

Climate Change Impacts on Hawaii

By Henry Kwong

THE ALOHA state of Hawaii is located in the middle of the Pacific Ocean, approximately 2,600 miles west of California. As the only state in the United States that is an island, Hawaii is unquestionably vulnerable to changes in climate. Like many islands across the world, Hawaii is susceptible to sea level rises, coastal flooding and a whole host of other impacts caused by climate change. According to the global climate change report on the United States (U.S. climate change report), islands have been experiencing rising air temperatures and sea levels in recent decades. Scientific evidence strongly suggests that these trends are very likely to continue into the foreseeable future.

According to the U.S. climate change report, small islands are considered among the most vulnerable to climate change because extreme events have major impacts on them. Changes in weather patterns and the frequency and intensity of extreme events, sea-level rise, coastal erosion, coral reef bleaching, ocean acidification, and contamination of freshwater resources by salt water are among the impacts small islands face. In addition, the availability of freshwater is likely to be reduced, with significant implications for island communities, economies, and resources.

Climate change and global warming are likely to have adverse potential impacts on Hawaii's environment, health, economy and natural resources. Sea-level rise explains the disappearance of Whale Skate Island, a small island formerly located in Hawaii's northwest region.¹ Its disappearance wiped out habitats for birds, turtles and other fish and wildlife. In general, the Northwestern Hawaiian Islands, which are low-lying and therefore at great risk from increasing sea levels, have a high concentration of endangered and threatened species, some of which exist nowhere else. The loss of nesting and nursing habitats is expected to threaten the survival of already vulnerable species, and unusually high temperatures and increased frequency of heat waves could very likely lead to a rise in heat-related deaths, particularly among the elderly, in a situation similar to what befell Europe in 2003, when several thousands more died above normal death rates.²

The scientific evidence for sea-level rise is strong and unequivocal. As the U.S. climate change report indicates, "Recent global sea-level rise has been caused by the warming-induced expansion of the oceans, accelerated melting of most of the world's

glaciers, and loss of ice on the Greenland and Antarctic ice sheets. A warming global climate will cause further sea-level rise over this century and beyond."³ Based upon data furnished at a presentation given at a National Oceanic and Atmospheric Administration (NOAA) meeting in San Francisco, sea levels are projected to rise three feet along the coast of Oahu during the rest of this century due to global warming.⁴ Clearly, islands and other low-lying coastal areas will face increased risk from coastal inundation due to sea-level rise and storm surge, with major consequences for coastal communities, infrastructure, natural habitats, and resources.

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Generally, Hawaii's beaches are not subject to any significant erosion thanks to coral reefs, which act as barriers to incoming waves. With documented warming of the seas, coral reefs will be subject to adverse environmental conditions which are harming their ecosystems, growth and sustainability. Without the protective quality of these coral reefs, which are the source of the island's white, sandy beaches, Hawaii's coastline will very likely undergo erosion over time. According to Next Generation Earth, a group associated with the Earth Institute at Columbia University, the cost of replenishing these beaches to prevent sea-level rise will range anywhere from \$350 million to \$6 billion.⁵ Based upon a study issued by NOAA along with several other government and research agencies, ocean water temperature increases are expected to amplify the frequency and severity of coral-bleaching events.⁶ Most of Hawaii's coral reefs are in fair to good condition, but this status will change for the worse if effective ecosystem management measures are not taken.

According to a United States Geological Survey report, warmer temperatures in Hawaii are having adverse effects on native bird species.⁷ Warmer temperatures expand the range of mosquitoes into higher mountain elevations. For birds such as the honeycreeper that live in higher, cooler mountain refuges, this will introduce new stresses and disease vectors into their environment. Without resistance to malaria, honeycreeper birds in their current habitats may face extinction as a result of the spread of mosquitoes and mosquito bites. As ecosystems move and change, other diseases are likely to migrate into regions of warmer temperature. Saving the honeycreepers and other bird species will require active environmental management of those areas they currently inhabit and the elimination or containment of mosquito populations.

Climate change impacts in Hawaii have an economic dimension with effects felt in the tourism industry and fisheries trade. As the U.S. climate change report notes, “coral reefs sustain fisheries and tourism, have biodiversity value, scientific and educational value, and form natural protection against wave erosion. For Hawaii alone, net benefits of reefs to the economy are estimated at \$360 million annually, and the overall asset value is conservatively estimated to be nearly \$10 billion.”⁸ Although further evidence is necessary, warmer seas may also promote toxic algae, leading to harmful algae blooms known as red tides. These blooms are toxic to habitat and shellfish nurseries as well as humans. In addition, clean-up costs must be taken into consideration.

Any environmental problems or disasters may have a net negative effect on Hawaii’s tourism industry, as tourists will be dissuaded from visiting an unstable, environmentally risky destination. In 2008, over 6.8 million visitors came to Hawaii and spent \$11.4 billion,⁹ which accounted for 18% of Hawaii’s gross domestic product.¹⁰ Sea-level rises and flooding contribute to submergence of beaches, and that will be a factor Hawaii policymakers must grapple with in planning the future of Hawaiian tourism. In recent decades, as sea levels have risen and more beaches have overflowed with seawater, more sea walls have been built along the famous Waikiki beachfront to stem the rise in ocean levels. As a possible consequence, many affected parts of the islands may experience declines in real estate values.

Unlike many small, developing island nations, as part of the United States, Hawaii has the capacity and resources to mount a credible defense against environmental impacts caused by climate change. Hawaii has exhibited foresight in anticipating climate change impacts. In 1998, the state issued a lengthy

report on the effects of climate change on the islands. Recommendations and action plans to improve energy efficiency and reduce greenhouse gas emissions over a broad range of industries were included in the report.¹¹ Hawaii is proactive and has positioned itself to combat climate change and reduce greenhouse gas emissions.

In 2007, Hawaii enacted “A Global Warming Solutions Act 234” to cap greenhouse gas emissions to the 1990 level by 2020.¹² In 2008, Hawaii launched a Clean Energy Initiative with the goal of creating a 70 percent clean-energy economy within a generation.¹³ As a result of its location and lack of fossil fuel resources, Hawaii is the most oil-dependent state in the nation, getting 90 percent of its energy needs from imported oil.¹⁴ In a memorandum of understanding signed in 2008, the Department of Energy (DOE) will assist Hawaii to achieve the goal of reducing its dependence on oil for electricity generation.¹⁵

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Hawaii has at its disposal a plethora of renewable energy options to transition to a renewable energy economy including biomass, hydro, wind, geothermal, ocean waves and, of course, solar. In its favor, Hawaii emits only 0.4 percent of the total U.S. greenhouse gas emissions and is therefore one of the lowest state emitters in the country.¹⁶ Hawaii is also part of the EPA’s Clean Energy State Partnership Initiative to support the introduction and use of clean, renewable energy. The Sierra Club reports that Hawaii also recently imposed a \$1 surcharge on each barrel of oil imported into the state. Funds collected here will be earmarked for the development of clean, renewable energy. Last but not least, the Governor of Hawaii, Linda Lingle, recently signed an energy bill into law mandating that 25 percent of Hawaii’s electricity must come from renewable energy sources by 2020 and 40 percent by 2030.¹⁷

The scientific evidence for climate change in Hawaii is strong. Rising sea levels and temperatures are increasingly affecting coastal areas, natural habitats, and will potentially have harmful effects on human health and the economy. To spotlight the severity of the problem with climate change and rising sea levels, the President of the Maldives, Mohamed Nasheen, recently conducted an underwater cabinet meeting to point out one possible future scenario for island nations if little or no action is taken to deal with climate change.¹⁸ With foresight and planning,

Hawaii is taking appropriate steps to adapt to changing conditions, strengthen its natural defenses and mitigate future climate troubles. It is highly unlikely that Hawaii would have to take the astonishing step of performing an instance of official government business underwater like the Maldives to bring awareness of the issue to a wider global audience. Given its global impact, the warming of the oceans and other climate changes are obviously beyond the sole control of the state and will present continuous challenges well into the foreseeable future. In this sense, Hawaii shares vulnerability with other small island nations in that its environmental resilience and destiny is as much determined by its own actions as it is dependent upon the actions of others in other parts of the world.

Henry Kwong grew up in Queens and has lived in New York City most of his life. A graduate of Brown University, he has lived and traveled in Britain, Canada and China. Henry has worked at the U.S. Attorney's Office where he assisted on several successful criminal cases and trials. Before attending NYU, Henry worked at Prudential, where he managed a portfolio of the company's domestic and international trademarks, domain names and intellectual property matters.

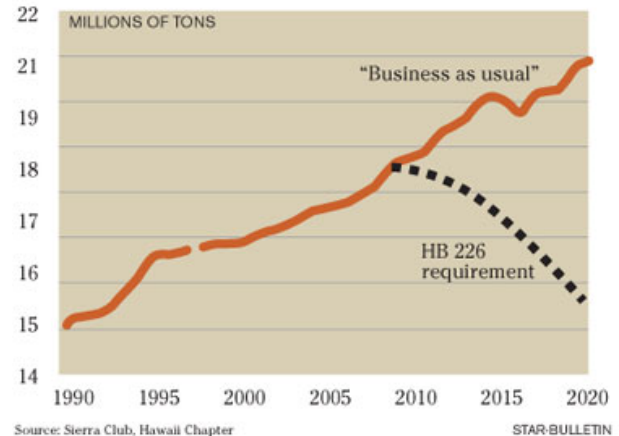
Through New York Cares and other organizations, Henry has volunteered on many projects to improve the lives and communities of New York City residents. Henry's academic interests are in energy and the environment and the private sector.

An enthusiastic sports participant, Henry can often be found on softball fields having fun and enjoying the sun during warmer months.

Appendix 1

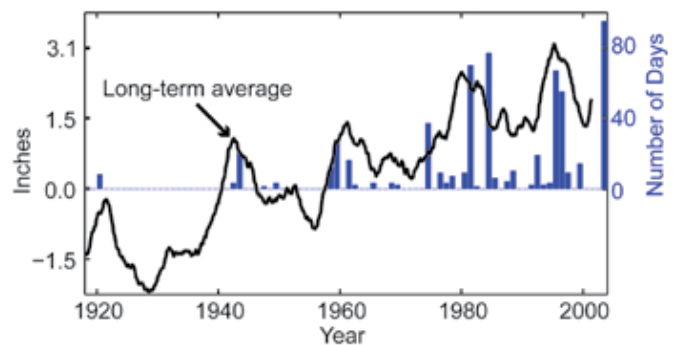
HAWAII'S ANNUAL GREENHOUSE GAS EMISSIONS

According to state estimates, Hawaii's greenhouse gas emissions could reach 25 million tons annually by 2020 if current trends continue. The Global Warming Solutions Act will require roughly a 15 percent decrease in greenhouse gases currently emitted statewide.



Appendix 2

Severe Sea Level Days – Honolulu, Hawaii



Source: Global Climate Change Impacts in the United States

¹ Jaymes Song, "Global warming threatens island species," *Honolulu Star-Bulletin*, May 3, 2004 <http://archives.starbulletin.com/2004/05/03/news/story3.html>. (accessed November 28, 2009).

² United Nations Environment Programme Environment Alert Bulletin, "Impacts of Summer 2003 Heat Wave in Europe," March 2004.

³ Thomas R. Karl, Jerry M. Melillo, and Thomas C. Peterson, (eds.), *Global Climate Change Impacts in the*

United States, U. S. Global Change Research Program (Cambridge University Press, 2009), p. 37.

⁴ Marnie Meyer, "Climate Change Adaptation Activities in Hawaii," National Oceanic and Atmospheric Administration, Western Coastal Managers Meeting 2009, San Francisco, January 26, 2009.

⁵ "Climate Change in Hawaii," Next Generation Earth, <http://www.nextgenerationearth.org/contents/view/19> (accessed November 28, 2009).

⁶ Alan Friedlander, et al., "The State of Coral Reef Ecosystems of the Main Hawaiian Islands," National

Oceanic and Atmospheric Administration and others, 2008, p. 3

<http://ccma.nos.noaa.gov/ecosystems/coralreef/coral2008/pdf/Hawaii.pdf> (accessed November 28, 2009).

⁷ United States Geological Survey, "Climate Change Threatens Endangered Honeycreeper Birds of Hawaii," *ScienceDaily*, May 27, 2009

<http://www.sciencedaily.com/releases/2009/05/090526140840.htm> (accessed November 28, 2009).

⁸ Karl, et al., p. 148.

⁹ State of Hawaii, Department of Business, Economic Development & Tourism 2008 annual visitor research report, p. 12.

¹⁰ State of Hawaii, Department of Business, Economic Development & Tourism, http://hawaii.gov/dbedt/info/economic/data_reports/qser/outlook-economy (accessed November 28, 2009).

¹¹ "Hawaii Climate Change Action Plan," State of Hawaii, Department of Business, Economic Development & Tourism, Energy, Resources, and Technology Division and Department of Health. November 1998.

¹² State of Hawaii, Department of Business, Economic Development & Tourism, <http://hawaii.gov/dbedt/info/energy/greenhouse/> (accessed November 28, 2009).

¹³ Hawaii Clean Energy Initiative, <http://www.hawaiicleanenergyinitiative.org/>.

¹⁴ State of Hawaii, Department of Business, Economic Development & Tourism, <http://hawaii.gov/dbedt/info/energy/> (accessed November 28, 2009).

¹⁵ State of Hawaii, Department of Business, Economic Development & Tourism, <http://hawaii.gov/dbedt/info/energy/hcei/> (accessed November 28, 2009).

¹⁶ Energy Information Administration, http://tonto.eia.doe.gov/state/state_energy_profiles.cfm?id=HI (accessed November 28, 2009).

¹⁷ "Lingle signs trio of alternative energy bills into law," *Honolulu Star Bulletin*, June 28, 2009 http://www.starbulletin.com/news/20090629_Lingle_signs_trio_of_alternative-energy_bills_into_law.html (accessed November 28, 2009).

¹⁸ BBC News, "Maldives cabinet makes a splash," October 17, 2009, http://news.bbc.co.uk/2/hi/south_asia/8311838.stm (accessed November 28, 2009).