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Project Participants: Sten Mander and John Shribbs

School Site: Casa Grande

Grade Level(s): 9-12

Course Name: Earth Science and AP Environmental Science

Name of Unit/Project: Watersheds

Integrated Academic Disciplines: Science, Math, English

Implementation Timeline: Aug-Sept 2015 - Collection and analysis of first flush samples.

April-May 2016 - Physical habitat assessments and bioassessment.

May 2016 - Final reports added to the Watershed Classroom website.

Key Learning Objectives: Students will learn:

- what a watershed is and how streams are affected by human activities in the watershed.
- how physical factors can affect salmonids and other aquatic life.
- how the life histories of macroinvertebrates can be used as proxies to assess stream conditions (i.e. temperature, oxygen levels, spawning substrate, riparian cover) and identify excessive inputs of pollutants (i.e. sediments, nutrients, pesticides).

Students will be able to:

- to assess the physical habitat of a stream by evaluating riparian cover, stream bank erosion, water flow, spawning substrate, pool frequency and depth, and water flow.
- identify which stream a sample of BMIs was collected from based on the stream's physical habitat and watershed characteristics.
- make recommendations for enhancing the physical habitat and reducing pollutants that affect a particular stream's health.

Provide a brief (50 word max.) description of this curriculum proposal, including the essential question.: The essential questions we seek to answer are: 1) What are the physical habitat and water quality conditions of the tributary streams of the Petaluma River?, and 2) What types of restoration efforts and pollution control efforts will make the greatest impacts on the health of these streams?

Provide a brief description (100 words max.) of how this coursework will integrate the core concepts of Geoliteracy: Interactions, Interconnections and Implications: This curriculum will give students a better understanding of the importance of our local streams to wildlife and how humans, not just in Petaluma, but in Northern California and beyond, depend on freshwater streams to sustain salmon fisheries. Students will also learn how their actions can impact local streams for better or for worse.

Describe the fieldwork activities involving the Petaluma River/Wetlands. Curriculum must include a minimum of three outdoor watershed educational experiences.: 1. Students will conduct a physical habitat assessment of Adobe Creek.

2. Students will collect and analyze water samples for temperature, pH, dissolved oxygen, nitrates, turbidity, and pathogens. Students will also assist with collecting BMIs.

3. Students will collect first flush storm drain samples at various sites in Petaluma for analysis of temperature, dissolved oxygen, nitrates, turbidity, and pathogens. (AP Environmental Science only)

Describe any other hands-on learning activities: Students will sort, identify, and tally BMIs and use this data to calculate several water quality metrics (i.e. diversity, EPT richness, percent pollution tolerant and intolerant, percent shredders, percent collector/filter-gatherers, etc.) from 5-7 streams.

Content Standards addressed: HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

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

Reading Tasks: What primary documents and informational texts will be read/analyzed?: Measuring the Health of California Streams and Rivers - Harrington and Born

Writing Tasks: What kinds of writing tasks (Arguments and Drawing Evidence) will be required?: As part of a final assessment, students will evaluate water quality metrics based on BMI and write an essay in which they argue from which stream the BMIs were collected from based on the stream's physical habitat and watershed conditions. Students will cite specific metrics which support their conclusion.

In addition, Environmental Science students will write a report on the physical habitat and water quality characteristics of a local stream and will make recommendations for restoration and/or pollution reduction measures that are appropriate for the stream.

Collaboration: How will students collaborate, communicate and organize together (Speaking and Listening/Discussion): Students will work in small groups of 3-4 to collect and analyze data and discuss watershed concepts and issues.

Integration of Media Sources and Skills: How will students use technology for research, communication, documentation and or presentation purposes?: Environmental Science students will create a presentation of their finding and present it to the class and at a workshop or meeting hosted by the Friends of the Petaluma River. Probes and sensors will be used to analyze water samples for pH, nitrates, phosphates, and possible sensors. Spreadsheets will be used to organize data and to make calculations. The final report will be uploaded to the Watershed Classroom's Interactive Watershed Atlas.

CA Core Standards-based Assessments: How will students demonstrate their acquisition of new knowledge and skills?: As part of a final assessment, students will evaluate water quality metrics based on BMI and write an essay in which they argue from which stream the BMIs were collected from based on the stream's physical habitat and watershed conditions. Students will cite specific metrics which support their conclusion.

In addition, Environmental Science students will write a report on the physical habitat and water quality characteristics of a local stream and will make recommendations for restoration and/or pollution reduction measures that are appropriate for the stream.

Presentation of Knowledge/Student Public Forum: Environmental Science students will post their bioassessment and physical habitat report to the Interactive Watershed Atlas. Collaborating with the Friends of the Petaluma River to present this information to the public as a workshop or other event is also a possibility.

Evaluation of Knowledge Mastery & Attitude Changes: For the 2015-16 school year we have added a pre- and post-assessment for students to take online before and after curriculum implementation. How will you integrate this evaluation into your implementation plan?: Students will take a pre- and post-assessment created on a Google Form to evaluate student understanding of watershed processes, human impacts on streams, and student attitudes about streams.

Other Comments: