

Introduction

OF OCEANS AND ISLANDS

There is a gulf of difference between viewing . . . “islands in a far sea” and as a “sea of islands.” **EPELI HAU’OFA**

ATLASES

Atlases are being redrawn as islands are disappearing. Yet many on continents are not even aware of where these islands are located, what their names are, or how climate change impacts them, despite the fact that continental land dwellers are often more responsible for producing carbon dioxide (CO₂) emissions and sea level rise. According to the Intergovernmental Panel on Climate Change (IPCC), Pacific Island nations are responsible for 0.03 percent of global emissions. Figures for islands in the Caribbean Sea are in a similar range. Island nations are among the nations that have contributed the least to CO₂ emissions and global warming; they are, however, suffering its impacts already, severely and disproportionately. Entire nations, their histories, cultures, and languages are at risk of being lost.

These low-lying islands are a harbinger of the future that awaits the residents of coastal cities and shorelines. Internationally, the cities projected to be most affected include but are not limited to Guangzhou and Shanghai, China; Hong Kong; Mumbai, India; Amsterdam, Netherlands; Lagos, Nigeria; Manila, Philippines; Dakar, Senegal; and Ho Chi Minh City, Vietnam.¹ Almost half of the US’s population, about 40 percent, lives in coastal states and cities. In other words, or numbers, it is estimated about 13 million US residents would be affected, in particular, in order of impact, in the states of Florida, Louisiana, California, New York, and New Jersey. A study published in *Nature*

1. Jonathan Watts, “From Miami to Shanghai: Three Degrees of Warming Will Leave World Cities under Water,” *The Guardian*, November 3, 2017; Josh Holder, Niko Kommenda, and Jonathan Watts, “The Three Degree World: Cities Drowned by Global Warming,” *The Guardian*, November 3, 2017.

in 2016 estimated that by 2100 as many as 13 million US residents could be affected by sea level rise. So-called “hundred-year floods” will happen every year in New England and mid-Atlantic regions and every one to thirty years along the Southeast Atlantic and Gulf of Mexico.² All states along the Eastern Seaboard will be affected. The difference? Residents on continents can retreat inland. For many islands, sea level rise may spell the end of their nation’s very existence.

How to make visible what might be geographically remote to some? How to render visible the climate science? How to encourage thinking with? How to encourage a thinking that is mindful of how we are all connected, as humans and with nonhumans? Spatially, actions in one place have an effect in another place. Temporally, actions in one era (the history of burning fossil fuels) have an effect in another era (the present). How to encourage a perspective that weaves together our past history and actions, including the legacy of colonialism, with a thinking about our present actions that works toward a livable future? How to activate a concept of living with? Is this about a world that structures its relations to land, people, animals, and ecosystems for profit and accumulation? Or is this about a way of living that is based on an acknowledgment of the interconnectedness of the ecosystems, of humans and nonhumans, and thinks those relations through to prioritize an equitable present and a livable future?

Atlases exist that map sea level rise impacts on cities in the US but no atlas exists that maps where the most impacted islands lie, that tells what the effects of sea level rise will be on these islands and that shares the islanders’ strategies to address and resolve them. *Sea Change: An Atlas of Islands in a Rising Ocean*, through its texts and maps, allows us to understand the dramatic changes taking place and activates imaginings of possible futures.

ISLANDS—IN THE COLONIAL IMAGINATION

Every island has a story. There are, of course, many more stories than there are islands. Spanning the globe. Which is another way of saying: (Narrative) vantage point is everything.

Islands are deemed to be paradisiacal. The blue ocean. The beaches. Palm trees gently swaying in a balmy breeze. Soft white sand underfoot. The temperate clime. Do an internet search for “paradisiacal” and the first example of its use in a sentence features an island: “a paradisiacal island in the Bahamas.” *Merriam-Webster’s* definition of “paradisiacal” features an island: “The 15-day, round-trip cruise, . . . includes visits to some of French Polynesia’s most *paradisiacal* islands.” Islands are paradisiacal. Paradise is an island.

2. Reza Marsooli, et al. “Climate Change Exacerbates Hurricane Flood Hazards along US Atlantic and Gulf Coasts in Spatially Varying Patterns,” *Nature Communications* 10.1 (2019). DOI: 10.1038/s41467-019-11755-z.

