# BIG WORLD, SMALL PLANET

# Module 1: Getting Started with Sustainability Teacher Edition



A comprehensive guide to global issues and sustainable solutions



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A Comprehensive Guide to Global Issues and Sustainable Solutions

**Teacher Edition** 



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**Module 1:** Getting Started with Sustainability Teacher Edition

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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 standardsbased 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.



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# **Table of Contents**

Note to Teachers	iii
Proposed Unit Schedule	iv
Academic Standards	vi

# Unit 1 Introduction to Sustainability

We're All Connected	2
What Is Sustainability	5
Sustainability as a Worldview	.11
Changing Worldviews	.15
The Anthropocene Period	.16
The Big Ideas of Sustainability	.19

# **Unit 2** Tools for Engaging with Sustainability Issues

Systems Thinking
Thinking Critically
How Systems Thinking and Critical Thinking
Contribute to a Sustinability Worldview <b>52</b>

## Activities

tivity 1: What is Sustainability?55	Activity
tivity 2: Set Up Nature Journal <b>56</b>	Activity
tivity 3: Nature Journal <b>58</b>	Activity
tivity 4: My Place	Activity
tivity 5: Sustainability in My Place62	Activity
tivity 6: Sustainability and My Values	Activity
tivity 7: Human and Nature Timeline	Activity
tivity 8: Local Sustainability Case Study, Part 1 <b>67</b>	Activity
tivity 9: Creating the Future We Want69	Activity

i

## Academic Standards

The following standards are addressed in this module.

Standard	Description				
Next Generation Science Standards - High Schoool					
Disciplinary Core Ideas					
HS-LS2.A	Interdependent Relationships in Ecosystems: Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem.				
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	A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability. 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	Adaptation: Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline – and sometimes the extinction – of some species. 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.				

## Introduction to Sustainability



## **Essential Questions For This Unit**

- 1. What does sustainability mean?
- 2. Why is sustainability important to me?
- 3. How can I live more sustainably?
- 4. How can I develop a sustainability worldview?



# We're All Connected

We live in an interconnected world. Movies, music, news, manufactured goods like clothing and electronics, and people travel across the globe. With this much exchange of ideas, culture, and material goods, our actions in one region are sure to affect people living in other regions. Understanding how and where we connect can help us understand how we might impact others. This understanding can also help us find ways to make these new lines of contact work benefit of all.

## Think About It!

With whom do you feel connected? Are they physically near or far from you? What makes a connection feel alive and central in your life? What other connections do you have – or could you have – beyond those with other people?



## Connecting with People

Today, we can connect with other people through various modes of technology: cell phones, social media, the Internet, even movies and television. But of course, we have not always had so many ways to communicate. For most of history, people could only connect with others near them. These close, face-toface relationships still form an important part of our sense of belonging. We connect personally with our families, our friends, our schoolmates, and our neighbors. Maybe we have coaches or teachers, teammates, or even pets to whom we feel close. These relationships are the foundation of connection. We care about these people and know they care about us. We help each other, enjoy each other, and live our lives with each other. We're connected!

As a society, we connect in broader ways. In the United States, we share a national government and Constitution, an economy, and national holidays. Although Americans have many different beliefs and perspectives, we share values such as personal liberty, freedom of expression and religion, and democracy. These common points of view create a sense of connection throughout communities and across the nation.



## Health and Resiliency

This big idea has to do with the health and well-being of individuals and the systems we depend on. Health can involve our individual habits and lifestyle choices, such as whether we prefer fast food or home cooked meals, or it can involve broad issues affecting individuals or society. Examples might be: hunger, disease, water quality concerns, drug or alcohol abuse, homelessness, etc. Health is also impacted by environmentally related conditions caused by poor air quality, climate change, and agricultural and industrial practices that damage the environment.

Resiliency is the capacity of a system, such as a community or an ecosystem, to deal with change and to continue to function and develop by adapting over time. Individuals can also be resilient and work towards or recover from hardship. Change can be a positive element in our lives.

A sustainability worldview is concerned with the health and resiliency of individuals and the various systems upon which they depend. Exercising control over and improving our health and that of natural and built systems allows us to more easily adapt to and even thrive throughout changing times.



## Think About It!

What are some times in your life that you have had to be resilient and adapt to life events? What elements of a healthy lifestyle do you incorporate into your life as an individual or would you like to start incorporating?

What elements would you like to be a part of changing so that your community is healthier? Has the community you live in had to be resilient in the face of an event? If not, can you think of another individual or community that has?

## A New Way of Thinking

Systems thinking shows us that we understand situations better when we see relationships and interconnections between the parts. Understanding these relationships between parts helps us see the big picture of sustainability issues. We can see how information flows and recognize hidden causes of problems. We can use this knowledge to create better solutions.

Learning to think in systems calls on us to think differently than we have done before. The Center for Ecoliteracy calls this change in thinking a "shift in perception." They compare systems thinking with the way we usually think, which is focused on simple cause-and-effect relationships. The table shown below summarizes these comparisons.



Traditional and Systems Thinking <sup>17</sup>				
<b>Cause-and-Effect Thinking</b> The focus is on:	<b>Systems Thinking</b> The focus is on:			
Objects	Relationships			
How parts behave	How the combined whole behaves			
Single events	Patterns of events, underlying causes, and longer time frames			
Things that can be measured	Both things that can be measured and things that cannot be measured			
Right answers	Right way of thinking			

Now that you have learned the basics of systems thinking, you may start to see systems all around you. With practice, you will see interconnections everywhere. This skill will be a strong foundation for your growing sustainability worldview.



