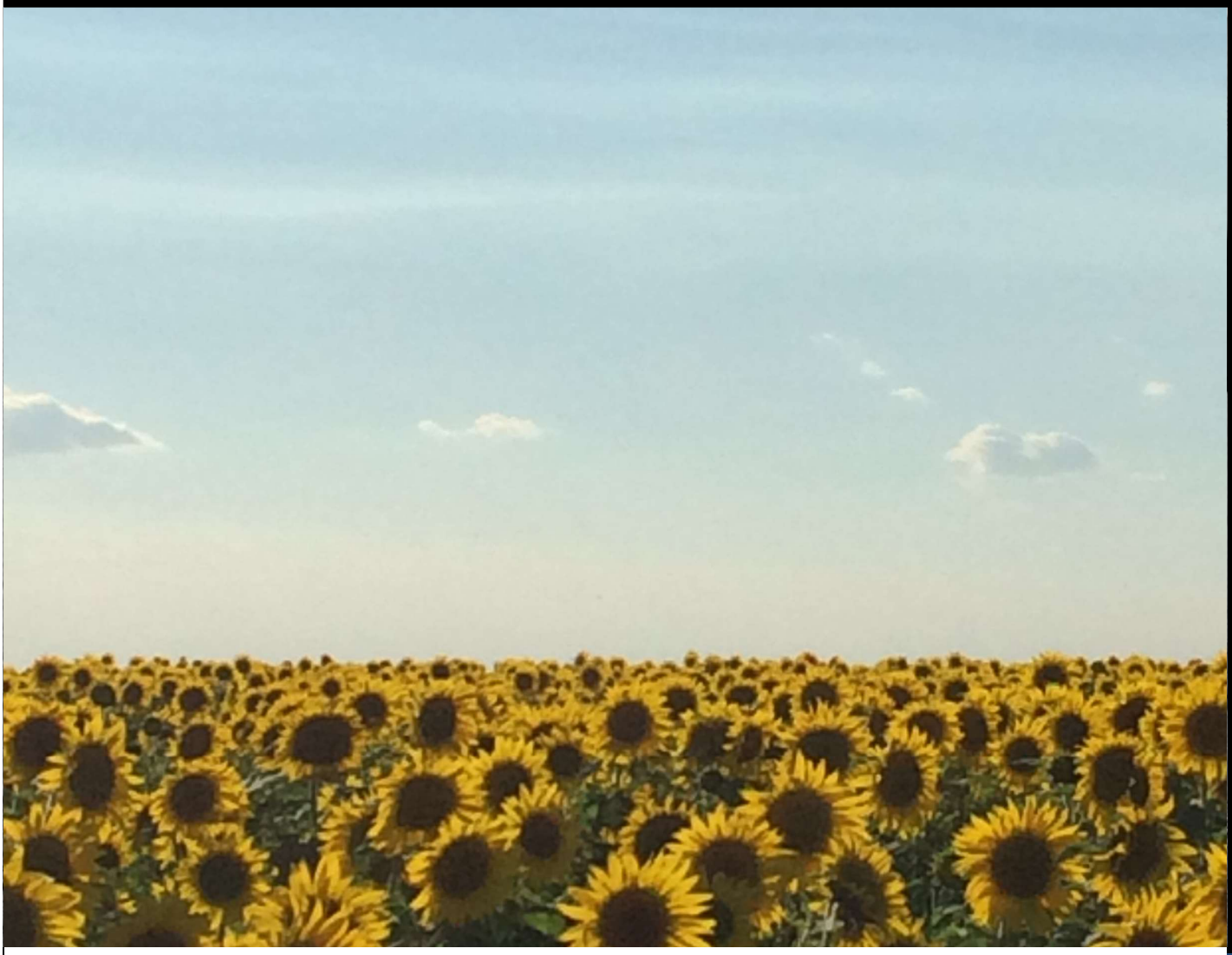

MHA CITIZEN SCIENCE PROJECT

INTRODUCTION & LESSON PLANS

The MHA Citizen Science Project is developed in partnership between the University of Colorado – Boulder and the Nueta Hidatsa Sahnish College (NHSC).

Prepared by Jen Shannon and Bailey Duhé, March 2016.

MHA CITIZEN SCIENCE PROJECT

The University of Colorado is working with the Nueta Hidatsa Sahnish College on a project to provide "teaching kits" focused on environmental monitoring for use in MHA Nation classrooms in light of the rapid changes brought by the oil boom.

Teaching kits include equipment and hands on activities plus lesson plans for teachers to use in their unit planning. MHA teachers guided the content and focus of the research that students will conduct. We will also be creating a community website to aggregate the data collected by students in various schools.

Who are the kits for?

- Most of the teachers are not science teachers, we must keep the language accessible to non-specialists
- The students are from 1st grade to 12th grade, so content will need to be varied
- High school students can be seen as student researchers, with younger students as research assistants

What are the kits for?

- To provide additional hands on resources for teachers to use in the classroom
- To engage students in better understanding what is going on in their community
- To encourage students to ask questions and find ways to investigate the answers
- To assist students in understanding, and practicing, scientific methods
- To empower students to learn what is data, where does it come from, and how can I use it?
- To assist teachers in developing lesson plans that address issues related to potential human and environmental impacts of resource development
- The lesson plans are starting points – they are provided in word documents so teachers can edit and change them as needed

Where are the kits?

- For this pilot program, three kits will be created in Boulder, CO
- They will be available to be "checked out" by teachers in MHA Nation at the Mandaree, New Town, and White Shield schools

Why were the kits made?

- MHA Nation partners would like more scientists to be "home grown," so together we are engaging students in questions and investigations that are relevant to them and their life experience
- MHA students hear a lot from the media about their community; this project provides them the means to think critically about these representations and go out into their community and their homelands and investigate for themselves
- Without quantitative data, it is very difficult for a community to publicly raise concerns, and without qualitative data it is difficult to assess how to appropriately address community concerns
- This project joins MHA scientists and MHA community members' expertise and experience with that of an environmental engineer and an anthropologist from Colorado, providing a balance of quantitative and qualitative research approaches

Prepared by Jen Shannon, Maddie Polmear, and Bailey Duhé, September 2016

INTRO TO FOSSIL FUELS AND HYDRAULIC FRACTURING

Developed by Maddie Polmear

Lesson Overview:

Subject Area: Earth Science, Energy Development

Grade Level: 6-12

Summary: Students will learn the basics of renewable and nonrenewable sources and how fossil fuels are formed. Students will also be introduced to energy development, including the difference between conventional and unconventional drilling and how hydraulic fracturing works.

Learning Objectives:
After this lesson, students should be able to:

- Explain the difference between renewable and nonrenewable energy and list a few examples of each
- Explain how fossil fuels are formed
- Understand the basics of the hydraulic fracturing process

Introduction/Motivation
Energy is a very important part of everyday life. We need energy to turn on the lights in our homes and to fuel our cars. It can be easy to take electricity and gasoline for granted because we just flip a light switch or drive to a gas station without really thinking about how the energy got there. It is important to understand where our energy comes from and, due to the prominence of hydraulic fracturing, how the process works.

The Basics
There are two types of energy sources: renewable and nonrenewable. Renewable sources are unlimited because they are naturally and continuously replenished. Nonrenewable sources are limited because there is only a certain amount in the Earth. Can anyone think of examples of renewable and nonrenewable energy?

Renewable energy sources include: solar, hydropower, geothermal, wind, biomass (organic material from plants like wood, grass, crops)

Nonrenewable energy includes: coal, natural gas, oil

Nonrenewable sources are common in industrial countries; the U.S. gets 40% of its energy from oil. It is projected that humans could run out of oil in the next 40-60 years, which is problematic because it takes millions of years to create oil. So how are nonrenewable resources like oil formed?

Fossil fuels are formed from plants and microorganisms that have long been buried deep inside the Earth. Millions of years ago, marine organisms died and became part of the ocean floor. As this process continued, layers of this sediment solidified and deposited on top of each other forming sedimentary rock. The plant and bacteria continued to get buried deeper and heat and pressure increased. The amount of heat and pressure and type of biomass determine if oil or natural gas is formed. Really high heat and more plant-based material create natural gas. The oil and natural gas then migrate through small holes in the surrounding rock until they become caught under impermeable layers of rock. These oil and natural gas deposits are what we drill into today.

Conventional vs Unconventional Drilling
Before 2006, oil and natural gas were drilled in North Dakota conventionally. This process involves drilling a well and having the natural pressure force the oil to the surface where it can be collected and refined. Conventional drilling has been common practice in the U.S. because it is cheaper and easier; however, many of the deposits that can be accessed with conventional drilling are running out New technologies like fracking are growing in the United States because it enables us to drill oil that was not previously economical to drill because the oil was trapped in rock and hard to access.

INTRO TO FOSSIL FUELS AND HYDRAULIC FRACTURING

Old Way of Drilling

Jelly Donut

Conventional Drilling
Basic Vertical Penetration
Limited Formation Contact

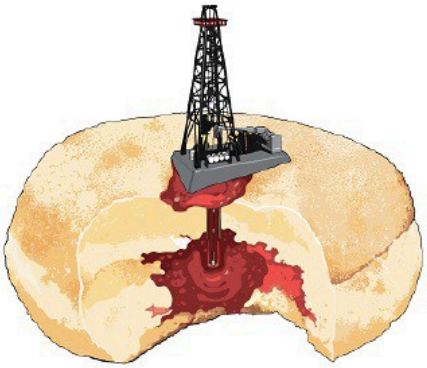

Illustration © James Scherrer 2014

New Way of Drilling

Tiramisu

Unconventional Drilling
More Sophisticated Horizontal Penetration
Extensive Formation Contact

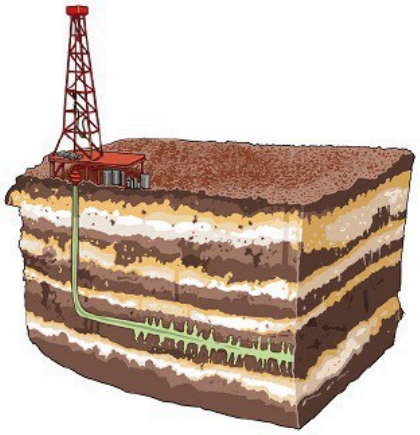

Illustration © James Scherrer 2014

How Hydraulic Fracturing Works

1) A hole in the ground, or well, is drilled vertically for over one mile
2) The well passes through many rock layers and formations until it reaches the rock with trapped oil and gas
3) The drill turns horizontal when it reaches the intended depth and continues for a distance of half a mile to a mile
4) A steel casing, or pipe, is then inserted along the length of the well and cement is pumped to surround the outside of the casing. The well is then like a long straw with many skinnier straws nested inside it to serve as layers of protection for the surrounding water and rock
5) A machine is inserted into the casing to punch small holes in the target zone that contains oil or gas
6) Fracturing fluid, which contains water, sand, and chemicals, is then pumped into the well at very high pressure and the fluid enters the holes and creates small cracks in the surrounding rocks, or fractures throughout the shale. The fractures in the rock are held open with the small bits of sand
7) The oil and gas can then flow through these fractures into the steel pipe
8) Fracturing fluid and the oil or gas flow back to the surface in this pipe and are separated for disposal or treatment
9) After production, the well can continue to produce oil or gas for months to years

INTRO TO FOSSIL FUELS AND HYDRAULIC FRACTURING

Environmental Concerns

As this process has become more common, people are concerned about health and environmental effects. Do you have questions about links between hydraulic fracturing and air or water quality?

