**Chapter 1: The State of our Earth**

**Reading Guide**

**Vocabulary**

Learn the definition of each term. The **bold** words require you to know more than just the definition. For example, ecosystem service: you should what they are, be able to name several types and describe how we benefit from those services.

System

Ecosystem

Biotic

Abiotic

**Ecosystem Services**

**Environmental Indicators**

Sustainability

**Biodiversity**

Genetic Diversity

Species Diversity

Ecosystem Diversity

Speciation

Background Extinction Rate

Greenhouse Gases

Anthropogenic

**Sustainable Development**

**Ecological Footprint**

**Scientific Method**

Hypothesis

Null Hypothesis

Replication

Sample Size

Accuracy

Precision

Uncertainty

Inductive Reasoning

Deductive Reasoning

Theory

Natural Law

Control Group

Natural Experiment

**Environmental Justice**

**Reading Outline**

**The Mysterious Neuse River Fish Killer**

1. What is Pfiesteria?
2. What does Pfiesteria do to humans? Fish?
3. What triggers Pfiesteria change from a harmless algae feeder to a toxin producing fish killer?
4. What are three different lessons we can learn from the Neuse River Mystery?

**1.1 Environmental science offers important insights into our world**

1. Explain how the Neuse River is part of a larger system.
2. Fill in the chart below to learn about biotic and abiotic factors

|  |  |  |  |
| --- | --- | --- | --- |
| Factor | Abiotic (A) or Biotic (B) | If abiotic, describe one biotic factor that is influenced by or impacted by the factor | If biotic, describe one abiotic factor that is influenced by or impacted by the factor |
| Sunlight |  |  |  |
| Bacteria |  |  |  |
| Water temperature |  |  |  |
| Trees |  |  |  |
| Soil nutrients |  |  |  |

**1.2 Humans alter natural systems**

1. How does new technology generally impact resource use?
2. Who uses more resources per capita: a child born in Los Angeles or a child born in rural India? Why?

**1.3 Scientists monitor natural systems for signs of stress**

1. Fill out the following chart about the five global environmental indicators outlined in Table 1.2 and pages 5-11

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Indicator | Increasing, decreasing or staying the same right now? | To achieve sustainability, does it need to increase, decrease or stay the same in the future? | Why should you (personally) care about this indicator? | How does this indicator connect to ONE other indicator? |
| *Biological Diversity* |  |  |  |  |
| *Food production* |  |  |  |  |
| *Average Global Temperature and [CO2]* |  |  |  |  |
| *Human Population* |  |  |  |  |
| *Resource depletion* |  |  |  |  |

**1.4 Human well-being depends on sustainable practices**

1. What happened on Easter Island and what should we learn from their mistakes?
2. Pick a resource that you use on a daily basis (food, gasoline, paper, whatever you want) and describe how that resource could be used sustainably and unsustainably.
3. List 10 things you NEED in order to survive and be a happy, well adjusted human being.
4. Go to <http://www.myfootprint.org/> and determine your ecological footprint. Record the following information at the end:
   1. How many earths would we need if everyone lived like you:
   2. Global acres required to support you:

**1.5 Science is a Process**

1. Design a simple experiment in which you identify the Hypothesis, Independent Variable, Dependent Variable, Control Variables, 2-3 Experimental Groups, Control Group.

**1.6 Environmental science presents unique challenges**

1. Why is it more difficult to study environmental science that other science disciplines such as biology and chemistry?
2. What is environmental justice and why should you care about it?

Additional Work:

Answer all the MC questions and FRQ #1 at the end of Ch 1.

**Chapter 2 Environmental Systems**

**Reading Guide**

**Vocabulary**

Learn the definition of each term. The **bold** words require you to know more than just the definition.

Isotopes

Radioactive Decay

**Half-Life**

**pH**

Law of Conservation of Matter

Potential Energy

Kinetic Energy

Chemical Energy

**1st Law of thermodynamics**

**2nd Law of thermodynamics**

**Energy Efficiency**

Energy Quality

Open System

Closed System

System Analysis

Steady State

**Negative Feedback Loops**

**Positive Feedback Loops**

**Adaptive Management Plan**

**A Lake of Salt Water, Dust Storms, and Endangered Species**

1. Why does Mono Lake have a buildup of a salt concentration so high that it is saltier than the ocean?
2. Why is the health of Mono Lake critical for many species’ survival?
3. What was done in the early to mid 1900’s that caused the health of Mono Lake to decline even further?
4. Did Mono Lake ever recover?

**2.1 Earth is a single interconnected system**

1. What is an environmental system?
2. Make a list of 3 environmental systems.

**2.2 All environmental systems consist of matter**

1. What is radioactive decay and why would we study it in environmental science? (see if you can come up with more than one reason)
2. What is a half life and why would we study it in environmental science?
3. How does carbon dating work?
4. Water has four important properties that help it support life on earth. List the four properties and define any that you are not familiar with.
5. The pH scale is logarithmic. How much more acidic is something with a pH of 2 than something with a pH of 5?

**2.3 Energy is a fundamental component of environmental systems**

1. What is energy? Name three types of energy.
2. For each situation below, state whether the 1st or 2nd law of thermodynamics applies
   1. In a car, only some of the energy from the gasoline is used to propel the car. The rest is lost as heat.
   2. Nothing can ever be 100% efficient in terms of converting energy to work.
   3. When you walk up a hill you gain the same amount of energy you will lose as you walk down.
   4. Your computer, TV, and refrigerator all need a fan to keep from overheating.
3. What is the difference between energy efficiency and energy quality?

**2.4 Energy conversions underlie all ecological processes**

1. Why are there very few plants near the poles? On the bottom of the ocean?

**2.5 Systems analysis shows how matter and energy flow in the environment**

1. What is the difference between an open and a closed system? Give an example of each.
2. Feedback loops (VERY IMPORTANT). Label the following as a positive or negative feedback loop:
   1. The baby boom resulted in lots of children which meant the US population grew. Those children grew up and had more babies making the population continue to grow -
   2. Cole takes a nap and gets a sticker when he gets up (yay stickers!) so the next day he takes a nap so that he will get another sticker -
   3. Cole does not take a nap and has to go to bed 1 hour earlier meaning he misses out on taking a walk, so the next day he takes a nap so he can stay up for the walk –
   4. Cole throws a temper tantrum, which means that Mommy stops doing whatever she is doing and he gets to sit in Mommy’s lap and “talk” about what he did wrong and then Daddy “talks” to him about it later that night, so he keeps throwing temper tantrums so he can have Mommy and Daddy’s undivided attention -
   5. Air conditioner and thermostat –
3. Positive and negative just indicate the direction of change (positive = keeps going in the same direction, negative = a change in direction). We use the words constructive and destructive to indicate whether or not the feedback loop is good (constructive) or bad (destructive). Give an example of a constructive negative feedback loop and a destructive positive feedback loop (you can make it up or use one of the above)

Additional Work:

Answer all the MC questions and FRQ #1 at the end of Ch 2.

**Chapter 20: Sustainability, Economics and Equity**

**Reading Guide**

**Vocabulary**

Learn the definition of each term. The **bold** words require you to know more than just the definition. For example, GPI: you should what it stands for, what it measures and how it is different from the HDI, the HPI and the GDP.

* **command-and-control approach**
* Demand
* DOE - Department of Energy
* ecological economics
* environmental economics
* EPA - Environmental Protection Agency
* **Externalities**
* **GDP - Gross Domestic Product**
* **GPI- genuine progress indicator**
* **green tax**
* **HDI - Human Development Index**
* **HPI - Human Poverty Index**
* human capital
* **incentive-based approach**
* leapfrogging
* manufactured capital
* market failure
* MEP - Market Equilibrium Price
* **microlending**
* natural capital
* OSHA - Occupational Safety and Health Administration
* **Precautionary principle**
* Supply
* Technology transfer
* triple bottom line
* UN - United Nations
* UNDP - United Nations Development Programme
* UNEP - United Nations Environment Programme
* valuation
* WHO- World Health Organization
* World Bank

**Reading Outline**

**Assembly Plants, Free Trade and Sustainable Systems**

1. List the benefits of the *maquiladora* system.
2. List the costs of the *maquiladora* system.
3. Describe one way to improve the *maquiladora* system by reducing a cost.

**20.1 Sustainability is the ultimate goal of sound environmental science and policy**

1. Define sustainability in terms of environmental science.

**20.2 Economics studies how scarce resources are allocated**

1. Look at Figure 20.1,
   1. What happens to the number of units SUPPLIED as price increases?
   2. What happens to the number of units DEMANDED as price increases?
   3. Does that make sense? Why or why not.
2. What is the Market Equilibrium Price?
3. How is solar energy an example of leapfrogging?
4. How does microlending help poor populations?

**20.3 Economic health depends on the availability of natural capital and basic human welfare**

1. Give three examples of market failures from an environmental perspective.
2. List multiple ways to valuate natural capital.
3. What is a cradle to grave system? What happens to the outputs of this kind of system?

**20.4 Agencies, laws, and regulations are designed to protect our natural and human capital**

1. You need to memorize the laws in Table 20.1. Figure out how you are going to do that.
2. Differentiate between a command-and-control approach and an incentive-based approach. Give an example of each.

**20.5 There are several approaches to measuring and achieving sustainability**

1. Vocabulary only. Define the bolded words in this section.

**20.6 Two major challenges of our time are reducing poverty and stewarding the environment**

1. Why is poverty an environmental problem?
2. What are the goals of the UN Millennium Development Resolution?
3. Who is most likely to bear the brunt of environmental hazards?
4. Give 2 examples of environmental justice situations.
5. Briefly describe Nike’s Cradle to Grave program. Do you think this program is environmentally sound? Why or why not.

Additional Work:

Answer the MC questions and the Measuring Your Impact question at the end of Ch 20.

**Chapter 19 : Global Change**

**Reading Guide**

**Vocabulary**

Learn the definition of each term. The **bold** words require you to know more than just the definition. *Italicized* words may not be in the book, but will be addressed in class.

*Albedo*

**CAFE Standards**

**Cap and trade**

**Carbon dioxide (CO2)**

**Carbon sequestration**

**Clorofluorocarbons (CFCs)**

*Glacial periods*

Global climate change

*Global cooling*

Global warming

**Global warming potential (greenhouse warming potential)**

Greenhouse effect

Greenhouse gases

Hydrochlorofluorocarbons (HCFCs)

*Interglacial periods*

Intergovernmental Panel on Climate Change (IPCC)

**Kyoto Protocol**

**Methane (CH4)**

*Methane hydrates*

*Mitigation*

**Nitrous oxide (N2O)**

Soil sequestration

**Water vapor**

**Reading Outline**

Walking on Thin Ice

1. Describe the role do polar bears play in the Arctic? Include ways other organisms depend on the polar bear.
2. What patterns are observed in the size of the polar ice cap?
3. How are polar bears impacted by the melting of the polar ice cap and what impact will this have on the rest of the Arctic ecosystem?

**19.1 Global change includes global climate change and global warming**

1. Using Figure 19.1, what four things are likely to occur as a result of **global climate change**?
2. What is the difference between global climate change and global warming?

**19.2 Solar radiation and greenhouse gases make our planet warm**

1. The greenhouse effect (Figure 19.2)
   1. Incoming solar radiation is composed of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
   2. \_\_\_\_\_ of the incoming radiation is reflected by \_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_.
   3. The rest of the solar radiation is absorbed by clouds or the earth’s surface. The solar radiation is converted to heat which warms the earth.
   4. The surface of the earth then radiates the heat back into the atmosphere as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
   5. The infrared radiation (also known as heat) is either\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
   6. When greenhouse gases (GHGs) absorb infrared radiation, the planet is (circle one) WARMER/COOLER.
   7. The (circle one) MORE/LESS GHGs there are in the atmosphere, the warmer the planet will be.
2. Learn Table 19.1
3. Which GHG listed in Table 19.1 has the largest global warming potential? the highest concentration?
4. Which GHG listed in Table 19.1 is least impacted by humans? Why?
5. Which GHG listed in Table 19.1 has the greatest impact on the greenhouse effect? Why?
   1. **Sources of greenhouse gases are natural and anthropogenic**
6. What impact do volcanoes have our global climate?
7. For each GHG below, list the natural sources
   1. Methane -
   2. Nitrous oxide -
   3. Water vapor –
8. For each anthropogenic source of climate change

|  |  |  |
| --- | --- | --- |
| **Source** | **GHGs produced** | **How it increases GHGs** |
| Burning fossil fuels |  |  |
| Agriculture |  |  |
| Deforestation |  |  |
| Landfills |  |  |
| Industry |  |  |

1. What are the main anthropogenic sources of the GHGs below?
   1. Methane -
   2. Nitrous oxide -
   3. Carbon dioxide –
2. Why do you think we rank sources of greenhouse gases?

**19.4 Changes in CO2 and global temperatures have been linked for millennia**

1. Figure 19.7 shows us two things about CO2 levels over the last 50 years. First, CO2 levels fluctuate throughout the year and second, overall carbon dioxide levels have increased.
   1. Why do CO2 levels fluctuate during a single year?
   2. About how much (in ppm) have CO2 levels risen since 1960?
2. How can China be a leading producer of CO2 but have relatively low per capita production? (See Figure 19.8)
3. What are some ways to measure historical temperature levels? CO2 levels?
4. Using Figure 19.13, which of the following best describes general pattern of CO2 levels over the last 400,000 years. Circle one below:
   1. CO2 levels have steadily increased over the last 400,000 years
   2. CO2 levels have steadily decreased over the last 400,000 years
   3. CO2 levels have fluctuated over the last 400,000 years but never rose above 300 ppm until recently
   4. CO2 levels have fluctuated over the last 400,000 years and the current warming pattern fits that trend
5. How many degrees Celsius are average global temperatures expected to rise by 2100?

**19.5 Feedback can increase or decrease the impact of climate change**

1. Label the following as positive or negative feedback loops and whether each will result in more or less global warming.

|  |  |  |
| --- | --- | --- |
| **Feedback** | **Positive or Negative?** | **More or less warming?** |
| As temperatures increase, more water evaporates, forming more clouds. Clouds block sunlight, reducing the amount of solar radiation reaching earth which reduces temperatures. |  |  |
| As temperatures increase, more water evaporates, meaning there is more water vapor in the atmosphere. Water vapor is a greenhouse gas meaning that GHG concentrations increase and temperatures increase. |  |  |
| As the earth warms, arctic regions become warmer and permafrost melts. Standing water from ice melt creates anaerobic conditions which produces methane instead of CO2 which is a more potent GHG than CO2. |  |  |
| As the earth warms, arctic regions become warmer and permafrost melts. Standing water reflects less sunlight than ice resulting is less albedo. More sunlight is absorbed, increasing temperatures in the arctic. |  |  |
| Higher CO2 levels increase temperatures. Higher temperatures lead to faster decomposition. Faster decomposition leads to higher CO2 levels. |  |  |
| More CO2 stimulates plant growth which means more photosynthesis. More photosynthesis means more CO2 absorption by plants. |  |  |

**19.6 Global Warming has serious consequences**

1. Fill in the chart below. SUMMARIZE! You may have to do additional research.

|  |  |  |  |
| --- | --- | --- | --- |
| **Category** | **What will happen?** | **How will this impact the ecosystem?** | **How will this impact humans?** |
| *Polar Ice Caps* | *They will shrink* | *Less habitat, loss of biodiversity* | *New shipping lanes will open, oil and gas easier to access, less food from arctic areas* |
| Glaciers |  |  |  |
| Permafrost |  |  |  |
| Sea Levels |  |  |  |
| Heat Waves |  |  |  |
| Cold Spells |  |  |  |
| Precipitation patterns |  |  |  |
| Storm intensity |  |  |  |
| Ocean currents |  |  |  |

**19.7 The Kyoto Protocol addresses climate change at the international level**

1. Why do developed countries have to reduce CO2 levels more than developing countries under the Kyoto Protocol?
2. Why has the US not ratified the Kyoto Protocol? (there are a couple of reasons)
3. What efforts has the US made to regulate CO2 emissions?
4. In your opinion, has the Kyoto Protocol been effective?

Additional Work:

Complete the MC questions and FRQ #1.

**Information for Test #1 Date : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

* **Ch 1 and 2 Introduction to APES**
* **Environmental Events and History**
* **Ch 20 Sustainability Basics**
* **Ch 19 Climate Change**