Name: Henderson Pm. 20 #: _____

Reducing the Human Footprint

STEMscopes: We are combining two Scopes for this packet (Human Footprint and Reducing the Human Footprint)

Each person on Earth uses the natural resources the planet provides. The use and disposal of these resources, over a lifetime, is known as our human footprint. Globally, the supply and demand for goods and services, and population growth, have increased use of natural resources, the rate of their consumption, waste production, and pollution of the environment. Agricultural, industrial, and everyday human activities have impacted Earth's land, vegetation, water, and the air. Four-fifths of the Earth's surface has been influenced by human presence or by activities designed to meet the demand for natural resources. One of the ways to affect human footprint is to become conscious of our energy usage. Although the 3 R's – reduce, reuse, and recycle – may seem cliché, they may be the only solution to reducing the human footprint we each have. Simple changes in the areas of transportation, energy source and use, food procurement and consumption, and taking action can have a positive impact on our human footprint.

Standards that will be addressed:

- **5-ESS3-1:** Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.
- **5-ESS3.C.1:** Human Impacts on Earth Systems: Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.
- **3-5-ETS1-2:** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

Remember to look at the Science tab on our class website for additional resources, information, and updates.

What's Included in the Packet:

1. Investigative Phenomena
2. Hook: Popcorn Resources
3. STEMscopedia
4. Linking Literacy: One Problem Multiple Solutions
5. Graphic Organizer
6. Content Connection Videos:
    a. Overfishing
    b. Overusing Resources
    c. Humans on Earth- True or False
    d. Environmental Awareness
    e. Environmental Changes
7. Science Today: Lake Water Cooling System
8. Independent Practice
9. Concept Attainment Quiz

Test Date & Journal Collection: Friday 3/13

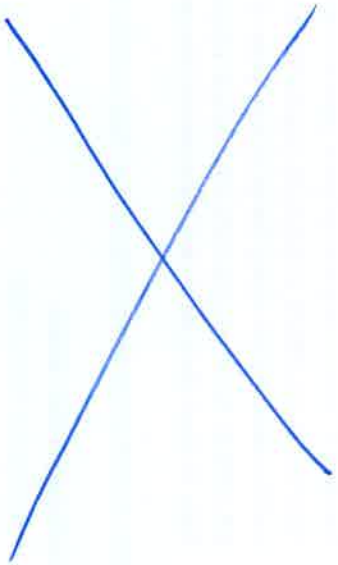
Students will also have a Scholars Speak assignment due on: _____

Investigative Phenomena

Name: _____ Date: _____

Student Wondering of Phenomena: How do our actions affect the environment, and what can we do to reduce our impact?

Record your thoughts about the Student Wondering of Phenomena question in the boxes below.

Before Instruction	During Instruction (Refine your thoughts as you learn more throughout the scope.)	After Instruction
We impact Earth by: • • • • • We can reduce by: • • •		Humans negatively impact the environment, and we must find ways to limit this...

Hook

Name: _____ Date: _____

Popcorn Resources

Use the table below to record your group's results. Then record the results of the other groups.

	Starting Amount Round 1	Ending Amount Round 1	Starting Amount Round 2	Ending Amount Round 2	Starting Amount Round 3	Ending Amount Round 3	Starting Amount Round 4	Ending Amount Round 4	Starting Amount Round 5	Ending Amount Round 5
Group 1	20	12	12	8	8					
Group 2					Answers will vary					
Group 3										
Group 4										
Group 5										
Group 6										

1. Why did some groups end up with more popcorn than others?
Some people decided to save and ration their popcorn, while others ate a lot at once.

2. Why did some groups run out of popcorn the first or second round?
Students ran out quickly because they ate it all at once.

3. What do you think the popcorn represents in the real world?
The popcorn represents: fossil fuels, water, fresh air, electricity/power, food/animals, minerals, trees/plants...

