ Tuvaluans struggle to find the balance between establishing new identities in their new communities, and maintaining ties to the Tuvaluan lifestyles they hold dear:

“I've seen the change as well with the younger generation, there are lots of Western ways our people have adopted, especially our young ones that have had schooling outside of Tuvalu. But hey, what can we do, the world is changing. I am a very old fashioned person even though I've moved here, I'm educated, but I still carry our ways, our values.”¹⁹⁵

These factors contribute to the opportunity of designing new forms of collectivity, that not only provide spatial anchors in new diasporic contexts, but also give Tuvaluans the agency to adapt and evolve their cultural identities.¹⁹⁶ This is particularly significant in a possible future where Tuvalu becomes minimally- or un-inhabitable. In this case, Tuvaluan cultural identity will exist primarily outside of Tuvalu, and will require transformed tools for its continued practice.

193. Ibid.

194. Interview with Tuvaluan migrant, Auckland NZ, June 2015

195. Ibid

196. See section on “Tactical Strategies”, particularly regarding ‘culture seeds’, page 216 - 237

FUTURE MIGRATIONS

As the subsequent discussion of uncertainty and climate change suggests,¹⁹⁷ climate science is inexact, and we can not predict with certainty its implications on the migration patterns of atoll communities. However, existing tendencies towards economic and educational migration, as well as the overpopulation problem in Tuvalu's capital settlement, suggest that migration will continue to increase even without climate-related disasters as a factor. Migration from Tuvalu to cities in larger nations is an extension of the growing trend of rural-urban migration, a phenomenon associated with global industrialization. Environmental risks linked tangentially or not at all to climate change will also likely promote out-migration, including pollution, contaminated water supplies, and food insecurity. However, in all likelihood climate change will result in a massive re-organization of settlement, particularly impacting low lying atoll nations such as Tuvalu. Even before sea level rise inundates the nation, increasingly intense cyclones have the capacity to cause massive, unrecoverable destruction.

Some have attempted to quantify the global reorganization of settlement, although no consensus exists for obvious reasons. In 2002, a much-cited paper by Norman Myers at the University of Oxford garnered much attention when it projected as many as 200 million environmental refugees were possible by the year 2050. This estimate was made by analyzing existing vulnerable regions and extrapolating from areas of existing environment-impacted migration.¹⁹⁸ Some have placed the estimate during the same time frame at an even more radical 1 billion.¹⁹⁹ If even the low range of these projections are correct, new tools for practicing cultural identity in the context of mobilized populations will be required even more urgently.²⁰⁰

While this thesis focuses on spatial tools that allow for displaced cultural practice, policy will also have to be redefined in order to accommodate these new forms of migration. New initiatives are beginning to emerge that focus on this complex future, including the Nansen Initiative, an intergovernmental organization focused on creating multilateral initiatives to protect individuals displaced by natural disasters and climate change.²⁰¹

In thinking about shifting human populations, it is also helpful to examine biotic migration associated with climate change. In fact, if, as with Tuvalu, we see cultural identity as linked to the geography and ecology of its context, (a connection that many interviewees noted) in some ways the physical context of Tuvaluan identity is shifting poleward as well. In general, the impacts of a warming climate on biodiver-

197. See page 173

198. Myers, Norman. "Environmental refugees: a growing phenomenon of the 21st century." *Philosophical Transactions of the Royal Society B: Biological Sciences* 357.1420 (2002): 609-613.

199. According to the International Organization for Migration.

200. See proposal for 'culture seeds,' page 216 - 237

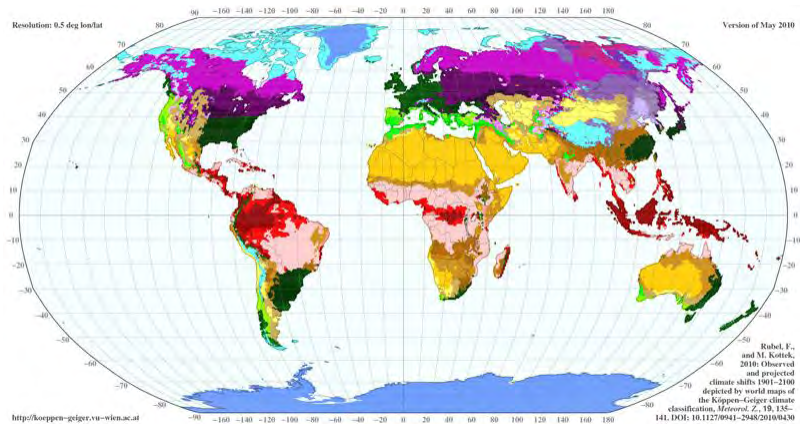
201. The Nansen Initiative. <https://nanseninitiative.org>

sity are poorly understood, but in the most general terms, we can expect a shift of climate zones as different regions become hotter, wetter, drier, or even (possibly) colder. This means that an organism's historic territory, or where they reside now, will no longer be their optimal environmental conditions, but another area (possibly adjacent, but perhaps distinct) might now meet that organism's environmental criteria.

Some of these shifting environmental zones may even be beneficial for Tuvalu; a UNDP report found that skipjack tuna might increase up to 30% with the Tuvaluan EEZ as a direct result of climate change. However, warming waters within the Tuvaluan archipelago also make vulnerable one of the nation's most important resources: coral reefs. Coral death and coral bleaching is already an issue in Tuvalu and other tropical zones, and if water temperatures exceed 29°C, coral dieoff could be massive. Since coral atolls rely on the sediment produced by coral reefs in order to survive as a geological formation, this risk could be catastrophic.

One of the most progressive proposals for dealing with these migrating climactic zones—which acknowledges the anthropocentric role of humans in today's environment—is assisted migration. Assisted migration is “the deliberate movement of non-human refugees to a new area for which they are believed to be better suited due to projected changes in climate.”²⁰² This is a particularly radical attitude in the field of conversational biopolitics, where preservation to historic conditions dominates. However, for some species it may be the only way to avoid climate-induced extinction.²⁰³

The first group to introduce the assisted migration model to the US is the Torreya Guardians, a loosely affiliated citizen activist group whose members have assisted with the Northward migration of the *Torreya taxifolia* conifer. This tree, historically found only in a small area along the Apalachicola River, has declined catastrophically since the mid-twentieth century, becoming the nation's most highly endangered conifer. Participating members help to ‘rewild’ *T. taxifolia* into environs further North that are more conducive to its propagation.



Map of global climate zones based on the Köppen-Geiger climate classification. Climate change will like cause these zones to shift polewards.

Image Source: Rubel, F., and M. Kottek, 2010: Observed and projected climate shifts 1901-2100 depicted by world maps of the Köppen-Geiger climate classification. *Meteorol. Z.*, 19, 135-141. DOI: 10.1127/0941-2948/2010/0430.

202. Camacho, Alejandro E. "Assisted migration: Redefining nature and natural resource law under climate change." *Yale Journal on Regulation* 27 (2010): 171.

203. Ibid.

The assisted migration model challenges the notion of 'natural' or 'wild' ecologies, and recognizes that we as humans play a dominant role in shaping environments in the era of the Anthropocene. Similarly, this thesis challenges assumptions about intervening systemically in natural processes, and the (un)fixed nature of various populations. In a climate-changed world, educated and careful interventions in natural processes may be the only way to curb problems we as humans have created for ourselves and our environs.

HUMAN RISK: SOCIO-CULTURAL LOSS

CURRENT SOCIO-CULTURAL RISK

While Tuvalu's catastrophic risks associated with climate change have received much attention globally, many Tuvaluans are more concerned with immediate risks associated with social issues and the islanders' fraught relationship with modernization.^{204,205} These questions too, particularly in terms of their association with capitalist development processes, also pose a potential threat to Tuvaluan cultural identities. In fact, one danger of the fetishization of the climate refugee is that these other, very real problems, receive little attention or funding:

“With this dominant international script for their residents – a script encouraged by the most threatened SIDS governments – there appears to be much less interest (and investment) by the international community, and by some SIDS authorities, in such immediate matters as health, employment/livelihoods, education and other day-to-day topics, unless they are somehow seen, or packaged, as sustainable development and climate change related.”²⁰⁶

However, these issues are often closely intertwined with climate change risks, and tend to reduce the ability of Tuvalu to cope with disasters. For example, coral death caused by pollution will reduce the ability of the island to build up in response to sea level rise, and the clearing of vegetated areas amplifies erosion risks. Perhaps more importantly, if local cultural identities are eroded entirely, or if the population eventually disperses to oblivion, development and climate adaptation aid lose their meaning. Why fund development for a culture that no longer exists?

Outside of climate change, overcrowding was the number one concern cited by interview subjects in Tuvalu, both in terms of the current state of overpopulation on Tuvalu and its anticipated future increase. The population of Funafuti has increased exponentially since Independence from the United Kingdom in 1978, when movement between islands was unrestricted and many Tuvaluans returned from jobs in Kiribati. The rapid population growth of Funafuti is a form of rural-urban migration²⁰⁷ from outer islands to the capital settlement on Funafuti. Despite government efforts to slow migration by creating infrastructure and employment projects on outer islands, migrants flock to Funafuti for work, increased modern amenities, and a desire to be more connected to a globalized world. Tuvalu's other islands are extremely remote, accessible only by private boat, or a once monthly “ferry” which delivers food, supplies and passengers. The population of these outer islands ranges from 35 to 1,600,¹⁸¹ so these are very small worlds indeed.

204. Dahlstrom, Jonas. *In the Eye of the Storm – Risk Perception and Perceived Adaptive Capacity among Civil Society Leaders in Tuvalu*. Masters Thesis in Development Studies, Department of Government, Uppsala University; 2013.

205. See also the section on short-term physical risks, page 52, particularly in terms of pollution and land degradation

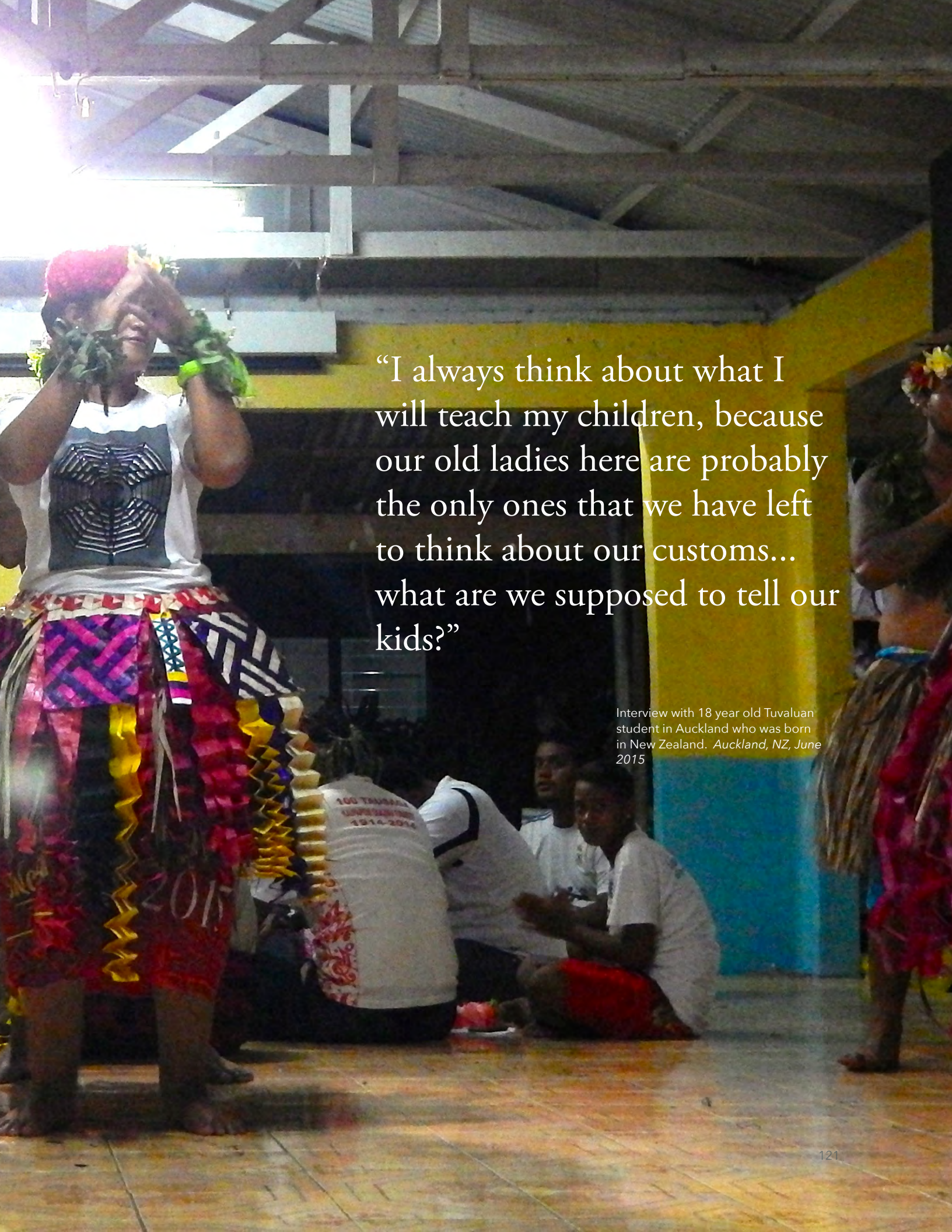
206. Baldacchino, Godfrey, and Ilan Kelman. “Critiquing the pursuit of island sustainability.” *Shima: The International Journal of Research into Island Cultures* 8.2 (2014).

207. See more about this process on page 111

208. Tuvalu Central Statistics Division. *Tuvalu Statistics*. <<http://www.spc.int/prism/tuvalu/>>



Tuvaluan *fatele* performed in Funafuti,
January 2015

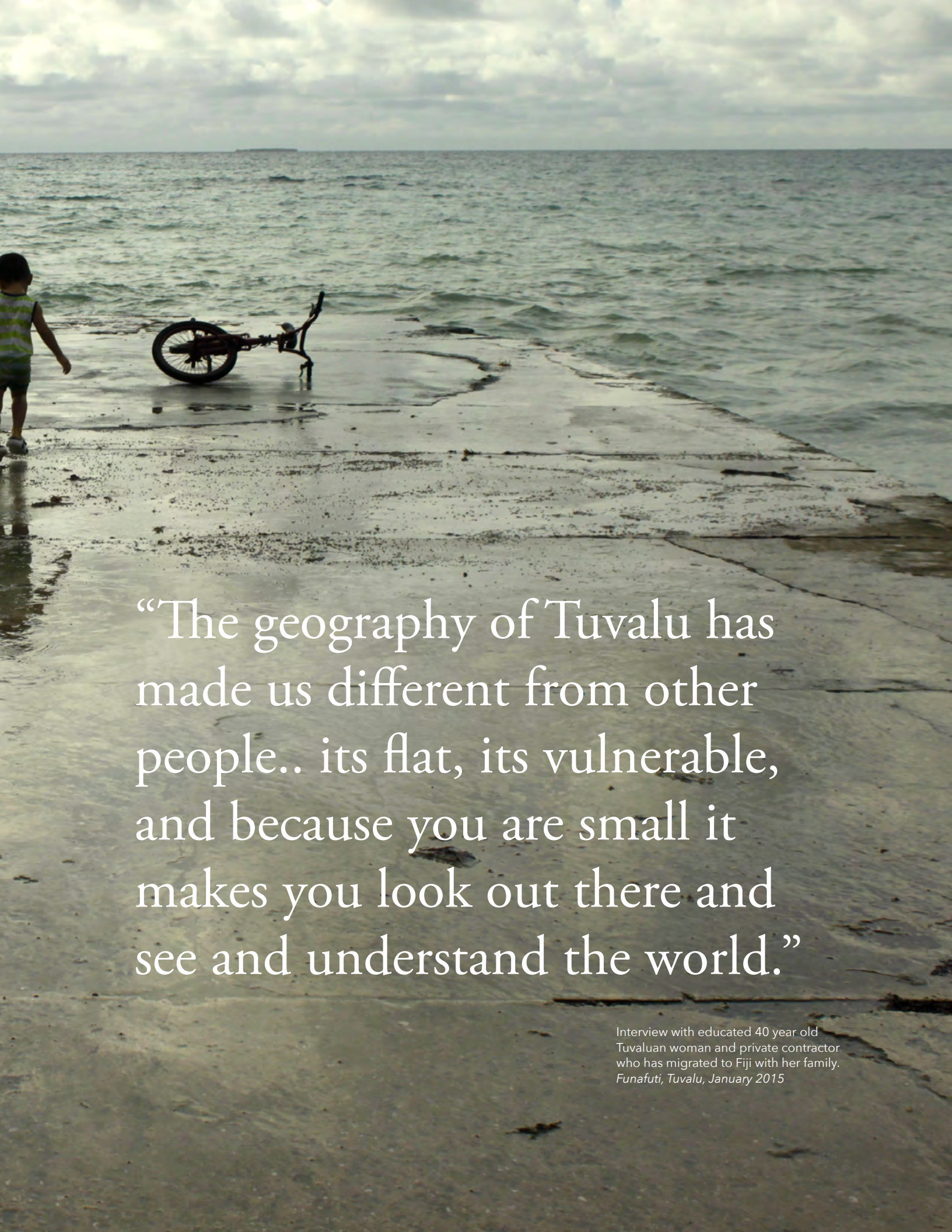


“I always think about what I will teach my children, because our old ladies here are probably the only ones that we have left to think about our customs... what are we supposed to tell our kids?”

Interview with 18 year old Tuvaluan student in Auckland who was born in New Zealand. *Auckland, NZ, June 2015*



Children swimming and fishing at the hotel pier, Funafuti, Tuvalu. Photo by author.

A photograph of a beach scene. In the foreground, a child in a striped tank top and shorts stands on the left, looking towards the ocean. A bicycle is lying on its side on the wet sand in the middle ground. The ocean extends to the horizon under a cloudy sky. The text is overlaid on the lower half of the image.

“The geography of Tuvalu has made us different from other people.. its flat, its vulnerable, and because you are small it makes you look out there and see and understand the world.”

Interview with educated 40 year old
Tuvaluan woman and private contractor
who has migrated to Fiji with her family.
Funafuti, Tuvalu, January 2015

“Here everybody knows each other, and everybody lives next to each other. To have a gathering, you don’t have to make an announcement on the radio, you just get on your bike, or walk to their house to let them know.”

Interview with 30 year old male seafarer, conducted on the patio of Filamona guesthouse. Funafuti, January 2015





Volleyball game on Funafuti airstrip. As the largest open space on the atoll, the airstrip is a site for all sorts of evening recreation.





Children playing near slum housing surrounding the burrow pits. Taken from motorbike.

“You know, the migration from outer islands, we now on Funafuti have almost 60% of Tuvalu’s population. I think its rising. So the question about the outer islands, yes, if current government policy... There was a policy, an act, in 1997 I think, that was designed so that people would stay in the outer islands. But I think its completely failed. People are still coming, and slowly the rate is increasing.”²⁰⁹

In general, those interviewed perceived rural-urban migration as the main contributor to overpopulation to Funafuti, and saw it as something that should be curtailed. Many expressed a degree of contempt towards recent migrants to Funafuti and the increasing strain they were placing on the small islet. It is worth noting that only one of the sixteen subjects interviewed in Tuvalu was born on Funafuti and considers it their home island; however, most had been settled on the capital atoll for many years or decades.

Migration to Funafuti was further amplified by the closing of phosphate mines in the neighboring nation of Nauru in the 1990s, which has served as employment for many Tuvaluans. Accustomed to a job and salary, these workers returned to Funafuti looking for employment instead of their home islands. ¹⁸³ As a product of this migration to Funafuti, it has become highly dense, and at this point developable land is almost nonexistent. The rapid pace of this migration, and lack of planning has led to a chaotic and poorly organized settlement. The following quotes exemplify the perception of Funafuti residents of this process:

“There is a risk lack of land for everybody, especially the population is growing, there will be more people”

Funafuti’s problem is less an issue of too much people than not enough land. The small land area which exists has not been planned in a such a way to accommodate this large and growing population:

“Overcrowding is a problem here on Funafuti. If we don’t manage the space properly, the land that we have, then overcrowding will come to be a bigger problem.”

For people arriving in Funafuti, lack of land is amplified by historic ownership structures carried down patrilineal lines and subdivided amongst children:

“Because before there was a lot of parcels of land here on the island, but now our whole populations are growing, our families are growing, and

209. Interviews, Funafuti, Tuvalu, January 2015.

210. Malua, Sagaa. “The Tuvalu Community in Auckland: A focus on health and migration.” Transnational Pacific Health through the Lens of Tuberculosis Research Group, Report No. 4. Department of Anthropology, School of Social Sciences, the University of Auckland, 2014

they are dividing between the families. In 50 years time, we may have one parcel of land shared among 5 siblings or 10 siblings.”

Without land available for purchase, (and likely a lack of funds to do so regardless) new arrivals move in with extended family, packing already-tiny homes to the brim. If the plot has sufficient space eventually families might construct a new structure for housing, but this further depletes areas for growing foodstuffs or burying the dead. If they are less fortunate, recent migrants will construct tin shanties on the narrow strip of land between the burrow pits and the ocean. Tenuously perched on the ocean side of the islet, these structures face incredible risk during storm events.

As migrants vie for land in Funafuti, families who traditionally resided in Funafuti and own land allotted in colonial times are given the upper hand. As non-land owners, migrants from outer islands are second class citizens who must buy their way in. Some are able to do so by securing government jobs. Politics in Tuvalu suffers from nepotism and low-level corruption; as with government benefits such as scholarships, getting hired into a government job typically requires friends in high places and existing monetary privilege. As one interviewee complained, “Tuvalu gives a lot of scholarship, but instead of who’s on top academically its like who knows who.”²¹¹ However, many government jobs come with housing and allow officials representing or coming from outer islands a foothold in the capital. Historically, these government employees were allowed to keep their homes and land even after retiring, so every generation of government workers further depleted the land available on Funafuti, contributing to the problem of overcrowding.

In addition to lack of space for the living, the capital has nearly squeezed out all places to intern the dead as well. Graveyards have been pushed to peripheral coast land, which suffers from erosion, meaning that sometime graves are eroded and bodies begin to emerge from the ground. Some families bury their dead at home, adding large grave-site structures to already crowded plots.

Overcrowding has also contributed to health issues for Tuvaluans. As people live in closer and closer proximity, sharing water and food supplies, the risk of communicable diseases increases. As discussed in the prior section, pollution resulting from increased populations increases health risks in addition to environmental damages.²¹² The population increase contributes to noncommunicable disease risk as well, if indirectly. With the resulting limited land area, traditional ways of living, are no longer possible. Since there is less available land for growing

211. Interview, Auckland New Zealand, June 2015

212. See page 54

food, Funafuti residents rely more on imported, processed foodstuffs. Sprawl along the atoll has made motorbikes a more desirable form of transportation, and many livelihoods no longer involve manual labor. With this combination of poorer diets and decreased physical activity, obesity has skyrocketed, along with associated diseases including diabetes and heart disease. Tuvalu is ranked fourth in the world for the amount of money it spends on healthcare relative to GDP.²¹³

DEFINING CULTURAL IDENTITY

When the media cites the risk of Tuvalu ‘disappearing’, they are speaking both about the physical islands and the local culture, typically represented by young women in flower garlands dancing at *fatele* or men in canoes, fishing the lagoon. These, of course, frame only the photogenic side of the Tuvaluan nation; like any developing country, their true identity is a hybrid. Handcrafted flower *fou*²¹⁴ are as ubiquitous as made-in-China leis, and in the capital more Tuvaluans get around by motorbike than by canoe (or by foot for that matter). Traditional foods are rivalled by pre-packaged rice and snacks, and during my visit Tuvaluan friends excitedly sought out the American TV shows on my computer’s hard drive. Defining a ‘Tuvaluan’ cultural identity is further complexified by the role of individual islands in cultural self perception; Tuvaluans identify by their home island(s) first, and as a nation second.²¹⁵

In this context, what is cultural identity, and what is *Tuvaluan* cultural identity? It is understood here a dynamic connection of practices which evolve overtime, based on a group of people’s shared background, local knowledge, and ongoing practices. How Tuvaluans perceive their own cultural identities is revealed by the interview question “What makes Tuvalu unique?”²¹⁶ Many responded by discussing traditions such as dance and song ceremonies, values such as respecting elders, and lifestyles which prioritize communal living. Aspects related to geography and ecology including ‘smallness’, local foods, and activities associated with the beach and lagoons were also frequent responses, suggesting that for Tuvaluans cultural identity is strongly tied to the atoll geographies they inhabit.

214. Flour crowns typically worn for special occasions or given as ephemeral gifts to loved ones

215. Interviews, Funafuti atoll, January 2015.

216. See tabulated interview data on pages 314 - 323

CULTURAL DISPLACEMENT/DISPERSION

The squeezing of this growing population with economic, political, or lifestyle aspirations onto the already strained landscape of the capital also contributes to a cultural shift from traditional, subsistence lifestyles

to import-dependant 'modernized' existence. Fongfale islet (the islet of the capital settlement on Funafuti) has very little free space, with most families only having a handful of coconut or pandanus trees. Local, self-caught fish remains the primary source of protein, but in general Funafuti households are increasingly dependant on imported foodstuffs to complete their diet. Building materials are also now predominantly imported, as there is no longer sufficient time nor trees in the capital for traditional housing typologies.²¹⁷

Tuvaluans struggle with a desire to assimilate to globalized society while maintaining a connection to a rich cultural heritage. This trajectory began with early European contact and subsequent British colonization, which undermined traditional social hierarchies and governance structures.²¹⁸ *Aliki*, or chiefs, were displaced by preachers and colonial governments, and the social hierarchy which the *aliki* underpinned crumbled. When Tuvalu achieved Independence 40 years ago, these societal structures had been largely consumed by organized Christianity and colonially-imposed parliamentary democracy. As societal structure was historically key to personal identity—each person had a specific role they fulfilled in the community—this superimposed organization played a large role in beginning the process in Tuvaluan cultural erosion.

In recent years, the immediacy of access to the world brought by inter-oceanic flights and internet access (the entire center of Funafuti settlement has wireless coverage) has accelerated this pace rapidly. Grappling with a world in which Tuvaluans wear *fou* (flower crowns) to events with DJs, and check their email while fishing from traditional canoes, Tuvaluans have projected conflicted views on modernization such as these:

“I can say that nowadays us Tuvaluans, we are like coconuts. We are brown on the outside and we are white on the inside.”

“Another big risk for Tuvalu is the culture is slowly fading away. The traditional way of doing food, and fishing..”

“I want to teach my kids, not to dedicate their lives to modernized stuff, and remember Tuvaluan culture, go fishing and other stuff”²¹⁹

The dilution of Tuvaluan culture in the context of migratory populations or possible future displacement puts the future of Tuvaluan culture identity into a position of further uncertainty. Interview subjects in New Zealand expressed concern about maintaining cultural identities in new contexts, particularly in terms of their children and grandchild-

217. See further discussion about changing housing typologies on page 98 - 101

218. Details regarding Tuvaluan history and colonization are discussed in the section on Fluid Populations, see specifically pages 82-84

219. Interviews on Funafuti, Tuvalu, January 2015.

dren. Adults gather with other Tuvaluans from their home island on a regular basis, to celebrate local holidays, or practice traditional crafts. However, many expressed that these types of gatherings were much more difficult than at home in Tuvalu. The dispersion of the population across Auckland or Wellington means that Tuvaluans must spend a significant amount of time traveling in order to gather. Since they hold jobs (many with long hours and commutes) these commitments were a strain on their schedules. Interviewees also complained about the costs of gathering, both in terms of gas money and the cost of providing traditional trays of food for social events. This was contrasted with the ease of social gatherings occur back home in Tuvalu, where you could simply walk over to the neighbor's house or hop on a motorbike for a couple of minutes to meet friends and family. For the children of migrated Tuvaluans, who were born in New Zealand and may have never visited their home atolls, Tuvaluan culture is even more distant. Generally children are taught to speak their mother tongue, to varying degrees of success, and some traditions, particularly associated with *fatele*, have been passed down. However, parents were worried about their children having sufficient cultural knowledge to share with future generations, and were also concerned about their increasing immersion into Western popular culture: television, music, and video games. These activities leave little time for cultural practice. Elders in particular were surprised at how foreign the children had become.²²⁰

220. Interviews with Tuvaluan migrants, New Zealand, June 2015.

221. Interview, Funafuti, Tuvalu, January 2015

222. See page 216 - 237 and page 264 - 281

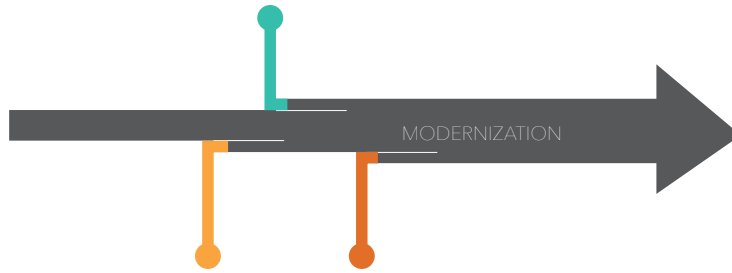
The physical and social geography of New Zealand has clearly disrupted and transformed Tuvaluan cultural practice, and the way it has begun to play out may be a testing ground for a possible Tuvaluan future where the entire diaspora exists outside of the Tuvalu's atolls. This begs the question of what will become of Tuvalu's culture when the population is dispersed around the planet. Can culture exist without place? As one interviewee astutely observed, "the geography of Tuvalu has made us different from other people."²²¹ The issue of maintaining culturally identity ex-situ, adapted to the nation's shifting contexts, is addressed in the proposals for New Zealand. Maintaining fluid identities is explored in two scenarios, through the lens of both claiming space for cultural practice, and tying community together through economy.²²²

ALTERNATIVE MODERNITIES: MAINTAINING FLUID CULTURE

This thesis positions itself in a worldview where the nature of societies is fluid and nonlinear. Traditional Polynesian worldviews operated in a liquid, uncertain world, in distinct contrast with the Western notion of progress:

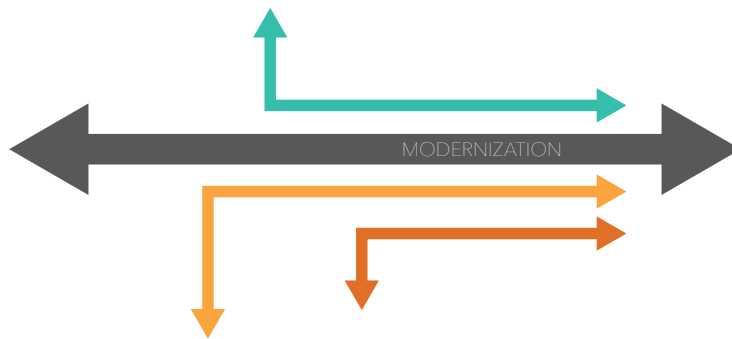
MODERNIZATION MACHINE

Existing cultures are obliterated by modernization and industrialization processes



INFORMED ECONOMIES

Existing cultures are informed by and interact with modern economies while retaining a connection to their own forms of knowledge and practice



HYBRID ECONOMIES

Existing cultures not only interact with, but also inform modern industrial economies to form new systems of cultural transaction. This act of mutual transformation recognizes the multiplicity of values inherent to these different social and economic structures



“There are local and temporary islands of decreasing entropy in a world in which entropy as a whole tends to increase, and the existence of these islands enables some of us to assert the existence of progress.”²²³

Indeterminate future models have growing relevance in the context of contemporary risk. The organization of tomorrow is within disorganization; uncertainty may, and likely will, unfold. As Wiener suggests above, progress, like an atoll, is its own kind of temporary island. Progress worldviews are poorly suited to uncertain and risk-laden futures. It assumes unending improvement instead of catastrophes such as cyclones, floods, and displacement. Progress-oriented models which characterize modernity assume the infinite importance of the development of human society within the contemporary moment, a “limited stretch of time”:

“It is quite conceivable that life belongs to a limited stretch of time; that before the earliest geological ages it did not exist, and that the time may well come when the earth is again a lifeless, burnt-out, or frozen planet.... Yet we may succeed in framing our values so that this temporary accident of living existence, and this much more temporary accident of human existence, may be taken as all-important positive values, not withstanding their fugitive characters.”²²⁴

When considered within the time and space scales of the universe, the “temporary accident of human existence” is decidedly uncertain. Although life on narrow sandbars in the South Pacific makes the tenuous nature of Tuvaluan existence highly visible, all life exists on a spectrum of indeterminacy. Notions of progress should be couched within a broader logic of future risk and uncertainty, particularly in the case of the unstable ground of Tuvalu. With this alternative model of an uncertain modernity, chance—and its response—takes priority over evolution. Operating within this new model of indeterminacy requires the kind of individual agency exhibited by Telematua in his early settlement of Tuvalu. Alternatives should be sought out actively; Tuvaluans, or any society inhabiting unstable ground (either conceptually or physically), can search out futures, and test them out, with an understanding that whatever they discover will not last forever, and many possible future spaces can be inhabited. Moments of organization can be constructed, and when they crumble, new ground can be sought out elsewhere.

For Tuvalu, the progress model has had problematic consequences. For example, in the shift from traditional to modern building materials, the knowledge of generations of atoll dwellers has been lost on how to build for tropical climates and cyclone risk. The shift to motorbikes,

223. Wiener, Norbert. “Progress and Entropy” from *The Human Use of Human Beings: Cybernetics and Society*. Boston: Houghton Mifflin, 1950.

224. Ibid.

a more 'modern' form of transportation, and modern imported food-stuffs, have both led to increased obesity and pollution. This project instead calls for an alternative *Tuvaluan* modernity, which incorporates traditional practices with new technologies in a locally specific way.

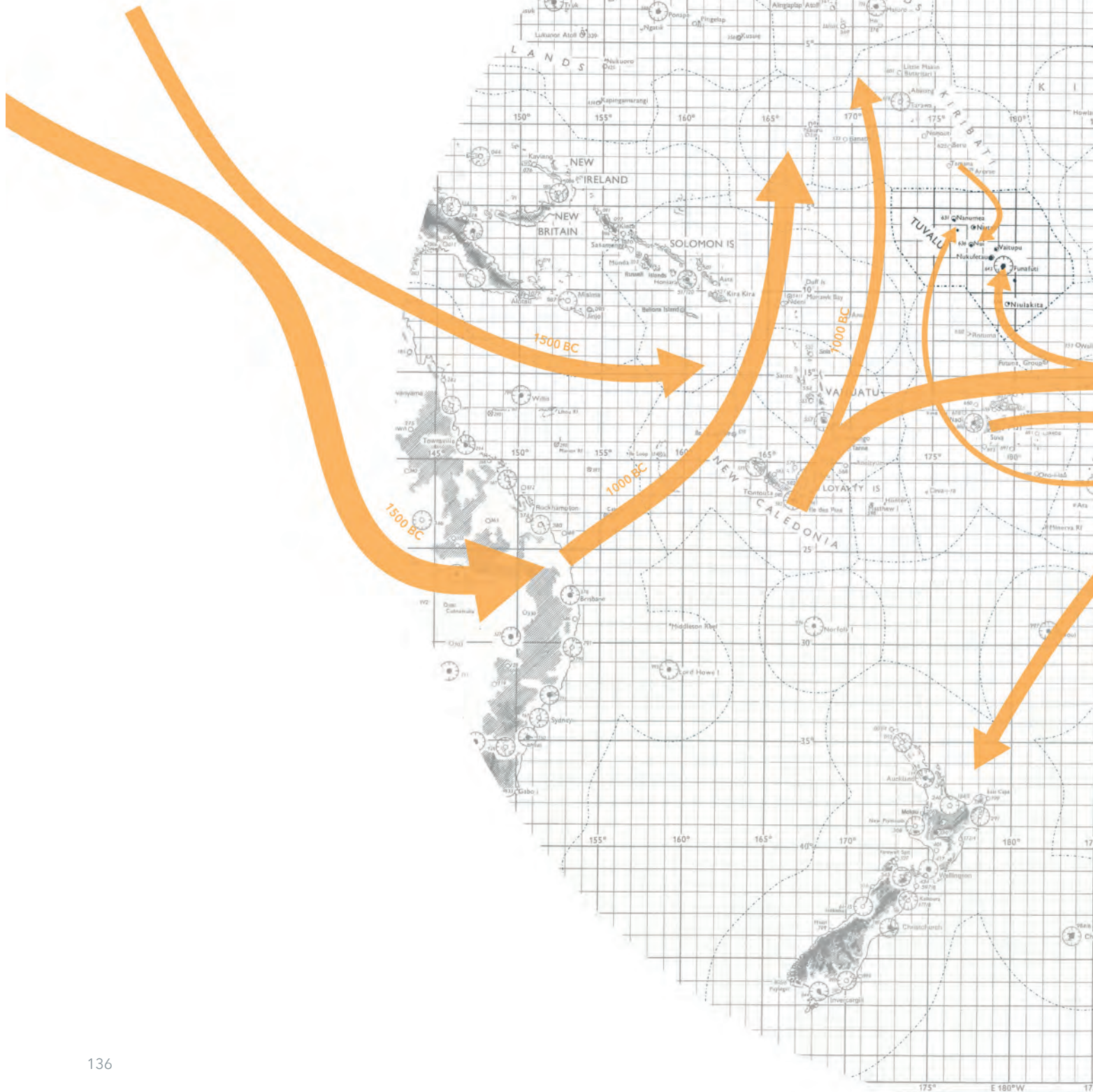
In an alternative modernity model, traditional knowledge and the logics of modernization are in dialogue and inform one another. Not a ludite or nostalgic call for a return to past practices, this concept instead suggests a locally defined future that synthesizes Tuvalu's own practices with selectively transformed aspects of modernity. This project rejects the notion that the trajectory of society has a pre-designated destination, as Hegel²²⁵ might suggest. Instead of Enlightenment models of constant improvement, or Hegel's cycle of progress, this dialectic is fluid, learning from multiple sources and responding to uncertain future events. A Tuvaluan modernity also suggests that its population has agency over the way its future might look; it is not a given that its development should look the way it has in the West, rather the nation's future should be locally constructed.

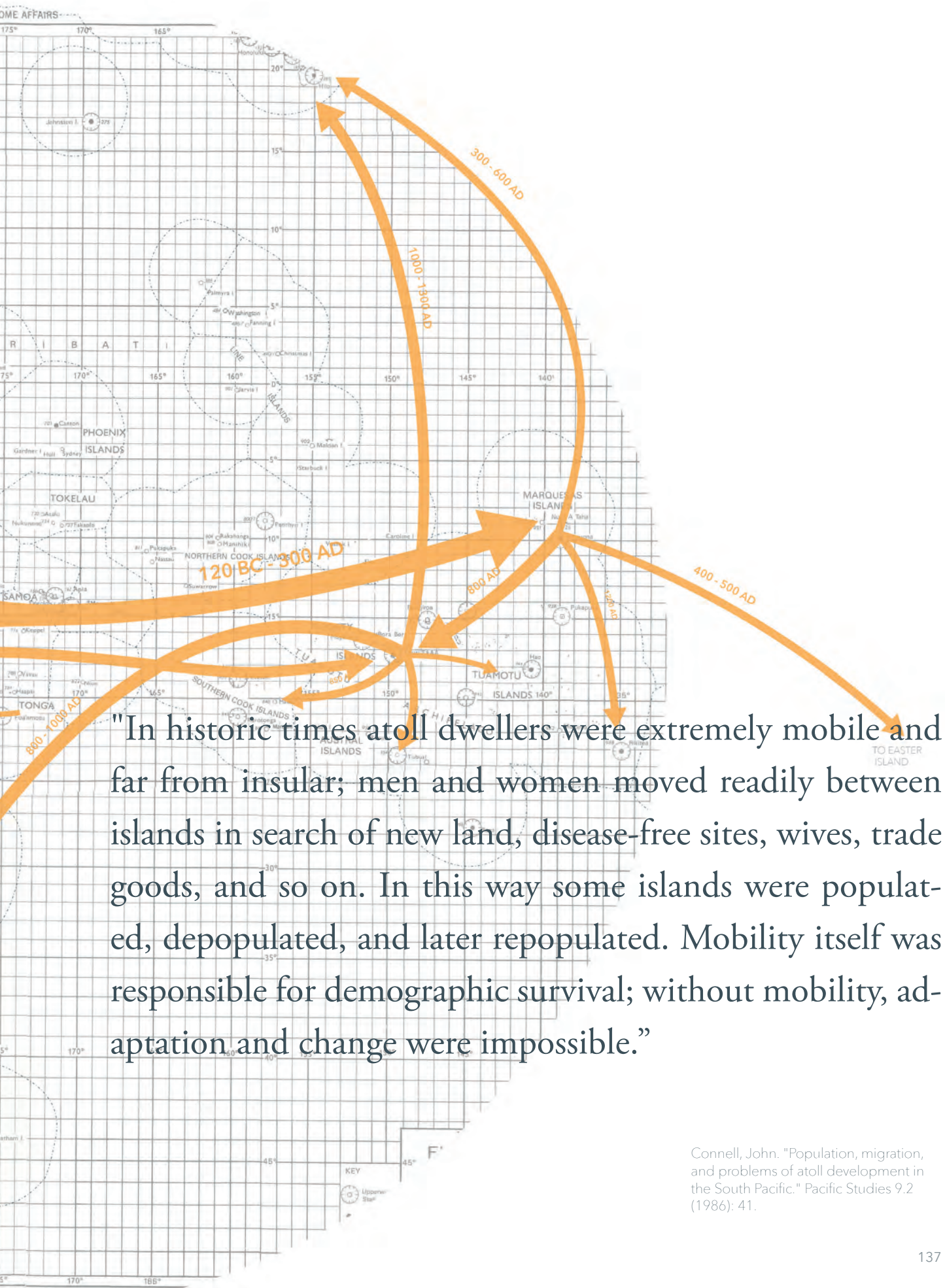
The proposals for Tuvalu's future outlined later in this book²²⁶ thus incorporate this stance on hybrid identities into proposals for Tuvalu's future, both in- and ex- situ, through a multi-scenario model that incorporates uncertainty, fluidity, and local agency.

225. The Hegelian dialectic model of progress, on which much modern theory relies, proposes that knowledge is based on a constant cycle of thesis and antithesis, always leading to a higher level of understanding.

226. Pages 183 - 292

FLUID POPULATIONS
Lapitian settlement of Polynesia

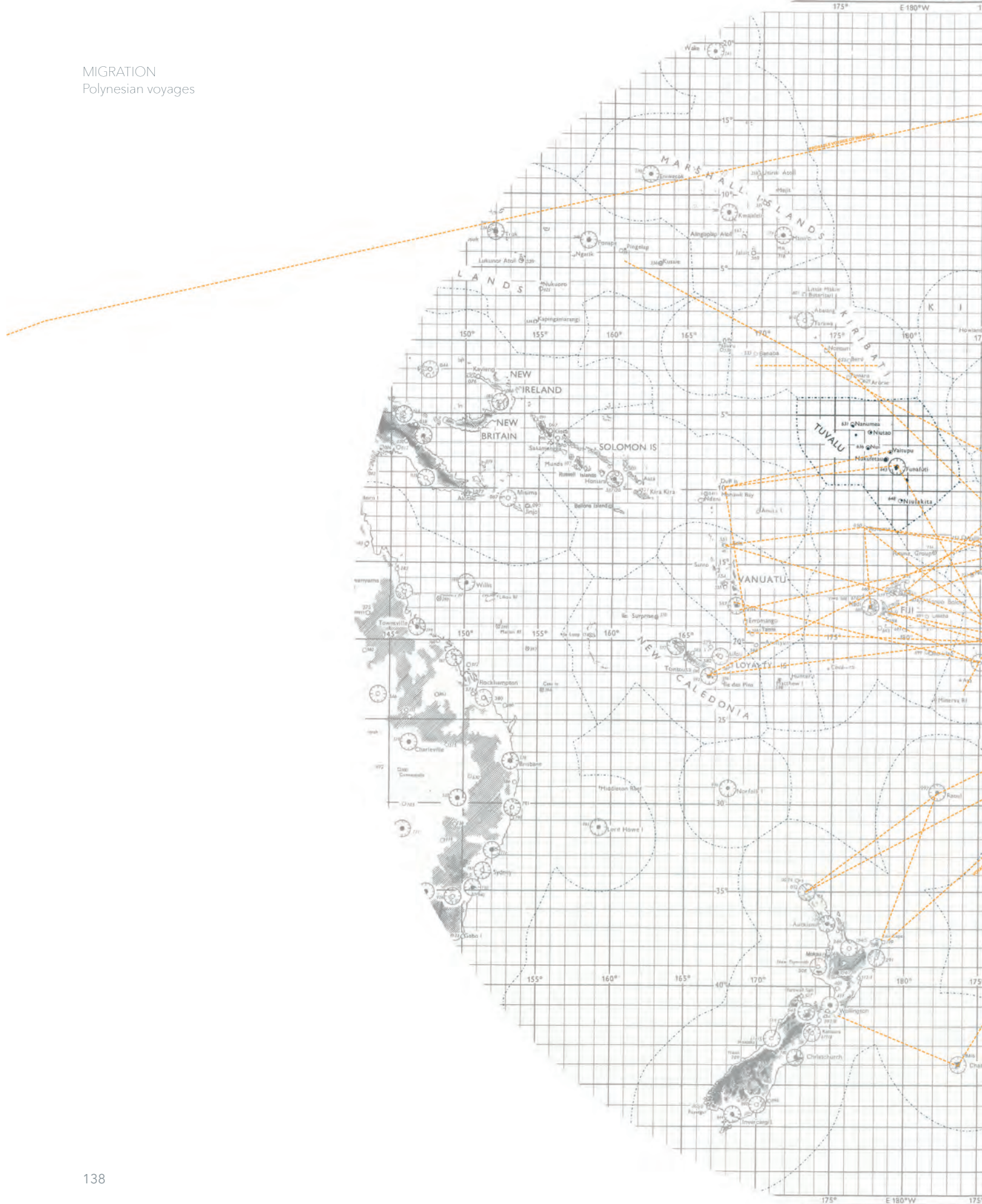




"In historic times atoll dwellers were extremely mobile and far from insular; men and women moved readily between islands in search of new land, disease-free sites, wives, trade goods, and so on. In this way some islands were populated, depopulated, and later repopulated. Mobility itself was responsible for demographic survival; without mobility, adaptation and change were impossible."

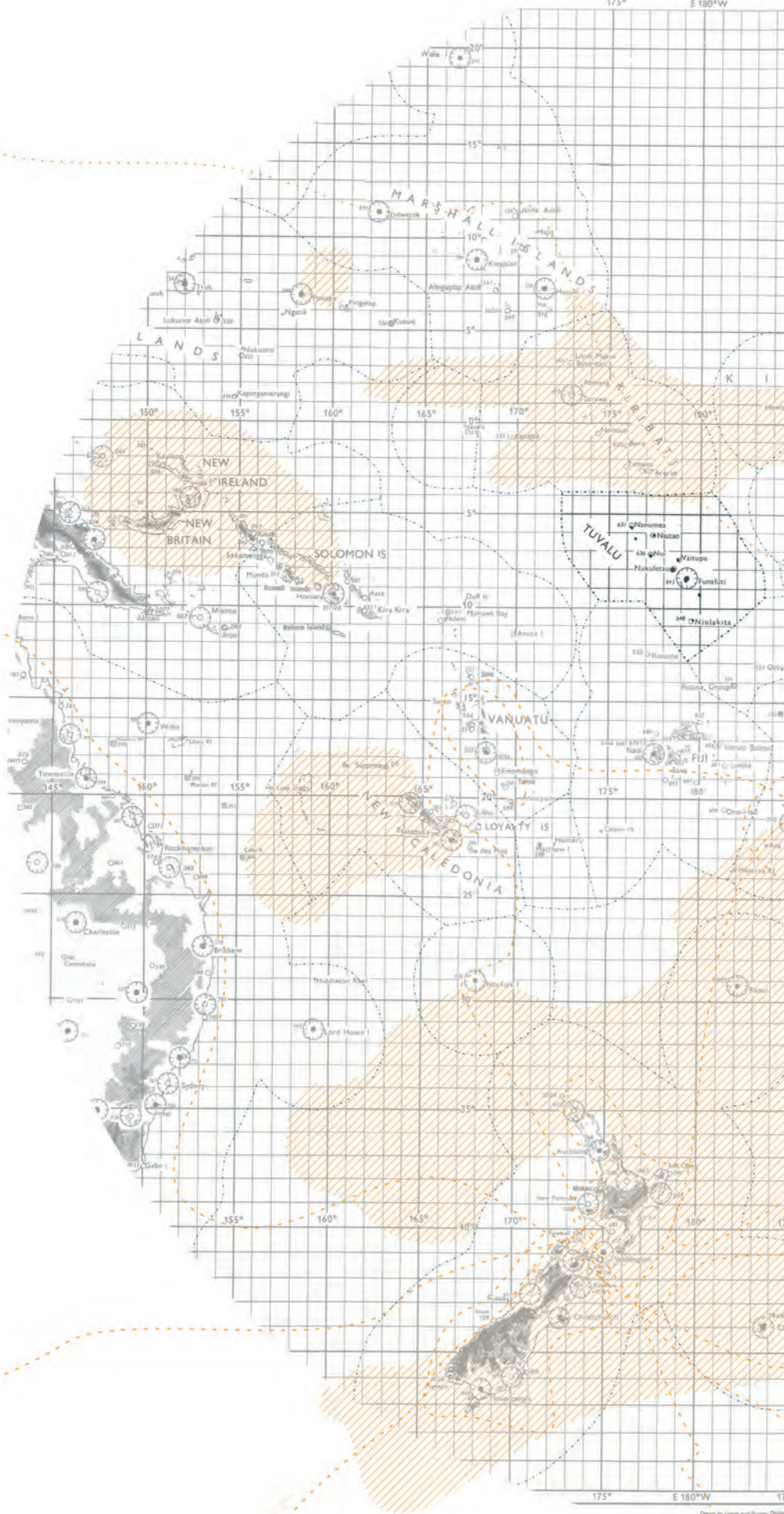
Connell, John. "Population, migration, and problems of atoll development in the South Pacific." Pacific Studies 9.2 (1986): 41.

