Jeff Ofstedahl

Earth Science/9th grade/Ecology 10-Week Unit (4th quarter) to Explore issues of Global Sustainability in ecology for Global Competency

This is a ten-week unit with ten lessons. Each lesson will take one week of class time to give the students a more in-depth project-based approach to some key ideas and global connections surrounding sustainability and world ecology.

Unit Goals for Global Competencies: (Competencies are color coordinated to highlight competencies in the lessons unit, part 3)

1) Investigate the world,

2) Recognize perspective,

3) Communicate ideas across multinational markets, and

4) Inspiring students to take action.

Websites and/or technology used and associated with this learning unit include but are not limited to the following:

Skype

[www.epals.com](http://www.epals.com)

www.seattlepi.com/nie

[www.myfootprint.org](http://www.myfootprint.org).

[www.footprintnetwork.org](http://www.footprintnetwork.org)

[www.prb.org](http://www.prb.org)

www.census.gov

www.uaswaterwise.org

[www.panda.org/climatewitness](http://www.panda.org/climatewitness)

[www.senate.gov/general/contact\_information/senators\_cfm.cfm](http://www.senate.gov/general/contact_information/senators_cfm.cfm)

[www.facingthefuture.org](http://www.facingthefuture.org)

[www.montereybayaquarium.org/cr/seafoodwatch.asp](http://www.montereybayaquarium.org/cr/seafoodwatch.asp)

[www.shadecoffee.org](http://www.shadecoffee.org)

