The Pacific Islands face numerous climatic threats including warming and acidifying oceans, intensified extreme weather, changing precipitation patterns, and sea level rise (Mimura et al. 2007). The need for climate education is therefore acute. Effective climate education is, however, notoriously difficult because concepts such as the global climate system and long-term climate change often appear abstract, invisible, nebulous, technical, and unrelatable (Gifford 2011; Weber 2006).

A promising antidote to these liabilities is a place-based approach. Place-based climate education aims to teach about climate by linking it to specific local places where the effects of climatic fluctuations are visible, and which carry aesthetic, spiritual, sociocultural, or practical value for local communities. The aim is for STEM curricula to cross-fertilize with culturally appropriate pedagogy and revitalization of local knowledge. This dovetails with the wider mission of the Pacific Islands Climate Education Partnership (PCEP), which seeks “to educate the region’s students and citizens in ways that exemplify modern science and indigenous environmental knowledge, address the urgency of climate change impacts, and honor Pacific island cultures” (see http://pcep.prel.org).

The place-based approach is inspired by several insights. First, many rural, indigenous, or subsistence-based communities with close ties to local places are keenly aware of local weather patterns and changing climates even when they are unaware of scientific terms such as “climate” and “the greenhouse effect” (Crate and Nuttall 2009). Second, even for urbanites or transient populations with less intimate knowledge of their surroundings, global climate change is relatable primarily through its visible impacts on local places (Rudiak-Gould 2013a). Third, while the climate is an interconnected planetary system and climate change is global in scope, climates vary widely by place and climate change adaptation is inherently local.

The place-based approach is likely to bear fruit in PCEP’s remit, namely the US-affiliated Pacific Islands (USAPI). Throughout the region, Pacific Islanders possess detailed knowledge of, and longstanding
attachment to, their home islands and land tracts (Campbell 2010). For Native Hawaiians, even the minutest features of the landscape have acted as repositories of history, memory, and identity (Sahlins 1992).

This Brief documents place-based climate education initiatives currently ongoing in O‘ahu, Hawai‘i and reports on the perspectives of place-based climate education practitioners. The aim is to suggest best practices that can be expanded on O‘ahu as well as adapted to other PCEP sites. Since few educational initiatives in O‘ahu are branded as specifically “climate” or “climate change” initiatives, this Brief documents place-based environmental or science education projects with links to climate and climate change, even when those themes are not explicitly emphasized by the associated educators. See Appendix 1 for a list of interviews and site visits conducted.

The author and principle researcher for this Brief is Dr. Peter Rudiak-Gould, an Oxford-educated cultural anthropologist specializing in the Pacific region and local attitudes towards climate change. He has studied the Marshall Islands since 2003, including 1 year and 9 months spent in the country and 9 months of fieldwork on local attitudes towards climate change, resulting in many publications (see for instance Rudiak-Gould 2013b). Dr. Rudiak-Gould, however, has no Native Hawaiian ancestry and had no previous fieldwork experience in Hawai‘i prior to this project. He gratefully acknowledges the willingness of his informants, most of them of Native Hawaiian descent and all of them possessing intimate knowledge of Hawaiian environments and culture, to share their expertise with an outsider.

Profiles of O‘ahu Place-Based Climate Education and Related Projects

Abupua‘a O Kahana State Park and associated community organizations
Ululani Beirne-Keawe, Erwin Kahala, May Au, Makani Christensen, Thorin Evans, and Kanoa Switzer

Abupua‘a O Kahana State Park is located on the windward side of O‘ahu and extends from the crest of the Ko‘olau mountains to the shore at Kahana Bay where the Kahana Stream joins the ocean. Kahana Valley is home to 31 families, many of whom maintain Native Hawaiian farming practices (Hawaii State Parks, n.d.). The community has an agreement with the State of Hawai‘i to perform 25 hours/month of outreach activities, with the aim of educating students, tour groups, and others about Native Hawaiian culture, agriculture, ecology, and environmental stewardship.

Ululani Beirne-Keawe is a recognized kupuna (elder) in the community and founded the Friends of Kahana as a non-profit organization in 1994 aimed at teaching Native Hawaiians leadership skills, organizing service projects, and emphasizing traditional values including mālama ‘āina (care for the land). She is also President of the Ko‘olauloa Hawaiian Civic Club, in part an educational organization focusing on Native Hawaiians. Also present at the site visit were Erwin Kahala, Vice President of the Kahana Community Association; May Au, Treasurer of the Kahana Community Association; Makani Christensen, Chairman of the Aha Moku Council of O‘ahu; and Thorin Evans and Kanoa Switzer, members of the Ko‘olauloa Hawaiian Civic Club.
Ms. Beirne-Keawe points to many special features of the Ahupuaʻa of Kahana. It is considered the last remaining intact ahupuaʻa (land division running from mountain to ocean) on Oʻahu, and one of only a few in the state that remains publicly owned. Its outstanding climatic feature is its abundant rainfall: it is one of the wettest valleys on the island, receiving 300 inches of rain annually in the uplands. It is also known for its abundance of taro farms, made possible by extensive freshwater resources.

The Kahana community frequently hosts K-12 school groups. The emphasis is on culturally relevant pedagogy, hands-on learning, and bridging environmental science with indigenous methods of stewardship. Visiting students make arts and crafts with traditional materials and techniques, learn the names of native Hawaiian plants, complete hands-on environmental lessons by testing the water quality of the stream, and participate in gatherings known as hukilau. Ms. Beirne-Keawe has observed that the students are immediately engaged by these projects.

Several specific places of interest merit mentioning. The Garden, located near the Visitor’s Center, is an organic, pesticide-free garden of taro, sweet potato, banana, paper mulberry, and other important Hawaiian crops. Mr. Kahala emphasized that food production is the key to Hawaiian culture and the culture can be perpetuated only by performing cultural practices oneself. Uncle Nana’s Loʻi is a taro farm located farther upland. Clinton Gorai tends it and often hosts school groups at the farm to teach them about Hawaiian agricultural techniques. Mr. Evans emphasized the damage caused by wild pigs, which uproot gardens and exacerbate erosion, caused in part by unreasonable legal restrictions on pig hunting.
The **Kahana Dam** is the site at which members of the community measure the flow of the Kahana Stream. Mr. Evans pointed to a tangle of branches slightly upstream from the dam which he said were blocking the flow. This, he said, could be an effect of climate change or simply because of the harvesting of water for piping to Honolulu. Mr. Christensen noted that water resources are threatened not only by climate change but also by the attempt to provide water to 1 million Honolulu residents and 8 million annual visitors. The **O'opu Pond** (o’opu means gobi fish, Hawaii’s only native species of freshwater fish) is also on the Kahana Stream. Ms. Beirne-Keawe pointed to the excess of foliage overhanging the stream’s banks, and said this must be cleared. The group also noted with concern an oil spill on the stream.

At the mouth of the Kahana Stream, adjacent to Kahana Bay, is the **Huilua Fishpond**, a site of traditional Hawaiian aquaculture which Ms. Beirne-Keawe considers to be the most important archaeological site in the ahupua'a. Ms. Beirne-Keawe pointed out the encroachment of invasive mangroves on one side of the pond, which she said must be removed. The pond has been impacted by four 20th century tsunami events and periodic high waves which, at their worst, have deposited large amounts of sand and debris into the pond and damaged the wall. Ms. Au believes that the fishpond has also been negatively affected by shoreline change caused by climate change. The Friends of Kahana organization is currently working to restore the fishpond to a functional state.
At the **Kahana Bay shoreline**, Ms. Beirne-Keawe noted that the river banks near the mouth of the Kahana Stream have eroded, and that the beach used to be much wider; she remembers a time approximately 60 years ago when the beach was wide enough that the community was able to stage horse races there. The community has also recently found human bones exposed by erosion near the beach which had to be reburied farther inland. Ms. Beirne-Keawe attributes this erosion to climate change but also faults the construction of the Kamehameha Highway over the Kahana Stream. Mr. Christensen, Ms. Au, and Mr. Switzer echoed her observation of shoreline erosion.

**Kapaʻeleʻele Koʻa** (a fish shrine) and **Keaniani Kilo** (a lookout point for seeing when schools of akule fish [Bigeye scad] are coming) are sites in Kahana Valley highlighted on the Hawaiʻi State Parks website ([www.hawaiistateparks.org/parks/brochure_pdfs/hsp_kapaeelele_koa_trail19.pdf](http://www.hawaiistateparks.org/parks/brochure_pdfs/hsp_kapaeelele_koa_trail19.pdf)) but not mentioned during the site visit. They could become sites of place-based climate education, as they encourage observation, relate to seasonal ecological patterns, and act as a reminder of declining marine resources in Oʻahu.

The educational activities at Kahana Valley are **not branded as “climate education,”** and **do not specifically emphasize the issue of global climate change.** That said, they relate intimately to climate and foster awareness of the impacts of changing weather patterns, particularly by highlighting the connection between traditional agricultural practices and freshwater resources.

**Mālama Loko Ea Foundation**

Jessica Casson and Ikaika Lum

Founded in 2009, Mālama Loko Ea Foundation is dedicated to restoring the approximately 400-year-old **Loko Ea Fishpond** in Haleʻiwa on Oʻahu’s North Shore and, in the last two years, to using the site and its restoration for educational purposes. Jessica Casson is the Executive Coordinator; Ikaika Lum is the Native Plant Specialist. The existence of the Foundation owes to the fact that the fishpond lies on land owned by Kamehameha Schools, which has recognized the pedagogical value of the site and allowed it to be used for that purpose. The Foundation hosts numerous student field trips, on average one per week, from many schools.

Ms. Casson and Mr. Lum encourage the students to engage in **observation.** They often allow the students time to simply walk around the fishpond, after which the students are required to share with the group an observation they made. Ms. Casson and Mr. Lum in particular encourage the students to make observations of native plants, tidal and lunar cycles, and garbage that has been dumped into the pond and the channel. A particularly effective lesson is to bring the students to the “**mini ahupuaʻa.”** This is a small rocky ledge near the pond. The students pour water onto the “summit” and watch as it flows down into the “lowlands” below. The movement of the water delights the students and shows the way in which upland and lowland parts of an ahupuaʻa are connected by the flow of fresh water. The students are shown the pond’s **mākahā** (sluice gates), which have gaps large enough to allow natural recruitment of fingerlings from the ocean but small enough to prevent the fish from exiting the pond once they have grown to full size. The pond requires a brackish environment created by exchange of fresh water from inland and salt water from the ocean.
The organizers emphasize service learning and hands-on activities. Students pull weeds from the pond, gut fish when they are harvested quarterly, and remove encroaching grass on the inland side of the pond to ease the flow of fresh water from springs. Mr. Lum and Ms. Casson agree that the students, especially those of elementary school age, are immediately excited by these activities. The Foundation also organizes monthly work days which have become so popular among Haleʻiwa residents and military families that the limit of 100 participants is often reached and additional volunteers have to be turned away.