We will learn more about these links and how to monitor them in the following lessons.

For an animation of how fracking works, you can watch this video:

https://www.youtube.com/watch?v=tzGVyJ01rKQ

https://www.youtube.com/watch?v=Uti2niW2BRA

Vocabulary list:

Word	Definition
Renewable energy	Energy that is collected from resources that are naturally replenished during human timescale
Nonrenewable energy	Energy that comes from sources that will not be replenished during out lifetimes
Solar power	Converting sunlight into electricity
Hydropower	Flowing water creates energy that is captured and turned into electricity
Wind power	Flow of air that is captured in turbines to generate electricity
Geothermal power	Heat from the Earth below the surface, especially near volcanoes, that can be captured and turned into electricity
Biomass	Energy from plants, like crops, grass, and wood, that can be used for fuel and power production

Please see additional materials for the "Fracking Model" activity in which students learn how fracking works by creating a model from a 20 oz. plastic bottle and gelatin.

ACKNOWLEDGMENTS

References and Resources

Introduction Lesson

http://blogs.dickinson.edu/marcellusmonitoring/files/2014/07/Fracking101.pdf

https://www.teachengineering.org/view_lesson.php?url=collection/cub_/lessons/cub_earth/cub_earth_lesson07.xml

http://naturalgasnow.org/time-tiramisu-conventional-vs-unconventional-drilling/

Air Quality Lesson

Collier, A., Hafich, K., Knight, D., Hannigan, M., Gordon, J., Ambos, E., Cecil, O., Danner, V., Magnus Hotaling, E., Lee, E., Hamilton Meyers, D., Adel Salamah, H., VanderKol, N. (2016) *An Introduction to Air Quality Research (Lesson)*. Curriculum Module submitted to Teach Engineering Digital Library(accepted pending revision)

http://www.takingspace.org/aircasting/airbeam/

https://www.teachengineering.org/view_lesson.php?url=collection/cub_/lessons/cub_air/cub_air_lesson01.xml

https://www3.epa.gov/airquality/oilandgas/basic.html

Water Quality Lesson

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http://www.waterworld.com/articles/print/volume-28/issue-10/departments/case-studies/fracking-concerns-quality-monitoring-program.html

http://www.onsetcomp.com/products/data-loggers/u24-001

http://blogs.dickinson.edu/marcellusmonitoring/files/2014/02/Shale-Gas-Volunteer-Monitoring-Manual-2.0-updated-links-2014.pdf

http://www.fondriest.com/environmental-measurements/parameters/water-quality/conductivity-salinity-tds/#cond6

Animal Tracking Lesson

https://nationalzoo.si.edu/Education/ClassroomScience/AnimalTracks/v3%20Animal%20Track%20Student%20worksheets.pdf

https://nationalzoo.si.edu/Education/ClassroomScience/AnimalTracks/analyze.cfm

http://www.educationworld.com/a_lesson/mammals-outdoors.shtml

http://www.nevadaoutdoorschool.org/Education/LessonPlans/kindergarten/K_AnimalTracksFinal.pdf

http://icwdm.org/inspection/scat.aspx

ACKNOWLEDGMENTS

Introducing Bailey and Maddie

Graduate students in Anthropology and Engineering who have worked hard to help create the lesson plans and materials you are reviewing.

Bailey Duhé is the project coordinator and has worked extensively on two of the lesson plans, Public Survey and Media Analysis. Bailey is originally from New Orleans, Louisiana. She is a first year graduate student in Cultural Anthropology; her advisor is Jen Shannon

Maddie Polmear has worked extensively on the three lesson plans that monitor water, air, and animals. Maddie is originally from Greenwood Village, Colorado and is a BS/MS student in civil/environmental engineering. Her advisor is Joe Ryan.

Consulting Scientists

Dr. Lisa McKenzie, Colorado School of Public Health (specializing in health effects and fracking)
For more on Lisa's work, see her faculty webpage here or a news article here.

Dr. Hall Sawyer, Research Biologist (specializing in animal migration)
For more about Hall's work, see here.

Dr. Mike Hannigan, Mechanical Engineer (specializing in air quality monitors)
For more about Mike's work, see here.

Dr. Joe Ryan, Environmental Engineer (specializing in water quality)
For more about Joe's work, see here.

Additional Consultants

Troy Burke, Web Developer for AirWaterGas Network

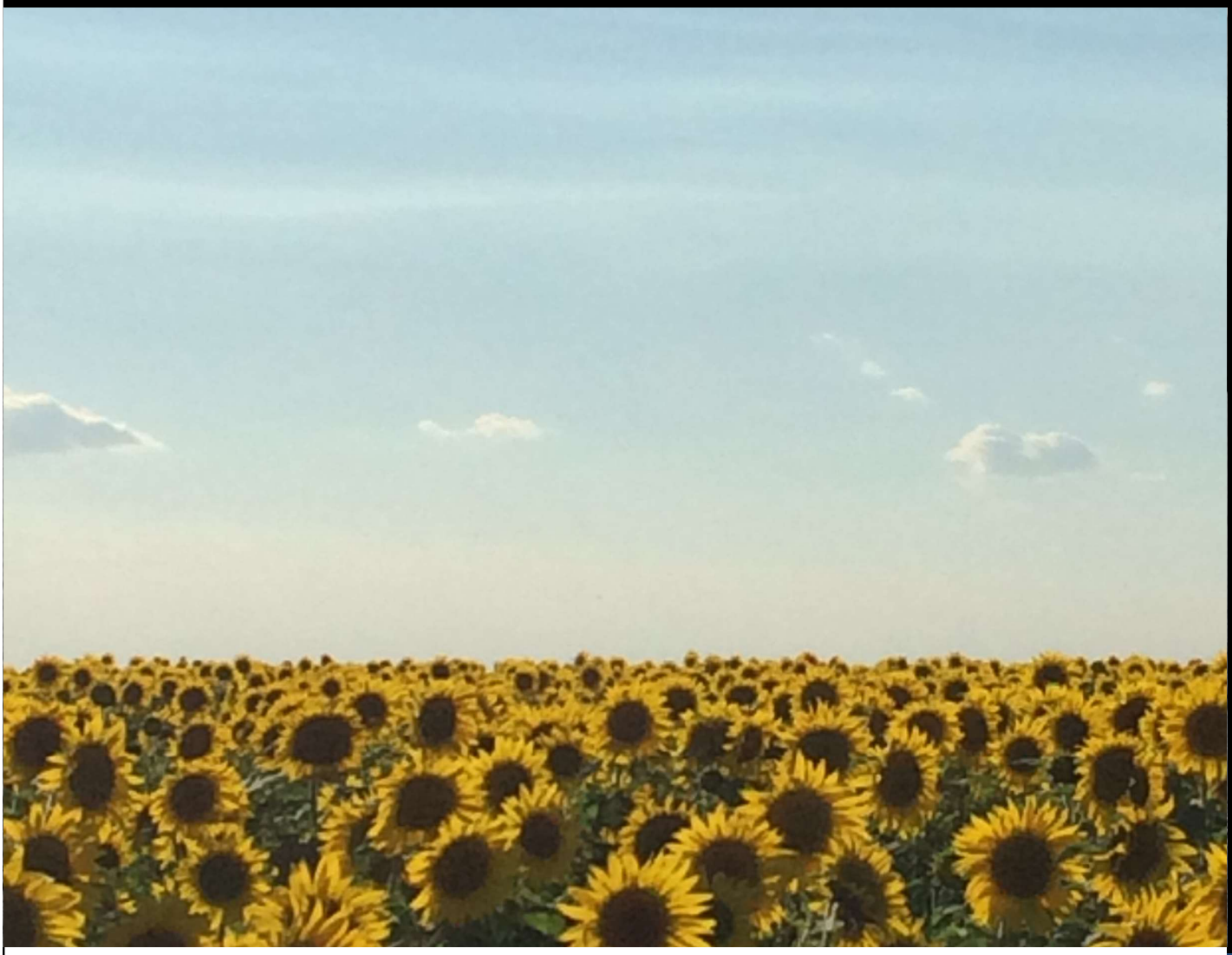
Jim Hakala, Senior Educator at the CU Museum of Natural

Alex Rose, Specialist in Citizen Science Projects

Katya Hafich, AirWaterGas Education and Outreach Coordinator

Questions about Air Quality

and additional materials



MHA CITIZEN SCIENCE PROJECT

LESSON PLAN

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Prepared by Jen Shannon and Bailey Duhé, March 2016.

INTRODUCTION TO AIR QUALITY

Developed by Maddie Polmear with input from Dr. Mike Hannigan (environmental and mechanical engineer)

Lesson Overview:

Subject Area: Earth Science, Technology

Grade Level: 9-12

Summary: Students will learn the basics regarding the structure of earth's atmosphere, what types of pollutants are present in our atmosphere, and the importance of air quality research.

Students will also be introduced to engineering topics, like the development and use of low-cost air quality monitors that will be used in citizen science projects.

Learning Objectives:
After this lesson, students should be able to:

- List and describe the three primary reasons to study air quality – health effects, visual appearance of the environment, and climate change
- Define the difference between primary and secondary pollutants, and gas-phase and particulate pollutants

Introduction/Motivation

Air is fundamental for all life on land. Human, animals, and plants rely on good air quality for survival; however, we hardly notice our air. People often take the air for granted but recent pollution problems have shed light on the importance of air quality and its effect on human health.

