STEMS² Unit Plan

BACKGROUND:

Wetlands are critical ecosystems that are defined as areas of land and soil that are covered by water for periods of time throughout the year (U.S. Environmental Protection Agency, 2025). These ecosystems are hotspots of biodiversity and serve a range of important ecological functions (National Park Service, 2025). Over time, human relationships with wetlands have evolved drastically, changing in many places from relationships of stewardship and cultivation to those of avoidance and destruction. There is a need to rebuild our relationships with wetlands and honor those whose relationships of cultivation of wetland spaces have persisted through time, in order to help to revitalize these wondrous ecosystems.

This unit plan is designed as an out-of-school workshop series aimed to help participants build and cultivate their relationships with wetlands through learning experiences that are grounded in local place and community. The workshop series is based on STEMS² pedagogy, which centers a sense of place and draws on values of aʻo, moʻolelo, makawalu, and advocacy in interdisciplinary teaching of STEM and social science content areas (O'Neill et al., 2023). Sense of place and engagement with local communities are integral and drive the content learning throughout the series. That is why the overall curriculum is designed with several huakaʻi (trip, journey, field trip) and ample opportunity to connect and engage with various community partners.

The original design of this workshop series is tied to places on Oʻahu, specifically referencing areas around Kailua, Mānoa, and Waikīkī. Various elements of content learning are related to the three aforementioned places and history relevant to the people inhabiting these places to work toward building the sense of place of participants who live on Oʻahu. However, that being said, the workshop series is designed to be flexible in implementation, and with some effort on the facilitator's end, the content can be adapted to relate to wetlands in different places. If you are intending to implement this workshop series in a place other than Kailua, Mānoa, and Waikīkī or Oʻahu, you are encouraged to adapt the content and field trips accordingly.

In addition to building sense of place, another main intention of this learning experience is to bring together community members to participate in a collaborative learning experience with the workshop facilitator and community partners.The detailed lesson plans for the workshops in this series include specific examples of community partners that may be contacted to work together on the implementation of lessons and assessments throughout the series. The selection of these examples were based on research on local wetlands sites and organizations associated with their stewardship and restoration activities, as well as personal experiences with some of the organizations and groups mentioned. You are invited to do your own research and reflect on community partners and organizations that you may already have ties to or would like to connect with through the implementation of this workshop series. If you are intending to implement this workshop series in a place other than Kailua, Mānoa, and Waikīkī or Oʻahu, I encourage you to look into organizations and community partners associated with wetlands education, stewardship, conservation, and restoration in your area. Regardless of which path you choose, I encourage you to connect with your chosen community partners well in advance of implementation, share this document and the detailed lesson plans with them for them to review, and discuss your personal intentions in leading this workshop series and how they can work with you throughout the series to foster a meaningful collaboration.

In general, as the workshop facilitator, you are encouraged to deliver the series in a way that aligns with your place and personal and community connections to create a truly community-engaged, place-based and personalized learning journey. Successful delivery of this workshop series would benefit from background knowledge about wetlands and associated ecology concepts, as well as knowledge around Indigenous cultural systems and practices around land management and cultivation local to your place, such as the ahupuaʻa system and restoration and maintenance activities for loko iʻa and loʻi if you are implementing this series somewhere in Hawaiʻi. However, in-depth knowledge of these topics is by no means required—there is plenty of opportunity to invite community partners and connections who have more lived and ancestral knowledge about these topics to assist with delivery.

Unit Overview:

This unit plan is written as a workshop series that is designed as a combination of huakaʻi, group discussions, and learning activities to be carried out in collaboration with community partners and connections. The purpose of this series is to help participants cultivate relationships with wetlands, both in literal terms with the physical wetlands that are local to their places, and metaphorically with conceptual learning of topics related to wetlands. Throughout the series, participants will focus on learning about wetlands as ecosystems and related ecological concepts, the history around wetlands in their places, and cultural practices associated with wetlands. The goal of this learning journey is to empower participants to take action to work on restoring, advocating for, or protecting a place that is a current existing wetlands or former wetlands.

The workshop series is comprised of a total of eleven hour and a half long sessions. Some of the sessions include huakaʻi to places that are wetlands or associated with the content learning around wetlands, while other sessions include learning activities and discussions. Throughout the series, participants will maintain a journal to explore and track how their relationships with the wetlands, both in terms of specific places and content learning, evolve over the course of the workshops. The series culminates in a showcase of the work participants put into the overarching project of restoration and/or advocacy work, or in other words, performing an act of love for their local wetlands.

