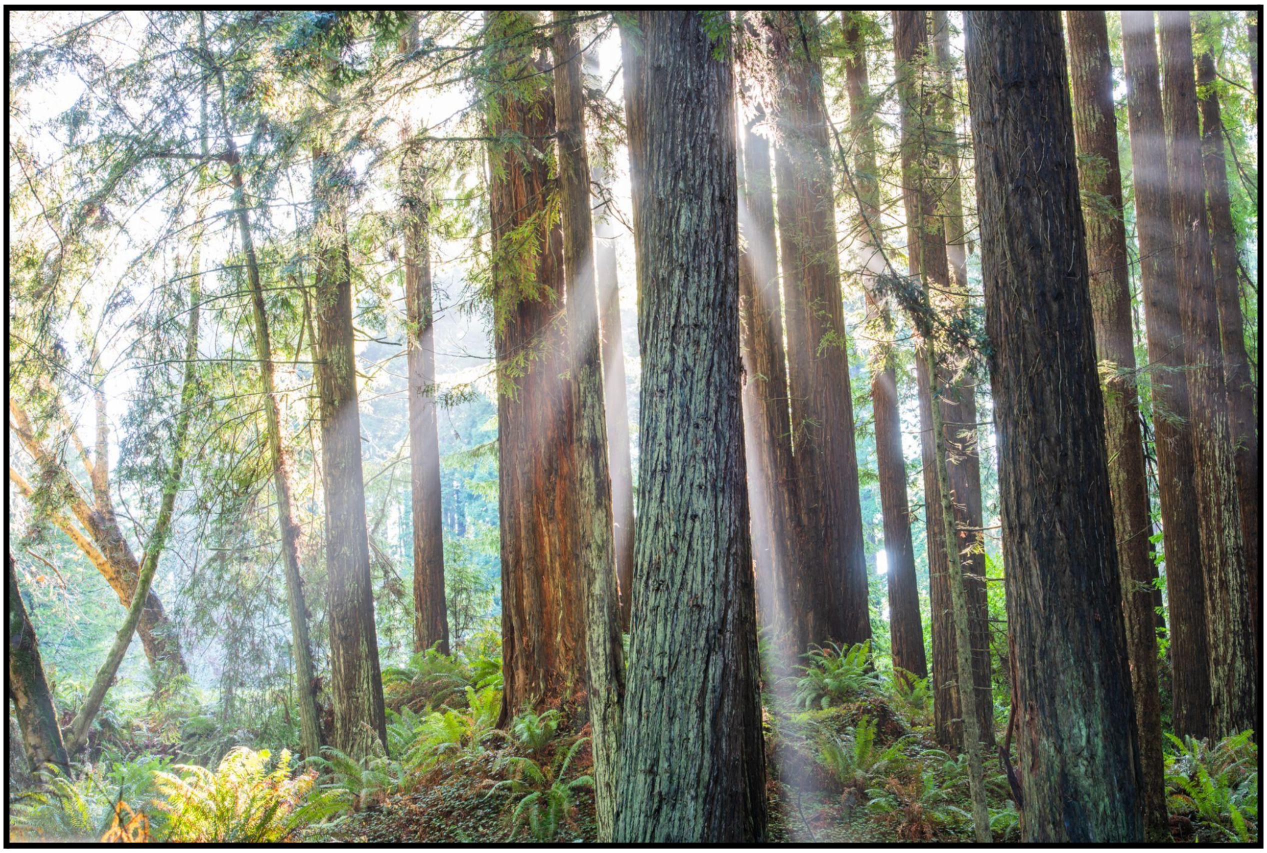
Cal Poly Humboldt

Climate Resilience Plan Executive Summary

Strategies to Build Resilience to Climate Change Impacts



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Introduction

In Humboldt County, like elsewhere in California and across the world, climate change-driven events are increasing in frequency and severity. Wildfire, sea level rise, intense storm events and other hazards have the potential of - or are already - disrupting nearly all aspects of community function, from public health to economic continuity, agricultural productivity, transportation networks, ecosystem services and infrastructure.