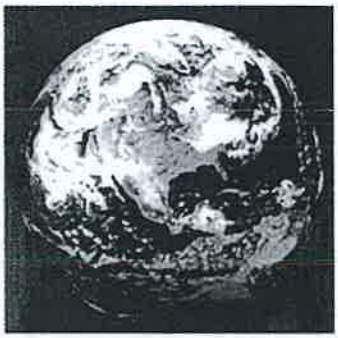
Reflect

A long time ago, the human **population** was very small compared to what it is today. Eventually, humans figured out how to grow crops, which allowed more people to live in a smaller area. People discovered medicine and ways to keep their living spaces clean. All these factors helped humans live longer. About 2,000 years ago, the human population began to grow very quickly. The increase in our population has had an effect on the **environment**.

population – all the living things that belong to the same species and live in the same area

environment – the living and nonliving things that are around an organism

Although the human population has grown extremely quickly in the past 2,000 years, Earth has remained the same size, with the same amount of resources.



- How do humans change the environment?
- Are all the changes bad?
- Is Earth able to adapt to the changes caused by people?

How do organisms, such as humans, change their environment?

Humans use Earth's resources. People take up space, grow and eat food, breathe air, use energy, and produce waste. Humans have a greater effect on their environment than ever before. What are some ways in which humans change the environment?

- **Changes to land:** Humans sometimes drain wetlands or cut down forests to build houses and other structures. They sometimes turn fields into landfills for trash. These changes may help humans find shelter and get rid of waste, but they can harm other living things in the environment.

Deforestation removes valuable resources that may never be recovered.

Humans take over other habitats. What do you think this land looked like 300 years ago?

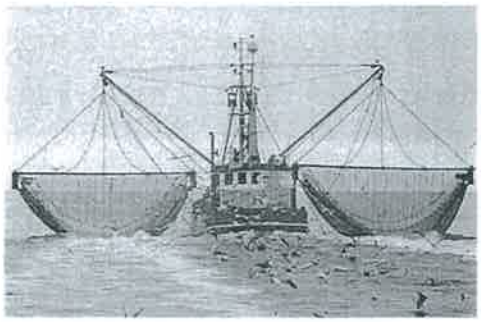
Landfills help humans by getting rid of waste, but they have negative consequences on the environments that are turned into landfills.

- **Changes to water**: Sometimes humans take and use too much fresh water from their environment. As a result, a river or stream might dry up. This kills the organisms that once lived there as well as those that may have depended on that water. Humans also litter and dump trash into freshwater and saltwater environments (such as streams, ponds, rivers, lakes, and oceans). This makes them unsafe for the organisms that live there. In addition, pollution from factories is sometimes dumped into various freshwater and saltwater ecosystems, often making the environment a difficult place for organisms to survive in.

Littering and industrial pollution are just two of the many ways that humans hurt water ecosystems.

- **Changes to air**: Cars, buses, trains, and other types of transportation use fuels that pollute the air. Factories also pollute the air when they burn chemicals and release gases into the air. Poor air quality leads to breathing trouble and other health problems. It also leads to acid rain, which occurs when pollution in the atmosphere mixes with water vapor in the air. Acid rain damages land and water where it falls.

Air pollution is harmful to organisms (including humans) that live near it.



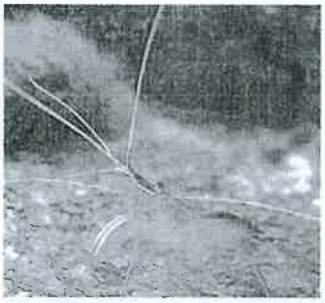
Overfishing in the North Atlantic almost depleted some species of fish in what used to be one of the world's richest fishing grounds.

- **Changes to animals**: Overhunting and overfishing can harm or destroy populations of organisms. On the East Coast, fish called *cod* used to be very common. Overfishing caused these populations to decline so much that they are now very rare in these areas. Because all species are interdependent, the larger fish that depended upon the cod for food had to move or find other sources of food. Similar patterns have been repeated in many ecosystems around the world.