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Overall, the workshop sessions are intended to be a collaborative learning experience with other workshop participants, the workshop facilitator, and community partners. It is open to all ages, but recommended for ages eight and up. Participants under the age of thirteen are required to attend with a parent or legal guardian. Additionally, the content covered in this workshop series is aligned with upper elementary-level standards and includes: wetlands spaces on Oʻahu (that exist in the current moment and spaces that have historically been wetlands), ecological functions served by wetlands, living organisms in ecosystems, and what actions can be taken to help restore and advocate for wetlands. The following central themes ground the learning experience: cultivating relationships with local places and communities, learning about places and ecosystems from a variety of perspectives, and learning as a means to empower advocacy for our communities and places.

Works Cited:

National Park Service. (2025). *Why are wetlands important?*. U.S. Department of the Interior National Park Service. https://www.nps.gov/subjects/wetlands/why.htm

O'Neill, T., Finau‐Faumuina, B. M., & Ford, T. U. L. (2023). Toward decolonizing STEM: Centering place and sense of place for community‐based problem‐solving. Journal of Research in Science Teaching, 60(8), 1755–1785. https://doi.org/10.1002/tea.21858

U.S. Environmental Protection Agency. (2025). *What is a Wetland?*. EPA. https://www.epa.gov/wetlands/what-wetland

STEMS² Unit Plan

STAGE 1:

Unit Plan Title: Cultivating Loving Relationships With Our Local Wetlands

Essential Question:

How does learning about local wetlands from multiple perspectives inspire us to love and care for these places?

Enduring Understanding(s):

Building a holistic understanding of local wetlands as complete and complex ecosystems helps us to cultivate a loving appreciation that empowers us to care for them.

Engaging with different forms of knowledge, including understandings that emerge from scientific, cultural, communal, and lived experiences, can lead to multi-dimensional perspectives about a place and/or ecosystem that inform how we can help restore and advocate for it.

Understanding the different types of relationships humans have formed with their places throughout history and across cultures gives insights into how these places exist in the present and inspires possibilities for the future.

Standard Benchmarks and Values

<table>
<tr><th>Science</th><th>Technology</th><th>Engineering</th><th>Mathematics</th><th>Social Science</th><th>Beyond</th></tr>
<tr><td colspan="6">
<u>Bodies of standards:</u>

Next Generation Science Standards (NGSS)
Common Core Mathematics Standards (CC-Math)
Common Core English Language Arts Standards (CC-ELA)
Hawaii Core Standards for Social Studies (HCSSS/C3)
Nā Hopena A'o (HĀ)
California Social-Emotional Learning Standards (CASEL)

<u>Mastered</u>:

NGSS

5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth’s resources and environment.
ESS3.C: HUMAN IMPACTS ON EARTH SYSTEMS: Human activities in agriculture, industry, and

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everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments. (5-ESS3-1). Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. (MS-ESS3-3)

- CC-ELA
  - CCSS-ELA-LITERACY.SL.5.1: Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners, building on others' ideas and expressing their own clearly.
  - CCSS-ELA-LITERACY.W.3.8. Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.
- HCSSS
  - Inquiry Standard SS.3-5.5.2: Explain different ways students could work individually or in collaboration with others (e.g., other students, teachers, community and/or global organizations) to address local, regional, or global problems or issues and predict possible results of their actions
- CASEL:
  - Self-Awareness, Belonging: 1.E.2. Students describe their roles and contributions in the different settings in which they participate.
  - Social Awareness, Agency: 3.G.2. Students explore the importance and power of community participation and service. Students collaborate with others to identify ways to contribute productively to their learning community.

Practiced:

- NGSS
  - LS2.C: ECOSYSTEM DYNAMICS, FUNCTIONING, AND RESILIENCE: Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (MS-LS2-4)
  - LS4.D BIODIVERSITY AND HUMANS: Populations live in a variety of habitats, and change in those habitats affects the organisms living there. (3-LS4-4)
  - MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
  - PS3.D: ENERGY IN CHEMICAL PROCESSES AND EVERYDAY LIFE: The energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water). (5-PS3-1)
  - LS2.A INTERDEPENDENT RELATIONSHIPS IN ECOSYSTEMS: The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem. (5-LS2-1) Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (MS-LS2-1)
- CC-ELA
  - CCSS-ELA-LITERACY.R.L.3.2. Recount stories, including fables, folktales, and myths from diverse cultures; determine the central message, lesson, or moral and explain how it is conveyed through key