## Local Sustainability Case Study, Part 1

### Activity**⊢**

Activity Eight

- Identify a sustainability issue that you feel passionate about or interested in. For ideas, review the issues you identified in Activity 5, Sustainability in My Place. Other sources of inspiration include work done by a local organization, a school situation, a scientific or technological development, a law or government policy, a current event, or an item in the news. Remember that sustainability issues include environmental, social, and economic interconnections. Look for a topic that gives you the opportunity to look at all three of these factors.
- Write a brief description of your issue. In your Field Book, write a few paragraphs explaining your issue and the sustainability implications it represents. Describe the situation carefully and consider different points of view. Use a table or Venn diagram to summarize the environmental, social, and economic aspects.



3. Use the Big Ideas of Sustainability Organizer to analyze your issue. Note examples of ways in which your issue reflects each Big Idea. Where possible, be sure to include strengths, where your topic successfully applies the Big Idea. Also note weaknesses, where the Big Idea is not represented. Use color or

67

#### MODULE ONE

Students should choose issues that are complex enough to work in some depth, that they know something about or can easily research key information, and for which they can brainstorm feasible solutions.

### Summary

Learners will use sustainability principles to analyze a local realworld wicked problem of their choosing. The real-world issue students select in this activity will be used in Activities Fourteen, Sixteen, and Seventeen.

#### **Time Required**

• Two 50-minute class periods

#### **Reading Prior to Assignment**

• Pages 19-26

#### **Key Concepts**

- Sustainability Big Ideas
- Sustainability Worldview

#### **Objectives**

- To frame a local issue using sustainability principles
- To establish a basis for further analysis and problem solving in Activities Fourteen, Sixteen and Seventeen

#### Inquiry/ Critical Thinking Questions

- How can the Big Ideas of Sustainability help analyze a problem?
- How can a sustainability worldview help develop a solution for a real-world problem?
- How can I find a "less bad/ more good" solution for a wicked problem?

#### Handouts

- Big Ideas of Sustainability Organizer, page 68A
- Sustainability Worldview Organizer, page 68B

#### **Materials**

 Prepare copies of the Big Ideas of Sustainability Organizer and Sustainability Worldview Organizer for each learner

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## Feedback in Systems continued

- 4. How could feedback be added to the following situations to improve sustainability?
  - a. A significant amount of manufacturing has been moved from developed countries like the United States to developing countries like India, China, Brazil, and Bangladesh. As manufacturing has increased in these countries, air pollution laws have been slowly adopted. Developing countries are following the same pattern that developed countries followed: air pollution has increased a faster rate than have laws that limit pollution. Consumers buying goods manufactured in developing countries may not know about the pollution that is related to their purchases.
  - b. Automobile drivers can reduce their fuel efficiency with the following practices:<sup>27a</sup>
    - i. Keep tires properly inflated: increase fuel efficiency by 5%
    - ii. Use cruise control on the highway: increase fuel efficiency by 6%
    - iii. Avoid engine idling: save 0.5 to 1 gallon of gasoline per hour
    - iv. Drive smoothly accelerate and brake lightly, when conditions allow: increase fuel efficiency by up to 30%
    - v. Combine trips to make sure you operate the car with a warmed-up engine: increase fuel efficiency by up to 50% on short trips

How can drivers be given feedback to encourage them to use these practices, which will help them reduce fossil fuel use, reduce air pollution, and reduce climate change?

c. Although most countries require that workers earn a minimum wage, the minimum wages in some cases not provide enough money to afford housing, food, clothing, basic medical care, and other basic needs. Employers are concerned that increased wages will make them lose customers, and customers are unable or unwilling to pay higher prices.

## Stocks and Flows

### Solutions

2. Let's look at a social system. Suppose we want to study factors influencing voting rights; voting rights will be the stock we want to optimize. What could be flows in and out of the voting rights stock?

Input flows would build the supply of voting rights; these flows could include laws, local programs including voter registration and mail-in ballot programs, and knowledgeable citizens. Voting rights would increase or decrease depending on the success of these programs. Output flows represent actions that affect existing rights; these could include implementation of programs, such as access to polling places or treatment of voters at polling places. Other factors like having a candidate you wish to vote for or your candidate getting elected are not examples of flows in this scenario; these factors do not affect the right to vote.



Draw a stock and flow diagram of voting rights.

#### Note that the three input flows are parallel to each another, and the two output flows are also parallel to each other.

3. When studying a system, we always need to decide which portions we want to study. There are usually more stocks and flows than we need to examine when considering a particular issue.

Let's consider the idea of replenishing groundwater in agricultural areas in central California. After several years of drought, groundwater levels are low. At the same time, snowmelt in wet years can overwhelm the state water collection system. Floodwaters can bypass levees and reservoirs. Stanford University has estimated that the state could collect and store six times more water by boosting groundwater storage than by expanding and building new reservoirs – for the same cost and with fewer environmental problems. Enhancing underground storage helps solve several problems: it collects snowmelt that could otherwise cause flooding; it refills underground aquifers; and it costs less, uses fewer resources, and creates fewer environmental problems than do other solutions. Let's create a stock and flow diagram to represent this situation. **You may want to go through this problem with the class.** 

List stocks in the portion of the water cycle and human water system being studied. **Stocks include underground aquifers, snowpack, and reservoirs.** 

List flows in this scenario. Flows include snowmelt, natural percolation into aquifers, pumped water into aquifers, floodwaters, and pumped water out of aquifers.