- **Changes to vegetation**: Humans have torn down and used much of the natural vegetation from around the world. Europe was once covered with forests, but by 1850 almost all the natural forests had been cut down by people for farming, lumber, and firewood. Right now, tropical rain forests are being cut down at an alarming rate. An area the size of North Carolina is being cleared every year. People clear land for the same reasons: farming and planting crops, lumber, and firewood. In the middle of the Great Plains area of the United States, farmers plowed up much of the natural vegetation to plant crops. Without the natural grasses to hold the soil in place, soil eroded away during a time of drought. This time period is called the *Dust Bowl*.

When the thin topsoil in the tropical rain forest is no longer protected by tree cover, it is washed away permanently.

Farmers helped cause the Dust Bowl of the 1930s by plowing up native vegetation.



These small shrimp have a hard time competing with the Asian tiger shrimp, an invasive species.

- **Other changes to living things**: Humans can also accidentally or purposely introduce new, non-native organisms into ecosystems. These organisms can use up food, space, and water that other organisms need. These animals or plants are called *invasive species*. They often outcompete native species for resources (sunlight, food, water, space, and shelter). For example, the Asian tiger shrimp was introduced to waters here in the United States. It has caused native shrimp populations to decline. The tiger shrimp grows larger, eats more, and grows faster than the populations that grow naturally in those waters. How do you think this will affect the ecosystem over time?

- **Changes in outer space**: Humans have even managed to change the environment in outer space. Space debris is littered where humans have visited. What is space debris? It is a collection of out-of-date, man-made objects left in outer space space—old satellite and rocket parts, equipment, and tools. More than 500,000 pieces of space debris orbit Earth.

Look Out!

Although humans often change the environment in ways that harm organisms that live there, people have the ability to prevent destructive change and help ecosystems recover. All people have the responsibility of caring for Earth. It is a home to many organisms that people depend on. Read the account of the scientist below who helped fix a problem that people had caused in the environment.

When birds ate insects poisoned by DDT, the DDT also poisoned them and damaged their eggs.

Scientists in the Spotlight: Rachel Carson

In the 1950s, people used a chemical called *DDT* to try to get rid of harmful insects, such as mosquitoes. DDT was good at killing insects, but people did not know how dangerous it could be to other animals. When animals ate the dead insects, they also ate the DDT. The dangerous chemical traveled up the food chain. Rachel Carson was a scientist who noticed that songbirds were dying because they were eating earthworms and other organisms that were full of DDT. The chemical also caused the eggshells of birds to not harden, preventing the baby birds from forming properly in the egg and surviving. This reduced bird populations. Carson wrote a book about the danger of DDT, called *Silent Spring*. Reading the book helped people understand how harmful DDT was to the environment. New laws were made that forced people to stop using DDT. Bird populations increased soon after DDT was banned.

Reflect

How do we protect and reclaim Earth from damage to environments?

Many times people think that developments and advancements in technology result in even more ways for humans to hurt the environment. However, people can and should use technology to conserve environments and protect areas from air, water, and land pollution and destruction. In addition, technology can be applied appropriately not only to prevent damage to environments but also to restore ecosystems that have been damaged by people's actions.

Try Now

How clean is the air around you?

Complete this short activity to find out what is in the air you breathe.

1. You will need five index cards, a pen or pencil, a hole punch, five pieces of string (each about 1 foot long), petroleum jelly, and paper towels.
2. Write the name of a different location around your school or home on each index card. Punch a hole at the top of each card. Tie a piece of string to each hole.
3. Use your finger to cover the cards with petroleum jelly on both sides. Wipe your hands with a paper towel when you are finished.
4. Hang the index cards in the five locations you listed. Leave them in place for 2 days. After 2 days, collect the cards. Do not let the cards touch each other.
5. Write down your observations of each card. Then answer the following questions:

- What kinds of materials did you see on the cards? Did you find both natural and man-made substances?
- Which card had the most material on it? Why do you think that location had the most material in the air?
- What are some ways in which you could improve the air quality around your school or home?

Reflect

What do you think of when you see the symbol on the right? What three words do you associate with this symbol? reduce, reuse, recycle

What are *you* doing to reduce your human footprint? Does your family recycle glass, plastic, paper products, and cans? Have you found ways to reuse items to keep them out of our rapidly filling dumps?