details in the text.
    - CCSS-ELA-LITERACY.W.5.7. Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.
    - CCSS-ELA-LITERACY.SL.SL.4.4. Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.
- CC-MATH
    - CCSS-MATH.K.MD.1: Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.
    - CCSS-MATH.K.G.1. Describe objects in the environment using names of shapes, and describe the relative positions of these objects using terms such as above, below, beside, in front of, behind, and next to.
    - CCSS-MATH.3.OA.7: Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division (e.g., knowing that $8 \times 5 = 40$, one knows $40 \div 5 = 8$) or properties of operations. By the end of Grade 3, know from memory all products of two one-digit numbers.
- HCSSS
    - Content Standard SS.4.4.7.2: Explain how core values of the early Hawaiians are applicable to modern-day Hawaiʻi
    - Inquiry Standard SS.3-5.5.4: Show evidence of taking individual or group action on one or more problems or issues
    - Inquiry Standard SS.3-5.4.3: Present arguments and explanations using a variety of print, oral, and digital technologies
- CASEL
    - Self-Management, Agency: 2.H.2. Students practice managing their own time, organizing their materials, and gathering what is needed for a task or activity.
    - Relationship Skills, Agency: 4.E.2. Students use constructive strategies to communicate their perspective and listen openly to the perspectives of others to solve a problem.
    - Social Awareness, Belonging: 3.D.2. Students identify appropriate, trusted people to seek support from based on their specific needs and recognize ways they can support others.
    - Responsible Decision-Making, Identity: 5.A.2. Students understand the importance of curiosity and practice staying open minded when meeting diverse groups of people or in new situations.
- Nā Hopena A'o (HĀ)
    - Strengthened Sense of Belonging
    - Strengthened Sense of Responsibility
    - Strengthened Sense of Excellence
    - Strengthened Sense of Aloha
    - Strengthened Sense of Total Well-Being
    - Strengthened Sense of Hawaiʻi

Introduced:
- NGSS
    - LS2.B CYCLES OF MATTER AND ENERGY TRANSFER IN ECOSYSTEMS: Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment. (5-LS2-1). Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level.

Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. (MS-LS2-3)
    - ESS2.A EARTH MATERIALS AND SYSTEMS: Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. (4-ESS2-1)
- HCSSS
    - Inquiry Standard SS.3-5.2.3: Gather relevant information from multiple sources that would be helpful in addressing compelling and supporting questions
    - Inquiry Standard SS.3-5.5.1: Identify local, regional, or global problems or issues in various times and places
- CASEL
    - Relationship Skills, Belonging: 4.D.3. Students explore different cultural practices and world views.
    - Responsible Decision-Making, Agency: 5.F.2. Students know and regularly practice decision-making strategies and use critical thinking to identify choices that result in the best outcomes for all involved.

Critical Skills and Concepts:

Wetlands sustain interconnected networks of living organisms and serve ecological functions that are critical to much of life on Earth:
- Characteristics of wetlands on Oʻahu
- Native living organisms to wetlands on Oʻahu (plants and animals)
- Ecological functions of wetlands, such as flood and erosion control, filtering, nutrient cycling, and promotion of biodiversity

Learning about wetlands can be a means to learn about various concepts related to ecology and environmental processes:
- Organization of living organisms in ecosystems: trophic levels and food webs
- Flow of energy and nutrients through an ecosystem through photosynthesis, consumption, and decomposition
- How water naturally cycles through ecosystems

Local wetlands hold specific relationships built from cultural practices:
- Practice of kilo
- Loko iʻa and loʻi (or other local and/or cultural examples of aquacultural and agricultural systems and practices associated with the wetlands)
- Ahupuaʻa system and land management (or other local and/or cultural examples of land management systems and practices associated with the wetlands)
- Biocultural restoration practices

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Building a holistic understanding of wetlands within the environment and how humans interact with them:

- Interpretation and synthesis of different forms of knowledge and understandings
- Critical thinking and considering of multiple perspectives
- Making observations and engaging with places in a respectful and ethical manner
- Relationship-building (with each other, with community, and with places)

Expressing what was learned:

- Creative expression of ideas and concept learning
- Engaging collaboratively in discussions and project work

STAGE 2:

Authentic Performance Tasks:

Final Project: Envisioning and Carrying out an Act of Love for a Local Wetland

Participants will demonstrate their understanding by conceptualizing & performing "an act of love" for space that is (or historically has been) associated with wetlands, such as Kawainui Marsh, Waikalua Loko Iʻa, or Waikīkī (or other specific places engaged with and visited throughout this workshop series). This "act of love" should be based on multiple perspectives, and participants should explain the impact/significance of their act of love for different communities (humans, living organisms, or even non-living entities) that have relationships with the wetland. The "act of love" can be almost anything the student can imagine and conceivably carry out (some ideas: doing one session of tangible restoration/health assessment work for the wetland independently of unit activities & capturing/presenting this work in some way; spreading awareness about the wetland via art, community gathering, etc; writing to local policymakers or another form of advocacy; uplifting community histories/stories about the wetland, etc.). Participants should create some kind of presentation to explain the context around their act of love and process of envisioning it and carrying it out. In their presentation, participants should also explain how their own relationships with the wetlands evolved through the workshop series and informed/contributed to their act of love. This project can be carried out individually or in groups.

Authentic Audience:

- Decide on an authentic and relevant audience for this task.
- Who can students show their understanding to in order to make an impact beyond the walls of their classroom?

Invitations will be extended to community partners who we engaged with throughout the unit. Examples could include folks from Pacific American Foundation, Kauluakalana, Department of Land and Natural resources, and panelists and speakers who were brought in throughout workshop sessions. If you engaged with different community partners and members, invite them to the showcase! You can also invite family members and other community members and stakeholders and make it into a community gathering as you feel comfortable.

Other Evidence:

- Journal entries demonstrating relationship building with wetlands and local wetlands-associated places
- Engagement in discussions
- Collaborative wetlands mind-map
- Creative activities throughout workshop sessions
- Participation in service learning and respectful engagement during huaka‘i

STAGE 3:

I believe that students learn best through hands-on activities, physically going into the places they're learning about, having the opportunity to make their own observations and ask questions on their own terms to drive their learning, and relating abstract concepts back to physical and tangible manifestations that are present in their own lives and communities. I tried to bring these ideas into the design of my learning plan.

Learning Plan:

The STEMS² pillars, sense of place, aʻo, moʻolelo, makawalu, and advocacy, (O'Neill et al., 2023) are integrated through the activities and delivery of the workshop series overall. The series and delivery of it overall strives to embody aʻo through a collaborative learning environment where the workshop facilitator and participants are on a journey of learning together, from each other, and from experiences with community partners. The pillars of makawalu and moʻolelo are addressed in the engagement with multiple perspectives, sources, and knowledge systems (including specific moʻolelo) to learn about local wetlands. Advocacy is a core part of the series with the final culminating project (authentic assessment) aiming to make a positive difference in local wetlands spaces and with service learning opportunities with community partners during some of the huakaʻi. Finally, the series is grounded in building participants' sense of place and relationships to place. Throughout the content learning, STEMS² disciplinary areas are integrated and engaged in interdisciplinary learning experiences. Through experiences on huakaʻi, learning about local wetlands, contexts, and stories, and learning from community partners and community members about work they have done to help restore and advocate for wetlands, participants will build the knowledge and skills to envision and perform their own act of love (through restoration and advocacy) for a local place associated with wetlands informed by multiple perspectives and ways of knowing.

Workshop Sequence:

1. Huakaʻi to Kawainui Marsh
2. Learning From Kawainui Marsh
3. Watershed Huakaʻi
4. Waikīkī and Wetlands
5. How Do Wetlands Love Us?
6. Huakaʻi to Waikalua Loko Iʻa
7. Relationships in the Wetlands

8. Cultivating and Loving the Wetlands
9. Huakaʻi Back to Kawainui Marsh
10. How We Love the Wetlands (Part 1)
11. How We Love the Wetlands (Part 2)

More Resources:

- Wetlands in Hawaiʻi:
  - https://storymaps.arcgis.com/stories/953e394bb1864929bc687b215614aa68
  - https://pacificbirds.org/birds-flyways/hawaiian-wetlands/
  - https://savethewetlands.org/wetlands-in-hawaiian-culture/
  - https://www.nature.org/en-us/get-involved/how-to-help/places-we-protect/heeia/
- Wetlands Across the World:
  - https://storymaps.arcgis.com/stories/3b25ad6843dc45559821d90eb02f18bf
  - https://www.youtube.com/watch?v=Kgkuu6lS1qM