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| **Stage 1 Desired Results** | | |
| **ESTABLISHED GOALS**   |  | | --- | | **AZ.CC.RST.9-10. Reading Standards for Literacy in Science and Technical Subjects**  **Key Ideas and Details**  RST.9-10.1.: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.  RST.9-10.2.: Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.  RST.9-10.3.: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.  **Craft and Structure**  RST.9-10.4.: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.  RST.9-10.5.: Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).  RST.9-10.6.: Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address  **Integration of Knowledge and Ideas**  RST.9-10.7.: Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.  RST.9-10.8.: Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.  RST.9-10.9.: Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.  **Range of Reading and Level of Text Complexity**  RST.9-10.10.: By the end of grade 10, read and comprehend science/technical texts in the grades 9-10 text complexity band independently and proficiently.  **Arizona High School Science Specific Standards:**  **Strand 1: Inquiry Process**  Inquiry Process establishes the basis for students’ learning in science. Students use scientific processes: questioning, planning and conducting investigations, using appropriate tools and techniques to gather data, thinking critically and logically about relationships between evidence and explanations, and communicating results.  **Concept 1: Observations, Questions, and Hypotheses**  Formulate predictions, questions, or hypotheses based on observations. Evaluate appropriate resources.  **Strand 3: Science in Personal and Social Perspectives**  Science in Personal and Social Perspectives emphasizes developing the ability to design a solution to a problem, to understand the relationship between science and technology, and the ways people are involved in both. Students understand the impact of science and technology on human activity and the environment. This strand affords students the opportunity to understand their place in the world **–** as living creatures, consumers, decision makers, problem solvers, managers, and planners.  **Concept 1: Changes in Environments**  Describe the interactions between human populations, natural hazards, and the environment.  **Concept 2: Science and Technology in Society**  Develop viable solutions to a need or problem.  **Concept 3: Human Population Characteristics**  Analyze factors that affect human populations. | | ***Transfer***  ***Students will be able to independently use their learning to…***   |  | | --- | | T1: Collaborate and answer questions about critical global issues.  T2: Experience the interconnectedness of global issues  T3: Understand how a change in one issue can positively or negatively affect a change in another issue  T4: Develop and discuss criteria for defining a global issue  T5: Explore and explain the interconnections between global issues as well as their own solutions  T6: Identify and prioritize global issues  T7: Explain the significance of exponential global population growth  T8: Explain the difficult struggles and choices facing refugees and internally displaced people  T9: Explore the root causes of refugee crises and the obstacles and options refugee groups face  T10: Identify the components of an ecological footprint and describe the mark it leaves on the environment, emphasizing the interconnectedness of lifestyle, population, and environmental impacts  T11: Experience the challenges, decisions, choices and impacts that face subsistence farmers in developing worlds  T12: Demonstrate how much of the world’s water is available for human and other species’ needs.  T13: Compare energy use and CO2 emissions between countries.  T14: Research and discuss energy impacts and sustainable energy solutions  T15: Address the disparity of energy use between countries  T16: Explore how technology, population growth, and sustainable practices impact fish populations and fisheries management.  T17: Understand the impact of today’s most urgent global health issues | | |
| ***Students will be able to independently use their learning to…***   |  | | --- | | T1: Collaborate and answer questions about critical global issues.  T2: Experience the interconnectedness of global issues  T3: Understand how a change in one issue can positively or negatively affect a change in another issue  T4: Develop and discuss criteria for defining a global issue  T5: Explore and explain the interconnections between global issues as well as their own solutions  T6: Identify and prioritize global issues  T7: Explain the significance of exponential global population growth  T8: Explain the difficult struggles and choices facing refugees and internally displaced people  T9: Explore the root causes of refugee crises and the obstacles and options refugee groups face  T10: Identify the components of an ecological footprint and describe the mark it leaves on the environment, emphasizing the interconnectedness of lifestyle, population, and environmental impacts  T11: Experience the challenges, decisions, choices and impacts that face subsistence farmers in developing worlds  T12: Demonstrate how much of the world’s water is available for human and other species’ needs.  T13: Compare energy use and CO2 emissions between countries.  T14: Research and discuss energy impacts and sustainable energy solutions  T15: Address the disparity of energy use between countries  T16: Explore how technology, population growth, and sustainable practices impact fish populations and fisheries management.  T17: Understand the impact of today’s most urgent global health issues | | |
| ***Meaning*** | |
| **UNDERSTANDINGS**  ***Students will…***  U1: Understand and define global issues and their interconnections.  U2: Develop criteria for determining what makes an issue global in scope.  U3: Brainstorm and list global issues.  U4: Group and prioritize issues, highlighting interconnections.  U5: Explore solutions.  U6: Collaborate in teams to answer questions about world populations, economics and environmental issues.  U7: Demonstrate the interconnectedness of global issues and solutions.  U8: Brainstorm, analyze and write about the sustainability of the actions of individuals, businesses and governments.  U9: Experience and discuss the dynamic, interconnected and self-organizing nature of systems.  U10: Consider how understanding the nature of systems can help us to find sustainable solutions.  U11: Experience how mental models can limit our success and keep us from reaching our goals.  U12: Redesign a system to accomplish a shared goal.  U13: Gain an understanding of the significance of global population.  U14: Create their own representation of 1 billion.  U15: Gain a sense of empathy for the hard choices facing refugees.  U16: Research and explain the root causes of refugee crises and the root solutions for preventing these crises.  U17: Learn about the asylum process and the protections offered to refugees.  U18: Debate the policies of developed nations’ immigration policies.  U19: Identify the resources, processes and impacts embodied in everyday activities.  U20: Describe the interconnectedness of population, lifestyle, economics and environmental issues.  U21: Discuss, create and implement ways to reduce ecological footprints.  U22: Experience the challenges, decisions, choices and impacts that subsistence farmers in developing worlds face.  U23: Understand the root causes of hunger.  U24: Consider sustainable solutions to help alleviate poverty and hunger.  U25: Understand that the world’s fresh water supply is limited.  U26: Understand what it might be like if they had to haul their own water daily.  U27: Consider the global implications of fresh water use and discuss solutions to water scarcity.  U28: Calculate and compare the percentage of energy use and emissions by country and sector to world average energy use and emissions.  U29: Brainstorm and research impacts of energy use by sector  U30: Brainstorm and research sustainable energy solutions.  U31: Write a resolution.  U32: present their resolution at a mock “World Energy Summit.”  U33: Identify the functions of plant and animal species in a forest stream ecosystem.  U34: Explore species interdependency.  U35: Consider what can be done to help protect biodiversity.  U36: Experience the “Tragedy of the Commons” as it relates to fishing resources.  U37: Consider social, environmental and economic impacts of overfishing.  U38: Identify sustainable fishing practices.  U39: Determine and explain purchasing and consumption choices.  U40: Develop quality of life indicators.  U41: Develop and administer a quality of life survey.  U42: Analyze data and present the results.  U43: Understand the connection between how quality of life is measured and global issues such as sustainability, inequality, poverty and good governance.  U44: Analyze several news articles using a model that helps identify the particular global patterns and economic, political, and social forces behind the stories.  U45: Diagram the events, patterns and underlying structures in a news article.  U46: Discuss structural solutions to address these events.  U47: Write an article about the emerging patterns and underlying causes of a particular current event.  U48: Understand the connection between poverty and poor health.  U49: Understand how international organizations, NGOs and local governments coordinate to address global health issues.  U50: learn how they can improve global health at the local level.  U51: Understand the difference between treating and preventing global health issues.  U52: Understand how the 3 parts of governance work together to create energy policy.  U53: Experience the process of finding common interests and building coalitions with other organizations.  U54: Recognize the difficult choices policy makers face in balancing the short- and long-term costs and benefits of their decisions.  U55: Understand the role governance plays in other global issues.  U56: Experience what it feels like to be part of a specific economic class.  U57: Consider social, environmental and economic impacts of poverty and scarcity.  U58: Consider and write about ways to alleviate poverty and create a just and sustainable world.  U59: Determine and explain purchasing/consumption choices.  U60: Compare difference purchasing/consumption choices and their social and environmental effects.  U61: describe how relative affluence and high consumption patterns relate to environmental degradation.  U62: Discuss and begin to implement personal choices they can make to reduce environmental impacts as well as develop and implement an action plan to help alleviate poverty.  U63: Brainstorm indicators of the health and well-being of women and girls around the world?  U64: research facts about the demographics and status of people in a given country.  U65: Give a verbal presentation of the situation in a given country.  U66: Prioritize the needs of each country in prder to develop an effective plan of action.  U67: Conduct Internet research on a developing country.  U68: Use Skype to communicate questions about a developing question with a resident of that developing country.  U69: prepare a microcredit business plan as if they were a person living in that country.  U70: Evaluate their peers’ business plans.  U71: Understand how structural solutions can help alleviate poverty.  U72: Understand the roots of conflict.  U73: learn to separate positions from interests.  U74: Analyze conflicts from multiple perspectives.  U75: Discuss and write about a pressing issue of the future from the perspective of a specific worldview.  U76: Determine what metaphor best describes the students’ view of the future.  U77: Evaluate how different perspectives on our level of control over the future influence our behavior and actions.  U78: Visualize the future they desire.  U79: Collaborate with their peers.  Identify issues they want to address, and identify and prioritize objectives.  U80: Present their findings. | **ESSENTIAL QUESTIONS**  E1: How are the issues of population, resource consumption, poverty, conflict, and the environment connected?  E2: How are global issues interconnected?  E3: How does a change in one global issue affect other global issues?  E4: How are solutions to global problems interconnected?  E5: What defines a global issue?  E6: How are global issues connected to each other and to our lives?  E7: What is the benefit of understanding the connections between global issues?  E8: What does sustainability mean and how does it apply to human activity?  E9: How is sustainability of an individual, business or government activity determined?  E10: How can we balance the needs of people, protect the environment, and have a vibrant and equitable economy?  E11: How can an activity be made more sustainable?  E12: What is the inherent nature of a system?  E13: How can understanding the nature of systems help us to find solutions to large, complex problems?  E14: How do mental models and assumptions keep us from reaching our goals?  E15: How can we redesign a system that is not functioning well to achieve our desired outcome?  E16: How much is 1 billion?  