Building resilience means anticipating risks and preparing for changing conditions, so that when a severe hazard strikes, the campus and community will not suffer irreparable harm. It requires us to clearly define our vulnerabilities, as well as our strengths and assets that may support resilience. To do so, we take an intersectional approach to develop adaptation strategies that build resilience within the economic, social, and environmental dimensions of our campus community. In this way, we are better able to prepare for changing conditions, to endure and recover rapidly from disruptions, and to prepare our students to be leaders in building resilient communities.

Campus and community stakeholder engagement has been critical to campus climate resilience planning and capacity building. This has included:

- Report on the Initial Assessment of Campus-Community Resilience[1], completed in April 2018, which identifies vulnerabilities to climate change impacts, initial opportunities to strengthen resilience, and indicators the campus and City of Arcata can use to track progress;
- The Community Resilience Building Workshop in March 2019[2], which brought together campus and community stakeholders to identify and prioritize actions to improve campus-community resilience;
- The Climate Resilience Deliberative Forum[3], held in April 2019, which hosted an expert panel and engaged 50 student participants in developing recommendations, and
- Development of the Student Leadership Institute for Climate Resilience (SLICR), a three-day immersive residential program with service learning project for 25 student leaders, which was canceled in March 2020 due to Covid-19 restrictions but has spawned development of a Certificate in Climate Justice program through the Environmental Studies department.

Climate Hazards of Greatest Concern

The Humboldt Bay region is exposed to three climate change hazards of greatest concern: sea level rise, extreme weather events, and wildfire. Additional climate-related impacts to our area include drought, storm surges, invasive species, and the influx of climate refugees into our communities. Although there is some uncertainty in the timing and levels of frequency and severity of future impacts, Humboldt is planning now to adapt to the climate change hazards affecting our area. The hazards of greatest concern are discussed below.

[1] The Initial Assessment of Campus-Community Resilience was developed in accordance with Second Nature Climate Commitment guidelines and reporting requirements.
[2] The HSU-Community Resilience Building Workshop utilized a model developed by Community Resilience Building. See the HSU Workshop Summary of Findings.
[3] See the Climate Resilience Deliberative Forum Summary Report.

A. Sea Level Rise

Sea level rise (SLR) is driven by increased global average temperatures causing thermal expansion of seawater and glacial melting. Humboldt Bay is currently experiencing the highest rate of *relative* sea level rise compared to the rest of California (0.2 inches per year, or 19 inches per century), and this rate is expected to increase in the future[4]. Models suggest that, by 2050, Humboldt Bay will experience between 1.5 - 3.2 feet of sea level rise, depending on different emissions scenarios[5]. Three feet of sea level rise may cause Humboldt Bay to increase in size by 60%, threatening vulnerable coastal ecosystems, communities and infrastructure due to increased flooding, daily inundation and erosion. Although the main campus is approximately 1.5 miles from Humboldt Bay, students, faculty and staff living within and/or utilizing roadways within potential inundation zones will be directly affected. Critical university, municipal and commercial infrastructure (e.g., Arcata Wastewater Treatment Facility, the Humboldt Bay Aquatic Center, port facilities, U.S. Route 101) and farmlands are also within vulnerable locations.