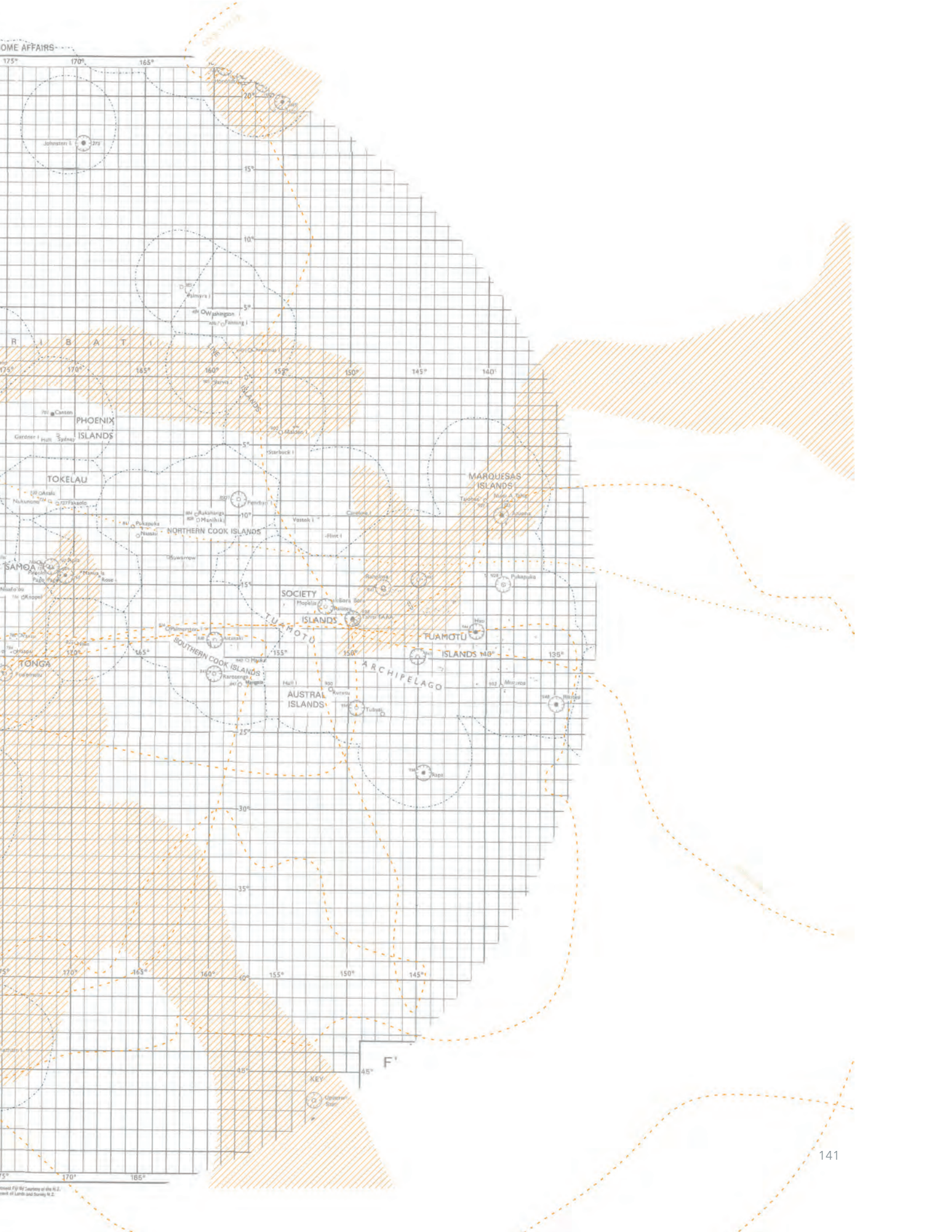
MIGRATION
Polynesian voyages



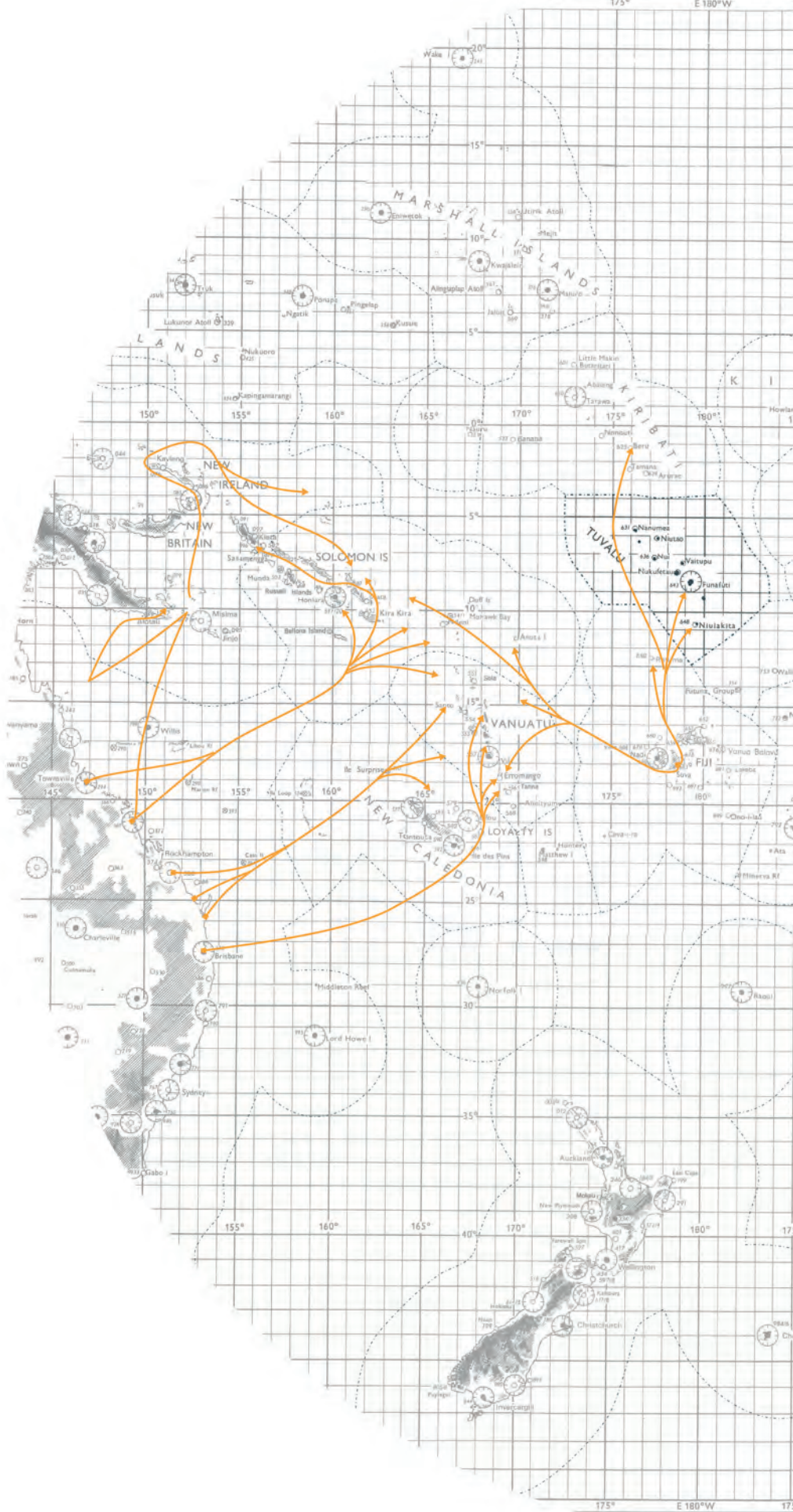


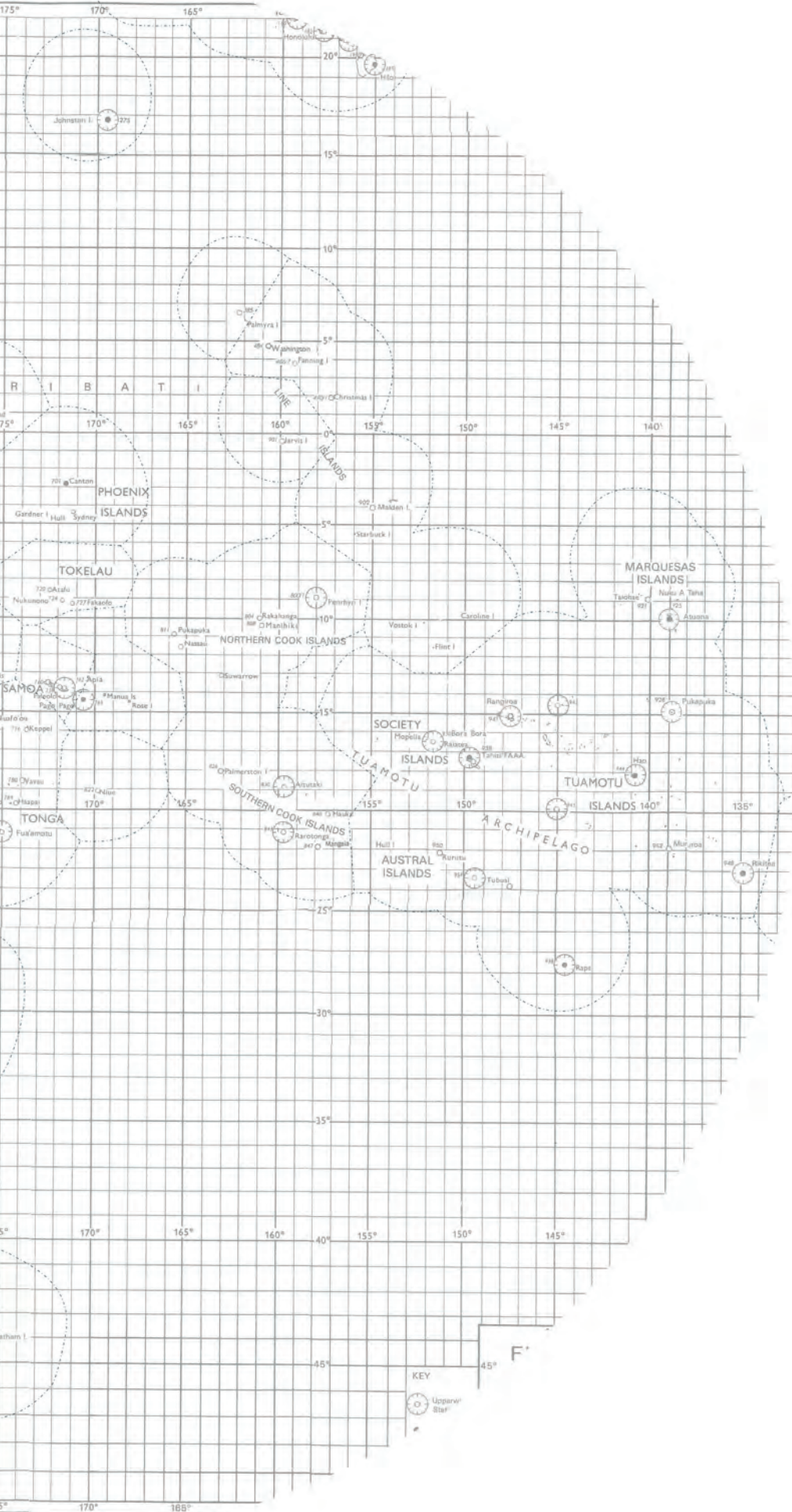
MIGRATION
European voyages





MIGRATION
Blackbirding

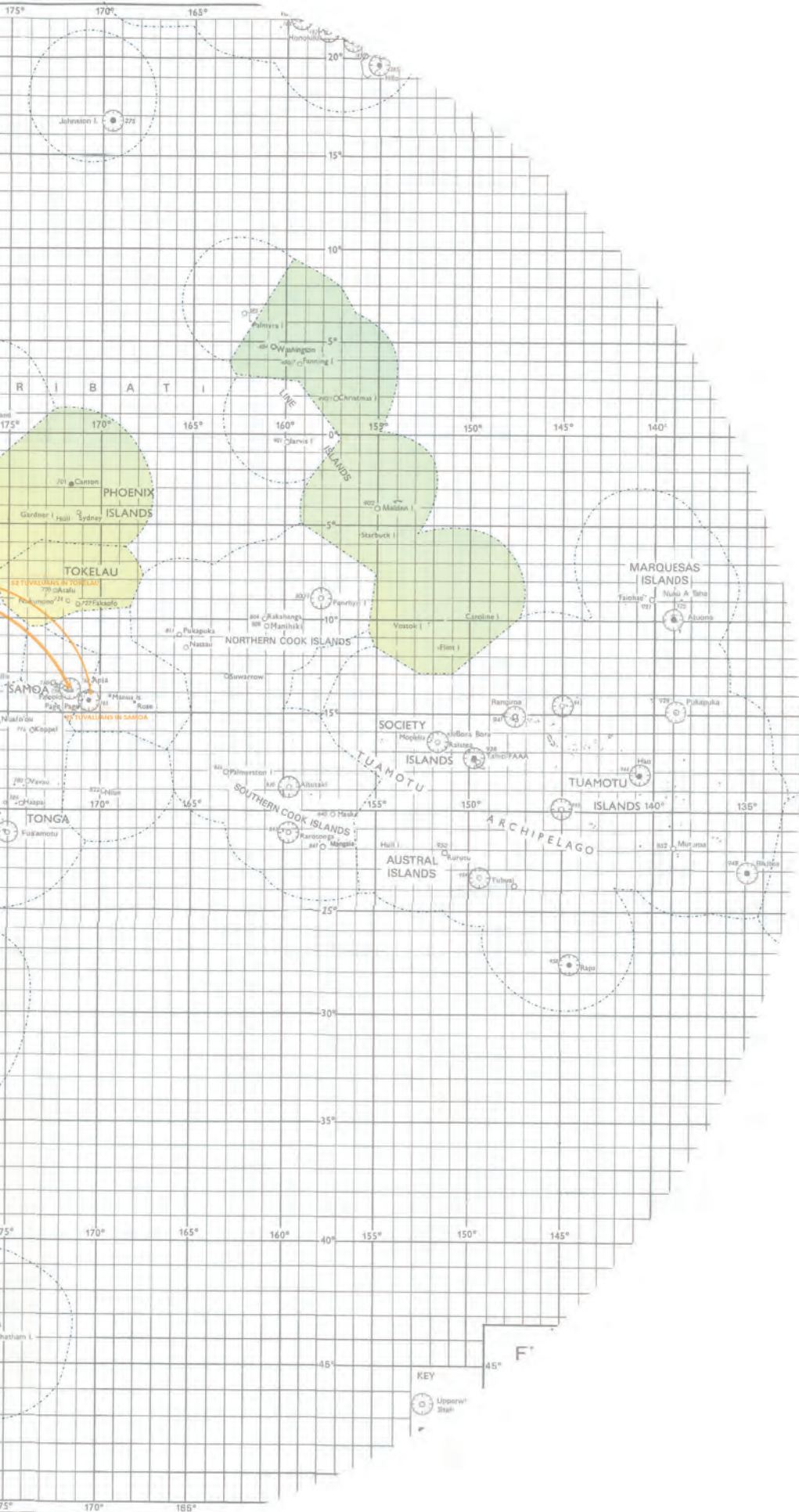




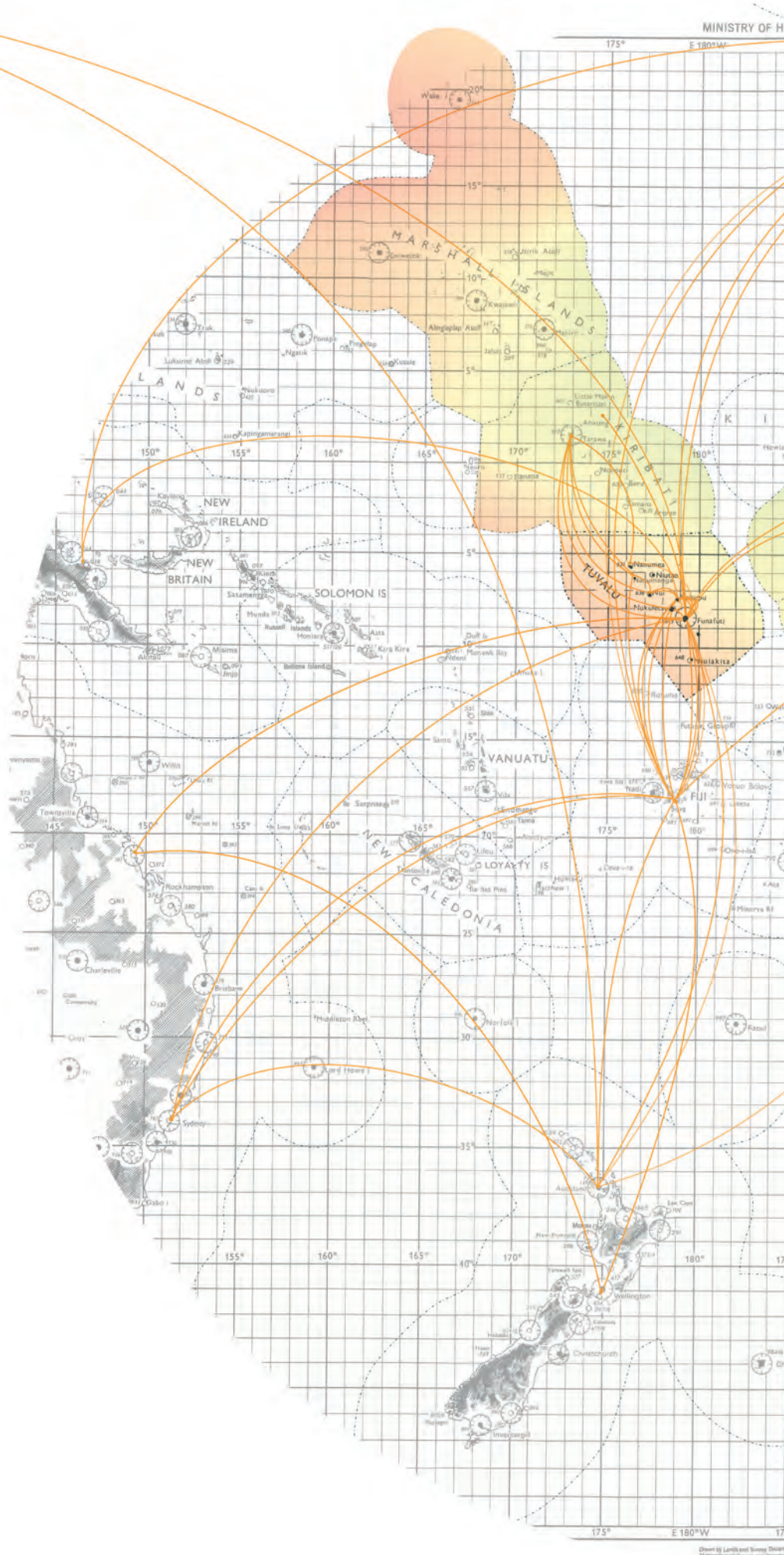
MIGRATION
Present migration and
Kioan resettlement

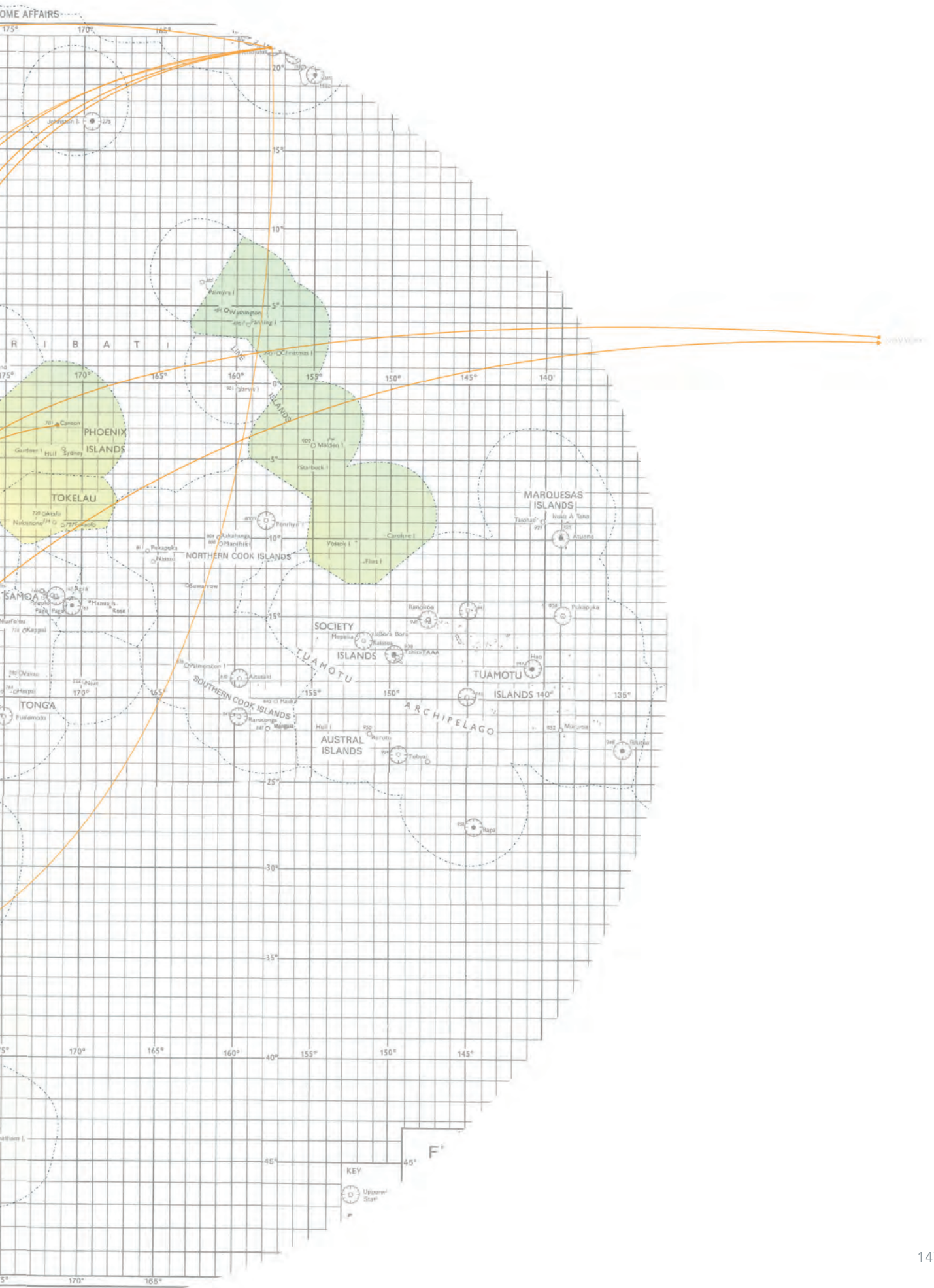
GREECE 78
ITALY 77
SPAIN 65
GERMANY 29





MIGRATION
Mobility of nterview subjects





Map of Fiji by Courtesy of the N.Z. Dept. of Land and Survey S.Z.



FLUID NATION

ARCHIPELAGIC
SOVEREIGNTY

The definition of Tuvalu has evolved over time and space, and its future may look very different than its past or present. The previous sections examined the fluid natures of both Tuvalu's geography and population. When both its ground and its society are in flux, what is the future of the Tuvaluan nation? These unstable frameworks sit uneasily in the modern notion of the nation-state, and this section explores the development and transformation of Tuvalu as a nation. Existing strategies for Tuvalu to deal with risk to the nation's physical instability have not been contextualized within this larger body of fluidity. Thus, this project proposes to explore design strategies that deal with physical and cultural risks through the lens of liquid uncertainty.

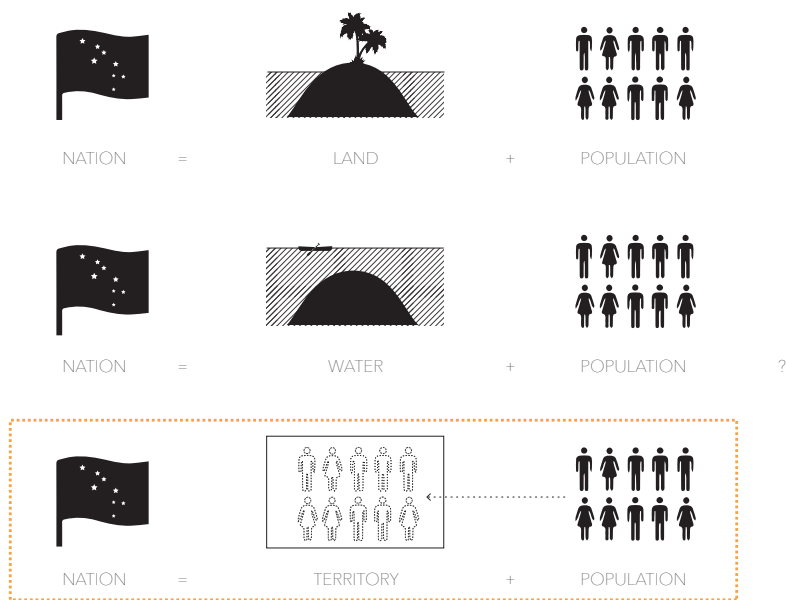
NATIONHOOD AT RISK

HISTORY OF TUVALU AS NATION

Tuvalu's combination of fluid ground and fluid people combine to create a shifting sense of nationhood, appropriate to the country's archipelagic context. Just over 2,000 years ago, in the equatorial waters of Western Polynesia, a nameless archipelago of nine coral islands existed unknown to man, inhabited only by migratory birds and swaying palms. While the Gauls were sacking Rome, these sunny islands surrounding shallow, cyan lagoons existed in peaceful anonymity, colorful coral communities haunted only by the occasional cyclone.

When the first settlers arrived from Lapitian settlements in Tonga and Samoa, they found lands not yet modified by man. The abundant reefs and bush, and tropical climate allowed for these newly discovered atolls to be inhabited with minimal interventions. As these first outposts grew into established communities, the settlements spread across of eight of Tuvalu's nine atolls. (The ninth, Niulakita, is surrounded by a sharp and dangerous reef and operated as an outpost of Nui). Each island had dispersed, clan-based settlements led by local *aliki*, and operated as its own world; it was at least a full day's canoe ride to their nearest neighbors. The atolls developed separated identities, traditions, and dialects and each saw their own communities as unique. They maintained relationships through trade and marriage, but also raids and war. These were separate kingdoms in dialogue, due to relative geographic proximity along the archipelago. It was as this affiliated collective, and not single-identity nation, that emerged the name Tuvalu, or eight-standing-together. To this day, Tuvaluans define themselves in terms of their home island first, and as Tuvaluans second.

These eight-standing-together islands were lumped together under one label during the early days of contact with European and Christian so-



Defining Nationhood: this project conceives of the nation as a peoples practicing their culture in a shared space.

cities. These outside ‘discoverers’ dubbed Tuvalu as the ‘Ellice Islands’, for administrative convenience during preliminary trade and subsequent Christianization. What had once been a network of clans, chiefs, and ocean voyagers was now lumped together as one group from the perspective of these outsiders. In the late nineteenth century, Tuvalu was further lumped together with the even more amorphous island agglomeration of Kiribati as the ‘Gilbert and Ellice islands.’ This was in spite of the fact that Tuvalu and Kiribati are separate geographic archipelagos, and entirely distinct cultures. Tuvaluans fall into the ancestral and cultural lineage of Polynesians, while the I-Kiribati are of Micronesian origin. By claiming this island region as a colony, the British empire converted a set of nuanced and networked social structures into subjects of a single, top-down authority. This systemic restructuring is the first step in the formation of the contemporary Tuvaluan nation-state.

The establishment of the centrally-ruled colony changed not only Tuvalu’s internal structure, but its relationship to other nations as well. Historically, individual atoll-communities had distinct relations with other groups outside the archipelago: Nanumea and Nanumanga traded prolifically with Tonga, and Nui had a strong relationship with I-Kiribati islands. Now centrally administrated, this complex web of relationships was singularly mandated by colonial authorities.

During the transition to colonial independence, Tuvalu quickly sought to separate itself from Kiribati, and in 1978 became an independent nation. However, its prior 8-standing-together structure had been eroded by these colonial processes, and the archipelago became dependent on a central governmental authority (also perpetuated by isomorphic development models). Of course, the shifting global context made its identity as an independent nation-state important as well; in order to enjoy participation in global economy and society, Tuvalu required the trappings of nationalist sovereignty.

THE MODERN NATION-STATE

The contemporary nation-state is both a *nation* (a group of *people* with shared history and culture) and a *state* (a political entity governing a *territory*). As has been discussed at length in the prior two sections, for Tuvalu, but the population and the territory of the nation-state are in flux. Thus, both Tuvalu's nationhood and statehood are fluid, and are operating in a context of future uncertainty. While the nation-state model sits uneasily on Tuvalu's fluid context, it is a necessary tool for existence and negotiation on the global stage. Without nation-state status, Tuvaluans would have little or no agency in a global society as we know it today.

The nation-state emerged in Western Europe in the era following Renaissance restoration, as feudal society gave way to independent nations. Many cite the Treaty of Westphalia (1648-9), which ended the bloody Thirty-Years War, as the beginning of the era of the nation-state. This political document "overturned the medieval system of centralized religious authority and replaced it with a decentralized system of sovereign, territorial states."²²⁹ This model was a territorial mode of governance (state) which ruled over a group of people with a shared culture or background (nation). The Western European nations who established this model contributed to its gradual spread across the globe, through colonization and trade.

A world of nation-states is composed of sovereign actors who each "can exercise supreme authority within its own territorial boundary" and are "recognized by the other sovereign states and identified as an equal member of the international society"²³⁰ Thus, the nation state must be defined by external forces as well as internal ones. This defining association of modern nation-states as we know it today was first established by the League of Nations (1919), following the first World War, and was followed by its current instantiation, the United Nations (1945). Through this system of association, worldwide models of the nation-state inform all other aspects of modern society: culture, education, business, and medicine. The societies composing the nation state "are structurally similar in many unexpected dimensions and change in unexpectedly similar ways," following pre-ordained patterns of development.²³¹ These isomorphic tendencies are driven by world economic and political competition. Culture, that aspect which might distinguish societies, "is of only marginal interest; money and force, power and interests, are the engines of global change." These external forces are thus the drivers of nation-state development, not individual actors



The world as enactment of culture. From Meyer, John W., et al. "World society and the nation-state." *American Journal of sociology* 103.1 (1997): 144-181.

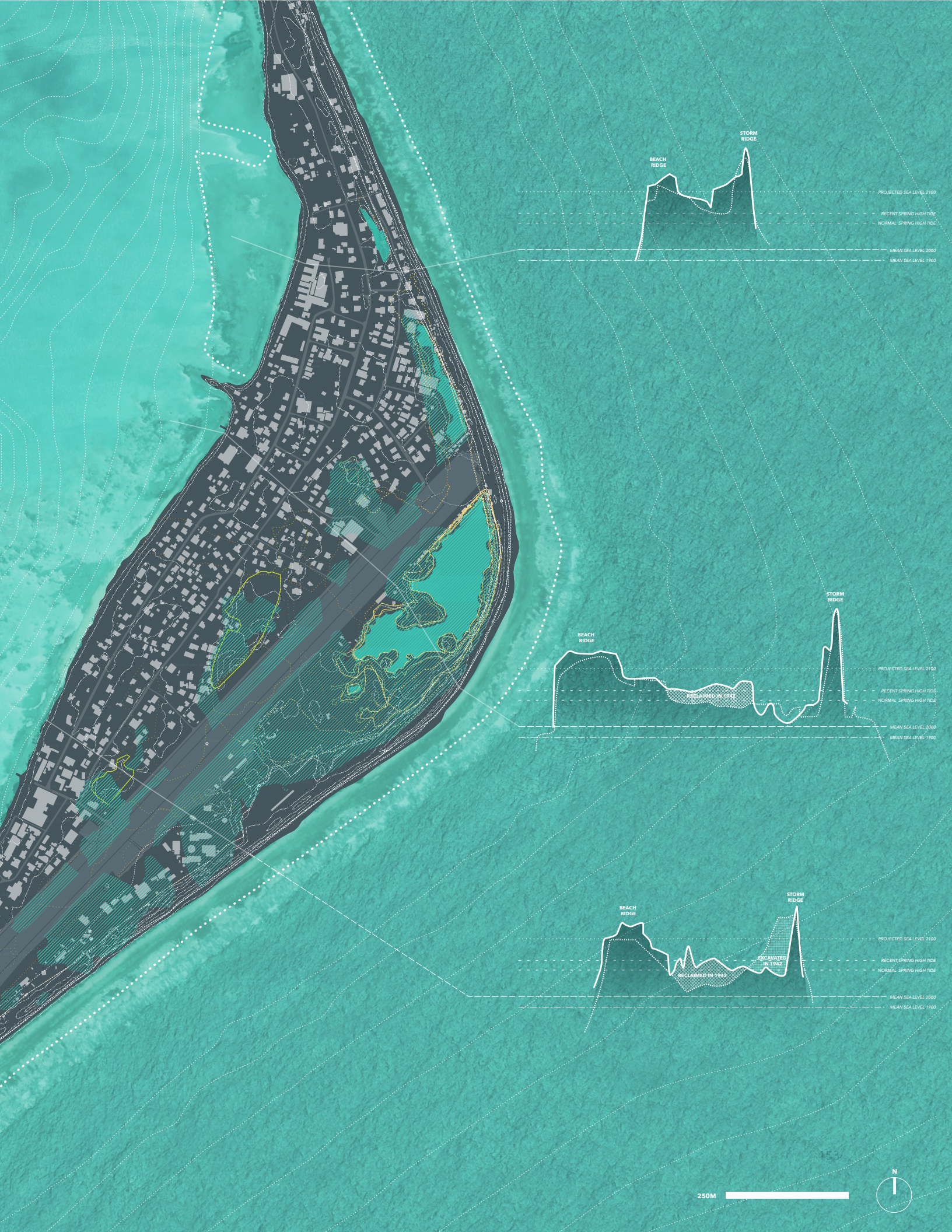
229. Vaughan, Michael. "After Westphalia, whither the nation state, its people and its governmental institutions?" *Ilsa Asia Pacific Regional Conference*. The University of Queensland, 2011.

230. *Ibid.*

231. Following here the world-system theory of nation-state development as established by Meyer et. al.

Transformed ground: the material surface of the atoll has transformed significantly over the last decade through both man-made and natural transformations. Funafuti capital settlement. *Drawing by author, with data from the UNDP*





BEACH RIDGE

STORM RIDGE

PROJECTED SEA LEVEL 2100
 RECENT SPRING HIGH TIDE
 NORMAL SPRING HIGH TIDE
 MEAN SEA LEVEL 2000
 MEAN SEA LEVEL 1900

BEACH RIDGE

STORM RIDGE

PROJECTED SEA LEVEL 2100
 RECENT SPRING HIGH TIDE
 NORMAL SPRING HIGH TIDE
 MEAN SEA LEVEL 2000
 MEAN SEA LEVEL 1900

BEACH RIDGE

STORM RIDGE

PROJECTED SEA LEVEL 2100
 RECENT SPRING HIGH TIDE
 NORMAL SPRING HIGH TIDE
 MEAN SEA LEVEL 2000
 MEAN SEA LEVEL 1900

250M





within the system. It is a top down societal force which self-reproduces through embedded structures and practices.²³²

When Tuvalu declared themselves as an independent nation in 1978, and went on to joining the United Nations in the year 2000, this is the global system of nation states they emerged into. While colonization and Christianization initially launched the process of ‘developing’ Tuvalu in a modern/Western trajectory, the isomorphic tendencies of the nation-state further promoted these trends. Like many developing nations:

“They claim all the features of the rational state actor: territorial boundaries and a demarcated population; sovereign authority, self-determination, and responsibility; standardized purposes like collective development, social justice, and the protection of individual rights; authoritative, law-based control systems; clear possession of resources such as natural and mineral wealth and a labor force; and policy technologies for the rational means- ends accomplishment of goals.”²³³

We can see this through Tuvalu’s establishment of a multi-hierarchical government with familiar departments, including a national Parliament, and local Town Councils, and a Constitution. However, like many of their peers,²³⁴ there is often a decoupling between the formal models they follow and what actually occurs in daily practice. For example, Tuvalu has a building code established in the 1980s by an Australian development group, but it is not followed and effectively serves no function in the way buildings are built. Culture and traditions are also counter to ‘development’ along these lines, and tend to be interpreted as problems or stored away in museums in development frameworks. This was the way that Tuvaluan indigenous religion was framed by colonizers, leading to its near-total erasure. The replacement of culture with international development standards has contributed to overpopulation and obesity, not to mention the cultural identity crisis discussed above. And while this structural mimesis is problematic in

233. Meyer, John W., et al. “World society and the nation-state.” *American Journal of sociology* 103.1 (1997): 144-181.

234. Other small island developing states (SIDS)

232. Tölölyan, Khachig. “The nation-state and its others: in lieu of a preface.” *Diaspora: A Journal of Transnational Studies* 1.1 (1991): 3-7.

these ways, it is nearly impossible for a nation to break out of this societal framework:

“Resistance to world models is difficult because nation-states are formally committed, as a matter of identity, to such self-evident goals as socioeconomic development, citizen rights, individual self-development, and civil international relations.”²³⁵

In order to function as part of a global society, or perhaps even to exist in our globalized world, the nation-state is the framework a national group such as Tuvalu must operate within. Thus, this thesis takes the nation-state as a starting point for the generation of Tuvaluan agency in the context of climate changed futures. However, the nature of the nation-state is changing, and new global structures (i.e. corporations) and crises (i.e. climate change) are prompting a rethinking of the nation-state as a model. This thesis, then, uses the nation-state as a starting point, but does not adhere to dated or rigid logics of what it should be. For example, the ex-situ proposals reject the notion promoted by Gellner that “the political and national unit should be congruent”²³⁶ and instead follows more open-ended models of national identity, such as the “nation as network,”²³⁷ “nation as institutional cultural and political form,”²³⁸ or “nation as invented tradition.”²³⁹ Hobsbawm’s notion of the “invented tradition” is especially useful for this thesis, as future Tuvaluans may well have to imagine how they re-invent their forms of practiced identities within new contexts.

Some authors have even gone so far as to predict the failure of the nation-state in the contemporary age. International relations theorists have called for a re-definition of “politics, sovereignty, and subjectivity”²⁴⁰ in a post-Westphalia era, and generally agree that the idea of sovereignty in particular is losing relevance in the context of transnational corporations and capital markets. Increasingly, national potency is measured by GDP rather than increments of physical territory, and is increasingly overshadowed by corporate systems.²⁴¹ Some South Pacific island nations have been cited as ‘failed nations’ due to their incapacity to operate after the failure of modern industries. Nauru is the starkest case, where the depletion of phosphate resources in the early 2000s fully eroded the nation’s economy to the point where they are now predominantly controlled by an independent contractor housing refugees seeking asylum in Australia. In this context, in order to have agency relative to other nations or other (i.e. corporate) entities, it is important that Tuvalu continues to exist as more than just an archipelago of islands. However, there is also the opportunity that even with the loss of habitable physical territory, Tuvalu may be able to operate independently on

235. Meyer, John W., et al. “World society and the nation-state.” *American Journal of sociology* 103.1 (1997): 144-181.

236. Gellner, Ernest. *Nations and Nationalism*. Ithaca: Cornell University Press, 1983.

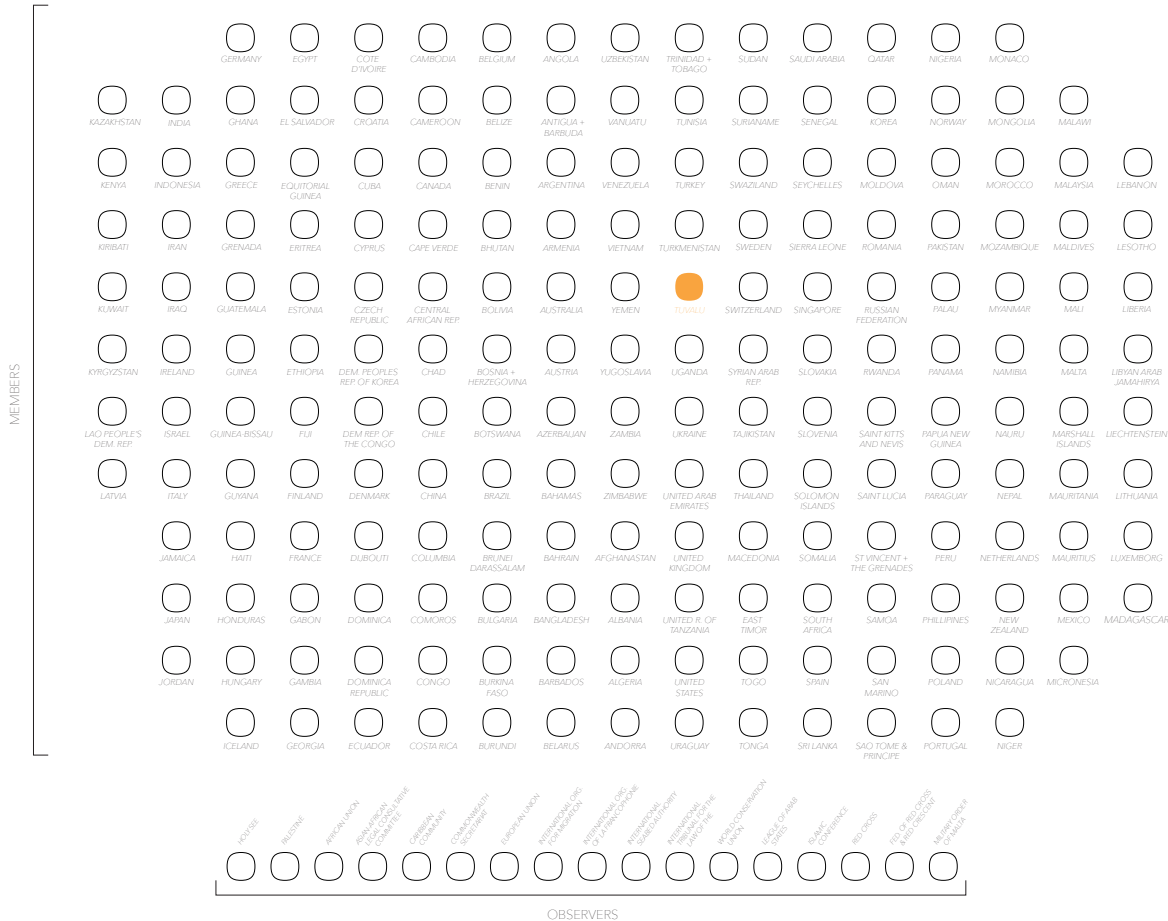
237. Bernal, Victoria. *Nation as Network: Diaspora, Cyberspace, and Citizenship*. University of Chicago Press, 2014.

238. Brubaker, Rogers. “Rethinking Nationhood: Nation as Institutionalized Form, Practical Category, Contingent Event.” *Contention* 4.1 (1994): 3-14.

239. Hobsbawm, Eric. “The nation as invented tradition.” *Nationalism* (1994): 76-82.

240. Vaughan, Michael. “After Westphalia, whither the nation state, its people and its governmental institutions?.” *Isla Asia Pacific Regional Conference*. The University of Queensland, 2011.

241. *Ibid.*



Tuvalu's seat in the UN General Assembly. Tuvalu's vote in the UN as a sovereign nation is one of their most powerful assets.

a global scale by expanding their economies within and beyond their territorial boundaries. The role of economy in Tuvalu's possible futures is explored in the second scenario of this thesis, which explore connecting a dispersed nation through strategic economies.²⁴²

WHAT'S AT STAKE: WHAT NATIONHOOD MEANS FOR TUVALU
 Through the risks of climate change, alongside additional issues of cultural erosion, Tuvaluans face not only the loss of their home islands, but also the loss of nationhood itself. As discussed above, the definition of nation-state contains two essential physical components: territory and population. More specifically, to exist as a *sovereign* nation, this thesis specifically defines nationhood as 'a collective practicing their shared culture in a space over which they have agency.' For Tuvalu, both sides of the national equation are unstable: its territory and its population are in a constant state of flux further catalyzed by climate change. However, as is suggested by the shifting role of the nation-state discussed above, while this process may be more visible in Tuvalu, nothing in the nature of society or environment is static. As John Locke has noted:

242. See pages 244 - 287

“Things of this world are in so constant a flux, that nothing remains long in the same state.”²⁴³ This idea was introduced in the context of representation, in terms of abandoned cities who retain equal potency in the Assembly as those which are large and flourishing. It remains to be seen whether so-called failed states will retain a seat at the table, in terms of the United Nations or any other systems of national recognition and identity. For Tuvalu, their seat in the United Nations is one of their strongest bargaining chips, and perhaps the only reason that larger society has become aware of the risk that climate change might create for Tuvaluans. For small island nations, sovereignty is one of their valuable forms of currency, allowing them not only self-determination, but rights to territorial waters, products of sovereignty including passports and ship flags, and a voice on a global stage.

EXISTING RISK RESPONSES

EXISTING ADAPTATION POLICIES AND STRATEGIES IN TUVALU

The above section addresses how the modern nation-state society values pre-defined frameworks as priorities for the ‘development’ of small island developing states (SIDS) such as Tuvalu. Thus, while the risks facing Tuvalu are more complex than these frameworks identify, theirs are the primary responses in play. Issues such as cultural identity, local sovereignty, or territorial strategization are discussed little if at all; “stakeholder consultations” contain little substance. Additionally, much of the existing aid Tuvalu receives towards addressing climate change or socio-economic risks occurs in exchange for political favors or fishing rights, which may be at odds with longer-term Tuvaluan interests.²⁴⁴

Tuvalu’s current development plan is outlined by Kakeega II (2005 - 2015), and was preceded by Kakeega I (1995 - 1998). As suggested by the above discussion on the isomorphic nature of the nation-state, its protocols and benchmarks are quite familiar. It is organized within a framework of eight strategic areas: good governance; macroeconomic growth and stability; social development: health, welfare, youth, gender, housing, and poverty alleviation; outer island and *falekaupule* development; employment and private sector development; human resource development; natural resources: agriculture, fisheries, tourism, and environmental management; and infrastructure and support services. It is organized according to multilateral development metrics, including the Millennium Development Goals, the Kyoto Protocol, and the Multilateral Environmental Agreements.

243. Locke, John, and Crawford Brough Macpherson. *Second treatise of government*. No. 31. Hackett Publishing, 1980.

244. For example, the donation of the government complex building by the Taiwanese government in exchange for recognizing Taiwan as a nation.

Currently, Tuvalu's primary plan for dealing with future risks is the National Adaptation Programme(s) of Action (NAPA I and NAPA II), as well as the more recently developed Ridge to Reef Programme (2015). While these documents are (ostensibly) produced by Tuvalu's local government, they are largely propped up by multilateral organizations, in this case namely the United Nations Development Programme (UNDP) for technical support and the Global Environment Facility (GEF) for funding. Because of their participation as one of many island nations in the broader UNDP climate adaptation framework, Tuvalu's adaptation plans look much like their island cohort's, and even shares many similarities with global urban and national climate change adaptation plans. These multilateral systems attempt to normalize Tuvalu into standard development frameworks, failing to acknowledge the distinctly fluid nature of the nation's components.²⁴⁵ This is highlighted in the NAPA I document through the analysis of Fualefeke Islet, an uninhabited islet on Funafuti atoll (see inset on opposite page). Since 1984, the coastline of this islet has migrated such that two parcels were eliminated, and additional land was accumulated on the lagoon side of the inlet (a formation typical of spit-generation processes). This island migration is cited as evidence of risk through which "the stability of the marine and terrestrial ecosystems will also be adversely affected."²⁴⁶ However, the document fails to acknowledge that this is perhaps more evidence of the problematics of Western property ownership structures overlaid on fluid islands than of risk. In fact, these processes are *inherent to* atoll marine and terrestrial geographies, and as a result, their ecosystems as well.

The NAPA projects (I & II) outline strategies that generally focus on near-term risks and issues peripherally associated with climate change: for example, food and water security, and ecosystem protections. Bigger picture uncertainties, such as sea level rise, are dealt with only through incremental and small-scale adaptations such as coastal plantings or even engineered defense systems which directly work against atoll fluidity. While these programs are ostensibly propagated by the local government and only supported by external institutions, in reality they are being largely managed, directly or indirectly, by external structures.²⁴⁷ This thesis is critical of NAPA-type multilateral-sponsored²⁴⁸ adaptation processes on two levels.

First, the framing of adaptation within isomorphic, globalized processes predetermined multilateral organizations with nominal 'stakeholder consultations.' These systems assume that there is one correct way to prepare for local risks associated with climate change and it is similar across the globe. They assume knowledge is portable, and can be trans-

245. During January of 2015 I was very fortunate to spend three weeks in-situ at the UNDP Fiji Multi-Country office in Suva with support from the MIT Public Service Center. The staff there was incredibly kind and helpful, working with the best of intentions in working to improve livelihoods in island nations. However, the day to day bureaucracy of Project Identification Forms (PIFS), frameworks, and methods, entirely subsumed the staff, leaving no room for innovation or context-specific variation from top-down frameworks.

246. NAPA 1 Document, Government of Tuvalu.

247. See the actor-network diagram on the following spread.

248. The United Nations Development Program is the dominant benefactor of aid and development in Tuvalu. However, there are many, many other organizations or national entities working on the ground or providing aid to Tuvalu including: Australia, New Zealand, Japan, South Korea, the EU, the Asian Development Bank, AUaid, SPREP, and also nonprofits including, TuCAN, the Red Cross, and TANGO.

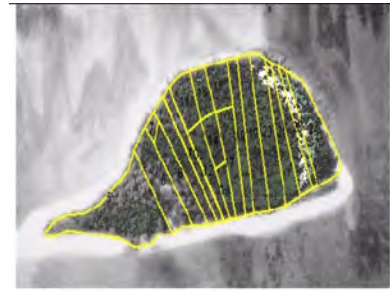
mitted by experts from one location to another.²⁴⁹ These multilateral methodologies also trap Tuvalu in an “aid curse”²⁵⁰ where increased foreign or institutional aid results in a decreased ability to self-govern. Thus, adaptation occurs not in a self-directed, bottom up way over which Tuvaluans have agency, but in an external operated, top down approach, which eliminates local agency in how these systems occur.

The second problematic of multilateral adaptation systems is the incremental and development-oriented approach. Within their own terms, programs like NAPA can be relatively good at framing solutions to short-term concerns such as sanitation, food security, and environmental degradation. These are all important issues and areas of concern for Tuvalu. And, as noted above, these sorts of short term risks severely impact the nation’s ability to deal with more long-term issues. However, none of Tuvalu’s current adaptation proposals address the larger, more catastrophic risks the climate change may pose: immense storm surges, home-wrecking cyclones, or sea level submersion. I argue that this is at least partially due to the fact that development frameworks are not well suited to dealing with these kinds of risks; their focus is on making Tuvalu more like other developed nations, and not on preparing for broader environmental uncertainties based upon local specificities. New models are required for mediating the unprecedented risks associated with climate change, but these models should draw first on local knowledge and cultural practice.