E17: How can we represent the number 1 billion?  E18: How many people can the planet support?  E19: How and why does someone become a refugee?  E20: How do nations determine who qualifies as a refugee?  E21: How are refugee issues tied to other global issues?  E22: What are the impacts of refugees populations on the environment, economies, and social fabric of their host and home countries?  E23: What are some sustainable solutions to addressing the root causes of refugee crises?  E24: What are the environmental, economic and social impacts of a typical US diet and lifestyle?  E25: What would be the consequences if the rest of the world adopted a US lifestyle?  E26: What can we do to reduce impacts associated with resource consumption?  E27: What are some of the challenges that subsistence farmers face in growing enough food to feed their families?  E28: What are the root causes of hunger and poverty and how can they be addressed sustainably?  E29: How much available fresh water exists worldwide?  E30: What are the causes and consequences of unequal water use around the world?  E31: How is water availability and use connected to other global issues?  E32: What can be done to conserve water resources and increase water availability?  E33: Hwow does energy use by different sectors compare between the US and China?  E34: How is energy use connected to other global issues?  E35: What can be done to conserve energy resources and reduce CO2 emissions?  E36: What is biodiversity and why is it important in an ecosystem?  E37: What factors threaten biodiversity?  E38: What can people do to help protect and conserve the earth’s ecosystems?  E39: What happens when a commonly owned resource is overused?  E40: What are the impacts of overfishing or exploiting a natural resource?  E41: How can we establish and maintain the sustainable use of a resource?  E42: How is quality of life measured?  E43: What are other ways to measure quality of life?  E44: How does the concept of what is necessary for a high quality of life change over the course of our lives?  E45: What are the economic, political and social forces that drive the dramatic events we see reported in the news?  E46: How are news events connected to each other in terms of their underlying causes?  E47: What are some positive ways we can address the structural causes of many negative world events?  E48: What are some of the world’s most pressing health issues?  E49: What are some of the root causes of global health issues?  E50: What can be done to improve global health?  E51: How are government policies determined and who has a say in creating energy policy?  E52: What considerations should be taken into account when developing energy policies?  E53: How are government policies connected to other global issues?  E54: How are resources distributed throughout the world?  E55: What are the factors contributing to the inequitable distribution of resources?  E56: What steps can be taken to alleviate hunger and poverty?  E57: What are the choices that people make with relatively little access to wealth/income can make compared to people with relatively high access?  E58: What are the impacts of each of those choices and decisions?  E59: What personal choices can we make to help reduce some of these impacts, and what actions can we take to help alleviate poverty?  E60: What does it take to make a population healthy?  E61: Why is women’s health so important for everyone?  E62: What are the root causes of a population’s poor health?  E63: Which solutions address the root causes of a population’s poor health?  E64: What are some structural causes of poverty?  E65: What is sustainable development?  E66: What is microcredit and how can it help alleviate poverty?  E67: What are some sources of conflict?  E68: How are these sources of conflict connected to global issues?  E69: How can outsiders (eg. mediators) help resolve conflict?  E70: How do perception and worldview influence and shape our actions?  E71: How can we create the future that we want?  E72: How do we envision and create a world we want for ourselves and for future generations?  E73: What unmet needs exist within our local and global communities?  E74: How do we identify structural solutions to global issues?  E75: How can we work together to plan a course of action?     |  | | --- | |  | |
| ***Acquisition*** | |
| *Students will know…*  K1: About critical global issues and their interconnectedness to societies and systems.  K2: How a change in one issue can positively or negatively affect a change in another issue  K4: How to develop criteria for defining global issues  K5: The interconnections between global issues and their solutions  K6: How to identify, group, and prioritize global issues  K7: The three components of global systems: economy, environment & society  K8: The dynamic interconnected and self-organizing nature of systems  K9: The limits of success and how to redesign a system to meet their goals  K10: How assumptions drive behavior  K11: The significance of exponential global population growth  K12: The difficult struggles and choices facing refugees and internally displaced people  K13: The root causes of refugee crises and the obstacles and options refugee groups face  K14: The components of an ecological footprint and the mark it leaves on the environment  K15: The interconnectedness of lifestyle, population, and environmental impacts  K16: The challenges, decisions, choices and impacts that face subsistence farmers in developing worlds  K17: How much of the world’s water is available for human and other species’ needs.  K18: Ho to compare energy use and CO2 emissions by sector in the US and China  K19: How to research and discuss energy impacts and sustainable energy solutions  K20: How to write a resolution addressing energy use and present their resolutions  K21: How to investigate the functions of plant and animal species in the ecosystem, and their interdependent relationships and consider the importance of preserving biodiversity in nature.  K22: How technology, population growth, and sustainable practices impact fish populations and fisheries management.  K23: How to develop indicators to measure quality of life and conduct a survey to obtain data, and analyze their data using spreadsheet software to produce charts  K24: How to use an analysis model to analyze the global patterns and underlying structural causes that drive events in the news  K25: The impact of today’s most urgent global health issues | *Students will be skilled at…*  S1: Analyzing research and data to make informed decisions.  S2: Using a globe and atlas to discuss world geography as it relates to global crises.  S3: Using researched sources to evaluate the advantages and disadvantages of economy and resources in the world community.  S4: Proposing, implementing, and evaluating the results of survey of their peers.  S5: Publishing a video lab report to present the findings of their investigations.  S6: Utilizing global communications systems via the Internet to connect with students their age in other countries.  S6: Organizing and implementing a local campaign to raise awareness and of global issues.  S7: Reflecting on the impact their knowledge of how their actions/decisions can have on the developing world.  S8: Creating models they can use to share their discoveries with other students and to mentor younger grades.  S9: Using data processing software (Excel) to analyze data and create graphs and charts. |
| **Stage 2 - Evidence** | | |
| **Evaluative Criteria** | **Assessment Evidence** | |
| 1: Students will provide insightful comparisons, display higher level thinking, provide textual evidence  2: Students will demonstrate thorough analysis of informational texts, provide accurate/appropriate responses to questions  3: Students will write with a grade-level proficiency, use correct spelling and grammatical writing styles  4: Students will demonstrate well-researched knowledge, and use thoughtful, detailed, informative connections and  Comparisons to back up their claims  5: Students will list, describe, recite, give examples, express, illustrate, explain, summarize, generalize, produce, show, point out, compose, create presentations to demonstrate the concepts being researched  6: Students will identify, locate, express, illustrate, organize, prepare, categorize, originate, develop, construct, compare detailed information in their presentations  7: Students will identify, locate, give examples, illustrate, summarize, produce, choose, apply, compare, differentiate, classify, develop, design, construct, organize information to support their arguments/positions  8: Students will locate, recite, give examples, summarize, organize, prepare, apply, compare, analyze, distinguish, infer, develop and create  9: Students will locate, illustrate, interpret and accurately produce charts and graphs using the U.S. Census Bureau’s website  10: Students will select, identify, describe, give examples, interpret, generalize, apply, analyze, classify, differentiate, infer, compose, hypothesize, develop, organize, judge, evaluate, critique  11: Students will describe, identify, give examples, express, interpret, generalize, apply, classify, distinguish, infer, hypothesize, evaluate, compare and consider the lives of peoples in other cultures and communities around the world to make global connections to their learning | TRANSFER TASK(S):  Lesson 1:  A: Students will read the article What Are Global Issues and will use prompts to consider and write their ideas about how they impact global issues in their lives as well as in the community.  B: Students will use Skype to connect with another student in a different country to discuss how climate issues are impacting each other. Based on what the student learns from the other student, students will create a poster that depicts what they learned to share with the rest of the class and to be posted on the science dept. bulletin board.  C: Students will use the Internet to interview a climate witness. Students will use online research to find data to back up the interviewee’s claims.    Lesson 2:  A: Students will read the article The Seventh Generation and use prompts to consider and write their ideas about how they impact global issues in their lives as well as in the community.  B: Students will research an energy topic on climate change and draft and send a letter to their U.S. senator telling him or her about their climate change concerns, asking him or her to take a specific action.  C: Students will visit [facing the future](http://www.facingthefuture) website’s Fast Facts & Quick Actions under Latest News, click on Climate Change, then choose one quick action and get started. Students will team up in groups of four and create an action plan that can be implemented at the school.  Lesson 3:  A: Students will read the article People and the Planet and will use prompts to consider and write their ideas about how they impact global issues in their lives as well as in the community.  B: Students will measure their Ecological Footprint as well as that of another student in a differing country by visiting www.myfootprint.org.  C: Students will compare their Footprint to average Footprints around the world by viewing the National Footprint Results from the Global Footprint Network at [www.footprintnetwork.org](http://www.footprintnetwork.org) and create a chart that demonstrates their ecological footprint and answers this question: If everyone lived like you, how many planets would we need?  C: Students will create a poster that compares the two eco-footprints.  D: Students will evaluate their trash list to see if any of the items they threw away could be reused or recycled in our community. Students will share their findings with the class. The class will brainstorm to create an action plan for reducing and recycling waste.  Lesson 4:  A: Students will read the article Energy in the Sustainability Puzzle and will use prompts to consider and write their ideas about how they impact global issues in their lives as well as in the community. Students will consider and write their ideas about how they impact global issues in their lives as well as in the community.  B: Students will create a chart that outlines their household’s peak and off-peak kilowatt usage, as well as the costs associated with the energy use.  C: Students will create a chart that shows how much energy your personal items use each day.  D: Students will research how much their electricity costs per kilowatt and how much alternative forms of generating electricity (such as wind power or solar power) would cost per kilowatt.  E: Students will find out how their electricity is generated and create a poster that compares their household’s energy use with the other student’s household energy use. Using Skype or ePals, students will connect with another student in another country and learn how much electricity is used in his/her home.  Lesson 5:  A: Students will read the article How Much Water is Available? and will use prompts to consider and write their ideas about how they impact global issues in their lives as well as in the community. Students will use prompts to consider and write their ideas about how they impact global issues in their lives as well as in the community.  B: Students will test their water IQ by going to http://savingwater.org/kids/ to explore the source of the water they use every day, and how they can use water wisely. Students will create a poster explaining what they found by researching the sources and uses of their daily water use.  C: Students will write an action plan based on what they learned by researching their Water IQ. Students will visit facing the future’s Fast Facts & Quick Actions under, click on  Water, then choose one quick action they can start doing to tackle water issues.  Lesson 6:  A: Students will read the The Ocean Planet and will use prompts to consider and write their ideas about how they impact global issues in their lives as well as in the community. Students will use prompts to consider and write their ideas about how they impact global issues in their lives as well as in the community.  B: Based on the Surfrider Foundation’s suggestions, students will create an action plan and a poster that includes two ways they can promote ocean health.  C: Using the Seafood Watch card downloaded from the Monterey Bay Aquarium, students will prepare a survey of seafood sold at our local markets and create a poster of the seafood using a red, yellow, green dot system and use it to determine which seafood is a good choice for maintaining healthy oceans.  Lesson7:  A: Students will read the article The Source of Our Stuff and will use prompts to consider and write their ideas about how they impact global issues in their lives as well as in the community.  Students will use prompts to consider and write their ideas about how they impact global issues in their lives as well as in the community.  B Students will create a web diagram of all the resources required to make their favorite item of clothing. Start by drawing the item in the center of a large piece of paper. Next, think about the different parts of the item, and write all of the environmental resources used on your web diagram.  C: Students will Join Plant for the Planet’s “Billion Tree Campaign,” and be part of a global reforestation effort and create a presentation based on what they learned by their participation with the Billion Tree Campaign.  Lesson 8:  A: Students will read the article Earth’s resources and use prompts to consider and write their ideas about how they impact global issues in their lives as well as in the community.  B: After clicking on *Shade Coffee*, then *FAQs, students will find the answers to these questions and create an advertising campaign that educates their peers about:*  • How does shade-grown coffee support increased biodiversity?  • Why do you think biodiversity is important?  C: Students will then choose one ‘quick action’ from the website *Latest News from Facing the Future* and create an action plan to make a difference in protecting biodiversity.  Lesson 9:  A: Students will read the article Populating the Planet and use prompts to consider and write their ideas about how they impact global issues in their lives as well as in the community.B: Students will compare the population, health and environment statistics of the United States and two other countries and answer these questions:  • How do life expectancy, rate of natural increase, and carbon dioxide emissions per capita compare among these three countries?  • What are some possible explanations for the trends that you observed?  B: Students will review the 2007 World Population Data Sheet on the Population Reference Bureau’s Web site at [www.prb.org](http://www.prb.org). Based on what they find, they will create an action plan to reduce their impact in one of these areas for one week. Students will create a poster to share with friends, family and classmates the results of their efforts to reduce energy consumption.  Lesson 10:  A: Students will read the article How Are We Growing? and use prompts to consider and write their ideas about how they impact global issues in their lives as well as in the community.  B: Students will visit www.census.gov to research the population of Sierra Vista, AZ, between 1950 and 2010. Calculate the rate of increase from 1950 through 2010. C: Based on their findings, estimate the population in the year 2050. Students will create a poster graphing the population growth over that time. Students will also research the levels of the water table at wwwuaswaterwise.org during those times and create side by side graphs showing human population growth compared to the levels of the water table.  C: Based on their research about population trends in their area, students will create a poster answering the following questions:  • How will your life change as a result of increasing population?  • In what ways do you think Sierra Vista, AZ, will look different in 2050?  C: Students will develop a project to support the reuse of at least one of these items their home, school or community, and create a poster encouraging others to do the same.  D: Students will find alternative uses for materials currently being thrown in landfills (such as tires, cell phones and computers) in their community. | |
| **Stage 3 – Learning Plan** | | |
| These lessons are based on students using articles about global issues from Seattle Newspapers In Education Skills for Everyday Living series on Global Issues and Sustainable Solutions: seattlepi.com/nie  **Lesson 1, Activity 1: Reading What Are Global Issues article:**  Students will read the article (included below) and will use prompts to consider and write their ideas about how they impact global issues in their lives as well as in the community.  Article contents:  *What are Global Issues?* (reading assignment)  Global issues are significant issues involving most or all of the earth. Local issues, on the other hand, involve only a single specific location or geographic region. Most global issues affect people locally all over the world. An issue is likely to be global if it:  • persists or is long-acting  • occurs across national and regional boundaries  • affects large numbers of people  • is an underlying cause of events  • is connected to other issues that meet these criteria  What are some global issues you have read or heard about? Take a look through the newspaper and use these criteria to find global issues in the news today.  Climate Change as a Global Issue  Climate change is a good example of a global issue. Climate change is a result of both natural and human-induced factors. Natural events such as volcanic eruptions can contribute to climate change. One major way that humans contribute to climate change is through activities that release greenhouse gases such as carbon dioxide and nitrous oxide. Greenhouse gases are released into Earth’s atmosphere when we burn fossil fuels (such as coal, oil and natural gas) for energy to heat our homes or run our cars. When greenhouse gases build up in the atmosphere, they trap heat from the sun near Earth’s surface, causing temperatures on Earth to warm.  Climate change is persistent and long-acting in that it may take many years to be fully felt, and it will require similar time frames to be resolved. Climate change has proven to be “transnational,” meaning that its effects are felt well beyond the borders of countries that contribute to it most. Climate change can significantly affect millions of people and is an underlying cause of many events such as desertification (spreading of desert areas), crop failure and diminished water supplies.  Climate change is also interconnected to many other issues such as food security and forced migration. For example, as sea levels rise, citizens of island nations such as the Maldives, Tuvalu and the Solomon Islands are moving to areas of higher elevation, abandoning low-lying areas. Some of these climate refugees have migrated to New Zealand and other larger islands, where they must find new homes and jobs.  Because climate change is interconnected to other issues, efforts to reduce climate change could in turn positively impact other issues. For example, reducing carbon dioxide emissions through use of more sustainable energy sources such as solar power would also reduce air pollution and smog.  The Iceberg Model    One model that is helpful for understanding global issues is the iceberg model. An iceberg is a large piece of ice floating in the ocean. We know that an iceberg has only 10% of its total mass above the water while 90% of it is underwater. But that underwater 90% is what the ocean currents act on and what creates the iceberg’s behavior at its tip.  Global issues can be looked at in this same way. If we apply the iceberg model to climate change, we would say that at the tip, above the water, are “events,” or things that we see or hear about happening in the world, such as flooding below glacial regions in Nepal or increased desertification in Chad. Events we hear about in the news often represent the iceberg tip.  If we look just below the water line, we often start to see patterns, or the recurrence of events. This might be multiple floods around the world or years of worsening desertification. Patterns are important to identify because they indicate that a given event is not an isolated incident. Like the different levels of an iceberg, deep beneath the patterns are the underlying structures or root causes that create or drive those patterns. For example, the flooding of  New Orleans from Hurricane Katrina may be a symptom of a much larger problem of increased hurricane frequency and intensity. These observed changes in weather are thought by many to be the result of long-term climate change. The devastating effect of Hurricane Katrina on the poorest citizens of New Orleans also highlights the potential of climate change to disproportionately impact the poor.  Finally, at the very base of the iceberg are the assumptions and worldviews that have created or sustained the structures that are in place. The important thing to understand is that in solving problems, changing the underlying structure will have the greatest effect on the events at its tip.  To reduce human contributions to climate change, we will need to examine the assumptions and worldviews that have contributed to climate change.  **Lesson 1, Activity 2, Writing Prompt:**  **Lesson 1, Activity 2, Taking global issues global:**  Students will Visit World Wildlife Fund’s Climate Witness Website [www.panda.org/climatewitness](http://www.panda.org/climatewitness) to read about and watch a video about the effects of climate change witnessed by people all over the world. They also will learn what people are doing to stop climate change from further impacting their homelands. Students will use Skype to connect with another student in a different country to discuss how climate issues are impacting each other. Based on what the student learns from the other student, students will create a poster that depicts what they learned to share with the rest of the class and to be posted on the science dept. bulletin board.  **Lesson 1, Activity 3, Making Connections:**  Students will use the Internet to interview a climate witness. Or, they can interview an older relative or community member to explain how climate (temperatures, rainfall, long-term weather patterns) has changed during his or her lifetime. If students interview a local person, they will also need to use online research to find data to back up the interviewee’s claims.    ----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------  **Lesson 2**  **Lesson 2, Activity 1: Reading The Seventh Generation article:**  Students will read The Seventh Generation article from Seattle Newspapers In Education Skills for Everyday Living series on Global Issues and Sustainable Solutions: seattlepi.com/nie (included below) and will use prompts to consider and write their ideas about how they impact global issues in their lives as well as in the community.  **The Seventh Generation**  Sustainability means that we meet our own needs without limiting the ability of people in the future to meet their needs. The “seventh generation” viewpoint of the Native American Iroquois Confederacy is a good example of what sustainability is all about. This viewpoint requires that tribal leaders consider the effects of their actions on their descendants through the next seven generations.  Finding Sustainable Solutions for Climate Change  Sustainable solutions to problems that people are facing today not only deal with present challenges, but also consider the well-being of future generations. The key to sustainability is first knowing what is necessary for a good life, and then figuring out how most people can have that and how future generations can have it as well. Sustainable solutions to climate change must consider three broad areas: environment, economy, and society — each of which must be healthy and viable over time.  Let’s look at a possible solution for climate change and whether or not it can be considered sustainable.  Wind energy can be used in many places to provide electricity without releasing the greenhouse gases that cause temperatures on Earth to rise. For wind energy to be a sustainable solution that will benefit us for many generations, it must be environmentally, economically and socially sustainable. Does wind energy provide a way to meet our needs today in such a way that future generations can also meet their energy needs?  