

**REPORT TO THE  
TWENTY-EIGHTH LEGISLATURE  
STATE OF HAWAII  
2016**

**PURSUANT TO HOUSE CONCURRENT RESOLUTION 108, SD1:  
Requesting the convening of a climate change and health working group to assess  
the scope and risks of climate change on the health of Hawai'i's residents and to  
develop a strategic plan to address climate change risks to health statewide.**

**2015 Preliminary Report and Recommendations from the Hawai'i Climate Change  
& Health Working Group**

**PREPARED BY  
DEPARTMENT OF HEALTH  
STATE OF HAWAII  
DECEMBER 2015**

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## **Foreword: Letter of Transmittal from DOH Director introducing Hawai'i Climate Change & Health Working Group report and recommendations**

Aloha Speaker Souki, President Kouchi, Members of the 28<sup>th</sup> Hawaii State Legislature, and Community Stakeholders;

The co-chairs and members of the Climate Change and Health Working Group, pursuant to House Concurrent Resolution 108, Session Laws of Hawaii (SLH) 2015, are pleased to submit preliminary report and recommendations.

Hawai'i has included climate change on its state policy agenda for several years, and has produced to date a number of initiatives, including the *Hawai'i State Green Growth (HGG)* and *Aloha Plus Challenge Initiative*, Act 83 SLH 2014 (the *Hawai'i Climate Adaption Initiative Act*) and Act 286 SLH 2012, which amended Chapter 226, Hawaii Revised Statutes, the State Planning Act, to incorporate climate adaption into county and state actions.

Health has been referenced in these initiatives, but the increasing global, national and regional evidence relating to the potentially catastrophic connections between climate change and its impact on health has brought increasing attention to and concern about this specific subset of climate change impacts. Our Hawai'i public health community has conveyed concerns about these potential impacts, but up until this time, has not had the opportunity or the mechanism to address them.

Climate change is not currently Hawai'i's most evident public health issue, but it is increasingly clear that climate change's influence and impacts are likely to adversely affect the health and well-being of our residents and will likely make our existing health priority challenges more problematic to address. The Hawai'i Climate Change & Health Working Group was convened to help the State consider and plan for the impacts of climate change on population-based human health and well-being.

An effort to address climate change and health will not be possible without significant public and private sector collaboration. The Working Group would like to acknowledge our fifteen knowledgeable and diverse Hawai'i Climate Change & Health Working Group members for volunteering their time and expertise to support our efforts to bring the issues to the table for review and discussion. We also wish to acknowledge the leadership of the Hawai'i Public Health Association for its role in co-leading this process from its inception and for assisting us to provide support to address this important public health issue. Finally, we would like to acknowledge Hawai'i House Health Committee Chair, Representative Della Au-Belatti, for her and her staff's logistical support throughout this initial working group process.

We look forward to sharing these preliminary findings and recommendations with the 2016 Legislature and other major stakeholders. The Hawai'i Climate Change and Health Working Group will continue to meet in the coming months to further gather related

updated/new information, process it and further define recommended actions and steps for Hawai'i's future health.

## **Executive Summary:**

Hawai‘i has addressed climate change on its State policy agenda for several years via initiatives such as *Hawai‘i State Green Growth (HGG)* and *Aloha Plus Challenge Initiative*, the *Hawai‘i Climate Adaption Initiative Act (Act 83)*, and Act 286, HRS 226-109.

The increasing global, national and regional scientific evidence relating to the connections between climate change and health requires more attention to and concern about this specific subset of climate change impacts. Climate change is not currently Hawai‘i’s most visible public health issue, but it is increasingly clear that its influence and impacts will adversely affect the health and well-being of our residents and will make our health priority challenges increasingly more problematic to address.

The Hawai‘i Climate Change & Health Working Group was initially convened in August of 2015 (HCR 108, SD1) to help the State consider and plan for the impacts of climate change on population-based human health and well-being and has developed some preliminary findings and recommendations for policymaker consideration. The Working Group intends to develop more specific climate change and health recommendations in the coming months of 2016 as well.

Climate change, together with other natural and human-made health stressors, influences human health and disease in numerous ways. Some existing health threats will intensify and new health threats will emerge. Potential health-related impacts include; respiratory and cardiac problems, heat-related morbidity and mortality, cancer risks, mental health related impacts, vector, food and water borne diseases and nutritional/food and water security issues.

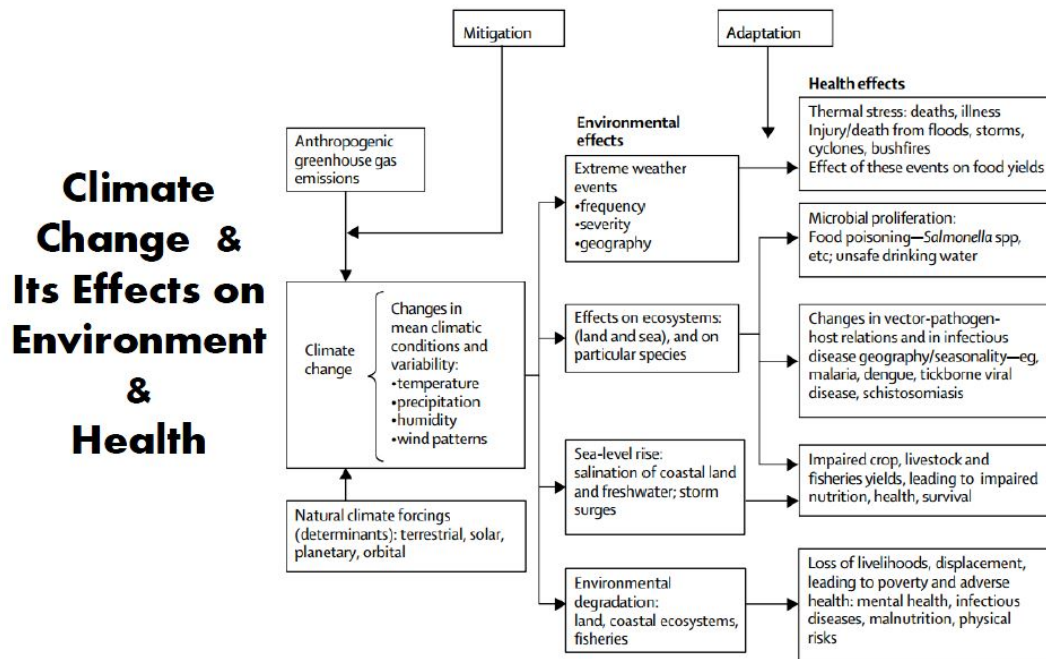
The Hawai‘i Climate Change and Health Working Group recommends attention be given to the following three priority areas, with specific recommendations for each:

1. A major focus for health should be on comprehensive and coordinated adaptation strategies by Hawai‘i’s public health system and related services, engaging scientists/researchers, planners, and policymakers to support our populations’ adaptation to changing environmental challenges and conditions.
2. The Hawai‘i State Department of Health should have increased dedicated fiscal and personnel resources to lead efforts addressing development of climate change and health issues
3. Protections against both infectious and chronic climate-associated disease threats should be strengthened.

## Chapter 1: Introduction: to climate change and health in Hawai‘i, the Pacific and globally; the interaction between climate and health

Climate change affects our environment and natural resources, and directly and indirectly impacts on our health in many ways, such as;

- Warmer temperatures that can increase the frequency, intensity, and duration of heat waves, which can pose health risks, particularly for young children and the elderly.
- Worsening air and water quality that can increase the spread of certain diseases and alter the frequency or intensity of extreme weather events.
- Rising sea levels which can threaten coastal communities and the ecosystems on which they depend.
- Changes in the patterns and amount of rainfall, as well as changes in the timing and amount of stream flow, can affect crucial water supplies and water quality.
- Changing ecosystems that influence the geographic ranges of many plant and animal species and the timing of their lifecycle events, such as migration and reproduction.
- Increases in the frequency and intensity of extreme weather events, such as heat waves, droughts, and floods that can cause morbidity and mortality.



McMichael, Anthony J., Rosalie E. Woodruff, and Simon Hales. "Climate change and human health: present and future risks." *The Lancet* 367.9513 (2006): 859-869.