The Foundation employs value-based education. Ms. Casson and Mr. Lum teach the students about Laniwahine, the moʻo spirit who guards the pond and punishes people for selfish behavior by withdrawing fish from the pond. There is a group of flat rocks in the pond where she is said to take physical form. This is used as a lesson in respect and responsibility, rooted in Native Hawaiian spiritual beliefs. Ms. Casson hopes that this and other parts of the Foundation’s work will encourage the students to have pride in their land. They consider the ahupuaʻa of Kawailoa, on which the fishpond stands, to be notable for having unusually fertile land, one of the longest streams in Oʻahu, abundant fresh water, and extensive taro production.

The Foundation does not explicitly highlight “climate change” in its educational activities, but climate is nonetheless an important component of its programs. Its educators encourage the students to take note of long-term environmental changes, including changes in weather and environmental changes that could be connected to global climate change. They teach students that, according to local elders, the water level of the stream and the connected channels has dropped drastically since their childhoods,
negatively affecting the pond. Ms. Casson and Mr. Lum believe this could be due to the development of a nearby sugar plantation or the nearby construction of seawalls. The organizers encourage the students to find evidence of long-term sea level fall, in the form of bleached portions of rocks in the pond that correspond to former high-water marks. Although the organizers do not teach the students about sea level rise, there are opportunities here for doing so. Ms. Casson described a high-wave event in January 2014 which deposited large amounts of sand into the channel, requiring extensive labor to clear. Previous high wave events have clogged the sluice gates with debris and excessively salinated the pond, with negative consequences for fish; this is an excellent example of the local knowledge possessed by educators.

Ms. Casson indicated that the Foundation seeks to pedagogically integrate science and local knowledge, and towards that end hoped to integrate more STEM content, potentially including explicit emphasis on global climate change, in future outreach work at the pond. In her words, “All the science and math is there already in the culture.”

A sluice gate; Jessica Casson and Ikaika Lum standing beside
Charles Ka’ai’ai is the Indigenous Coordinator at the Western Pacific Fishery Management Council, an organization devoted to ecosystem-based management of fisheries in the USAPI. Through this work he is often called upon to engage with climate change adaptation and outreach at the community level. He participated in the First Stewards Symposium conference in Washington DC in 2012, which brought together representatives from coastal indigenous communities in the US mainland and USAPI to discuss locally visible climate change impacts.

Mr. Ka’ai’ai is committed to engaging with indigenous communities to assist in adaptation to climatic disturbances and environmental change. However, he does not find the concept of “climate change” per se helpful in his outreach. Scientists’ climate change projections are, in his experience, too uncertain, conjectural, and unreliable to be of use in community outreach and planning. Furthermore, in his view, scientific models of climate change address scenarios in the far future, while there are many more immediate disasters for which communities are unprepared. He gives the example of typhoons, which are already a threat and for which important preparedness questions remain unanswered, such as how many hospital beds will be needed, and how Hawai‘i will subsist in the event of a shipping stoppage.

He prefers instead to use the phrase “climate change” to tap funding that can then be strategically used for community-level disaster planning. By preparing for disasters, a community becomes better adapted to whatever climatic changes arise in the future, whether scientifically foreseen or not. “Disaster,” he believes, is better than “climate change” as a framing for outreach because it is more practical, more present-oriented, and more empowering to communities.

He begins outreach by asking community members which disasters they have experienced and which they are most concerned about. It is important not to assume beforehand which disasters will be of concern to people; simply ask instead. The answers may be climatic disasters but also other sorts of environmental, or even economic, disturbances, such as surges in the price of oil. The best practice for outreach that he named was “Always start with the community.” Success, he says, can be measured by to what extent the community feels ownership of the resulting disaster plan. Mr. Ka’ai’ai’s belief in outreach that is specifically tailored and responsive to a particular community underscores his support for place-based approaches.

Working at the community level is also beneficial because it allows local knowledge to be used for adaptation. Responding to disasters, he emphasizes, is built into indigenous cultures. For instance, he believes that the Hawaiian principle of aloha (love, welcome) will be helpful when Hawaiians begin to adapt to a second-hand climate change impact, namely the future influx of climate-driven migrants to Hawai‘i from other USAPI.

