

UH Hilo scientists tackle climate issues

UH Hilo researchers are seeking innovative ways to understand the potential environmental impact of climate change on our island home ... and on the world.

The following excerpts about two of these projects are from a five-part series on UH Hilo climate change research by Anne Rivera, a junior in communication and public information intern in the Office of the Chancellor at UH Hilo. To learn more, visit hilo.hawaii.edu/news/stories.

Unmanned aerial vehicles help monitor coasts for erosion signs

Climate change is affecting our coasts and sea levels. Researchers at UH Hilo are monitoring these changes and the impact on local communities by gathering data that will help officials make sound predictions about, and decisions for, the future.

Rose Hart, a first-year graduate student in the UH Hilo Tropical Conservation Biology and Environmental Science program, has teamed up with Dr. Ryan Perroy, assistant professor of geography and environmental science, to begin monitoring shorelines using an exciting and innovative technique.

The researchers are using small unmanned aerial vehicles to capture images of coastal areas across

hundreds of acres. The images are used to create 3D data sets to observe past and present changes.

The project aims to determine from a historical point of view how these coasts and regions have changed over time to present day. It also evaluates short-term coastal changes through the collection of data every couple of months to every few weeks.

The overall goal is to try to make accurate predictions on how the rise in sea level will affect the coast and what that entails for communities and the county in regard to planning.

Forest studies also offer insight to climate change

Scientists at UH Hilo are tackling climate change issues with research projects focusing on areas ranging from testable theories to the collection of data. UH Hilo faculty, graduate students and island resource managers are working together to conduct important research focused on building the community's ability to adapt to future climate and land use changes.

Biology professor Dr. Becky Ostertag leads two such projects – a long-term forest research project with many partners across the Hawaiian Islands, and a research



UH Hilo grad student researcher Rose Hart holds a UAV used to survey coastal areas. Photo by Zoe Coffman

study on alternative agricultural methods with graduate student Joanna Norton. Both projects link established and potential problems related to our forests to further help scientists and island resource managers understand the effects of climate change on the island's environment.

Ostertag's forest research project, called the Hawai'i Permanent Plot Network or HIPNET, is the deployment of permanent research sites across Hawai'i that track various factors in Hawaiian forests – the birth and death of trees, growth rates, species and so forth – all monitored with the data compiled together like an information packet.



As sea level rises, much of Honolulu & Waikīkī will be vulnerable to groundwater inundation

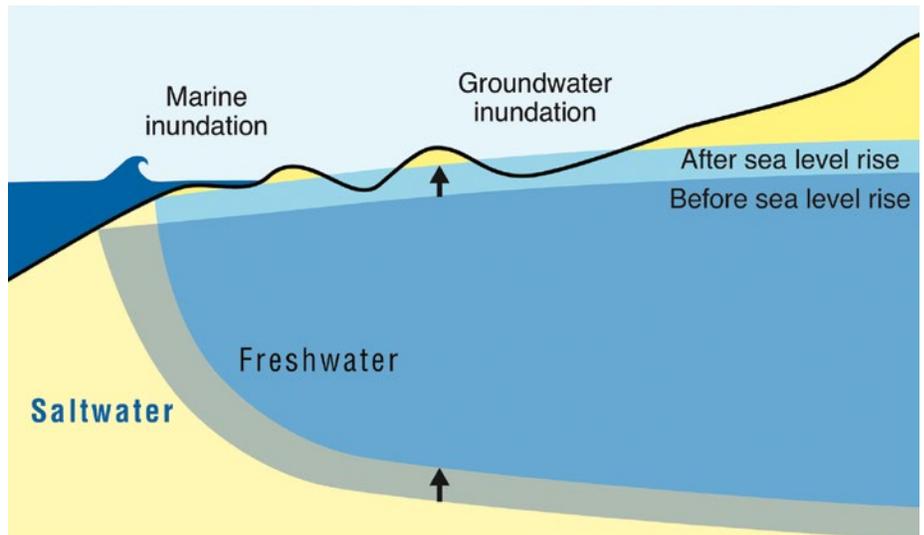
New research from UH Mānoa reveals a large part of Honolulu and Waikīkī is at risk of groundwater inundation – flooding that occurs as groundwater is lifted above the ground surface due to an increase in the sea level.

Shellie Habel is lead author of the study and a doctoral student in the Department of Geology and Geophysics in UH Mānoa's School of Ocean and Earth Science and Technology (SOEST). She and her colleagues developed a computer model that combines ground elevation, groundwater location, monitoring data, estimates of tidal influence and numerical groundwater-flow modeling to simulate future flood scenarios in the urban core as the sea level rises.