## **Climate change is real and is the result of human activity.**

According to the United Nations' Intergovernmental Panel on Climate Change (IPCC 2007), climate change is, "a change in the state of the climate that can be identified (e.g., using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or as a result of human activity."<sup>1</sup>

Since the industrial age, our climate has been changing in unprecedented ways. The chemical composition of the atmosphere is in flux, mostly due to human emission of greenhouse gases that contribute to excessive global warming (IPCC 2007, 2013). While warming of the Earth's ocean and air are at the heart of global climate change, the effects of this change are not limited to warming—they include a multitude of complex and often compounding feedback mechanisms and localized changes to Earth's natural systems that extend from pole to tropics.<sup>2</sup>

Increasing greenhouse gas concentrations observed in recent decades drive changes in a variety of Earth's systems. Global average ocean and air temperatures have been increasing; precipitation patterns have been changing; snow cover and ice sheets have been melting; the oceans have been acidifying; and global sea levels have been rising at accelerated rates.

The globe is experiencing climate change at a rate that is unprecedented, based on the paleo-climate records. These changes are attributed in large part to the burning of fossil fuels and the resultant release of carbon dioxide. Carbon dioxide is a greenhouse gas, that, in increasing concentrations, has a net warming effect on the air and ocean temperatures. As the planet warms, there are a number of effects and indicators. For the Pacific, these include: rising sea level, ocean acidification, and changing rainfall, wind, wave and storm patterns. These changes and many others impact water, agriculture, and species distribution including fisheries, which in turn affects the quality of life, food security, and overall health of the population in the region.<sup>3</sup>

While there is near-universal scientific consensus that significant climate change is occurring, there is less confidence on the future rates of climate changes and the net results. There is a range in the scientific projections, depending on the level of carbon dioxide projected and the net impact of that concentration and other greenhouse gases, such as methane. Future predictions seem mixed, but it is conceivable that globally we

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<sup>1</sup> Climate Change Impacts in Hawai'i- *A summary of climate change and its impacts to Hawai'i's ecosystems and communities*. University of Hawai'i at Manoa Sea Grant College Program. June 2014.

<sup>2</sup> Climate Change Impacts in Hawai'i- *A summary of climate change and its impacts to Hawai'i's ecosystems and communities*. University of Hawai'i at Manoa Sea Grant College Program. June 2014.

<sup>3</sup> [http://www.cakex.org/sites/default/files/documents/NCA-PIRCA-FINAL-int-print-1.13-web.form\\_.pdf](http://www.cakex.org/sites/default/files/documents/NCA-PIRCA-FINAL-int-print-1.13-web.form_.pdf)

will experience a net rise in air temperature of 2 degrees Celsius (3.6 degrees Fahrenheit) and a rise in sea level in the 1 meter (3.3 feet) range by the year 2100.<sup>4</sup>

Different downscaling approaches have been to predict Hawaii's future climate trends. This is difficult, given the small size and extreme topography of the Hawaiian Islands. One model projects a range of near-surface temperature increases ranging from 1.2°C to 4.9°C by the end of 2100, with increases predicted in rainfall and tradewind inversion.<sup>5</sup> Other model results predict decreasing precipitation, with average rainfall likely to decrease over the 21<sup>st</sup> century with strong drying on the leeward sides of Kauai, Oahu, Maui and Hawai'i Island, and slight increases in rain in windward areas. Reduced rainfall may also occur if climate change increases the frequency of trade wind inversion or decreases its elevation.<sup>6</sup> Scientists are continuing to refine models for predicting climate change related weather changes for Hawai'i.

Any rise in sea level increases the net impacts associated with natural disasters, such as storm surges from tropical systems and tsunamis. While Hawai'i avoided a direct hit, an unprecedented 15 tropical cyclones developed this past hurricane season in the eastern and central Pacific, and it is likely that increased cyclone/hurricane activity will occur as the planet warms

Climate change will impact the coral reefs and coastal marine flora and fauna resulting generally decreased biodiversity. Increased temperatures and reduced precipitation in some areas will affect the terrestrial flora and change species ranges for animals and insects. Additional chemical composition and aerosol concentrations in the atmosphere will impact air quality and result in oceanic chemical composition changes, such as increased ocean acidification.

The impacts of climate change are not occurring in isolation along demographic and socioeconomic changes, such as increases in human populations, especially along the coasts. Moreover, modern industrial societies put added pressure on resources and contribute to enhancing greenhouse gas production. Given this complex dynamic, it is imperative to be prepared for the potential direct and indirect impacts of climate change for Hawai'i, including impacts, which directly or indirectly affect our health.

Globalization and larger scale regional migration will further exacerbate the occurrence and spread of diseases, as areas of the Pacific and Asia are projected to experience even

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<sup>4</sup> <http://science.nbcnews.com/news/2013/01/06/16369939-horrible-sea-level-rise-of-more-than-3-feet-plausible-by-2100-experts-say?lite>

<sup>5</sup> Alex Lauer, C. Zhang, O.L. Elison-Timm, Y. Wang and K. Hamilton 2013, Downscaling of Climate Change in the Hawaii Region Using CMIP5: On the Choice of the Forcing Fields, *J. of Climate* 26: 10006-10030.

<sup>6</sup> Elison-Timm, O., T. W. Giambelluca, and H. F. Diaz (2015), Statistical downscaling of rainfall changes in Hawai'i based on the CMIP5 globalmodel projections, *J. Geophys. Res. Atmos.*, 120, 92–112, doi:10.1002/2014JD022059.



greater impacts than Hawai‘i is expected to experience. These impacts may cause a few small island nations to become uninhabitable due to a myriad of impacts, including lack of fresh water, salt water intrusion making crops unsustainable, and coastal inundation due to sea level rise. Unknown numbers of these migrants may migrate to Hawai‘i and elsewhere to seek a more sustainable environment, and may add to resource stresses here, while also affecting the public health landscape. Hence, the public health system cannot only focus on Hawai‘i, but must take a larger regional and global perspective that accounts for our inter-connected societies.

“Pacific Island countries are among those most vulnerable to the effects of climate change. The projected increase in atmospheric and sea surface temperatures, changing rainfall patterns, prolonged drought periods, an increased frequency of extreme weather events, and rising sea levels will seriously impact the lives of Pacific Islanders. It is therefore crucial that Pacific Island communities are armed with the skills to respond knowledgeably, prudently and efficiently to these changes.”<sup>7</sup>

The “climate migrant” has captured increasing attention and is meant to denote the individuals and communities that the impacts of climate change—whether extreme precipitation, drought, or sea level rise—displace or force to relocate. The term holds no legal weight; nonetheless, there is an emerging phenomenon of climate-related events that appear to trigger relocation. This phenomenon is climate-induced migration and it is anticipated to increase in the coming decades.<sup>8</sup>

Developing research and much debate has focused on the relationship between climate and migration, though researchers widely recognize that a lack of clarity characterizes the climate-migration nexus. Climatic changes often act in concert with other socioeconomic and political factors to drive displacement. Environmental changes can generate health problems or food insecurity, and their role may be amplified when coupled with political, social, or economic tension. The large number of factors affecting the timing and scale of migration translates to high uncertainty and local variability. Indeed, the exact number of possible climate displaced individuals will remain elusive, as climate change may be an indirect cause of relocation for many who are on the move.

For Hawai‘i, it is important to consider the public health implications of migration, despite existing uncertainties. A look at the health outcomes of wider refugee populations during the early phases of displacement might foretell the impacts of climate-induced migration on public health. Negative impacts to maternal and child health, malnutrition, increased sexually transmitted infections, impacts to mental health resulting from pre- and post-displacement stressors, increased incidence of chronic diseases, and

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<sup>7</sup> Brunken, F., *Coping with Climate Change in the Pacific Island Region*, South Pacific Commission/ Dec. 2015.

<sup>8</sup> Burkett, M., *In Search of Refuge: Pacific Islands, Climate-Induced migration and the Legal Frontier*. Asia Pacific Issues, EWC, Jan 2011

infectious agents that can move with migrants and displaced populations are among the health issues that may accompany climate-induced migration. Lack of sufficient language services by health care providers as well as literacy and cultural concerns compound the challenges to migrants as well as the care systems of the receiving community.