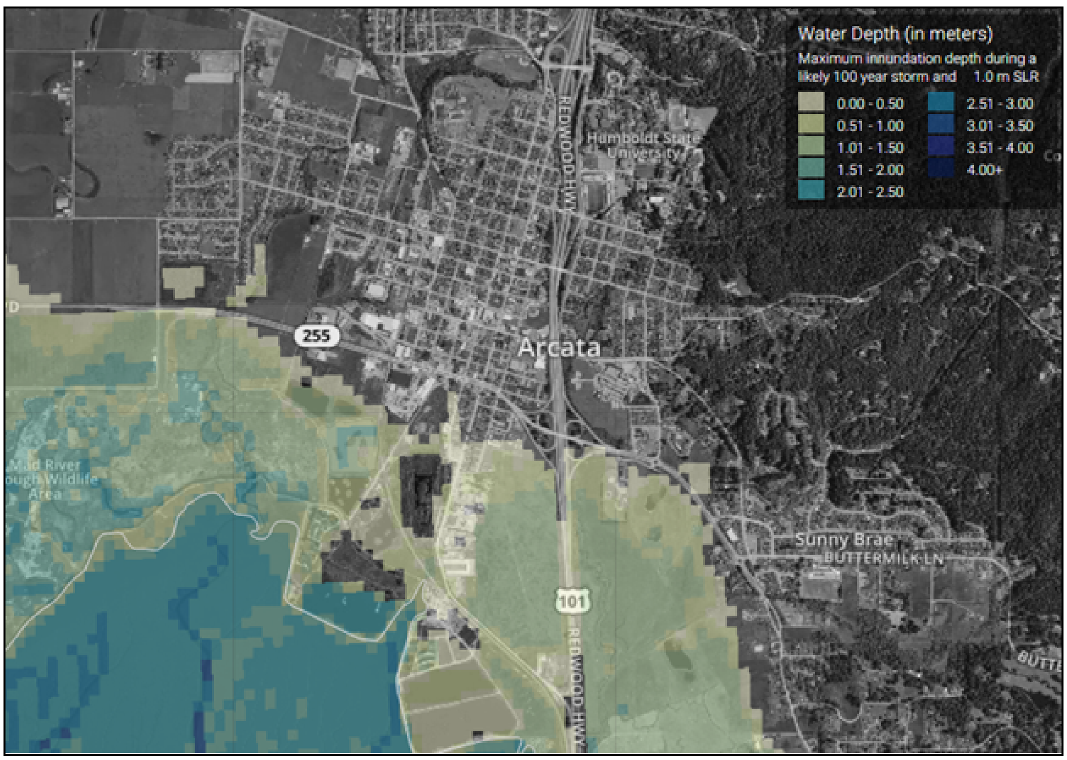

Figure 15. Map depicting Humboldt Bay inundation into the City of Arcata with a sea level rise scenario of 3.2 feet. Source: Cal-Adapt, http://cal-adapt.org/tools/slr-calflod-3d/.

[4] *Relative* sea level rise accounts for both the rate of sea level rise and land subsidence (local sinking), caused by the movement of tectonic plates. Humboldt Bay is experiencing subsidence of approximately 0.09 inches per year, or almost 10 inches per century. Interestingly, mankind's manipulation of Humboldt Bay has made it into a carbon source: thousands of acres of "reclaimed" tidelands (cut off from the bay by the construction of dikes) are now seasonal freshwater wetlands generating methane emissions, although these emissions may subside over time as SLR-driven expansion of Humboldt Bay returns the freshwater wetlands to saltwater wetlands. For more information on Humboldt Bay and SLR, see the Humboldt Sea Level Rise Initiative.

[5] Laird, A. (2018). Humboldt Bay Area Plan Sea Level Rise Vulnerability Assessment.

B. Extreme Weather

Climate change is expected to result in growing frequency and intensity of high precipitation events, such as extreme atmospheric rivers responsible for great amounts of rain in a short period of time[6], increasing the likelihood of larger and longer-lasting floods and landslides with far-reaching consequences. Already, during winter storm events, one or more of the primary routes into Humboldt County (i.e., US Routes 101 and 199, State Routes 299 and 36) are regularly closed, due to landslides, flooding or snow conditions. Our communities feel the impacts of these extreme weather (EW) related closures in the loss of economic activity, the movement of goods and services, and the ability of residents to reach their homes, work, or emergency services. Similarly, students and employees may find themselves unable to get to campus or leave the county during winter break highway closures. Food shipments to HSU's dining services may not reach the campus, affecting on-campus residents. In September 2019 the Humboldt Bay area was struck by a supercell rain event. Within the span of approximately 45 minutes, the event caused flooding in over 15 campus buildings and facilities, causing tens of thousands of dollars in damage, closures, and relocation of campus residents[7]. Heavier downpours on campus and communities surrounding Humboldt Bay will also increase the amount of urban run-off into streams, rivers and the bay, stressing wastewater treatment facilities and washing pollutants, trash, sediment, nutrients and other materials into sensitive areas. Roadways, made impassable by flooding or landslides, will prevent the movement of people and goods to campus and surrounding communities.

