Natural-Cultural Resources and Climate Change in Kaʻūpūlehu

Place-based communities around the world are observing climate change as it affects the resources most important to them. Kamaʻāina from and people connected to Kaʻūpūlehu are attuned to seasonal and other cycles and patterns, and they have an acute sense of those changes. Their in-depth knowledge and experiences inform our understandings of environmental and climate change. Although scientists are improving the specifity of their projections on how weather, landscapes, and species may be affected by a changing climate, there is still a lot we do not know, including how many of the resources that are imporant for culture, sense of place, livelihoods, and subsistence are, and will be affected. Combining scientific, traditional, and local knowledge to desigin adaptation strategies and research initiatives that are scientifically sound and attuned to local value systems and priorities is critical for our communities. In this image of Kaʻūpūlehu we see locally important plants, animals, weather, and other features. Below is a description of how they may or may not be affected by climate change.

Lani (Sky)

Ua – Beginning about 30 years ago, kūpuna began noticing less rain and less predictable rain. Local observations are that the Kona winds used to bring rain in the winter months, but this no longer happens. Scientific research also documents how Kona has been experiencing a decrease in precipitation over the last three decades, and this trend of more consecutive dry days (drought) is also expected to continue (Chu et al 2010).

Kōlea – Kamaʻāina have observed the timing of the seasonal appearance and migration of the golden plover has changed. Although it used to come during the winter months, it can now be seen in summer, too.

Mahana (warm weather represented by the thermometer) - Kamaʻāina and kūpuna especially have observed warmer air temperatures and shorter cool seasons. They have also noticed that the snow on Mount Hualālai is a rare occurrance, not like the years when snow used to cover the mountain for two to three months, along with the snow on Mauna Kea and Mauna Loa. The warming air temperature trend over the last 30 years is expected to continue with significant increases at higher elevations and at night (Giambelluca et al 2008).

Makani - Kamaʻāina have observed that trade winds are less frequent and Kona winds are more frequent. Research has also documented a downward trend in the northeast trade wind frequency since 1973 (Garza et al 2012).

ʻIo – Most native bird populations are projected to suffer losses due to warming air temperatures. These are expected to increase avain malaria and decrease forest bird habitat (Fortini et al 2014). Because the endemic and endangered Hawaiian hawk is thought to be relatively immune to malaria, its future may be brighter, but research is still underway.

Honua (land)

Kukui **and ʻUlu** – Mo'olelo tell us of the kukui and ʻulu groves that once spanned Kaʻūpūlehu. They have decreased due to lava flows and other landscape transformations. Remaining trees may decrease further due to increasing drought and fires intensified by climate change.

Hala pepe –Climate change is predicted to further threaten the survival of many of Kaʻūpūlehu's rare plants that are already stressed by invasive species and habitat destruction. As the climate warms and dries, populations of many native trees such as hala pepe are projected to shift mauka and decline (Fortini et al. 2013).

ʻŌhiʻa lehua and ʻŌhiʻa lehua mamo – The majority of habitat for the most common species of ʻŌhiʻa lehua (*Metrosideros polymorpha*) will likely remain suitable for this species in the future, even with the effects of climate change (Fortini et al. 2013). As one of the most widely distributed native plants on Hawaiʻi Island, ʻŌhiʻa lehua is more tolerant and less vulnerable than many other native species. It is expected to continue to be a defining feature of Kona landscapes.

Wiliwili – The vulnerability of this native dryland forest tree to a warming and drying climate may be exacerbated by damaging gall wasp infestations.

Fountain grass – With decreasing rainfall and increasing fires, invasive species such as fountain grass are projected to continue to spread (Vorcino et al. 2014).

Lava fields - Despite extensive damage the lava flows caused to the native ecosystems, the breadfruit grove, and fishponds, the people of old adapted to their circumstances and continued to live on the land. Their descendants also continue to live and work on the land and tell the history of it from one generation to the next.

Kahakai (shoreline)

Limu – Local observers have noticed that the availabiltiy of limu kala, limu paheʻe, and limu kohu have decreased in the last 10-15 years. Kamaʻāina explain this is due to less rain at the shoreline and collection practices that are not pono such as overharvesting, harvesting at the wrong time, and removal of the entire root structure. With decreasing rain, their populations will continue to be stressed.