Current migration from the Marshall Islands provides a relevant analogue for the ways in which the climate-migration-health intersect may impact on Hawai'i. Because of the wide range of health conditions that Marshall Islanders suffer from, including tuberculosis, diabetes, hypertension, thyroid tumors, alcoholism and depression, access to high quality and affordable health care already drives out-migration from the Marshalls to Hawai'i and the continental United States. Climate change could fuel that migration, impacting similarly-situated sending communities and, potentially, increasing the costs of service to additional at-risk populations in receiving communities in Hawai'i.

Hawai'i is experiencing climate change impacts in unique and region-specific ways. One example is that the rapid acceleration observed in globally averaged rates of sea-level rise (SLR) has not yet been observed in local sea-level data to date for Hawai'i, however, Oahu's daily temperature range is changing much more rapidly than the global mean. It is crucial to focus on the localized impact of climate change to adequately understand and prepare for the changes to come.<sup>9</sup>

The primary impacts by ecosystem to show the complex changes of climate change compounding in geographic areas, while recognizing that ecosystems are linked to one another so that some impacts are felt in multiple ecosystems, such as thermal stress, which affects the health of humans, corals, vegetation, and more.<sup>10</sup>

**There is consensus among U.S. scientists that human-caused climate change is happening.**

The National Aeronautics and Space Administration (NASA) reports that 97% or more of actively publishing climate scientists agree that climate-warming trends over the past century are very likely due to human activities. In addition, most of the leading scientific organizations worldwide have issued public statements supporting this position.<sup>11</sup>

The vast majority of climate scientists and peer-reviewed published papers, understand that the phenomenon known as "global warming" (warming of the upper 2,000 meters of

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<sup>9</sup> Climate Change Impacts in Hawai'i- *A summary of climate change and its impacts to Hawai'i's ecosystems and communities*. University of Hawai'i at Manoa Sea Grant College Program. June 2014.

<sup>10</sup> Climate Change Impacts in Hawai'i- *A summary of climate change and its impacts to Hawai'i's ecosystems and communities*. University of Hawai'i at Manoa Sea Grant College Program. June 2014.

<sup>11</sup> <http://climate.nasa.gov/scientific-consensus/>

the ocean, the sea surface, and that atmosphere at the surface of the land) is happening, and is caused by human greenhouse gas pollution.<sup>12</sup>

The global average temperature has increased by more than 1.5 F since the late 1800s. Some regions of the world have warmed by more than twice this amount. The buildup of greenhouse gases in our atmosphere and the warming of the planet are responsible for other changes such as:

- Changing temperature and precipitation patterns
- Increases in ocean temperatures, sea level and acidity
- Melting of glaciers and sea ice
- Changes in the frequency, intensity, and duration of extreme weather events
- Shifts in ecosystem characteristics, such as the length of the growing season, timing of flower blooms, and migration of birds
- Increasing threats to human health<sup>13</sup>

### **Climate change can be harmful to people.**

Hawai‘i is deemed to be at risk from climate changes that will affect nearly every aspect of life. Rising air and ocean temperatures, shifting rainfall patterns, changing frequencies and intensities of storms and drought, decreasing stream flows, rising sea levels, and changing ocean chemistry will threaten the sustainability of globally important and diverse ecosystems on land and in the oceans, as well as local communities, livelihoods, and cultures.

On most islands, increased temperatures coupled with decreased rainfall and increased drought will reduce the amount of freshwater available for drinking and crop irrigation. Rising sea levels will escalate the threat to coastal structures and property, groundwater reservoirs, harbor operations, airports, wastewater systems, shallow coral reefs, sea grass beds, intertidal flats, and other social, economic, and natural resources.<sup>14</sup>

Rising temperatures will enable mosquitoes carrying diseases like avian malaria to thrive at higher elevations. Economic impacts from tourism loss will be greatest on islands with more developed infrastructure. In Hawai‘i, for example, where tourism comprises 26% of the state’s economy, damage to tourism infrastructure and eco-systems, such as coral reefs, could have large economic impacts. The loss of Waikiki Beach alone could lead to an annual loss of \$2 billion in visitor expenditures, which can adversely affect workers’ abilities to support themselves and their families as a result.<sup>15</sup>

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<sup>12</sup> Anderegg W R L, Prall J W, Harold J and Schneider S H 2010 Expert credibility in climate change Proc. Natl Acad. Sci. USA 107 12107-9

<sup>13</sup> <http://www3.epa.gov/climatechange/science/overview.html>

<sup>14</sup> 2014 National Climate Assessment. U.S. Global Change Research Program.

<sup>15</sup> 2014 National Climate Assessment. U.S. Global Change Research Program.

Because Hawai‘i is 80-90% or more dependent on imported food, fuel, and material, the vulnerability of ports and airports to extreme events such as sea level rise and increasing wave heights, is of great concern. Climate change is also expected to have serious effects on human health, for example, by potentially contributing to an increase in dengue fever. In addition, sea level rise and flooding may overwhelm sewer systems and threaten public sanitation.<sup>16</sup>

The traditional lifestyles and cultures of indigenous communities in Hawai‘i and other Pacific islands will be seriously affected by climate change. Drought threatens traditional food sources such as taro and breadfruit, and coral death from warming-induced bleaching will threaten subsistence fisheries in island communities. Climate change impacts, coupled with socioeconomic or political motivations, may be challenging enough to cause some people to relocate to Hawai‘i. Depending on the scale and distance of migration, a variety of challenges face both the migrants and the communities receiving them.<sup>17</sup>

### **Climate Change Affects Health**

- There is currently an information gap in climate relevant health-related data and impacts, which makes it difficult to make objective evidence-based policy decisions.
- Freshwater water quality and quantity is limited and threatened
- Sea level rise, with increased coastal flooding and erosion
- Rising temperatures, causing increasing heat-related impacts due to dengue fever, increased mosquito habitat and new diseases
- Intense rainfall: Flooding, ponding with impacts on sewage and sanitation
- More frequent and intense wind, waves and storms
- Drought: Food security, sustainable development issues in prolonged drought areas
- Impacts tend to hit the most vulnerable populations first: climate-induced migrants<sup>18</sup>

According to the CDC, “Climate change, together with other natural and human-made health stressors, influences human health and disease in numerous ways. Some existing health threats will intensify and new health threats will emerge. Not everyone is equally at risk. In the U.S., public health can be affected by disruptions of physical, biological, and ecological systems, including disturbances originating here and elsewhere.

“The health effects of these disruptions include: increased respiratory and cardiovascular disease, injuries and premature deaths related to extreme weather events, changes in the

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<sup>16</sup> 2014 National Climate Assessment. U.S. Global Change Research Program.

<sup>17</sup> 2014 National Climate Assessment. U.S. Global Change Research Program.

<sup>18</sup> Pacific Islands Regional Climate Assessment Project (PIRCA), East West Center, 2014

prevalence and geographical distribution of food- and water-borne illnesses and other infectious diseases, and threats to mental health.”<sup>19</sup>

**Specific impacts and effects that climate change is anticipated to potentially have on Hawai‘i health, includes:**

**Asthma, Airway Diseases, & Respiratory Allergies**

Changes in trade winds, temperature, and precipitation may alter human exposure to pollen, molds, air pollution, aerosolized marine toxins, and dust, leading to increases in asthma, airway diseases, and allergies. Altered growing seasons would affect pollen, extreme or more frequent precipitation could promote mold growth, air pollution and aerosolized marine toxins, while drier conditions could increase dust in the air. Hawai‘i has a sizable population of people, both child and adult, with asthma, respiratory allergies and airway diseases, and this population is projected to be among those most adversely affected by climate changes that affect our air quality. Diminishing trade winds statewide will also cause more vog-related air quality impacts to occur more regularly as well.

**Heat-Related Morbidity & Mortality**

With increased temperatures, vulnerable populations of children or adults may face increased morbidity and mortality due to extreme heat and related illnesses such as heat exhaustion, heat stroke, cardiovascular and chronic kidney disease.<sup>20</sup>

**Cancer**

High temperatures/heat is projected to be more problematic for people who spend more time outdoors, are less likely to wear protective clothing and more at risk for sunburns, due to increased intensity of ultraviolet (UV) radiation. Higher temperatures are projected to increase risks for heat-related illnesses, as well as sunburn and skin cancer.