Air Quality Basics

Our atmosphere is ~21% oxygen and ~78% nitrogen; the remaining 1% is considered "trace gases" and this includes everything else. The atmosphere is essential for human survival because it acts like a blanket around the earth, keeping it warm and blocking out harmful solar rays. As a result protecting the atmosphere and air quality is important to keeping humans, animals, and plants healthy.

Poor air quality can negatively affect both human and environmental health. In humans, poor air quality can lead to many problems including respiratory (lung) and cardiovascular (heart) diseases. We tend to think first of asthma and breathing problems, but some particles are so small they can enter your blood stream through your lungs and cause swelling leading to problems beyond our breathing. In plants, poor air quality can also cause disease, which can sometimes lead to crop loss. In addition to human and environmental health, many pollutants we worry about are greenhouse gases and contribute to climate change. Finally, poor air quality can impact quality of life. Consider visibility issues in National Parks or odors in industrial areas of cities; in addition to potential health dangers, these air quality issues can make daily life unpleasant.

INTRODUCTION TO AIR QUALITY

Pollutant Types

There are two types of pollutants: particles and gases. Particulate matter is really small material that floats in the air, like dust and ash, and negatively impacts visibility and human health. Particles can be solid or liquid, as opposed to gas compounds.

Another important distinction is between primary and secondary emissions. Primary emissions are direct emissions, for example the pollutants from a tailpipe or smokestack. Secondary pollutants form in the atmosphere. An example is ground-level ozone, which requires several primary pollutants and sunlight to form.

Air Quality and Hydraulic Fracturing

The recent fracking boom in the United States has drawn attention to air quality in communities where oil and natural gas development is happening. According to the United States Environmental Protection agency (USEPA), the oil and natural gas industry is the largest industrial source of volatile organic compound emissions. This group of compounds is problematic because it contributes to ground-level ozone, smog. Smog is the combination of fog and smoke that reduces visibility and is linked to asthma and increased emergency room and hospital visits. Oil and natural gas development also emits methane, a greenhouse gas that contributes to climate change. How many of you have heard about carbon dioxide increasing the effects of climate change? Methane is 20 times as intense as carbon dioxide so it is even more troubling for climate change. The oil and natural gas industry also emits air toxins, which are pollutants known or suspected of causing cancer and other health effects. As a result of these potential health and environmental problems, it is important to study air quality and understand pollution sources around us.

Air Quality Monitoring Tool

We will be using the AirBeam, a wearable monitor that maps, graphs, and puts on a website your pollution exposure via the AirCasting app so that once many people input their data, you can begin to see trends in different areas of the reservation. The AirBeam was developed as a low-cost, portable air quality instrument to get an accurate assessment of personal exposure to pollution. The AirBeam measures PM2.5, particles smaller than 2.5 microns in diameter. These particles are so small that 30 of them could fit across the width of a human hair. PM2.5 is problematic for human health because the small particles can penetrate into our lungs and pass through our bloodstream leading to short and long-term health effects.

So how does the device work? The AirBeam draws air through a sensing chamber where light from an LED bulb scatters particles. The light scatter is registered by a detector and converted to measurements that estimate the number of particles. Bluetooth communicates the measurements to the AirCasting app, which produces maps and graphs in real-time on the tablet and online.

INTRODUCTION TO AIR QUALITY

Vocabulary List:

Word	**Definition**
Air	Mixture of odorless, tasteless, and invisible gases that surround the Earth
Air pollution	Gases and particles that negatively impact air quality and are harmful to the environment and human health
Asthma	A medical condition that causes swelling in breathing tubes leading to difficulty breathing and wheezing
Atmosphere	Layer of air that surrounds Earth keeping it warm and protecting it from harmful solar (sun) rays
Greenhouse gas	Gases that trap heat from the sun making Earth warmer
Particulate matter	Really small material that floats in the air, can be solid or liquid, like dust and ash
Pollutant	A harmful chemical or material that is released into the air or water
Volatile organic compound	Hazardous air pollutants that react with sunlight to form ozone and cause serious health problems
Ground-level ozone/smog	The combination of smoke and fog created from reactions in the atmosphere, causes visibility and health problems

AIR QUALITY MONITORING ACTIVITY

Name:_____ **Date:**__/__/__ **School:**_____ **Grade:**_____

Materials:

- 1 AirBeam
- 1 Andriod tablet

We will be using small air quality monitor to understand our personal exposure to particulate matter (also known as "PM"). It will take an instant reading of PM in the location you select.

1. **We will be monitoring PM exposure inside the classroom, near a busy road, and near a well. Please write down the specific locations that your class visits with the AirBeam.**

   _____

   _____

   _____

2. **Why do you think these locations were picked?**

3. **What do you think the results will show?**

AIR QUALITY MONITORING ACTIVITY

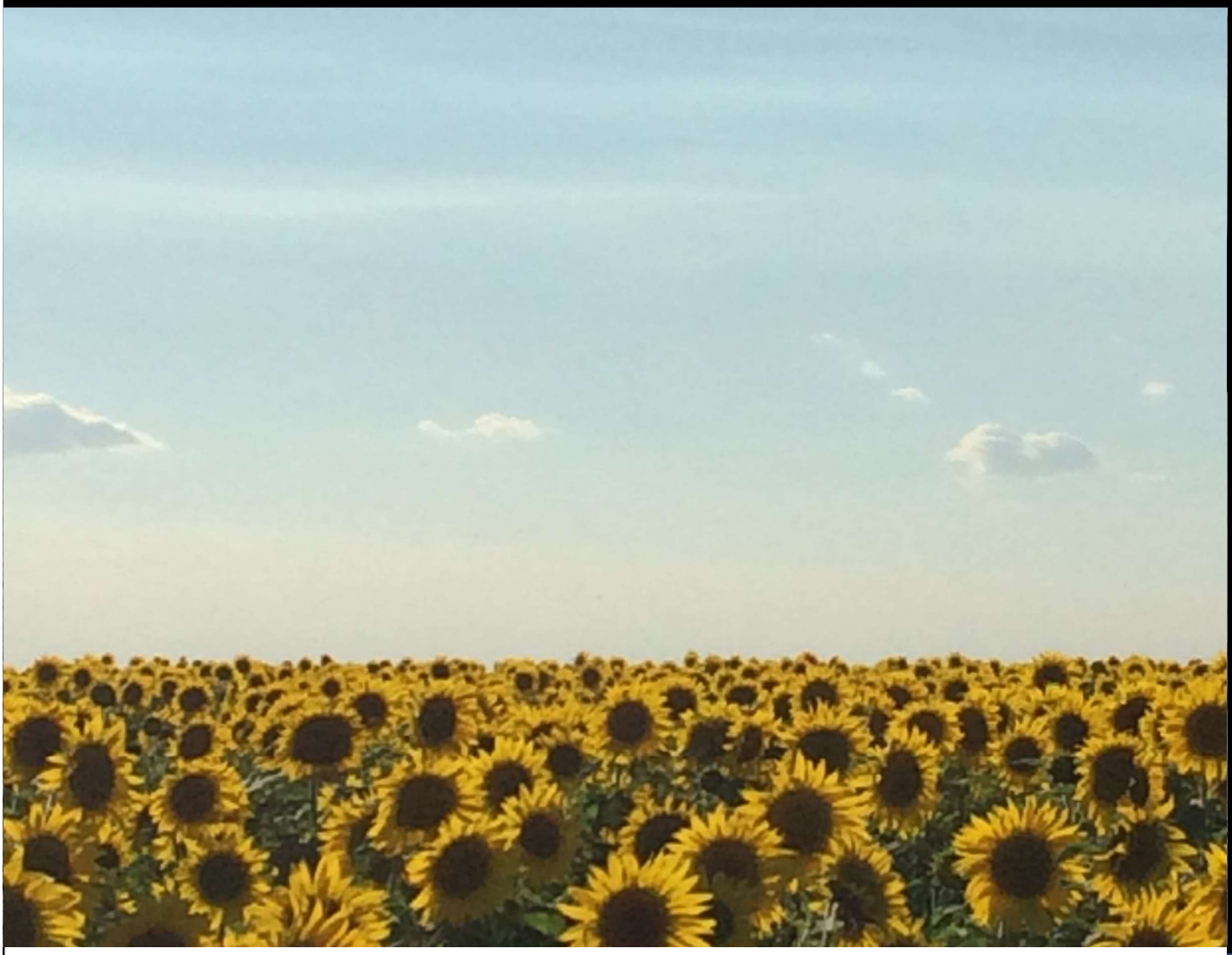
1. **Using the AirBeam and the AirCasting app, determine your exposure to particulate matter in the 3 locations. What do the results show? What is the PM concentration?**

2. **What conclusions can you draw about particulate matter from this activity?**

3. **What impact does hydraulic fracturing have on PM concentration?**

Questions about Water Quality

and additional materials



MHA CITIZEN SCIENCE PROJECT

LESSON PLAN

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Prepared by Jen Shannon and Bailey Duhé, March 2016.

INTRODUCTION TO WATER QUALITY

Developed by Maddie Polmear with input from Dr. Joe Ryan (environmental and civil engineer)

Lesson Overview:

Subject Area: Earth Science, Water Quality

Grade Level: 6-12

Summary: This lesson will help students understand what water quality means and how it is measured. Students will also be introduced to the connection between water quality and hydraulic fracturing.

Students will learn about a conductivity meter that is used in citizen science monitoring projects in areas near oil and natural gas development and will be able to collect their own data to assess local water quality.

Learning Objectives:
After this lesson, students should be able to:

- Discuss parameters used to assess water quality
- Understand the connection between water quality and hydraulic fracturing
- Understand the importance of water quality monitoring
- Explain how the LaMotte Tracer PockeTester works

Introduction/Motivation: Since water serves a number of essential functions for plant and animal communities, aquatic habitats, and humans, we need to understand the quality of the water. Water quality parameters indicate the health of the system and show human impacts.

Water Quality: Water quality is defined by physical, chemical, biological, and visual characteristics. Good water quality is necessary for a healthy environment with rich and varied communities of plants and animals. Humans also rely on safe water quality for consumption, recreation, fishing, and irrigation. There are a number of parameters used to evaluate the quality of a water source. The kind and amount of living organisms in the water indicates if the supply is clean and healthy enough to support animal and plant communities. Chemical factors also help us understand water quality and can show the effects of human activities. In areas near hydraulic fracturing, we are especially interested in monitoring conductivity and salinity. These parameters indicate the saltiness of the water. Flowback water, the water that flows back to the surface after a well is drilled, has a high concentration of salts from the fracking fluid and shale formation. The conductivity of spilled fracking fluid is 200 times greater than normal due to this salt pollution. Monitoring efforts in water bodies near hydraulic fracturing can help establish a baseline, how conditions are normally, to understand if there is any unusual activity. Spikes in conductivity could show a spill or contamination from the fracking fluid or flowback water.

