

Online Extensions

Suggested topics for in-depth investigation

- Plants
- Water
- Environmental contamination

To further illustrate the impact of humans on Earth, my classes carried out a series of extension projects. As in the previous unit, the extensions are broken into two concurrent segments: (1) planning and carrying out a scientific investigation, and (2) researching the influence of science and technology (in the areas of agriculture) on society and the natural world.

Extension 1: Plants

Student teams plan and carry out competition investigations based on results from their previous studies (involving small and large duckweed). Through their investigations, students visualize what happens when there is competition for a particular resource and manipulate the environment, thus strengthening their understanding of how a change in the environment results in a change in a system. For example, a team may choose to carry out an investigation involving nutrients. In their initial investigations (in the main unit), students determined that small duckweed grows best at lower nutrient levels, while large duckweed grows best at higher nutrient levels. Students could then set up several petri dishes, all containing low nutrient levels and the same amount of large and small duckweed, and would hypothesize that the small duckweed would eventually “take over” the petri dish. Several times a week, students would examine the petri dishes, noting the amount of duckweed in each. After approximately five days, students would increase the nutrient levels in half of their samples. This is analogous to a sewage treatment plant releasing untreated water (high in nutrients) into a local pond. Students would continue the investigation for an additional five days, noting any growth changes. Upon conclusion of the investigation, students produce a formal laboratory report explaining why their hypothesis was or was not supported, the impact of the environmental change, and how their investigation findings may be applied to the human impact disciplinary core idea.

The goal of the research segment is for students to learn how science and technology have an influence on society and the natural world. This is accomplished as students explore the history of food production and agricultural technology (see Resources). Ideally, all students should acquire a broad understanding of these topics. This is accomplished as students individually complete 3-2-1 summaries (see 3-2-1 summary template). Then, working in teams, students select a topic for in-depth investigation (see suggestions below) and conduct online research. Students chart their research progress on posters displayed about the room. This gives all students the opportunity to receive feedback, during a gallery walk, prior to summarizing their findings and responding to the questions:

- How do you “edge out” the competition?
- How do humans “leverage technology” to increase their competitive advantage?• What are the implications (to society) when people are hungry?

Suggested research topics

- agricultural pollution
- fertilizers
- hydroponics
- GMOs
- world seed bank
- organic farming
- sustainable agriculture

Extension 2: Water

The growth of the human population has also had an impact on Earth’s water systems; particularly in the United States, where the per-capita water consumption is among the highest in the world (UN 2006). This extension brings to light what many students take for granted—clean, safe drinking water—and how human populations affect its supply. Through videos and internet research (see below), students think critically about factual information, using it to explain how water diversion has ecological consequences and how water rights have affected societies.

Extension 3: Environmental contamination simulation

The United States Environmental Protection Agency (EPA) has divided the country into 10 regions, each with a staggering number of Superfund sites—“a Superfund site is an uncontrolled or abandoned place where hazardous waste is located, possibly affecting local ecosystems or people” (U.S. EPA 2014). In this extension, students make connections to engineering and technology as they construct a contaminated aquifer. Teams then apply science as they implement research-based remediation strategies. A detailed description of the project setup may be found at the EPA website (see Resources). It is recommended that the EPA project be modified to allow students to research, select, and implement a method of “contaminant cleanup” as opposed to following the “see what happens when” approach. If time permits, this segment may be further extended and several project iterations completed, giving students practice in implementing engineering design strategies.

References

United Nations Development Program - Human Development Report 2006, via Data 360
http://www.data360.org/dsg.aspx?Data_Set_Group_Id=757

Resources

Extension 1: Plants

Agriculture and Rural development

<http://data.worldbank.org/topic/agriculture-and-rural-development>

As children starve, the world struggles for a solution. CNN.

<http://www.cnn.com/2008/US/11/17/hunger.week/index.html?iref=hpmostpop>

Hunger and children in America: slow and steady starvation ABC

<http://abcnews.go.com/Health/US/hunger-children-america-slow-steady-starvation/story?id=14328390>

World Food Bank- Hunger Statistics

<http://foodtank.com/news/2013/05/twenty-four-ted-talks-that-will-help-save-the-food-system>

History of Food Production. Encyclopedia Britannica

<http://www.britannica.com/EBchecked/topic/1350805/history-of-technology/14905/Food-production>

Feed the Future. The U.S. Government's Hunger and Global food Security Initiative

<http://www.feedthefuture.gov/article/using-modern-agricultural-technology-increase-production-food-security-and-profitability>

Modern Food Production Technology

<https://www.youtube.com/watch?v=KgN7EEkqLME>

Science Daily: "New methods increases food and bioenergy production from cassava."

ScienceDaily, 24 September 2013.

<www.sciencedaily.com/releases/2013/09/130924091327.htm>.

Rainforest Agrarian International Network

<http://www.rainprogram.org/about/>

Extension 2: Water

Safe drinking water for Africa (6 min)

<http://www.coca-colacompany.com/videos/safe-water-for-africa>

Bill Nye- Water and Sewer Systems

<http://app.discoveryeducation.com/search?Ntt=clean+water>

Discovery School: The Clean Water Act- A Natural Focus

<http://app.discoveryeducation.com/search?Ntt=clean+water>

Discovery School: Source of Life- Water in our Environment

<http://app.discoveryeducation.com/search?Ntt=clean+water>

TED Talk- Water quality and future generations

<http://tedxtalks.ted.com/video/Water-Quality-and-Future-Genera;search%3Awater%20quality>

Water Supply Overview <http://www.worldbank.org/en/topic/watersupply/overview>

United States Geological Survey (USGS). The USGS Water School. (June 2014)

<http://water.usgs.gov/edu/qa-home-percapita.html>

ChartsBin- water data

<http://chartsbin.com/view/1455>

Blue/Gold Water Wars

<http://topdocumentaryfilms.com/blue-gold-world-water-wars/>

Water Wars: A Story of People, Politics & Power

Honey Rand

<http://www.amazon.com/Water-Wars-Story-People-Politics/dp/product-description/1413409059>

National Resources Defense Council

<http://www.nrdc.org/water/default.asp>

Improved Water Source Data

<http://data.worldbank.org/indicator/SH.H2O.SAFE.ZS>

Extension 3: Environmental contamination and remediation

25 Biggest Man Made Disasters in History

<https://www.youtube.com/watch?v=xuAWa4JK0KI>

What is hazardous waste? <http://www.lhwmp.org/home/hhw/proper-disposal.aspx>

Superfund Sites Where You Live <http://www.epa.gov/superfund/sites/>

EPA: Haz-Ed http://www.epa.gov/superfund/students/class_act/haz-ed/intro.htm

EPA: Superfund Program <https://www.youtube.com/watch?v=QEksEIrcLVg>

EPA- What is the EPA? <http://www.epa.gov/region9/video-audio/>

Bioremediation <https://www.youtube.com/watch?v=ivqMJM2fY2s>

Site clean up <https://www.youtube.com/watch?v=B1OUIPb14tY>

Preserving the Legacy- Bio and Phytoremediation

<http://app.discoveryeducation.com/search?Ntt=phytoremediation>

Fungi clean up oil spills

<http://www.sciencedaily.com/releases/2014/05/140521094743.htm>

National Geographic- Toxic Waste

<http://environment.nationalgeographic.com/environment/global-warming/toxic-waste-overview/><http://app.discoveryeducation.com/search?Ntt=phytoremediation>

U.S. EPA. 2014. Superfund Sites Where You Live. <http://www.epa.gov/superfund/sites>