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Caring for Clear Lake

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Introduction

AB 707 established the [Blue Ribbon Committee for the Rehabilitation of Clear Lake](#) (BRC) and provided funding for researchers from UC Davis Center for Citizen and Community Science (CCCS) and Center for Regional Change (CRC) to conduct applied research to guide the Committee in improving the environmental quality and environmental education for the communities surrounding Clear Lake in Lake County, California. Clear Lake communities are diverse with historical and contemporary interconnections reliant on interdependent systems including the lake and its watershed. Seven Tribal nations call the Clear Lake region home - the Habematolel Pomo of Upper Lake, Big Valley Band of Pomo Indians, Elem Indian Colony, Robinson Rancheria of Pomo Indians, Middletown Rancheria of Pomo Indians, Scotts Valley Band of Pomo Indians, and Koi Nation. Working collaboratively with such key stakeholders, we developed a framework centered on building mutual relationships, caretaking, and justice. Our

work with partners, including the BRC, is in service to equity and educational access. We have sought to advance environmental education in the region by learning from and building on the Lake County Strong program as well as myriad existing projects, programs, and resources in the region. Our work has leveraged a youth community and citizen and community engaged process to further develop youth agency and draw on local expertise in understanding the environment. Doing so has strengthened the social systems that are only interdependent and foundational in the development of the region.

Blue Ribbon Committee for the Rehabilitation of Clear Lake

The BRC recognizes that the health of Clear Lake is intertwined with the health of the people who rely on it. Youth and other residents have the knowledge, skills, and values needed to become effective stewards of the Clear Lake environments and succeed in related education and career pathways. Existing programs run by organizations throughout the region provide opportunities for youth stewardship. The BRC expressed a desire for the development of educational materials that support local organizations to build a Clear Lake stewardship ethic among youth.

These materials support the goals of the BRC toward revitalizing the lake and its surrounding communities by:

- Designing the educational materials to be accessible for non-formal educators lake-wide.
- Building a stewardship ethic among youth by engaging them in real science projects taking place in the Clear Lake region.
- Promoting existing programs that actively engage learners in hands-on scientific discovery and that provide pathways to academic and professional achievement.
- Actively partnering with area Tribal governments and residents in the development and implementation of materials in ways that respect traditional ecological knowledge and current culturally-relevant approaches to caring for the lake and its communities.
- Ensuring that Clear Lake non-formal educators have the curriculum and training needed to be effective in utilizing the newly created educational materials.
- Sharing our resource findings and EE materials in a variety of easily accessible formats.
- Orienting all activities around building local capacity for long-term sustainability.

Project Development

The project team worked with key local partners (including Tribal nations and government agencies, non-profit organizations, educators, and others) to identify existing environmental educational (EE) and participatory science resources and programs in the region. This includes projects and programs of Tribal Nations, community-based organizations, and other local government departments. An initial web scan created an inventory of the publicly available information on environmental educators, projects, programs, and curriculum from

community-based organizations. The project team then met with individuals to discuss their personal and organizational perspectives on environmental education in the region.

The conversations and information from the web scan provided an initial understanding of the region's strengths, challenges, and environmental concerns. The project's initial findings, [documented here](#), provide background on the region's unique natural and cultural history, and current environmental issues and solutions. In addition to the local resources and [conversations with over 50 Tribal and community members](#), the project team learned about the region's needs and priorities during local organizational and public meetings, outreach events, and presentations. This process supported the BRC's request that the project integrate the region's existing projects, programs, and curriculum.

An initial draft of the project's EE materials was shared with a Tribal Environmental Education Advisory Committee (TEEAC). Members of all seven Tribes within the Clear Lake region were invited to receive compensation to participate in a series of three meetings to review and provide feedback on the initial draft. This feedback is integral in ensuring that the materials are culturally relevant, accessible, accurate, and address Tribal priorities for EE in the region. The BRC and the project team strongly place Tribal support as integral to the success of this project, and the TEEAC was one of multiple places Tribes have generously informed this project. The initial draft was also shared with Tribal and community members who spoke with the project team in the initial phase.

Changes from the TEEAC meetings and invited individuals' feedback were incorporated into a second draft of the materials. The second draft of the materials was then organized onto a Google site, used during a training for interested educators in the region. Outreach to the project's contact list, with additional help from others, resulted in an attendance of 17 educators representing non-profit organizations, schools, and agencies, who were offered compensation for their time. Some participants of the March educator training agreed to receive additional compensation for their time piloting the materials in their educational setting and providing feedback through an evaluation survey. The final draft of the materials addressed the feedback from the educators who participated in the training and piloting. This process ensured that the project's materials were not only relevant to the programming for educators, but also broadly easy to use and adapt to a variety of educational settings.