There are many different ways you can help improve our environment. Read on to find out how other people are using technology, education, and effort to improve environmental conditions where they live and around the world.

What are we doing about littering?

There is a new campaign to reduce litter called "Ten on Tuesday." It is sponsored by reverselitter.com. People can go to the website and take a pledge to pick up 10 items of trash every Tuesday, disposing of them properly. That is much easier than picking up trash along a highway.

Picking up litter does not just improve how Earth looks; it also helps decrease pollution.

In Boston, MA, these plaques remind pedestrians and motorists that the water on the street drains into Boston Harbor.

Preventing Water Pollution

The Clean Water Act of 1972 regulates the dumping of pollutants into the nation's water supply. Many communities have started labeling storm drains to remind citizens where the water goes. Boston, Massachusetts, displays brass plaques on buildings to make people aware of the danger. They hope the simple message will cut down on foreign objects and materials being introduced into the water supply. Some communities stencil storm drains with warning messages, such as "Don't dump!," along with a picture of a brightly colored fish as an eye-catching reminder to take care of the water supply.

What can we do about air pollution?

The United States passed the Clean Air Act to try to prevent and control air pollution throughout the United States. It provides money for researching air pollution and pollution solutions. It also regulates industrial and auto pollution.

A worldwide movement toward community gardens is a simple way to reduce the human footprint. Community gardens can supply fresh food, offer employment, beautify neighborhoods, and build community spirit, while replacing oxygen to the atmosphere.

The REAL (Rainwater Environmental Alliance for Learning) School Gardens organization supports outdoor learning centers (gardens) in elementary schools for hands-on learning and a connection with nature. Education and participation are key to keeping Earth healthy.

Try Now

Many things happen as a result of environmental changes. Use what you have learned to consider how humans can change the environment. Read each change described in the chart below and study the images. Predict how the change will affect the organisms in that environment. Record your answers in the *Effect* column. Be creative—there are many correct responses!

Change		Effect
	A company clears a large area of wetlands to build a new neighborhood.	· drain wetlands · displace animal habitats · possible invasive species
	A dam is built across a river to generate electricity and control flooding.	· the dam becomes a blockade · disturbs the habitat
	A highway is built in the middle of a forest.	· deforestation · CO_2 in the air and pollution · car pollution, and run over
	A logging company promises to plant five trees for every one it cuts down.	· tree rate grow · more O_2

Questions:

- Do most changes seem to create positive or negative effects?

  Most have negative effects.

- Do the changes seem necessary? Why or why not?

  Some are neccsary, the ones that humans need for survival.

Linking Literacy

Name: _____ Date: _____

One Problem—Multiple Solutions

One common problem all over our nation is the use of plastic grocery bags. Many of these grocery bags end up in landfills. Think of three different ways you can prevent a plastic grocery bag from going straight to a landfill. Think of a way we could use fewer of them (reduce), reuse them, or recycle them. Draw and describe your solutions in the space below.

Reduce

Answers may vary

Reuse

Recycle

Graphic Organizer

Name: _____ Date: _____

How Can You Reduce Your Human Footprint?

Explain a human footprint in each rectangle. In the arrow next to the rectangle, explain ways that the human footprint can be reduced.

Answers will vary

Human Footprint

deforestation

Ways to Reduce

plant more trees

Human Footprint

over population

Ways to Reduce

Human Footprint

pollution (cars)

Ways to Reduce

Human Footprint

polar over fishing/ hunting

Ways to Reduce

Human Footprint

ocean pollution

Ways to Reduce

Graphic Organizer

Human Footprint

Use the space below to record how the human activity affects land, vegetation, water, air, and outer space.

Effects on Land

- pollution in the streets
- holes, potholes, mining
- fires

Effects on Vegetation

- fires
- deforestation
- overhunting animals
- food web implications

Effects on Water

- water pollution
  - oil spills/leaks
  - litter (plastic)
  - acidic
- overfish

Effects on Air

- air pollution
  - factories
  - smog
  - cars
  - fires/smoke
- fossil fuels

Effects on Structures

- build new communities/centers
  it kills habitats

Additional Effects and Information

outerspace
- ozone layer
- debris (trash ring)

Content Connections Video

Name: _____ Date: _____

Overfishing

1. What comes to your mind when you hear extinction? (Pause 0:23)
I think of...

2. Why do fish face extinction? (Pause 0:40)
Fish face extinction because of overfishing.

3. What is overfishing? (Pause 0:55)
Overfishing is when reproduction can't replace the fish that are caught, and they face extinction.

4. How much has the population of the blue fin tuna decreased in the last 40 years? (Pause 1:23)
Blue fin tuna has decreased by over 70%.

5. What has led to the decrease in the population of fish in the last few years? (Pause 2:03)
The decrease in fish is due to cat food, canned food, and the rise of sushi.

6. What has been introduced to protect the blue fin tuna? (Pause 2:31)
Laws have been introduced on the number and size that are allowed to be kept.

7. Do all countries follow these laws? (Pause 2:57) not all countries do

8. What are other ways the blue fin tuna can be saved?
- blue fin tuna could be a seasonal fish
- each fisherman can only catch a certain amount
- we can put fines in place

9. Draw a poster on saving bluefin tuna.

Be creative! Answers will vary.

Content Connections Video

Name: _____ Date: _____

Overusing Resources

1. Draw a pie graph on the percent of freshwater vs. saltwater. (Pause 0:46)

2. Which country has a large share of the drinking water available? (Pause 1:05)
Canada

3. Which area has the smallest share of drinking water available? (Pause 1:14)
North Africa and the Middle East

4. In order to have enough water for the growing populations, what must be done? (Pause 1:39)
We must conserve the water and protect it from pollution.

5. Where are natural gas and oil mainly found? (Pause 1:57)
The Middle East

6. When natural gas and oil are gone, we will need to find other fuels to meet our energy needs. (Pause 2:20)

7. What is the only country in which you can find phosphorus? (Pause 2:35)
Morocco

Content Connections Video

8. What is phosphorus used for, and how does it help? (Pause 3:00)

Phosphorus is a key ingredient used in fertilizer. fertilizer increases food production.

9. What are ways we can reduce our human footprint?

- finding ways to limit use
- share supplies

Content Connections Video

Name: _____ Date: _____

Humans on Earth

1. How many people live on Earth? (Pause 0:17)
   Over 7 billion, and it goes up daily.
2. Name some resources in high demand (Pause 0:40)
   · food · building materials
   · water
   · fuel
3. Deforestation is: (Pause 1:24)
   The removal of many trees in a forest, it deprives animals of their habitat.
4. What is extinction? (Pause 1:52)
   Extinction is the death of a species.
5. How does deforestation affect extinction? (Pause 1:52)
   As a result of deforestation, animals lose their home and can die without protection.
6. What is water pollution? (Pause 2:07)
   Water pollution is caused by the waste we produce.

Content Connections Video

7. When water is diverted to cities, what harm does it cause? (Pause 2:19)

Lakes are dried out when water is diverted.

8. Explain how the world's growing need for food harms our Earth. (Pause 2:49)

- land is cleared for crops
- grazing animals destroy vegetation
- fertilizer kills fish and coral reefs

9. What can be done to help the effects of world growth? (Pause 3:18)

- reforest
- create reserves
- breeding programs

Concept Attainment Quiz

Name: _____ Date: _____

Part I: Vocabulary Matching

A The space, conditions, and all the living things around an organism

D Actions by one thing that have an effect on a different or separate thing

E The science, art, and business of cultivating soil, producing crops, and raising livestock

C Something that we can use

B All the plants found in a particular area

A. Environment

B. Vegetation

C. Resources

D. Interactions

E. Agriculture

Part II: Identification

Fill in the table below with information you have learned.

History of Human Impact	Steps to Avoid it Today
The Dust Bowl occurred when there was no longer grass to hold the soil in place.	-plant more
There are over 500,000 pieces of space debris orbiting Earth.	Answers may vary - regulations on air pollution
Some major cities have poor air quality as a result of pollution from factories and cars.	

Content Connections Video

Name: _____ Date: _____

Environmental Awareness

1. Bees pollinate over 1/3 of food. (Pause 0:29)

2. How many honeybees die each year? (Pause 0:48)
millions

3. What happens if honeybees disappear? (Pause 1:20)
We would have to pollinate the plants by hand, an almost impossible task.

4. What is interdependent? (Pause 1:39)
Interdependence is one species depending on another/ each other.

5. What happens when we cut down the rainforest? (Pause 2:20)
It will destroy the habitats of plants and animals that live there, including humans.

6. What harm does litter cause the environment? (Pause 2:55)
Litter washes away to oceans and kills marine life, this can lead to fewer fish to eat.

Content Connections Video

7. What are some ways we could save the honeybees?

- wildlife reserves
- limit and test pesticides
- make safe pesticides

8. How can we help species survive in the environment?

- protect all species
- use less natural resources

Content Connections Video

Name: _____ Date: _____

Environmental Changes

I can predict how even small changes in ecosystems can affect all the organisms living there, since everything in an ecosystem is connected.

1. **Directions:** The video discussed changes in an ecosystem that occurred when beavers built a dam across a stream, creating a pond. List three changes that could be helpful, and three that could be harmful when the dam was built.

Helpful Changes	Harmful Changes
1. bridge, tunnel, overpass	1. highway built
2. created new habitat	2. water and organisms are trapped
3. calm waters	3.

2. **Explain:** Think of a prairie habitat with buffalo, deer, wolves, rabbits, and lots of grasses. What might happen in the ecosystem if the wolves were trapped and removed?

The herbivores would eventually overpopulate and run out of food.

3. **Explain:** Give two examples of helpful changes humans can make in the environment, and two examples of harmful changes.

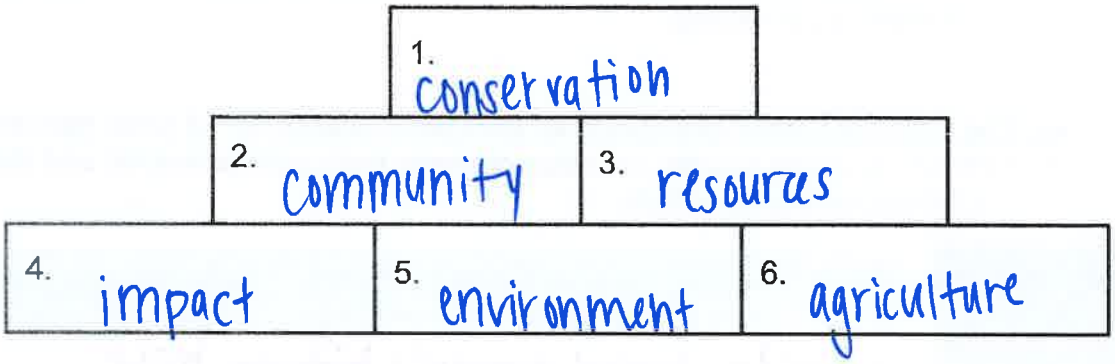
Recycle, reduce, reuse, conserve water, not litter...

Independent Practice

Name: _____ Date: _____

Part I: Pyramid

Directions: Fill in the blanks with the correct word. Then write the word in the corresponding box on the pyramid. The first letter has been given for you.

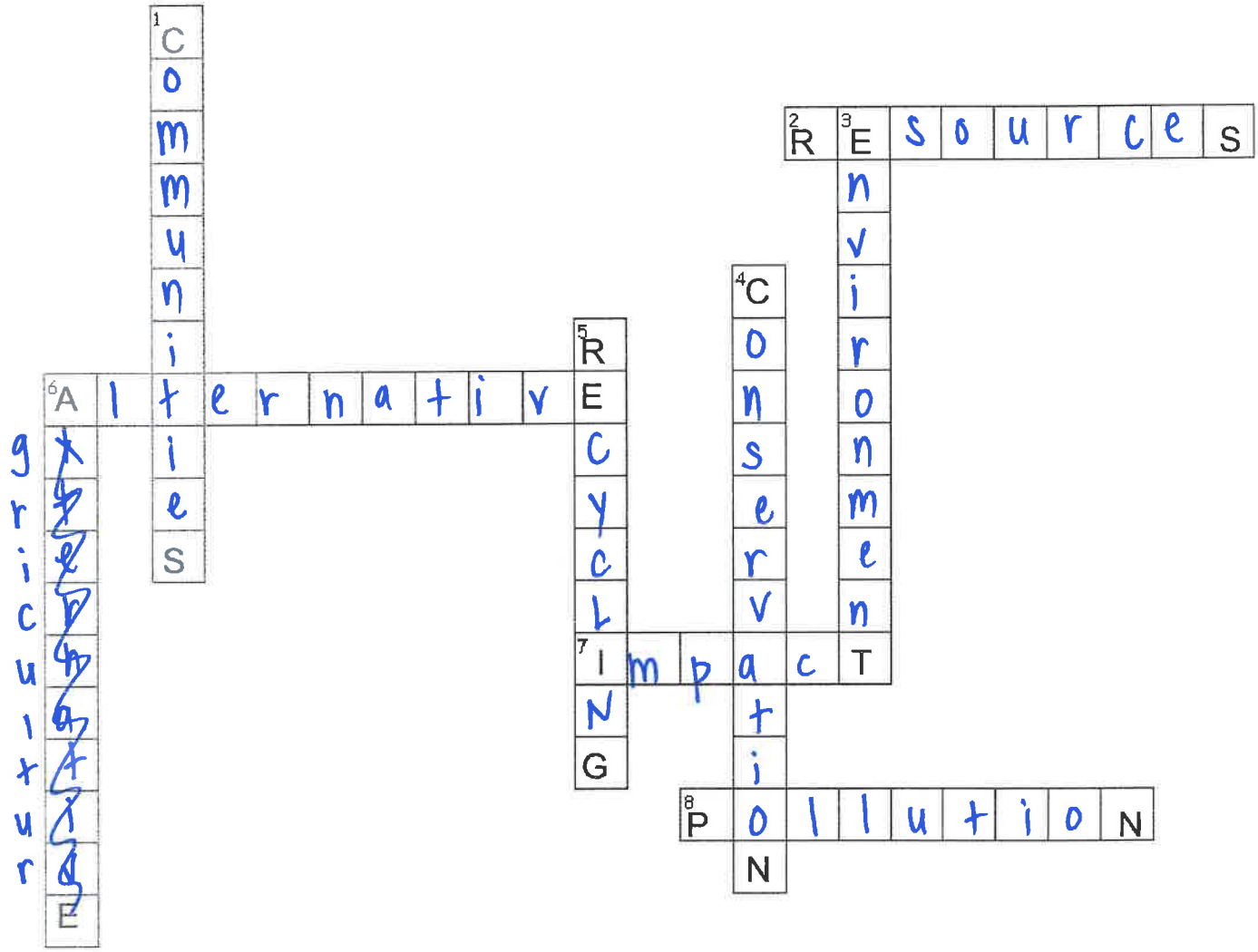


1. When humans prevent waste or loss, it is known as c onservation.
2. All the populations in an area that interact are called a c ommunity.
3. Wood, oil, and water are all examples of r esources.
4. To have an i mpact, there has to be change.
5. Everything surrounding an organism and how it interacts with these things is called the e nvironment.
6. Raising crops and livestock is known as a gricture.

Independent Practice

Part II: Crossword

Directions: Use the clues to fill in the crossword puzzle with the correct words. Multiple words do not have spaces in between.



Across

2. Things found in nature that we use
6. Wind, solar, geothermal, and hydroelectric are examples of _____ energy.
7. Having a direct effect or change upon something
8. Harmful or poisonous substances introduced into an environment

Down

1. In a specific area, all the interacting populations
3. The living and nonliving things in a given space
4. Human attempts to save or prevent loss
5. To reprocess a waste material and make it useful again
6. The growing of crops or raising of livestock