Water and Hydraulic Fracturing: Water concerns are related to use and contamination. Approximately 2-10 million gallons of water are used for every well. The process requires huge volumes of water, which raises concerns about the availability of the precious resource. There are also a number of potential pollution pathways by which the fracturing fluid or flowback water can reach drinking water sources. Spills from trucks and leaks in wells, pipes, and tanks can allow the contaminants to mix with drinking water sources. This is a concern because flowback and produced water contain gases, salts, and metals that may be harmful to animals, plants and humans.

Water Quality Monitor: There are a number of portable devices that enable field measurements of water quality parameters. We will be using the LaMotte Tracer PocketTester to collect data on conductivity and total dissolved solids. The meter works by applying a voltage between electrodes. The positively charged ions (like sodium) will move toward the negatively charged electrode and the negatively charged ions (like chloride) will move toward the positively charged electrode because opposites attract. These ions generate an electrical current because they are changed and moving. The meter is able to measure that current and provide direct readings of conductivity and total dissolved solids.

INTRODUCTION TO WATER QUALITY

Vocabulary List:

Word	**Definition**
Parameter	A measurable factor that defines a system
Conductivity	A measure of water's ability to pass electrical flow, which is related to the concentration of dissolved solids in the water. For example, seawater has a lot of salt, which is made up of ions, and has high conductivity.
Salinity	A measure of the salts in water, which contribute to conductivity.
Flowback water	Water that returns to the surface after a well is hydraulically fractured
Fracking fluid	Combination of water, sand, and chemicals that is injected into a well
Produced water	Water that is released from an underground rock formation and come to the surface with the oil and gas after a well is hydraulically fractured
Total Dissolved Solids	Minerals, salts, and metals that are dissolved (suspended) in water
Voltage	The difference in electrical energy between two points
Electrode	A conductor through which electricity enter or leaves a non-metal material
Ion	An atom or molecule with an electrical charge

WATER QUALITY MONITORING ACTIVITY

Name:_____ **Date:**___/___/____ **School:**_____ **Grade:**_____

We will be using a LaMotte Tracer PocketTester to measure conductivity to assess local water quality.

Materials:

- 1 LaMotte Tracer PocketTester
- Tablet or cellphone to collect GPS location information for each sampling point

Step 1: Calibrate the meter. Calibrating instruments is important to ensure consistency with other measurements and to determine the accuracy and reliability of the device.

A video is available with instruction on meter calibration: https://www.youtube.com/watch?v=zECBNcey_BA

1) Turn the meter on by pressing the ON/OFF button.
2) Take off the bottom cap covering the electrodes.
3) The meter must be in conductivity mode ("µS" will be displayed above the reading; to change modes, press the MODE button for 3 seconds).
4) Place the meter in 20 mL of 1413 µS/cm standard calibration solution. Press and hold the CAL button for ~2 seconds. "CAL" will appear on the bottom of the screen and 1413 will flash on the screen.
5) The device will automatically recognize and calibrate to the conductivity standard. 1413 will stop flashing and the display will briefly read "SA" and "End". ("SA" will not appear if the calibration fails.)
6) Rinse the meter with distilled water, shake dry, and turn the meter off.

Step 2: Take conductivity measurements:

1) Turn on the meter by pressing the ON/OFF button.
2) Take off the bottom cap covering the electrodes.
3) "SELF CAL" will flash and then disappear on the display.
4) Make sure the meter is in conductivity mode ("µS" will be displayed above the reading; to change modes, press the MODE button for 3 seconds).
5) Place the meter directly into the water you want to test, which can include lake, river, stream, well or faucet, making sure the electrodes are completely immersed in the water.
    a. If you prefer, you may take a water sample from the middle of the stream and place the meter in the clean sample container.
        i. Enter the stream downstream from your monitoring point to avoid introducing disturbed stream sediment to the sample.
        ii. Move to the center of the stream, if possible.
        iii. Collect the water sample using a clean sample bottle facing upstream from where you are standing (water is flowing towards you).
6) Allow the reading to stabilize.
7) Record the conductivity measurement on your data sheet.
8) Hold the MODE button for approximately 3 seconds (TDS will flash on the bottom of the display and "ppm" will be in the top left corner of the display. There should not be an "S" above the reading – that is the salinity mode).
9) Allow the reading to stabilize.
10) Record the TDS measurement on your data sheet.
11) When finished, rinse the meter with distilled water and turn the meter off.

Additional information can be found at:
http://blogs.dickinson.edu/marcellusmonitoring/water-quality-monitoring/

WATER QUALITY MONITORING ACTIVITY

1. **Imagine that you have to setup a local monitoring program. What considerations do you think are important and why? Examples of consideration include length of study, site locations, and data analysis.**

2. **What is the importance of doing baseline measurements?**

3. **Which locations do you think would be good sites for measurement? You can think of where your drinking water comes from or where you like to swim or fish. You can also think about water bodies that are close to oil wells and where the source water flows. Name three:**

   _____

   _____

   _____

4. **Use the provided instructions to collect conductivity measurements at the sites you identified. Make 2 measurements at each site and record the conductivity and total dissolved readings at the 3 locations.**

Site	Reading	Conductivity	TDS
Site 1	1		
	2		
Site 2	1		
	2		
Site 3	1		
	2		

WATER QUALITY MONITORING ACTIVITY

5. **How do the measurements change between locations?**

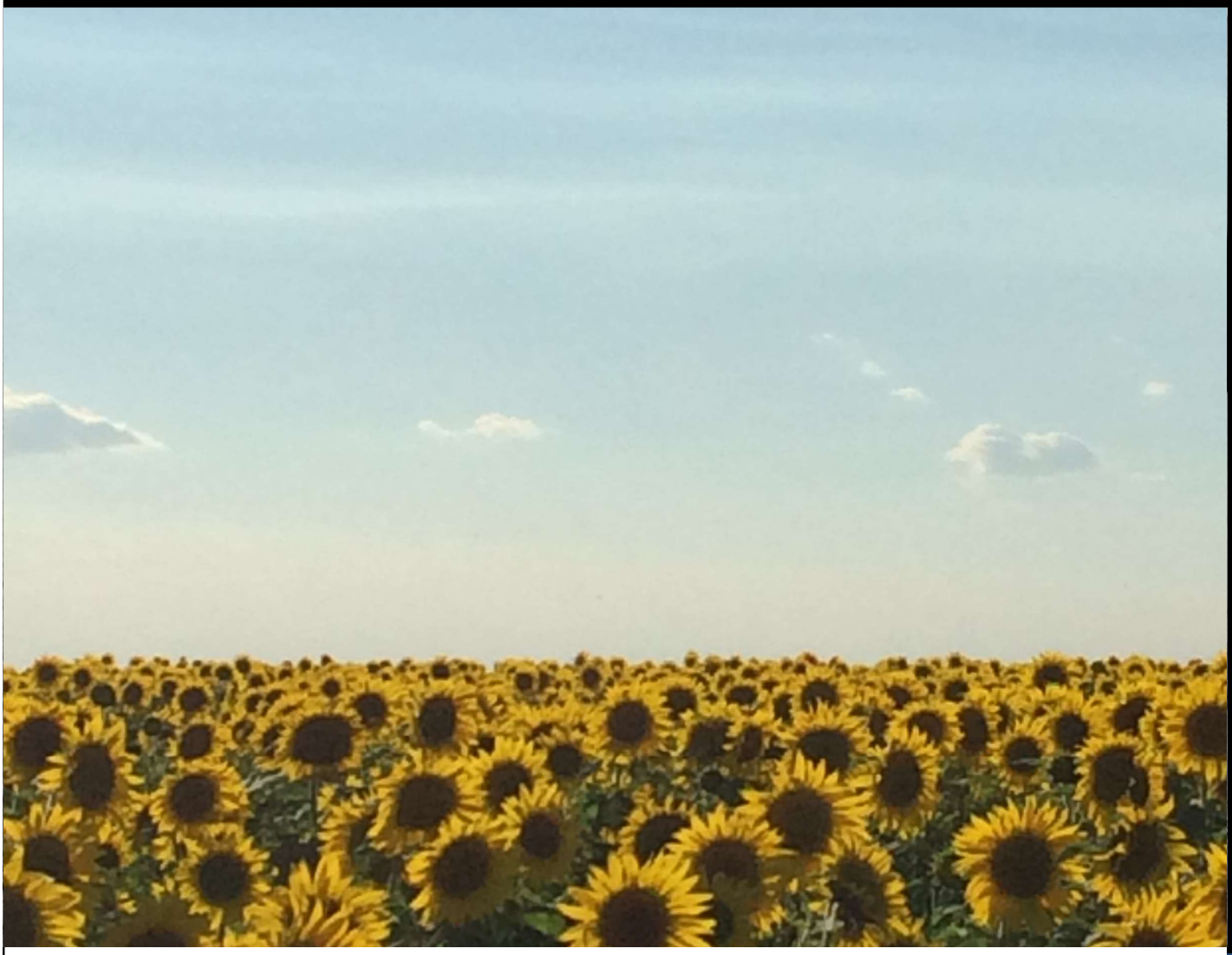
6. **What do you think causes these changes?**

7. **What conclusions can you draw from the results?**

8. **Are there any other parameters or locations you are interested in measuring?**

Questions about Animal Behavior

and additional materials



MHA CITIZEN SCIENCE PROJECT

LESSON PLAN

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Prepared by Jen Shannon and Bailey Duhé, March 2016.

INTRODUCTION TO ANIMAL TRACKING

Developed by Maddie Polmear with input from Dr. Hall Sawyer (biologist)

Lesson Overview:

Subject Area: Earth Science, mammals

Grade Level: 6-12

Summary: This lesson was developed to help students identify mammal populations and behaviors.

Students will learn about the traits of tracks and droppings and use these signs to deduce information about local mammal species.

Learning Objectives:
After this lesson, students should be able to:

- Discuss characteristics of tracks and droppings
- Understand how these parameters are good proxies for mammal sightings
- Conduct an investigation to identify local mammals

Introduction/Motivation

It can be challenging to observe animals directly. Some animals are only awake at night, some travel over great areas, and some are secretive in hiding from other species. However, all mammals leave tracks and droppings and these can serve as clues to better understand their behavior, quantity, and movement.

