Conserving Resources

Background

Early humans likely had little need to conserve resources. They were mainly hunters and gatherers who followed herds of animals and collected fruits when and where they were ripe. Human numbers did not put significant pressure on resources. As humans increased in number and developed permanent communities and complex economies, the idea and practice of conservation arose.

Around 12,000 years ago, people developed agriculture, which allowed for settlement and led to the construction of villages, towns, and cities. The aggregation of people in common areas taxed some local resources, increased specialization, spurred more trade, and marked the start of a significant rise in the global population.

Roughly 250 years ago, the Industrial Revolution brought about cheap goods and mass consumption. Electricity was harnessed and fossil fuels burned to power industries and homes. More people left farms and moved to urban areas. Larger amounts of land were farmed, but by fewer people, thanks to the development of new agricultural technologies. Natural resources were in high demand, and the human population expanded.

Within the last 50 years, advances in communication and transportation have rapidly globalized most industries, increasing the extent to which natural resources are extracted and transported from and to many places to produce goods that are likewise transported. The human population has passed 6 billion people, and global demand for products continues to grow. The supply of natural resources decreases, and pollution and waste accumulate. We are beginning to see supply problems with vital resources. For example, there is talk of "peak oil," the point at which the world's extraction of petroleum reaches its peak and begins its inevitable decline, raising prices and geopolitical tensions.

Currently, people view the environment and natural resources through three basic lenses. Few people fall completely into one of the three camps, but one view tends to predominate in each person's thinking. The first attitude can be simply termed development. Developers tend to view the earth's resources as there for humans to use. The idea is to acquire resources to produce products. The more that are produced and sold, the more wealth accumulates, and the better the people's living conditions will be. Inherent is the risk of overexploiting natural resources (i.e., overdevelopment).

The opposing view is called preservation. Preservationists tend to place the "natural environment" above human needs. They may advocate keeping large areas of land untouched by humans, and they tend to view nature more as an escape from everyday working life than as a resource to be used. They view the natural world as having an intrinsic value or inherent worth. Strict adherence to the preservationist attitude runs the risk of too greatly limiting access to resources for all people. Ironically, both extreme preservationists and ardent developers tend to see people as separate from nature rather than as an integral part of nature.

The viewpoints of both developers and preservationists have some merit and some flaws. A third view, called conservation, strikes a balance between the two. Conservationists strive to moderate the amount of development and the extent of preservation and to balance human well-being and the sustainability of our natural resources for the future. One hallmark of the conservationist approach is sustainable development, the idea that current development should not compromise future development through overuse of resources or pollution of the environment. By means of renewable resources and energy, sustainable development can meet people's needs without destroying the ecosystem. Although most people would say that they agree with the idea of conservation, people often disagree about the method and extent of its practice.

Increasingly, scientists, engineers, and leaders look to nature to find ways for people to live more sustainably. Four basic principles underlie this thrust. The first is reliance on the sun for energy. Every living organism depends on the sun, and tapping into this clean energy can help sustain human needs. The next is maintenance of biodiversity. Nature includes intricate food webs and uninvestigated connections between organisms. As conditions on Earth change, a diverse gene pool helps assure species' survival. A third principle is the management of human population growth. Populations that expand beyond their carrying capacity use more resources than are available, often at their own expense or the expense of other organisms. The fourth principle is the recycling of resources, including nutrients as well as materials for manufactured goods.

Objective(s)

- ✓ to investigate ways to conserve in a community
- ✓ to establish sustainable practices in a simulated community

Materials

- chips (x50 of each color: yellow, red, blue, green)
- clear cups (x5)
- 1 die
- Town Simulation Data Sheet

Pre-Lab Questions

Answer the following questions on your lab paper. For actual questions, you must either write out the questions, or include the questions in your responses. Be sure to use complete sentences and show your work for math problems.

1. What is "peak oil?" How has the timing of peak oil changed since the inception of the concept? What is the consensus among scientists regarding when peak oil is expected to occur? What factors go in to determining its timing?
2. Create a Venn diagram to compare and contrast the preservation-oriented and development-oriented viewpoints. Components of conservationism would be found in the overlapping section of the diagram.
3. Describe a few benefits and drawbacks of conservation.

Safety

★ *There are no special safety precautions for this activity*

Procedure

Your team will model and guide the growth of a town through as many as 10 generations. The town has a finite pool of resources. As its population grows, the town consumes more of those resources. Different-colored chips represent the following resources: energy, water, land, and people. You are limited to 50 chips of each type. Your town begins with 4 people. As your town grows, your team decides which industries will employ townspeople, how power will be generated, and what conservation measures your town will implement. Each decision has pros and cons. After 10 generations, you will assess the town's consumption of resources and determine whether your choices are leading the town to a sustainable future.

Rules:

- ✓ Everyone must be employed. Each industry employs a certain number of people. If the population increases beyond this number, you must start another industry.
- ✓ Everyone needs electricity. Each type of power plant supports a certain number of people. If the population increases beyond this number, you will need to add another power source.
- ✓ At the start of each generation, extract the needed resources according to the number of people for that generation. The resources needed per person remain constant for each generation.
- ✓ When the population exceeds a range, even by one, count it as another set. For example, if the instructions state that 1 land and 1 energy are required for every 10 people, then for a population of 11, you must provide 2 lands and 2 energies. When the population passes 20, you must provide a third land and energy, and so on.
- ✓ Any discarded chips at the end of a generation cannot be retrieved. These represent resources that cannot be used by future generations (due, for example, to pollution, erosion, or burning of nonrenewable resources).

To Start:

- ✓ Begin with 50 of each color of chip in each of four different cups. Reserve a fifth cup for discarded chips.
    - Red chips represent energy
    - Blue chips represent water
    - Green chips represent land
    - Yellow chips represent people
- ✓ As you progress through generations, you will record information on the Town Simulation Data Sheet. Generation 1 has been filled in for you. You will need to use resource chips as directed in the Instructions below. The initial population of the town is just 4 people. (Take out 4 yellow chips. This number is already recorded on your Town Simulation Data Sheet as Number of People to Start Generation 1.)
- ✓ Since the technology has not been developed for alternative power, the initial source of electricity is a fossil fuel plant. Take out the correct number of chips.
- ✓ People need to eat, so the first industry must be agriculture. For Generation 1, this is recorded on your data sheet. Take out the correct number of chips.
- ✓ Follow the instructions below for each generation and record all your data on the Town Simulation Data Sheet. At the end of each generation, see if you are eligible to alter your town. Finish when you have completed 10 generations or have exhausted a natural resource.

Instructions:

1. Basic needs (in numbers of chips):
- For each person, provide 1 water
- For each group of up to 10 people, provide 1 water and 1 land for their food supply
- For each group of up to 10 people, provide 1 land and 1 energy for housing needs

2. Employment:
- Agriculture: provides 5 jobs; uses 2 lands and 1 water
- Industrial: provides 10 jobs; uses 2 lands, 2 energies, and 1 water
- Service: provides 3 jobs; uses 1 land and 1 energy
- Retail: provides 5 jobs; uses 2 lands and 1 energy

3. Power Sources:
- Fossil Fuel Plant: supports 10 people; uses 1 energy, 1 water, and 3 lands
- Nuclear Plant: supports 10 people; uses 1 energy, 1 water, and 2 lands (available after 3 generations)
- Renewable Energy Plant: supports 3 people; uses 1 energy and 1 land (available after 5 generations)

4. Waste:
Operation of landfill and water treatment plant for every group of up to 10 people; uses 1 land, 1 energy, and 1 water.

5. Resource Recovery:
Some of the water and land can be recovered and reused for the next generation, but some will be lost to pollution and erosion. At the end of each generation, recover all but 2 waters and 2 lands. Return the recovered chips to the original cups to use for the next generation, and place the discarded chips in the fifth cup. Energy cannot be recovered unless you have a renewable energy plant. For every renewable energy plant in your town, recover 2 energies. Record the number discarded and return any recovered energies to the original cup.

Special Recovery Situations: After 5 generations, you can institute land and water conservation measures that allow you to recover an additional land and water in subsequent generations. During one out of every 3 generations, you can mandate energy conservation measures that allow you to recover two additional energies. Place a check mark next to any generation number in which this happens.

6. Population:
   After you finish recovering and discarding chips for a generation, calculate the population for the next generation. Roll the die twice. Count the higher number as the increase (births and immigrants) and the lower number as the decrease (deaths and emigrants). Record the difference on the data sheet as "Population Increased By." Add this increase to that generation's starting number to get the starting number for the next generation. (If the same number is rolled twice, there will be no increase.)
7. Even though your town's population changes are dictated by rolls of the die, your team can exercise choices about how to adjust for the changes and plan for the future:
   • After the first generation, you may alter the employment for your town. (You will always need at least one group for agriculture.)
   • After the third generation, nuclear power becomes available.
   • After the fifth generation, renewable power becomes available.
8. After each generation, record all the results on the data sheet and move on to the next generation.

Clean Up

✓ everything returned to its original location

TOWN SIMULATION DATA SHEET

Generation Number		1	2	3	4	5	6	7	8	9	10
Number of People to Start Generation		4									
Type(s) of Employment	Agriculture (5 jobs)	×1									
	Industrial (10 jobs)										
	Service (3 jobs)										
	Retail (5 jobs)										
Type(s) of Power	Fossil (10 people)	×1									
	Nuclear (10 people)										
	Renewable (3 people)										
Number of Waters Used		8									
Number of Lands Used		8									
Number of Energies Used		3									
Number of Waters Discarded		2	2	2	2	2					
Number of Lands Discarded		2	2	2	2	2					
Number of Energies Discarded		3									
Population Increased By											