Let’s first consider if wind energy is environmentally sustainable. If wind is a sustainable resource, this means that wind energy cannot be used faster than it can be replaced, or substituted for, and that its use does not damage the environment. How many and what kinds of resources are used for wind energy, and what kind of waste is created? How does its use impact ecosystems?  Next let’s examine the economic sustainability of wind energy. If wind energy is economically sustainable, it will have a positive impact on economic systems. Is it affordable? Does it create meaningful work and contribute to a community’s economic development?  Finally, let’s consider if wind energy is socially sustainable. Being socially sustainable means that it will not harm cultural and traditional resources and it will not benefit certain people while harming others. Does use of wind energy improve quality of life for all people? Does it preserve the cultural traditions or social institutions of present or future generations?  Two Types of Solutions  Throughout this series we will explore some “personal solutions” that individuals can take to bring about a more sustainable world. We will also discuss “structural solutions” that address the underlying causes of problems and often require action by governments, nations and large organizations.  Both types of solutions are important because the solutions to many of the issues facing us today are interconnected. For example, you may not be able to recycle (a personal solution that can reduce your greenhouse gas emissions) if recycling services are not available in your community. You can, however, encourage local governments to offer recycling in your community (a structural solution).  It’s All About You!  In many ways, sustainability is about making choices as an individual. The choices we make as individuals influence the choices that we make as a society. And the choices we make as a society can have a global impact. Eating foods grown closer to home can reduce carbon emissions from transporting food long distances. Using buses, trains and bicycles to get where you need to go rather than using a car can also reduce your contributions to climate change. Recycling helps, too: It takes less energy to make an aluminum can, plastic bottle or piece of paper from recycled materials than from raw materials.  It’s About All of Us!  Structural solutions occur primarily through government decisions and policies. All governments, regardless of their type, create policies and laws that encourage or discourage certain economic and social behaviors in their populations and in other nations. Policies designed to reduce the greenhouse gas emissions that contribute to climate change have been created at all levels of government, both in the United States and abroad.  Some schools have even gotten involved in structural solutions. Redmond High School and other schools are working to reduce their greenhouse gas emissions as part of the Cool Schools program. They set targets each year to reduce the greenhouse gas emissions produced by their school and then measure the progress of their energy conservation and recycling efforts.  **Lesson 2, Activity 1, Writing Prompt:**  Based on reading this article, what are some choices we make as a society can have a global impact?  **Lesson 2, Activity 2:**  Based on this reading and other research, students will form an opinion about the future of energy and draft and send a letter to their U.S. senator telling him or her about your climate change concerns. Ask him or her to take a specific action (such as signing a climate treaty or supporting development of energy sources that do not emit greenhouse gases). To find the senator’s name and address, visit www.senate.gov/general/contact\_information/senators\_cfm.cfm  **Lesson 2, Activity 3:**  Students will visit [www.facingthefuture.org](http://www.facingthefuture.org) and click on Fast Facts & Quick Actions under Latest News from Facing the Future. Click on Climate Change, then choose one quick action and get started. Students will team up in groups of four and create an action plan that can be implemented at the school.  ----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------  **Lesson 3**  **Lesson 3, Activity 1: Reading The Seventh Generation article:**  Students will read People and the Planet article from Seattle Newspapers In Education Skills for Everyday Living series on Global Issues and Sustainable Solutions: seattlepi.com/nie (included below) and will use prompts to consider and write their ideas about how they impact global issues in their lives as well as in the community.  **People and the Planet**  There are certainly many people on the planet right now (about 6.6 billion, in fact!) — twice as many as there were just 40 years ago and 78 million more than just one year ago. Even in the time it takes to read this paragraph, about 80 more people will have been added to the planet.  That seems like a large amount of growth. But are there too many people? Have we grown beyond Earth’s ability to support us all? Scientists use a term called “carrying capacity” to figure this out. Carrying capacity refers to the maximum number of people the planet can support (or “carry”) now, without using up resources that future generations will need to support themselves. In other words, carrying capacity is the number of people that is sustainable — not using resources faster than the earth can reproduce them.  What’s Your Shoe Size?  Because it’s difficult to determine Earth’s exact carrying capacity, some scientists have developed another way to study the impacts of human population and consumption. They use a concept called “Ecological Footprint.” Each person has an Ecological Footprint, the area of  Earth’s productive surface that it takes to support that person. This includes farmland, pasture and fishing grounds to provide food, as well as forested area to provide lumber and paper. It takes into account freshwater resources such as lakes and rivers. It includes all the area necessary to provide energy and jobs and dispose of wastes (including carbon dioxide). It also includes buildings, roads and recreational areas.  Ecological Footprints vary tremendously with each person’s lifestyle and resource consumption choices. Experts calculate that the average person in India has a Footprint of about 2 acres. That means that 2 acres of land are required to support the average person in India, supplying that person’s food, shelter, energy, oxygen and waste disposal needs. By comparison, the average Footprint is 6.4 acres in Mexico, 13.8 acres in France, and 23.7 acres in the United States.  This is an average, and some people in each of these countries have Footprints that are bigger or smaller. An acre is about the size of a football field. So now you can imagine the size of these people’s average Footprints and see the differences between them. If everyone on Earth had a Footprint the size of the average U.S. citizen (24 football fields apiece), it would take five more planets to support us all.  As population grows, the total human Footprint on Earth grows too. If the average level of resource consumption per person increases, the human Footprint on Earth also increases. If both population and resource consumption per person increase — as is the case today — the total human Footprint on Earth grows even faster. The size of our Ecological Footprint can affect other species when we use environmental resources they depend on.  What Can We Do to Reduce  Our Footprint?  If more people means a bigger global Footprint, then stabilizing our population is one way to limit our Footprint on the planet. If we reduced world population over time, we would have even more resources available for each person. Another way to shrink our global Footprint is through technology. Much of the human Footprint today is taken up by the wastes we create, especially the land and water area needed to absorb our carbon dioxide emissions. The good news is that there are some technologies — such as more effective farming techniques and more energy-efficient appliances — that allow people to consume resources while lowering their Footprint.  Of course we can also shrink our Footprint by reducing resource consumption. Some of this can be done by understanding what we truly need and not consuming more than we need. This means looking closely at how we live, including how much and what kind of food we eat, how we get around, what we do for recreation, and what we choose to buy.  One challenge is that some people in the world desperately need to increase their consumption of resources. There are 1.2 billion people who live in extreme poverty around the world; they need more food, more education, more health care, and more fuel and energy resources. Only after their basic needs have beenmet and when they have economic options can these people make choices about sustainable consumption.  Ultimately, the number of people Earth can support depends on the choices we make. Every day, each of us makes decisions about our lifestyle, our economic system, our values and what kind of world we want to live in. What kinds of choices can you make that will help enhance Earth’s carrying capacity?  **Lesson 3, Activity 1, Writing Prompt:**  Based on this article, consider and respond to these questions:  Can we use cleaner sources of energy for electricity?  Can we build cities in such a way that people can walk or ride their bikes more easily?  Can governments regulate the amount of greenhouse gases released into Earth’s atmosphere?  **Lesson 3, Activity 2, Research:**  A: Students will measure their Ecological Footprint by visiting [www.myfootprint.org](http://www.myfootprint.org) and then choose an average student’s ecological footprint in another country. They will create a chart that compares and contrasts their ecological footprint with the other student’s and answers this question: If everyone lived like you, how many planets would we need? They will create a poster that compares the two eco-footprints.  **Lesson 3, Activity 3, Trash Audit:**  Students will conduct a trash audit. Write down everything they throw away during the course of one day. Evaluate their list to see if any of the items they threw away could be reused or recycled in our community. Students will share their findings with the class. The class will brainstorm to create an action plan for reducing and recycling waste.  **Lesson 4**  **Lesson 4, Activity 1: Reading Energy in the Sustainability Puzzle article:**  Students will read Energy in the Sustainability article from Seattle Newspapers In Education Skills for Everyday Living series on Global Issues and Sustainable Solutions: seattlepi.com/nie (included below) and will use prompts to consider and write their ideas about how they impact global issues in their lives as well as in the community.  **Energy in the Sustainability Puzzle**  The largest component of the world’s Ecological Footprint is energy. As you may recall, an Ecological Footprint is the area of land and sea required to support a particular human lifestyle. Energy is required for everything we do! We need energy to cook, to heat our homes and to travel from place to place. By learning about the resources required for different types of energy use and the kinds of wastes produced, we can investigate the sustainability of our energy use.  Energy sources, or fuels, are often categorized as renewable or nonrenewable. Renewable sources can provide us with energy indefinitely. For example, solar energy is a renewable resource because it is continuously created by the sun. Coal, on the other hand, is a nonrenewable source of energy because it can take millions of years for new coal to be produced.  Nonrenewable Energy Sources  Fossil fuels, such as coal and petroleum oil, are energy sources that are produced by the decomposition of prehistoric plants and animals. Burning fossil fuels has many environmental impacts, such as acid rain and smog. Also, when we burn fossil fuels, carbon dioxide and other gases are released into Earth’s atmosphere. Carbon dioxide (CO2) is a greenhouse gas that increases temperatures on Earth’s surface by trapping the sun’s heat. According to scientists from the Intergovernmental Panel on Climate Change, climate change caused by greenhouse gases could lead to droughts, rising sea levels and extreme weather events.  Burning fossil fuels is unsustainable not only because of its effects on Earth’s atmosphere; fossil fuels are also nonrenewable resources. After we use them, they will not be replaced in our lifetime.  Renewable Energy Sources  Approximately one-third of all energy in the world is used for electricity in buildings, such as homes and offices. While energy for use in buildings can be obtained from nonrenewable sources such as oil or natural gas, it can also be obtained from renewable sources such as solar, wind, geothermal and water resources. These energy sources are renewable because they can be replenished when we use them. Because they are renewable and produce far fewer greenhouse gases than fossil fuels, these energy sources are more sustainable than nonrenewable energy sources.  