Mr. Ka’ai’ai is enthusiastic about service learning. He emphasizes that one must do a cultural practice in order to preserve cultural knowledge. For instance, the staff of Loko Ea Fishpond accumulate great knowledge of fishponds because they perform the extremely labor-intensive process of preventing the accumulation of sediment in the pond.
Any inhabited place on O‘ahu is vulnerable to disaster, Mr. Ka‘ai‘ai says, and therefore he cannot point to particular well-suited sites for place-based climate education. However, he believes that place-based learning could be organized on the level of the moku (district), of which O‘ahu has six (Kona, ‘Ewa, Wai‘anae, Waialua, Ko‘olina, Ko‘olau). He believes that it is important to realize that when a place is transformed (for instance when the Waikīkī tourist developments were created by draining wetlands and importing white sand, or when a fishing spot used by him and his father suddenly disappeared during the creation of Sand Island) this is both a destruction and a creation of place; it makes the place less important to some segments of the community but more important to other segments.

_The Nature Conservancy of Hawai‘i_

_Sam Gon_

Sam Gon is a noted ethnoecologist, combining scientific expertise (a PhD in Animal Behavior) with local expertise (the traditional Hawaiian status of kāpuna kākalaleo). He has worked at The Nature Conservancy of Hawai‘i since 1986, currently as Senior Scientist and Cultural Advisor, and has sat on the State Board of Land and Natural Resources since 2006. Through his conservation work in O‘ahu and beyond he often engages in outreach at the community level.

Dr. Gon emphasizes **human ecology**. He believes that safeguarding Hawaiian culture and protecting the Hawaiian environment go hand-in-hand. He perceives **no significant conflict** between Hawaiian knowledge and Western science, as they are both based on sustained observation. Conflict between the two has never been an impediment to his work, as long as one accepts that there is not always a “one-to-one” congruence between the two knowledge systems. A useful way to bridge the two is to make environmental observations of the sort that Native Hawaiians have done for generations, and then to employ scientific instruments to measure those phenomena more precisely.

Dr. Gon perceives great pedagogical value in **observation**. Students take field trips to the Nature Conservancy’s more accessible reserves, and it is pedagogically effective to allow them to make their own observations and then to insist that each student share his or her observation with the group. Dr. Gon finds opportunities for observation even in downtown Honolulu, for instance noticing the regrowth of coral in **Honolulu Harbor** and the nesting of native birds in **Foster Botanic Garden** and on the **ledges of buildings**.

According to Dr. Gon, environmental education and climate education are necessarily place-based, as the Hawaiian names of rains, winds, and other climatic phenomena differ from valley to valley even within a single district of an island. Astronomical observations, traditionally used for meteorological forecasting, are often specific to small, circumscribed areas. For instance, on approximately May 2nd each year, from the lawn by the Waikīkī aquarium, near the original location of Kakahihewa’s temple, the sun sets into the cone of Pu‘u o Kapolei; this observation works only in that exact location. More generally, he highlights the need to learn which sites are valued by a community before approaching them for outreach work. This allows one to predict which local places the community will wish to protect from climate change and other threats, providing an entrée to place-based climate education. Furthermore, if
an outsider approaches the community knowing less than a child does about the important local sites, he or she will not be taken seriously.

Dr. Gon perceives many climate change impacts and threats. Climate change-driven changes in the distributions of disease-carrying insects threaten native bird species. Climate change is expected to render Oʻahu’s lowlands hotter and dryer, pushing the cooler, wetter zones to higher elevations; given the relatively low elevation of Oʻahu’s mountains, the cool, wet zones are expected to disappear altogether. In terms of specific venues for place-based climate education on Oʻahu, Dr. Gon points to **coastline houses** that have been featured on the news that have required emergency sandbagging; winter storms, he says, are causing more coastline damage now than in the past. **Storm drains in Waikīkī** have been observed to emit ocean water at the highest high tides, and in the winter season cars drive through two feet of salty water on **Mapunapuna Street** in Honolulu, a phenomenon that locals have linked to climate change-induced sea level rise. When planning place-based climate education activities, Dr. Gon recommends, one should focus on the place’s observed changes in 1) seasonal temperature profiles, 2) rainfall (Dr. Gon gives the example of **home gardens and lawns in Mānoa**, which locals are accustomed to never having to water, but which may need to be watered in the near future), 3) stream flow, 4) patterns of vegetation (e.g. the advance of drought-tolerant plants at the expense of other plants), 5) wildfires, including how long it takes plant life to recover from fire and which plant species become established post-fire.

**Paepae o Heʻeia**

Hiʻilei Kawelo

Established in 2001, Paepae o Heʻeia is a non-profit organization dedicated to the restoration (kū hou kuapā) and educational potential (ka ‘ai kamahaʻo) of the **Heʻeia Fishpond** in Heʻeia on Oʻahu's windward side. As in the case of Loko Ea Fishpond, the land is owned by Kamehameha Schools and the existence of Paepae o Heʻeia owes in part to that landowner's recognition of the pedagogical value of the site. The fishpond itself is unusually old (as much as 800 years) and very large (88 acres) with a 1.3-mile circular wall surrounding it, about half of which has been restored by the organization. It connects both to the Heʻeia Stream and to the ocean, maintaining a brackish environment.

Hiʻilei Kawelo is the founder of Paepae o Heʻeia and has been its Executive Director since 2007. The organization frequently hosts school groups, who come from Oʻahu, other islands of Hawaiʻi, the US mainland, and abroad, encompassing all ages from kindergarten through college. Some students come for a single, three-hour visit, while others (e.g. 7th graders at Halau Ku Mana Public Charter School in Honolulu) return repeatedly, visiting once a week.

