BIG WORLD, SMALL PLANET

Module 4: Wants Versus Needs: Pushing the Boundaries

Teacher Edition



A comprehensive guide to global issues and sustainable solutions

Facing THE Future™

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SMALL PLANET

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and Sustainable Solutions

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About Facing the Future

Facing the Future is a program of Western Washington University. Facing the Future's mission is to create tools for educators that equip and motivate students to develop critical thinking skills, build global awareness, and engage in positive solutions for a sustainable future.

Facing the Future develops and delivers standards-based hands-on lessons, student texts, curriculum units, and professional development opportunities for educators. Facing the Future curriculum is in use in all 50 U.S. states and over 140 countries by teachers and students in grades K-12, in post-secondary education, and across multiple subject areas. Facing the Future reaches over 1.5 million students through its programming.

For more information, visit **www.facingthefuture.org**.

WESTERN WASHINGTON UNIVERSITY

The Facing the Future Program
Western Washington University
516 High Street, MS-9102
Bellingham, WA 98225
www.facingthefuture.org

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To the Teacher

Here are a few comments about getting started with the Activity Guide.

1. **Teacher Edition Contents:** Some material is provided only in the Teacher Edition. In addition, the Teacher Edition also includes work papers to be copied and handed out to students when needed.

2. **Reading Assignments:** Activities note which pages should be read to prepare for that particular assignment. The unit schedule notes the pages that are required pre-reading for the activity to be done each day. It also lists recommended reading for each day of a 20-day unit. This recommended reading schedule spreads the reading over the 20-day unit and will have students prepared for each day's activities.

3. **Field Books:** Students will prepare Field Books at home after Day 1 of the unit. In the Field Books, students will record their work during the unit; write reflections on class activities; and describe daily observations of wild nature, using both sketches and text.

   The Field Books can be created using binders, 8-1/2" by 11" composition books, spiral-bound notebooks, or stacks of paper held together with brads or binder clips. Students will need to add pages from time to time; if you use bound or spiral notebooks, students will need tape or glue pages into their Field Book occasionally.

4. **Field Book Reflections and Discussion Questions:** Daily activities have Discussion Question and Field Book sections at the end. Discussion questions relate to the classwork. Field Book instructions include prompts for nature journaling, references to Think About It boxes in the day's reading assignment, and sometimes other reflection questions or activities.

   You may also choose to ask students to answer some of the Discussion Questions in their Field Book reflection pages instead of discussing them in class. You can also choose – or let students choose – which Think About It boxes you would like students to respond to in writing; there are probably more than you will want to assign on some days.

5. **Unit Schedule:** A proposed unit schedule is included. The schedule includes daily activities, reading needed for the assignment, text reading assignments, and a summary of Field Book activities and reflections.

6. **Academic Standards:** U.S. Next Generation Science, Common Core, and National Council for the Social Studies high school standards are provided. Middle school standards are available on the Facing the Future website.

Academic Standards

The following standards are addressed in this module.

Standard	Description
Next Generation Science Standards - High Schoool[i]	
Disciplinary Core Ideas	
HS-PS3.D	Energy in Chemical Processes: The main way that solar energy is captured and stored on Earth is through the complex chemical process known as photosynthesis.
HS-LS1.C	The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products.
HS-LS2.B	Cycles of Matter and Energy Transfer in Ecosystems: Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes. Plants or algae form the lowest level of the food web.
HS-LS2.C	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.
HS-LS4.C	Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species' evolution is lost.
HS-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.
HS-ESS2.A	Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun's energy output or Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time scales from sudden (e.g., volcanic ash clouds) to intermediate (e.g., ice ages) to very long-term tectonic cycles.
HS-ESS2.C	Role of Water: The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks.
HS-ESS2.D	Weather and Climate: Current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere.
	The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re-radiation into space.
	Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate.
HS-ESS2.E	The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual co-evolution of Earth's surface and the life that exists on it.

Unit 1

Introduction to Consumerism

Essential Questions For This Unit

1. *How can I make more sustainable consumer choices?*
2. *Where do the things that I use go at the end of their useful life?*
3. *Who made the things that I use? What is life like for those people?*
4. *How does my consumption of goods affect overall global sustainability?*

Introduction to Consumerism

In 1955, the economist Victor Lebow made this statement:

> *Our enormously productive economy... demands that we make consumption our way of life, that we convert the buying and use of goods into rituals, that we seek our spiritual satisfaction, our ego satisfaction, in consumption... We need things consumed, burned up, worn out, replaced, and discarded at an ever increasing rate.*[1]

It is not clear whether Mr. Lebow meant to encourage or simply recognize consumption as a driver of our economy. Either way, he correctly described the global economy today. For example, according to the World Bank, consumer spending has accounted for about two-thirds of the United States' economy since 2000, and similar patterns of consumption can be seen in many other developed countries including Sweden, Venezuela, India, and Great Britain.[2]

developed country:
A country that has an advanced technological infrastructure and in which average income is higher than average, compared with other countries in the world. Sometimes the term "More Economically Developed Country" is used to refer to countries in this category.