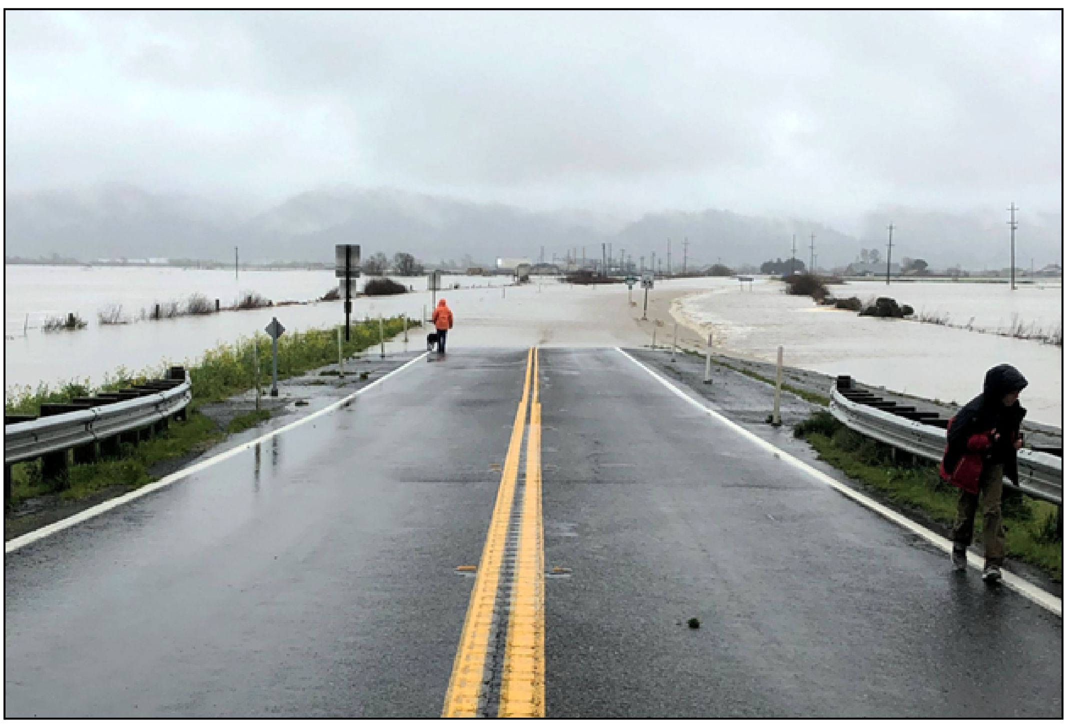

Figure 16. In February 2019, heavy rains brought flooding to the Eel River Valley, closing Highway 211, isolating the town of Ferndale and causing the death of one person. Source: California Department of Transportation.

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[6] Dettinger, M. (2011). Climate change, atmospheric rivers, and floods in California - a multimodel analysis of storm frequency and magnitude changes. *Journal of the American Water Resources Association*, 47(3), 514-523.
[7] See the *Lost Coast Outpost*, HSU Ravaged by Yesterday's Flooding; Numerous Buildings Suffer Water Damage.

C. Wildfire

Although the Humboldt Bay area is mostly within a low fire-hazard severity zone, the majority of the rest of Humboldt County is in high or very high fire-hazard severity zones[8]. Wildfire (WF) frequency and severity are projected to intensify in our region, and Humboldt County is projected to have one of the highest increases in burn areas in California, with projections as high as 300% by 2085[9]. Over the coming decades the campus community will be further exposed to diminished local air quality resulting from nearby wildfires. Atmospheric conditions will drive smoke and ash into the area, exacerbating heart and respiratory conditions within vulnerable groups, and reducing productivity as outdoor activities are canceled and HVAC systems struggle to maintain indoor air quality. Other risks to the campus community include loss of natural systems, property damage, power and telecommunication outages[10], landslides and soil erosion.