Paepae o Heʻeia is devoted to **service learning**. Visiting school groups always engage in a hands-on, practical activity, such removing invasive mangroves and algae from the pond and transporting rocks to restore and fortify the wall. Ms. Kawelo feels that this is necessary for teaching the students that the pond exists not merely for aesthetic value but also for food production (ʻāina momona). It is a functional aquaculture installation in which fish are harvested and eaten (especially predator and non-native species, in order to reduce their numbers). The students, according to Ms. Kawelo, are far more responsive to
doing than to talking, and especially enjoy activities involving food. While Honolulu-based students are sometimes reluctant at first to step into the pond’s mud, they eventually embrace the hands-on work. This emphasis on service learning also encompasses values-based education, as the practical work of restoring the fishpond conveys the importance of mālama ʻāina (taking care of the land). School groups that visit repeatedly engage in more advanced service projects, such as catching native crabs.

Ms. Kawelo believes in culturally relevant pedagogy. Paepae o Heʻeia’s outreach integrates STEM with traditional knowledge. Ms. Kawelo perceives no conflict between the two knowledge systems and has never found this to be an obstacle in her work. For instance, students gauge the temperature of the pond with both traditional tools (their hands) and scientific tools (thermometers); the two complement each other. In addition to celebrating the expertise of ancient Hawaiian aquaculture specialists, the fishpond offers many opportunities for STEM curriculum. The design of the sluice gate is used as a lesson in engineering, and the monitoring of pond water characteristics becomes a lesson in chemistry. Ms. Kawelo stressed the value of a place-based approach by noting that every fishpond is different and that no fishpond project should model itself off of another.

The organization does not brand itself in terms of “climate change.” Ms. Kawelo does not find the scientific concept of “climate change” helpful in her educational work, for several reasons. 1) Native peoples automatically respond to climatic changes and have always done so, so there is no need to introduce a scientific theory of it. 2) Climate change predictions are based on arbitrary assumptions and are unreliable. 3) Global climate change is not her area of expertise so she does not address it. 4) Using the term “climate change” and “global warming” immediately loses students’ attention, even if climate education is the goal.
That said, the organization's educational programs address climate in a number of ways. Ms. Kawelo noted that the uniqueness of each fishpond is a direct response to the local climate: this provides an entrée to place-based climate education. She encourages multiple-visit students to note changes in seasonality (e.g. changes in the timing of fish recruitment from the ocean) and she believes these changes could be linked to global climate change. The practice of place-based observation at the pond, she says, personalizes climate change. She has perceived many changes at the fishpond site that could be attributed in part to global climate change, including abnormally strong winds in the last year; brief, heavy rainstorms rather than sustained precipitation, resulting in reduced groundwater seepage; and noticeable sea level rise year to year requiring staff and volunteers to add layers of rock on top of the wall to keep pace. She is especially concerned by the scientific prediction of decreasing freshwater resources, which will alter the pond’s carefully maintained brackish composition.

"Learning from Local Ecological Knowledge to Understand Climate Change Impacts and Preserve Key Cultural and Natural Resources in Kaʻūpūlehu, Hawaiʻi"

Heather McMillen

Dr. Heather McMillen has worked as an Ethnoecology Curriculum Designer at the Center for International Forestry Research, and is now Postdoctoral Research Fellow in Local Ecological Knowledge and Climate Change in the University of Hawaiʻi, Mānoa’s Department of Botany. An anthropologist and ethnobotanist by training, Dr. McMillen is now jointly heading the project “Learning from Traditional Ecological Knowledge to Understand Climate Change Impacts and Preserve Key Cultural and Natural Resources in Kaʻūpūlehu, Hawaiʻi,” funded by the Pacific Islands Climate Change Cooperative. Beginning in 2012 and slated to conclude in late 2014, this is a participatory outreach program aimed at bridging science and local knowledge for the purpose of community-based climate change adaptation. Dr. McMillen emphasizes that this is fundamentally a collaborative endeavor and that its success must be judged by to what extent the community feels that the project is “theirs.”

Through this project, Dr. McMillen is currently in the process of developing educational tools linking climate science to local knowledge that can be exported to communities beyond the project site at Kaʻūpūlehu. Dr. McMillen perceives no significant conflict between science and local knowledge. Among the products being developed are: seasonal calendars (summarizing local knowledge of markers that indicate particular ecological events such as flowering and spawning and which can then be used as a baseline for measuring climate change-driven changes in seasonality); a Timeline of Adaptation (synthesizing local accounts of the community’s response to past environmental disturbances); biocultural resource maps (including spatial representations of expected climate change impacts); and proverbs and couplets that express local ecological knowledge (see http://hbmpweb.pbrc.hawaii.edu/kaupulehu/). Dr. McMillen considers these tools to be successful if they are voluntarily used by the people they are intended to serve.

Climate change is an integral part of this project, but Dr. McMillen stresses that “climate change” per se has not been and should not be used as the headline. “Climate change” is, as she puts it, “an outsider framing” that fails to resonate with locals. Kaʻūpūlehu residents are more concerned about the immediate impacts of local development than about the future impacts of global warming. Dr. McMillen considers
“environmental change” a far more helpful framing than “climate change” for community outreach. Given the multiple drivers of change, standalone climate change programs are, in her view, inherently misguided.