A discussion at the BRC's Socio-Economic Subcommittee April 2024 meeting provided guidance for long term community ownership and maintenance of the project's materials. A fourth TEEAC meeting held in June 2024 determined the responsibilities for maintaining this project's materials, desired next steps within the community, and a partnership for housing the materials. This ensured that this project's product is owned by the community, has dedicated oversight on keeping materials up-to-date, and can have local leadership expand upon it in the future if desired. As a result of this meeting, the Lake County Office of Education became the point of contact and host for this project after July 2024.

Clear Lake Caretaking: Community-Based Partners

To create EE materials that are relevant, used long-term, and truly serve the community, reflecting contributions from local partners (including Tribal nations and government agencies, non-profit organizations, educators, and others) is essential. We acknowledge and honor the important contributions to this project from local partners through the following:

- Providing free and publicly available educational resources as background information for the project team as well as supporting the module activities.
- Sharing their knowledge, experiences, and perspectives on regional EE in conversations with the project team.
- Informing and educating the project team on how to improve institutional engagement in the local community.
- Sending the project team resources to share or link to in the EE materials.
- Providing thoughtful comments and writing to the project's EE materials.
- Inviting the project team to give presentations or attend events or meetings.
- Supporting this project through word-of-mouth or sharing outreach materials.
- Housing, updating, and adding to the project's EE materials long-term.

A full list of collaborators to this project is available in the [Contributors and Community Partners](#) section.

Approaches

Honoring Tribal Ecological Knowledge and Leadership

We would like to take a moment to respectfully acknowledge that the land on which we stand, Lake County and the land surrounding Xa Batin or today's Clear Lake, is in the traditional territory of:

- Danoxa, Mountains by the water (Robinson Rancheria)
- Elem, The people of the water (Elem Indian Colony)
- Habematolel, Village of the rock people (Hebematolel of Upper Lake)
- Wilokyomi, Ash Home (Middletown Rancheria)
- Kuhlanapo, Waterlily People and Xabenapo, Rock People (Big Valley Band of Pomo Indians)

- Ye-Ma-Bax, People of Above and Beyond (Scotts Valley Band of Pomo Indians)
- and Koi (Koi Nation)

At one time there were more than thirty villages in Lake County of which these seven Federally recognized tribes remain today. We acknowledge that each tribe has a rich history and living culture steeped in a reciprocal relationship with the land, and all other living beings.

We acknowledge the painful history of genocide and forced occupation of these territories and we respect the diverse indigenous people connected to this land on which we gather.

We acknowledge that as the original stewards of this land, these tribes carry traditional and ecological knowledge that can help to heal the damage that has been done following colonization of these territories.

We dedicate these materials to the original and continued stewards of the Clear Lake watershed: the region's seven Pomo Tribes and Tribal people who have inhabited and cared for the land and waters and the ecosystem as a whole for millennia. The intention of this project is to honor and incorporate Tribal ecological knowledge and environmental resource management expertise, whether cultivating and protecting materials for their world-renowned woven baskets or monitoring Harmful Algal Blooms in their state-of-the-art science labs.

The materials are therefore designed to draw from Indigenous traditions of cherishing and protecting the environment for the benefit of both instead of the dominant Euro-American view in which humans and nature are separate and in which humans dominate and exploit nature. The materials strive to reflect an Indigenous perspective on the interconnectedness of all elements of the ecosystem: its land, water, animals, soil, and plants as well as human communities.

The materials are intended to support educating the next generation of Tribal and non-Tribal youth environmental stewards in ways that promote academic and professional advancement in scientific careers as well as individual actions. They also highlight the cultural dimensions of ecological knowledge and stewardship. Towards these ends, the materials feature activities that both grow ecological knowledge and help all students to apply this knowledge in building individual environmental ethics and informed collective action to care for the Clear Lake ecosystem as their common home.

From [Sally \(hīn 'ónni\) Peterson, Middletown Rancheria of Pomo Indians of California](#):

We live off the land. It is the land that is being impacted by climate change. Unless we do something drastically, quickly, the land will not be salvageable. We are tied to the land. If the land goes away, we go away as a people.