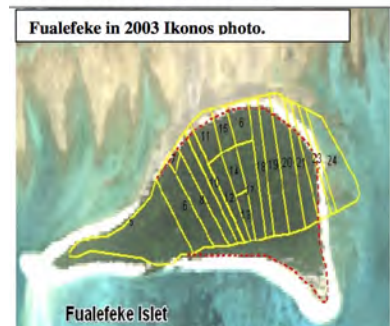
In response to these existing models of adaptation in Tuvalu (which are essentially the same across the Pacific region)²⁵¹ this thesis first prioritizes strategies which emerge from essential Tuvaluan logics of fluidity and mobility, and second, frames large-scale, longer term risks as equal priority to short-term, incremental risks. This model of designing for uncertainty and risk in a specific local context is discussed in further detail in the subsequent section.²⁵²

EXISTING ADAPTATION POLICIES AND STRATEGIES IN GLOBALLY

In a global context, climate change adaptation typically occurs through similar institutional frameworks in developing contexts, or in more developed contexts through self-directed municipal, regional, or national adaptation plans. For the developed world, the municipal adaptation plans are common models in addition to national policies. The structure of these policies is enforced by transnational policy as well: Article 3 of the UN Framework Convention on Climate Change encourages governments to formulate adaptation plans. Like other frameworks in



Aerial Photo of Fualefeke Islet 1984.



Fualefeke in 2003 Ikonos photo.
Fualefeke Islet

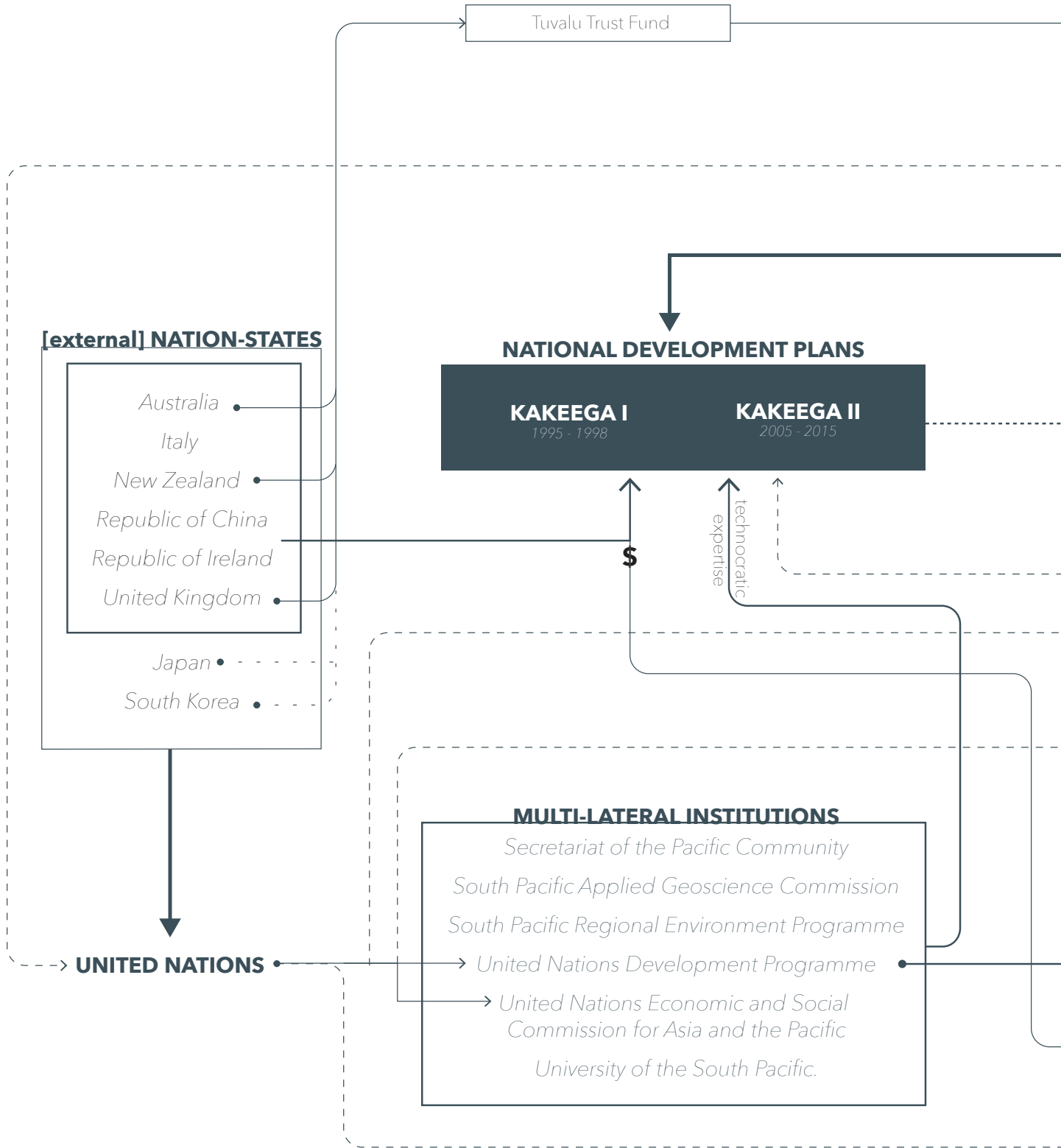
“Coastal erosion and its cost on Tuvalu landowners and families” in the *Tuvalu’s National Adaptation Programme of Action*. Island migration processes are illustrated here as a risk associated with climate change instead of as an inherent process of atoll geographies.

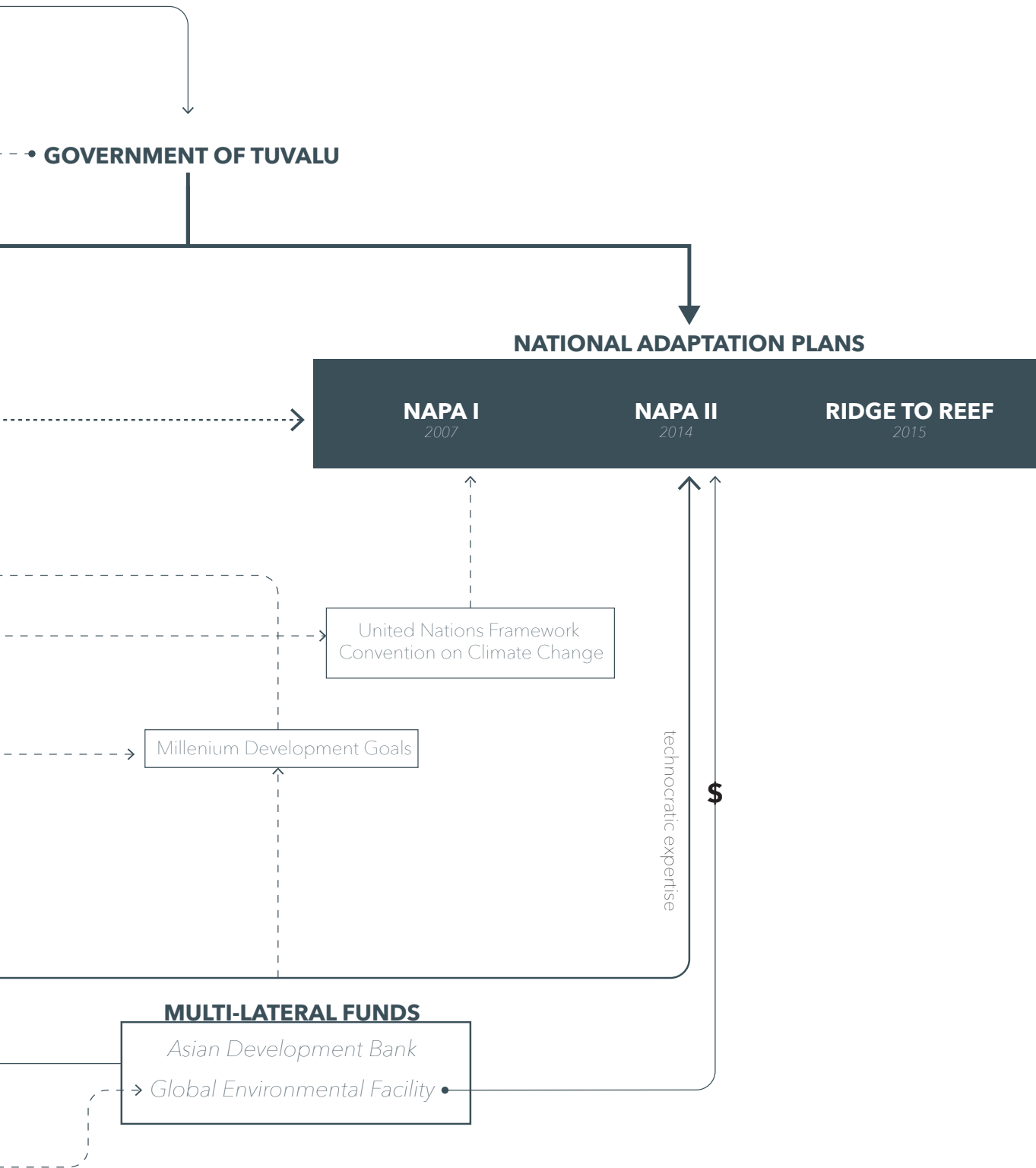
249. Mehos, D., & Moon, S. (2011). The uses of portability: Circulating experts in the technopolitics of Cold War and decolonization. In *Entangled Geographies: Empire and Technopolitics in the Cold War* (pp. 43-74).

250. Djankov, Simeon, Jose G. Montalvo, and Marta Reynal-Querol. “The curse of aid.” *Journal of Economic Growth* 2008: 169. JSTOR Journals. Web. 30 Jan. 2016.

251. The UNDP Fiji Multi-Country office is working on adaptation programs in 13 island nations in Oceania.

252. See page 173





TUVALUAN RISK GOVERNANCE IN THE NATION-STATE CONTEXT: Actor Network Drawing by Author. Data Sourced from SPREP, UNDP, GoT.

the context of nation-states, they follow globalized, isomorphic trends. Many of these plans contain highly similar frameworks, and are sponsored (and thus formulated) by a similar set of organizations.²⁵³ Common chapters in national and subnational government-led adaptation programs are shaped by multilateral frameworks. They generally follow either a hazards based approach, which looks at incremental risk impacts of climate change, or a vulnerability-based approach, which begins with an assessment of current risks in calculating future climate risk. IPCC and UNEP guidelines for adaptation follow a hazards-based approach, while the UNDP and GEF frameworks focus on vulnerability assessments.²⁵⁴ It is this vulnerability-based framework undertaken in Tuvalu which fails to examine larger, longer-term climate risks (such as displacement), instead focusing on technocratic solutions to immediate vulnerabilities as determined by multilateral frameworks.²⁵⁵

With this project, I argue that multilateral frameworks are *not* well-suited to climate change adaptation by their very nature. While this top-down frameworks may make gestures towards local involvement and analysis, they are inherently part of a global framework. Climate change is imbued with uncertainty, with a unique range of possible impacts and risks depending on local geographies, populations, governance, and resources. The imposition of multilateral best-practices leaves no room for radical and *site specific* invention and innovation that will be necessary to deal with the risks posed by a dynamic climate. The subsequent proposals respond to these existing models by introducing design-based strategies at multiple scales, up to and including the Tuvaluan nation-state.

In addition to these governance-led adaptation policies, there is a growing body of work on localized adaptation by NGOS, local government agencies, individuals, and private firms, which includes the emergent field of resilient design. These include increased passive thermal strategies, water retention techniques, elevated first floors, and the selection of materials and site strategies that cope with specific local risks. While these new models are important to creating a built environment that can accommodate climate change, this project posits an increased dialogue between this sort of building-scale tactics and municipal or national adaptation strategies.

253. Adger, W. Neil, Nigel W. Arnell, and Emma L. Tompkins. "Successful adaptation to climate change across scales." *Global environmental change* 15.2 (2005): 77-86.

254. Füssel, H-M. "Adaptation planning for climate change: concepts, assessment approaches, and key lessons." *Sustainability science* 2.2 (2007): 265-275.

255. Leckie, Scott. *Land Solutions for Climate Displacement*. Routledge, 2014.

PROPOSED TUVALUAN FUTURES: ALTERNATIVE ADAPTATIONS
Adaptation frameworks such as that provided by the UNDP/GEF fail to sufficiently address the very likely possible future that Tuvalu becomes uninhabitable. Tuvalu's government has refused to address this

very real risk, focusing on their symbolic role supporting climate change mitigation instead of making action plans for more dramatic risks and adaptation. Within this vacuum, several conceptual outcomes/proposals have emerged for low-lying atoll nations such as Tuvalu, Kiribati, the Marshall Islands, and the Maldives: *the de-territorialized nation*, *planned resettlement*, and *constructed islands*.

The *de-territorialized nation* is a cultural assemblage which lacks a territory, in effect, a nation without a state. This is the strategy posited by Kiribati president Anote Tong when he calls for skill training programs that will allow for his nation's residents to migrate as skilled workers to other nations around the world. While in one sense the concept of the ex-situ nation can be seen as the inevitable outcome without intervention, simply a loose and unplanned diaspora as Tuvaluans incrementally migrate to high ground, it also has the potential to be an intentional post-territorial nation, specifically a *nation ex-situ*. This dispersed nation also has a precedent in the historic mobility of the Tuvaluan archipelago:²⁵⁶ "the cultural and political spaces of.. archipelagic forms suggest that the 'fit' of climate change emigration strategies depends on complex relations at different scales, and on particular conceptions and practices of mobility and space."²⁵⁷

The *nation ex-situ* is a proposal for "a status that allows for the continued existence of a sovereign state, afforded all of the rights and benefits of sovereignty amongst the family of states, in perpetuity."²⁵⁸ This structure would allow nations such as Tuvalu to retain their nation-state status, cultural identity, and position in the United Nations even lacking a physical territory over which the nation governs. The members of this nation would retain their identities (while potentially gaining additional ones as well) so that they retain their ability to operate as Tuvaluan agents. It also helps to absolve some of the risks of becoming 'stateless agents' upon the archipelago's physical demise.

These concepts of deterritorialized and ex-situ nationhood play prominently in the subsequent design proposals. They recognize the very real possibility of new structures of national agency in a post-climate-change era, and understand the nation-state as part of a larger societal construct. These concepts figure particularly highly in the extra-territorial proposals for Auckland.²⁵⁹

The planned corollary to a diasporic scenario is that of intentional relocation, potentially including the creation of a physical enclave within another nation state. Planned resettlement may be the most commonly-cited strategy for dealing with the uncertain future of atoll ground.

THE ORDER OF MALTA

The Sovereign Military Hospitaller Order of Saint John of Jerusalem of Rhodes and of Malta, or the Order of Malta for short, is the world's smallest nation, at only 3 full citizens (and an additional 13,000 non-citizen members), but it is also the world's only extraterritorial nation. While the Order of Malta is an extraordinary case, it suggests the possibility of future extra-territorial nations, which retain their seats in the UN, right to issue passports, and other trappings of sovereignty even if they no longer govern over sovereign territory.

See: Wong, Derek. "Sovereignty Sunk?"

256. See section on Fluid Populations, pages 79 - 118

257. Stratford, Elaine, Carol Farbotko, and Heather Lazrus. "Tuvalu, sovereignty and climate change: considering Fenua, the archipelago and emigration." (2013): 67.

258. Burkett, Maxine. "The Nation Ex-Situ: On climate change, deterritorialized nationhood and the post-climate era." *Climate law* 2.3 (2011): 345-374.

259. See pages 216 - 237 and 264 - 281



Male, Capital of the atoll nation of the Maldives. Fortification and land-building processes have eliminated this atoll's ability to respond to sea level rise through coral/atoll processes. Source: Wikimedia Commons

While it does allow for a possible continued physical cohesion of Tuvaluan society, it creates new problems by asking other nations to cede territory for the proposed enclave. As a nation within another nation, it also asks questions regarding parallel or inset sovereignty and legal structures.²⁶⁰ Some, such as Matthew Risse, have called for the carbon-producing developed world to take on these resettled populations as a matter of moral necessity as part of the philosophic principle of the *collectively owned earth*:

“What obligations arise in a situation in which a co-owner finds oneself unable to exercise ownership rights in his or her native location? Under circumstances in which a territory is lost to sea rise there is no longer a way of respecting the troubled party’s co-ownership rights by helping them to make a living in their current location. Rather, the only way of respecting these rights is to allow the affected people to immigrate.”²⁶¹

Risse goes on to argue that if there are countries that have an amount of space exceeding their needs, that those countries would have an obligation to offer at-risk island nations the option of resettlement in whole. Nations who have exceeded their share of carbon production could offer this as a way of offsetting their affront to humanity.

As discussed in the section on *Fluid Populations*,²⁶² the resettlement of a group of Vaitupu islanders to Kioa Island in Fiji offers a precedent for the mass relocation model for Tuvaluans, and some have even suggested Kioa as a preferred site to do so.²⁶³ Past prime ministers have argued in Risse’s model for Australia to accept the displaced population, and the purchase of land in Fiji has also been discussed.²⁶⁴ The nation of Kiribati, which faces similar risks, has already purchased land in Fiji, but maintain that the land will be used for food production only. However, the present Prime Minister of Tuvalu, Enele Sopoaga, has held firm to mitigation discourse, dismissing the need to consider more drastic measures.

Finally, the third set of proposals for dealing with uninhabitability has to do with the construction of *new ground*. This ranges from the relatively reasonable proposals of land reclamation in interior lagoons to more fantastic floating islands or oil-rig city-states. The idea of land reclamation was cited by several interview subjects on Funafuti as an option for maintaining habitability and accommodating burgeoning populations, specifically the construction of new islands off the coast of Dubai. Of course, both the hydrologies and economies of these two places are vastly divergent, and land reclamation poses a number of problems in Tuvalu. Besides the obvious question of cost, considering

260. Kelman, Ilan. “Island evacuation.” *Forced Migration Review* 31. October (2008): 20-21.

261. Risse, Mathias. “The right to relocation: disappearing island nations and common ownership of the earth.” *Ethics & international affairs* 23.3 (2009): 281-300.

262. See page 79

263. Stratford, Elaine, Carol Farbotko, and Heather Lazrus. “Tuvalu, sovereignty and climate change: considering Fenua, the archipelago and emigration.” (2013): 67.

264. Corlett, David. *Stormy Weather: The Challenge of Climate Change and Displacement*. UNSW Press, 2008.

Tuvalu's annual GDP of 38 million,²⁶⁵ newly formed land suffers from instability and erosion issues which would be particularly problematic in the context of Tuvalu's complex atoll hydrodynamics, discussed in the section on *Fluid Ground*.²⁶⁶ Tuvalu is not a static sandbar, but a fluid system of coral and sediment; any land accretion strategies should take these geological processes into consideration. For example, Male, the capital of another atoll nation, the Maldives, has been highly fortified, causing problems of perimeter erosion but more significantly interrupting the atoll's natural ability to accrete vertically in response to sea level rise.

265. World Bank data

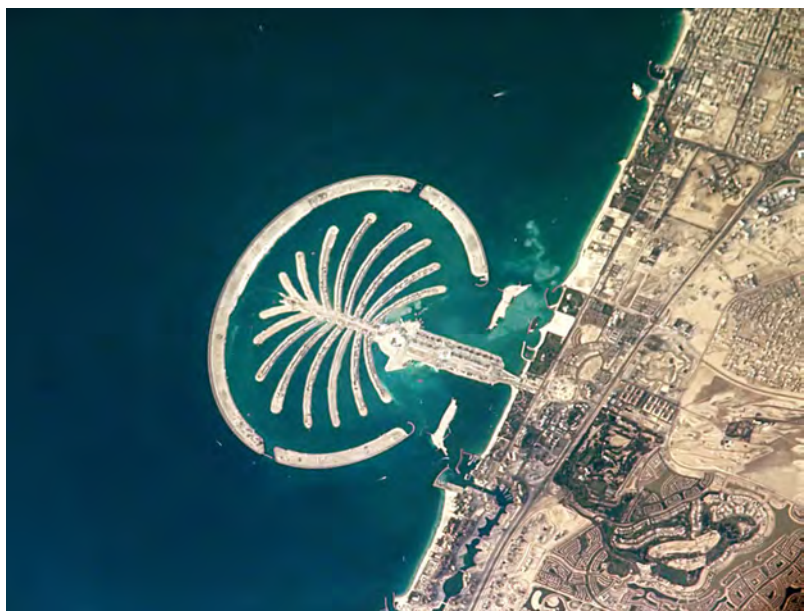
266. See page 37

Most dramatic are proposals for creating entirely new islands: floating, stilted, or supported on oil-rig type infrastructures. While these proposals have primarily existed in the realm of creative speculation, the Seasteading Institute, is an organization that is actively researching the strategies for creating autonomous floating communities in international waters.²⁶⁷ While the benefit of these sorts of proposals include the maintenance of autonomy, these visions would be expensive, experimental, and bring with them a whole new set of risks and uncertainties.

267. See www.seasteading.org

The design proposals in this thesis learn from and are informed by all three of these models. Rather than appropriating these models directly, the design research is informed by the earlier studies of fluid ground and fluid populations, thus taking a critical stance on existing 'solutions.' Proposing multiple strategies, this thesis explore how concepts of deterritorialized nationhood, right to relocation, and strategic accretion tactics might be implemented for both in- and ex-situ Tuvaluan populations.

Palm Island resort constructed on reclaimed land in Dubai.
Source: Wikimedia Commons



EXPANDED DESIGN RESEARCH QUESTIONS

WICKED PROBLEMS

As this chapter begins to explore, this thesis has thoroughly embroiled itself in a ‘wicked problem,’²⁶⁸ a set of issues without single solutions and with a complex and sticky framework. Many problematics emerge: why preserve a nation when the nation-state is a decreasingly relevant unit? Why propose adaptation strategies as an outsider when outside intervention has led to much of Tuvalu’s problems? How can you propose methods for dealing with climate change when its risks are inherently uncertain?

Design is a discipline well-suited to positioning proposals within the context of this wealth of uncertainty and complexity. Unlike more scientific disciplines, the act of design is one of nuanced synthesis where strategies emerge in the context of thorough understanding of complicated, and sometimes contradictory problems. While it means that in this case there is no single, one-size fits all solution, in the case of large-scale social and environmental risks, this is perhaps an asset. Instead of attempting to solve Tuvalu’s problems, the design research questions posed here offer new ways of framing the uncertain risks created by climate-changed futures.

QUESTION 1: ON INHABITING FLUID GROUND

The contemporary framework of nationhood postulates the contents of the nation-state (its population and its geography) as relatively static. However, in Tuvalu both of these components are inherently fluid, and their rate of flux will be further amplified by climate change. This condition problematizes the hard lines of territory and state drawn sharply in the contemporary era. Responding to the *problematique* of fluidity in the framework of nationhood, the subsequent design proposals²⁶⁹ seek to address the following questions:

268. A wicked problem is a complex issue that may be difficult or even impossible to solve due to its complexity. See: Churchman, C. West. “Guest editorial: Wicked problems.” (1967): B141-B142.

269. While all of the design proposals of this thesis are closely intertwined and are informed by the body of these research questions, the in-situ proposals focus deal more directly with question 1, and the ex-situ proposals with question 2, although 2D effectively spans both the in-situ and ex-situ proposals in Scenario 2.

A. When both ground and people are acknowledged as fluid entities, how can we reimagine the spatial and social form of the Tuvaluan nation?

B. How can Tuvalu continue to exert territorial claims when both the subject and object of nationhood are in flux?

QUESTION 2: ON MAINTAINING FLUID CULTURE


Alongside risks associated with climate change (cyclones, sea level rise, food and water insecurity) Tuvaluans are being squeezed out of Tuvalu by globalizing economic and societal pressures. Tuvaluan culture is highly tied to its local small-scaled communities and specific geography, and risks being dissolved into a distributed diaspora. Recognizing the inherent value of Tuvaluan identities, this thesis asks:

C. How can this spatially-oriented cultural identity be maintained as Tuvalu's population becomes increasingly mobile?

As a nation Tuvalu faces risks to the local economies that underpin its survival and have traditionally been a part of daily lives. Subsistence livelihoods and Tuvalu's small national income achieved from the sales of fishing rights will disappear if rights to the EEZ are lost with atoll submergence. Even in its current condition Tuvalu is not able to sufficiently capitalize on its massive fish stocks due to lack of capacity and sells fishing rights to developed nations for pennies on the dollar. Thus, the thesis posits the fishing economy as central to Tuvaluan cultural identity as well:

D. How can this lucrative resource, which is projected to potentially even expand with climate change, be harvested even as Tuvalu's rights to their EEZ are threatened? How can economy become a tool for cultural identity?

These research questions are addressed in the following sections through a series of scenarios and strategies designed to return national agency and cultural self-determination to Tuvaluan in the context of fluid cultures and geographies.

A large cargo ship is visible on the horizon of a tropical ocean. The water is shallow and turquoise, with darker patches of seabed visible. The sky is blue with scattered white clouds.

“Even if another nation gave us
a volcanic island, or a piece of
an island, we need to have our
sovereignty.. Not under another
island [nation], but autonomous
sovereignty so that we do what we
want, we can develop as a nation.”

Interview with educated 40 year old
Tuvaluan woman and private contractor
who has migrated to Fiji with her family.
Funafuti, Tuvalu, January 2015





FUTURES
DESIGNING FOR
UNCERTAINTY

This design research acknowledges not only the general un-knowability of the future, but the particular uncertainty associated with climate change projections as they related to Tuvalu's atoll context. Using alternative methods such as mapping and deep timescale research, this thesis seeks to integrate the concept of uncertainty into the design process directly.

CLIMATE CHANGE UNCERTAINTY

How the effects of greenhouse gases will play out on global timescales is highly uncertain. While much ink has been spilled on the topic, even the Intergovernmental Panel on Climate Change (IPCC) acknowledges huge gaps in our collective scientific knowledge²⁷⁰. Some of this uncertainty arises from the inability of models to exactly replicate the complexity of the earth's atmospheric systems, and the existence of "non-linear dynamical processes intrinsic to the atmosphere"²⁷¹, or 'noise' resulting from atmospheric processes. This is combined with the indeterminacy of the future actions of nation-states and individuals; while agreements such as the recent talks in Copenhagen set precedents for carbon production, not all nations are engaged, and there is little or no capacity for enforcement. Even if we could understand exactly how much greenhouse gases would enter the atmosphere and calculate its impact on global temperatures and precipitation, the causal effects of these changes on ecosystems and economies would be impossible to predict with any level of precision.

Even within the IPCC's 5th Assessment projections (which many scientists consider conservative) the range of "likely" temperature projects is between .3°C and 4.8°C; an enormous range as far as agriculture and ecosystems are concerned. And this doesn't even take into account what happens if a more "unlikely" scenario comes to fruition. Sea level rise projections are similarly variable: .26 to .98 meters by 2100 within the "likely" range. However, this calculation does not account for the possibility of the rapid collapse of the Antarctic ice sheet. The West Antarctic Ice Sheet is considered highly fragile and could raise global sea level up to two or even three meters. To further add to this complexity, it is worth noting that the sea is not actually level, and "sea level rise will not be uniform."²⁷² Over the past fifty years the rate of sea level rise has been particularly fast-paced in the Western Pacific, the region immediately surrounding Tuvalu.

270. Intergovernmental Panel on Climate Change Fifth Assessment Report (Cambridge Univ. Press, 2014); <http://www.ipcc.ch/report/ar5/>

271. Deser, Clara, et al. "Uncertainty in climate change projections: the role of internal variability." *Climate Dynamics* 38.3-4 (2012): 527-546.

272. Intergovernmental Panel on Climate Change. *Climate Change 2013: The Physical Science Basis*. "Summary for Policymakers," 2013

LOCAL MAPPINGS

At the local scale, these maps examine the fluid nature of Funafuti atoll, socially and physically. As a geography closely bound to the lives of coral reefs and the movement of waves and currents, The islets are temporal and mobile. (Pages 50-1, 76-7, 152-3)

REGIONAL MAPPINGS

The subsequent pages (178-81) examine Tuvalu's role within regional systems. At the regional scale, these maps examine the flows of people, atmospheres, fluids, and other life, as juxtaposed against the territorial boundaries imposed by nation-states.

CRITICAL CARTOGRAPHY: MAPPING BLURRED LINES

Embodying logics of fluid time and space, this project seeks out alternative forms of mapping and representation that demonstrate unfixed conditions through a fixed medium. Critical cartography is a method of mapping as a tool for critique and intervention. The explosion of the accessibility of mapping techniques in recent decades has allowed for cartography to become a tool for the masses which redistributes the power structures typically associated with maps.²⁷³ Throughout history, maps have been used as tools which embody political motivations and hidden assumptions, restricted to those with the means to construct them. Maps were—and are—a means of political control.

Modern cartography is closely tied with modern concepts of nation building, where drawing a line on a map corresponds to territorial claims and nationalist agendas.²⁷⁴ This has been particularly important for the nation of Tuvalu, whose boundaries have been drawn and redrawn over time, as different political bodies have staked claims and redefined territories.²⁷⁵ As discussed above²⁷⁶, the islands themselves are fluid, as, of course, is the 900,000 square kilometers of ocean territory under Tuvalu's jurisdiction.

The production of maps inherently involves the selective inclusion (and exclusion) of information.²⁷⁷ In making this process explicit, this project uses a series of mapping studies in order to track Tuvalu's fluid territoriality over time, and explores how spatial interventions, examined cartographically, can reconsider its vulnerable future. As mapping theorist Denis Woods notes:

Map artists ... claim the power of the map to achieve ends other than the social reproduction of the status quo. Map artists do not reject maps. They reject the authority claimed by normative maps uniquely to portray reality as it is, that is, with dispassion and objectivity²⁴³

Thus, this project uses the map just not as representation, but as cause for intervention (or even interventions in and of themselves), by illuminating the role of space and territory in the complicated risks faced by Tuvalu. Mapping is not passive, but active; it is both design and politics, defining a "choice of new worlds, new societies."²⁴⁴ This is achieved here through the production of maps at multiple scales showing temporal spatial subjects. Mapped subjects are loosely divided into physical/environmental issues (i.e. currents, climate and fauna) and anthropocentric issues (i.e. migration and political territories), as a way to explore the interrelationships between these two spatial activities.

273. Crampton, Jeremy W., and John Krygier. "An introduction to critical cartography." *ACME: an International E-journal for Critical Geographies* 4.1 (2006): 11-33.

274. Wood, Denis. *Rethinking the power of maps*. Guilford Press, 2010.

275. See diagram, page 170

276. See page 46-7

277. Monmonier, Mark S. *How to lie with maps*. Chicago: University of Chicago Press, c1996.

278. Wood, Denis. *The cartographic perspectives catalogue of map artists*. *Cartographic Perspectives* 53, 61-67, 2006.

279. Rolnik, Suely. *Sentimental Cartography*. SubmaP, 08 March 2005.

Each of the maps in this thesis makes a case for an expanded understanding of territory for both Tuvalu and its Oceanic neighbors. Prior to colonization, just two hundred years ago, Tuvalu was not a nation, or even a singular group, but rather an archipelago of island-communities with loosely defined relationships and a shared language. 2,000 years ago, they were vacant sandbars planted only with whatever seeds had been washed up on shore or deposited by passing seabirds. 18,000 years ago, at the last glacial minimum, the atolls would have been unrecognizable limestone mounts towering above the sea.

The Tuvaluan peoples themselves are also characterized by temporarily and fluidity, as represented by the migration maps shown in the section on *Fluid Populations*.²⁸⁰ A long history of movement and migration mean that Tuvaluans have always been dually identified; Samoan/Tongan settlers becoming Tuvaluans, Tuvaluan migrants become New Zealand or Fijian citizens, or even within the nation itself as the outer islanders migrate to Funafuti and establish an identity with that place.²⁸¹

280. See page 79 - 118

281. See page 97

DEEP HISTORY / LONG SPAN FUTURES (LONGER DUREE)

By contextualizing the research and design within longer spans of time, this thesis explores whether, when we move into the process of design, it is necessary to defer to lived time scales. This is particularly relevant in the case of Tuvalu, where temporarily is an inherent part of the history. In this vein, a secondary question explored by this work is how design can intervene or be incorporated into broader scales of time.

The maps and indexical drawings of this thesis²⁸² conceive of the present moment in the history of Tuvalu and Oceania as not a single event, but part of a long duration of evolving geophysical, climatological, and human systems. Thus, the window of time contextualizing the project is opened up as broadly as possible, considering timescales from the last ice age to the impending collapse of our current glaciers. Through this design research, I propose that a study of futures, such as those prompted by climate change risks, should also include a study of pasts, of cases where humanity and environment have previously collided in the historical timeline.

282. For example, see the timeline on pages 22 - 27

In a place such as Oceania where survival is hinged on delicate and fluid nonhuman systems, the relationship between people and their environments has been especially close knit. Sea level changes have eradicated past atoll inhabitants, such as the Nanumanga cave dwellers, and evidence of other atoll peoples have likely been swept away with the tides. The most recent inhabitants of the Tuvaluan archipelago are relatively

recent arrivals in the span of human history, and a mere blip in geological time. The definition of Tuvaluan culture in under 2,000 years, and the myth-narratives of island settlement by Tongan and Samoan visitors, demonstrate the fluidity of Oceanic migration within long spans of time.

MULTIPLE FUTURE(S): TUVALUAN DESIGN ACTIVISM

Designers inherently work with the intangible matter of the future. Our realms is the as-yet-unknown, the projective, the uncertain. Through the window of climate change, a well studied but still decidedly unpredictable future (un)certainly, this project seeks to expand out what it means to design with and for uncertain futures. The use of the term *futures* in the plural is deliberate. Climate change has become fetishized as a singular narrative: rising sea levels, retreating cities, sweltering, weather-ravaged communities. However, even climate scientists are operating in the realm of extrapolation, and thus the inherently unknown; they can project probabilities and possibilities, but never certainties. Our planet has never faced anthropogenic change at this scale before. Recognizing this uncertainty, alongside the Tuvaluan indeterminate future models discussed above in the section on *Fluid Populations*,²⁸³ this thesis makes the case for the role of the designer as envisioning multiple possible futures mediated through responsive and time-based design strategies. These are not specific recommendations or kits of parts, but rather show (given the future uncertainties of climate change) how design can be projective and productive, leveraging existing systems and circumstances.

283. See pages 79- 118

I propose that in the case of Tuvalu, projected futures (through the lens of the designer) deal with future time in two primary ways: through multiple *scenarios* and through *expanded time scales*. Multiple scenario proposals, set in alternative possible futures, re-politicizes²⁸⁴ climate change, by taking it from fetishized apocalyptic imaginaries²⁸⁵ into a rich and complex social issue. This method invites discourse over what climate-changed futures might be, and how we as a society can deal with this future uncertainty. Within each of these future scenarios, design interventions deal not with a single moment in time, but operate in expanded time scales. They envision not a final project, but processes and systems that unfold responsively over time.

284. Swyngedouw, Erik. "Depoliticized environments: the end of nature, climate change and the post-political condition." *Royal Institute of Philosophy Supplement* 69 (2011): 253-274. Swyngedouw argues that through its fetishization in the spheres of media and politics, climate change becomes depoliticized, "placing Nature outside the political, that is outside the field of public dispute, contestation, and disagreement"

285. Swyngedouw, Erik. "Apocalypse forever? Post-political populism and the spectre of climate change." *Theory, Culture & Society* 27.2-3 (2010): 213-232.

These frameworks are not radically new, but draw on existing models of design and planning, particularly scenario planning and ecological or landscape urbanism. Scenario planning, or scenario building, in issues of the built environment, uses plausible (but often simplified) descriptions of the future in order to develop skills, strategies, and knowledge bases necessary to deal with these possible and plausible future condi-

tions. This model is often emphasized in conditions of risk or uncertainty, for example in Dutch models of planning for urbanism relative to water engineering the polder landscape.²⁸⁶ The benefits of scenario planning range from learning through the development of scenarios, possible solutions to them, and the communication of possible future conditions to the general public.²⁸⁷ While scenario planning methods are helpful in thinking about a range of future possibilities, ecological and landscape urbanism provide a framework for thinking about strategies that play out over a long range of time, with embedded responsiveness to diverse future conditions. Landscape urbanism emerged as a way to deal with the pace and scale of urban change and de-industrializing processes. Ecological urbanism takes this concept one step further, to work projectively in the context of alternative futures.²⁸⁸

For Tuvalu, alternative strategies of future visioning are particularly potent. Tuvalu has been fetishized for the past decade as a symbol of climate change risks, as a “sinking island”²⁸⁹ full of prospective climate refugees.²⁹⁰ Within the framework of this singular narrative, it has been nearly impossible for Tuvaluans to develop alternative futures for their archipelago. That this narrative is applied by the outside Western world is further problematic, positioning Tuvalu as a tiny pawn in a global narrative in spite of their rich history of cultural identity and indeterminate future-thinking. The future visioning process considered in this thesis provides Tuvalu agency over its own future, drawing on Tuvalu’s own history and culture. In this sense, conceptual proposals provide a model of *design activism*: design as a method for local agency in the production of alternative futures and new, locally-produced modernities.

Of course, a critical observer²⁹¹ might note that my own self-insertion in the construction of possible future narratives runs counter to this concept of promoting Tuvaluan agency. In response to this potential criticism, I will preemptively respond on several levels. First, the rigorous site and community based research that the my design projections emerge from. Rather than being driven by outside logics (such as my own artistic intentions, or global design frameworks) I’ve made an earnest attempt with this project to draw from logics that are inherently Tuvaluan: mobility, fluidity, collectivity, identity. Second, the proposition not of a single design ‘solution’, but rather of multiple strategies and tactics over different scales of time and place, are intended as possible tools for new was of thinking and designing in the context of Tuvaluan risk environments. Couching these strategic design tactics in semi-fictional narrative futures show how these are possible responses, rather than pre-determined finalities. Thus, this work is intended as a new way of looking at possible future problems, rather than prescriptions for existing struggles.

286. Salewski, Christian Martin. Dutch new worlds. Diss. Diss., Eidgenössische Technische Hochschule ETH Zürich, Nr. 19286, 2010, 2010.

287. Khan, Shabana, et al. “Scenario building as a process and tool in urban governance.” *Geographies of Urban Governance*. Springer International Publishing, 2015. 193-214.

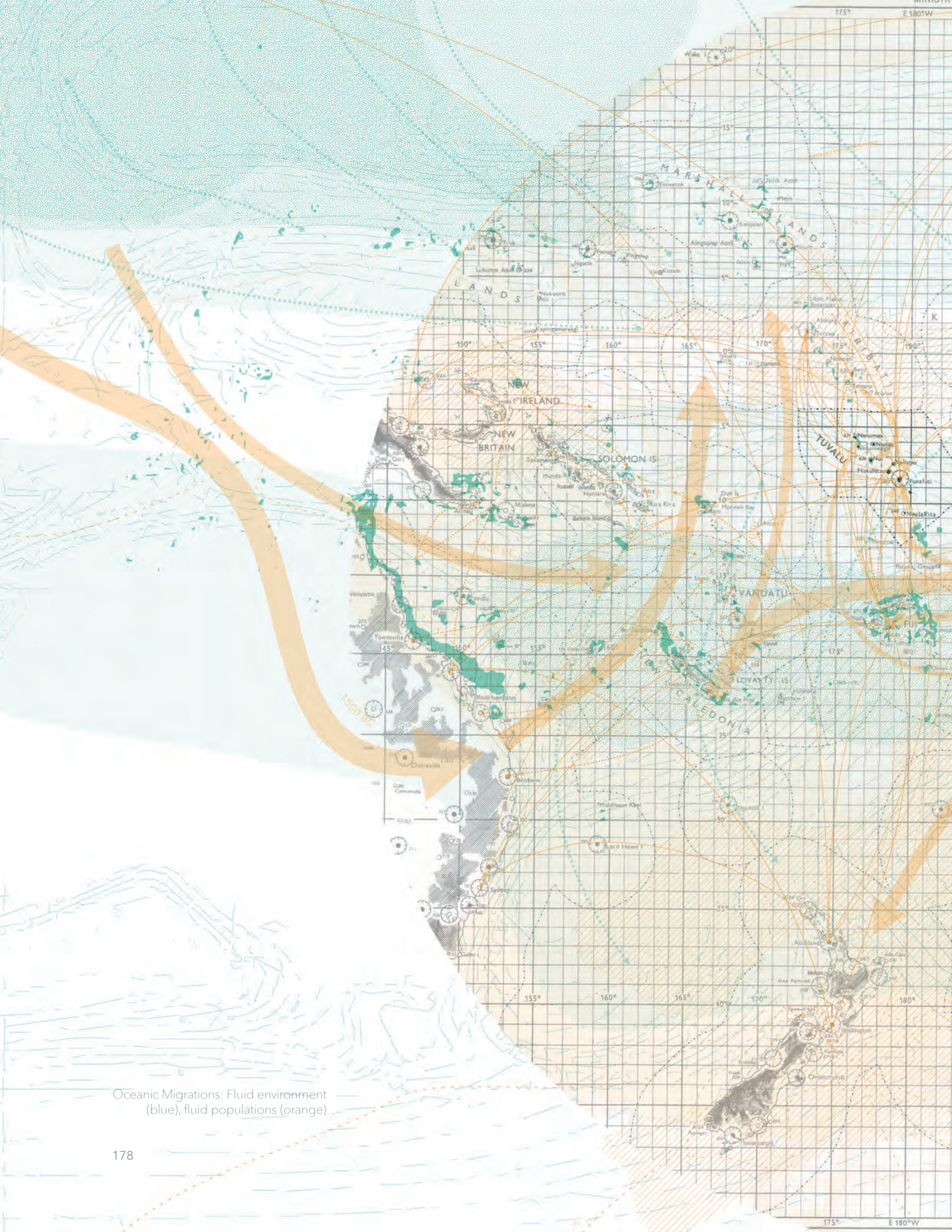
288. Waldheim, Charles. “On landscape, ecology and other modifiers to urbanism.” *Topos* 71.2 (2010).

289. Park, Susin. “Climate Change and the Risk of Statelessness: The Situation of Low-lying Island States.” UNHCR, May 2011. The United Nations High Commission on Refugees (UNHCR) refers to the low-lying island nations at risk for inundation as “sinking island states”

290. Shen, Shawn, and François Gemenne. “Contrasted views on environmental change and migration: the case of Tuvaluan migration to New Zealand.” *International Migration* 49.s1 (2011): e224-e242.

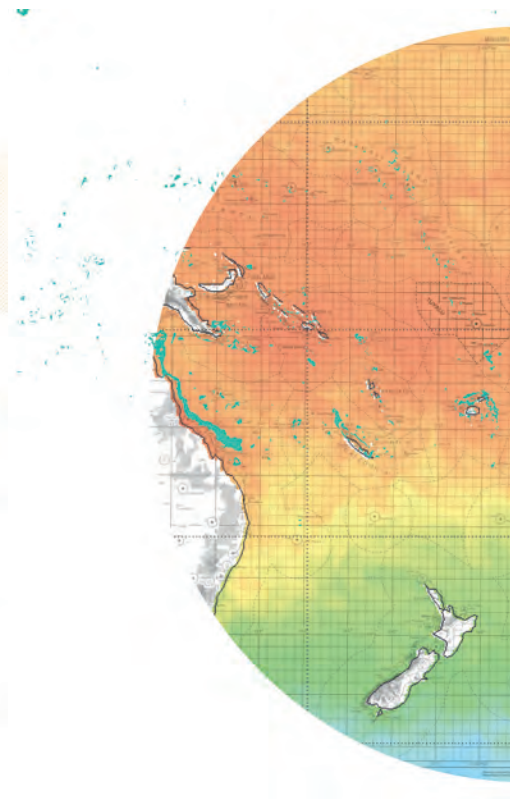
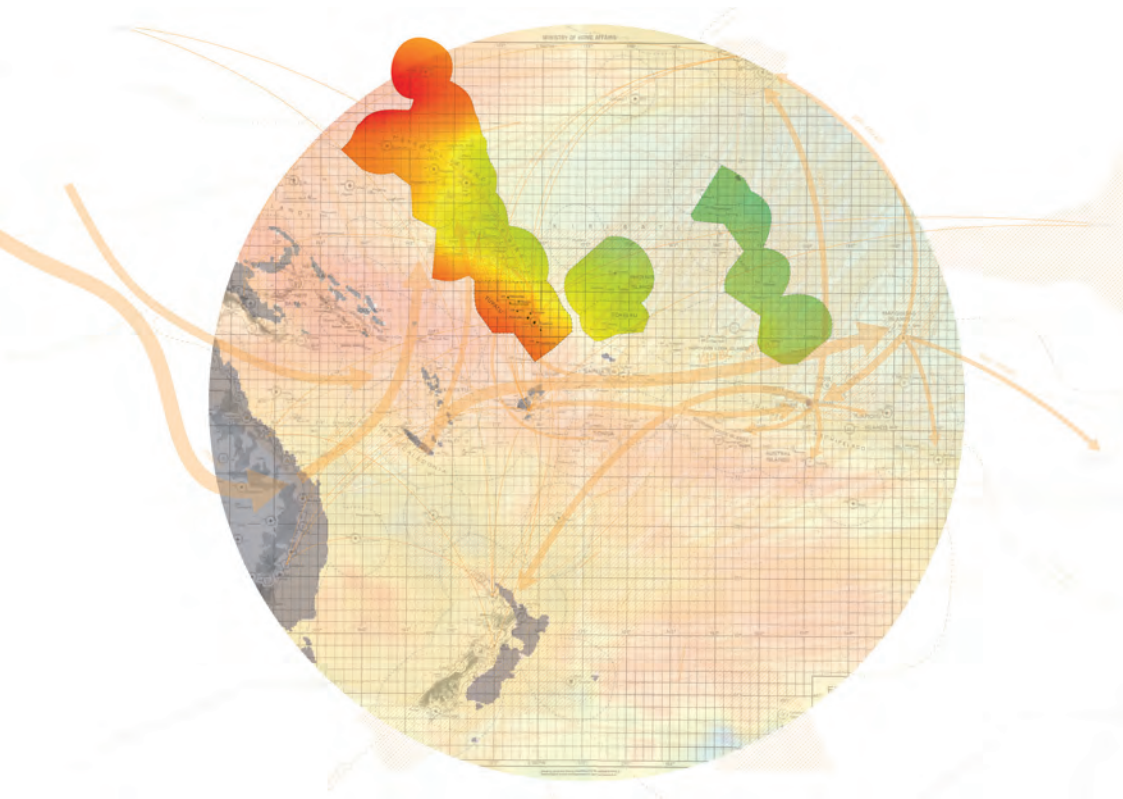
While at this point no Tuvaluans have been forced to migrate because of climate change problems, it is a growing concern, and interview subjects expressed in particular the need for providing opportunities for their children abroad. Additionally, Tuvaluans have taken advantage of the climate refugee narrative as leverage in international proceedings on climate change regulation.

291. i.e. Timothy Hyde

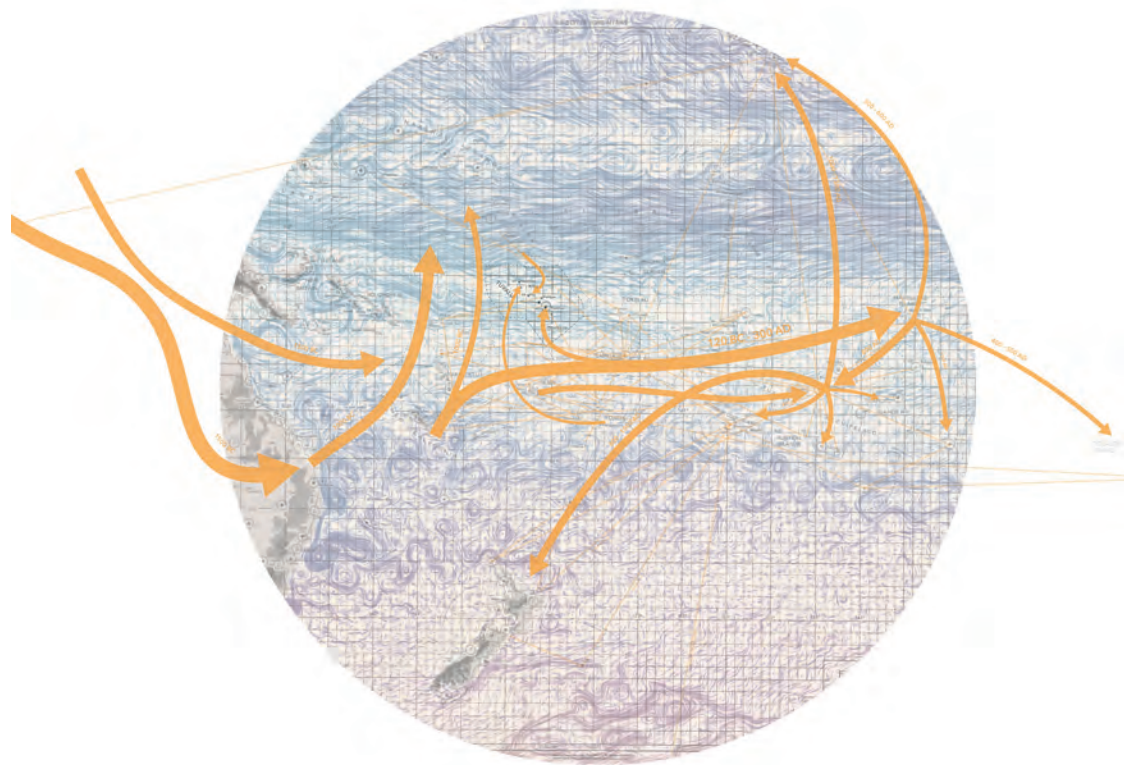
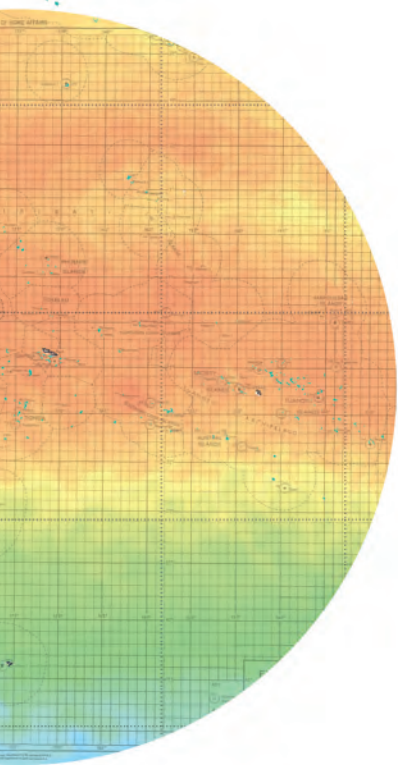


Oceanic Migrations: Fluid environment (blue), fluid populations (orange)





Above: Migrations/
[at Risk] EEZs
Middle: Coral Reefs/
Sea Surface Temperatures
Opposite: Past Migrations/
Surface Currents



TACTICAL STRATEGIES

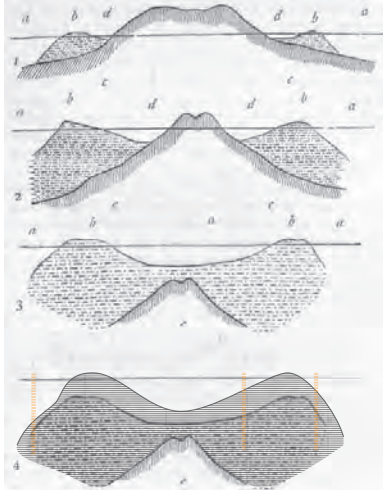
SCENARIOS FOR
SEEDING TERRITORY

As a primary design strategy, the subsequent proposals use the logic of architectural ‘seeds’ with as a way to ‘grow’ territory in the context of fluid populations and geographies. These small-scale interventions have implications at much larger scales of statehood and cultural identity, operating within the frameworks of culture, economy, land, and territory. Seed interventions are intended to be implemented selectively and incrementally by Tuvaluans as tools for planning their own futures in the context of (climate) uncertainty. This thesis thus rejects the notion of designing for a single scenario or a single solution and instead proposes a range of interventions across two future scenarios, each studied in both local and diasporic sites.

‘SEEDING TERRITORY’ CONCEPT:

The design proposals encompassed here apply a series of small interventions, which by either accumulation or through other implications serve Tuvaluan futures at much larger scales. They are proposed as operable components within the complex and fluid systems of Tuvaluan cultures and geographies discussed in the previous chapters. Like the atolls Tuvaluans have traditionally inhabited, these ‘seeds’ accumulate incrementally over time, responding to dynamic contexts. Instead of *building* large scale infrastructures to blockade against sea level rise or house massive displaced populations, this thesis instead proposes *growing* responsive architectures and landscapes for fluid ground and mobile populations, which can respond and adapt over time and space. The seeds are intended to be tactics applied by and for Tuvaluans. As a micro-nation with minimal social and economic resources, it is essential that Tuvalu leverages what it does have (sovereignty, oceanic territory, coral reefs, fish stocks, cultural independence) in strategic ways that allows the population to benefit broadly from minimal and incremental interventions.

In essence, this thesis posits the propagation of the architectural ‘seed’ as a way to ‘grow’ territory in the context of Tuvalu’s fluid nationhood. Territory is here broadly defined, and includes the physical ground of Tuvaluan atolls, the legal mechanism of the Exclusive Economic Zone, as well as territory as space for Tuvaluan identity and cultural practices both within and without the nation’s boundaries. Thus, these seeds grow territory for the Tuvaluan nation-state; grow space for economies that tie together in- and ex-situ populations; and grow room for Tuvaluan cultural practice even if and when presently defined Tuvaluan ground is no longer habitable.



HACKING DARWIN'S THEORY

Darwin proposed his theory of atoll formation in 1842. This thesis proposes a fourth step in the process, where humans selectively intervene in the atoll formation process.

Opposite: SEED CATALOG

This thesis proposes four sets of seeds, which grow territory in the context of culture, economy, land, and territory. Each is proposed for a different scenario/site, but there are some overlaps across scenarios. Each seed set contains multiple scales or types, accommodating a range of timescales and available resources

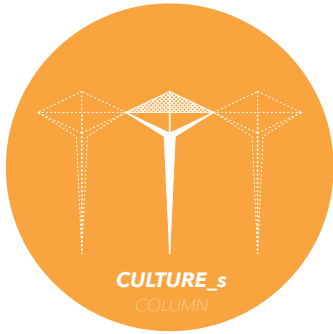
STRATEGIES + TACTICS

The distinction between the proposed 'seeds', which play out on the ground at a human scale, and their larger cultural, social, economic, and territorial aims, draws on Michel de Certeau's notion of "strategies and tactics." In his seminal work "The Practice of Everyday Life" de Certeau distinguishes between *strategies*, the "manipulation of power relationships" at a site-specific macro-scale, and *tactics* or "calculated actions" without specific sites which operate in response to immediate conditions. These are embodied in the "practice of everyday life" in terms of the strategies of broad institutions which plan and explain urbanism at a holistic level, and the individual user, who, while "walking in the city" tactically responds to their environment.²⁹² In so describing, de Certeau places strategies and tactics as categorical opposites: the tactics of the user and creatively deployed against the strategies of governmental or institutional power structures. However, instead of placing strategies and tactics in opposition, as governor vs. governed, or organizations vs. individual, or even top-down vs. bottom-up, this thesis instead proposes a collusion of strategies and tactics in service of a collective agenda. Thus, the tactical activities of placing the architectural 'seeds', undertaken by individuals or small groups, can serve larger Tuvaluan agendas as they work toward strategies of creating new economic networks, land-making, cultural space-making, or territorial protection. Thus, these territorial seeds could be seen then as a 'tactical strategy', which generate and work towards broader agendas from the ground up, instead of from the top down. The close-knit nature of Tuvaluan communities makes these broadly shared agendas feasible in ways that might be difficult in more heterogeneous societies; however, in other contexts the 'tactical strategy' of the seed might serve as a tool for resistance or idealized worldmaking through self-generated collectives at other scales.

Each of the four sets of seeds (ground, territory, economy, and culture) is deployable at multiple scales, allowing for different degrees and typologies of intervention within the 'seeding' framework. The seeds proposed here are not intended to be exhaustive, but rather provide example ways of thinking about the current and possible future risks faced by Tuvalu through this lens. Of the four sets of seeds, two deal with the in-situ condition of fluid ground, and two with the ex-situ condition of fluid populations. Within the categories of fluid ground / fluid populations, each seed set is focused towards a single scenario,²⁹³ though not exclusively so. Rather, these general frameworks can bleed between scenarios, demonstrating how they can accumulate towards a holistic agenda for Tuvaluan agency and spatial claiming within the

292. De Certeau, Michel. *The Practice of Everyday Life*. University of California Press, Berkeley, 1984.

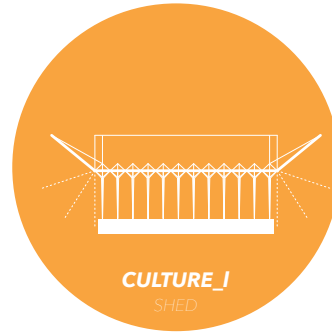
293. The scenarios are discussed in detail in the following section.



CULTURE_s
COLUMN



CULTURE_m
PLATFORM



CULTURE_l
SHED



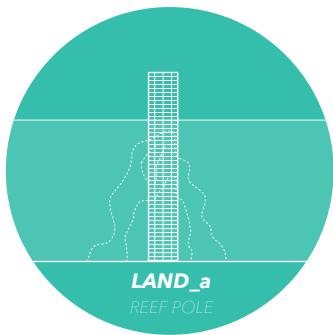
ECONOMY_s
DISTRIBUTION



ECONOMY_m
SHOP



ECONOMY_l
HUB



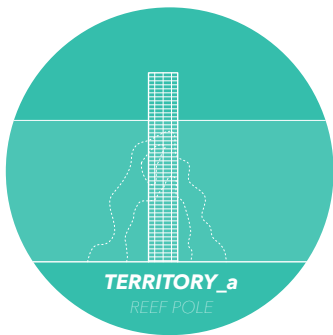
LAND_a
REEF POLE



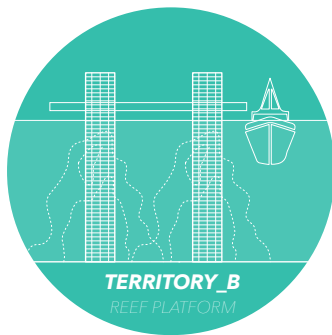
LAND_b
LAND SLAB



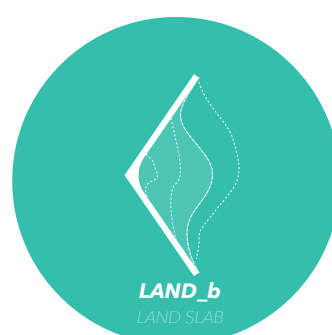
LAND_c
HOUSING SLAB



TERRITORY_a
REEF POLE



TERRITORY_b
REEF PLATFORM



LAND_b
LAND SLAB

context of uncertain futures. The catalog of seeds thus operates as a system, in order to maintain Tuvalu's nationhood both in- and ex- situ.

SEEDS FOR FLUID GROUND: GROWING LAND AND TERRITORY

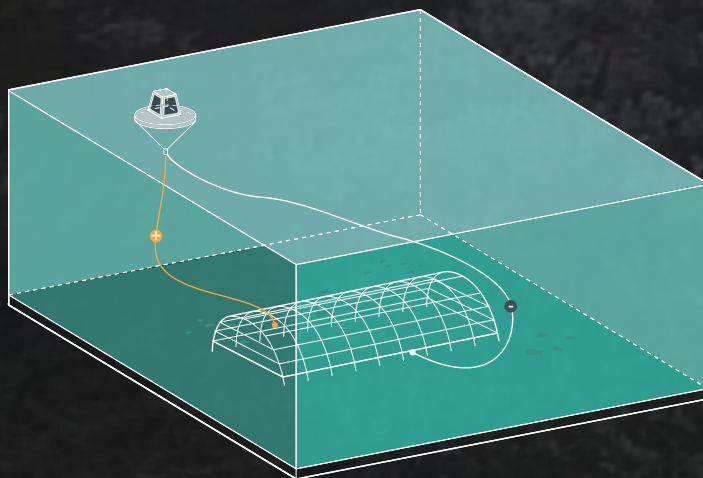
In designing for conditions and risks associated with Tuvalu's fluid ground (which in any scenario is likely to become increasingly unstable) the proposed sets of seeds include selective interventions aimed at curating existing atoll formation processes. For Tuvalu, oceanic territory is tied to ground above sea level through the legal instrument of the UN Convention on the Law of the Seas²⁹⁴ so tactics for growing ground overlap significantly with those for growing territory. Legal mechanisms such as UNCLOS associated with Tuvalu's status as a sovereign nation provide a primary point of leverage, where small gains in ground above sea level can reap huge growth in oceanic territories.

In order to *grow* land and territory, these seeds selectively curate the atoll-formation process; the existing ecological system is tweaked in order to allow ongoing processes of currents and coral growth to serve the needs of the Tuvaluan population.²⁹⁵ The foundation for these seeds is Biorock²⁷⁵ technology, a system where an electrically charged, light-weight metal framework can accumulate coral reef growth at up to four times the pace of a typical reef. Combined with rapid-growing super-corals, the rate of coral growth could exceed 25 times normal reef

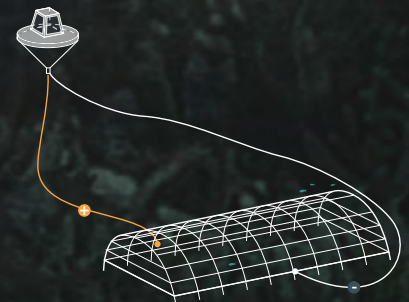
294. See pages 70 - 77

295. See pages 37 - 47 for a full description of atoll formation and atoll hydrodynamics, which these seeds draw upon

296. Biorock technology is a system for accelerated reef construction developed by Prof. Wolf Hilbertz. An electrified, submerged steel mesh frame accumulates and calcifies minerals dissolved in sea water. This mineral substrate then becomes the support for coral reef growth, which can be further accelerated by coral transplants, particularly if those transplants are genetically modified 'super-corals' which grow at 25 times the pace of typical reefs.



CONSTRUCTED REEF BIOROCK



1 ELECTROSTATIC CHARGE

A welded, electrically conductive frame, made from wire mesh, is submerged and anchored to the sea bottom. A low voltage direct current is applied using an anode.

formation. *Reef seeds* are frames for coral reef growth which over time curate and intensify the sedimentation/deposition process which builds coral atolls. As the corals on these cyborg reefs complete natural life cycles, they produce sediment, as small pieces of the reef die and break away. This sediment accumulates over time to build up existing coastlines, or even to form new islands on existing coral mounts.

Land building processes are curated by *slab seeds*, lightweight, rigid structures which curate the flow of sediment produced by the reef seeds. Drawing from existing research on the relationship between coastal engineering and hydrologic processes, these slabs, via their shape and position relative to coastlines, sediment sources, and surface/subsurface currents, are used to accumulate land in specific sites, or even to selectively erode land, in the case of ports and shipping channels. They also stabilize existing or new ground, limiting future erosion. The set of seeds for growing the ground of Tuvalu allows Tuvaluans to become an active agent in their island geomorphology. Instead of being represented as victims of climate change, implementors of these seeds harness a toolkit that allows them to operate a new model of anthropogenic world-making in response to anthropogenic climate change. By controlling the land which is above sea level, these seeds also allow control over the nation's territorial waters delineated by the 200 nautical mile EEZ offset.²⁹⁷ Thus, these reef and slab seeds can then be used to

297. See pages 70-77 for details on the territorial governance of the ocean, regulations which the territory seeds operationalize.



2 CRYSTALIZED FRAME

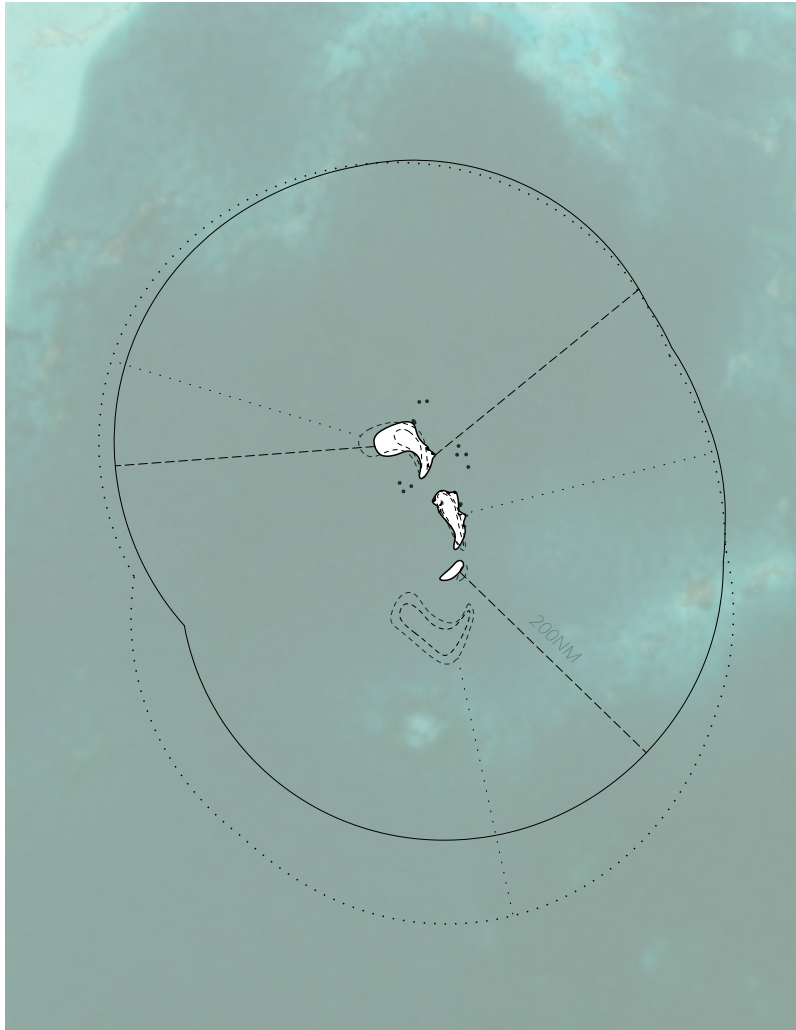
This initiates an electrolytic reaction causing mineral crystals naturally found in seawater, mainly calcium carbonate and magnesium hydroxide, to grow on the structure. Within days, the structure takes on a whitish hue as it becomes encrusted with precipitated minerals adding rigidity and strength. Electrical fields, plus the shade and protection offered by the metal/limestone frame, attract a wide range of colonizing marine life including fish, crabs, clams, octopus, lobster, and sea urchins.

3 CORAL GRAFT

Once the reef structure is in place and minerals begin to coat the surface, divers transplant coral fragments from other reefs, attaching them to the ark's frame. Immediately, these coral pieces begin to bond to the accreted mineral substrate and because of evolved oxygen and the electrochemically facilitated accretion of dissolved ions, such as bicarbonate - start to grow-typically three to five times faster than normal. Super-corals can be grafted which grow 25 times the typical pace.

4 ESTABLISHED REEF

Soon the reef takes on the appearance and utility of a natural reef ecosystem rather than a man-made one. Electrolysis of bio-rock reefs enhances coral growth, reproduction and ability to resist environmental stress.



Curating EEZs: reef/land seeds allow control over oceanic territory to be maintained in light of current UNCLOS mandates

curate Tuvalu’s national territory through manipulating land and ocean boundaries. With these mechanisms, Tuvalu can leverage its current status of nationhood and associated transnational legal mechanisms to secure its ongoing existence as a sovereign nation. Furthermore, they can actively grow their oceanic territory, claiming further exclusive economic zone area through the appropriation of UNCLOS legislation.

Leveraging their stabilized position in the ocean floor, *slab seeds* and *reef seeds* can then become the supporting infrastructure for additional functions. As slab seeds become embedded in coastlines, they can become the foundations for elevated housing as settlements expand onto this new land. They also secure ground for agricultural production, contributing to much-needed food security. Reef

seeds anchored in deeper waters can become the substructure for offshore fishing platforms, allowing for outposts even when no dry ground is available (as is currently the case in the South Banks area near Tuvalu’s oceanic border with Fiji). These offshore platforms, along with expanded EEZs allows Tuvaluans agency over their local economy by leveraging a multi-million dollar tuna fishing industry currently exploited by foreign fishing vessels from Taiwan, Japan, and Europe.

SEEDS FOR FLUID POPULATIONS: GROWING CULTURE + ECONOMY

Based on the conditions of two possible future scenarios (explained in the following section), this thesis explores two strategies for maintaining the Tuvaluan nation ex-situ, in the context of mobilized populations: growing culture and growing economy. Unlike the land/territory categories, these two seed catalogs are distinct, though they have the potential for re-combination in alternative scenarios. In the fluid trajectory of Tuvaluan territorial identity traditionally tied to the physical

space of Tuvalu, these seeds for the mobilized population imagine a dispersed Tuvaluan nation by claiming ex-situ territory via culture and economy.

The set of culture seeds draw on the necessity of space for cultural practice in ex-situ communities. New Zealand Tuvaluans interviewed cited a lack of shared space as a major concern for their diasporic community, especially at a local level. Long commutes to cultural events, and lack of appropriate space, was pulling this community apart. Thus, the *culture seeds* enlist a flexible spatial strategy that allows for temporal space of cultural practice in local contexts at the small scale, and permanent cultural hubs in an urban environment at the largest scale.

The collective culture seed is inspired by the traditional Tuvaluan *maneapa* (community hall), a collective construction in which each community member plays a role: children gather leaves, women thatch and weave, and men assemble the pandanus- and coconut-wood frame. Social hierarchy is also represented through its usage: respected male elders—*aliki*—are permitted to lean against a pole as a symbol of their status. This seed re-interprets the *maneapa* in a democratic formation for its new context, where each member of the community brings part of the building, into which their own pole to lean against is incorporated²⁹⁸. The building itself a participatory construction, formed when these *deployable maneapa* columns are assembled by the community to create a collective space. The scale of assembly reflects the cultural practice occurring inside; a *kaupule* (meeting), *fakaala* (feast) or *fatele* (dance). The column units cannot operate on their own, but require at least three units—thus at least three participants—to stand.

Each of these *maneapa seeds* is a demountable, flat pack system, so not only is the space of assembly temporal, but the units themselves are easily mobile. Reinterpreting traditional Tuvaluan construction methods, the column portion is constructed from wood; using plywood sheets instead of raw island timber. Using hinged and jointed connections, this component can pack flat into a 48" x 3" x 4" unit, weighing under 20 pounds. The construction methods draw on both modern technologies such as a shareable CNC router file, but also traditional methods of pinned connections and mobile architectures.²⁹⁹ The pole also serves as a frame for a lightweight roof system, which is woven from available contemporary materials using methods drawn from traditional mat-weaving. Thus, each *maneapa* unit because a hybrid of traditional and 'modern' processes, standardized to fit together, but unique to the individual who has constructed it.

298. See pages 102-3 for more about the role of the *maneapa* and its construction in Tuvaluan society, and pages 106-7 for a diagram of *maneapa* construction methods

299. See pages 98 - 101 for more about traditional Tuvaluan architecture typologies.

In order to test the operation of the flat pack wooden column and its relationship to the fabric upper, an initial prototype was constructed. This unit allowed for a clearer understanding of scale, material, operation, and relationship to the body, in order to refine the design. It also helped to emphasize the multi-scalar aims of this thesis; from a human-scaled architectural unit to the spatial politics of an entire nation.

The maneapa pole system is designed to operate without any additional infrastructure in its most lightweight manifestation. This allows for claiming space for cultural practice regardless of a Tuvaluan's legal claim to specific ground. However, it also operates at medium scale with a permanent base, which provides infrastructure that the maneapa poles plug into. At the largest scale a proposed permanent, dynamic building typology provides large-scale cultural space for Tuvaluans and other displaced islanders. The multiscale variants, discussed further in the specific scenarios, allow for Tuvaluan space to be claimed ex-situ with a wide range of available resources and sizes of diaspora groups.³⁰⁰

The economy seeds tie Tuvalu's largest territory (ocean) and most abundant resource (fish) with the need for new forms of economy. While this is true for both in- and ex-situ Tuvaluans, the economy seeds focus on the need of generating new economies for a displaced population. As is discussed in prior chapters³⁰¹, fisheries, particularly tuna, are underutilized as a macro-economic strategy by Tuvalu, and climate change is anticipated to actually increase this valuable resources as schools shift eastward into Tuvaluan waters. Currently only a tiny fraction of fish stocks are harvested by Tuvaluans, and licenses are sold by the government to foreign fishing vessels for pennies on the dollar. In essence, presently Tuvaluan agency over fish stocks is exchanged for development aid with problematic implications.³⁰²

The economy seeds, anchored by a proposed Tuvalu Fish Pier in downtown Auckland, tie displaced Tuvaluans together through this alternative economy. These fish-related seeds give economic agency to Tuvaluans who are often forced to work in difficult agricultural jobs complicated by the poor English skills and lack of knowledge of wage labor and market economies of recent migrants. The Tuvalu Fish Pier would provide a physical link between displaced Tuvaluans in Auckland and the resources of their homeland. Its translucent, operable facade also creates a visible Tuvaluan presence ex-situ, indexing what is being harvested and how it is being sold. This fish economy is networked throughout the diasporic city through a system of smaller, neighborhood scale markets, and a networked vehicular distribution system.

300. See pages 216 - 237

301. See pages 94, 96

302. See pages 94, 96



New Urban Archipelagos: Over 20% of Tuvaluans already reside in New Zealand. By claiming (sub) urban space in diasporic settlements, new urban or transnational Tuvaluan archipelagos are established through mechanisms of culture and economy.

TESTING FUTURES

TWO SCENARIOS

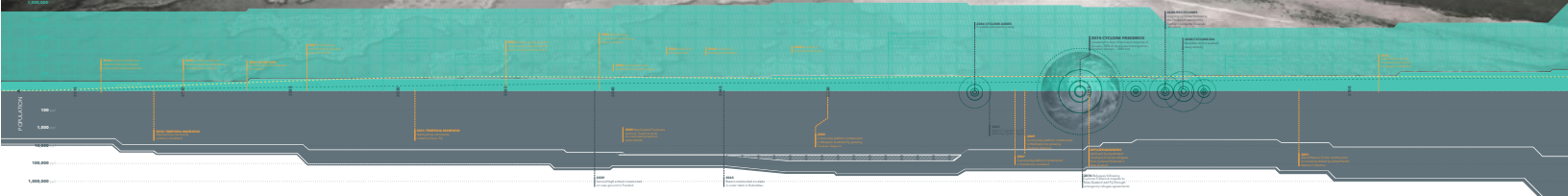
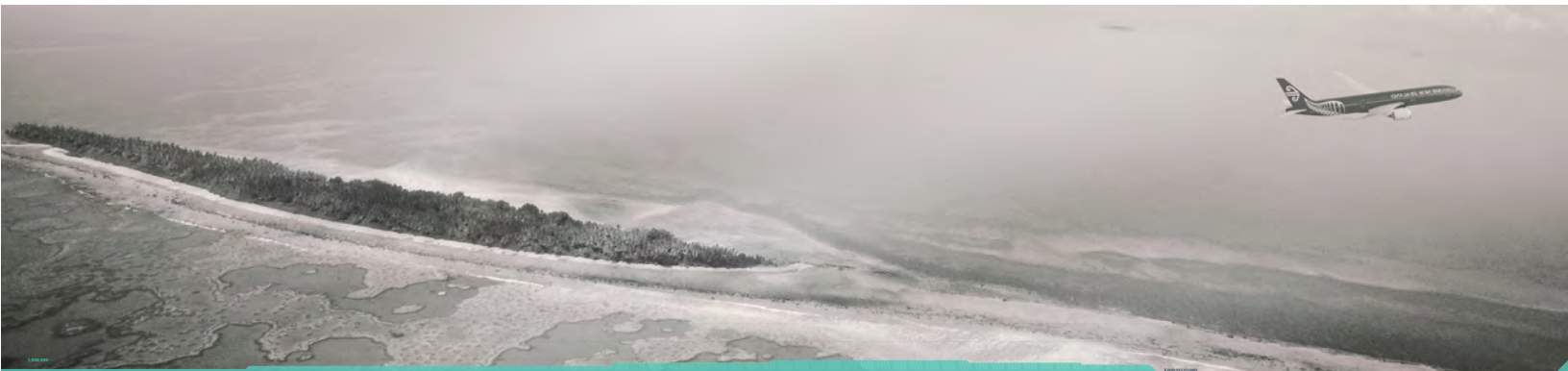
As discussed in the earlier section on uncertainty,³⁰³ possible future climate scenarios in Tuvalu, and their human implications, are limitless. However, through extrapolation based on historic non-anthropogenic climate change and more recent climate documentation, the current science suggests some scenarios as more probable than others. This thesis uses as a starting point two of these possible scenarios, with each examining not only different climactic/social events but also exploring broad ranges of time and space. Playing out these scenarios and timelines as semi-fictional narratives frames possibilities for how design can intervene in possible futures in ways that advocate for Tuvaluan populations.

The first scenario, *Future A*, or ‘climate change as usual’ (pages 196 - 243) looks at a condition of incremental sea level rise, aligning with existing IPCC projections, and extrapolates Tuvalu’s existing population boom. The seeds suggest possible strategies for growing the Tuvaluan nation.

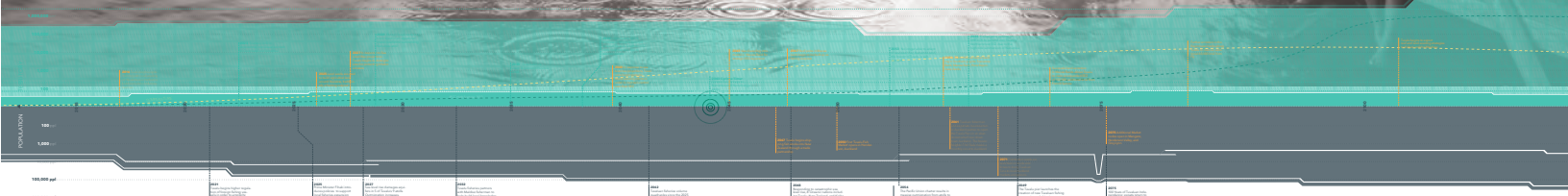
The second, *Future B*, looks at a rapid ice-melt scenario, (pages 244 - 287) where the collapse of major ice sheets in the near future and continuing over the coming centuries results in rapid out-migration and necessitates strategies for defending the EEZ. Here, the nation is re-imagined as a strategic, collectivized economy.

Combined, these two scenarios provide a productive comparison for their range of climatological and social impacts. Each scenario explores how the seeds described in the prior section might be propagated over time, both within Tuvalu, and within the growing territories of the diaspora (specifically New Zealand), as well as impacts and implications from the scale of architecture to urbanism to the Oceania region. The seeds, scenarios, and research were developed side-by-side and inform one another, such that while the seeds attempt to deal specifically with the scenarios as developed, they also operate strategically in Tuvalu’s larger context of unstable ground and mobile populations.

303. See page 173. Current climate models have poor accuracy, and projections are constantly being updated. Furthermore, the condition of our future climate is largely dependent on decisions we as a society make in coming years, decades, and centuries.



FUTURE A:
 CLIMATE CHANGE AS USUAL
 Incremental sea level rise and ongoing population expansion leading to continued outmigration

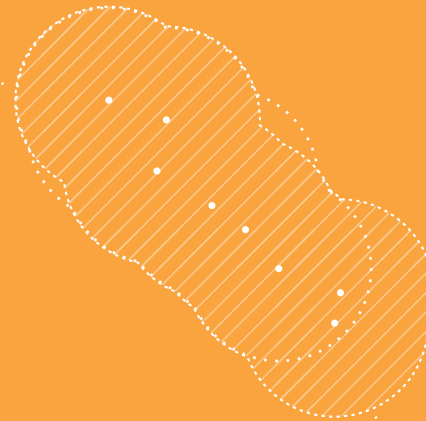


FUTURE B:
 RAPID ICE MELT
 Ice sheet collapse leads to rapid and drastic sea level rise and a sudden evacuation of the Tuvaluan archipelago

1878 - 2015
CURIATING THE EEZ

In a scenario of rapid ice melt, atoll-growing seeds are used to maintain existing key islets and associated EEZ. Furthermore, new atolls are grown as a tactic for expanding territorial waters and associated fishing rights.

FUTURE SCENARIO B



2025 - ?
NEW TUVALUAN TERRITORY

Through architectural space-claiming seeds, Tuvaluan nationhood persists in the context of New Zealand, establishing ex-situ territories.

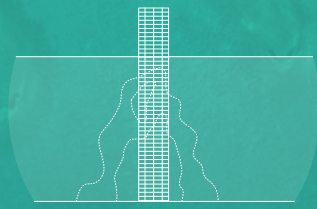


2015 - 2025
CLIMATE REFUGEES

In a scenario of incremental ice melt, Tuvaluans migrate to New Zealand at a quickened pace as the atolls become overpopulated and the risk increases for extreme weather events. This growing diaspora requires alternative strategies for Tuvaluan space-making.

FUTURE SCENARIO A





TERRITORY_a1
REEF POLE



TERRITORY_b1
LAND SLAB



TERRITORY_b2
HOUSING SLAB

Above: Land Seeds and Culture Seeds applied in *Future A: Climate Change as usual*

FUTURE A: CLIMATE CHANGE AS USUAL

Within the climate change as-usual scenario, the seeds help to mediate Tuvalu's burgeoning population, land shortages and increasingly mobilized society. As has been explored in detail in the context section,³⁰⁴ Tuvalu's capital atoll of Funafuti has exploded in population since Independence in 1978, resulting in overcrowding and shortages of productive and buildable land. As such, within Tuvalu, the design strategies of this scenario explore how to grow land for the expanding populace, as well as ground for agricultural production to support this population, in order to decrease dependency on imported, and often unhealthy foodstuffs.³⁰⁵ This land-growing occurs in dialogue with incremental sea level rise by directing and accelerating typical coral atoll response to sea level rise. Instead of losing ground to rising waters, in this scenario Tuvaluan land expands.

Increasing rural-urban migration and overcrowding within Tuvalu also contributes to growing migration abroad, a phenomenon which is extrapolated in this scenario as well. There are few jobs to be had within Funafuti, and so this scenario explores the increasing desire of Tuvaluans to migrate to other nations, temporarily or permanently.³⁰⁶ In doing so, the scenario examines current issues faced by the Tuvaluan diaspora: a feeling of disconnection from culture, a lack of shared spaces, and a need for translation of cultural practices tied closely to their home atoll geography into foreign contexts. Thus, in this portion of the scenario the design strategies explore the making of Tuvaluan space for collective cultural practices, and furthermore, the claiming of extra-national territory, even temporarily, in order to enact Tuvaluan nationhood ex-situ.

Within Tuvalu, the set of *land seeds* are incrementally deployed to expand space for occupation and production. Land-accretion strategies are concentrated in atolls with large, shallow lagoons which will be able to accumulate land more quickly and easily. These sorts of atolls have a tendency to infill over time, and the *land seeds* will catalyze this process at a

304. See pages 128 - 129

305. Obesity and associated noncommunicable diseases such as diabetes are a major problem for Tuvaluans. These trends are associated both with a shift from subsistence diets to packaged foods, as well as increasingly sedentary lifestyles. During my visit, I saw very few Tuvaluans walking to get around the small capital; instead, they relied on motorbikes for even very short trips. Tuvalu lacks appropriate health infrastructure for many of these diseases, meaning the government covers expensive trips to Fiji for medical treatment (depleting their already limited budget).

306. For more on Tuvalu's mobile diaspora, see pages 110 - 114



CULTURE_s
COLUMN



CULTURE_m
PLATFORM



CULTURE_l
SHED

visible speed. The accretion is prioritized in Funafuti, currently the site of over half of Tuvalu's population, and particularly starved for land. As outer islanders migrate to the capital, a single one-story house might accommodate dozens of people:

"I live with my entire extended family; 40-50 people.. The house is a double bedroom house with a big living room where most of us sleep."²⁸⁶

New space for living is needed urgently. Particular land seed typologies are designed to facilitate different aspects of this process. *Reef seeds* are concentrated within the lagoon to facilitate land growth in this protected area. They are sited up-current from selected growth zones, focusing on the heart of the Funafuti settlement. *Slab seeds* serve several functions. At the ocean edge, they serve to curb erosion and protect existing development. On the lagoon side, they curate the siting of sediment produced by the *reef seeds*, providing control over where new ground is constructed. Slabs concentrate the new sediment and become the substrate for elevated housing on this new land. Through analysis of existing street grids and settlement patterns, the slabs provide a substrate to facilitate connective growth. By aligning with existing streets, they extend the city's fabric above new land into new ground in the lagoon. By reaching down into the coral bedrock below, the *housing slabs* provide a strong foundation for new development in addition to their role in sediment stabilization. This set of *land seeds* provides the existing burgeoning capital settlement with new space for self-determination, and also allows for incremental growth of land upwards to counteract the tides of rising seas.

Even with expanded space for settlement, out-migration from Tuvalu will increase, as Tuvaluans seek new opportunities for education and work. This necessitates strategies for reproducing the cultural space of the nation ex-situ, which New Zealand sorely lacks in the current diasporic context. The set of *culture seeds* provides a cadre of strategies for temporally claiming Tuvaluan space on new ground, facilitating space for the

practice and translation of culture to new contexts. These seeds allow Tuvalu to exist, in a modified form, in the bustling city of Auckland, NZ.

At the smallest and most immediate scale, individuals can deploy *maneapa seeds* in suburban culdesacs or public parks for events associated with their particular island communities. This might include a Nanumean craft group, or a Funafuti holiday celebration.

At the scale of a larger neighborhood, *culture platform seeds* are platforms with embedded infrastructure. Maneapa seeds can be plugged into the platforms in order to create space for larger scale events, such as inter-island weddings or holiday fakaala (feasts). The organization of the column elements brought by individuals onto the platform can be adapted to the scale and organization of the activity. Permanent infrastructure and service spaces housed in the system provides support for these larger events. The more permanent form of these platforms suggests a physical and visible presence of Tuvalu (and Tuvaluan space) in Auckland, which can be shared with the city's broader multinational community. When not in use, they act as a shared surface for public space, where visitors can play, picnic, and make use of the shared restrooms or kitchens.

CURATING GROUND:

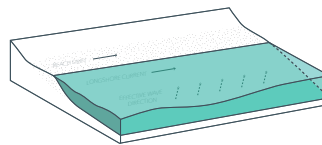
COASTAL DEFENSE TECHNOLOGIES

A number of mechanisms exist for manipulating coastlines, drawing on a basic understanding of currents and sediment flows. These models are adapted in the 'slab seeds' as mechanisms for curating sediment deposition and selective erosion in the building up of islands. In congruence with 'reef seeds' which provide an increased burst of sediment production, new islands can even be grown with this framework

Typically, flows of sediment that make or destroy islets are considered acts of nature, outside of the control of man.

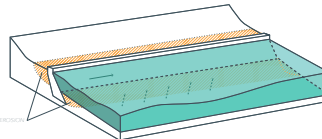
This is clear in the discussion around the destruction of Fualefeke islet in the Tuvaluan National Adaptation Plan (see page 159). In contrast, this model understands Tuvaluans as participants in the geomorphological processes of atoll construction and seeks out models that maximize land growth with minimal physical interventions.

EXISTING

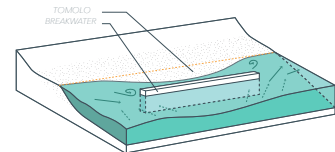


TYPICAL COASTAL CONDITIONS

PROTECTING

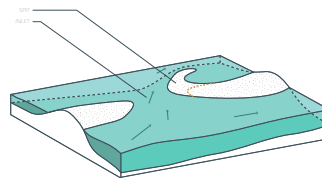


COASTAL DEFENCES SEA WALL

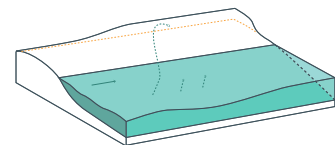


COASTAL DEFENCES BREAKWATER

GROWING



NATURAL LANDFORMING SPIT

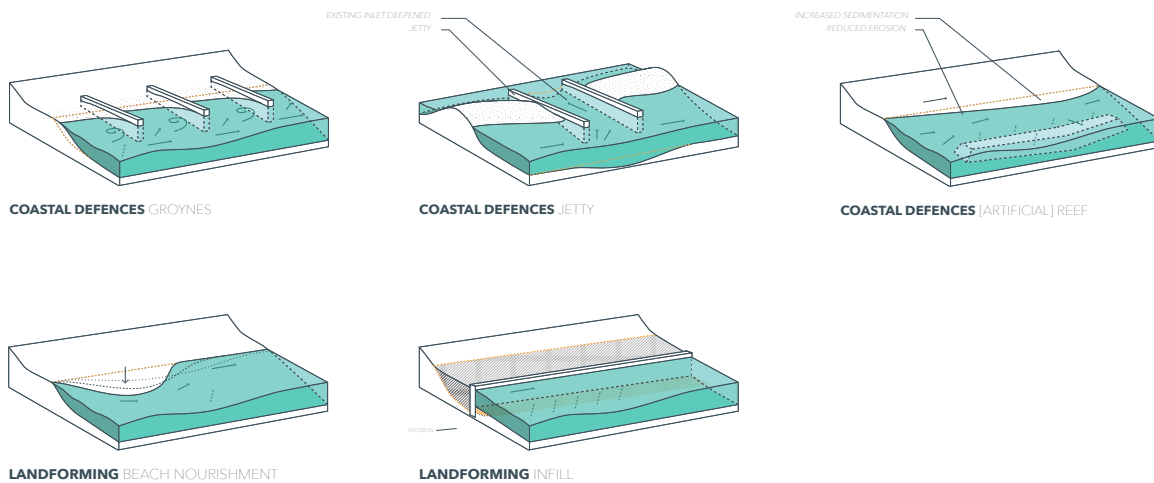


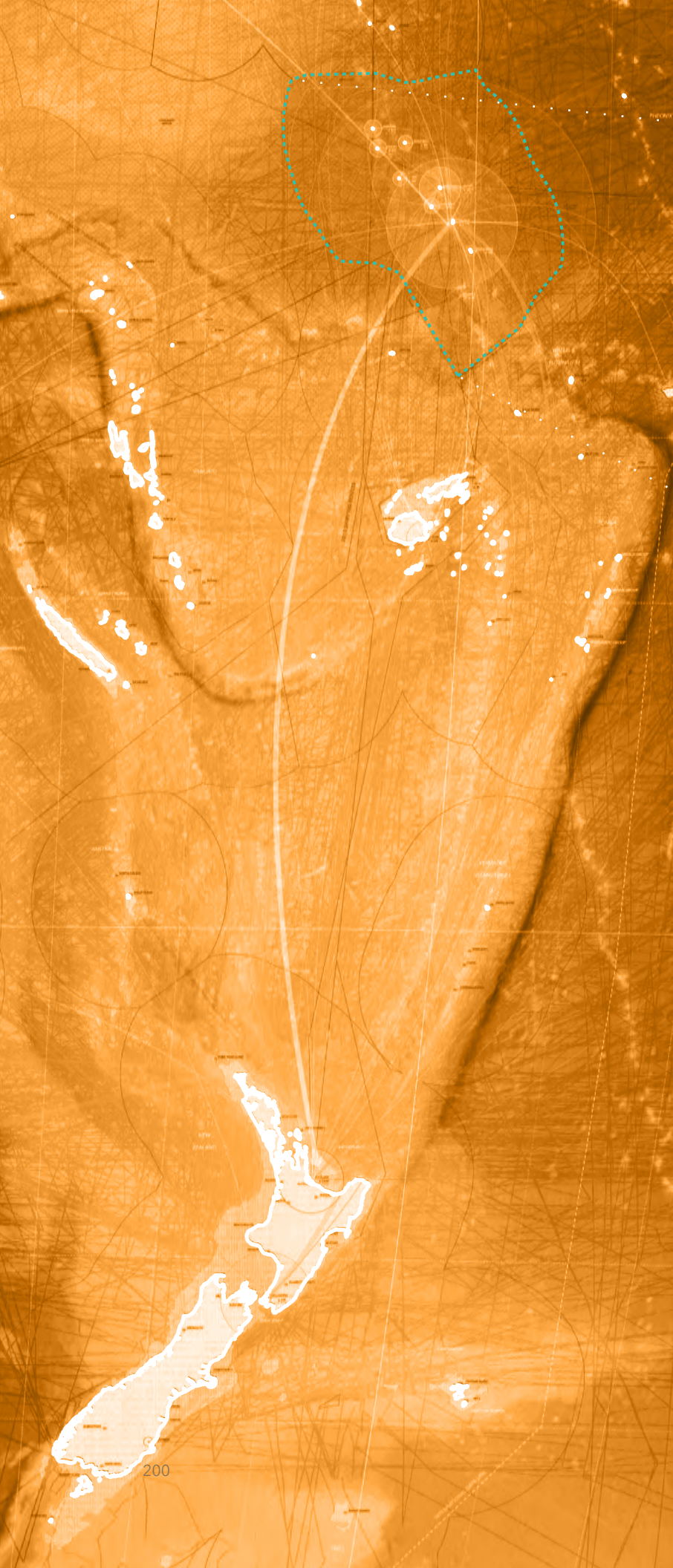
NATURAL LANDFORMING STORM RIDGE

These two smaller scale seeds will establish new models of multicultural space activation in the New Zealand context. Their visibility will help to facilitate other island nation diasporas to establish their own national spaces in Auckland. Garnering momentum from these new cultural spaces, Islander communities come together to establish a larger, permanent shared space. In broader scales of time and space than the first two culture seeds, the *culture shed seed* establishes a highly visible Pacific Islander space in Victoria park in downtown Auckland, making clear the important role of Tuvaluans and all Pacific Islanders in the broader, diverse New Zealand community.

While the two sets of seeds in this scenario are distinct in their strategies, scales, and settings, the *land seeds* and *culture seeds* operate in tandem to expand Tuvalu's space. By expanding their existing ground, and claiming new ground ex-situ, Tuvaluans are provided with increased flexibility in possible spaces of inhabitation, without being forced into established Western models of dense, fortified urban living in Funafuti or dispersed, car-based Kiwi practices in Auckland.³⁰⁷

307. See pages 130 - 131 for notes on Tuvaluans' difficult relationship with modernity





FUTURE SCENARIO [A]
TUVALU



FUTURE SCENARIO [A]
NEW ZEALAND





*Future A: **Climate change as usual***

GROWING THE CAPITAL

CREATING NEW GROUND FOR GROWING POPULATIONS IN FUNAFUTI

Scenario A in Tuvalu explores a future where ongoing incremental climate change combines with the capital settlement's existing expansion and overcrowding. In order to accommodate this growing population alongside sea level rise, this scenario examines how the implementation of reef-growing poles and land-curating slabs can selectively grow the ground of the capital atoll to accommodate new space for housing and agricultural production, protect vulnerable edges from erosion, and carve deeper shipping channels that facilitate Funafuti's increasing connectivity to the broader world. This collection of tactics works towards incrementally securing Tuvalu's future in light of climate change risks, working with atoll processes and the surrounding coral reefs to incrementally build up this living island.

In the capital settlement proper, known both as 'Funafuti' for the atoll it inhabits or Fongfale for the particular islet of the settlement, land accretion is concentrated on the lagoon edge near the central zone currently inhabited by the government complex, airport, and hotel. This is achieved through up-current reef seeds which produce sediment, and near-shore slab seeds which curate where that sediment is deposited while also stabilizing the new

landmass. On the ocean edge near the airstrip and dugout zones known locally as the 'burrow pits', slab formations are implemented to deflect currents and prevent erosion in this zone frequented by flooding and overwash. This tip takes the brunt of the ocean's current. This site is explored in further detail in the subsequent drawing.

At the Southern tip of the atoll on the islet known as Funafale, land near an existing small settlement is expanded in order to expand agricultural production. The capital is currently largely reliant on imported foodstuffs as the proliferation of housing has eaten away agricultural space (referred to as plantations) and the coconut-laden 'bush.' This new ground will provide space for both traditional crops and alternative salt-resistant plantings, helping to improve the agricultural security and self-sufficiency of the nation.

An existing shipping channel at Funafuti atoll's Northwest tip created naturally through erosion is intentionally deepened using slab seeds which increase the speed of currents and strip away sediment. This allows larger ships to enter the lagoon. The channel accommodates fishing vessels, as well as possible future cruise ships or larger trade vessels. This zone is also grown as an offshore fishing outpost, serving an expanding locally-run fishing industry.



FISHING OUTPOST

WESTERN ISLES, CAPITAL SETTLEMENT

CAPITAL EXPANSION

FONGDALE ISLES, CAPITAL SETTLEMENT

AGRICULTURAL PRODUCTION

FINSEFALA SLETT

GROWING THE CAPITAL:
SEEDING GROUND



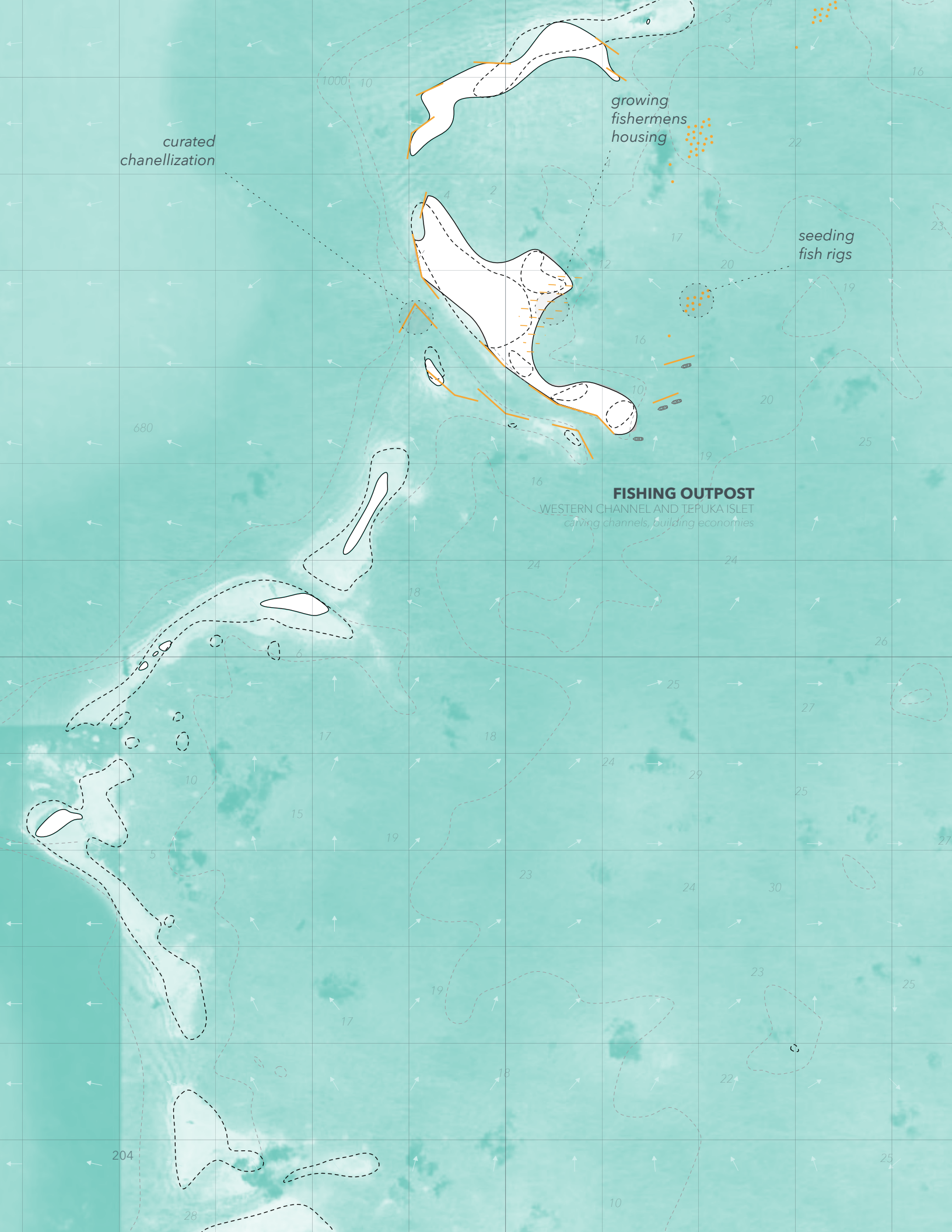
LAND_a

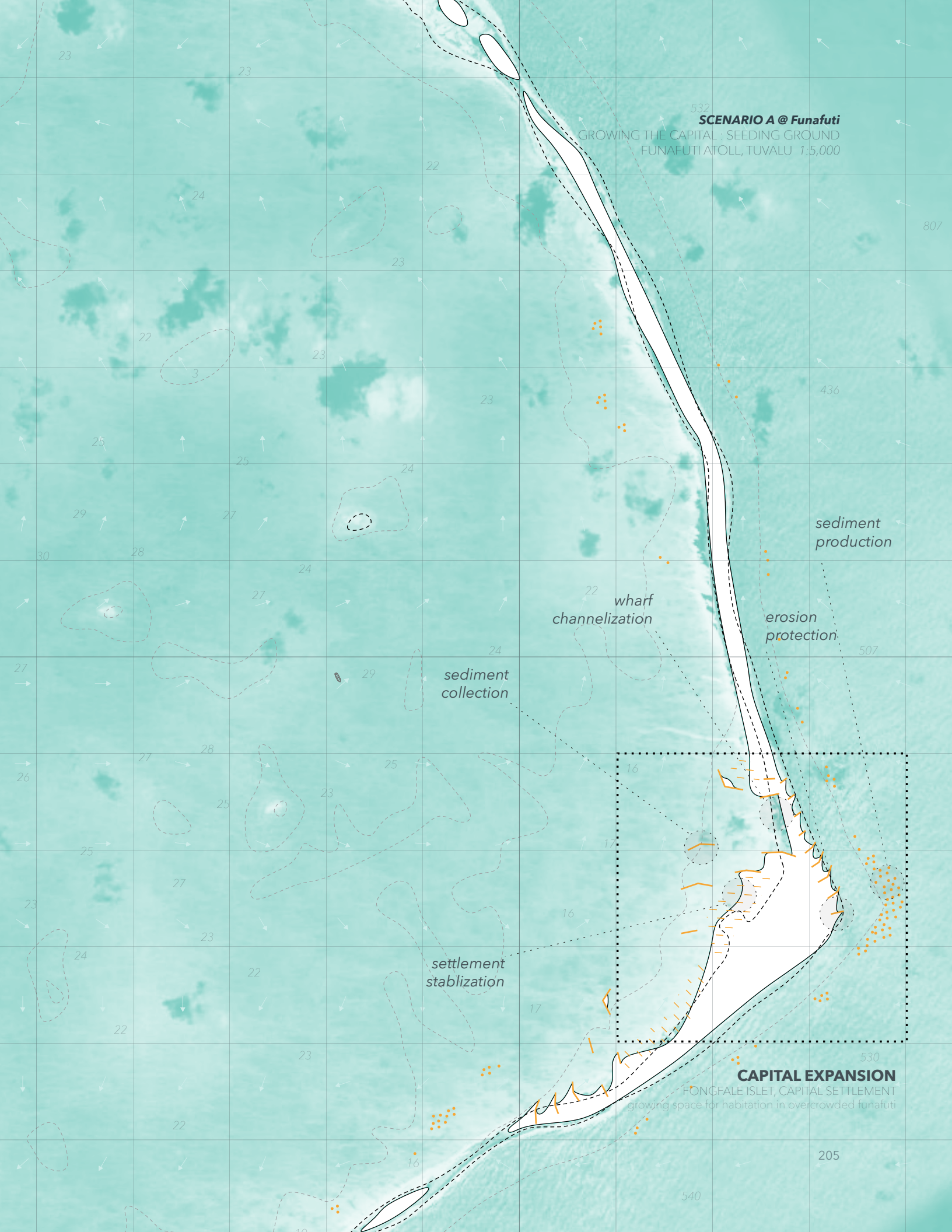


LAND_b



LAND_c





SCENARIO A @ Funafuti

GROWING THE CAPITAL : SEEDING GROUND
FUNAFUTI ATOLL, TUVALU 1:5,000

sediment
production

erosion
protection

wharf
channelization

sediment
collection

settlement
stablization

CAPITAL EXPANSION

FONGFALE ISLET, CAPITAL SETTLEMENT
growing space for habitation in overcrowded funafuti

205

540

16

530

436

507

807

23

23

22

532

24

23

22

23

23

25

25

24

29

27

30

28

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23

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27

23

17

23

24

22

17

22

23

16

22

16

530

540



250M

280

**GROWING GROUND:
CAPITAL EXPANSION**

ACCUMULATING SPACE FOR FUNAFUTI'S EXPLODING POPULATION
Tuvalu's capital settlement at Funafuti currently suffers from severe overcrowding. When mobility restrictions associated with colonization were lifted with Tuvaluan Independence in 1978, the population of the capital exploded from less than 1,000 to over 2,000 in just a few years. This growth continued of the following decades, and Funafuti now houses over 6,000 residents, many of whom share tight spaces with large extended families. The surface of the islet is covered with extra dwellings built in backyards and constructed informally around the standing water of the 'burrow pits' and along the narrow 'legs' of the islet to the North and South of the central settlement.