Producing and Consuming Goods

Consumption is part of a larger system called the materials economy. The **materials economy** includes all the steps involved in producing and consuming goods, including disposal.

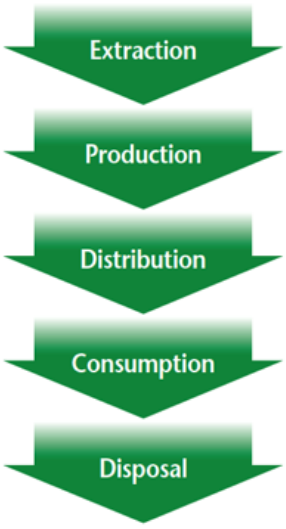
One way to envision this system is as a series of sequential steps. This sequence is sometimes called a "take-make-waste" process because materials and energy are used in one step after the other, usually ending with the product being thrown away. Let's look at this approach to get a feel for the steps involved in the traditional manufacturing and purchasing process. At each step along the chain, there are environmental, economic, and social considerations.

Extraction

Extraction is the removal of resources from a natural environment. Extraction can refer to harvesting; for example, trees are harvested to make lumber. Extraction can also refer to mining, such as coal that is mined from deep inside mountains or below the Earth's surface. Water use is also considered a form of extraction; it involves the removal of a natural resource from the environment for human consumption.

Extracting materials requires energy to find, harvest, refine, and transport materials. Extracting also often creates large amounts of waste, since the desired raw material must be separated from other materials. Jobs in the extraction industry, such as logging and mining, often pay relatively well but may have very dangerous working conditions.

Steps in the Materials Economy



Effects of Rising Temperatures

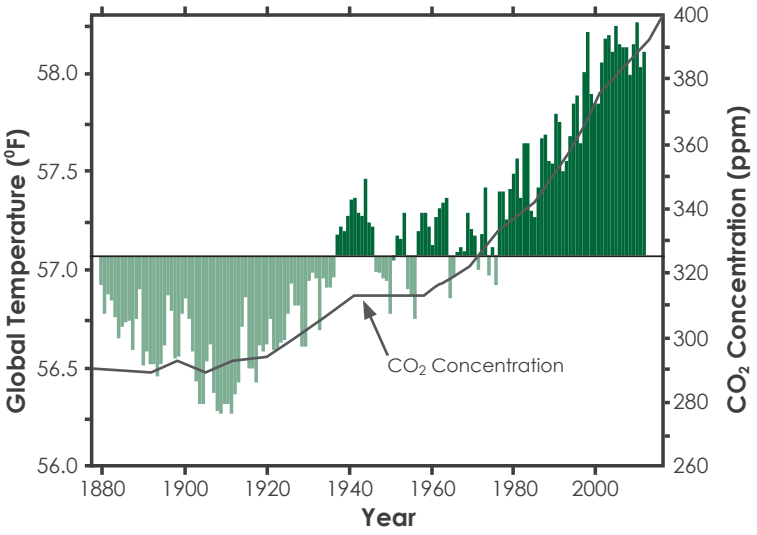
The steady increase in Earth's average temperature is having varied and complex consequences. Different locations around the planet are affected in different ways. Some regions may experience drought and extreme heat while others may experience heavy rainfall and flooding. Sea level may rise because polar ice caps may melt. Changing temperatures can affect ecosystems, requiring species to migrate to find regions that meet their temperature and weather needs. While average temperatures rise for the planet as a whole, some areas could experience more snow, more rain, and lower temperatures. Bigger temperature increases would cause stronger and more wide-ranging effects.[47]

Carbon Dioxide and Climate Change

Carbon dioxide is the most abundant greenhouse gas. Scientists have observed a close correlation between variations in atmospheric CO_2 levels and average global temperatures over thousands of years. There has been a sizeable increase in CO_2 levels beginning in the mid-1700s with the start of the Industrial Revolution. As CO_2 concentrations have increased, so has the overall average temperature on Earth's surface.