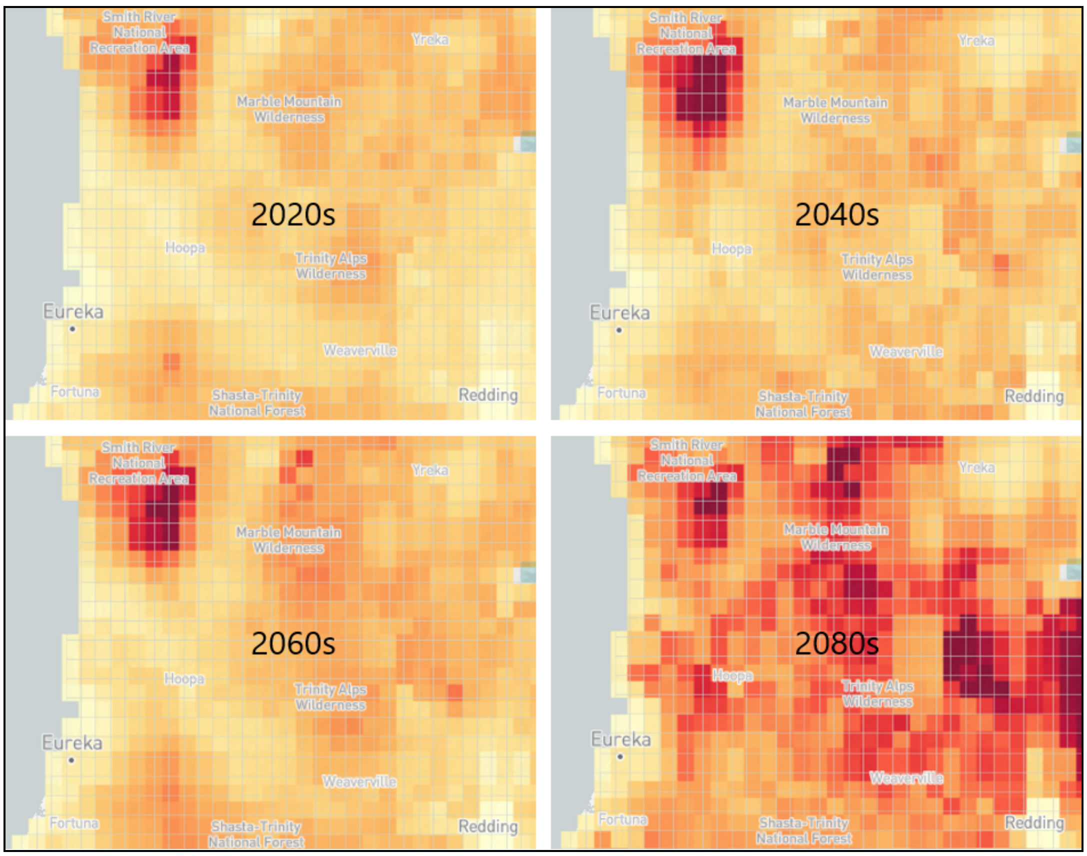

Figure 17. Decadal Averages Map showing Modeled Annual Area Burned under a Medium Emissions scenario and Central Population Growth scenario. Each grid cell represents 100 hectares. Source: https://cal-adapt.org/tools/wildfire/

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[8] CalFire. (2007). *Draft Fire Hazard Severity Zones in LRA*.

[9] Westerling, A., Bryant, B.P., Preisler, H.K., Holmes, T.P., Hidalgo, H.G., Das, T., & Shrestha, S.R. (2011). Climate change and growth scenarios for California wildfire. *Climatic Change*, 109 (SUPPL. 1), 445-463.

[10] Public Safety Power Shutoffs (PSPS) are conducted by PG&E, particularly during heavy wind events, to reduce risk of the utility's equipment starting wildfires. In 2020 PG&E was successful in islanding the Humboldt Bay Generating Station from the larger grid so it can continue to supply electricity locally while other parts of the grid are de-energized.