**Cardiovascular Disease & Stroke**

Increasing heat stress can exacerbate existing cardiovascular disease by increasing the body burden of airborne particulates, and changing the distribution of zoonotic vectors that cause infectious diseases linked with cardiovascular disease. People with cardiovascular disease are among the most susceptible to climate change due to the effects of air pollution and extreme heat.

**Mental Health and Displacement Impacts**

Changes to the predictability of the environment such as those brought about by climate change can impact at-risk or vulnerable populations suffering mental health or marginal living conditions. Impacts may include chronic disaster adjustment, heat-related violence, intergroup conflict, displacement and migration, reactions to impact disparities and decreased access to healthy ecosystems. The indirect impacts that may follow included

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<sup>19</sup> Climate Effects on Health: <http://www.cdc.gov/climateandhealth/effects/default.htm>

<sup>20</sup> National Resources Defense Council, 2014

anxiety, worry, depression, despair, grief, mourning, numbness, apathy, and vicarious psychological trauma.<sup>21</sup>

### **Vector-borne Disease**

The relationship between climate change (including changes in temperature, precipitation, risk of extreme weather events, rising sea levels) on vector ecology, pathogen development, intermediate host and human risk of disease is complex and mediated by multiple factors, including standards of living, public health infrastructure, travel patterns, and the ability of communities to apply adaptive measures.<sup>22</sup> Climate-associated impacts will likely have substantial changes on patterns of vector-borne disease. Precipitation changes from climate change will likewise, vary based on location and will have varying effects on the distribution of vectors. Additional research will be important to clarify the specific risks to the State of Hawai‘i and these risks will likely vary, depending on local conditions across the islands.

### **Food- and Water-borne Diseases**

Extreme precipitation events may compromise recreational and drinking water sources through increased runoff and compromise to sewage and drainage systems.<sup>23</sup> Runoff events increase the risk of contamination of agricultural land and the food supply.<sup>24</sup> Increased ocean temperatures have been associated with increased growth of waterborne pathogens such as those of the *Vibrio* genus, which can be transmitted to humans through consumption of contaminated seafood.<sup>25</sup> Increased temperatures can increase the growth of common foodborne pathogens and development of toxins.<sup>26</sup>

### **Nutrition** (staple food shortages, malnutrition).

Drought and extreme precipitation can affect crop productivity. Also, increased temperatures in the atmosphere and ocean likely will increase the risk of disaster. An estimated 85-90% of Hawai‘i’s food is imported, which makes the food supply unstable for the whole population due to disasters and events that disrupt shipping and food availability.<sup>27</sup> Even with adequate food supply, more Hawai‘i households are deemed food insecure, compared to the national average.

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<sup>21</sup> Doherty and Clayton, 2011

<sup>22</sup> Gubler, D.J., P. Reiter, K.L. Ebi, W. Yap, R. Nasci, and J.A. Patz, 2001: Climate Variability and Change in the United States: Potential Impacts on Vector- and Rodent-Borne Diseases. *Environmental Health Perspectives*, 109, 223-233

<sup>23</sup> Converse, R.R., M.F. Piehler, and R.T. Noble, 2011: Contrasts in concentrations and loads of conventional and alternative indicators of fecal contamination in coastal seawater. *Water Research*, 45, 5229-5240

<sup>24</sup> Castro-Ibanez, I.M., M.I. Gil, J.A. Tudela, and A. Allende, 2014: Microbial safety considerations of flooding in primary production of leafy greens: A case study. *Food Research International*, doi:10.1016/j.foodres.2014.05.065.

<sup>25</sup> Baker-Austin, C.J.A. Trinanés, N.G.H. Taylor, R. Hartnell, A. Siitonen, and J. Martínez-Urtaza, 2013: Emerging *Vibrio* risk at high latitudes in response to ocean warming. *Nature Climate Change*, 3, 73-77.

<sup>26</sup> Wu, F., D. Nhatnagar, T. Bui-Klimke, I. Carbone, R. Hellmich, G. Munkvold, P. Paul, G. Payne, and E. Takle, 2011: Climate change impacts on mycotoxin risks in US maize. *World Mycotoxin Journal*, 4, 79-93

<sup>27</sup> Hawaii Dept. of Business and Economic Development, 2012

## **Chapter 2: Background on Hawai‘i response to climate change and to health implications of climate change to date; the role of public health in climate change**

Public health is led in Hawai‘i by our Hawai‘i State Department of Health (DOH), with the mission to protect and improve the health and environment for all people in Hawai‘i and with the guiding philosophy that health, an optimal state of physical, mental, social, and environmental well-being, is a right and responsibility for all of Hawai‘i’s people. The Department of Health works in collaboration with many public and private sector partners to address this mission to provide the many population-based, prevention oriented and assurance of quality services for our State’s populations.<sup>28</sup>

In 2012, Hawai‘i’s State Legislature passed Act 286, HRS 226-109, which amended the State Planning Act to incorporate climate adaption into county and state planning and activities relating to transportation, agriculture, health and other public services areas (HSL 2012).

In 2014, Governor Abercrombie signed Bill HB 1714 for the Hawai‘i Climate Adaption Initiative Act 83 (HSL 2014), which established the Interagency Climate Adaptation Committee that was administratively attached to the Hawai‘i State Dept. of Land and Natural Resources (DLNR), in order to develop a statewide climate adaptation plan to protect the state’s economy, health, environment, and way of life. The Interagency Climate Adaptation Committee has committed to an initial focus on the impacts of sea level rise (SLR) in Hawai‘i.

As a relatively new visible stakeholder in the Hawai‘i climate change dialogue, the Hawai‘i Public Health Association (HPHA) is an affiliate of the national American Public Health Association (APHA), and has a 650 member association of community members, public health professionals and organizations statewide dedicated to improving public health. HPHA serves as a community voice for public health, as well as a repository for information about public health in the Pacific.

In 2013, HPHA’s Board began discussing the public health implications of climate change and its potential for impacts on health. In 2014, HPHA received a small grant from the American Public Health Association to establish and implement a public policy project, entitled *Health in All Policies* (HIAP), which was designed to increase Hawai‘i policy-level dialogue on climate change and its consequences on health outcomes. Following an HPHA climate change & health survey of HPHA public health membership in fall 2014, an informational briefing was held for interested stakeholders at the State Capitol to share information gathered to date on climate change and health in Hawai‘i. Approximately 58% of public health professionals responding to the Fall 2014 HPHA climate change & health survey were “very concerned” about the potential impacts of climate change and health on Hawai‘i residents, with 66% of those responding indicating that the impacts of climate change and health in Hawai‘i had received “little to no

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<sup>28</sup> <http://health.hawaii.gov/about/mission-statement/>

attention” to date. Few of those surveyed (less than 6%) felt that the impacts of climate change and health have received, “alot or too much attention”.

In Hawai‘i, it appears that our public health professionals want to help address climate change & health, but many of these workers feel that they lack the climate change and health expertise, knowledge and/or skills to do so. It seems clear that the public health community and its partners need to discuss these emerging/perceived threats in order to develop a more coordinated effective response to climate change and health. Public health professionals appear to be ready to step up and do their part, if provided appropriate education, skills and resources.

During Hawai‘i’s 2015 legislative session, two concurrent bills were introduced to address climate change and health: HB 591 and SB 882. Because of the health-related focus that was not the initial priority for the newly-established DLNR-led Climate Adaption Committee, a new approach to establishing climate change and health in the form of a resolution was undertaken. As a result, HCR 108, SD1, “Requesting the convening of a Hawai‘i Climate Change and Health Working Group by the Department of Health to assess the scope of risks of climate change on the health of Hawai‘i’s residents and to develop a strategic plan to address climate change risks to health statewide” was proposed and passed by the 2015 Hawai‘i Legislature.

The Hawai‘i Climate Change and Health Working Group was assembled and convened to help the State consider and plan for impacts from climate change on population-based human health and well-being. The Hawai‘i Climate Change & Health Working Group is a diverse working group of 15 invited members with the mission to discuss and review existing preliminary climate change & health information in order to help develop recommendations and steps that Hawai‘i can utilize to move forward with on addressing climate change adaptation.

The mission of this working group is to come up with preliminary major points & recommendations before the start of the 2016 legislative session, and to continue working on these ideas after the 2016 legislative session ends. Due to resource and time restrictions, no strategic plan for climate change and health was developed in 2015. This report and recommendations is instead focused primarily on information and resource gathering, as well as sharing preliminary information and recommendations in key areas of health impacts and climate change. One key goal for the future is to obtain climate change-dedicated resources for the Department of Health, so that it can address ongoing planning and development of climate change and health public health issues. Meetings held by the Hawai‘i Climate Change & Health Working Group to date have included:

**Meeting 1: Aug 20, 2015:** Focus: Introduction to Hawai‘i Climate Change & Health Working Group; overview of HCR108, SD1 and working group’s purpose; Climate change Hawai‘i activities; Developing, improving, integrating & maintaining state and regional disease surveillance systems and monitoring capacity to respond to health-related effects of climate change.



**Meeting 2: Sept. 17, 2015:** Focus: Water Safety, food safety, and vector-borne infectious diseases

**Meeting 3: Oct. 15, 2015:** Focus: Respiratory and pulmonary effects, including responses to air allergens; the health effects of air pollution, including heightened sensitivity to air pollution; Brief overview of the implications of climate change for the world and Hawai‘i; and the need for action on climate change

**Meeting 4: Nov. 19, 2015:** Focus: Cardiovascular effects and chronic disease surveillance; the U.S. Centers for Disease Control & Prevention (CDC) *Building Resilience Against Climate Effects* (BRACE) resources on climate adaptation.

**Meeting 5: Dec.17, 2015:** Focus: Report and Recommendations to the 2016 Hawai‘i Legislature and connections with the Hawai‘i State Green Growth (HGG) and Aloha Plus Challenge Initiative.

A poster describing the work of the Hawai‘i Climate Change & Health Working Group’s process and findings to date was developed and presented at the November 2015 American Public Health Association (APHA) meeting in Chicago, Illinois. The poster was well-received by those attending as a potential model for state response to climate change and health. The APHA has identified climate change as a key public health issue, and is a founding partner of *Climate for Health*, a network of health leaders committed to protecting the health and well-being of Americans and leading by example on a path to a positive future for climate solutions.<sup>29</sup>

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<sup>29</sup> <https://www.apha.org/topics-and-issues/climate-change>

### **Chapter 3: Preliminary Conclusions and Recommendations of the Hawai'i Climate Change & Health Working Group**

#### **Preliminary Key Conclusions from the Hawai'i Climate Change & Health Working Group:**

1. Climate change is now occurring and will continue for decades.
2. Climate change impacts will vary from location to location, including within Hawai'i (i.e. drought on leeward sides of islands).
3. Trends in observed climate variables include: increased average air temperatures, a decrease in trade wind days, sea level rise, decreased statewide rainfall, greater numbers of consecutive dry days, decreasing base flow in streams, decreasing habitat for native species, and declining coral reef health.
4. Projected climate change effects for Hawai'i are expected to include: Increased average air temperatures, more drought risk on leeward sides, flooding and damage to coastal infrastructure, increasing sea level rise, more intense wind, waves, storms and hurricanes.
5. The range of health issues that may increase or be intensified by climate change includes: airborne allergens, potential morbidity and mortality due to wildfires, temperature extremes, and precipitation extremes, as well as diseases carried by vectors, food and waterborne disease, along with water and food security issues.
6. Climate change is projected to increase and exacerbate already-existing public health problems, such as acute and chronic diseases, stress and mental health issues, dengue, other vector and waterborne diseases. A major challenge will be to identify, measure and analyze/interpret key health indicators to determine changing health trends that are attributable to climate change conditions.
7. Increased heat is projected to increase problems with air and respiratory and cardiac-affected populations, as well as increase risks for more heat-related illness and death: vector-borne (mosquitos), water-borne, and food-borne (food poisoning).
8. Disparities in health impacts are projected for already-vulnerable populations, such as elderly, poor, young, ill, marginalized populations, as well as specific at-risk groups such as workers exposed to increased heat and sun outdoor risks.
9. Freshwater and terrestrial natural resources may decrease in quality or availability, affecting access to clean water and available, affordable and nutritious food (Hawai'i depends on imported food to meet 80-90% or more of its food needs, and some key food-producing states like California are in an extended drought period affecting water and crop productivity).
10. Hawai'i has limited and fragile freshwater resources. Water scarcity may increase on leeward sides of all islands, along with sea level rise, affecting potential salinity of coastal wells, with possible water and crop access impacts.
11. Sanitation problems are projected to increase, with pumping stations becoming more overwhelmed and sewer systems flooded with potential for contamination-related illnesses, with beaches and oceans contaminated due to more brown water events.

12. Population crowding, due to less land and rising sea levels, is expected to worsen health conditions.
13. Mental health disorders and stress impacts are projected to increase, due to changing conditions and increasing long-term future adaptation required and potential mental distress associated with anxiety about impacts and fear of losing one's home.
14. Hawai'i's public health system is a conventional model which has challenges in meeting current needs. Climate change will require significant systemic adaptation in responding to emerging and future climate change-related public health challenges.
15. The Pacific region is already facing significant challenges due to climate change impacts, and it is anticipated that Hawai'i will play a major role in the climate change coordination response to these challenges.
16. Due to current resource constraints, no strategic plan for climate change & health is being developed at this time. There is currently focus on identifying key stakeholders, information and resource gathering as well as developing preliminary information and recommendations in key areas of health impacts due to climate change.

**Preliminary Key Recommendations from the Hawai'i Climate Change & Health Working Group:**

1. A major focus for health should be on comprehensive and coordinated adaptation strategies by Hawai'i's public health system and related services, engaging scientists/researchers, planners, and policymakers to support our populations' adaptation to changing environmental challenges and conditions. These strategies include:
  - Coordinating response planning among climate change stakeholders, such as the University of Hawai'i, climate change research organizations such as the Pacific Regional Integrated Sciences and Assessments (RISA) Program, epidemiologists, the Governor's Office, the Department of Defense, the Department of Land and Natural Resources, the Department of Human Services, the Department of Education, the Department of Agriculture, and the Department of Health.
  - Developing and implementing a multi-disciplinary collaborative approach health-in all-policies response to climate change that includes transportation, sustainability, agriculture, urban planning, education and health.
  - Inclusion of climate change and its projected effects on disaster preparation and emergency management in the Hawai'i State Hazard Mitigation Plan.

- Aligning climate change and health adaptation and mitigation coordination with the six targeted goals for the year 2030 via the Hawai‘i ALOHA Plus Challenge.
2. The Department of Health would benefit from increased dedicated fiscal and personnel resources to lead efforts addressing development of climate change and health public health issues, including:
- Identifying and hiring departmental key leads in climate change/environmental epidemiology and climate change health planning and coordination.
  - Providing the public health workforce with advanced information and skills training in adaptation-oriented public health preparedness and prevention planning.
  - Adequate resources to include several questions on climate change and health on the state health survey.
  - Implementing general and targeted public education and information initiatives on climate change connections, including more focused work with identified vulnerable and at-risk populations and communities; this should include statewide and county-specific heat event and heat-wave adaptation planning for, in particular, the elderly, those with chronic disease, children, and workers who are primarily working outdoors on a daily basis.
3. Protections against both infectious and chronic climate-associated disease threats should be strengthened by working to develop predictive capability through a cross-discipline and agency team, which identifies and links environmental precursors that precede disease outbreaks. including:
- Further identifying factors that affect the risks of vector-borne, foodborne and waterborne diseases.
  - Increasing disease surveillance to provide a baseline measure of disease activity and enable the detection of new diseases and tracking the geographic spread of diseases and vectors.
  - Focusing disease surveillance on major projected climate change threats in order to link climate indicators to health impacts (heat, chronic diseases, mental health, communicable diseases, food-related illness, water-related illness) and to help provide early warning of potential health threats.

- Developing new tools to measure and predict changes in diseases and disease determinants and also identify new approaches to prevent, detect, and respond to changing disease threats.
- Improving knowledge of and devoting resources directed toward chronic diseases that are prevalent in Hawai‘i (respiratory, cardiovascular, kidney and other) and their interactions with climate change.
- Installing more climate monitoring stations in Hawai‘i and throughout the Pacific.
- Participating in CDC’s National Environmental Tracking Network, to collect and analyze Hawai‘i -specific data on climate change and heat impacts over time.
- Requesting technical and resource support from the CDC to develop and implement CDC’s BRACE (Building Resilience Against Climate Effects) framework so as to better prepare for impending climate changes and associated health impacts in the near and longer-term future.

Attachment 1: HCR 108, SD1, 2015 Hawai'i State Legislature

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# HOUSE CONCURRENT RESOLUTION

REQUESTING THE CONVENING OF A CLIMATE CHANGE AND HEALTH WORKING GROUP TO ASSESS THE SCOPE AND RISKS OF CLIMATE CHANGE ON THE HEALTH OF HAWAII'S RESIDENTS AND TO DEVELOP A STRATEGIC PLAN TO ADDRESS CLIMATE CHANGE RISKS TO HEALTH STATEWIDE.

1           WHEREAS, climate change, together with other natural and  
2 human-made health stressors, influences human health and disease  
3 in many ways; and

4  
5           WHEREAS, as a result of climate change, some existing  
6 health threats will intensify, and in other cases, new health  
7 threats will emerge; and

8  
9           WHEREAS, public health may be affected by disruptions of  
10 physical, biological, and ecological systems, including  
11 disturbances originating in Hawaii or elsewhere; and

12  
13           WHEREAS, the potential health effects of these disruptions  
14 include: increased asthma and other respiratory and  
15 cardiovascular diseases, heat-related morbidity and mortality,  
16 injuries and premature deaths related to extreme weather events,  
17 changes in the prevalence and geographical distribution of food-  
18 and water-borne illnesses and other infectious diseases, and  
19 greater levels of mental and emotional stress in response to  
20 climate change and extreme weather-related emergencies; and

21  
22           WHEREAS, Hawaii is not alone in its concern about the issue  
23 of climate change and health; and

24  
25           WHEREAS, the American Public Health Association and other  
26 national health organizations, such as the Centers for Disease  
27 Control and Prevention, have identified climate change and  
28 health as a major public health issue; and



1 WHEREAS, the magnitude and frequency of climate change-  
2 related events are projected to increase and will stress the  
3 capability of existing response systems to manage them; and  
4

5 WHEREAS, when these crucial response systems, such as  
6 communications for emergency medical services or transportation  
7 for evacuation, become stressed, public health will be affected;  
8 and  
9

10 WHEREAS, there are ways that the entire array of public  
11 health strategies, including health policy advocacy, health  
12 surveillance and monitoring, environmental health intervention,  
13 infectious disease intervention, health education, and other  
14 public health services, can help to mitigate and reduce the  
15 health effects of climate change; and  
16

17 WHEREAS, public health workers in the State surveyed by the  
18 Hawaii Public Health Association in 2014 expressed a desire to  
19 help address the effects of climate change on health; and  
20

21 WHEREAS, however, most public health workers feel that they  
22 lack the specific expertise, knowledge, or skills to do so; and  
23

24 WHEREAS, a coordinated public health response is needed to  
25 discuss emerging and perceived threats while also providing  
26 public health workers with the necessary education, skills, and  
27 resources; and  
28

29 WHEREAS, recognizing that climate change is one of the most  
30 significant public health issues of our time and that there are  
31 many other ways in which climate change is already affecting  
32 public health, the goal of the State should be to increase  
33 effective public health engagement and action regarding climate  
34 change; now, therefore,  
35

36 BE IT RESOLVED by the House of Representatives of the  
37 Twenty-eighth Legislature of the State of Hawaii, Regular  
38 Session of 2015, the Senate concurring, that the Director of  
39 Health is requested to convene the Climate Change and Health  
40 Working Group to assess the scope and risks of climate change on  
41 the health of Hawaii's residents in order to develop a strategic  
42 plan to address climate change risks to health statewide; and  
43





1 BE IT FURTHER RESOLVED that the Climate Change and Health  
2 Working Group be composed of public- and private-sector  
3 organizations and entities that will focus on assisting health  
4 professionals in preparing for and responding effectively and  
5 efficiently to the health effects of climate change through the  
6 following:

7  
8 (1) Developing, improving, integrating, and maintaining  
9 state and regional disease surveillance systems and  
10 monitoring capacity to respond to health-related  
11 effects of climate change, including specific threats  
12 related to:

13  
14 (A) Water security, food safety, and vector-borne  
15 infectious diseases;

16  
17 (B) Respiratory and pulmonary effects, including  
18 responses to air allergens;

19  
20 (C) Cardiovascular effects, including impacts of  
21 temperature extremes;

22  
23 (D) The health effects of air pollution, including  
24 heightened sensitivity to air pollution; and

25  
26 (E) Mental and behavioral health impacts of climate  
27 change in the health of displaced persons and at-  
28 risk populations and communities;

29  
30 (2) Creating evidence-based tools for predicting and  
31 monitoring the public health impacts of climate change  
32 at the state and community levels;

33  
34 (3) Identifying and prioritizing communities and  
35 populations vulnerable to the health effects of  
36 climate change, and determining actions and  
37 communication strategies that should be adopted to  
38 inform and protect these communities and populations;

39  
40 (4) Developing recommendations for health communication,  
41 public education, and outreach programs aimed at  
42 public health and health care professionals as well as  
43 the general public to promote preparedness and



- 1 response strategies related to climate change and
- 2 public health;
- 3
- 4 (5) Developing recommendations for expanding and training
- 5 the public health workforce to strengthen its capacity
- 6 to respond to and prepare for the health impacts of
- 7 climate change; and
- 8
- 9 (6) Developing recommendations for the development,
- 10 implementation, and support of preparedness and
- 11 response planning to anticipate and reduce the health
- 12 threats due to climate change; and
- 13

14 BE IT FURTHER RESOLVED that the Director of Health, or the  
 15 Director's designee, serve as the chairperson or co-chairperson  
 16 of the Climate Change and Health Working Group; and

17  
 18 BE IT FURTHER RESOLVED that the Climate Change and Health  
 19 Working Group include representation from both public- and  
 20 private-sector representatives in public health and health care;  
 21 and

22  
 23 BE IT FURTHER RESOLVED that the Climate Change and Health  
 24 Working Group submit a report, to be prepared and drafted by the  
 25 Department of Health, of its findings and recommendations,  
 26 including any proposed legislation, to the Legislature no later  
 27 than twenty days prior to the convening of the Regular Session  
 28 of 2016; and

29  
 30 BE IT FURTHER RESOLVED that the Climate Change and Health  
 31 Working Group will be dissolved on June 30, 2016; and

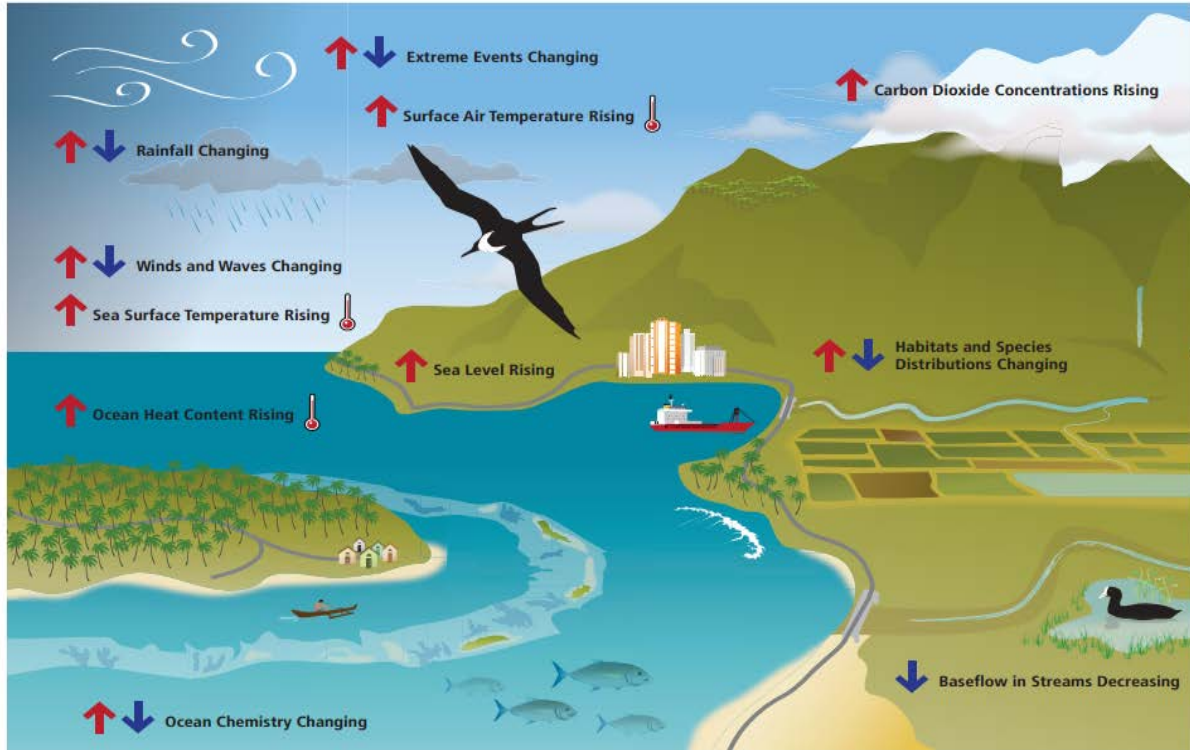
32  
 33 BE IT FURTHER RESOLVED that certified copies of this  
 34 Concurrent Resolution be transmitted to the Director of Health  
 35 and President of the Hawaii Public Health Association.



Attachment 2: Committee Members of the Hawai‘i Climate Change and Health Working Group-2015

1. Dr. Virginia Pressler, Director of Health & Chair, Hawai‘i State Department of Health
2. Nancy Partika, President, Hawai‘i Public Health Association, Co-Chair
3. Scott Glenn, Director, Hawai‘i State Office of Environmental Quality Control (OEQC)
4. Dr. Nancy Lewis, Director of Research & Senior Researcher on Climate Change & Health, East West Center,
5. Dr. Victoria Keener, Ph.D. Research Fellow, East-West Center
6. Dr. Tai-Ho Chen, MD, CDC Quarantine Medical Officer- Hawai‘i
7. Rear Admiral Colin Chinn, PACOM Command Surgeon-U.S. Pacific Command,
8. Dr. Seiji Yamada, Associate Professor, UH-Manoa Dept. of Family Medicine & Community Health, JABSOM
9. Judy Kern, Education & Training Coordinator, Hawai‘i State Department of Health Disease Outbreak Control Division
10. Vicky Rayle, Public Health Advisor/Project Officer, Centers for Disease Control & Prevention (CDC)
11. Maxine Burkett, Associate Professor of Law, UH-Manoa School of Law
12. Emi Chutaro, Executive Director, The Pacific Islands Health Officers’ Association (PIHOA)
13. Jessica Yamauchi, Executive Director, Hawai‘i Public Health Institute
14. Dr. Robert Hirokawa, Executive Director, Hawai‘i Primary Care Association
15. Capt, Barry Choy, National Oceanic and Atmospheric Administration Liaison to US Pacific Command

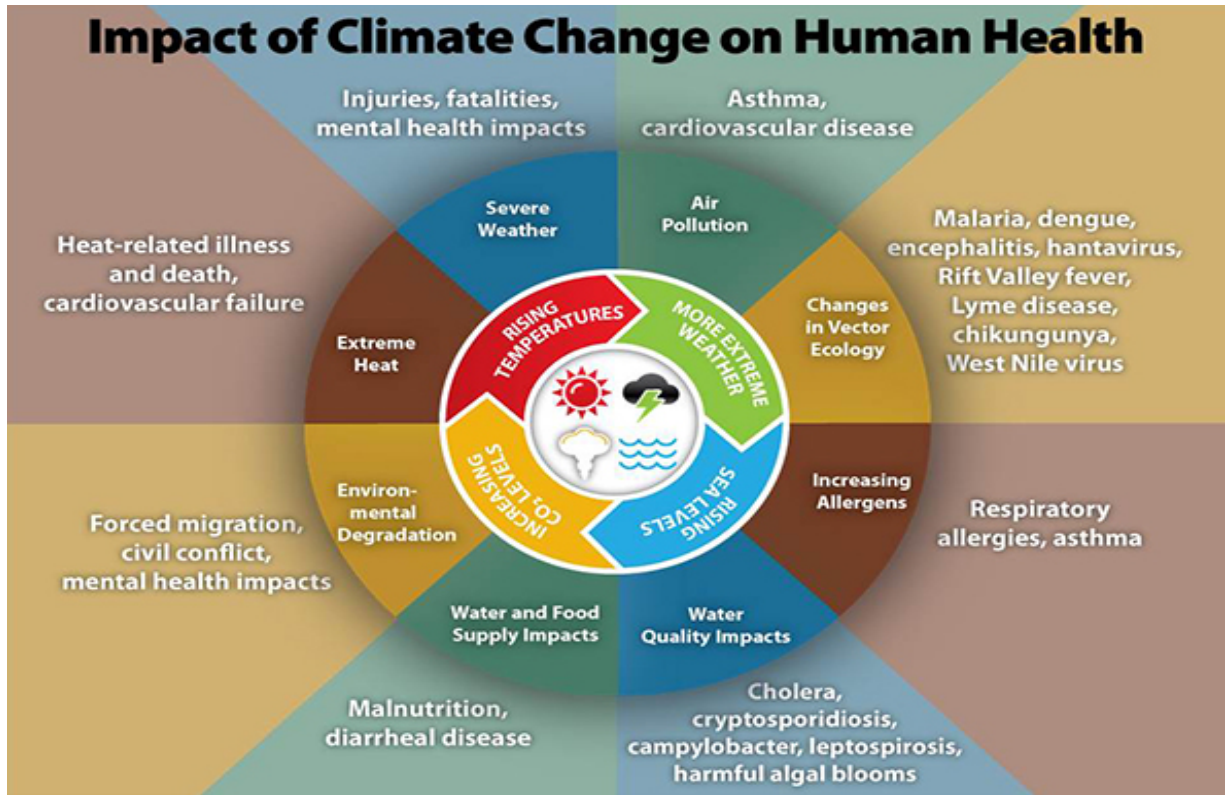
### Attachment 3: Pacific RISA Graphic



*Key Indicators of Climate Change in the Pacific Islands Region.*

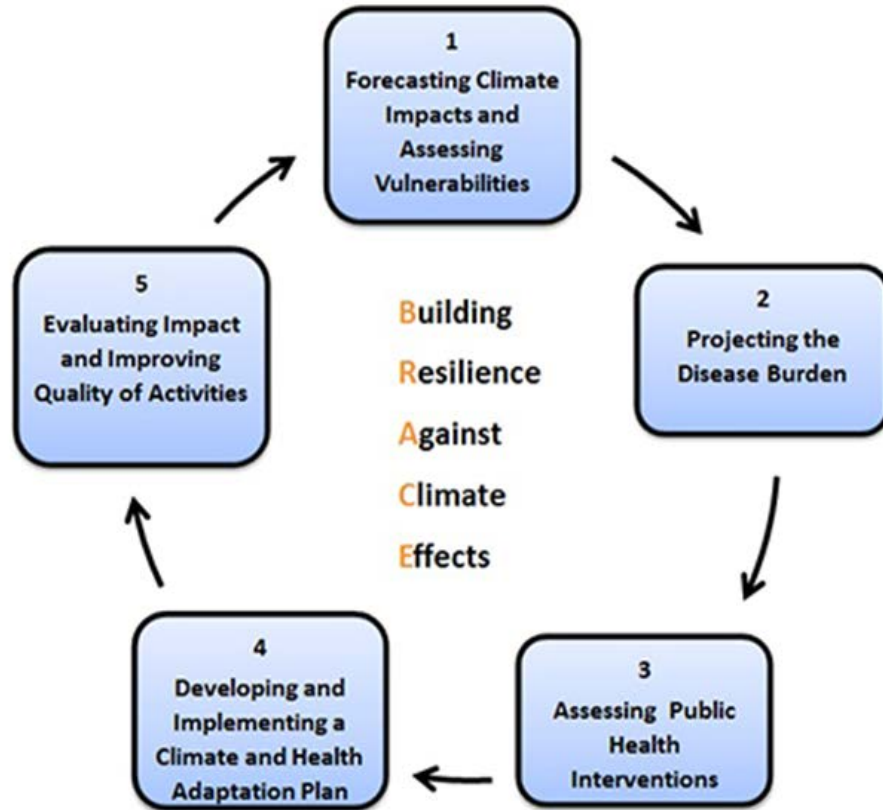
*Source: Pacific Island Regional Climate Assessment (PIRCA), 2012, graphic designed by Susan Yamamoto, adapted from "Ten Indicators of a Warming World," in NOAA National Climatic Data Center, State of the Climate in 2009 (report)*