Nonetheless, Dr. McMillen has discovered a number of ways in which the community has become engaged with climate change. Scientific projections of future climate change do resonate with locals, but only if the projections are 1) **downscaled** to the local level, 2) tailored to places and resources that locals value, 3) communicated in non-technical language, and 4) presented in such a way that local expertise is also acknowledged. Drought is, in Dr. McMillen’s experience, an effective entrée to climate education in the community, as Kaʻūpūlehu is located on the dry leeward side of the Big Island and is expected to become drier. Sea level rise predictions can resonate with the community, as some elders have observed storm surges during their lifetimes and trust that the ocean can rise again in the future. Sea level rise can also be addressed by calling attention to the threat it poses to the **habitat of limpets** (ʻōpīhi, a local delicacy), and to archaeological sites including **coastal salt collection areas**, **coastal petroglyphs**, and **coastal burial sites**. The community is also receptive to predictions of ocean acidification and coral bleaching when these predictions are presented on local maps, because reef-based subsistence practices are of great cultural significance.

**Kapono Ciotti Inc. and other organizations**

**Kapono Ciotti**

Kapono Ciotti is an Oʻahu-based educator who specializes in culturally appropriate pedagogy and culture- and place-based science curriculum development. His affiliations include Isis Hawaii, where he is Culture-Responsive Curriculum and Professional Development and Design Thinking Lead Facilitator; the Pacific American Foundation, for which he writes culture- and place-based science curriculum; and Maryknoll School, where he was Academic Dean from 2000-2012 and co-organized a place-based climate education summer program in the Marshall Islands for Hawaiian and Marshallese students. He also works with the National Association of Independent Schools on issues of diversity in education, and with many Oʻahu schools through his consulting firm.

Mr. Ciotti is extremely enthusiastic about the value of, and potential for, place-based climate education in Oʻahu schools. Currently he sees only a tiny percentage of Oʻahu classrooms implementing place-based climate education, but he believes that opportunities for its development exist in abundance. Place-based climate education, in his view, must be **aligned to standards** to be implemented. This alignment can be achieved by linking it to the benchmarks defined by the Common Core State Standards Initiative. The Common Core defines only benchmarks, not specific content, so there is ample scope, in Mr. Ciotti’s view, for place-based climate education to be incorporated. For instance, “informational” texts that students read for English Language Arts could focus on climate or climate change, or math lessons could ask students to compute a heating bill and the resulting greenhouse gas emissions. Place-based climate education could also be aligned to the Hawaii Content and Performance Standards (HCPS) or to the Next Generation Science Standards (NGSS) which the State of Hawaiʻi are considering adopting and which offer many entry points for place-based climate education. Aligning place-based climate education to standards is absolutely necessary, in Mr. Ciotti’s view, because teachers are already overloaded; they will be
able to embrace place-based climate education only if it achieves pre-existing learning goals, thus replacing or being integrated into existing units rather than adding additional units.

Place-based climate education, in Mr. Ciotti’s view, requires cooperation between teachers, with their knowledge of standards, and community organizations, with their place-based ties and firsthand experience of climate change. According to Mr. Ciotti, the dearth of place-based climate education in O‘ahu can be attributed to the fact that many teachers do not have the specific training needed to design climate education, and community organizations rarely have a staff member who is familiar with standards. Hence, many opportunities for place-based climate education are missed. The solution in his view is to increase knowledge of standards among staff members in community organizations and increase knowledge of climate education among teachers.

Mr. Ciotti has many suggestions for specific sites for place-based climate education in O‘ahu. Sea level rise can be taught at “blue line” project sites, and by pointing to coastal apartment buildings and hotels in Waikīkī which are built on sand and reclaimed marsh and are thus highly vulnerable. Climate change-driven declines in rainfall can be taught at Hālawa Xeriscape Garden in ‘Aiea, O‘ahu, which showcases drought-tolerant native plants, and the Waiāhole Ditch Trail, where students can enter a tunnel and see the water table through a window from within the mountain; school gardens, which offer opportunities to observe rainfall and seasonality and which are already numerous and easily visited by students; and aquaponics installations, which are ideal venues for place-based climate education related to precipitation and the need to conserve water resources. These installations already exist at several O‘ahu schools, Mari’s Gardens in Mililani, and the Waimanalo Research Station of UH-Mānoa’s College of Tropical Agriculture and Human Resources. Mr. Ciotti further pointed out that tsunami education can be linked to place-based climate education and to Native Hawaiian knowledge through the term kai e’e, which simultaneously means “tsunami” and “rising sea”; place-based education provides opportunities to explore similarities and differences between scientific and local terms for climatic and environmental phenomena.

Other relevant projects and sites

The Hawai‘i Institute of Marine Biology on Moku o Lo‘e (Coconut Island) in Kāne‘ohe Bay hosts place-based environmental education initiatives, including the UH-Mānoa-affiliated Ethnomathematics Summer Institute.