The amount of CO_2 in the atmosphere is measured in parts per million. This measurement is similar in concept to percentages, which can be thought of as parts per hundred. Scientists consider a concentration of 350 parts per million, or 0.035%, to be a safe level.[48] The following chart shows the trends in atmospheric CO_2 and global temperatures.

Global Temperature and Carbon Dioxide



Source: Globalchange.gov[49]

Summary

Throughout the duration of the module, students will adopt a daily practice of noticing and recording an example of wild nature in their everyday lives.

Time Required

- 5-10 minutes per day

Key Concepts

- Nature is everywhere
- I am part of nature

Objectives

- To create a sense of belonging in and awareness of the student's local place
- To build a habit of recognizing nature's continual presence in everyday life
- To bring an appreciation of natural beauty to students

Inquiry/Critical Thinking Questions

- Do I live in wild nature?

Materials

- Colored pencils

Activity Three

Nature Journal

Activity

1. **Observe wild nature.** Each day, look for an example of wild nature in your daily life. You might notice a bird on a nearby tree, hear rain falling on the roof, or spot a weed pushing up through cracks in the sidewalk. The only requirement is that the observation not reflect a manufactured object or anything made with a manufactured object.

60

One option is to choose something to observe every day over the four weeks of the unit. You could notice the phases of the moon, the time and location of the sunset, the presence of birds or insects, patterns of wind or clouds, or something else that catches your interest.

Here is a mindfulness-based process you can use for observing wild organisms and building a sense of nature connection:

> Step outside with the intention of experiencing yourself as part of nature. Try to let your thoughts run in the background of your mind without focusing on them. As you step outside, use your entire field of vision to take in your surroundings. Notice everything, living and non-living alike. Tune in to all of your senses. Notice sights, smells, sounds, temperature, wind, and sun. Allow some living organism to draw your attention. Keep your focus on it for at least 10 seconds, longer if you

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One way to use this activity is to ask students to respond to the prompts in the Field Book sections of each activity. These prompts are intended to help learners see connections between themselves and nature in ways that relate to the content.

You can also choose to have students use this activity for finding a daily nature connection, making their own informal observations or – if they choose – using the mindfulness-based observation process below. Daily nature observation helps build a sense of nature connection and often reduces stress. The instructions below guide students in this method of nature journaling.

You can have students spend the first five minutes of class writing or drawing in their nature journal. Or they can complete the journal at home. Have colored pencils available, or have students have a set at home or at school.

Name: _____

Weather and Climate Work Paper

1. Explain the similarities and differences between the two graphs below in terms of weather and climate.

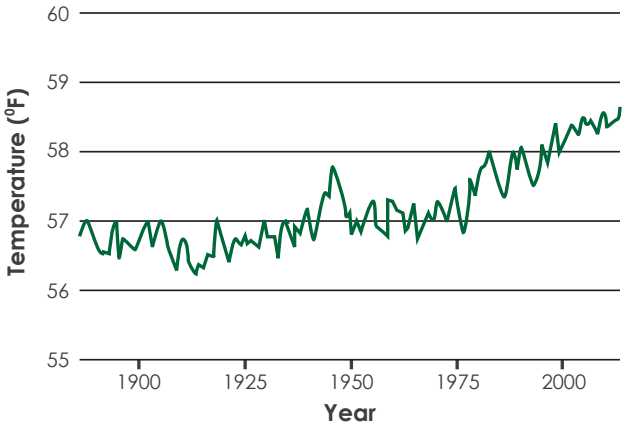
_____

_____

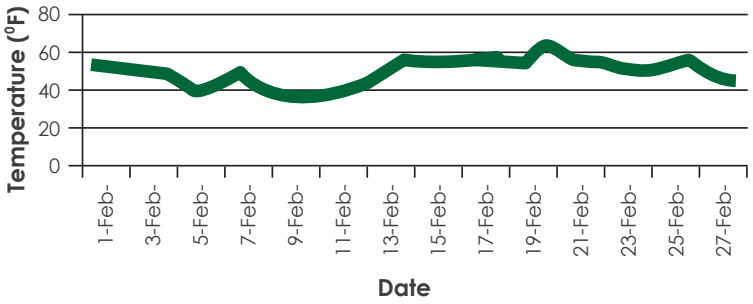
_____

_____

Average Global Temperature by Year [93g]



Maximum Daily Temperatures in London - February, 2017 [93h]



2. Explain the differences in the reports below in terms of weather and climate.

_____

_____

_____

_____

Report 1

"There has been a substantial increase in most measures of Atlantic hurricane activity since the early 1980s, the period during which high quality satellite data are available. These include measures of intensity, frequency, and duration as well as the number of strongest (Category 4 and 5) storms. The recent increases in activity are linked, in part, to higher sea surface temperatures in the region that Atlantic hurricanes form in and move through." [93i]

Report 2

"Heavy rainfall has disrupted normal life in Mumbai in the last 48 hours with the weatherman predicting rainfall at regular intervals in the next 24 hours.