Tracks

Think about when you walk. Imagine how different parts of your feet touch the ground. If you are running, are your footprints different than if you are walking? Do your footprints looks different than an adult's or baby's? What about if you dropped something like food or clothing when you are walking? All of the distinct characteristics of the footprint help us piece together information about the creature that left them.

Tracks not only reveal an animal's presence, but also provide clues to the animal's behavior, diet, and movement. The number and pattern of the tracks help us understand which animals are in the area, how many there are, and how they are moving. By examining tracks, we can start to understand how other creatures live in this ecosystem that we all share. Monitoring over time can also show changes in animal populations and patterns. These recordings can help us learn about the factors that influence animal populations and migrations.

Droppings

Scat (or animal poop) is another important sign of animals. All mammals leave dropping so these provide a clue about the type and number of animals. The size, shape, form, count, and composition of the droppings all provide insight into the mammal that left them.

INTRODUCTION TO ANIMAL TRACKING

Animal List:

ANIMAL TRACKING ACTIVITY 1

Name:_____ **Date:**__/__/__ **School:**_____ **Grade:**_____

We will be using tracks and droppings to understand mammal populations and migrations.

Materials:

- Trail camera
- Gloves
- Tablet to collect GPS location and take pictures of tracks and droppings

Before going into the field, answer the following questions:

1. **What are the basic features of an animal track?**

2. **How can you identify an animal from its track?**

3. **What can you learn about an animal from its track?**

4. **How do human activities influence animal populations and movements?**

Fill out the following table when you are in the field. Use these characteristics and a guidebook to hypothesize the mammals that you are tracking.

ANIMAL TRACKING ACTIVITY 1

Location (GPS coordinates): _____

5. **Characteristics of the tracks in area near human development (wells, streets, buildings)**

	Animal 1	Animal 2
Length (cm)		
Width (cm)		
Depth (cm)		
Number of toe prints		
Number of tracks		
Sketch		
Hypothesis		

6. **Characteristics of the droppings in area near human development (wells, streets, buildings)**

	Animal 1	Animal 2
Length (cm)		
Width (cm)		
Form (pellet, tubular, smooth)		
Count (one or multiple)		
Particles present (hair or food)		
Time of day (old or fresh)		
Hypothesis		

ANIMAL TRACKING ACTIVITY 1

7. **Characteristics of the tracks in open area away from human development**

	Animal 1	Animal 2
Length (cm)		
Width (cm)		
Depth (cm)		
Number of toe prints		
Number of tracks		
Sketch		
Hypothesis		

8. **Characteristics of the droppings in open area away from human development**

	Animal 1	Animal 2
Length (cm)		
Width (cm)		
Form (pellet, tubular, smooth)		
Count (one or multiple)		
Particles present (hair or food)		
Time of day (old or fresh)		
Hypothesis		

ANIMAL TRACKING ACTIVITY 1

1. **How would you change this activity to understand more long-term mammal patterns and movements?**

2. **Develop a field study to examine mammal populations over time. Some parameters to consider include:**

Length of study	
Sampling frequency	
Evidence to look for	

ANIMAL TRACKING ACTIVITY 2

Name:_____ **Date:**__/__/__ **School:**_____ **Grade:**_____

Instructions:

- Ask for students' input for interesting places to setup trail camera. Consider places near wells or in areas where changes in mammal populations have been observed.
- Setup the camera outside of class time and inform students of general area but not specific location.
- Leave the camera in a discrete location for 5 days
- Download recordings and show to the class
- Repeat the exercise regularly to track changes

Activity:

Fill out the following table based on your observations from the trail camera

Animal Species (what type of animal)	**Quantity (how many did you see over the whole period)**	**Time of observation (day or night)**	**Behavior (was the animal alone or were multiple captured at once)**

ANIMAL TRACKING ACTIVITY 2

1. **Did the footage match your expectations? Please explain your answer.**

2. **What clues does the footage give about local animal populations?**

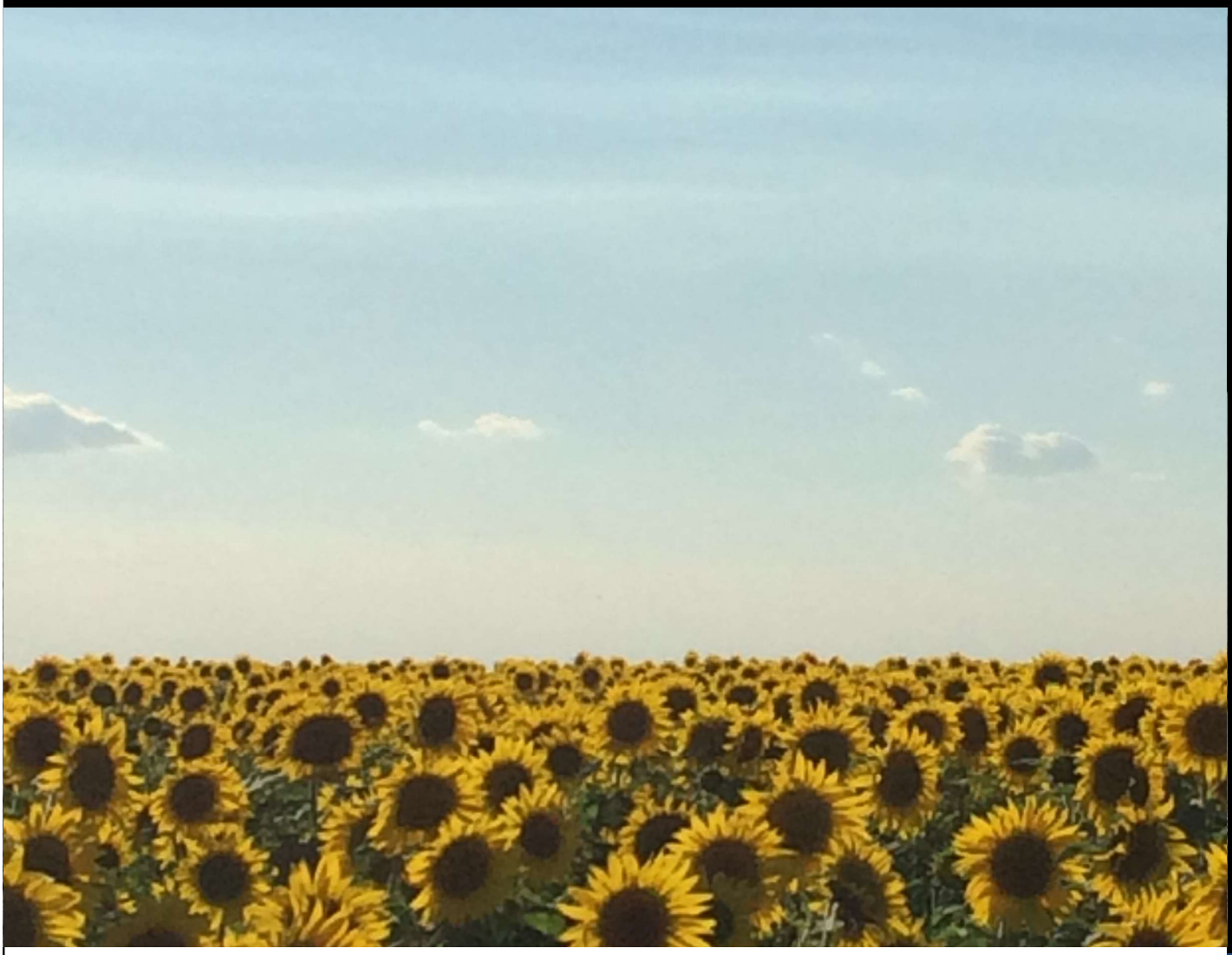
3. **What factors do you think affect the animal populations?**

4. **How would you set up a monitoring project to see how populations change over time?**

5. **What location would be most interested in placing a camera?**

Questions about Public Health

and additional materials



MHA CITIZEN SCIENCE PROJECT

LESSON PLAN

The MHA Citizen Science Project is developed in partnership between the University of Colorado – Boulder and the Nueta Hidatsa Sahnish College (NHSC).

Prepared by Jen Shannon and Bailey Duhé, March 2016.

INTRODUCTION TO SURVEYS

Developed by Bailey Duhé with input from Dr. Lisa McKenzie (public health scientist) and Jen Shannon (cultural anthropologist)

Lesson Overview:

Subject Area: Public Health, Surveying

Grade Level: 6-12

Summary: This lesson is designed to teach students to identify and respond to community questions about human and health impacts from oil development.

Learning Objectives:
After this lesson, students should be able to:

- Understand the process and purpose of surveying
- Collect data through surveys and accurately record data
- Analyze and evaluate compiled data in both its quantitative and qualitative forms
- Summarize and discuss findings

Introduction/Motivation

In meetings with teachers and students, impacts on family and home life were of concern; students expressed particular interest in conducting surveys to gather information related to drug use and its impacts on family and community, human and health impacts from oil development and environmental issues.

Format of Curriculum
This curriculum has three components:

1) Understanding what a survey is and the steps involved in creating a meaningful survey

2) Discuss the process of conducting a survey and accurately recording data

3) Participate in practice survey and data recording

4) Conduct actual surveys and report responses

5) Compare and discuss quantitative and qualitative data in order to better understand some aspects of your community and make informed decisions

PART 1: IN-CLASS INTRODUCTION TO SURVEYS

Write several general questions on the board such as the ones listed below. Have students answer the questions below. Make sure to record their results on the board:

- Raise your hand if you know what a survey is?
- Raise your hand is you can define the world ***survey***.
- Raise your hand if you have ever participated in (or been part of) a survey?
- Who is the tallest student in this class?
- What is your favorite thing to eat for lunch?
- Which do you like better: Winter or summer?

After asking the questions and recording the results on the board, explain to the class that they have just participated in a survey. Discuss the results with them.

Ask the class to think about and discuss:

- What kind of information do we now know about our class?
- What other information could we find out using a survey?
- How and why would someone use a survey?
- What were the differences in the types of questions asked?

Distribute the "Survey Information Sheet" and review the information in a class discussion.

Discuss the types of surveys and the types of answers collected: the survey they will conduct for their project will be a sample survey

- The survey they will conduct will use different versions of the **Likert scale** and an option for those who do not know what to answer
- Their surveys will contain both **qualitative** and **quantitative** data

Review the types of questions: Go back to the data you recorded at the beginning of class and ask the students to identify what type of questions you asked.

