

“Our Ecological Footprint” Lesson Makeover: 5th grade

Background

My name is Kathleen O’Neill and I am a senior at Eastern Michigan University who is majoring in elementary education. I designed a three-day lesson plan on the ecological footprint for a biology class I took in the winter of 2007. The students in my class and I were each required to teach our lessons to a small group of fifth grade students. The test results of the fifth graders can be found on the last page of this document.

My lesson would have not have existed had I not taken a class on social foundations taught by Susan Santone* at Eastern Michigan University. In her class I was introduced to the Ecological Footprint and to the importance of strongly integrating the idea of a healthy ecological system into the classroom. Furthermore, my social foundations class and children have taught me how important it is to give children a feeling of purpose in what they do at school and to connect the curriculum to their lives. All the students live in Canton, MI so some parts of the lesson solely concentrate on local information that I found, which directly connected the lesson to my fifth grade audience.

My lesson was conceived as an introduction to a larger unit on the ecological footprint because it gives children a good foundation and overview to build from. The lesson was originally planned to be taught over two days, a half hour for each day, but when I went to teach the fifth graders I realized that one hour was not enough time. I had to cut valuable discussion time short and speed through important information. For this reason, I have adjusted the time frame to how I would actually teach it in my own classroom.

Before presenting my lesson plan, I created a sample “before” Ecological Footprint lesson. This lesson provides much less depth, and is typical of the type of environmental instruction I have witnessed in classrooms, especially among teachers not comfortable in science. By comparing the “before” and the “after,” the reader can gain a sense of how a new teacher has learned to deepen the quality of instruction through increased understanding of sustainability content and pedagogy.

* Susan Santone is the Executive Director of Creative Change Educational Solutions.

“Before” Lesson description

Lesson: “Ecological Footprint”

Grade Level: 5th

Benchmarks:

I.1.E.1 Ask questions that help students learn about their world

III.5.E.4 All students will analyze how humans and the environment interact

Activities:

- Students take the “Bobbie Footprint Quiz” online.
- A class discussion is held on what things adversely impact or help the environment. Teacher explains that doing things that hurt the environment makes your ecological footprint bigger and doing things that help the environment makes your ecological footprint smaller.

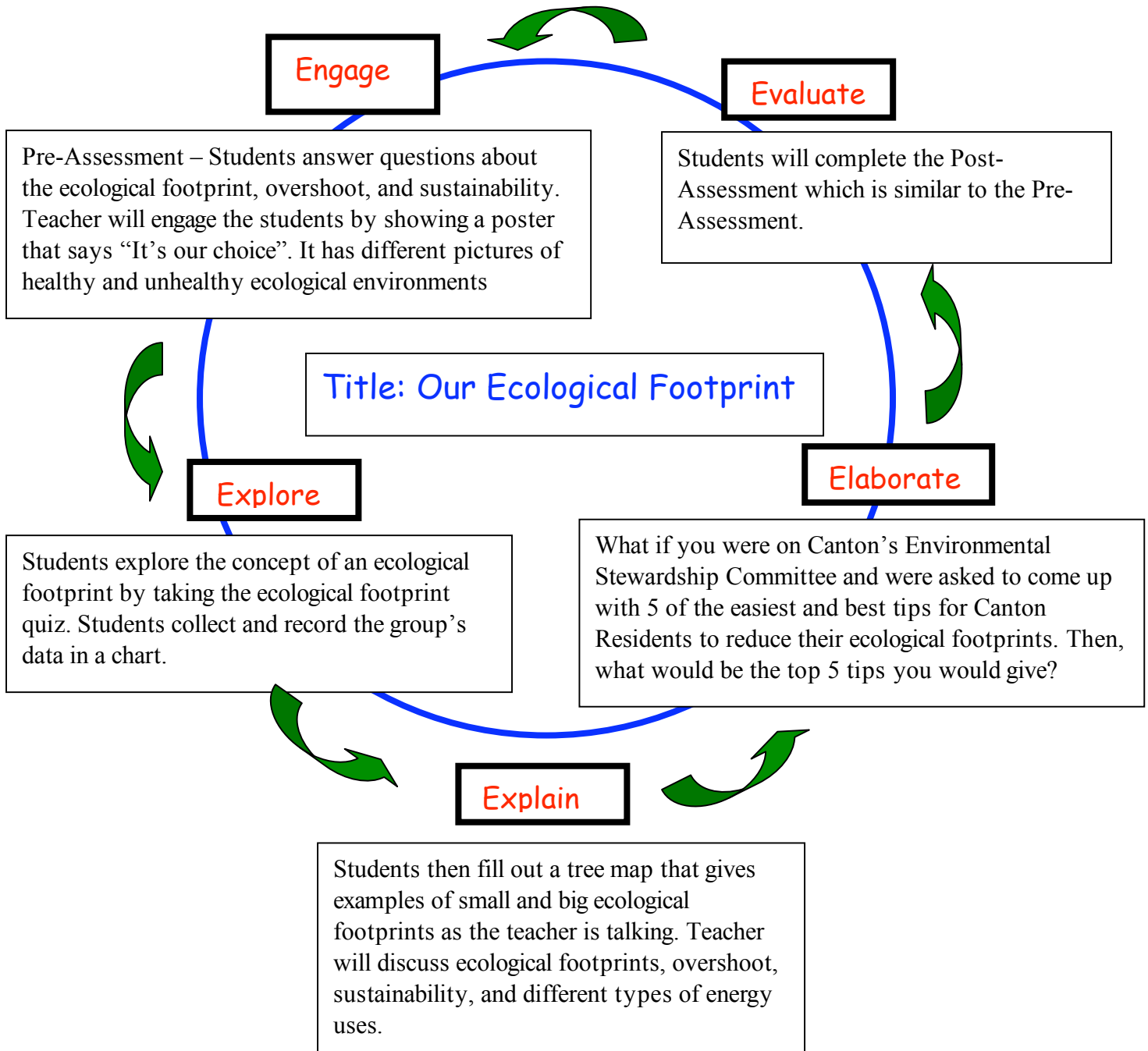
Assessment:

- Have students draw and color big and small footprints. Inside the footprints have them write different examples of practices that could make them that size. For instance, in the small footprint, students could write recycling.

“After” lesson begins on the following page.

Name Of Lesson: Our Ecological Footprint

The 5 - Step Learning Cycle



Title: Our Ecological Footprint

Grade level: 5th

Alignment Tables

Strand I

Lesson Objective	Students will be able to measure their environmental impacts of lifestyle choices by taking the ecological footprint quiz.
Michigan Benchmark	I.1.E.1 Ask questions that help students learn about their world
Process Skill	Observing, communicating, and estimating
5E step	Explore
Thinking level	Structuring, organizing, and relating (orange)

Strand II

Lesson Objective	Students will be able to show how their ecological footprints were measured
Michigan Benchmark	II.1.E.4 Develop an awareness and sensitivity to the natural world
Process Skill	Collecting data, classifying, inferring, and communicating
5E step	Explain
Thinking level	Convergent generalization

Lesson Objective	Students will be able to explain how the size of their ecological footprint impacts the environment
Michigan Benchmark	II.1.E.2 Show how science is related to other ways of knowing
Process Skill	Inferring and interpreting data, predicting and communicating
5E step	Explain
Thinking level	Convergent generalizing

Strand III

Lesson Objective	Students will be able to develop strategies to reduce one's ecological impact on the environment
Michigan Benchmark	III.5.E.4 All students will analyze how humans and the environment interact
Process Skill	Communicating and predicting
5E step	Elaborate
Thinking level	Divergent thinking

Core Concepts (Big ideas are underlined.)

Evidence, Models, and Explanation – These concepts fit with my lesson because we will see evidence of healthy and unhealthy ecological environments. The footprint model will be used to understand our impact on the Earth. We will be able to explain how our ecological footprints impact us, other species, and the Earth. At least one of these concepts will be covered in each 5E section.

Characteristics of Living Things (MR. H2O)

Interdependence – Our ecological footprints impact the Earth’s environment and the Earth’s environment impacts us. Humans impact the Earth’s environment because we have the power to destroy it or sustain it. The Earth impacts us because it is our home. This MR. H2O concept will be covered in each 5E section.

Materials Per student (Refer to Appendix and Resource sections)

- 1 pre-assessment form
- 1 blank ecological footprint quiz
- 1 clip board
- 1 blank ecological footprint tree map
- Pictures of different energy uses
- 1 post-assessment form

Materials for Teacher (Refer to Appendix and Resource sections)

- Poster of healthy and unhealthy ecological environments
- 1 Pre-assessment with answer sheet
- 1 computer
- Audio/Visual materials
- 1 Ecological footprint tree map with answer sheet
- 1 data chart
- 1 Post-assessment with answer sheet
- Dry erase board to write down students’ ideas

Connection to the Real World

Teacher: Has anyone ever gone to “River Day”? What was it like? “River Day” is a fun event that happens every year where volunteers get together to clean Canton’s creeks and streams. Over 400 people volunteered last year. “River Day” also has nature walks and a tent where you can build bird houses. This is just one of the ways you can help save the environment in your own community. Has anyone ever been to Fellows Creek Wetland Nature Trail in Flodin Park? The Fellows Creek Wetland improves water quality, reduces pollutants entering the Rouge River, and benefits fish and wildlife. Frogs, butterflies, muskrats, and bats are just some of the wildlife that live in this area. (See resources)

Day 1

Pre-assessment (5 min)

Students complete the traditional pre-assessment. (See appendix)

Grading Guidelines

1 point each for questions 1-3: 3 points

1 point for each listing in questions 4 and 5: 6 points

Total = 9 points

Engage (10 min)

Teacher: Does anyone know who Blue Man Group is? (Teacher plays a short and entertaining public service announcement about global warming that Blue Man Group created. See the resources page to find out how to get the video.) Each and every one of us has an impact on the Earth. It is up to us to decide what kind of world we want to live in and what kind of world we want future generations to live in. (Teacher shows a poster that says “It is our choice”. The poster also shows pictures of healthy and unhealthy ecological environments. (See reference section) What do you notice about the poster? The unhealthy ecological environments have been caused by humans but we have the power to clean and restore our environment.

Has anyone ever gone to “River Day”? What was it like? “River Day” is a fun event that happens every year where volunteers get together to clean Canton’s creeks and streams. Over 400 people volunteered last year. “River Day” also has nature walks and a tent where you can build bird houses. This is just one of the ways you can help save the environment in your own community. Has anyone ever been to Fellows Creek Wetland Nature Trail in Flodin Park? The Fellows Creek Wetland improves water quality, reduces pollutants entering the Rouge River, and benefits fish and wildlife. Frogs, butterflies, muskrats, and bats are just some of the wildlife that live in this area.

Explore (20 min)

Teacher: Now we are going to explore our concept by taking the ecological footprint quiz. (<http://www.myfootprint.org>. See resources) If you are not sure how to answer one of the questions just take a guess. There are no wrong answers. (Students take the quiz. See the appendix) The quiz we just took can be found online and the url address is at the top of your page. I had my cousin, Colin, who is also in the fifth grade take the quiz online. Now we are going to see what it would like if you were to take the quiz online. I wrote down Colin’s answers so that we can use his as an example. (Teacher then goes to take the quiz online for the students to see. The results are shown.) We can see from the results that if everyone lived like Colin we would need two and a half Earths. Now let’s collect some of our groups’ data by sharing our answers to the following questions. How much of the food you eat is processed, packaged and not locally grown? On average, how far do you travel by car as a passenger? Do you bicycle, walk or use animal power to get around? Approximately how many hours do you spend flying each year? How many miles per gallon does the car you ride in get? (Students record data in their charts. (See appendix for a copy of the chart)

Day 2

Explain (45 min)

Teacher: Please fill in the tree map by listening to me. (Copy of the blank tree map and a completed tree map can be found in the appendix.) The quiz we took on yesterday measured our ecological footprints. An **ecological footprint** is the amount of space that is required to support the resource needs and waste of a person. Ecological footprints come in all different sizes. If we have a big ecological footprint this can be called **overshoot**. Overshoot is when a person takes more than the earth can renew. If you take out and look at the graph titled, Humanity's Ecological Footprint, you can see that we have a big overshoot. If we have a small ecological footprint this can be called **sustainability**. Sustainability is when a person takes more than the Earth can renew. If you take out and look at the picture with the buildings, street, and trees you can see that we can meet our needs and still live in a healthy ecological environment. We are going to look at some different examples of overshoot and sustainability and try to find ways we can come more in the middle. **Our ecological footprints are calculated by finding out how much energy we use. We use energy for food, water, shelter, and mobility.** There are different ways we use energy in our home. Take out and look at the picture of the room with the television and lamp. What do you notice about the picture? The television is on and the light is on but no one is in the room. Also, the door is open and the heat is being let out. The electricity we use becomes a waste and creates air pollution. Take out and look at the picture that says "switch it off". Switching off electronics, appliances, and lights is a great way to save energy. Another way we use energy is by transportation. Automobiles and airplanes pollute our environment by burning fuel or oil which is a non-renewable resource and releasing carbon dioxide and other gases from combustion of oil and coal. Take out and look at the picture of the semi truck. What do you notice? You can see the gasoline fumes coming out. Walking, riding a bicycle, carpooling, or riding a bus are ways we can save energy. Take out and look at the pictures of the person bicycling and the bus. Do you notice anything about the bus? It is a hybrid which means it has lower miles per gallon which ultimately means that it pollutes less. Take out and look at the convertible. It is a Saturn that gets twenty miles per gallon. Now take out and look at the other car. It is a Ferrari that only gets ten miles per gallon. That is half the amount of the Saturn. Transportation plays a big part in the food system because food has to be transported from harvest to market, and for processing, packaging, and storage. Growing food yourself or buying locally grown food can save a lot of energy in food production. Has anyone ever been to Whole Foods Market in Ann Arbor? All the foods there are local because they traveled less than ten hours away to get there. Food that you get from Walmart could come all the way from somewhere like Australia. This sort of thing especially happens during our winter because the Southern Hemisphere has summer at that time.

(Information on the previous topics can be found in the resource section. See appendix for copies of the pictures.)

Day 3

Elaborate (15 min)

Teacher: Does anyone know what an environmental steward is? It is a person who serves the environment by doing things to make it a better place to live in. Anyone and everyone can be an environmental steward. One example of how we can serve the Earth is to plant trees. Who would like to share another way we can serve the Earth? (Teacher writes down students' ideas) Did you know that Canton has an Environmental Stewardship Committee? The committee works to protect our natural resources. They help to put on events like River Day and try to teach people about ways they can help out our environment. (See resources) What if you were on Canton's Environmental Stewardship Committee and were asked to come up with five of the easiest and best tips for Canton residents to reduce the size of their ecological footprints? What would the top five tips be?

Optional Extension

A letter can be written to the school principal proposing the formation of an environmental stewardship committee.

Evaluate (5 min)

The evaluation is the same as the pre-test except there is one more additional question will be given and it is worth 1 point. (See appendix for a blank copy of the post-test and answer key)

Science Education Safety Checklist Items

1. Always perform an experiment or demonstration prior to allowing students replicate the activity. Look for possible hazards. Alert students to potential dangers.
2. Safety instructions should be given orally and be posted each time an experiment is begun.
3. Never eat or drink in the laboratory or from laboratory equipment. Keep personal items off the lab tables.
11. Teachers must set good lab safety examples when conducting demonstrations and experiments. They should model good lab safety techniques such as wearing aprons and goggles.
12. Rough play or mischief should not be permitted in science classrooms or labs.

Lesson Plan Differentiation

English as a Second Language – The teacher allows the student to draw pictures for the assessments and during the elaborate section. The teacher also orally reads the ecological footprint quiz and the other assessments.

Attention Deficit Hyper Disorder – The teacher writes very clear and short directions for assessments and other activities in the lesson. If the student gets off track the teacher tells the student to look back at the directions so that he/she remembers what to do. The teacher makes sure it is silent during independent work to reduce the chance of the student being distracted.

Resources

Blue Man Group, “Earth to America” public service announcement. <http://www.youtube.com>

“It’s Our Choice”. NoE101 It’s our choice. Petersburg, Va. Feenix Publishing Inc.

“Fellows Creek Nature Trail”. 2006. Canton Township Website. <http://www.leisure.canton-mi.org/parks/wetland.asp>

“Volunteers make Canton’s River Day a success”. 2006. Canton Township Website. http://www.canton-mi.org/press/2006_press_releases.asp?=1340

“Community Activities”. 2007. Canton Township Website. <http://www.canton-mi.org/>

“Ecological Footprint Quiz”. 2002. Redefining Progress. <http://www.myfootprint.org>

Pictures of different energy uses found within google image search.

<http://www.images.google.com>

“2007 Saturn Sky”. 2007. U.S. Government.

<http://www.fueleconomy.gov/feg/noframes/23094.shtml>

“2007 Ferrari 612 Scageitetti”. 2007. U.S. Government.

<http://www.fueleconomy.gov/feg/2001cartablef.jsp>

“Conserve Resources”. 2007. U.S. Government. <http://www.fueleconomy.gov/feg/consres.shtml>

Ecological Footprint Resource CD. 2004. Redefining Progress.

<http://www.redefiningprogress.org>

“Canton’s Environmental Stewardship Committee”. 2007. Canton Township Website.

<http://www.canton-mi.org/environment.asp>

Appendix

- Blank pre-test
- Blank post test
- Pre and post test answer key
- Ecological footprint quiz
- Blank group data chart
- Picture of blank tree map
- Picture of completed tree map
- 5th grade students’ test results and academic gains

Pre-test

Name _____

Directions: Please answer the following questions.

- 1.) What measures the amount of space that is required to support the resource needs and waste of a given population or person?

- 2.) What is it called when a person takes more than the Earth can renew?

- 3.) What is it called when a person does **not** take more than the Earth can renew?

- 4.) List three things that would make your Ecological Footprint **bigger**.
 - 1.
 - 2.
 - 3.

- 5.) List three things that would make your Ecological Footprint **smaller**.
 - 1.
 - 2.
 - 3.

Post-test

Name _____

Directions: Please answer the following questions.

1.) What measures the amount of space that is required to support the resource needs and waste of a given population or person?

2.) What is it called when a person takes more than the Earth can renew?

3.) What is it called when a person does **not** take more than the Earth can renew?

4.) List three things that would make your Ecological Footprint **bigger**.

1.

2.

3.

5.) List three things that would make your Ecological Footprint **smaller**.

1.

2.

3.

6.) In one or two sentences, explain why you think it is important to make your Ecological Footprint smaller?

Pre and Post Test Answer Key

Name _____

Directions: Please answer the following questions.

1.) What measures the amount of space that is required to support the resource needs and waste of a given population or person?

Ecological Footprint

2.) What is it called when a person takes more than the Earth can renew?

Overshoot

3.) What is it called when a person does **not** take more than the Earth can renew?

Sustainability

4.) List three things that would make your Ecological Footprint **bigger**.

1. **Not recycling**
2. **Turning up the heat really high all the time in my house**
3. **Taking a one hour shower**

5.) List three things that would make your Ecological Footprint **smaller**.

1. **Turn off the lights in my house**
2. **Stop drinking from water bottles and instead reuse one cup with a lid**
3. **Use a real plate instead of a paper plate.**

6.) In one or two sentences, explain why you think it is important to make your Ecological Footprint smaller?

It is important for me to make my Ecological Footprint smaller because I want to live in a clean environment.

Ecological Footprint Quiz can be taken online at <http://www.myfootprint.org>

Name _____

Directions: Please answer the following questions.

Food Footprint

1. How often do you eat animal base products? (beef, pork, chicken, fish, eggs, dairy products)
 - a. Never (vegan)
 - b. Infrequently (no meat, and eggs/dairy a few time a week) (strict vegetarian)
 - c. Occasionally (no meat or occasional meat, but eggs/dairy almost daily)
 - d. Often (meat once or twice a week)

2. How much of the food that you eat is processed, packaged, and not locally grown (from more than 200 miles away)?
 - a. Most of the food I eat is processed, packaged, and from far away
 - b. Three quarters
 - c. Half
 - d. One quarter
 - e. Very little. Most of the food I eat is unprocessed, unpackaged, and locally grown

Goods Footprint

3. Compared to people in your neighborhood, how much waste do you generate?
 - a. Much less
 - b. About the same
 - c. Much more

Shelter Footprint

4. How many people live in your household?
 - a. 1 person
 - b. 2 people
 - c. 3 people
 - d. 4 people
 - e. 5 people
 - f. 6 people
 - g. 7 or more people

5. What is the size of your home?
 - a. 2500 square feet or larger
 - b. 1900-2500 square feet
 - c. 1500-1900 square feet
 - d. 1000-1500 square feet
 - e. 500-1000 square feet
 - f. 500 square feet or smaller

6. Which housing type best describes your home?
 - a. Free standing house *without* running water
 - b. Free standing house *with* running water
 - c. Multi-story apartment building
 - d. Row house or building with 2-4 housing units
 - e. Green-design residence

7. Do you have electricity in your home?
 - a. No
 - b. Yes
 - c. Yes, with energy conservation and efficiency

Mobility Footprint

8. On average, how far do you travel on public transportation each week (bus, train, subway, or ferry)?
 - a. 200 miles or more
 - b. 75-200 miles
 - c. 25-75 miles
 - d. 1-25 miles
 - e. 0 miles

9. On average, how far do you go by motorbike each week as a passenger?
 - a. 200 miles or more
 - b. 75-200 miles
 - c. 25-75 miles
 - d. 1-25 miles
 - e. 0 miles

10. On average, how far do you go by car each week as a passenger?
 - a. 400 miles or more
 - b. 300-400 miles
 - c. 200-300 miles
 - d. 100-200 miles
 - e. 10-100 miles
 - f. 0 miles

11. Do you bicycle, walk or use animal power to get around?
 - a. Most of the time
 - b. Sometimes
 - c. Seldom

12. Approximately how many hours do you spend flying each year?
 - a. 100 hours
 - b. 25 hours
 - c. 10 hours
 - d. 3 hours
 - e. Never fly

13. How many miles per gallon does the motorbike you ride in get?
 - a. More than 80 miles per gallon
 - b. 65-80 miles per gallon
 - c. 45-65 miles per gallon
 - d. 30-45 miles per gallon
 - e. Less than 30 miles per gallon

14. How many miles per gallon does the car you ride in get?
 - a. More than 50 miles per gallon
 - b. 35-50 miles per gallon
 - c. 15-25 miles per gallon
 - d. Fewer than 15 miles per gallon

Group Data Chart

How much of the food you eat is process, packaged, and locally grown?

Most of the food	Three Quarters	Half	One Quarter	Very little

On average, how far do you travel by car as a passenger?

400 miles or more	300-400 miles	200-300 miles	100-200 miles	10-100 miles	0 miles

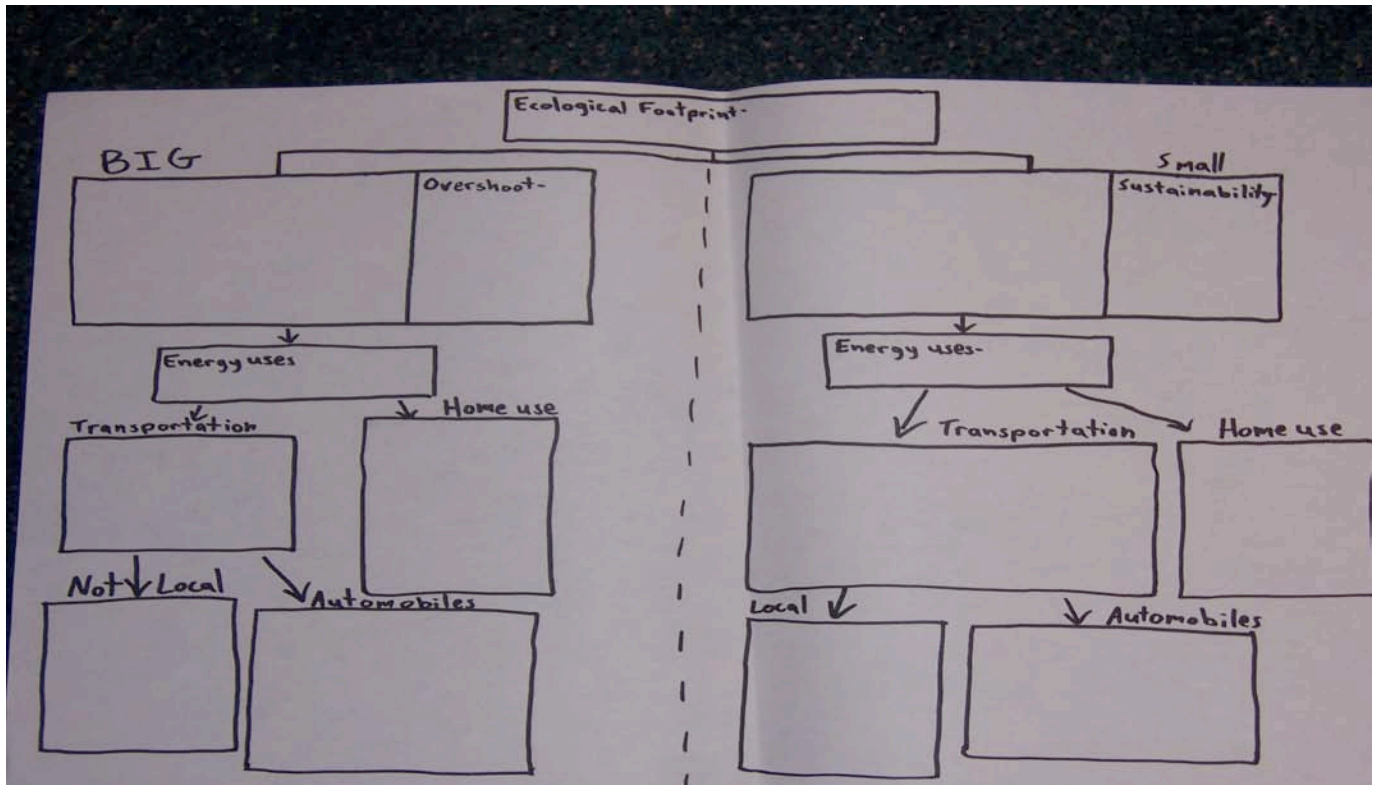
Approximately how many hours do you spend flying each year?

100 hours	25 hours	10 hours	3 hours	Never fly

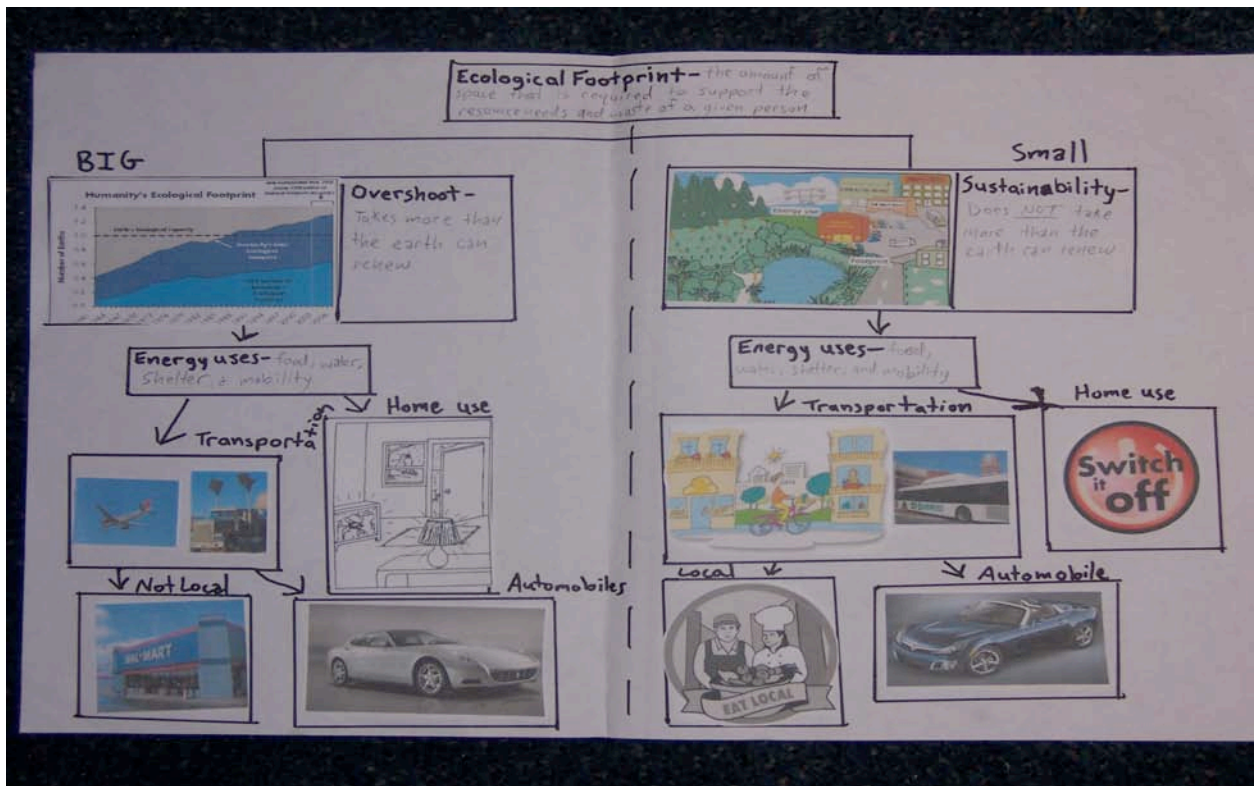
How many miles per gallon does the car you ride in get?

More than 50 miles per gallon	35-50 miles per gallon	15-25 miles per gallon	Fewer than 15 miles per gallon

Picture of Blank Tree Map



Picture of Completed Tree Map



Test Results

The graph below shows the pre and post test scores of the 5th grade students I taught. The blue bars indicate the before score and the red bars indicate the after score. Students who received a zero for the before score will not have a blue bar.

