

WATERSHED STABILITY

Teachers: Philip Tacata

Duration: 6 months

Subject/Course: Marine Science

School: Petaluma High School

Grade Level: 11-12

Collaborating Organizations: Friends of the Petaluma River

Standards Met
(NGSS, CCSS, or otherwise) Please include full text of standards.

NGSS

LIFE SCIENCES

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- Anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species.

LS4.D: Biodiversity and Humans

- Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value.

HUMAN SUSTAINABILITY

- **HS-ESS3-4.** Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

CROSCUTTING CONCEPTS

Stability and Change

- Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and processes at different scales, including the atomic scale.
- Small changes in one part of a system might cause large changes in another part.
- Much of science deals with constructing explanations of how things change and how they remain stable.
- Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible.

<p>Project Summary (include student role, issue, problem or challenge, action taken, and purpose/beneficiary)</p>	<p>This December, students will cover an in-depth survey of the ecological community of the Elkhorn Slough National Estuarine Reserve. This survey is in preparation for the students’ winter trip to the Monterey Peninsula where they will do a biological tour –on kayak– of the Slough. In the early spring, students will cover a comparative survey of the ecological community of their local Petaluma River Watershed. Subsequently, students will explore how climate change affects the ecology of riparian and estuarine communities and their related urban ecosystems.</p> <p>Ultimately, students will participate in either a watershed restoration event or a storm-drain signage project in the spring. Student groups will create a video presentation of their watershed restoration work or participation in the storm-drain signage project.</p> <p>The beneficiaries of our student actions will be the residents of our local community.</p>	
<p>Essential Question Question students will explore throughout the course of the unit.</p>	<p>What is a “healthy” watershed? How does a healthy watershed stabilize local ecosystem biology, geology, and toxicology? What can I do to help promote and maintain a healthy watershed in my community?</p>	
<p>Key Learning Objectives and Assessments Concrete objectives for student skill building and comprehension and how these will be measured.</p>	<p>Learning Objective</p>	<p>Assessment</p>
	<p>Students will be able to compare and contrast the ecological communities of the Moss Landing Elkhorn Slough and the Petaluma River Watershed.</p>	<p>Students will create a pamphlet-style chart that will compare the primary producers, primary consumers, secondary consumers, etc. between the Elkhorn Slough Reserve and the Petaluma River Watershed.</p>
	<p>Students will be able to explain how the role of a healthy Petaluma River Watershed can buffer some of the deleterious effects of climate change.</p>	<p>Questions pertaining to this learning objective will be on a spring midterm exam.</p>
	<p>Students will explore ways that community members can help reinforce and maintain the stability of a healthy Petaluma Watershed.</p>	<p>Student groups will create a 2-5 minute video presentation of their stewardship fieldwork. Videos will be uploaded to the PHS MarS website and presented at the Petaluma Watershed Classroom Student Showcase</p>
	<p>XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX</p>	<p>XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX</p>

Orientation	In-Class Visit		Field Trip to River Heritage Center	X	Other		If other, describe in timeline how you will meet entry activity requirements
Making Products Public Include how student work will be shared with community members and/or organizations, who students will engage with during/at end of project, and which product(s) will be presented at the Watershed Classroom Student Showcase.	Students will self-select groups of 4-6. In the spring, groups will participate either a watershed restoration event or the storm drain signage project. Each group will be responsible for creating a 2-5 minute video on their stewardship work and its importance in our community, especially in the wake of climate change. Their video will be uploaded online to the PHS Marine Science Website and presented at the Watershed Classroom Student Showcase.						

PROJECT TIMELINE

Please list all activities which are part of the unit in the order they will be implemented. Timeline must include pre and post-assessments, other in-class assessments, an entry activity, at least three outdoor fieldwork activities, a plan for participation in the student showcase, and any other supporting activities and classwork.

Activity	Type of Activity (Field Work, In-Class, Presentation, Assessment)	Description	Resources Needed	Exact or Approximate Dates
<i>Name the activity</i>	Field Work: Any hands-on outdoor lesson or field trips In-Class: Any in-class activity or project Presentation: Any activity during which students share their work with each other or an outside audience Assessment: Any written or oral exams given to assess student understanding and knowledge	<i>A thorough outline of the activity.</i>	<i>All reading materials, activity materials and equipment, transportation, third party help, or other resources needed to make the activity possible.</i>	<i>Please be as specific as possible so that we best know when to reach out with resources and tools to aid in implementation. Exact dates will be emitted from publicly shared version to protect student privacy.</i>
Organismal survey of the Elkhorn Slough Esturine Reserve	In-Class	In-depth lecture and demo of common organisms found in the Elkhorn Slough. Includes niche, adaptations, and species interactions.	None	11/17
Kelp Forest and Wetland Ecosystems Organismal ID Lab Practical	Assessment	60-minute, timed, lab practical, 1-minute stations. Students must identify a kelp forest or wetland ecosystem organism (from the Elkhorn Slough) and provide the scientific name + several short facts about the organism.	None	11/17
Kayaking tour of the Elkhorn Slough	Field Work	An on-water ecological expedition and tour of Monterey's native estuary, the Elkhorn Slough. The naturalists of Monterey Bay Kayaks will lead our students on intimate 2.5-hour tours of the	Expedition to the Monterey Peninsula costs \$600 per student (students have been fundraising since August to defray costs)	1/18 & 2/18 (one class will attend in January, the other in February)

		Elkhorn Slough, exploring both the flora and fauna of this delicate ecosystem. On these tours, students get up-close-and-personal with any number of organisms that live in this biologically rich and protected brackish-water environment, including face-to-face encounters with California sea otters (which use the Slough as a feeding ground and residence during the winter months).		
Organismal survey of the Petaluma River Watershed	In-Class	In-depth lecture and demo of common organisms found in the Petaluma River Watershed. Includes niche, adaptations, and species interactions.	None	2/18
Orientation – Field Trip to the Petaluma River Heritage Center	Field Work	Class Field Trip(s) to the Petaluma River Heritage Center. Members of Friends of the Petaluma River will introduce students to the Watershed Classroom.	None	2/18
Watershed Restoration Event or Storm Drain Signage Project	Field-Work	Student groups will participate in either a watershed restoration project or the storm drain signage project.	None	2/18 through 5/18
2-5 minute Video Presentation of Group Stewardship Work	Assessment	Student groups will create a 2-5 minute video presentation of their stewardship fieldwork.	None	To be presented on the date of the Petaluma Watershed Classroom Students Showcase (approx. 5/22/18)

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Other Notes:

