Inside the Outdoors

DRAFT – CORE/MWDOC High School Water Program

Where's my Water?

This program will be appropriate for a variety of classes, such as Environmental Science, Earth Science, Biology, Ecology, Government/Political Science, History, and Economics

- Water is a limited resource:
    - Only about 3% of the world's water is fresh water
    - Only about 1% of the world's water is usable freshwater.
        - (Use bottles of water to represent this, or a graph.)
- Water in Southern California is particularly limited, especially considering our population size and distribution, climate, and recurring droughts.
    - Compare the summer and winter precipitation maps, focusing on California and Florida as different climates with different precipitation patterns.
    - Compare precipitation and population maps of California.
- What do we need water for?
    - Ask students to list major water uses
    - Group similar ideas together, if time.
- Tell students that in order to decide how much water to allocate for each use; we need to prioritize them, since different interests, such as residents, industry and agricultural, compete for available supplies
    - Pass out Major Water Uses Chart to each student.
    - Put students into small groups to work together to rank the major water uses in order of importance.
- Ask groups to report back to the class, and record their rankings on a class chart so that everyone can see.
    - Compare and discuss the different rankings.
        - Discuss how everyone may not be satisfied when decisions are made.
- Introduce the problem in the Delta.
    - Briefly: What and where is the Delta?
    - About half of the water used by the population in Southern California is provided by the Metropolitan Water District, which is allotted a certain amount of water from Northern California and the Colorado River
        - Resource:http://www.amnh.org/content/download/141382/2285494/file/LinC5_ColoradoRiver.pdf
    - This water goes through the Delta, but there are problems with this:
        - Ecological issues
        - Recreational issues
        - Safety issues
            - 11,000 miles of levees
                - Might fail in an earthquake, and our water could be contaminated by saltwater, flow could be reduced or stopped. Major flooding in the Delta region could occur.
    - What should we do about it?

- Have students read, discuss, and choose one of the following thoughts, or come up with their own thoughts to address the problem in the Delta. (Some of these positions that others hold may be true or false.)
    - Update the levee system to protect the local population from the risk of flooding in heavy rain and snowmelt years, and reduce the chance of damage from an earthquake. This would be moderately expensive and will be paid for by the people living in and around the Delta. It does little to protect the flow of water to the Southern California population, since the levees could still fail if there's a major earthquake. It also doesn't address many of the current ecological concerns.
    - Dig a tunnel for a pipeline to run under the delta so that water coming to Southern California is secure from earthquake damage. This is very expensive and will be paid for by the people receiving water in Southern California. It doesn't address the problem of the levees breaking, but does reduce some of the ecological problems, and secures Southern California's water.
    - Do nothing. It's working for right now and other solutions are too expensive. People gamble there won't be an earthquake that will severely damage the levee system. Maybe we will come up with a better idea before then.
    - Slash water use in Southern California so that so much water is not needed, reducing the need to transport water through the Delta. This would be hard for Southern Californians, but we should all learn to use less water in such a dry place, anyway. With more water staying in the Delta, it may seem like it would reduce many ecological and recreational issues, but does not address the problem of levees failing. While this has no direct cost, it could have a significant negative impact to the economy in Southern California, which would have an impact on the rest of the state.
    - Come up with your own plan!
- Have groups report their decisions to the class. Discuss the reasoning behind their decisions, and the pros and cons of each. Allow groups to question each other if appropriate.

High School Standards: Referenced Next Generations Science Standards, History-Social Science and Common Core State Standards

NOTE: The below cited standards all have different outlines and formats. These are the standards that have been published by the state. Teachers use these standards to align their lessons and to use non-formal programs, like Inside the Outdoors, to support student learning. This is a list of standards that Inside the Outdoors supports with this program. If there is an inconsistency with numbering, it is because that particular standard has been omitted as it does not align with the Where's My Water curriculum.

Next Generation Science Standards:

High school science, students learn about human impacts on the Earth and sustainability.