Acknowledging and Valuing Youth Expertise and Assets

Young peoples' knowledge, talents, vision and energy are critical to the success of environmental caretaking efforts; however, they usually are not included in decision making processes that directly impact them. In contrast to the predominating approach of youth marginalization and exclusion, these materials were developed with a focus on youth engagement. The goal of these materials is to center and support youth perspectives and engagement as the driving forces guiding the learning process. By acknowledging, valuing and cultivating young peoples' expertise, leadership, skills and agency, they can become key contributors to the caretaking of Clear Lake and its interconnected ecosystems.

We drew from a number of frameworks and models to develop these materials, including positive youth development, experiential education, youth community and citizen science (YCCS), and youth participatory action research (YPAR). The resulting process-oriented approach is intended to emphasize hands-on learning, reflection, relationship building, risk-taking and fun in an environment that is conducive to youth's safety and needs.

To support even greater youth leadership and agency, we also designed a youth-driven pathway through these materials. This suggested sequence of activities pulls from multiple modules and local resources. It also draws upon YPAR principles and practices and includes activities adapted from the [Community Futures, Community Lore Stepping Stones YPAR Toolkit](#) from the UC Davis School of Education and Center for Regional Change. Facilitators who want to run a process that is driven by local youths' knowledge and interests and supports their leadership and action more explicitly can find additional information in the [Overview of Activities and Modules](#) section.

Participatory Science

In community and citizen science, people who do not self-identify as professional scientists actively participate in scientific research and monitoring. There are many different practices and approaches, stemming from academic traditions such as citizen science, participatory action research, and community-based participatory monitoring. To honor the history and distinct approaches of each, the materials use the umbrella term, participatory science.

Participatory science is an approach to scientific research in which members of the public work alongside professional scientists as active contributors rather than passive subjects. The collaboration can occur in various stages of the research process, from project design to data collection and analysis. Participatory science aims to involve a diverse range of participants, including individuals from different backgrounds, ages, and levels of expertise. This diversity enhances the richness of data and brings varied perspectives to scientific inquiry. The approach seeks to democratize access to and engagement with scientific research, allowing non-experts to contribute meaningfully to the advancement of knowledge.

Overall, participatory science emphasizes the idea that scientific research can be a collaborative and inclusive endeavor, benefiting from the collective efforts of both experts and interested members of the public. This approach has gained popularity due to its potential to address complex research questions, increase the scale of data collection, and promote science literacy and engagement within communities.

Youth Community and Citizen Science (YCCS) Framework

Youth participation in participatory science projects supports not only understanding science content, but also youth identities with science and agency in taking action for the environment. Community and citizen science embodies the ‘power of place’ as students investigate issues affecting their local area, which can contribute to conservation decisions and community resilience. When youth participate in science investigations that also examine human behaviors and community concerns, they are able to draw on funds of knowledge built outside the classroom to engage in complex scientific reasoning. Youth participation in community and citizen science projects therefore presents the opportunity for collective learning activities focused on observing changes in one’s place, creating an explicit link between doing science, deepening connection with place, and taking action with science—all of which may influence participants’ identity and environmental science agency in different and profound ways. The UC Davis Center for Community and Citizen Science has distilled these research findings into its [YCCS framework](#), which provides core activities and practices for fostering environmental science agency.

YCCS Framework and this Project

These materials integrate core activities, key educator practices, and key youth practices described in the YCCS framework. Learning becomes more powerful when youth are encouraged to take on meaningful roles and view their work as purposeful. In order to position youth as people who do science, the activities provide diverse pathways for expressing understanding and taking action. By centering local environmental issues like invasive species, harmful algal blooms, pollution, and wildfires, students can draw on their lived experiences and existing connections to Clear Lake. The learning is culturally relevant to students, and they can see direct benefits to the data they contribute to participatory science projects to their community. Framing the impact that they are able to have on issues in the Clear Lake region as part of the broader global scientific endeavors ultimately facilitates students’ development of agency. Each of the module overviews list the participatory science projects highlighted within each module.

Lake County Strong

The fully integrated, multi-disciplinary, project-based [Lake County Strong Curriculum](#) is designed for teachers to support families and students across grade levels in learning about Lake County’s

past and present. The curriculum addresses state standards while allowing students to follow their own interests and think about how they can have a positive impact in Lake County.

Students complete activities, a community-building project, and a final project. Families choose 2 activities each for students to complete under ELA, math, science, and social studies subjects. The community-building project allows for students to help “make Lake County strong” by choosing, participating in, and reflecting on a community service project. Student learning from both the activities and community-building project is shared through the final project.

In 2020, representatives from Big Valley Band of Pomo Indians, Elem Indian Colony, Habematolel Pomo of Upper Lake, and Robinson Rancheria of Pomo Indians worked with the Lake County Office of Education to develop a strand of specific Pomo-based activities for the curriculum. The successful collaboration between Tribes and Lake County Office of Education has produced a curriculum that also incorporates culturally significant topics. As a result, the curriculum offers opportunities for students, both Native and non-Native, to connect to Lake County’s history and future.

The Lake County Strong Curriculum and this Project

This project’s materials build off of the shared goals of the Lake County Strong curriculum. The Lake County Strong curriculum, like this project’s materials, can be used lake-wide with non-formal educators to support families and youth to engage in uniquely locally relevant activities. Lake County Strong’s Pomo strand of lessons is particularly important as Tribes have shared knowledge on caretaking the lands surrounding Clear Lake since time immemorial, and continue to lead the way for others today.

This project’s activities incorporate lessons from all five strands of the Lake County Strong curriculum. The purpose of these connections is to extend learning opportunities on environmental issues and activism within Lake County to build stewardship amongst youth and their families. Educators have the option to use the suggested Lake County Strong activities in addition to or in conjunction with the module activities.

Standards Connections

Next Generation Science Standards (NGSS) and the Environmental Principles and Concepts (EP&Cs)

Engaging in authentic research through a participatory science project can allow students to express their understanding in different ways and deepen their engagement across content

standards. California adopted the NGSS in 2013, which called for an instructional shift focused on inquiry and systems thinking rather than the learning of discrete facts. In 2018 the California Department of Education (CDE) called for the EP&Cs to be integrated into all future frameworks as well. From the CDE:

“California's Environmental Principles and Concepts (EP&Cs) highlight the deep relationship between humans and the natural world. Teachers can support environmental literacy by helping students to understand and apply the EP&Cs across academic disciplines and in the real world.”

The EP&Cs are addressed through multiple academic content areas provided on the [CDE Content Standards](#) web page.

Utilizing the UC Davis Center for Community and Citizen Science's YCCS framework throughout the materials provides opportunities for students to engage with all three dimensions of NGSS. Students learn the disciplinary core idea as outlined in their grade level through the practice of analyzing and interpreting data, and gain a deeper understanding of the cross cutting concepts of systems and system models. They can access English Language Arts content on a more complex level because they see how their own observations and research are connected to their reading and writing. With this deeper understanding of how the ecosystems around them function, they begin to also understand the EP&Cs as they look at human impacts and ways they are able to take action and make change.

Next Generation Science Standards (NGSS) K-12 Connections

Science and Engineering Practices	Crosscutting Concepts
Ask Questions Develop and Use Models Plan and Carry Out Investigations Analyze and Interpret Data Use Mathematical and Computational Thinking Construct Explanations Engage in Argument from Evidence Obtain, Evaluate, and Communicate Information Define Problems and Design Solutions	Patterns Cause and Effect Scale, Proportion and Quantity Systems and System Models Energy and Matter Structure and Function Stability and Change

Disciplinary Core Ideas

Life Science	Earth Science	Physical Science
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From Molecules to Organisms: Structures and Processes Ecosystems: Interactions, Energy and Dynamics Heredity: Inheritance and Variability of Traits Biological Evolution: Unity and Diversity *Engineering Design	Earth's Place in the Universe Earth's Systems Earth and Human Activity *Engineering Design	Matter and Its Interactions Motion and Stability: Forces and Interactions Energy Waves and Their Application in Technology for Information Transfer *Engineering Design
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Environmental Principles and Concepts, TK-12

Read in full [here](#).

Principle 1 - People Depend on Natural Systems

The continuation and health of individual human lives and of human communities and societies depend on the health of the natural systems that provide essential goods and ecosystem services.

Principle 2 - People Influence Natural Systems

The long-term functioning and health of terrestrial, freshwater, coastal, and marine ecosystems are influenced by their relationships with human societies.

Principle 3 - Natural Systems Change in Ways that People Benefit From and Can Influence

Natural systems proceed through cycles that humans depend upon, benefit from, and can alter.

Principle 4 - There are no Permanent or Impermeable Boundaries that Prevent Matter from Flowing Between Systems

The exchange of matter between natural systems and human societies affects the long-term functioning of both.

Principle 5 - Decisions Affecting Resources and Natural Systems are Complex and Involve Many Factors

Decisions affecting resources and natural systems are based on a wide range of considerations and decision-making processes.