This drawing shows how through the collection of 'ground seeds', the space of the capital settlement could be expanded to better accommodate this growing population while also gradually raising the surface of the atoll in order to combat against incremental sea level rise. Reef poles are sited up-current from the desired growth zone along the lagoon edge of the settlement's center, as well as on the ocean edge to facilitate growth instead of erosion. Orange arrows show where the current has picked up new sediment from the reef poles. The reef-building technology of this system is particularly pertinent for kick-starting coral growth in lagoon zones that have been degraded through pollution. Biorock technology and super-corals which are part of the reef seed system are more resilient to contamination and can help return life to lagoon reefs. Coral sediment is key in the ongoing survival of atolls, as they are formed from the incremental accumulation of coral sediment.

This sediment is then selectively accumulated through the technology of the 'slab seeds' which curate material deposition and stabilize newly formed ground. Slabs are sited relative to currents based on a groyne-technology accumulation system, but also align with the existing urban fabric in order to integrate new zones for building with the existing settlement. Dashed parallel lines show the trajectories of these slab corridors. This allows the slabs not only to build up ground, but to become the substrate for new circulation corridors, and structural supports for new elevated housing. On the vulnerable ocean edge, slabs angled perpendicular to the current prevent erosion and build up a sediment buffer zone.











LAGOON INFILL

Slab seeds allow sediment to be accumulated in a selectively, growing and curating the capital settlement to defend against sea level rise and accommodate a growing population, while defining a new relationship towards the lagoonal coastline. Oriented perpendicular to the coastline in a variation of groyne coastal engineering technology, the slabs maintain view corridors out towards the ocean. Constructed of aerated concrete, they use local coral sediment as a construction aggregate. The structures become part of Tuvaluan lifestyles and landscapes, appropriated as sites for mooring canoes, fishing for reef fish, and swimming and diving, in much the same way the pier is now used. At fixed heights above sea level, they also serve as an index of sea level rise and land accumulation. Over time and as needed, new slabs can be built outwards into the lagoon to further expand new ground for settlement.



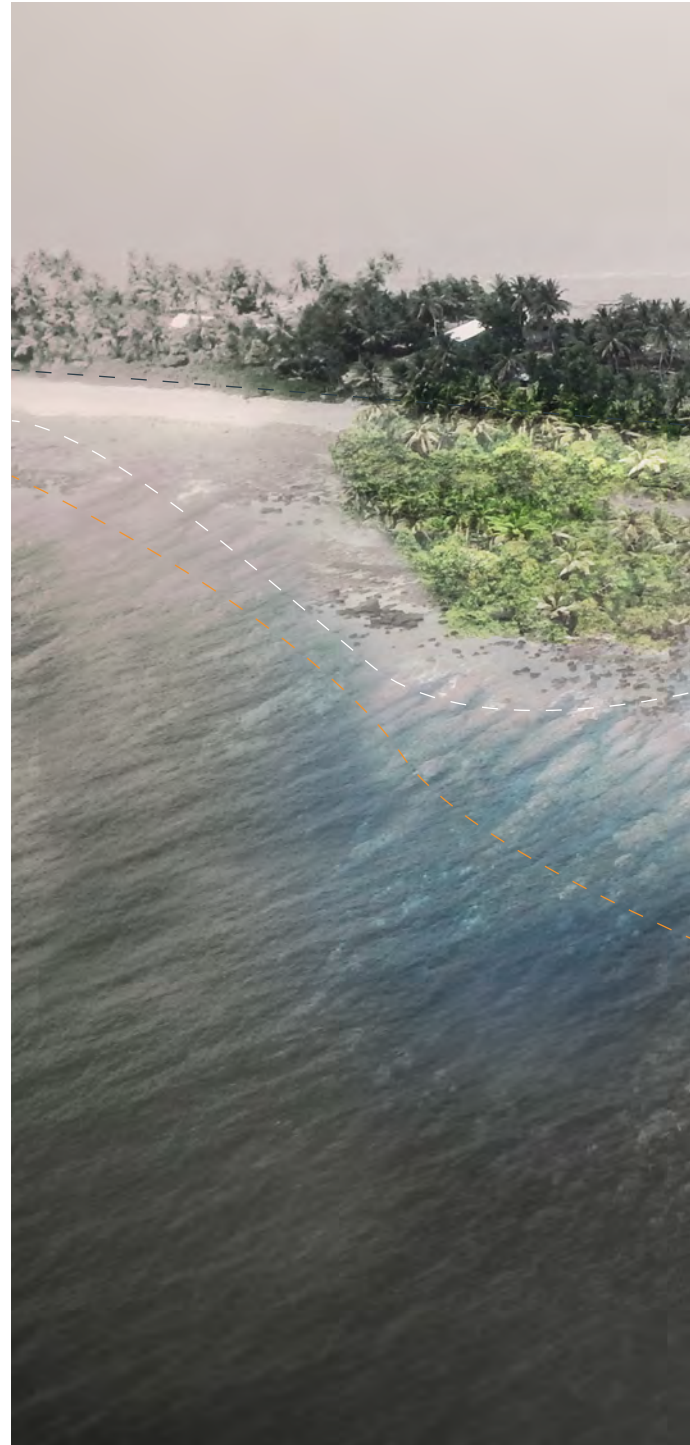
ACCUMULATING AGRICULTURE

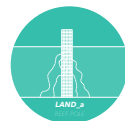
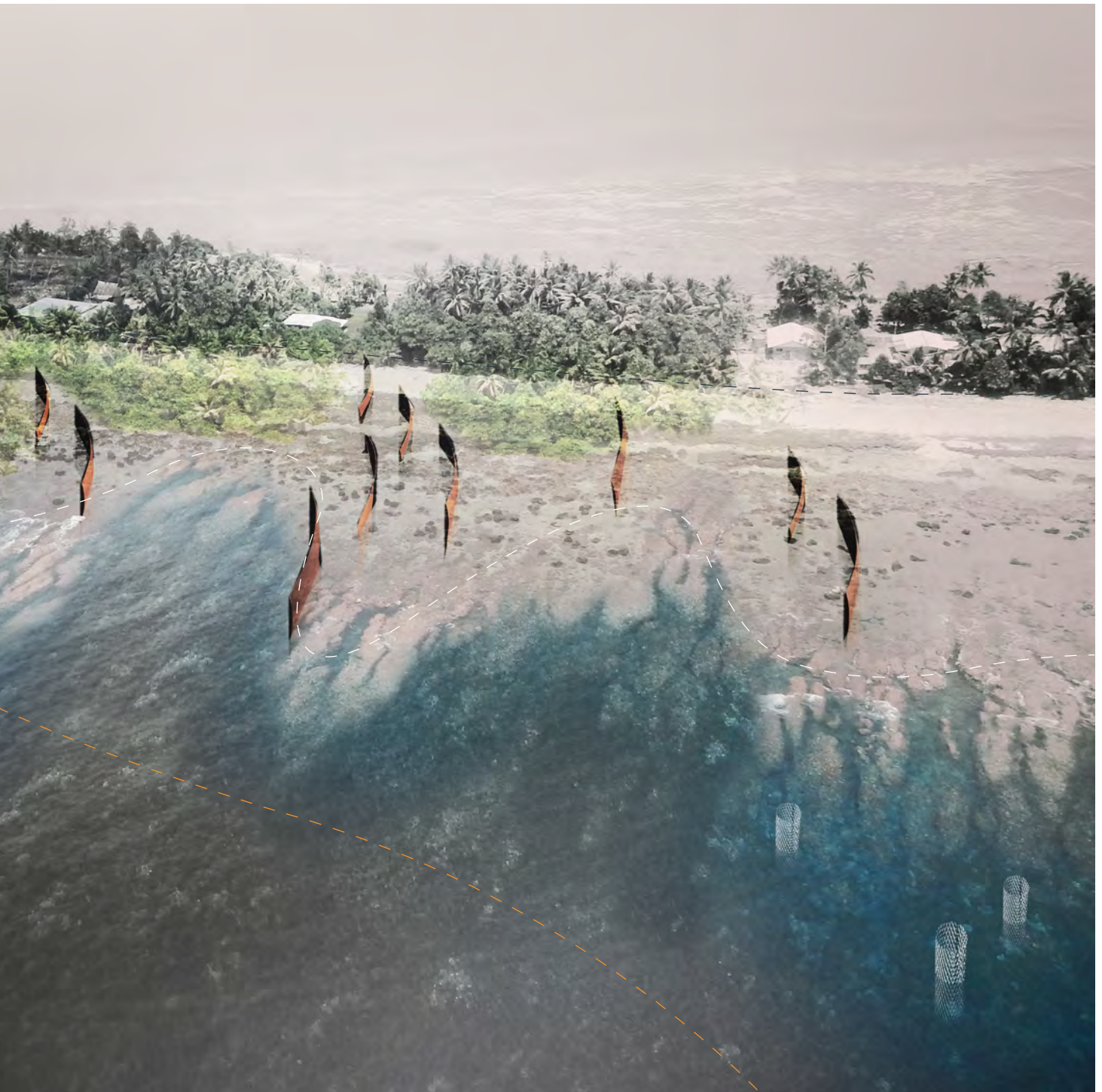
On the sparsely populated Southern islet of Funafale on Funafuti atoll, new ground is accumulated through reef poles and ground slabs. This new ground is used to expand local agricultural production of coconut, taro, pandanus, breadfruit, and bananas.

Presently, the capital suffers from a lack of space for local foodstuffs and residents increasingly rely on imported, preserved products, contributing to an ongoing obesity epidemic. This issue will be further exacerbated by climate change, as taro pits are inundated and space for planting and housing erodes.

While the ground seeds applied in the capital settlement serve to expand the fabric of town, here the land is maintained as an agricultural preserve, and housing is limited to the caretakers of the site. As a rural area close to the capital settlement, this area can continue to serve as a picnic spot and a site where capital-dwellers travel to collect coconuts and other local 'bush' foods. The site will not be managed as a privatized space, but rather will be maintained in a Tuvaluan collective model, or *kaitasi*, an asset shared by and for the good of the entire community.

Sites such as this which expand Tuvalu's independence from imports and aid add to a conception of local agency and self sufficiency derived from a reinterpretation of existing models. In this alternative modernity, a cyborg atoll can grow space for collectively owned new and traditional crops, serving globalized Tuvaluan society rooted strongly in (variations on) local culture and traditions which are strongly tied to local foods.





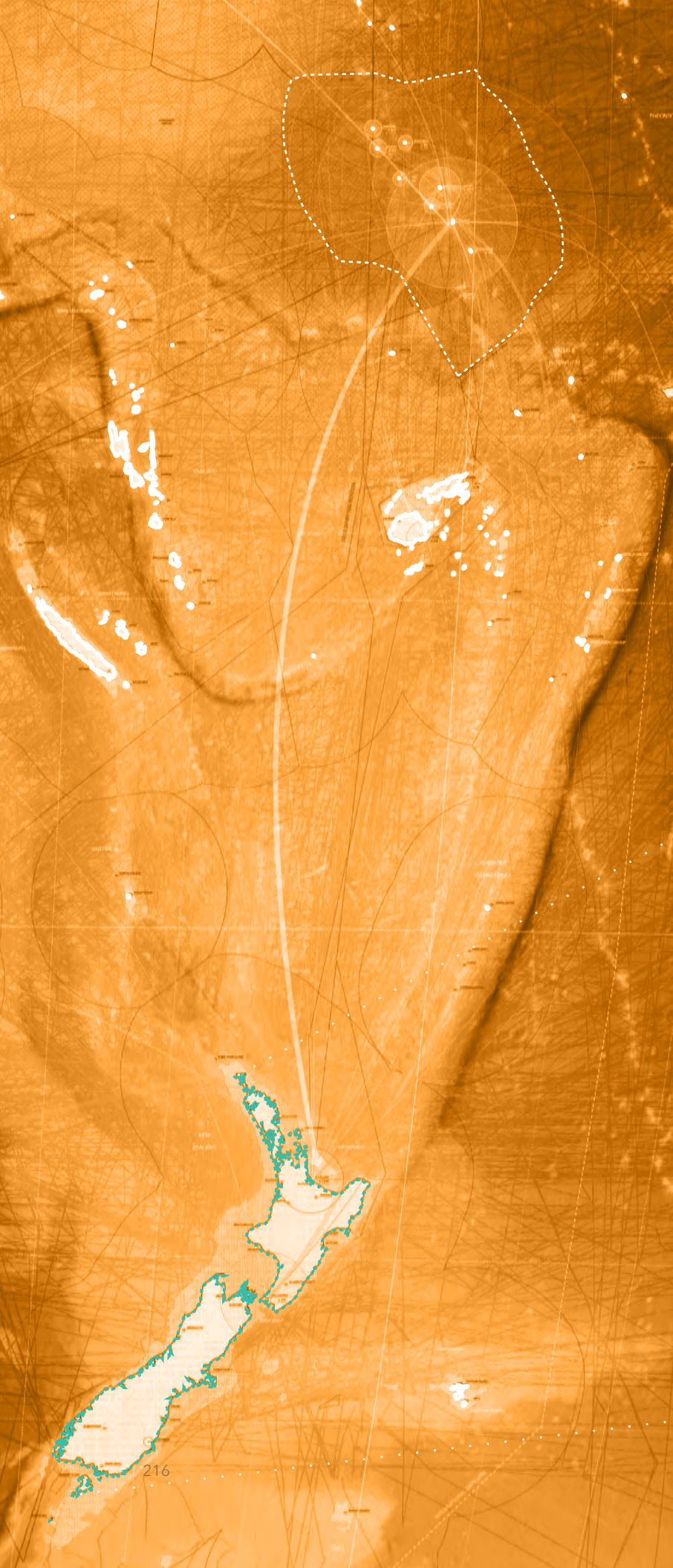
SLAB HOUSING

As the slab seeds work their way outwards into the lagoon and sediment begins to accumulate, slab structures become the substrate for housing expansion, alleviating the massive overpopulation in Funafuti and supporting elevated structures that are securely above storm surges and King Tides. Much of the existing housing in Tuvalu is built of low-quality building materials and is built at or near ground level. The ground slabs define a new plane for building construction that will help prevent against frequent flooding issues. Acknowledging that the ground of atolls is inherently fluid, alternative supports allow for the ground to grow and change without destabilizing structures.

The supporting slab seeds are arranged perpendicular to currents to facilitate sediment accumulation, but also as an extension of existing circulation routes and settlement patterns so that housing and amenities can expand outwards onto this new ground uninterrupted.

The housing built on this new ground and slab supports is adapted to the tropical climate of Tuvalu. Much of the aid housing built after Hurricane Bebe, along with most new construction, is built modeled on Western housing typologies requiring active cooling systems, in spite of an understanding by the majority of interviewees that open-air structures such as those traditionally inhabited by Tuvaluan peoples are significantly more comfortable and pleasant to inhabit. In light of this logic, new structures will adopt open air facades and through-ventilation combined with adaptable systems that can be closed down in cases of inclement weather. This too is an interpretation of traditional technologies, where woven wall hangings can be raised or lowered depending on the weather. Combining local knowledge with new technologies and materials, these structures will hybridize the needs of a globalized population with generations of local knowledge.





FUTURE SCENARIO [A]
TUVALU

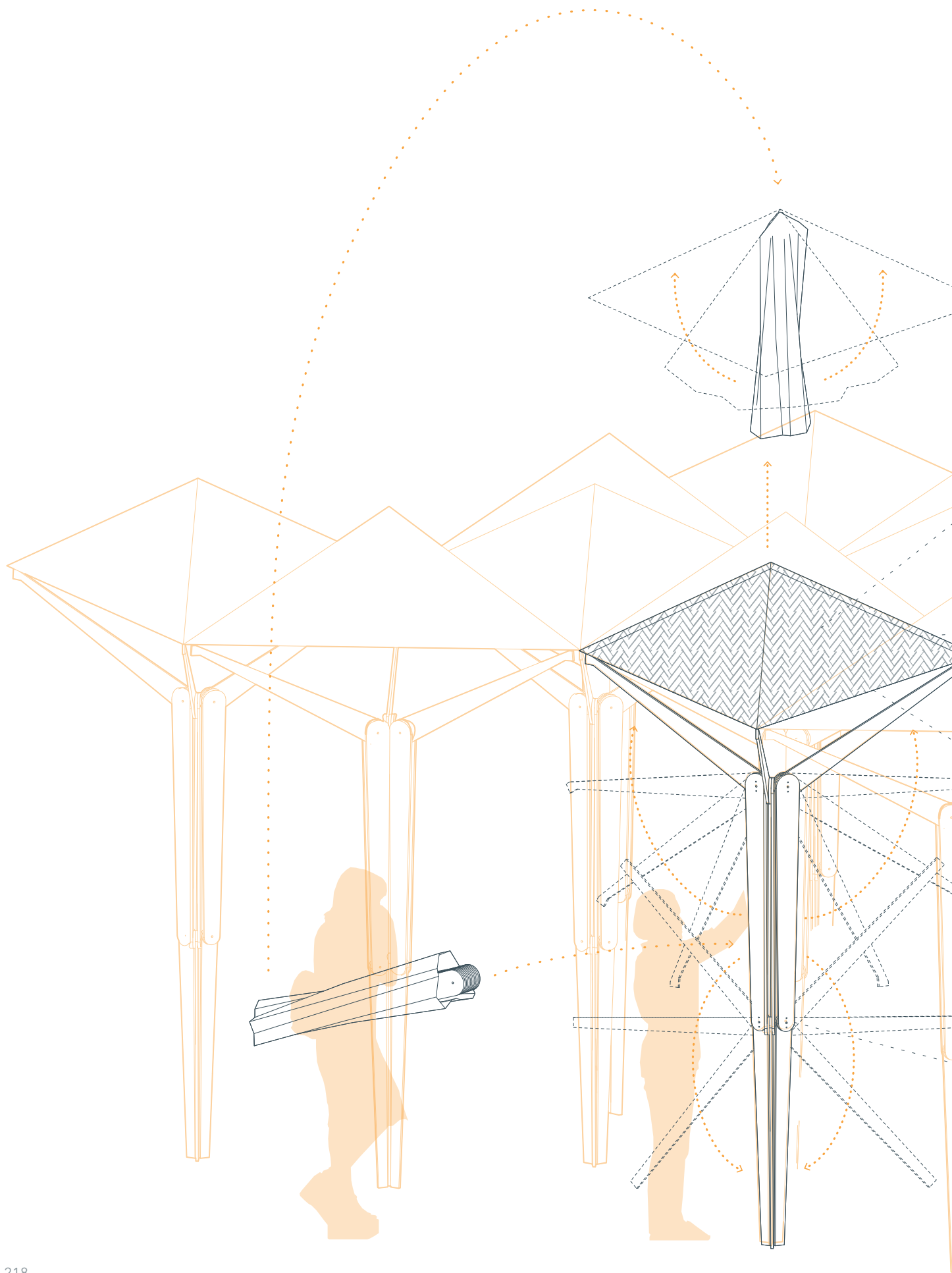


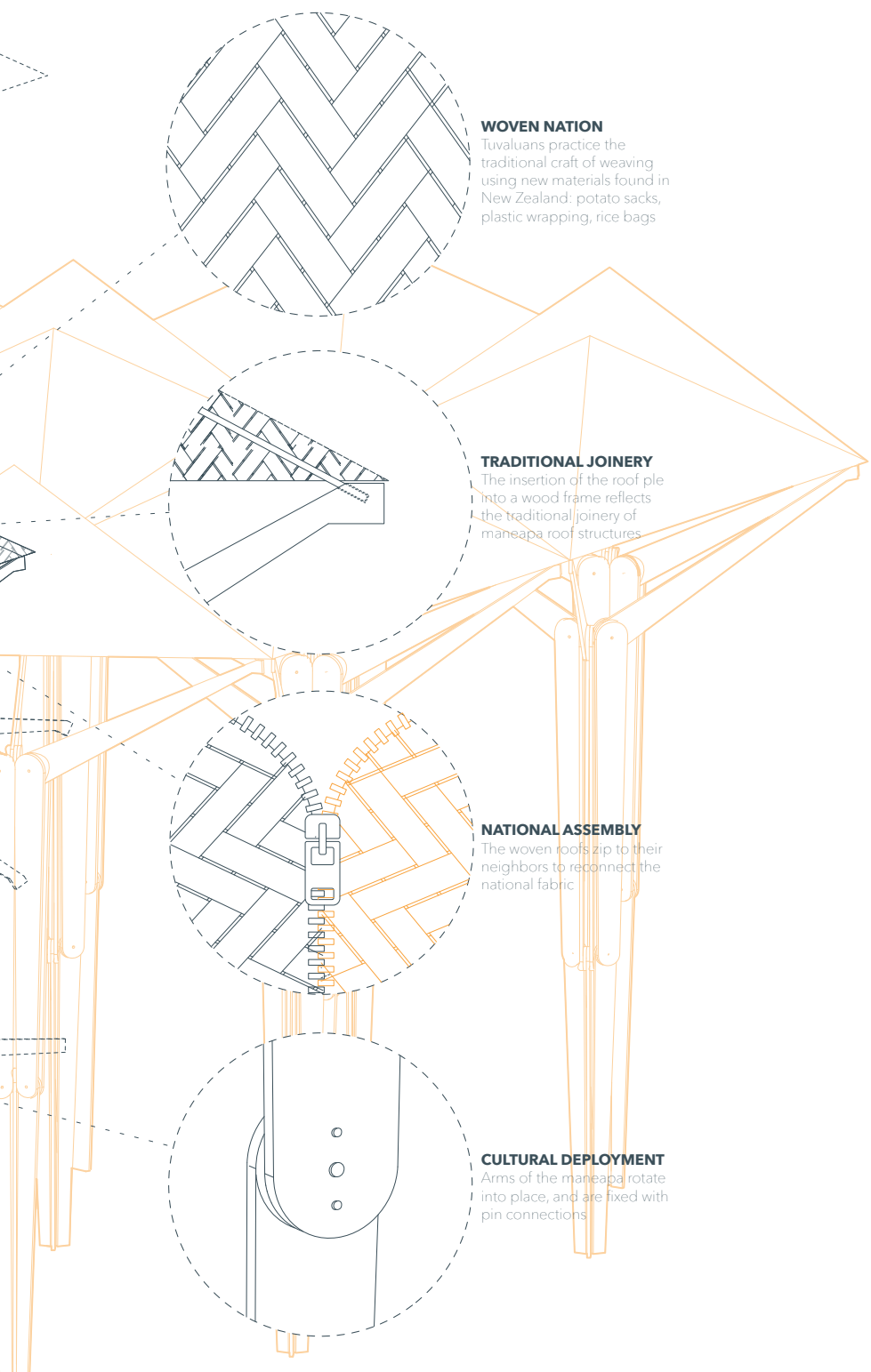
FUTURE SCENARIO [A]
NEW ZEALAND





4 *Future A: **Climate change as usual***





WOVEN NATION

Tuvaluans practice the traditional craft of weaving using new materials found in New Zealand: potato sacks, plastic wrapping, rice bags

TRADITIONAL JOINERY

The insertion of the roof ple into a wood frame reflects the traditional joinery of manepa roof structures

NATIONAL ASSEMBLY

The woven roofs zip to their neighbors to reconnect the national fabric

CULTURAL DEPLOYMENT

Arms of the manepa rotate into place, and are fixed with pin connections

MANEAPA SEED:

ASSEMBLING COLLECTIVE SPACE FOR A DISPLACED NATION

This deployable architecture comes together when a collective of diaspora Tuvaluans bring together their individual manepa columns and assemble them into a collective space. Much of Tuvaluan culture revolves around the manepa, a meeting-house pavilion traditionally built of pandanus thatch and coconut posts, and constructed as a collective assembly, where each community member plays a role (see page 106-7). In this re-interpretation of a manepa for migrated Tuvaluans, a 'pop-up' manepa is constructed from modern materials. Each community member brings their own 'manepa seed', which forms a collective architecture for Tuvaluan events when they come together.

Each of these manepa seeds is a demountable, flat pack system, so not only is the space of assembly temporal, but the units themselves are easily portable. Reinterpreting traditional Tuvaluan construction methods, the column portion is constructed from wood; using plywood sheets instead of raw island timber. Using hinged and jointed connections, this component can pack flat into a 48" x 3" x 4" unit, weighing under 20 pounds. The construction methods draw on both modern technologies such as a shareable CNC router file, but also traditional methods of pinned connections and mobile architectures. The pole also serves as a frame for a lightweight roof system, which is woven from available contemporary materials using methods drawn from traditional mat-weaving. Thus, each manepa unit becomes a hybrid of traditional and 'modern' processes, standardized to fit together, but unique to the individual who has constructed it.

In order to test the operation of the flat-pack wooden column and its relationship to the fabric upper, an initial prototype was constructed in the research phase of this thesis. This unit allowed for a clearer understanding of scale, material, operation, and relationship to the body, in order to refine the design. It also emphasizes the multi-scalar aims of this thesis; from a human-scaled architectural unit to the design politics of an entire nation.

**POP-UP NATION:
Maneapa deployment**

The maneapa seeds are designed to be deployed on the fly as a tactic for rapidly claiming space for Tuvaluan cultural practice. Drawing on Hobsbawm's notion of an 'invented tradition,' these architectural elements create new traditions for Tuvaluans displaced by climate change, or who have simply migrated in search of work opportunities and better education for their children.

Through this device, Tuvaluans can deploy national space ex-situ, performing a pop-up nation.

Having established a site to meet, a minimum of three Tuvaluans and their maneapa seeds are required to assemble the pop-up maneapa. Here, three defines the minimum scale of a pop-up nation, and the maneapa will not stand without three points of support. Thus, the structure begins

by three initial maneapa poles being unpacked and locked into place. They connect to their neighbors through a zipper connection on the roof of the structure (see assembly drawing on page 218-19). From there, a small scale event can already occur; perhaps a crocheting group from the Nanumanga island community. However, the structure—and the ex-situ national space—can continue to accumulate, as more Tuvaluans arrive and assemble their maneapa poles, leaning them into place.

In a traditional Tuvaluan maneapa, a pole-and-beam construction creates a limited number of in-line columns, which are reserved for male Tuvaluan elders. However, in this democratized invented tradition designed for the new social landscape of New Zealand, each participant brings their own column, so everyone receives the privilege of having a column to lean on.





1



2



3



4



5



6



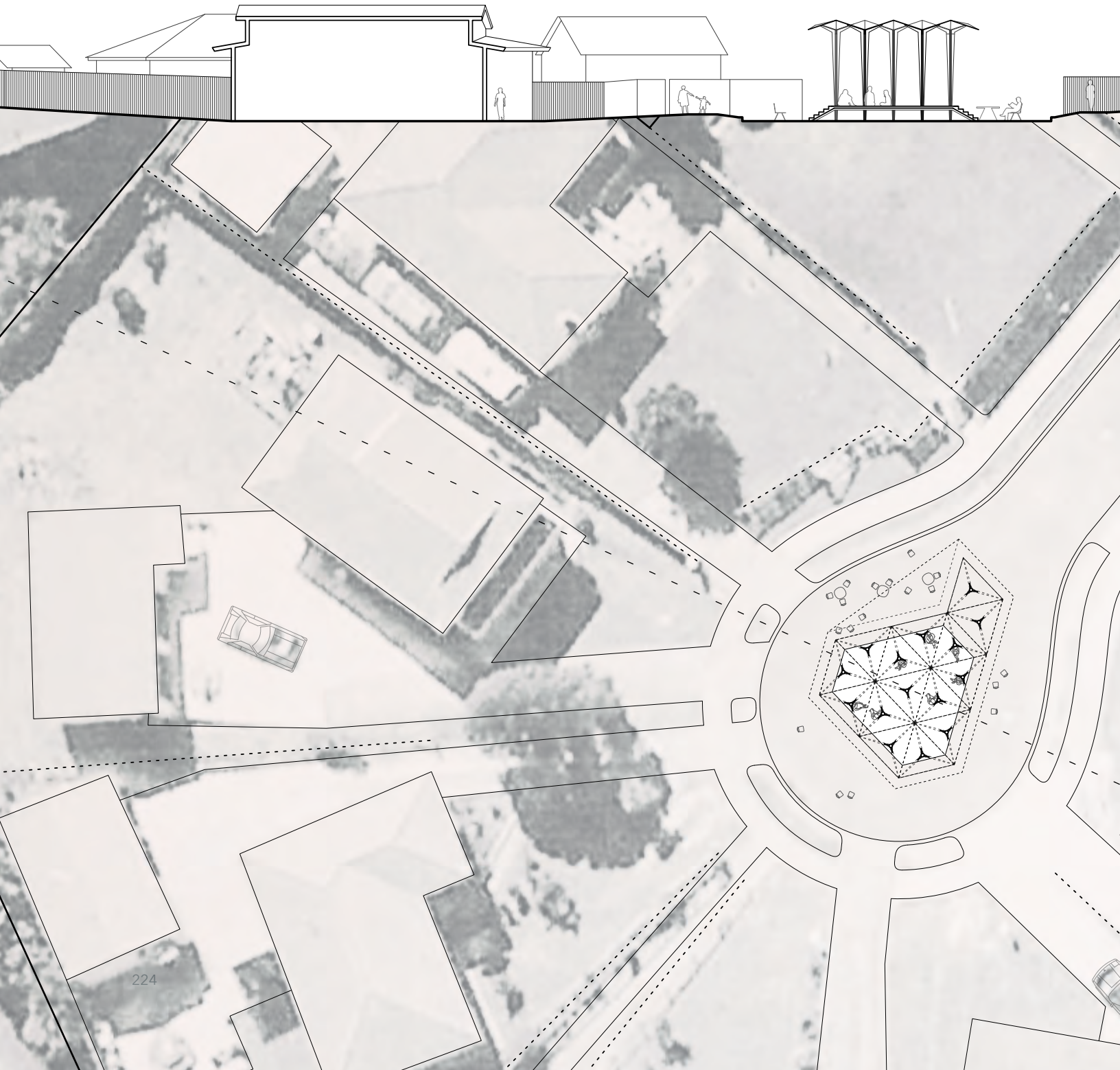
POP-UP NATION:

A temporal space for cultural practice

Today's Tuvaluans in Auckland are dispersed across the polycentric metropolis, and they lack permanent shared spaces. Only the Vaitupu islanders have a permanent islander meeting space; other island communities rely on rented meeting halls, or must use households for events. The pop-up maneapa, at the smallest scale, can be assembled by community members in open space in their neighborhood, temporarily claiming Auckland's ground as Tuvaluan territory, much in the way that a beach umbrella stakes claim to a spot on the sand.

Depending on the size of the group in question, each person deploys their own maneapa column and fastens it into the larger system. The resultant space is opened in all directions and non-hierarchical, accommodating a range of possible activities. Here, a small group has gathered in an Auckland suburban cul-de-sac to practice the Tuvaluan craft of weaving, using a combination of traditional and found materials. Some may be weaving the roofs of their maneapa column, which are created with a re-working of this traditional craft. This structure makes space for activities to occur that are distinctly Tuvaluan, but looking forward instead of back. Drawing on long cultural histories, the deployable maneapa allows for new traditions to be invented which maintain strong identities in a wholly new context.



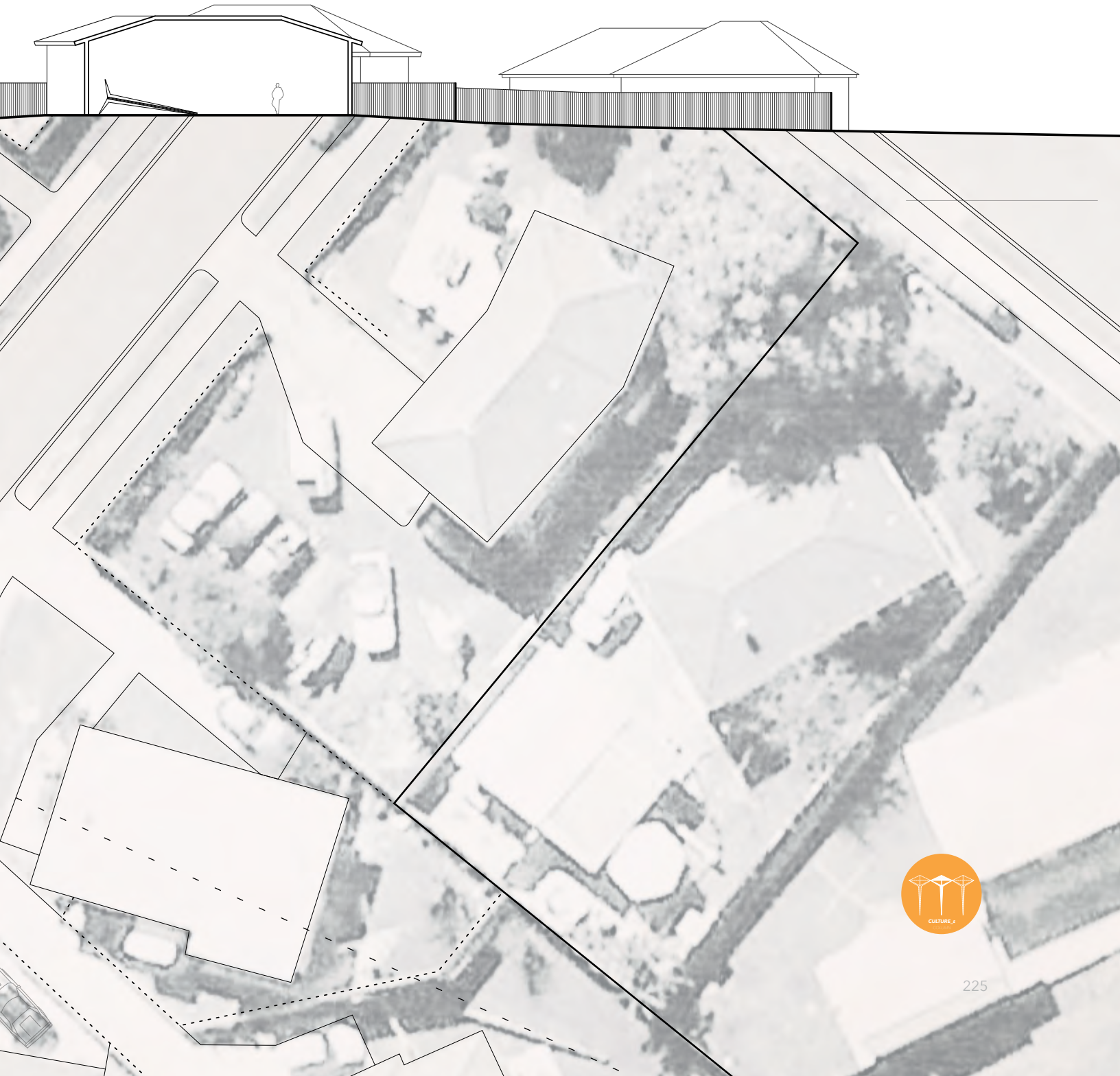


**POP-UP ISLAND OF NANUMEA
DISPERSED REPUBLIC OF TUVALU**

The Auckland suburban cul-de-sac, the primary neighborhood typology of the Tuvaluan diaspora, is re-claimed as Tuvaluan space through temporal architectural devices. Maneapa columns assemble a kind of pop-up nation by claiming space with their canopy. However, the

structures also open up multi-directionally, inviting in the surrounding community; non-Tuvaluans as well are invited to participate in the cultural practices occurring inside. The form of these deployable structures seeks to insert collective space into the privatized and fenced off urban fabric, subverting the individualized nature of suburban living

typologies. Over time, these temporary structures might become more permanent, confirming the need for new forms of collective space for Tuvaluans and all suburban dwellers. More permanent *maneapas* will help to re-center Tuvaluan communities, providing a focal point for new migrants entering New Zealand.



**MANEAPA PLATFORM
MANGERE PARK, AUCKLAND NZ**
FRAMEWORK FOR CULTURAL PRACTICE

The maneapa seeds described on the previous page can operate without a support structure, assembled by community members in a public park or suburban cul-de-sac. However, in a more established variant, a permanent concrete base embeds the *maneapa* into a community's landscape.

Maneapa seeds can be plugged into the platforms in order to create space for larger scale events, such as inter-island weddings or holiday *fakaala* (feasts). Individuals attending the event would bring these portable architectural units with them, and assemble the units into place on the surface of the platform, plugging into the concrete landscape. In a democratic variant on the traditional Tuvaluan *maneapa*, each participant brings their own column to lean against. The organization of the column elements brought by individuals onto the platform can be adapted to the scale and organization of the activity occurring inside. For example, a dance ceremony (*fatele*) could occur on a slightly raised plinth with spectators seated viewing the performance. Or for a Tuvaluan cooking class, small clusters can be created atop the plinth accommodating more intimate groups. In this scenario, the integrated cooking pits can be used to create variants on traditional Tuvaluan foods. Permanent infrastructure and service spaces housed in the platform provides support for these larger events, such as lighting, sound, plumbing, cooking pits, and permanently enclosed spaces for kitchens, bathrooms, and meeting areas.

This image superimposes several possible configurations of the platform into a single drawing. White linework indicates a marriage *fakaala* (feast), orange indicates a *fatele* (dance ceremony) celebrating a Funafuti holiday, and dark gray is used to depict a cooking workshop organization. Human actors and their desire lines are indicated as well, as the inhabitants are essential to the creation and operation of this architecture. The flexible model of the deployable maneapa system draws on traditional Tuvaluan architecture and settlements which employ transformable components that accommodate changes in weather and resources. In a mobilized era of Tuvaluan society, flexibility is perhaps more important than ever.

The more permanent form of these platforms relative to the platform-free variation suggests a physical and visible presence of Tuvalu (and Tuvaluan space) in Auckland, a space which can be shared with the city's broader multinational community. When not in use, they act as a shared surface for public space, where visitors can play, picnic, and make use of the shared restrooms or kitchens. These structures will also serve as magnets in the Tuvaluan diaspora, places which are established as Tuvaluan and become landmarks for the community in the city. They may serve to differentiate Tuvaluan neighborhoods in the city; currently Tuvaluans are widely dispersed across the sprawling metropolis of Auckland. Different platforms may be associated with different island groups in the Tuvaluan archipelago, with Tuvaluans strongly identify culturally, or they may be shared between island communities.



MARRIAGE FAKAALA (FEAST)

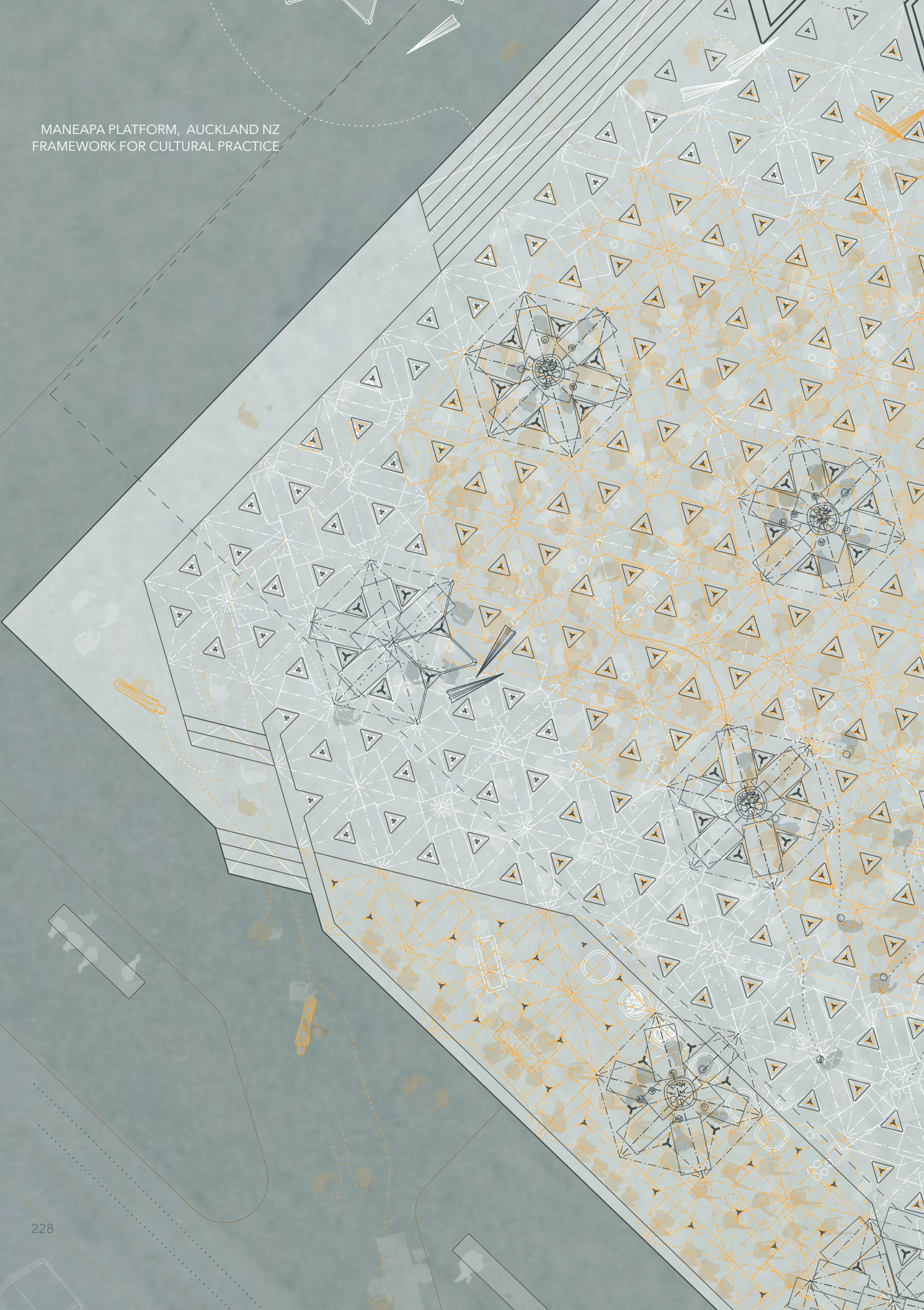
BEBE URY FATELE (DANCE PERFORMANCE)

kitchen

PULASAMI COOKING WORKSHOP



MANEAPA PLATFORM, AUCKLAND NZ
FRAMEWORK FOR CULTURAL PRACTICE





**MANEAPA PLATFORM, MANGERE,
AUCKLAND: BEBE DAY FATELE**

Here the maneapa platform has been configured for a *fatele* (dance ceremony) celebrating a Tuvaluan holiday. The structure creates a space for traditional dances to continue to be practiced, however the environment in which it is occurring is entirely new. Dancers move within a landscape of columns, spaced such that each dancer maintains the space for the fluid arm gestures associated with their dances. Above, a patchwork of maneapa roofs zipped together reflect the diversity of the community assembled here. While some roofs may be woven entirely of traditional palm fronds, other are created from a collection of modern materials, including translucent plastic that allows a dappled light to filter into the structure. Cooking pits allow for traditional foods, or variations on traditional foods, to be cooked within the structure, ventilated through special hooded roofs over these zones.

This structure does not seek to exactly reflect a Tuvaluan maneapa; rather, it attempts to reinterpret it for a modern, mobile, Tuvaluan population. As an architecture and a practice, these cultural seeds seek to allow Tuvaluan identities to persist while new traditions are formed.









PACIFIC ISLANDER CULTURE SHED

VICTORIA PARK, AUCKLAND: PASIFIKA DANCE AND CULTURE FESTIVAL

The catalog of cultural seeds is designed to operate at multiple scales, serving different sizes of community (island group, Tuvaluan nation, or Pacific Islanders more broadly) as well as accommodating different resource bases and available spaces. In this, the largest variation, a larger, more permanent cultural space borrows a dynamic facade logic from the smaller deployable maneapas, and serves a broader, pan-Islander community in the heart of Auckland.

Island identities are already visible in New Zealand, and the Pasifika festival held every March hosts eleven Pacific Island nations, showcasing their traditional foods, song, and dance. This space seeks to further embed Pacific Islanders into the urban fabric of New Zealand by creating a flexible, multi-functional space for Islander events.

In addition to large-scale celebrations, the structure can also host smaller music and cultural festivals such as the Islander Film Fest, or provide a venue for sporting events. Sited in Victoria Park in the heart of Auckland, the structure can also operate in daily use as a public pavilion, operating multi-functionally much in the way that the airstrip does in Funafuti (see page 124-5). This structure too is flexible, through the mechanism of an operable facade that allows the structure to convert from closed event hall to open-air pavilion. This operation also serves as a kind of spectacle, attracting onlookers from all backgrounds to the site. These large operable surfaces can also become a kind of billboard for the different events occurring within the space.