Final key concepts:

- **Consent**
    - Define consent
    - Talk about why a survey can only be given to someone who agrees to take it and have their answers put on record, and why it is important to protect someone's identity
    - Ask students to think of reasons why a person might not want to be a part of a survey
    - Talk to the students about what to do if a responder suddenly doesn't want to answer anymore questions and how to deal with that data previously collected

- Ask the students why it is important to record results honestly and accurately. Discuss how the results will not be useful to the group if they are not accurate. Use the favorite lunch food question as an example. For example: If more people gave 5's for *pizza* but the recorder does not like *pizza* and decides to record *hotdog* instead of *pizza*, what would happen when cafeteria workers use the results to plan the lunch menu?

PART 1: IN-CLASS INTRODUCTION TO SURVEYS

Vocabulary

Accurate	Correct in all details
Consent	Permission for something to happen or agreement to do something
Data	Facts and statistics collected together for reference or analysis
Likert Scale	A response scale used to obtain responder's preferences or degree of agreement with a statement or set of statements; this is a non-comparative scaling technique
Protocol	The official procedure or system of rules
Qualitative Data	Information about qualities; information can't actually be measured numerically
Quantitative Data	Data expressing a certain quantity, amount, or range. Usually, there are measurement units associated with the data.
Response	A verbal or written answer
Respondent	A person who replies to something, especially one supplying information for a survey or questionnaire
Scale	To arrange in a graduate series
Survey	Systematically examine and record a general or comprehensive view of a situation
Surveyor	A person who surveys or investigates and examines something

PART 2: IN-CLASS HANDOUT ABOUT SURVEYS

WHAT ARE SURVEYS?

A survey is a tool for collecting information (known as data) that represents the opinions of the community or group in which you are interested.

THREE MAIN TYPES OF SURVEYS:

1) Case study surveys - collect specific information from a part of a group or community
2) Sampled surveys - ask a sample portion of a group to answer your questions (we will be participating in this type of survey)
3) Census surveys - you give your survey questionnaire to every member of the population you want to learn about

TYPES OF SURVEY QUESTIONS:

Survey questions can take many forms and can include:

- Open-ended: Designed to prompt complete answers. For example: Why is it important to brush your teeth?
- Closed-ended: Specific questions that prompt yes or no answers. For example: Do you brush your teeth every time you eat?
- Multiple choice: Allows the respondent to select one answer from a few possible choices. For example: I brush my teeth …. (a) every time I eat, (b) most times I eat, (c) occasionally after I eat, (d) only before I go to bed, (e) never.
- Likert scale: Each respondent is asked to rate items on a response scale. Commonly, they rate a question on a 1-to-5 response scale. For example: Brushing your teeth after every meal is important.

  1 = strongly disagree
  2 = disagree
  3 = undecided
  4 = agree
  5 = strongly agree

OTHER FACTS ABOUT SURVEYS:

1) Surveys are usually written, but the surveyor (person conducting the survey) can read the questions out loud and record the answers.
2) Surveys can be distributed in many ways: mailed, emailed, by phone or in person.
3) The goal of surveys is to collect information in as uniform a manner as possible -- asking each respondent the same questions in the same way
4) Respondents have to (**consent**) agree to participate in a survey and should be as honest as possible in answering the questions.

PART 3: IN-CLASS SURVEY ACTIVITY

Your students can practice giving the consent speech and surveying each other using the following practice sheet. The template below contains questions regarding cafeteria food, however you can change the questions to meet the interests of your class.

After the survey:
After each student has finished surveying, write the following formula on the board:

Q1	5	4	3	2	1	0
Q2	5	4	3	2	1	0

Have each student come to the board and add a tally mark underneath the appropriate response they collected from each question.

For example, if four students answered a 5 for question 1, the board for that question should look like this:

Q1	5
	IIII

After each student has added their collected responses to the board, count the totals for each question. In order to gather the quantitative data from this survey, take the number of responses for each answer choice and divide it by the number of students. For example, if four students answered with a 5 for question 1 and you have 20 students who participated, 4/20 divides to .2, which is 20% of the class. Therefore, you can say that 20% of students surveyed strongly agree that the cafeteria should serve pizza at least once a month.

Next, you can ask the students whose respondents marked a 5 for question 1 to read out the explanations. These explanations represent the qualitative data.

Ask students to point out the differences between the quantitative and qualitative data and then what happens when both sets of data are used together.

After completing this exercise, ask the students how they felt about asking for consent, giving consent, being the surveyor and then being the responder.

Your students are now ready to choose their surveys and conduct their own research.

PART 3: IN-CLASS SURVEY ACTIVITY

You have been asked to conduct a survey to help the cafeteria decide what should be served for lunch. In order to complete this assignment, use the questions below to interview one responder from your class. Remember to follow the survey protocol.

1. Review the consent script below with the person you are interviewing to be syre they understand the purpose of your questions.

2. Practice saying this script out loud and when you are ready, use this script to ask the responder for their consent to participate in your survey and to use their data to report back to the cafeteria.

Consent script (this is to collect practice data and is not a real study and will not be on a website)

Hi, my name is _____ and I am a student at _____. My classmates and I are conducting surveys for the cafeteria to help them decide what to serve for lunch. The information will be collected by our class and displayed on the cafeteria's website, but no one will be identified by their name. Please let me know if you want to stop this survey at any time. Can I ask you a few questions regarding your opinion on the cafeteria menu?

The Survey

What town do you live in? _____

How old are you? _____ I am (circle one): Male Female

Please answer the following questions on a scale of 1-5: 1 is strongly disagree; 2 is disagree; 3 is not sure; 4 is strongly agree; 5 is strongly agree; or prefer not to answer.

Q #	Question	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree	Prefer not to Answer	Explanation
1	The cafeteria should serve pizza at least once a week.	1	2	3	4	5	0	Why?
2	The cafeteria should never serve peas.	1	2	3	4	5	0	Why?
3	The cafeteria should serve salad everyday.	1	2	3	4	5	0	Why?

When you have finished your survey, wait further instructions from your teacher.

PART 4: CONDUCTING SURVEYS AND REVIEWING RESULTS

(This section is not fully developed – information on the website interface is required to complete this section)

Teachers can have students either choose which survey they are interested in conducting or assign students a survey to conduct. The surveys are designed to address various topics (listed at the top of the survey) and are estimated to take approximately 5-10 minutes to complete.

If desired, teachers can assign students in lower gradesto be recorders during the interview while older students ask the survey questions.

Each student should interview three people for their homework. It is up to the teachers to clarify if family members or other students are acceptable responders before surveys begin and to designate the amount of time students have to complete and return the survey results.

After the surveying: (NEED TO UPDATE AFTER TALKING TO TROY)

Once the surveying is completed, each student can enter their collected responses into a template on the MHA Citize Science website (still working on a name for it!).

For the qualitative responses collected in the explanation section, students should **INSERT PROTOCOL HERE AFTER CONSULTING WITH TROY**. The qualitative responses do not have to be inputted to the website and can be for in-class discussion. That is up to the class/students to decide. (This section, including how to best process the qualitative portion, is still under consideration. Any input on how you think the students would best benefit from this portion of the data is greatly appreciated!)

PART 5: DISCUSSING RESULTS, MAKING HYPOTHESES

(This section is not fully developed – information on the website interface is required to complete this section)

After all of the data has been collected, have students as a class review a few graphs or charts of your choosing.

Ask the students to identify some of the results from the charts.

Next, read a few of the qualitative responses that correlate to the chart from the appropriate question.

Ask students what information the qualitative and quantitative sets of data together present.

Next, ask the students how they feel about those results:

- Are students surprised by the response?
- Did the results match their initial assumptions? If not, in what ways were the results different from expectation?
- In what ways is the collected data useful? What can the results be used for?

(Optional) Assessment:

(This section is not fully developed – information on the website interface is required to complete this section)

Break students into small groups and have them review the results of a survey. During the activity, have each group answer the following questions:

- What do the results from the survey say about the topic of the survey?
- Do the results make the students feel a certain way?
- What are some ideas for how students might act on or do something about the results of the survey?

Teachers can grade students on the following:

- Student successfully completed the surveying and data input
- Student was able to identify the meaning behind the graphs and charts generated from the collected survey results
- Student was able to hypothesize action to take based on their feelings from the generated results
- Student demonstrated and articulated grade appropriate critical thinking skills when answering questions regarding the results of the survey and their larger impacts
- Student was able to evaluate and make informed judgments on validity and usefulness of the surveys and contributed to the discussion regarding future surveying and usefulness of data

SURVEYS

Attached to this document are the surveys for students to conduct. Teachers can print the selected survey document for students to use.

The surveys are as follows:

1. Impacts of Oil Development (Perceived Benefits and Risks)

2. Impacts of Oil Development (Social Relations and Quality of Life)

3. Impacts of Oil Development (Future of Our Community)

4. Impacts of Oil Development (Land and Environment)

5. Impacts of Oil Development (Media)

Each survey has a total of 10 questions and should take between 5-10 minutes to complete.

SURVEY 1: IMPACTS OF OIL DEVELOPMENT (PERCEIVED BENEFIT AND RISK)

<u>Introduce yourself and ask permission to interview</u>: Hi, my name is _____ and I am a student at _____. My classmates and I are conducting surveys regarding the impacts of oil development on our community. The information will be collected by our class and displayed on a website, but no one will be identified by their name. Please let me know if you want to stop this survey at any time. Can I ask you a few questions regarding your opinions on the oil development?

<u>Basic Questions:</u>

What town do you live in? _____ **How old are you?** _____

Are you a member of the MHA Nation? Yes No **I am:** Male Female Other

Q#	Question	Circle the appropriate response:						Explanation / Why? – Prompts for further discussion
	Answer the following questions on a scale of 1-5: 1 is extremely negative; 2 is negative; 3 is neither negative nor positive; 4 is positive; 5 is extremely positive; 0 is I don't know							
1	**What has been the impact of the oil boom (since around 2008) on your community?**	**1**	**2**	**3**	**4**	**5**	**0**	What do you see as positive/negative?
2	**What has been the impact of the oil boom (since around 2008) on your family?**	**1**	**2**	**3**	**4**	**5**	**0**	What do you see as positive/negative?
3	**What has been the impact of the oil boom (since around 2008) on you personally?**	**1**	**2**	**3**	**4**	**5**	**0**	What do you see as positive/negative?