The Western imagination often casts islands as utopias—or dystopias. Early on, in *Timaeus* and *Critias*, Plato wrote about the lost island of Atlantis that would threaten to conquer Ancient Greece.³ Greece, the cradle of Western civilization, encompasses thousands of islands dispersed throughout the Aegean and Ionian seas. Of course, these islands are intimately tied to maps. In the sixteenth century, German–Flemish geographer Gerardus Mercator, who created the famous or perhaps infamous Mercator map, is credited with coining the term *atlas*, referring to a collection of maps in a book. Mercator named his *Atlas Sive Cosmographicae Meditationes de Fabrica Mundi et Fabricati Figura* (Atlas or Cosmographical Meditations upon the Creation of the Universe and the Universe as Created) after the Greek god Atlas. The Atlantic Ocean, literally translated, is the sea of Atlas. Atlantis, translated from the Ancient Greek, means Atlas’s island. Thomas More revisited the mythical place Atlantis in *Utopia* (1516) and Francis Bacon in *New Atlantis* (1627),⁴ but More set his Atlantis in the Pacific between Sri Lanka and the Americas and Bacon locates it in the South Seas.⁵

For a long stretch, to Europeans, islands often rested in the fantastical realm of uncharted (to them) oceans accompanied by gods or sea monsters. In Ptolemy’s *Geography*, which introduced latitude and longitude, the Fortunate Islands (or Isles of the Blessed) where the Greek gods lived was the westernmost land known at the time. Roman Pliny the Elder wrote of the Fortunate Islands in *Natural History* that they “abound in fruit and birds of every kind.” Pliny the Elder put forward the notion that all land animals had an equivalent in the sea. If there were dogs and pigs, so the thinking went, there had to be sea dogs and sea pigs. Aside from these benevolent creatures, malevolent sea monsters were believed to lurk in the sea.

Monsters continued to adorn medieval *mappa mundi*.⁶ Sea unicorns. Giant worms. Enormous lobsters. And, of course, those dangerous sirens, who since Odysseus’s return have lured sailors to shipwreck with their beautiful voices. All of these fantastical creatures appeared on maps from the tenth to the sixteenth century. Then, as European navigators explored and charted the oceans, the sea monsters disappeared from their maps.

Narratives of disappeared islands—referred to as lost lands—took their place.⁷ Lemuria might be the most famous example.⁸ Also known as Kumari Kandam, this cradle of ancient Tamil

3. Plato, *Timaeus and Critias*, trans. Desmond Lee (Penguin, 2008).

4. Thomas More, *Utopia* (Penguin, 2012); Francis Bacon, *New Atlantis* (New Atlantis, 1952).

5. L. Sprague de Camp, *Lost Continents: Atlantis Theme in History, Science and Literature* (1954; Dover, 2012). Ignatius Donnelly, *Atlantis: The Antediluvian World* (Dover, 2011).

6. Chet Van Duzer, *Monsters on Medieval and Renaissance Maps* (British Library, 2014); Joseph Nigg, *Sea Monsters: A Voyage around the World’s Most Beguiling Map* (University of Chicago Press, 2013); Ptolemy’s *Geography*, 150; and Pliny the Elder, *Natural History*, 79.

7. Edward Brooke-Hitching, *The Phantom Atlas: The Greatest Myths, Lies and Blunders on Maps* (Chronicle Books, 2018).

8. Wishar S. Cerve, *Lemuria: The Lost Continent of the Pacific* (Rosicrucian Press, 1935); Sumathi Ramaswamy, *The Lost Land of Lemuria: Fabulous Geographies, Catastrophic Histories* (University of California Press, 2004).

civilization was believed to have rested in the Indian Ocean and to have bridged the African island of Madagascar to the west, India to the north, and Australia to the east in a theory proposed in 1864 by British zoologist and geographer Philip Sclater. Similarly, in the early twentieth century, the British engineer, inventor, and occult writer James Churchward argued that a lost continent of Mu once sat in the central Pacific Ocean, occupying a space that spanned from the Marianas (see Northern Mariana Islands (16) in this atlas) in the west to Rapa Nui (Easter Island) in the east, from Hawai'i in the north to the Kūki 'Āirani (see Cook Islands (31)) in the south.⁹

But the monsters lingered in the Western literary imagination. In Jules Verne's *Twenty Thousand Leagues under the Sea* (1870), Captain Nemo aims to find a mysterious sea monster that has sunk numerous ships.¹⁰ In Daniel Defoe's *Robinson Crusoe* (1719), the eponymous protagonist is a castaway who spends twenty-eight years on an island near Trinidad.¹¹ He encounters cannibals and mutineers. So popular was the book that it launched a new genre about castaways marooned on islands: the Robinsonade.¹² Islands were framed as remote and thus dangerous. William Golding's *Lord of the Flies* (1954) tells of a group of British boys stranded on a desert island. Their attempt to survive does not end well.