Haʻukeʻuke and ʻōpihi – Local observations of decreased populations of these traditional food species are usually attributed to overharvesting. Although rising sea levels will change the shoreline habitat for these favored foods, it is not known how their populations will be affected. Community-based monitoring of these resources will continue to inform our understanding of how they are being impacted and how they can best be managed.

Pa‘akai – With unpredictable rains, kama‘āina report that the traditional time to collect salt at Kalaemanō no longer is consistent with when the salt is ready to be harvested.

Ki‘i pōhaku and artifacts – Cultural resources at the shoreline will be affected by sea level rise. The papa kōnane found at the edge of an anchialine pond already becomes partially submerged when the tide is high.

‘Ōpae ‘ula and ae‘o - Anchialine ponds are habitat for the endemic red shrimp and Hawaiian stilt. The ae‘o critical habitat, including nesting areas, are projected to be affected by seal level rise. ‘Ōpae ‘ula habitat is projected to change, with some ponds going underwater, new ponds emerging, and some ponds becoming connected. There is concern about how this can connect and spread invasive fish and insects from affected to “pristine” ponds (Marrack 2014).

Kai pāpa‘u (shallows) and papa (coral)

Coral – Annual bleaching of corals around the world is projected to occur by 2070 (van Hooidonk et al 2013). Ocean acidification will also affect coral growth and recruitment and the entire marine ecosystems that rely on them.

He‘e - This favorite food may be affected by climate change, although it is not yet known how.

‘Āweoweo – Prized as a food and medicine, this fish relies on the reef. Hawaiian mythology describes the rare, but huge schooling/swarming events of these fish. Changes in current reproductive patterns and larval survival will likely affect ‘āweoweo in a negative way.

Manini and Pākuikui – These much loved foods also rely on the reef, especially as juveniles. The loss of coral that is predicted to happen as oceans become warmer and more acidic will negatively affect juvenile growth and survival, which will eventually decrease adult populations.

Kai hohonu (deep ocean)

Ulua – With changes to coral reef habitat and warming waters, ulua populations may be affected. More pono fishing practices can reduce the current stress on ulua populations and better help them withstand the impacts of climate change.

Manō – Kalaemanō, named for the point frequented by sharks, may experience different visitation patterns of sharks, such as the tiger shark depicted here.

Compared to reef fish, ulua and manō are expected to be less directly affected by climate change because they are transient predators and can hunt widely for prey. However, if the abundance of the fish they feed on declines, as is projected over the next 50 years, they will also be affected. These predators are the most susceptible to fishing pressure, which is projected to increase as the human population on Hawai‘i Island increases. This means that local commitments to manage fisheries in Ka‘ūpūlehu can play a strong role in supporting a

healthier, functional reef ecosystem. Those efforts can help buffer against the potential effects of climate change (Graham et al 2011).

ʻŌpelu – With warming waters and changes to currents, ʻŌpelu populations will likely decline due to the overall decline in ocean productivity around Hawaiʻi (Polovina et al . 2008). Because these fish are such an important part of subsistence and identity, they will likely be an important measure for observing change locally.

Looking ahead: resilient and adaptive communities

While no one community can stop global climate change, people can support healthy ecosystems in their own communities. This can make them more resilient, and better able to handle the stress from climate change. Based on close relationships with the land and ocean, people in Kekaha developed in-depth knowledge systems, and these guided their local resource management and use. They were keen observers and they learned to monitor and adapt to environmental changes and extreme events. They also passed on knowledge of their local environment to the younger generations so they could thrive. These traditions continue to inspire generations today. We can learn from the wise words of kūpuna from Kekaha. They represent the nature of adaption: being aware, taking care, and being flexible.

"*Taking care of each other was our culture*."
- Uncle Sonny Keakealani

"*We can't just live. We have to practice what our ancestors have shown us and practice how to take care of what we have*."
-Aunty Shirley Keakealani

"Continuing to *be nimble in response to our changing circumstance is critical*."
- Aunty Hannah Kihalani Springer"

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