Critical Vulnerabilities to Hazards of Greatest Concern

Cal Poly Humboldt and the communities near Humboldt Bay are impacted, either directly or indirectly, by the same climate change hazards, and therefore share many of the same vulnerabilities. The interrelationship between Humboldt and local communities provides a framework for evaluating critical vulnerabilities to hazards of greatest concern (Figure 18):

Figure 18. Identified Vulnerabilities to Climate Hazards of Greatest Concern

		Hazard		
Dimension	**Vulnerability**	SLR	EW	WF
Infrastructural	Telecommunications		■	■
	Power Grid		■	■
	Water Supply/Treatment	■	■	
	Roads/Transportation Networks	■	■	■
	Buildings	■	■	■
Societal	Housing Security	■		■
	Outreach & Education	■	■	■
	Food Security	■	■	■
	Medical and Emergency Services	■	■	■
Environmental	Coastal Ecosystems (marsh, wetland, dune)	■	■	■
	Terrestrial Ecosystems (forests, riparian corridors)		■	■
	Agricultural lands (farming, ranching, aquaculture)	■	■	■
	Air Quality			■
SLR = Sea Level Rise | EW = Extreme Weather | WF = Wildfire				

Strengths and Assets

Strengths and assets are resources, capacity and characteristics that can be leveraged to overcome climate change impacts. Local governments, tribes, NGO's and Humboldt are already engaged to varying degrees in climate change adaptation, resilience planning and capacity building – a common strength that is building cohesive, self-sufficient communities with engaged citizens (Figure 19):

Figure 19. Strengths and Assets that Support Resilience

Dimension	Strengths and Assets
Infrastructural	Emergency power (micro-grids at the Blue Lake Rancheria and Humboldt County Airport)
	Capacity for emergency shelter (gymnasiums and other facilities)
	Stable domestic water systems with existing large capacity emergency water storage
Societal	High concentration of educated, actively engaged members of community and campus (e.g., technological and organizational expertise, educators)
	Local expertise in traditional ecological knowledge and self-sufficiency
	Proactive local and tribal governments building capacity and planning for disruptions
	Coordinated and collaborative emergency response
Environmental	Temperate climate
	Water supplies are stable
	Community protection and restoration of wetlands, forests, coastal buffers, parks and trails
	Local agricultural land, bay and ocean can be used to raise food for local consumption
	Local forests provide habitat, carbon sequestration, nutrient cycling, air and water purification, and other benefits to humans and non-humans

Strategies to Build Resilience

Cal Poly Humboldt understands resilience as the capacity to anticipate risk and to prepare for changing conditions, to retain essential functions during and after a hazard strikes, and to rapidly recover from severe disruptions. We build resilience through the implementation of adaptation measures that reduce our carbon footprint, that build equity and self-reliance, that protect biological and cultural diversity, and that ensure that basic goods and services (healthy food, clean water, health care, transportation) are accessible to all. The following strategies support Humboldt's core educational mission, values and strategic priorities.

Figure 20. Resilience (RES) Goal, Strategies and Actions

RES Goal	Develop a campus and community that can withstand and thrive through climate change-driven disruptions
Strategy 1	Plan now for a future constrained by climate change impacts.
1.A	By 2025, integrate climate resilience, equity, adaptation and hazard mitigation strategies into the campus physical master plan.
1.B	Add climate adaptation planning to the charge of relevant committees, including the Space & Facilities Advisory Committee, the Landscape and Tree Advisory Committee, and the Parking & Transportation Committee.
1.C	Advocate for transfer agreements with other CSU's to facilitate educational continuity during a disaster-driven campus closure.
1.D	Maintain and enhance community partnerships to improve emergency response, decrease response times, better utilize resources, and advocate for vulnerable/underserved populations.
1.E	Strengthen dialogue with tribal, cultural and faith-based leaders to build trust and coordinated responses to climate related hazards. (e.g., community resilience collaborative).
Benefits	• Proactive vs. reactive approach to climate change impacts • Bake in nimbleness to response to future risks • Forge stronger relationships with community • Engage campus decision makers in resilience planning
Challenges	• Requires investment in education and training of constituents • May require paradigm shift in how planning is conducted
Economics	Low investment today will avoid potentially significant costs in the future (due to clean-up and repair costs, loss of productivity due to climate related disruptions, high costs for emergency response, insurance costs, etc.).
Feasibility	Achievable: Campus is already engaged in a master plan update and has built relationships with community partners.
Leads	Office of the President, Administration & Finance