4	**What has been the impact of the oil boom on the health of the people living at Fort Berthold?**	**1**	**2**	**3**	**4**	**5**	**0**	If agree, what health problems are you most concerned about?
5	**What has been the impact on your community of the increased infrastructure in the last five years (paved roads, street lights, bypass, housing, etc.)?**	**1**	**2**	**3**	**4**	**5**	**0**	What changes have you seen?
	Answer the following questions on a scale of 1-5: 1 is it has increased a lot; 2 is it has increased some; 3 is no change; 4 is it has decreased a lot; 5 is it has decreased a lot; 0 is I don't know							
6	**What has been the impact of the oil boom on illegal drug trafficking and use at Fort Berthold since the oil boom began in 2007.**	**1**	**2**	**3**	**4**	**5**	**0**	What changes have you seen?
	Answer the following questions on a scale of 1-5: 1 is not at all; 2 is a little; 3 is somewhat; 4 is very; 5 is a lot; 0 is I don't know							
7	**How concerned are you with the water quality in the area in which you live?**	**1**	**2**	**3**	**4**	**5**	**0**	Why?
8	**How concerned are you with the air quality in the area in which you live?**	**1**	**2**	**3**	**4**	**5**	**0**	Why?
9	**Do you feel you are living in a safe environment?**	**1**	**2**	**3**	**4**	**5**	**0**	Why?
10	**Have you heard members of your family or community expressing concerns about health in relation to the oil?**	**1**	**2**	**3**	**4**	**5**	**0**	What has been the focus of their concern?

SURVEY 2: IMPACTS OF OIL DEVELOPMENT (SOCIAL RELATIONS AND QUALITY OF LIFE)

Introduce yourself and ask permission to interview: Hi, my name is _____ and I am a student at _____. My classmates and I are conducting surveys regarding the impacts of oil development on our community. The information will be collected by our class and displayed on a website, but no one will be identified by their name. Please let me know if you want to stop this survey at any time. Can I ask you a few questions regarding your opinions on the oil development?

Basic Questions:

What town do you live in? _____ **How old are you?** _____

Are you a member of the MHA Nation? Yes No **I am:** Male Female Other

Q#	Question	Circle the appropriate response:						Explanation / Why? – Prompts for further discussion
	Answer the following questions on a scale of 1-5: 1 is not at all; 2 is a little; 3 is somewhat; 4 is very; 5 is a lot; 0 is I don't know							
11	**Are you concerned about people moving away from the reservation?**	**1**	**2**	**3**	**4**	**5**	**0**	Why?
12	**Are you concerned about people moving to the reservation?**	**1**	**2**	**3**	**4**	**5**	**0**	Why?
13	**How satisfied are you with your financial situation?**	**1**	**2**	**3**	**4**	**5**	**0**	
14	**Have you earned income from oil development?**	**1**	**2**	**3**	**4**	**5**	**0**	If so, positive or negative impact on your family?

15	**Have illegal drugs negatively affected the community?**	**1**	**2**	**3**	**4**	**5**	**0**	
16	**Have oil revenues affected you or your family?**	**1**	**2**	**3**	**4**	**5**	**0**	In what ways?
17	**Are you concerned about how the media represents our community?**	**1**	**2**	**3**	**4**	**5**	**0**	In what ways?
18	**Are you concerned about increasing crime rate on the reservation?**	**1**	**2**	**3**	**4**	**5**	**0**	
19	**Are you concerned about the oil trucks on the roads?**	**1**	**2**	**3**	**4**	**5**	**0**	Why or why not?
20	**Have you noticed a significant change in behavior of community members since the oil boom?**	**1**	**2**	**3**	**4**	**5**	**0**	Please explain.

SURVEY 3: IMPACTS OF OIL DEVELOPMENT ON MY COMMUNITY (FUTURE OF OUR COMMUNITY)

<u>Introduce yourself and ask permission to interview</u>: Hi, my name is _____ and I am a student at _____. My classmates and I are conducting surveys regarding the impacts of oil development on our community. The information will be collected by our class and displayed on a website, but no one will be identified by their name. Please let me know if you want to stop this survey at any time. Can I ask you a few questions regarding your opinions on the oil development?

<u>Basic Questions:</u>

What town do you live in? _____

Are you a member of the MHA Nation? Yes No **How old are you?** _____

I am: Male Female Other

Q#	Question	Circle the appropriate response:						Explanation / Why?
	Answer the following questions on a scale of 1-5: 1 is not at all; 2 is a little; 3 is somewhat; 4 is very; 5 is a lot; 0 is I don't know							
21	**Do you feel you have a say in the development that's occurring on the reservation?**	**1**	**2**	**3**	**4**	**5**	**0**	Explain.
22	**Are you concerned about the recent slowdown in the oil boom?**	**1**	**2**	**3**	**4**	**5**	**0**	Why or why not?
23	**Do you want the oil boom to continue?**	**1**	**2**	**3**	**4**	**5**	**0**	Why or why not?

24	**Do you think your community is prepared for continuing oil development?**	**1**	**2**	**3**	**4**	**5**	**0**	Explain.
25	**Do you feel you have a say in the future path of your community?**	**1**	**2**	**3**	**4**	**5**	**0**	Why or why not?
26	**Has the current oil boom provided new opportunities for your family?**	**1**	**2**	**3**	**4**	**5**	**0**	Why?
	Answer the following questions on a scale of 1-5: 1 is extremely negative; 2 is negative; 3 is neither negative nor positive; 4 is positive; 5 is extremely positive; 0 is I don't know							
27	**When you think about the future of the MHA Nation, is it:**	**1**	**2**	**3**	**4**	**5**	**0**	And why?
28	**The future of my family is:**	**1**	**2**	**3**	**4**	**5**	**0**	And why?
29	**What has been the effect of oil jobs on your community?**	**1**	**2**	**3**	**4**	**5**	**0**	
30	**The quality of the environment at Fort Berthold in the future will be:**	**1**	**2**	**3**	**4**	**5**	**0**	Why or why not?

SURVEY 4: IMPACTS OF OIL DEVELOPMENT (LAND AND ENVIRONMENT)

Introduce yourself and ask permission to interview: Hi, my name is _____ and I am a student at _____. My classmates and I are conducting surveys regarding the impacts of oil development on our community. The information will be collected by our class and displayed on a website, but no one will be identified by their name. Please let me know if you want to stop this survey at any time. Can I ask you a few questions regarding your opinions on the oil development?

Basic Questions:

What town do you live in? _____ **How old are you?** _____

Are you a member of the MHA Nation? Yes No **I am:** Male Female Other

Q#	Question	Circle the appropriate response:						Explanation / Why?
	Answer the following questions on a scale of 1-5: 1 is not at all; 2 is a little; 3 is somewhat; 4 is very; 5 is a lot; 0 is I don't know							
31	How much do you like where you live?	1	2	3	4	5	0	Can you explain?
32	Do you think past spills and other forms of negligence have been adequately dealt with?	1	2	3	4	5	0	Why or why not?
33	Are you concerned about changes in animal populations and movements, for ex. mule deer?	1	2	3	4	5	0	Why?

34	**How satisfied were you with your physical environment prior to the most recent oil boom?**	**1**	**2**	**3**	**4**	**5**	**0**	Can you explain?
35	**How satisfied are you with your physical environment now?**	**1**	**2**	**3**	**4**	**5**	**0**	Can you explain?
36	**How healthy is your physical environment?**	**1**	**2**	**3**	**4**	**5**	**0**	
37	**Future spill response – is the community prepared?**	**1**	**2**	**3**	**4**	**5**	**0**	Can you explain?
38	**How healthy is the tap water in your home?**	**1**	**2**	**3**	**4**	**5**	**0**	
39	**How healthy is the air that you breathe while at home?**	**1**	**2**	**3**	**4**	**5**	**0**	
	Answer the following questions on a scale of 1-5: 1 is extremely poor; 2 is poor; 3 is neither poor nor good; 4 is good; 5 is excellent; 0 is I don't know							
40	**How has your health been since the oil boom?**	**1**	**2**	**3**	**4**	**5**	**0**	Can you explain?

SURVEY 5: IMPACTS OF OIL DEVELOPMENT (MEDIA)

<u>Introduce yourself and ask permission to interview</u>: Hi, my name is _____ and I am a student at _____. My classmates and I are conducting surveys regarding the impacts of oil development on our community. The information will be collected by our class and displayed on a website, but no one will be identified by their name. Please let me know if you want to stop this survey at any time. Can I ask you a few questions regarding your opinions on the oil development?