The Mokaua Fishermen’s Association on Mokaua Island (near downtown Honolulu) hosts place-based environmental education projects. Kamehameha High School students have visited the site to test water quality and marine debris; the Aqua Kids television series has produced an educational YouTube video in this location (http://www.youtube.com/watch?v=VK-4eRAycL4); and participants in the Ethnomathematics Summer Institute have made pedagogical use of the Mokaua Fishpond.

The Pacific Worlds project (http://www.pacificworlds.com), created by geographer Doug Herman, has compiled a list of notable places on O‘ahu (http://www.pacificworlds.com/nuuanu/native/native.cfm), which may be adapted to the purposes of place-based climate education
Lessons Learned in the Oʻahu Context

Oʻahu practitioners show great enthusiasm for place-based approaches

There is of course a strong selection bias, in that interviewees were chosen for their interest and involvement in place-based education. Nonetheless, it is encouraging that so many place-based initiatives with a climate component (or obvious potential for such) could be found on Oʻahu in a short period of research.

Many sites favorable to place-based climate education exist on Oʻahu

For each of the key climate change impacts—changing precipitation, changing seasonality, storms, sea level rise, coral bleaching/ocean acidification—Oʻahu has at least one site with obvious pedagogical links. Many sites exist in which several of these impacts can be discussed together. See Appendix 2 for a list. Moreover, many of these locations already have educational infrastructure in place. Undoubtedly many more favorable sites exist that were not discovered in the short period of fieldwork.

Fishponds are especially promising sites for place-based climate education

Fishponds are uniquely well suited to climate education. They connect upland, lowland, shoreline, and marine environmental issues in a single package, since they are located between the terrestrial and marine zones, and require abundant freshwater from one side and salt water from the other. They illustrate the indigenous partitioning of the landscape into watersheds (abupuaʻa) with interconnected upland and lowland zones, thus fostering culturally relevant pedagogy. They are vulnerable to erosion and sand deposition from storm events and sea level rise, and to drought from the uplands, thus linking to three key climate change impacts. They offer engaging, hands-on learning opportunities ranging from clearing mangroves (suitable for even the youngest students) to engineering sluice gates (suitable to high school or college students). Fishponds have educational infrastructure already in place and are strongly backed by Kamehameha Schools.

Fishpond-based climate change education could be practiced throughout Hawaiʻi, as fishponds exist on all major islands (Kirch 2010: 54). Although Hawaiian-style fishponds are not found in other territories in which PCEP works, traditional fish weirs (used for catching, but not for raising, fish) exist in the Marshall Islands (e.g. Kwajalein, Wotje, Namu, and Majuro), Pohnpei, Chuuk, Yap, the Mortlock Islands (e.g. Namoluk Atoll), and Palau (clam farming) (Albert Davletshin, Keith Marshall, Craig Severance, Nancy Pollock, Ingrid Ahlgren, Laurence Carucci, personal communication; also see Dieudonne et al. 2002). Although fish weirs do not constitute true aquaculture, they could perhaps be used for place-based climate change education nonetheless.

Implications for Wider PCEP Application

Place-based education may have wider advantages than previously thought

This project began with the theory that place-based approaches are more effective than global approaches because a human scale makes climate change more relatable. Interviews with Oʻahu practitioners corroborated this idea, and also indicated many other advantages. Compared to the global approach, the
The place-based approach is: more conducive to learning by firsthand observation; more consistent with indigenous understandings of the landscape and thus more easily compatible with culturally relevant pedagogy with values-based education; more easily linked to local communities; more conducive to service-based learning with tangible results; more motivating and engaging for students; and more favorable to taking full advantage of educators’ own local knowledge, which interviews showed to be substantial. In this way, the place-based approach by its very nature incorporates many best practices for climate education.

**Place-based climate educators can teach both science and local knowledge**

There may be concerns that the place-based approach is inappropriate to science education due to the universalistic, place-transcending tendencies of science (Banuri and Apffel-Marglin 1993), or more generally that science and local knowledge will butt heads in climate education due to differing methods, values, and conclusions. Fieldwork for this Brief allayed these concerns. Oʻahu practitioners have identified many ways in which “universal” science can be taught in local places. Interviewees were unanimous in reporting that incompatibilities between science and local knowledge have presented no obstacle to their work. Although conflicts may arise in other cultural contexts, the lack of concern among Oʻahu practitioners suggests that, pedagogically speaking, science and local knowledge are more compatible than some academic discussion has assumed. Climate educators can and should pedagogically integrate the two knowledge systems in their work.

**Suitable places for climate education cannot be determined from afar**

When asked which Oʻahu sites would be favorable for place-based climate education, each interviewee named different sites, with little overlap between individuals. Many of the sites were extremely specific to particular Oʻahu communities and unknown to others (e.g. Uncle Nana’s Loʻi; the “mini-ahupuaʻa” at Loko Ea Fishpond). Many places that might have been expected to be named were not. Archaeologists make much of heiau (temple) sites, but interviewees rarely mentioned them. The website www.hawaiistateparks.org emphasizes a fish shrine and a fish lookout point as significant sites in the Kahana Valley, but interviewees never mentioned them. Diamondhead is ubiquitous in tourist imagery but virtually absent in interviews. The implication is that suitable places for climate education can only be determined by asking locals; they cannot be chosen beforehand, from afar, or on behalf of all communities across a territory.