Strategy 2	Educate the campus community about climate change vulnerabilities and adaptation strategies.
2.A	Develop "Building Resilience to Climate Change" displays or dashboards highlighting vulnerabilities, strengths and progress.
2.B	Expand emergency preparedness training programs for students, faculty and staff, to address response to poor air quality, flood hazard, and other climate change-driven hazards.
2.C	Increase ability to respond to future disasters on and off campus by supporting Center Activities' delivery of CPR, first aid and first responder training.

2.D	Foster research on climate adaptation strategies by offering faculty professional development opportunities and encouraging systems to share best practices.
2.E	Integrate preparedness, climate resilience and traditional ecological knowledge (TEK) modules into relevant academic curricula.
2.F	Enhance opportunities for students to gain hands-on learning in climate resilience through service learning, internships, and other community based offerings.
Benefits	• Prepares students, faculty and staff with skills and knowledge to be active participants in climate resilience and emergency response • Fosters self-sufficiency • Builds community resilience through research outcomes • STARS credits
Challenges	• May depend on securing grants from unpredictable funding sources • Requires faculty and staff with interest and expertise • May be perceived as an attack on faculty autonomy
Economics	Net cost to enhance training and professional development programs; research can be funded by grants.
Feasibility	Some challenges but achievable: an emergency preparedness program is already in place, professional development on integrating climate resilience into the curriculum has been launched.
Leads	Academic Affairs, Dean of Students, Sustainability Office, Risk Management

Strategy 3	Reduce food and housing insecurity.
3.A	Expand and support the Oh SNAP! food pantry's fresh farm stand, its partnership with local working farms, and its food education programs.
3.B	Support the development of traditional and culturally appropriate campus gardens, edible landscapes and curriculum to increase opportunities for students to learn how to grow, find and preserve food.
3.C	Support campus and municipal efforts to develop affordable, equitable, transit-oriented housing in proximity to campus.
3.D	Except where infeasible, incorporate community garden space into the design of all new on- or off-campus housing developments.
Benefits	• Addresses basic needs • Fosters self-sufficiency • Cost savings and GHG reductions for students • Potential to positively impact enrollment
Challenges	• Costs and available land for new housing, transit and bike parking infrastructure • Limitations to space and solar access for edible landscapes/gardens
Economics	Net Cost
Feasibility	Achievable but with Challenges: High costs for new housing, but some managed gardens and edible landscapes already exist on campus, Oh SNAP currently coordinates a limited farm stand, and the campus participates in housing discussions with the City.

Leads	Facilities Management, Health Education

Strategy 4	Improve ecosystem management to increase biodiversity, remove invasive species, and foster pollinator health.
4.A	Develop and implement an Integrated Pest Management (IPM) plan.
4.B	Phase out the use of glyphosate, aka Roundup ®, and other pesticides harmful to biodiversity and human health.
4.C	Where possible, replace invasive species with native and pollinator friendly plants.
4.D	Where possible, convert unused turf areas to native, climate adapted and pollinator friendly plants.
4.E	Become a *Bee Campus USA* affiliate[11].
4.F	Process all green waste on site to use for composting, mulching, moisture retention and carbon sequestration.
4.G	To the greatest extent possible, incorporate climate resilient landscape design and the use of native, climate adapted plants into landscape planning for all new construction on and off campus.
Benefits	• Enhances ecosystems services • Fosters human health, including health of Grounds personnel • Reduces resource consumption and GHG emissions • Service learning opportunities for students • STARS credits
Challenges	• Replacing chemical applications with cultural and mechanical practices may require additional labor hours • May need to train Grounds personnel in alternative techniques • Maintenance of some non-turf landscapes may take as much or more time than turf
Economics	Cost Neutral to Net Cost: cost savings realized from reduced gas, water and chemical use, and from green waste transport costs and fertilizer purchases may offset turf conversion costs, IPM plan development and Bee Campus application fee.
Feasibility	Achievable: the Grounds department has completed some turf conversions already and practices limited application of chemical treatments.
Lead	Facilities Management