In these tales the focus so often is on the explorers. Those who seek gold. Those who hunt whales. Those who mutinied. Those who are marooned. Those who die of thirst, of disease, on tropical islands. Those who freeze to death on Arctic islands. Those who look for the Northwest Passage and never return from the icy terrain. Most characters and protagonists in these tales are men. Few are women. Moreover, when islanders appear at all, they are cast from a colonizer's point of view. The islands are cast as remote. Desolate. Deserted. Too hot. Too cold. Islands empty due to volcanic eruptions. Islands empty because of nuclear testing. Islands that held prisoners. Islands whose creatures have been hunted to extinction.

But there is another vantage point, which follows after a brief excursus into the science.

THE SCIENCE

In 2009, I attended the Copenhagen climate conference, formally the fifteenth meeting of the Conference of the Parties (or COP 15) convened by the United Nations Framework Convention on Climate Change (UNFCCC). While some media coverage concentrated overly on the US-China

9. James Churchward, *The Lost Continent of Mu* (The Brotherhood of Life, 1987).

10. Jules Verne, *Twenty Thousand Leagues under the Sea* (Penguin, 2018).

11. Daniel Defoe, *Robinson Crusoe* (Penguin, 2014).

12. Rebecca Weaver-Hightower, *Empire Islands: Castaways, Cannibals and Fantasies of Conquest* (University of Minnesota Press, 2007).

relationship—that is, the question of whether either nation, as the largest emitters, would take the lead in emissions reductions—the stories shared inside the conference told another story. As nations stood up one by one, individually, and also as part of the UN cluster groups to which they belonged—in UN parlance, the Alliance of Small Island States (AOSIS), the Africa Group, the Least Developed Countries (LDCs), and the Small Island Developing States (SIDS)—they shared information about the ongoing situation in their home countries. Since the UNFCCC takes place annually toward the end of the year, many nations have just weathered the season when cyclones, hurricanes, or typhoons have been most active. After the annual UN climate negotiations, if one is listening to what is being presented by representatives of individual nations and UN cluster groups, one comes away with a visceral sense of climate change impacts worldwide. But one would never know about this larger context if one read the papers.

As to the US and China, many nations believe that the US, given its historical responsibility for producing CO₂ emissions and given its current per capita rates at more than twice China's amount (in 2021: US, 15.53 tons; China, 6.59 tons), should lead the way.¹³ The US thinks China, which is currently the biggest producer of CO₂ emissions, should do so (in 2021: US, 5.00 billion tons; China, 9.04 billion tons).¹⁴ China and other nations often counter that China's CO₂ emissions are high because of the products it produces and ships to the US (per capita rates). That debate continues.¹⁵

So, too, does the increase in CO₂ emissions and thus of global warming and therefore of sea level rise and, in turn, the impacts on low-lying island nations. Climate models take into account both air and water temperature, but much of the discourse on global warming tends to focus on air temperature and on keeping it from increasing more than 2.0°C (3.6°F). Yet Tony De Brum, the late former foreign minister for the Republic of the Marshall Islands, and other island nations advocate “1.5 to Stay Alive” or “1.5 to Thrive.” For many Pacific Island nations—such as the Marshall Islands, which on average sit no more than 2 meters (6.56 feet) above sea level—a 2.0°C (3.6°F) increase would be what they refer to as a “death warrant,” so they advocate a maximum increase of 1.5°C (2.7°F).

Sea levels rise mainly as a result of two factors, each created by global warming. First, increased ocean temperatures lead to thermal expansion: that is, when water heats up, it expands. Warmer

13. Kindest thanks to Lucia Green-Weiskel for helpful exchanges about the US and China with regard to the UN climate negotiations that help inform this paragraph.

14. “Emissions Database for Global Atmospheric Research,” European Commission; “CO₂ Emissions from Fuel Combustion,” IEA Atlas of Energy; “Statistical Review of World Energy 2021,” BP; “Each Country’s Share of CO₂ Emissions,” Union of Concerned Scientists; and “Fossil CO₂ Emissions for All World Countries,” European Commission Joint Research Centre, 2020.