<u>Basic Questions:</u>

What town do you live in? _____ **How old are you?** _____

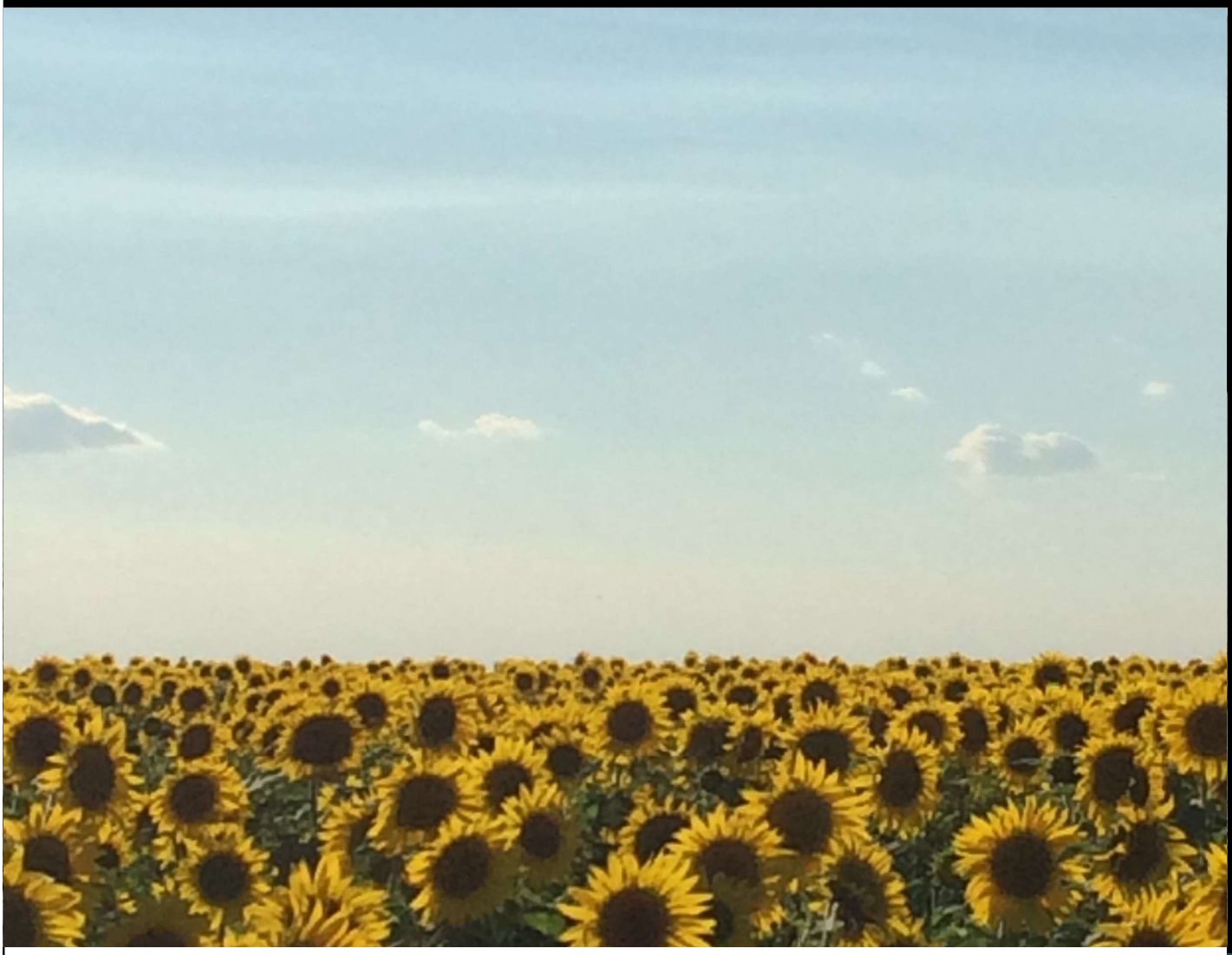
Are you a member of the MHA Nation? Yes No **I am:** Male Female Other

Q#	Question	Circle the appropriate response:						Explanation / Why?
	Answer the following questions on a scale of 1-5: 1 is not at all; 2 is a little; 3 is somewhat; 4 is very; 5 is a lot; 0 is I don't know							
41	**Do you agree with how the oil boom has been covered in the media?**	**1**	**2**	**3**	**4**	**5**	**0**	Why or why not?
42	**Has has the media impacted your view of the oil industry?**	**1**	**2**	**3**	**4**	**5**	**0**	Can you explain?
43	**Do TV shows that depict the oil boom affect your community?**	**1**	**2**	**3**	**4**	**5**	**0**	Why or why not?
44	**Have journalists talked with community members?**	**1**	**2**	**3**	**4**	**5**	**0**	Explain.

45	**Do you believe that the news generally tells the truth about their stories regarding the oil boom and your community?**	**1**	**2**	**3**	**4**	**5**	**0**	
46	**Do you feel that your perspective is represented in the media stories you encounter regarding the oil boom?**	**1**	**2**	**3**	**4**	**5**	**0**	Why or why not?
47	**Have local news sources covered the oil boom in an adequate way?**	**1**	**2**	**3**	**4**	**5**	**0**	Why or why not?
	Answer the following questions on a scale of 1-5: 1 is extremely negative; 2 is negative; 3 is neither negative nor positive; 4 is positive; 5 is extremely positive; 0 is I don't know							
48	**In general, media about the oil boom has been:**	**1**	**2**	**3**	**4**	**5**	**0**	Can you explain?
49	**The media has influenced me to view the oil boom as:**	**1**	**2**	**3**	**4**	**5**	**0**	Can you explain?
50	**Since the oil boom, how has the community handled media stories?**	**1**	**2**	**3**	**4**	**5**	**0**	

Thinking about Media and its Impacts

and additional materials



MHA CITIZEN SCIENCE PROJECT

LESSON PLAN

The MHA Citizen Science Project is developed in partnership between the University of Colorado – Boulder and the Nueta Hidatsa Sahnish College (NHSC).

Prepared by Jen Shannon and Bailey Duhé, March 2016.

INTRODUCTION TO CRITICAL MEDIA ANALYSIS

Developed by Bailey Duhé with input from Jen Shannon

Lesson Overview:

Subject Area: Media Studies, Journalism

Grade Level: 6-12

Summary: This lesson is designed to encourage students to question and assess the value of the information they receive on a daily basis in the news, in print, or on social media websites.

Students will learn to critically analyze media and judge the credibility of its sources.

Learning Objectives:
After this lesson, students should be able to:

- Critically read and interpret information given from a media source and understand how the media influences our opinions
- Evaluate the credibility of the content and perspectives presented in media sources
- Analyze and form judgments about how the media chooses to present material in order to form appropriate responses

Introduction/Motivation

The media can often times be one-sided and present partial or biased stories. This lesson will help teach students to think critically about media and to produce their own version of what they see is going on today.

Format of Curriculum

This curriculum has three components:

1) Introduce your students to the vocabulary and process of questioning.

2) Assign the critical media analysis worksheet as a take-home assignment.

3) Facilitate conversation among your students after they complete individual projects.

INTRODUCTION TO CRITICAL MEDIA ANALYSIS

Find a short clip or story from a popular media source to show to your students. After reading or watching the story, ask your students the following questions:

1) What do you think is the purpose of this story?
2) Who is telling the story and what is their point of view?
3) Why is this story being told?
4) How does this story make you feel? Do you think this story is biased?
5) What perspectives or facts do you think are left out? What else do you think you need to know about this story?

Once a discussion has started, ask students to define the following terms together as a class:

Analyze	To examine methodically and in detail the structure of something for the purposes of explanation and interpretation
Bias	Prejudice in favor of or against one thing, person, or group
Critical Media Analysis	A method used to interpret and understand the media and the perspectives it represents
Critique	A detailed analysis and assessment of something
Journalism	The activity of profession of writing for newspapers or magazines, or of broadcasting on radio or television
Media	The main means of mass communication (includes television, radio, newspapers, magazines, the Internet, etc.)
Phrasing	To put into a particular form of words
Point of View	A particular attitude or way of considering a matter
Purpose	The reason for which something is done or created
Tone	The general character or attitude of a place, piece of writing, situation, etc.

After this discussion, challenge students to analyze similar statements that can have different meanings. For example, ask your students to find the differences between these two similar statements:

- Most people agree that popcorn is delicious.
- Not everyone thinks popcorn is delicious.

While these statements all say that some people think popcorn is delicious, how do the changes in phrasing convey different messages? Try to find examples from the media piece analyzed in class to show students the importance of phrasing.

After your students have discussed vocabulary and analyzed the class discussion, assign the critical media analysis worksheet for homework.

PART 2: CRITICAL MEDIA ANALYSIS WORKSHEET

Name:_____ **Date:**__/__/__ **School:**_____ **Grade:**____

Step 1: First Impressions
Select one piece of media from your local newspaper or online news source and answer these questions:

What is the name of article/story: _____

Where did you find this piece? _____

When was this story written? _____

Who was the author of this story? _____

Step 2: Dig Deeper

What do you think is the purpose of this story?	
Who is telling the story and what is their point of view?	
Why is this story being told?	
How does this story make you feel? Do you think this story is bias?	
What perspectives or facts do you think are left out? What else do you need to know about this story?	

Step 3: What do you think? Share your work on the MHA Citizen Science Website

In about 500 words, create a news piece for the *MHA Times*, or a 2-minute video review of the media piece you selected. Be sure to include: what the piece is about, the main perspectives from which it was produced, your critical analysis of the piece, and how you would do it differently. How could this story have been told differently?

PART 3: In-Class Review of Media Worksheet

Once your students have completed their assignments, have them get into groups of 3-4 and discuss the stories they read and what they learned which analyzing and writing their response piece.

Ask each group to answer the following questions:

1) How did this activity impact your ability to understand and evaluate stories in the media?
2) How might your new understanding of evaluating media affect your decisions and actions in the future?
3) After participating in this activity, how could you explain to someone else the importance of critically evaluating media?

Have each group share their answers in an open discussion on the project and what they learned. Ask students how this exercise affected the way that they interact with the media.

Ask your students to think about how this project could be used long term? What would be the benefits of knowing how to affectively analyze media? What do they think would happen if everyone engaged in critical media analysis?

(Optional) Assessment

Teachers may choose to grade final papers based on the following criteria:

- Student successfully completed the worksheet and produced a short response piece
- Student was able to identify author's main purpose, perspective, and bias
- Student was able to hypothesize information that may have been left out and the reasons behind that information's omission
- Student demonstrated and articulated grade appropriate critical thinking skills when answering questions regarding additional perspectives and missing information
- Student was able to evaluate and make informed judgments on validity and usefulness of the piece

Additionally, teachers may ask students to give a short presentation on their findings or show the videos if applicable.

Lesson Follow-up

Consider sharing the students' responses with their community via citizen science website, school newspaper, local newspaper, posting printed responses on bulletin boards, sharing the responses on the school website, etc.

Critical Media Analysis Additional Resources

Below are some additional questions for the instructor that might be helpful in guiding the class discussion:

First Impressions:

1) Did you like this piece? Why or why not?
2) Why do you think this piece was produced?
3) Whose perspective is represented in this piece?
4) Where is the person who produced this piece from? Did this influence the story?
5) What do you think is accurate in the story? Why?
6) What do you think is not accurate in the story? Why?
7) Do you agree with the way the story was told? Why or why not?
8) How might people within your community respond to this piece?
9) How might the same story told from your community's perspective be different?
10) How might this affect how people outside your community see or understand MHA Nation?

Questions about Authorship and Purpose:

1) Who made this?
2) When was this made?
3) Who was this made for? (Who is the intended audience?)
4) How do you know who this was made for?
5) Who paid for it?

Questions about Content:

1) What is the main message that is communicated?
2) Through what kinds of imagery and language are these messages conveyed?
3) What ideas and values are directly communicated?
4) What ideas and values are implied without being said directly?
5) What is left out of this message that might be important to know?

Questions about Credibility:

1) Is this fact, opinion, or something else? How do you know?
2) How credible is this? Are the sources of information named?

Question about Impact:

1) Where or how was it shared with the public?
2) Who might benefit from this? Who might be harmed by it?
3) What is my interpretation of this, and what do I learn about myself from my reaction or interpretation?
4) What kinds of actions might I take in response to this?