Wind energy is an example of a growing source of renewable energy. The U.S. Department of Energy reports that wind captured from just 6 percent of U.S. land area has the potential to supply more than 1.5 times the amount of energy currently used in the United States! Wind power is clean, abundant and inexpensive.  Transportation accounts for almost 30 percent of worldwide energy use. Many renewable energy sources can help us get around. For example, gasoline-electric hybrid cars rely partially on a gasoline engine and partially on an electric motor. Biodiesel is a fuel created from vegetable oil; it can be used as an alternative to petroleum-based diesel (a fossil fuel).  Ethanol is an alcohol made from grains or other plant materials; it can be mixed with gasoline to create a fuel that produces less CO2 when it is burned.  You may already have guessed that human power is also a renewable source of energy. You can get around on your skateboard, bicycle or feet without polluting the air.  You Have the Power!  We can all reduce our Ecological Footprint by using sustainable sources of energy. One way to promote renewable energy resources is to purchase “green power,” or electricity generated from sustainable sources. Purchasing green power instead of nonrenewable sources of energy reduces greenhouse gas emissions and supports the development of sustainable energy sources. Your household can contact your local electricity provider to inquire about purchasing green power.  Conserving energy is another way that everyone can have a positive impact on the earth right now. “Conservation” is the careful use and preservation of natural resources, such as forests and water. We can conserve energy by making simple changes in our lives at home and at school to reduce energy use. Did you know that 5 percent or more of your home’s electricity is “leaked” from appliances and other electronics that are turned off but still plugged in? This is called a “phantom load.”  At home, turn off lights, computer equipment and appliances when you are not using them to save energy. Your voice can be a powerful tool for creating change. You can teach others about the importance of reducing energy use and using renewable energy sources when possible. Just think: If you persuade just one other person to live more sustainably, you’ll have twice the impact that you would alone!  **Lesson 4, Activity 1, Writing Prompt:**  Think of at least two ways that you can reduce your Ecological Footprint by altering your energy consumption and carbon dioxide emissions. Share your ideas with everyone in your home. If you work together, you will have an even greater impact (plus, you might get a little moral support for helping to reduce the household costs)!  **Lesson 4, Activity 2, Research:**  A: students will ask their parents for a copy of a recent electric or utility bill. Create a chart that outlines your household’s peak and off-peak kilowatt usage, as well as the costs associated with the energy use.  B: Collect the various items that you use personally, examine the manufacturer’s energy label on the back and create a chart that shows how much energy your personal items use each day.  C: Contact your local energy company and find out how it generates electricity. Go online and learn about how much CO2 emissions are generated by the plant that produces your electricity. Research how much your electricity costs per kilowatt and how much alternative forms of generating electricity (such as wind power or solar power) would cost per kilowatt.  **Lesson 4, Activity 3, Global Outreach:**  Using Skype or ePals, connect with another student in another country and learn how much electricity is used in his/her home. Find out how their electricity is generated and create a poster that compares your household’s energy use with the other student’s household energy use.  **Lesson 5:**  **Lesson 5, Activity 1: How Much water is Available? article:**  Students will read How Much Water is Available? Article from Seattle Newspapers In Education Skills for Everyday Living series on Global Issues and Sustainable Solutions: seattlepi.com/nie (included below) and will use prompts to consider and write their ideas about how they impact global issues in their lives as well as in the community.  How Much Water Is Available?  Imagine all the ways you use water each day: drinking, cooking and bathing. “Potable” water is clean and drinkable fresh water. What would your life be like if you did not have easy access to potable water? Water is a renewable resource because it can be replaced as it is used — but there is a fixed amount of water on Earth.  The following are some basic facts from the U.S. Geological Survey about water on Earth:  • Of all water on Earth, 97% is salt water in the oceans  • Of the remaining 3% that is fresh water, approximately 70% is frozen in the polar icecaps; the other 30% is mostly present as soil moisture or in underground aquifers  • Less than 1% of the world’s fresh water is readily accessible for human uses  Where Does Our Water Come From?  Aquifers (large, underground lakes) are a major source of drinking water. Humans drill wells into aquifers in order to pump the water out. Some aquifers get recharged by rainwater draining into the ground. Others called “fossil aquifers” recharge extremely slowly, over millions of years, if at all. Once they’re pumped dry, the stored water is essentially gone forever.  The Ogallala Aquifer in the United States, for example, after years of being used for farming, has fallen sharply in some areas and run completely dry in others. As a result, farmers in parts of the U.S. Great Plains have faced water shortages. Some farmers have been forced to stop irrigating their land altogether.  Water from rivers, another important source of freshwater, is replenished by precipitation and snowmelt. This water is often diverted for uses such as dams for producing electricity and water for irrigation. Great rivers such as the Nile in Africa, the Ganges in India and the Huang He in China  have all been impacted by dams. The Colorado River in the United States often runs dry before reaching the sea because of reduced snow in the Rocky Mountains and increased human demands for its water.  Water Stress  There are different causes of water stress in different places. In some places, one community’s need for water may reduce another community’s water supply.  In other regions, water stress may be the result of climate change. Rivers and aquifers are both fed by rain and snowfall. Climate change can cause weather patterns to shift, which sometimes means that rain and snow fall in smaller amounts or in different places. Snow is particularly important because it stores the water over time, gradually releasing it as the snow melts.  Currently, 745 million people face water stress or water scarcity, which means they can’t get enough water throughout the year to meet their needs.  1: In the next few decades, up to two-thirds of the world’s population will be affected by water scarcity.  2: Many of the places experiencing water scarcity are also experiencing rapid population growth, which results in more people competing for access to water. Water scarcity in many parts of the world has led to predictions that in this century, wars will be fought over who has access to water. Fortunately, there are many ways we can conserve water so that more people can use this essential resource.  Providing Enough Water  for Everyone  Seventy percent of all freshwater is used for growing food and raising crops. Because agriculture requires a large amount of water, one way to conserve water is to irrigate crops more efficiently. Researchers have found that there are many ways to grow the same amount of food while using less water for irrigation. Technologies such as drip irrigation and irrigating less often but with more precise timing can save up to 25 percent of the water used to grow crops.  3: Another key to water conservation is growing food that requires less water to produce. It takes about 37 times more water (1,260 gallons) to raise 500 calories-worth of beef than it does to grow 500 calories-worth of corn.  4: The cow itself doesn’t drink this much water, but most cattle today are fed grains such as corn — and those grains require water to irrigate them. If people around the world eat a diet of foods that require less water to produce, there will be more water available for other uses.  What Can You Do?  There are many international organizations committed to improving access to safe water supplies around the world.  Other groups such as the Washington State Department of Ecology are working to ensure availability of water locally. You can help preserve water resources through water conservation measures. Water conservation can help address local and global water availability issues.  **Lesson 5, Activity 1, Research:**  Students will investigate how much water the average household uses in another country and then investigate how much water they use in their home. Students will create a poster comparing the two.  **Lesson 5, Activity 2:**  Students will test their water IQ. Go to http://savingwater.org/kids/ to explore the source of the water used every day, and how they can use water wisely.  **Lesson 5, Activity 3, Take Action:**  Students will visit [www.facingthefuture.org](http://www.facingthefuture.org) and click on Fast Facts & Quick Actions under Latest News from Facing the Future. Click on Water, then choose one quick action and create an action plan to start tackling water issues that answers these questions: How can you use less water at home? How could your school conserve water?  -----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------  Lesson 6:  Students will read The Ocean Planet Article from Seattle Newspapers In Education Skills for Everyday Living series on Global Issues and Sustainable Solutions: seattlepi.com/nie (included below) and will use prompts to consider and write their ideas about how they impact global issues in their lives as well as in the community.  **The Ocean Planet**  Living in Washington, we are surrounded by water — Puget Sound, Hood Canal, the Columbia River, the Pacific Ocean. It also falls from the sky on a regular basis. With water all around, it can be easy to take it for granted and not think about how human actions can impact the waters that are so much a part of this state and our lives.  Nearly 95 percent of all space available for life on the planet is within the world’s oceans. Oceans dominate world weather systems. They function somewhat like the human circulatory system, absorbing and redistributing heat around the globe and watering Earth’s surfaces. Humans depend on the ocean for much of their oxygen, and also as a habitat for fish that are the main source of protein for 1 billion people.*1*  **Human Impacts on Ocean Health**  The oceans are so big that it would seem like humans couldn’t significantly impact their health. Unfortunately, the facts tell a different story. Many human activities cause damage to ocean ecosystems. The good news is that you have the power to make positive contributions to ocean health. Read on for ways you can help!  **Marine Pollution and Solutions**  You may have seen a storm drain on the street with a fish stencil painted near it and the words “Dump No Waste: Drains to Stream.” That stencil is there to remind us that much of the rain that falls on the ground ends up in the nearest body of water. That runoff takes with it whatever chemicals may be on the ground it washes over — oil that leaks from a car, or agricultural or lawn chemicals. These substances are a type of pollution called “nonpoint source pollution,” which is pollution that doesn’t come from one specific place or source. Nonpoint source pollution includes industrial chemicals and agricultural pesticides, as well as nutrients such as fertilizers and animal waste.  Trash that enters the ocean is a different kind of marine pollution. Any long-lasting man-made material (like plastic) that enters the marine environment is known as “marine debris.” Some examples of trash found in the ocean include tires, fishing nets and plastic shopping bags. This debris can harm many kinds of animals, including whales, fish, seals, turtles, sea birds and corals. Animals can get tangled in marine debris or they may try to eat marine debris, mistaking it for food.  You can prevent nonpoint source pollution and marine debris from entering ocean environments by disposing of trash properly and not putting any waste in storm drains. You could even label storm drains so that other people will know not to put garbage in them. If you have a pet, cleaning up your pet’s waste will also help keep our waters clean.  **Fishing for the Future**  Marine biodiversity (the variety of ocean life forms) is important for healthy ocean ecosystems. Maintaining high ocean biodiversity supports marine food webs. Unfortunately, numerous species of fish are suffering from overconsumption by humans. Between 1950 and 1994, ocean fishers increased their catch 400 percent by doubling the number of boats and using more effective fishing gear. In 1989, the world’s catch leveled off at just over 82 million metric tons of fish per year. That was almost 20 years ago, and we’re not catching any more fish than that today because the oceans can’t produce more than that.