PACIFIC ISLANDERS

- 5-9%
- 10-14%
- 15-19%
- 20-29%
- 30+%

GROWING CULTURE, AUCKLAND NZ

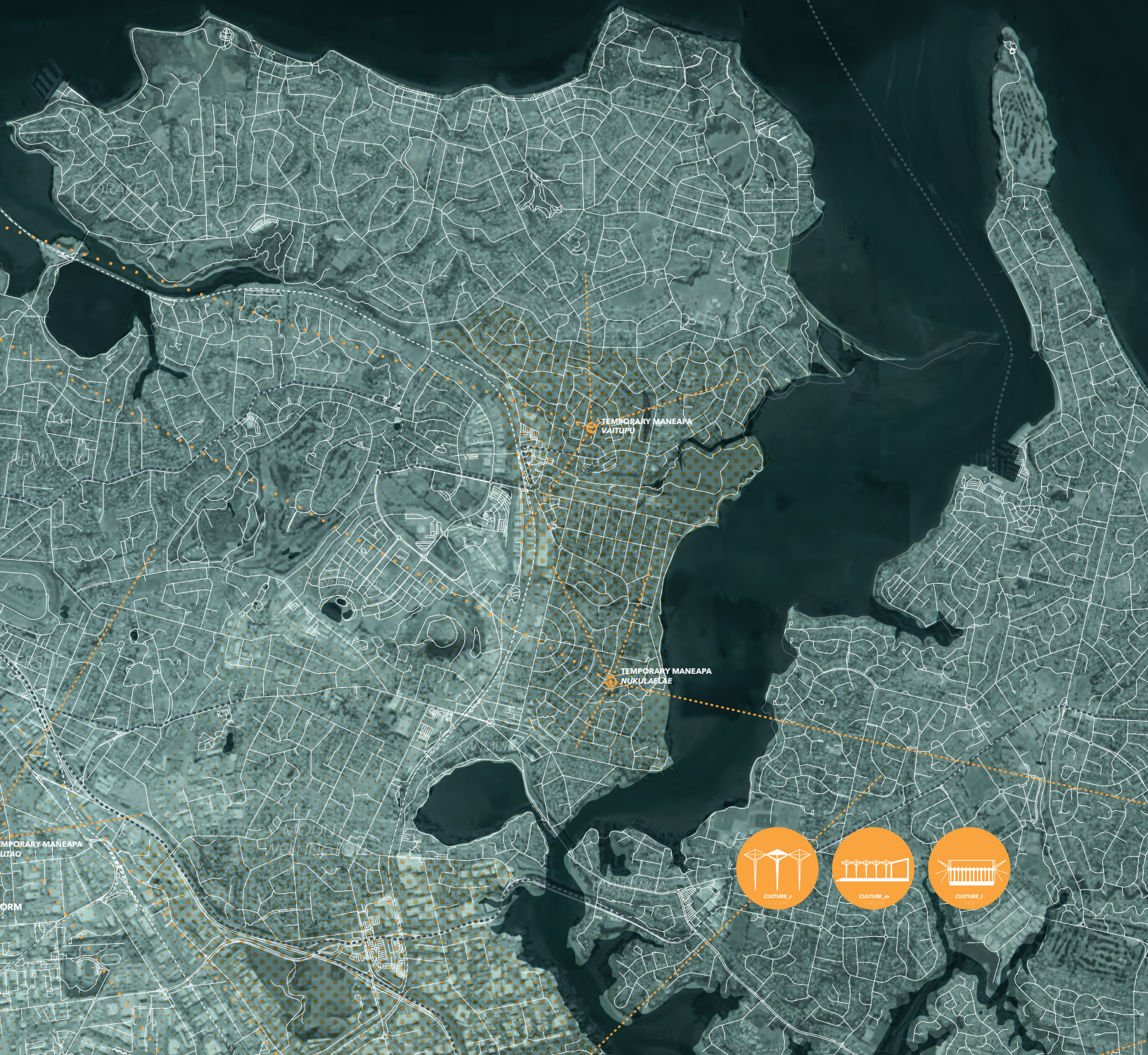
SYSTEMS FOR A DISPERSED COLLECTIVE

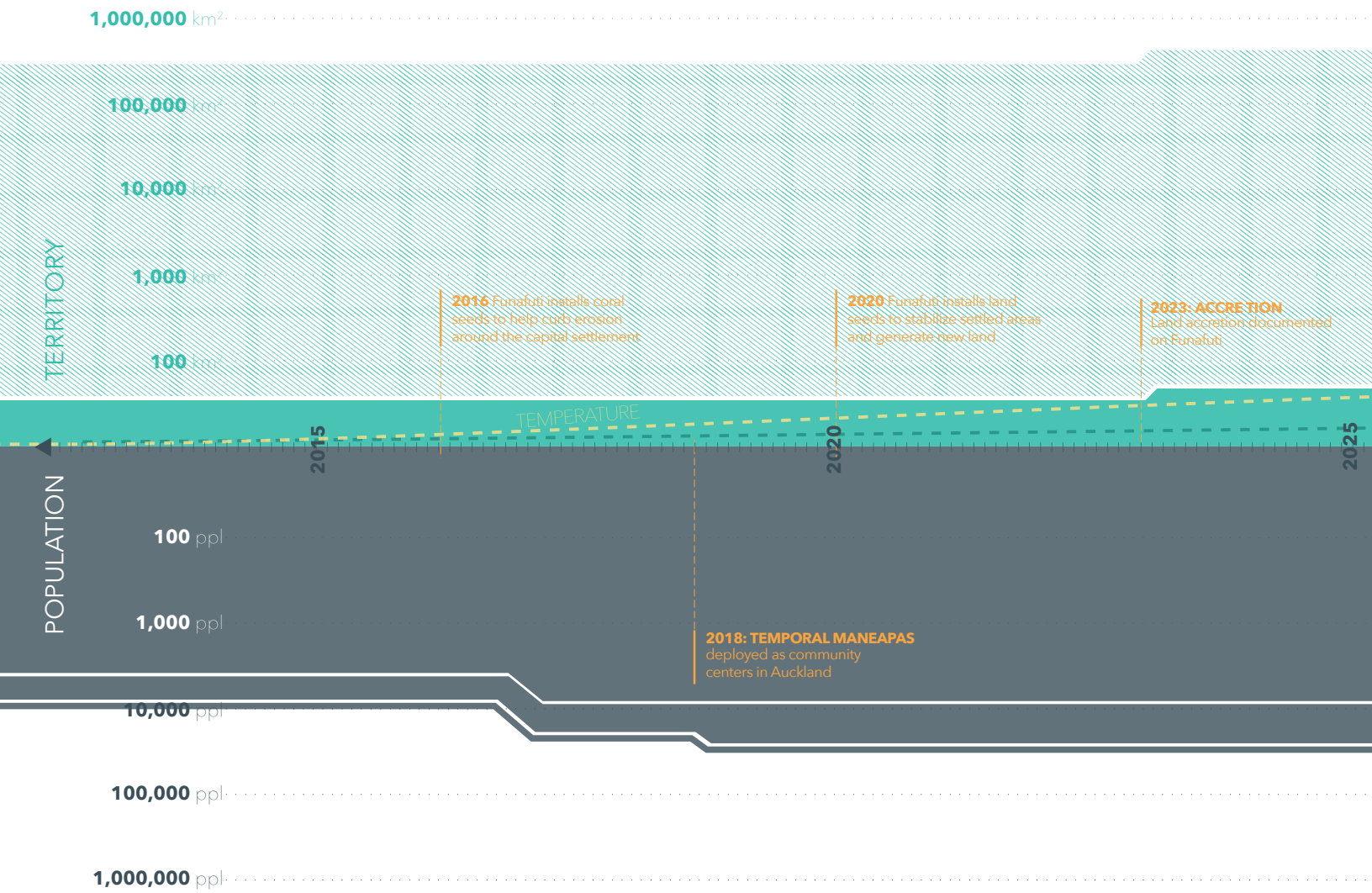
While the Tuvaluan community in Auckland has strong social ties, its current form lacks physical infrastructure to tie the community together. These proposals thus make new space for cultural practice. The set of cultural seeds proposes a series of ways of claiming Tuvaluan territory, even temporally, within the fabric of Auckland, at multiple scales. These small/temporal, medium/semi-permanent, and large/established seeds are designed to work as a system, inscribing new Tuvaluan and Pacific Islander hubs into Auckland's fabric while reinforcing existing social centers. Currently, many Tuvaluans live in suburbs to the West and South of the city center, sites that may take hours to move between by public transit or during rush hour. By establishing new Tuvaluan spaces, and carving out Islander space within the heart of Auckland, this dispersed Tuvaluan fabric can be re-centered and stitched back together. Furthermore, by creating established Tuvaluan spaces within New Zealand, new migrants will be able to identify existing clusters of cultural space, helping to establish neighborhood networks and support systems.

As Tuvalu's diaspora continues to grow, many Tuvaluans express concern that their practices and traditions will dissolve away as foreign, Western ways of live dominate. By claiming Tuvaluan territory within ex-situ fabrics, space is created for existing cultural practice and the formation of new Tuvaluan traditions. Even small and temporary spatial interventions can encourage Tuvaluan practices to thrive. Through this system, it is argued that in order to 'modernize', Tuvaluans don't necessarily have to conform to traditional, Western models of modernity; rather, through alternative spatial practices new, distinctly Tuvaluan future models can emerge.

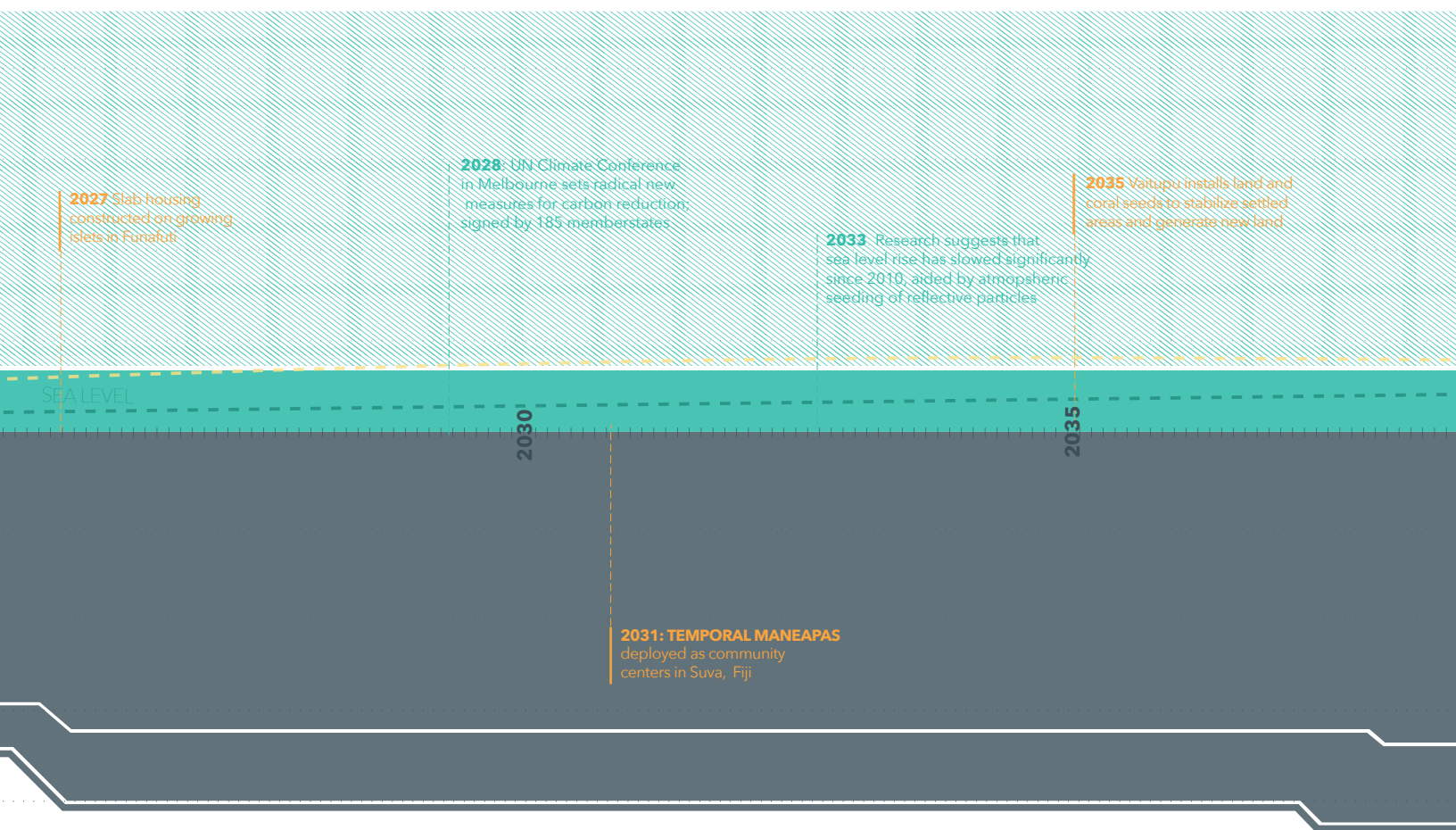


GROWING CULTURE , AUCKLAND, NZ
SYSTEMS FOR A DISPERSED COLLECTIVE





{ SCENARIO A } **GROWING THE CLIMATE CHANGE AS USUAL DISPERSED NATION**

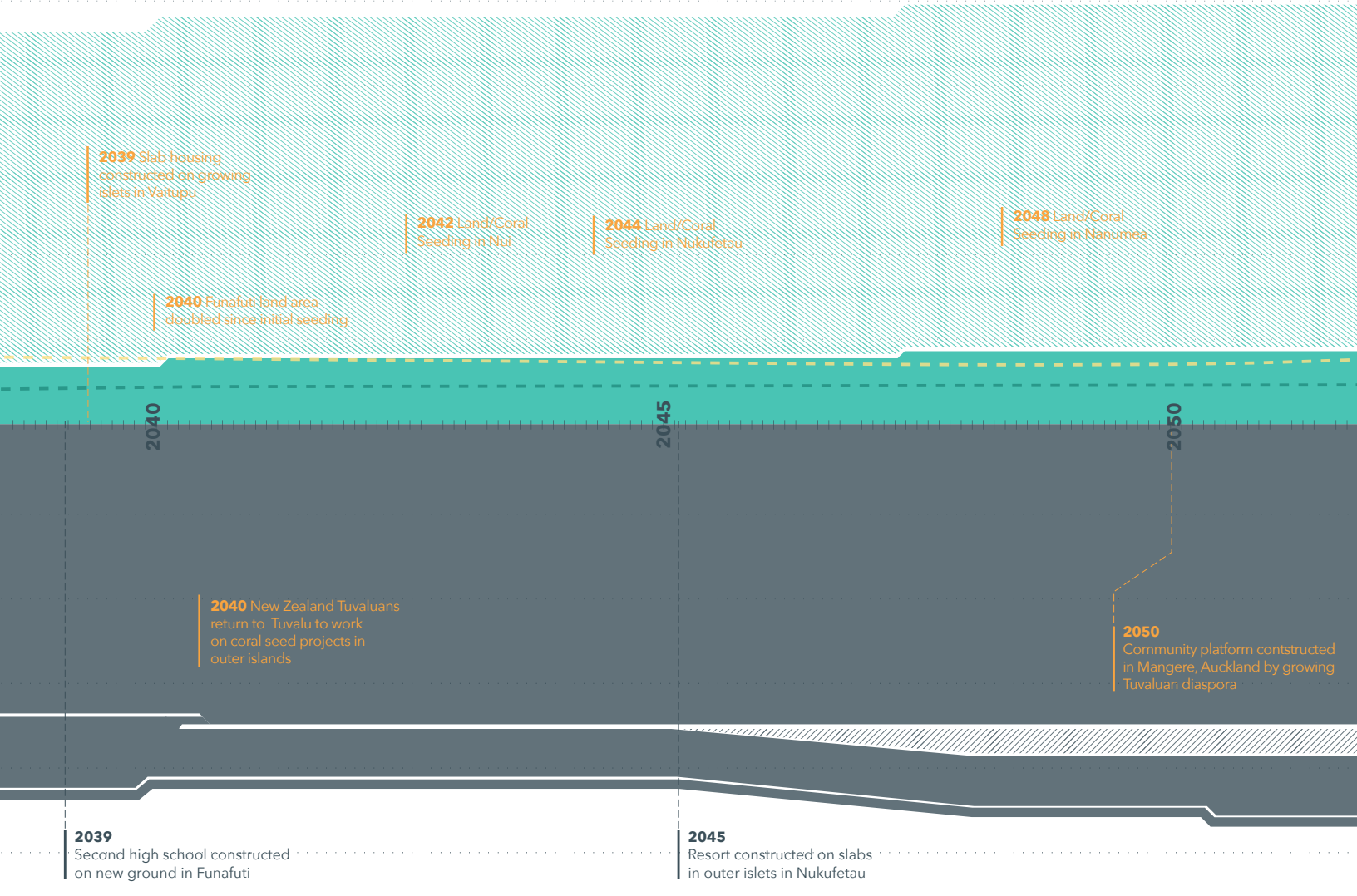


SCENARIO A TIMELINE

TUVALU + NEW ZEALAND

In the model of the historical timeline (page 22-7), this timeline illustrates a narrative of a possible future where incremental sea level rise continues in Tuvalu, and migration continues

towards New Zealand. Events in orange indicate moments when 'land seeds' and 'culture seeds' are implemented to mediate against population expansion, sea level rise, and diasporic population dispersion.



2052 Scientists find only 1.6 degree change in temperature and .23 increase in sea level since 2000 thanks to UNCCM and atmospheric seeding

2064 CYCLONE AGNES
Funafala islet washed away

2074 CYCLONE FREDERICK
Catastrophic loss of land and property in Tuvalu; 90% of structures destroyed on Funafuti, Vaitupu; 3000 lost

2065
Spike in migration to NZ following Cyclone Agnes

2069
Community platform constructed in Wellington by growing Tuvaluan diaspora

2067
Community platform constructed in Henderson, Auckland

REFUGEE MANEAPAS
deployed by expatriated Tuvaluans to house refugees from Cyclone Frederick in New Zealand

2074 Refugees following Cyclone Frederick migrate to New Zealand and Fiji through emergency refugee agreements

2080-90 CYCLONES

ongoing cyclones following the Frederick catastrophe further cripple the Tuvaluan economy

2088 CYCLONE IDA

Niulakita atoll is washed away entirely

2095 Following the loss of Niulakita atoll, France claims the southernmost portion of Tuvalu's EEZ based on its territory in Wallis and Futuna

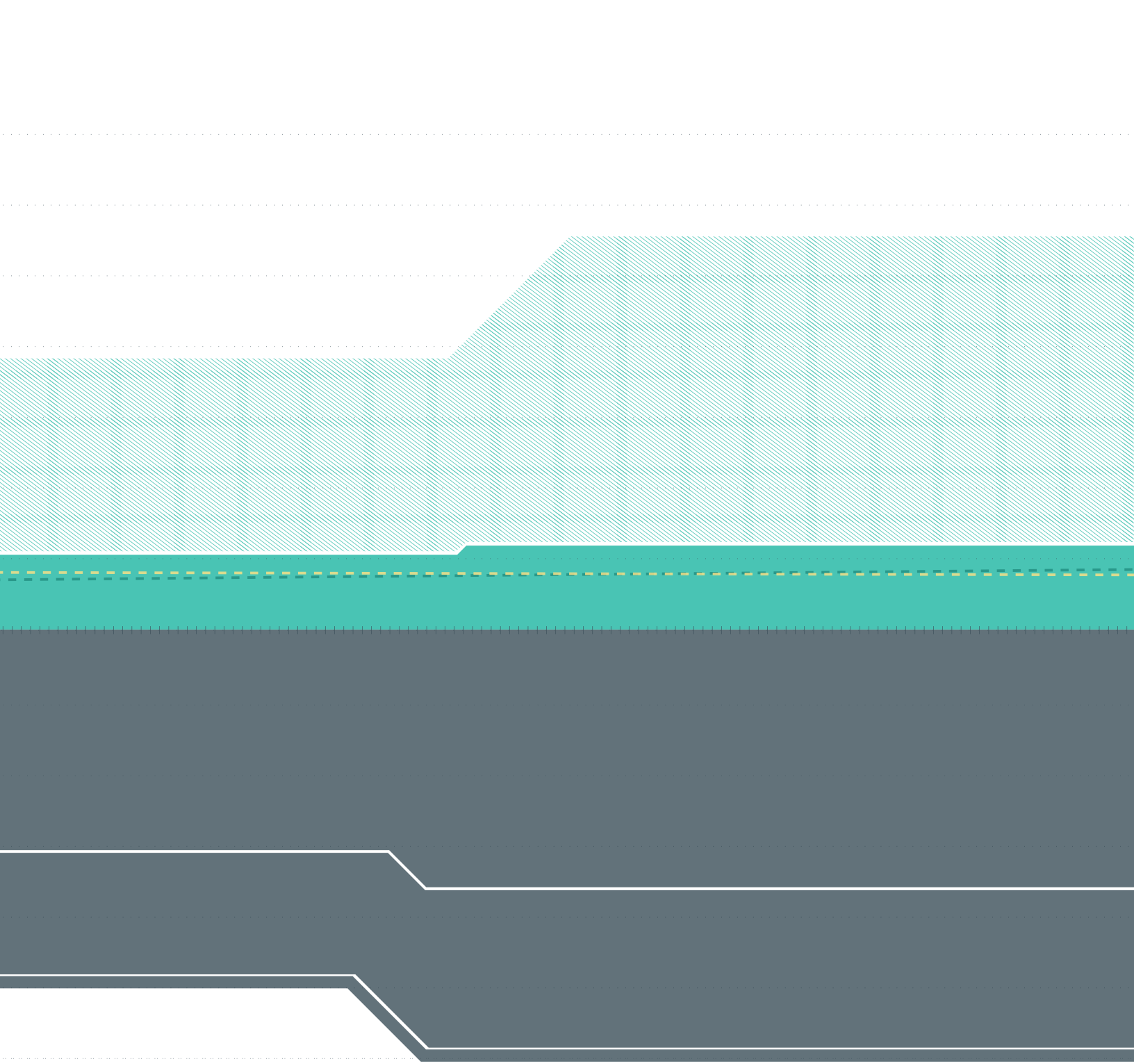
2110

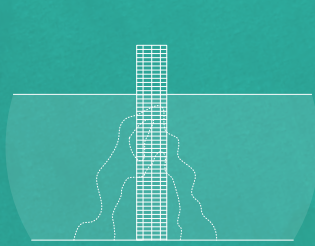
New Zealand grants Tuvaluan legal rights to maneapa-claimed land

2100

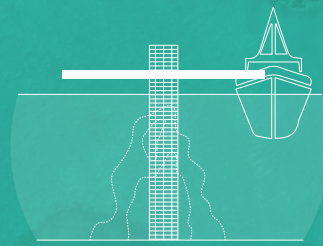
2091

Island Nations Center constructed in central Auckland by United Pacific Nations Collective





TERRITORY_a1
REEF POLE



TERRITORY_a2
REEF PLATFORM



TERRITORY_b1
LAND SLAB

Above: Territory and Economy seeds, applied in the *Future B: Rapid Ice Melt* scenario

FUTURE B: RAPID ICE MELT

This second scenario explores how architectural seeds can be used in a more dire possible future, where rapid ice melt makes atoll inundation an immediate risk, and where Tuvaluans become displaced rapidly. Within this scenario, territorial seeds maintain Tuvalu's EEZ to protect and expand territorial waters, allowing Tuvalu to retain agency over its expansive tuna stocks. This creates a Tuvaluan economy even without Tuvaluan land, generating work opportunities for a growing population displaced by rising waters. Economy seeds which facilitate an economy of processing and sale of tuna ex-situ, in Auckland, ties the displaced community together.

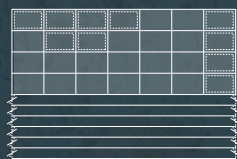
Within Tuvalu's existing territorial waters, *territory seeding* strategies are implemented at key points in the archipelago in order to maintain the existing EEZ perimeter. Nine sites on Tuvalu's current atolls have been identified as essential in retaining as viable land in order to maintain the existing EEZ extents, based on the 200 nautical mile buffer designated by the UN Law of the Seas.³⁰⁸ In these sites, rapid land accretion would be facilitated by *reef seeds* and *slab seeds* which concentrate sediment on small zones of existing atolls, ensuring the longevity of valuable oceanic territory even as other islets disappear. This will allow an emergent Tuvaluan tuna fishing industry to expand, so that even if their homes become submerged Tuvaluans retain a way to tie together and participate in the global marketplace that they have been forced into. Fishing outposts established using reef poles as substructure will provide sites for the processing and distribution of tuna. By shifting the tuna economy from foreign fisheries into the hands of Tuvaluans, this will also allow more local oversight over fishing processes, ensuring the lasting health of tuna stocks for future generations.

The southern part of Tuvalu's ocean territory is home to reefs and sunken atolls, fertile sea mounts which could be grown into new islands as part of a longer range-strategy to increase Tuvalu's sovereign space (and available fishing grounds). Seeding these sites with *reef* and *slab seeds* will result in new land, allowing Tuvalu to expand their EEZ claims and increase access to tuna stocks over time. These new sites could allow for expansion into unclaimed international waters, or could contest existing territorial claims

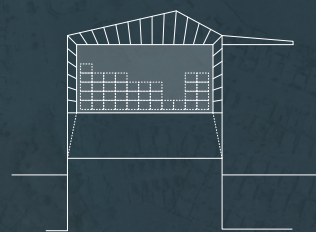
308. See pages 70 - 78 for details on how oceanic territories are established.



ECONOMY_s
DISTRIBUTION



ECONOMY_m
SHOP



ECONOMY_l
HUB

associated with Fiji and France. Reef poles on these new atolls become the foundations for fishing outposts in this South Banks region as well, and can form temporal settlements for the harvesting and distribution of fish. As rates of ice melt and sea level rise slow, the new islands established in these Southern sites can provide ground for more permanent new villages housing fishing industry workers.

Over time, this expanded Tuvaluan fishing industry will require new methods and models for distribution, particularly with the agenda of maintaining the tuna economy as an enterprise by and for Tuvaluan peoples. Fish caught in Tuvalu's territorial waters will be transported due south to the nearest metropolis, Auckland, and will come in through the Tuvalu Fish Pier designed on an empty site in the city's bustling downtown harbor. Like the culture shed discussed in the previous scenario, this primary *economy seed* will become a visible Tuvaluan icon in a global city, as well as a major workplace for displaced Tuvaluans.³⁰⁹ Beyond the unloading and storage of fish at this site, a network of smaller-scale seeds for distribution of fish will embed this emergent Tuvaluan tuna economy into local neighborhoods. Fish market storefronts in neighborhoods with a high density of Pacific Islanders will bring a welcome taste of home island cuisines. Establishing new community hubs for Tuvaluans and other Pacific Islanders creates physical spaces associated with growing cultural networks, spaces which Auckland presently lacks.³¹⁰ The space between the market and the operable facade becomes a seating area or small cafe space for gathering, where locals might come to check up on community news. The operable facades can also become billboards for what's fresh, or posting spaces for community events. Trucks which transport fresh fish to these markets, as well as farmers markets or grocery stores also utilize an operable facade, that allow them to transform into fish food trucks, selling fresh fish on ice at outdoor markets, or selling traditionally prepared fish dishes at special events.

These two sets of seeds reimagine the Tuvaluan nation as a strategic economy. A collective tuna industry associated with the Tuvaluan EEZ is protected and transformed into a national-cultural tool, from the scale of the territory to the individual Tuvaluan participating in this growing economy.

309. See pages 266- 273 for more on the market seed

310. Based on interviews in Auckland June 2015



*Future B: **Rapid Ice Melt***

FUTURE SCENARIO [B]
TUVALU



STRATEGIC ATOLLS: GROWING TERRITORY IN THE SOUTH BANKS

In a scenario of rapid ice melt, Tuvalu risks losing sovereignty over its Exclusive Economic Zone (EEZ), the oceanic territory which is tied to its habitable ground above sea level through the UN Law of the Seas (see page 70 - 78). This scenario proposes selective, intensive island-growing using 'territory seeds'; reefs and slabs that curate already ongoing atoll formation processes in sites critical in maintaining the existing extents of the EEZ.

Additionally, in Tuvalu's South Banks a series of existing sunken atolls and coral reefs are prime sites for growing new islands, which can be catalyzed using the territory seeds. Reef poles rapidly accelerate the rate of coral growth, which produces sediment that provides the substrate for atolls and coral islands (see pages 37 - 47 for more on atoll formation processes). The deposition of this sediment is curated using land slabs, which also stabilize this newly formed ground. New islands can serve as offshore fishing outposts, but more importantly they help Tuvalu to expand and curate the extents of their EEZ, expanding the area in which Tuvaluans can harvest fish and other resources. This scenario proposes that Tuvalu expands its regional fishing economy, regaining agency relative to foreign fishing vessels that currently dominate Tuvaluan waters in exchange for aid. As the atolls become less inhabitable, destabilized through rapid sea level rise, this collectively operated economy can become a tool for tying a dispersed Tuvaluan society together.



NUKULAE LAE ATOLL

KOSCIUSKO BANKS

NIULAKITA

STRATEGIC ATOLLS: GROWING
TERRITORY IN THE SOUTH BANKS





BAYONNAISE BANKS

INSET

EEZ / FUI + DM

EEZ / FUI + DM

EEZ / FUI + DM

252

STRATEGIC ATOLLS: GROWING
TERRITORY IN THE SOUTH BANKS

TUSCARORA BANK

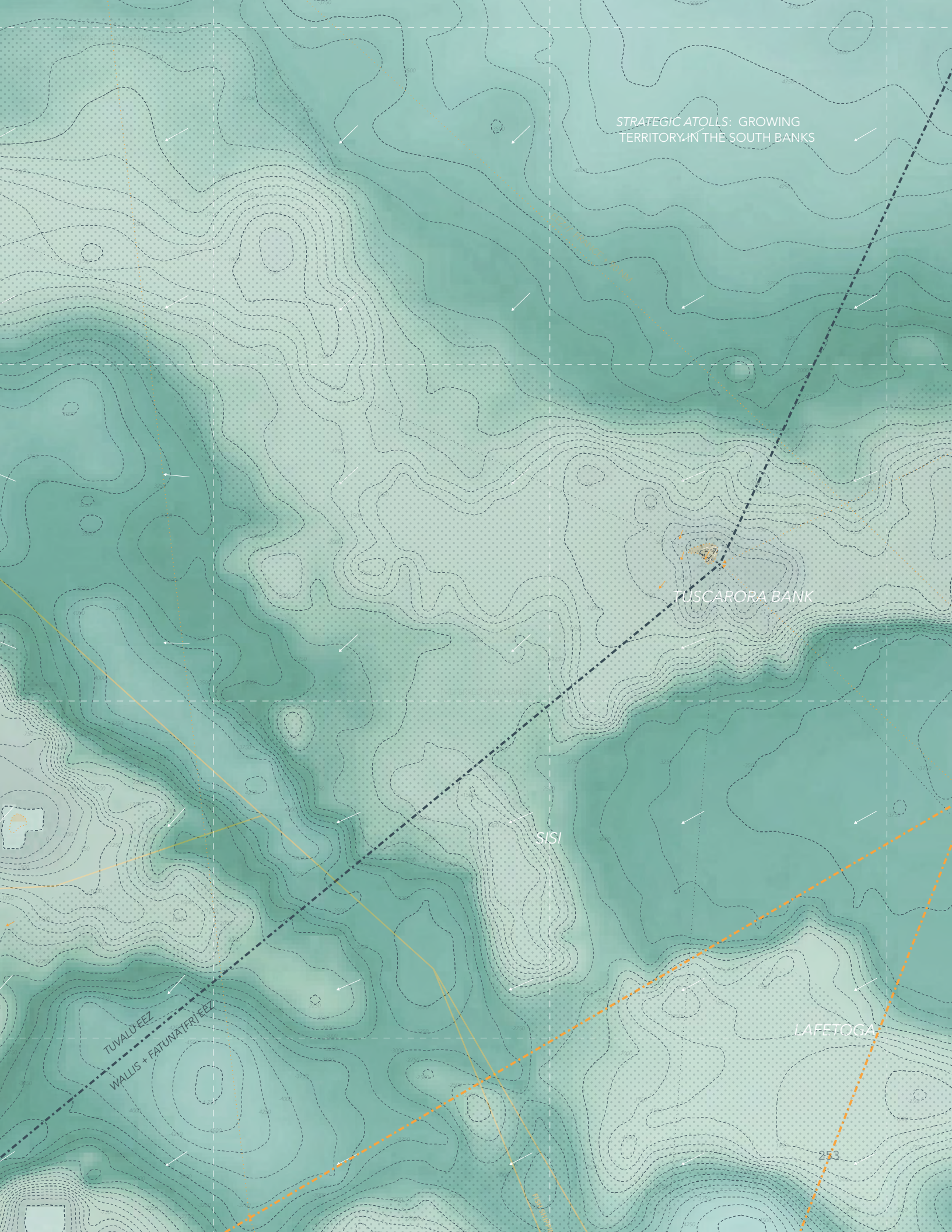
S/S

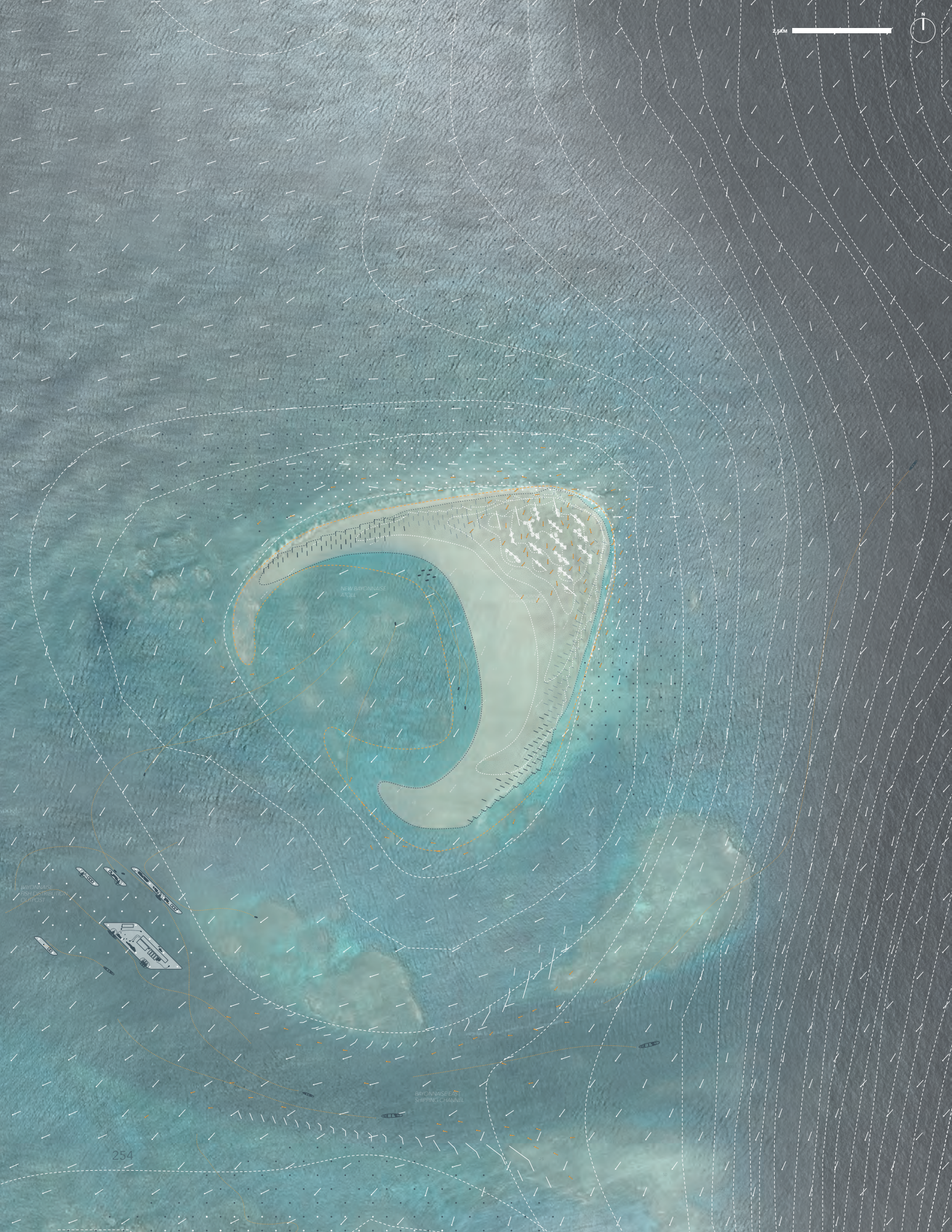
TUVALU'EEZ

WALLIS + FATUNATERI'EEZ

LAFETOGA

253





NEW BIRCHMASE ATOLL

BIRCHMASE FISH DISTRIBUTION OUTPOST

BIRCHMASE EAST SHIPPING CHANNEL

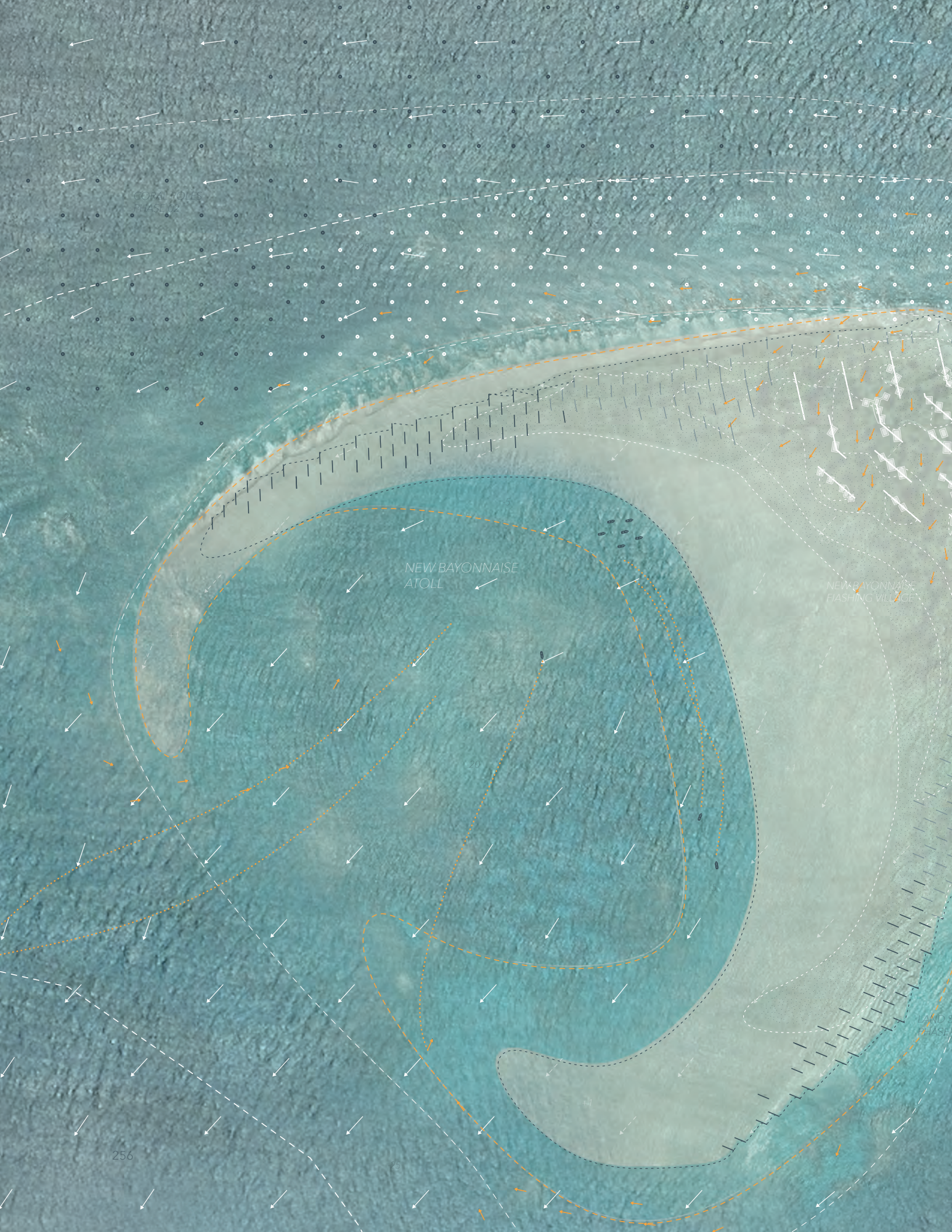
254

STRATEGIC ATOLLS: FISHING OUTPOST, BAYONNAISE BANKS

This drawing illustrates a detail of new atoll formation on sunken reefs in Tuvalu's Bayonnaise banks, to the South of the existing archipelago. This single newly formed island would add over 50,000 square kilometers to Tuvalu's oceanic territory, expanding the capacity of a newly expanded independent Tuvaluan tuna fishing industry. This fishing industry is a mechanism for Tuvaluan autonomy even when the society has increasingly been forced to migrate elsewhere; economy becomes a way to bring a dispersed collective together.

The atoll is formed by the incremental placement of a series of reef seeds up-current from existing shallows. These reef poles combine Biorock technology (see pages 186 - 187) and super-corals to rapidly grow new reefs. The sediment produced by these reefs becomes the material for new islands; orange arrows depict sediment picked up the currents. This material is captured by slab seeds angled perpendicular to the current within the shallows. As land is collected, new slabs can be added for stabilization and to expand the formation. In the drawing, white linework indicates early phase interventions and gray indicates poles and slabs added later. Along with the new island formation, the slabs are used to speed up currents, carving a channel for large fishing vessels to the South of the island, and creating a route to an off-shore fisheries outpost in this semi-protected zone.

The fishing outpost is created on top of reef poles that are feeding an additional island further down-current. This offshore outpost site is used to sort and process fish, and prepare it for transport to international sites, such as the Tuvalu Fish Pier in Auckland shown in the following section. Seasonal workers can lodge on the newly created island, a space which allows them closer connection to beach and sea.



CORAL FIELDS
PHASE 2

NEW BAYONNAISE
ATOLL

NEW BAYONNAISE
FISHING VILLAGE

LANDS
PHASE

256

25

20

25



STRATEGIC ATOLLS FISHING OUTPOST
Carving channels, building economies,
growing nations, on the Bayonnaise
Banks

CORAL POLES
PHASE 01

MABS
01

MABS
02

MABS
03

MABS
04



BAYONNAISE
FISH DISTRIBUTION
OUTPOST

250

250

100

200

250

200

250

250

100

100

100

50

25

258

50

50

00

STRATEGIC ATOLLS FISHING OUTPOST
Carving channels, building economies,
growing nations, on the Bayonnaise
Banks



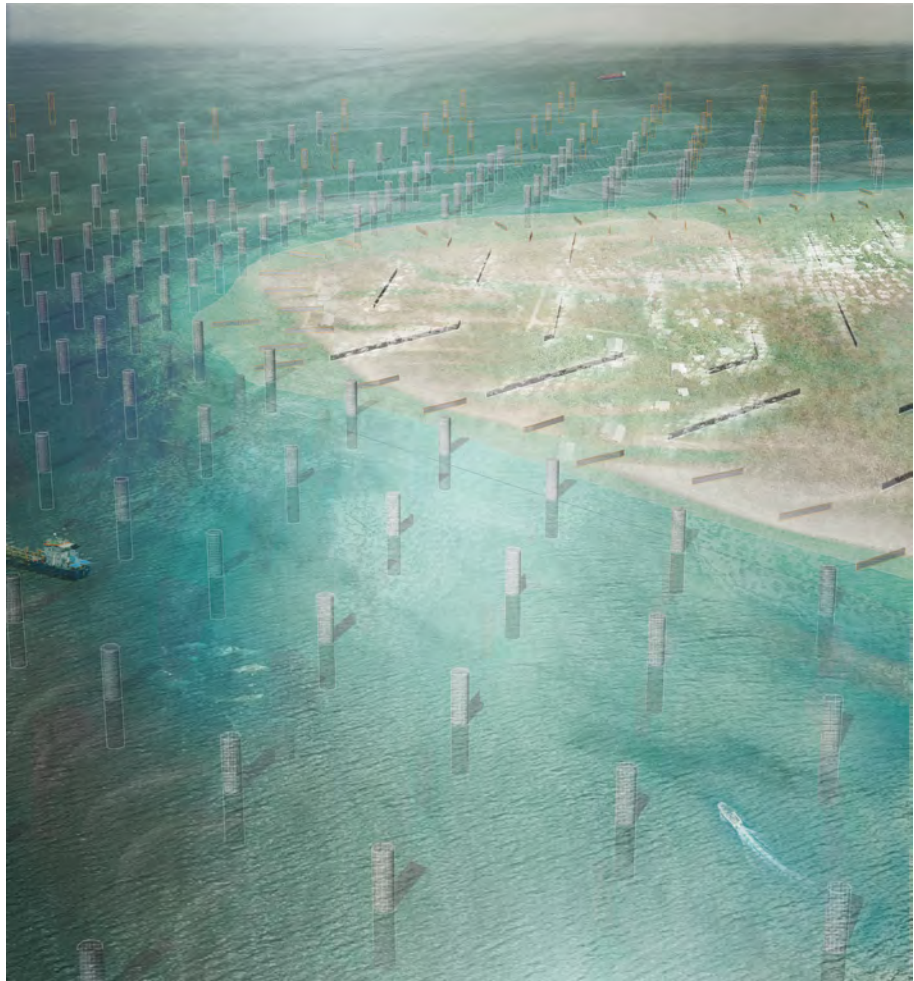
GROWING ISLANDS: TUVALU'S SOUTH BAYONNAISE BANKS

Offshore of this newly grown island, an ephemeral landscape of reef-columns creates a rhythm across the horizon. An expanded metal mesh frame allows the columns to reflect light and show views through, making the field dissolve into the ocean. The spacing accommodates passing fishing vessels, but at sufficient density to kick-start reef formation and sediment accumulation. Long, low slabs perpendicular to the current collect this sediment, slowly growing a new island in this site.

Inhabitants of this new island are seasonal workers for the newly formed cooperative offshore tuna industry.

Instead of being housed in oil-rig style barracks, workers reside here, where on their off hours they can maintain connections to the atoll geography that is essential to their cultural practices. Stabilizing slabs can become supports for elevated housing, or on other sites deep caissons are used to elevate structures, in order to mediate flooding risk and deal with fluid ground conditions. Over time, tropical vegetation such as pandanus, coconuts and taro will grow that further curbs erosion and provides a local food source. These essential workers in the Tuvaluan tuna cooperative do their daily commute by boat, from the sandy beaches of their new atoll to the offshore outposts where tuna is stored, processed, distributed, and delivered.

The strategic siting of this particular island further serves to expand the Tuvaluan EEZ, generating new oceanic territory and fishing grounds into which this emergent industry can expand.



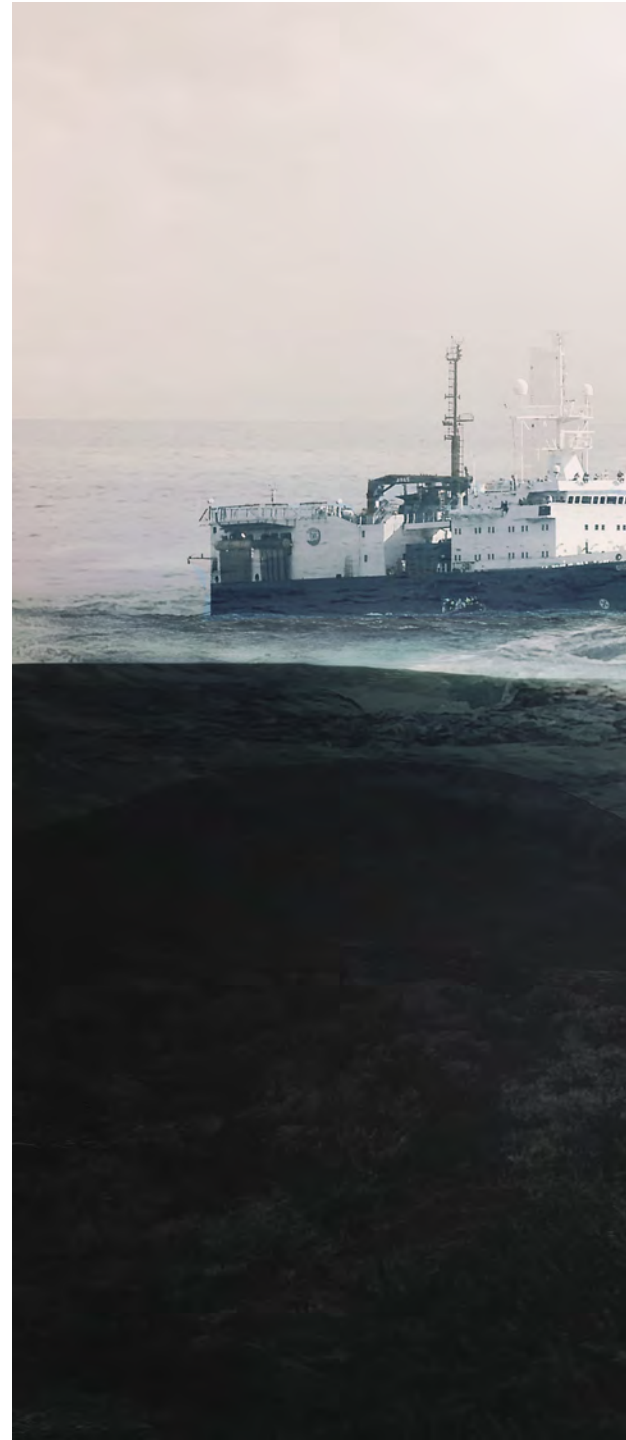
FISHING OUTPOST TUVALU'S SOUTH BANKS

Deep at sea, these reef poles dissolve into the reflective surface of the ocean.

New coral pole may be the only solid sites for hundreds of miles, thus serving as a resting point for migratory birds.

As islands and atolls are submerged by sea level rise, these avian stopovers may become even more significant. Below sea level, reef poles begin to accumulate healthy and rapidly growing coral reefs the a combination of electrification and new coral species, here examined by a scuba-ing reef scientist.

Eventually, these poles will help new islands to form, expanding Tuvalu's local fishing economy and establishing new fishing grounds by expanding oceanic territories. The new economic formation of a pan-Tuvalu fishing cooperative will help to establish national autonomy through an independent and self-directed economy. Even as the physical ground of the nation becomes unstable and Tuvalu's population disperses, this industry can serve as a strategic lever for Tuvalu as nation, while tying mobilized peoples together through shared resources and agendas.