**Climate change education need not be branded as such**

That climate change should be taught does not imply that “climate change” should be the headline; these are two different questions. Interviewees showed little support for framing their place-based environmental education initiatives in terms of “climate change.” Doing so, according to some interviewees, may alienate students before the project has even begun; helplessly focus attention on far-future scenarios; encourage blind trust of uncertain climate forecasts; and falsely isolate climate change as a standalone issue. “Environmental change” and “disaster” may be more effective and resonant framings.
References


## Appendices

### Appendix 1: List of interviews and site visits

<table>
<thead>
<tr>
<th>Date (2014)</th>
<th>Type</th>
<th>Researcher</th>
<th>Informants / Interviewees</th>
<th>Associated Organization(s)</th>
<th>Audio</th>
<th>Photo</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/5</td>
<td>Site visit, interview</td>
<td>PRG</td>
<td>CB</td>
<td>Ululani Beirne-Keawe (principle), Erwin Kahala, May Au, Makani Christensen, Thorin Evans, Kanoa Switzer</td>
<td>Ahupua’a O Kahana State Park and associated community organizations including Friends of Kahana</td>
<td>✓</td>
</tr>
<tr>
<td>5/6</td>
<td>Site visit, interview</td>
<td>PRG</td>
<td>CB</td>
<td>Jessica Casson, Ikaika Lum</td>
<td>Mālama Loko Ea Foundation</td>
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</tr>
<tr>
<td>5/7</td>
<td>Interview</td>
<td>PRG</td>
<td>CB</td>
<td>Charles Kaaiai</td>
<td>Western Pacific Fishery Management Council</td>
<td>✓</td>
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<tr>
<td>5/8</td>
<td>Interview</td>
<td>PRG</td>
<td>CB</td>
<td>Sam Gon</td>
<td>The Nature Conservancy of Hawai‘i</td>
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<tr>
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<td>PRG</td>
<td>CB</td>
<td>Hi‘ilei Kawelo</td>
<td>Paepae o He‘eia</td>
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<tr>
<td>5/9</td>
<td>Interview</td>
<td>PRG</td>
<td></td>
<td>Heather McMillen</td>
<td>UH-Manoa, “Learning from Local Ecological Knowledge to Understand Climate Change Impacts and Preserve Key Cultural and Natural Resources in Ka‘ūpūlehu, Hawai‘i”</td>
<td>✓</td>
</tr>
</tbody>
</table>

PRG = Peter Rudiak-Gould  
CB = Corrin Barros

Note: other initiatives related to place-based climate education that were not possible to be profiled during the period of fieldwork can be found here: [http://malama.hawaii.edu/resources/index.htm](http://malama.hawaii.edu/resources/index.htm)

* Although each informant was speaking about his or her experiences working in outreach with a particular organization, ultimately the informants were expressing their own perspectives and opinions, which are not necessarily the same as those of the organization and should not be construed as such.
Appendix 2: O‘ahu sites suited to place-based climate education

<table>
<thead>
<tr>
<th>Place</th>
<th>Possible climate topic(s)</th>
</tr>
</thead>
</table>
| Ahupua‘a O Kahana State Park  
- The Garden  
- Uncle Nana’s Lo‘i  
- Kahana Dam  
- O‘opu Pond  
- Hululu Fishpond  
- Kahana Bay shoreline  
- Kapa‘ele‘ele Ko‘a / Keaniani Kilo | Freshwater resources, seasonality  
Freshwater resources, seasonality  
Freshwater resources  
Freshwater resources  
Freshwater resources, sea level rise, storms  
Sea level rise  
Seasonality? Marine resources? |
| Loko Ea Fishpond  
- “Mini Ahupua‘a”  
- Mākāhā (sluice gates) | Freshwater resources, sea level rise, storms  
Freshwater resources  
Storms |
| O‘ahu moku (districts)  
- Kona  
- Ewa  
- Wai‘anae  
- Waialua  
- Ko‘olauloa  
- Ko‘olupoko | Numerous |
| Honolulu  
- Coastal buildings  
- Waikīki storm drains  
- Mapunapuna Street  
- Mānoa home gardens/lawns  
- Honolulu Harbor | Sea level rise, storms  
Sea level rise  
Sea level rise  
Freshwater resources / precipitation  
Marine resources, coral bleaching / ocean acidification |
| He‘eia Fishpond | Freshwater resources, sea level rise, storms |
| “Blue line” project sites | Sea level rise |
| Hālawa Xeriscape Garden | Freshwater resources |
| Waiahole Ditch Trail | Freshwater resources |
| Schools  
- School gardens  
- School aquaponics installations | Seasonality, freshwater resources / precipitation  
Freshwater resources |
| Mari’s Gardens aquaponics installation | Freshwater resources |
| Waimanalo Research Station aquaponics installation | Freshwater resources |
| Moku o Lo‘e (Coconut Island) | Sea level rise, marine resources, coral bleaching / ocean acidification |
| Mokaua Island  
- Mokaua Fishpond | Sea level rise, marine resources  
Sea level rise? Storms? |
Appendix 3: Map of significant places referenced in Brief

A detailed map of ʻahu’s traditional land divisions can be found here: http://www.ahamoku.org/wp-content/uploads/2013/03/M6OahuRasterFile-1.png