*2*  Sustain fish and shellfish populations by eating only sustainably harvested seafood. Find out which types of seafood are best to eat by visiting Monterey Bay Aquarium’s Seafood Watch Web site: www.montereybayaquarium.org/cr/seafoodwatch.aspwhere you can download a seafood guide to carry with you.  **Exotic Species: Local Pests**  Another threat to marine biodiversity is nonnative, or exotic, species. Eighty-four percent of the world’s coastal waters are affected by nonnative species.*3* These species can be introduced to a new marine area when they are accidentally transported in ships’ ballast water and discharged into environments where these species did not previously live. (Ballast tanks are large tanks of water that stabilize ships.) A local example of an exotic species is the European green crab, which has been found in Grays Harbor and Willapa Bay on the Washington coast. The commercial Dungeness crab fishery is important to the economy of Washington state. According to the Washington Department of Fish and Wildlife, European green crabs may beat out native Dungeness crabs for food and habitat, which could harm the Dungeness crab fishery.  You can help to prevent nonnative species from entering Washington state ecosystems and reducing local biodiversity. Never release nonnative plants or animals into the wild.  **Small Actions Can Make Big Waves**  The immense size of the oceans and the time lag between a damaging human action and its final impact on oceans may allow people to remain unaware of their impact on the world’s oceans. But the reality is that many of our actions can have a large effect on marine environments. It is important that we work to protect our “blue planet.” Can you think of other ways that we can protect the world’s oceans?  *Like a mobile, global issues are interconnected. The solutions to global issues are often interconnected as well.*  **Lesson 6, Activity 1, Writing Prompt:**  Students will use prompts to consider and write their ideas about how they impact global issues in their lives as well as in the community using the prompt: Can you think of other ways that we can protect the world’s oceans?  **Lesson 6, Activity 2, Research**: Based on the Surfrider Foundation’s suggestions, students will create an action plan and a poster that includes two ways they can promote ocean health.  **Lesson 6, Activity 3, Taking Action:** Using the Seafood Watch card downloaded from the Monterey Bay Aquarium, students will prepare a survey of seafood sold at our local markets and create a poster of the seafood using a red, yellow, green dot system and use it to determine which seafood is a good choice for maintaining healthy oceans. Students then will communicate their findings via poster that they will share with their peers and another international student using epals.com.  **Lesson6, Activity 4, Communicating Ideas:**  Students will work in groups to research various aspects of the connections between the Great Pacific Ocean Garbage Patch and how plastics polluting the oceans is showing up in the ecological food web. They will create a poster based on their findings to be used as a Gallery Walk as well as to be posted around the school to educate their peers.  **Lesson 7:**  **Lesson 7, lab Activity 1:**  Prior to reading this unit’s article, students will engage in the Tragedy of the Commons lab to get hands-on experience with overfishing an area of the oceans and its effects on local populations and the ecosystem.  Students will read the article The Source of Our Stuff from Seattle Newspapers In Education Skills for Everyday Living series on Global Issues and Sustainable Solutions: seattlepi.com/nie (included below) and will use prompts to consider and write their ideas about how they impact global issues in their lives as well as in the community.  **The Source of Our Stuff**  Can you think of anything you use that doesn’t come from nature? Even man-made items such as laptop computers originally come from the earth. Our clothes, food and homes are all made of resources that the earth produces. The electricity we use to power our homes and the fuel we use to power our cars, buses and airplanes also come from Earth’s resources.  How we use Earth’s resources affects the present and future supply of these resources — or their sustainability. Sustainability means using the resources we currently need without limiting the ability of future generations to have the resources they need. The natural environment is one important component of sustainability.  Some of Earth’s resources are renewable, meaning they can be restored or replenished at basically the same rate that we use them. Forests and fish are examples of living resources that may be renewed through natural processes, careful management and conservation. Wind, water, tides and solar radiation are examples of nonliving renewable resources.  Other resources are nonrenewable, meaning they exist in fixed amounts and cannot be quickly renewed or restored by natural or human processes. Nonrenewable resources include metals, minerals (including gold and silver) and fossil fuels (such as oil, gas and coal). Resources such as soil and water may be considered either nonrenewable or renewable, depending on circumstances. For example, water is often considered a renewable resource. Yet, some underground water reservoirs (or aquifers), such as the Ogallala Aquifer in the southwestern United States, take over thousands of years to replenish.  The availability and use of renewable and nonrenewable resources are important because they largely determine how many people the earth can support now and into the future.  **The Tragedy of the Commons**  “Commons” are those resources that all members of a community may use, without payment. Examples include rivers and lakes, the air we breathe and the vast oceans that no one person can own. What commons are you using right now?  Garrett Hardin was a biologist who came up with a concept to describe how humans tend to use the natural resources that we share: “The tragedy of the commons.” Commons can be destroyed when people use or pollute resources so heavily that they are no longer available for others to use. There are a number of examples of the tragedy of the commons: pollution of the air and atmosphere, deforestation and overfishing fish stocks in global waters.  **Fishy Business**  Fish is a key food source in the world today. One billion people rely on fish as their primary source of animal protein.*1*  When there is no catch limit, a fisherman’s best short-term interest is to catch as many fish as possible before others take home a larger share of the total catch. As the total number of available fish gets smaller, fishermen compete even more intensively to pay for their salaries, boats and fuel. Technology also plays a role as faster boats and improved fishing technology speed this race to a point where the fish stocks become too low to support a fishery. At this point, fishermen often shift to harvesting other fish species. This tragedy of the commons can repeat itself until many stocks are diminished or overfished.  **A Success Story**  How can we avoid the tragedy of the commons with wild fisheries? Sustainable fisheries can preserve fish species and provide humans with valuable protein. Alaskan fisheries are an example of sustainable management of the commons. The management of Alaska’s major commercial species — salmon, pollock and cod — has been certified as sustainable by the Marine Stewardship Council.  It wasn’t always that way. Alaskans learned about sustainability the hard way when salmon were overfished in the 1950s. Tough measures that limited catches were put in place. Slowly, the salmon runs were built up to record levels that have continued since the 1990s.  As a result of these efforts, not all fishermen can get a permit or catch as much as they would like. But many agree that the regulations have resulted in stable catches, increased efficiency and lower operating costs to fishermen, higher market value for fish and safer working conditions for fishermen.  The lesson from Alaska is that protecting common resources ensures that they are available for future generations.  *Like a mobile, global issues are interconnected. The solutions to global issues are often interconnected as well.*  **Lesson7, Activity 2, Research and Writing Prompt:**  Students will use prompts to consider and write their ideas about how they impact global issues in their lives as well as in the community using the prompt: Research one area addressed in the article concern the Tragedy of the Commons and create a one-page report based on their findings as well as a concept poster that demonstrates their findings to present to their classmates.  **Lesson 7, Activity 3, Research:**  Students will create a web diagram (concept map) of all the resources required to make their favorite item of clothing. Start by drawing the item in the center of a large piece of paper. Next, think about the different parts of the item, and write all of the environmental resources used on your web diagram.  **Lesson 7, Activity 4, Taking Action:**  Students will join Plant for the Planet’s “Billion Tree Campaign,” and be part of a global reforestation effort and create a presentation based on what they learned by their participation with the Billion Tree Campaign.  **Lesson 7, Activity 5, Making Connections:**  Students will watch the online video The Story of Stuff and complete a series of questions based on their understandings of the concepts discussed in the film.  Students will make connections using epals.com and create a dialog to understand how the material flow of goods affects students their age in other parts of the world. Based on what they learn, students will create a poster to be used in a classroom Gallery Walk that can also be posted throughout the school.  Lesson 8:  Students will read the article Earth’s resources from Seattle Newspapers In Education Skills for Everyday Living series on Global Issues and Sustainable Solutions: seattlepi.com/nie (included below) and will use prompts to consider and write their ideas about how they impact global issues in their lives as well as in the community.  **Earth’s Resources**  Earth produces everything that human beings need to survive — food, water, shelter and energy — as well as the beauty and diversity of nature. Does this mean that we can expect our planet to keep meeting our needs forever, no matter how we use its resources? Consider these facts:  • During modern times, half of the planet’s tropical rain forests have been destroyed or degraded  • On average, three unique plant and animal species become extinct every hour*1*  **Variety Is the Spice of Life!**  The health of the planet depends on the health of its many ecosystems. An ecosystem is a community of organisms (plants, animals, fungi and bacteria) that function as a unit together with their environment. The interdependence among diverse organisms and their environment defines and shapes an ecosystem. When any species is taken out of an ecosystem, the entire ecosystem is affected. The variety of life in all its forms is called “biodiversity.”  Unfortunately, the world’s biodiversity is disappearing. Each year as many as 27,000 species of animals, plants, insects and microorganisms vanish forever.*2* Mountain gorillas, giant pandas and snow leopards are just a few of the more well-known animal species on the brink of extinction. Many scientists believe that between 20 percent and 50 percent of all species on Earth could disappear in the next 30 years.*3* Loss of habitat is the main threat to terrestrial species that are classified as “threatened” or “endangered” by the International Union for Conservation of Nature and Natural Resources.  **Beans, Birds and Biodiversity**  In the developing world, many farmers cultivate a single cash crop such as coffee or cocoa rather than produce staple food crops. In the 1980s, to meet rising worldwide demand for coffee, forests in Latin America and other developing regions were extensively cut and replaced with high-yield coffee trees that grow in the sun. This resulted in hillside erosion and habitat loss for many species, especially for birds like the western tanager that depend on the shade of the forest for survival. Additionally, the extensive use of pesticides to maximize coffee tree yields often pollutes nearby rivers and the lungs of coffee workers.  Agriculture workers in the coffee industry often toil for long hours in difficult conditions, and many small coffee farmers earn prices for their coffee that are less than the costs of production. This perpetuates a cycle of poverty and debt, as farmers borrow money to get from one coffee season to the next. Thankfully, of the 25 million coffee farmers in the world, approximately 1 million farming households in the Southern Hemisphere alone have already improved their living conditions as a result of sustainable coffee production.*4*  The United States consumes about one-fifth of the world’s coffee, more than any other single country. Fortunately, people in the U.S. can now purchase “shade-grown,” “organically certified” and “fair trade” coffee. Shade-grown coffee promotes higher biodiversity than sun coffee because it can be grown without clearing forests. Organic coffee is grown without the use of pesticides, which is a benefit to biodiversity and farmers’ health.  