HS-ESS3-1. **Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.** [Clarification Statement: Examples of key natural resources include access to fresh water (such as rivers, lakes, and groundwater), regions of fertile soils such as river deltas, and high concentrations of minerals and fossil fuels. Examples of natural hazards can be from interior processes (such as volcanic eruptions and earthquakes), surface processes (such as tsunamis, mass wasting and soil erosion), and severe weather (such as hurricanes, floods, and droughts). Examples of the results of changes in climate that can affect populations or drive mass migrations include changes to sea level, regional patterns of temperature and precipitation, and the types of crops and livestock that can be raised.]

HS-ESS3-2. **Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.*** [Clarification Statement: Emphasis is on the conservation, recycling, and reuse of resources (such as minerals and metals) where possible, and on minimizing impacts where it is not. Examples include developing best practices for agricultural soil use, mining (for coal, tar sands, and oil shales), and pumping (for petroleum and natural gas). Science knowledge indicates what can happen in natural systems—not what should happen.]

HS-ESS3-3. **Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.** [Clarification Statement: Examples of factors that affect the management of natural resources include costs of resource extraction and waste management, per-capita consumption, and the development of new technologies. Examples of factors that affect human sustainability include agricultural efficiency, levels of conservation, and urban planning.] [Assessment Boundary: Assessment for computational simulations is limited to using provided multi-parameter programs or constructing simplified spreadsheet calculations.]

HS-ESS3-4. **Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.*** [Clarification Statement: Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes to biomass and species diversity, or areal changes in land surface use (such as for urban development, agriculture and livestock, or surface mining). Examples for limiting future impacts could range from local efforts (such as reducing, reusing, and recycling resources) to large-scale geoengineering design solutions (such as altering global temperatures by making large changes to the atmosphere or ocean).]

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.*** [Clarification Statement: Examples of Earth systems to be considered are the hydrosphere, atmosphere, cryosphere, geosphere, and/or biosphere. An example of the far-reaching impacts from a human activity is how an increase in atmospheric carbon dioxide results in an increase in photosynthetic biomass on land and an increase in ocean acidification, with resulting impacts on sea organism health and marine populations.] [Assessment Boundary: Assessment does not include running computational representations but is limited to using the published results of scientific computational models.]

HS-ETS1.3 **Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.**

California State History-Social Science Standards:

In high school, students should learn historical and social science analysis skills through the course of their classes. These include:

Historical Interpretation

> 5. Students analyze human modifications of landscapes and examine the resulting environmental policy issues.

In 11th grade social science, students learn about American History in the 20th century.

11.11 Students analyze the major social problems and domestic policy issues in contemporary American society.

> 5. Trace the impact of, need for, and controversies associated with environmental conservation, expansion of the national park system, and the development of environmental protection laws, with particular attention to the interaction between environmental protection advocates and property rights advocates.

In 12th grade, students learn about principles of American democracy for a semester and principles of economics for the other semester.

From the History-Social Science Framework, adopted by the State Board of Education July 14, 2016:

> Among the persistent issues facing the United States, and California in particular, is how to balance individual rights and liberties with the common good in matters related to land as well as water, air, and other natural resources. Students examine case studies that embody the struggle to find this balance and consider the spectrum of factors that influence and negotiate policy decisions about natural resources and natural systems (California Environmental Principle V). Students learn that many conflicts over environmental issues result from competing perspectives involving individual rights and the common good, an illustrative example of the reciprocity between rights and obligations. (See EEI Curriculum Unit 12.2 – This Land is our Land).

The course might culminate in an activity in which students analyze a local, state, national, or international political or social problem or issue. Students could be assigned a research paper or a multi-media project in which they analyze a problem or issue, consider its civic, economic, geographical and/or historical dimensions, research it by examining multiple sources and point of view, evaluate the sources, critique and construct claims and conclusions based on the evidence, and present and defend their conclusions. Alternately, the activity might be a civics-based service-learning project in which students identify local problems or issues of concern; research and analyze them in terms of causes and effects and multiple points of view; identify, discuss, and evaluate public policies relating to the issues, including interacting with public officials; and construct a project to address it or a multimedia presentation to educate about it.

Common Core State Standards:

9th-10th grade:

SL 9-10 1. Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

b. Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, and presentation of alternate views), clear goals and deadlines, and individual roles as needed.

c. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.

d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.

11th-12th grade:

SL 11-12 1. Initiate and participate effectively in a range of collaborative discussions (one-on- one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.

c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.

d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task.