15. See Tina Gerhardt and Lucia Green-Weiskel, “Obama Admin Takes Aim at China’s Renewable Energy Subsidies,” *Grist.org*, December 29, 2010; and Tina Gerhardt and Lucia Green-Weiskel, “Sputnik Moment: Historic Meetings between US and China May Spur a Clean Energy Race,” *Grist.org*, January 17, 2011.

oceans take up more space. Second, melting land ice creates higher sea levels. Land ice includes ice sheets (or glaciers) and ice caps in Antarctica and Greenland. Melting in the cryosphere will add intensely to sea level rise. Greenland alone is estimated to contribute about 20 percent of sea level rise.

The most reliable scientific research to forecast climate change and related global effects, such as sea level rise, comes from the United Nations IPCC. Established in 1988 by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO), the IPCC gathers and reports the science related to climate change and its effects. This science is intended to provide a basis for what in UN speak are called mitigation and adaptation plans. In other words, how does a nation plan to mitigate? That is, to limit climate change impacts? Reduce CO₂ emissions? How does it plan to adapt, for example, to sea level rise? Managed retreat?

The current IPCC report is the Sixth Assessment Report (AR6) published in 2021.¹⁶ The report puts together four different scenarios, ranging from a very low greenhouse gas (GHG) emissions scenario, to a low, to an intermediate, to a very high GHG emissions scenario. On a very high GHG emissions scenario, the IPCC predicts 0.63–1.01 meters (2.06–3.31 feet) of sea level rise by 2100. Under the most extreme emissions scenario, sea level rise could reach 2 meters (6.56 feet) by the century's end. The IPCC estimates are known to be quite conservative.

In February of 2018, the *Proceedings of the National Academy of Sciences* released a report stating that the melting in Greenland is accelerating and could lead to twice as much sea level rise as previously thought—that is, up from 1 meter (3 feet) by the century's end to over 2 meters (6.56 feet) by the century's end. In December 2018, a report published in *Nature* revealed that runoff from Greenland's ice sheets is about 50 percent higher than preindustrial levels. Also in 2018, a study published in *Nature Geoscience* found that ice sheets in Antarctica are melting away at their base, which had not been detected because it is below the sea surface, and could soon overtake Greenland to become the biggest source of sea level rise.¹⁷ Research conducted by the Institute for Climate Impact Research and published in the *Proceedings of the National Academy of Sciences* in June 2019 stated: “We find that a global total SLR [sea level rise] exceeding 2 m by 2100 lies within the 90% uncertainty bounds for a high emission scenario. This is more than twice the upper value put forward by the Intergovernmental Panel on Climate Change in the Fifth Assessment Report.”¹⁸

Moreover, sea level rise varies by location.¹⁹ For example, according to the California Coastal Commission and its 2018 update *State of California Sea-Level Rise Guidance*, “California will be

16. Intergovernmental Panel on Climate Change, Sixth Assessment Report, August 7, 2021. www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Full_Report.pdf. Information about the results of the high emissions scenario appears on page 29 of the report.

17. Hannes Konrad, et al., “Net Retreat of Antarctic Glacier Grounding Lines,” *Nature Geoscience* (2018). DOI:10.1038/s41561-018-0082-z.

18. Jonathan L. Bamber, et al., “Contributions to Future Sea-Level Rise from Structured Expert Judgment,” *Proceedings of the National Academy of Sciences* 116.23 (June 4, 2019): 11195–11200.

19. Rebecca Hersher, “Why Sea Level Rise Varies across the World,” *All Things Considered*, NPR, August 20, 2019.

greatly impacted by sea level rise. San Francisco is projected to see a rise between 1.1 [0.33 meter] and 2.7 feet [0.85 meter] by 2050. By 2100, San Francisco could experience between 2.4 and 6.9 feet [0.073 and 2.1 meters] of sea level rise, depending on how strongly we curtail our use of fossil fuels, with a potential for more than 10 feet [3.04 meters] of rise if there is extreme melting of the West Antarctic ice sheet.” As California Coastal Commissioner Donne Brownsey said in an interview, “We don’t have as much time as we think.” Sea level rise is “accelerating. Every year we find out our estimates were too conservative.”²⁰

Tools for checking predicted sea level rise for different locations are available online through Climate Central’s Surging Seas site and the Sea Level Rise Viewer of the US’s National Oceanic and Atmospheric Administration (NOAA). The latter only covers the US and its territories. For that reason, this book generalizes the IPCC data to say 1 foot (0.3 meter) by 2050 and 3 feet (0.91 meter) of sea level rise predicted by 2100. For a handful of islands (particularly those nearest the equator in the western Pacific Ocean), the numbers predicted in the IPCC report are slightly higher due to a combination of factors that will be discussed throughout the atlas. It is important to note that all of the numbers used in this book rest on the conservative end of possible predictions, so the reality of sea level rise could in fact be a lot more grave than what is shown on these maps (for more, see “Mapping Choices” in this introduction).

Climate change is, of course, not merely an issue. It is a framework that encompasses all else. It is the lens through which to see all else. That is, it is food (fish, produce). It is housing. It is health care. It is education. It is employment. It is transportation. Each one of these issues interfaces with global warming. Underpinning this atlas is a question: If climate change necessitates a radical retooling of our economies and infrastructures, why not do so in a way that deals not only with the climate threat but also with social justice, economic justice, and racial justice, in a way that ensures environmental justice. Opportunities to do so appear throughout the atlas.

ISLANDS—WHAT’S YOUR CENTER?

Narrative vantage point is everything. Vacation on an island and you will have one experience. Live on an island and you will have another experience. Being from and living on an island is yet an altogether different thing. And being from an island and being diasporic is yet another thing.

A vacation on the island will doubtless conjure up and confirm the images mentioned at the outset. These are images created and stoked by centuries of travel writing, films, and the tourism industry. “Oh my god! It must be *so* great to live there!” exclaim those who have never visited but have an image fully formed or quickly forming in their head.

20. Anne C. Mulkern, “Local and States Officials Clash on ‘Managed Retreat,’” *E&E News*, July 15, 2019.

Live on an island and you will have another impression. The high cost of food. Why? Because most of it has to be shipped in. On some islands much of the land has been given over to the use of military bases or to tourism, often the two main industries or employers. One realizes the food insecurity when shipments only come in twice a week. Or the island might rely on subsistence agriculture and fishing. What happens to it when the land for the agriculture decreases? When sea surge salinizes the soil, challenging agriculture? When ocean temperatures rise and together with overfishing deplete fish stocks? What happens to food security when a hurricane, typhoon, or tropical storm passes through the ocean?

The high cost of housing. Why? Because housing often sits empty for seasonal tourists either as second homes or as timeshares. Because the occupying military on some islands, such as Hawai'i has run out of housing for its troops and now cuts into and competes on the local real estate market.²¹ But the hourly wage of the locals cannot compete with the housing allowances members of the military receive. The higher cost also results from a limited amount of land on which housing can be built given an island space, compounded by land gobbled up by the aforementioned two industries: the military and tourism.

The high cost of energy bills. Why? Because often the energy source is oil. Even for electricity. Again, it is shipped in. Because the use of fossil fuels tethers an island more to an occupying force. Because many islands do not have the economic resources to transition to renewable energy. The challenge for a just energy transition is often not the technology but the capital. One realizes the energy insecurity.

Being from an island is yet another altogether different thing. It is the aforementioned and more. In terms of housing, in overpriced housing markets, such as Hawai'i, Native Hawaiians and Pacific Islanders constitute a disproportionate number of the homeless.²² In terms of food, one realizes that the food that is shipped in is not as healthy as eating the local fish and produce one's grandparents once did, which would also reduce CO₂ emissions. Obesity rates run high for Pacific Islanders. According to the World Health Organization, of the top ten most obese countries or territories globally, nine are Pacific Islands.²³ Consequently, rates of diabetes are also high among Pacific Islanders.²⁴ One reason: instead of traditional diets of fresh fish, vegetables, and fruits, the diet now consists of canned foods, highly processed meat, and sugary soft drinks.²⁵

21. Brenton Awa, "How the Military Impacts Rent Prices in Hawai'i," KITV, February 23, 2017.

22. Mahealani Richardson, "Count Shows Homelessness Down, but the Number of Unsheltered Homeless Swells," *Hawaii News Now*, May 25, 2019.

23. Meera Senthilingam, "How Paradise Became Fat," *CNN*, May 1, 2015.

24. See the article by Samoan poet Sia Figiel, "Diabetes Took My Teeth but Not My Life," *CNN*, February 21, 2014.

25. See Craig Santos Perez, "Spam's Carbon Footprint," *Prairie Schooner* 90.4 (Winter 2016): 12–16.