Some climate change scenarios project that this increase will be three feet this century.



A Waikīkī construction trench shows that the water table is nearly at the ground surface at high tide. Photo courtesy of UH Mānoa Coastal Geology Group



Sea level rise lifts freshwater, causing groundwater inundation in low-lying areas. Image by UH Mānoa Coastal Geology Group

“This flooding will threaten \$5 billion of taxable real estate; flood nearly 30 miles of roadway; and impact pedestrians, commercial and recreation activities, tourism, transportation and infrastructure,” said Habel. “The flooding will occur regardless of seawall construction, and thus will require innovative planning and intensive engineering efforts to accommodate standing water in the streets.”

“Our findings suggest that coastal communities in Hawai‘i and globally are exposed to complex groundwater flooding hazards associated with sea level rise in addition to the typical concerns of coastal erosion and wave overtopping,” said Dr. Chip Fletcher, professor of geology and geophysics, associate dean of SOEST and principal investigator on the study.

“Groundwater inundation will require entirely unique adaptation methods if we are

to continue to live in and develop the coastal zone,” said Fletcher. “Coastal planners and community stakeholders will need to work with architects, engineers, geologists, ecologists, economists, hydrologists and other innovative thinkers in order to manage these problems.”

This study identified particular locations and infrastructure that will be vulnerable to future flooding and is a crucial first step toward addressing future challenges. The team of researchers hopes to use this methodology to identify future flooding and at-risk infrastructure in other locations, as well as assist in developing adaptation efforts among vulnerable coastal communities.

This research was funded by Hawai‘i Department of Land and Natural Resources, the Honolulu Board of Water Supply, UH Sea Grant and the Harold K.L. Castle Foundation.

Future farmers formed through MA'O Organic Farms-UH partnership

MA'O Organic Farms in Wai'anāe helps feed UH's sustainability efforts, the community and some of Hawai'i's best restaurants. What's not as widely known is how a unique partnership between the farm and UH is growing future farmers.

MA'O has been providing scholarships and stipends for post-secondary expenses for qualified UH students through its Youth Leadership Training program since 2001. For more than 15 years, the MA'O program has supported more than 300 students from Leeward Community College, UH West O'ahu and UH Mānoa for a total value of more than \$1 million in scholarships and other aid.



"It's definitely helping us go to school," says UH West O'ahu student Chelsie Onaga, who is working on a degree in sustainable community food systems. "Some of us might not be able to afford it on our own, but by working here, we can afford to go to school and pursue a better education for ourselves."

MA'O Organic Farms Executive Director Kukui Maunakea-Forth said that UH has been a great partner in providing a foundation for the students.

"The tuition support that comes as part of students' participation in MA'O's Youth Leadership Training program is really a huge incentive and huge motivator for many of them," she said.

The practical fieldwork through employment at MA'O provides hands-on experience that is invaluable to budding farmers.

Leeward Community College student Scott Kaeo Jr. said he does not know of any other farms hosting internships like MA'O's. Through his work there



he's learned to appreciate how much food Hawai'i imports. "We can grow it down here cheaper," Kaeo said. "Not only does it save money, it's more healthy."

UH West O'ahu recently began offering a Bachelor of Applied Science degree in sustainable community food systems to help to build Hawai'i's green-collar economy.

Boston native Samantha Ahern, who moved to Hawai'i to study sustainable food systems at UH West O'ahu, said, "It's really cool to be able to put into action what we're learning in the classroom."

Continued from front



This comprehensive history helps to evaluate how Hawaiian species respond to climate fluctuations and allows researchers to make predictions about how Hawaiian forests will do with long-term climate change. The collected field data relates to climate change by linking factors such as minimum and maximum temperatures, rainfall, solar radiation, soil moisture and wind speed.

The biggest issue that Hawaiian species will face is how quickly they will get water, especially in higher temperatures, Ostertag explains. "Water is going to become an important issue with climate change."

UHM earns international top rank for earth, environmental sciences

UH Mānoa has been ranked 12th among universities internationally for earth and environmental sciences according to Nature Index, which ranks institutions based on the number of research papers published in *Nature* and a select group of 67 other prestigious peer-reviewed scientific journals.

UH Mānoa's significant research in ocean and marine science, including microbial oceanography, conducted by the School of Ocean and Earth Science and Technology, the College of Natural Sciences, and the College of Tropical Agriculture and Human Resources is one of the main reasons for the high ranking, along with research in geology, geophysics and mineral physics, and climate science.



View of the Pacific from deck of UHM research vessel Kilo Moana. Photo by T. Clemente / C-MORE