From Wednesday 8 am to 8 am this morning, the city recorded 84.7 mm rainfall, western suburbs recorded 95.89 mm, while eastern suburbs registered 76.27 mm rainfall, according to civic body weather stations.

"Heavy to very heavy rainfall at regular intervals are likely to occur at one or two places in the city today," a senior official at Met Department, Mumbai regional office, said.

The official informed that other parts of the state have also recorded adequate rainfall."[93j]

Climate Change and Systems Thinking Work Paper

Solutions

What flows could be increased or decreased to reduce the amount of greenhouse gases in the atmosphere?

Fossil fuel combustion, deforestation, agricultural fertilizers, and methane leak flows could be reduced to limit the amount of greenhouse gases in the atmosphere. Regenerative farming or carbon capture and sequestration flows could be increased to draw greenhouse gases out of the atmosphere.

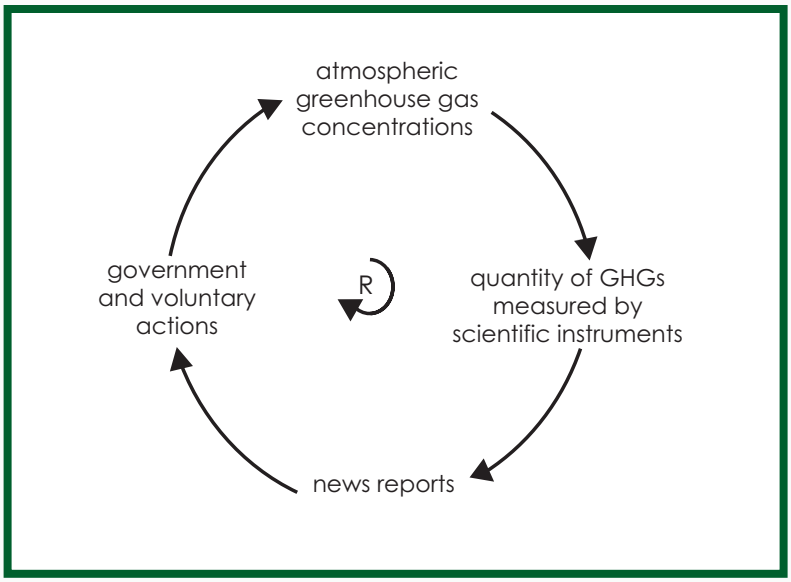
How do people know if the stock of greenhouse gases in the atmosphere were filling up?
How would we know if it was getting too full?

Scientific measurements are one way for us to track the concentration of greenhouse gas emissions. If we understand climate science, we can deduce that there greenhouse gas concentrations would increase based on our observations of changes in climate. Because the climate is complicated and changes based on many interactions, observing effects would not give us certainty that greenhouse gas concentrations were increasing.

What do you think of mitigation as a climate strategy compared to reducing greenhouse gas emissions?

The precautionary principle advises us to "prevent harm as the best method of environmental protection, and when knowledge is limited, apply a precautionary approach."[107g] Since we aren't sure how effectively, quickly, or economically we can remove greenhouse gases from the atmosphere, the precautionary approach suggests avoiding emissions as the best approach.

3. **Feedback Loop in Human Systems:** In nature, feedback loops provide systems with information that allows them to adapt to changing conditions. Systems that lack feedback have difficulty recognizing changing conditions, and so have a harder time adapting. In human systems, feedback often comes in the form of news, reports, scientific data, or other numerical or verbal information. Using the feedback loops and discussions on pages 39 and 44 as guides, draw a feedback loop that could provide people with information on changing climate conditions to help drive action. Draw the diagram in your Field Book.



Is this loop a balancing or reinforcing feedback loop? How do you know?

It is a reinforcing loop. If greenhouse gas concentrations increase, the quantity of greenhouse gases measured by scientific instruments will increase. This measurement will increase news reports of the increase. Then government and voluntary actions will increase. Actions will decrease the emissions of greenhouse gases or increase mitigation measures, decreasing atmospheric greenhouse gas concentrations. This cycle will continue to reinforce change at least until a safe level of greenhouse gas concentration is reached.