Attachment 4: CDC Graphic on Climate Change & Health



Attachment 5: CDC-BRACE Graphic

CDC's Building Resilience Against Climate Effects (BRACE) Framework



Attachment 6: Connections between climate change & migration to/from Hawai'i: How that may affect health and well-being? (Maxine Burkett)

**A. How many climate refugees are there currently? (globally, HI or other states)**

"The United Nations (UN) estimates that in 2008 **20 million** people were displaced by climate change." In the longer term, he said, "you can imagine that the UN estimates of **200 million** such refugees, more than the total number of worldwide migrants today, may be about right".

<http://www.bbc.com/news/magazine-23899195>

The International Red Cross estimates that there are more environmental refugees than political refugees fleeing from wars and other conflicts. The United Nations High Commissioner for Refugees (UNHCR) says 36 million people were displaced by natural disasters in 2009, the last year such a report was taken.

<http://education.nationalgeographic.org/encyclopedia/climate-refugee/>

The exact numbers of climate migration is hard to capture at this point because climate change may be an indirect cause of movement for many.

Beyond the obvious loss of land in low-lying island states like Tuvalu and Kiribati, climate change will likely also invoke migrations due to higher rates of extreme weather, drought and ensuing famine and even further resulting conflict.

While rising seas threaten coastal regions, drought can create climate refugees inland. When people cannot grow crops on the land where they live, they have to move somewhere else in order to survive.

<http://education.nationalgeographic.org/encyclopedia/climate-refugee/>

Climate change may also increase the number of traditional refugees. Antonio Guterres, the U.N. High Commissioner for Refugees, has noted, "Climate change can enhance the competition for resources—water, food, grazing lands—and that competition can trigger conflict."

<http://education.nationalgeographic.org/encyclopedia/climate-refugee/>

Many political and environmental analysts have made the case that the war and refugee crisis in Syria is directly related to the country's climate-change caused drought.

<http://ecowatch.com/2015/11/27/climate-change-refugees-syria/>

Today, \_\_\_ Palauans, Micronesians and RMI have found themselves displaced  
Numbers are hard to specify because of waiver issue

Exact number of individuals living in the United States is difficult to ascertain because citizens from the Compact States (Micronesia, Marshall Islands and Palau) may freely enter.

Marshallese migration to US increased from 6700 to 22,434 persons according to US Census Bureau tripled b/w 2000 and 2010 (9)

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3254229/>

- Micronesia
- Palau

Not a lot of migration based solely on climate, YET...

A number of factors have contributed to the significant out-migration of the Marshallese from their homeland.

- Lack of Economic Opportunity
- The Pursuit of Education
- Health Care as a Drawl
  - Access to high-quality, affordable health care is critically important to Marshall Islanders, given the wide range of health problems suffered by this population, including tuberculosis, diabetes, hypertension, thyroid tumors, alcoholism, depression, and Hansen's Disease/leprosy, as well as higher rates of suicide.

<http://www.migrationpolicy.org/article/marshall-islanders-migration-patterns-and-health-care-challenges>

## **B. Medical concerns associated with refugees/induced by climate change?**

Where climate change contributes to large-scale displacement, health outcomes can be expected to resemble those of refugees during the early phases of flight and displacement. As with refugees, many of the places that will receive climate-change-affected migrants are in developing regions where public health resources are lacking or inadequate (Carballo et al. 2008). <http://ehp.niehs.nih.gov/1104375/>

Social instability and displacement present high-risk situations for the spread of Potential Health Issues that have developed in refugee populations in the past...

<http://ehp.niehs.nih.gov/1104375/>

- **Sexually transmitted infections** – attributed to overcrowding, poverty, disruption of family and social structures, increased sexual violence, and limited access to barrier contraceptives and health services and education (Toole 2005).
- **Maternal and child health** – elevated risks of maternal mortality, unmet needs for family planning, limited access to clinical health services, complications after unsafe abortions, and gender-based violence (Jones 1999; Petchesky 2008; UNHCR 2003).
- **Malnutrition** – resulting from food shortages [Toole 2005; UNHCR/World Food Program (WFP) 2006] and there is a high incidence of micronutrient deficiency diseases has been reported in refugee camps, including pellagra (niacin deficiency), scurvy (vitamin C deficiency), and anemia (iron deficiency) (UNHCR/WFP 2006).



- **Mental Health** – attributable in part to pre-displacement experiences of violence and trauma. However, post-displacement stressors also create substantial mental health risks (McMichael and Manderson 2004; Watters 2001), including fragmented social networks and separation from family, loss of familiar social contexts, poor social connections, diminished sense of belonging, economic deprivation, inadequate housing, little educational and job security, and in some cases mandatory detention (Carballo et al. 2008; Scudder and Colson 1982; Silove et al. 2001; Steel et al. 2004).
  - **Chronic Diseases (cancer, hypertension, coronary heart disease, diabetes)** - The increased incidence of chronic disease after rural–urban and international migration, relative to source populations, has been attributed to changes in diet, acculturative stress, physical inactivity, isolation, and increased health risk behaviors such as smoking and hazardous use of alcohol (Bermingham et al. 1999; Burns 2004; Montgomery et al. 2003; Palinkas 1995; Westermeyer 1993).
  - **Infectious agents (Malaria, dengue, TB, hepatitis B, intestinal parasites)**- can move with migrants and displaced populations, and this can lead to increased risk of infectious disease (e.g., tuberculosis, hepatitis B, intestinal parasite infections) in host populations (Palinkas et al. 2003). Malaria and dengue pathogens often move with people, and migration from endemic areas can initiate outbreaks or increase transmission in sites of settlement.
  - Lack of appropriate language services by health care providers coupled with literacy and cultural issues may affect their ability to efficiently navigate the health care system.
  - Estimated that Hawaii spends over \$90 million annually in uncompensated social, education, healthcare and legal costs attributed to COFA migrants
  - \$30M in aid is divided annually between HI, CNMI, Guam
    - Hawaii’s share in 2000 was 11.2 however, state spends \$37M annually on health care for COFA migrants in the public and government sectors
    - In 2007, the social, health and welfare costs attributed to the estimated 13,000 COFA migrants in Hawaii was \$90M dollars
- <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3254229/>

**C. What are the barriers to access in resolving these medical issues? Why? How do we overcome?**

Three important patterns of health care seeking behavior among Marshallese migrants

1. Marshallese migrants do not seek health care until they perceive a health crisis
  - cultural notion of ‘present crisis-oriented health care’ governs overall health care behaviors of Marshallese migrants
2. Marshallese migrants are highly reliant on parochial networks for health care, given the strong mutual trust and value assigned to interdependency within their culture.
  - Despite many benefits still a heavy dependence
  - results in failure to obtain timely care when network resources become inaccessible or unavailable.

3. Marshallese migrants in Hawai'i do not rely on traditional health care practices as much as on the allopathic health care system.

[http://www.shsu.edu/~jyc002/documents/Seekinghealthcare\\_MarshallesemigrantsinHawaii.pdf](http://www.shsu.edu/~jyc002/documents/Seekinghealthcare_MarshallesemigrantsinHawaii.pdf)