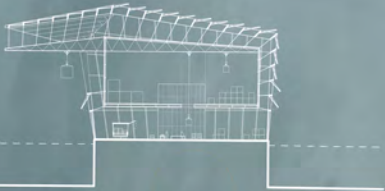
*'Future B: **Rapid Ice Melt***

FUTURE SCENARIO [B]
TUVALU

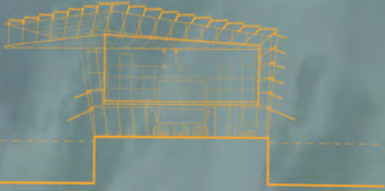


FUTURE SCENARIO [B]
NEW ZEALAND





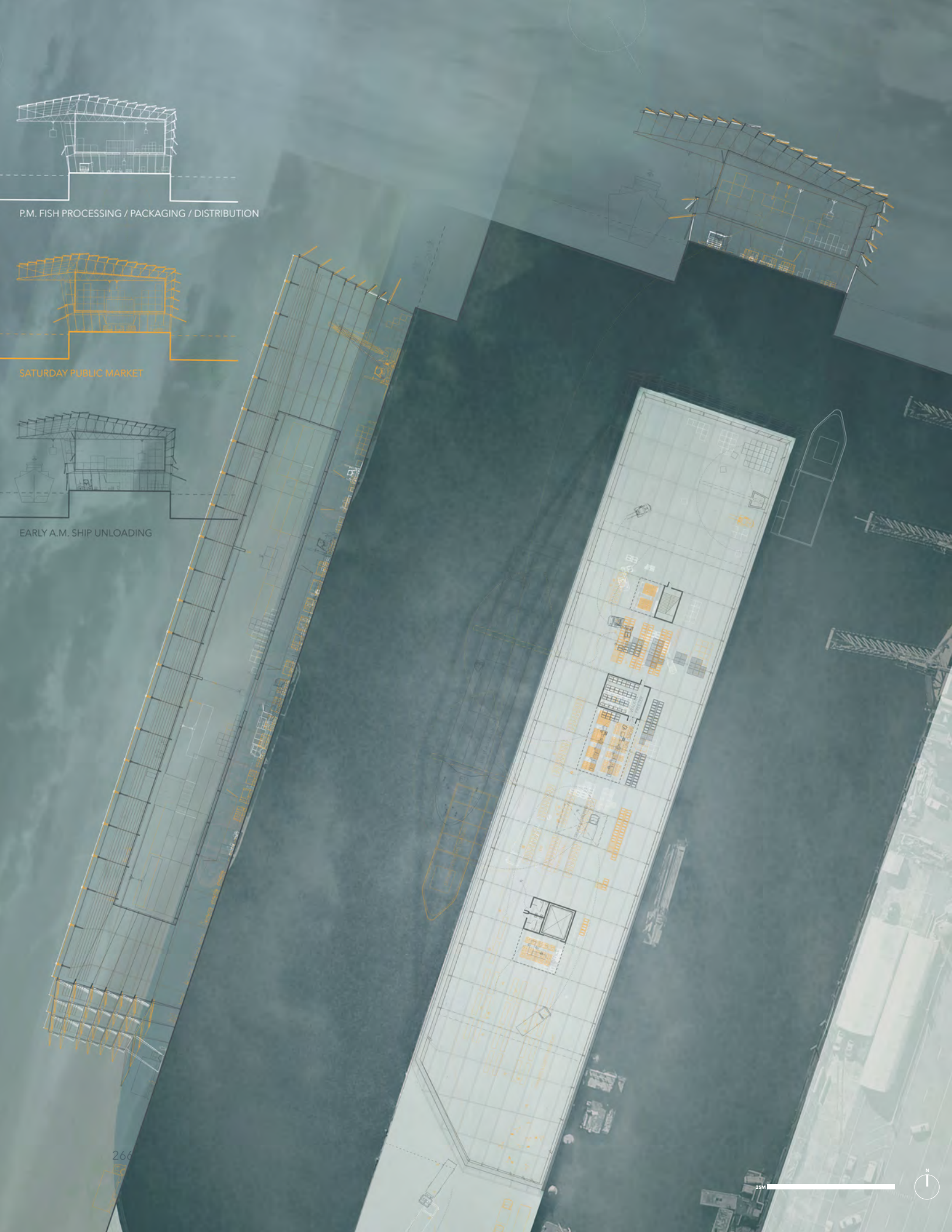
P.M. FISH PROCESSING / PACKAGING / DISTRIBUTION



SATURDAY PUBLIC MARKET



EARLY A.M. SHIP UNLOADING



TUVALU FISH PIER, AUCKLAND NZ

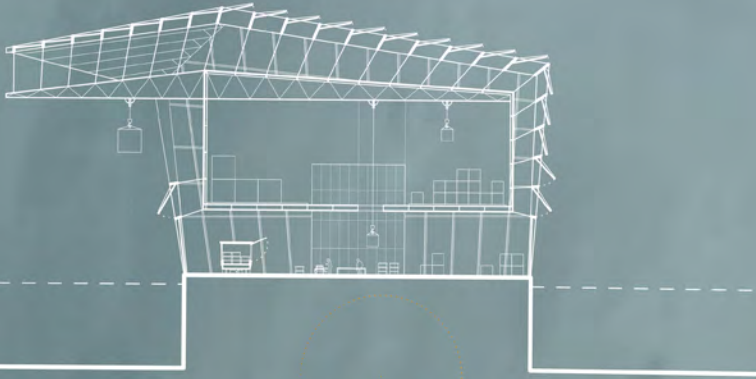
Economy seeds tie Tuvalu's largest territory (ocean) and most abundant resource (fish) with the need for new forms of economy for a diaspora rapidly displaced by ice sheet collapse and sea level rise. As is discussed in prior chapters, fisheries, particularly tuna, are underutilized as a macro-economic strategy by Tuvalu, and climate change is anticipated to actually increase this valuable resources as schools shift eastward into Tuvaluan waters. Currently only a tiny fraction of fish stocks within the Tuvaluan EEZ are harvested by Tuvaluans, and licenses are sold for pennies on the dollar. In essence, in the present condition, Tuvaluan agency over fish stocks is exchanged for development aid with problematic implications. Thus, the strategies in this scenario for developing an alternative tuna economy are intended to expand autonomy for both in-situ and ex-situ Tuvaluans.

Over time, the expanded Tuvaluan fishing industry described in the prior section will require new methods and models for distribution, particularly in terms of maintaining the tuna economy as a cooperative enterprise by and for Tuvaluan peoples. This fish, caught in Tuvalu's territorial waters will be transported due south to the nearest metropolis, Auckland, and will come in through the Tuvalu Fish Pier designed on an empty site in the city's bustling downtown harbor, as shown here. Like the culture shed discussed in the previous scenario, this primary economy seed will become a visible Tuvaluan icon in a global city, as well as a major workplace for displaced Tuvaluans.

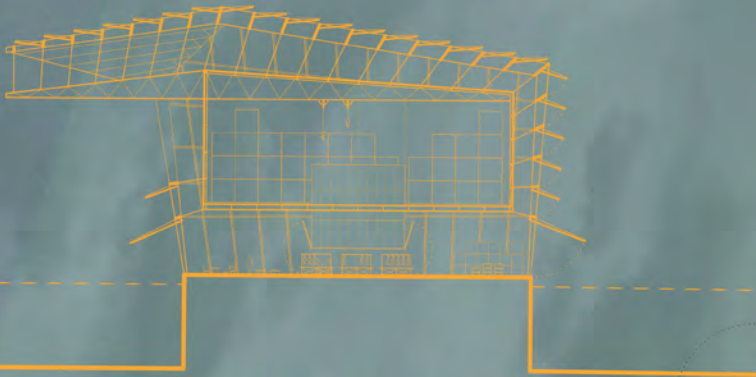
The structure borrows flexible design logics and open floor plans from traditional Tuvaluan housing typologies, where a single-room house can be used for eating, sleeping, work and recreation by keeping the ground clear; the floor becomes the medium for all of these activities. Furniture and other objects are stored in the rafters above (see pages 100 - 101 for a diagram of this model) Traditional homes are largely open air, but woven panels can be raised or lowered as temporary walls depending on the weather conditions outside. Appropriating and adapting these logics for a market pier typology in Auckland, the ground floor is kept largely open, punctured by three cores which transmit fish and people between levels. Fish can also be transferred through a system of pulleys and openings in the second

floor plate. This allows the ground plane to become a flexible space, serving as an unloading dock when fishing vessels arrive, a sorting and processing zone for preparing fish-related products, and an auction hall for fish sales with a community market at the front. These three possible configurations are illustrated simultaneously in the plan through superimposition, with orange, white, and gray lines each illustrating different usage scenarios. The lifting of the second level to 20' allows delivery trucks and small machines and trailers to operate freely in this space, while its opening towards the Auckland harbor walk invites visitors to enter the public front portion of the pier.

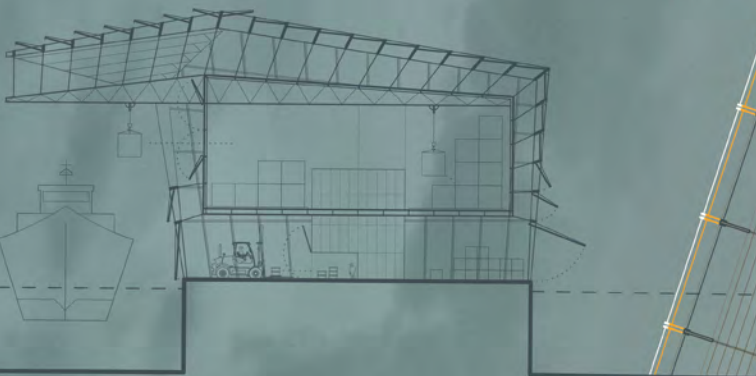
The facade system also learns from the flexible logic of Tuvaluan structures; an external skin which is peeled away from the storage volume provides a structural system and environmental regulation, with a louver system that opens and closes using sensors which respond to heat, humidity, and precipitation. The building breathes and undulates according to daily cycles, seasonal shifts, and ad-hoc weather patterns. The facade can also be used to regulate the level of publicness the building exhibits, inviting in visitors when a market is in action, and shutting the building down when heavy unloading activities are occurring. The superstructure also supports a cantilever system that allows fish containers to be drawn directly into the second level.



P.M. FISH PROCESSING / PACKAGING / DISTRIBUTION

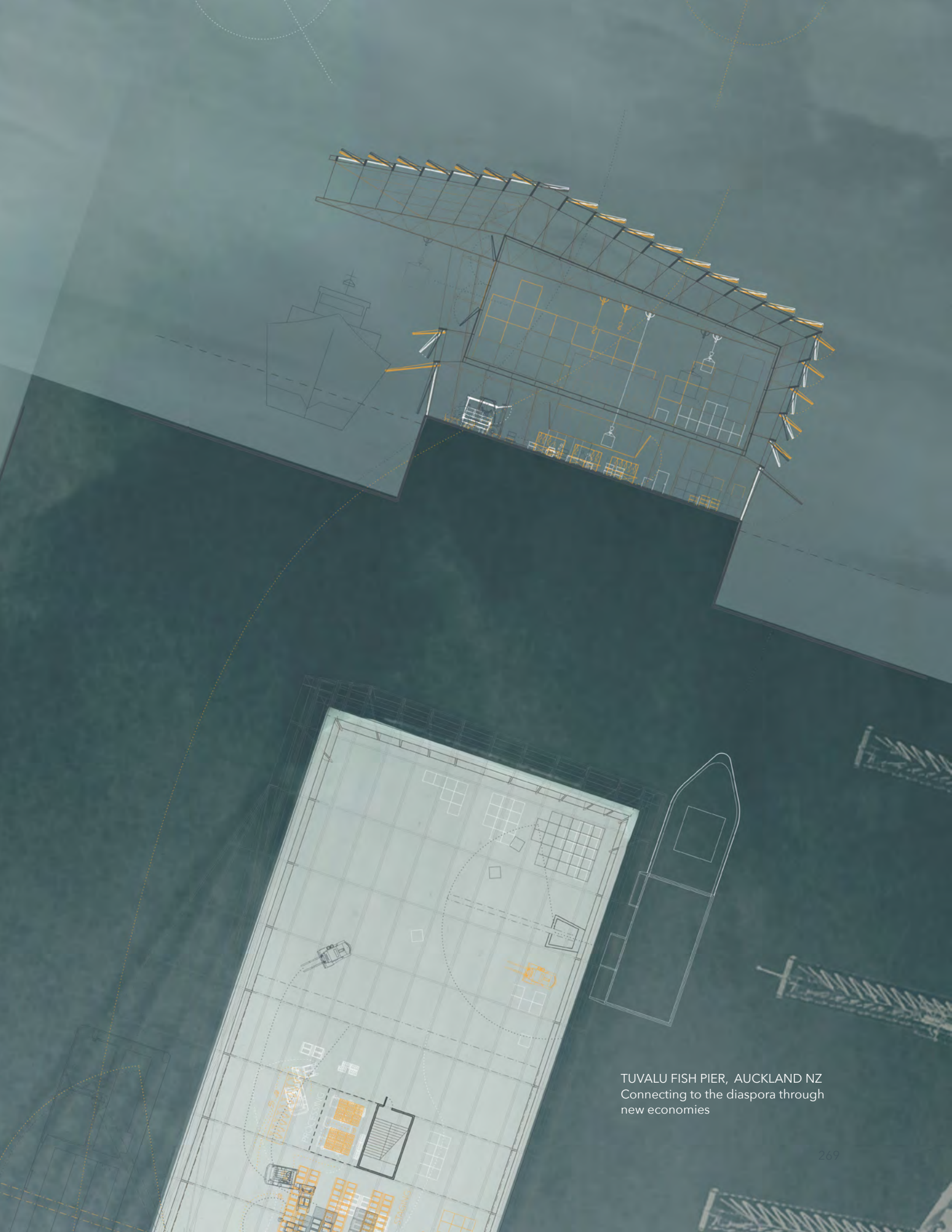


SATURDAY PUBLIC MARKET



EARLY A.M. SHIP UNLOADING





TUVALU FISH PIER, AUCKLAND NZ
Connecting to the diaspora through
new economies





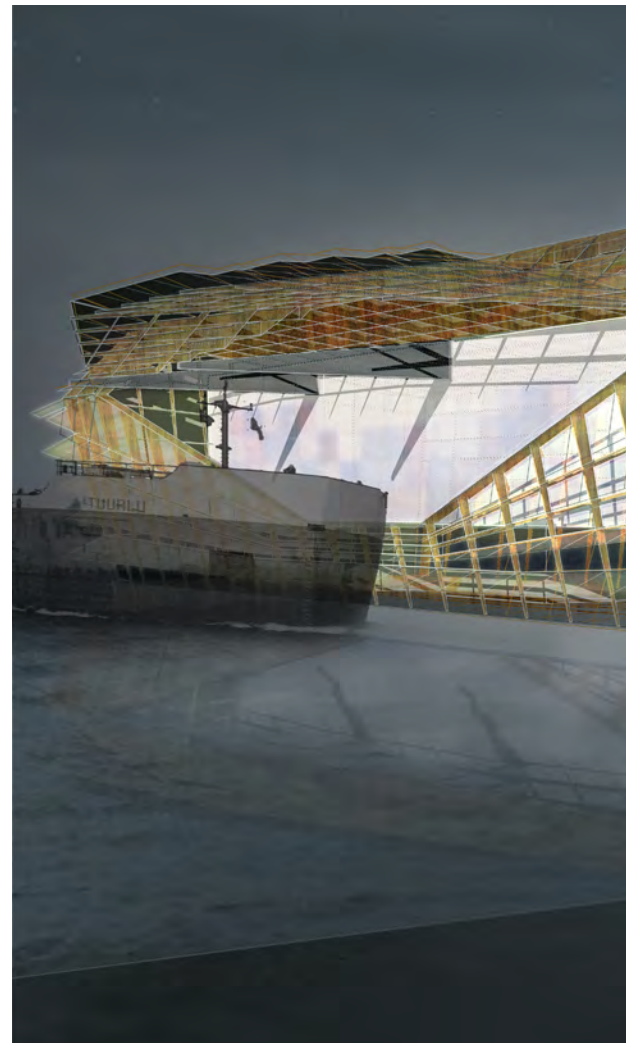
TUVALU FISH PIER, AUCKLAND NZ
Connecting to the diaspora through
new economies

TUVALU FISH PIER, AUCKLAND NZ

Spaces and strategies for a new, cooperative Tuvaluan fishing economy, anchored by this Tuvalu Fish Pier in downtown Auckland, ties displaced Tuvaluans together. Tuna economy seeds give economic agency to Tuvaluan migrants who are often forced to work in difficult agricultural jobs complicated by the poor English skills and lack of knowledge of wage labor and market economies. The Tuvalu Fish Pier links displaced Tuvaluans in Auckland and the marine resources of their homeland.

A raised storage volume applies a translucent, aerogel facade which provides a visible index of Tuvaluan tuna imports, creating a kind of ex-situ Tuvaluan space providing a direct physical connection to the home islands. This elevated storage zone helps Tuvaluans and others passing by see how the fish industry is faring by the number of containers visible inside. By lifting the storage from the ground plane below, flexible space is created for fishing processing activities or community events, such as the night market shown here. After dusk, this volume glows through internal lighting, providing an iconic Tuvaluan presence on the Auckland harbor.

Surrounding the aerogel volume, an operable wooden superstructure provides a responsive environmental system that draws on Tuvalu's traditionally flexible architectures. Louvers open and close using sensor mechanisms depending on time of day, season, and weather events, and can also be opened or closed depending on the nature of the events occurring inside. In contrast to the high-technology aerogel, this system is built of wood and clad in woven louvers, juxtaposing material innovation with more traditional surfaces.







**SEMESE'S FISH SHOP
MANGERE SUBURB, AUCKLAND NZ**

Beyond the unloading and storage of fish, a network of smaller scale seeds for distribution of fish will embed this emergent Tuvaluan tuna economy into local neighborhoods. The ex-situ fish economy is networked throughout the diasporic city through a system of small, neighborhood scale markets, and a networked distribution system.

Fish market storefronts in neighborhoods with a high density of Pacific Islanders will bring a welcome taste of their home island cuisines. Establishing new community hubs for Tuvaluans and other Pacific Islanders creates physical spaces associated with growing islander cultural networks, types of spaces which Auckland presently

lacks. The zone between the market itself and the operable facade can become a seating area or small cafe space for gathering, to check up on community news. The operable facades of the market, a quotidian version of those applied in the iconic waterfront pier, can also become billboards for what's fresh, or posting spaces for the community. When the shop is open, these facades invite the public in and provide additional shading; when the market closes for the day, the building shuts down too, communicating that fish-seekers will have to return tomorrow.

**MOBILE MARKET, HENDERSON,
AUCKLAND, NZ**

Further expanding this networked economy into Auckland, a system of trucks transports fresh fish from the downtown pier to markets like the one above, farmers markets, or grocery stores. The operable facade logic is also applied to the trucks, which allow them to open up and transform into fish food trucks, selling fresh fish on ice at outdoor markets, or traditional prepared fish dishes at special events. As these trucks rove about the city, decorated by their operators to illustrate their Tuvaluan Tuna status, they add to the visibility of the economy network as well as the displaced nation.



**GROWING ECONOMY:
AUCKLAND, NZ**

Across the city, the networked market system creates a connective tissue for the displaced Tuvaluan collective.

Anchored by the Tuvalu Fish Pier in downtown Auckland, market shop outposts and roving trucks in suburbs and neighborhoods stitch a distributed diaspora together. Within local communities, shops and markets become nodes for meeting as a community, while bringing jobs and traditional foods into the area. The central Fish Pier doubles as a larger collective space, and a major marker of Tuvaluan presence in Auckland society.

In the trajectory of Tuvaluan territorial identity traditionally tied to the physical space of Tuvalu, these seeds for the mobilized population re-imagine a dispersed Tuvaluan nation by claiming ex-situ territory via this new cooperative economic network. Displaced Tuvaluans gain agency over their futures through access to the collectively directed operation of the tuna industry, providing economic survival and tying displaced populations to the resources of their homeland (and sea).



PACIFIC ISLANDERS

- 5-9%
- 10-14%
- 15-19%
- 20-29%
- 30+%

2.5KM





TEMPORARY MANĒAPA
VAITUPU

TEMPORARY MANĒAPA
FĒNAPU

TEMPORARY MANĒAPA
NĪKULĀELĀE

TEMPORARY MANĒAPA
FĒNAPU 1

TEMPORARY MANĒAPA
NĪKULĀELĀE

TEMPORARY MANĒAPA
NĪTĀO

HENDERSON
MANĒAPA PLATFORM

TEMPORARY MANĒAPA
FUNAFUTU

TEMPORARY MANĒAPA
NĀNUMĒA

TEMPORARY MANĒAPA
VAITUPU

POINT
CHEVALIER

MO

THE
HILL

THE
HILL



GROWING ECONOMY: AUCKLAND, NZ
Market systems as a connective network for the displaced collective

WESTHAVEN

TUVALU FISH PIER

PACIFIC ISLANDS CULTURE SHED

GREY LYNN

LOMIATA'S FISH SHOP

HEAVEN MARKET

ORAKEI

MOUNT ALBERT

SANDRINGHAM

TEMPORARY MANEAPA
TUKARUTI

REMUEA

EILERSLIE

MOUNT WELLINGTON

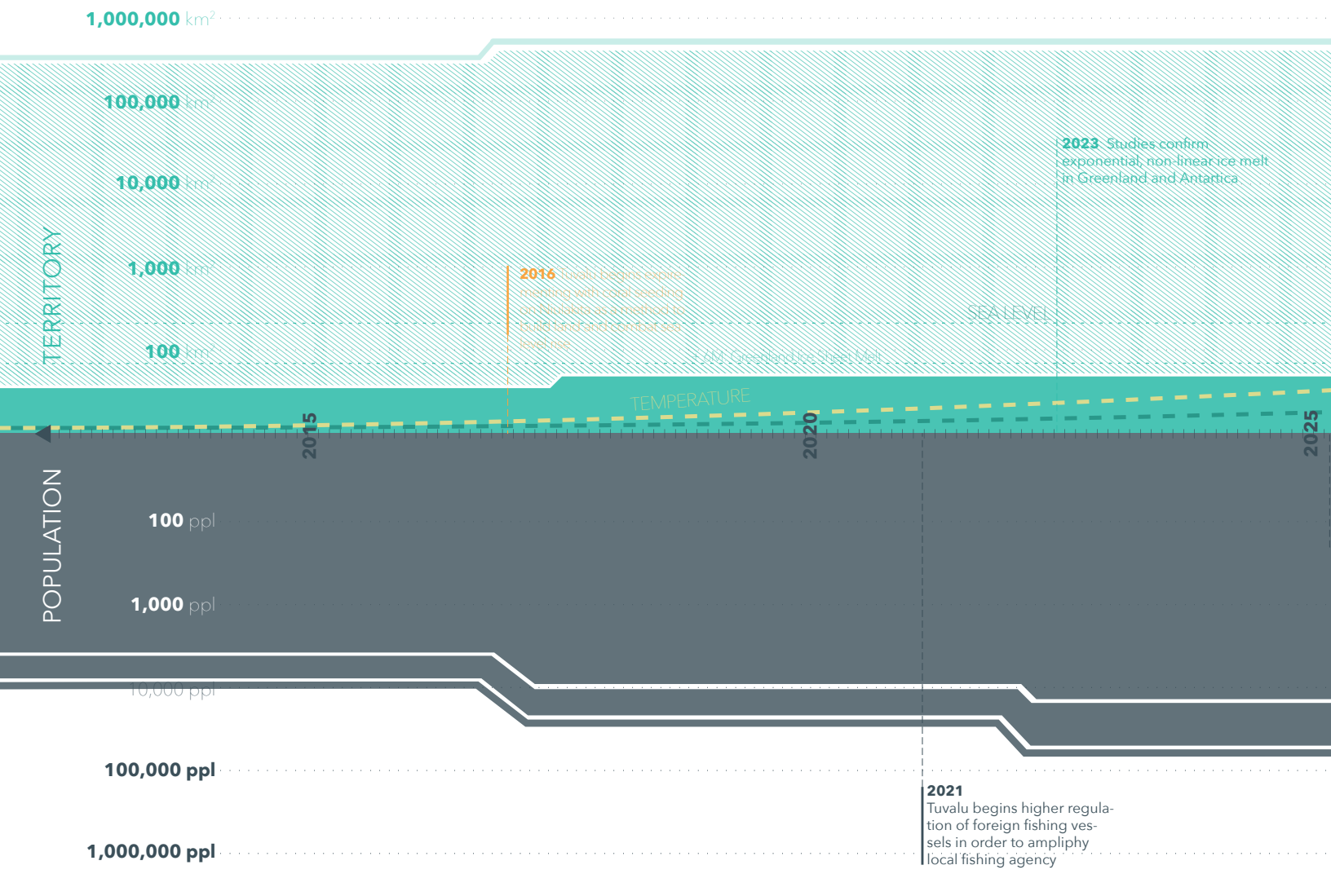
TEMPORARY MANEAPA
NIUMULAE LAE

THREE KINGS

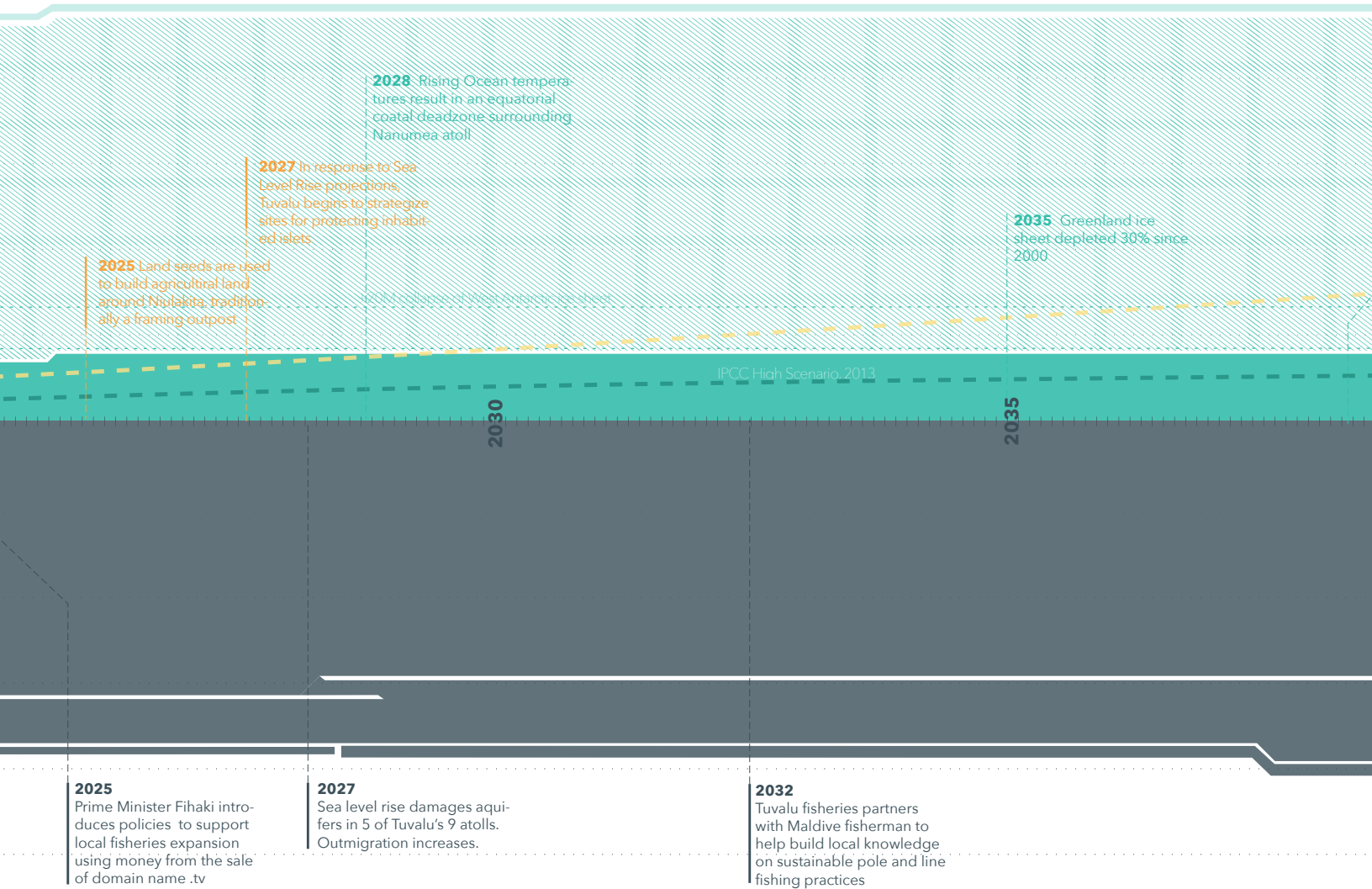
TEMPORARY MANEAPA
WILUO

OHEHUNGA
MANEAPA PLATFORM

HILLSBOROUGH



{ SCENARIO B } **GROWING STRATEGIC ECONOMIES**
ICE SHEET COLLAPSE

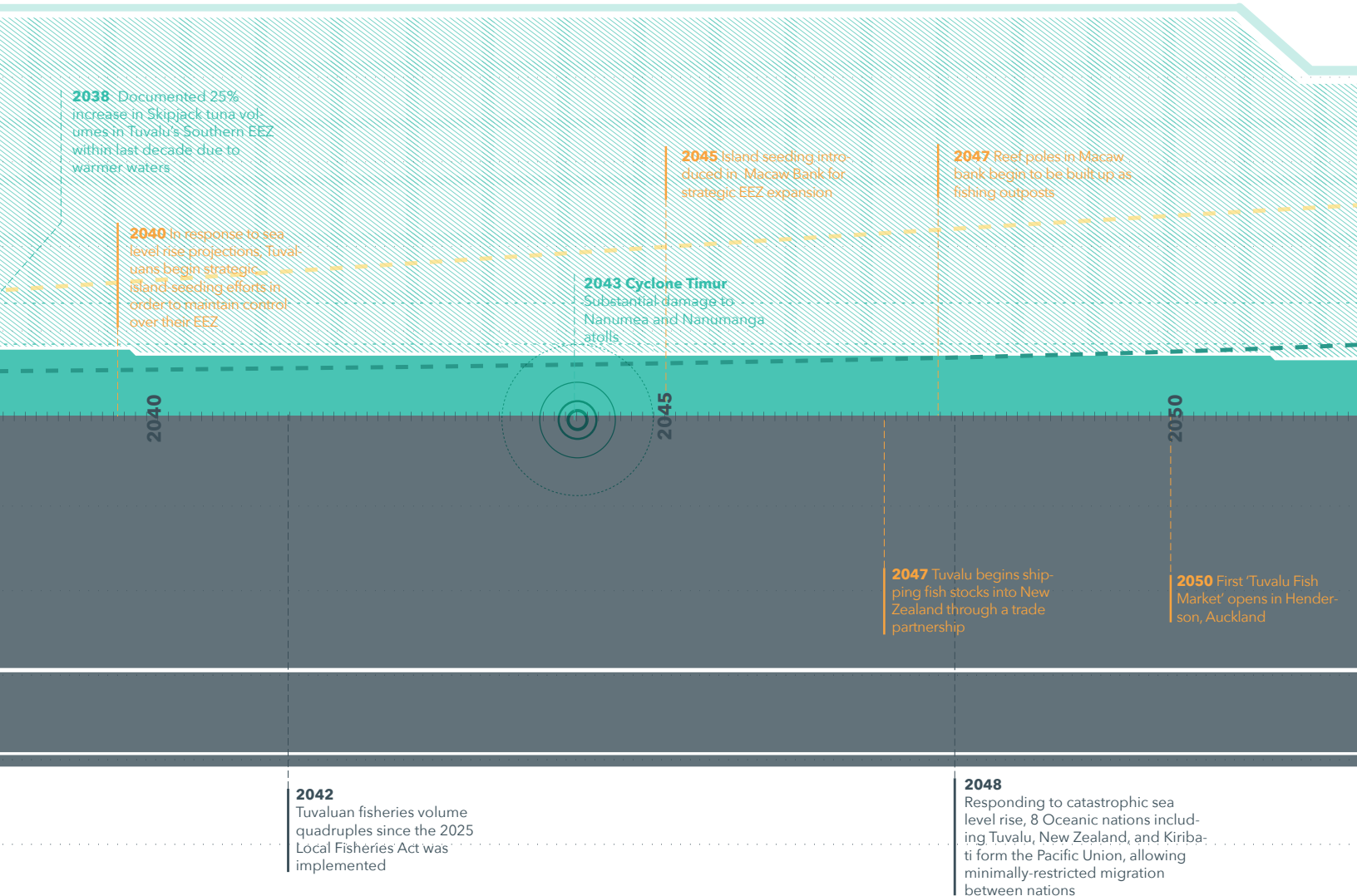


SCENARIO B TIMELINE

TUVALU + NEW ZEALAND

Modeled on the deep historical timeline from the research section (pages 22-7), this timeline illustrates the narrative of a possible future where rapid ice melt causes severe submersion risk in Tuvalu, and rapid population displacement

occurs to New Zealand. Events in orange indicate moments when 'territory seeds' and 'economy seeds' are implemented to mediate against the possibility of population dispersion, sea level rise, territorial submersion, and loss of autonomy.



2053 No longer able to adapt to sea level rise, Nanumea atoll, the lowest in Tuvalu, is submerged.

2055 Kiribati wins petition to UNCLOS to expand into Tuvalu's Northernmost EEZ due to the high-tide submersion of Nanumea

2054-70 Additional Island seeding in Southern guyots: Tuscarora Bank, Macaw Bank, Hera Bayonnaise Banks

Successful land accretion in Macaw Banks allows Tuvalu to claim an expanded EEZ of 100,000 additional km² from French Samoa

2061 Tuvaluan fisherman and expatriate businessmen in Auckland partner to open the Tuvalu Pier on an abandoned wharf near downtown Auckland. The freezer freighter TVV Eliala makes a monthly circuit to Auckland

2071 Distribution seeds are launched on trucks and ferries to bring Tuvaluan Tuna to local Auckland markets and grocers

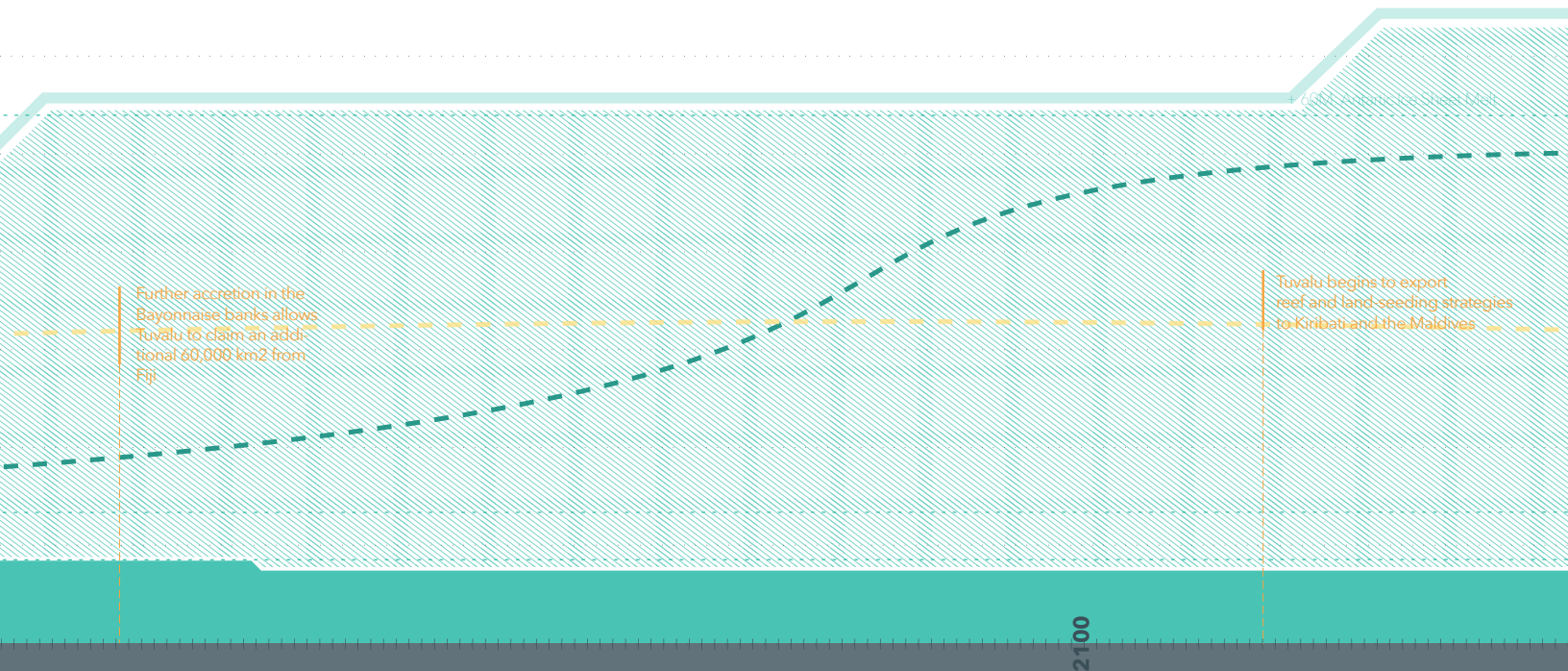
2054
The Pacific Union charter results in massive outmigration from atolls to high-ground nations; particularly Fiji, New Zealand, and Samoa

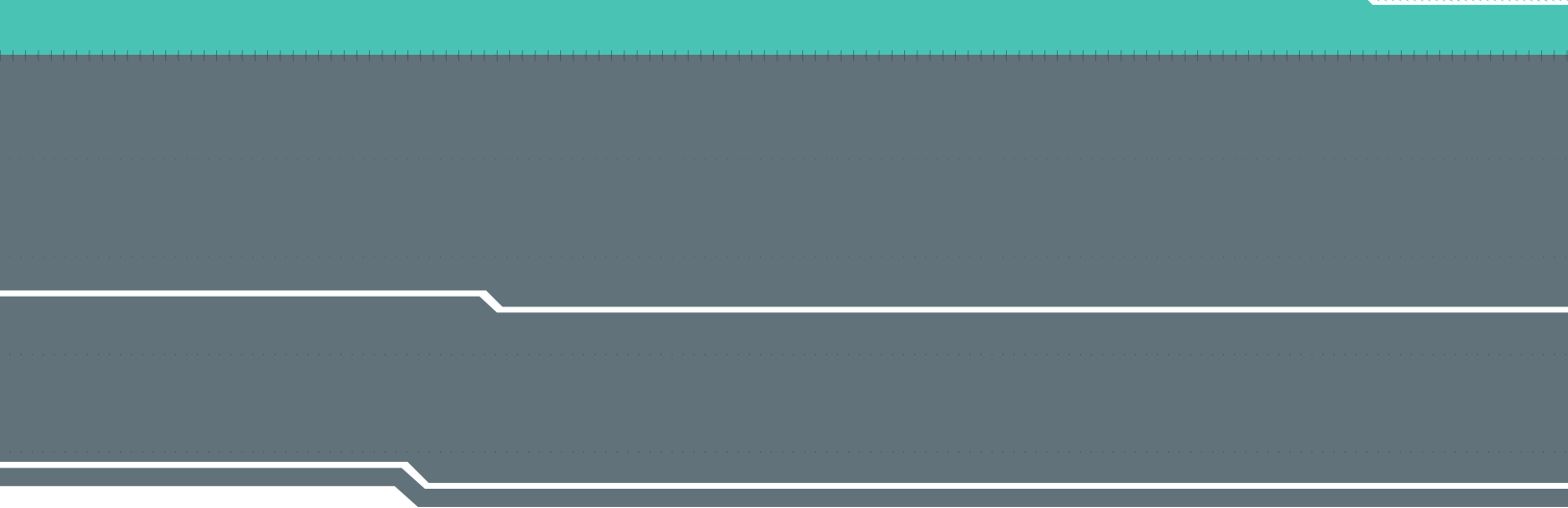
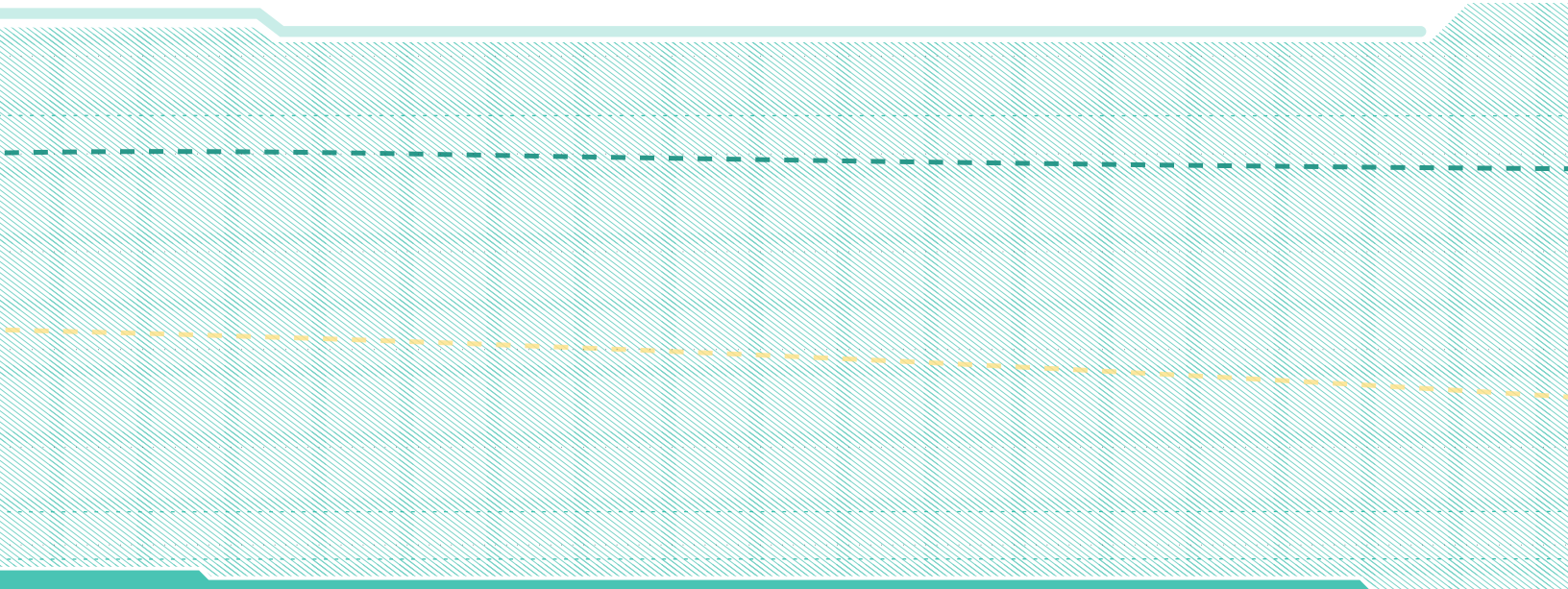
2069
The Tuvalu pier launches the creation of new Tuvaluan fishing companies and shipping routes; 2 additional vessels operate out of the pier.

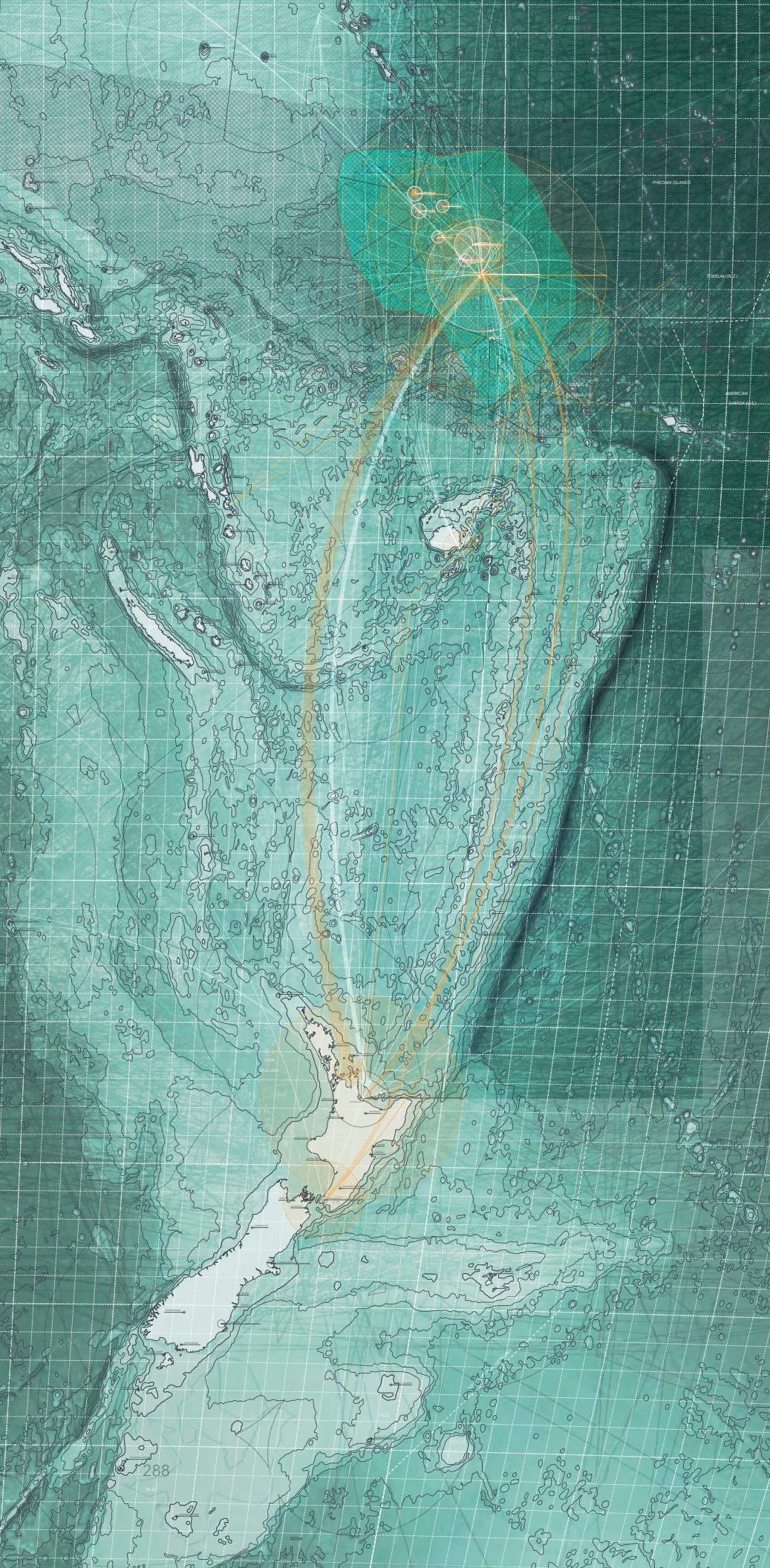
2075 Additional Market nodes open in Mangere, Henderson Valley, and Grey Lynn

2075
100 Years of Tuvaluan Independence; expats return to home islands to celebrate

2075







BEYOND THE SCENARIOS: MULTIPLE STRATEGIES FOR UNCERTAIN FUTURES

These architectural seeds, at the scale of the unit, building, or component, deployed strategically, allow Tuvaluans to curate the future of their nation. Tuvalu throughout history has been in flux, both physically and culturally, and in a vulnerable future new strategies and tactics are required for the nation to persist in the face of vast changes of climate and global society. These seeds are not intended to preserve Tuvalu in a static historical moment through cultural nostalgia, but rather promote the power of local adaptations and alternative modernities that retain important evolving cultural identities.

While these two scenarios and two sites provide a starting point for addressing Tuvalu's future uncertainty, neither can provide an accurate portrayal of what will really occur. Rather, they are intended as demonstrations of how these architectural seeds as a model can accumulate into flexible strategies for maintaining Tuvaluan spatial agency in uncertain futures. The reader should not be preoccupied with understanding the specificities of the scenarios in isolation; rather, a superimposition of the scenarios, strategies, and tactics provides a clearer picture of how Tuvaluans might operate these seeds to preserve Tuvaluan-directed futures.

The land and people of Tuvalu have throughout its history constituted a fluid archipelagic nation. These seeds allow Tuvalu can continue to exist in the markets of the Pacific, the cul-de-sacs of Auckland, and within its own dynamic boundaries. This thesis recognizes unstable, dynamic nature of nationhood and attempts to give Tuvaluans agency over the nation's possible futures.

Opposite: Synthesis drawing of the impact of the interventions associated with both of the two scenarios on migration, population growth, shipping, and Tuvaluan national space.