Strategy 5	Improve storm, wastewater and irrigation management.
5.A	Develop and implement a holistic, Low Impact Development (LID) plan, based on flood modeling, to manage stormwater, wastewater and groundwater (e.g., with bioswale, permeable surfaces, storm drain maintenance, rainwater capture/storage, and greywater treatment/re-use).
5.B	Integrate LID and infiltration elements, such as permeable pavement and bioswales, into new paving projects to reduce runoff volume.

[11] See the Bee Campus USA Commitments. Application fee is $300.

5.C	Where feasible, decrease runoff from existing parking lots by adding LID elements like open-grid pavement and vegetated bioswale areas.
5.D	Work with the City of Arcata to determine the feasibility of irrigating campus with reclaimed water.
Benefits	• Clean and slow down release of stormwater prior to discharge into the creeks and City system • Comply with stormwater discharge requirements • Mitigate point source pollutants entering waterways • Reduce dependence on domestic water • STARS credits
Challenges	• Costs and maintenance requirements for certain LID elements like bioswales • Costs and permitting for "purple pipe" reclaimed water infrastructure
Economics	Net Cost: Some savings may be achieved by reducing domestic water consumption and stormwater discharge fees.
Feasibility	Doable to Challenging: Significant capital outlay may be required for reclaimed water infrastructure and for planning, engineering and installation of LID elements.
Lead	Facilities Management

Strategy 6	Improve indoor and outdoor air quality.
6.A	Develop and implement Smoke Readiness Plans for campus buildings.[12]
6.B	Design new housing with specific measures to minimize occupant exposures to wildfire smoke events, e.g. main entrance doors on the opposite side of the building from prevailing winds, high efficiency HVAC filtration, and building weatherization to limit smoke entry.
6.C	Designate and equip indoor clean air respite centers to protect the most vulnerable from hazardous air quality.
6.D	Strengthen Zero/Low Volatile Organic Compounds (VOC) requirement for all paints, floor coverings and furniture.
6.E	Communicate and comply with CARB anti-idling regulations[13]
Benefits	• Protect health and well-being of vulnerable populations • Improved building comfort and air quality • STARS credits
Challenges	• Space and resource requirements to open clean air respite centers • Low to moderate additional capital outlay for high efficiency filtration for buildings • Zero/Low VOC materials and furnishings generally cost more
Economics	Net Cost, although some energy savings may be realized over time through weatherization and HVAC efficiency.
Feasibility	Achievable with Some Challenges: May be difficult to retrofit some existing buildings.

[12] See the ASHRAE Planning Framework for Protecting Commercial Building Occupants from Smoke During Wildfire Events.
[13] California Air Resources Board (CARB) anti-idling regulations.

Lead	Facilities Management, Risk Management & Safety Services

Strategy 7	Strengthen campus emergency operations and response.
7.A	Maintain emergency water supply to provide a gallon a day per campus resident for up to seven days.
7.B	Maintain and strengthen redundancies in campus telecommunications and IT networks.
7.C	Install a solar microgrid with battery storage on campus to maintain continuity of power to critical loads in times of power outage (see BEF 2.1.A).
7.D	Support systems for non-electronic communication that require no electricity or internet, such as emergency wayfinding signage.
Benefits	• Maintain continuity during extended power outages • Help ensure basic needs are met for most vulnerable populations • Enhance quick response times in an emergency
Challenges	• Solar and battery project requires long term contract with a third party • May require additional utilities and other infrastructure • Emergency water distribution requires organized distribution and communications
Economics	Neutral to Net Cost: utility savings can be realized from solar electric systems supplying the microgrid. Grants, incentives and financing mechanisms may apply.
Feasibility	Achievable: Emergency water supply system is currently in place, the IT department is already investing in telecommunications redundancies, and RFP for solar and battery has been released.
Leads	Facilities Management, Risk Management & Safety Services