Fair Trade certification assures consumers that a fair price is paid to coffee farmers. To become Fair Trade certified, an importer must pay a minimum price per pound, provide credit to farmers and offer technical assistance such as learning organic farming techniques.  The dominant player in the world coffee market is Starbucks, holding about 25 percent of the world market share. Since 1998, Starbucks has developed programs to lessen its environmental impact by promoting biodiversity and economic well-being. These practices include ecologically sound growing and harvesting, reduction of emissions during roasting, use of recycled materials for the storage and transport of beans and use of recycled paper coffee cups. A portion of Starbucks coffees are shade-grown varieties and purchased at fair-trade prices.  Many other coffee roasters and sellers are also promoting sustainable coffee production. Some coffee roasters have gone a step further than buying Fair Trade certified beans by directly purchasing the beans from coffee farmers rather than buying them from a broker. This practice is called “direct trade.”  Purchasing a cup of coffee may seem like a small choice, but consider the millions of cups of coffee consumed each day. All of our small choices have a large collective impact. By making choices to sustain Earth’s ecosystems, we can help the planet continue to meet basic human needs.  **Lesson 8, Activity 1:**  Students will use prompts to consider and write their ideas about how the choices they make as consumers impact lives in the communities of the natural resources being consumed.  **Lesson 8, Activity 2, Research:**  Students will learn more about coffee and biodiversity by visiting www.shadecoffee.org. Click on *Shade Coffee*, then *FAQs* and answer these questions:  • How does shade-grown coffee support increased biodiversity?  • Why do you think biodiversity is important?  **Lesson 8 Activity 3, Taking Action:**  Students will then choose one ‘quick action’ from the website *Latest News from Facing the Future* and create an action plan to make a difference in protecting biodiversity in their own community and in another selected international community and communicate their action plan with other students using epals.  -----------------------------------------------------------------------------------------------------------------------------------------------------------------  **Lesson 9:**  Students will read article Populating the Planet from Seattle Newspapers In Education Skills for Everyday Living series on Global Issues and Sustainable Solutions: seattlepi.com/nie (included below) and will use prompts to consider and write their ideas about how they impact global issues in their lives as well as in the community.  **Populating the Planet**  It might be argued that without the pressure of population growth, none of the issues facing humanity today would be large enough to qualify as global. Stabilizing population growth and lowering the consumption rate of wealthy nations are two interconnected and critical steps to addressing global issues.  About 50 years ago, there were 2.5 billion people living on Earth. It took nearly all of human history — from prehistoric time until after World War II — for human population to reach that level. Now that number has more than doubled to 6.6 billion people, with about 80 million people added to the planet each year. That’s like adding another Germany every year or another San Francisco every three-and-a-half days. Experts who study population growth project that by 2050 there will be over 9 billion people living in the area where 6.6 billion of us live now.*1*  The larger question surrounding population growth is not only the number of people living on the planet, but also what their collective impact is — whether positive or negative.  **Planting the Population Seeds**  For most of human history, population growth occurred slowly. Living in small tribes as hunter-gatherers, early humans (about 50,000 years ago) followed the migrations of animals and the seasonal growth of plants. Population during this time remained stable, with almost as many people dying every year as were born.  About 10,000 years ago, that started to change. Human existence and population growth rates were radically altered as people learned to grow plants and raise animals. Farming can produce up to 100 times as much food as will grow wild on the same amount of land. When food is plentiful, a population tends to grow. When people learned to grow their own food, regional populations around the world grew rapidly and were increasingly concentrated in towns and villages. The cycle of increased food supplies and growing populations has continued throughout history.  Can you find any articles in the newspaper that demonstrate the connections between food and population today?  By the early 1900s, the discovery that germs cause disease led to improvements in medicine and sanitation. Better water and sewer systems cut back the death toll from communicable diseases. The development of antibiotics and vaccines controlled many diseases that had been fatal in the past. The seeds for a modern population explosion had been planted.  **The Population Equation: It All Adds Up**  Population growth is affected by numbers of births and deaths worldwide. About 139 million people are born each year and 60 million die; the difference is the increase in global population.*2* The bottom line is that the human population grows whenever more people are born in a year than die. As population increases, exponential growth (a constant rate of growth applied to a continuously growing base) can cause population to increase faster and faster.  The fertility rate for a society is the average number of children born per woman. Although many developing countries are currently experiencing high fertility rates, worldwide fertility rates have come down, from an average of five children per woman in 1950 to 2.8 children per woman in 2004. However, there are many more people of childbearing age today than ever before. It takes only a slight increase in fertility rates to significantly increase population.*3*  Tune in on Friday for a more in-depth look at how exponential growth impacts population size and Earth’s carrying capacity. We will also take a closer look at personal and structural solutions to this global issue.  **Lesson 9 Activity 1, Research and Writing Prompt:**  View the 2007 World Population Data Sheet on the Population Reference Bureau’s Web site at **www.prb.org**. Compare the population, health and environment statistics of the United States and two other countries and answer these questions:  • How do life expectancy, rate of natural increase, and carbon dioxide emissions per capita compare among these three countries?  • What are some possible explanations for the trends that you observed?  **Lesson 9, Activity 2:**  While the United States only has 5 percent of the world’s population, we consume 25 percent of the Earth’s resources. The energy consumed in our homes and our methods of transportation are the two biggest culprits. Create an action plan to reduce your impact in one of these areas for one week. Share with your friends, family and classmates the results of your efforts to reduce your energy consumption.  **Lesson 10:**  Students will read the article How Are We Growing from Seattle Newspapers In Education Skills for Everyday Living series on Global Issues and Sustainable Solutions: seattlepi.com/nie (included below) and will use prompts to consider and write their ideas about how they impact global issues in their lives as well as in the community.  **How Are We Growing?**  Each year there are more and more people on Earth. Population projections suggest that by 2050 there will be over 9 billion people living in the area where 6.6 billion of us live now. *1* How and where will world population change? With almost half of the world’s population under age 25, world population will increase by several billion when those young people start families over the next few decades.*2* Currently 95 percent of all population growth occurs in developing countries. India is expected to soon surpass China as the world’s most populous country. Meanwhile, shrinking populations are predicted for some developed countries such as Japan, Russia and the nations of Europe.*3*  These population statistics and trends have important consequences, especially when combined with other global issues such as poverty. Of the 5.2 billion people living in developing countries, nearly 60 percent do not have basic sanitation, and one-quarter lack proper housing. Twenty percent do not have access to modern health services, and 20 percent of children do not attend school through grade five.*4* Given these harsh realities, people in poorer countries may rely on large extended families to make a living and to care for the elderly. For example, in rural areas, people need help to gather cooking fuel, carry water, grow food and tend livestock. Yet because disease and malnutrition (inadequate or unbalanced nutrition) kill many children before they grow up, large families are often seen as a necessity. This tends to keep fertility and population growth rates up, which can have the effect of perpetuating poverty, illness and conflict over limited resources.  **How Many People Can the Earth Support?**  An important concept in looking at population growth is that of Earth’s “carrying capacity.” Carrying capacity is the number of people the Earth can support without using resources faster than the planet can reproduce them. Experts disagree on this number because carrying capacity depends on a number of debatable factors: the type and quantity of available resources; how these resources are distributed; how much of the resource each person uses; and people’s relative quality of life.  Another variable in determining carrying capacity is whether or not people believe that areas need to be left for plants and wildlife, in addition to providing for humans and their immediate needs.  **Sustainable Solutions to the Population Puzzle**  Population growth and the associated demand for resources bring urgency to other pressing global issues such as poverty, conflict and environmental degradation. Stabilizing population growth could allow humans to live within Earth’s carrying capacity and improve quality of life for many people. Given that people in wealthier countries on average have large Ecological Footprints, reducing Footprints in these countries is another important way to live within the carrying capacity of the planet.  **Personal Solutions**  At some time in their lives, most people will need to make a decision about family size. Family planning is perhaps the most important personal solution to population growth and carrying capacity.  Because of relatively higher rates of consumption of the average person in the United States compared to many other parts of the world, reducing our Ecological Footprint is another possible solution to population-related issues. Here are a few ideas to get you started on shrinking your Footprint:  • If you or your family is going to buy a new car, consider getting one that is fuel-efficient and minimally polluting.  • Whenever you can, use your feet, a bicycle, a skateboard or take a bus to get around.  • Eat one fewer meal including meat each week Production of meat requires many more resources than production of nonmeat protein sources.  Can you think of other humane ways in which individuals can personally address population growth and carrying capacity issues?  **Structural Solutions**  Many structural actions can be taken to help stabilize human population growth. One important step is providing primary health care around the world in order to lower infant and child mortality, increase life expectancies and provide other essential services. If families had access to basic health care — which prevents most childhood deaths — many families would have only the number of children that they ideally want. Reproductive health care is an important part of primary health care.  **Lesson 10, Activity 1, Research and Writing Prompt:**  Students will visit www.census.gov to find out the population of Sierra Vista, AZ, between 1950 and 2010. Calculate the rate of increase from 1950 through 2010. Students will create a poster graphing the population growth over that time. Students will also research the levels of the water table at wwwuaswaterwise.org during those times and create side by side graphs showing human population growth compared to the levels of the water table.  Based on their findings, estimate the population in the year 2050. Then answer the following questions:  • How will your life change as a result of increasing population?  • In what ways do you think Sierra Vista, AZ, will look different in 2050?  **Lesson 10, Activity 2, Taking Action:**  Students will find alternative uses for materials currently being thrown in landfills (such as tires, cell phones and computers) in your community. Develop a project and action plan to support the reuse of at least one of these items in your home, school or community. | | |
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