UNCLAIMED WATERS

DUFF ISLANDS

DUFF ISLANDS

SAN CRISTOBAL

ANENDO

SANTA CRUZ ISLANDS

KANKOLO ISLANDS

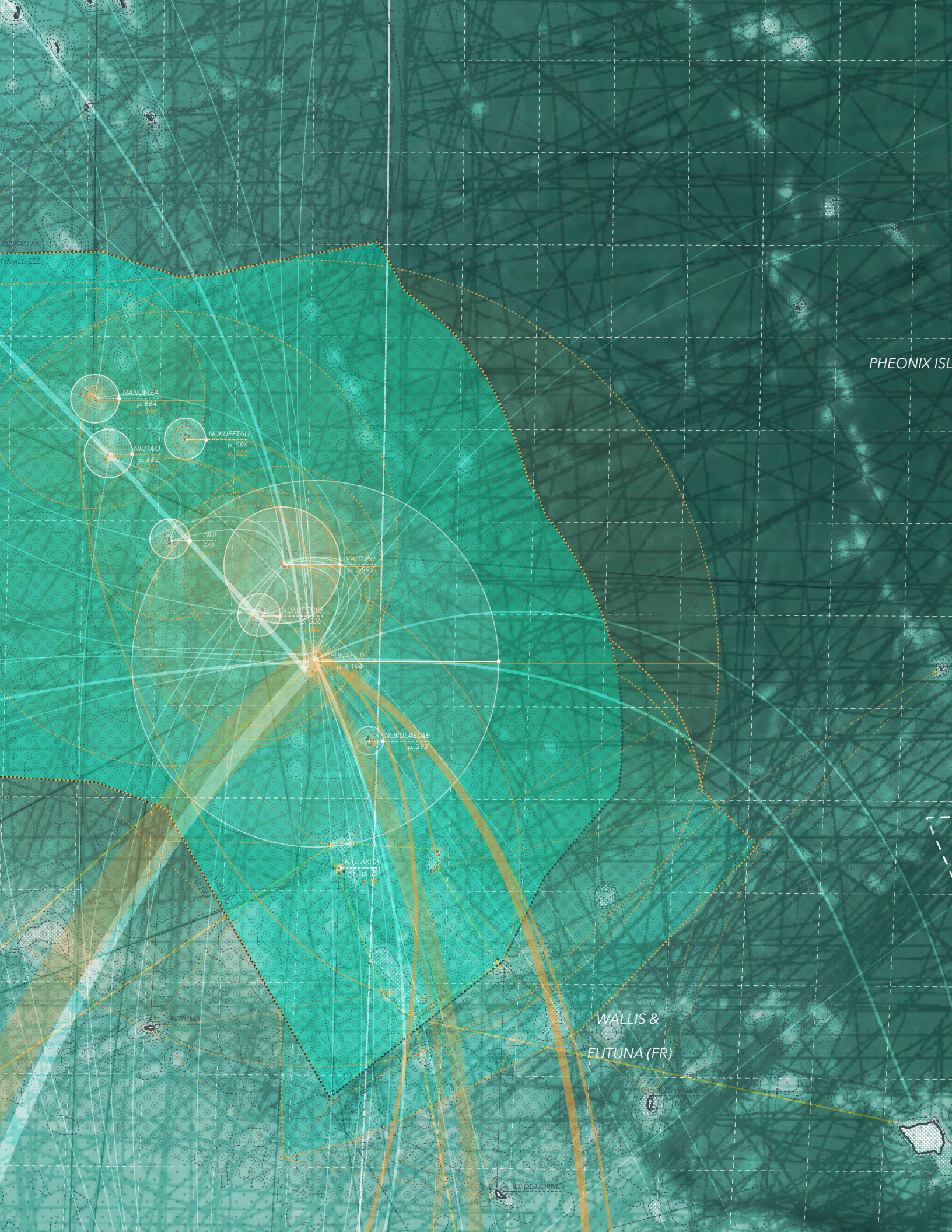
ANUTA

KATAKA

TIKEPIA

TORRES ISLANDS

290





NEW
ZEALAND

THREE KINGS ISLAND

WHANGAREI

GREAT BARRIER

MANUKAU

AUCKLAND
P. 2,530
P. 1,020

ROTORUA

HAMILTON

NEW PLYMOUTH

WANGANUI

PALMERSTON NORTH

NELSON

BLenheim

WELLINGTON
P. 375
P. 2,030

COOK STRAIT

GREYMOUTH

CHRISTCHURCH

TIMARU

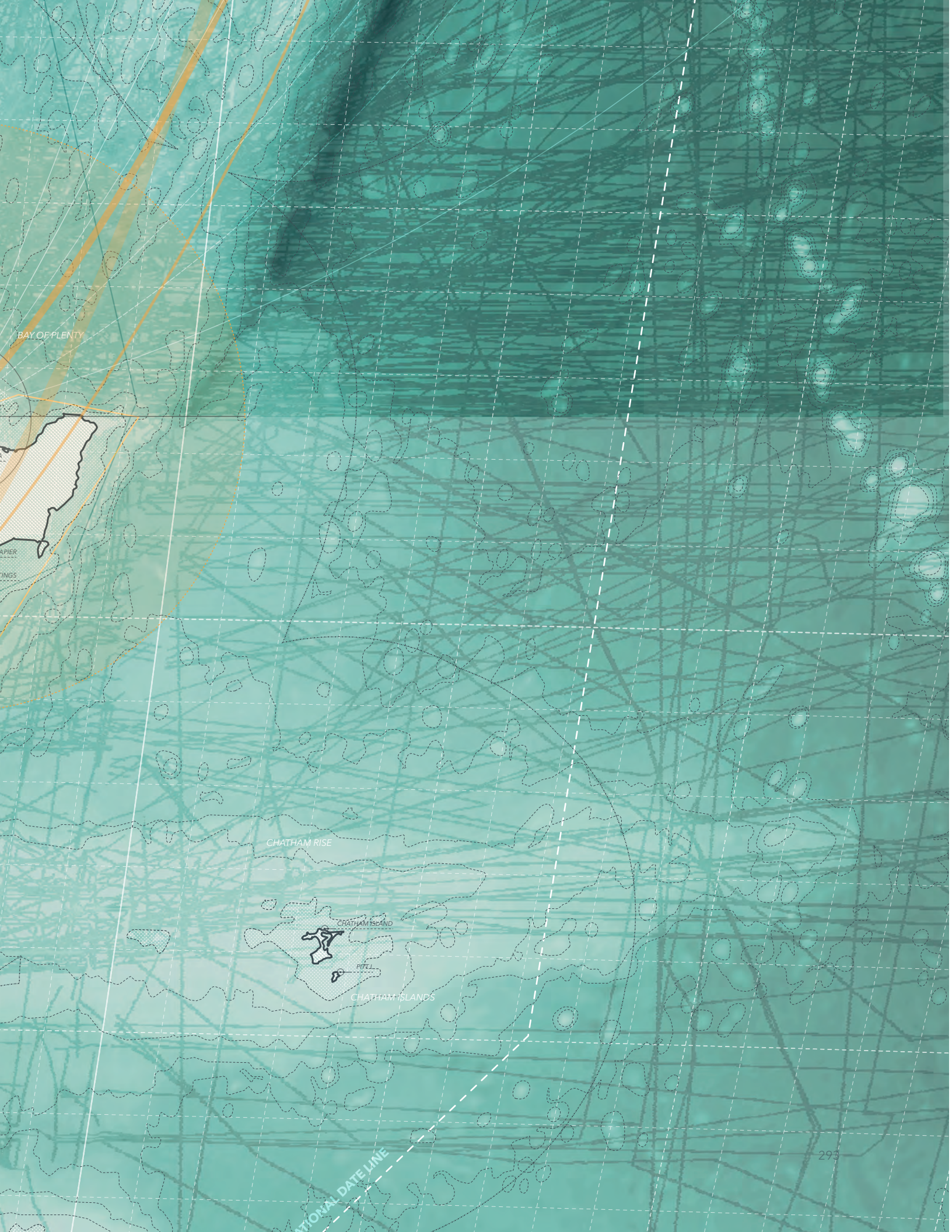
DAMARU

QUEENSTOWN

DUNEDIN

INVERCARGILL

STEWART ISLAND



BAY OF PLENTY

APIER
INGS

CHATHAM RISE

CHATHAM ISLAND

PIPEL

CHATHAM ISLANDS

ATIONAL DATE LINE



CODA

DISCIPLINARY
IMPLICATIONS

This thesis starts from a firm understanding of and commitment to design as a political act. The designer of spatial tools is not a technocrat, nor a sculptor. Imagining and introducing forms and spaces into human environments is inherently tied to spheres of power, and as Albert Speer so unconvincingly claimed, designers cannot sever their work from who they design for and how. The work of spatial practitioners is already influential at levels beyond the building and city. From the design of iconic forms and spaces of capital cities to the building of islands in the South China Seas to the building of physical walls or fences to defend borders, the physical manipulation of our material environments is key to national imaginaries. This thesis simply asks that we examine more closely how politics operate spatially from local to transnational levels, and explores how multiscale design can inform those politics. As a joint thesis in architecture and urban planning, the thesis attacks these issues, through the lens of Tuvalu's climate-changed futures, not only from multiple scales (ranging from the architectural object to transnational regions) but also from a multiple disciplinary vantage points. The work applies planning tools of policy and collective action, (such as subverting the UN Law of the Seas and creating participatory practices for disenfranchised Tuvaluan migrants) with design visioning of alternative physical architectures and possible futures.

In response to the failures of technocratic, engineered solutions to complex social and environmental problems, this thesis seeks to combine lessons from anthropology, political science, natural sciences, engineering, geography, cartography, planning, and design. The limitations of multilateral planning and hard engineering in climate change adaptation are clear; both rely on technocratic best practice solutions modeled on 'portable knowledge'³¹¹ developed in Western contexts. Multilateral development has failed to incorporate local knowledge and cultural practice, and protective sea walls are eroded through both environmental and social systems.³¹² In addressing Tuvalu's climate changed futures through broad disciplinary perspectives, I draw on skill sets developed in both architecture and planning, but also seek to draw on an issue-based approach instead of developing a response framed only by disciplinary skills. In my probing of the issue of designing for Tuvalu's uncertain future, the answer was not a building or a masterplan. Rather, in order to accommodate both individual Tuvaluan agency and larger collective goals, the thesis proposes a collusion of top-down strategies and bottom-up tactics through the model of small-scale 'seeds' which 'grow' into larger-scale territorial systems.³¹³

311. ` Mehos, D., & Moon, S. (2011). The uses of portability: Circulating experts in the technopolitics of Cold War and decolonization. In *Entangled Geographies: Empire and Technopolitics in the Cold War*

312. In Tuvalu, concrete blocks designed to harden coastal edges are appropriated by residents as building materials, and waves and currents erode underneath and behind the structures

313. See page 184 for more on strategies vs. tactics, and the 'seeding' model more broadly.

The complexity of Tuvalu's environmental and cultural risks required that I develop new skills and knowledge bases, for example by working with the UNDP's climate adaptation program in Tuvalu, studying systems for coastal engineering, sharing my research at an international relations conference, and consulting with atoll geoscientists. These lessons were then unpacked with the tools of architects and urbanists, particularly drawings and mappings. These expansive research tactics are in part a response to the disciplinary silo-ing of the contemporary era. The crisis of climate change does not fit easily into the purview of any single discipline, and dealing with the massive uncertainties it portends requires new transdisciplinary models. This speaks to the value of a dual degree in architecture and planning, and of disciplinary maneuverability more generally. Operating across these two disciplines (and beyond) has allowed me to see the limits of each more sharply. While planning is headily aware of spatial injustice, local advocacy, and the value of political action, it is limited by an emphasis on talking over action, and incrementalism over innovation. Architecture, on the other hand, is unmatched its disciplinary capacity to imagine alternative futures, but is often lacking in broader societal contextualization. **Drawing from productive aspects of both architecture and planning disciplines, the intent of the thesis is to provide radical future visioning as a political act in response to spatialized risk and inequities.**

Specifically, the architectural project benefited from plannerly processes of deep social research, including extensive interviews in both Tuvalu and New Zealand,³¹⁴ and also a deeper understanding of the broader social and political issues in which climate change risk in Tuvalu manifests. It also takes on environmental injustice directly, and advocates for Tuvaluans on a global stage, recognizing climate change in small island states as a clear illustration of Soja's framing of spatial injustice.³¹⁵ In contrast to planning models, the project benefits from the architect's ability to imagine alternative futures, thinking projectively instead of re-tailoring existing response frameworks. Furthermore, it leverages physical objects and spaces in addition to intangible social propositions, including portable cultural spaces for displaced populations,³¹⁶ or land-growing reef infrastructures.³¹⁷

Claiming space is an inherently political act, and this thesis advocates for the re-politicization of spatial design disciplines. I argue that in the case of Tuvalu (as both a nation and a peoples) claiming space for displaced diaspora populations in ex-situ contexts is as important as developing techniques for claiming and expanding territorial waters made fragile by a combination of international regulation and climate change³¹⁸ and that both are political acts through which spatial design-

314. Refer to the appendix (page 310) for a detailed discussion of interview methodology and findings

315. Soja, Edward. "The city and spatial justice." *Justice Spatiale, Spatial Justice* 1 (2009): 31-39.

316. See pages 218 - 228

317. See pages 206 - 215

318. See pages 70 - 78 for a discussion of Tuvalu's territorial risk

ers can serve as local advocates. It is impossible to design for Tuvalu's climate changed future without acknowledging deep colonial histories, territorial politics, and the extreme inequalities of the olig-anthropocene. This means taking an active stance on issues of climate justice and establishing the work as a tool for advocating for vulnerable Pacific Islander populations. When design conversations become increasingly insular, or focus on best-practice solutions, we actively depoliticize our work in the built environment. As de Block notes:

“Although current rhetoric formulates an urbanism ‘against’ engineering, one could state it is even closer to what is narrowly defined as technocratic, problem-solving engineering projects”³¹⁹

This particularly problematic in the scope of designing and planning for climate change and associated global resettlement, a wicked problem that will require radically new strategies. Current development models for climate change adaptation which revolve around problem-solving best practices are problematic not only in their lack of cognition of the politicized sphere in which they operate, but also for the application of one-size fits all strategies in the realm of complex and entirely new problems, not to mention the diversity of cultural and social contexts in which similar models are applied.³²⁰ In a critique of these existing worldviews, this thesis aspires to launch new conversations surrounding the role of design and planning in scenarios of climate and environmental risk. It asks that instead of designing one solution, perhaps we should design many;³²¹ instead of designing for a single point in time, we design for deep futures; instead of relying the portable knowledge of technocrats, we develop techniques that draw on deep local knowledge;³²² instead of isomorphizing unique island nation-states into mini-models of the West, we help imagine what locally driven alternative modernities might look like.³²³

Climate change similarly suffers from a de-politicization in the public sphere. It is accepted as a technical problem, and for the liberal-leaning public, projections of sea level rise and temperature increase are generally accepted as unchanging truths. As has been unpacked in earlier sections,³²⁴ relegating climate change to the sphere of the scientists disallows more progressive conceptions of what climate change might mean for our society, and how we as humans might critically engage with new climactic regimes—by curating atoll geomorphology³²⁵ or rethinking the frame of the nation-state³²⁶—as this thesis proposes.

The thesis rejects authoritarian, one-off design solution as a remedy to the complexities of broad Tuvaluan vulnerabilities. It also rejects clear-

319. De Block, Greet. “Ecological infrastructure in a critical-historical perspective: From engineering ‘social’ territory to encoding ‘natural’ topography.” *Environment and Planning A* 48.2 (2016): 367-390.

320. See pages 157 - 161 for a critical view on the nature of climate change adaptation in the contemporary aid-organization sphere

321. See page 176 for a discussion of the multiple scenarios approach

322. For example, drawing on local construction methods in the construction of portable maneapas and diaspora markets (pages 218 - 228 and 266 - 281)

323. See page 132 for a discussion of the concept of alternative modernities

324. See page 30 - 31 for a discussion on the depoliticization of climate change

325. See page 186 - 188

326. See diagram on page 194

327. I acknowledge that as an American designer at an American university designing for Tuvaluan futures, even with a focus on creating tools and tactics, I maintain a risk of imposing my own Western worldview on indigenous communities. However, two factors are of importance. First, the design thesis is intended as a conceptual exercise, and there is little risk of it being reproduced into reality. Second, the work is produced with deep research on Tuvaluan history and culture, with in-depth fieldwork intending to align the work as best as possible with Tuvaluan worldviews and agendas.

328. See pages 22 - 27, 238 - 243, 282 - 287

329. See pages 178 - 181

330. Scott, James C. *Seeing like a state: How certain schemes to improve the human condition have failed*. Yale University Press, 1998.

331. See page 188

332. See pages 200 - 215

333. See pages 188 - 191

334. See page 314

cut climate change projections in a world of wild uncertainty. Designing for multiple sites and scenarios across long spans of time was a key critical decision of the work, intended to rethink design perspectives on how we can provide visionary alternatives without mandating them unconditionally. The tactic-accumulation, or 'seeding' -based approach attempts to return agency to the population in question instead of relegating them to victims, pawns, or Photoshop entourages. The seeds are designed to be implemented by and for Tuvaluans. With the stance that climate change is one more way that the developed West is dominating and victimizing the globe's 'developing' and vulnerable populations, I attempt to design on behalf of Tuvaluans without colonizing their future with my own vision(s). This is also framed through a lens of 'alternative modernities,' which imagines that 'development' doesn't have to be synonymous with Western globalizing practices, and that Tuvaluans can ensure their own future security and well-being without becoming more like us.³²⁷

The above provides the theoretical positioning of this thesis relative to design and urban theory discourse. The toolkit which serves this position is also of significance, and contributes to the framing of the project's design politics at multiple scales of time and space. These include:

Critical Visualizations: Including critical cartographies of time and space, these representations attempt to use visualization as a tool for discovery and intervention, by making visible deep time, fluid space, and complex networked relationships. For example, mapping deep past and future timelines of Tuvalu³²⁸ and constructing mappings that blur rigidly drawn national boundaries through illustrations of fluid populations and ecologies.³²⁹

Multiscalarity: Thinking and designing at multiple scales helps to demonstrate relationships between the national territory as a political technology and the daily practices of individuals. Operating through multiple scales allow the work to operate with national-scale agendas, without "seeing like a state"³³⁰ and dehumanizing the population in question or oversimplifying the context on the ground. For example, this thesis worked from the scale of the nation, curating territorial waters³³¹ and national identities, to the scale of the city, defining strategies for growing ground in overpopulated atolls³³² and creating networks for displaced populations³³³, to the scale of the architectural object, crystallized in a 1:1 prototype of a portable maneapa unit.³³⁴

Longue Duree: Designing in the context of large scales of not only space, but also of time helps to deeply contextualize the work in the context of

fluid notions of space and identity. Further, it asks design and planning to expand the scope of their thinking, not only problem-solving in immediate timescales but showing how, in deep futures, small but incremental strategies might have broad, rippling effects. This is illustrated in the thesis through the development of detailed scenarios over long spans of time, in which small strategies can accumulate and become meaningful, 'growing' territory for Tuvaluan urbanism and economies at home, as well as territory for cultural practice and new forms of collectivity in the diaspora.³³⁵

Multiple Scenarios and Strategies: As discussed above, this thesis favors multiple tactics over one-off solutions. This is key in an acknowledgment that climate changed futures are inherently uncertain, but also in avoiding neo-colonially imposed futures in favor of agency-expanding tools. Here, the scenarios examine two conditions: 'climate change as usual' and 'rapid ice melt,' and both scenarios are studied in both Tuvaluan and diasporic contexts (namely New Zealand).³³⁶

APPLICABILITY

A main agenda of this thesis is to expand the role of design thinking as it relates to complex territorial and political problems, as faced by many vulnerable communities around the world. Design and designers should play an expanded role in strategizing complex problems such as climate change-related adaptation, retreat or migration. As such, design research on Tuvalu's at-risk future will be meaningful for multiple groups. The project seeks to further (extra-) disciplinary discourses surrounding climate change adaptation to include possibilities of assisted migration,³³⁷ dealing with the complex resettlement patterns which climate change will inevitably require.³³⁸ For those immediately affected by risk of inundation and evacuation, especially atoll-dwellers and Tuvaluans, the thesis provides projective approaches that accommodate a spectrum of future timelines. These designs could serve as a starting point for conversations about future physical strategies associated with their post-island³³⁹ state beyond the standard multilateral best practices.

Over 600 million people (10% of the global population) live in low-lying regions, 10 meters or less above sea level.²⁷⁹ While every community will face different risks associated with climate change, many issues will be shared broadly: for example, increased storm and flood risk, damage to coastal ecosystems, and saltwater infiltration. This project has primary relevance for conversations surrounding the future of the Tuvalu archipelago; however, its meaning extends beyond these 11,000 citizens. The strategies proposed here have direct implications for devel-

335. See scenario timelines, pages 238 - 243, 282 - 287

336. See page 192 for a discussion of the scenarios.

337. Ste-Marie, Catherine, et al. "Assisted Migration: Introduction To A Multifaceted Concept." *Forestry Chronicle* 87.6 (2011): 724-730. *Environment Index*. Web. 30 Oct. 2014.

338. Valsson, Trausti. *How the World Will Change with Global Warming*. Iceland University Press: Reykjavik (2006).

339. While a literally 'post-island' future of submersion is a possibility for Tuvaluans, the term also means a state of logics that exceed isolated islands, seeing Tuvalu as part of a broader global archipelago.

340. McGranahan, Gordon, Deborah Balk, and Bridget Anderson. "The rising tide: assessing the risks of climate change and human settlements in low elevation coastal zones." *Environment and urbanization* 19.1 (2007): 17-37.

oping alternative models of climate adaptation for other atoll nations such as Kiribati or Tokelau, or in nations that contain atolls amongst other island types. More broadly, for all climate-risk regions, especially coastal, where relocation will become an impending necessity, this project could provide a model for a broader dialogue on climate changed futures that embrace wide perspectives on time and history, and fluid definitions of nationhood and citizenship.

NEXT STEPS (POST-THESIS FUTURES)

I see this thesis as part of a broader, ongoing personal project on re-positioning the role of spatial design disciplines in environmental crises, particularly climate change and associated migration. I aspire to create models of alternative design practice that advocate for vulnerable populations in these kinds of contexts. Many of the conceptual frameworks and design tools I applied to the thesis are part of longer term research trajectories: including questions of multiscale design, alternative modernities, and design as activism. These are all projects I plan to continue to develop in future work.

As a thesis, this was inherently an independent project. Well I benefited from fantastic guidance and cross-disciplinary consultations, future projects will be more directly collaborative, drawing on essential skills and knowledge from other disciplines.

The work will be carried on as I reformat aspects of the thesis to share with stakeholders in Tuvalu and New Zealand, and as a research project I am developing a broader framework for understanding the role of design for climate-induced mobility. As recent events in Syria, the Middle East, and Europe have shown, designers will need to play an increasing role in improving conditions for mobilized vulnerable populations. I will also expand the research on the ground through collaborations the Tuvaluan diaspora in New Zealand during a Fulbright research fellowship for the year of 2017.



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APPENDIX

GLOSSARY

anthropocene - proposed as a new global epoch where human beings become actors in global climates, geographies, and ecosystems

atoll - a form of coral island characterized by a sandy ring of islets surrounding a central lagoon. Atolls are formed on the rim of volcanoes, as coral reefs build upwards while the volcanic cone subsides.

coral island - islands formed by coral reefs, including atolls, pseudo-atolls, and raised coral islands.

diaspora - peoples dispersed from their homeland, here typically referring to Tuvaluan peoples who have migrated to New Zealand

ex-situ nation - In the model of the Order of Malta, a nation that no longer operates sovereignty over a territory

Exclusive Economic Zone (EEZ) - a designation by the UN Law of the Seas that gives nations economic sovereignty over a 200 nautical mile radius buffer off of their coastlines.

inlet - on a coral atoll, the zone between two islets where water enters and exits the lagoon during tidal shifts.

islet - on a coral atoll, one of the small islands that ring the lagoon

king tides - a colloquial term for the highest tides of the year, or 'high high tides', occurring on an annual basis when the earth, sun and moon are in alignment.

Millennium Development Goals - also known as MDGs, a set of targets established by the UN for alleviating global poverty and associated risks

multilateral organizations - organizations formed between multiple nations to work towards shared goals, often associated with development. Organizations associated with the UN, such as the UNDP, UNEP, or UNHCR are primary examples.

nation-state - a sovereign unit peopled by a semi-homogeneous collective; both a *nation* (a group of *people* with shared history and culture) and a *state* (a political entity governing a *territory*)

oliganthropocene - a term borrowed from Eric Swyngedouw in which global systems of climate, ecology, and geography are influenced not by all peoples (as suggested by the term 'anthropocene', but rather by a small, powerful segment of the global populations.

Seasteading - a movement to create a new, independent, sovereign nation in unclaimed waters of the high seas through the construction of floating islands (see Seasteading.org)

SIDS - Small Island Developing States, a group of small and vulnerable island states sharing similar development issues, defined and categorized by the United Nations.

sovereignty - the authority of a state to self-govern within an established territory.

taro - a root vegetable and staple Tuvaluan crop cultivated in pits that are increasingly vulnerable to saltwater infiltration

territorial waters - waters over which a nation operates full or partial sovereignty, including inland waters, territorial seas, the contiguous zone, and the exclusive economic zone.

territory - a political technology; an area over which a ruler or group operates sovereignty; a zone which a peoples claims for cultural practice

UNCLOS - the UN Convention on the Law of the seas, a 1982 treaty that established transnational regulations for oceanic sovereignty

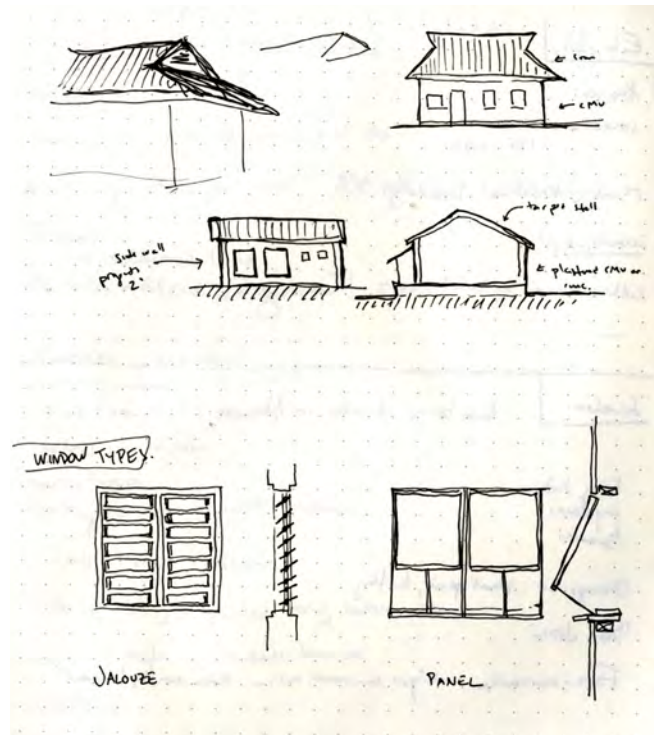
UNDP - the United Nations Development Programme, a United Nations agency which focuses on development, poverty eradication, and climate change adaptation.

RESEARCH METHODS

This thesis benefited greatly from fieldwork in Funafuti, Tuvalu sponsored by the MIT Public Service Center and an Emerson Travel grant, and in Auckland and Wellington New Zealand, sponsored by the MIT Urban Risk Lab and a Lloyd and Nadine Rodwin International Travel Fellowship. In both sites, semi-structured interviews were a primary research tool. Interview subjects were selected using a snowball method, with help from colleagues at the United Nations Development Programme in Tuvalu. I was able to collect 16 interviews in Funafuti from a diverse set of participants. Connections made in Tuvalu allowed me to connect to Tuvaluans in Auckland and Wellington, who then assisted in finding subjects in the New Zealand sites. I collected 11 interviews in New Zealand, although one subject was of Tokelau origin and is excluded from the results, and for another the audio file of the interview was corrupted. Interviews were planned to be 30 minutes or less, but ranged in length from 20 minutes to two hours, depending on the interest of subjects.

In Tuvalu, the interviews were held in a variety of locations convenient to the subjects; their homes, places of work, or other, public sites. Many occurred out of doors. In Wellington interviews were held at the office of the High Commissioner of Tuvalu, and in Auckland at the Te Wananga o Aotearoa Community College in Henderson.

In addition to interviews, in Funafuti I also conducted documentation of coastal conditions, housing typologies, and public spaces through drawings, photographs, video clips, and notes. I was also invited to attend cultural events, such as a dance ceremony (*fatele*) and feast ceremonies (*fakaala*), adding to my understanding of Tuvaluan culture. The research also benefitted from an improved understanding of Tuvaluan culture based on daily experiences during my week on the island in January 2015; for example, observing coconut sap harvesting, experiencing the (in)famous ‘coconut express’ rumor mill, seeing the minimal grocery options in the island’s shops, and observing the prevalence of scooters as a form of transit. I greatly benefited during this time from my contacts at the UNDP, who introduced me to the community and helped with the logistics of my travel.



Sample sketches of housing details from fieldwork in Funafuti

The research also benefited from an internship with UN Development Programme, where was able to learn about multilateral development and adaptation practices in the Pacific. I worked with the organization remotely during the summer of 2014 and on-site in Fiji during January 2015, on developing communication materials for the Ridge to Reef program that drew on Pacific Islander visual communication models. I also worked on the Ridge to Reef project document. Through this embedded experience, I gathered invaluable experience first hand about how climate risk is currently being addressed in the Pacific through multilateral organizations.

As a joint design and planning thesis, in addition to the above analytic methods of information gathering, I also consider ‘design’ to be a research tactic deployed in this project. The design proposals are intended not as implementable solutions, but rather as design research that explores alternative models for designing in uncertain, risky, and remote scenarios at multiple scales.

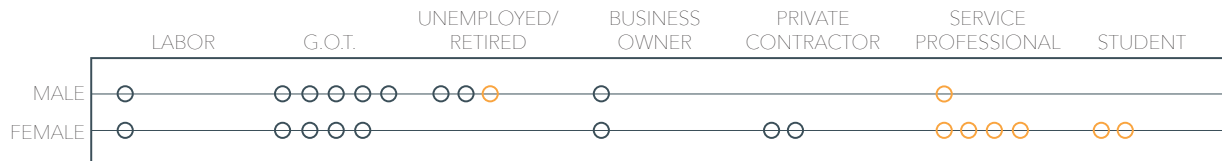
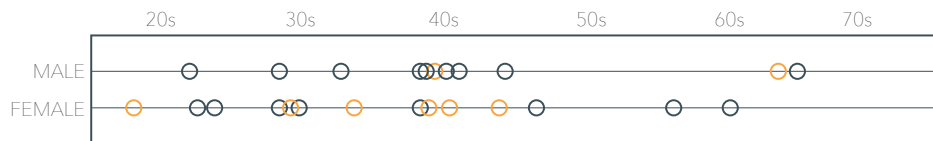
MANEAPA POLE [CULTURE SEED] PHYSICAL PROTOTYPE

This thesis firmly believes in the benefits of addressing design issues at multiple scales, from the scale of the human to that of the nation. In order to more fully explore the manifestation of the project in the daily lives of stakeholders, I created a one-to-one mock-up of the ‘maneapa pole’³⁴¹ to test the design in reality. The prototype was constructed as illustrated in the design section, including CNC routed plywood frame, cast concrete base, and fabric roof structure. The assembled unit reached 12’ tall with a canopy of 6’ at the widest point. Intended as a system of ‘portable architecture’, the entire system was demountable and packed flat. The wooden column structure used pins to rotate into place, and provided a structure for the fabric upper. The roof was not fully woven as suggested by the ‘culture seed’ design, but this intention was expressed through screen printing the surface of the fabric with the intended weaving pattern.

341. See page 218 - 223

INTERVIEW FINDINGS

The following pages catalog the findings of the interviews (described above) visually. In general, for Tuvaluans in Tuvalu, climate change was a major concern, but interviewees were not planning to migrate because it was either financially and logistically impossible, or because they felt such a deep connection to their home islands. The sense of culture, community, value, and traditions was very strong for both in-situ and ex-situ Tuvaluans. Migrated Tuvaluans were all happy with their new lifestyles and planned to stay in New Zealand, but expressed a longing for the lifestyles and communities of home. However, many noted that they saw migration as essential and even inevitable, and had attempted to convince friends and family to join them in New Zealand. Nearly all interviewees expressed belief in climate change, but those in New Zealand had more concrete concerns about cyclones and inundation. This was perhaps amplified by Cyclone Pam, a catastrophic hurricane that occurred in March 2015, 3 months prior to my visit to New Zealand (and after my trip to Funafuti). The event caused extensive flooding on the outer islands and caused the Prime Minister to declare a State of Emergency. For those in Tuvalu, all understood and believed in climate change as a concept but many had a hard time reconciling the risk of catastrophic inundation with their daily lifestyles and beliefs.

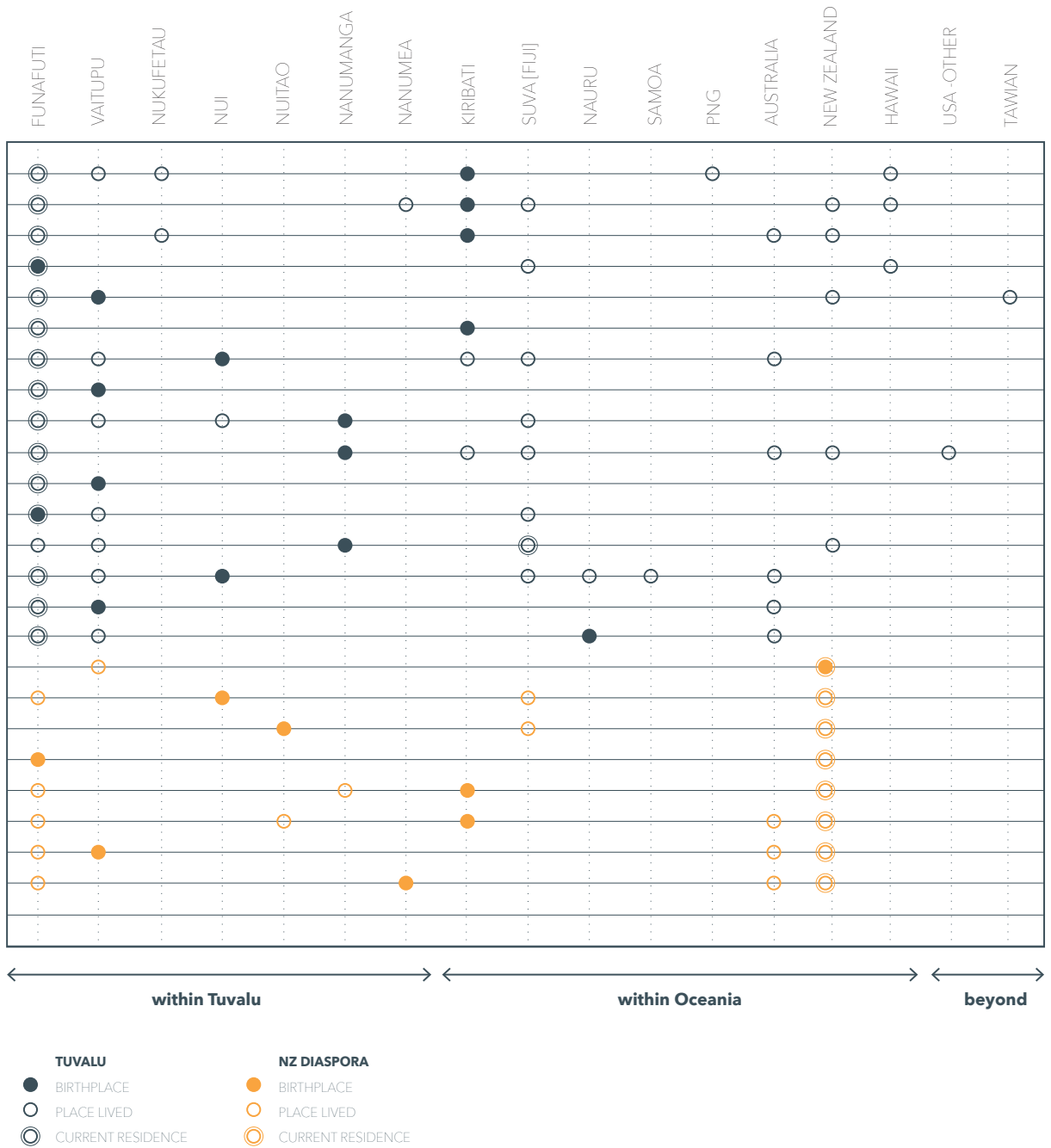


○ TUVALU ○ NZ DIASPORA

BASIC DEMOGRAPHIC DATA

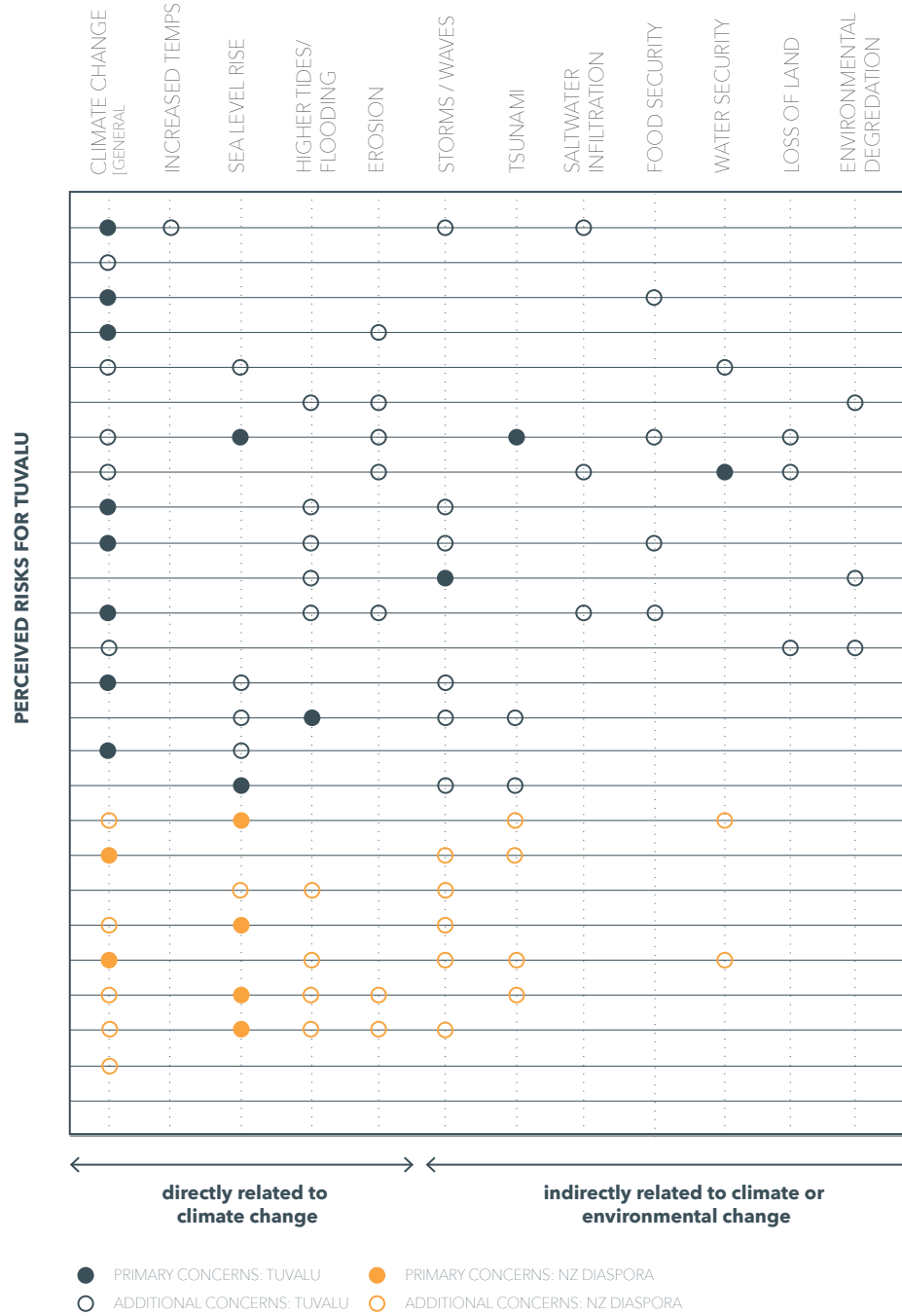
INTERVIEWS: NEW ZEALAND + TUVALU

The study attempted to sample a mix of age groups, backgrounds, and genders. In total, 17 participants were interviewed in Funafuti, and an additional 9 people were interviewed in New Zealand



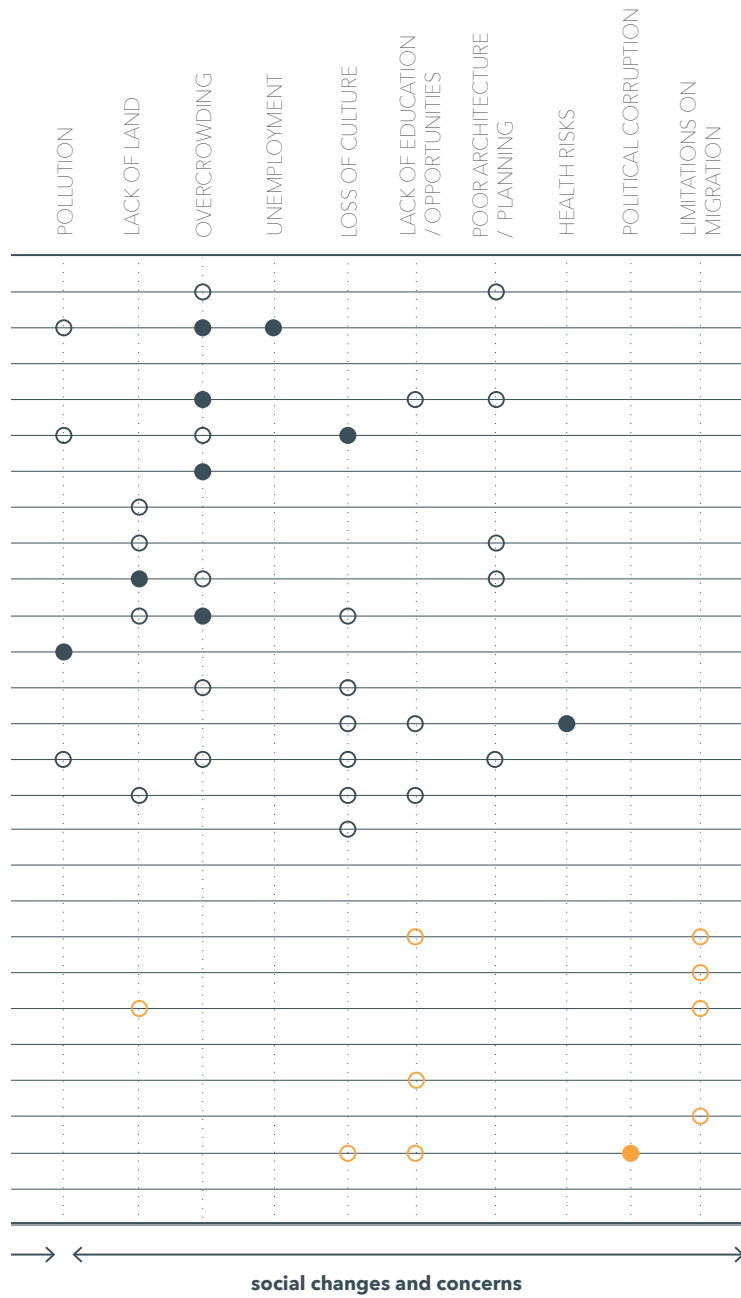
PLACES LIVED INTERVIEW SUBJECTS
 In general, both the Funafuti and New Zealand interviewees were very mobile; all had resided outside Tuvalu at some point during their lives. However, in general the subjects were better educated than average Tuvaluans due to

sampling bias. The majority had received a scholarship for some level of education abroad. The participants born in Kiribati had parents working there prior to Independence, and those born in Nauru had parents working in the phosphate industry.



PERCEIVED RISKS FOR TUVALU

Response to the question: What do you think are the biggest concerns for Tuvalu's future? Climate change concerns dominated for migrants, while Tuvalu residents were more concerned with more immediate local environmental and social issues.





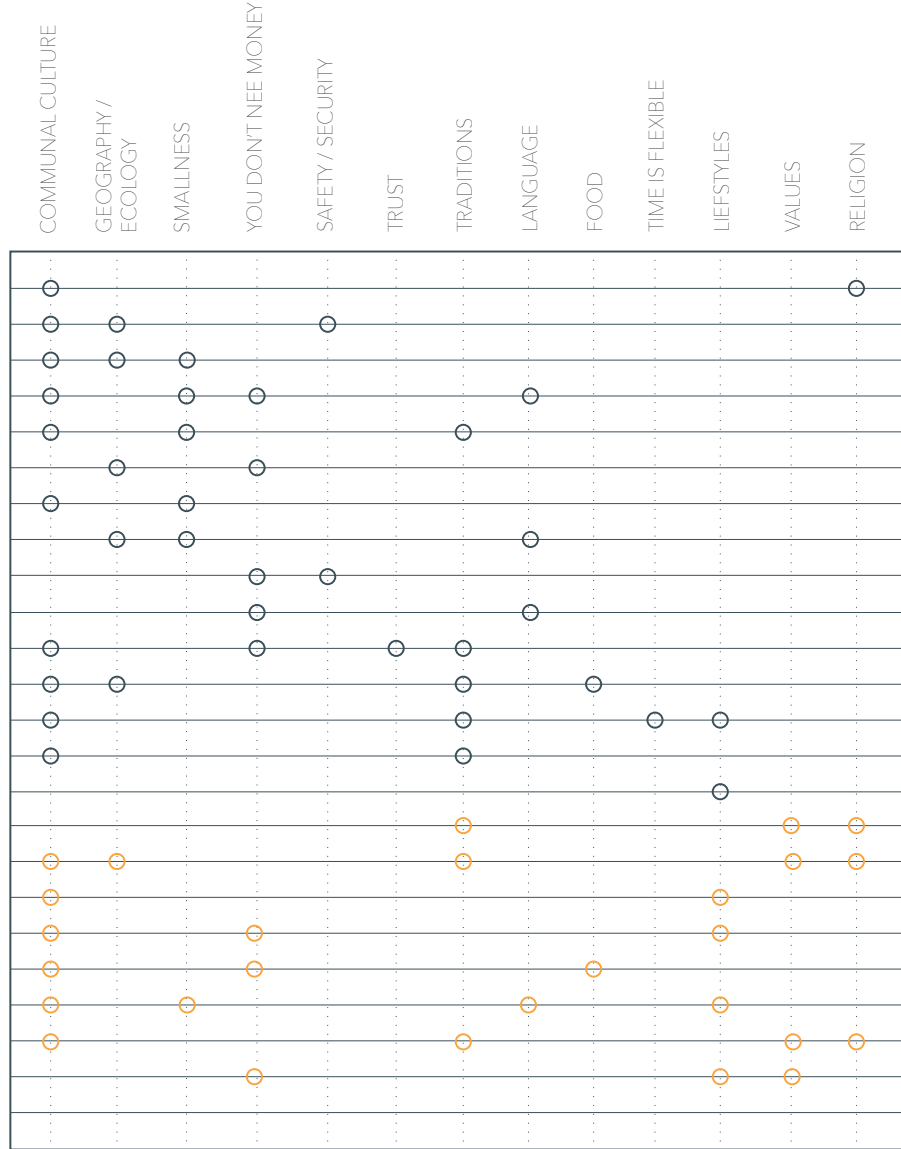
FAVORITE PLACES

Response to the question: What is your favorite place in Tuvalu? This question was only posed to the in-situ population. Nearly all responded with an outdoor, natural space: rural islets, the sea, the beach. These reveal the strong connection Tuvaluans retain to the ocean, even as Funafuti residents are relying less and less on subsistence fishing and beach gathering. Instead, these became places of rest and relaxation. 'Home' was also a common answer, speaking to the strong family values of interviewees.

BELIEF IN CLIMATE CHANGE

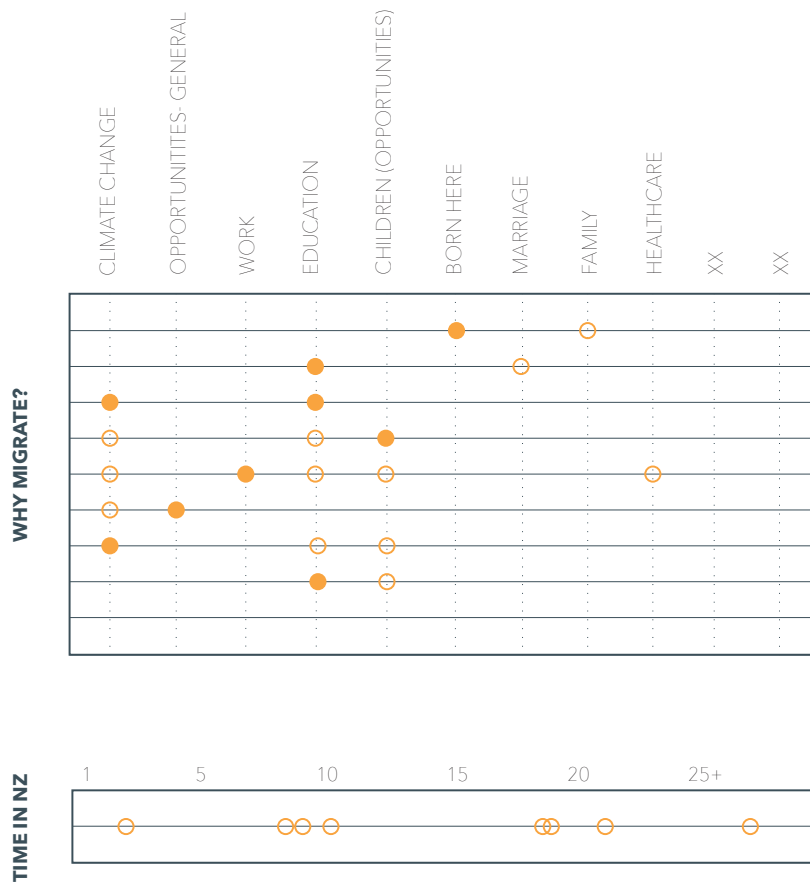
Nearly all interview subjects brought up concerns regarding climate change without prompting. Unlike earlier studies, I found belief in climate change to be very high, although again sampling bias is possible. However, it seemed that most had learned about climate issues in school or through other awareness initiatives. For those whose belief was qualified, the qualifier was usually religion. These subjects expressed an internal conflict in believing in climate change and believing that God would protect them.

WHAT MAKES TUVALU UNIQUE?



WHAT MAKES TUVALU UNIQUE?

Response to the question: What makes Tuvalu unique? Or What is special about Tuvalu? Responses were similar between Tuvalu and diaspora subjects, and tended to focus on Tuvalu's community oriented culture and specific traditions, such as songs and dance. Funafuti residents were more likely to emphasize Tuvalu's geography, while migrants were more likely to mention religion and cultural values, likely responding to a distinction relative to Western worldviews in New Zealand.



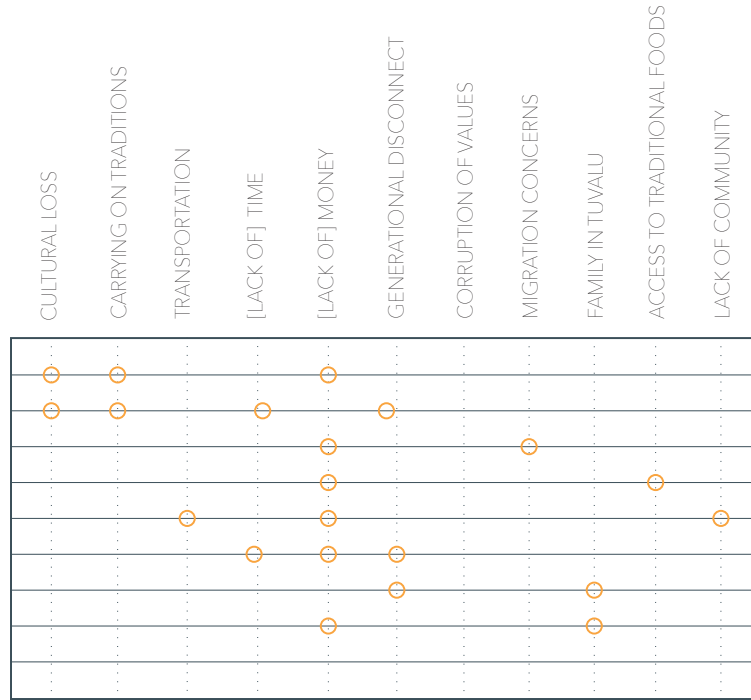
WHY MIGRATE?

Response to the question: Why did you initially decide to move to New Zealand? For most, it was a combination of factors including opportunities for children, education, and concerns about climate change. A majority expressed climate change as a primary or secondary factor, differing from what earlier studies have found. Just one subject was born in New Zealand.

TIME IN NEW ZEALAND

Migrants had been in New Zealand for a wide variety of timespans, from 2 to 28 years. As such, their migration experiences varied significantly as immigration policies have become more stringent over time.

BIGGEST CONCERNS FOR MIGRANTS



CONCERNS FOR MIGRANTS

Tuvaluans in New Zealand expressed a number of concerns about their diaspora lives, although all were happy with their decision and planned to continue living in Auckland or Wellington, or possibly continue on to Australia. Primary concerns had to do with a lack of time and money, representing a contrast to one of the unique qualities of Tuvalu many mentioned, that ‘you don’t need money’ to live there. These concerns suggest the strain that modern lifestyles placed on migrants, even ones who had been settled for some time. Another main concern was maintaining traditional cultures and practices, particularly for future generations.



DRAWINGS AND IMAGES

All photographs and drawings produced by the author, unless otherwise noted. Drawings produced in Adobe Photoshop and Illustrator. This document uses the fonts Avenir Next and Adobe Garamond Pro.

